DUBLIN PORT COMPANY

Dublin Harbour Capital Dredging Project

Volume 2 EIAR Main Document



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Contents

1 INTRODUCTION 1-1
1.1 Context 1-1
1.2 Purpose of the EIAR 1-1
1.3 Function of the EIAR 1-2
1.4 Technical Difficulties or Lack of Data 1-2
1.5 The Applicant & Masterplan 1-3
1.6 The Dublin Harbour Capital Dredging Project 1-6
1.7 Requirement for the EIAR 1-6
1.8 Methodology and Structure of the EIAR 1-7
1.8.1 EIAR Content 1-7
1.8.2 Assessment Methodology 1-8
1.8.3 Structure of the EIAR 1-12
1.9 Viewing and Purchasing of the EIAR 1-17

2 NEED FOR THE CAPITAL DREDGING PROJECT 2-1
2.1 Introduction 2-1
2.2 Project Rationale 2-1
2.2.1 Introduction 2-1
2.2.2 Dublin Harbour Capital Dredging Project Objectives 2-2
2.2.3 Projected Future Growth at Dublin Port 2-3
2.2.4 Impact of Brexit 2-6
2.2.5 Impact of Covid-19 2-7
2.2.6 Growth in ship sizes 2-7
2.2.7 Implementing the Dublin Harbour Capital Dredging Project – the need for 8 year consents 2-9
2.3 Spatial Planning Policy 2-11
2.3.1 Introduction 2-11
2.3.2 Relevant European Planning and Development Policy 2-11
2.3.3 Relevant National Planning and Development Policy 2-13
2.3.4 Relevant Regional Planning and Development Policy 2-16
2.3.5 Relevant Local Planning and Development Policy 2-19
2.3.6 The North Lotts and Grand Canal Planning Scheme 2-23
2.3.7 Poolbeg West SDZ Planning Scheme 2-23
2.3.8 Dublin Port Masterplan 2040 2-24

3 PROJECT DESCRIPTION 3-1
3.1 Location of Project and Site Characteristics 3-1
3.1.1 Site Location 3-1
3.1.2 Proposed Capital Dredge Area 3-1
3.2 Proposed Capital Dredging Works 3-11
3.2.1 Capital Dredging Design Considerations 3-11
3.2.2 Capital Dredging Volumes 3-11
3.2.3 Loading Operations 3-14
3.2.4 Disposal Operations 3-16
3.3 Environmental Management of the Dredging Operations 3-17
3.3.1 Working Hours 3-19
3.3.2 Site Compound 3-19
3.3.3 Traffic 3-20
3.3.4 Capital Dredging Environmental Protection Measures 3-20
3.3.5 Programme 3-22
3.4 Operational Phase 3-23

3.4.1 Maintenance Dredging ... 3-23
3.4.2 Pollution Control ... 3-23
3.4.3 Navigation ... 3-23
3.5 Description of the risk of accidents having regard to substances and technologies used ... 3-24
3.6 Project change and Decommissioning ... 3-24
3.7 Other related projects and potential for ex-situ effects ... 3-24
3.7.1 Foreshore History Relevant to the Project ... 3-24
3.7.2 Planning History Relevant to the Project ... 3-25

4 EXAMINATION OF ALTERNATIVES ... 4-1
4.1 Introduction ... 4-1
4.2 Examination of Strategic Alternative Options ... 4-3
4.2.1 Description of Strategic Alternative Scenarios ... 4-3
4.3 Examination of Project Level Alternative Options ... 4-14
4.3.1 Loading Alternatives ... 4-14
4.3.2 Disposal and Re-use Alternatives ... 4-16
4.4 Summary of Consideration of Alternative Options ... 4-20

5 PROJECT SCOPING AND CONSULTATION ... 5-1
5.1 Introduction ... 5-1
5.2 Consultation and the Masterplan Review ... 5-1
5.3 Consultation and the Dublin Harbour Capital Dredging Project ... 5-6
5.3.1 Pre-application Consultation with Statutory and Non-Statutory Bodies ... 5-6
5.3.2 Public Consultation ... 5-9
5.3.3 Conclusions ... 5-10
5.4 Scoping ... 5-11
5.4.1 Scoping Approach ... 5-11
5.4.2 Extent of Environmental Appraisals ... 5-13

6 RISK OF MAJOR ACCIDENTS & DISASTERS ... 6-1
6.1 COMAH land use planning assessment ... 6-1
6.1.1 Planning Context ... 6-1
6.1.2 COMAH Establishments ... 6-3
6.1.3 Risk Assessment Methodology ... 6-10
6.1.4 Scenarios ... 6-14
6.1.5 Risk Assessment ... 6-22
6.1.6 Conclusion ... 6-23
6.2 Risk of Collision – Dublin Bay Marine Traffic Management ... 6-26
6.3 Emergency Response Management ... 6-26
6.3.1 Dublin Port Traffic Management ... 6-26
6.3.2 Dublin Port Security ... 6-27
6.3.3 Dublin Port Emergency Management Plan ... 6-27
6.3.4 Dublin City Council Major Emergency Plan ... 6-30
6.3.5 Emergency Response Exercises ... 6-31
6.3.6 Dublin Port Dangerous Cargoes Bye-laws ... 6-31
6.4 Conclusion ... 6-33

7 BIODIVERSITY, FLORA & FAUNA ... 7-1
7.1 Benthic Biodiversity & Fisheries ... 7-2
7.1.1 Assessment Methodology ... 7-2
7.1.2 Receiving Environment ... 7-5
7.1.3 Likelihood and Description of Likely Significant Impacts ... 7-7
7.1.4 Mitigation Measures ... 7-17
7.1.5 Residual Impacts ... 7-18
7.1.6 Potential Cumulative Impacts ... 7-18
7.1.7 Conclusions ... 7-21

7.2 Marine Mammals 7-22
7.2.1 Assessment Methodology 7-22
7.2.2 Receiving Environment 7-23
7.2.3 Likelihood of Impacts 7-36
7.2.4 Description of Likely Significant Impacts 7-36
7.2.5 Mitigation Measures 7-40
7.2.6 Residual Impacts 7-41
7.2.7 Potential Cumulative Impacts 7-41
7.2.8 Conclusions 7-42
7.3 Avian Biodiversity 7-43
7.3.1 Assessment Methodology 7-43
7.3.2 Receiving Environment 7-46
7.3.3 Likelihood of Significant Impacts on Birds 7-56
7.3.4 Description of Likely Significant Impacts 7-57
7.3.5 Mitigation Measures 7-59
7.3.6 Residual Impacts 7-59
7.3.7 Potential Cumulative Impacts 7-59
7.3.8 Conclusions 7-60

8 LAND, SOILS, GEOLOGY AND HYDROGEOLOGY 8-1
8.1 Assessment Methodology 8-1
8.1.1 Guidance 8-1
8.1.2 Assessment of Significance 8-2
8.1.3 Impact Assessment 8-3
8.1.4 Significance Criteria 8-3
8.1.5 Significance of Residual Effects 8-4
8.2 Receiving Environment 8-4
8.2.1 Land 8-4
8.2.2 Soils 8-6
8.2.3 Geology 8-31
8.2.4 Hydrogeology and Groundwater Vulnerability 8-32
8.2.5 Designated Sites 8-34
8.2.6 Summary 8-35
8.3 Likelihood of Impacts 8-36
8.4 Description of Likely Significant Impacts 8-37
8.4.1 Land 8-37
8.4.2 Soil 8-37
8.4.3 Geology 8-37
8.4.4 Hydrogeology and Groundwater Vulnerability 8-38
8.5 Mitigation Measures 8-38
8.5.1 Construction Phase Mitigation Measures 8-38
8.5.2 Operational Phase Mitigation Measures 8-38
8.6 Residual Impacts 8-38
8.7 Potential Cumulative Impacts 8-38
8.7.1 Dublin Port Company ABR Project 8-39
8.7.2 Dublin Port Company MP2 Project 8-39
8.7.3 Dublin Port Company – Dublin Port Maintenance Dredging 2022-2029 8-40
8.8 Conclusions 8-41

9 WATER QUALITY 9-1
9.1 Assessment Methodology 9-1
9.2 Receiving Water Environment 9-3
9.2.1 Study Area Water Bodies 9-4
9.2.2 Water Framework Directive 9-5

9.2.3 Protected Areas 9-9
9.2.4 Marine Strategy Framework Directive Environmental Status 9-13
9.2.5 ABR Project - Capital Dredging Water Quality Monitoring 9-14
9.2.6 Water Quality Summary 9-42
9.3 Likelihood of Impacts 9-43
9.3.1 Potential Impacts 9-44
9.4 Description of Likely Significant Impacts 9-44
9.4.1 Capital Dredging & Disposal Operations 9-44
9.5 Mitigation Measures 9-44
9.5.1 Capital Dredging & Disposal Operations 9-44
9.5.2 Water Quality Monitoring 9-46
9.5.3 Dublin Port Company Environmental Management System 9-47
9.6 Residual Impacts 9-47
9.7 Potential Cumulative Impacts 9-47
9.7.1 Dublin Port Company ABR Project 9-47
9.7.2 Dublin Port Company MP2 Project 9-48
9.7.3 Dublin Port Company – Dublin Port Maintenance Dredging 2022-2029 9-49
9.8 Conclusions 9-50

10 AIR QUALITY AND CLIMATE CHANGE 10-1
10.1 Assessment Methodology 10-1
10.1.1 Baseline Air Quality 10-1
10.1.2 Baseline Climate 10-2
10.1.3 Construction Phase Impacts 10-3
10.1.4 Operation Stage Impacts 10-4
10.1.5 Assessment Criteria 10-4
10.1.6 Potential for Cumulative Impacts 10-7
10.2 Existing Environment 10-7
10.2.1 Receiving Environment 10-7
10.2.2 Existing Sources in the Area 10-8
10.2.3 Baseline Air Quality 10-9
10.2.4 Baseline Climate 10-18
10.2.5 ‘Do-Nothing’ Scenario 10-22
10.3 Impact Assessment 10-23
10.3.1 Construction Stage 10-23
10.3.2 Operation Phase 10-28
10.3.3 Mitigation Measures 10-28
10.3.4 Residual Impacts 10-29
10.4 Conclusions 10-29

11 TERRESTRIAL NOISE & VIBRATION 11-1
11.1 Assessment Methodology 11-1
11.1.1 Relevant Noise Guidance Documents 11-1
11.1.2 Relevant Vibration Guidance 11-4
11.1.3 Assessment Methodology for Determining Noise Impacts 11-5
11.1.4 Methodology for Noise Monitoring 11-6
11.2 Receiving Environment 11-7
11.2.1 Baseline Noise Survey 11-7
11.2.2 Noise Monitoring of Dredging Activity 11-9
11.3 Likelihood of Impacts 11-10
11.3.1 Noise Assessment of Previous Dredging 11-10
11.3.2 Worst-Case Noise Assessment of Proposed Dredging 11-10
11.3.3 Vibration 11-11
11.3.4 Potential Cumulative Noise Impacts 11-11

11.4 Description of likely significant impacts 11-12
11.4.1 Dredging Noise 11-12
11.4.2 Dredging Vibration 11-12
11.5 Mitigation Measures 11-12
11.6 Residual Impacts 11-15
11.7 Monitoring 11-15
11.8 Conclusion 11-15

12 UNDERWATER NOISE 12-1
12.1 Underwater Noise Overview 12-1
12.2 Assessment Methodology 12-2
12.2.1 Receiving Environment 12-2
12.2.2 Sensitivity of the Receiving Environment 12-3
12.2.3 Strive Report (2011) 12-3
12.2.4 ABR Project 12-4
12.2.5 2017 Piling Noise 2020 12-4
12.3 Likelihood of Impacts 12-4
12.3.1 Dredging 12-5
12.3.2 Dumping 12-5
12.3.3 Underwater Noise Sources 12-6
12.4 Description of likely significant impacts 12-8
12.4.1 Underwater Noise Sources 12-9
12.4.2 Underwater Noise Impacts 12-9
12.4.3 Potential Cumulative Effects 12-9
12.5 Mitigation Measures 12-9
12.5.1 Monitoring 12-10
12.6 Conclusions 12-10

13 MATERIAL ASSETS – COASTAL PROCESSES 13-1
13.1 Dredging Operations 13-1
13.2 Assessment Methodology 13-1
13.2.1 Modelling Methodology 13-1
13.2.2 Coastal Process Modelling Software 13-1
13.2.3 Coastal Process Models and Data Sources 13-2
13.3 Receiving Environment 13-6
13.3.1 Tidal Regime at Dublin Port 13-7
13.3.2 Wave Climate at Dublin Port 13-8
13.4 Likelihood of Impacts 13-10
13.4.1 Potential Impacts of Dredging and Disposal Operations 13-10
13.5 Description of Potential Impacts 13-11
13.5.1 Potential Impacts as a result of dredging operations 13-11
13.5.2 Assessment of Potential Impacts 13-11
13.6 Model Validation 13-26
13.6.1 Sediment Plume Validation Modelling – Dumping Operations 13-26
13.6.2 Sediment Plume Validation Modelling – Loading Operations, inner Liffey channel 13-27
13.7 Mitigation Measures 13-27
13.7.1 Residual Impact 13-28
13.8 Conclusion 13-29

14 CULTURAL HERITAGE 14-1
14.1 Assessment Methodology 14-1
14.2 Existing environment 14-1
14.2.1 Cartographic sources 14-1
14.2.2 Known monuments and features 14-4
14.2.3 New Observations 14-5

14.2.4 Conclusions 14-6
14.3 Likelihood of effects 14-6
14.4 Cumulative impacts 14-7
14.5 Mitigation measures 14-7
14.6 Residual impacts 14-8
14.7 Conclusions 14-9

15 POPULATION & HUMAN HEALTH 15-1
15.1 Assessment Methodology 15-1
15.2.1 Relevant Policy and Guidance 15-1
15.2.2 Assessment Scope 15-3
15.2.3 Study Area 15-3
15.2.4 Assessment Criteria and Assignment of Significance 15-4
15.2.5 Limitations of the Assessment 15-5
15.2 Receiving Environment 15-6
15.3.1 Existing Baseline Conditions 15-6
15.3.2 Future Baseline Conditions 15-7
15.3 Consultation 15-8
15.4 Appraisal of Significance 15-8
15.5.1 Construction Phase 15-8
15.5 Mitigation Measures 15-10
15.6 Residual Impacts 15-10
15.7 Cumulative Impact 15-10
15.8.1 Human Health Effects from Changes in Air Quality 15-10
15.8.2 Human Health Effects from Changes in Noise Exposure 15-11
15.8 Monitoring 15-11
15.9 Summary of Effects 15-11
15.10 Conclusions 15-11

16 CUMULATIVE EFFECTS AND ENVIRONMENTAL INTERACTIONS 16-1
16.1 Cumulative Effects 16-1
16.1.1 Methodology 16-2
16.1.2 Assessment of Cumulative Effects 16-4
16.2 Environmental Interactions within Dublin Harbour Capital Dredging Project 16-20
16.3 Assessment Summary and Conclusion 16-33
16.3.1 Cumulative Effect between the Dublin Harbour Capital Dredging Project and Projects in the same area 16-33
16.3.2 Interactions between the various impacts within the Dublin Harbour Capital Dredging Project. 16-33

17 SUMMARY OF MITIGATION MEASURES AND CONCLUSIONS 17-1
17.1 Summary of Mitigation Measures 17-1
17.1.1 Dublin Harbour Capital Dredging Project Mitigation Measures 17-1
17.1.2 Implementation of Construction Phase Mitigation Measures 17-13
17.1.3 Dublin Harbour Capital Dredging Operational Phase 17-15
17.2 Conclusions 17-15
17.2.1 Need for the Dublin Harbour Capital Dredging Project 17-16
17.2.2 Project Description 17-18
17.2.3 Examination of Alternatives 17-19
17.2.4 Scoping Consultation 17-19
17.2.5 Risk of Major Accidents 17-20
17.2.6 Biodiversity, Flora & Fauna 17-20
17.2.7 Land, Soils, Geology & Hydrogeology 17-21
17.2.8 Water Quality 17-22
17.2.9 Air Quality & Climate Change 17-22

17.2.10 Terrestrial Noise & Vibration 17-23
17.2.11 Underwater Noise 17-23
17.2.12 Material Assets - Coastal Processes 17-24
17.2.13 Cultural Heritage 17-25
17.2.14 Population & Human Health 17-25
17.2.15 Cumulative Effects & Environmental Interactions 17-26
17.2.16 Concluding Remarks 17-27

Bibliography & References .....

Appendices

Appendix 6-1 Dublin Port Company Emergency Diversion Routes

Appendix 6-2 Dublin Port Company Emergency Management Plan

Appendix 7-1 Full species/abundance matrix and species list.

Appendix 7-2 Poolbeg Outfall Dredging Disturbance Study

Appendix 8-1 Marine Institute Sampling Analysis Plan (2020)

Appendix 8-2 Hydromaster Sediment Chemistry Report (2020)

Appendix 8-3 Sediment Chemistry Laboratory Reports (2020)

Appendix 8-4 Material Analysis Reporting Form (2020)

Appendix 8-5 Eco-Toxicological Sampling and Analysis Plan 2020

Appendix 8-6 ASU Eco-Toxicological Report

Appendix 8-7 2006-2020 Sediment Chemistry Trend Analysis Data

Appendix 8-8 EPA Radiological Analysis Report (2018)

Appendix 13-1 Hydromaster Plume Monitoring Programme (2020)

Appendix 13-2 RPS Model Validation Report

Appendix 14-1 Hydromaster Marine Geophysical Survey Report (2020)

Appendix 15-1 Human Health Baseline

Appendix 16-1 Stage 1 & 2 Identification and shortlisting of existing and/or approved projects

GLOSSARY OF TERMS

AA	Appropriate Assessment
AADT	Annual Average Daily Traffic
AAGR	Average Annual Growth Rate
ABC	Construction noise assessment method
ABR	Alexandra Basin Redevelopment
ABP	An Bord Pleanála
ADCO	Archaeological Diving Company Ltd
ADCP	Acoustic Doppler Current Profilers
AEP	Annual Expedience Probability
AERMOD	Atmospheric dispersion modeling system
AG4	Air dispersion modelling from industrial installations ***guidance*** notes
BAT	Best Available Technique
Bankseat	Abutment to support a ramp in order to provide safe and fast access for loading and unloading a ship.
BCI	Bat Conservation Ireland
BCT	Bat Conservation Trust
bgl	below ground level
Break bulk	Loose cargoes such as reels of paper, bales of timber. Also includes project cargoes such as power transformers, wind turbine components.
BUGS	Bike User Groups
Bulk Liquid	Primarily comprises petroleum products (such as petrol, diesel, aviation fuel) but also includes products such as molasses.
Bulk solid	Products such as animal feed, grains, cereals, peat moss, scrap steel loaded / discharged using quay side cranes with grab attachments.
CD	Chart Datum, depths in the Port vary with tidal conditions and all depths (and heights) are referenced to an appropriate datum point called “chart datum”.
CDL	Coal Distributors Limited, also refers to a mooring structure on the south side of the River Liffey, near the Poolbeg power station owned by Coal Distributers Limited
CDM	CDM Smith, consulting engineers
CEMP	Construction Environmental Management Plan
CFRAM	Catchment Flood Risk and Management
CIÉ	Córas Iompair Éireann
CIEEM	Chartered Institute of Ecology & Environmental Management
CIRIA	Construction Industry Research and Information Association
CISS	cast-in-steel-shell, concrete piers fabricated within a steel shell.

CL	Conservation Limit, the number of adult fish of a particular species that are needed to return to a system each year to spawn in order to maintain a healthy sustainable population in the system.
CNG	Compressed Natural Gas
CO	Carbon Monoxide
CO2	Carbon Dioxide
CO_{2eq}	Total estimated greenhouse gas emissions
COSHH	Control of Substances Hazardous to Health
CPT	Carriage Paid To
CRTN	Calculation of Road Traffic Noise
CTMP	Construction Traffic Management Plan
cSAC	Candidate Special Area of Conservation
CSO	Central Statistics Office
DART	Dublin Area Rapid Transport
DAHG	Department of Arts, Heritage and the Gaeltacht
dB(A)	Decibel, expression of sound level. The (A) denotes that levels are “A”- weighted.
DBT	Dibutyltin
DDDA	Dublin Docklands Development Authority
Deadman	Buried structure to serve as an anchor for a quay wall
DEDs	District Electoral Divisions
DCC	Dublin City Council
DCIHR	Dublin City Industrial Heritage Record
DEHLG	***Department of the Environment Heritage and Local Government***
DFT	Dublin Ferry Terminal
DGPS	Differential Global Positioning System
DHI	Danish Hydraulic Institute
DIN	Dissolved Inorganic Nitrogen
DMRB	Design Manual for Roads and Bridges
DO	Dissolved Oxygen
DOS	Degree of Saturation
DPC	Dublin Port Company
Dry Bulk	Cargoes of free flowing dry solids such as grain or sand
DS	Directional Signage
Dublin Port Estate	DPC owned lands in the north port area bounded by the River Liffey to the south and East Wall Road to the west.
EA	Environment Agency
EAL	Environmental Assessment Level

EC	European Community
EEA	***European Environment Agency***
EIAR	Environmental Impact Assessment Report
EIS	Environmental Impact Statement
EMEP	European Monitoring and Evaluation Programme, European policy to identify and measure air pollutants
EMS	Environmental Management System
EPA	***Environmental Protection Agency***
EQS	Environmental Quality Standard
ERBD	Eastern River Basin District
ES	Estuarine Species, fish species dependent on estuaries.
ESB	***Electricity Supply Board***, also refers to a mooring structure on the south side of the River Liffey, near the Poolbeg power station owned by the Electricity Supply Board
EU	European Union
EUNIS	European Nature Information System
FRA	Flood Risk Assessment
FRAM	Flood Risk Assessment Management
GDA	Greater Dublin Area
GDP	Gross Domestic Product
GES	Good Environmental Status
GGBS	Ground Granulated Blast Furnace Slag
GLVIA	Guidelines for Landscape and Visual Impact Assessment
GPS	Global Positioning System
GSI	***Geological Survey of Ireland***
GHG	Green House Gas
Gross tonnes	Dublin Port measures cargo tonnage in gross tonne. The CSO, on the other hand, uses net tonnes. In the case of bulk liquid, bulk solid and break bulk, gross tonnes and net tonnes are the same. For unitised freight (Ro-Ro or Lo-Lo), gross tonnes includes the weight of the shipping container or trailer; net tonnes includes the weight of the goods themselves plus immediate packaging. For port operations, gross tonnes is a more useful measure as ship carrying capacity, crane handling capacities and road / rail capacities are determined by gross tonnage.
HCB	Hexachlorobenzene
HD	Hydro Dynamic
H_{mo}	Significant wave height
H_2S	Hydrogen sulphide
HAT	Highest Astronomical Tide
Hectare	Land areas in Dublin Port are referred to in hectares (where one hectare is equivalent to 2.47 acres and is equal to 10,000m^2).

HGV	Heavy Goods Vehicle
HS	Hydrographic Surveys Ltd., environmental and hydrographic survey company
HSA	***Health and Safety Authority***
Hz	Hertz, SI unit of frequency. It is defined as the number of cycles per second of a periodic phenomenon.
HV	Heavy Vehicle
ICAN	noise and vibration consultancy
ICOMOS	International Council on Monuments and Sites
ICPSS	Irish Coastal Protection Strategy Study
IFI	***Inland Fisheries Ireland***
IGSL	Ground investigation and geotechnical company
IMO	***International Maritime Organization***
INFOMAR	Integrated Mapping for the Sustainable Development of Ireland's Marine Resources.
INSS	Irish National Seabed Survey
IPPC	Integrated Pollution Prevention Control
ISO	International Standards Organisation
ISPS	International Ship and Port Security code, originally introduced by the IMO (International Maritime Organisation) and later incorporated into EU legislation.
IQI	***Infaunal Quality Index***, assessment of the ecological status based on the soft ***sediment*** infaunal communities of transitional and coastal waters.
ITAP	Institut für technische und angewandte Physik GmbH, a measuring body for noise emission
ITM	***Irish Transverse Mercator,*** geographic coordinate system for Ireland
IUCN	***International Union for Nature Conservation***
IUFT	Interim Unified Ferry Terminal
IWeBS	Irish Wetland Bird Survey
IWDG	***Irish Whale and Dolphin Group***
MS	Marine Stragglers, fish species which are fully marine and are only occasionally found in the lower reaches of estuaries.
JNCC	***Joint Nature Conservation Committee***
L_{Aeq}	The continuous equivalent A-weighted sound pressure level. This is an “average” of the sound pressure level.
L_{Amax}	This is the maximum A-weighed sound level measured during a sample period.
L_{Amin}	This is the minimum A-weighted sound level measured during a sample period.
$L_{night,outside}$	Threshold of night noise exposure for the purposes of assessing overall annoyance.
LAT	Lowest Astronomical Tide
LCS	Land Control Systems
LGV	Light Goods Vehicle

Linkspan	Structure to level the height difference between the quay and the cargo deck of a ship in order to provide safe and fast access for loading and unloading.
LV	Light Vehicle
Lo-Lo	Lift-on Lift-off , cargo mode which involves shipping containers lifted on and off ships with quayside cranes
LOI	Loss on Ignition, method of calculating organic matter content of soil samples
LVIA	Landscape and Visual Impact Assessment
MARPOL	International Convention for the Prevention of Pollution From Ships
MDS	Multidimensional Scaling
MEPC	Marine Environment Protection Committee
MHWM	Mean High Water Mark
MIKE	Coastal process modelling software
MM	Marine Migrant, marine fish species that use estuaries primarily as nursery grounds but usually spawn and spend much of their adult life at sea, while often returning seasonally to estuaries when adult.
MMP	Mobility Management Plan
MMO	Marine Mammal Observer, a qualified marine mammal observer is a visual observer who has undergone formal marine mammal observation training.
MRP	Molybdate Reactive Phosphorus
MSFD	Marine Strategy Framework Directive
MSL	Mean Sea Level
MTL	***Marine Terminals Ltd.,*** shipping & forwarding agents
NBDC	National Biodiversity Data Centre
NCEHD	National Civil Engineering Heritage Database
NCT	National Car Test
NHA	Natural Heritage Area
NIEA	***Northern Ireland Environment Agency***
NIR	Natura Impact Report
NMI	***National Museum of Ireland***
NNG	Night Noise Guideline
NO_2	Nitrogen Dioxide
NO_x	Oxides of nitrogen
NPWS	***National Parks and Wildlife Service***
NQE	North Quay Extension
NRA	***National Roads Authority***
NSS	National Spatial Strategy
NTA	National Transport Authority
NTS	Non-Technical Summary

NTS	Not To Scale (drawings)
OD	Ordnance Datum
ODOM	Single frequency portable hydrographic echo sounder
OEE	Office of Environmental Enforcement
OGV1	Other Goods Vehicle Type 1
OGV2	Other Good Vehicle Type 2
OMP	Odour Management Plan
OPW	***Office of Public Works***
OSPAR	Convention of fifteen Governments of the western coasts and catchments of Europe, together with the European Union, aiming to protect the marine environment of the North-East Atlantic.
P&O	Ferry operators
Pa	Pascal, SI derived unit of pressure. It is a measure of force per unit area, defined as one Newton per square meter.
PAH	Poly Aromatic Hydrocarbon
PAG	Project Appraisal Guidance
PCB	Polychlorinated Biphenyl
PCU	Passenger Car Units
PRC	Practical Reserve Capacity
PPV	Peak Particle Velocity
pNHA	Proposed Natural Heritage Area
$PM_{2.5}$	Particles measuring 2.5µm or less
PM_{10}	Particles measuring 10µm or less
PSA	Particle Size Assessment
PSD	Particle Size Distribution
PSV	Passenger Service Vehicle
pSPA	proposed Special Protected Area
PTS	Permanent Threshold Shift, a permanent elevation of the hearing threshold due to noise exposure
Ramsar	Convention on Wetlands of International Importance, an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.
RMP	Record of Monuments and Places
RNLI	***Royal National Lifeboat Institution***
RPII	***Radiological Protection Institute of Ireland***
RPS	Rural Planning Service, consulting engineers
RPS	Record of Protected Structures
Ro-Ro	Roll-on Roll-off, cargo mode which includes freight trailers, tourist vehicles and trade car imports all of which are driven on or off ferries / specialised ships.

SAC	Special Area of Conservation
SECA	Sulphur Emission Control Area
SEA	Strategic Environmental Assessment
SEPA	***Scottish Environmental Protection Agency***
SEL	Sound Exposure Level, the constant sound level in one second, which has the same amount of acoustic energy as the original time-varying sound i.e., the total energy of a sound pulse
SFPA	***Sea Fisheries Protection Authority***
SMRU	Sea Mammal Research Unit
SNIFFER	Scotland and Northern Ireland Forum for Environmental Research
SPAR	Southern Port Access Route
Standard Depth	The Standard Depth is the minimum depth to which the navigation channel or berths will be maintained. It is the minimum depth available for vessels, measured from Chart Datum. The dredged depth during capital or maintenance dredging operations may be below the Standard Depth to allow for dredging tolerances
$S0_2$	Sulphur Dioxide
SPA	Special Protection Area
SPL	Sound Pressure Level, a logarithmic measure of the effective sound pressure of a sound relative to a reference value.
S/S	Solidification/Stabilisation, remediation technology that relies on the reaction between a reagent and soil to reduce the mobility of contaminants
SSC	Suspended Sediment Concentration
SW	Spectral Wave, simplification of surface conditions giving the distribution of wave energy among different wave frequencies of wave-lengths on the sea surface.
TEN-T	Trans-European Transport Networks, a set of integrated international road, rail, air and water transport networks in Europe.
TEU	Twenty Foot Equivalent Unit. Shipping containers come in many lengths including 20”, 30”, 40” and 45”. TEU is used as an industry standard measurement for containers where a 20” is 1.0 TEU , a 40” 2.0 TEU and so forth. The TEU measurement particularly is useful when specifying container ship or container terminal capacities.
TICCIH	***The International Committee for the Conservation of the Industrial Heritage***
T_m	Mean wave period
TSAS	Trophic Status Assessment Scheme
TBT	Tributyltin
TBM	Temporary Benchmark
TII	Transport Infrastructure Ireland
TTA	Traffic and Transport Assessment
TSP	***Total Suspended Particulate***
TTS	Temporary Threshold Shift, a temporal elevation of the hearing threshold due to noise exposure

UN	***United Nations***
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UFT	Unified Ferry Terminal
Units Unitised	Freight can be in the form of shipping containers or trailers. The sizes of shipping containers vary and are measured in terms of TEU . Trailers vary to a lesser extent and are generally 13.6m long. Trailers are shipped either accompanied (by a road tractor unit and driver) or unaccompanied. In general each unit of unitised freight moved by road will generate at least one HGV movement into the Port and a second one out of the Port.
URPACTII	Programme funded by the European Regional Development Fund to develop a strategy for the development of cruise traffic and the urban regeneration of city ports.
USEPA	***United States Environmental Protection Agency***
UTC	Coordinated Universal Time
UWWT	Urban Waste Water Treatment
VDV	Vibration Dose Value
VMU	Vertical Mixed Use
VMS	Variable Message Signage
VOC	Volatile Organic Compound
W	Historic shipwreck inventory
WFD	Water Framework Directive
WHO	***World Health Organisation***
y-HCH	Lindane
ZVI	Zone of Visual Influence

1 INTRODUCTION

1.1 Context

This Environmental Impact Assessment Report (EIAR) has been prepared by RPS on behalf of Dublin Port Company (DPC) for the Dublin Harbour Capital Dredging Project, for which two consents are being sought:

- Foreshore Licence from the Department of Housing, Local Government and Heritage (DHLGH); and
- Dumping at Sea Permit from the Environmental Protection Agency (EPA).

The capital dredging requirements are taken from the Dublin Port Masterplan 2040, reviewed 2018.

DPC is seeking consents of an 8-year duration to facilitate the capital dredging works.

This EIAR will be used to support the relevant assessments to be carried out by the respective competent authorities required for consent.

This chapter of the EIAR introduces the project for which consent is sought and documents the procedures that were followed in preparing this EIAR.

1.2 Purpose of the EIAR

Environmental Impact Assessment (EIA) is a procedure under the terms of European Directives[1] for the assessment of the likely significant effects of a project on the environment. An Environmental Impact Assessment Report (EIAR) is a statement prepared by the applicant, providing information on the likely significant effects on the environment based on current knowledge and methods of assessment. It is carried out by competent experts, with appropriate expertise, to provide informed assessment within their discipline.

The primary objective of the EIAR is to identify the baseline environmental context of the proposed project, predict potential beneficial and/or adverse effects of the project and propose appropriate mitigation measures where necessary. In preparing the EIAR, the following legal provisions and guidelines were considered:

- the requirements of EU Directives and Irish law regarding Environmental Impact Assessment *(including the European Union (Planning and Development) (Environmental Impact Assessment)* Regulations 2018);
- European Commission Environmental Impact Assessment of Projects Guidance on the preparation of the Environmental Impact Assessment Report (Directive 2011/92/EU as amended by 2014/52/EU)(European Commission, 2017);
- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (Environmental Protection Agency, Draft August 2017);
- Draft Advice Notes for Preparing Environmental Impact Statements, (EPA 2015);

[1] *EU Directive 85/337/EEC as amended by Directives 2011/92/EU and DIRECTIVE 2014/52/EU*

In addition, specialist disciplines have had regard to other relevant guidelines, as noted in the specific chapters of the EIAR.

1.3 Function of the EIAR

This EIAR is a report of the effects, if any, which the proposed project, if carried out, would have on the environment and includes the information specified in Annex IV of the Environmental Impact Assessment Directive. The EIAR is the document prepared on behalf of the applicant that presents the output of the assessment conducted on behalf of the applicant, and contains information regarding:

- the project;
- the likely significant effects of the project;
- the baseline scenario;
- the proposed alternatives;
- the features and measures to mitigate adverse significant effects;
- any additional information specified in Annex IV of the EIA Directive; as well as
- the Non-Technical Summary.

The EIAR must include the necessary information for the competent authority to reach a reasoned conclusion and should be of a sufficient quality to enable this judgement. Many of the EIA Directive's requirements and provisions aim to ensure that the EIAR is of a sufficient quality to effectively serve this purpose. Article 5 of the EIA Directive sets out what must be included in the EIAR, and how to ensure that it is both of a sufficient high quality and complete.

The EIAR has been prepared following an examination, analysis and evaluation of the direct and indirect significant effects of the project in relation to the receiving environment.

1.4 Technical Difficulties or Lack of Data

The compilation of the information necessary for the EIAR did not present any significant difficulties. In addition to published datasets, the preparation of the EIAR has drawn on the environmental monitoring programme which is currently in place for the construction of the Alexandra Basin Redevelopment (ABR) Project, the first Strategic Infrastructure Development brought forward to planning from the Dublin Port Masterplan 2040, and which is currently at the construction stage of development. The monitoring programme comprises:

- continuous noise and dust monitoring at two locations;
- periodic vibration monitoring;
- continuous water quality monitoring within the inner Liffey channel at four locations (turbidity, dissolved oxygen, temperature, salinity);
- continuous water quality monitoring within Dublin Bay at four locations (turbidity at three depths). This is complemented by continuous wave climate and tidal current measurements.

- Passive Acoustic Monitoring (PAM) for Harbour Porpoise detection at two locations within Dublin Bay;
- Static Acoustic Monitoring (SAM) for Harbour Porpoise detection at four locations within Dublin Bay;
- records of marine mammal sightings by MMOs during dredging and piling operations;
- benthic surveys of the licenced dumping at sea site at the entrance to Dublin Bay;
- monthly seal surveys at Bull Island;
- lamprey surveys within the Liffey;
- wintering waterbird surveys within the South Dublin Bay & River Tolka Estuary SPA;
- tern colony surveys;
- black guillemot surveys; and
- underwater noise surveys during piling and dredging activities to validate models used to assess the impact on migratory fish and marine mammals.

The site-specific scientific data collected to date was used to support the preparation of the EIAR for the Dublin Harbour Capital Dredging Project and serves to illustrate the depth of understanding of the environment in and around Dublin Port, including the inner Liffey channel (Dublin Harbour) and Dublin Bay.

The preparation of the EIAR was further assisted by the extensive environmental datasets collated during the preparation of the Strategic Environmental Assessment (SEA), for the purposes of the review of the Dublin Port Masterplan during 2017 and 2018.

Additional survey work has been undertaken in order to provide up-to-date baseline information on which to undertake the environmental assessments, in addition to the site-specific information from the existing databases from official sources.

1.5 The Applicant & Masterplan

Dublin Port Company (DPC) is a State-owned commercial company responsible for operating and developing Dublin Port.

Dublin Port is the largest freight and passenger port in Ireland, with all cargo handling activities being carried out by private sector companies operating in intensely competitive markets within the port.

Dublin Port has been identified as a Core Port of international significance in the Trans European Network (TEN-T) Guidelines and it forms part of the European Union's Core Transportation Network, and it is also designated a Tier 1 Port of national importance in the National Ports Policy 2013.

Dublin Port's large share of national port volumes, particularly in the Roll-On Roll-Off (Ro-Ro) and Load-On Load Off (Lo-Lo) modes, arises due to a combination of two factors; location and depth of water. Dublin Port is a key part of the national port system and DPC seeks to ensure that it plays its role in providing national port capacity. For all of Ireland's major national ports, it is essential that capacity constraints do not emerge which could lead to supply chain inefficiencies. The Dublin Port Masterplan 2040, reviewed 2018, seeks to ensure that no capacity constraints emerge in Dublin Port between now and 2040.

The Masterplan 2012-2040 was first adopted by the Board of DPC on 26th January 2012, and published in February 2012. In the eight years since, it has guided the development of the port particularly through three major initiatives:

- Firstly, the Alexandra Basin Redevelopment (ABR) Project obtained planning permission in July 2015 and construction is now underway. The ABR Project includes a significant capital dredging programme to deepen Dublin Port's navigation channel from a standard depth of -7.8m Chart Datum (CD) to -10.0m CD.
- Secondly, the construction of the 44 hectare Dublin Inland Port, located 14 km from Dublin Port, has commenced, following a grant of planning permission by Fingal County Council, and will allow non-core port-related activities to be relocated away from Dublin Port. This, in turn, will free up much needed land close to the quays and berths in Dublin Port for the transit storage of cargo.
- Thirdly, the MP2 Project which obtained planning permission in July 2020. The MP2 Project complements the ABR Project in providing capacity for growth in the Ro-Ro and Lo-Lo modes on the north side of the port and at its eastern end in addition to providing suitable infrastructure for increasing numbers of ferry passengers.

In the years from 2012 to 2020, five significant policy documents have been published:

- National Ports Policy, 2013;
- DPC's Franchise Policy, 2014;
- Dublin City Development Plan 2016 – 2022;
- Project Ireland 2040 National Planning Framework, 2018; and
- DPC's Dwell Time Policy, 2019

There has been unanticipated and strong economic recovery after the 2008 recession which has led to large growth in cargo volumes from 28.1m gross tonnes in 2011 to 39.0m gross tonnes in 2020, an increase of 35.2%.

Against this background, a review of the Masterplan 2012-2040 was completed in 2018 and this review led to two fundamental conclusions:

- Firstly, where the Masterplan had originally envisaged a return to an eastern expansion of Dublin Port into the Tolka Estuary, DPC is no longer pursuing this as an option.
- Secondly, to meet anticipated capacity requirements, Dublin Port needs to be developed on the basis of an average annual growth rate (AAGR) in port volumes of 3.3% over the 30 years from 2010 to 2040, rather than the 2.5% originally assumed in 2012.

Since the review in 2018 two developments with significant potential to impact economic growth and capacity requirements at Dublin Port have occurred, Brexit in January 2020 and the Covid-19 pandemic response initiated in March 2020. Both of these events are assessed in Chapter 2 of this EIAR. Their overall impact is considered to be transitory and the resulting economic slowdown in the years to 2030 will have no perceptible influence on the medium to long term demand for additional port capacity.

Therefore, the conclusions above create a significant degree of certainty on the ultimate scale and impact of Dublin Port on the city, the environment and on local and national transport networks.

Between now and 2040, major development projects are envisaged on both the north side of the port and on the Poolbeg Peninsula, as envisaged in the Dublin Port Masterplan 2040. These projects include capital dredging works to complete the deepening of the navigation channel and basins from -7.8m CD to -10.0m CD and to provide for deep water berths. These projects will be subject to detailed scrutiny in terms of their environmental impact and, particularly, their potential impact on Natura 2000 sites in or near Dublin Bay.

Given the high growth rates projected, and the need to cater for this growth without further eastern expansion into the Tolka Estuary, DPC will only bring forward development projects which are consistent with the principles of proper planning and sustainable development, and which can be objectively demonstrated not to adversely affect the environment in all its facets, including the integrity of Natura 2000 sites.

DPC is challenged to complete major infrastructure projects without disruption to the port's large and increasing throughput of both cargo and passengers.

Dublin Port's Masterplan 2040 provides the necessary framework to allow these essential projects to be brought forward for consent and to be completed in time to meet demand. The Masterplan also indicates to all of the port's stakeholders how the port will be developed to meet their needs in the years ahead.

The past and projected growth to 2040 is in large part due to the growth in the country's population. In 1950, the population was 3.0m and by 2040 is projected to grow to 5.6m. Over this period, volumes through Dublin Port are projected to increase 27-fold from 2.9m gross tonnes in 1950 to 77.2m in 2040.

Port infrastructure is long lived. For instance, Dublin Port critically depends, for its depth of water and sheltered berths; firstly, on the 18th century Great South Wall; and, secondly on the North Bull Wall, completed in 1824. These breakwater structures, which today are of significant historic value, remain the port's primary line of defence against storm waves entering Dublin Bay from the expansive waters of the Irish Sea. The maintenance and long-term stability of the Great South Wall and the North Bull Wall are thereby essential to the operation of Dublin Port.

In addition to accommodating increased port capacity, the Dublin Port Masterplan 2040 also guides the development of Dublin Port to achieve a second and equally important objective of integrating Dublin Port with Dublin City and with Dublin Bay. This will involve a range of projects and initiatives based on the port's heritage and on the natural environment.

Dublin Port is an essential part of Dublin and contributes to the life of the city in many ways. Dublin Port is a crucial part of the national infrastructure which facilitates merchandise trade in and out of Ireland. The port is also of key importance to the national tourism sector as an important gateway for visitors to Ireland. The contribution that Dublin Port makes to the national and regional economy and to the people of Ireland as a strategic piece of infrastructure gives port lands, navigation channel and berths their real intrinsic value.

Dublin Port is a significant focal point for employment in Dublin, both directly through businesses operating in the port and regionally through enterprises supported by the trading activity carried out at the port. An efficient and dynamic Dublin Port will contribute to the generation of more employment in the economy.

The Dublin Harbour Capital Dredging Project is now being brought forward for consent from the Dublin Port Masterplan 2040.

1.6 The Dublin Harbour Capital Dredging Project

The Dublin Harbour Capital Dredging Project at Dublin Port is being proposed for consent in accordance with the Dublin Port Masterplan, reviewed 2018.

Figure 3 in the Masterplan (reproduced in Figure 1-2) identifies the land uses and infrastructure projects on port lands which will allow the port to increase its capacity to 77.2 million gross tonnes by 2040. The Masterplan identifies that this is the ultimate capacity of Dublin Port.

The Dublin Port Masterplan 2040 envisages that the development of Dublin Port to this ultimate capacity will be achieved by a number of significant infrastructure projects:

1. the Alexandra Basin Redevelopment (ABR) Project (29N.PA0034), which is under construction;
2. the construction of the Dublin Inland Port, located 14 km from Dublin Port, which has also commenced,
3. the MP2 Project, which received planning permission on 1 July 2020 (ABP-304888-19); and
4. a project on the Poolbeg Peninsula (as shown in Figure 1-2 including development of land areas K, L, M, N and O) and possibly also including the development of the Southern Port Access Route (SPAR) to provide connectivity between the Dublin Port Tunnel and the south port lands as envisaged in NTA's Transport Strategy for the Greater Dublin Area 2016 to 2035.

Figure 5 in the Masterplan (reproduced in Figure 1-3) provides an indicative layout of the navigation channel, basins and berthing pockets at Dublin Port at 2040.

The Dublin Harbour Capital Dredging Project brings forward for consent key elements of the capital dredging works required to create the required depth of the navigation channel, basins and berthing pockets.

The works proposed in the Dublin Harbour Capital Dredging Project are shown in Figure 1-4 and Figure 1-5 and comprise a number of elements:

- Deepening the navigation channel between North Wall Quay Extension and the Western Oil Jetty, including riverside Berth 35;
- Deepening of Alexandra Basin East and deepening/widening of berths;
- Deepening of the Oil Basin and widening of berths;
- Deepening of the Ferryport Basin;
- Deepening of riverside Berth 52;
- Widening the South Port (Berths 42 - 47) berths, and
- Removal of ridge between the navigation channel and the Poolbeg Oil Jetty (Berth 48).

The proposed capital dredging works will be restricted to the winter period (October – March). Maintenance dredging will be restricted to the summer period (April – September). This separation provides the clarity required by the EPA to enforce proposed separate capital and maintenance dredging Dumping at Sea Permits.

1.7 Requirement for the EIAR

The Dublin Harbour Capital Dredging Project falls within the following class of development identified in Environmental Impact Assessment (EIA) Directive 97/11/EEC, Annex II, 2. Extractive Industry:

(c) Extraction of minerals by marine or fluvial dredging

Annex II of this EU Directive has been transposed into Irish Legislation by S.I. No. 600/2001 – Planning and Development Regulations. The proposed capital dredging in Dublin Harbour falls under the following section of the 2001 Planning and Development Regulations (as amended):

Fifth Schedule Part II, 2. Extractive Industry

(d) Extraction of stone, gravel, sand or clay by marine dredging (other than maintenance dredging), where the area involved would be greater than 5 ha or, in the case of fluvial dredging (other than maintenance dredging), where the length of river involved would be greater than 500 m.

Screening, in respect of the Dublin Harbour Capital Dredging Project, was undertaken on behalf of the applicant. The area of the project is circa 27 ha. It was therefore determined that the thresholds set out in the EIA Directive, and applicable Irish Regulations, were exceeded, and therefore an Environmental Impact Assessment would be required to be undertaken by the relevant competent authorities on the respective applications for consent. This screening determination was confirmed by Dr Terry McMahon, Director of Marine Institute and former chair of the Marine Licensing Vetting Committee (MLVC).

For the purposes of the application for consent, the proposed capital dredging is taking place entirely within the foreshore and therefore falls under the remit of the Foreshore Act 1933 (as amended). The relevant competent authority is therefore the Department of Housing, Local Government and Heritage (DHLGH). An application for a Foreshore Licence is thereby required to be submitted to DHLGH supported by an Environmental Impact Assessment (EIA).

In this regard an EIAR is a requirement of the Foreshore Licence process. To facilitate the Minister for DHLGH in carrying out the necessary assessment, the application documentation includes an EIAR.

The competent authority for the Dumping at Sea Permit is the EPA. The EIAR will also be submitted to the EPA as supporting information.

1.8 Methodology and Structure of the EIAR

The main aim of this EIAR is to provide information on the project to the public, public concerned, prescribed bodies and the competent authority. To this end, Article 3(1) of the EIA Directive requires that significant effects are identified, assessed and described in an ‘appropriate manner’. Article 5(1) sets the form – the information should be presented in an EIAR that enables stakeholders and authorities to form opinions, and to make decisions regarding the project. While there are no formal requirements concerning the format and the presentation of the report, this EIAR clearly sets out the methodological considerations and the reasoning behind the identification and assessment of likely significant effects.

1.8.1 EIAR Content

Article 5(1) sets out what must be included as a minimum in the EIAR. Annex IV to the Directive, expands on these requirements. In short, this includes the following:

- A description of the project: this is an introduction to the project, and includes a description of the location of the project, its characteristics, including land use requirements during capital dredging operations and operational phases, as well as estimates of the expected residues, emissions, and waste produced during each phase.
- Baseline scenario: a description of the relevant aspects of the current state of the environment, and the likely evolution thereof, without the implementation of the project, on the basis of the availability of environmental information and scientific knowledge.
- Environmental factors affected: a description of the environmental factors likely to be significantly affected by the project, including consideration of climate change mitigation and adaptation, biodiversity, natural resource sustainability, and the risks of major accidents and disasters.
- Effects on the environment: a description of the likely significant effects of the project on the environment. Such significant effects include direct and indirect, secondary, cumulative, transboundary, short-term, medium-term and long-term, permanent and temporary, and positive and negative, as appropriate.
- Assessment of alternatives: a description of the studied reasonable alternatives to the project, with an indication of the main reasons for the selection of the option chosen, including a comparison of environmental effects.
- Mitigation measures: a description of the measures envisaged to avoid, prevent, reduce and, where possible, offset any identified significant adverse effects on the environment, including a determination of the effectiveness of such measures, their reliability and certainty, as well as the commitment to ensuring their practical implementation and monitoring of results.
- Monitoring: a description of any measures proposed to monitor significant adverse effects on the environment and/or measures taken to mitigate them.
- Non-Technical Summary: an easily accessible summary of the content of the EIAR presented without technical jargon, hence understandable to anybody without a background in the environment or the project.
- Quality of the EIAR: the experts responsible for preparing the EIAR are competent.

1.8.2 Assessment Methodology

Specific topic-related methodologies are outlined in this section.

Baseline Scenario

An assessment of the relevant aspects of the current state of the environment, and the likely progression thereof, without implementation of the project, is undertaken by relevant and qualified experts on the basis of the environmental data and scientific knowledge which is available.

The outcomes of the assessment are provided in a description of existing environmental conditions, and the do-nothing scenario, within each environmental topic chapter. This forms the foundation against which likely significant effects can be compared and evaluated. It further provides the basis upon which post monitoring can be used to measure change once the project has been initiated.

Environmental Factors

The following environmental factors are considered so as to appropriately identify, describe and assess the likely significant effects which might impact upon them as a result of the implementation of the project:

- biodiversity, flora and fauna;
- land, soils, geology and hydrogeology;
- water quality and flood risk;
- air and climate;
- noise and vibration;
- material assets - coastal processes;
- material assets - traffic and transportation;
- archaeology and cultural heritage;
- landscape and visual;
- population and human health; and
- waste.

Further to these, consideration is also given to the factors below. These are incorporated into assessment procedures so as to provide a complete understanding of the interaction between the project and the environment.

Climate Change

In addition to considering the effects of the project upon climatic factors, consideration is also given to the vulnerability of the project to future changes in the climate, and to its capacity to adapt to such changes into the future.

Accidents and Disasters

Consideration is given to the potential of the project to cause accidents and/or disasters (both natural and man-made), and to the vulnerability of the project to potential accidents and/or disasters.

Biodiversity

Further to consideration of the effects of the project upon flora and fauna, particularly with regard to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC, consideration is also given to the effects of the project upon biodiversity; understood to be the interactions and variety of, and variability within species, between species and between ecosystems.

Natural Resources

Consideration is given to the sustainability of resources, particularly with regard to land, soil, water and biodiversity, as well as energy. The assessment of the project's impacts upon the availability of natural resources is in addition to the assessment of the impacts of the project upon the resource itself.

Assessing Impacts

The identification, description and assessment of the effects of the project upon the aforementioned factors is premised upon an understanding of the likely magnitude of predicted impacts and the sensitivity to change of affected receptors. This provides for a determination of the likely significance of effects.

The baseline scenario relating to each environmental factor is used to identify potential receptors. The sensitivity of a given receptor is dependent on the receptor concerned, and the effect to which it is subject. For this reason, given that sensitivity is context-specific, it is thus defined within each topic chapter, but nonetheless considers:

- the vulnerability of the receptor;
- the capacity of the receptor to recover; and
- the value/importance attributed to the receptor.

An impact is defined as a physical change to the environment which is attributable to the implementation of the project. The impacts which are likely to arise, and their magnitude, are detailed within individual topic chapters. Nonetheless, unless otherwise stated, the magnitude of impacts generally takes into account factors such as:

- the extent of the impact;
- the duration of the impact;
- the frequency of the impact; and
- the capacity for the impact to be reversed.

The significance of an effect, defined in terms of the express consequence of an impact, is determined with regard to the magnitude of the impact and the sensitivity or value of the receptor. As a result, the level of significance of effects is defined separately within each chapter. With that being said, Figure 1-1 provides an indication of the general categorisation of the scale of significance:

Effects are also considered, and categorised, in terms of being direct and indirect, secondary, cumulative, transboundary, short-term, medium-term and long-term, permanent and temporary, and positive and negative, as appropriate.

Cumulative effects are changes to the environment that are caused by an action in combination with other actions. They can arise from a number of sources, where relevant, including:

- the interaction between all of the different projects in the same area; and
- the interaction between the various impacts within a single project.

More Significant  **Less Significant**	**Effects which are substantial.** They represent key factors in the decision-making process with regard to development consent. These effects are generally, but not exclusively, associated with site or features of international, national or regional importance that are likely to suffer the most damaging impact and loss of resource integrity.
	Effects which are major. These beneficial or adverse effects are considered to be very important considerations and are likely to be material in the decision-making process.
	Effects which are moderate. These beneficial or adverse effects may be important but are not likely to be key decision-making factors. The cumulative effects of such factors may influence decision making if they lead to an increase in the overall adverse effect on a particular resource or receptor.
	Effects which are minor. These beneficial or adverse effects may be raised as local factors. They are unlikely to be critical in the decision-making process but are important in enhancing the subsequent design of the project.
	Effects which are negligible. No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

Figure 1-1 General categorisation of the scale of significance

The cumulative effects of the Dublin Harbour Capital Dredging Project, in conjunction with other proposed projects, are considered within each topic chapter. Relevant developments considered within the cumulative assessments include those which are:

- under construction including other dredging and disposal activity;
- permitted, but not yet implemented;
- submitted, but not yet determined; and
- identified in the Development Plan (and emerging Development Plans – with appropriate weight being given as they move closer to adoption), recognising that much information on any relevant proposals is limited.

It is noted that projects that are built and operational at the time of submission are considered to be part of the existing baseline conditions.

Each topic chapter further considers whether there are significant cumulative effects which are likely to arise as a result of interaction between effects as part of the same project, so as to identify potential secondary, cumulative or synergistic effects.

Mitigation and/or Compensation Measures

Where required, mitigation measures are identified and described within individual topic chapters. These are measures which could further avoid, prevent, reduce and, where possible, offset likely significant adverse effects upon the environment.

A description of those adverse effects which proposed mitigation measures are intended to avoid, prevent, reduce or offset are provided in addition to a summary regarding the measure's effectiveness, reliability and certainty, as well as the commitment to ensuring their practical implementation and monitoring of results.

Monitoring

Further to mitigation measures, appropriate and proportionate monitoring measures are also identified and summarised within individual topic chapters.

Such monitoring measures may arise either as a result of legislative requirements and/or directly in relation to the effects of the project upon environmental factors. Nevertheless, duplication of efforts will be strictly avoided.

In any case, monitoring measures will be developed so as to ensure that:

- significant adverse impacts from the capital dredging operations and operational phase of the project do not exceed impacts projected in the EIAR, and that measures taken to avoid, prevent, reduce and/or offset such impacts are carried out as planned;
- mitigation methods can be assessed for robustness. This can help to improve the identification of impacts in future EIARs;
- the EIAR is in line with other EU legislation, especially the SEA Directive; and that
- the systematic ex-post impact monitoring of adverse significant effects, resulting from the project, offers an opportunity to identify if forecasted impacts are not developing as predicted, so that steps may be taken for rectification.

Conclusion on Likely Significant Effects

A conclusion by the authors of the EIAR on the likely significant effects of the Dublin Harbour Capital Dredging Project on the environment, taking into account the results of the examination of the information presented in the EIAR is provided. In addition, a summary of the key impacts and mitigation and monitoring measures associated with the proposed development is provided, along with a discussion of cumulative impacts, interactions and inter-relationships between environmental topics. This conclusion will inform the reasoned conclusion to be made by the competent authority in conducting the Environmental Impact Assessment.

1.8.3 Structure of the EIAR

The EIAR has been structured in accordance with the European Commission's Guidance "Environmental Impact Assessment of Projects Guidance on the preparation of the Environmental Impact Assessment Report (Directive 2011/92/EU as amended by 2014/52/EU)" (2017). Accordingly, the EIAR:

- is presented with a clear structure with a logical sequence that describes, inter alia, existing baseline conditions, predicted impacts (nature, extent and magnitude), scope for mitigation, proposed mitigation measures, significance of unavoidable/residual impacts for each environmental factor;
- contains a table of contents at the beginning of the document;
- comprises a description of the consent procedure and how Environmental Impact Assessment fits within it;

- reads as a single document with appropriate cross-referencing and is concise, comprehensive and objective;
- is written in an impartial manner without bias;
- includes a full description and comparison of the alternatives studied;
- makes effective use of diagrams, illustrations, photographs and other graphics to support the text;
- uses consistent terminology with a glossary;
- references all information sources used;
- has a clear explanation of complex issues;
- contains a good description of the methods used for the studies of each environmental factor;
- covers each environmental factor in a way which is proportionate to its importance;
- provides evidence of effective consultations;
- provides a basis for effective consultations to come;
- makes a commitment to mitigation (with a programme) and to monitoring;
- contains a Non-Technical Summary which does not contain technical jargon;
- contains, where relevant, a reference list detailing the sources used for the description and assessments included in the EIAR.

The EIAR is broken down into the following Chapters.

- Introduction
- Need for the Capital Dredging Project
- Project Description
- Examination of Alternatives
- Project Scoping and Consultation
- Risk of Major Accidents
- Subsequent chapters address specific environmental factors and provide a description of the existing environment, the likelihood of effects, the significance of effects, remedial and mitigation measures, residual impacts and monitoring measures. The specific environmental factors considered, following Environmental Impact Assessment Scoping as described in Chapter 5 of the EIAR, are:
  - Biodiversity, Flora and Fauna
  - Land, Soils, Geology and Hydrogeology
  - Water Quality
  - Air Quality and Climate

  - Terrestrial Noise and Vibration
  - Underwater Noise
  - Material Assets - Coastal Processes
  - Cultural Heritage
  - Population and Human Health
- Cumulative Effects and Environmental Interactions
- Summary of Mitigation Measures and Conclusion
- References and Bibliography
- Glossary of Terms

The advantages of using this type of format are that it is easy to examine each environmental topic and it facilitates easy cross-reference to specialist studies undertaken as part of the assessment.

Each topic of environmental assessment is considered as a separate chapter and is drafted by relevant specialists.

The EIAR is presented in three volumes of the application documentation, as follows:

- Volume 1 EIAR Non-Technical Summary
- Volume 2 EIAR Main Document
- Volume 3 EIAR Appendices

In addition to the EIAR and its appendices, the application for consent also includes:

- Populated Application Form
- Capital Dredging Drawings
- Screening for Appropriate Assessment & Natura Impact Statement

The following companies were involved in the preparation of the EIAR

- RPS – Lead Environmental consultants
- Irish Whale and Dolphin Group Consulting (IWDG) – Marine Mammals
- Aquatic Services Unit, University College Cork – Benthic Biodiversity and Fisheries
- ADCO – Cultural Heritage
- Natura - Avian Biodiversity
- Byrne Ó Cléirigh Consulting - Risk of Major Accidents (COMAH Land Use Planning Assessment)

The production of the EIAR has been co-ordinated by RPS. The EIAR structure, responsibility and qualified input for each chapter are detailed in Table 1-1.

Table 1-1 List of Contributors to EIAR Chapters

Chapter of EIAR	Lead Author(s)	Company	Subject	Qualifications
Chapter 1	Alan Barr	RPS	Introduction	BSc PhD CEng CSci CWEM FICE FIEI MCIWEM
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	Helena Gavin	RPS	Planning Policy	BA, MSc Town & Country Planning, PG Dip EnvEng, MIPI
Chapter 3	Alan Barr	RPS	Project Description	BSc PhD CEng CSci CWEM FICE FIEI MCIWEM
Chapter 4	Grace Glasgow	RPS	Examination of Alternatives	MEng EurIng CEng CSci CWEM FIEI FCIWEM FICE
Chapter 5	Ruth Barr Alan Barr	RPS	Project Scoping and Consultation	BSc (Hons) MSc CSci CWEM MCIWEM BSc PhD CEng CSci CWEM FICE FIEI MCIWEM
Chapter 6	Douglas Adamson	Byrne Ó Cléirigh Consulting	Risk of Major Accidents (COMAH Land Use Planning Assessment)	BA BAI ME(Mgmt) CEng MIEI MEI
Chapter 7	Gerard Morgan	Aquatic Services Unit, University College Cork	Benthic Biodiversity and Fisheries	BSc (Hons) MSc
	Simon Berrow	IWDG Consulting	Marine Mammals	BSc (Hons) PhD
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Chapter of EIAR	Lead Author(s)	Company	Subject	Qualifications
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Chapter 10	Paul Chadwick	RPS	Air Quality and Climate	BA (Mod) M.Phil AIEMA
Chapter 11	Stephen Cleary	RPS	Noise and Vibration	BA(Mod) MSc MIEMA MIOA CEnv
Chapter 12	Eugene McKeown	RPS	Underwater Noise	BE, LLB, MSc., C. Eng., MIoA, MASA
Chapter 13	Adrian Bell Kris Calder	RPS	Material Assets - Coastal Processes	BSc CEng FIAE FIEI MICE MIStructE BSc MSc CSci CWEM MCIWEM
Chapter 14	Niall Brady	ADCO	Cultural Heritage	PhD, FSA
Chapter 15	Andrew Buroni	RPS	Population and Human Health	PhD, MSc, BSc (Hons), Fellow of the Royal Society of Medicine, Fellow of the Royal Society for Public Health
Chapter 16	Daniel Hogan Alan Barr	RPS	Cumulative Effects	BSc MSc CSci CWEM MCIWEM BSc PhD CEng CSci CWEM FICE FIEI MCIWEM
Chapter 17	Alan Barr	RPS	Summary of Mitigation Measures and Conclusions	BSc PhD CEng CSci CWEM FICE FIEI MCIWEM

1.9 Viewing and Purchasing of the EIAR

The EIAR is available to view and download at the following dedicated web address www.dublinportdredgingforeshoreconsent.ie.

The EIAR can be viewed at the reception of the Dublin Port Centre, Alexandra Road, Dublin 1 during normal working hours. Hard copies and e-copies of the EIAR may also be purchased from Dublin Port Company at the reasonable cost of making such copy by phoning the following number during normal business hours, 01 8876000 and ask for Charlie Murphy or in his absence Edel Currie; or by post to Dublin Port Centre, Alexandra Road, Dublin 1; or by email to info@dublinport.ie

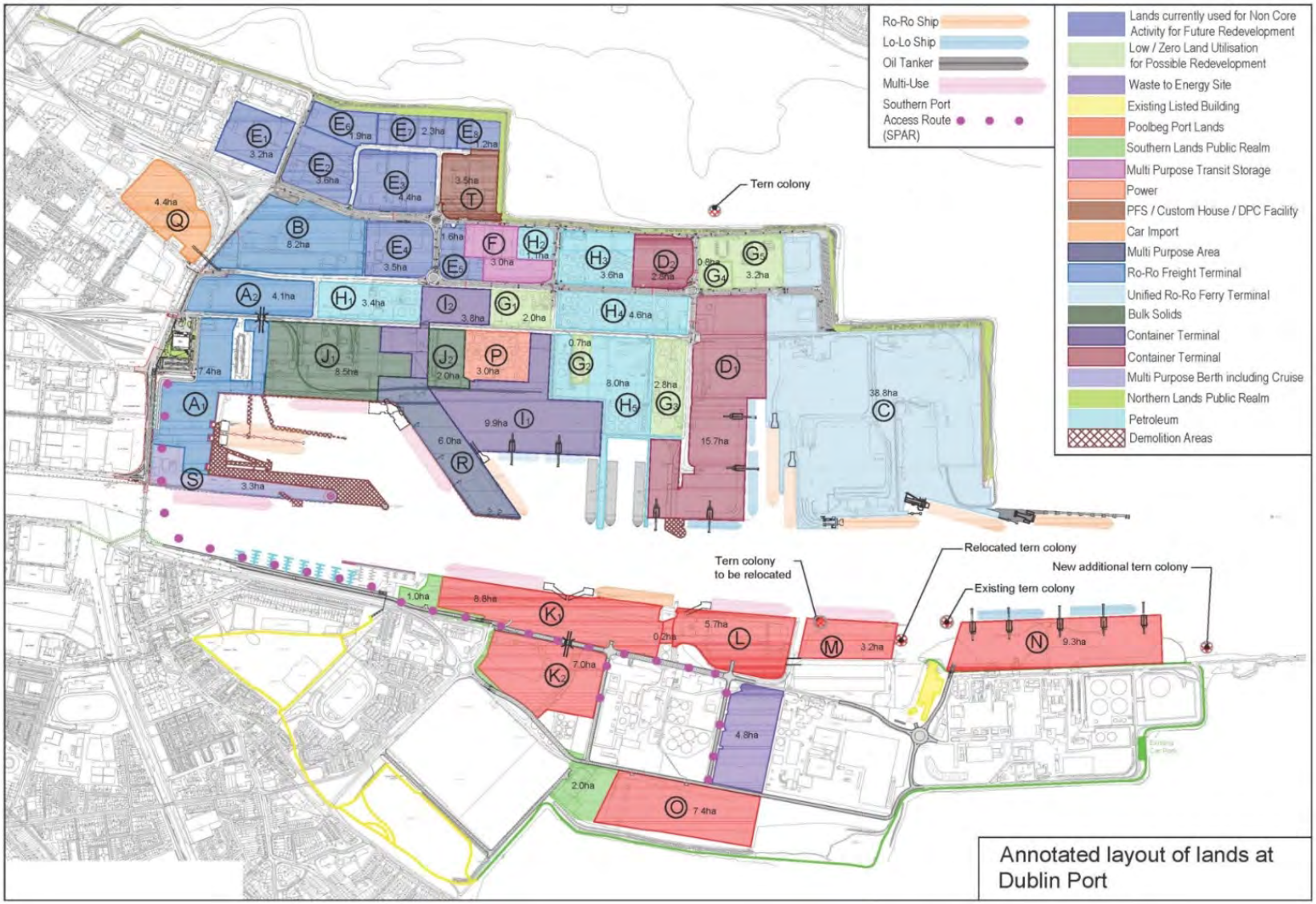


Figure 1-2 Dublin Port Masterplan 2040, reviewed 2018, Annotated Layout at Dublin Port (Reproduced from Figure 3 of the Masterplan)

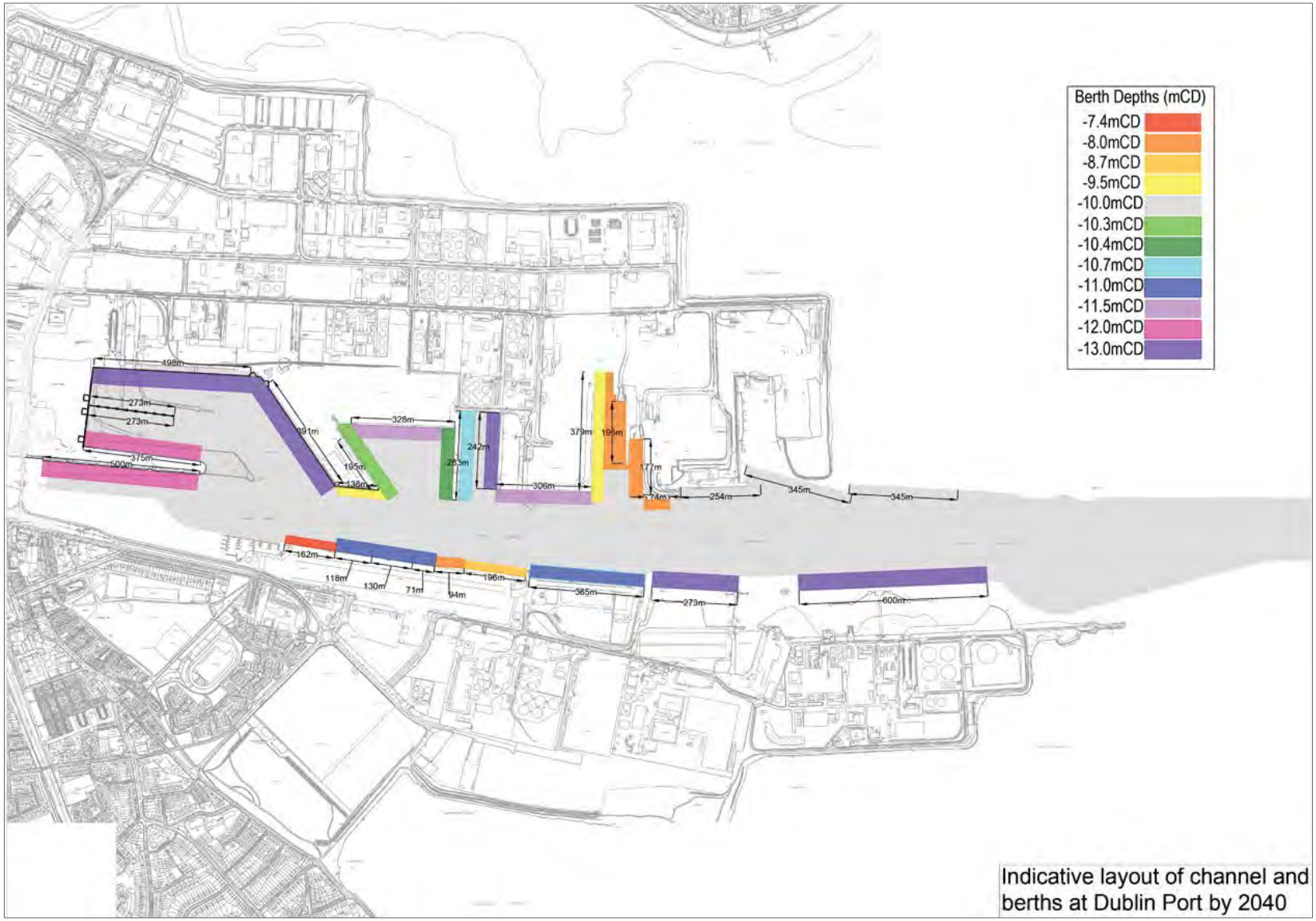


Figure 1-3 Dublin Port Masterplan 2040, reviewed 2018, Indicative Layout of channel and berths at Dublin Port at 2040

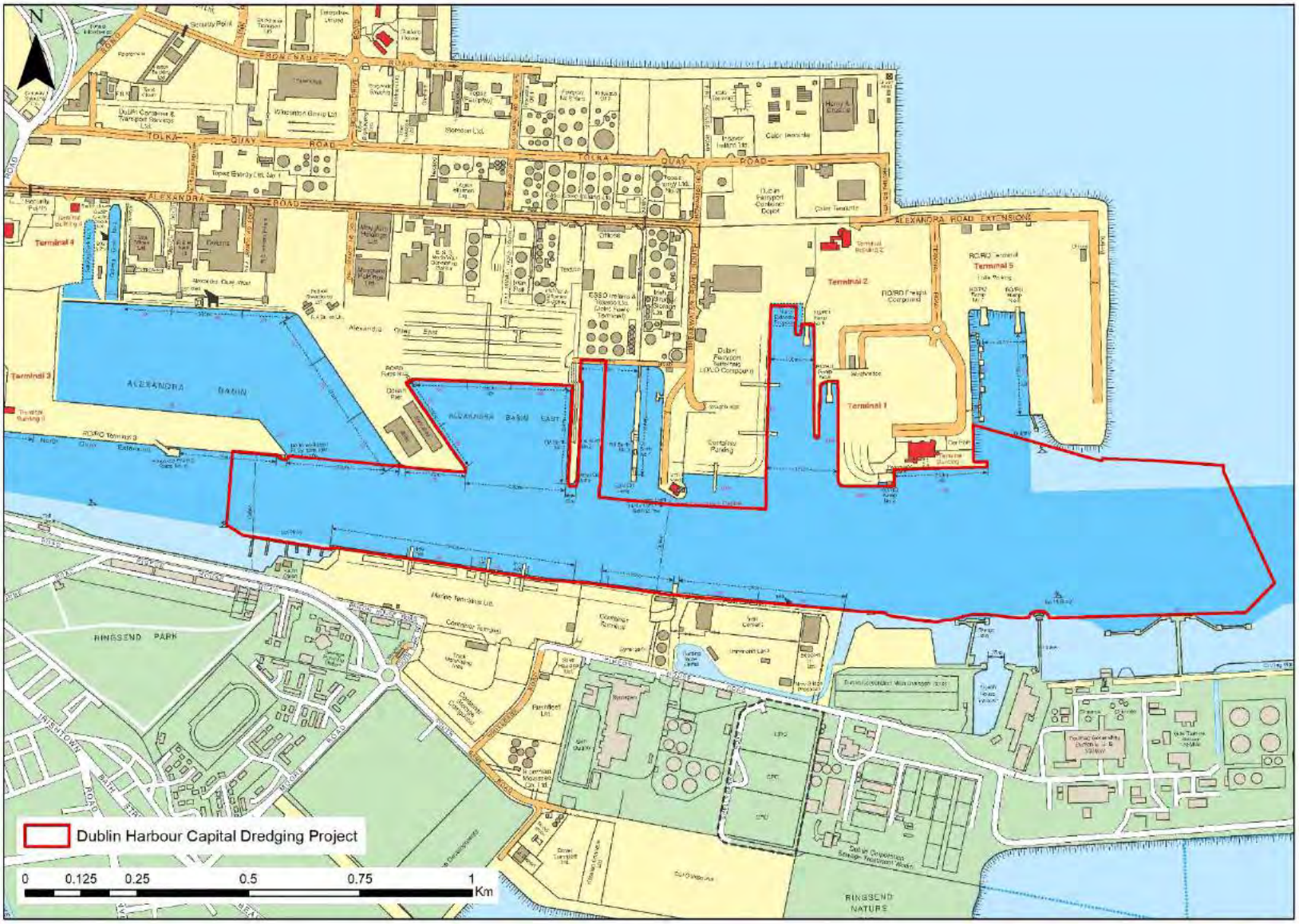


Figure 1-4 Existing Site with Foreshore Application Boundary on DPC Lithograph

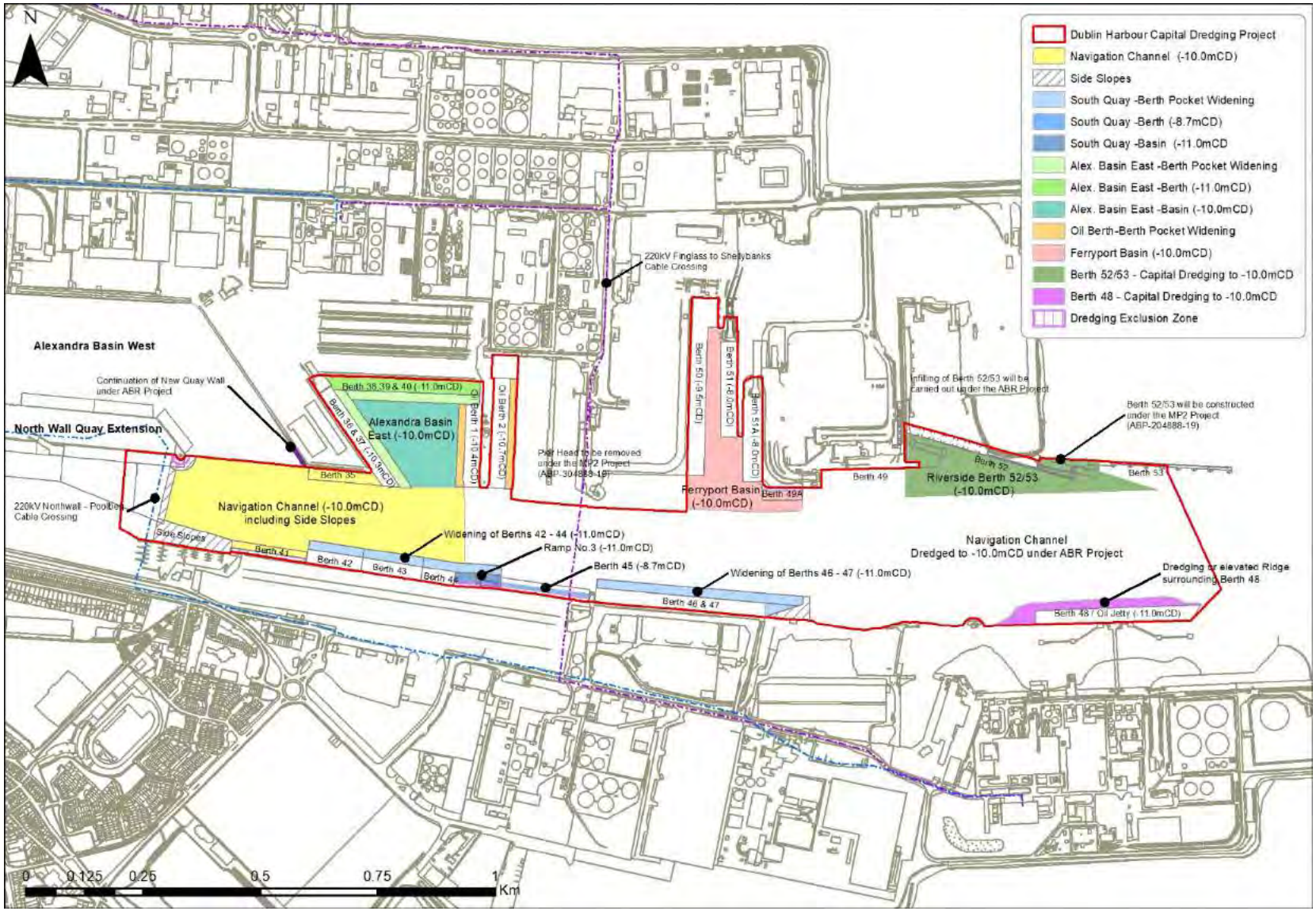


Figure 1-5 Main elements of the Dublin Harbour Capital Dredging Project

2 NEED FOR THE CAPITAL DREDGING PROJECT

2.1 Introduction

This chapter of the EIAR details the need for the Dublin Harbour Capital Dredging Project and examines this in the context of relevant spatial planning policy having regard to international, national, regional and local policy objectives.

This chapter should be read in conjunction with Chapter 3 'Project Description' which describes the Dublin Harbour Capital Dredging Project and provides information on the project site, design, size and other relevant features.

2.2 Project Rationale

2.2.1 Introduction

Dublin Port is the largest and most important port in the country. The combination of reasonable depth of water, proximity to the largest concentration of population on the island and excellent access to the national road and rail networks gives Dublin Port its importance in both the EU TEN-T network[1] and in the national port system.

In common with other important parts of national infrastructure, there has been significant underinvestment in Dublin Port for many decades. For example, for 31 years from 1979 to 2010 Dublin Port & Docks Board and latterly Dublin Port Company (DPC) sought permission to expand the port by infill into Dublin Bay opposite Clontarf rather than optimising existing quays and lands.

A new direction for the development of the Port was established by the Dublin Port Masterplan 2012-2040 published in February 2012.

The Masterplan was reviewed and updated and the current version is the Dublin Port Masterplan 2040 Reviewed 2018, published in June 2018.

Between the publication of the original Masterplan in 2012 and the updated version in 2018, the challenges facing the Port changed significantly due to a number of factors:

- Rapid economic recovery after the 2008 recession led to large growth in cargo volumes from 28.1m gross tonnes in 2011 to 38.0m gross tonnes in 2018, an increase of 35.2%.
- The country's population increased by 6.2% from 4.6m in 2011 to 4.9m in 2018.
- Following the referendum in the UK concerning Brexit in June 2016 and the UK's decision to leave the EU in January 2020, the patterns of trade have already begun to change with increased growth on services between Dublin and ports in Continental Europe such as Rotterdam, Zeebrugge and Cherbourg.

[1] The Trans European Network for Transport (TEN-T) is a central concept within EU Transport Policy as set out in the EU white paper *Roadmap to a Single European transport area – Towards a competitive and resource efficient transport system, COM(2011) 144 final* and in many EU policy and funding initiatives subsequently. The TEN-T network recognises ports as key nodes within the wider road, rail and shipping networks that facilitate trade within and outside the EU. There are 319 ports identified in the network. 83 (including Dublin) are in the *core* network and 236 are in the *comprehensive* network.

The review of the Masterplan modified DPC's view of how Dublin Port needs to be developed:

- Firstly, the long-term growth rate assumption for capacity planning[2] was increased from 2.5% to 3.3%
- Secondly, where the original Masterplan had posited the ultimate deepening of the Port to -12.0m CD, it is now accepted that the ultimate depth will be -10.0m CD.
- Thirdly, where the Masterplan published in 2012 had envisaged a possible return to the eastwards expansion of the Port, this has now been ruled out and all remaining developments will be based on the existing footprint of the Port.
- Finally, it is envisaged that major works in Dublin Port will need to be completed before 2040 at which stage the Port will have reached its maximum and ultimate capacity of 77.2m gross tonnes.

The ABR Project and MP2 Project are two of a series of Dublin Port Masterplan projects required to provide capacity for this growth. The Dublin Harbour Capital Dredging Project supports these significant infrastructure developments by providing sufficient water depth within Dublin Harbour's navigation channel, basins and berths for the safe movement of vessels to and from the port and whilst at berth.

2.2.2 Dublin Harbour Capital Dredging Project Objectives

The Dublin Harbour Capital Dredging Project has been carefully devised by DPC to ensure that:

- It is consistent with the Dublin Port Masterplan 2040
- The proposals selected for development make optimum use of the Port's finite resources of river berths and quayside lands
- The proposed configuration reflects and responds to assessments of the potential environmental impact of different options to achieve the project's objectives
- The chosen project option best meets all applicable environmental and ecological requirements
- The project can be constructed in a way that minimises the impact on existing port operations
- The proposed project is consistent with the principles of proper planning and sustainable development
- The project makes provision for future population growth and a concomitant increase in demand for port infrastructure at the location closest to where the need for additional capacity arises

The Dublin Harbour Capital Dredging Project (see Figure 2-1, repeated from Figure 1-5) is designed to provide:

- Deepening of the navigation channel from -7.8m CD to -10.0m CD between the North Wall Quay Extension and the Western Oil Jetty, including deepening of riverside Berth 35 (Ocean Pier) to -10.0m CD and widened to 50m.
- Deepening of Alexandra Basin East from -7.8m CD to -10.0m CD with Berths 36 and 37 widened to 50m and Berths 38, 39 and 40 deepened to -11.0m CD and widened to 50m.

[2] 30 year average annual growth rate of gross tonnes of cargo

- Deepening of the Oil Basin from -7.8m CD to -10.7m CD with Berths OB1 and OB2 widened to 50m.
- Deepening of the Ferryport Basin from -7.8m CD to -10.0m CD.
- Deepening of riverside Berth 52 to -10.0m CD following construction of the new Berth 52 quay under the MP2 Project (ABP-304888-19).
- Widening of South Port Berths 42, 43, 44, 45, 46 and 47 to 50m.
- Removal of ridge between the navigation channel and the Poolbeg Oil Jetty (Berth 48) to -10.0mCD.

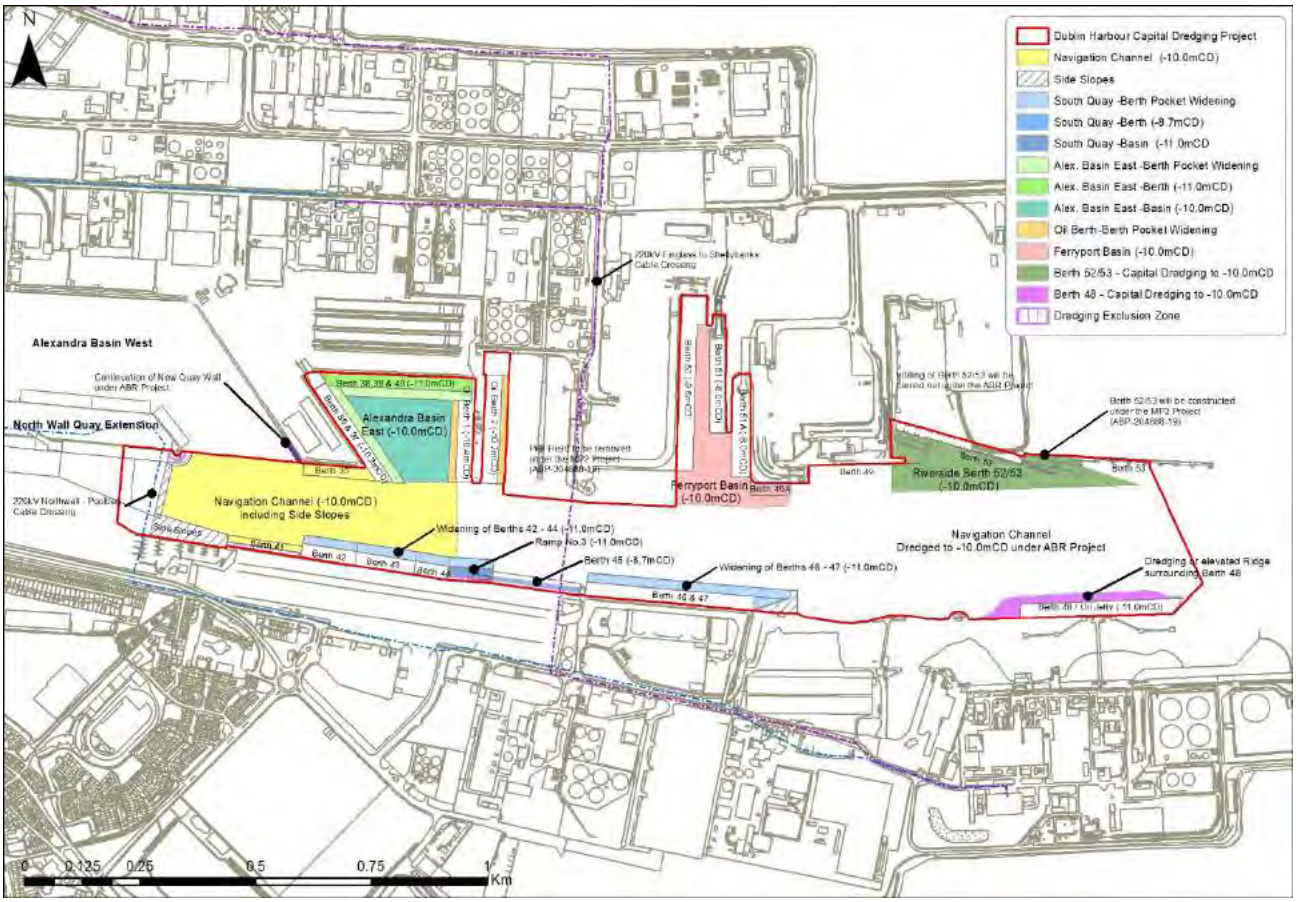


Figure 2-1 Main elements of the Dublin Harbour Capital Dredging Project

2.2.3 Projected Future Growth at Dublin Port

The need for the developments envisaged in the Dublin Port Masterplan 2040 arises from the level of future growth which DPC is projecting. The basis of these projections is discussed next by reference to trends over the long, medium and short terms.

Long-term growth trends (1950 to 2040)

The key driver of growth in Dublin Port is population increase. The *National Planning Framework* envisages the country's population growing by 20% from 2016 to 2040. This is equivalent to a population increase of just over one million with 49% of this increase occurring in the Eastern & Midland region, the natural hinterland of Dublin Port. Table 2-1 shows the historic and projected levels of national population and of Dublin Port cargo throughput from 1950 to 2040. The population projection for 2040 is the planning assumption used in the *National Planning Framework*. The volume projection for 2040 is from Dublin Port's Masterplan 2040.

Table 2-1 National population and Dublin Port volumes 1950 to 2040

	Population	Gross tonnes	AAGR
1950	3.0m	2.9m	
1980	3.4m	7.3m	3.2%
2010	4.6m	28.9m	4.7%
2040	5.6m	77.2m	3.3%

DPC looks at growth trends over long periods (30 years). The current planning projection of an average annual growth rate (AAGR) of 3.3% over the 30 years to 2040 is unremarkable by comparison with historic trends shown on Table 2-1.

Figure 2-2 shows the 30 year average annual growth rate from 1980 to 2018[3]. This indicates that the AAGR grew during the boom years to reach a high of 4.9% in 2008. It then fell to 4.5% in 2012 before beginning to grow again, reaching 5.5% in 2018.

The trend shown in Figure 2-2 suggests that the Masterplan's long-term planning growth rate assumption of 3.3% is more likely to be an underestimate than it is to be an over-estimate.

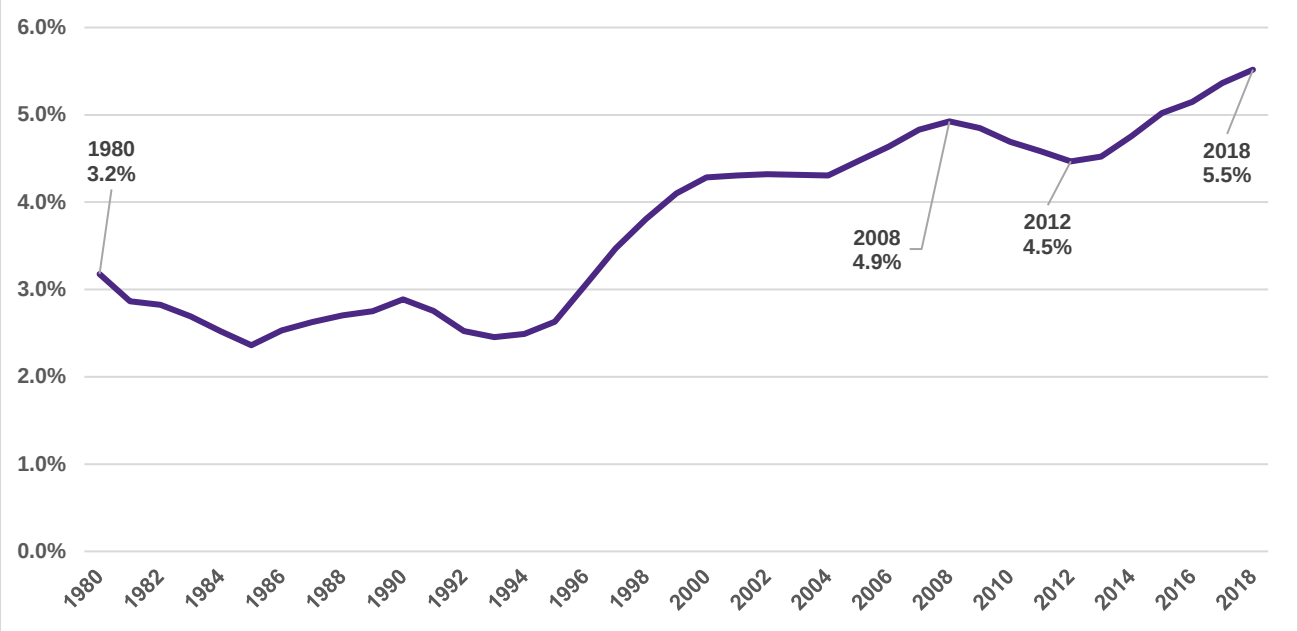


Figure 2-2 Thirty year Average Annual Growth Rates, 1980 to 2018

Medium-term growth trends (1995 to 2018)

The unitised modes (Ro-Ro and Lo-Lo) account for 82% of Dublin Port's throughput and 97% of the growth projected over the period to 2040 is in these modes.

[3] By way of explanation, the growth rate shown in 1980 is the average annual growth rate over the 30 years from 1950 to 1980. Likewise, the rate for 2018 of 5.5% is the average annual growth rate over the 30 years from 1988 to 2018.

The rapid increase in Dublin Port's unitised volumes began in the mid-1990s as result of major restructuring initiatives and reforms in Dublin Port in 1992. These changes led to an unprecedented period of growth every year from 1993 to 2007, a record year for overall throughput.

This growth was driven by the unitised modes and Ro-Ro volumes in Dublin Port and in 2018 were five times higher than they were in 1995. Lo-Lo volumes are two and a half times higher, as shown in Figure 2-3.

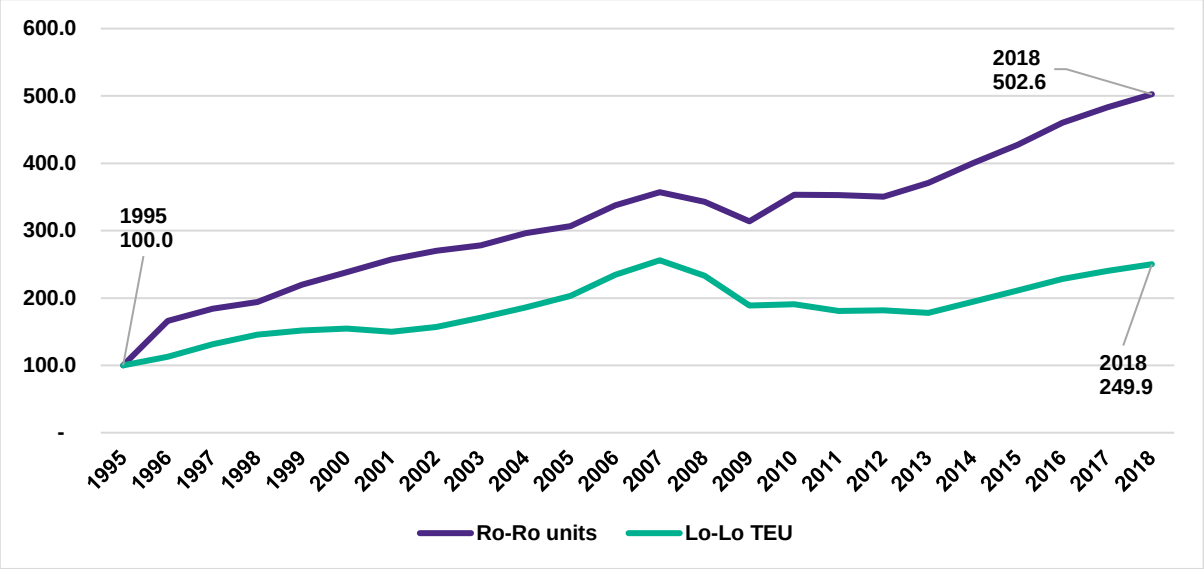


Figure 2-3 Trends in Dublin Port Ro-Ro and Lo-Lo, 1995 to 2018

Short-term growth trends (2013 to 2018)

Looking at more recent trends, Dublin Port's volumes have recovered strongly since the recession in 2008 and are now 23% higher than they were in 2007 (38.0m gross tonnes in 2018 compared to 30.9m in 2007). The growth trends seen from 1995 to 2007 have re-emerged as shown in Table 2-2.

Table 2-2 Year on year growth rates of Ro-Ro and Lo-Lo in Dublin Port, 2013 to 2018

	Ro-Ro	Lo-Lo
2013	5.9%	-2.0%
2014	7.9%	9.4%
2015	6.8%	8.6%
2016	7.6%	8.1%
2017	5.0%	5.2%
2018	4.0%	4.0%

DPC believes that future growth will slow down by comparison to recent trends as shown in Figure 2-3. These year-on-year growth rates combined with the actual growth from 2010 to 2016 suggest the 30 year growth rate to 2040 of 3.3%.

Table 2-3 Annual growth rates assumed 2017 to 2040

	Year on year growth rate
2017 to 2019	5.0%
2020 to 2029	4.0%
2030 to 2040	3.0%

Masterplan 2040 projections for Ro-Ro and Lo-Lo

Table 2-4 below shows the projected volumes and growth rates for Ro-Ro and Lo-Lo in the Dublin Port Masterplan 2040.

Table 2-4 Masterplan projections for Ro-Ro and Lo-Lo, 2010 to 2040

Dublin	2010	2040	AAGR (30)
Ro-Ro Units	701,000	2,249,000	4.0%
Lo-Lo TEU	641,000	1,574,000	3.0%

These projected levels of growth are consistent with historical trends over the long, medium and short terms. Importantly, they are also consistent with the *National Planning Framework's* Policy Objective 1b which foresees a growth in population of between 490,000 and 540,000 in the Eastern & Midland Region bringing the population in Dublin Port's natural hinterland to 2.85 million.

The ABR Project and MP2 Project are two of a series of Dublin Port Masterplan projects required to provide Dublin Port's ultimate capacity of 77.2m gross tonnes, based on an annual average growth rate of 3.3%. The Dublin Harbour Capital Dredging Project supports these significant infrastructure developments by providing sufficient water depth within Dublin Harbour's navigation channel, basins and berths for the safe movement of vessels to and from the port.

2.2.4 Impact of Brexit

The Dublin Harbour Capital Dredging Project will take place in the aftermath of Brexit.

In the context of the long life cycle for the development and operation of port infrastructure, DPC believes that the full impacts of Brexit (which are unknown) will be short-term.

Just as the enormous shock to the Irish economy in the recession post 2008 has already been absorbed and port volumes in 2019 reached a fifth consecutive annual record, so also the effects of Brexit in years to come are not expected to be significant.

These potential effects are twofold:

- Firstly, a diminution in economic growth with a consequent effect on the growth of port volumes.
- Secondly, a changing of trade patterns with an increasing proportion of Ro-Ro and Lo-Lo trade on direct routes to Continental Europe at the expense of UK routes.

The first effect is a timing effect. A negative economic impact from Brexit will result in a lower growth in port volumes than there would otherwise have been in future years. This is consistent with the February 2018 Copenhagen Economics Brexit report which concluded that a hard Brexit would reduce Ireland's GDP in 2030

by 7.0% compared to what it otherwise would have been with no Brexit[4]. Over the 12 years from 2019 to 2030, this 7.0% reduction would be equivalent to an annual reduction in GDP of 0.6%. Against a background of 36.0% growth in Dublin Port volumes over the six years to 2018, such a slowdown in the years to 2030 would have no perceptible influence on the demand for additional port capacity.

The second effect of changing trade patterns is already evident with increased deployment of new large ships (e.g. Irish Ferries *W.B. Yeats* and CLdN's *Celine* and *Laureline*) on direct routes to Continental Europe.

The Dublin Harbour Capital Dredging Project will facilitate the provision of sufficient depth of water to support these changed trade patterns.

2.2.5 Impact of Covid-19

During 2020, the Covid-19 pandemic has resulted in an unprecedented shock to the Irish economy and will undoubtedly lead to a sharp diminution in economic growth with a consequent effect on the growth of port volumes in the short term. The negative economic impact from Covid-19 will result in a lower growth in port volumes than there would otherwise have been in future years, however it is DPC's view that such a slowdown in the years to 2030 would again have no perceptible influence on the medium to long term demand for additional port capacity.

The Covid-19 pandemic shows that there can be unforeseen circumstances which impact on the timing of planned project works in Dublin Port. In such circumstances, it is very difficult to predict when individual projects within Dublin Port should commence.

2.2.6 Growth in ship sizes

The future growth in Ro-Ro and Lo-Lo will be accompanied by increases in ship sizes and the Dublin Harbour Capital Dredging Project will provide deeper and wider berths notably for Ro-Ro ferries and for Lo-Lo container ships.

The Dublin Harbour Capital Dredging Project is being proposed against a background where work is progressing within the ABR Project to deepen Dublin Port's navigation channel to -10.0m CD, from the Western Oil Jetty in Dublin Harbour to the -10.0m CD contour in Dublin Bay. Moreover, the Dublin Port Masterplan 2040 has confirmed that -10.0m CD will be the final depth of the navigation channel at Dublin Port.

These factors provide a clear context in which to relate the proposed capital dredging to future ship sizes.

The depth constraints in Dublin Port, Table 2-5 shows the maximum ship draughts which Dublin Port will be capable of handling. In order to be able to maintain set schedules, Ro-Ro ferries need to be able to access Dublin Port at all stages of the tide. Table 2-5 indicates that ferries with draughts up to about 9.7m will be able to access the port. This is sufficient for any conceivable size of Ro-Ro ferry that might be deployed by operators in the future

[4] Ireland & the Impacts of Brexit Strategic Implications for Ireland arising from changing EU-UK Trading Relations: https://dbei.gov.ie/en/Publications/Publication-files/Ireland-and-the-Impacts-of-Brexit.pdf

Table 2-5 Draught handling capabilities at -10.0m CD

	Mean high water	Channel depth	Max draught	Mean low water	Channel depth	Max draught
Spring tides	4.1m	14.1m	13.1m	0.7m	10.7m	**9.7m**
Neap tides	3.4m	13.4m	**12.4m**	1.5m	11.4m	10.4m
Note: max draughts assume an under keel clearance of 1.0m						

Table 2-6 shows the dimensions of selected Ro-Ro ferries including both ferries in service in Dublin Port or planned to be introduced together with ferries in service elsewhere or under construction.

Table 2-6 Sample Ro-Ro ferries

Ship	Operator	LOA	Draught	Comment
Ulysses	Irish Ferries	209m	6.4m	In service in Dublin Port since 2001
W.B. Yeats	Irish Ferries	195m	6.7m	In service in Dublin Port since January 2019
Hull 777	Irish Ferries	226m	6.7m	Commenced in Dublin Port in 2020
Stena Hollandica	Stena Line	240m	6.5m	In service on Harwich to Hook route
Stena E-flexer	Stena Line	215m	6.4m	Commenced in Dublin Port in 2019
Stena E-flexer	Stena Line	240m	6.4m	Construction of two ships commenced in July 2018
Celine	CLdN	234m	8.1m	In service in Dublin Port since October 2017
Laureline	CLdN	216m	8.2m	In service in Dublin Port since March 2019

In the case of Lo-Lo container ships, the maximum size which can currently be handled in Dublin is limited by a combination of constraints (including basin depth, berth depths/widths and channel depth) to give a practical maximum draught in the region of 9.0m. The maximum size of container ship which has called to the Port in recent years is in the order of 1,400 TEU.

The deepening of the Port to -10.0m CD as part of the ABR Project removes the channel constraint within the navigation channel from Dublin Bay as far as the Western Oil Jetty. The Dublin Harbour Capital Dredging Project would lessen the existing basin and berth constraints and allow large container ships to safely operate.

Table 2-7 shows an analysis of the distribution of ship draughts for 2,726 ships in the 1,000 TEU to 3,500 TEU subset of the worldwide fleet of container ships.

Table 2-7 Distribution of container ship draughts in the range 1,000 TEU to 3,500 TEU[5]

Length	# ships
100m	11
150m	327
200m	1,620
250m	737
300m	31
	2,726

Draught	# ships	Cumulative %
8.0m	100	3.7%
9.0m	460	20.5%
10.0m	574	41.6%
11.0m	545	61.6%
12.0m	829	92.0%
12.4m	111	96.1%
13.0m	76	98.9%
14.0m	31	100.0%
	2,726	

Comparing the draft handling capabilities in Table 2-5 with the distribution of ship draughts in Table 2-7 shows that the Dublin Harbour Capital Dredging Project would enable a large proportion of the world fleet of container ships in the capacity range from 1,000 TEU to 3,500 TEU to be handled at Dublin Port.

The ability to handle larger container ships at Dublin Port is essential if the increased throughput projected by the Dublin Port Masterplan 2040 is to be achieved.

2.2.7 Implementing the Dublin Harbour Capital Dredging Project – the need for 8 year consents

The Dublin Port Masterplan approach of redeveloping existing brownfield sites which are already in operation, to deliver strategic infrastructure projects such as the ABR Project and MP2 Project is not straightforward. The areas where much needed infrastructural improvements is required are in daily use and throughput volumes are expected to grow to 77.2 million tonnes by 2040.

DPC is currently constructing the ABR Project by way of discrete work packages designed to allow existing customers' growing businesses to continue with minimum disruption. The same approach will be necessary for the already consented MP2 Project.

The Dublin Harbour Capital Dredging Project supports these significant infrastructure developments by providing sufficient water depth within Dublin Harbour's navigation channel, basins and berths for the safe movement of vessels to and from the port. The same constraints are applicable whereby the project will need to be delivered through a series of discrete work packages to minimise disruption to existing port activities.

The experience of recent years suggests that there can be unforeseen circumstances which impact on the timing of planned project works in Dublin Port. In such circumstances, it is very difficult to predict when individual works packages within the Dublin Harbour Capital Dredging Project should commence.

[5] Based on data extracted from Sea-Web™ database (www.sea-web.com)

Because of such uncertainties, DPC requires an 8 year Foreshore Licence and associated Dumping at Sea Permit to provide the required flexibility to deliver the capital dredging project at the optimum times within that timeframe.

DPC estimates that the total cost of implementing the Dublin Port Masterplan 2040 will be in the order of €1.7 billion (2020 prices). In the shorter term, DPC has a €1 billion ten year capital expenditure programme from 2019 to 2028. By any standards, the scale of the infrastructural development challenge in Dublin Port is enormous.

In this dynamic environment, the construction timescales for individual projects within the overall Masterplan development programme are liable to change in response to circumstances. This is an inevitable consequence of DPC's preferred sustainable approach to the brownfield development of the existing Dublin Port estate rather than the less sustainable greenfield development at another location where construction timelines could be far shorter and more certain. DPC's choice of the brownfield approach rather than a greenfield approach is founded on DPC's commitment to the principles of proper planning and sustainable development.

The framework of the Dublin Port Masterplan (including the 2018 review) and the related Strategic Environmental Assessment (SEA) and Natura Impact Statement (NIS) in conjunction with the Environmental Impact Assessment Report (EIAR) and the NIS at the project level of the Dublin Harbour Capital Dredging Project provide a robust basis for DHLGH and the EPA to complete all relevant environmental assessments to facilitate consents of 8 years duration.

The environmental appraisals presented in this EIAR have taken into account the environmental implications of an 8-year consent and conclude that there is no environmental impediment to the granting of an 8-year consent. A summary is presented below:

- The environmental appraisals have been undertaken within the context of the Strategic Environmental Assessment (SEA) prepared for the Dublin Port Masterplan which is based on an assessment of incremental time periods from 2018 to 2040.
- The footprint of the Dublin Harbour Capital Dredging Project lies entirely within Dublin Harbour (no capital dredging is proposed within Dublin Bay). There are no benthic habitats, flora & fauna of conservation value within the application boundary of the site. Prolonged capital dredging activities over an 8-year period will therefore have no impact on biodiversity, flora & fauna as no natural changes are expected within that period of time.
- The Dublin Harbour Capital Dredging Project has been engineered to ensure that any potential impact on the surrounding Natura 2000 sites is at a *de minimis* level. The capital dredging period of 8-years has been assessed in the biodiversity, flora & fauna appraisals.
- No prolonged nuisance to the local communities is expected as a result of an 8-year capital dredging period because of the relatively low noise emissions generated by the dredging operations and the distance separation from the dredging operations and the nearest noise sensitive receptors
- It is however accepted that marine sediments not dredged within the first 5 years of the consent would need be subject to further sediment chemistry sampling and analysis, and eco-toxicological testing, if

required, in accordance with OSPAR Guidelines. DPC accept that this should be conditioned by the Foreshore Licence and Dumping at Sea Permit.

2.3 Spatial Planning Policy

2.3.1 Introduction

This section of the EIAR considers EU, national, regional and local land use and transport planning and development policy guiding and regulating the development of Dublin Port. Figure 2-4 illustrates an overview of the Irish Planning System and the importance of policy in the assessment of planning applications. The relevant planning policies are set out for each level within the hierarchy in the sections that follow.

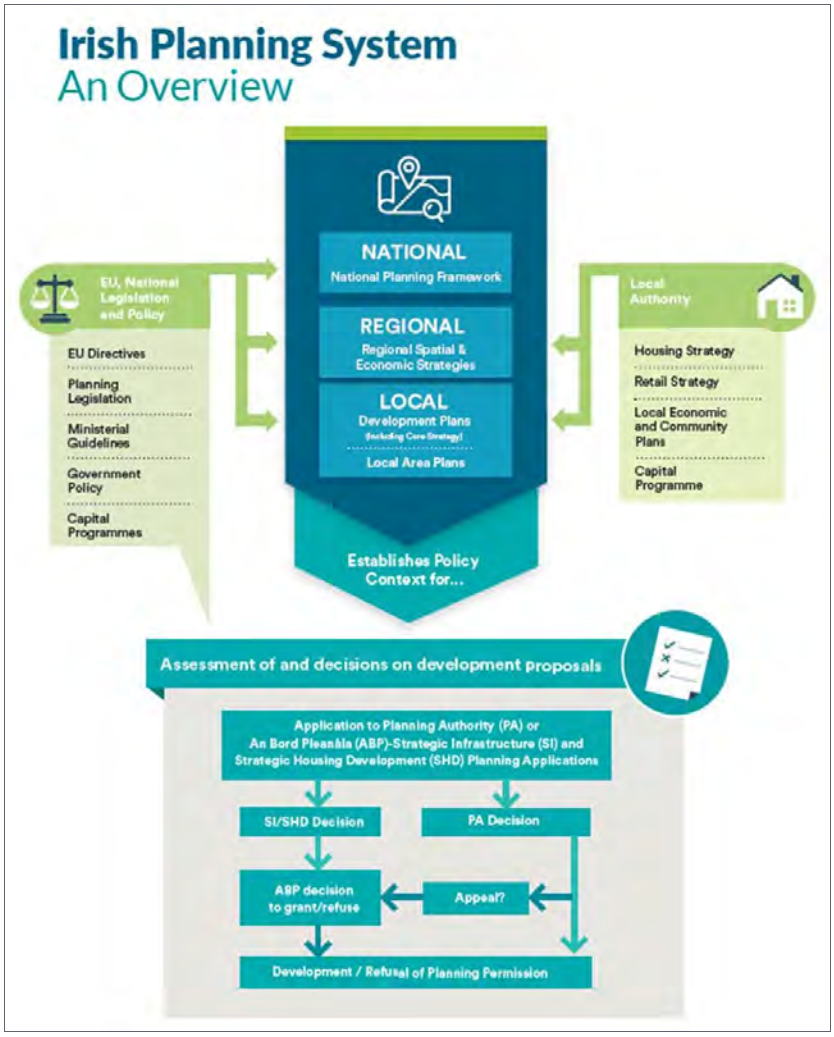


Figure 2-4 Planning Policy Hierarchy (Source: Project Ireland 2040 National Planning Framework, May 2018)

2.3.2 Relevant European Planning and Development Policy

2.3.2.1 Trans European Network – Transport (TEN-T)

The EU has defined a Trans European Network-Transport (TEN-T) which connects the major European urban areas and includes the major European transport corridors and multimodal hubs. The TEN-T network provides integrated international long-distance high speed routes. The network involves the provision of guidance and investment.

Ports are a key part of the TEN-T and Dublin Port is a core port on the TEN-T network. Dublin Port is a designated node on the North Sea-Mediterranean Core Network Corridor as shown in Figure 2-5. Dublin Port capital projects, including the ongoing ABR Project (Board Ref. PL 29N.PA0034), are grant funded under the TEN-T Programme and supported by finance from the European Investment Bank (EIB).

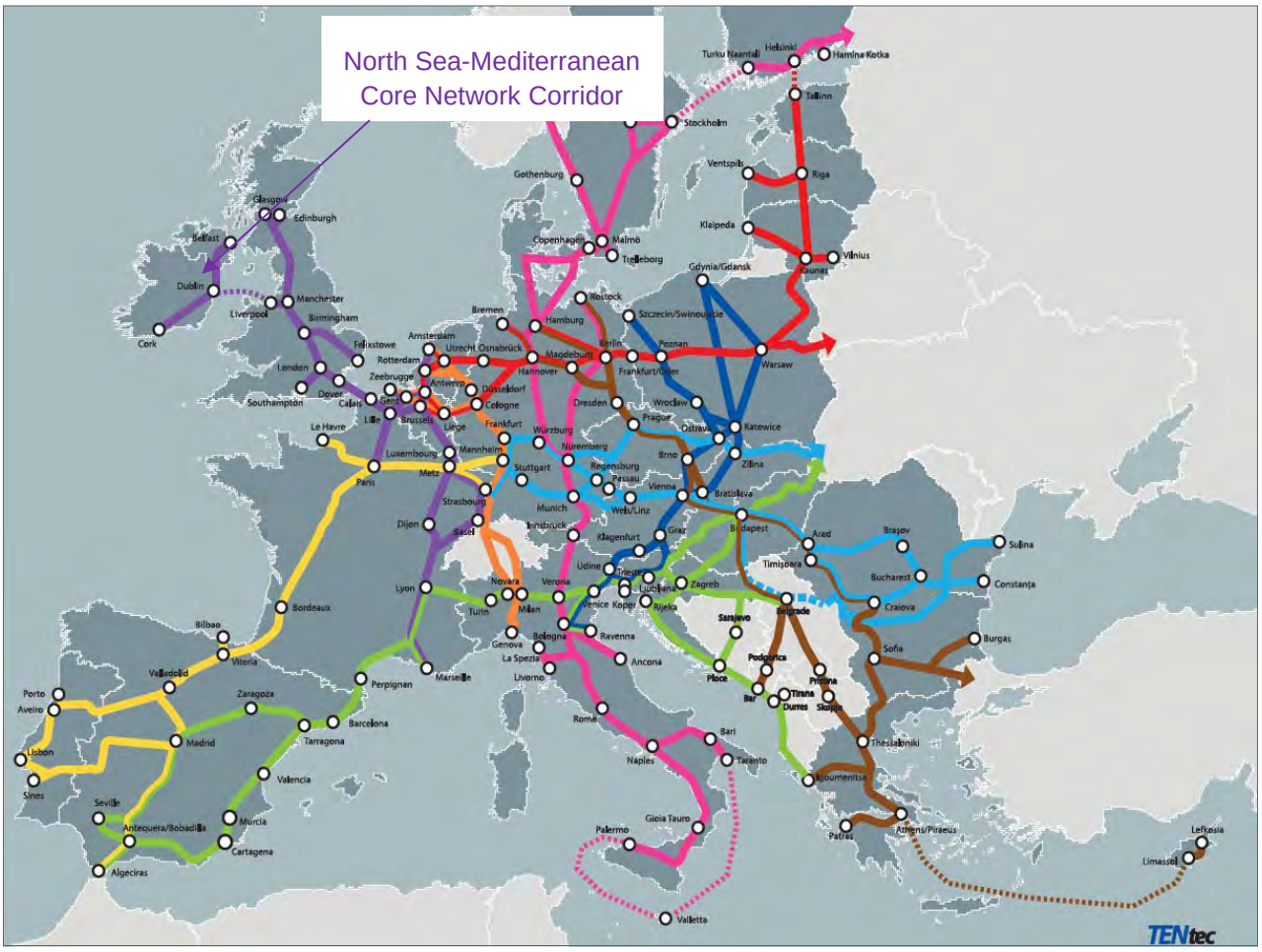


Figure 2-5 TEN-T Core Network Corridors (Pre-Brexit)

The programme envisages coordinated improvements to transport infrastructure thereby creating integrated and intermodal long-distance, high-speed corridors. Motorways of the Sea are considered the maritime pillar of the TEN-T and contribute towards the achievement of a European Maritime Transport Space without barriers, connecting Core Network Corridors by integrating the maritime leg and also facilitating maritime freight transport with neighbouring countries. Dublin Port is a designated node on the North Sea-Mediterranean Core Network Corridor (shaded purple on Figure 2-5).

In view of the withdrawal of the United Kingdom from the EU on 31st January 2020, the parts of the alignment of the North Sea – Mediterranean Core Network Corridor related to the United Kingdom have become obsolete. Recognising this Regulation (EU) 2019/495 amending Regulation (EU) No 1316/2013 provides for a realignment of the corridor. This regulation also make provision for infrastructure for purposes of security and checks on external borders.

2.3.2.2 Marine Spatial Plan

In 2014, the adoption of Directive 2014/89/EU established an EU-wide framework for maritime spatial planning. The directive details the main goals and minimum requirements for Member States as follows:

- Balanced and sustainable territorial development of marine waters and coastal zones;
- Optimised development of maritime activities and business climate;
- Better adaptation to risks; and
- Resource-efficient and integrated coastal and maritime development.

Marine spatial planning may be defined as—

> *"… a process by which the relevant Member State's authorities analyse and organise human activities in marine areas to achieve ecological, economic and social objectives"* (Directive 2014/89/EU).

Ireland transposed the Directive through the European Union (Framework for Maritime Spatial Planning) Regulations 2016, signed into law on 29th June 2016. A National Marine Spatial Plan must be in place by 2021.

2.3.3 Relevant National Planning and Development Policy

2.3.3.1 Project Ireland 2040 National Planning Framework

Project Ireland 2040 National Planning Framework, published in July 2018, is the primary articulation of spatial, planning and land use policy within Ireland. The framework recognises the role ports play in supporting the Irish economy stating:

> *"We depend on the quality and efficiency of our ports to a far greater extent than many of our trading partners. To maintain economic growth, we must be capable of delivering additional port capacity in a timely and predictable manner".* (page 94)

The framework recognises the National Ports Policy stating:

> *"National ports policy requires Tier 1 and Tier 2 ports, or ports of national and regional significance, to lead the response in meeting Ireland's future port capacity requirements. There are major redevelopment projects taking place at our Tier 1 ports (i.e. Dublin, Cork and Shannon-Foynes) at present. These developments will result in a greater concentration of traffic through these ports, with implications for shore-based and marine-based infrastructure.*
>
> *The long-term international trend in ports and shipping is toward increased consolidation of resources in order to achieve optimum efficiencies of scale. This has knock-on effects in terms of vessel size, the depths of water required at ports and the type and scale of port hinterland transport connections.*
>
> *Tier 1 ports are located within close proximity to Dublin, Cork and Limerick and the role of these ports will be considered and addressed in tandem with long-term infrastructural requirements as part of the relevant Regional Spatial and Economic Strategy and concurrent and subsequent metropolitan area or city/county development plan processes".* (pages 102-103)

National Policy Objective 40 states:

> *"Ensure that the strategic development requirements of Tier 1 and Tier 2 Ports, ports of regional significance and smaller harbours are addressed as part of Regional Spatial and Economic*

> *Strategies, metropolitan area and city/county development plans, to ensure the effective growth and sustainable development of the city regions and regional and rural areas".* (page 103)

National Strategic Outcome 4 outlines "High-Quality International Connectivity". The framework notes that, nationally, infrastructure objectives have been identified to improve land transport connections to the major ports. Infrastructure requirements pertaining to Dublin Port are identified as:

> *"Facilitating the growth of Dublin Port through greater efficiency, limited expansion into Dublin Harbour and improved road access, particularly to/from the southern port area".* (page 37 & 142)

Dublin Harbour Capital Dredging Project is consistent with national infrastructure policy and objectives.

2.3.3.2 National Development Plan

The implementation of the National Planning Framework will be fully supported by the Government's investment strategy for public capital investment. The *National Development Plan 2018-2027* identifies the strategic priorities for public capital investment in order to underpin the implementation of the National Planning Framework.

The National Development Plan strongly supports the continued development and improvement in Ireland's ports and strengthening access routes to ports.

The National *Development Plan 2018–2027* (NDP) identifies strategic priorities for public capital investment in order to underpin the implementation of the NPF.

National Strategic Outcome 6 *"High-Quality International Connectivity"* seeks to target continued investment in port and airport connections to the UK, the EU and the rest of the world. Given that Ireland is an island this is considered by the NDP to be integral to underpinning international competitiveness. It is also central to responding to the challenges as well as the opportunities arising from Brexit. Strategic Investment Priorities 2018–2027 allocate €4.8 billion to Airports and Ports.

It is envisaged by the NDP that this investment will strongly support the continued development and improvement in Ireland's ports and State airports by the relevant responsible commercial State Owned Enterprises (SOEs), consistent with sectoral priorities already defined through National Ports Policy and National Aviation Policy.

The NDP continues that significant investment in Ireland's airports and ports will play a major role in safeguarding and enhancing Ireland's international connectivity which is fundamental to Ireland's international competitiveness, trading performance in both goods and services and enhancing its attractiveness to foreign direct investment. The NDP clearly states that the importance of this objective cannot be understated in the context of the UK's exit from the EU.

Dublin Harbour Capital Dredging Project supports the next phase of this capital infrastructure programme at Dublin Port and is consistent with national policy.

2.3.3.3 National Ports Policy

The *National Ports Policy* is the statement of national policy underpinning the development and operation of Ireland's ports. Ports are divided into Ports of National Significance (Tier 1), Ports of National Significance (Tier 2) and Ports of Regional Significance.

Within the Irish Ports Policy, Dublin Port is a Port of National Significance (Tier 1) where Tier 1 ports are responsible for 15% to 20% of overall tonnage through Irish ports (of which Dublin Port handles 44%), and have clear potential to lead the development of future port capacity in the medium and long term, when and as required.

Referring specifically to the *Dublin Port Masterplan* the *National Ports Policy* confirms that:

> *"The Government endorses the core principles underpinning the company's Masterplan and the continued commercial development of Dublin Port Company is a key strategic objective of National Ports Policy".* (page 25)

The *National Ports Policy* highlights that the relationship and interaction between the commercial ports sector and the planning and development system is extremely important in ensuring continued sustainable development of the ports sector. It continues that:

> *"The provision of adequate and efficient capacity into the future is a crucial Government strategic objective".* (page 43)

To this end the policy document states:

> *"Therefore, Government expects the Ports of National Significance (Tier 1) to lead the response of the State commercial ports sector to future national port capacity requirements……It is the Government's position that those ports considered to be of national significance must be capable of the type of port capacity required to ensure continued access to both regional and global markets for our trading economy".* (page 44)

With respect to the planning policy hierarchy the *National Ports Policy* confirms:

> *"National and Regional Planning Guidelines should also recognise the importance of the three categories of ports and allow for their continued development. To this end, the Department contributes as necessary to the development of Regional Planning Guidelines in order to ensure that the goals of National Ports Policy are recognised in the planning hierarchy".* (page 45)

To this end, the Department contributes as necessary to the development of Regional Planning Guidelines in order to ensure that the goals of *National Ports Policy* are recognised in the planning hierarchy.

2.3.3.4 National Marine Spatial Plan

Marine Spatial Planning (MSP) in Ireland is underpinned at the highest level by the European Marine Spatial Planning Directive (Directive 2014/89/EU) (MSPD). This Directive sets out the date by which member states must have in place plans for their seas, 31st March 2021, as well as articulating a range of activities that must be included within the MSP process and plan. The MSPD is reflected in domestic law through the Planning and Development (Amendment) Act 2018. The Act describes MSP in Ireland as being made up of one marine spatial plan for the entire of the maritime area and/or different marine spatial plans for different parts of the maritime area with the singular plan or suit of plans.

Ireland's first marine spatial plan, National Marine Planning Framework (NMPF), will serve as a parallel to the NPF, will set out the Government's long-term planning objectives and priorities for the management of our seas

over a 20-year time frame. It will create an overarching framework for marine decision-making that is consistent, evidence based and secures a sustainable future for Ireland's marine area.

A draft NMPF was published in Q3 2019 for a period of public engagement and consultation (this follows an earlier engagement phase on the development of the NMPF Baseline Report), with the final plan due in 2021. Both the draft and final plan will set out specific objectives and marine planning policies for all of the activities taking place in Ireland's seas, from aquaculture through to waste water treatment.

2.3.3.5 Marine Planning Policy Statement (Consultation Draft)

The Department of Housing, Local Government and Heritage is currently inviting submissions on the Marine Planning Policy Statement. The Marine Planning Policy Statement will apply to all facets of marine planning. It is being introduced initially on a non-statutory basis, pending the introduction of legislation in 2021 that will provide for the preparation, adoption and review of statutory marine planning policy statements on six-yearly cycles. It reflects the comprehensive updating and renewal now underway of Ireland's marine planning system, setting out core principles to inform evolving marine planning and development management process.

The draft Marine Planning Policy Statement is intended to do the following[6]:

> *"Describe the existing components of Ireland's marine planning system;*
>
> *Outline a vision for the future development of our marine planning system;*
>
> *Set out the overarching policies and principles the Government expects marine planning bodies and other public bodies that engage with the marine planning system to observe (in terms, for example, of public engagement, transparency, governance, environmental assessment, climate action, social and economic benefit);*
>
> *Set out high-level priorities for the enhancement of the marine planning system in Ireland."*

The provisions of national policy provide support for the development of, and investment in, Dublin Port in general as it is recognised as a key element of infrastructure necessary for economic growth. In particular, National Ports Policy explicitly endorses the planned development of Dublin Port. The proposed Dublin Harbour Capital Dredging Project is therefore consistent with national policy and objectives.

2.3.4 Relevant Regional Planning and Development Policy

The Regional Spatial and Economic Strategy (RSES) for the Eastern and Midland Region including the Metropolitan Area Spatial Plan (MASP) for Dublin was published in June 2019. The RSES is a strategic plan and investment framework to shape the future development of the region to 2031 and beyond. The RSES provides a:

Spatial Strategy – to manage future growth and ensure the creation of healthy and attractive places to live, work, study, visit and invest in.

[6] https://www.housing.gov.ie/planning/marine-spatial-planning/public-consultation-marine-planning-policy-statement

Economic Strategy – that builds on our strengths to sustain a strong economy and support the creation of quality jobs that ensure a good living standard for all.

Metropolitan Plan – to ensure a supply of strategic development areas for the sustainable growth and continued success and competitiveness of the Dublin Metropolitan Area.

Investment Framework – to prioritise the delivery of key enabling infrastructure and services by government and state agencies.

Climate Action Strategy – to accelerate climate action, ensure a clean and healthy environment and to promote sustainable transport and strategic green infrastructure.

The RSES, prepared in accordance with the NPF, sets the context for each local authority within the Region to develop county and city development plans in a manner that will ensure national, regional and local plans align.

With respect to the profile of the region the RSES notes that the Dublin region is the main global gateway to Ireland, with Dublin Airport one of the fastest growing in Europe and continued growth both in the import and export of goods through Dublin Port. In this regard the RSES identifies three strategic connections in the region which include the Eastern Corridor, strategic connections to the Northern and Western Region, and strategic connections to the Southern Region.

The RSES defines the Dublin - Belfast Economic Corridor, which is contained within the Eastern Corridor, as the largest economic agglomeration on the island of Ireland with the cities and towns along the corridor home to a population of around 2 million. The corridor connects the large towns of Drogheda, Dundalk and Newry by high-capacity national road and rail links, major airports of Dublin Airport, Belfast International Airport and Belfast City Airport and Belfast and Dublin ports. The RSES supports the development of the Dublin - Belfast Economic Corridor through targeted investment in transport infrastructure and services complementing and maintaining its function as part of the EU TEN-T core network. Directly relevant to Dublin Port and its growth is the identification of the M50 Dublin Port South Access Road as one of the Strategic Road Network projects (RPO 8.10) which will be appraised and delivered subject to the outcome of appropriate environmental assessment and the planning process (page 185).

The RSES states that the Dublin City and Metropolitan Area accounts for about half of the Region's population or a quarter of the national population, as well as being the largest economic contributor in the state. As Ireland's only international city of scale, Dublin acts as the global gateway to Ireland and its influence extends well beyond its administrative boundaries. Growth Enablers for Dublin City and Metropolitan Area include:

> *"Protect and improve access to the global gateways of Dublin Airport and Dublin Port for the Region and to serve the Nation, and safeguard and improve regional accessibility and service by rail, road and communication, with a key focus on the Dublin-Belfast Economic Corridor." (page 34)*

To achieve the vision the MASP identifies a number of Guiding Principles for the sustainable development of the Dublin Metropolitan Area. With respect to Dublin Port these include:

> *"Dublin as a Global Gateway – In recognition of the international role of Dublin, to support and facilitate the continued growth of Dublin Airport and Dublin Port, to protect and improve existing access and support related access improvements." (page 95)*

The NPF includes High-Quality International Connectivity as a National Strategic Outcome and recognises the crucial role that the provision of high-quality international connectivity has for overall international competitiveness and addressing opportunities and challenges from Brexit through investment in our ports and airports, in line with sectoral priorities already defined through *National Ports Policy* and *National Aviation Policy* and signature projects such as the second runway for Dublin Airport and major redevelopment at Dublin Port including proposals for a southern port access route.

The RSES recognises that Ireland's port and shipping services play an important role as enablers of economic growth, noting that the Region is home to the largest sea port in the country, Dublin Port. The RSES states that given the nature and function of ports, combined with the location interfacing with the marine environment, there is potential for environmental conflict with the existing ecosystem. It continues that this sensitivity is further increased by the proximity of most of the Region's ports to designated sites.

In order to minimise potential impacts on EU protected habitats, the RSES advocates, brownfield port developments which maximise the capacity of existing port sites should be prioritised over greenfield developments.

It continues that the approach to port development in the Region shall adhere to the European Commission guidelines on the Implementation of the Birds and Habitats Directives in Estuaries and Coastal Zones. As required by National Ports Policy (2013), a National Ports Capacity study has been commissioned which will assess the capacity of the national ports network.

In terms of port facilities, the RSES acknowledges that the *National Ports Policy* and the national hierarchy or tiering of ports recognises the long term international trend in ports and shipping towards increased consolidation of resources in order to achieve optimum efficiencies of scale. It notes that this has knock-on effects in terms of vessel size, the depths of water required at ports and the type and scale of port hinterland transport connections. As set out under Section 3.3 *National Ports Policy* seeks to ensure that the strategic development requirements of Tier 1 Ports, ports of regional significance and smaller harbours are addressed to ensure their effective growth and sustainable development at a national and regional level, this is acknowledged in the RSES.

With specific regard to Dublin Port, the RSES states that it is the largest port in the Country handling almost 50% of all trade in Ireland and growth of 35.7% over the last five years. Dublin Port is recognised in this RSES as a critical national facility; a key economic driver for the Region and the nation and an integral part of Dublin City, in line with the Dublin Port Masterplan 2040, Reviewed 2018.

Regional Policy Objectives guiding the development of ports and specifically Dublin Port within the RSES which states:

> *"RPO 8.21: The EMRA will support the role of Dublin Port as a Port of National Significance (Tier 1 Port) and its continued commercial development, including limited expansion and improved road access, including the Southern Port Access Route.*
>
> *RPO 8.23: The EMRA supports the protection of the marine related functions of ports in the Region in order to ensure the future role of ports as strategic marine related assets is protected from inappropriate uses, whilst supporting complimentary economic uses including the potential for facilitating offshore renewable energy development at ports.*

> *RPO 8.24: The EMRA supports the undertaking of feasibility studies to determine the carrying capacity of ports in relation to potential for likely significant effects on associated European sites including SPAs and SACs." (Page 190)*

Strategic Greenways proposed and/or under development in the metropolitan area include:

> *"East Coast Route from Sutton to Sandymount with potential to link into a Dublin Port Greenway, to extend north to link into the Fingal Coastal Way and to develop a wider East Coast Trail from Rosslare to Northern Ireland." (page103)*

The RSES also supports the protection of the Dublin Bay Biosphere. RPO 7.20 states:

> *"Promote the development of improved visitor experiences, nature conservation and sustainable development activities within the Dublin Bay Biosphere in cooperation with the Dublin Bay UNESCO Biosphere Partnership." (Page 156)*

The Dublin Harbour Capital Dredging Project seeks to accord with the identified need to enhance international capacity and expand port facilities serving the region whilst protecting Dublin Bay Biosphere.

2.3.4.1 The Transport Strategy for the Greater Dublin Area, 2016 to 2035

The *Transport Strategy for the Greater Dublin Area, 2016 to 2035*, prepared by the National Transport Authority sets out how transport will be developed across the region, covering Dublin, Meath, Wicklow and Kildare up to 2035.

As such the strategy is largely concerned with transport within the GDA and Ireland. The strategy does however seek to protect and enhance the capacity of the TEN-T network including Dublin Port. The importance of Dublin Port at a regional and national level is recognised within the strategy and the need for landside connectivity is prioritised.

> *"The need to facilitate the expansion of activity at Dublin Port into the future, as both a commercial and passenger port, must, therefore, be supported by the Strategy, through the clear identification and safeguarding of designated access routes".* (page 36)

The delivery of a link road connecting the southern end of the Dublin Port Tunnel to the South Port area is included as a National Road project to be delivered in the Transport Strategy.

The provisions of regional policy support the development of Dublin Port as it is recognised as a key element of infrastructure necessary for economic growth at the national level. The Dublin Harbour Capital Dredging Project is consistent with regional policy and objectives.

2.3.5 Relevant Local Planning and Development Policy

2.3.5.1 Dublin City Development Plan 2016-2022

The Dublin City Development Plan 2016-2022 (Development Plan) is the primary statutory land use planning policy document guiding development within Dublin City including Dublin Port.

Section 4.5.1.2 of the Development Plan recognises and outlines general support for the activities of Dublin Port:

> *"Dublin City Council fully supports and recognises the important national and regional role of Dublin Port in the economic life of the region and the consequent need in economic competitiveness and employment terms to facilitate port activities.*
>
> *Dublin Port will have a significant role to play in the future development and growth of the city and it is considered prudent to plan the structure of this part of the city, including the proposed public transport network, to fully integrate with the developing new city structure and character, while having regard to the Dublin Port Company Masterplan 2012 – 2040".* (page 59)

In addition to this high level support the Development Plan contains a number of policies and objectives facilitating Dublin Port operations and activities, including:

> *"SC9: To support and recognise the important national and regional role of Dublin Port in the economic life of the city and region and to facilitate port activities and development, having regard to the Dublin Port Masterplan 2012 - 2040.* (page 46)
>
> *CEE23 (iii): To recognise that Dublin Port is a key economic resource, including for cruise tourism, and to have regard to the policies and objectives of the Dublin Port Masterplan".* (page 83)

The protection of the Eastern By-Pass routes is also an objective of the Development Plan:

> *"MTO32: To protect the routes of the proposed eastern by-pass from existing Dublin Port tunnel to Poolbeg, also referred to as the Southern Port Access Route, and in the longer term to provide a route corridor between Poolbeg and the Southern Cross/South Eastern Motorway (in accordance with the NTA Strategy for the Greater Dublin Area 2016 – 2035). The preferred route for DCC is by means of a bored tunnel, under Sandymount Strand and Merrion Strand and will be subject to full statutory Environmental Assessment, together with an Appropriate Assessment for the entire proposed routes, in accordance with the Habitats Directive, together with a full consultation process".* (page 133)

Key strategic policies and objectives of Dublin City Council set out in the Development Plan endorse the improvement of port infrastructure in order to facilitate economic growth and policies relating to the protection of the natural and built environment. The Dublin Harbour Capital Dredging Project is consistent with these policies and objectives.

2.3.5.2 Land Use Zoning

The lands adjoining the Dublin Harbour Capital Dredging Project are entirely zoned Z7 Employment Industry

The Z7 Employment Industry zoning objective is, "to provide for the protection and creation of industrial uses and facilitate opportunities for employment creation including Port Related Activities". With respect to lands zoned Z7 Employment Industry the plan states:

> *"The majority of these lands are located in the Port area. The primary uses in these areas are those that can result in a standard of amenity that would not be acceptable in other areas. They can sometimes lead to disamenities which would need to be managed through the planning process to safeguard residential amenity when necessary. Activities include industry, other than light industry; manufacturing repairs, open storage, waste material treatment, and transport operation services".* (page 244)

Port-related industries and facilities are permitted in principle within the Z7 land use zoning objective. The Dublin Harbour Capital Dredging Project is wholly consistent with the land use zoning objectives applicable to the development site.

2.3.5.3 Built Heritage

There are no Protected Structure sites located within the Foreshore application boundary.

The Dublin City Industrial Heritage Record (DCIHR) survey makes recommendations for sites to be added to the list of Protected Structures in the life of the Development Plan. The Development Plan notes that a review of the DCIHR will be undertaken for the Kilmainham and Inchicore areas, together with the unique maritime heritage of the North and South Docklands, and the full DCIHR will be published online as soon as resources permit and within the period of this development plan.

Item 6 of Objective CHCO10 states:

> *"To have regard to the city's industrial heritage and Dublin City Industrial Heritage Record (DCIHR) in the preparation of Local Area Plans (LAPs) and the assessment of planning applications and to publish the DCIHR online. To review the DCIHR in accordance with Ministerial recommendations arising from the national Inventory of Architectural Heritage (NIAH) survey of Dublin City and in accordance with the Strategic Approach set out in Section 11.1.4 of this chapter".* (page 197)

The Dublin Harbour Capital Dredging Project includes marine archaeology measures to address this objective.

2.3.5.4 SEVESO Directive Sites

Appendix 12 of the Dublin City Development Plan provides a list of Seveso sites in the city including their respective consultation zone. Activities are listed in an 'Upper Tier' and others in a 'Lower Tier'. There are 7 no. Upper Tier and 8 no. and Lower Tier Seveso establishments within the general vicinity of the Dublin Harbour Capital Dredging Project. These include:

Upper Tier

- Calor Teoranta, Tolka Quay, Dublin 1
- Dublin Waste to Energy Ltd., Pigeon House Road, Dublin 4
- Esso Ireland Ltd., JFT Dublin, Alexandra Road, Dublin Port, Dublin 1
- Fareplay Energy Ireland, Tankfarm 1, Alexandra Road and Tankfarm 2, Tolka Quay Road, Dublin Port, Dublin 1
- Indaver Ireland Ltd., Tolka Quay Road, Dublin Port, Dublin 1
- National Oil Reserves Agency Storage Facility, Shellybanks Road, Ringsend, Dublin 4
- Tedcastles Oil Products, Yard 2, Tolka Quay Road, Dublin Port, Dublin 1

Lower Tier

- Electricity Supply Board, North Wall Generating Station, Alexandra Road, Dublin 1

- Electricity Supply Board, Poolbeg Generating Station, Ringsend, Dublin 4
- Iarnród Éireann, Alexandra Road, North Wall, Dublin 1
- Iarnród Éireann, Iarnród Éireann Maintenance Works, Inchicore, Dublin 8
- Tedcastles Oil Products, Yard 1, Promenade Road, Dublin Port, Dublin 1
- Topaz Energy Limited, Terminal 1, Alexandra Road, Dublin Port, Dublin 1
- Topaz Energy Limited, Yard 3, Alexandra Road, Dublin Port, Dublin 1
- Utility Operations & Maintenance Services Ltd. t/a Synergen Ltd., Dublin Bay Power Plant, Pigeon House Road, Ringsend, Dublin 4 (300 m from bund wall).

A COMAH Land Use Planning Assessment is included within Chapter 6 of the EIAR: Risk of Major Accidents and Disasters.

2.3.5.5 Development Management Standards

The development management guidelines specific to Dublin Port recognise policy CEE 23(iii) and outlines a number of considerations with which the planning authority examine during the assessment of proposals within Dublin Port, which include:

> *"Recognition of the important role of Dublin Port in the economic life of the city and the region and the consequent need in economic and employment terms to facilitate port development*
>
> *The periphery of the port area facing residential areas shall be designed and landscaped to minimise the impact of its industrial character*
>
> *The impact on nature conservation, recreation and amenity use, and other environmental considerations, including having regard to the designation of Dublin Bay as a UNESCO biosphere and other environmental designations such as Special Area of Conservation (SAC) and Special Protection Area (SPA)*
>
> *The protection of the amenities of residential and commercial uses in adjoining areas*
>
> *Design criteria including landscaping, finishes, signage and site layout*
>
> *Facilitating plans to make Dublin a 'home port' for cruise tourism, with complementary cruise tourism facilities in the port and wider city/region". (page 347)*

The Development Plan is relevant in terms of assessing whether the proposed development is consistent with the proper planning and sustainable development of the area in which it is proposed to be located.

The key strategic policies and objectives of Dublin City Council relevant to the Dublin Harbour Capital Dredging Project endorse the improvement of port infrastructure in order to facilitate economic growth. The Dublin Harbour Capital Dredging Project has been designed to comply with policies relating to the protection of the natural and built environment.

2.3.6 The North Lotts and Grand Canal Planning Scheme

The North Lotts and Grand Canal Planning Scheme was approved by An Bord Pleanala on 16th May 2014 and includes lands adjacent to Dublin Port to the west. The proximity of Dublin Port to the Planning Scheme lands and the opportunity to maintain the maritime character of the area and integrate better with Dublin Port is recognised in the Planning Scheme.

There are limited policies and objectives within the Planning Scheme pertaining to Dublin Port, however a number of objectives support improved cruise liner and passenger facilities including:

> *"ER17 To engage with Dublin Port Company, Fáilte Ireland and the Department of Transport, Tourism and Sport to facilitate the development of a new cruise tourism terminal at Alexandra Basin.* (page 44)
>
> *PR12 To support the provision of a suitable terminal for cruise liners and other passenger vessels with Dublin Port".* (page 154)

2.3.7 Poolbeg West SDZ Planning Scheme

The Poolbeg West SDZ Planning Scheme has been prepared on foot of the Planning and Development Act 2000 (Designation of Strategic Development Zone: Poolbeg West, Dublin City) Order 2016.

The Order states the SDZ is designated a "*mixed use development which may principally include residential development, commercial and employment activities including, office, hotel, leisure and retail facilities, port related activities and the provision of educational facilities, transport infrastructure, emergency services and the provision of community facilities as referred to in Part III of the First Schedule to the Act, including health and childcare services, as appropriate".*

Article 4 of the Order states development of this area shall take into consideration inter alia the Dublin Port Masterplan 2012-2040.

The Poolbeg West Planning Scheme lands are south of the Liffey and approximately half of which are owned by Dublin Port Company. The Planning Scheme is centred on 'Themes', one of which is to 'Protect'. In this regard the Planning Scheme states the following:

> *"Key principle: Ensure that the development of Poolbeg West and the ongoing operations of Dublin Port, municipal facilities and future transport schemes are mutually taken in account and integrated into the urban structure of the city.*
>
> *The peninsula will have an ongoing industrial function related to port activities, waste water treatment and energy generation. To ensure that these essential regional services continue the SDZ Planning Scheme includes lands for 'Port/ Industrial Compatible Uses' to facilitate growth, consolidate activities, and promote alternatives for underutilised lands, together with 'soft edges' and 'buffer zones'".* (page 8)

With specific regard to Dublin Port the Planning Scheme states in section 5.4.3:

> *"Dublin City Council fully supports and recognises the important national and regional role of Dublin Port in the economic life of the region and the consequent need in economic*

> *competitiveness and employment terms to facilitate port activities. Dublin Port will have a significant role to play in the future development and growth of the Poolbeg West area as well as the wider city. With this in mind, this planning scheme recognises the importance of retaining port uses and port related activities on site"* (page 21)

The Planning Scheme supports the Southern Port Access Route and Eastern Bypass:

> *"MV4 To protect the route of the proposed Southern Port Access Route and Eastern Bypass in accordance with the objectives of Transport Infrastructure Ireland and the National Transport Authority Strategy for the Greater Dublin Area 2016-2035. As an interim measure it is proposed to provide a separate road access to the south port area via a new link located north of the existing Seán Moore Roundabout".* (page 28)

Dublin City Council on 2nd October 2017 decided by resolution to make the Poolbeg West Planning Scheme. The decision of the Council was subsequently appealed to An Bord Pleanála (Ref. PL29S.ZD2013). On 9th April 2019 the Board approved the Poolbeg West Planning Scheme.

The role and function of Dublin Port is recognised and facilitated in the Planning Scheme as approved with some modifications.

2.3.8 Dublin Port Masterplan 2040

The Dublin Port Masterplan 2040 is a key document guiding future development within the port up to 2040. The Masterplan is a non-statutory plan which has nonetheless been framed within the context of EU, national, regional and local development plan policies and explicitly endorsed in the National Ports Policy, 2013. The Masterplan presents a vision for future operations at the Port and critically examines how the existing land use at Dublin Port can be optimised for merchandise trade and passengers (including cruise ships).

The Masterplan was prepared by DPC in order to:

- *"Plan for future sustainable growth and changes in seaborne trade in goods and passenger movements to and from Ireland and the Dublin Region in particular.*
- *Provide an overall context for future investment decisions.*
- *Reflect and provide for current National and Regional Guidelines and initiatives.*
- *Ensure there is harmony and synergy between the plans for the Port and those for Dublin City, the Dublin Docklands Area and neighbouring counties within the Dublin Region.*
- *Give some certainty to customers about how the Port will develop in the future to meet those requirements"* (page 14)

Since the Masterplan was published in 2012 Dublin Port has experienced particularly high rates of economic growth and traffic growth with volumes of traffic increasing by 30.1% in the five years to 2017. In light of the high level of growth a review of the Masterplan took place in 2017-2018. The Review concluded:

- An eastern expansion of Dublin Port into Dublin Bay is no longer a viable and is not being pursued as an option.

- To meet anticipated capacity requirements Dublin Port needs to be developed on the basis of an average annual volume growth of 3.3% over the 30 years from 2010 to 2040 rather than the 2.5% originally assumed in 2012.

The *Dublin Port Masterplan 2040 Reviewed 2018,* published in July 2018, sets out options for the development of Dublin Port which will meet these requirements and objectives. These options are shown in Figure 1-2[7]**.** The supporting capital dredging requirements are set out in Figure 1-2. The Dublin Harbour Capital Dredging Project seeks to deliver a number of the capital dredging elements set out in the Masterplan.

[7] Source: *Dublin Port Masterplan 2040 Reviewed 2018*

3 PROJECT DESCRIPTION

3.1 Location of Project and Site Characteristics

3.1.1 Site Location

Dublin Port is the largest Port in Ireland, situated in Dublin on Ireland's Eastern Coastline. The Northern Lands and Southern Lands of Dublin Port (Dublin Port Estate) comprise an area of 265 ha of land entirely within the ownership of Dublin Port Company. The entire Port Estate comprises 309 ha, including the lands at the Dublin Inland Port.

The proposed Dublin Harbour Capital Dredging Project comprises capital dredging works within the Dublin Harbour area of Dublin Port.

The proposed area to be dredged lies entirely within the Foreshore of the inner Liffey Channel between the Northern Lands of Dublin Port and the Southern Lands of Dublin Port.

It is proposed to dispose of the dredge spoil at a licenced offshore disposal site located to the west of the Burford Bank at the approaches to Dublin Bay.

The main road transportation route between the Dublin Port Estate and the national road network is via the Dublin Port Tunnel. The site is also connected to the national rail network.

Until recently, Dublin Port's navigation channel and fairway was maintained to a standard depth of -7.8m CD. The main navigation channel between the Western Oil Jetty and Dublin Bay has now been deepened to -10.0m CD under the permitted Alexandra Basin Redevelopment (ABR) Project (ABP Ref. 29N.PA0034) to enable the safe passage of larger vessels bringing freight and passengers to and from the Port.

3.1.2 Proposed Capital Dredge Area

The proposed capital dredge area for which Foreshore and Dumping at Sea consents are sought, and in respect of which this EIAR has been prepared, is defined by the 'red line' application boundary as illustrated on the application drawings. The project application boundary, overlain on the existing Port layout is presented in Chapter 1, Figure 1-3 and Figure 1-4. The application site area is 27 ha (excluding the area of the licenced offshore disposal site).

As illustrated in Figure 3-1, the Dublin Harbour Capital Dredging Project consists of the following elements:

- Deepening of the navigation channel from -7.8m CD to -10.0m CD between the North Wall Quay Extension and the Western Oil Jetty, including deepening of riverside Berth 35 (Ocean Pier) to -10.0m CD and widened to 50m.
- Deepening of Alexandra Basin East from -7.8m CD to -10.0m CD with Berths 36 and 37 widened to 50m and Berths 38, 39 and 40 deepened to -11.0m CD and widened to 50m.
- Deepening of the Oil Basin from -7.8m CD to -10.7m CD with Berths OB1 and OB2 widened to 50m.
- Deepening of the Ferryport Basin from -7.8m CD to -10.0m CD.

- Deepening of riverside Berth 52 to -10.0m CD following construction of the new Berth 52 quay under the MP2 Project (ABP-304888-19).
- Widening of South Port Berths 42, 43, 44, 45, 46 and 47 to 50m.
- Removal of ridge between the navigation channel and the Poolbeg Oil Jetty (Berth 48) to -10.0mCD.

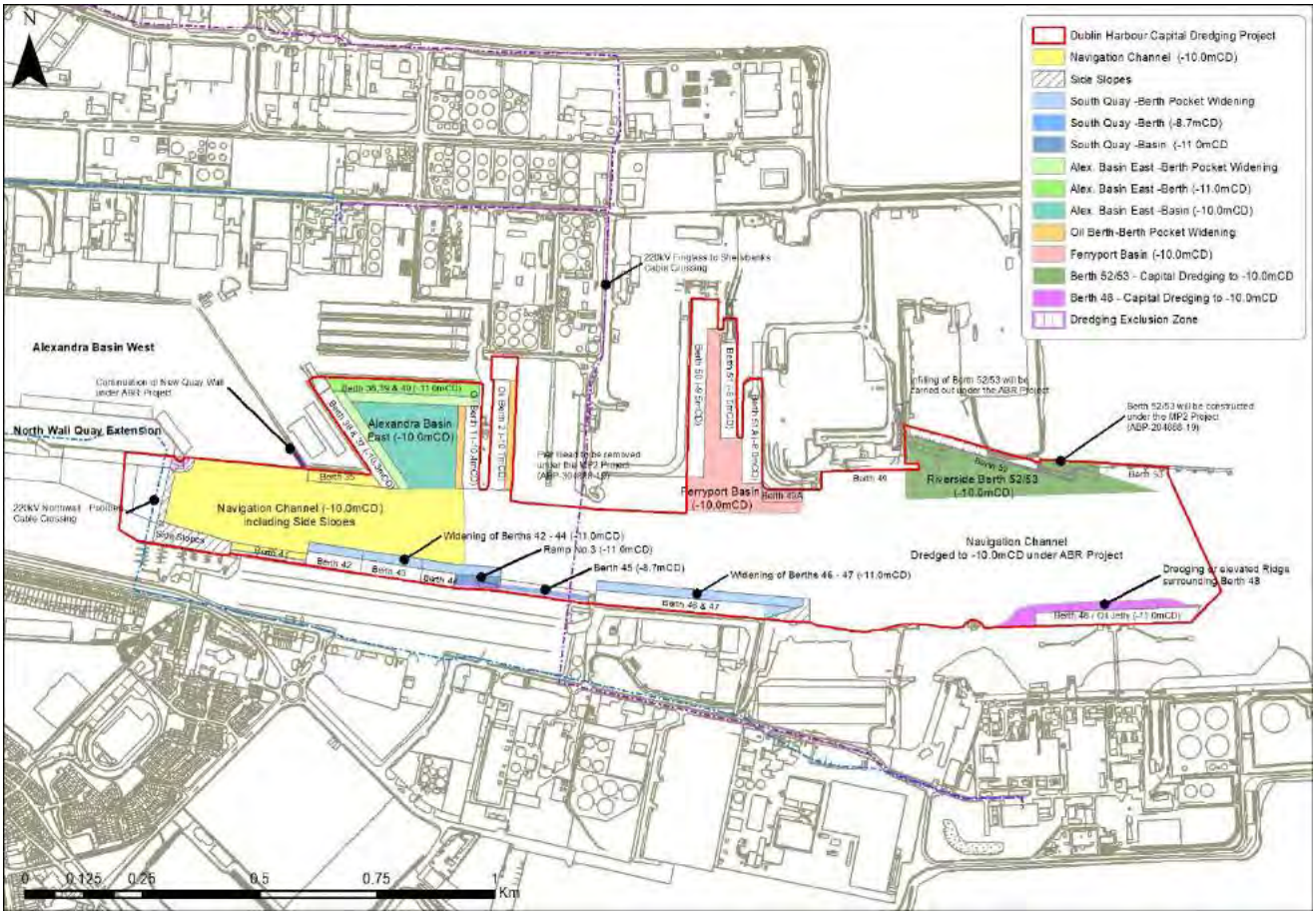


Figure 3-1 Site Location Map

The port use of each of the elements of the proposed Dublin Harbour Capital Dredging Project is described below:

Navigation channel

Capital dredging is required within the main navigation channel between the North Wall Quay Extension and the Western Oil Jetty to deepen the channel from -7.8m CD to a standard depth of -10.0m CD. This element of dredging will complete the dredging of the navigation channel envisaged by the Alexandra Basin Redevelopment (ABR) Project, originally permitted under Foreshore Licence MB/2016/01725 but which only remains valid to 20th June 2022.

The dredging of the navigation channel will terminate 15m downstream of an existing 220 kV cable crossing of the River Liffey which is located between Poolbeg Marina and the terminus of the North Wall Quay Extension as shown in Figure 3-1. The cable lies at a depth of circa -10m CD. Terminating the capital dredging 15m downstream of the cable crossing creates a sufficient buffer to ensure it is not affected in any way.

The proposed capital dredging works will also enable the riverside Berth 35 at the southern end of Ocean Pier to operate at a standard depth of -10.0m CD. Berth 35 is designed for multi-purpose use utilising mobile cranes to transfer the cargo from ship to shore.



Plate 3-1 Navigation Channel at entrance to Alexandra Basin West

Alexandra Basin East

Alexandra Basin East hosts a number of port activities described below:

Lo-Lo (Lift-On Lift-Off) Container Freight Terminal

There is one major Lo-Lo Container Freight Terminal within Alexandra Basin East utilising Berth 38, Berth 39 and Berth 40 along its northern perimeter.

There are two main groups of cargo handling equipment used for containers: primary handling equipment and secondary handling equipment.

Primary handling equipment refers to cranes of different types used to load and unload containers on and off the ship. There are two main types of crane in use in Dublin Port, rail mounted gantry cranes and dock mobile cranes. Containers are moved between the stacks and the quay side cranes by special heavy duty truck and trailer combinations or by reach stackers. Secondary handling equipment refers to the equipment (usually gantry cranes of one type or another) used to store containers in back areas in large stacks.

In Dublin, there are rubber-tyred gantries (RTGs) and rail mounted gantries. The largest RTGs can store containers in stacks up to six containers high and seven wide. These stacks occupy large areas of port land and DPC has a utilisation target of 40,000 TEU (twenty-foot equivalent units) per hectare per annum for the port's container freight terminals.

Ro-Ro (Roll-On Roll-Off) Freight Terminal

There is one major Ro-Ro Freight Terminal within Alexandra Basin East utilising Berth 36 and Berth 37 along its eastern perimeter (Ocean Pier) with a ramp located at the northern end of Berth 36 to off-load and on-load freight.

Ro-Ro refers to shipping services and activities where vehicles are driven on and off ferries or other specialised ships (such as car carriers). Some services are freight only; others carry a combination of freight and passengers. The Ro-Ro Terminal in Alexandra Basin East is for freight only.

Ro-Ro freight is transported either “accompanied” or “unaccompanied”. “Accompanied” refers to trailer units to which the cab is attached at all times and the driver accompanies the vehicle on the Ro-Ro ferry. “Unaccompanied” refers to freight trailers that are delivered and collected from the compound adjacent to the vessel. These trailers are driven on and off ships by dock workers.

The main difference in the two operations is the amount of land needed to service the units. In the case of accompanied freight, the units drive off the vessel and leave the port immediately. Unaccompanied freight requires larger areas of parking.

Multi-purpose Use of Berths

The Berths in Alexandra Basin East are designed to be multi-purpose. In particular Berth 37 is used for a wide range of cargo which utilises mobile cranes to transfer the cargo from ship to shore.



Plate 3-2 Container Freight Terminal, Alexandra Basin East



Plate 3-3 Berth 36 and Berth 37 (Ocean Pier), Alexandra Basin East

Oil Basin and Berths

Dublin Port handles many different bulk liquid products including petrol, diesel and kerosene, but also non-petroleum liquids such as molasses. 65% of oil imported into Ireland comes through Dublin Port.

The liquid petroleum products are discharged from tanker ships at four dedicated berths within the Dublin Port Estate and then pumped through a pipeline system, shared by different operators, to their storage tanks within the Port. Storage capacity in excess of 300,000 tonnes of oil products is available within the Port. Oil products are delivered by road from the Port to distribution centres and filling stations outside the Port.

There are two Oil Jetties in operation within the Dublin Port Estate supporting a range of above ground pipework. The Western Oil Jetty has two berths (Oil Berth 1 and Oil Berth 2). These berths facilitate the majority of petroleum product imports at Dublin Port. In 2017 Oil Berth 1 had 181 ship arrivals and Oil Berth 2 had 190 ship arrivals. The Western Oil Jetty forms the boundary between Alexandra Basin East and the Oil Basin. The Dublin Harbour Capital Dredging Project includes for dredging Oil Berth 1, Oil Berth 2 and the Oil Basin. The Eastern Oil Jetty also has two berths (Oil Berth 3 and Oil Berth 4). These berths facilitate the majority of bitumen products and all of the Liquid Petroleum Gas (LPG) imports at Dublin Port. In 2017 Oil Berth 3 had 59 ship arrivals: Oil Berth 4 is rarely used and had only 5 ship arrivals.

The works associated with the MP2 Project will include the infilling of the basin east of the now virtually redundant Oil Berth 4 on the Eastern Oil Jetty. As part of the infilling of Oil Berth 4, it is proposed to redevelop Oil Berth 3 as a future deep-water container berth (standard depth of -13.0m CD) for the Container Freight Terminal. This will facilitate the change of use of the berth from petroleum importation to container handling when the throughput of petroleum products through Dublin Port declines as a result of national policies to

decarbonise the economy. The Dublin Harbour Capital Dredging Project excludes Oil Berth 3 which will be subject to capital dredging under the MP2 Project.



Plate 3-4 Western Oil Jetty - Oil Berth 2



Plate 3-5 Oil Basin between Oil Berth 2 (left) and Oil Berth 3 (right)

Ferryport Basin

There are currently three Berths within the Ferryport Basin with ramps for Ro-Ro freight and passengers, Berth 49A, Berth 51 and Berth 51A. These berths are served by two ferry terminal buildings. Terminal 2 is used by Stena Line and Terminal 1 is used by Irish Ferries, with seasonal use by Isle of Man Steam Packet Company. Terminal 2 will be demolished as part of the MP2 Project with the existing Terminal 1 Building being used as a unified terminal building thereafter. The eastern perimeter of the Ferryport Basin (Berth 50) forms part of a major Lo-Lo Container Freight Terminal.



Plate 3-6 Ferryport Basin used for Ro-Ro freight & passenger and Lo-Lo freight operations

Berths 52 /53

Berths 52 / 53 are currently located within a basin at the eastern end of the Port, on the northern side of the River Liffey. Both Berths 52 and 53 are fitted with Ro-Ro ramps and are currently used by Seatruck for their Ro-Ro services to the UK. In 2014, the Alexandra Basin Redevelopment Project was granted permission by An Bord Pleanála (ABP Ref. PL29N.PA0034). The permissions included for: the dismantling and removal of the existing Berth 52/53 infrastructure; the construction of a new quay wall (Riverside Berth 52); Infilling of existing Berth 52 / 53 with treated dredged material raising of existing surface levels by approx.1.4m and the installation of a Ro-Ro ramp. In July 2020, An Bord Pleanála granted Planning Permission for the MP2 Project (ABP Ref. ABP 304888-19) which included the construction of a new Ro-Ro Jetty (Berth 53) and re-orientating the already consented Berth 52. The new riverside berths (Berth 52 and Berth 53) will be used predominantly used for the berthing of Ro-Ro ferries. The new berthing infrastructure will accommodate the bow-to and stern-to berthing of a wide range of ferries up to 240m in length.



Plate 3-7 Existing Berth 52/53 configuration (top) / Permitted riverside Berth 52 and Berth 53 (bottom). The area to be dredged is shown in 'green'

South Port Berths

The South Port Berths 42 – 47 are located on the River Liffey, adjoining the Poolbeg Peninsula. The berths are currently used to support a major Lo-Lo Container Freight Terminal and Bulk Cargo operations. The Bulk Cargo operations utilise a number of yards, warehouses and silos for the temporary storage of the cargo.



Plate 3-8 South Port Berths (Poolbeg Peninsula)

Poolbeg Oil Jetty (Berth 48)

The Poolbeg Oil Jetty (Berth 48) is located north of the ESB Generating Station on the Poolbeg Peninsula. It is used to transfer petroleum products to and from the nearby oil tanks operated by the National Oil Reserves Agency (NORA) and ESB.



Plate 3-9 Poolbeg Oil Jetty - Berth 48 (Poolbeg Peninsula)

3.1.1.1 Adjacent Land Uses

The site lies within the lower River Liffey (Dublin Harbour) which is the main navigation channel for Dublin Port. DPC is the authority with responsibility for the safe passage of all shipping entering and leaving the Port. No other commercial activities are permitted within the navigation channel for safety reasons.

A number of events are hosted by DPC including the annual 'Riverfest'. Accommodation is also made for sailing and boating activity based at the Poolbeg Yacht, Boat Club and Marina and Stella Maris Rowing Club.

The site is bounded to the north by the Northern Lands of Dublin Port.

To the east lies the inner Liffey channel and the Tolka estuary. The Tolka estuary is used for recreational purposes mostly by small sailing craft based at Clontarf. Swimming also takes place from the North Bull Wall throughout the year, including the winter season. There are no licenced aquaculture sites within the estuary. The Tolka Estuary is also of international importance due to its large populations of waterbirds.

The Site is bounded to the south by the Southern Lands of Dublin Port (Poolbeg Peninsula). Poolbeg Yacht, Boat Club & Marina Stella Maris Rowing Club lie in close proximity to the site. The nearest residential properties are located at Pigeon House Road and Coastguard Cottages.

To the west lies the Tom Clarke Bridge over the River Liffey, and Dublin City.

3.1.1.2 Amenity Designations

There are a number of Natura 2000 sites designated as Special Protection Areas (SPAs) or Special Areas of Conservation (SACs) which could have connectivity with the proposed capital dredge area. The key sites are considered to be:

- South Dublin Bay and River Tolka Estuary SPA
- North Bull Island SPA
- North Dublin Bay cSAC
- South Dublin Bay cSAC
- Rockabill to Dalkey Island SAC
- Howth Head cSAC
- Howth Head Coast SPA
- Ireland's Eye SPA
- Codling Fault Zone SAC

The spatial configuration of these amenity sites and relationship with the proposed Dublin Harbour Capital Dredging Project is presented and assessed in Chapter 7 of this EIAR and the separate Appropriate Assessment Screening & Natura Impact Statement submitted with the application for consent.

There are no protected archaeological or industrial heritage features designated within the capital dredge area. The Great South Wall is a protected structure and National Monument but is remote from the site and is not affected by the Dublin Harbour Capital Dredging Project. The spatial configuration of cultural heritage sites and their relationship with the proposed project is presented and assessed in Chapter 14 of this EIAR.

3.2 Proposed Capital Dredging Works

3.2.1 Capital Dredging Design Considerations

The following design elements have been considered when carrying out the design of the capital dredging works:

- Maximise the potential of the existing port property in the context of the Dublin Port Masterplan 2040, reviewed 2018;
- Provide sufficient water depth within the navigation channel, basins and berths for the design vessels proposed;
- Minimise the impact of capital dredging on the operation of existing berths;
- Provide a sufficiently wide channel to accommodate the manoeuvring and piloting of vessels;
- Take full cognisance of environmental constraints and where feasible provide mitigation through engineering design.

3.2.2 Capital Dredging Volumes

The volume of capital dredging required for each element of the works, as described above, has been calculated from hydrographic surveys undertaken by Hydromaster in Q3 2020. Figure 3-2 and Figure 3-3 show the depth of material above the proposed design level (m) for each of the dredging zones. The total estimated dredge volume is estimated to be 500,000m^3 and includes a siltation tolerance/ contingency to account for material

which has settled in Dublin Harbour in the period between successive maintenance dredging campaigns and the commencement of the capital dredging campaign (Table 3-1)

The material to be dredged comprises clays, silts, sands and gravels with occasional cobbles. No dredging of rock is required. The sediment chemistry and eco-toxicological properties of the dredged material is presented in Chapter 8 of this EIAR.

Table 3-1 Capital Dredging Volumes

Dredge Zone	Estimated Dredge Volume above design (m^3)
Zone 1 – Navigation Channel	121,008
Zone 2 – South Port Berths	26,146
Zone 3 – Alexandra Basin East	47,020
Zone 4 – Oil Basin	7,842
Zone 5 – Ferryport Basin	27,970
Zone 6 – Riverside Berth 52	127,515
Zone 7 –Poolbeg Oil Jetty (Berth 48)	11,296
Dredge Volume (m^3)	368,797 m^3
Siltation / Tolerance / Contingency (m^3)	131,203 m^3
Total Dredge Volume (m^3)	**500,000 m^3**

Note:

1. Volumes include for all Berths to be widened to 50m (the existing Berths range from 24m to 35m wide, see Table 3-2).

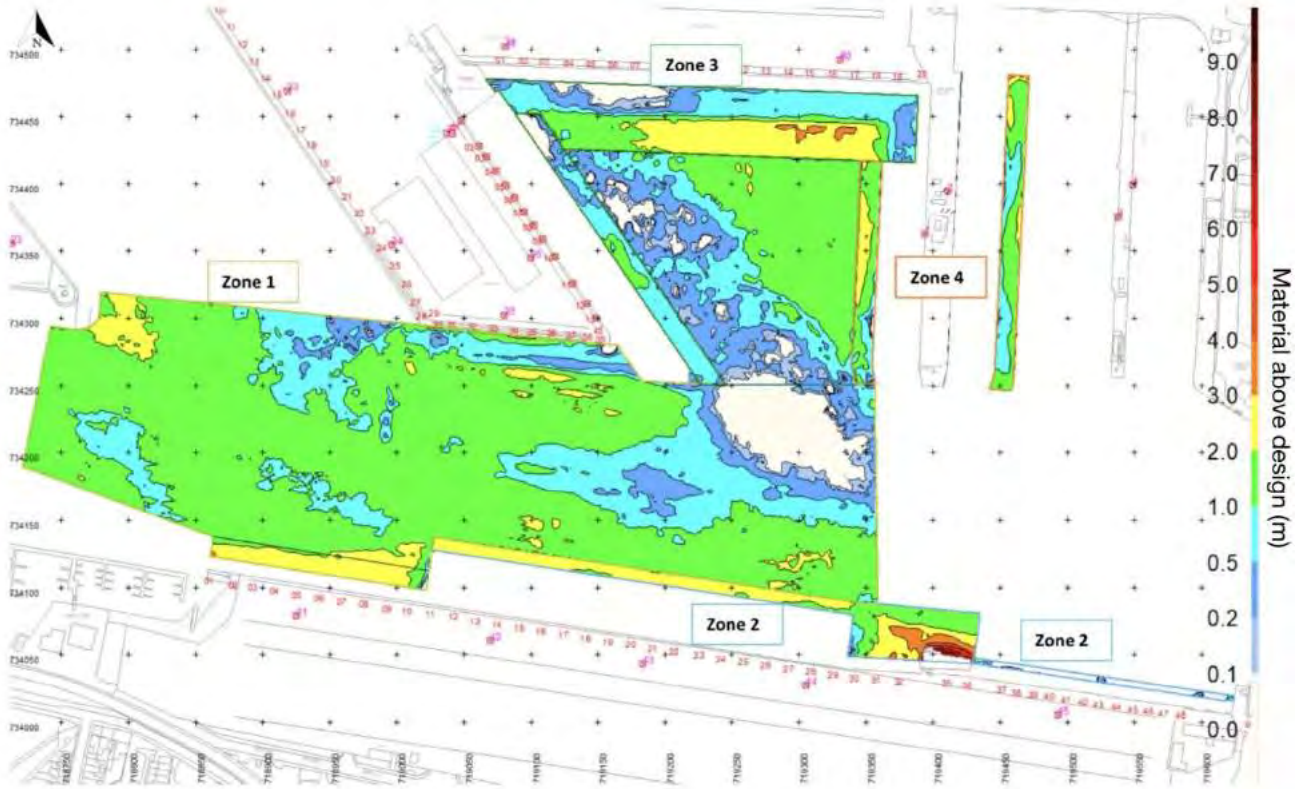


Figure 3-2 Plot showing depth of material between current bed level and design depth (metres) – Zone 1,2,3 and 4

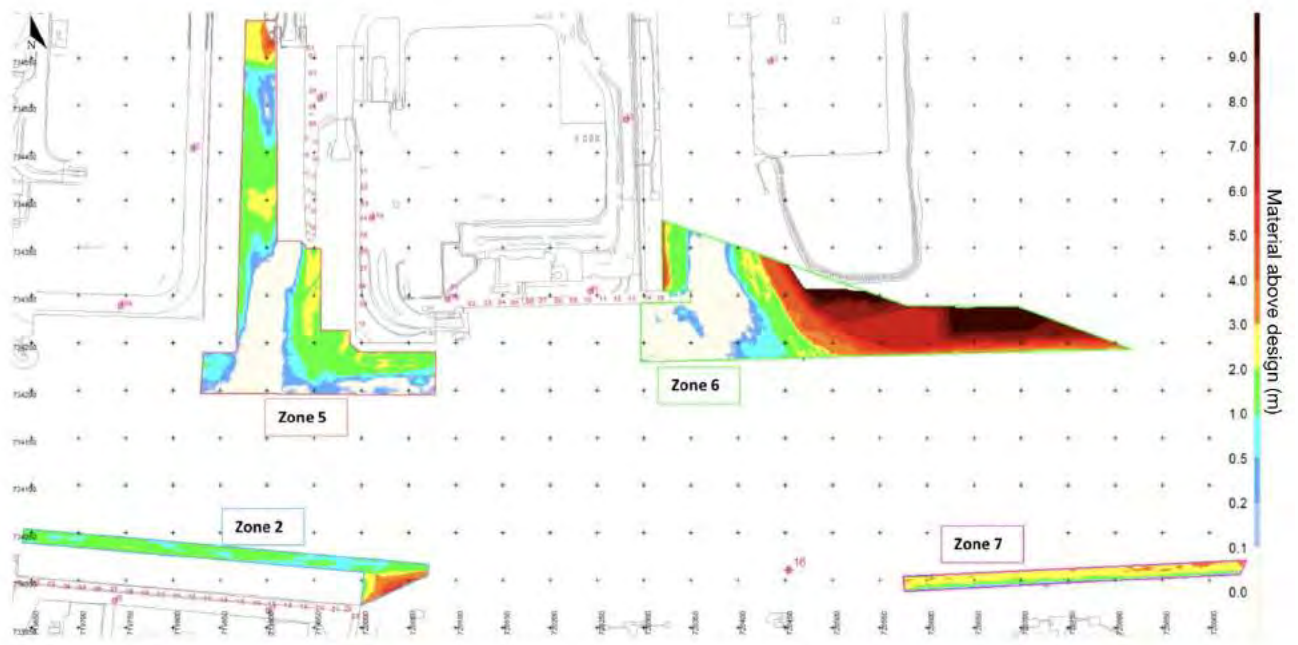


Figure 3-3 Plot showing depth of material between current bed level and design depth (metres) – Zone 2,5,6 and 7

Table 3-2 Proposed widening of Berths

Element of Work	Existing Design Width (m Chart Datum)	Proposed Design Width (m Chart Datum)
Navigation Channel, Ocean Pier		
Berth 35	25m	50m
Alexandra Basin East		
Berth 36 & 37	30m	50m
Berth 38, 39 & 40	30m	50m
Oil Basin		
Oil Berth 1	30m	50m
Oil Berth 2	30m	50m
South Port		
Berth 42	30m	50m
Berth 43	30m	50m
Berth 44	30m	50m
Berth 45	25m	50m
Berth 46 & 47	30m	50m

3.2.3 Loading Operations

The capital dredging works will be carried out using a trailing suction hopper dredger (TSHD) and/or a backhoe dredger. Alternative dredging options are presented in Chapter 4 of this EIAR. A typical TSHD which has previously undertaken capital dredging works at Dublin Port is shown below.



Plate 3-10 Typical Trailing Suction Hopper Dredger (*Freeway*)

The TSHD operates by lowering its trailing arm until the dredging head makes contact with the seabed. The sediments on the seabed are then sucked up through the trailing arm into a hopper located within the hull of the vessel (similar in many ways to a giant vacuum cleaner). When the allowed capacity of the hopper has been reached, the TSHD lifts the trailing arm back into its resting position and sets sail to the licenced offshore disposal site to dispose of the dredged material.

Computer controlled equipment on board the TSHD accurately sets the depth and track of the dredge head and monitors the quantity of material being dredged. The tracks of the TSHD for each loading and disposal trip are also recorded.

No overspill of the hopper will be permitted during the loading operations to minimise the amount of suspended solids within the River Liffey channel during the loading operations. When working within the navigation channel, the TSHD will also work in the direction of flow to avoid any potential of creating elevated levels of suspended solids across the River Liffey. The assessment of dredging activities on water quality is presented in Chapter 9 of this EIAR.

All capital dredging operations will take place within the period October to March inclusive.



Plate 3-11 Typical Trailing Suction Hopper Dredger Arrangement

There will also be a requirement for a back-hoe dredger mounted on a barge on site to carry out small scale elements of the dredging works, notably for areas where the TSHD cannot reach or where the material is too stiff to be removed by the TSHD. This material is either pulled into the track of the THSD for collection or loaded into a separate hopper barge which is taken directly to licenced offshore sea disposal site to dispose of the dredged material.

Alternatively, the dredging contractor may select a back-hoe dredger mounted on a barge, supported by hopper barges, to be the primary means of undertaking the capital dredging works.

Other ancillary equipment will include a bed-leveller to remove peaks and troughs created by the dredger and a survey vessel.



Plate 3-12 Typical Bed Levelling Vessel



Plate 3-13 Typical Survey Vessel

3.2.4 Disposal Operations

It is proposed to dispose of the dredged material at the licenced disposal site at the entrance to Dublin Bay located to the west of the Burford Bank, presented in Figure 3-4. Alternative options considered to disposal at sea are presented in Chapter 4 of this EIAR. The suitability of the dredged material for disposal at sea is presented in Chapter 8 of this EIAR. The disposal operations are undertaken by the TSHD, or equivalent hopper barge, within the confines of the disposal site. The TSHD has doors at the bottom of the hull which are opened whilst the vessel moves at low speed allowing the dredged material within the hopper to be released. The disposal operation typically takes 10-15 minutes to empty the hopper. The hopper is then washed down with seawater whilst remaining within the confines of the disposal site before returning to the loading area. Each loading / dumping trip typically takes 2-4 hours.

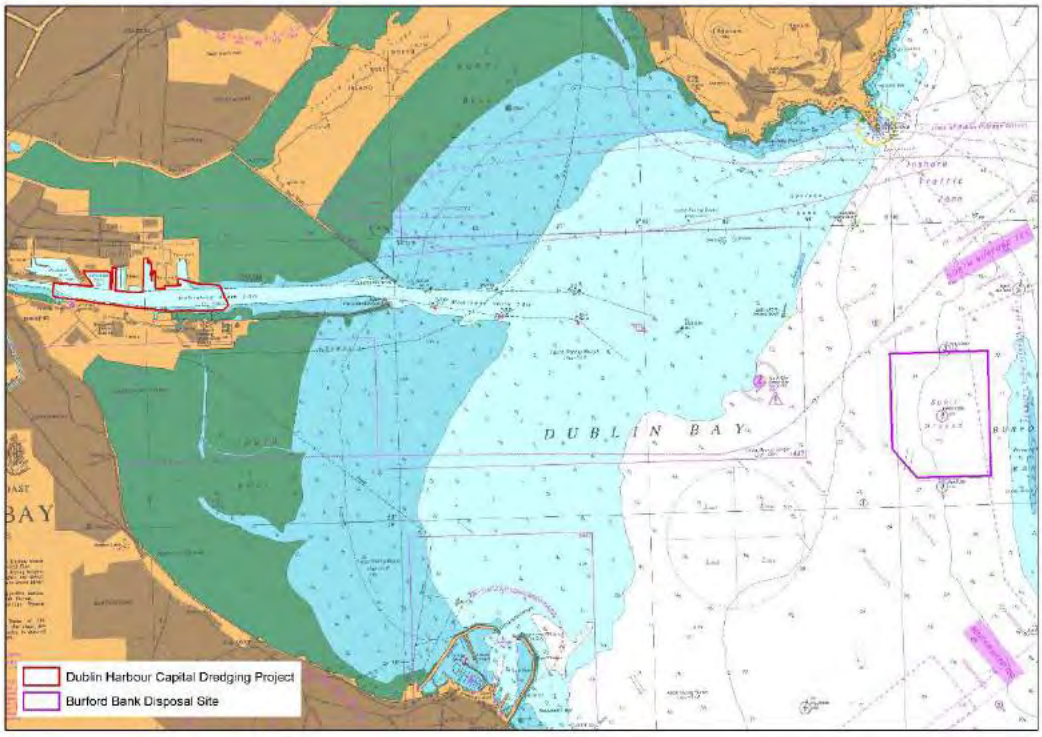


Figure 3-4 Location of licensed offshore disposal site



Plate 3-14 Trailing Suction Hopper Dredger *Reynaert* at offshore disposal site with CoastEye monitoring buoy in the foreground

3.3 Environmental Management of the Dredging Operations

This section sets out typical management procedures undertaken by DPC for all dredging operations within Dublin Port.

Details of the planned dredging campaign are circulated in advance to all stakeholders and the public using a range of media platforms including the DPC website, newspaper advertisements and Notice to Mariners and through direct communication with users of the Inner Liffey Channel such as the Poolbeg Yacht, Boat Club and Marina, Stella Maris Rowing Club, Bull Wall Swimmers Group, ESB Generating Station, Synergen Power Station, Covanta Waste to Energy Plant and Dublin Port operators.

The Port Engineer manages operations during the dredging campaign and chairs a Dredging Working Group comprising representatives from the Harbour Master's Office, the Dredging Contractor, Environmental Facilities Manager, Marine Mammal Observers and Marine Archaeology Observers.

The Dredging Working Group convenes in advance of commencement, and at frequent regular intervals throughout the dredging campaign. The issues to address are set out in a comprehensive, detailed standing agenda.

In advance of commencement the Dredging Working Group confirms that all consents and permits are in place and that all monitoring and mitigation measures are operational. The Dredging Working Group also confirms that the contractor understands the dredging information to be recorded and the required reporting frequency.

The Dredging Working Group ensures that appropriate Health and Safety arrangements are in place. This includes:

- registration and certification of all vessels involved in the campaign by the Marine Survey Office;
- preparation of a project specific Health and Safety Plan by the contractor and approval by DPC;
- preparation of a project specific Emergency Response Plan by the contractor and approval by DPC;
- ensure all DPC and contractor inductions take place as required for all dredging and monitoring personnel; and
- preparation of waste disposal arrangements.

The Dredging Working Group confirms that the contractor understands and appreciates all conditions and constraints applying to dredging operations during the dredging campaign. This includes statutory consent conditions, exclusion zones, prior notification of specific stakeholders before operating in designated areas, time and tidal constraints, permissions required from monitoring personnel to commence or recommence any operations.

A bathymetric survey is completed within one week of commencement of the dredging campaign. A schedule of operations is agreed by the Port Engineer and the Dredging Working Group which takes account of Port Operations and vessel movements within the port.

Progress meetings of the Dredging Working Group are convened at an appropriate frequency determined by operations and conditions and may be daily.

The detailed standing agenda addresses:

- Health and Safety
- Water Quality Monitoring
- Marine Mammal Observers' reports (issued daily)
- Marine Archaeologists' Reports (issued daily)
- Contractor dredging and dumping logs and areas of operation
- Review of latest bathymetric survey charts to assess progress
- Port Vessel Traffic

- Delays or incidents
- Weather Forecast
- New or modified mitigation required such as altered or new exclusion zones
- Operational details such as bunkering or berthing requirements.

At the end of the dredging campaign a final bathymetric survey is undertaken within one week of completion. This is reviewed at a close-out meeting of the Working Group along with summary dredging documents prepared by the contractor. There may also be a requirement for additional post-dredge monitoring surveys.

The Port Engineer collates and files all data relating to the dredging campaign. All monitoring activities and results are reported in a yearly Environmental Report prepared for DPC by its environmental consultants.

This information is presented within an Annual Environmental Report (AER) submitted to the Office of Environmental Enforcement, EPA who review the information and make it publically available on the EPA Website. The information is also kept on file within Dublin Port and is available to view by any interested party including members of the general public.

3.3.1 Working Hours

The proposed Dublin Harbour Capital Dredging Project is not expected to cause a nuisance to the local community. It is therefore proposed that the capital dredging operations will be carried out on a 24 hour basis, 7 days a week (24/7 basis). The impact of noise at the nearest noise sensitive receptors including Pigeon House Road is presented in Chapter 11 of this EIAR. Noise monitoring will be put in place and adjustments made to the working hours, if required, to ensure compliance with Dublin City Council's standard construction noise limits for day time and night time working.

3.3.2 Site Compound

A secure site compound within the grounds of existing DPC facilities (for example, the Maintenance and Supply Building) will be made available to the dredging contractor for the duration of each dredging campaign within the project. The facilities will comprise a Portable Office for management, engineering and drafting staff and an area for staff car parking.

Quayside berths will also be made available, as required, to enable the dredging vessels to undertake the following activities:

- Crew Transfers
- Fuel bunkering
- Collection of objects of potential archaeology interest discovered and retained during dredging operations
- Occasional removal of skips storing debris picked up during the dredging operations such as pieces of discarded cabling, fendering etc by a licenced waste operator.

3.3.3 Traffic

The Dublin Harbour Capital Dredging Project will be undertaken by specialist dredging vessels described previously in Section 3.2.3 arriving by sea and departing by sea. Occasional service vehicles are required for bunkering and removal of skips. Private car use will be limited to circa 10 dredging contractor staff.

Consequently, there will be no perceptible traffic impact on the national road network.

3.3.4 Capital Dredging Environmental Protection Measures

A series of capital dredging environmental protection measures were developed through the preparation of this EIAR whose primary objective is to identify the baseline environmental context of the proposed project, predict potential beneficial and/or adverse effects of the project during the capital dredging phase and propose appropriate mitigation measures where necessary. The preparation of the environmental appraisals was guided by the requirements of EU Directives and Irish law regarding Environmental Impact Assessment (including the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018) and European Commission Environmental Impact Assessment of Projects Guidance on the preparation of the Environmental Impact Assessment Report (Directive 2011/92/EU as amended by 2014/52/EU) (European Commission, 2017).

Detailed scoping was undertaken in respect to the Dublin Harbour Capital Dredging Project in accordance with the European Commission's 2017 "Environmental Impact Assessment of Projects Guidance on Scoping" and the EPA's Environmental Impact Assessment Reports, Draft Guidelines (August 2017). The scoping of the project greatly benefitted from the environmental monitoring programme which is currently in place for the construction of the ABR Project. The site-specific scientific data collected to date has been used to support the preparation of the EIAR and NIS for the Dublin Harbour Capital Dredging Project and facilitates a depth of understanding of the environment in and around Dublin Port including the inner Liffey channel and Dublin Bay. The scope of the Dublin Harbour Capital Dredging Project was further considered in the context of the extensive environmental datasets collated during the preparation of the Strategic Environmental Assessment (SEA) which complemented the review of the Dublin Port Masterplan during 2017 and 2018.

Above all, the consultation process undertaken during both the review of the Dublin Port Masterplan and specifically for the Dublin Harbour Capital Dredging Project provided a sound basis for confirming the key issues to be addressed, the extent of the environmental appraisals required, and the level to which these issues needed to be addressed.

Following the scoping process, the following environmental topics have been comprehensively addressed within the EIAR including:

- Examination of Alternatives
- Risk of Major Accidents
- Biodiversity, Flora and Fauna
- Land, Soils, Geology and Hydrogeology
- Water Quality

- Terrestrial Noise & Vibration
- Underwater Noise
- Material Assets – Coastal Processes
- Cultural Heritage
- Population and Human Health
- Cumulative Effects.

Once the key issues were identified, baseline studies/surveys were carried out. The studies enable the prediction of the likely environmental impacts arising from the Dublin Harbour Capital Dredging Project. These impacts are evaluated in terms of their significance, nature and magnitude.

Integration of the engineering design and environmental requirements from an early stage in the project has enabled mitigation by design to be used, causing many likely significant effects to be eliminated or reduced to an acceptable level during the preliminary design stage. Prime examples are:

- Preventing over-spill at the surface of the dredger for all dredging activities within the inner Liffey Channel;
- Limiting dredging to one side of the navigation channel at a time to prevent the formation of a silt curtain across the River Liffey.
- Switching off the TSHD pumps when the drag head is being lifted and returned from the bottom as the dredger turns between successive lines of dredging to minimise the risk of fish entrainment, whilst dredging within the River Liffey, in the direction of flow.

Mitigation by avoidance has also been used, where possible. An example of mitigation by avoidance includes:

- Restricting the capital dredging operations to the winter seasons (October to March) to avoid disturbance of nesting terns.

Following an examination, analysis and evaluation of the direct and indirect significant effects of the project in relation to the receiving environment, additional mitigation measures and monitoring programmes have been recommended which will be fully implemented during the capital dredging operations of the Dublin Harbour Capital Dredging Project.

This includes limiting the capacity of the TSHD hopper to 4,100m^3 to prevent the accumulation of elevated suspended solids at the disposal site.

Precautionary measures will be undertaken to minimise the risk of injury or disturbance to marine mammals in the area of operations in line with National Parks and Wildlife Service (NPWS) Guidelines (2014). Notably a trained and experienced Marine Mammal Observer (MMO) will be put in place during the loading and disposal operations. The MMO will scan the surrounding area to ensure no marine mammals are in a pre-determined exclusion zone in the 30-minute period prior to operations. The NPWS exclusion zone is 500m for dredging activities.

Chapter 17 of the EIAR sets out all of the mitigation measures and monitoring programmes which will be implemented during the capital dredging operations.

3.3.5 Programme

Chapter 2, Section 2.2.7 sets out the rationale for an 8 year consent and programme. In summary:

- The Dublin Port Masterplan approach of redeveloping existing brownfield sites which are already in operation, to deliver strategic infrastructure projects such as the ABR Project and MP2 Project is not straightforward. The areas where much needed infrastructural improvements is required are in daily use and throughput volumes are expected to grow to 77.2 million tonnes by 2040.
- DPC is currently constructing the ABR Project by way of discrete work packages designed to allow existing customers' growing businesses to continue with minimum disruption. The same approach will be necessary for the already consented MP2 Project.
- The Dublin Harbour Capital Dredging Project supports these significant infrastructure developments by providing sufficient water depth within Dublin Harbour's navigation channel, basins and berths for the safe movement of vessels to and from the port. The same constraints are applicable whereby the project will need to be delivered through a series of discrete work packages to minimise disruption to existing port activities.

The following programme constraints will also apply:

- Capital dredging will be undertaken within the confines of a busy working port. The dredger is likely to require multiple movements to give way to vessels moving to and from the port and vessels berthed at the port.
- Capital dredging of Berth 35 can take place only after the completion of the Ocean Pier redevelopment works permitted under the ABR Project.
- Capital dredging of riverside Berth 52 can only take place after completion of the new quay wall across the entrance to the basin containing existing Berths 52/53.
- Capital dredging of the South Port Berths in the vicinity of Ramp 3 can take place only after the removal of existing Ramp 3 and the demolition of its caisson supports.
- The capital dredging operations will be restricted to the winter seasons (October to March).

Given the above constraints, the capital dredging programme will need to be given a high degree of flexibility.

Experience of capital dredging at Dublin Port through the ABR Project has shown that circa 1,000,000 m^3 of material from the navigation channel was removed from the navigation channel each winter season (October to March). The rate of dredging is likely to be slower during the Dublin Harbour Capital Dredging Project because of the additional constraints outlined above. Nevertheless, even as a worst case scenario if capital dredging was a factor of 4 times slower compared to the ABR Project, the total dredging time within the 8 year timeframe to remove the required 500,000 m^3 would only be circa 12 months in total.

3.4 Operational Phase

There are no significant changes to the existing types of operations, processes and activities (regular and occasional) proposed by the Dublin Harbour Capital Dredging Project. The following maintenance, pollution control and navigational measures will be implemented.

3.4.1 Maintenance Dredging

During the operational stage there will be a requirement for maintenance dredging to be carried out within the berths, basins and channel area.

DPC is currently seeking Foreshore and Dumping at Sea consents for an eight year maintenance dredging programme 2022 – 2029 from the Department of Housing, Local Government and Heritage (DHLGH) and Environmental Protection Agency (EPA) respectively.

It is proposed that future maintenance dredging operations will take place within the period April to September annually to avoid any overlap with the proposed Dublin Harbour Capital Dredging Project.

3.4.2 Pollution Control

All waste from berthed vessels will be disposed of in accordance with the Dublin Port Ship's Waste Management Plan. The storage of waste at the berth will not be permitted. Waste will be collected directly by a licensed waste disposal contractor. Disposal from vessels directly into the water at the berth, Liffey Channel, or Dublin Bay is strictly prohibited.

3.4.3 Navigation

Vessel Speed Limit: The Dublin Harbour Capital Dredging Project will not impact upon the navigation speed limit enforceable within the harbour.

Navigation Charts: The proposed capital dredging works will require updating of the appropriate navigation charts for the area. This will be done through consultation with the United Kingdom Hydrographic Office.

Radar and GPS: Impacts on radar are not envisaged. Global Positioning System navigation charts will be updated based on updates to Navigation Charts.

VHF & Communication: Impacts on VHF radio and other communication systems are not envisaged.

Marine Notices: Marine Notices will be issued to alert the general public of the proposed changed depths to the harbour.

Vessel Manoeuvring: The proposed capital dredging works will improve navigability within Dublin Port.

3.5 Description of the risk of accidents having regard to substances and technologies used

The risk of accidents can arise during both the capital dredging operations and future maintenance dredging requirements of the Dublin Port Capital Dredging Project. There are no substances or technologies being proposed that are not considered 'normal' either by the construction industry or by Port operations.

The capital dredging works are within the vicinity of several establishments that fall within the scope of the *Chemicals Act (Control of Major Accident Hazards Involving Dangerous Substances) Regulations*, 2015 (the COMAH Regulations). In light of the nature of the activities that will take place within the project site, and the nature of the surrounding environment, the most significant risks of major accidents and disasters are associated with the COMAH establishments.

The assessment of the risk of major accidents and disasters is presented in Chapter 6 of the EIAR which concludes that, from a COMAH perspective, the potential direct and indirect risks arising from the Dublin Port Capital Dredging Project satisfy the Health and Safety Authority's COMAH land use planning guidance. It also concludes that other, non-COMAH direct and indirect major accident and disaster risks arising from the Dublin Port Capital Dredging Project are not significantly different from the current risks.

DPC has developed a comprehensive emergency management plan that caters for the range of accident and emergency events that may occur within its estate (or that may occur outside the estate and that have a direct, knock-on effect), and this plan is provided to the other relevant stakeholders, including An Garda Síochána, Dublin City Council, Transport Infrastructure Ireland, and the Principal Response Agencies. In the event of an incident at a COMAH establishment that could impact on people at other facilities in the Port, or on road traffic entering or exiting the Port, DPC will activate its Emergency Management Plan, in which case people would be directed away from the source of the hazard.

3.6 Project change and Decommissioning

Following completion of the capital dredging phase of the works, any temporary works required to facilitate the capital dredging permanent works will be removed from site such as temporary marker buoys.

There are no plans proposed for the decommissioning of the permanent marine works of the Dublin Port Capital Dredging Project given the nature of the Port development which can be considered as 'permanent works'.

3.7 Other related projects and potential for ex-situ effects

3.7.1 Foreshore History Relevant to the Project

DHLGH has granted a number of foreshore consents to DPC. The Foreshore Reference and a description of the works within the foreshore are presented in Table 3-3. This Table also presents foreshore applications submitted by DPC and currently under consideration by DHLGH:

Table 3-3 Foreshore History

Foreshore Reference	Description
MS/51/4/481A	Construction of seawater pumping platform
MS51/4/473	Extending, constructing and maintaining a berth and quays at Berth 50 in Dublin Port
MS51/4/481	Infilling of Graving Dock No. 1 and adjacent area in Dublin Port
MB/2016/01723	ABR Project – Foreshore Lease
MB/2016/01725	ABR Project – Foreshore License
FS005699	ABR Project – Ministerial Consent (Section 10)
MB/2016/0752	Marine Site Investigations as part of ABR Project
AKC/2016/00262	Maintenance Dredging, Navigation Channel and Berths at Dublin Port
FS006806	Pontoons at Berth 50
FS006980	Maintenance Dredging 2020 – 2021
Additional Foreshore Applications submitted (subject to DHPLG Approval)	
FS007132	Eight Year Maintenance Dredging Programme 2022 - 2029

These existing and pending Foreshore Consents are taken into consideration in Chapter 16 Cumulative Effects of this EIAR.

3.7.2 Planning History Relevant to the Project

3.7.2.1 Subject Site

Planning history relevant to the Dublin Port Capital Dredging Project is outlined below with the approximate location of each planning reference illustrated in Figure 3-5 and Figure 3-6. Further consideration has also been made in respect to the common use of the licenced offshore disposal site. These Planning Consents in the vicinity of Dublin Port are taken into consideration in Chapter 16 Cumulative Effects of this EIAR.

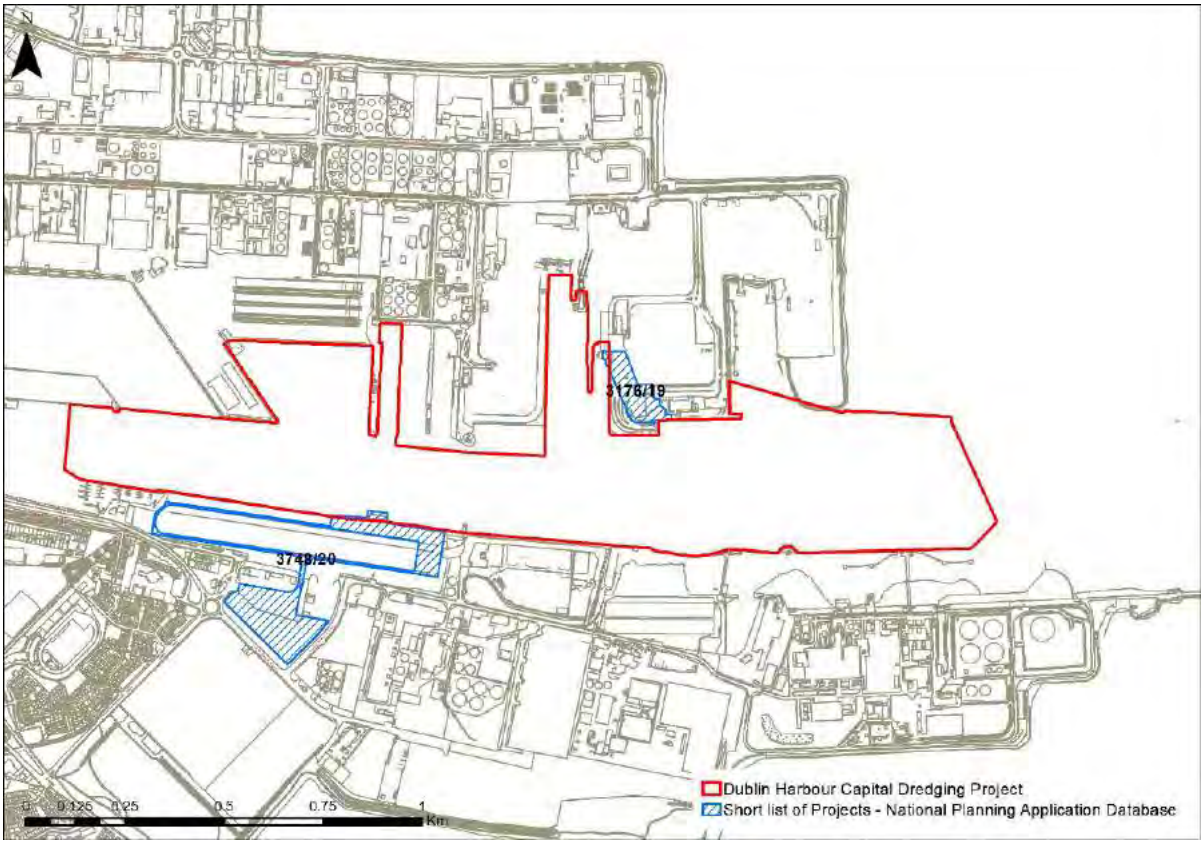


Figure 3-5 Planning History Relevant to the Dublin Port Capital Dredging Project (also refer to Figure 3-6)

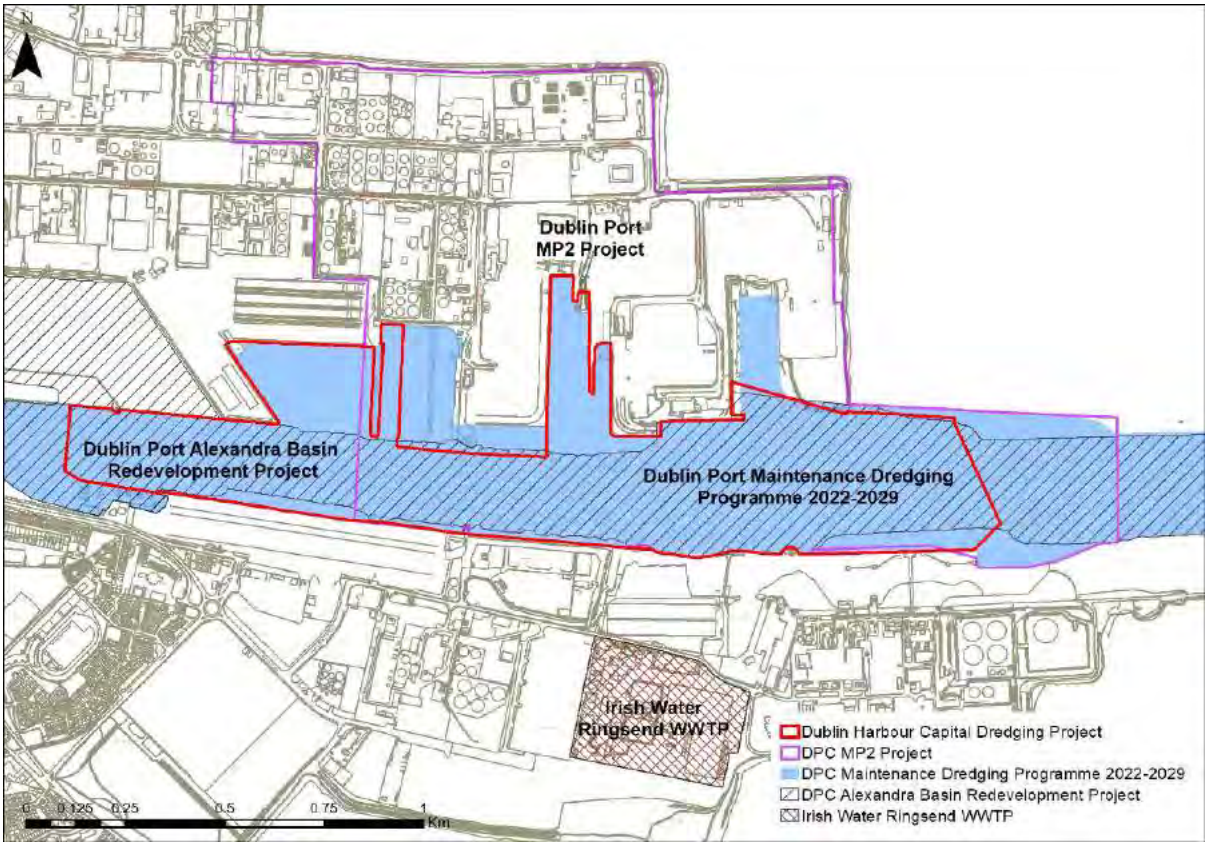


Figure 3-6 Planning History Relevant to the Dublin Port Capital Dredging Project (also refer to Figure 3-5)

3.7.2.2 Dublin Port Company. Eight Year Maintenance Dredging Programme 2022-2028 (Foreshore Reference: FS007132)

Dublin Port Company (DPC) need to carry out regular maintenance dredging of the navigation channel, basins and berthing pockets in order to maintain their advertised charted depths and hence provide safe navigation for vessels to and from the Port.

The loading of dredged material will be restricted to those areas of the navigation channel, basins and berthing pockets which contain sediments which are suitable for disposal at sea (Class 1 : uncontaminated, no biological effects likely). Confirmation of the suitability of the dredged sediments for disposal at sea is made through a programme of sediment chemistry sampling and analysis and eco-toxicological testing. It is proposed to dispose of the dredged sediments at the existing licenced offshore disposal site located at the entrance to Dublin Bay to the west of the Burford Bank, (6.75 km from the lighthouse at the end of the Great South Wall).

The maximum amount of material to be dredged is 300,000 m^3 per annum and it consists mostly of silt and sand with elements of clay, gravel and cobbles. Dredging will be carried out by a trailer suction hopper dredger and support vessels. It is proposed to undertake the maintenance dredging and disposal at sea operations within the period April to September each year between 2022 and 2029. An additional closed period will operate within the inner Liffey channel upstream of Berth 49, including the main channel and channel side berths but not including the basins between 1st April and 14th May to protect migrating Atlantic salmon smolts and River lamprey. The dredging campaign within each of these periods is expected to last approximately 4-6 weeks, depending on weather conditions.

3.7.2.3 Dublin Port Company. MP2 Project (ABP-304888-19)

DPC was granted planning permission subject to conditions, on 1st July 2020, under Section 37E of the Planning and Development Act 2000, as amended, for the MP2 Project comprising the following elements:

- Construction of a new Ro-Ro jetty (Berth 53) for ferries up to 240m in length on an alignment north of the Port's fairway and south and parallel to the boundary of the South Dublin Bay & River Tolka SPA (004024).
- A reorientation of the already consented Berth 52 (ABP Ref. 29N.PA0034). Berth 52 is also designed to accommodate ferries up to 240m in length. The works also comprise an amendment to the consented open dolphin structure (ABP Ref. 29N.PA0034) to create a closed berthing face at the eastern end of Berth 49.
- A lengthening of an existing river berth (50A) to provide the Container Freight Terminal with additional capacity to handle larger container ships. These works will include the infilling of the basin east of the now virtually redundant Oil Berth 4 on the Eastern Oil Jetty. These works also include dredging to a standard depth of -11.0m CD which is a proposed amendment to the channel dredging as permitted under the ABR Project (ABP Ref. 29N.PA0034).
- As part of the infilling of Oil Berth 4, Oil Berth 3 will be redeveloped as a future deep-water container berth (standard depth of -13.0m CD) for the Container Freight Terminal. This will facilitate the change of use of the berth from petroleum importation to container handling when the throughput of petroleum products through Dublin Port declines as a result of national policies to decarbonise the economy.
- The dredging of a berthing pocket to a standard depth of -13.0m CD at Oil Berth 3 will require stabilisation of the existing quay wall at Jetty Road. It is not proposed to use this quay wall for the berthing of vessels.
- Dredging at the proposed Berth 53 and channel widening to a standard depth of -10.0m CD which is a proposed amendment to the channel dredging as permitted under the ABR Project (ABP Ref. 29N.PA0034).
- Consolidation of passenger terminal buildings, demolition of redundant structures and buildings, and removal of connecting roads to increase the area of land for the transit storage of Ro-Ro freight units as a Unified Ferry Terminal (UFT). Works include reorganisation of access roads; two proposed check in areas comprising a total of 14 check lanes; proposed set down and parking area for the existing Terminal 1 building; proposed pedestrian underpass to access the existing Terminal 1 building; three proposed toilet blocks and a proposed ESB Substation. These works comprise amendments to consented developments with planning reference numbers 3084/16 & 3638/18 (detailed in section 3.6.2.5 and 3.6.2.6 below), and the ABR Project (ABP Ref. 29N.PA0034).
- A heritage zone adjacent to Berth 53 and the Unified Ferry Terminal set down area. This comprises an alteration to consented development planning reference 3084/16.

3.7.2.4 Dublin Port Company. Alexandra Basin Redevelopment (PL29N.PA0034)

DPC was granted planning permission subject to conditions, on 8th July 2015, under Section 37E of the Planning and Development Act 2000, as amended, for the redevelopment of Alexandra Basin, Berths 52 and 53 and dredging of the channel of the River Liffey together with associated works in Dublin Port. Elements of the proposed development can be summarised as follows:

Alexandra Basin West:

- The infilling of graving Dock No. 2 having an area of 6,055m^2;
- The excavation and restoration of historic Graving Dock No. 1;
- The demolition of the bulk jetty having an area of 3,200m^2;
- The demolition of a section of North Wall Quay extension having an area of 21,700m^2;
- Extension of Alexandra Quay West of 130m in length;
- New 273 m long Ro-Ro jetty and provision of three Ro-Ro ramps; and
- The dredging of: 470,000m^2 of contaminated material to a depth of -10.0m Chart Datum (CD) over an area of 194,000m^2 within the redeveloped Alexandra Basin West and its remediation.

Berth 52 and 53:

- The demolition of existing berths 52 and 53;
- Jetty at Berth 52 having an area of 500m^2;
- Concrete Dolphin at Berth 53 having an area of 500m^2;
- The construction of:
    - A new river berth at Berths 52/53, 300m long;
    - New 75m mooring jetty at new river berth;
    - New 40m long mooring jetty to extend existing berth 49, 50m long;
- The infilling of the Terminal 5 Ro-Ro basin, an area of 45,650m^2;
- Raising of existing levels by 1.4 m over an area of 95,000m^2; and
- Dredging of new river berth to -10.0m CD.

Liffey Channel:

- Construction of a marina protection structure to a height of +7.0m CD and a length of 220m on the south side of the river channel. Dredging of the shipping channel to a depth of -10m CD from a point 55m to the east of the East link bridge, to a location in the vicinity of Dublin Bay, a total distance of 10,320m.

3.7.2.5 Ringsend Wastewater Treatment Plant – PL 29S.301798

Irish Water submitted a planning application for strategic infrastructure development to the Board seeking permission to further progress the upgrade of the Ringsend Wastewater Treatment Plant (WwTP) on 6th June 2018. The application sought permission for works required to facilitate the use of Aerobic Granular Sludge (AGS) technology, to omit the previously permitted long sea outfall tunnel and to upgrade the sludge treatment facilities at Ringsend, Dublin 4, and to provide for a Regional Biosolids Storage Facility in Newtown, Dublin 11. The Board granted permission for the proposed development on the 24th April 2019.

3.7.2.6 Dublin Port Company. Berth 49 Approach and Ramp (Reg. Ref. 3176/19)

DPC was granted planning permission on the 9th September 2019 for the development of an additional approach and ramp in addition to office and staff facilities building at Berth 49.

3.7.2.7 Dublin Port Company. Demolition and removal of Ramp No. 3 (Reg. Ref 3748/20)

The disused Ramp No. 3, and its supporting structures are located in the South Port area within the existing MTL container freight terminal. The Ramp No.3 was constructed in circa 1974 and consists of a structural steel girder ramp supported on two gravel filled concrete caissons on the west end and one gravel-filled concrete caisson on the east end. The ramp and supports have been subject to a number of vessel collisions over its lifetime which have affected the condition of the structure and its interface to the quay. DPC was granted planning permission on the 20th f January 2020 for the demolition and removal of Ramp No.3 and its support structure; and all associated ancillary site development works.

3.7.2.8 Howth Yacht Club. Demolition and removal of Ramp No. 3 (Reg. Ref 3748/20)

Howth Yacht Club currently holds of a Dumping at Sea Permit (Ref. No. S0010-01) to load and dump a maximum of 120,000 tonnes of dredged material from Howth Marina over a one year period at the licenced dump site located at the approaches to Dublin Bay, west of the Burford Bank. In its application documents, Howth Yacht Club estimated a maximum daily quantity for dumping of 1,200 tonnes and 800 tonnes in each load. It also suggested a spring or winter commencement and campaign duration of six months.

4 EXAMINATION OF ALTERNATIVES

4.1 Introduction

Assessment of reasonable alternatives is mandatory under the EIA Directive. The process allows for adjustment to minimise environmental impact thus minimising project significant effects on the environment.

Alternatives are different ways of carrying out the Project in order to meet its agreed objective and there are a range of types of alternatives in relation to a Project: Design; Technology; Location; Size; and Scale.

The assessment of alternatives for the Dublin Harbour Capital Dredging Project has been undertaken in accordance with the following guidance documents:

- The EU Commission's Environmental Impact Assessment of Projects Guidance on the Preparation of the Environmental Impact Assessment Report (Directive 2011/92/EU as amended by 2014 /52/EU)
- The EPA's Advice notes on Current Practice (in the preparation of Environmental Impact Statements) and The Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIARs) (EPA, 2017)
- The Department of Housing, Planning and Local Government Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment August 2018.

The DHPLG Guidelines state that the EIA Directive requires that an EIAR includes *"a description of the reasonable alternatives studied ….. which are relevant to the project and its specific characteristics".* This *"must also indicate the main reasons for the option chosen taking into account the effects of the project on the environment ….. The type of alternatives will depend on the nature of the project proposed and the characteristics of the receiving environment ….. It is generally sufficient for the developer to provide a broad description of each main alternative studied and the key environmental issues associated with each. A 'mini-EIA' is not required for each alternative studied."*

Assessment of alternatives includes consideration of the avoidance, prevention, reduction, or offsetting of adverse environmental effects, which may be described at a number of levels including:

- those assessed at plan stage (which the EU guidance states *"it would likely be unnecessary to consider them again")* and
- those assessed at design stage (which the EU guidance describes as *"alternatives or variants of Project components in order to mitigate significant environmental impacts that emerge during assessment"*).

The Dublin Harbour Capital Dredging Project is a key supporting element of the infrastructural development of Dublin Port which is being developed in accordance with the Dublin Port Company's Masterplan to increase its capacity to 77.2m gross tonnes by 2040. The Project aligns with the Masterplan's fundamental approach of maximising the utilisation of Dublin Port's brown-field lands rather than seeking to build new additional Port facilities at a green-field location to deliver this increased capacity.

Figure 3 in the Masterplan (reproduced in Figure 1-2) identifies the land uses and infrastructure projects on port lands which will allow the port to increase its capacity to 77.2 million gross tonnes by 2040. The Masterplan identifies that this is the ultimate capacity of Dublin Port.

The Dublin Port Masterplan 2040 envisages that the development of Dublin Port to this ultimate capacity will be achieved by a number of significant infrastructure projects:

- the Alexandra Basin Redevelopment (ABR) Project (29N.PA0034), which is under construction;
- the construction of the Dublin Inland Port, located 14 km from Dublin Port, which has also commenced,
- the MP2 Project, which received planning permission on 1st July 2020 (ABP-304888-19); and
- a project on the Poolbeg Peninsula (as shown in Figure 1-2 including development of land areas K, L, M, N and O) and possibly also including the development of the Southern Port Access Route (SPAR) to provide connectivity between the Dublin Port Tunnel and the south port lands as envisaged in NTA's Transport Strategy for the Greater Dublin Area 2016 to 2035.

Figure 5 in the Masterplan (reproduced in Figure 1-3) provides an indicative layout of the navigation channel, basins and berthing pockets at Dublin Port at 2040.

The Dublin Harbour Capital Dredging Project brings forward for consent key elements of the capital dredging works required to create the required depth of the navigation channel, basins and berthing pockets.

The works proposed in the Dublin Harbour Capital Dredging Project are shown in Figure 1-4 and Figure 1-5 and comprise a number of elements:

- Deepening the navigation channel between North Wall Quay Extension and the Western Oil Jetty, including a manoeuvring area and riverside Berth 35;
- Deepening of Alexandra Basin East and deepening/widening of berths;
- Deepening of the Oil Basin and widening of berths;
- Deepening of the Ferryport Basin and widening of berths;
- Deepening of riverside Berth 52 and its approaches
- Widening the South Port (Berths 42 - 47) berths
- Deepening the approaches to Poolbeg Oil Jetty (Berth 48)

This chapter of the EIAR examines the 'alternatives' that have been considered at a plan / strategic level (in the preparation of Dublin Port's Masterplan, reviewed 2018) and at detailed, technical, level in the design stage evolution of the Dublin Harbour Capital Dredging Project.

The strategic assessment of alternatives considered at Masterplan level was conducted in accordance with the pertinent SEA Directive and its supporting guidance. This level of assessment addressed reasonable and feasible alternatives mainly with regard to the location, size and scale of these alternatives.

The assessment of detailed alternatives during the project-level design evolution process considers primarily the design and technology alternatives and variants with due regard to their location, size and scale.

This chapter should be read in conjunction with Chapter 2 'Need for the Dublin Harbour Capital Dredging Project' as this provides the statement of need and land-use planning support for the Project, having regard to international, national, regional and local policy and objectives. Chapter 3 'Project Description' is also pertinent as it describes the proposed development and provides information on the project site, design, size and other relevant features.

4.2 Examination of Strategic Alternative Options

Dublin Port Company (DPC) conducted a review of its Masterplan 2040 in 2018 following the grant of permission for the ABR project. As part of this plan level assessment process, alternative development options for the Port were considered with regard to their feasibility and reasonableness. These strategic options included retaining the existing Masterplan strategy which included further expansion of the Port within the Tolka Estuary.

During the preparation and review of the Masterplan, detailed consideration was given to Dublin Port's ultimate capacity and how this could be achieved alongside the Port's current activities. This mainly addressed the location, size and scale of the alternatives. A suite of assessments was undertaken and presented for public consultation in order to establish the strategic needs for infrastructural development at Dublin Port including the need for capital dredging which is being taken forward to this more detailed consenting phase.

The Dublin Harbour Capital Dredging Project would support the reviewed Masterplan's fundamental approach of providing capacity in Dublin Port for the 77.2m gross tonnes projected by 2040 by providing the required depth of water within the navigation channel, basins and berths. This would be achieved by maximising the utilisation of Dublin Port's brown-field lands, rather than seeking to expand eastwards into Dublin Bay to build new additional Port facilities at a green-field location. The assessment process, in support of the Masterplan review, identified that this the most feasible and reasonable approach, and therefore the most sustainable approach. The primary reason for the decision to select this alternative over the original Masterplan strategy is the avoidance of direct adverse significant environmental impact on the designated SPA within the Tolka Estuary.

The SEA for the Dublin Port Masterplan 2040, reviewed 2018 was prepared in accordance with Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment (SEA Directive), as transposed into Irish law by the European Communities (Environmental Assessment of Certain Plans and Programmes) Regulations 2004 [S.I. 435/2004] and the Planning and Development (Strategic Environmental Assessment) Regulations 2004 [S.I. 436/2004], and their recent amendments of European Communities (Environmental Assessment of Certain Plans and Programmes) (Amendment) Regulations 2011 [S.I. 200/2011] and the Planning and Development (Strategic Environmental Assessment) (Amendment) Regulations 2011 [S.I. 201/2011]. All relevant SEA resources and guidance prepared by the EPA were taken into account in the development of the Masterplan Review, including the SEA Pack, the SEA Process Checklist, Developing and Assessing Alternatives in SEA, the SEA Spatial Information Sources and the Synthesis Report on developing an SEA Methodology for Plans and Programmes in Ireland.

4.2.1 Description of Strategic Alternative Scenarios

During the preparation of the Dublin Port Masterplan 2040 reviewed, consideration of alternative options to the planning of the Port's future were considered at a strategic level. This process has informed the consideration of alternatives in the preparation of the Dublin Harbour Capital Dredging Project. A number of potential scenarios were assessed yielding a full range of potential options as follows:

- No Port Expansion:
  - No port expansion. (This particular option represents the strategic 'do-nothing' scenario).
- Optimise Main Port Lands:

  - Optimise throughput of existing facilities
  - Optimise throughput of existing facilities and increase berthage in North Port lands
  - Optimise throughput of existing facilities and increase berthage in North Port and South Port lands

- Optimise Main Port Lands and Increase Port Lands:
  - Rationalise existing facilities, increase berthage in the North Port and South Port lands, improve road infrastructure and infill adjacent to Port (part of Tolka Estuary). (This particular option represents the implementation of the original Masterplan strategy which addresses the scenario of "The Evolution of the Environment in the Absence of the Masterplan 2040, reviewed 2018").
  - Rationalise facilities, increase berthage in North Port and South Port lands, improve road infrastructure and develop Inland Port.
  - Rationalise facilities, increase berthage in North Port and South Port lands, improve road infrastructure and develop additional Coastal Port Facility external to Dublin Port.

The potential strategic options were assessed against a technical requirement in the first instance. The target for expansion is to achieve a throughput of 77.2m gross tonnes by 2040 (the predicted cargo volumes by this year). This value is utilised as a pass/fail criteria to screen and short list the options. A technical assessment is used to determine the growth that any potential option can accommodate.

It was determined that only those potential options involving optimising the main port lands and increasing port lands would be capable to delivering the required capacity to meet growth projection. This sub-set of potential options which passed the capacity test were then subjected to further technical, environmental and social assessment.

The basis for comparison of alternative options was to determine if they were technically feasible within the timescale of capacity demand, environmentally sustainable and socially acceptable.

Option 1: This option, which comprised rationalising existing facilities, increasing berthage in the North Port and South Port lands, improving road infrastructure and infilling adjacent to Port (part of Tolka Estuary), was screened out on environmental grounds. This was on the basis of its potential impact on the designated SPA, whilst a viable alternative of utilising addition lands at an Inland Port for certain suitable activities had been identified, this potential impact was thus assessed to be avoidable. However this potential option, as established by the original masterplan, represented a strategic scenario in the absence of a plan and was therefore retained in the analysis to provide a reference point against which other options could be assessed.

Option 2: This option comprised rationalising facilities, increasing berthage in North Port and South Port lands, improving road infrastructure and developing an Inland Port (to provide capacity for non-core port activity and thus support the Dublin Port minimum dwell time initiative). This option satisfied the further technical, environmental and social criteria. It presents the preferred option identified by the Masterplan review process and the Dublin Harbour Capital Dredging Project forms a key element of this option.

The potential option of rationalising facilities, increasing berthage in North Port and South Port lands, improving road infrastructure and developing additional Coastal Port Facility external to Dublin Port was not considered to

be achievable within the timescale of the capacity demands. This option was therefore not considered further as a means of achieving the required Port capacity to 2040.

The findings of the comparison of alternative strategic options that prepare for potential further future growth in port demand, are summarised in Table 4-1. Further detail on these two options and their short, medium and long term impacts are summarised in the following section.

The Dublin Harbour Capital Dredging Project is an integral part of the Masterplan and its comparison as part of Options 1 and 2 is described within the following sections.

Table 4-1 Details of how the Strategic Options were identified in Technical Assessment

Long List of Options	Achieves Throughput of 77.2m Tonnes (Technical Screening – Pass/Fail)	Achieve Throughput of 77.2m Tonnes (Technical Screening – Reasoning)	Short list of Reasonable Options	Short Description
No Port Expansion				
No port expansion	Fail	Does not provide adequate expansion	No further Port Expansion once projects through the planning process are completed	The existing port lands continue the present day/*status quo* operations and facility use, the ABR development, and other smaller projects (DPC internal roads, demolitions and associated upgrade works, and yards upgrades) which have been approved and are under construction form part of this regime.
Optimise Main Port Lands				
Optimise throughput of existing facilities	Fail	Does not provide adequate expansion	Not Applicable	Increased capacity is provided by relatively minor improvements to the existing operations and facilities, towards maximising efficiencies and capacity use of brownfield sites.
Optimise throughput of existing facilities and increase berthage in North Port lands	Fail	Does not provide adequate expansion	Not Applicable	Increased capacity is provided by an additional eastern jetty and further quay development within the North Port area alongside relatively minor improvements to the existing operations and facilities, towards maximising efficiencies and capacity use of brownfield sites.
Optimise throughput of existing facilities and increase berthage in North Port and South Port lands	Fail	Does not provide adequate expansion	Not Applicable	Increased capacity is provided by an additional eastern jetty and further quay development within the North Port area and development of new quays within the South Port lands, alongside relatively minor improvements to the existing operations and facilities, towards maximising efficiencies and capacity use of brownfield sites, using existing road infrastructure linkages.

Optimise Main Port Lands and Increase Port Lands				
Rationalise existing facilities, increase berthage in the North Port and South Port lands, improve road infrastructure and infill adjacent to Port (part of Tolka Estuary).	Fail	Provides adequate expansion, however, the Art 6(4) process of the Habitats Directive (IROPI) would require no better alternative to exist (regardless of cost)	Not Applicable OPTION 1	Increased capacity is provided by infilling adjacent to the North Port lands (part of Tolka Estuary) and development of quays within the North Port and South Port lands, alongside rationalisation/relocation of the existing operations and facilities, towards maximising efficiencies and capacity use of brownfield sites, using enhanced road infrastructure linkages including new bridge across the River Liffey.
Rationalise facilities, increase berthage in North Port and South Port lands, improve road infrastructure and develop Inland Port.	Pass	Provides adequate expansion, within 2040 timescale	Rationalise facilities, increase berthage in North Port & South Port lands, improve road infrastructure & develop Inland Port. OPTION 2	Increased capacity is provided by the creation of a new Dublin Inland Port, and development of quays within the North Port and South Port lands, alongside rationalisation/relocation of the existing operations and facilities, towards maximising efficiencies and capacity use of brownfield sites and enhancing road infrastructure linkages including new bridge across the River Liffey.
Rationalise facilities, increase berthage in North Port and South Port lands, improve road infrastructure and develop additional Coastal Port Facility external to Dublin Port.	Fail	Provides adequate expansion, but not technically feasible within 2040 timescale and inconsistent with current national Ports Policy	Not Applicable	Increased capacity is provided by developing an additional coastal facility, and development of quays within the North Port and South Port lands, alongside rationalisation/relocation of the existing operations and facilities, towards maximising efficiencies and capacity use of brownfield sites and enhancing road infrastructure linkages including new bridge across the River Liffey.

Option 1: Original Masterplan Strategy

Prior to the review of the Dublin Port Masterplan in 2018, the major Strategic Infrastructure Development projects outlined in the first iteration of the Dublin Port Masterplan 2040 were considered for development. Under Option 1, these developments were envisaged to progress in the short (2017 – 2021), medium (2021 – 2031) and long (2031 - 2040) term. Port operations would have been ongoing in tandem with the proposed developments throughout the period of the Masterplan.

Short Term: 2017 – 2021:

Developments within the short term timescale of the original Masterplan Strategy were to be concentrated within the Northern Port Lands. Construction of the ABR Project continues throughout this time. In summary the main proposed developments were:

- Development of the ABR Project including infilling of Berths 52/53 and the development of Alexandra Basin West. Non-ABR related development within the Alexandra Basin West will include the development of a new bulk solid conveyor system and partial demolition of existing buildings to extend Ocean Pier multi-purpose area.
- Commencement of a capital dredging programme to deepen the Alexandra Basin West and navigation channel to a standard depth of -10 m CD as part of the ABR Project.
- Construction of public realm and greenway.
- Construction of revised road network in Northern Port Lands.

Medium Term: 2021 – 2031

Development within the first five years (2021-2026) of the medium term was concentrated within the Northern Port Lands. Development within the last five years (2026-2031) of the medium term was concentrated in the Southern Port Lands. The completion of the ABR Project and the Dublin Gateway Project takes place in the medium term. In summary the main proposed developments were:

- Completion of the capital dredging programme as part of the ABR Project.
- Completion of the ABR Project with the demolition of North Quay Wall.
- Completion of the Dublin Gateway Project including an eastward extension of approximately 21 ha, development of two new river berths and development of a multi-user check in area for Ro-Ro traffic. This development will provide a new Ro-Ro facility in the Northern Port Lands.
- Public realm works including the conservation of a graving dock and pump house in Northern Port Lands, and the provision of the North Quay Wall Light House and Stoney Blocks interpretative zone.
- Development of a bridge over the River Liffey and upgrading of the road network in the Southern Port Lands. Reclaiming of 12.6 ha for development of a multi-purpose berth in front of the Poolbeg Power Station. Development of new quay wall and berth directly west of reclaimed land for bulk solid.
- Extension/upgrade of Southern Greenway.

Long Term: 2031+

All Dublin Port Masterplan development were to be completed by the long term stage, with infrastructure at the Port capable of handling a throughput of 60 million tonnes per annum. This infrastructure is capable of handling the required throughput of Dublin Port until 2032.

Option 2: Dublin Port Masterplan 2040, reviewed 2018

With the implementation of the Masterplan 2040, reviewed 2018 (Option 2), the Strategic Infrastructure Development projects outlined in the Masterplan would take place in the same timescales as in Option 1. Port operations would be ongoing in tandem with proposed developments throughout the timescale of the Masterplan.

Short Term: 2017 – 2021

Development within the short term timescale of the Masterplan 2040 were to be concentrated within the Northern Port Lands, with the exception of the Dublin Inland Port. Construction of the ABR Project continues throughout the short term. In summary the main proposed developments were:

- Development of the ABR Project including infilling of Berths 52/53, development of a new river berth and the development of Alexandra Basin West. Non-ABR related development within the Alexandra Basin West will include the development of a new bulk solid conveyor system and partial demolition of existing buildings to extend Ocean Pier multi-purpose area.
- Commencement of a capital dredging programme to deepen the Alexandra Basin West and navigation channel to a standard depth of -10 m CD as part of the ABR Project.
- Construction of public realm and greenway.
- Construction of revised road network in Northern Lands.
- Development of the Dublin Inland Port including the construction of roads, buildings and yards, and the relocation of non-core users to Dublin Inland Port.

Medium Term: 2021 – 2031

Development within the first five years (2021-2026) of the medium term would be concentrated within the Northern Port Lands. Development within the last five years (2026-2031) of the medium term would be concentrated in the Southern Port Lands. The completion of the ABR Project and the MP2 Project within the medium term are two milestone infrastructure project completions which would allow for growth to be accommodated. In summary the main proposed developments were:

- Completion of the capital dredging programme as part of the ABR Project.
- Completion of the ABR Project i.e. demolition of North Quay Wall and development of washwall on southern side of Liffey.
- Completion of the MP2 Project i.e. construction and operation of a unified ferry terminal (UFT) and neighbouring container terminal (see Chapter 2 Project Description).

- Public realm works including the conservation of a graving dock and pump house in Northern Port Lands, and the provision of the North Quay Wall Light House and Stoney Blocks interpretative zone.
- Development of the SPAR (requiring construction of a bridge over the River Liffey and partial infill of the southern foreshore of the Inner Liffey Channel) and upgrading the road network in the Southern Port Lands. Reclaiming and redevelopment of 13.8 ha for deepwater Lo-Lo and multi-purpose berths, relocating Lo-Lo operations east towards Poolbeg Power Station away from the Poolbeg SDZ West scheme. This relocation will allow for development of Ro-Ro operations adjacent to the Poolbeg SDZ West scheme.
- Extension/upgrade of Southern Greenway, reopening of section of Great South Wall adjacent to ESB generating station as public realm and allocation of 4 ha public realm to create buffer between Southern Port Lands and the Poolbeg SDZ West scheme.
- Development of the Dublin Inland Port including the construction of roads, buildings, yards and a road juncture, and the relocation of non-core users to Dublin Inland Port to support the Dublin Port dwell time initiative.

Long Term: 2031+

Within the last nine years of the Masterplan only small plots on the Northern Lands currently utilised by the Bulk Liquid may be acquired and redeveloped for unitised freight. The infrastructure in place at this juncture would allow for the throughput of 77.2m gross tonnes per annum, equating to a growth rate of 3.3% per year.

Summary of Strategic Option Assessment

The main differences in potential environmental impacts between the two options were assessed at strategic level during review of the Masterplan. These are summarised as follows with regard to SEA environmental issues and taking mitigation into account:

- Option 1 proposed to infill 21 ha of land, part of which located within the South Dublin Bay and River Tolka Estuary SPA. The omission of this element within Option 2 results in long term positive impacts to the designated and undesignated biodiversity of this area, with no loss in their habitat, and an improvement in the landscape of the Dublin Bay Biosphere with no eastward extension of land.
- Option 2 proposed development of Dublin Inland Port alongside the MP2 Project. The potential environmental impacts resulting from Option 2 are likely to be less than those arising from Option 1 which included the Dublin Gateway Project. No designated biodiversity sites are likely to be significantly affected, and the natural landscape designated in the Dublin Bay Biosphere remains unaltered.
- Option 2 proposes to relocate Lo-Lo operations on southern lands away from the Ringsend SDZ and Poolbeg SDZ. This is likely to result in medium and long term reductions in noise and vibration impacts to the area and to the local community.
- Option 2 proposes to develop the SPAR link with the aim of keeping port traffic within the Port Estate. This is likely to reduce long term impacts on the public road network, thereby reducing negative impacts to material assets, and reduce long term disturbance impacts and air emissions to the local communities.

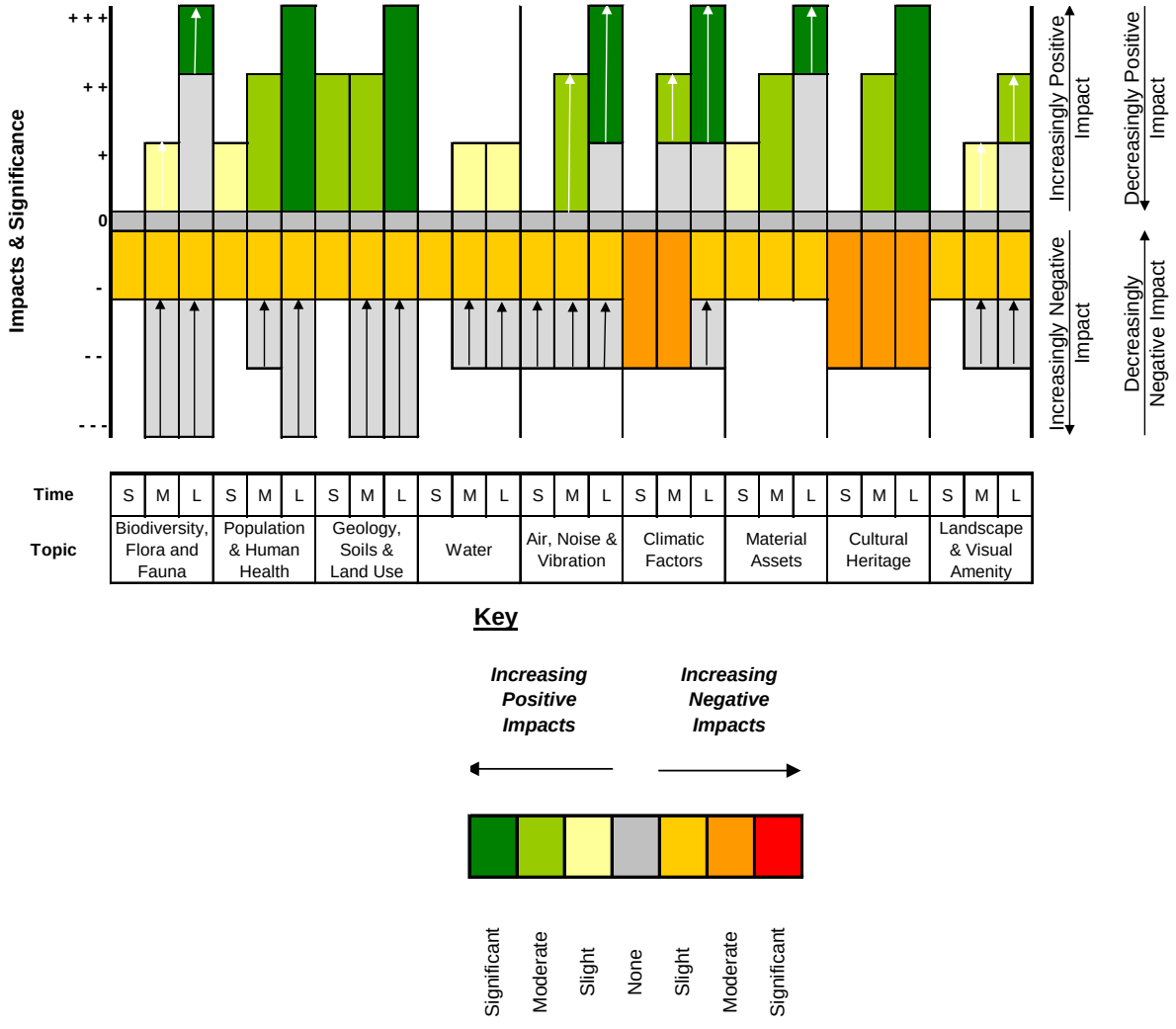
- Option 2 proposes to install shore-side electricity facilities at new berths. This will result in permanent reductions in local air emissions, reducing negative air, noise and climatic factor impacts associated with port operations.
- Option 2 proposes to design future development for flood risk and climate change. This is likely to reduce negative impacts resulting from flooding to material assets owned by DPC in the long term, and improve climatic factor and water impacts.
- Option 2 proposes to reopen a section of the Great South Wall as public realm and allocate 4 ha public realm. These will result in an increase of social amenity areas available to the local communities, and an improvement of the landscape in the medium and long term with areas of public realm blocking views of industrial port activity.
- Option 2 proposes to design screening for the greenways and public realm areas to ensure views of industrial port activity are partially blocked to the public, resulting in benefits to the landscape in the medium and long term.
- Option 2 proposes to design screening into the greenways to ensure the public and the industrial port activity is partially blocked to the waterbird species in the South Dublin Bay and River Tolka Estuary SPA, resulting in benefits to the biodiversity in the medium and long term through reduced disturbance.
- The NIS concluded that the loss of the tern dolphins in the South Dublin Bay and River Tolka Estuary SPA can only go ahead if certain conditions are met at the detailed project level to maintain the integrity of the SPA. As a result, this process is likely to decrease the potential negative impacts to biodiversity in the medium and long term.

A comparison of the potential positive and negative scores that have been generated from the mitigated assessment of these strategic options is presented in Table 4-2. Option 1 (Original Masterplan Strategy implementation) is taken as the base case for comparison with Option 2 (Masterplan 2040, reviewed 2018): the comparative arrows show increases in positive impact and reductions in negative impact. In all cases Option 2 is either equal to, or better, than Option 1 with regard to the environmental topics.

Table 4-2 Comparison of Strategic Options by SEA Environmental Issue

Environmental Topic	Short Term Difference	Medium Term Difference	Long Term Difference
Biodiversity, Flora & Fauna	0 / 0	+2 / +1	+2 / +1
Population & Human Health	0 / 0	+1 / 0	+2 / 0
Geology, Soils and Landuse	0 / 0	+2 / 0	+2 / 0
Water	0 / 0	+1 / 0	+1 / 0
Air, Noise & Vibration	+1 / 0	+1 / +2	+1 / +2
Climatic Factors	0 / 0	0 / +1	+1 / +2
Material Assets & Infrastructure	0 / 0	0 / 0	0 / +1
Cultural, Architectural & Archaeological Heritage	0 / 0	0 / 0	0 / 0
Landscape & Visual Amenity	0 / 0	+1 / +1	+1 / +1

Comparison of Options



The implementation of Option 2 will result in a greater number of positive impacts when compared to the impacts resulting from Option 1. The medium and long term impacts to biodiversity, flora and fauna are likely to increase to slight and moderate impacts, respectively, with screening designed into the greenway developments. The long term impacts to biodiversity, flora and fauna are likely to increase from moderately positive to significantly positive with the exclusion of the Dublin Gateway Project. The medium and long term significant negative impacts to biodiversity, flora and fauna are likely to decrease to slight negative impacts with the removal of the tern dolphin going ahead only in the case that the integrity of the South Dublin Bay and River Tolka Estuary SPA is not impacted. The medium and long term negative impacts to the population and human health are likely to reduce to slight negative impacts with less noise disturbance and air emissions to the local communities. The significant negative medium and long term impacts to geology, soils and landuse are likely to reduce to slight negative impacts with the omission of the Dublin Gateway Project in Option 2. The moderate negative medium and long term impacts to water are likely to reduce to slight negative impacts, with improvements in flood risk management at Dublin Port. Air, noise and vibration impacts are likely to permanently reduce to slight negative impacts with the instalment of shore-side electricity facilities, and are likely to become moderately positive in the medium term and significantly positive in the long term with the creation of public realm, development of the SPAR link and the relocation of Lo-Lo operations away from the local communities. There is likely to be an overall improvement in climatic factor impacts in the medium and long term with the instalment of shore-side electricity facilities and the inclusion of management for flood risk into all future development at the Port. Medium and long term negative impacts to the overall landscape are likely to improve with the omission of the Dublin Gateway Project, the inclusion of greater public realm in Option 2 and the inclusion of screening into the design of greenways and public realm areas. Overall Option 2 is a more sustainable development programme which allows for the achievement of the required 77.2m gross tonnes throughput per annum.

The Dublin Harbour Capital Dredging Project is a key element of the Masterplan's implementation, underpinning the Masterplan's fundamental approach of providing capacity in Dublin Port for the 77.2m gross tonnes projected by 2040 by maximising the utilisation of Dublin Port's brown-field lands. The assessment process in support of the Masterplan identified that this is the most feasible and sustainable approach available to the Port within the project's timescale.

Conclusion of the strategic option Appraisal

The assessment process, in support of the Masterplan review (Option 2), identified that this is the most feasible and reasonable approach, and therefore the most sustainable approach. The primary reason for the decision to select this alternative over the original Masterplan strategy is the avoidance of direct adverse significant environmental impact on the designated SPA within the Tolka Estuary.

4.3 Examination of Project Level Alternative Options

This section of the EIAR describes the project level evolution of the design of, and associated technology used for, the proposed dredging works required to achieve the objective of the Dublin Harbour Capital Dredging Project. The key objective is to bring forward for consent key elements of the capital dredging works required to create the required depth of the navigation channel, basins and berthing pockets as set out in the Dublin Port Masterplan 2040, reviewed 2018.

The location, size and scale of the required capital dredging is determined by the existing port infrastructure and consented port Infrastructure under the ABR Project and MP2 Project. The project level design and technology evolution focussed on alternatives for the loading and disposal stages taking into account the following key factors

- Dredging methodology; and
- Environmental impacts.

4.3.1 Loading Alternatives

Capital dredging is undertaken by experienced dredging contractors using specialist equipment to remove sediments from the seabed to achieve the required design depth of water. This dredging operation is known as 'Loading' in accordance with the Dumping at Sea Acts 1996 to 2010.

There are a number of alternative methods of undertaking the loading process

- Mechanical Dredging
  - Backhoe dredger - uses an open-faced excavator bucket to pick up sediment.
  - Bucket-ladder dredger - picks up sediment using many circulating buckets attached to a wheel chain.
  - Clamshell dredger - picks up sediment with a "clamshell" bucket, operated by a crane or fixed-arm excavator.
  - Plough dredger - blade pulled behind a suitable vessel.
- Hydraulic Dredging
  - Trailing suction hopper dredger - sucks up the sediment as a slurry which is held in a ship (hopper).
  - Pipeline dredger - sucks up the sediment slurry and pumps it through a pipeline directly to its destination.
  - Injection dredger – water jets fluidise the sediment and it flows under gravity to settle in deeper water.

4.3.1.1 Assessment of mechanical dredging options

Of the alternative mechanical dredging options, a Backhoe dredger is preferred over a Bucket-ladder dredger or Clamshell dredger because it is better suited to remove stiff material which is likely to be encountered at the lower dredged depths (gravels and stiff clays) at this site and more mobile to allow the dredger to move a safe distance from vessels operating at the port.

A Plough dredger would not be suitable at this site on environmental grounds. This is because it has the potential to release large volumes of sediment into the water column which could settle in the adjacent South Dublin Bay and Tolka Estuary SPA.

The Backhoe dredger usually operates with an adjacent Hopper Barge. The Backhoe dredger loads the dredged sediment into the Hopper Barge and is exchanged for an empty barge when filled. The Hopper Barge transports the dredged material to its final destination.

4.3.1.2 Assessment of hydraulic dredging options

Of the alternative hydraulic dredging options, a Trailing Suction Hopper Dredger (TSHD) is the preferred option. A TSHD is a self-propelled, fully contained vessel which uses a drag head to pump dredged sediment directly into a hopper. When the hopper is full, the TSHD transports the dredged material to its final destination.

A Pipeline dredge is not suitable due to the distance between the loading area and the final destination at this site (see Section 4.3.2).

Injection dredging also would not be suitable at this site on environmental grounds. This is because it has the potential to release large volumes of sediment into the water column which could settle in the adjacent South Dublin Bay and Tolka Estuary SPA.

4.3.1.3 Loading Final Design

Further to the assessment of mechanical and hydraulic dredge options, the final design comprises the following:

- Use of a Backhoe Dredger and/or a Trailing Suction Hopper Dredger (TSHD).

A TSHD requires to work in straight lines with sufficient water depth and access to be able to operate. A TSHD often works in conjunction with a Backhoe dredger to reach areas in confined spaces. Other ancillary vessels include the following:

- Survey vessel; and
- Bed Leveller to flatten the peaks and troughs created by the main dredger.

No over-spill will be permitted whilst loading within the inner Liffey channel (Dublin Harbour). The quantity of dredged material entering the water column as a sediment plume is therefore expected to be similar for both types of dredger. Monitoring undertaken during the ABR Project has shown that loading operations within Dublin Harbour has had no significant impact on water quality (see Chapter 9).

It is therefore likely that both a TSHD and a Backhoe Dredger will be used for the loading operations in different parts of the overall project but with no difference in environmental impact.

4.3.2 Disposal and Re-use Alternatives

The Dublin Harbour Capital Dredging Project will require the disposal of 500,000m^3 of marine sediments. The marine sediments comprise a mixture of clay, silt, sand and cobbles. No rock will be dredged.

A chemical sediment and eco-toxicological sampling and analysis programme, described in Chapter 8, confirmed that the marine sediments have no biological effects and thereby suitable for disposal at sea.

The following disposal and re-use alternatives for the dredged marine sediments were considered:

- Do-Nothing Scenario;
- Beneficial Re-use;
- Disposal on Land;
- Incineration;
- Disposal at Sea.

4.3.2.1 Do-Nothing Scenario

The proposed capital dredging is required to achieve the required charted depth of water within the navigation channel, basins and berths.as set out in the Dublin Port Masterplan 2040, reviewed 2018.

In the absence of the capital dredging works, port investment would fail to deliver the required increase in usage identified by the Masterplan.

The deepening of the navigation channel and basins is required for the safe passage of vessels entering and leaving the port, accommodating large vessels into the future.

The berthing pockets are required to provide sufficient depth of water at all stages of the tide, to vessels berthed at the Port. This is also essential for the safe and effective operation of the proposed port facilities. Should the pockets not be dredged to the required depths then this would result in the limited capacity of these berths to accommodate large vessels into the future.

The overall consequence of this is the port would fail to provide for future anticipated growth. This would have a critical impact upon national and regional economies, particularly by way of trade, employment and associated taxes for societal benefit. This in turn, will undermine the port's ability to contribute towards achieving the sustainable transport objectives of National Port Policy.

Additionally, the absence of the proposed capital dredging works would result in limits to future port investment resulting from a loss of predicted revenue following capacity constraints. This would inhibit the attainment of objectives specified within the Masterplan; including the integration of the port with the city, by way of the promotion of sustainable linkages, and the amelioration of the visual impact of the port upon its landward surroundings. It would further hinder the growth of the port's existing vessel operators and prohibit any potential for new operators from residing at the port as well.

The do-nothing scenario, in the absence of these elements, is largely representative of existing activities already taking place within this location. Therefore this scenario will not impact upon the environmental factors such as biodiversity, flora and fauna, air and water quality etc at the site.

In the event that Burford Bank is not used to deposit sediment from Dublin Port as part of the Dublin Harbour Capital Dredging Project, then there will no significant environmental, social or economic consequences. Dredge disposal activities currently undertaken at Burford Bank, in relation to Dublin Port, will continue to take place in compliance with existing Foreshore Licences and Dumping at Sea Permits. The environmental, social and economic consequences of this will continue as they presently exist.

However, the absence of the Dublin Harbour Capital Dredging Project would have a critical economic impact thus undermining the Port's ability to attain the objectives specified within the Masterplan.

4.3.2.2 Beneficial Re-use

The options for beneficial uses of the mainly sandy CLAY marine sediments to be dredged are limited. The potential uses for the dredged marine sediments are:

- Engineering Uses
  - Using the dredged material as construction material
  - Beach Nourishment
  - Land Creation/Reclamation/Capping as part of port development
  - Flood and coast protection (above the level of mean high water springs)
- Environmental Enhancement
  - Wetland Habitat Creation/Enhancement
  - Sediment Cell Maintenance
- Agricultural Uses
  - Improve land of poor agricultural quality.

Engineering Use - Construction Material: The physical characteristics of the sandy CLAY which makes up the dredged marine sediments renders them unsuitable for forms of engineering works, other than for reclamation purposes which is discussed later.

Engineering Use - Beach Nourishment: Beneficial re-use of the dredged marine sediments was considered for beach re-nourishment, particularly at sites along the northern shoreline of Dublin Bay where erosion is taking place. However, the grading of the marine sediments to be dredged is too fine to be suitable for this type of use.

Engineering Use - Land Creation/Reclamation: Dublin Port Company is focussed on the redevelopment of brown-field sites within the Dublin Port Estate. Consequently, there is no further requirement for fill material within the Dublin Port Estate.

Engineering Use – Flood/Coastal Protection Works: Again, the physical characteristics of the sandy CLAY which makes up the dredged material makes them unsuitable for coastal protection works.

Environmental Enhancement - Wetland Habitat Creation/Enhancement: Fine dredge material can be used for habitat creation and re-nourishment projects such as mudflat recharge or salt marsh restoration. These types of projects however, typically require small quantities of sediment (e.g. 1,000m³ - 5,000m³) (UKMSAC, 2001). A search of the greater Dublin area did not identify any suitable sites for this type of beneficial re-use.

Environmental Enhancement - Sediment Cell Maintenance: The Dublin Harbour Capital Dredging Project has been designed to ensure that the sand and gravel fractions of the marine sediments to be dredged are not lost from the natural Dublin Bay sediment cell. The offshore disposal site to the west of the Burford Bank has been selected to keep the sands and gravels deposited at the site within the natural Dublin Bay sediment cell. Over time, the fine sand fraction will migrate from the site, particularly as a result of storm action, and will remain part of the natural coastal processes regime of Dublin Bay. The site is also dispersive with respect to silts and clays. Silts and clays deposed of at the offshore disposal site will be dispersed in a north-south direction to the wider Irish Sea.

The use of this site to dispose of sand and gravel fractions as part of the Dublin Harbour Capital Dredging Project would result in no environmental impacts given its current use for this purpose under the ABR project. Whilst, the extent to which sand and gravel fraction are deposited within Burford Bank would be greater, this would have no discernible environmental impact within Dublin Bay or on the qualifying interests of the Rockabill to Dalkey Island SAC.

This has been identified as a feasible re-use option for the coarser portion of the dredged materials, as these will remain within the cell to replenish its coastal processes. It is a partial technology alternative as it is not suitable for the finer materials.

Agricultural Use - Improve land of poor agricultural quality: Again, the physical characteristics of the sandy CLAY which makes up the dredged material makes them unsuitable for agricultural use.

Beneficial re-use forms a partial technology suitable for the coarser portions of the dredged materials through Environmental Enhancement - Sediment Cell Maintenance technology.

4.3.2.3 Disposal on Land

This disposal option would require the dredger to bring the dredge spoil ashore, either by barge or by pumping. The material would then be temporarily stored in a designated hard standing or lagoon area to allow for dewatering/drying before subsequent transfer by road to a landfill site.

Even following a period of settlement, the dredged sediment would be likely to be considered a wet material for the purposes of land-filling. Landfill space is in very short supply and it is often the case that landfill sites are only licensed to receive relatively small volumes of wet waste (e.g. 500m³) per week. Due to the large quantity of material arising from the dredging activities, this option is considered to be unfeasible on a technical basis.

4.3.2.4 Incineration

There are no suitable incineration facilities in Ireland capable of accepting the proposed type or quantity of dredge spoil. The dredge spoil would therefore need to be transported to mainland Europe. This option is considered to be unreasonable and has been ruled out due to prohibitive cost and having regard to the proximity principle.

4.3.2.5 Disposal at Sea

A chemical sediment and eco-toxicological sampling and analysis programme, described in Chapter 8, confirmed that the marine sediments can be classified as Class 1 (uncontaminated, no biological effects likely) in accordance to the Guidelines for the Assessment of Dredge Material for Disposal at Sea (Marine Institute, 2006). The dredged marine sediments are therefore suitable for disposal at sea.

The closest licenced offshore disposal site is located at the approaches to Dublin Bay to the west of the Burford Bank as presented in Figure 4-1. The site lies within the Rockabill to Dalkey Island SAC for which the qualifying interests are Harbour Porpoise and Reefs.

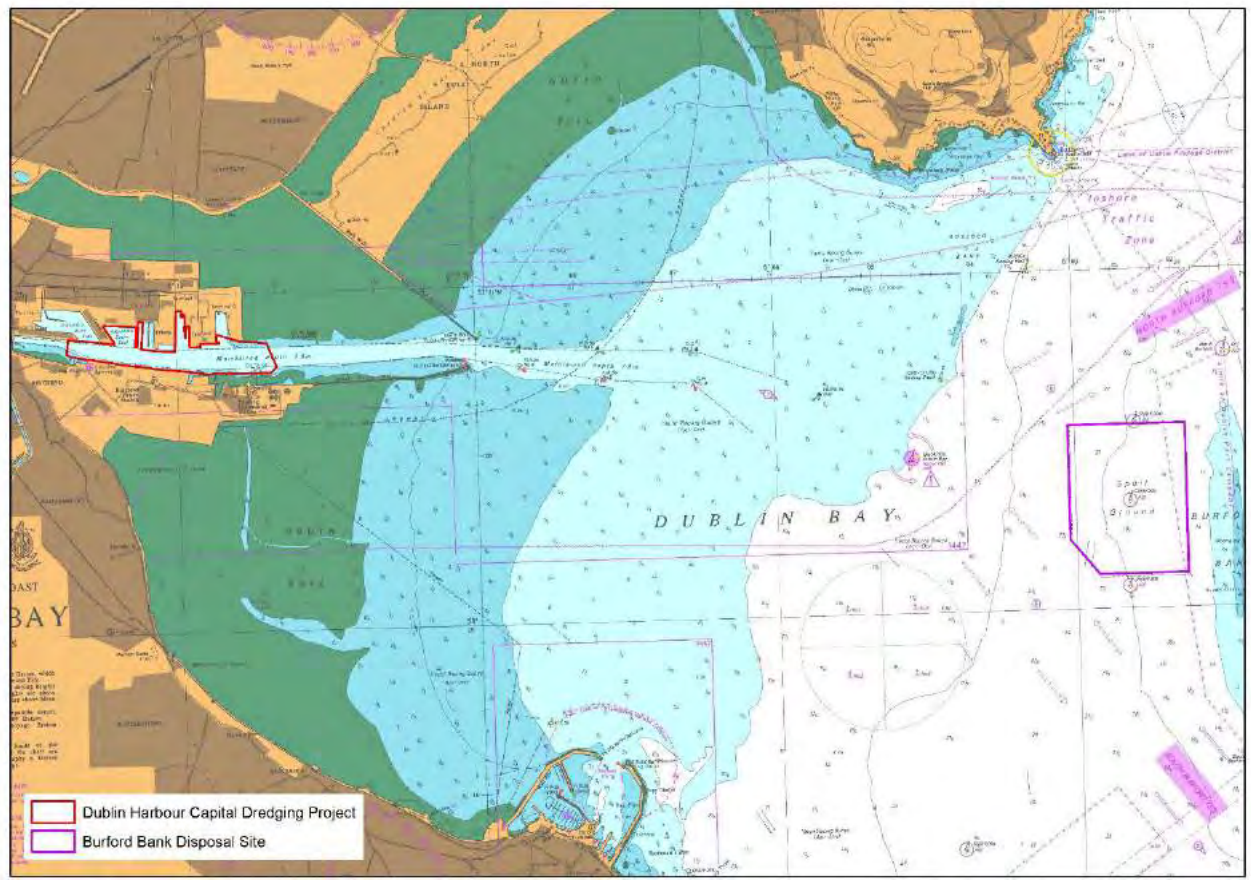


Figure 4-1 Location of the closest licenced offshore disposal site

This site is currently being used to dispose of dredge spoil arising from the ABR Project under Dumping at Sea Permit S0024-01 as granted by the EPA in September 2016. The site is also used by DPC for the disposal of dredge spoil arising from maintenance dredging. The site is similarly used for the disposal of dredged spoil from Dun Laoghaire and Howth Harbours.

As discussed under the technology of Environmental Enhancement - Sediment Cell Maintenance, the use of this site to dispose of sand and gravel fractions as part of the Dublin Harbour Capital Dredging Project would result in no environmental impacts given its current use for this purpose under the ABR project. Whilst, the extent to which sand and gravel fraction are deposited within Burford Bank would be greater, this would have no discernible environmental impact within Dublin Bay or on the qualifying interests of the Rockabill to Dalkey Island SAC.

Extensive environmental monitoring has been undertaken with respect to the dumping of dredged spoil from the ABR Project. The results of the monitoring undertaken during 2017-2020 are presented in the Annual Environmental Reports (AERs) which are available for download on the EPAs Website. During this period capital dredging took place within the inner Liffey channel and Dublin Bay and maintenance dredging took place within the inner Liffey channel including the Dublin Harbour Capital Dredging Project area.

The AERs concluded that measured turbidity results demonstrated that both the maintenance dredging campaigns and the ABR Project capital dredging campaign did not cause any discernible increase in turbidity above recorded background levels (see Chapter 9 Water Quality).

The environmental impact of dredging and the disposal activities is described in detail within the EIAR (see Chapter 7 Biodiversity, Flora and Fauna, Chapter 9 Water Quality, Chapter 12 Underwater Noise, Chapter 13 Coastal Processes and Chapter 14 Cultural Heritage). The assessments have concluded that disposal of the dredged marine sediments will have no discernible environmental impact within Dublin Bay or on the qualifying interests of the Rockabill to Dalkey Island cSAC.

The licenced offshore disposal site has been proven to be suitable for the safe disposal of dredge spoil arising from the Dublin Harbour Capital Dredging Project. The site also has the advantage that it is dispersive for clays and silts but sands and gravel are retained within the natural Dublin Bay sediment cell (see section on Environmental Enhancement - Sediment Cell Maintenance above).

There are no other licenced offshore disposal sites within the Greater Dublin Bay Area. The opening of a new disposal site further offshore would have no additional environmental benefit. On the contrary, it would lead to unnecessary increases in energy usage to transfer the dredged marine sediments from the dredging area to the disposal site; it would lose sands and gravels from the natural Dublin Bay sediment cell and it may have a greater impact on fisheries interests.

4.3.2.6 Disposal Final Design

The Disposal at Sea method, in combination with Environmental Enhancement - Sediment Cell Maintenance technology, has been selected as the disposal final design with no environmentally better alternative.

4.4 Summary of Consideration of Alternative Options

At strategic level, the Masterplan identified that the Dublin Harbour Capital Dredging Project is a key element of its implementation, underpinning the Masterplan's fundamental approach of providing capacity in Dublin Port for the 77.2m gross tonnes projected by 2040 by maximising the utilisation of Dublin Port's brownfield lands.

The assessment process in support of the Masterplan identified that the development in this area of the Port is the most sustainable approach and the desired approach from a strategic point of view.

The Dublin Harbour Capital Dredging Project is concluded to be an essential step in achieving the Port's ambitious throughput objective.

At detailed design level the evolution of the proposed capital dredging works was considered to achieve the Dublin Harbour Capital Dredging Project's objective of loading and disposing of 500,000m^3 of marine sediments.

A number of alternative loading options were examined including the use of a range of mechanical and hydraulic dredgers. The preferred option identified was the use of a backhoe dredger and/or a Trailing Suction Hopper Dredger. No over-spill will be permitted whilst loading within the inner Liffey channel (Dublin Harbour). The quantity of dredged material entering the water column as a sediment plume is therefore expected to be similar for both types of dredger. Monitoring undertaken during the ABR Project has shown that loading operations within Dublin Harbour has had no significant impact on water quality.

A number of disposal options were also examined including: do-nothing; beneficial re-use; disposal on land; incineration and disposal at sea. The preferred option identified was a combination of disposal at sea and re-use with computational modelling undertaken to determine appropriate method, rate, timing and location of these activities. A sediment chemistry and eco-toxicological sampling and analysis programme confirmed the sediments had no biological effect and thereby suitable for the safe disposal at sea. No significant environmental impacts of this design choice were identified.

5 PROJECT SCOPING AND CONSULTATION

5.1 Introduction

The Dublin Harbour Capital Dredging Project is being brought forward for consent from the Dublin Port Masterplan 2040, revised 2018. The evolution of the Dublin Harbour Capital Dredging Project to its current form reflects the extensive consultation processes undertaken, initially in the preparation of the Masterplan, and more directly in the context of this specific project. The process of consultation has enabled Dublin Port Company (DPC) to solicit opinions on general development options for the port and facilitated differing perspectives to be taken into account in the initial stages of the project.

The Environmental Impact Assessment (EIA) Directive provides for a mandatory scoping process where requested by a developer, however, DPC did not request a "formal" scoping opinion from any competent authority in relation to the Dublin Harbour Capital Dredging Project, rather, and in accordance with good practice, DPC "informally" or voluntarily scoped the contents of an Environmental Impact Assessment Report (EIAR) by engaging in consultations with statutory bodies and stakeholders and through public consultation. The informal scoping was undertaken in accordance with the European Commission's 2017 "Environmental Impact Assessment of Projects Guidance on Scoping", which states:

> "*It is good practice to carry out Scoping even if it is not required by legislation: Developers should endeavour to include a Scoping stage in their work programme for EIA, so that all of the concerns can be identified and addressed during the Scoping stage*."

The purpose of the EIAR scoping process is to identify the issues which are likely to be important during the environmental impact assessment and to eliminate those that are not relevant. The scoping process identifies the sources or causes of potential environmental effects, the pathways by which the effects can happen, and the sensitive receptors, which are likely to be affected. It defines the appropriate level of detail for the information to be provided in the EIAR. The primary focus of scoping is to define the most appropriate assessment of significant effects related to the proposed development.

In relation to consultation, the EIA Directive, Irish implementing legislation and recent guidance documentation make clear that there are specific requirements regarding the use of the EIAR, both as a tool to inform concerned stakeholders and the public, as well as to make decisions regarding development consent for projects. Accordingly, this EIAR provides evidence of effective consultations which have already taken place and provides the basis for effective consultations to come.

The scoping and consultation process has resulted in an iterative design procedure, such that the project has been modified to address the issues raised by statutory consultees, stakeholders and the public.

5.2 Consultation and the Masterplan Review

In 2017, DPC commenced a review of the Dublin Port Masterplan 2012 – 2040 (the Masterplan). When adopted in 2012, the Masterplan made provision for periodic reviews to take account of changes in the demand for the use of port facilities and developments in port operations.

This first review of the Masterplan has involved a detailed public consultation process aimed at securing views from relevant stakeholders whose perspectives on the port are important.

The consultation process took two distinct stages:

Stage 1: 2017 Masterplan Review Consultation Process

The 2017 Masterplan Review consultation process ran from January 2017 to March 2017 and involved the following elements:

- The publication of a detailed Masterplan Review 2017 Consultation Paper, outlining the issues that were being taken into consideration in the context of the review of the Masterplan.
- The initiation of a formal consultation process to secure submissions on the Masterplan Review.
- Extensive face to face briefings with key stakeholders prior to the launch of the Masterplan Review 2017 Consultation Paper.
- Presentations to the Central and South East Local Area Committees of Dublin City Council on the review of the Masterplan.
- A comprehensive media campaign surrounding the Masterplan Review designed to generate interest and encourage participation in the master planning process.
- A public information campaign including advertisements, door to door leaflet drops and an information briefing published for local residents and stakeholders.
- Briefings with DPC staff on the review of the Masterplan and an information display for the duration of the consultation period at the offices of DPC with all materials available for staff and visitors to inspect.
- Social media campaign to raise awareness, engagement and attendance across Facebook and Twitter channels.
- A Street Team active over two days in areas directly adjacent to Dublin Port distributing 6,000 flyers, placing 300 posters and visiting over 260 individual commercial premises.
- A series of events including:
  - local community briefings at Clontarf, East Wall and Ringsend

    [Clontarf Public Information Day held at Scoil Uí Chonaill GAA Club, 13th February 2017];

    [East Wall Public Information Day held at Sean O'Casey Community Centre, 15th February 2017];

    [Ringsend Public Information Day held at Clanna Gael Fontenoy GAA, 16th February 2017];
  - direct briefings with a selection of community and environmental groups.
- The publication of a Masterplan Review 2017 Environmental Report Consultation Paper by RPS Consultants in January 2017.

The 2017 consultation process led to a high level of participation from stakeholders with 130 people attending community briefings. There were 67 formal written responses received from a broad range of respondents including individuals, Resident's Groups, commercial interests, statutory bodies and environmental entities.

Following the 2017 consultation process a detailed report outlining the responses to the consultation process was prepared. This Report can be accessed on the Dublin Port website (www.dublinport.ie).

As a consequence of the 2017 consultation process a number of specific issues and observations emerged from the submissions and responses received which fed into the Masterplan Review Process in the following ways:

DPC decided to initiate a Strategic Environmental Assessment (SEA) and an Appropriate Assessment (AA) of the proposals to revise the Masterplan. RPS was commissioned by DPC to carry out these assessments.

I. The first stage of the SEA process was Screening, to determine if the Masterplan Review required an SEA. The initial output of the first stage was the SEA Screening Report, which was circulated in May 2017 to the statutory consultees for SEA in Ireland, being the Environmental Protection Agency (EPA), Department of Housing, Planning and Local Government (DHPLG), Department of Communications, Climate Action & Environment (DCCAE), Department of Agriculture, Food and Marine (DAFM), and Department of Culture, Heritage and the Gaeltacht (DCHG). The SEA Screening Report introduced the potential for development of port lands on the north and south side of the River Liffey as part of the overall Masterplan.

II. The second stage of the SEA process was Scoping, which was to provide sufficient information on the Masterplan 2040 to enable the consultees to form an opinion on the appropriateness of the scope, format, level of detail, methodology for assessment and the consultation period proposed for the SEA Environmental Report. This SEA Scoping Report was circulated to the statutory consultees for SEA in Ireland in August 2017 as well as the appropriate authorities in the UK to illicit their view on any potential transboundary environmental effects. A scoping workshop was held in September 2017 to allow for statutory consultees to participate in the scoping phase of the Masterplan 2040. A revised scoping report was developed to incorporate comments received from this workshop as well as those received during the statutory consultation period. Non-statutory stakeholders were provided with the revised Scoping Report on 24th November 2017 and all information was made publicly available on the DPC website. Non-statutory stakeholders who were provided with the SEA Scoping Report for comment were the Department of Transport, Tourism and Sport (DTTAS), Dublin City Council (DCC), Office of Public Works (OPW) including the Eastern Catchment Flood Risk Assessment and Management (CFRAM) Project, Electricity Supply Board (ESB), National Transport Authority (NTA), Inland Fisheries Ireland (IFI), Transport Infrastructure Ireland (TII), Bird Watch Ireland, Local Residents Associations, Local Amenity Groups, Dublin Port Tenants, The Heritage Council, An Taisce; and the Irish Nautical Trust. The SEA Scoping Report again introduced the potential for development of port lands on the north and south side of the River Liffey as part of the overall Masterplan and introduced the concept of the phasing of developments that would be proposed by the Masterplan.

III. A strategic Transportation Study was commissioned to determine how enhanced connectivity between the North and South Port areas could be provided and explore connectivity for different transport modes within the Port Estate in a context that is compatible with existing transportation strategies.

IV. The existing Soft Values Programme of DPC was reviewed to determine opportunities for enhanced accessibility and integration between the port and the city.

V. The approach of DPC to protecting and promoting cultural heritage and leisure aspects relevant to the port was assessed to determine how best to facilitate both elements in the context of future developments at the port.

VI. Additional meetings were arranged between DPC and a number of stakeholders who raised specific issues during the consultation process, including ESB, Birdwatch Ireland, TII, Poolbeg Yacht, Boat Club and Marina and Stella Maris Rowing Club.

VII. The draft text of the Masterplan was reviewed and amended to reflect inputs and feedback by stakeholders to the consultation process.

Stage 2: 2018 Masterplan Review Consultation Process

In 2018, DPC undertook a further consultation process concerning the Masterplan which involved:

- Publication of a Strategic Environmental Assessment (SEA) Environmental Report and a Natura Impact Statement (NIS) on the draft Dublin Port Masterplan 2040, reviewed 2018. These environmental assessments compared the original Masterplan proposals published in 2012 to revised proposals that would enable Dublin Port to meet the anticipated throughput of 77 million tonnes per annum by 2040. The revised proposals comprised two significant Strategic Infrastructure Development Projects within the North Port Estate; the Alexandra Basin Redevelopment (ABR) Project, already at construction phase, and the MP2 Project in combination with improvements to the internal road network and the development of a Dublin Inland Port. The strategic environmental assessments found these revised development proposals to have significantly less environmental impacts compared to the Dublin Gateway Project which was proposed within the original Masterplan. This is because the Dublin Port Masterplan 2040, reviewed 2018, focusses on the redevelopment of existing port infrastructure on brownfield sites already in operation within Dublin Port, rather than expanding into the Tolka estuary.
- The draft Dublin Port Masterplan 2040, reviewed 2018, along with the associated SEA Environmental Report and NIS were completed and circulated in April 2018 to the Irish and UK statutory consultees for SEA. A public notice was placed in the National Press and on the DPC's website to notify the public about the draft Dublin Port Masterplan 2040, SEA Environmental Report and NIS, and to welcome comments. The consultation phase was open to responses from 17th April 2018 to 25th May 2018.
- A national and local media campaign in July 2018 formally announcing the publication of the final Dublin Port Masterplan 2040, reviewed 2018, with a social media campaign running in tandem.

The 2018 Masterplan Review consultation process drew 12 responses from a range of stakeholders, including Resident's Groups, statutory authorities, individuals and commercial organisations.

The key observations which emerged from the 2018 Consultation responses include the following:

- The importance of cycling and pedestrian access to and through the Port Estate.
- The need to factor the impact of the proposed Masterplan development projects in the Port Estate on current commercial users operating from sites that are strategically important to their businesses.
- Welcome for the decision not to infill any additional land in the Tolka Estuary.
- Support for the greater integration of Dublin Port with Dublin City and its people.

- The need to ensure that the operation of the port takes account of residential amenity, particularly at night time.
- Requests for continued and ongoing engagement and communication between DPC and surrounding communities and statutory bodies on future projects.
- The importance of maintaining the current height limits and looking to improve the visual impact of port operations on surrounding communities.
- The consistency of the Masterplan with the proposals relating to port development in the National Planning Framework 2040.
- The absence of transboundary effects arising from the Masterplan.
- The absence of recognition in the Masterplan of the potential for a film studio on DPC owned lands in Poolbeg West Strategic Development Zone (SDZ).
- The need for the Masterplan to take account of the objectives of the planning scheme for Poolbeg West SDZ.
- Support for the MP2 Project Community Gain proposal for an urban farm in East Wall.
- The need for the Masterplan to take account of the draft Water Animation Framework for the River Liffey and the Local Environmental Improvement Plan for Ringsend.
- The importance of improving public transport links between the port and the city and effective mobility management within the port to encourage a shift to more sustainable forms of travel for port users, including staff.
- The need to ensure that the Masterplan road proposals are consistent with the strategic road transport plans of Dublin City Council (DCC), Transport Infrastructure Ireland (TII) and the National Transport Authority (NTA).
- The importance of managing impacts on structures of heritage value and maintaining the amenity value of Pigeon House Harbour in the context of future port development projects arising from the Masterplan.
- The importance of maintaining the existing amenity value of swimming areas off the North Bull Wall.
- Improving rail connectivity with Dublin Port and limiting the impact of the existing rail lines on road traffic.
- The importance of the Masterplan remaining consistent with national and regional and environmental plans.
- The integration of SEA and AA findings and mitigation measures in the Masterplan.
- A more frequent and fixed timeframe for reviewing the Masterplan should be considered.
- The need to give further consideration to climate change in the Masterplan and the SEA through the inclusion of a commitment in the Masterplan to reduce the port's carbon footprint and promote low carbon alternatives through the supply chain.
- The importance of demonstrating the rationale behind the selection of alternatives in the context of the possible development options selected in the Masterplan.

- A commitment to prepare an integrated Environmental Management Plan should be contained in the Masterplan.

The final Masterplan 2040, reviewed 2018, was adopted by the DPC Board and published in July 2018. It was accompanied by a SEA Statement which provided a description of the consultation process and how the issues raised during the 2017 and 2018 consultation processes have been integrated with the Masterplan with the objective making a robust, sustainable Masterplan.

Section 5 of the Final Masterplan 2040, reviewed 2018, discusses the infrastructure proposals, including reference to the berths and channel in Dublin Port envisaged by 2040.

Section 10 of the Final Masterplan 2040, reviewed 2018, sets out the principle environmental mitigation and monitoring measures to be undertaken for capital dredging operations.

5.3 Consultation and the Dublin Harbour Capital Dredging Project

Building on the consultation carried out during the process to review the Dublin Port Masterplan 2040, DPC and their consultants, RPS, carried out further extensive consultation on the Dublin Harbour Capital Dredging Project in the course of developing the current proposal.

5.3.1 Pre-application Consultation with Statutory and Non-Statutory Bodies

A letter and information pack on the Dublin Harbour Capital Dredging Project was issued to 33 statutory and non-statutory bodies listed in Table 5-1 in September 2020. The consultees were invited to make a submission on the proposed development and outline any issues which they would like to see addressed in the EIAR.

Table 5-1 Statutory and Non-Statutory Bodies consulted as part of the EIA Process

Consultee List		
Dept. of Housing, Planning and Local Government	Dept. of Communications, Climate Action & Environment	Dept. of Agriculture, Food and the Marine
Environmental Protection Agency	Office of Public Works	Dublin City Council
Office of Radiological Protection, EPA	Development Applications Unit, Department of Culture, Heritage and the Gaeltacht	Eastern and Midland Regional Assembly
Dept. of Transport, Tourism and Sport	Inland Fisheries Ireland	Health and Safety Authority
Commissioners of Irish Lights	RNLI	Arts Council
Heritage Council	Failte Ireland	An Taisce
Waterways Ireland	Bord Iascaigh Mhara	Sea Fisheries Protection Authority
Marine Survey Office	Marine Institute	Geological Survey of Ireland
Birdwatch Ireland	Irish Whale and Dolphin Group	Irish Seal Sanctuary
Irish Water	Department of Business, Enterprise and Innovation	Electricity Supply Board (ESB)
Dept. of Foreign Affairs & Trade	Department of Health	Health Service Executive

Responses were received from twelve of the Statutory and Non-Statutory Bodies consulted as part of the EIA Process. A summary of the responses received from the consultees is set out in Table 5-2.

Table 5-2 Summary of Written Responses from Consultees

Organisation	Date Consultation Issued/Format	Response Received/Format	Summary of Response/Further Action Carried out or Required
Development Applications Unit	28/9/2020 Email	04/02/2021	• Acknowledgement of receipt of consultation material
Office of Public Works	29/9/2020 Email	29/9/2020/ Email	• Automated email acknowledgment received. • Email states that OPW aims to respond within 20 days and if no response is received in this time then re-issue email again. Nothing further was received from OPW.
Eastern and Midland Regional Assembly	29/9/2020 Email	29/9/2020 Email	• Automated email acknowledgment received with advice that staff are currently working from home due to Covid 19 to contact EMRA director for further assistance. Email address for EMRA Director was provided.
	30/9/2020		• Issued Consultation Pack to EMRA Director
		30/9/202	• Acknowledgement of receipt of Consultation Pack from Jim Conway, EMRA Director
Commissioners of Irish Lights	29/9/2020 Email	29/9/2020 Email	• Email from Captain Catriona Dowling – she provided the following advice: *Thank you for your email below. Irish Lights would not have any comment to make regarding the following :* • *Foreshore Licence issued by the Department of Housing, Planning and Local Government* • *Dumping at Sea Permit issued by the EPA* *These works would however require the temporary movement of a number of Aid to Navigation and a temporary statuary sanction would be required for each of these moves. A program for these moves would need to be drawn up and advanced notification and application made to Irish Lights for these temporary statuary sanctions approvals. Additionally if you require the temporary placement of buoys with turbidity monitoring these would be subject to additional temporary statuary sanction applications. These temporary statuary sanction application would be made to Irish lights from the Local Light House authority in this case Dublin Port and they are familiar with the process.* *We await more information regarding the above from Dublin Port.*
Bord Iascaigh Mhara	29/9/2020 Email	29/9/2020 Email	• Automated email acknowledgment received • BIM endeavour to respond to emails within 5 working days.

Organisation	Date Consultation Issued/Format	Response Received/Format	Summary of Response/Further Action Carried out or Required
			Nothing further was received from BIM.
Marine Survey Office	29/9/2020 Email	29/9/2020 Email	• Email from Captain Alan Quinn. He provided the following advice: *Post review of the information submitted I have no comment on behalf of the MSO regarding the capital dredging project.* *For your information any ship which will be engaged in the capital dredging project is required to comply with our national legislation whilst operating domestically, thus an application for survey should be made via the Mercantile Marine Office for each vessel to ensure compliance.*
Geological Survey of Ireland	29/9/2020 Email	1/10/2020 Email	• Email from Sean Cullen of GSI *"Regarding the Dredging in Dublin Port the GSI has no specific data to assist in those operations directly. We understand that the statutory licences have been applied for and could only request that the hydrographic survey data might be forwarded on to our INFOMAR programme (www.infomar.ie) on completion.* *Regarding the dumping of material our own concern would be that the original dumping ground was licenced as a spoil area for maintenance dredging and that the volumes envisaged by the capital works would possibly be much larger than what the area was originally licenced to receive. These volumes of spoil will be constrained by the Burford Bank which in turn could hold sediment within the bay with possible impacts to Dun Laoghaire Harbour and even possibly Howth Harbour. It is our understanding that DHPLG must regulate for the foreshore licence in this case along with the EPA. If a review of the dumping area is required the GSI will assist with any hydrographic data required to look at the 'before' scenario and if necessary expand the area of a post dumping survey carried out by the contractor."*
Birdwatch Ireland	29/9/2020 Email	29/9/2020 Email	• Acknowledgment of email from Michelle Kavanagh • Ms. Kavanagh stated that the consultation pack was forwarded to their policy officer for comment.
Irish Seal Sanctuary	29/9/2020 Hard Copy	3/10/2020 Email	• Thank you for information on the Dublin Port proposal. Attached is 1st and most recent census of seals in the Bay and Biosphere, to date their population and use of Bay is little known (see earlier submissions to Dublin Gateway/ ABP). Irish Seal Sanctuary (ISS) would recommend closer and more protective regime and the role of MMO, in place for

Organisation	Date Consultation Issued/Format	Response Received/Format	Summary of Response/Further Action Carried out or Required
			cetaceans be extended to seals and same mitigation measures to apply when in area of dredging and disposal zones. Please also provide ISS with cumulative data for all dredging operations, disposal and impact about Burford Bank?
		3/10/2020 Email	• Attachment to email with the following report, "*DublinBaySealCensus2018_ISS*"
	5/10/2020 Email		• Email from RPS to ISS with an attachment (*IWDG Seal Monitoring Report for ABR Project with results from 2016-2020*)
Electricity Supply Board	29/9/2020 Email	29/9/2020 Email	• Automated email acknowledgment received • ESB endeavour to respond to queries as soon as possible
		30/9/202 Email	• Acknowledgement email from customer services to say that email has been sent to the relevant department in ESB.
Department of Jobs, Enterprise and Innovation	29/9/2020 Email	29/9/2020 Email	• Acknowledgment email from Monica Kenny • Ms Kenny stated that she forwarded the consultation pack to a colleague in IDA.
Health Service Executive (Dr. Kevin Kelleher)	29/9/2020 Hard Copy	5/10/2020 Email	• I wish to acknowledge receipt of your letter to Dr. Kevin Kelleher, in relation to the above. He has forwarded this on to his colleague, Dr. Mairin Boland, Public Health Specialist in the Public Health Dept. East, based in Dr. Steeven's Hospital, Dublin 8 who looks after this area.

5.3.2 Public Consultation

As well as consulting the main statutory and non-statutory organisations about the proposed Dublin Harbour Capital Dredging Scheme, DPC also consulted with relevant stakeholders such as community groups and sporting clubs. DPC has a dedicated community liaison officer acts as the point of contact between DPC and the local communities in the vicinity of the Dublin Port. The following organisations/groups were issued with the consultation pack containing information about the proposed Dublin Harbour Capital Dredging Project:

South Port

- Stella Maris Rowing Club
- St. Patrick's Rowing Club
- Irish Nautical Trust
- Half Moon Swimming Club
- Poolbeg Yacht & Boat Club
- 1st Port Sea Scouts

- Ringsend Registered Fishermen & Private Boat Owners Association
- South Bank Combined Boat Clubs Development Committee
- Sea Safari
- Dublin Bay Old Gaffers Association
- Diving Groups and individual divers who responded to the Dublin Port Masterplan consultation phase.
- Poolbeg Training CLG (Rinn Voyager)
- Raytown Angling
- Liffey City Currach Regatta

North Port

- Clontarf Yacht & Boat Club
- Bull Wall Swimmers
- 5th Port Sea Scouts
- East Wall Water Sport
- Irish Underwater Search & Recovery Unit
- Clontarf Residents Association

General

- Irish Underwater Council (trading as Diving Ireland)
- City Kayaking
- Sail Training Ireland

Issues raised during the public consultation exercise

There was no response from any of the above groups as a result of this consultation effort.

5.3.3 Conclusions

The development proposals advanced in the Dublin Harbour Capital Dredging Project reflect the significant levels of consultation that have taken place since 2017 on the future of Dublin Port.

The various submissions and comments made in relation to the Dublin Harbour Capital Dredging Project have been fully considered by the consultants in the preparation of the EIAR and by the applicants in the design of the scheme. Every effort has been made to address all concerns raised and, where possible, mitigation measures have been proposed to minimise the environmental impact of the Dublin Harbour Capital Dredging Project.

5.4 Scoping

5.4.1 Scoping Approach

Detailed scoping has been undertaken in respect to the Dublin Harbour Capital Dredging Project. As stated above, DPC “informally” or voluntarily scoped the contents of an EIAR by engaging in consultations with prescribed and other authorities, bodies and stakeholders and through public consultation, in accordance with the European Commission’s 2017 “Environmental Impact Assessment of Projects Guidance on Scoping” and the EPA’s Environmental Impact Assessment Reports, Draft Guidelines (August 2017), which state:

> *"'Scoping' is a process of deciding what information should be contained in an EIAR and what methods should be used to gather and assess that information. It is defined in the EC guidance45 as:*
>
> *'determining the content and extent of the matters which should be covered in the environmental information to be submitted in the EIAR'*
>
> *Scoping is best carried out by personnel having appropriate expertise and relevant prior experience of the factors involved. Knowledge of the characteristics of the project type and of the sensitivities likely to be present in the receiving environment are particularly useful for scoping.*
>
> *[…]*
>
> *Scoping is carried out on a case-by-case basis because the significant issues, for different projects are unlikely to ever be identical. However, there are standard issues that a developer should consider for each project to establish whether they apply in specific cases. The Advice Notes47 contain guidance on relevant environmental factors for principal project types.*
>
> *The potential for likely significant effects throughout different phases of the proposed project, are considered as far as possible at scoping stage – whether they would individually require consent or not. These include, as relevant, site investigations, construction, commissioning and operation to eventual decommissioning. Scoping also considers the range of alternatives to be considered in an EIAR.*

In conducting the scoping process, and in preparing this EIAR, consideration has been given to publications including the Advice Notes and various other documents.

The scoping of the Dublin Harbour Capital Dredging Project has greatly benefitted from the environmental monitoring programme which is currently in place for the construction of the ABR Project.

The monitoring programme comprises:

- Continuous noise and dust monitoring at two locations
- Periodic vibration monitoring
- Continuous Water Quality monitoring within the inner Liffey channel at four locations (turbidity, dissolved oxygen, temperature, salinity)
- Continuous Water Quality monitoring within Dublin Bay at four locations (turbidity at three depths at each location). This is complemented by continuous wave climate and tidal current measurements.
- Passive Acoustic Monitoring (PAM) for Harbour Porpoise detection at two locations within Dublin Bay
- Static Acoustic Monitoring (SAM) for Harbour Porpoise detection at four locations within Dublin Bay
- Records of marine mammal sightings by MMOs during dredging and piling operations
- Benthic surveys of the licenced dumping at sea site at the entrance to Dublin Bay
- Monthly seal surveys at Bull Island
- Lamprey surveys within the Liffey

- Wintering waterbird surveys within the South Dublin Bay & River Tolka Estuary SPA
- Tern colony surveys
- Black Guillemot surveys
- Underwater surveys during piling and dredging activities to validate models used to assess the impact on migratory fish and marine mammals.

The site-specific scientific data collected to date has been used to support the preparation of the EIAR and NIS for the Dublin Harbour Capital Dredging Project and facilitates a depth of understanding of the environment in and around Dublin Port including the inner Liffey channel and Dublin Bay. The scope of the Dublin Harbour Capital Dredging Project was further considered in the context of the extensive environmental datasets collated during the preparation of the Strategic Environmental Assessment (SEA) which complemented the review of the Dublin Port Masterplan during 2017 and 2018.

Above all, the extensive consultation process undertaken during both the review of the Dublin Port Masterplan and specifically for the Dublin Harbour Capital Dredging Project, described in Sections 5.2 and 5.3 above, provided a sound basis for confirming the key issues to be addressed, the extent of the environmental appraisals required, and the level to which these issues needed to be addressed.

The scope of the EIAR, conducted in respect of the Dublin Harbour Capital Dredging Project, has had due regard to the following statutory and guidance documents:

- Statutory requirements of the Planning and Development Act 2000 – 2017 and the Planning and Development Regulations 2001 – 2018.
- European Commission Environmental Impact Assessment of Projects Guidance on Scoping (Directive 2011/92/EU as amended by 2014/52/EU), (2017)
- Guidelines on the information to be contained in Environmental Impact Statements and Advice Notes on Current Practice in the preparation of an EIS both published by the EPA 2003.
- Advice Notes for preparing Environmental Impact Statements (Draft) EPA 2015
- Guidelines on the information to be contained in Environmental Impact Assessment Reports (Draft) EPA 2017
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment, 2018
- The requirements of Dublin City Council as detailed in the Dublin City Development Plan 2016 – 2022.

5.4.2 Extent of Environmental Appraisals

Following the scoping process, the following environmental topics have been comprehensively addressed within the EIAR including:

- Examination of Alternatives
- Risk of Major Accidents

- Biodiversity, Flora and Fauna
- Land, Soils, Geology and Hydrogeology
- Water Quality
- Noise & Vibration
- Material Assets – Coastal Processes
- Archaeology and Cultural Heritage
- Population and Human Health
- Cumulative Effects

Once the key issues were identified, baseline studies/surveys were carried out. The studies enable the prediction of the likely environmental impacts arising from the Dublin Harbour Capital Dredging Project. These impacts are evaluated in terms of their significance, nature and magnitude.

Through the scoping process which has been carried out in the preparation of this EIAR, the issues which are likely to be important during the environmental impact assessment have been identified. The scoping process has identified the sources or causes of potential environmental effects, the pathways by which the effects can happen, and the sensitive receptors, which are likely to be affected, and has defined the appropriate level of detail for the information to be provided in the EIAR.

The following potential issues have been screened out as a result of the scoping process

- Biodiversity, Flora and Fauna – Terrestrial Biodiversity
- Material Assets – Services;
- Water Quality – Discharges from vessels.
- Flood Risk
- Material Assets – Traffic and Transportation;
- Landscape and Visual Impacts; and
- Waste

The reasons why these topics were screened out are set out in Table 5-3.

Table 5-3 Topics screened out during the scoping process

Topic	Reasons for screening topic out
BIODIVERSITY, FLORA AND FAUNA – TERRESTRIAL BIODIVERSITY	
Terrestrial Biodiversity	The proposed project comprises capital dredging works within Dublin Harbour and the associated dumping of dredge spoil at a licenced offshore disposal site. As such, all works will take place within the estuarine and marine environment of Dublin Harbour and Dublin Bay, with no terrestrial elements to the project proposed. It is considered therefore that the proposed capital dredging project has no potential to give rise to any terrestrial biodiversity impacts and on this basis terrestrial biodiversity has been screened out of the EIAR.
MATERIAL ASSETS - SERVICES	
Water Supply	The supply of potable water to the Dublin Port Estate is provided by Irish Water. Water is used in the port for a variety of uses including; - Supply of water to passenger terminals and administration buildings; - Supply of water to vessels to re-stock their internal water tanks; - Washing down facilities The Dublin Port Capital Dredging Project will have no impact on the water supply to tenants or other vessels within the Dublin Port Estate or on the neighbouring communities.
Electricity Supply	The electricity supply to the Dublin Port Estate is provided by ESB Networks. The current electricity supply to the port is robust and provides ample capacity to the Dublin Port Estate. The Dublin Port Capital Dredging Project will have no impact on the electricity supply to tenants within the Dublin Port Estate or on the neighbouring communities
Natural Gas Supply	There are no natural gas pipelines traversing the areas of foreshore to be dredged. The Dublin Port Capital Dredging Project will therefore have no impact on the natural gas supply to the neighbouring communities.
Wastewater	Separate foul and storm water drainage systems are in existence within the Dublin Port Estate. The sewerage network is connected to the municipal wastewater system for Dublin City which is operated and managed by Irish Water. The Dublin Port Capital Dredging Project will not require any discharge to the existing foul and storm water drainage systems and will therefore not impact on the wastewater demand of tenants within the Dublin Port Estate or of the neighbouring communities.
WATER QUALITY – DISCHARGE FROM VESSELS	
Discharge from vessels	Vessels arriving and departing from Dublin Port are strictly forbidden to discharge wastewater of any sort within the basins or approach waters to Dublin Port. This includes - Foul sewage; - Bilge Water; and - Ballast Water

Topic	Reasons for screening topic out
	There are currently no pump-out facilities for vessels at the port and there are no plans for same as a result of the Dublin Harbour Capital Dredging Project.
FLOOD RISK	
Flood Risk	The impact of the Dublin Harbour Capital Dredging Project on the coastal processes within the inner Liffey channel is presented in Chapter 13 of the EIAR. The results from this appraisal show there is no significant impact on the tidal flow regime or wave climate. Consequently there is no source or pathway for the proposed capital dredging to cause an increase to the risk of flooding.
MATERIAL ASSETS – TRAFFIC AND TRANSPORTATION	
Traffic & Transportation	The Dublin Harbour Capital Dredging Project will be undertaken by specialist dredging vessels arriving by sea and departing by sea. Occasional service vehicles are required for bunkering and removal of skips. Private car use will be limited to circa 10 dredging contractor staff. Consequently, there will be no perceptible traffic impact on the national road network.
LANDSCAPE AND VISUAL IMPACTS	
Landscape and Visual Impacts	All capital dredging works will take place below the Low Water Mark and will therefore have no Landscape & Visual impact.
WASTE	
Waste	The focus of this EIAR is the potential environmental impact of capital dredging loading and disposal operations. The options for the disposal of the dredge material is presented in Chapter 4 Assessment of Alternatives. The analysis of the material to be dredged is presented in Chapter 8 Land, Soils and Geology which demonstrates that the material to be dredged is suitable for disposal at sea. The environmental impact of the loading and disposal operations is presented within the remaining technical chapters of the EIAR. The only other potential for waste generation is from debris picked up during the dredging operations such as pieces of discarded cabling, fendering etc. This material is temporarily stored on the dredger within a skip. The skip is removed from the dredger when berthed within the harbour, placed on the quay and removed from site by a licenced waste operator. This operation is not expected to give rise to a significant environmental impact.

6 RISK OF MAJOR ACCIDENTS & DISASTERS

This chapter of the EIAR describes the assessment undertaken of the potential risk of major accidents and disasters presented to the Dublin Harbour Capital Dredging Project.

In light of the nature of the activities that will take place, and the nature of the surrounding environment, the most significant risks of major accidents and disasters are associated with the COMAH establishments. The development is within the vicinity of a number of establishments that fall within the scope of the *Chemicals Act (Control of Major Accident Hazards Involving Dangerous Substances) Regulations*, 2015 (the COMAH Regulations), both on the northern and southern parts of the Port Estate.

This chapter contains a COMAH land use planning assessment of the Dublin Harbour Capital Dredging Project conducted by Byrne Ó Cléirigh. The purpose of this assessment is to examine the development in the context of the Health and Safety Authority's COMAH land use planning guidance. It describes the assessment of the development and conclusions as to the individual and societal risk presented to the development from the COMAH establishments.

The chapter also describes other events that could contribute to a major accident and disaster including the risk of ship collisions during the capital dredging works.

6.1 COMAH land use planning assessment

6.1.1 Planning Context

6.1.1.1 Dublin City Development Plan

In accordance with the Planning and Development Act, 2000, as amended, Dublin City Council (DCC) has prepared the latest version of its development plan: *The Dublin City Development Plan 2016- 2022*. Section 9.5.10 of the Plan summarises the COMAH legislative regime and the role of the Health and Safety Authority (HSA) in providing advice to planning authorities. DCC also sets out its policy regarding developments of establishments that fall within the scope of the COMAH Regulations and developments near such establishments:

> *It is the Policy of Dublin City Council:*
>
> *SI28: To have regard to the provisions of the Major Accidents Directive (2012/18/EU), relating to the control of major accident hazards involving dangerous substances and its objectives are to prevent major accidents and limit the consequences of such accidents. Dublin City Council will have regard to the provisions of the directive and recommendations of the HSA in the assessment of all planning applications located on or impacted by such sites.*

6.1.1.2 Planning & Development Regulations

Part 11 of the *Planning and Development Regulations*, as amended setsout the requirements for planning applications relating to developments subject to the COMAH legislation. Article 137(1) requires that a planning authority[1] notifies the HSA where:

> *(c) a planning authority receives a planning application relating to development whichwould, in its opinion, be*
>
> *(i) in the vicinity of an establishment, and (ii) relevant to the risk or consequences of a major accident,*
>
> *and the Health and Safety Authority has not previously provided, either in relation to the development to which the application relates or on a generic basis, relevant technical adviceon the risk or consequences of a major accident, the planning authority shall notify the Health and Safety Authority*.

As the Dublin Harbour Capital Dredging Project will take place, broadly, in the vicinity of the COMAH establishmentswithin the Port, the provisions of Article 137(1)(c) may apply.

6.1.1.3 COMAH Regulations

The COMAH Regulations have been made under the *Chemicals Acts 2008 and 2010* to transpose *Directive 2012/18/EU of the European Parliament and of the Council of 4 July 2012 on the control of major accident hazards involving dangerous substances, amending and subsequently repealing Council Directive 96/82/EC* ("the SEVESO III Directive"). The purpose of the COMAH Regulations is tolay down rules for the prevention of major accidents involving dangerous substances, and to seek to limit as far as possible the consequences for human health and the environment of such accidents when they occur, with the overall objective of providing a high level of protection in a consistent andeffective manner.

The COMAH Regulations place an obligation on operators of establishments that store, handle or process dangerous substances above certain thresholds to take all necessary measures to prevent major accidents and to limit the consequences for human health and the environment. Under the Regulations, an establishment may qualify as upper tier or lower tier, depending on the inventory ofdangerous substances; sites that store, handle, or process dangerous substances below a certain threshold do not qualify as establishments under the Regulations.

The types of dangerous substance that contribute to an establishment's inventory include flammable substances (such as liquefied petroleum gas, gasoline / petrol, kerosene, and certain solvents), toxic substances, and substances that are hazardous to the aquatic environment. The types of establishment that may fall within the scope of the Regulations (depending on their inventories) include oil storage & distribution sites, LPG storage & distribution sites, pharmaceuticalplants, and sites that manufacture and / or store certain types of fertiliser.

Under Part 7 of the Regulations, the HSA, as the Central Competent Authority, can provide technical advice to a planning authority2 on developments of, or in the vicinity of, COMAH establishments, as follows:

> *24(2) The Central Competent Authority shall provide technical advice in response to a noticesent by a planning authority under Part 11 of the Planning and Development Regulations 2001 (SI No. 600 of*

2001), requesting technical advice on the effects of a proposed development on the risk or consequences of a major accident in relation to the following types of developments…

(c) new developments including transport routes, locations of public use and residential areas in the vicinity of establishments, where the siting, modifications or developments may be the source of, or increase the risk or consequences of, a majoraccident.

This COMAH land use planning assessment of the Dublin Harbour Capital Dredging Project has been prepared in accordance with the *Policy & Approach of the Health & Safety Authority to COMAH Risk-based Land-use Planning (2010)* to assist the competent authorities in their consideration of the applications for development consent.

6.1.2 COMAH Establishments

6.1.2.1 North of River Liffey

The COMAH establishments within Dublin Port (on the north side of the River Liffey) are listed in Table 6-1 and shown on the Figure 6-1. Most of these establishments store petroleum products (eight of the ten establishments). Of the remaining two, one stores and distributes LPG (Calor), and the other (Indaver) operates a hazardous waste facility.

Table 6-1 COMAH Establishments North of the River Liffey

Establishment	Location	Tier	Activity	Consultation Distance[1]
Calor Teoranta	Tolka Quay Road, Dublin 1	Upper	LPG storage & distribution	600 m
Fareplay Energy Ltd. (under the Topaz Energy Group)	Tankfarm 1, Alexandra Road, Dublin Port, Dublin 1 Tankfarm 2, Tolka Quay Road, Dublin Port, Dublin 1	Upper	Oil storage & distribution	400 m
Indaver Ireland Ltd.	Tolka Quay Road, Dublin Port, Dublin	Upper	Hazardous waste	700 m
Tedcastles Oil Products	Yard 1, Promenade Road, Parish of St. Thomas, Dublin Port, Dublin 1	Upper	Oil storage & distribution	400 m
Tedcastles Oil Products	Yard 2, Tolka Quay Road, Parish of St. Thomas, Dublin Port, Dublin 1	Upper	Oil storage	400 m
Valero Energy Ireland Ltd.	Alexandra Road, Dublin Port, Dublin 1	Upper	Oil storage & distribution	400 m

[1] The Dublin City Development Plan 2016 – 2022 includes the consultation distances for the COMAH Establishments.

Establishment	Location	Tier	Activity	Consultation Distance[1]
Electricity Supply Board	North Wall Generating Station, Alexandra Road, Dublin 1	Lower	Oil storage	300 m
Iarnród Éireann[2]	Alexandra Road, North Wall, Dublin 1	Lower	Oil storage	300 m
Circle K Ireland Energy Ltd	Terminal 1, Alexandra Road, Dublin Port, Dublin 1	Lower	Oil storage & distribution	400 m
Circle K Ireland Energy Ltd	Yard 3, Alexandra Road, Dublin Port, Dublin 1	Lower	Oil storage	300 m

- The Calor establishment comprises 17 no. aboveground and 4 no. semi-mounded LPG tanksand a road tanker loading facility, and a storage area for containerised LNG.
- Indaver operates a hazardous waste facility for blending and transhipment of solvent wastes, and for receipt, storage and transfer of packaged wastes to other waste facilities. The facility comprises a solvent blending tank farm to the northeast of the site, and severalwarehouses for the storage of packaged wastes to the west of the site.
- The oil storage sites, other than ESB and Iarnród Éireann, store classes[3] I, II and III petroleumproducts, and distribute them via road tanker. ESB has the capacity to store class III petroleum as a backup fuel for the North Wall Generating Station, while Iarnród Éireann stores class III petroleum for distribution to its regional depots via road tanker.

[2] The HSA's list of COMAH establishments and the public information notices under regulation 25 (available on the HAS website) refer to the registered name of the operator as Iarnród Éireann

[3] Petroleum products are classified as class I, class II or class III depending on their flash point (the minimum temperate at which a liquid, under specific test conditions, gives off sufficient flammable vapour to ignite momentarily on the application of an ignition source). Class I products includes gasoline / petrol, class II product include kerosene and clas III prodcuts include diesel/ gas oil.

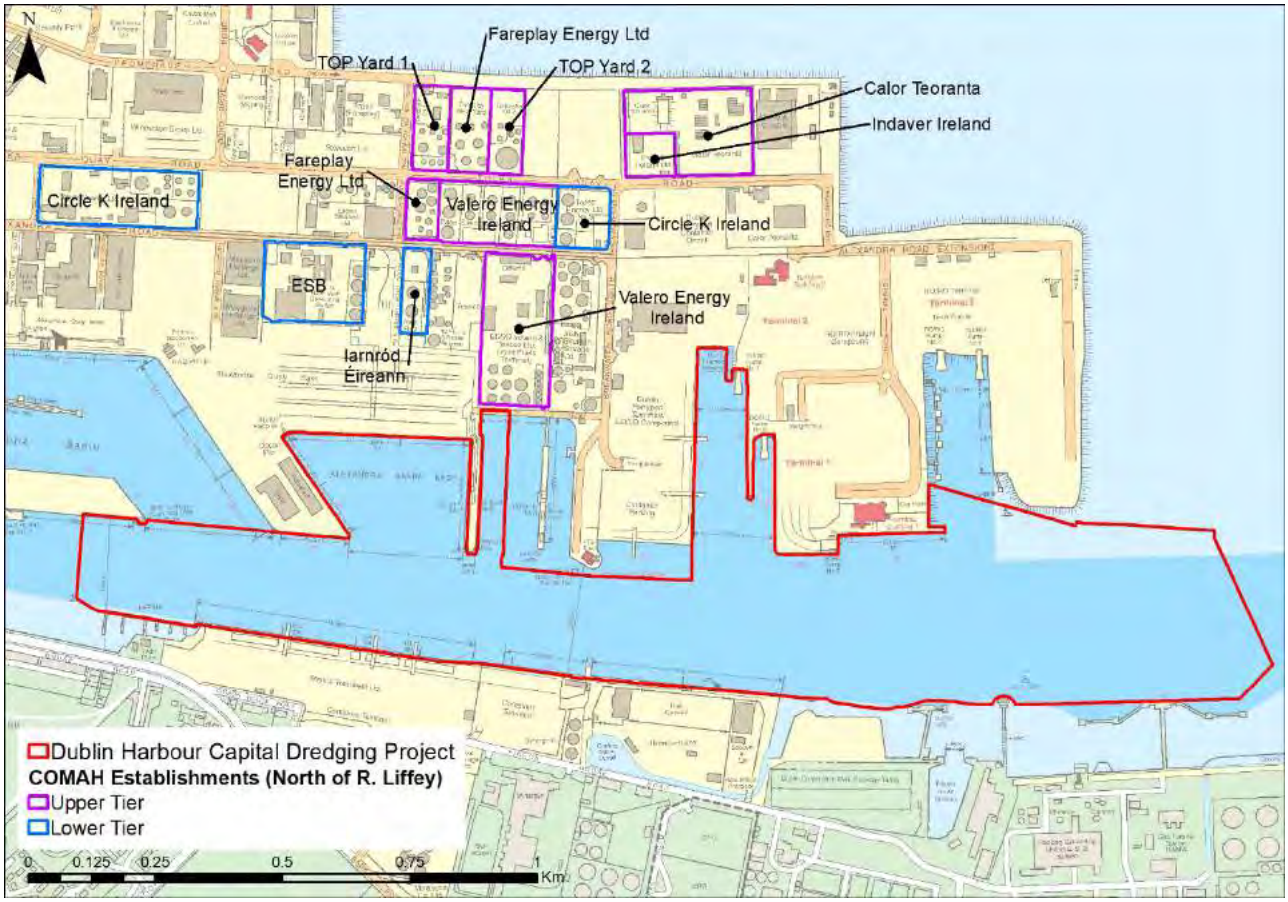


Figure 6-1 COMAH Establishments (North of the River Liffey)

6.1.2.2 South of River Liffey

The COMAH establishment within the port, south of the River Liffey, are listed in Table 6-2 and illustrated on Figure 6-2.The three establishments store and / or distribute petroleum products.

Table 6-2 COMAH Establishments South of the River Liffey

Establishment	Location	Tier	Activity	Consultation Distance[4]
Synergen Power Ltd t/a ESB Dublin Bay Power	Pigeon House Road, Ringsend, Dublin 4	Lower	Oil storage (power generation)	300 m
The National Oil Reserves Agency.	Shellybanks Road, Ringsend Dublin 4	Upper	Oil storage	300 m
The National Oil ReservesAgency	Pigeon House Road, Ringsend, Dublin 4	Upper	Oil storage	300 m

- Synergen Power stores class III petroleum as a back-up fuel for its natural gas fired powerplant; natural gas is supplied to the site via an above ground installation at the southeast corner of the site.

[4] The Dublin City Development Plan 2016 – 2022 includes the consultation distances for the COMAH Establishments.

- The National Oil Reserves Agency's (NORA) facility on Shellybanks Road (NORA Ringsend),stores class III petroleum, while NORA's facility on Pigeon House Road (NORA Poolbeg), stores class II in a single tank and class III petroleum in the remaining tanks.
- The ESB Poolbeg combined-cycle gas turbine power station is located to the west of NORAPoolbeg. It does not form part of a COMAH establishment; however, it is supplied by a natural gas pipeline and as it is immediately adjacent to a COMAH establishment we have included the aboveground pipeline in this assessment in line with the HSA's guidance.

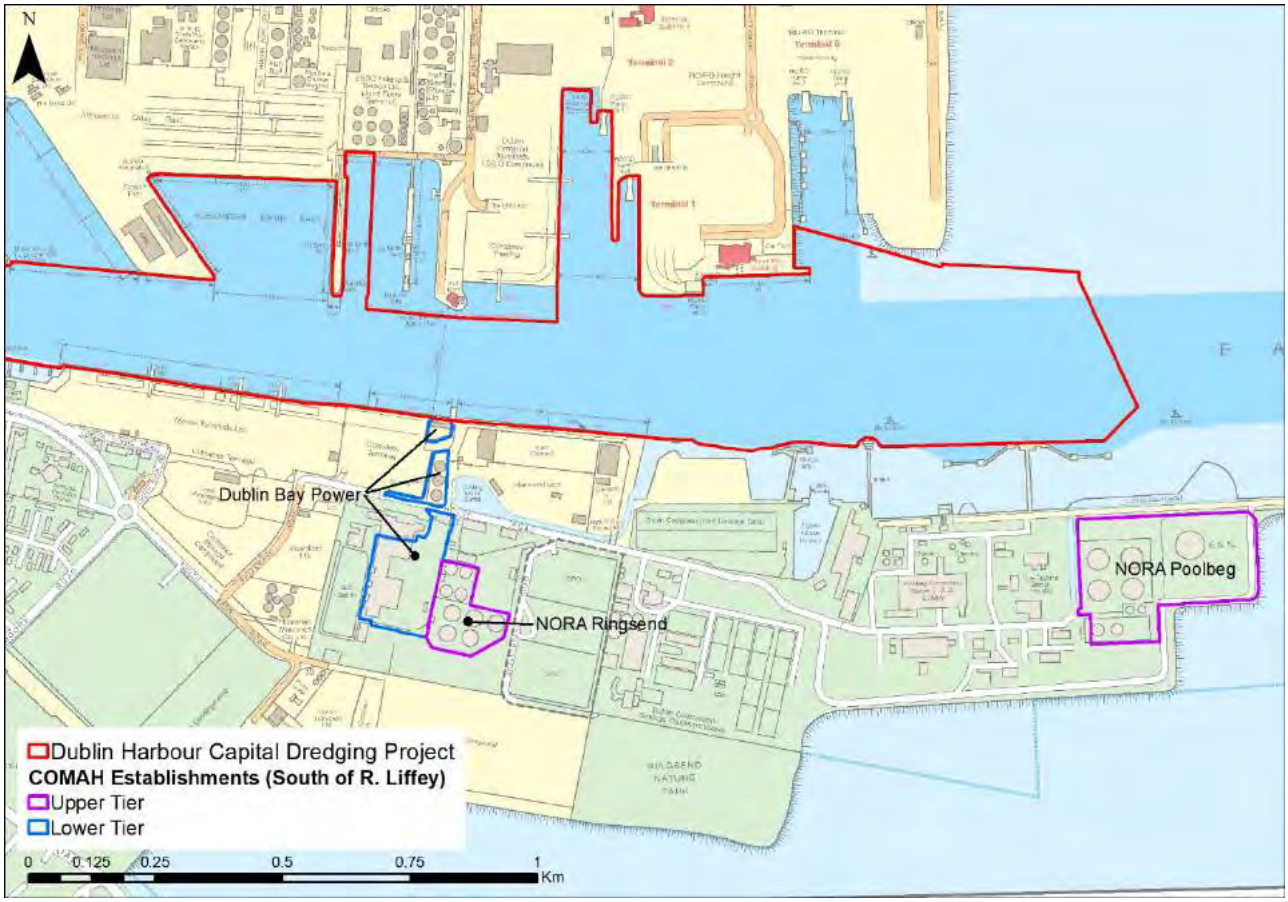


Figure 6-2 COMAH Establishments (South of the River Liffey)

6.1.2.3 Planning Permissions

Table 6-3 summarises the recent planning history for the current and prospective COMAH establishments. These developments have been accounted for in this COMAH land use planning assessment, as appropriate; where developments have not progressed within the timeframe of the planning permission, they have not been incorporated into the assessment.

Table 6-3 Planning Permissions for COMAH Establishments

Establishment / Planning Ref	Description	Status / Comment
Tedcastles Oil Products, Yard 2 Planning Ref: 1761/08/x1	The development consists of the construction of a new above ground vertical, steel petroleum product storage tank, located at the North end of the existing bund in Yard 2 for Class 1 motor spirit, 9600 tes, 33 m dia × 4.8 m high. It will also consist of the installation of new pipe work, pumps, fire defence system and associated works	Extension of time to 16-Jan-19. Development not progressed under this planning permission. The development at Yard 2 was not progressed and the planning permission was not extended further; therefore, this development is not included in the assessment.
Fareplay Energy Ltd., Yard 2 Planning Ref: 1460/08	The development will consist of (in the area of waste ground located at the northern end of the yard): the construction of a retention bund with reinforced concrete base and walls, construction of two above- ground vertical steel petroleum product storage tanks, and installation of associated equipment including; pipework, pumps, access platforms, fire monitors and underground interceptor within the confines of the bund. The tanks will comprise of 5171 tes motor spirit tank, 26.42 metres diameter by 14.63 metres high, and a 8139 tes auto diesel tank, 30.06 metres diameter by 14.63 metres high. Preparation of the waste ground for construction of the concrete bund, tanks and their foundations will require digging and/or removal of existing ground material in the area. The development will raise Yard 2 form an S.I. 74 of 2006, European Communities (Control of Major Accident Hazards Involving Dangerous Substances) Regulations 2006, 'lower tier' establishment to an 'upper tier' establishment.	Final grant of permission on 03-Dec-08. Development not progressed under this planning permission. This development has not been progressed, and the planning permission has not been extended and has, accordingly, ceased to have effect; therefore, this development has not been included in this assessment.
Tedcastles Oil Products, Yard 2 Planning Ref: 1761/08/x1	The development consists of the construction of a new above ground vertical, steel petroleum product storage tank, located at the North end of the existing bund in Yard 2 for Class 1 motor spirit, 9600 tes, 33 m dia × 4.8 m high. It will also consist of the installation of new pipe work, pumps, fire defence system and associated works	Extension of time to 16-Jan-19. Development not progressed under this planning permission. The development at Yard 2 was not progressed and the planning permission was not extended further; therefore, this development is not included in the assessment.

Establishment / Planning Ref	Description	Status / Comment
Tedcastles Oil Products, Yard 1 Planning Ref: 3820/08/x1	Planning permission for development is outlined hereunder. The development will consist of the construction of a new bund in the north end of Yard 1, 35 m × 40 m × 0.3 m high, including all associated works to prepare ground and construct foundation. It will also consist of the construction of a new aboveground, vertical, double skinned, steel petroleum product storage tank, located within the newly constructed bund in Yard 1 for Class II Kerosene, 6283 tes, 26.5 m dia × 14.6 m high with an outer shell 30.5 m dia × 12.5 m high. It will further consist of the installation of new pipework, pumps, fire defence system and associated works.	Extension of time to 13-Aug-19 Development not progressed underthis planning permission The development at Yard 2 was not progressed and the planning permission was not extended further; therefore, this development is not included in the assessment.
Topaz Energy Limited Planning Ref: 3221/14	Permission for development at New Topaz Terminal, Promenade Road, Dublin Port, Dublin 3, bounded to the south by Tolka Quay Road, to the west by TOP Yard 2, and to the east by an access lane. The development will consist of modifications to previously approved planning permission, Reference 3171/12. The modifications will consist of the following: 1. Re-designation of Tank 6 (T406) to store Jet A 1/Kerosene instead of Ethanol; 2. Re-designation of Tanks 7 and 8 (T407 and T408) to store ethanol instead of unleaded gasoline (ULG); 3. Tanks 1, 2, 3, 4, 5 and 6 to be located in one bund instead of two bunds; 4. Tanks 7, 8 and 9 to be double-skin tanks with a single bund wall instead of single-skin tanks with two bund walls; 5. Deletion of the 3m high secondary containment (inner) concrete wall around Tanks 7, 8 and 9; 6. Reduction of the height of the tertiary containment concrete walls of the bunds and of the perimeter walls from 3 metres to 2 metres. There will also be palisade fencing on the boundary. These changes will reduce the storage capacity for Class I liquids by approximately 30 %. The total storage capacity of all hydrocarbons will be unchanged. The development will be an Upper Tier Seveso site and comes within the meaning of Part 11 of the planning regulations. An Environmental Impact Statement (EIS) and a Natura Impact Statement (NIS) will be submitted to the planning authority with the planning application and the EIS and NIS will be available for inspection or purchase.	Final grant of permission on 14-Nov-14. Development not progressed under this planning permission. This development did not commence under the planning permission and the timeframe for the planning permission has expired[5]. The area has since been developed under separate planning permission (reference 2429/17).
Circle K Terminal 1 Planning Ref: 0184/20	EXPP: Existing lub oil loading gantry to be converted to facilitate jet fuel loading. This involves to relocate existing equipment on the jet gantry and removing equipment onthe lub oil gantry.	Exempt development
Circle K Yard 3 Planning Ref: 2071/20	Planning Permission for development at this site address: Circle K Yard 3, Alexandra Road, Dublin Port, Dublin 1. This site is regulated by the Major Accidents Directive. The development will consist of: Increasing the containment volume of the existing bund. Modifications will include raising	Final grant of permission on 22-Jun-2020

[5] The grant of permission does not specify a period for the duration of the permission and therefore it was interpreted the appropriate period under Section 40(3)(b) of the Planning and Development Act 2000, as amended (five years from the date of grant).

Establishment / Planning Ref	Description	Status / Comment
	the height of the existing bund wall by circa 0.5m, extending the bund to the east and lowering the ground level in the area of this bund extension from approximately 4.07m to 3.8m. The site's storm water, fresh water and foul sewer drainage will be modified to accommodate the bund extension.	
Circle K Terminal 1 Planning Ref: 3691/20	The proposed development consists of dismantling a portion of the Terminal 1 site including the loading gantry, office buildings, workshops, and control tower. Existing equipment including pumps will be moved to facilitate transfer of fuel to other terminalsand Bill of Lading facilities will be moved as part of the works and the existing warehouse will be modified to store spare parts. The modifications also include relocating the Jet Fuel loading gantry and installing a new internal entrance gate and fence which is the subject of an exempted development application (see application 0184/20). The Major Accidents Directive is applicable to the site and as such a significant modification assessment has been completed.	Invalid application(see 3773/20)
Circle K Terminal 1 Planning Ref: 3773/20	Planning permission for the proposed development consists of dismantling a portion of the Terminal 1 site incl. the loading gantry, office buildings, workshops and control tower. Existing equipment including pumps will be moved to facilitate transfer of fuel to other terminals and Bill of Landing facilities will be moved as part of the works and the existing warehouse will be modified to store spare parts. The modifications also include relocating the Jet Fuel loading gantry and installing a new internal entrance gate and fence which is subject of an exempted development application (see application 0184/20). The Major Accidents Directive is applicable to the site and as such a significant modification assessment has been completed.	Final grant of permission on 8-Mar-2021
Fareplay Terminal 2 Planning Ref: 2688/20	The proposed development consists of dismantling a portion of the Terminal 2 site including a redundant building and a repair shop which will allow new entrance gates and associated boundary works to be carried out to accommodate for two entrance lanes for retail commercial loading tankers. Existing equipment including pumps, samplesroom, lab, and dye tanks will be relocated as part of the works. A new 30m3 additive tank will be provided. The existing Vapour Recovery Unit in Terminal 2 will be refurbished. Improved information signage for drivers at entrance and loading gantry will be installed and new internal road markings will be painted to identify parking spaces. The Major Accidents Directive is applicable to the site and as such a significantmodification assessment has been completed.	Final grant of permission on 23-Feb-2021

6.1.3 Risk Assessment Methodology

6.1.3.1 Guidance

EU Guidance on Land Use Planning

The EU's guidelines on land use planning[6] describe the ideal LUP technical advice system:

In principle all risk assessment methods without regard to individual applications have the same relevant elements; these are:

- *Definition of scope, objectives and risk criteria*
- *Description of the object or area of concern*
- *Identification of hazards*
- *Identification of vulnerable targets*
- *Assumption of source terms or hazardous incidents*
- *Development of escalation scenarios*
- *Estimation of consequences*
- *Estimation of likelihood*
- *Presentation of resulting risk and comparison with established tolerability criteria*
- *Identification of mitigation measures*
- *Acceptance of result, modification or abandoning*

Besides these elements a proper risk assessment should furthermore ensure

- *A level of detail proportional to the severity of consequences*
- *The use of acknowledged methods (or it must be demonstrated that these are equivalent)*
- *Reliability of data and relevant information and*
- *Transparency of the process*

The HSA has set out its policy and approach to conducting land use planning assessments in itsguidance: *Policy & Approach of the Health & Safety Authority to COMAH Risk-based Land-use Planning (19 March 2010)*.

HSA Guidance

The HSA has set out its policy and approach to conducting land use planning assessments in its guidance[7] , which is to adopt a conservative and consistent approach. The HSA notes that its proposed risk-based approach is not intended to be as detailed as that required for a full quantified risk assessment (QRA), but rather is a relatively simple approach based on the consideration of a smaller number of representative events which are the most significant in terms of off-site land use planning.

For the risks associated with each of the COMAH establishments, the HSA's risk based approach was applied, based on the likelihoods and consequences for the types of major accident that could arise at the different COMAH establishments and the natural gas pipelines associated with the two generating stations.

[6] Land Use Planning Guidelines in the Context of Directive 96/82/EC and 105/2003/EC

[7] Policy & Approach of the Health & Safety Authority to COMAH Risk-based Land-use Planning (19 March 2010)

6.1.3.2 Assessment Criteria

Individual Risk

The criterion against which the level of individual risk is assessed is based on the HSA's guidance and the use of a three-zone traffic light system shown in Table 6-4.

Table 6-4 Risk Based Contour Zones for Individual Risk

Zone	Description
Inner zone	Risk of fatality of 1×10^{-5} per year (1 in 100,000, or 0.001%)
Middle zone	Risk of fatality of 1×10^{-6} per year (1 in 1 million, or 0.0001%)
Outer zone	Risk of fatality of 1×10^{-7} per year (1 in 10 million, or 0.00001%)

These three zones have been determined for the COMAH establishments in the port based on the probabilities of the scenarios arising, as described in Section 6.1.4, and on the results from the consequence assessment, as described in Section 6.1.5.

Societal Risk

The societal risk can be assessed using several techniques. The HSA's guidance recommends the use of the societal risk index (SRI, also referred to as the scaled risk integral) as an initial screening tool in assessing the societal risk to new developments in the vicinity of existing establishments. The societal risk can also be assessed using an FN curve, which is a more detailed approach and is also accepted by the HSA.

The focus of the societal risk assessment is to examine the overall risk to which the population may be exposed as a result of their proximity to the existing COMAH establishments. The HSA's approach in such instances is to use the SRI. The SRI was developed by the UK HSE and methodology for its calculation is provided by Carter (1995)[8]:

$$SRI = \frac{P \times R \times T}{A}$$

Where:

- *P* is the population factor, defined as $(n+n^2)/2$.
- *n* is the number of persons at the development.
- *R* is the average estimated level of individual risk (in 'chances per million', CPM).
- *T* is the proportion of time the development is occupied by *n* persons.
- *A* is the area of the development (in hectares).

[8] Carter, D. A *he Scaled Risk Integral – A Simple Numerical Representation of Case Societal Risk for Land Use Planning in the Vicinity of Major Accident Hazards*, Loss Prevention and Safety Promotion in the Process Industries, Volume II, 1995

The HSA's guidance also notes that, for certain developments, it may be appropriate to account for the sensitivity of the population by scaling 'n'; for a sensitive population, the guidance notes that a scaling factor of 4 may be applied. Table 6-5 summarises the assessment criteria for the SRI.

Table 6-5 Assessment Criteria for the Scaled Risk Integral (SRI)

SRI	Description
2,500	The lower comparison value for dwellings by Carter (1995) The value below which the UK HSE would normally 'not advise against' a development
4,000	The upper comparison value for dwellings given by Carter (1995)The value that the HSA uses to assess a broadly acceptable risk
35,000	The value above which the UK HSE advises against a development
500,000	The value above which the UK HSE considers the societal risk to be intolerable and *considers* requesting call-in
750,000	The value above which the UK HSE considers the societal risk to be intolerable and requestscall-in.

The societal risk can be assessed in more detail by means of an FN curve for the COMAH establishments and the surrounding environment. An FN curve shows the relationship between the frequency of an outcome and the cumulative severity of the outcome, typically plotted on a log-log scale to account for the range of values for both the frequency of occurrence and the severity of the outcome, shown in Figure 6-3.

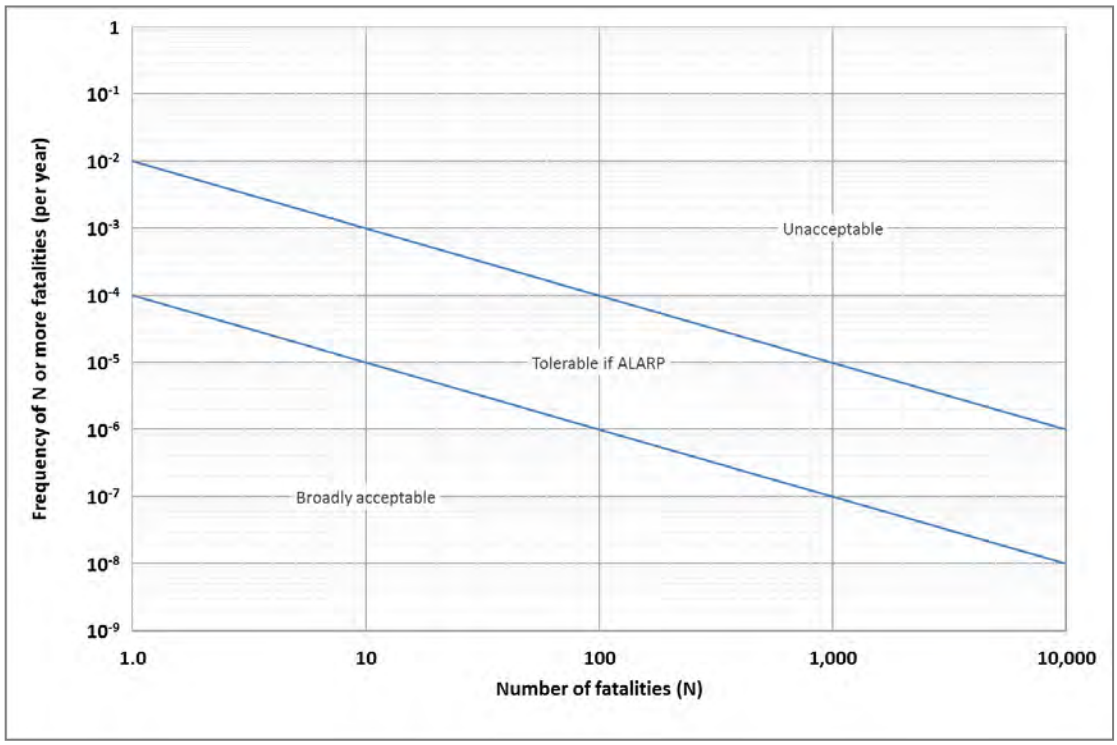


Figure 6-3 FN Curve – Societal Risk Assessment Criteria

When assessing whether the level of societal risk may be regarded as tolerable, it is necessary to select appropriate criteria. In its guidance, the HSA identifies two criterion lines:

- an upper criterion of 1 in 5,000 for 50 fatalities
- a lower criterion line of 1 in 100,000 for 10 fatalities

The area above the upper criterion is the intolerable / unacceptable region and the area below the lower criterion line is the broadly acceptable region. The area between the two lines is generally considered to be the ALARP region, where the risk may be considered to be 'tolerable' provided that it is **A**s **L**ow **A**s **R**easonably **P**racticable (ALARP)[9]. The two criterion lines from the HSA's guidance are shown in Figure 6-3.

Based on the nature of the Dublin Harbour Capital Dredging Project and its proximity to the COMAH establishments, the SRI is an appropriate method for assessing the societal risk.

6.1.3.3 Development Sensitivity Levels

The HSA provides advice to the planning authorities, in accordance with the COMAH Regulations, using a similar system to that applied by the UK HSE. Different types of development are categorised under one of four sensitivity levels (Level 1 to Level 4). The HSA provides its advice to planning authorities in the form 'advises against' or 'does not advise against' depending on which zone the development lies within, as shown in Table 6-6 (a tick indicating 'do not advise against' and across indicating 'advise against'). The development sensitivity levels applicable to the Dublin Harbour Capital Dredging Project – a workplace are shown in Table 6-7.

Table 6-6 HSA Matrix for Land Use Planning Advice

Sensitivity Level	Individual Risk Zone (refer to Table 4)		
	Inner Zone	Middle Zone	Outer Zone
Level 1	✓	✓	✓
Level 2	×	✓	✓
Level 3	×	×	✓
Level 4	×	×	×

Table 6-7 Development Sensitivity Levels - Workplaces

Development Type	Examples	Development Detail & Size	Justification
DT1.1 Workplaces	Offices, factories, warehouses, haulage depots, farm buildings, non-retail markets, builder's yards.	Workplaces (predominantly nonretail), providing for less than 100 occupants in each building **and**less than 3 occupied storeys – **Level 1**	Places where the occupants will be fit and healthy, and could be organised easily for emergency action. Membersof the public will not be present or will be present in very small numbers and for ashort time.
	Exclusion		

[9] The UK HSE comments on the use of the terms *so far as is reasonably practicable* (SFAIRP) and *as low as reasonably practicable* (ALARP). It notes that SFAIRP is most often used in the context of workplace health andsafety legislation and that ALARP is used by risk specialists. The HSE uses the term ALARP in its COMAH guidance and, in its view, considers that the two terms are (generally) interchangeable

		DT1.1 ×1 Workplaces (predominantly non-retail) providing for 100 **or** more occupants in any building or 3 or more occupied storeys in height - **Level 2** (except where the development is at the major hazardsite itself, where it remains Level 1).	Substantial increase in numbers at risk with no direct benefit from exposure to the risk.

6.1.4 Scenarios

Overview

The HSA's land use planning guidance outlines the types of scenario to be considered as part of a COMAH land use planning assessment. The scenarios are based on the types of hazard at the respective installations and are intended to account for the worst-case scenario in each case. The COMAH establishments included in this assessment, and the COMAH substances that may give rise to major accident scenarios, are summarised in Table 6-8; the scenarios applicable to each establishment are summarised in Table 6-9.

Table 6-8 COMAH establishments & substances

Establishment	Location	Tier	COMAH Substances
Calor Teoranta	Tolka Quay Road, Dublin 1	Upper	Class 0 (LPG)Class III
Fareplay Energy Ltd.(under the Topaz Energy Group)	Tankfarm 1, Alexandra Road, Dublin Port, Dublin 1 Tankfarm 2, Tolka Quay Road, Dublin Port, Dublin 1	Upper	Class I, II & IIIClass I, II & III
Indaver Ireland Ltd.	Tolka Quay Road, Dublin Port, Dublin	Upper	Flammables & toxics
Tedcastles Oil Products	Yard 1, Promenade Road, Parish of St. Thomas,Dublin Port, Dublin 1	Upper	Class I, II & III
Tedcastles Oil Products	Yard 2, Tolka Quay Road, Parish of St. Thomas,Dublin Port, Dubl:in 1	Upper	Class I & III
Valero Energy IrelandLtd.	Alexandra Road, Dublin Port, Dublin 1	Upper	Class I, II & III
Electricity Supply Board	North Wall Generating Station, Alexandra Road,Dublin 1	Lower	Class III
Iarnród Éireann	Alexandra Road, North Wall, Dublin 1	Lower	Class III
Topaz Energy Limited	Terminal 1, Alexandra Road, Dublin Port, Dublin 1	Lower	Class I & II
Topaz Energy Limited	Yard 3, Alexandra Road, Dublin Port, Dublin 1	Lower	Class III
Synergen Power Ltd t/aESB Dublin Bay Power	Pigeon House Road, Ringsend, Dublin 4	Lower	Class III Natural gas[10]
The National Oil Reserves Agency.	Shellybanks Road, Ringsend Dublin 4	Upper	Class III

[10] Natural gas is not stored at these sites, but the sites are supplied by a natural gas pipeline via an AGI (above ground installation) and therefore this substance is included in this assessment consistent withSection 3.4.5 of the HSA's guidance.

Establishment	Location	Tier	COMAH Substances
The National Oil Reserves Agency	Pigeon House Road, Ringsend, Dublin 4	Upper	Class II & III
ESB Poolbeg CCGT	Pigeon House Road, Ringsend, Dublin 4	Note 2	Natural gas[11]

[11] The ESB Poolbeg generating station is not a COMAH establishment. However, as it is supplied by a natural gas pipeline via an AGI (above ground installation) it is included in this assessment consistentwith Section 3.4.5 of the HSA's guidance

Table 6-9 Major Accident Scenarios from HSA Guidance

Installation type	Establishment	Scenario	HSA reference / default probability	Potential risk reduction measure	Probability used in assessment
LPG (HSA §3.1)	Calor	BLEVE	1×10^{-4} / year per site or1×10^{-5} / year per vessel	Intumescent coating on vessels	1×10^{-6} / year per vessel
Large scale flammable storage (VCE risk) (Class I) (HSA §3.2)	Topaz 1 Valero (north) Fareplay 1 Fareplay 2 TOP 1 TOP 2 Topaz (see Table 3)	VCE	1×10^{-4} / year per site 1×10^{-5} / year per tank	Implementation of Buncefield recommendations	1×10^{-6} / year per tank
		Unbunded pool fire	1×10^{-4} / year per small installation 1×10^{-4} / 100π per metre / year	High flashpoint (e.g. kerosene) Reduction of overtopping	1×10^{-5} / 100□ per metre / year
		Bund fire	1×10^{-3} / year per bund	High flashpoint (e.g. kerosene)	1×10^{-4} / year per bund
Large scale flammable storage (no VCE risk) (Class I with no VCE risk, or Class II) (HSA §3.3)	Topaz 1 Valero (north) Fareplay 1 Fareplay 2 NORA PoolbegTOP 1 TOP 2 Topaz (see Table 3)	Unbunded pool fire	1×10^{-4} / year per small installation 1×10^{-4} / 100π per metre / year	High flashpoint (e.g. kerosene) Reduction of overtopping	1×10^{-5} / 100□ per metre / year
		Bund fire	1×10^{-3} / year per bund	High flashpoint (e.g. kerosene)	1×10^{-4} / year per bund
Storage of Class III(1) petroleum products (HSA §3.4)	ESB Iarnród ÉireannNORA Poolbeg NORA RingsendSynergen Topaz Yard 3 Valero (south)	Unbunded pool fire not containedat the site (off-site fire)	1×10^{-5} / year per small installation 1×10^{-5} / 100π per metre / year	None	1×10^{-5} / 100π per metre / year
Warehouses (HSA §3.6 &		Release from drum of toxic	1×10^{-4} / year	None	1×10^{-4} / year

Installation type	Establishment	Scenario	HSA reference / default probability	Potential risk reduction measure	Probability used in assessment
§3.7)	Indaver	material			
		Pool fire from drum of flammable material	1×10^{-4} / year	None	1×10^{-4} / year
		Bund fire	1×10^{-3} / year per bund	None	Not applicable – non-credible event
		Warehouse fire	1×10^{-4} / year	None	1×10^{-4} / year
Natural gas pipeline	Synergen Power ESB Poolbeg	Jet fire	None	None	

The HSA provides guidance on the probability (frequency) of occurrence applicable to each of the accident scenarios, which the HSA notes are estimated conservatively. For certain scenarios, the HSA identifies risk reduction measures that, if applicable to and applied at the particular establishment, yield reduced probabilities for the relevant scenario. For example, in the case of large-scale petroleum storage facilities that present a risk of a vapour cloud explosion (VCE), the HSAadvises that the probability of occurrence can be reduced from the 'default' by an order of magnitude if the establishment has implemented the recommendations from the Buncefield Report[11]. The risk reduction measures in the Buncefield Report[12] are applicable to the oil storage sitesin the Port that store class I petroleum (gasoline), and the HSA has advised that it is reasonable to apply the corresponding reduction in risk.

However, the HSA's guidance does not include the probability of loss of containment from a naturalgas pipeline and therefore we have applied the guidance from *Guidelines for quantitative risk assessment*, Publication Series on Dangerous Substances (PGS 3), published by the Advisory Councilon Dangerous Substances (2005) – also referred to as the Purple Book.

LPG Releases

The worst-case event for an LPG site is a BLEVE of a storage tank, with a frequency of 1×10^{-5} pervessel per year as per the HSA's guidance. To reflect the different sizes of tanks at the Calor establishment, we have accounted for BLEVE of the four larger semi-mounded tanks to the northwest of the site and the 15 aboveground tanks to the centre / east of the site separately. As the above ground tanks and the exposed end caps of the semi-mounded tanks are protected by means ofa fire-proof insulation, we have applied the lower likelihood of 1×10^{-6} per vessel per year.

Bund Fires

A bund fire may arise following the release of petroleum product from a tank (the primary containment). The probability of fire in a bund storing class I material is 1×10^{-3} per year, and for a bund storing class II material is an order of magnitude less (1×10^{-4} per year). The high flash point ofclass III products means that there is effectively no risk of ignition following a spill where it is confined within the bund area.

For bunds that contain more than one class of petroleum product (e.g. class I and class II), the assessment is based on the higher (more volatile) class of product. Therefore, for a bund containingboth class I and class III tanks, the scenario has been modelled as a class I fire.

The storage tanks in the solvent blending area of the Indaver establishment are double skinned tanks and therefore catastrophic failure of a tank resulting in a bund fire has been discounted as acredible scenario.

Unbunded Fires

In the event of a catastrophic failure of a storage tank in which the full contents of the tank are released, the material may have sufficient momentum to 'overtop' the bund wall resulting in an uncontained pool of material. The extent to which the pool may spread depends on multiple factors, including the volume of material released, the momentum of the material, the type of material, and the nature and topography of the surrounding area. As

[12] *Safety and environmental standards for fuel storage sites*, Process Safety Leadership Group, Final Report,2009

it is not practicable or reasonable to estimate the probability of each potential pool size for each tank, we have adopted the HSA's guidance and have estimated the size of an unconfined pool as:

$$R = 6.85 \times V^{0.44537}$$

In this formula, *R* is the radius of the pool (in metres) and *V* is the volume of material (in cubicmetres). As per the HSA's guidance, the size of an unconfined pool is subject to a maximum diameter of 100 m (a radius of 50 m).

It was assumed that if product from one bund overtops towards another bund, the material will be contained within the second bund and will not migrate further. In such cases, the size of the poolis taken to be that of the second bund. Each bund was taken to be of quadrilateral shape and the direction of release to be perpendicular to the bund walls; therefore, the probability of an overtopping release was calculated for each of four directions for each bund.

The probability of an unbunded pool fire extending up to 100 m from a bund wall is calculated as follows:

$$f = \frac{1 \times 10^{-4}}{100\pi} \times bund\ perimeter$$

For class III product, the high flash point means that where a spill does not migrate beyond the boundary of the COMAH establishment or beyond another COMAH establishment, then there is effectively no risk of ignition. If the class III material does migrate beyond the site boundary into an area in which there are no controls on ignition sources (e.g. onto a road), we conservatively assume that the unbunded material ignites.

Vapour Cloud Explosion

A vapour cloud explosion (VCE) is a credible scenario at an installation that stores bulk flammableliquids that meets the following criteria:

- used for the storage of class I petroleum (petrol)
- in vertical, cylindrical, non-refrigerated, above-ground storage tanks
- with side walls greater than 5 m in height
- at filling rates greater than 100 m3 per hour

The HSA's guidance advises that the probability of a VCE occurring at such an establishment can conservatively be taken as 1×10^{-4} per site per annum, or as 1×10^{-5} per tank per annum. However,this can be adjusted to take account of protection systems and other controls that may be in place.If a site has implemented all the recommendations arising from the Buncefield investigation, the likelihood of a VCE arising can be reduced by an order of magnitude to 1×10^{-5} per establishment per annum, or to 1×10^{-6} per tank per annum.

In light of the number of class I storage tanks within the Port, we have applied the probability of 1×10^{-6} per tank per annum and we have assumed that the measures in place at the bulk storage installations storing class I petroleum in the Port satisfy the Buncefield recommendations

Warehouse Fire

The probability of a warehouse fire is dependent on a variety of factors, including the nature of the materials stored (whether they are flammable), the volume of materials stored and the size of individual containers and storage areas, and the systems in place to protect against a fire. For this assessment, we have conservatively assumed the probability of a fire within the flammable drum store at the Indaver establishment to be 1×10^{-4} per annum, as per the HSA's guidance for a major fire involving 100% of the inventory of a flammable goods warehouse.

Natural Gas Jet fire

A jet fire could occur in the event of a loss of containment (leak or rupture) of an aboveground natural gas pipeline followed by direct ignition. The probability of such an event is dependent on the diameter of the pipeline, length of pipeline and probability of ignition; the Purple Book provides probability data for such releases and ignition. The probability of a jet fire occurring at an aboveground installation is calculated using the following inputs:

- Probability of a loss of containment from a pipeline with diameter greater than 150 mm:
  - 1×10^{-7} per metre per year for full bore rupture
  - 1×10^{-7} per metre per year for a leak (equivalent to 10% of diameter)
- Probability of ignition of methane from a continuous release (0.09 for a flow rate greaterthan 100 kg/s)

We assess two scenarios for each aboveground pipeline: full bore rupture and leak from a hole equivalent to 10% of the pipeline diameter. The probability of a jet fire from each scenario wasdetermined using the following equation:

$$P_{JET\ FIRE} = P_{LOSS\ OF\ CONTAINMENT} \times \text{length of aboveground pipeline} \times P_{IGNITION}$$

The heat flux from the resultant jet fire is calculated using the equation by Jo and Ahn (2005)13, as recommend in the HSA's guidance, which assumes that the risk can be determined using a point source thermal radiation model. The heat flux (I) is given by:

$$I = \frac{\eta \tau_a Q H_c}{4\pi r^2}$$

Where:

- η is the radiation fraction (0.2)
- $\tau a$is the atmospheric transmissivity (1)
- Hc is the heat of combustion
- Q is the release rate
- r is the radial distance from the release

[13] Jo, Y.-D. and Ahn, B.J., *A Method of Quantitative Risk Assessment for Transmission Pipeline Carrying Natural Gas*, J. Haz.Mat. A123, 2005

The consequences arising from the individual accident scenarios were calculated and expressed in terms of risks to people exposed by use of the probit function. Probit functions account for the variation in tolerance to harm for an exposed population, with the fatality rate of personnel exposed to harmful agents over a given period calculated using a function of the general form:

$$Y = k_1 + k_2 \ln (V)$$

where:

- Y is the probit, a measure of the percentage of the vulnerable resource that might sustain damage (the probability of fatality).
- k1 & k2 are constants depending upon the type of harm that the population is exposed to (thermal, pressure, toxic effects).
- V is the product of intensity (I) or concentration (C) of the received hazardous agent to an exponent n and the duration of exposure in seconds or minutes (t). In other words:

$$V = C^n \cdot t$$

The probit function can be used to calculate the risk to people exposed to the hazardous agent (thermal radiation, overpressure or concentration of toxic substance), expressed as a probability of lethal impacts, as follows:

$$Probability = \frac{1}{\sqrt{2\pi}} \int_{u=-\infty}^{u=Y-5} exp\left(-\frac{u^2}{2}\right) du$$

For example, a probit value of 5 corresponds to a probability of fatality of 50%. Similarly, probit values of 3.72 and 6.28 correspond to probabilities of fatality of 10% and 90%, respectively.

Thermal Effects

The probit function for thermal effects is:

$$Y = -14.9 + 2.56 \cdot \ln \left(I^{4/3} \cdot t\right)$$

In this equation, *I* is the thermal flux expressed in kilowatts per square metre (kW/m^2) and the time *t* is expressed in seconds. For long duration events, such as bund and pool fires, the duration is typically set at 75 seconds to take account of the time required for people to escape from the area. For events that affect a smaller area, such as jet fires, the duration is set at 30 seconds as less time isrequired to escape from the area.

In accordance with the HSA's guidance, the bunded and unbunded fires of class II and III materialhave been modelled using a surface emissive power of 25 kW/m^2.

6.1.5 Risk Assessment

The COMAH land use planning assessment is based on the Dublin Harbour Capital Dredging Project as described in Chapter 3 of this EIAR. The capital dredging works will be carried out using a trailing suction hopper dredger (TSHD) and/or a backhoe dredger. All capital dredging operations will take place within the period October to March, inclusive. The dredged material will be disposed at the licenced disposal site at the entrance to Dublin Bay located to the west of the Burford Bank. The disposal operations are undertaken by the TSHD, or equivalent hopper barge, within the confines of the disposal site. The disposal operation typically takes 10 to 15 minutes to empty the hopper. Each loading / dumping trip typically takes 2 to 4 hours.

The Dublin Harbour Capital Dredging Project will be carried out over the period from 2022 to 2029, with approximately 50 days of dredging works over this 8-year period. When the dredging works take place, they will typically last for 24-hours at a time and involve approximately 12 personnel, comprising both the dredger crew and marine mammal observers.

Individual Risk

The aggregated risk contours for the inner, middle and outer zones around the COMAH establishments are shown in Figure 6-4. The risk contours show that the area of the Dublin Harbour Capital Dredging Project lies largely outside the contours, with only a small proportion of the overall area of the works lying inside the contours, in particular at the following locations:

- The channel to the west of Oil Berth 1 and the east of Oil Berth 2, directly to the south of theValero establishment, lying partly within the outer zone and partly within the middle zone.
- The channel at Berths 50, 50S, 51 and 51A lying within the outer zone, and at Berth 50N lying within the middle zone.
- A small portion of the channel to the north and east of Berth 45, to the north of Synergen Power Ltd., lying within the outer zone.
- A small portion of the channel to the east of the jetty serving the NORA Poolbeg (and ESB Poolbeg generating station), lying within the outer zone.

As outlined in Section 6.1.3 the works constitute a workplace and therefore we consider it appropriate to classify the area as sensitivity level 1. Under the HSA's individual risk criteria, developments of sensitivity level 1 can be accommodated within the inner, middle and outer zones (and outside the outer zone). Therefore, from an individual risk perspective, the project satisfies the HSA's criteria, with the highest individual risk that people in the area may be exposed conservatively estimated at 3.7 × 10-6 per year.

Societal Risk

Based on the nature of the Dublin Harbour Capital Dredging Project, we have conservatively assessed the SRI using the following inputs:

- Number people: the upper population of 12
- Occupancy factor: 0.137 (50 days per year, compared to the anticipated occupancy of 50 days over 8 years).

- Development area: the approximate area of the development lying within the individual risk contours, 4.7 ha.
- Individual risk: 3.7 chances per million (3.7 × 10-6 per year), the highest individual risk attributable to the COMAH establishments.

Based on these conservative inputs, the SRI is estimated at approximately 8.4, which is significantly less than the lower comparison value of 2,500 and the HSA's criteria of 4,000.

6.1.6 Conclusion

Based on this conservative assessment, it is considered that the Dublin Harbour Capital Dredging Project satisfies the HSA's criteria under its land use planning guidelines. The highest individual risk within the project boundary is approximately 3.7 × 10-6 per year, with the majority of the project lying outside the individual risk contours, and the works taking place on approximately 50 days over an 8-year period.

It is considered appropriate to classify the area of the works as development sensitivity level 1 as the dredging project constitutes a work activity. Developments of sensitivity level 1 may be permitted in any of the four individual risk zones, and therefore while a small proportion of the project boundary lies within the middle and outer zones, it satisfies the HSA's societal risk criteria, with the societal risk index (SRI) falling within the broadly acceptable range.

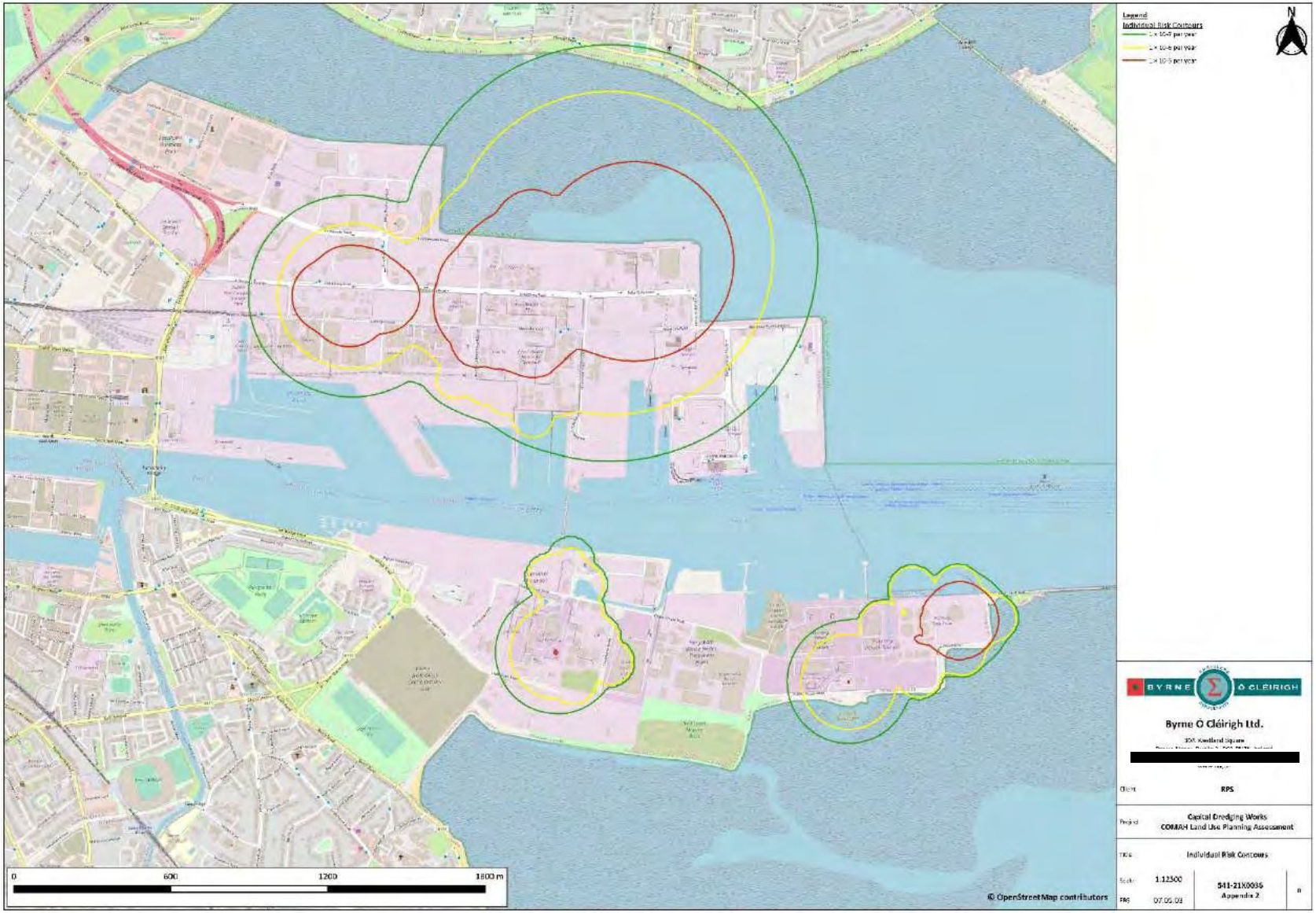


Figure 6-4 Aggregated risk contours for the inner, middle and outer zones around the COMAH establishments

6.2 Risk of Collision – Dublin Bay Marine Traffic Management

Dublin Bay is very busy with marine leisure events and small craft movements. Agreement was reached with all the sailing and motor clubs how best to co-exist. To that end the commercial shipping channels, access routes and anchorage areas are well defined and kept clear. The organised leisure industry operates within the confines of the areas agreed for their events. Individual craft must operate within the international maritime legislation governing all vessels big and small.

Marine activity will be able to operate with little or no disruption as the dredging operation will be subservient to the demands of commercial movements. The leisure craft are not normally allowed to operate within the confines of the main approach channel. As the dredging is confined to the navigation channel, basins and berths channel there should be no effect. When small craft are entering or leaving the Port they must do so under the control of VTS. Therefore they will be well informed and aware of any dredging operations and of their requirements to stay clear. Again this is in compliance with International Legislation.

Dublin Bay, the approaches to the Port and the shipping channel are monitored at all times by Vessel Traffic Services (VTS). All vessels are advised regarding works, developments or issues that are ongoing in the Dublin Port area of jurisdiction. Prior to any dredging a DPC “Notice to Mariners” is sent out to all shipping informing them about the planned work and dates. During the dredging operation the vessel traffic is supervised and controlled.

The Harbour Master’s Office thereby have the experience, expertise and systems in place to avoid the risk of a major accident through two vessels colliding. There has been no incidents, or near misses, reported as a result of dredging activity within Dublin Port.

6.3 Emergency Response Management

Dublin Port’s approach to Emergency Response Management is described in the following sub-sections, in the context of the potential for major accident hazards to arise at the COMAH establishments and, more generally, for other incidents and accidents that may arise across the Port estate.

6.3.1 Dublin Port Traffic Management

There are three access / egress points within the Port:

- The main entrance to and exit from the Port is on Promenade Road, which is manned 24 hours per day, 7 days per week, 365 days a year, by An Garda Síochána.
- The entrance to / exit from the Port on Tolka Quay Road is normally closed to traffic, but it can be opened in the event of an emergency in consultation with DCC and An Garda Síochána.
- The entrance to / exit from the Port on Alexandra Road is normally open and is manned 24 hours per day, 7 days per week, 365 days a year, by An Garda Síochána. This entrance / exit provides access to DPC’s administration / office building and to parts of the commercial and industrial areas of the Port; in normal operation, it is not used for access to / egress from ferry Terminals 1, 2 or 5.

These three entrances / exits provide access to / from the three main roads running east-west: Promenade Road, Tolka Quay Road and Alexandra Road. The normal traffic routes through the Port for the majority of traffic, and in particular for the traffic accessing Terminals 1, 2 and 5 is via the main entrance on Promenade Road to the roundabout at the junction with Bond Drive Extension.

In the event of an incident, traffic can either be held by the Harbour Police and Dublin Port Security at a safe location, depending on the location and nature of the incident / emergency, or alternatively it can be diverted onto one of the other east-west (or adjoining roads) to facilitate egress from the Port. DPC implements these diversion routes on a regular basis, not due to incidents in the Port, but rather due to closures in the Dublin tunnel which requires traffic to be diverted in conjunction with DCC, An Garda Síochána and Transport Infrastructure Ireland.

If an incident at one of the COMAH establishments resulted in a bund or unbunded fire at or immediately adjacent to one of the primary access roads (e.g. on Tolka Quay Road), the Port would activate its emergency procedures and divert any traffic from the eastern end of the Port (e.g. disembarking traffic from the ferry terminals) via Dublin Ferryport Terminal (DFT). In addition, the Port has significant capacity to store cargo (tourist cars & HGV) at a combination of Terminals 1, 2, 5, depending on the nature and location of the particular event requiring the emergency action. The holding areas at Terminals 1 and 5 are located in the outer zone or outside the outer zone.

Overall, the Port has two normally open routes in / out (via Promenade Road and Alexandra Road) and a back-up route (via Tolka Quay Road). Given the layout of the Port and the location of the COMAH establishments, a major accident at one establishment is unlikely to affect access via all three routes, and in all but the largest events, an event is only likely to affect one of the three routes. Therefore, the Port will always have an alternative route to provide access to / egress from the estate.

6.3.2 Dublin Port Security

DPC operates its own Harbour Police & Port Security, which is present 24 hours per day, 7 days per week, 365 days a year. Two patrol vehicles operate at all times in conjunction with An Garda Síochána, and the Port has a close working relationship with DCC, the operator of the Dublin Port Tunnel, and TII. In addition, DPC has a comprehensive CCTV system across the estate, with over 130 camera locations monitoring the complete road network and port infrastructure, with the system monitored by Harbour Police & Port Security 24 hours per day, 7 days per week, 365 days a year. Therefore, in the event of an incident on the road network, or an incident at a COMAH (or other facility) within the Port requiring the diversion of traffic, the Port can respond immediately and co-ordinate directly with the relevant emergency services (Appendix 6-1).

6.3.3 Dublin Port Emergency Management Plan

Summary

As set out in *A Framework For Major Emergency Management* (produced by the National Steering Committee for Major Emergency Management), the Harbours Act places responsibility on the Harbour Master for the safety of shipping and all activities within the defined port limits. The legislation also requires that emergency plans be prepared in respect of the major ports. These emergency plans are designed generally to deal with incidents,

in the first place using the port's own resources. Each port is also required to prepare an oil pollution plan to deal with oil pollution incidents, and responsibility for implementing the plan rests with the harbour master. Where COMAH establishments are located within a port (or harbour), the port authority is designated as a local competent authority and as such is included in the relevant external emergency planning process.

In this context, DPC has developed its Emergency Management Plan (Appendix 6-2), the aim of which is to set out the structures and arrangements that will be used in response to an emergency to mitigate:

- loss of life or injury to employees, contractors, visitors and local residents,
- damage to the environment, and
- damage to the facilities, plant and equipment within the port, its commercial partners, tenant companies and neighbours.

The plan also aims to ensure that DPC emergency management structures and arrangements are compatible with the requirements of the Framework for Major Emergency Management.

The actions to be taken in an emergency are decided by the Emergency Management Team (EMT) and the plan itself may be activated by the Chief Executive Office, the Emergency Management Marine Coordinator (EMMC), or the Emergency Management Land Coordinator (EMLC), depending on the circumstances and severity of the incident.

The plan is designed to cater for both marine and land-based emergencies; land emergency scenarios may include:

- major fire within the general port area,
- major oil spill,
- major spill of hazardous material,
- a vehicle accident involving hazardous material,
- chemical incidents (e.g. toxic cloud), or
- major incident in an oil, gas or hazardous material storage facility.

The *Dublin Port Emergency Management Plan* also contains several scenario-specific sub plans for the individual types of emergency scenario, which focus on the immediate actions to be taken by internal sections of the Port Authority.

Dublin Port Alarm

The DPC fire alarm panel system is located in the Harbour Police / Port Security Control Room, situated on the ground floor of the Port Operations Centre. The fire alarm system monitors approximately 21 sites, and break glass units are located throughout the port estate.

The fire alarm system can be activated manually or automatically from various points around the port directly linked to the system. When activated, the Harbour Police / Port Security are immediately alerted and investigate the alarm before deciding on what action is required. The port wide sirens are located at the ESB North Wall

Generating Station, the oil jetties, and DP Warehousing. With the exception of alarm tests, all pumping stops immediately on sounding of the Port-wide siren. Fire Wardens on the oil jetties communicate with all COP users by VHF radio.

For confirmed alarm activations, the affected site and Harbour Police / Port Security request the attendance of the emergency services, advising them of the nature of the emergency, name and location of the site affected using the ETHANE pneumonic:

- **E**xact location of the emergency.
- **T**ype of emergency (e.g. fire; hazardous material spill; road traffic accident).
- **H**azards (present and potential).
- **A**ccess route to the emergency.
- **N**umber and type of casualties (if known).
- **E**mergency Services (those present and those required).

Once confirmed, the Harbour Police / Port Security immediately open the emergency gates located at the western end junction of Tolka Quay Road and East Wall Road, and this immediate area operates as the emergency services rendezvous point. Dublin Fire Brigade will be dispatched to the Port to deal with the incident, whilst the Harbour Police / Port Security will implement a traffic control plan, with the support of An Garda Síochána, as required.

The Port-wide alarm system is a continuous wailing alarm sound. On hearing this alarm, Port users should:

- Be aware that an incident is ongoing.
- Account for staff, visitors and contractors.
- Continue to operate as normal unless instructed otherwise, or individual company standard operating procedures indicate otherwise.
- Wait for further instructions from the Harbour Police / Port Security or the Principal Emergency Services[14].

Port users should await further information from the Harbour Police / Port Security, whilst members of the public should tune in to a national radio station for updates.

Port Evacuation

During an emergency it may be necessary to evacuate the Port, or parts of the Port. The Port is divided into six separate areas for evacuation planning purposes, as shown in Figure 6-5. The Harbour Police / Port Security control traffic flow throughout the Port in the event of an evacuation of one or more areas.

[14] An Garda Síochána, the Ambulance Service and the Fire Service. A fourth principal emergency service, the Irish Coast Guard, is responsible for the initiation, control and co-ordination of maritime emergencies in the Irish territorial waters, harbours and coastline.

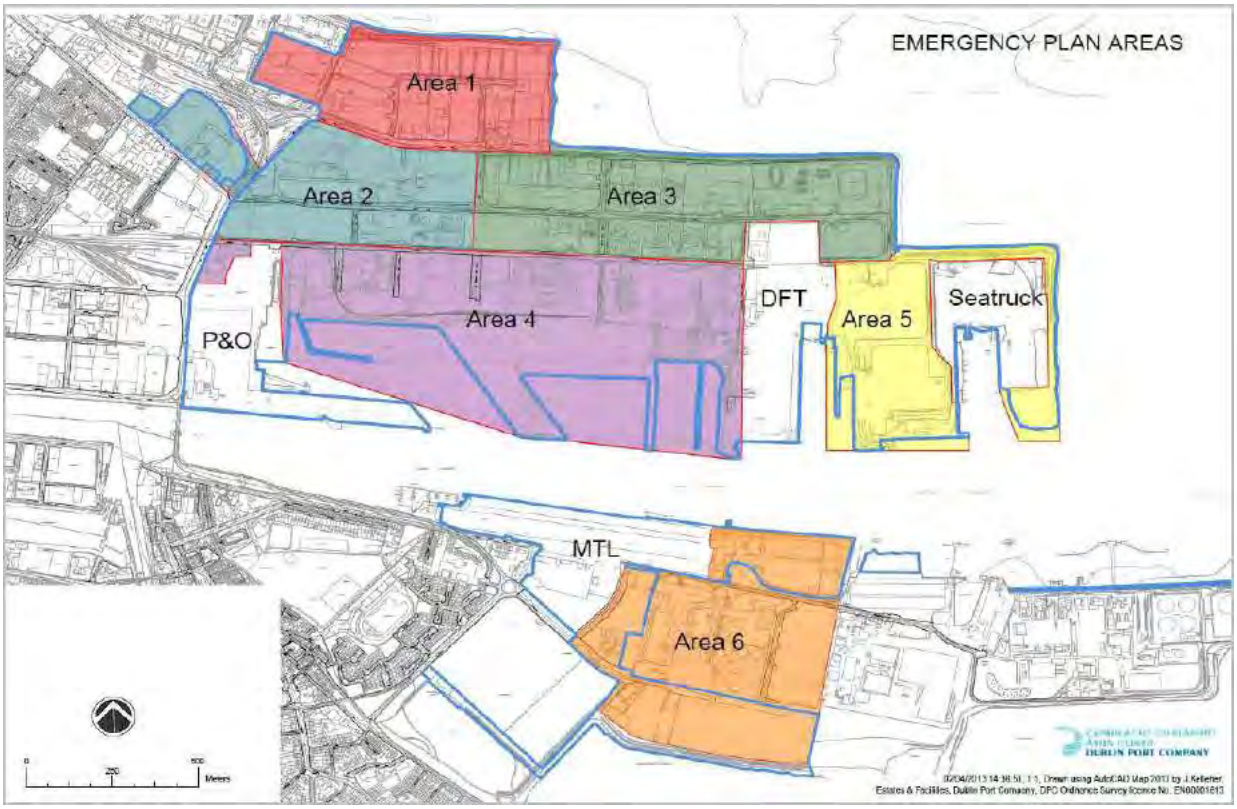


Figure 6-5 Dublin Port Company Evacuation Areas

6.3.4 Dublin City Council Major Emergency Plan

Dublin City Council, the relevant Garda Division and Health Service Executive District are the principal response agencies (PRA) charged with managing the response to emergency situations that arise within Dublin City Council's administrative boundary. The Dublin City Council Major Emergency Plan is supported by, and is compatible with, the major emergency plans of An Garda Síochána and the Health Service Executive. In certain circumstances, the local response may be escalated to regional level, thus activating the plan for regional level co-ordination. If this is activated, the management of the incident is coordinated from a regional perspective.

Several specific local plans, such as the response plan to flood emergencies, remain in place as standalone plans, which can be implemented under the general arrangements and structures set out in the plan. Certain types of emergency have a particular focus, thus enabling a hazard or site-specific plan to be activated. Sub-plans deal with a range of incidents, such as severe weather emergencies, large crowd events and hazardous substances storage sites (such as COMAH establishments).

In the Dublin City Council administrative area there are eight upper tier establishments notified to the HSA, for which interagency specific off-site plans have been prepared. In addition, the Port (which lies within the Dublin City Council administrative boundary) has prepared emergency plans and maintains emergency services commensurate with the hazards within the port boundary. Dublin Port authorities generally request the attendance of the principal emergency services at alerts, incidents and exercises at the facility. Where appropriate, a major emergency may be declared by the principal response agencies when responding to an incident in Dublin Port.

Dublin Fire Brigade provides the primary response to emergencies in the city and to the Port. The Council supports this response by providing amongst others, the following functions:

- coordinating the delivery of services from all council departments,
- making buildings such as leisure and community centres available to people displaced by the emergency,
- providing a volunteer civil defence organisation,
- providing advice and assistance with clean up after major flooding or pollution,
- assessing structural damage to buildings, and
- co-ordinating and leading multi-agency meetings to plan community recovery.

Overall, and in accordance with the requirements of *A Framework for Major Emergency Management*, the *Dublin City Council Major Emergency Plan* has been prepared to facilitate the response to, and recovery from major emergencies as well as ensuring the Council's arrangements are coordinated with those of the other designated principal response agencies, the Health Service Executive and An Garda Síochána.

6.3.5 Emergency Response Exercises

The Port conducts regular emergency response exercises across its estate (2 no. half-day exercises a year), covering incidents at the COMAH establishments in co-ordination with the operators of the establishments and with the emergency services, incidents at other facilities in the Port, road traffic incidents including incidents outside the Port estate that can have a knock-on effect on traffic within the Port, and incidents at the ferry terminals or berths. These exercises test the Port's procedures, response actions and the resources that may be deployed (personnel and emergency response equipment), thereby ensuring that the Port is well prepared to respond to an incident or emergency.

6.3.6 Dublin Port Dangerous Cargoes Bye-laws

In addition to the obligations on operators of COMAH establishments under the COMAH Regulations, and on the obligations of vessels and goods vehicles transporting dangerous goods under the *European Agreement concerning the International Carriage of Dangerous Goods by Road* (ADR) and the *International Maritime Dangerous Goods* (IMDG) Code, dangerous goods within the Port estate are governed by the *Dublin Port Bye-Laws - Dangerous Goods (Cargoes)* 2014. Table 6-10 lists the classes and divisions of dangerous goods that are subject to the byelaws.

Table 6-10 Classification of Dangerous Goods

Class	Division	Dangerous Goods
2	-	Gases
-	2.1	Flammable Gases (e.g. LPG, acetylene, natural gas)
-	2.2	Compressed non-flammable gases (e.g. nitrogen, argon)
-	2.3	Toxic gases (e.g. chlorine, sulphur dioxide, ammonia)
3	-	Flammable liquids (e.g. petrol, kerosene, solvents)

Class	Division	Dangerous Goods
4.1	-	Flammable solids, self-reactive substances and solid desensitized explosives
4.2	-	Substances liable to spontaneous combustion
4.3	-	Substances which on contact with water emit flammable gasses.
5.1	-	Oxidising substances (e.g. ammonium nitrate, solid pool chlorine)
5.2	-	Organic peroxides (e.g. methyl ethyl ketone peroxide – MEKP)
6.1	-	Toxic Substances (e.g. sodium cyanide, pesticides)
6.2	-	Infectious substances (e.g. medical waste)
7	-	Radioactive material (e.g. monazite, uranium)
8	-	Corrosive substances (e.g. sulphuric acid, caustic soda, hydrofluoric acid)
9	-	Miscellaneous dangerous substances and articles

The byelaws regulate the movement and storage of dangerous goods within the Port, including:

- arrival by sea in packaged form, in liquid bulk or in solid bulk,
- departure by sea,
- arrival by road or rail, and
- storage / staging in the Port estate.

In the context of storing / staging dangerous goods within the Port, including at the COMAH establishments, the byelaws require that:

7.4.1 All Port Terminals and tenants must have a Company approved Dangerous Goods Storage and Emergency Response Plan. The Plans must be reviewed annually and are subject to inspection by the Company.

7.4.2 All Port Terminals and tenants must have in place a Dangerous Goods Inventory in an approved format on site and available for inspection by the Company at all times and inventories must be emailed to dg@dublinport.ie each day the terminal or tenant premises operate.

7.4.3 All Port Terminals and tenants must hold and have readily available Safety Data Sheets for all Dangerous Cargoes stored on their site.

7.4.4 All Port Terminals and tenants must carry out an annual exercise of their emergency response plan and document for audit purposes.

7.4.5 All Port Terminals storing, staging or loading / unloading Dangerous Goods must have a qualified Dangerous Goods Safety Advisor (DGSA) employee certified by a HSA approved training organisation.

7.4.6 The Company recommends all facilities storing or staging Dangerous Goods should have a Chemical Risk Assessment completed and staff involved complete a Dangerous Goods Awareness Course.

7.4.7 The Harbour Master, his nominee or authorised officer or representative of the Company, may under exceptional circumstances allow by written authorisation that dangerous goods may be temporarily stored at the Port. Note exceptional circumstances exclude matters of commercial gain or expediency.

7.4.8 All Port Terminals and tenants requesting derogation of storage time and quantity must do so in writing to the Company stating Dangerous Goods class (UN specific) and must be accompanied by risk assessment and relevant Safety Data Sheet.

6.4 Conclusion

Based on this conservative assessment, it is considered that the Dublin Harbour Capital Dredging Project satisfies the HSA's criteria under its land use planning guidelines. The highest individual risk within the project boundary is approximately 3.7×10^{-6} per year, with the majority of the project lying outside the individual risk contours, and the works taking place on approximately 50 days over an 8-year period.

It is considered appropriate to classify the area of the works as development sensitivity level 1 as the dredging project constitutes a work activity. Developments of sensitivity level 1 may be permitted in any of the four individual risk zones, and therefore while a small proportion of the project boundary lies within the middle and outer zones, it satisfies the HSA's societal risk criteria, with the societal risk index (SRI) falling within the broadly acceptable range.

In addition, Dublin Bay, the approaches to the Port and the shipping channel are monitored at all times by Vessel Traffic Services (VTS). All vessels are advised regarding works, developments or issues that are ongoing in the Dublin Port area of jurisdiction. Prior to any dredging a DPC "Notice to Mariners" is sent out to all shipping informing them about the planned work and dates. During the dredging operation the vessel traffic is supervised and controlled.

Dublin Port Company has also developed a comprehensive emergency management plan that caters for the range of accident and emergency events that may occur within its estate (or that may occur outside the estate and that have a direct, knock-on effect), and this plan is provided to the other relevant stakeholders, including An Garda Síochána, Dublin City Council, Transport Infrastructure Ireland, and the Principal Response Agencies. In the event of an incident at a COMAH establishment that could impact on people at other facilities in the Port, or on road traffic entering or exiting the Port, DPC will activate its Emergency Management Plan, in which case people would be directed away from the source of the hazard. As it is not possible to model the different combinations of major accidents, and the corresponding emergency response actions within the societal risk assessments, the estimated societal risk is concluded to be conservative.

Accordingly, on the basis of the information set out in this chapter, it is concluded that, from a COMAH perspective, the potential direct and indirect major accident and disaster risks arising from the Dublin Harbour Capital Dredging Project satisfy the Health and Safety Authority's COMAH land use planning guidance. It is also concluded that other, non-COMAH direct and indirect major accident and disaster risks arising from the Dublin Harbour Capital Dredging Project are not significantly different from the current risks.

7 BIODIVERSITY, FLORA & FAUNA

This chapter of the Environmental Impact Assessment Report (EIAR) identifies, describes and assesses in an appropriate manner, the direct and indirect significant effects of the Dublin Harbour Capital Dredging Project on biodiversity.

The proposed project comprises dredging works within Dublin Port and the associated dumping of dredge spoil at a licenced offshore disposal site. As such, all works will take place within the estuarine and marine environment of Dublin Harbour and Dublin Bay, with no terrestrial elements to the project proposed. It is considered therefore that the proposed capital dredging project has no potential to give rise to any terrestrial biodiversity impacts and on this basis terrestrial biodiversity has been screened out of the appraisal (See Chapter 5 of the EIAR).

As noted in the EC (2013) *Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment*, biological diversity or 'biodiversity' is one of the key terms in conservation, encompassing the richness of life and the diverse patterns it forms. The 1992 UN Convention on Biological Diversity defines biological diversity as 'the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems'.

Ecological Impact Assessment (EcIA) is a process of identifying, quantifying and evaluating the potential and likely significant effects of a proposed project on ecological features, where ecological features are the species, habitats and biodiversity components of ecosystems that have the potential to be affected by the Dublin Harbour Capital Dredging Project.

As all biodiversity comprises an enormous amount of species and habitats, ecological assessment is typically divided into specialist subject areas. The biodiversity chapter of this EIAR contains a description of the marine and avian biodiversity features and designated sites within a zone of influence (ZoI) of the Dublin Harbour Capital Dredging Project, followed by an assessment of the potential and likely significant effects of the Dublin Harbour Capital Dredging Project on marine and avian biodiversity features and designated sites.

This chapter contains information on different specialist subject areas of ecology, and has been written by a number of authors as specified in Table 1-1 '*List of Contributors to EIAR Chapters'* of Chapter 1 of the EIAR.

The chapter has been broken down into the following sub-sections:

7.1: Benthic Biodiversity and Fisheries

7.2: Marine Mammals

7.3: Avian Biodiversity

In addition a Natura Impact Statement (NIS) has been prepared on behalf of Dublin Port Company (DPC) in respect of the applications for development consent in relation to the Dublin Harbour Capital Dredging Project. The NIS has been submitted so as to enable the competent authorities to carry out the assessments required under the Habitats Directive and Irish law.

7.1 Benthic Biodiversity & Fisheries

7.1.1 Assessment Methodology

The proposed project entails dredging 26.51ha including basins, berths within those basins, riverside berths and a section of the navigation channel between Tom Clarke Bridge and the downstream end of Alexandra Basin East. Virtually all the area in question has already been dredged as part of various previous maintenance and capital dredging campaigns, most recently in 2020, and is required in order to deepen existing basins and berths, as well as sections of the main channel to allow for the berthing and manoeuvring of vessels with greater drafts.

The maximum projected dredge volume comes to 500,000m^3, just over 26% of which is an additional amount estimated to accumulate due to routine sedimentation predicted to occur during the lifetime of the project. The dredge spoil arising will be disposed of at the Dublin Bay licenced dump site near the Burford Bank at the entrance to Dublin Bay.

Table 7-1 lists the various individual areas which will be dredged within the 8 year lifespan of the project.

Dredging will be carried out in the period October to March each year using either a trailer hopper suction dredger (THSD), a backhoe dredger or a combination of both.

The campaigns will be managed in order to minimise potential environmental impacts and will include several mitigation measures to achieve this.

Table 7-1 Dredge volume in each dredge zone over the seven years of the project

Dredge Zone	Estimated Dredge Volume above design (m^3)
Zone 1 – Navigation Channel	121,008
Zone 2 – South Port Berths	26,146
Zone 3 – Alexandra Basin East	47,020
Zone 4 – Oil Berths	7,842
Zone 5 – Ferryport Basin	27,970
Zone 6 – Riverside Berth 52	127,515
Zone 7 – Berth 48/Oil Jetty	11,296
Dredge Volume (m^3)	368,797
Siltation Tolerance / Contingency (m^3)	131,203
Total Dredge Volume (m^3)	500,000

Benthic Sampling

A total of 8 sub-tidal grab samples were collected within the basins and shipping channel within Dublin Harbour. All samples were collected on the 7th July 2020 and were sampled using a 0.1m^2 stainless steel Van-Veen Grab for benthic faunal analysis. Drop-down video was also collected at 11 locations within the survey area. Video data was collected at each of the grab sample locations, as well as at an additional 2 locations along the shipping channel. All sampling stations were positioned using a Garmin *eTrex* 20x. A list of the stations sampled are presented in Table 7-2 and these stations are displayed on a map (Figure 7-1).

Table 7-2 Positions of sub-tidal soft sediment grab sampling stations (CS_01 - 09) and drop-down video sites (CS_01-09 and CV_A-B)

	Easting (IG)	Northing (IG)		Easting (IG)	Northing (IG)
CS_01	318211.31	234271.78	CS_07	318913.16	234518.10
CS_02	320675.99	234099.84	CS_08	319561.95	234269.35
CS_03	319330.02	234311.97	CS_09	320680.22	234247.50
CS_04	319973.53	234357.64	CV_A	319092.27	234181.87
CS_05	318806.75	234117.30	CV_B	320269.32	234104.39
CS_06	319368.92	234151.48			

The following was undertaken at each station:

- 1 x 0.1m^2 Van-Veen grab taken for benthic faunal analysis. [9 Sites]
- 1 x 0.1m^2 Van-Veen grab from which a small amount of sediment was retained for Particle Size Analysis and Loss on Ignition Analysis. [7 Sites] (No grain size was collected at sites CS_04 & 05 due to equipment issues on site).
- Drop-down video imagery collected [11 Sites]

Grab samples were sieved through a 1mm mesh sieves on board and preserved in 4% formalin. In the laboratory, samples were sorted by eye using a binocular microscope and fauna identified to the lowest taxonomic level possible using standard keys to north-west European fauna by specialist taxonomists from Thomson Ecology.

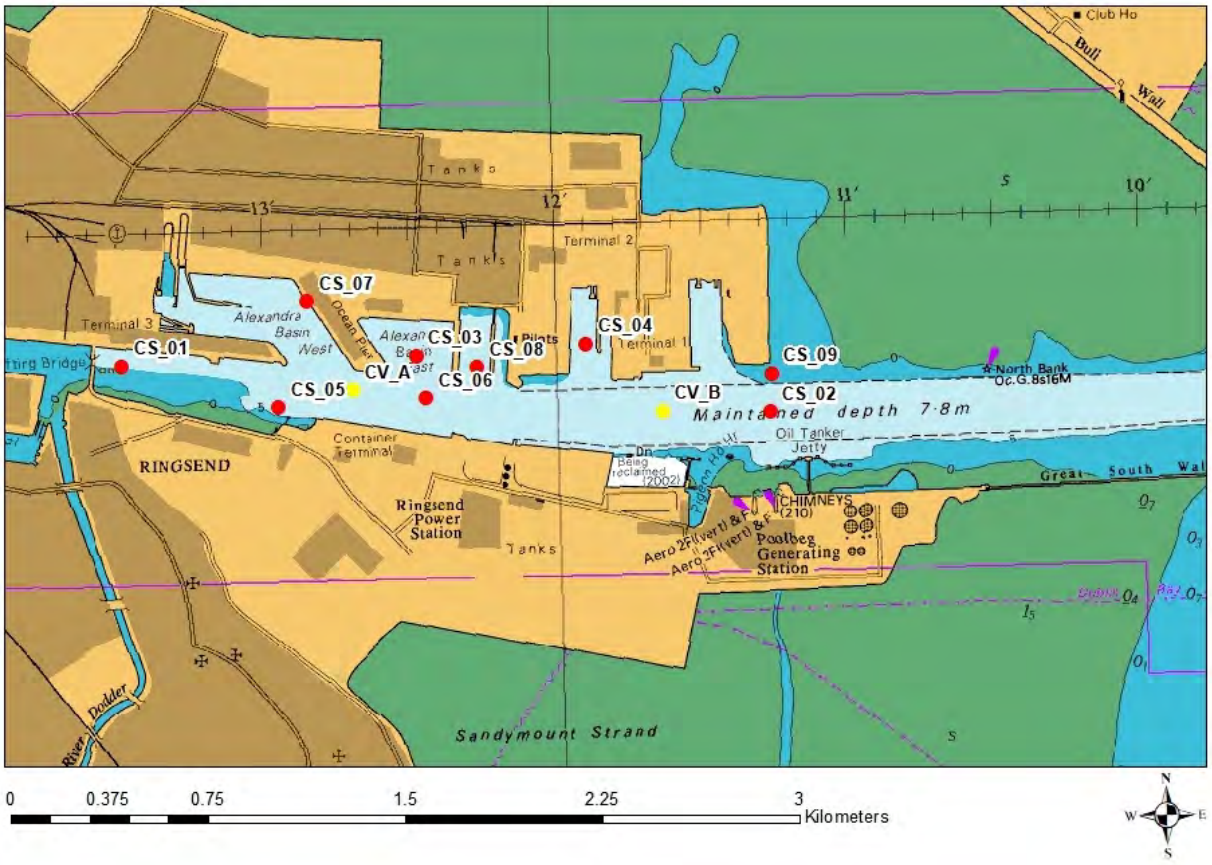


Figure 7-1 Map showing the positions of video and sub-tidal grab samples (Red Circles) and video only sample locations (Yellow Circles) taken in Dublin Bay

Three biotic indices were calculated from the species/abundance matrix from the grab samples. These included Simpson's Dominance Index [where values range from low dominance (0) to high dominance (1)], Shannon-Wiener Diversity Index [values ranging from low diversity (0) to high diversity (4)] and Pielou's Evenness Index [values ranging from low evenness and dominated by a few species (0) to high evenness and a more even spread of species (1)].

Video data was recorded as MPEG4 format files directly to a portable DV recorder. At each station a single recording was taken with the video camera lowered to above the seafloor. Each recording was examined in order to assess the nature of the bottom habitat and to identify any visible fauna.

Granulometric Analysis

Granulometric analysis was carried out on oven dried sediment samples from each station using the protocols described by Holme & McIntyre (1984). The sediment was pre-treated with hydrogen peroxide (H_2O_2), dried and passed through a series of nested brass test sieves with the aid of a mechanical shaker. The sieve series included 2mm, 1mm, 500µm, 250µm, 125µm and 63µm. The sediments were further divided into three fractions: % Gravel (>2mm), % Sand (<2.0mm >63µm) and % Silt-Clay (<63µm). Textural group assessment was made using the Folk and Ward Classification method described in Holme & McIntyre (1984).

Organic Matter Analysis

Organic matter was estimated using the Loss on Ignition (LOI) method. One gram of dried sediment was ashed at 450˚C for 6 hours and organic matter calculated as % sediment weight loss.

Fisheries Sampling

The fisheries component of this study comprised a desktop examination of published Inland Fisheries Ireland (IFI) surveys of the lower Liffey Estuary as background to the resident and migratory marine/estuarine component of the fish community in the general port area. This was combined with records from traps (eel & lamprey) and counters (salmon) at Islandbridge weir in the lower freshwater reaches of the Liffey supplied by the Marine Institute, as a means of assessing trends in Annex II migratory species and eels. Six beam trawl tows were also undertaken: two (C_T1 and C_T2) on the dump site, and four (CT_3 – CT_6) in the inner port area (Table 7-3, Figure 7-2). The C_T4 trawl tow was repeated due to lack of catch and the replicate tow is reported as C_T4 x2. The length of the disposal site trawl tows (C_T1 & C_T2) ranged in length from 1.0-1.2km, while those in the inner port area ranged from 0.2-0.46km. Towing speeds ranged from 2-3.5knots. The beam trawl was 2m wide and fitted with 3 tickler chains. The survey was undertaken on 08th July 2020.

Table 7-3 In and Out positions from Bream Trawls taken in Dublin Harbour and offshore dump site

	Easting (IG)	Northing (IG)		Easting (IG)	Northing (IG)
C_T1 In	330643.5	231432.5	C_T1 Out	330648.0	232522.2
C_T2 In	330902.2	232815.0	C_T2 Out	330876.5	231648.7
C_T3 In	320448.4	234270.4	C_T3 Out	320619.0	234157.8
C_T4 In	319966.9	234516.2	C_T4 Out	319970.8	234228.6
C_T4 x2 In	319956.0	234287.6	C_T4 x2 Out	319962.1	234486.4
C_T5 In	319278.7	234326.3	C_T5 Out	319408.9	234182.9
C_T6 In	319457.1	234074.6	C_T6 Out	318996.0	234129.9

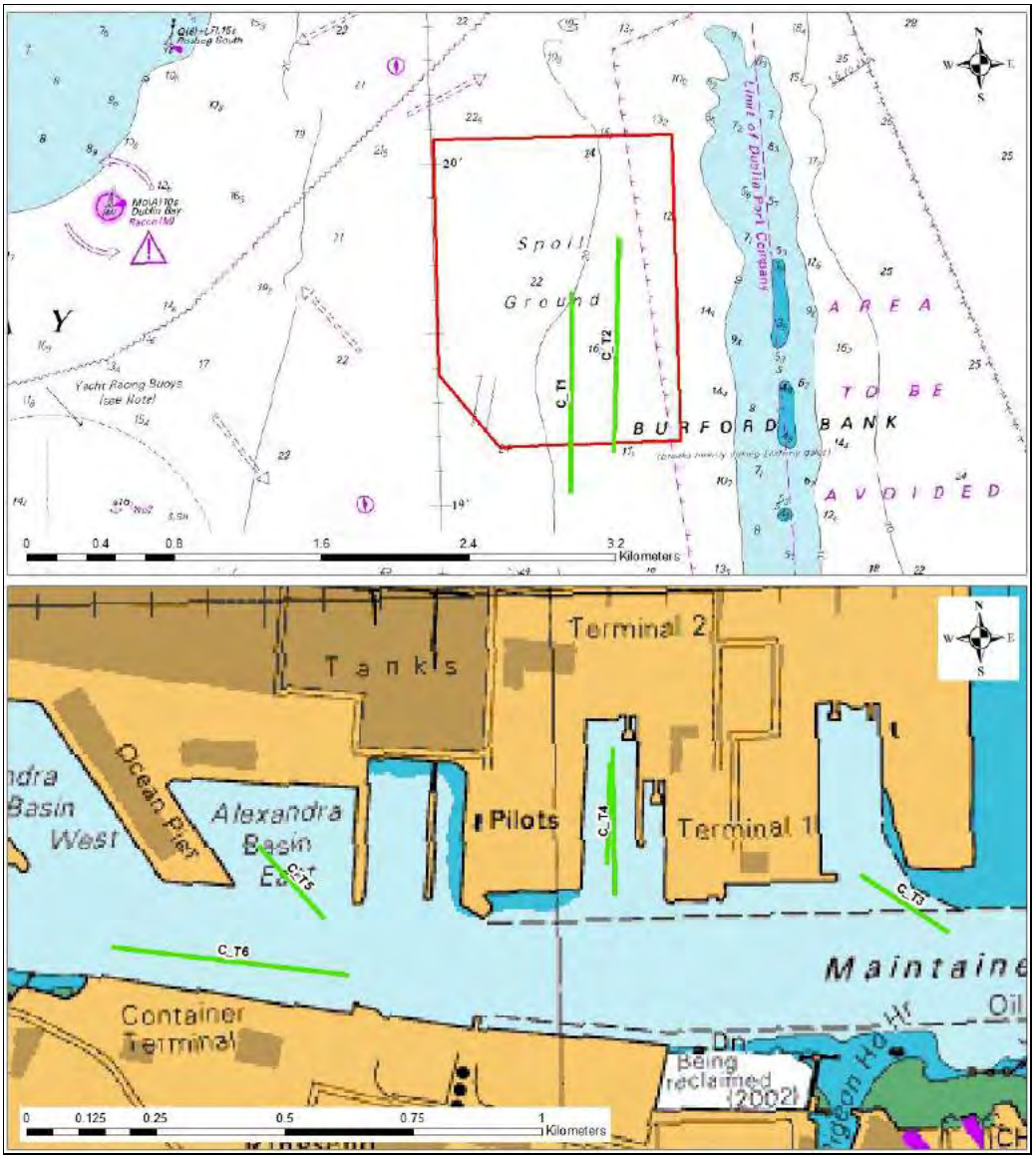


Figure 7-2 Map showing the positions Beam Trawl locations (Green Lines) taken in Dublin Harbour and offshore dump site

7.1.2 Receiving Environment

Marine Benthos at Loading Area

Particle Size and Loss on Ignition Assessment

Results from the survey indicate the presence of muds and sandy muds across the survey area (Table 7-4, Figure 7-3 & 7-4). This was also reflected in the Loss on Ignition values for the area, with relatively high organic matter levels at most sites (Table 7-4).

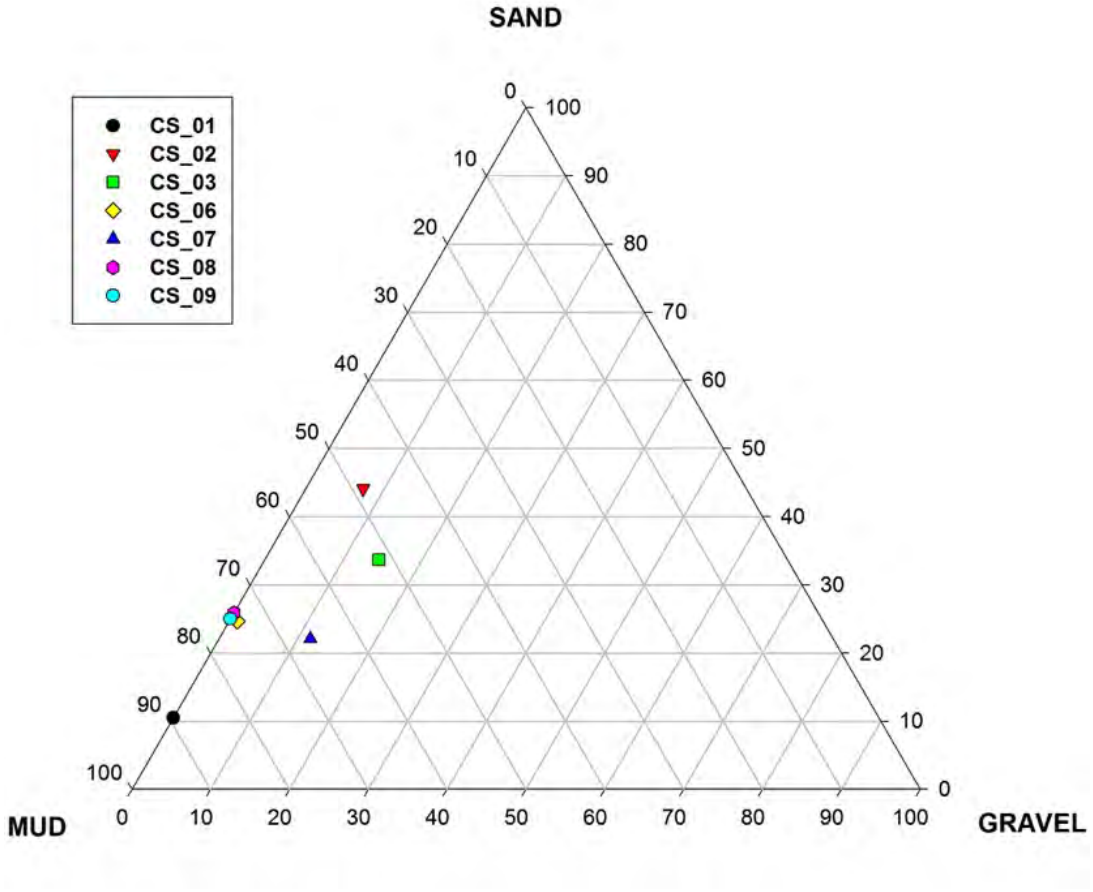


Figure 7-3 Ternary Plot of granulometric results from Dublin Harbour

Table 7-4 Granulometric and Loss on Ignition results from samples taken within Dublin Harbour

	CS_01	CS_02	CS_03	CS_06
% Gravel	0%	7.3%	14.5%	1%
% Sand	10.5%	44.1%	33.7%	24.7%
% Mud	89.5%	48.6%	51.8%	74.3%
% LOI	5.88%	2.22%	3.83%	4.14%
Textural Group	Sandy Mud	Gravelly Sandy Mud	Gravelly Sandy Mud	Slightly Gravelly Sandy Mud
	CS_07	**CS_08**	**CS_09**	
% Gravel	11.6%	0%	0%	
% Sand	22.1%	25.9%	25%	
% Mud	66.3%	74.1%	75%	
% LOI	4.88%	4.36%	4.18%	
Textural Group	Gravelly Sandy Mud	Sandy Mud	Sandy Mud	

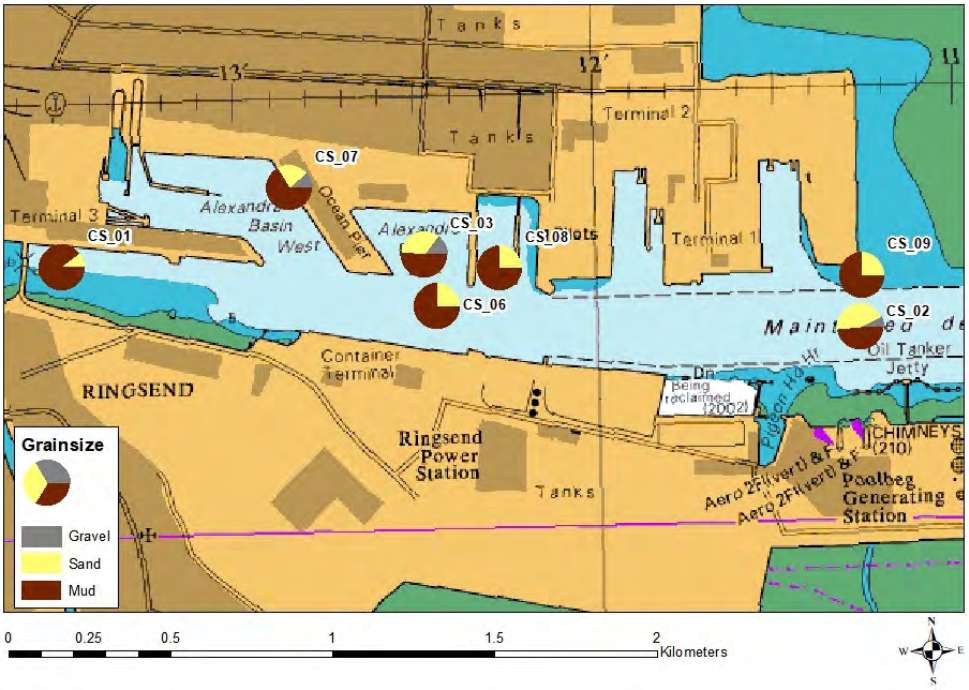


Figure 7-4 Proportions of particle sizes in samples within the survey area. (Grey – Gravel; Yellow – Sand; Brown – Mud). No grainsize samples were collected from sites CS_04 and CS_05

Benthic Assessment

A total of 44 taxa were recorded in the infaunal grab samples (see Appendix 7-1 for a full species / abundance matrix and species list). Diversity indices calculated for the countable taxa are presented in Table 7-5.

Table 7-5 Diversity indices derived from infaunal counts in grab samples from Dublin Harbour

	CS_01	CS_02	CS_03	CS_04	CS_05	CS_06	CS_07	CS_08	CS_09
No. of Species	3	20	10	9	9	8	2	2	9
No. of Individuals	5	1190	103	58	103	40	5	6	268
Shannon-Wiener	1.050	0.940	1.450	1.370	0.611	1.540	0.500	0.451	1.350
Pielou's Evenness	0.960	0.314	0.628	0.622	0.278	0.741	0.722	0.650	0.614
Simpson's Dominance	0.360	0.647	0.374	0.378	0.767	0.301	0.680	0.722	0.376

Results from the multivariate analysis on the infaunal grab data identified the presence of two distinct faunal groupings within the survey area (Table 7-6; Figures 7-5 & 7-6). A single site was classified as an outlier (CS_08) due to the low species diversity on site and the mixed nature of the benthos within the basin. The distribution of these two faunal groups form a distinct pattern, with Group 1 present in the downstream part of the survey area and Group 2 present from Tom Clarke Bridge to the Oil Berth (See Figure 7-1). The stress value indicates the degree to which the multivariate analysis summarises the observed sample data. This result obtained (0.06) indicates that the analysis provides a good indication of the faunal distribution pattern.

There is a large degree of overlap in the fauna present within the two groups. Cirratulid worms (such as *Tharyx* spp. and *Caulleriella* sp.) and Capitellid worms (such as *Mediomastus fragilis* and *Capitella sp.*) dominate the survey area. Although two distinct faunal groups have been identified, this separation is primarily down to the presence of large numbers of *Capitella* sp. in Group 2.

Table 7-6 Results from multivariate analysis of the fauna identified in each faunal sub-group identified in the survey area

GROUP 1: (Average Similarity: 50.59)

Capitella	*Caulleriella*	*Actinaria*
Tharyx robustus	*Tubificoides benedii*	*Mediomastus fragilis*
Ophryotrocha	*Nematoda*	

GROUP 2: (Average Similarity: 34.70)

Tubificinae	*Tharyx robustus*	*Mediomastus fragilis*
Tharyx sp.	*Nephtys hombergii*	

The species identified in the present survey (Appendix 7-1) are typical of shallow subtidal, estuarine communities, with all species identified common in Irish coastal waters.

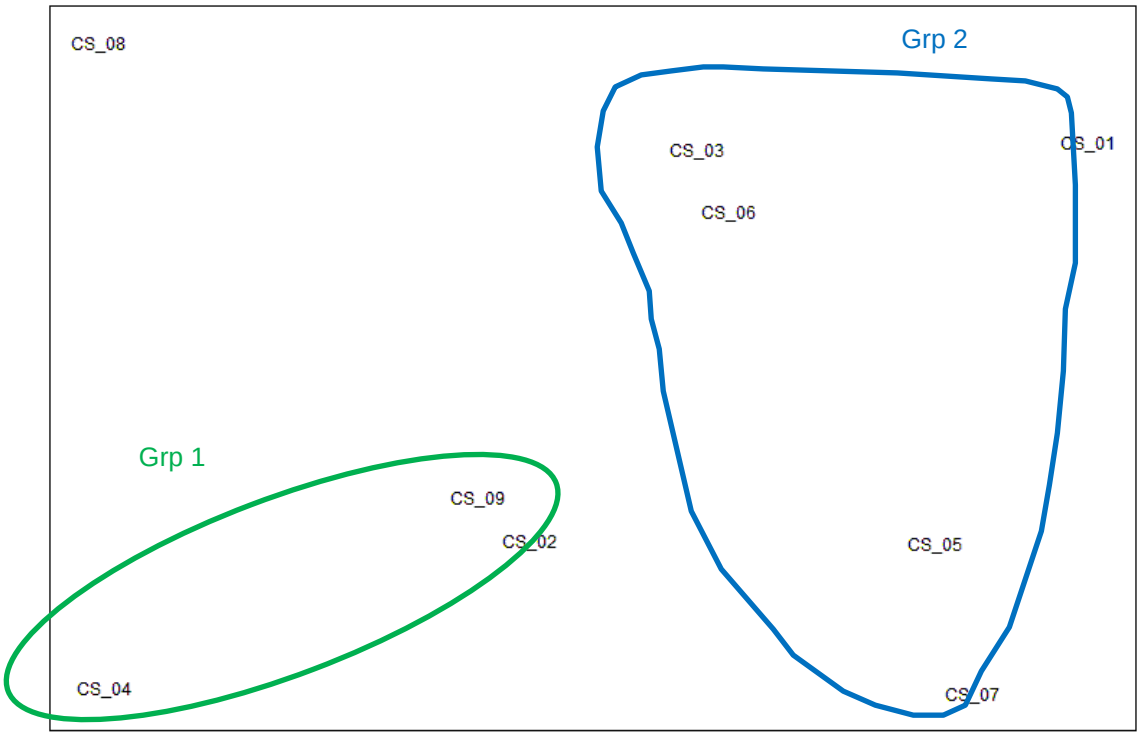


Figure 7-5 MDS plot of Dublin Port fauna (Stress = 0.06). Group 1 is coloured green and Group 2 is coloured blue

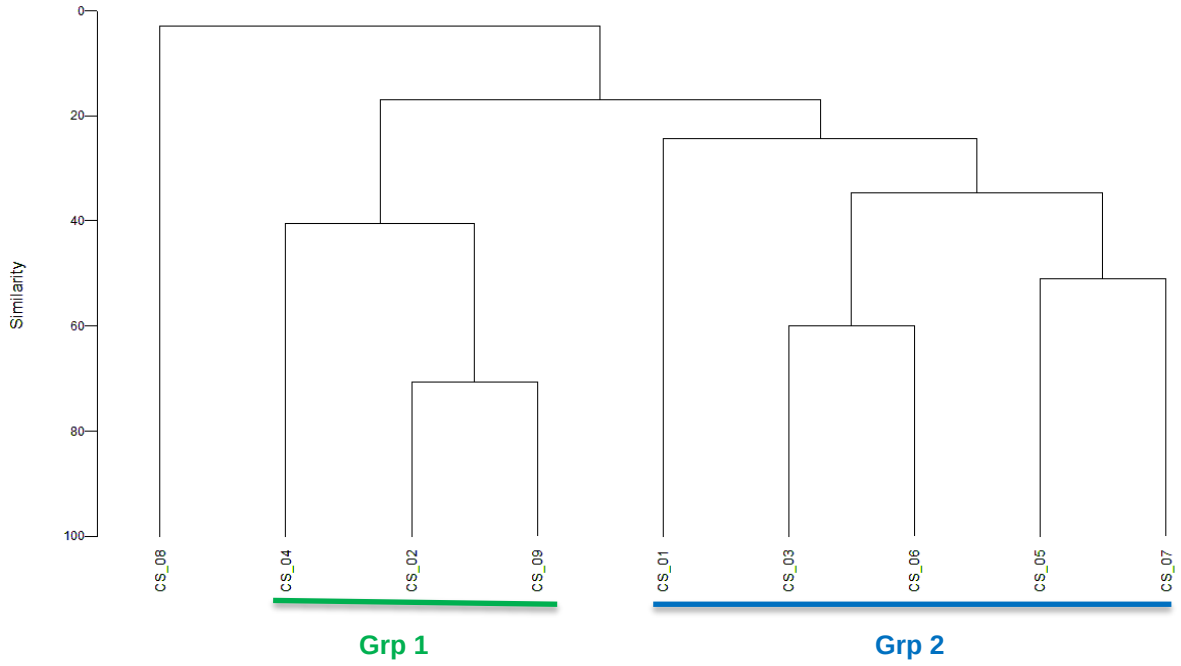


Figure 7-6 Cluster dendogram indicating the distribution of sites based on faunal distribution within the survey area of Dublin Harbour (Group 1 is coloured green and Group 2 is coloured blue)

Video Assessment

Results from the video survey undertaken in July 2020 confirm the results obtained from the granulometric analyses, with finer muds (and consequently reduced visibility) present within large parts of the Dublin Harbour area. Occasional areas of coarser substrate were recorded in parts of the downstream section of the survey area. It is thought that this is linked to ship manoeuvring in the channel resulting in soft sediment continually being winnowed out.

Tom Clarke Bridge to Ocean Pier (Figure 7-7)

The main shipping channel was dominated here by sandy muds, with the anoxic layer present just beneath the sediment surface. Visibility was reduced across this part of the survey area due to elevated amounts of floc in the water column. There was more cobble and gravel visible at drop CV_A compared to the other sites within the shipping channel. Burrowing anemones (*Actinaria* spp.) were present in the video transects recorded in the shipping channel (CS_01, CS_05 and CV_A) and green crab *Carcinus maenas* and brown shrimp (*Crangon crangon*) were present on the sediment surface at all sites. The benthos in Alexandra Basin West was similar to that in the channel, with sandy muds present across the video transect and *Crangon* abundant on the sediment surface.

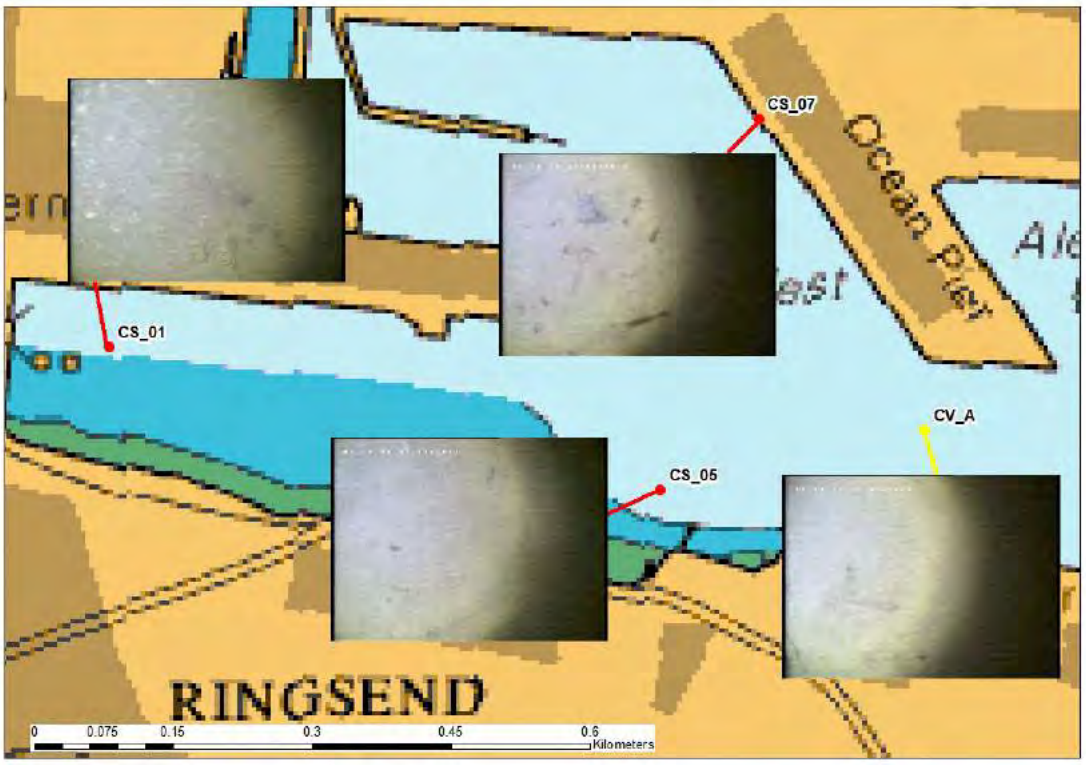


Figure 7-7 Representative imagery captured from the video taken along the inner extent of the survey area

Ocean Pier to Oil Berth (Figure 7-8)

The sediment in this part of the navigation channel consisted of sandy muds with *Crangon* (CS_06). The Alexandra Basin East (CS_03) and Oil Berth (CS_08) had slightly gravelly sandy muds with *Crangon* and green crab (*C. maenas*) present on the sediment surface.

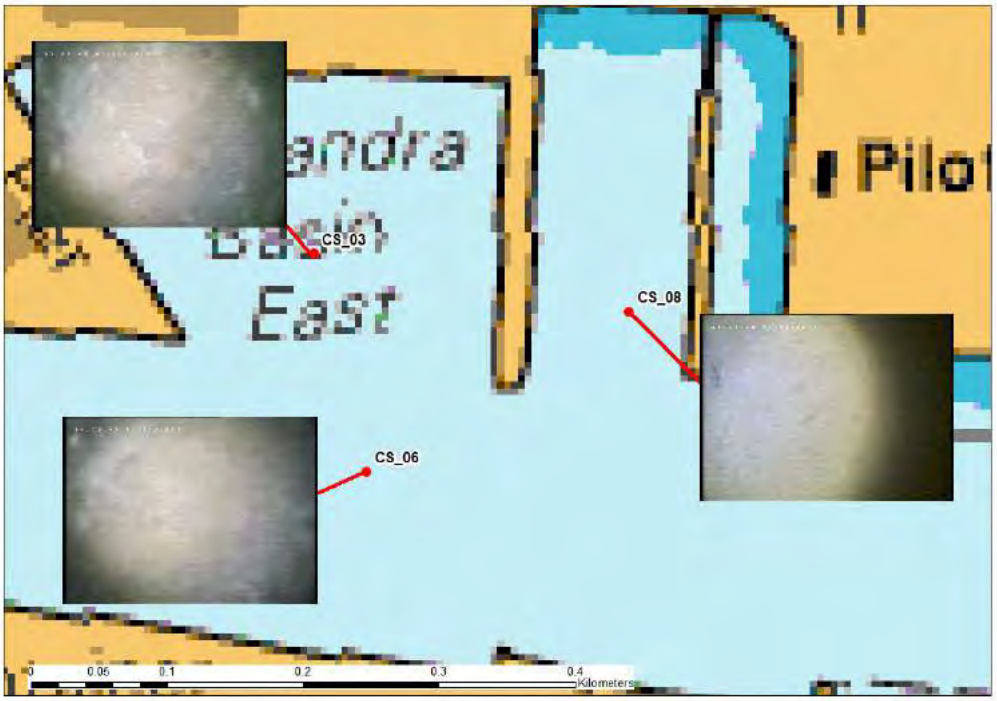


Figure 7-8 Representative imagery captured from the video taken along the inner extent of the survey area from Alexandra Basin East to the Oil Berth

Oil Berth to Berth 52 (Figure 7-9)

The substrate at CS_04 and CV_B consisted of gravels and mixed coarse sediments. pIt is thought that this is also linked to vessel movements. The sediment immediately adjacent to Berth 52 and the navigation channel in that area consisted of sandy muds (CS_09 & CS_02). Anemones, green crab and *Crangon* were identified in the videos at these sites.

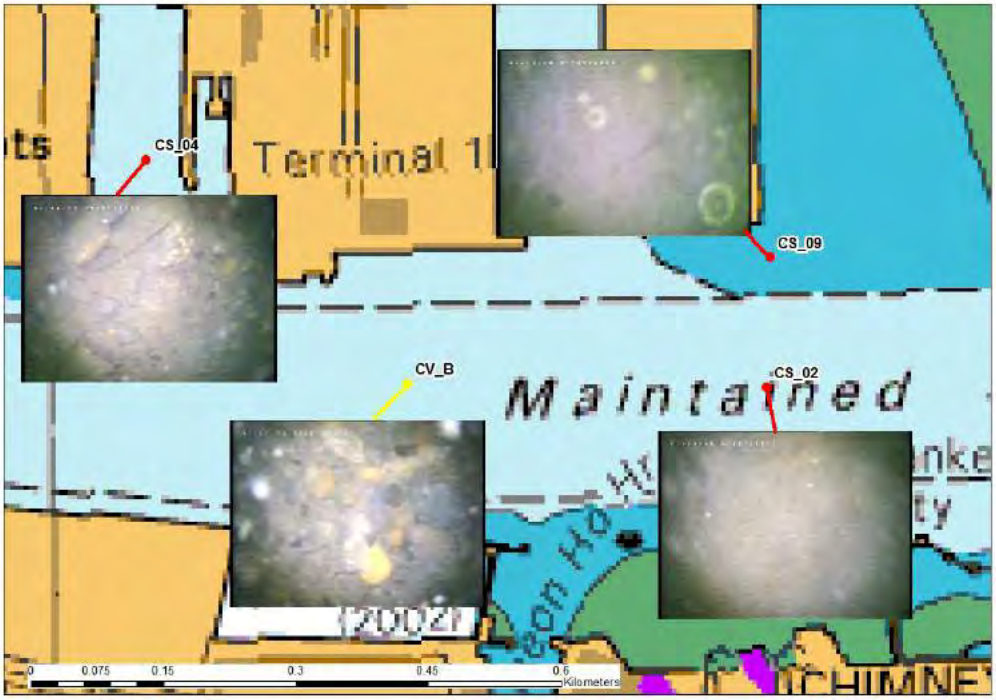


Figure 7-9 Imagery captured from video data collected around the sites from the Oil Berth to Berth 52

Habitat Assessment

Results from the faunal grab and video surveys were analysed to identify habitat distributions within the survey area. Each site was assigned habitat codes based on the JNCC System (Connor *et al*., 2004) which is closely aligned to EUNIS, the European Habitat Classification System. The distribution of these habitats is presented in Figure 7-10 based on sediment type and water depth.

It is important to note that although some characteristic species are absent, the other fauna present in the area are typical of the assigned habitats and as such the groups are tentatively assigned to these habitats.

The dominant taxa present in the study area were Oligochaetes, *Cirratulid* worms and *Capitellid* worms, fauna typical of muddy estuarine conditions. Although detailed analysis of the data indicates the presence of two distinct faunal groups, there is a large degree of overlap in the fauna present between the sites across the full survey area. The main factor which influenced the separation of groups was the presence of large numbers of the polychaete worm *Capitella* sp. present at three of the downstream sites (CS_02, CS_04 & CS_09). The The lower Dublin Harbour area has been classified as SS.SMuVS.AphTubi (*Aphelochaeta marioni* and *Tubificoides* spp. in variable salinity infralittoral mud). Although *Aphelochaeta marioni* was missing from the area, other cirratulid worms were common in the area (such as *Tharyx* spp.) in addition to oligochaetes. The EUNIS classification system (EUNIS Marine Habitat Classification Review – 2019) characterises this habitat as

> "*Variable salinity cohesive muddy sediment (sometimes with some coarser material) dominated by the polychaete* Aphelochaeta marioni *(or other* Aphelochaeta *species e.g.* A. amplivasatus*) and the oligochaete* Tubificoides *spp. These taxa are generally accompanied by* Nephtys hombergii *whilst the polychaetes* Capitella capitata *and* Melinna palmata *may also occur in high numbers in some areas. Other members of the cirratulid polychaete group e.g.* Caulleriella zetlandica*. and* Tharyx *spp. may also occur in high numbers, sometimes replacing* A. marioni *as the dominant polychaete. However, there is still inconsistency in the identification of the cirratulid group which is further compounded by fragmentation during sample processing. This biotope is very common in stable muddy environments and may extend from reduced salinity to fully marine conditions."*

The area from the Tom Clarke Bridge to the Oil Berth Basis has been classified as SS.SMuVS.AphTubi (*Aphelochaeta marioni* and *Tubificoides* spp. in variable salinity infralittoral mud). The area from the Oil Berth Basin to Berth 52 contained fauna typical of SS.SMuVS.AphTubi (*Aphelochaeta marioni* and *Tubificoides* spp. in variable salinity infralittoral mud) albeit with higher *Capitella* numbers. As a result, this group has been classified as a mixed SS.SMuVS.AphTubi (*Aphelochaeta marioni* and *Tubificoides* spp. in variable salinity infralittoral mud) with *Capitella*.

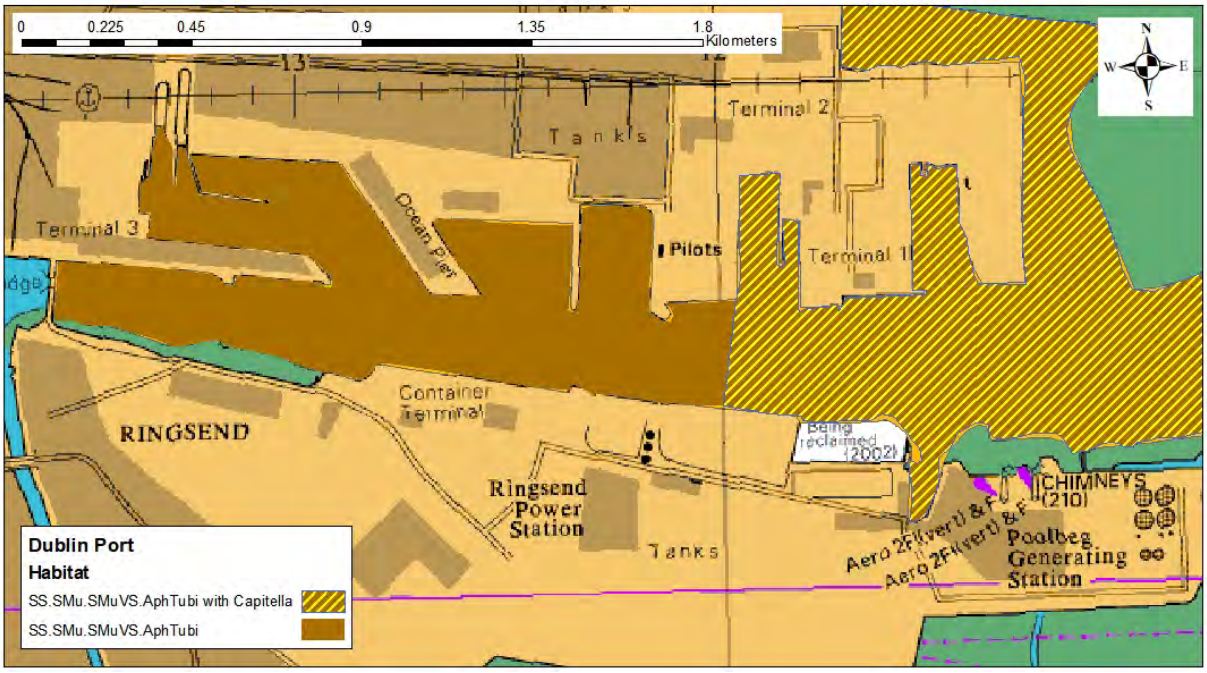


Figure 7-10 Habitat distribution map of benthic communities identified in the present survey

The nature of the habitats identified in the Dublin Harbour survey area is typical of estuarine, organically enriched areas, containing high numbers of opportunistic species (such as *Cirratulid* and *Capitellid* worms) with low diversity. The sites had Shannon-Wiener diversity indices ranging from 0.5 to 1.54, reflecting the poor diversity across the site. Species numbers were lower in the downstream area Group 2 (6.4 ± 3.6) compared with the upstream area Group 1 (12.7 ± 6.4). This is also reflected in the number of individuals, which were generally lower in Group 2 (51.2 ± 49.4) compared to Group 1 (505 ± 602.1). These findings mirror results from previous surveys undertaken in the area in 2013, with the same biotope groups identified and similar findings in relation to the diversity and dominance of species across the area (RPS, 2014 ABR Project EIS).

Marine Benthos at Disposal Area

Geological surveys undertaken at the dump site (INFOMAR 2010) indicate the site is dominated by fine to medium sands, with pockets of coarser material also present in parts (Figure 7-11). Medium sands and gravels dominate stretches along the western side, with muddy sands and fine sands present along the eastern part of the dump site. The dominance of coarse sediments (gravels and sands) reflects the water movement in the area, which are typified by relatively strong currents.

Benthic surveys were commissioned by Dublin Port to be undertaken on the dump site in 2016 and 2018. A baseline survey was undertaken in 2016 to identify benthic habitats within and immediately adjacent to the Burford Bank dump site. Results from the baseline survey indicated the presence of two discrete biological communities within and immediately adjacent to the dump site (Figure 7-12). The fauna identified in the baseline survey were assigned biotopes based on the JNCC classification system of Connor *et al*. (2004).

The fauna identified in Group 1 were characterised by the presence of the echinoderm *Amphiura filiformis*, polychaetes *Lanice conchilega*, *Notomastus fragilis* and *Lumbrineris gracilis*, the crustacean *Ampelisca brevicornis* and molluscs *Nucula nitida* and *Mactra stultorum*. This group was given the JNCC classification SS.SMu.CSaMu.AfilMysAnit (*Amphiura filiformis*, *Mysella bidentata* and *Abra nitida* in circalittoral sandy mud) and was located in the areas of fine and muddy sands located along the western parts of the survey area.

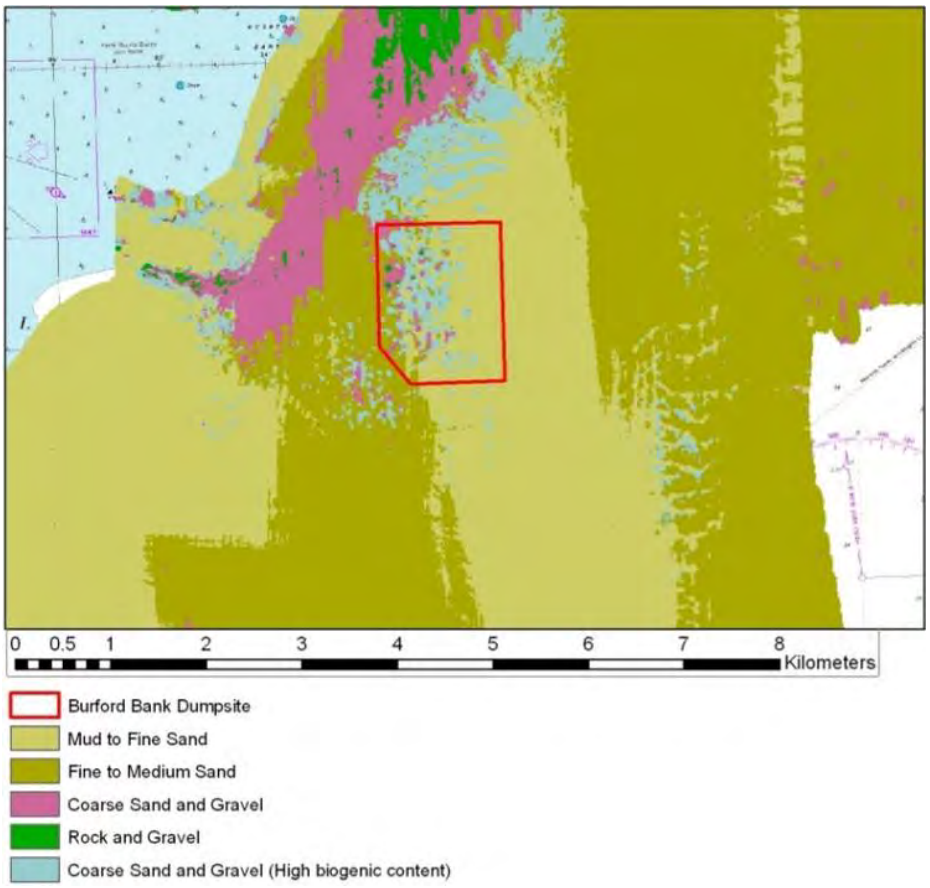


Figure 7-11 Sediment characterisation across the seabed of the dumpsite disposal area. Data reproduced from INFOMAR (2010)

Group 2 contained fauna which were consistent with coarser sediments and were characterised by the polychaetes *Nephtys cirrosa*, *Ophelia borealis* and *Polycirrus medusa* and the bivalve mollusc *Abra prismatica*.

This group best conformed to the JNCC habitat SS.SSa.CFiSa.ApriBatPo (*Abra prismatica*, *Bathyporeia elegans* and polychaetes in circalittoral fine sand). This biotope is known to grade into the sandy mud AfilMysAnit biotope identified to the west of the survey area, as the finer sediments increase.

Results from this baseline survey were consistent with a survey undertaken in November 2007 (Kennedy, 2008), which was undertaken in the area of the existing dump site and used to assess the levels of recovery at the site from previous spoil disposal events. A total of ten sampling stations were sampled within the dump site and in its immediate vicinity. Results from this survey indicated that all stations located within and immediately adjacent to the dump site were characterised by the presence of polychaete *Nephtys hombergii* and *Ophelia borealis* and the mollusc *Macoma balthica*. This assemblage conformed to the JNCC habitat SS.SMu.ISaMu.NhomMac (*Nephtys hombergii* and *Macoma balthica* in infralittoral sandy mud). The sampling stations located within 1 km and 2.5 km to the west and southwest of the dump site contained fauna typical of the JNCC habitat SS.SMu.CSaMu.AfilMysAnit (*Amphiura filiformis*, *Mysella bidentata* and *Abra nitida* in circalittoral sandy mud). In addition, Kennedy assessed the Infaunal Quality Index across all sampling locations. A status classification of '*High*' was identified at all sites with reference to Water Framework Directive criteria. His findings concluded that the site had recovered well from previous dredging events.

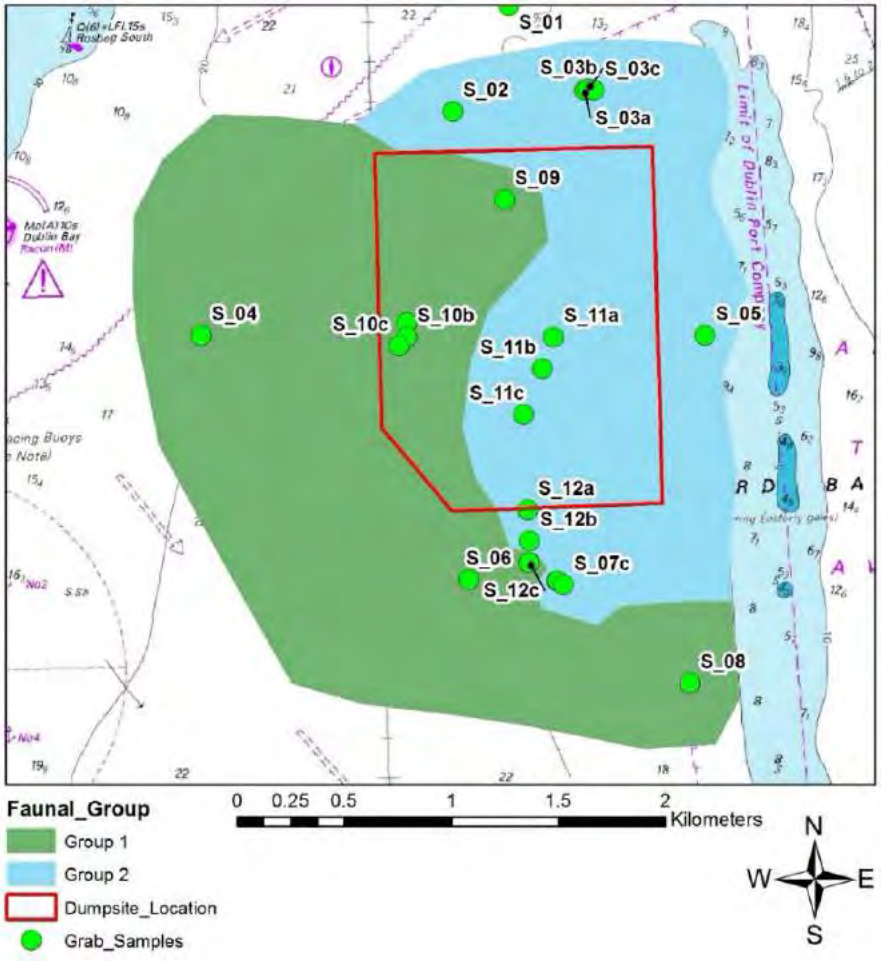


Figure 7-12 Spatial distribution of the faunal groups identified in the survey area during a baseline survey undertaken in 2016

In 2011, Aqua-fact undertook a sampling programme in the vicinity of the dump site (Dublin City Council, 2012). Ten sites were sampled, three of which were within the western margin of the disposal area and six stations were located immediately west of the site (Figure 7-13). Dominant fauna identified in the area included the molluscs *Nucula* spp., *Abra* sp. and *Kurtiella* (*Mysella*) *bidentata* as well as the echinoderm *Amphiura filiformis*.

The biological communities identified from the dump site and the adjacent areas in these surveys are similar to those recorded by Walker and Rees (1980), who had identified communities present in Dublin Bay dominated by similar fauna over 20 years earlier. This indicates the stable nature of the benthos within the Outer Dublin Bay area and in the vicinity of the dump site.

In 2018, two repeat surveys were undertaken at the site to assess recovery. In May 2018 (3 months following cessation of dredge spoil disposal for that year) a reduced survey was undertaken at several sites from the baseline survey. In September 2018, a full repeat survey was carried out on all the sites sampled during the baseline survey. Results from these surveys indicated that although there were impacts associated with the dredge spoil disposal (October-March), such as reduced biomass and faunal diversity, recovery of both biomass and diversity was noted in follow-up surveys 3 months and 6 months later. In addition, fauna at the site from both May and September surveys were consistent with fauna identified in the baseline survey of 2016. Results from these surveys indicate that the disposal area had commenced the process of recovery within three months following cessation of disposal activities.

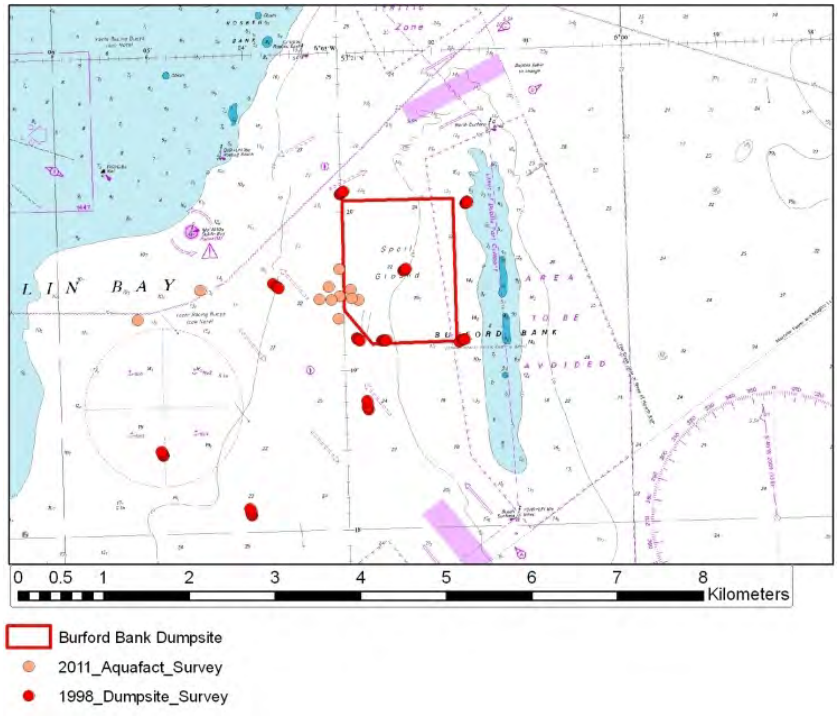


Figure 7-13 Sampling locations from the 1998 survey (red dots) and the 2011 survey (orange dots) in the vicinity of the Burford Bank disposal area

Fisheries Assessment

All the trawls (Figure 7-2) except Trawl C_T4 (which was trawled twice) contained catch. Trawl CT_4 in the LoLo Container basin between Berths 50 and 51 only turned up cobble without fauna which may relate to a lot of propeller wash in that basin. Photographs of each trawl are listed in Appendix 7-1. Overall, there were 12 species of fish taken in the current survey, on average 3.8 species per trawl, with a range of zero in Trawl CT_4

to 6 species in Trawl C_T2 on the dump site (Table 7-7). Most of the fish were demersal, with seven species of which could be described as bottom or near bottom dwellers, including the flat fish dab, plaice and flounder, as well as butterfish, dragonet, short-spined sea scorpion and thorn-back ray. Species tended to have a recognisable distribution within the study area, with some apparently more confined than others. Thorn backed ray (*Raja clavata*) and dab for example only occurred on the dump site i.e. in Trawls C_T1 and C_T2, whereas plaice were present in all five trawls that had fish, with its highest numbers in the shipping channel between Alexandra Basins East and West. The other frequently encountered species were *Pomatoschistus* gobies, probably mainly or all *P. minutus* (sand goby). They were present in three of the six trawls which contained fish, with the highest densities in Alexandra Basin East. Flounder, which are known to penetrate freshwaters on the Liffey (authors' observation), were only recorded in Trawl C_T6, the most upstream in the series.

In terms of epibenthic invertebrates (Table 7-7) there were at least 4 species of crab, as well as brown shrimp (*Crangon crangon*), at least 2 species of brittle star (*Ophiura* spp. and *Ophiothrix fragilis*), common starfish (*Asterias rubens*), 3 species of mollusc, including common whelk (*Buccinum undatum*), and 2 unidentified sea slugs. Cnidarians, including a hydroid and the soft coral *Alcyonium digitatum* (Deadman's fingers), and an unidentified solitary tunicate (sea squirt) were also recorded. Most abundant among these were brittle stars at the outermost site (Trawl C_T1) and green crab (*Carcinus maenas*) and *Crangon* in the inner sites (Trawl C_T6).

Four of the eight fish species taken in trawls in the inner port area in 2020 were also recorded in previous trawl surveys in the same area in 2018 and 2013, namely gobies, plaice, flounder and butterfish (Table 7-8). Across the three surveys plaice, gobies, butterfish and to a lesser extent flounder were either most frequently encountered or present in higher numbers. Pogge and dragonet were also previously recorded on more than one occasion, so that this assemblage can be considered the principal resident benthic species within the inner port area.

The dominant invertebrates in all three surveys were brown shrimp (*Crangon crangon*), especially in 2020, and green crab. Solitary sea squirts were prominent in 2013 and 2018 but not in 2020. A possible reason for this is that the areas sampled in 2020 were subject to greater amounts of propeller wash. Another explanation is that this group is not mobile and when removed due to dredging requires a suitable attachment surface and time to re-grow, whereas the mobility of other invertebrates allow them to recolonise from adjoining areas. Overall, there are strong similarities between the trawl surveys in 2020, 2018 and 2013.

Table 7-7 Fish and invertebrate contents of beam trawls (8th July 2020)

		C_T1	C_T2	C_T3	C_T4	C_T5	C_T6
Thornback ray	*Raja clavata*	1	1	-	-	-	-
Dragonet	*Callionymus lyra*	2	-	-	-	-	-
Sand eel (greater)	*Hyperoplus lanceolatus*	-	1	-	-	-	-
Sand eel (lesser)	*Ammodytes sp..*	-	1	-	-	-	-
Dab	*Limanda limanda*	8	14	1	-	-	-
Cod	*Gadus morhua*	-	-	-	-	1	-
Short-spined Sea scorpion	*Myoxocephalus scorpius*	-	-	-	-	1	-
Butterfish	*Pholis gunnellus*	-	-	-	-	-	1
Goby	*Pomatoschistus sp.*	-	-	5	-	60+	2
Flounder	*Plathichtys flesus*	-	-	-	-	-	1
Nilsson's Pipefish	*Syngnathus rostellatus*	-	1	1	-	-	1

		C_T1	C_T2	C_T3	C_T4	C_T5	C_T6
Plaice	*Peluronectes platessa*	2	4	2	-	2	18
No. Fish Taxa		4	6	4	0	4	5
Deadmans Fingers	*Alcyonium digitatum*	x4 (0.3kg)	-	-	-	-	-
Common Starfish	*Asterias rubens*	6 (0.2kg)	1	-	-	-	-
Brittle star	*O. fragilis*	1.5kg	10	-	-	-	-
Brittle star	*Ophiura*	++	1	-	-	-	-
Common Whelk	*Buccinum undatum*	2	-	-	-	-	-
Hydroid	Hydrolamia falcata	-	+	-	-	-	-
Sea slug	Nundbranch indet	-	-	3	-	-	-
Sea slug	*Philinesp.*	-	-	1	-	-	-
Harbour crab	*Liocarcinus*	-	1	-	-	4	-
Velvet crab	*Necora puber*	-	-	-	-	1	0.25kg
Brown shrimp	*Crangon*	-	-	0.8kg	-	2.5kg	>5kg
Green crab	*Carcinus maenas*	-	-	0.55kg	-	6 (0.2kg)	1.5kg
Brown crab	*Cancer pagurus*	-	-	-	-	0.45kg	-
Sea squirts	Ascidian indet	-	-	-	-	+	-

Table 7-8 Comparison of the contents of trawls from the inner port area and adjoining berths for the current (2020) survey (Trawls C_T3 – C_T6) and the equivalent trawls for the 2018 MP2 EIAR survey (T3-T5) and the 2013 ABR EIS survey (T1-T4)

Fish		2020	2018	2013
Goby	*Pomatoschistus sp.*	67	-	9
Plaice	*Pleuronectes platessa*	22	4	20
Nilsson's Pipefish	*Syngnathus rostellatus*	2	-	-
Dab	*Limanda limanda*	1	-	-
Flounder	*Platichthys flesus*	1	-	3
Cod	*Gadus morhua*	1	-	-
Butterfish	*Pholis gunnellus*	1	1	3
Short-spined Sea scorpion	*Myoxocephalus scorpius*	1	-	-
5-bearded Rockling	*Mustela ciliata*	-	-	1
Pogge	*Agonus cataphractus*	-	5	-
Dragonet	*Callionymus lyra*	-	2	1
Invertebrates				
Green crab	*Carcinus maenus*	2.25kg	2kg	0.35kg
Harbour crab	*Liocarcinus sp(p)*	x4	-	x1
Brown crab	*Cancer pagurus*	0.45kg	-	-
Velvet crab	*Necorus puber*	0.25kg	-	-
Small spider crabs	Majidae	-	-	3
Brown shrimp	*Crangon crangon*	~8.3kg	+++	x130
Prawn	*Palaemon serratus* (?)	-	-	x3
Crustacean indet.	Crustacean indet.	-	-	x1
Common starfish	*Asterias rubens*	-	-	x3
Sea squirts	Tunicata	+	12kg	2.45kg
Cuttle fish	*Sepiola atlantica*	-	-	x1
Snail	*Philine sp.*	x1	-	-
Bivalves		-	+++	-
Sea slug	Nundibranch indet	x3	x2	-
Sea anemone	Anthazoa sp.	-	-	x4

Dump Site

Two beam trawl hauls were undertaken within the dump site in the July 2020 survey and seven species of fish were recorded. This compares with 13 species recorded in four trawls on the site in September 2018 (Table 7-9). Total numbers collected in 2020 were between a fifth and a quarter of the 2018 totals. The absence of species from the 2020 survey which were present in low numbers in the 2018 survey such as herring and red mullet can be explained by chance. Furthermore, the fact that 2018 was a very warm year and that the survey was carried out two months later than the 2020 survey may also explain some of the differences e.g., species such as lesser weever and red mullet, with a more southerly distribution and a slightly higher temperature preference might have done better later in the season in a warmer year. The fact that two hauls were taken in 2020 compared to four in 2018 would be significant for species with more clumped distributions, e.g., all the 2018 poor cod were present in just one of the four trawls. Nevertheless, the complete absence of sand gobies and to a lesser extent gurnard in the 2020 survey is not as readily explained, as these were present in all four trawls in 2018. Looking only at total numbers captured, the fact that the trawling speed at around 3.5knots in 2020 was higher than in 2018 (1.5-2knots) might also have contributed to the lower numbers if the higher speeds meant that the trawl didn't move as smoothly along the bottom. This fact was only noted after the trawling was completed.

Table 7-9 Comparison of Beam Trawl fish returned in July 2020 and September 2018 on the dump site location

	2020 (July)	2018 (Sept)
Goby	-	98
Dab	22	39
Plaice	6	24
Poorcod	-	20
Sandeel (lesser)	2	20
Sandeel (greater)	1	-
Gurnard	-	17
Lesser Weever	-	14
Dragonet	2	10
Whiting	-	8
Nilsson's Pipefish	1	4
Red Mullet	-	3
Herring	-	1
Thornback Ray	2	1
Total Counts	36	161

Inland Fisheries Data – Liffey Estuary

Two surveys undertaken by Inland Fisheries Ireland in the outer Liffey estuary in 2008 (Kelly *et al.,* 2009) and 2010 (Kelly *et al.,* 2011) (Table 7-10) recorded all the same fish species and more, as well as higher numbers, compared to the current (2020) and 2018 and 2013 ASU surveys. The main reason for the higher numbers in the IFI surveys was the use of beach seine nets which trapped small shoals of pelagic species (sprat and juvenile mullet), while the greater diversity is likely related to the use of several types of sampling gear (i.e., beach seines, fyke nets and bean trawls) as opposed to beam trawls used in the 2020 and the 2013 ASU surveys. Note that the use of beam trawls is thought to better reflect the species most at risk from trailer suction dredging, i.e., bottom and near bottom dwelling species but the IFI data gives a better overview of the fish diversity in the estuary.

Table 7-10 IFI transitional water surveys of the Lower Liffey Estuary in 2008 and 2010

Liffey Lower Estuary	September 2008	Liffey Lower Estuary	October 2010
Sprat	212	Grey mullet	1078
Sand Goby	43	Sand goby	24
Sand Smelt	10	Flounder	9
3-spined stickleback	10	Long-spined sea scorpion	4
Cod	6	Lesser sandeel	3
Grey Mullet	5	5-bearded rockling	3
Pollack	5	Cod	3
Eel	4	Pollack	3
Flounder	3	15-spined stickleback	3
Long-spined Sea Scorpion	2	Sand smelt	2
Whiting	2	Plaice	2
Dab	1	Greater pipefish	2
Plaice	1	Red Gurnard	1
Salmon	1	Corkwing wrasse	1
		Ballan wrasse	1
		Butterfish	1
		Sprat	1

Migratory Species

Atlantic Salmon

The Lower Liffey Estuary is also a transit channel for salmon, river lamprey and eel. The ESB manage a salmon counter at Islandbridge Weir on the lower River Liffey, where the Marine Institute also have an elver trap that monitors trends in glass eel, elver and bootlace eel movements, and more recently lamprey also. Table 7-11 lists the total net upward migrating salmon at the counter from 2010 to 2020, while Figure 7-14 graphs these data on a monthly basis. The average number of salmon recorded by the counter in Islandbridge between 2010 and 2020 was 991 fish per annum and the 2019 and 2020 annual counts of 345 and 337 respectively dropped markedly below that average count. At the same time such pronounced number reductions were not noted at either the River Boyne or River Slaney salmon counters. On a national basis, according the Scientific Standing Committee (Gargan *et al*., 2021),

"*There has been variation in the mean count since 2002, with highest numbers recorded in 2007 coinciding with the closure of offshore drift netting. However, there has been a marked decline in salmon counts subsequently with 2014 and 2015 being the two lowest values in the entire time series. A minor upturn was evident from the series low of 2014 until 2017 with mean abundance in 2020 an upturn on the preceding two years. These counter data can be considered as an index for other rivers nationally and probably reflect the national trend. This would also tend to highlight the lower returns in the Liffey, especially in 2020".*

However, these are average trend from all the rivers with salmon counters and not all followed this trend. The SSC also note, in the same report, that

"Marine survival values in the past five years are amongst the lowest recorded since the coded-wire tagging programme commenced in 1980".

Table 7-11 Total annual salmon counts (both SW and MSW fish) in Islandbridge counter (2010 – 2020) (data from Marine Institute and ESB Fisheries)

Year	Numbers
2020	337
2019	345
2018	945
2017	717
2016	948
2015	1012
2014	849
2013	1109
2012	1028
2011	1589
2010	2018

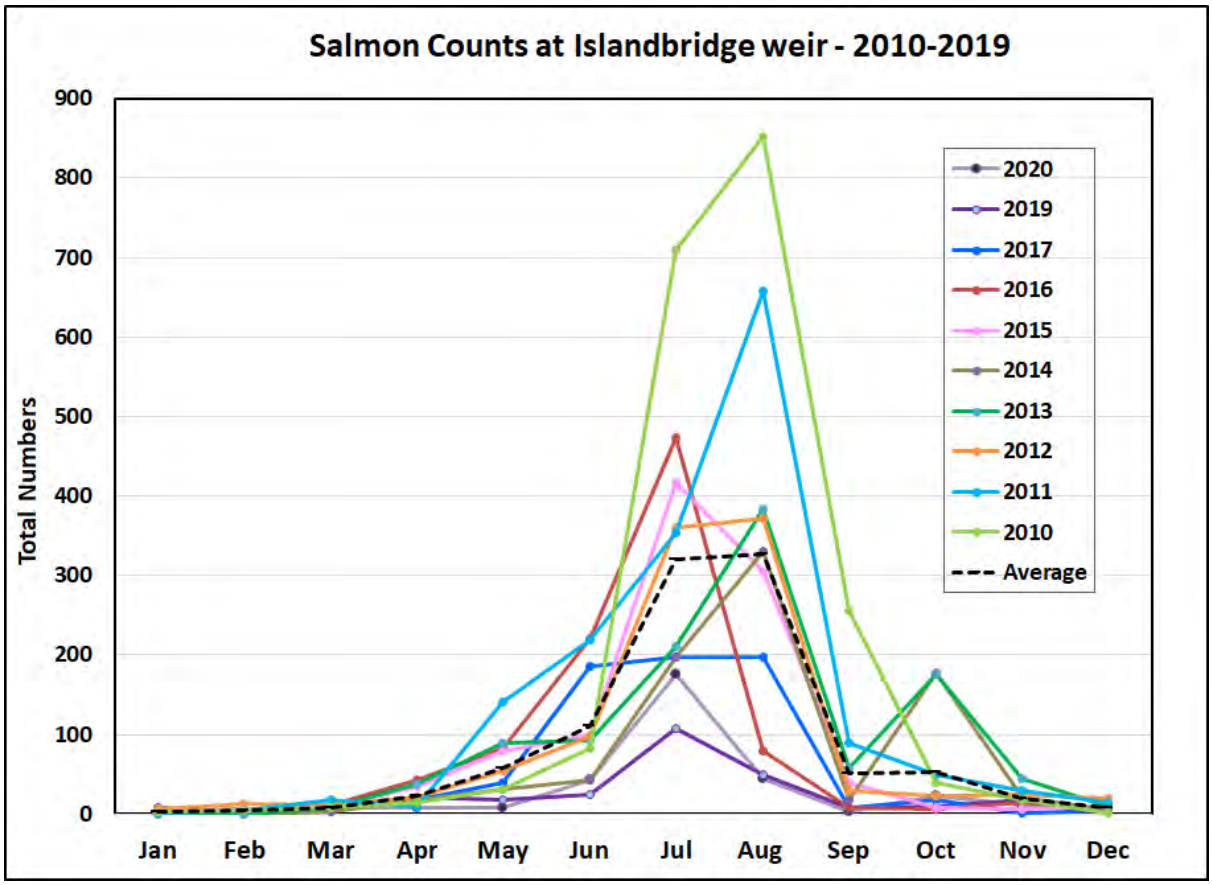


Figure 7-14 Monthly salmon count at Islandbridge fish counter (2010-2020) data for 2018 not graphed. (Data: ESB Fisheries)

Eel and River Lamprey

Table 7-12 lists the annual total for juvenile eel and lamprey (2012-2020) recorded at the Islandbridge elver trap. On average, glass eel numbers at the trap peak in April and May (Figure 7-15), while elvers numbers rise in May, peak in June and tail off in July and August (Figure 7-16). In terms of absolute numbers. 2012-2014 and 2018 returned the highest numbers for elvers, while glass eel numbers were highest in 2012, 2013 and 2015.

The matting substrate used in the elver trap was changed in 2017 and the trap began to capture upward migrating river lamprey. They begin to appear in September in low numbers and continue through until the following April with autumn-winter (October – November) and spring (March-April) peaks, see Figure 7-17. The

data so far is the best available on the species for the Liffey and clearly shows the strong seasonal trends in the migration.

Table 7-12 Total annual glass eel, elver and lamprey counts in Islandbridge elver traps (2012 – 2020) (Data Marine Institute)

	Glass eels	Elvers	[1]Lamprey
2012	147	2116	-
2013	251	3139	-
2014	38	1364	-
2015	144	549	-
2016	37	323	-
2017	-	49	3
2018	56	2176	36
2019	4	226	120
2020	28	223	150
2021(to 21/3/21)	0	0	58

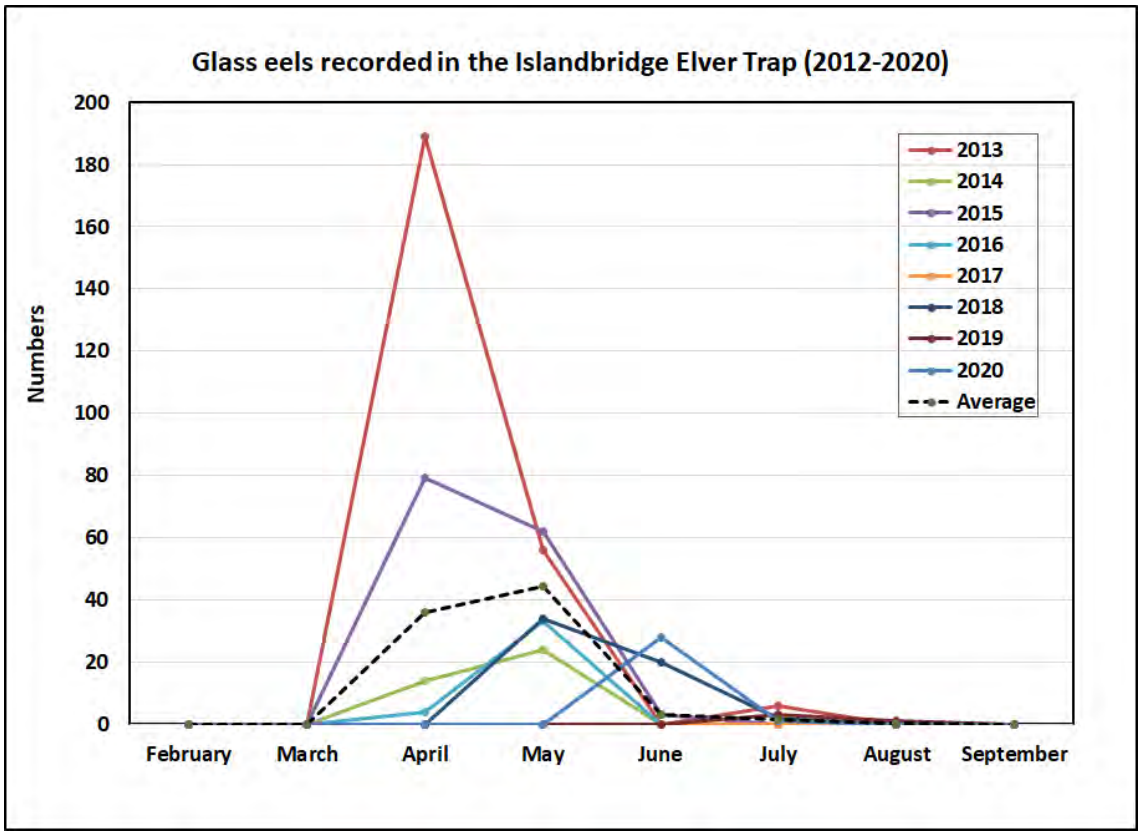


Figure 7-15 Monthly glass eel counts at the Islandbridge weir (data Marine Institute) [2]

[1] Note that outside of the period March to September inclusive each year virtually no glass eel and elver are recorded in the trap

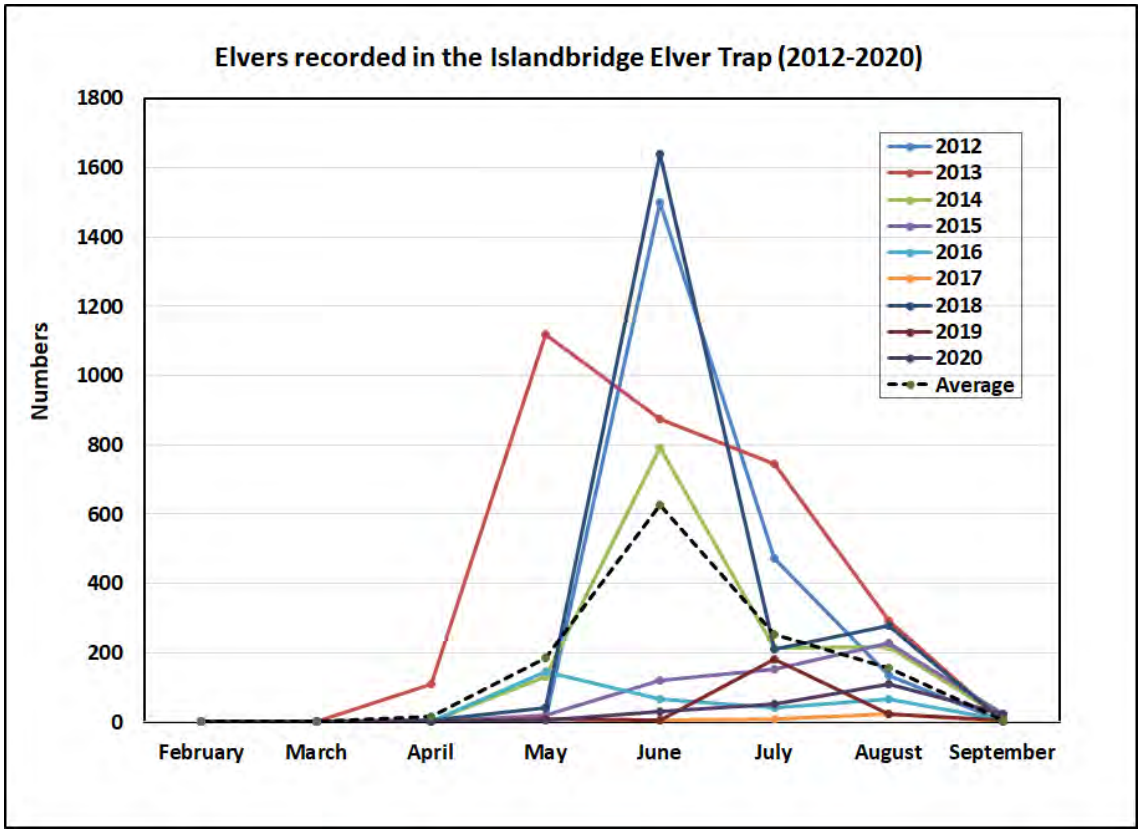


Figure 7-16 Monthly elver counts at the Islandbridge weir (data Marine Institute)

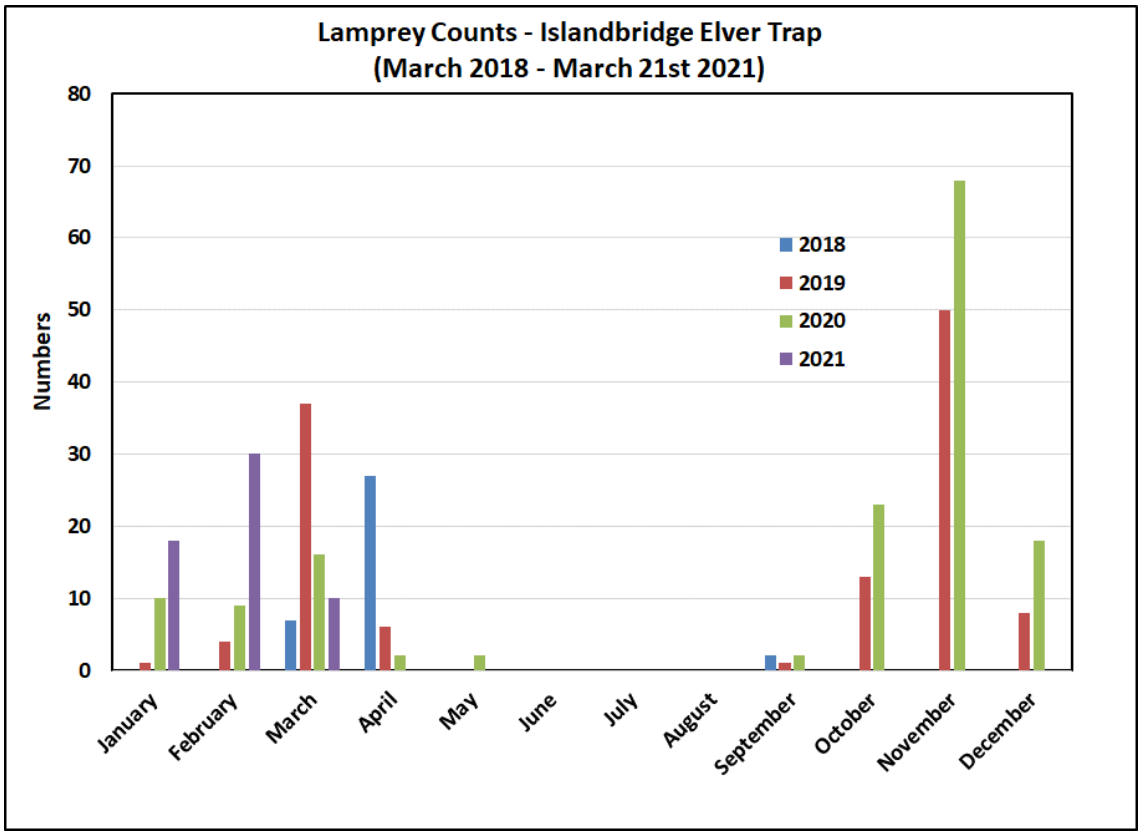


Figure 7-17 Monthly lamprey counts at the Islandbridge weir (data Marine Institute)

7.1.3 Likelihood and Description of Likely Significant Impacts

Impacts associated with capital dredging

Benthic Impacts

Capital dredging will take place between October and March from 2022 to 2029. There will be a total of 500,000 m^3 of mixed sediment removed from these areas during the full course of the 8-year cycle, which amounts to about one fifth of the volumes which will be removed over the same period during maintenance dredging. Dredging will be undertaken using a trailer suction hopper dredger (TSHD), a backhoe dredger or a combination of the two. The spoil will be disposed of at the licenced disposal site to the west of the Burford Bank at the entrance to Dublin Bay. Only sediments which are deemed suitable for disposal at sea (Class 1: uncontaminated) will be disposed at the dump site.

Impacts associated with capital dredging on the benthos include:

- Habitat disturbance as a result of dredge loading operations
- Habitat smothering and associated effects due to spoil disposal

Habitat disturbance associated with Dredging

The area of the inner port which will be dredged amounts to 26.51 ha in total (Figure 7-13, Table 7-13). However, over half of this area (15.3ha, 57.3%) has already been dredged to shallower depths since February 2020 as part of the ABR capital dredging programme and as part of the existing maintenance dredging campaign (Figure 7-18). This means that the surface layers of the areas in question i.e., the surface to about 20cm of sediment where most of the benthic fauna reside will already have been removed at least once before the works begin. At least 'once' in this context means that by the time some of these areas will have been capital dredged, they will likely already have been maintenance dredged on at least one occasion. When this is further combined with the daily disturbance caused by propeller wash during berthing and manoeuvring of large vessels it serves to demonstrate the generally unstable nature of the benthic sediments and the associated stress caused to benthic communities present in a busy commercial port like Dublin.

Table 7-13 Areas (in ha) earmarked for dredging in each of the seven dredging components of the project

Dredge Loading Areas	Area to Be Dredged (ha)	Proportion already dredged since Feb 2020 (%)
Berth 48 / Oil Jetty	0.83	100
River Berth 52	3.56	100
Ferryport Basin	2.92	100
Oil Berths	0.62	100
Navigation Channel	11.06	2
Alexandra Basin East	4.95	100
South Port Quays	2.57	84
Total Area to be Dredged (ha)	**26.51**	**57.7**
Overall Area Recently Dredged	**15.30**	

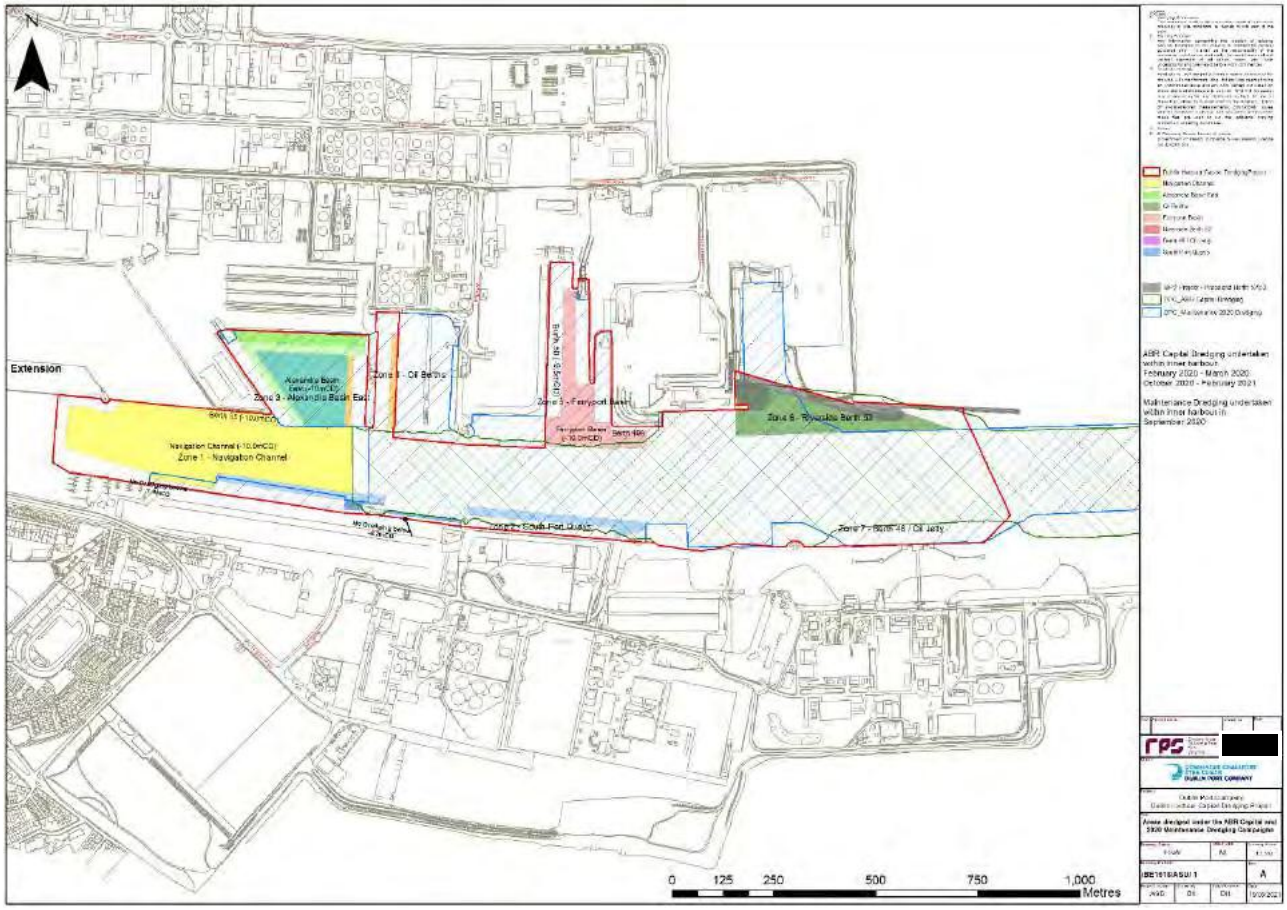


Figure 7-18 The extent of previous dredging (Green and Blue hatched areas) within the proposed capital dredging area (marked by the red boundary)

A previous survey undertaken in 2013 (RPS 2014, ABR Project EIS) recorded a single biotope in the Inner Liffey Channel area and a single biotope in the Dublin Bay area. Analysis of the data, which compared sites across the inner and outer areas which had been dredged within the previous 12 months to sites which had not been dredged in that time, found no discernible differences between the sites, indicating the rapid recovery of the benthos in these areas following dredging.

Inner Liffey Channel (Dublin Harbour area within the Bull Walls)

Results from the present survey mirror findings of previous surveys in 2013, with faunal communities identified in the Inner Liffey Channel consisting of taxa which are highly opportunistic and expected to rapidly recover after disturbance associated with dredging. It is expected that this dredging-associated habitat disturbance will be a temporary, minor, negative impact. The nature of the biotopes identified, and the opportunistic species which pre-dominate in the area, indicate that these faunal communities are expected to recover rapidly (<12 months) following cessation of dredging.

Dredge Spoil Disposal

The proposed capital dredging programme will result in the disposal of 500,000m^3 of mixed sediment from the dredge areas over an 8-year period. This sediment will consist of sandy muds to muddy sands from the Inner Liffey Channel basins and berths. The proposed maximum volume to be disposed in any single October and March window is expected to be circa 164,058 m^3 with the minimum amounting to just 10,632m^3

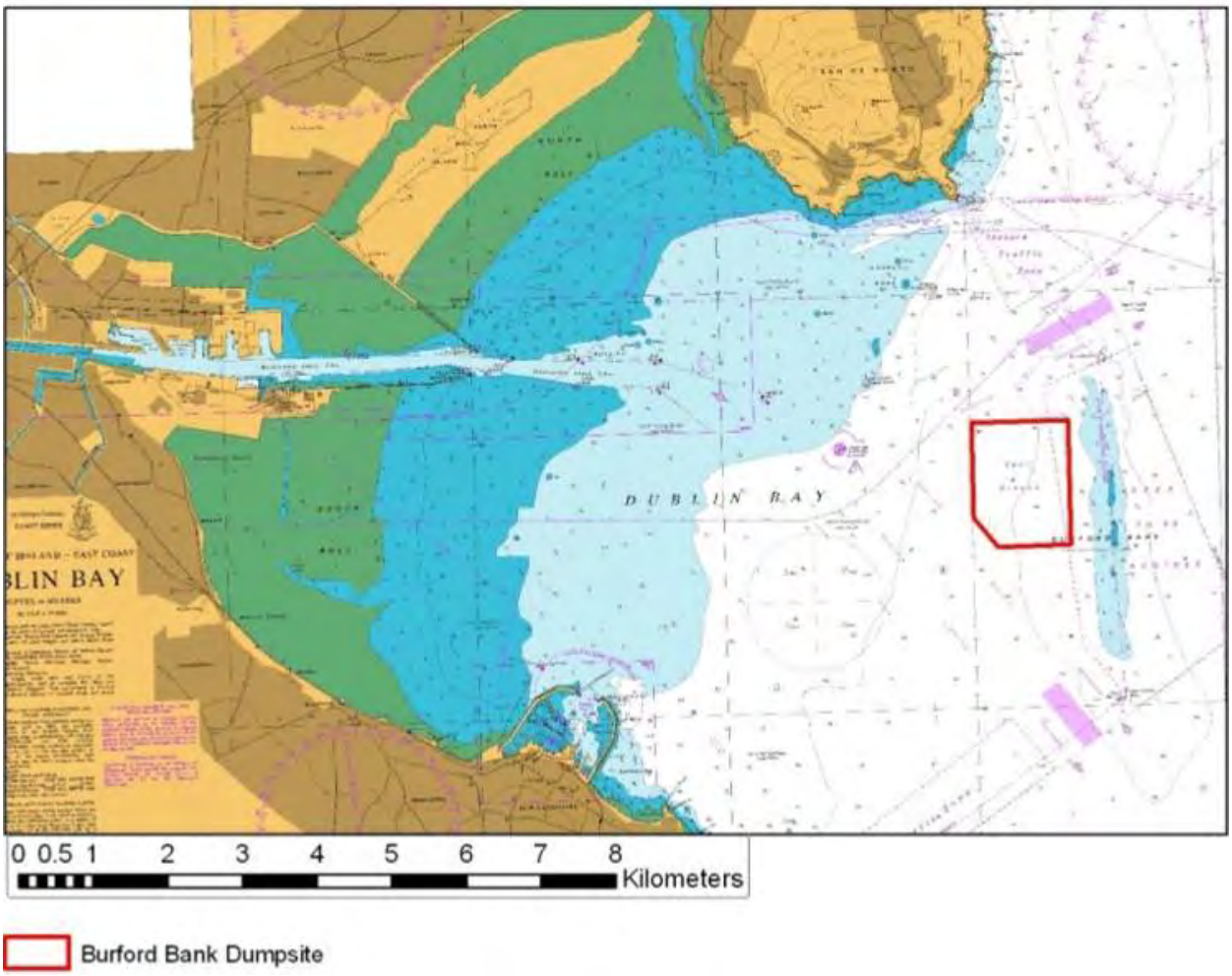


Figure 7-19 Burford Bank dump site location

The approved dump site is located approximately 7km east of Poolbeg and 3km south of Howth Peninsula, immediately west of the Burford Bank (Figure 7-19). The dump site covers an area of 2.27 km^2 and is currently used by Dublin Port to dispose of dredge spoil from licenced capital and maintenance dredging works. The dump site has been in regular use since 1996 having been moved from its previous location nearby.

Ecological impacts associated with dredge spoil disposal are considered site specific (Ware *et al*., 2010) with factors such as volume of disposal, frequency and timing of the disposal, type & quality of the dredge spoil, hydrodynamic regime of the receiving environment and the habitat type of the receiving environment all playing important roles in the recovery of the benthos.

At soft sediment sites, recovery would be expected to follow a typical pattern. If the sediment to be disposed is similar in nature to the receiving environment, then the impacts will be less, with recovery proceeding more rapidly than would be the case if the sediment was different compared to that in the receiving environment. This feature of recovery has been noted in several studies reported in the literature (Smith & Rule, 2001; Ware *et al*., 2010; Bolam *et al.,* 2006). Immediately after spoil deposition, macroinvertebrate species diversity, abundance and biomass will be temporarily reduced. If the sediment deposited on the site is similar in nature to the native sediment, and the layer of deposition is thin (<15cm) then vertical migration through the sediment of existing fauna may occur (Wilbur *et al.,* 2007; Fredette & French, 2004, Maurer *et al.,* 1981 (a), Maurer *et al.,* 1981 (b), Maurer *et al.,* 1982). This will be complemented by lateral migration of mobile fauna from adjacent areas and through larval settlement from the plankton.

Where the dredge spoil contains different sediment than the native sediment, recovery occurs in several stages depending on a range of factors. In highly hydrodynamic areas, such as the Dublin Bay dump site, the silt fraction initially settles with the sand fraction. Vertical migration through predominantly mud sediments would be reduced and recolonisation of these sediments would be through lateral migration of mobile species and larval settlement from the plankton. Initial colonisation will be by small, fast-growing, opportunistic species, especially small polychaete and oligochaete worms. Due to the dynamic nature of the site, the finer material will disperse away from the site rapidly and the benthic community will gradually revert, through the process of recolonisation, to a community more closely resembling that which occurred before disposal, i.e. typical of the dominant substrate and the prevailing hydrodynamic regime.

The Burford Bank disposal area is considered a dispersive site, with maximum tidal current speeds of between 0.8 and 0.9 metres per second during mid-flood (RPS 2020, ABR Capital Dredging Annual Environmental Report, 2019). Coastal modelling from the ABR Project (RPS 2014, ABR Project EIS) indicates that sands and gravels will stay largely within the footprint of the disposal site under normal tidal conditions. It is expected that the silt fraction will gradually disperse from the site under the same conditions. Although the model predicts some minor, far-field sediment deposition beyond the dump site boundary, no significant impact on any of the qualifying interests in the Rockabill to Dalkey Island Special Area of Conservation is anticipated.

Disposal of a maximum of circa 164,058m^3 of mixed sands and muds at the dump site is expected to have a minor, negative, and temporary to short-term impact on the benthos within the dump site. Recovery is expected to begin once disposal activities cease on-site, with full recovery anticipated to be achieved within 12 – 24 months.

Fisheries Impacts

The potential impacts on fish arise from spoil loading, and spoil dumping at the licenced dump site during the proposed dredging operations in Dublin Harbour. The nature of those impacts can be both direct and indirect. The main mechanisms of impact will be associated with increased suspended solids in the water column generated during dredging and disposal, deposited solids at the dump site, and those associated with entrainment of fish by the dredger during loading.

Dredging Impacts

As part of ongoing monitoring of the ABR Project, turbidity is being monitored at 4 channel-side monitoring stations in Dublin Harbour. Readings have been taken every 15minutes since December 2017. Table 7-14 lists the summarised results for the period December 2017 to October 2020. These clearly show that the values measured near the East Link Bridge upstream of intensive port activities and upstream of any dredging had significantly lower values than the remaining three sites.

Table 7-14 Summary statistics of turbidity and suspended solids (derived by calculation from NTU)measured every 15minutes at four locations in the Liffey Channel between December 2017 and October 2020

Sensor Location	Turbidity NTU		Suspended Solids mg/l		
	Mean	95%ile	Mean	95%ile	No. Readings
East Link	2.2	8	5.5	20	95,745
Poolbeg	4.9	19	12	48	79,520
North Bank	4.1	15	10	38	84,389
Tolka Estuary	6.1	22.5	15	56	65,621

The dataset was analysed for the period of maintenance dredging in September of 2020 which showed that the highest NTU value measured that could be linked to the dredging was measured at the Poolbeg sensor, i.e., 27 NTU (67.5 mg/l suspended solids). It important to bear in mind that these are channel-edge values, and one would expect higher values close to the dredger and close to the channel bed. Nevertheless, estuaries can be naturally turbid places, for example in a study on juvenile flatfish in the Thames Estuary, Power *et al.*, (2000) quote mean suspended solids levels of 88.88mg/l (297 readings over several years) and Maes *et al*., (1998) describing the fish and macroinvertebrate community of a turbid estuary (Zeeschelde in Belgium) reported a turbidity of 165NTU. Both those studies had fish and invertebrate species as major community components that were also commonly encountered species in the current Dublin Port assessment e.g., plaice, *Crangon* and green crab. These data show that the same community of fish and principal mobile invertebrates occur abundantly in estuaries with turbidity levels significantly higher on average than the Dublin Port area, including levels occurring during channel dredging.

Undoubtedly, local spikes in turbidity can be expected to occur during dredging, especially close to the dredger. However, the impact of elevated suspended solids is a product not just of concentration but also duration of exposure and dredging by its nature involves a mobile operation so that at any fixed point the suspended solids levels are likely to vary continuously as the dredger moves closer or farther from that point. This will also be influenced by the direction and strength of the tidal current and the degree of riverine discharge at the time. Moreover, dredging is not a continuous process. The dredger sails to the dumping site to empty the hopper every few hours during which interval the dredging plume will dilute and dissipate, thereby reducing suspended solids concentration.

Furthermore, fish are highly mobile and can avoid inimical turbidity levels. Therefore, they are unlikely to experience very elevated concentrations in expansive estuarine waters except for very short periods. Nevertheless, the possible effect of repeated exposures will depend on a fish's sensitivity, which may also be a feature of its development stage and size. For example, the literature points to some eggs and larvae being more sensitive than juveniles, and juveniles being somewhat more sensitive than adults (Wilber and Clarke, 2001), so that for a given turbidity level, earlier development stages may be more likely to succumb or suffer more ill effects than later developmental stages. In this regard dredging near a site of intense spawning of a rare or commercially important species could prove detrimental to that species, especially if that spawning takes place on the bottom substrates being dredged and if spawning locations were also very concentrated and of limited distribution in the wider area. These conditions however do not arise in the case of Dublin Port in that most of the common species (e.g., flatfish, gadoids, sprat, grey mullet etc) spawn in the marine environment

and migrate into estuaries, while rare or protected species spawn either in freshwater (salmon and lamprey) or in the ocean (eel).

Research on the sensitivity of fish to elevated turbidity has concentrated on valuable freshwater species, in particular salmonids, and much of the work on non-salmonids has been done on North American species. Data on the impact of suspended solids (e.g., [3]NOAEL or LC50) on many non-salmonid marine and estuarine species is limited. However, a trend that has been noted in several reviews on the subject is that species that generally live on or close to the seabed tend to be more tolerant of suspended solids, often much more so, than those species that normally live in clear waters higher in the water column. This is another reason why most of the species commonly found in estuaries are less at risk from elevated suspended solids levels. Overall, the modest levels of suspended solids/turbidity measured during both dredging and non-dredging periods since 2017 indicate that elevated suspended solids are likely to be having at most a very slight adverse impact on the resident and migrant species by virtue of either natural tolerance or limited duration of exposure.

Entrainment

Trailer suction hopper dredgers are known to entrain fish during dredging operations. The species most likely to be entrained are the bottom or near bottom dwelling species recorded from the area, which in Dublin Bay will include plaice, flounder, gobies, pogge, butterfish, dragonet, eel, pipefish etc. Fish moving higher in the water column such as mullet, sprat and bass, or species more associated with marginal hard substrate areas e.g., pollack and wrasse, may be less at risk. Clearly, all mobile or attached bottom-associated invertebrates, especially crabs and shrimps will be susceptible to entrainment. Essentially, the degree of entrainment will be determined by local density of occurrence, combined with proximity to the bottom and susceptibility to entrainment. Susceptibility may be increased by poor hearing e.g., all flatfish have poor hearing, so noise from the dredger is unlikely reduce their susceptibility to capture. At the other end of the scale clupeids such as sprat and herring are hearing specialists and likely to have early warning of the approach of the dredger. Cod and bass also have a degree of auditory sensitivity which could assist them, while other species are likely to be less sensitive. Certain behavioural traits such as burying in bottom sediment (sand eel) or a tendency to freeze or bury when startled (flounder and sole) will increase the risk of entrainment, as would slow burst speeds e.g., dogfish.

The greatest potential for impact due to entrainment would be if fish were concentrated into a narrow channel during dredging operations. In the current project, a group of high value or protected species (e.g., Annex II fish) including salmon smolts, but also adult salmon, lamprey, glass eels and silver eel, migrate through the Liffey channel. Some life-stages of these species will be at lower risk as the dredging period is limited to October-March and outside the peak of their migration.

Smolts: The vast majority of salmon smolts would be expected to migrate on the Liffey from late spring to early summer, principally in April and May, so that the proposed October-March dredging period for this project will effectively have no adverse impact on smolt migration.

3 NOAEL = No Observed Adverse Effect Level

LC_{50} = Lethal Concentration 50% i.e. the concentration of a substance which results in the death of 50% of the test organisms after a defined exposure period, usually 96 hrs (4-days)

Adult salmon: Data from the Islandbridge adult salmon counter indicates that the bulk of inwardly migrating salmon on the Liffey pass upstream between June and August, with occasional smaller peaks outside this window (Figure 7-15). On average, between 2010 and 2020 10% of the adult salmon ran between October and March each year and on average ranging from 3%-25% annually with October by itself accounting for 2%-21% annually. This timing means that in most years the vast bulk of adult salmon will avoid the dredging period.

As already indicated, the dredging will not be continuous, and will certainly not require the entire October-March period for its completion in any calendar year. Moreover, given the relatively small width of the drag head (3-4m including the zone of suction – see Drabble 2012) when compared to the width of the channel within the port area (150m/200m at Tom Clarke Bridge rising to 400m-500m at the seaward end of the port upstream) combined with a salmon's mobility and ability to move rapidly throughout the channel and higher in the water column than the drag head, considerably reduces the risk of adult salmon being entrained, while probably not eliminating it entirely. When this is considered in the context of the known seasonality of the adult salmon run in the Liffey, with just a small proportion of salmon running in the October to March period, mainly in October, it would indicate that the risk of entrainment of adult salmon by the proposed dredging is extremely low.

River lamprey: River lamprey which migrate upriver at any time from autumn to the following spring would be susceptible to entrainment if they pass close to the drag head while in operation. In the area where dredging is to take place the channel width ranges from about 150m immediately below Tom Clarke Bridge to approximately 500m just upstream of the Poolbeg Oil Jetty (Berth 48). Seaward of this point the shipping channels gets wider still. Recent Marine Institute data from the Islandbridge elver trap (Figure 7-14) shows that the peak lamprey immigration takes place from October right through to March, with declining numbers in April. Within this period, there are peaks in November and March in particular. Overall, therefore, inward migrating river lamprey would potentially be exposed to entrainment by the October-March dredging operations. As outlined for adult salmon above, the stop-start nature of the dredging operation, combined with the spatially confined suction field of the active dredger within a channel ranging from 150m-500m wide is likely to significantly reduce the risk of entrainment of river lamprey, although not entirely eliminate it.

Silver eel*:* In preparation for their seaward spawning migration yellow eel begin to alter their physiology which is outwardly manifest by a process known as silvering. Sliver eels, which have completed this process migrate during autumn and early winter. A recent publication using a long-term dataset on silver eel migration in a west of Ireland catchment (the Burrishoole in Co. Mayo) showed that the vast bulk of silver eels migrated between August 1st and November 30th a migratory window it shared with a river in southern Norway, which was subject of the same study (Sandlund *et al.*, 2017). The actual commencement date was shown to be very variable and depended on a combination of factors, the most important of which were temperature in preceding months and, closer to the time, flow levels. Assuming that similar time scales are applicable for the Liffey and making the fairly crude assumption that a quarter of the migratory stock for any given year will migrate in each of the months August to November, then by the end of the dredging season at the end of March, as much as 50% or more of the migrating cohort may have been exposed to the risk of entrainment. The study also noted that during the migratory period that the numbers migrating on any given day was influenced by water levels, with increased flow stimulating eels already sufficiently silvered to migrate. Moreover, there appeared to be a tendency for eels to migrate in bulk and in the dark, both behaviours thought to be anti-predator strategies. It would seem therefore that silver eels would be exposed to entrainment during the dredging window, probably mainly in October-November and more so at night than during the day. The tendency for eel to use the main tidal flow to assist

their outward migration, and the tendency for more eels to migrate during high flow events, probably reduces the risk of entrainment by speeding up their passage, and possibly by being associated with greater water depths during concentrated migratory movements caused by the associated increase in discharge.

Glass eel and elvers: Glass eels arrive on Irish coasts from the Sargasso Sea in November and December and tend to wait in the lower reaches of estuaries until temperatures rise stimulating them to move upstream toward the tidal limits in the spring. The limited data available on glass eels in the Liffey come from the elver trap counts operated by the Marine Institute at Islandbridge. Glass eels recorded at the trap arrive mainly in March and April (Figure 7-12) but these same eels may have arrived at the coast much earlier. Elvers, which are eels that have transformed from glass eels, becoming fully pigmented and physiologically prepared for the transition from saline to freshwater conditions, peak at the Islandbridge trap in the period June to August (Figure 7-13). These are believed to have transformed from glass eels that arrived into the lower estuary either in early spring or late winter and spent the intervening months within the upper estuary i.e. above the port area, while they awaited temperatures to rise and begin actively swimming upstream.

Glass eels are poor swimmers and rely on tidal transport to bring them progressively up through estuaries. On flood tides they tend to be well distributed throughout the water column but particularly in the main tidal flow, whereas at early ebb they move toward the channel margins and during full ebb they move toward the bed of the estuary in order to bury into sediment or to remain in slacker flows so as to reduce seaward displacement (Harrison *et al.,* 2014). This oscillating cycle of a big step upstream on the flood and a shorter backward step during ebb is the mechanism whereby glass eels move upstream undergoing physiological changes as they move to enable them to migrate further upstream into rivers and streams. The glass eel migration seems to be spread over several months and may involve more than one wave of arrivals from the sea. There is insufficient information to be able to quantify the level of overlap between the glass eel migration and dredging, mainly because it is not known how long glass eels delay within the upper estuarine and tidal freshwater reaches of the Lower Liffey while transforming into elvers. While it is likely that some glass eels will be entrained during dredging, because of their diffuse spread across the channel depending on the tidal stage, it is expected that the vast majority will pass upstream unimpeded.

Taken as a group, while both silver eels and glass eels are at risk from the dredging, the fact that glass eels do not home to the same rivers from which their silver eel parents emigrated means that any mortalities due to dredging, which are expected to be low in any case, will not be reflected in a reduction in recruitment of glass eels in subsequent years.

Overall, the loss of resident fish and invertebrates as a result of dredging can be categorised as slight adverse and short-term, as the vast bulk of what will be entrained will be the most widespread and common species. The impact will be confined to a small area relative to the Liffey Estuary and the wider Dublin Bay, where all the same species will occur to varying degrees and begin to recolonise any vacant niches in the dredged areas as soon as dredging is completed during any given season. In terms of more valuable and protected migratory species, there is very little overlap between the proposed October-March dredging season and the outward migration of salmon smolts or the inward migration of adult salmon, so neither life stage will be at significant risk of entrainment. In terms of migratory windows, the greatest degree of overlap will be for inward migrating river lamprey and glass eel, and out-migrating silver eel. As indicated in the discussion, some entrainment of eel, should it occur, will have no impact on future recruitment of the species into the Liffey by virtue of the complex

biology of the species. River lamprey, while likely the most exposed of the Annex II species to dredger entrainment are not expected to be significantly adversely impacted at the level of the Liffey population due to their very extended migratory period, combined with the spatially and temporally confined nature of the active dredger.

It is worth noting also that the risk of entrainment of migratory species is likely to be confined to dredging within the navigation channel and the berths along the channel, and largely or completely absent during dredging within the basins and along berths within the basins. Moreover, entrainment is largely a feature of TSHD dredging and will constitute little or no risk during back-hoe dredging operations. It's also important to emphasise the stop-start nature of the dredging process in that for every loading and dumping cycle, which on average has been estimated to last 112 minutes, actual dredging will only constitute 25% of the time, the majority elapsing in the steaming of the dredger to and from the disposal site.

Disposal Site Impacts

A study was undertaken at the dump site in spring 2020 which measured the surface and mid-water turbidity levels (RPS, 2020). This involved a monitoring vessel tracking over and back along the extent of the dredger plume within and just beyond the boundaries of the disposal site while a disposal event was taking place. A total of 12 disposal events were monitored during March 2020. A conversion factor of 2.5, based on laboratory testing, was applied to the turbidity results in order to estimate the equivalent suspended solids concentrations. As would be expected, the suspended solids levels varied along the plume path with points closer to the dredger tending to have the highest concentrations, but that was not always the case. Another feature of the data was the significantly lower concentrations in general of the surface suspended solids compared to the mid-water values. The speed of the tidal current also appeared to impact the results with slacker current speeds resulting in a shortening of the distance from the dredger within which higher concentrations were detected, the reverse tending to be the case with higher current speeds. In terms of absolute concentrations, the surface concentrations rarely spiked up to 400mg/l and were generally below 50mg/l and more often below 25mg/l as suspended solids. Mid-water concentrations spiked to between 500mg/l and 1000mg/l, were often above 50mg/l but frequently below that concentration also. Clearly, concentrations close to the dredger and close to the bottom would have been higher.

These findings are in general agreement with results of a study of the disposal process in open waters described in a review by Truitt (1988) which showed that significantly elevated turbidity levels are generally confined to the lower 15-20% of the water column depth, declining by orders of magnitude toward the surface. Turbidity levels at all depths decline rapidly, approaching background levels within a matter of minutes to tens of minutes, with the bottom levels declining slowest. This would indicate that fish would only be exposed to the highest concentration for very short durations and those higher in the water column (i.e., pelagic species such as sprat and herring) would be least exposed, with species on or close to the bottom most exposed. However, the latter species are generally more tolerant of higher turbidity levels than pelagic species also. During several days of disposal in succession it is possible that pelagic species might avoid the immediate area of the dump site, although that doesn't seem to have been much studied in field surveys. What is clear however is that the dump site will continue to be used by fish during the dredging process.

Elevated suspended solids in the water column associated with dredge spoil plumes are likely to impact early fish development stages i.e., eggs and larvae more than juveniles and adults. In the Irish Sea, surveys have

shown the presence of both eggs and larvae in the water column over large areas in April and May (Nichols *et al.,* 1993) for a wide range of the species which have been found on or near the Dublin Bay disposal site or in the Lower Liffey Estuary in the current and recent previous surveys. These include those of plaice, dab, flounder, cod, whiting, pollack, gobies, dragonet, gurnard, sprat, lesser weever etc. Others such as sandeel (mainly *Ammodytes marinus*), butterfish (gunnel), gobies and pogge, which have demersal eggs only appear in the plankton as larvae. This would suggest that the risk to the early developmental stages of these fish would be extremely low for a dredging operation undertaken between October and March.

In the area of the concentrated plume i.e., immediately beneath the hopper drops, some species living on or close to the bottom may well be smothered, something more likely to affect smaller species or younger individuals of larger species. The same smothering impact is also likely to affect mobile epibenthic invertebrate species such as shrimp, crabs, starfish etc. This effect is likely to be quite patchy and confined to within the boundary of the dump site. All these effects combined would be expected to reduce the density of fish using the site during and immediately after the dredging period. However, not all sites nor all fish are likely to respond the same way to dredge spoil disposal, as is made clear in the following paragraph.

The impact of dredge spoil disposal on fish and mobile epibenthos is likely to be site-specific depending on the habitats/substrates present at the disposal site and the nature of the hydrological regime. This to some extent will determine the importance or otherwise of the site to a range of species, it will also play a role in the rate of recovery of a site. For example, sites which are shallower and more dynamic in terms of tidal currents and wind-forcing are less likely to show significant impacts compared to deeper, less dynamic sites with slacker flows (Fields *et al.,* 2019). If dumping results in a change in the native dominant substrate at a disposal site, then this could result in a change of fish community, with previous dominant species, which relied largely or exclusively on that habitat, having to move. This is less likely to impact species which have a broad range of food preferences. Hatin *et al*., (2007) noted this at a US disposal site which after a disposal event resulted in a very sharp drop in the density of Atlantic sturgeon at the site and in an adjoining spread area. The authors attributed this to the sudden change in substrate from the native mud substrate with high densities of worms on which this species relied exclusively and which were only present in very low densities in the replacement sand habitat. Another species of sturgeon (lake sturgeon) which also occupied the area, but which had a much broader range of food preferences was much less affected, which was also the case for two other species utilising the area. What this shows is that fish site utilisation before and after disposal may change to a greater or lesser degree depending on the ecology of the species in question. In another study in which fish densities were surveyed before and after a disposal event, Pezy *et al.*, (2017) noted that after a large one-off disposal event at a sandy site on the approaches to the outer Seine estuary in France, there was a marked increase in the density of plaice and dab using the site after the dumping, a trend that was maintained for dab for 9 months after the event and for plaice for 27 months. The authors attribute this to an input of benthic food with the deposited dredge spoil. Both these species are common members of the fish community at the Dublin disposal site and Dublin Bay in general.

The Dublin disposal site is relatively shallow and exposed to strong tidal currents, and it is also affected by storm events which means that it is a more dynamic site. It also has a relatively diverse fish fauna whose more common members are widespread within the wider Dublin Bay and Liffey Estuary areas, suggesting that they are more resilient. For these reasons the fish community at the site is less likely to suffer severe impacts and more likely to recover to an equilibrium community in a shorter period than at a deeper, less dynamic site. The

process of recovery will likely be ongoing, even during spoil disposal, with fish from inside and outside the site moving in to scavenge on biological material in the dredge spoil and the process will accelerate after the disposal is completed. Full recovery will probably take 1-2 years, with substantial diversity and biomass recovery after one full season. The latter is likely to remain the case while dumping takes place annually, i.e., annual interruption in the recovery process but substantial recovery in the approximately 10 months between disposal events, when the site will continue to be utilised by a typical range of bottom and near-bottom dwelling fish species. It is also the case, that recovery is likely to be more rapid after the disposal of smaller dredge spoil volumes compared to larger ones.

7.1.4 Mitigation Measures

The following key mitigation measures apply to the Capital Dredging Scheme to minimise the impact of the proposed works on marine ecology:

- No over-spilling at the surface of the dredger for all dredging activities within the inner Liffey Channel will be permitted;
- The dredger will work on one half of the channel at a time within the inner Liffey channel to prevent the formation of a silt curtain across the River Liffey;
- The dredging of sediments within the navigation channel will be carried out during the winter months (October – March) to negate any potential impact on salmonid migration (particularly smolts) and summer bird feeding, notably terns, in the vicinity of the dredging operations;
- A trailer suction head dredger (TSHD) or Back-hoe dredger will be used for the capital dredging works. When operating in the River Liffey Channel, the TSHD pumps will be switched off when the drag head is being lifted and returned from the bottom as the dredger turns between successive lines of dredging to minimise the risk of fish entrainment;
- A maximum of 4,100m^3 of sediment and entrained water will be loaded into the dredger's hopper for each loading/dumping cycle, equivalent to approximately of 2,030 tonnes (wet weight).
- Dredge spoil will be disposed at the site in as even a distribution as possible, maintaining a maximum disposal layer of 10-15cm per disposal event. Disposal events should be spread evenly across the site to minimise the build-up of large amounts of sediment in certain areas.
- It is important that every effort be made to maintain the elver trap and salmon counter at Islandbridge in operation all year around, as the data being provided from these is extremely valuable in providing trend information on these valuable migratory species (i.e., eel, salmon and lamprey).

7.1.5 Residual Impacts

The proposed capital dredging in Dublin Port will result in the temporary loss of habitat across the dredged area. Substrate in these areas consist primarily of sandy muds and muds dominated by highly opportunistic fauna where there is evidence that recovery from previous dredging activities has occurred rapidly.

The Burford Bank disposal area is currently being used to dispose of sediment from Dublin Port maintenance dredging and recently for the disposal of the ABR capital dredge spoil. The biological communities present in

the area are adapted to continuing intermittent sediment disposal at the site and as a result, the continuation of disposal for this capital dredging programme at the site is expected to have a temporary, minor adverse impact on the benthos and fish in the area. No impacts are expected from either dredging or disposal activities on the Annex I listed habitats Reefs & Sandbanks.

In addition, the temporary disturbance of fish at the disposal site which constitutes just 0.25% of the area of the adjacent Rockabill to Dalkey Island SAC is expected to have no adverse impact on the feeding of the porpoise population which is the main conservation objective of the SAC.

7.1.6 Potential Cumulative Impacts

The proposed capital dredging project will overlap with two other projects within Dublin Port with aquatic components, one already granted, the MP2 Project, and the other under application, the 2022-2029 Maintenance Dredging Campaign. Two other projects within the same area i.e., the ABR Capital Dredging Project and the 2020-2021 Maintenance Dredging Project will have been completed by the time that the current project is due to commence and are therefore likely to have a negligible cumulative impact and will therefore not be addressed further in this assessment.

DPC Maintenance Dredging (2022-2029)

This falls into the category of regular port management in that it secures navigable depths within the shipping channel, basins and berths of Dublin Port and is repeated as required on a regular basis to allow the port to operate efficiently and safely. This campaign will see a total of up to 2.4million m^3 of sediment, mainly sand and mud, dredged from any part of the port as required and disposed of at the licenced dump site. Consent will have several conditions attached in order to minimise potential environmental impact as follows:

1. The annual maximum which can be dredged is 300,000m^3, all between April and September each year.
2. No dredging will be permitted upstream of Berth 49 between April 1st and May 14th each year in order to minimise potential impacts on outward migrating salmon smolts.
3. No overspill of the TSHD hopper will be allowed within the inner Liffey channel

With respect to timing of dredging there will be no activity overlap between the maintenance dredging project and the proposed capital dredging project as the latter will be undertaken from October to March each year.

In terms of the benthos within the loading areas, the potential for cumulative impact is low. The main areas of the capital dredging programme which are not currently subjected to dredging activities occur in the Navigation Channel (between Tom Clarke Bridge and Alexander East Basin) and along the South Port Quays, where an additional 10.8ha and 0.41ha are to be dredged (Figure 7-18). The benthic communities in these areas are similar to those identified in the areas which have been dredged in the recent past and which have shown good levels of recovery following that dredging. Areas which have been previously maintenance dredged and are earmarked for dredging as part of the capital dredging programme are expected to recover in the normal way, described previously, following cessation of dredging in those areas. The same mode of recovery is expected in the areas which are only subjected to dredging under the proposed capital dredging programme.

The Burford Bank dump site is currently being used by DPC to dispose of sediments from maintenance dredging as well as capital dredging works undertaken as part of the ABR Project and MP2 Project. It should be noted

that there will be no overlap between the capital dredge programme and the maintenance dredging works. The disposal of sediment at the site between October and March is expected to delay recovery in areas where dredge spoil is disposed. However, due the dispersive nature of the site, as well as the nature of the benthos at the dump site, recovery is expected to commence immediately, and full recovery is expected to occur rapidly once all dredge spoil disposal has ceased on site. Accordingly, cumulative impacts are expected to be low at the disposal site.

In terms of fish entrainment, there is the potential for cumulative impacts on eel (glass eel and silver eel), adult salmon and river lamprey, even though it isn't expected that any of these species will be impacted at a population level. No cumulative impacts are expected to affect salmon smolts as both campaigns avoid peak out-migration of this life stage of the species. In the case of glass eel, the very dispersed distribution of this life stage as it advances upstream carried by tidal movements would suggest that only a very small portion of the population is likely to be exposed to entrainment during either maintenance or capital dredging. Depending on the flow conditions and the cumulative water temperatures in any given year, silver eel could be exposed to entrainment toward the end of the maintenance dredging season, probably mainly in September, and at the beginning of the capital dredging season, mainly in October and November. Again, however, the very confined suction width of the dredge intake (3-4m) relative to the width of the channel 150-450m, combined with the stop-start nature of the dredging cycle, where the active loading phase of each dredge-dump cycle on average lasts just 25% of that time, would suggest that only a very limited number of silver eel are likely to be entrained. Thus, the cumulative impact of both projects should be only of minor, adverse, significance and only arise if the maintenance dredging is undertaken at the end of the April-September dredge window and then only if this coincides with a concentrated run of eels during that month and that the capital dredging is undertaken in the next two months (October and November) because if undertaken any later it would probably miss the main seasonal migration of this life stage. Moreover, the fact that eels in the North East Atlantic are considered a single population and that unlike salmon, they do not home to rivers (as they spawn at sea), any cumulative impact on the species in the Liffey, will not impact on future recruitment to that river. Negligible cumulative impacts are anticipated in terms of the risk of adult salmon entrainment as the vast majority of salmon will usually have run up the Liffey by the time the capital dredging begins in October.

MP2 Project

The MP2 project will require a total of 424,644m^3 of capital dredging spread between four separate compartments as follows:

- Berth 53 159,595m^3
- Channel Widening 111,995m^3
- Oil Berth 3 83,414 m^3
- Berth 50A 69,640 m^3

The MP2 project will overlap with the 2022-2029 capital dredging as both will see spoil disposal within the October-March window. However, dredging will not run concurrently, i.e., only one dredger will operate at any one time. To put the volumes of spoil into perspective, even if all of the 500,000m^3 of the 2022-2029 capital dredging was disposed of in the same year as the 424,644 m^3 of the MP2 Project it would still be less than a single year of the ABR capital dredging just completed. However, the likelihood is that both projects will be

staggered across several years due to considerations related to the associated quayside construction sequencing.

Potential cumulative impacts associated with the benthos from the loading areas are considered low. Overlap between the capital dredging programme and MP2 Project is limited to the dredging of areas immediately adjacent to Berth 52, with dredging of the seabed to -10.0m CD. Although dredging from the capital dredging programme will be undertaken during the same time period as the MP2 Project, dredging would be carried out sequentially, with no overlap occurring between the dredge works of both projects. The sequential nature of the dredging activities minimises the potential for impacts on the benthos within and immediately adjacent to the footprint of the proposed works. The nature of the seabed in the area, which is regularly exposed to disturbance events, such as maintenance dredging and benthic disturbance from vessel movements, means the cumulative impact of these projects would be considered minor, adverse and temporary.

While there is a degree of overlap between the capital dredging programme and MP2 Projects, with both projects expected to use the disposal area between October and March each season, the volumes for disposal are comparatively low. The combined total of sediment to be disposed from both the MP2 Project and Dublin Harbour Capital Dredging Project over the full period of both projects is 942,000m^3 of sands and muds. It is expected that the combined maximum to be disposed of per dredging season will be 300,000m^3. Once mitigation measures are undertaken for the disposal of sediment at sea, then the cumulative impacts associated with the disposal of these volumes of sediment at the Burford Bank dump site is expected to be low.

In terms of potential cumulative impacts on fisheries these are expected to be very minor for salmon because of the relatively small proportion of either adult or smolts migrating during the October-March window and also for eel for the same reasons outlined above for the maintenance dredging campaign. The greatest overlap between the two projects and Annex II fish migration will be for inwardly migrating river lamprey which may give rise to a minor cumulative increase in the risk of entrainment of the species in years where significant amounts of dredging for both projects occur in the same October-March window. Even with this however, this is thought very unlikely to have an impact at the population level for the Liffey lamprey for the following main reasons: (i) juveniles of the species remain in freshwaters for 6-7 years maturing before migrating to sea which means that in any given year the bulk of the population resides within the freshwater realm, (ii) the spawning migration is spread over 4-6 months, thereby spreading the risk and (iii) aspects of the dredging process i.e. the spatially restricted entrainment effect relative to the width of the Liffey channel and the stop-start nature of the loading process combine to minimise the number of lamprey likely to be entrained by the dredger.

Overall, therefore, it is expected that the cumulative impacts on benthos and fisheries of the Dublin Harbour Capital Dredging Project and other planned dredging projects will be at worst minor, adverse and temporary.

7.1.7 Conclusions

The proposed Dublin Harbour Capital Dredging Project is expected to have only a temporary and minor adverse impact in the benthos within the footprint of the dredging works. Areas of the bottom earmarked to be dredged will have their benthos temporarily removed, but due to the nature of the benthos present, recovery is expected to occur rapidly following cessation of dredging activities. The area is subjected to regular maintenance dredging, and the benthos that has developed there is typical of muddy areas subject to episodic stress events. The benthos within the footprint of the Burford Bank disposal is expected to undergo a cycle of temporary impact

(during disposal) followed by partial recovery before the next disposal event until the completion of the capital dredging programme, followed by complete recovery expected to occur within 2 years of the cessation of the project. Overall, these impacts can be classified as temporary to short-term, minor and adverse.

The proposed capital dredging is expected to have only a negligible impact on salmon (adults or smolts) in the Liffey, mainly due to the minor seasonal overlap between migration of the species and the dredging activity. Eel, mainly outward migrating silver could potentially be exposed to entrainment by the dredging but that will not impact future recruitment of the species into the Liffey and the entrainment of glass eel is expected to have a negligible impact on the Liffey population. The potential for entrainment of river lamprey during the project is probably highest of the migratory high conservation species. However, aspects of its biology and migratory strategy are likely to result in the impact at worst being minor, adverse and short-term, with minimal effect at the population level in the Liffey. Impacts on the general non-conservation migratory and resident fish populations in the study area are expected to be at worst minor, adverse and temporary. The impact of dredge spoil disposal at the dump site is not expected to have any adverse impact on the protected porpoise population in the Rockabill to Lambay Island SAC by virtue of the tiny proportion of the SAC constituted by the dump site and the fact that fish will still feed at the site during or immediately after disposal events so that there will effectively be no dredging related diminution in the porpoises' fish diet as a result.

Cumulative impacts with the MP2 Project and 2022-2029 maintenance dredging projects have the potential to increase the risk of entrainment for silver eel and river lamprey, but not to the extent that the impact levels outlined for the main project would warrant changing.

7.2 Marine Mammals

This section assesses the potential impacts of the proposed capital dredging campaign over the period 2022-2029 on marine mammals and their habitats (marine mammal biodiversity) and consitutes a Marine Mammal Risk Assessment.

7.2.1 Assessment Methodology

Dublin Bay is recognised as an internationally important site for marine mammals. Grey and Common (Harbour) seals occur within the site and one of only three protected sites in Ireland for harbour porpoise occur immediately to the east of Dublin Port. Other species such as bottlenose dolphin and minke whale regularly occur and both are entitled to strict protection under EU legislation (both on Annex IV of the EU Habitats Directive). Humpback whales are common and Risso's dolphins are occasionally recorded adjacent to Dublin Bay and are also entitled to strict protection under EU legislation (both also on Annex IV of the EU Habitats Directive).

Field surveys of cetaceans before 2016

The Irish Whale and Dolphin Group (IWDG) have co-ordinated a Cetacean Sighting Scheme since 1991, which validates and logs all cetacean sightings both casual and those with associated effort, if available. The data is accessible online and is regularly reviewed (Berrow et al. 2010; Wall et al. 2013). The IWDG database was accessed in October 2020 to prepare distribution maps for this assessment.

Dedicated harbour porpoise surveys off Co Dublin were first carried out in 2008, when distance sampling was used to calculate density and abundance estimates in North County Dublin and Dublin Bay (Berrow et al. 2008; 2014). Subsequent to SAC designation as the Rockabill to Dalkey Island SAC in 2011, surveys of the site were carried out in 2013 and 2016 (Berrow and O'Brien 2013; O'Brien and Berrow 2016).

Despite the importance of the area for harbour porpoise little is known about their general ecology. The only studies on the diet of harbour porpoise in Ireland were carried out by Rogan and Berrow (1996) and Rogan (2008) but there were few data from the east coast.

Field surveys of seals before 2016

Dublin Bay was surveyed for both Grey and Common seals between 1997 and 1998 by Kiely et al. (2000) and during All-Ireland seal surveys in 2003 (Cronin et al. 2004) and 2005 (O'Cadhla et al. 2007) and between 2009-2012 (O'Cadhla et al. 2013) and in 2012 (Duck and Morris, 2013).

The ecology and foraging behaviour of Common and Grey seals off Dublin is not known. Kiely et al. (2000) carried out some photo-identification of grey seals between Skerries and Ireland's Eye to explore movements and site fidelity. The diet of Common seals off southwest Ireland was described by (Kavanagh et al. 2007) but not from samples from the east coast.

Field surveys of harbour porpoise between 2016 and 2020

A number of field studies have been carried out under the ABR Project marine mammal monitoring programme which has led to a significant increase in our knowledge of harbour porpoise in Dublin Harbour, Dublin Bay and in the surrounding area. These include sightings during maintenance dredging campaigns (September 2017, April 2018 and September 2020) and capital dredging campaigns (October- March, 2017-2020) and static acoustic monitoring.

Under the ABR Project, a Static Acoustic Monitoring programme using C-PODs was initiated to better inform on how harbour porpoise use the spoil grounds prior to, and during, the capital dredging campaign and to monitor if any displacement occurred. Four locations were monitored between September 2017 and April 2020. SAM is independent of weather conditions once deployed and thus ensures high quality data is collected but only at a small spatial scale. Static Acoustic Monitoring using C-PODs can identify feeding buzzes which can provide information of feeding rates. Data collected during acoustic monitoring as part of the ABR Project was explored to determine the influence of seasonal and diel and tidal patterns on occurrence.

Field surveys of seals between 2016 and 2020

A number of field studies have been carried out during the ABR Project which has led to a significant increase in knowledge of seals in Dublin Harbour, Dublin Bay and in the surrounding area. These include sightings during maintenance dredging campaigns in 2016, 2017 and 2020 and capital dredging campaigns in 2017-2019 and monthly seal counts of a haul out site on Bull Island since May 2016. An updated population estimate for Grey and Common seals in Ireland was provided by Morris and Duck (2019) from thermal imaging aerial surveys carried out between 2017 and 2018. More recently, Cooney and Dunne (2020) published results of a four year study of Grey and Common seals at North Bull Island.

7.2.2 Receiving Environment

Dublin Bay is defined as around 10 km wide stretching from Howth Head to the north to Dalkey Island to the south. Dublin Bay is bordered to the west by Dublin Harbour and to the east by the Rockabill to Dalkey Island SAC, which includes harbour porpoise as a qualifying interest. The spoil ground for dredged material occurs within this SAC. To the north of Dublin Bay is Lambay Island SAC which, although is greater than 15km from Dublin Port, includes both Grey and Common seals as qualifying interests. Seals are highly mobile and seals from Lambay Island are likely to forage in Dublin Bay and Harbour (Table 7-15).

Table 7-15 Qualifying Interests of Special Areas of Conservation in the vicinity of Dublin Bay

Qualifying Interest Species	Rockabill to Dalkey Island SAC	Lambay Island SAC
Harbour porpoise *(Phocoena phocoena)*	Yes	No
Grey seal *(Halichoerus grypus)*	No	Yes
Common seal *(Phoca vitulina)*	No	Yes

These Natura 2000 sites are designated for 3 species of marine mammals that are qualifying interests. It should be noted that the likely significant effects of the project on the European sites and their Qualifying Interests are appraised in the Screening for Appropriate Assessment and Natura Impact Statement submitted with the application for consent.

Cetaceans, other than harbour porpoise

Bottlenose dolphin and minke whale are frequently recorded in, or adjacent to, Dublin Bay. Bottlenose dolphins have been reported throughout the year, though mainly in the summer and from all along the coast, but mainly off Howth Head and especially from Dún Laoghaire and south to Wicklow. Most sightings are of small groups though occasionally large groups of greater than 20 dolphins occur but usually only for short periods. A small group of 3 individual bottlenose dolphins frequented Killiney Bay from August 2010 to August 2012. Bottlenose

dolphins off Dublin are part of the highly mobile coastal population which has been recorded all around the Irish coast and some individuals reported off Scotland (O'Brien *et al.* 2009; Robinson *et al.* 2012). Surprisingly, there was no evidence of movement between the east coast of Ireland and Wales, which holds a large number of this species. This highly mobile Irish coastal population is thought to number between 200-400 individuals.

Risso's dolphin were regularly recorded to the south of Dublin Bay, in the spring and early summer for a number of consecutive years from 1999 to 2006 but have not been recorded regularly since 2013. They were likely part of a wider Irish Sea population whose occurrence is associated with the presence of squid, which may be an unpredictable food source.

a) b)

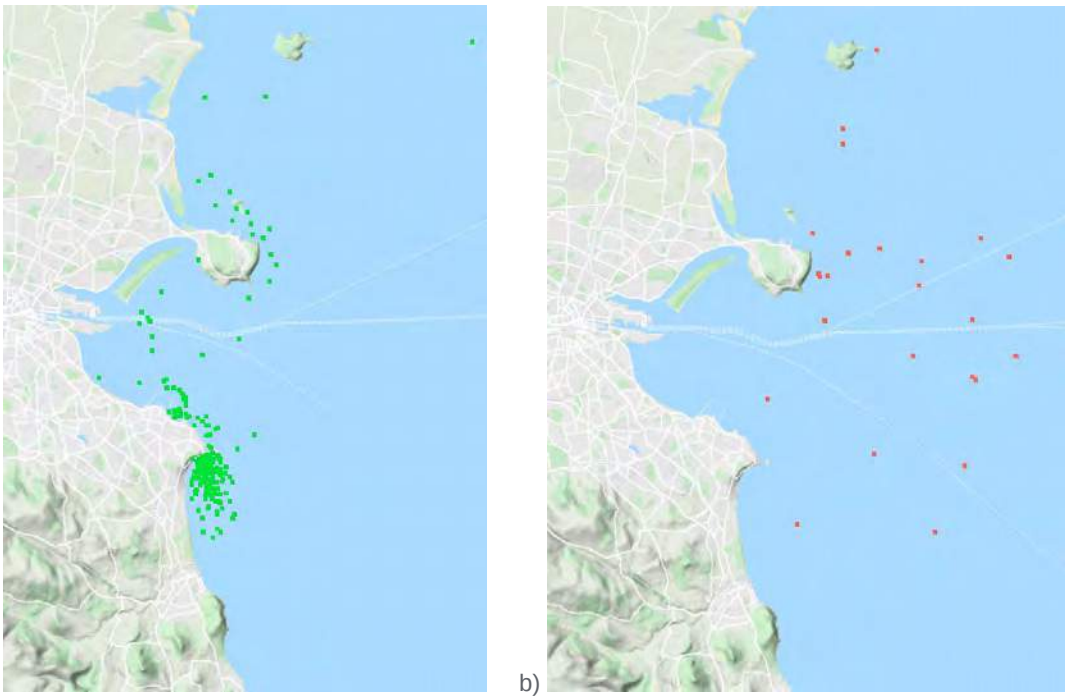


Figure 7-20 Sightings of a) bottlenose dolphin (green) and b) minke whale (orange) in Dublin Bay

Minke whales occur seasonally, especially off north County Dublin from Howth Head to Lambay Island and on the Kish Bank. They are usually solitary but up to 5 have been seen foraging in the same area at any one time.

Common dolphin and humpback whales have also been recorded. Common dolphins are thought to be more abundant in the Irish Sea in the summer and tend to occur further offshore than bottlenose or Risso's dolphins. They have been recorded from Rockabill to Dun Laoghaire.

Single humpback whales were recorded in July for two consecutive years in 2010 and 2011 off north Dublin and are thought to be increasing in number in Irish coastal waters, suggesting they are likely to be more frequently observed off Dublin in future years.

Harbour porpoise

Dedicated porpoise surveys off Co Dublin were first carried out in 2008, when density estimates of 2.03 porpoises per km^2 were recorded in North County Dublin and 1.19 porpoises per km^2 in Dublin Bay (Berrow *et al.* 2008). The densities off North County Dublin ranged from 0.54 to 6.93 and were the highest recorded at any of the eight sites surveyed by Berrow *et al.* (2014), including two cSACs off the southwest which were designated to protect harbour porpoise.

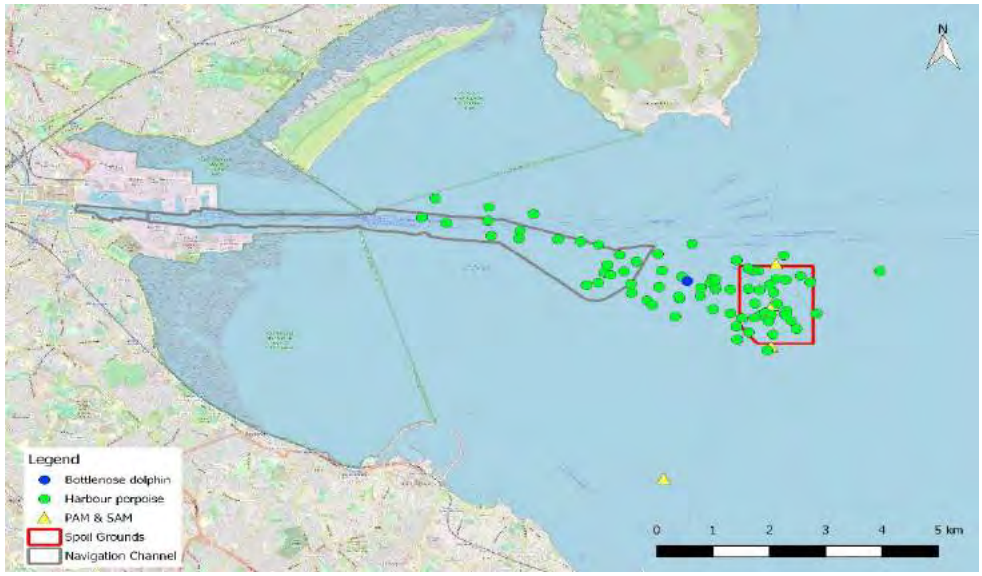
A survey of the Rockabill to Dalkey Island SAC in 2013 resulted in density estimates ranging from 1.13-2.61, with an overall density of 1.44 porpoises per km^2 which was similar to an overall density of 1.61 for the two sites combined in 2008. A second survey was carried out in 2016 which reported densities between 1.37 and 1.87 porpoises per km^2 and with an overall density of 1.55 porpoises per km^2. All these density estimates are very consistent and high compared to other sites in Ireland supporting the conclusion that Dublin Bay, and especially North County Dublin, provide some of the most important habitats for harbour porpoise in Ireland. Calves consistently accounted for around 7% of the porpoises surveyed and porpoise are thought to move offshore to calve in April-May before moving back inshore. The diet of harbour porpoise is poorly known but thought to consist of small benthic or demersal fish such as gobies, sandeels, whiting and other gadoids and pelagic species such as herring and sprat when available (Rogan 2008).

There were 77 sightings (26% of total marine mammal sightings) of harbour porpoise during the first season of the ABR Project capital dredging campaign (2017-2018) and one sighting of a single bottlenose dolphin. All sightings were outside Dublin Harbour with sightings increasing further east and on the spoil ground (Figure 7-21a).

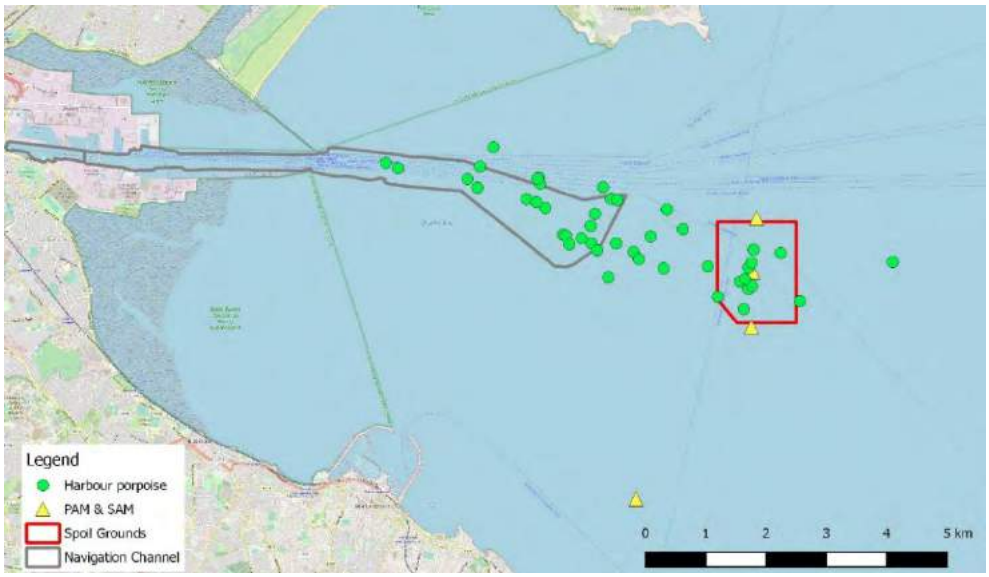
Between October 2018 and March 2019 during the capital dredging campaign there were 44 sightings of harbour porpoise, which was 33% of all marine mammal sightings. Again all sightings were outside Dublin Harbour with sightings increasing further east and on the spoil ground (Figure 7-21b).

During the 2019 - 2020 campaign there were 84 sightings of harbour porpoise with (27% of all marine mammal sightings) with all sightings at the spoil ground and in the channel outside Dublin Harbour (Figure 7-21c).

a)



b)



c)

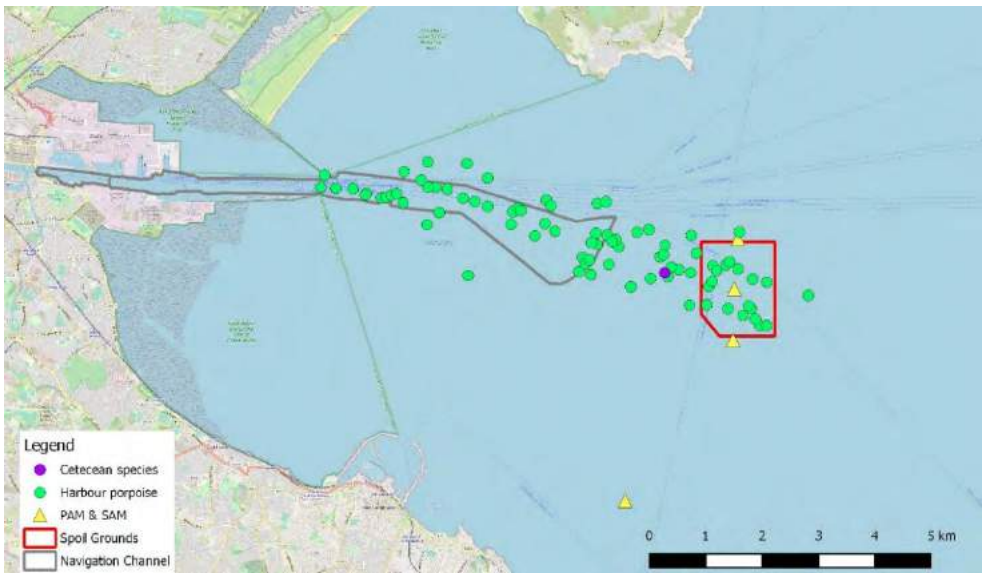
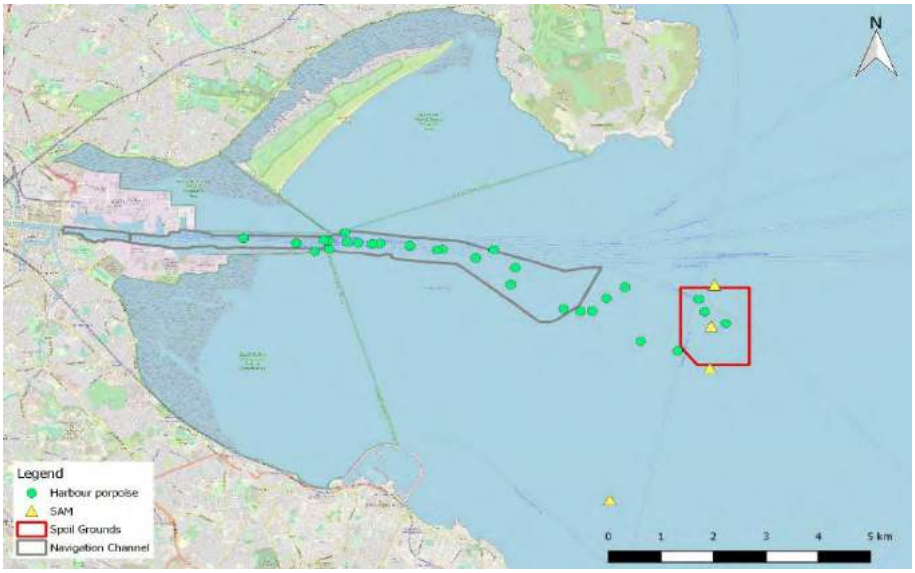
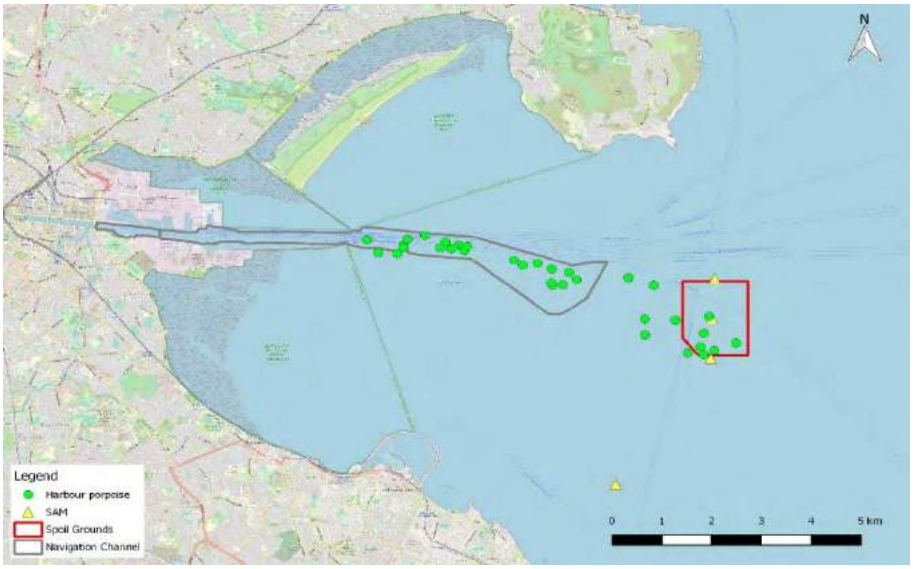


Figure 7-21 Harbour porpoise and bottlenose dolphin sightings during a) 2017-2018 b) 2018-2019 and c) 2019-2020 Capital Dredging Campaigns

a)



b)



c)

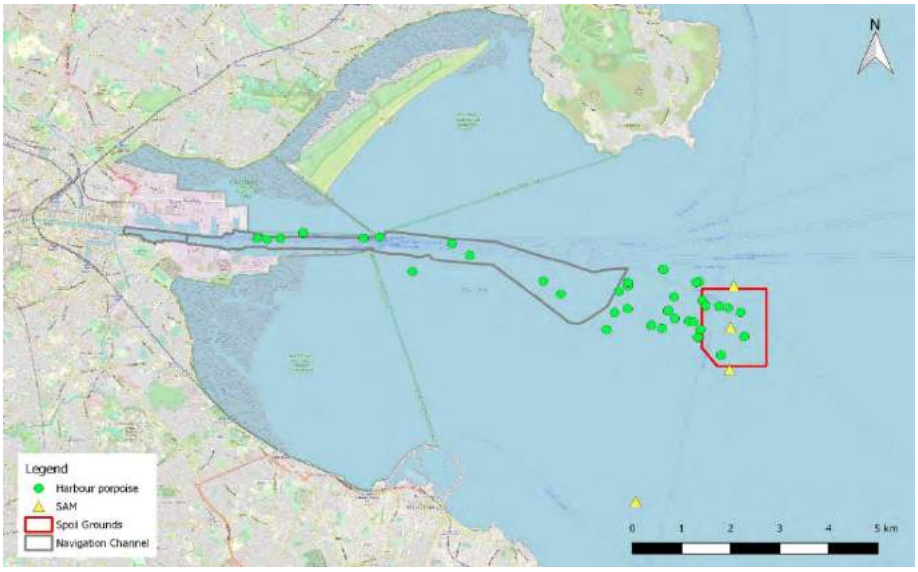


Figure 7-22 Marine mammal sightings during a) 2017, b) 2018 and c) 2020 Maintenance Dredging Campaigns

A similar pattern was recorded during maintenance dredging campaigns. A total of 35 sightings of harbour porpoise (32% of all marine mammal sightings) were recorded from 14 to 30 September 2017, 29 (16%) between 9 to 22 April 2018 and 37 sightings (53%) 10 to 27 September 2020 (see Figure 7-22).

Static Acoustic Monitoring Programme

Four locations were monitored using C-PODs, during the Static Acoustic Monitoring programme under the ABR Project (Figure 7-23). The monitoring is presented in three sections (ABR1: May 2017-April 2018, ABR2 May 2018-April 2019, ABR3: May 2019-April 2020). Generalized linear mixed-effect models (GLMM) were carried out to assess significant differences between monitoring locations, allowing for a detailed but preliminary assessment of fine scale use of the survey area during the dredging campaign by harbour porpoise.

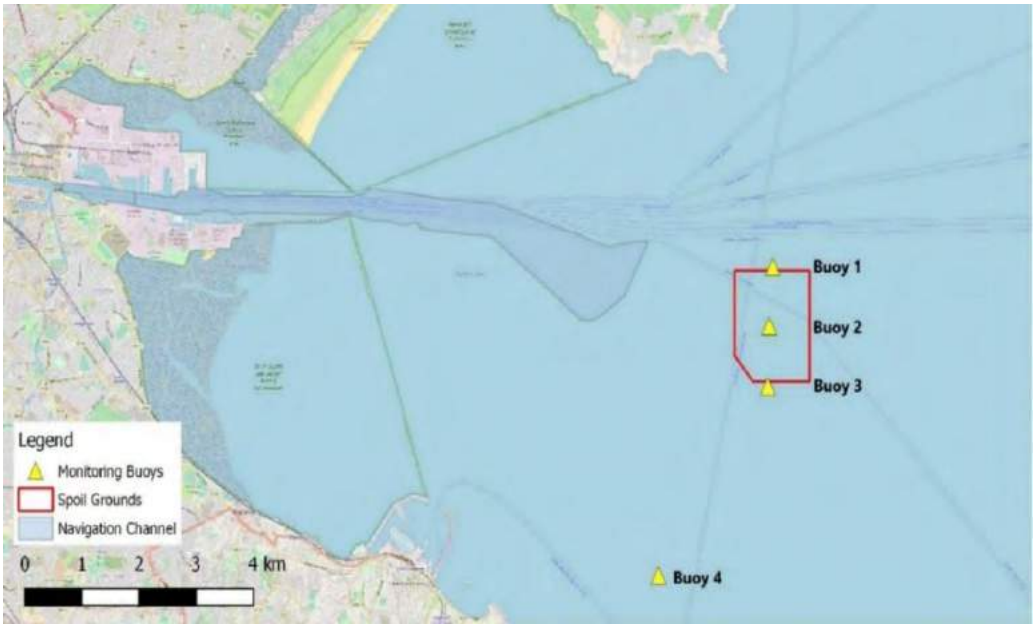


Figure 7-23 Monitoring buoy positions within the spoil grounds and Dublin Bay (Buoy 1: North Spoil Ground, PAM & SAM, Buoy 2: Middle Spoil Ground, PAM & SAM, Buoy 3: South Spoil Ground SAM and Buoy 4: Control off Dalkey, SAM)

ABR1: May 2017-April 2018

The sampling period varied between 140 and 259 days at each location. Harbour porpoise were the most frequently detected odontocete species, with few confirmed dolphin detections during this deployment and were present on average 97-100% of days monitored. The highest detections were at Buoy 1, with around one-half of these detections at the other sites but early retrieval of the C-POD on Buoy 3 and the loss of the C-POD from Buoy 4, resulted a lower number of monitoring days at these sites. (Table 7-16).

Modelling showed presence was highest during autumn months at Buoy 3 and during the winter months at Buoys 1 and 2 and during the hours of darkness (incl. dawn and dusk) and a range of tidal cycles and phases (Table 7-17).

Table 7-16 Summary of results of Static Acoustic Monitoring from September 2017 to March 2018

Location	No. of days	Dates	Porpoise	Dolphin	Total	% days detected	Mean DPM/day
North SG	173	Sep 2017-Mar 2018	9,238	262	9,500	99	53.1
Middle SG	173	Sep 2017-Mar 2018	15,919	65	15,984	100	91.4
South SG	140	Sep – Nov 2017 Dec 2017-Mar 2018	6,341	101	6,442	97	44.9
Dalkey	259	Sep 2017-May 2018	13,048	32	13,080	100	50.5

Table 7-17 Significant results from the long-term dataset at each site; Buoy 1 = North SG, Buoy 2 = Middle SG, Buoy 3 = South SG and Buoy 4 = control off Dalkey Island

Significant factors	Buoy 1	Buoy 2	Buoy 3	Buoy 4
Season	Winter	Winter	Autumn	Summer
Diel	Night	Night	Night	Evening
Tidal phase	Neap/Trans	Neap	Trans	Trans
Tidal cycle	High	High	Ebb	Low

ABR2: May 2018-April 2019

Harbour porpoise were present on 98-100% of days between 2018 to 2019, but detection rate was highest at the control site in Dalkey Bay (Table 7-18). Again modelling showed presence was highest during autumn months at Buoy 3 and during the winter months at the other sites and during the hours of darkness (incl. dawn and dusk) and a range of tidal cycles and phases (Table 7-19).

Table 7-18 Summary of results of Static Acoustic Monitoring from July 2018 – April 2019

Location	No. of days	Dates	Porpoise	Dolphin	Total	% days detected	Mean DPM/day
North SG	283	July 2018 – April 2019	15,139	972	16,111	100	57
Middle SG	212	July 2018 – April 2019	13,267	25	13,292	100	63
South SG	268	July 2018 – April 2019	10,483	216	10,699	98	40
Dalkey	276	July 2018 – April 2019	26,756	43	26,799	100	97

Table 7-19 Significant results from the long-term dataset at each site; Buoy 1=North SG, Buoy 2=Middle SG, Buoy 3= South SG and Buoy 4=control off Dalkey (*no significance)

Significant factors	Buoy 1	Buoy 2	Buoy 3	Buoy 4
Season	Winter	Winter	Autumn	Winter
Diel	Night	Night	*	Evening
Tidal phase	Neap/Trans	Spring	Neap	Spring/Trans
Tidal cycle	High	E&H	Ebb	High

ABR3: April 2019-April 2020

During the 369-day sampling period between May 2019 and April 2020, harbour porpoise were detected on between 77 and 100% of days at all monitoring sites; the lowest 77% at the control site in Dalkey Bay (Table 7-20). During the last deployment at Buoy 2 (middle SG), the C-POD was missing during servicing in April 2020. The highest detections were at Buoy 1, the north site off the SG.

Table 7-20 Summary of SAM results from April 2019 – April 2020

Location	No. of days	Dates	Porpoise	Dolphin	Total	% days detected	Mean DPM/day
North SG	353	April 2019 – April 2020	26,228	4,543	30,771	99	74.3
Middle SG	184	April 2019 – April 2020	12,153	679	12,832	100	66
South SG	369	April 2019 – April 2020	20,561	1,479	22,040	99	55.7
Dalkey	331	April 2019 – April 2020	21,504	94	21,598	77	65

Modelling showed presence was highest during autumn months at Buoy 4 and during the winter months at all other buoys and during the hours of darkness (incl. dawn and dusk) and a range of tidal cycles (Table 7-21).

Table 7-21 Significant results from the long-term dataset at each site; Buoy 1=North SG, Buoy 2=Middle SG, Buoy 3= South SG and Buoy 4=control off Dalkey (*no significance)

Significant factors	Buoy 1	Buoy 2	Buoy 3	Buoy 4
Season	Winter	Winter	Winter	Autumn
Diel	Night	M, E, N	Night	Evening
Tidal phase	*	*	*	*
Tidal cycle	Flood	High	High	*

There was a clear increase in detections during the winter months while dredging operations were ongoing (Figure 7-24). This was consistent across dredging campaigns. What has lead to this increase in detections is unclear, whether it's due to increased foraging opportunities or difficulties in navigation but there does not appear to be any displacement from the spoil grounds during disposal of dredged spoil.

The results from this visual and acoustic monitoring show that harbour porpoise do not use the immediate port area and are rarely recorded inside the harbour. Thus harbour porpoise in Dublin Bay will only be affected by dumping of spoil and associated shipping and not to dredging activity inside the harbour.

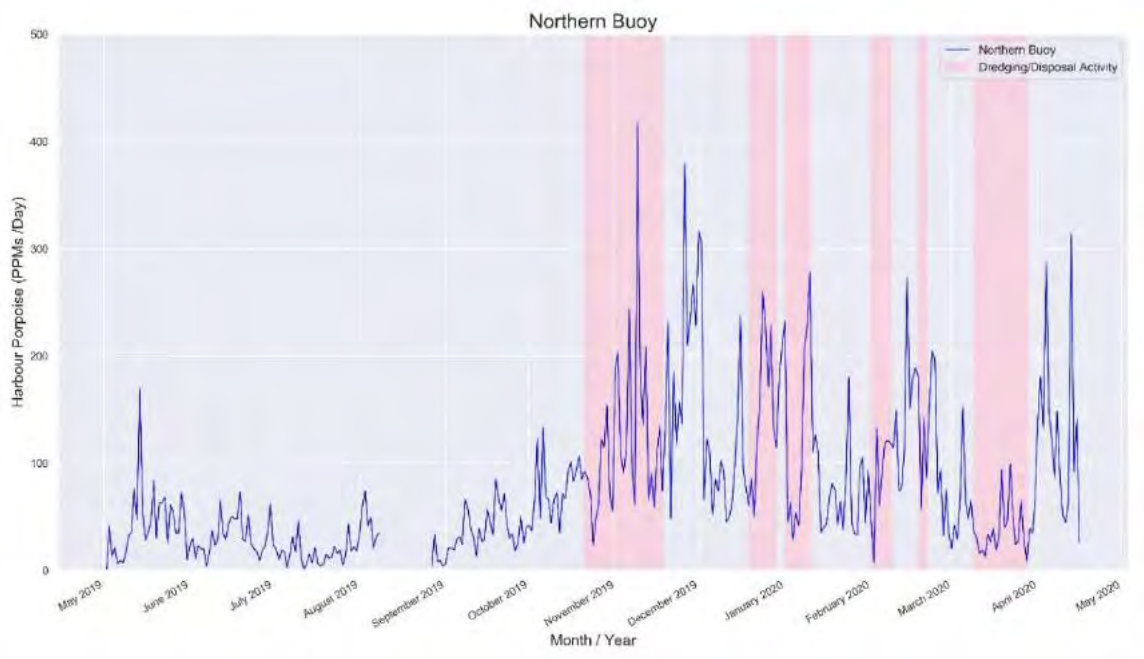
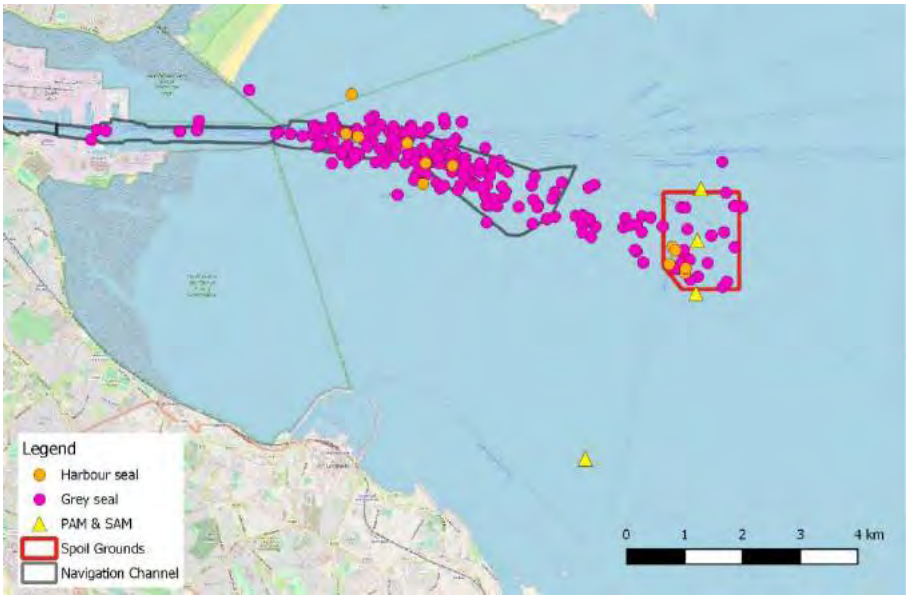


Figure 7-24 Number of harbour porpoise and dolphin species detections per day recorded at site to the north of the spoil grounds with the red transparency columns indicating the dates of the capital dredging campaigns (2019-2020)

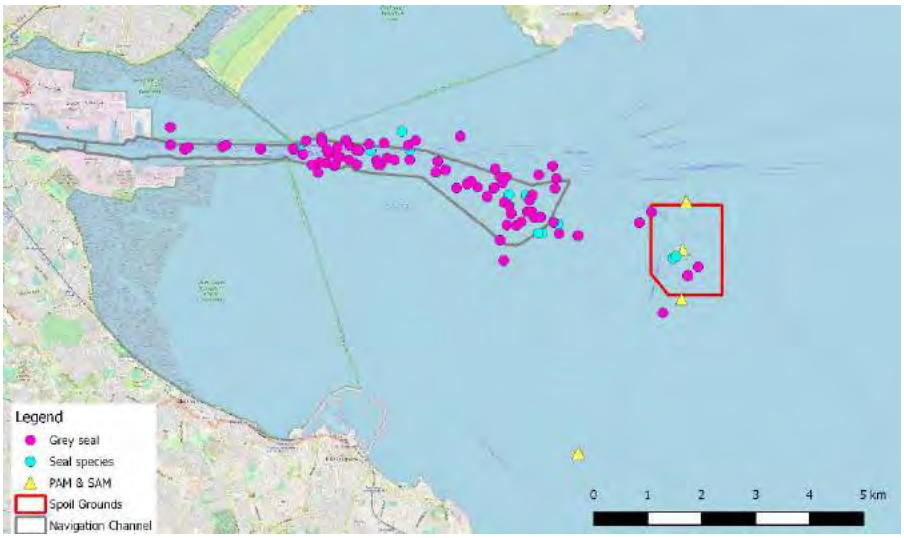
Seals

Between 1997 and 1998, Kiely *et al.* (2000) identified six islands off North Dublin as Grey seal haul out or breeding sites. Lambay Island and St Patricks Island, Skerries were the most important sites for immature and adult seals while Colt and Shenick Islands off Skerries the least important with around 1.5 seals on average. Rockabill and Ireland's Eye both held around nine seals on average. The distribution of seals was found to vary significantly with season, though were present throughout the year. Cronin et al. (2004) also recorded 16 Grey seals in Dublin Bay in 2003 and 131 between the Baily lighthouse and Knocknagin and a further 64 were recorded on Lambay Island. In 2005, two Grey seal pups were recorded on St Patricks Island off Skerries, three on Islands Eye and 2 on Dalkey Island with a further 49 pups on Lambay Island (O'Cadhla *et al*. 2007). Further surveys conducted in 2009 recorded 58 pups on Lambay Island and Ireland's Eye resulting in a minimum pup production of 77 pups between 2009-2012, which provides an all age population size of between 270-347 individuals (O'Cadhla *et al*. 2013).

a)



b)



c)

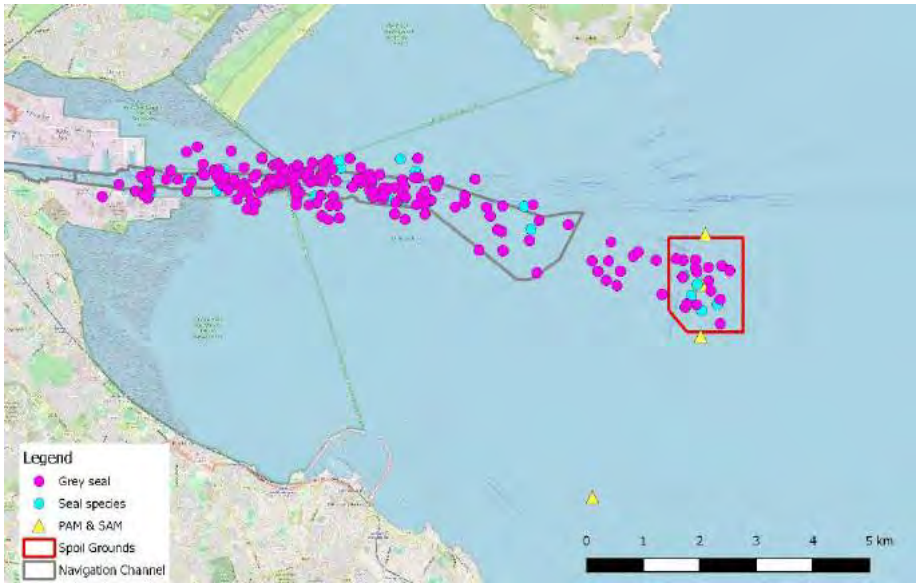


Figure 7-25 Seal sightings during a) 2017-2018, b) 2018-2019 and c) 2019-2020 Capital Dredging Campaigns

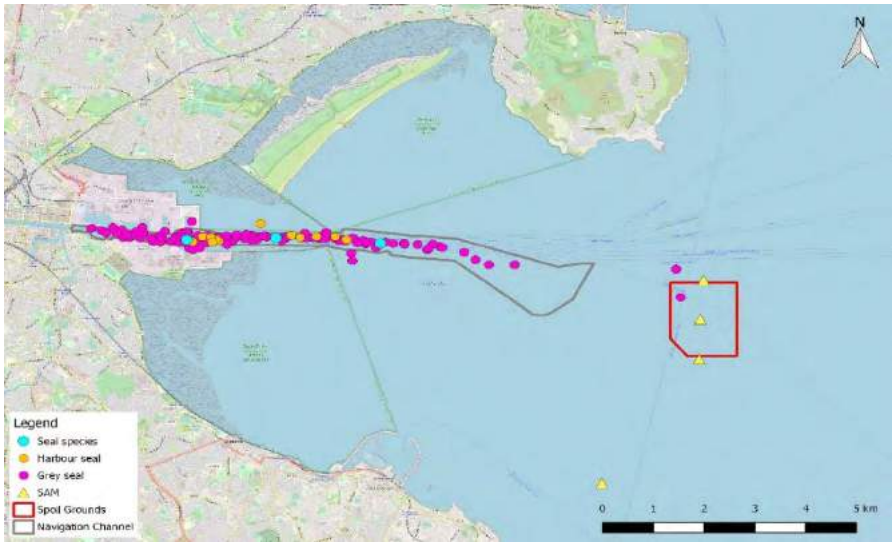
Only 3 Common seals were observed between the Baily lighthouse, on the north side of Dublin Bay and Knocknagin, Co Meath during a national aerial census in 2003 (Cronin *et al*. 2004) and six in Dublin Bay in 2012 (Duck and Morris 2013). The same surveys recorded 31 and 23 Common seals on Lambay Island. During thermal imaging surveys of seals carried out between 2017 and 2018, 335 Grey seals and 70 Common seals were reported in Area 2 of the East Region (from Skerries to Dalkey Island) (Morris and Duck 2019), which was an increase of around 2 – 2.3 times the number reported in 2011/12 and 1.6-2.1 times the number reported in 2003.

The ecology and foraging behaviour of Common and Grey seals off Dublin is not known though it is known seals on the east coast range widely. Kiely *et al*. (2000) carried out some photo-identification of Grey seals between Skerries and Ireland's Eye and showed individual seals did show a degree of site faithfulness but some individuals were recorded moving between these sites and sites off southwest Wales. The first satellite telemetry of a seal in Ireland was carried out by the Irish Seal Sanctuary, which tracked a young Grey seal post-release from Co Dublin to Co Wexford, and then north to County Down over a period of 20 days. Common seals off southwest Ireland are considered opportunistic, generalist feeders, and probably consume prey in relation to its availability. Eighteen prey species were identified, with sandeels constituting 55% of the prey items by number. Sole, sandeels and *Trisopterus* species were found to be the most important species by weight (Kavanagh et al. 2007).

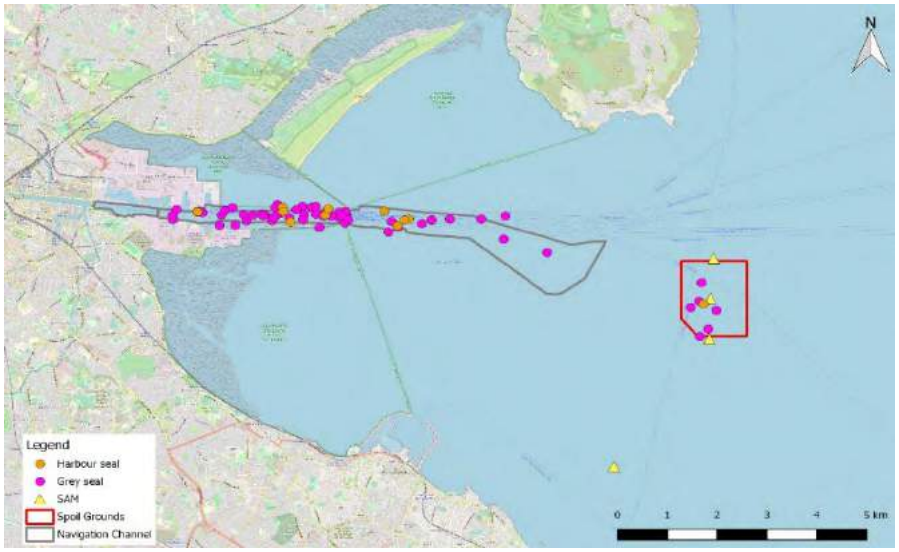
There were 209 sightings (70% of total marine mammal sightings) of Grey seals during the first season of the ABR Project capital dredging campaign (2017-2018) with only 12 sightings (4%) of common seal (Figure 7-25a). Grey seals were observed within, and at the mouth of, Dublin Harbour, with sightings decreasing further east and on the spoil ground. Common seal followed a similar distribution, but with more sightings at the spoil ground. A similar pattern is apparent during the 2018-19 and 2019-20 capital dredging campaigns (Figure 7-25b and Figure 7-25c).

There were 143 sightings (76% of total marine mammal sightings) of Grey seals during the September 2017 maintenance dredging campaign with 12 sightings (6%) of Common seals (Figure 7-26a), 65 sightings (58% of total marine mammal sightings) of Grey seals during the April 2018 maintenance dredging with 11 sightings (10%) of Common seal (Figure 7-26b) and 16 sightings (23%) of Grey seals and 8 sightings (11%) of Common seals during September 2020 with 9 (13%) sightings of seals not identified to species level (Figure 7-26c).

a)



b)



c)

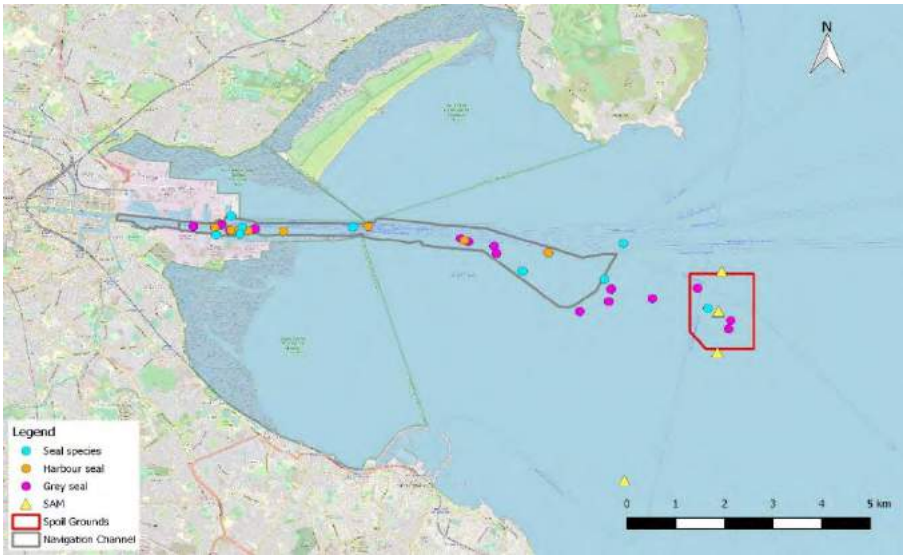


Figure 7-26 Seal Sightings during a) September 2017, b) April 2018 and c) September 2020 Maintenance Dredging Campaigns

These data suggests that seals will be exposed to both dredging and disposal operations as they occur throughout the harbour, navigation channel and on the spoil grounds.

Seals using Bull Island as a haul out site

Bull Island was surveyed for the presence of hauled out seals each month under the ABR Project Marine Mammal Monitoring Programme from May 2016 and May 2020. Grey seals were recorded hauled out between May and November each year with highest numbers (17-23) recorded in June and July (Figure 7-27).

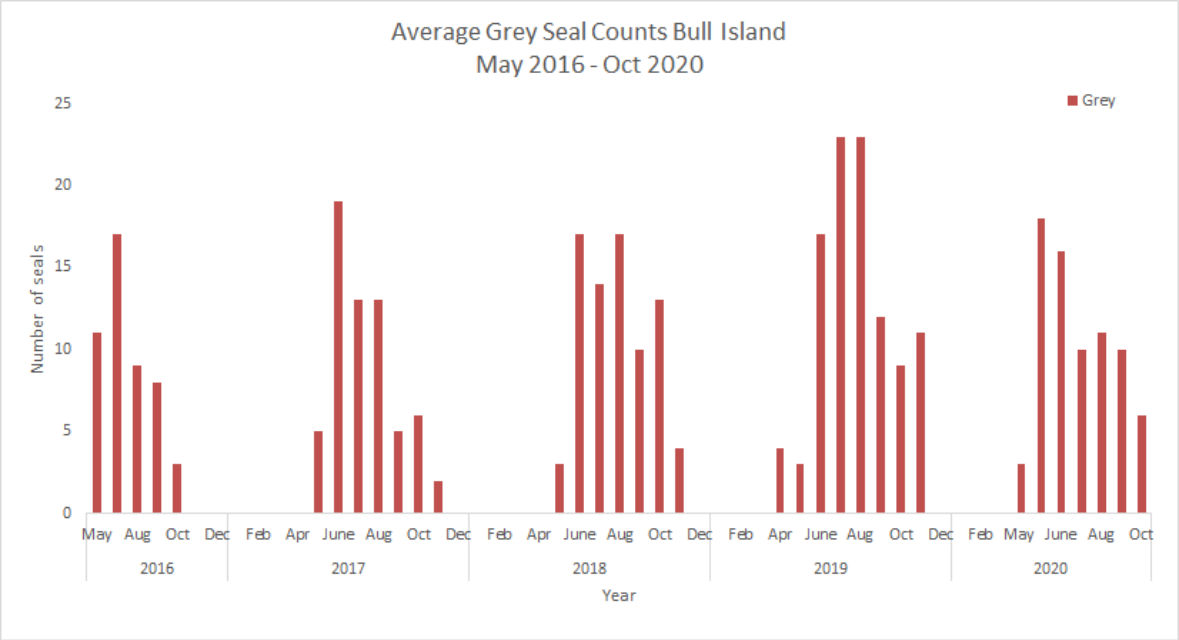


Figure 7-27 Numbers of Grey seals hauled out on Bull Island between May 2016 and October 2020

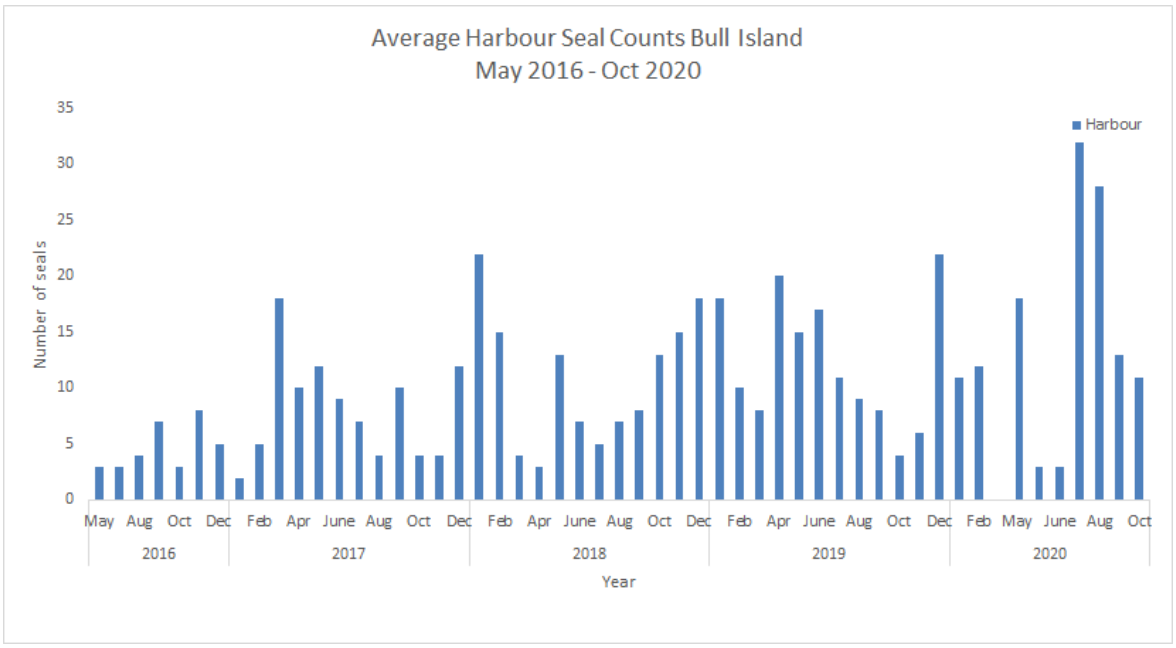


Figure 7-28 Numbers of Common (Harbour) seals hauled out on Bull Island between May 2016 and October 2020

Grey seal abundance peaks from June to August, with low numbers from September to November and no seals present in December, which coincides with their breeding and moulting seasons. Grey seals may move to Lambay Island or Ireland's Eye to breed, which are known breeding sites.

Common seals were present year around on North Bull Island (Figure 7-28). Common seals were present year around on North Bull Island but numbers fluctuate. There is a seasonal affect with numbers declining in the summer months and peaking in winter months. The Common seal breeding season occurs from approximately May to June and their annual moult occurs in August to September when they would spend a significant time resting on land at Ireland's Eye and Lambay Island.

These results are consistent with that reported by Cooney and Dunne (2020) who also showed that birthing by Common seals took place on Bull Island and that site fidelity with photographic evidence of the same individual Common seals at the site over a two year period.

7.2.3 Likelihood of Impacts

The Dublin Harbour Capital Dredging Project will require the dredging and disposal of 500,000m^3 over the life of the project (2022 – 2029). Capital dredging will take place between October and March.

7.2.3.1 Direct Impacts

The main potential impacts of capital dredging on harbour porpoise will be disturbance during dumping of dredged spoil at the proposed disposal site. The disposal site is situated within the Rockabill to Dalkey Island SAC which includes Harbour porpoise as a qualifying interest. The likelihood of impacts on Harbour porpoise without mitigation is moderate. However, with the implementation of mitigation measures (as set out in Section 7.2.5), there are no residual impacts predicted.

The main impact of capital dredging on seals will be exposure to potential disturbance during dredging within Dublin Harbour and dumping of dredged spoil at the proposed disposal site. The likelihood of impacts on seals without mitigation is moderate. However, with the implementation of mitigation measures (as set out in Section 7.2.5), there are no residual impacts predicted.

7.2.3.2 Indirect impacts

There are no predicted indirect impacts on marine mammals or their preferred prey species through dredging and dumping. Seal haul out sites are used during breeding, moulting, resting between foraging trips in the open sea, and to engage in social activity (Bonner 1990). Bull Island provides an important haul-out site for Grey and Commom seals and they often haul-out on man-made structures. The likelihood of indirect impacts of disturbance on seals at Bull Island from activities in Dublin Port is very low. No long-term impacts on fish distribution or abundance is predicted (See Section 7.1), thus the likelihood of indirect impacts on prey abundance and distribution is low.

7.2.4 Description of Likely Significant Impacts

7.2.4.1 Predicted Direct impacts on Marine Mammals

Potentially, direct impacts on marine mammals may occur during dredging and dumping. Potential direct impacts on harbour porpoise from dumping may arise if are very close to the dredger during dumping of sediment at the spoil ground leading to injury. Potential direct impacts on seals from dredging and dumping may arise if are very close to the dredger during the start of dredging or during dumping of sediment at the spoil ground leading to injury. Trailing Suction Hopper Dredgers produce broadband sound between 20-1000 Hz and

the highest levels occur during loading. Evans (2000) suggested dredging activities produce sounds varying from 172-185 db re 1 µPa at 1 metre over the broadband range 45 Hz to 7 kHz. Even without the implementation of the recommended mitigation measures, the likelihood of impacts is extremely low and the impact of any such is low. The impact of dredging noise is not regarded as likely to have a significant effect while proposed mitigation, through the implementation of NPWS (2014) Guidelines and appropriate Mitigation Zone will reduce this potential impact further.

7.2.4.2 Predicted Indirect impacts during dredging

Dredging has been shown to displace bottlenose dolphins from a busy shipping port in Scotland over a prolonged dredging campaign (Pirotta *et al*. 2013). Diederichs *et al*. (2010), through the use of acoustic monitoring with click detectors, showed that Harbour porpoises temporarily avoided an area where sand extraction took place off the Island of Sylt, Germany. However, a recent guidance document by the World Organisation of Dredging Associations (WODA 2013) suggested that sound produced from dredging has the potential to impact on aquatic life and it is assumed that most of these impacts would concern disruption of communication due to masking or alteration of behaviour patterns. However, cumulative and long-term exposure leading to Temporary Threshold Shift has to be considered for marine mammals (Kastelein et al. 2012), but Permanent Threshold Shift or other auditory injuries are unlikely.

The capital dredging and disposal operations will span at least eight winter seasons, between 2022 and 2029, with no more than 500,000m^3 of spoil being disposed of in total.

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

Noise measurements were taken during maintenance dredging in July 2016 to determine the acoustic noise generated during the dredging and dumping operations (RPS 2016). Underwater noise measurements were carried out using an underwater noise recorder, moored less than 300 m from the dredging activity and approximately 90 m from the dumping activity. Tonal components between 200 Hz and 2 kHz were attributed to the pump with dredging generating more higher-frequency noise than the dumping operation but both showed a significant drop in energy at frequencies above 2 kHz. The 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. The sound level for the dumping operation at a range of 90m was very slightly above the disturbance threshold for harbour porpoise, but this level was still below the general behavioural threshold for marine mammals of 160 dB re 1 µPa SPLRMS adopted by NOAA. This study confirms that noise emitted from dredging operations does not significantly impact Harbour porpoise at ranges of 213m, but the noise emitted from dumping operations may impact Harbour porpoise at close ranges of less than 100 m. The likelihood of this is low and the impact negligible. Proposed mitigation, through the implementation of NPWS (2014) Guidelines and appropriate Mitigation Zone will reduce this potential impact further.

The sound levels for the dredging operations at ranges of 213m and 268m were below the disturbance threshold for seals at 160 dB re 1 µPa. The sound level for the dumping operation was below the general behavioural threshold for marine mammals of 160 dB re 1 µPa SPLRMS adopted by NOAA. This study confirms that noise emitted from dredging operations does not significantly impact marine mammals at ranges of 213m. The likelihood of this is low and the impact negligible. The proposed mitigation, through the implementation of NPWS (2014) Guidelines and appropriate Mitigation Zone will reduce this potential impact further.

There will be no impact from the presence of an additional vessel (the TSHD) as this increase in vessel activity occurs in an underwater noise environment which is already subject to significant shipping traffic.

NPWS Assessment Criteria

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

Grey seals are the most frequently observed marine mammal species at the dredge and dump site followed by Harbour porpoise and to a lesser extent harbor seal. Bottlenose dolphins may occasionally occur near the dump site and minke whale in the wider area. There is an important haul out site for grey and harbor seals nearby on Bull Island. All marine mammals are part of a larger population and are very mobile.

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

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

Noise Impact

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

Physical Impact

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

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

No abundance estimates for marine mammals exposed to the proposed activity are available. Abundance estimates are available for grey and harbour seals from a haul out site at Bull Island near to the dredging site. The numbers of grey seals range from 2-19 between May and November and harbour seals from 2-22 and occur throughout the year. Abundance of grey seals at nearby Lambay Island was estimated at 49 pups, with small numbers of pup's present (<3) at Irelands Eye, Dalkey Island and St. Patricks Island during a national census in 2005 (Ó Cadhla et al. 2007). A further Island. Further surveys 77 pups were recorded on Lambay Island and Ireland's Eye in 2009 (Ó Cadhla et al. 2013). Abundance of harbour seals during at nearby Lambay

Island, was estimated at approximately 30 during a national census in 2003 (Cronin et al. 2004) and 2012 (Duck and Morris, 2012).

Monitoring of Bull Island haul out site consistent records peak counts of 20-25 grey seal and a similar number of harbour seals but peaking at different times of year.

Harbour porpoise density and abundance estimates are available from the Rockabill to Dalkey Island SAC and range from 1.44 to 1.62 porpoises km-1 during dedicated surveys between 2013 and 2016 (O'Brien and Berrow, 2016). Berrow et al. (2014) calculated a density estimate of 1.19 porpoise km-1 in the summer of 2008. These equate to abundance estimates of between 391 and 424 in Rockabill to Dalkey Island SAC and 138 in Dublin Bay. Monitoring during the ABR Project suggest some 10's of seals occur within Dublin Port and between Dublin and the disposal site. Observations from MMOs during monitoring suggest harbor porpoise abundance would be similar.

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

The proposed works are recommended to be carried out between October and March. This avoids the Common seal pupping period but coincides with Grey seal pupping and breeding season. As Grey seals are only known to pup at Lambay Island which is >15km from the dredging and dump site it is unlikely to have any effect as Grey seal pups remain close to shore and females forage close to pupping sites during this period. Harbour porpoise occur throughout the year at the site and there is no evidence the period October to March is a sensitive period for this species.

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

There are no data to suggest that any particular gender or age group for seals or cetaceans predominates in the area. As breeding and haul out sites for seals occur in the broader area of the dredging and dumping site it is likely all age groups and both gender occur. Similarly for harbour porpoise both adults and juveniles have been recorded at the site and adults with calves during summer months.

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

As harbour porpoise and seals (especially grey seals) frequently and regularly occur at both the dredging and dump sites and in the broader adjacent areas, there may be temporary disturbance to individuals. However, they are accommodated to human activities and are likely to not be affected, indeed there is some evidence dredging and dumping may provide foraging opportunities for both seals and harbour porpoise.

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

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

7.2.5 Mitigation Measures

7.2.5.1 Harbour Porpoise

The likelihood of impacts without mitigation are low and the effects also low. However, mitigation is recommended, in line with best practice and long term acoustic monitoring. Proposed mitigation, through the implementation of NPWS (2014) Guidelines and appropriate Mitigation Zone will reduce this potential impact further.

The following precautionary measures will be undertaken to minimise the risk of injury or disturbance to marine mammals in the area of operations in line with National Parks and Wildlife Service (NPWS) Guidelines (2014)

- A trained and experienced Marine Mammal Observer (MMO) will be put in place during dredging and dumping operations. The MMO will scan the surrounding area to ensure no marine mammals are in a pre-determined exclusion zone in the 30-minute period prior to operations. The NPWS exclusion zone is 500m for dredging activities.
- Noise-producing activities will only commence in daylight hours where effective visual monitoring, as performed and determined by the MMO, has been achieved. Where effective visual monitoring is not possible, the sound-producing activities will be postponed until effective visual monitoring is possible. Visual scanning for marine mammals (in particular Harbour porpoise) will only be effective during daylight hours and if the sea state is WMO Sea State 4 (≈Beaufort Force 4 conditions) or less.
- If there is a break in dredging activity for a period greater than 30 minutes then all pre-activity monitoring measures and ramp-up (where this is possible) will recommence as for start-up.
- Once normal operations commence, there is no requirement to halt or discontinue the activity at night-time, nor if weather or visibility conditions deteriorate, nor if marine mammals occur within a radial distance of the sound source that is 500m for dredging activities.
- Any approach by marine mammals into the immediate (<50m) works area will be reported to the National Parks and Wildlife Service.
- The MMO will keep a record of the monitoring using a ‘MMO form location and effort (coastal works)’ available from the National Parks and Wildlife Service (NPWS) and submit to the NPWS on completion of the works.

7.2.5.2 Common and Grey Seals

Proposed mitigation, through the implementation of NPWS (2014) Guidelines and appropriate Mitigation Zone will reduce this potential impact further.

7.2.5.3 Static Acoustic Monitoring

As an additional mitigation measure for Harbour porpoise, a Static Acoustic Monitoring (SAM) programme, first established during the ABR Project, will continue for duration of the Dublin Harbour Capital Dredging Project.

CPODs are self-contained click detectors which log the echolocation clicks of dolphins and porpoises. They can be deployed on a mooring for 3-4 months before recovery and downloading of data. These data can be analysed as detection positive minutes (DPM) to generate an acoustic index of activity. This technique provides large

datasets to enable changes in activity to be identified at high resolutions. CPODs are spatially constrained having detection distances of around 250m for harbour porpoise and 800m for bottlenose dolphins (O'Brien et al. 2013). O'Brien et al. (2013) recommended a minimum of four units should be deployed in small inshore study areas to ensure that statistically robust data can be collected. The number of CPODs required should reflect the parameters or factors to be tested (e.g. fine scale diel or larger scales such as seasonal trends). Using an even number design for replication purposes can allow for parameters such as inshore and offshore trends to be explored in larger areas. The more units that can be deployed in an area, the more an informed evaluation of a site and successful monitoring indices will be generated. Hence we recommend four stations are established for SAM. These stations will be monitored pre-dredging, during dredging and for a minimum of two years post-dredging in line with best international practice.

7.2.5.4 Seal monitoring

Monthly counts of seals hauled out on Bull Island will be undertaken to ensure there is no long-term impact of capital dredging activities at Dublin Port on this important haul out site and to contribute to increasing knowledge of seals using this UNESCO World Heritage site.

7.2.6 Residual Impacts

There are no residual impacts predicted in circumstances where the mitigation measures outlined above are implemented effectively.

7.2.7 Potential Cumulative Impacts

The projects that will potentially have cumulative impacts on marine mammals in conjunction with the Dublin Harbour Capital Dredging Project are as follows:

DPC Maintenance Dredging (2022-2029)

This falls into the category of regular port management in that it secures navigable depths within the shipping channel, basins and berths of Dublin Port and is repeated as required on a regular basis to allow the port to operate efficiently and safely. This campaign will see a total of up to 2.4million m^3 of sediment, mainly sand and mud, dredged from any part of the port as required and disposed of at the licenced dump site. Consent will have several conditions attached in order to minimise potential environmental impact as follows:

1. The annual maximum which can be dredged is 300,000m^3, all between April and September each year.
2. No dredging will be permitted upstream of Berth 49 between April 1st and May 14th each year in order to minimise potential impacts on outward migrating salmon smolts.
3. No overspill of the TSHD hopper will be allowed within the inner Liffey channel

With respect to timing of dredging there will be no activity overlap between the maintenance dredging project and the proposed capital dredging project as the latter will be undertaken from October to March each year. No cumulative impact will therefore occur.

MP2 Project

The MP2 project will require a total of 424,644m^3 of capital dredging spread between four separate compartments as follows:

- Berth 53 159,595m^3
- Channel Widening 111,995m^3
- Oil Berth 3 83,414 m^3
- Berth 50A 69,640 m^3

The MP2 project will overlap with the 2022-2029 capital dredging as both will see spoil disposal within the October-March window. However, dredging will not run concurrently, i.e., only one dredger will operate at any one time. To put the volumes of spoil into perspective, even if all of the 500,000m^3 of the 2022-2029 capital dredging was disposed of in the same year as the 424,644 m^3 of the MP2 Project it would still be less than a single year of the ABR capital dredging just completed. However, the likelihood is that both projects will be staggered across several years due to considerations related to the associated quayside construction sequencing. Potential cumulative impacts are therefore considered to be *de minimus*.

Overall, the potential cumulative effect as outlined above will not alter any of the conclusions in this EIAR with regard to the predicted residual significance of impacts described. There are no additional, additive, incremental, associated, or connected effects resulting in synergistic impacts above a magnitude already predicted in the EIAR.

7.2.8 Conclusions

Dublin Bay and approaches to the port are important for marine mammals including the regular occurrence of Grey and Common (Harbour) seals and Harbour porpoise. Recent dredging associated with the ABR Project and ongoing maintenance dredging has provided an excellent understanding of the marine mammal community exposed to dredging and dumping and the likely effects. IWDG recommend full implementation of the NPWS Guidelines to minimise the acoustic impacts of dredging to enable the dredging campaign to be carried out which will result in no significant impacts to marine mammals or on the conservation objectives of the Rockabill to Dalkey Island SAC.

7.3 Avian Biodiversity

This section assesses the potential impacts of the proposed Dublin Harbour Capital Dredging Project on birds and their habitats (avian biodiversity).

7.3.1 Assessment Methodology

Wintering Bird Surveys

There is a long history of bird surveys in the area of the proposed Dublin Harbour Capital Dredging Project from the 1990s to present day, and the results of these surveys have been reviewed and relied upon for this project. The Irish Wetland Bird Survey (I-WeBS) has been carried out consistently between 1994/95 and 2019/20 covering the entire intertidal area of Dublin Bay (Crowe 2005, Boland & Crowe 2012). This is normally undertaken on a rising tide but is confined to the months of September to March each year. Data for these surveys in association with the 20 sub-sites was provided to RPS by Birdwatch Ireland. Sub-sites utilised for these surveys, which cover the entirety of Dublin Bay are shown on Figure 7-29.

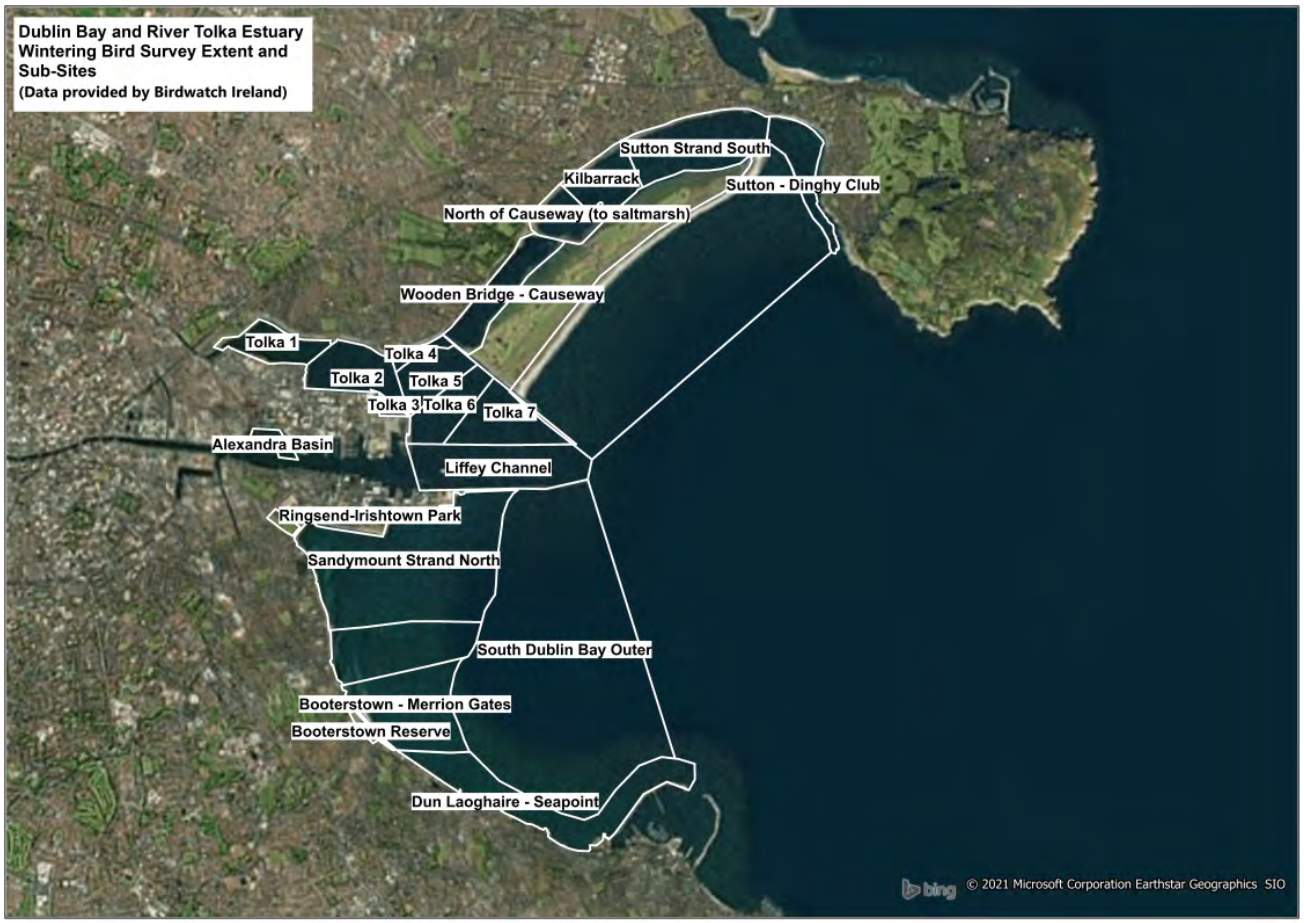


Figure 7-29 Wintering Bird Survey Area and Sub-sites in Dublin Bay and Tolka Estuary during the period 2013 to 2020

Non-breeding Waterbird Surveys

Additional surveys of this area have been undertaken at low tide during all months between July 2013 and March 2019 as part of the Dublin Bay Birds Project which is funded by Dublin Port Company. A series of surveys of all waterbirds in the Tolka Estuary was undertaken within two hours either side of low tide as part of the Dublin Bay Birds Project. Birds were counted and mapped in their foraging areas from a series of vantage points

on the northern, eastern and southern shorelines of the estuary (locations shown at Figure 7-30). Additional surveys, to ensure complete coverage of intertidal areas within the estuary, were undertaken on eight dates in 2018 and 2019. These surveys were undertaken in order to support the previously permitted MP2 Project. These dates were selected in advance as some intertidal substrate may be exposed in the area within 200m of Berth 53 when the tide falls below the 0.25m OD level. At levels in excess of this no intertidal area is exposed. On the lowest spring tides, both a gravel zone and a sandflat area are exposed. Some of the extreme low tides during winter occur in darkness or semi-darkness. For this reason, floodlighting was used to survey the birds foraging on the site on some of the dates.



Figure 7-30 Low tide survey area in the Tolka Estuary during the period 2013 to 2019

Dredging Disturbance surveys

A capital dredging campaign of the navigation channel as part of Alexandra Basin Redevelopment (ABR) Project consented under Dumping at Sea Permit S0024-01 was undertaken in late October 2019. This activity presented an opportunity to capture any disturbance events that might occur when the permitted dredging activity was taking place in proximity to a waterbird roost at the cooling water outfall from ESB's Poolbeg Power Station located at the base of the Great South Wall in the Liffey Channel, where a small area of mudflat is exposed at low-tide (refer Figure 7-31).

In order to assess potential disturbance events caused by the presence of the dredging vessel, suitable vantage points overseeing the outfall and surrounding lands were established.

The dredging vessel, *Freeway*, was a 92m long Trailing Suction Hopper Dredger. During monitoring the dredger slowly passed by the survey area at the inner limit of the dredging area, approximately 200m from shore, or approximately 150m from the low water mark. During operation, the dredger was passing the survey area for 10-15 minutes.

A vantage point (VP), located on the southern bank of the Liffey, on the quayside adjacent to Poolbeg Tank Farm was chosen. Due to restrictions on access over a bank holiday weekend, a second vantage point was

required. The second VP was located on reclaimed land adjacent to Terminal 5 on the northern bank of the Liffey.

Vantage point watches were conducted within a window, +/- 2.5 hours either side of low water on days where day light permitted. Observers recorded all disturbance events during surveys, including potential disturbance events, noting the species and numbers present and their reaction to the disturbance event.

In order to provide a series of control observations, surveys were conducted over several days prior to the dredger moving into the area, as well as during dredging activities and after dredging activities had ceased.



Figure 7-31 Roost and Vantage Point survey locations for Dredging Disturbance surveys

Breeding tern surveys

From 2013 to 2019 monitoring of Common Terns and Arctic Terns nesting within Dublin Port has been carried out by BirdWatch Ireland as part of the Dublin Bay Birds Project which is funded by Dublin Port Company. The monitoring involved a census of Apparently Occupied Nests (AON) on each of these structures following the methods of Mitchell *et al.* (2004) and BirdWatch Ireland carried out additional studies on the tern colony including ringing and productivity estimates. On two separate dates each year, two surveyors undertook walked transects through each subsite of the colony recording the number of egg clutches of each species present. One clutch of eggs is treated as one Apparently Occupied Nest (AON). Monitoring was carried out under licence in compliance with the Wildlife Acts 1976 to 2012 (Sections 9 and 22(9)(d)).

The survey each year was timed to coincide with the peak of incubation activity when the maximum number of nests and incubating adults were present for AON counts and when adult attendance is most stable. All visits to the nesting structures were made by means of a rigid inflatable boat. Visits were made only in fair weather, as disturbing the colony on cold or wet days would be harmful to chicks and eggs. Time spent on each colony

was kept to an absolute minimum, to minimise disturbance and to ensure that eggs and small chicks were not chilled on cool days or overheated on warm days. Locations of the subsites are shown at Figure 7-36.

Breeding Black Guillemot surveys

The population of Black Guillemots nesting within Dublin Port has been censused consistently from 2013 to 2019 following the methods of Mitchell *et al.* (2004). Additional guidance was obtained from Greenwood (2015) and Walsh *et al.* (1995). Two census visits were made on in late April and early May each year in winds no stronger than Beaufort force 4 and in calm sea conditions. Each census was conducted from a boat which passed close to all quaysides and shipping berths within the working port area.

The section of the River Liffey from East Link Bridge to Matt Talbot Bridge was censused from the land with viewing from both north and south quays (Figure 7-35). The count unit used was the number of adult Black Guillemots visible on land or on the sea within 300m of the shore. Any Apparently Occupied Sites (AOS) were mapped and Black Guillemots associated with such sites were recorded separately.

7.3.2 Receiving Environment

Protected Areas

The location of the proposed Dublin Harbour Capital Dredging Project lies adjacent to the boundary of the South Dublin Bay and River Tolka Estuary SPA and 1,445m southwest of the nearest boundary of the North Bull Island SPA (see Figure 7-32). The proposed project will involve dredging works within 25m of the SPA, however the majority of proposed dredging locations lie at greater distances from the SPA.

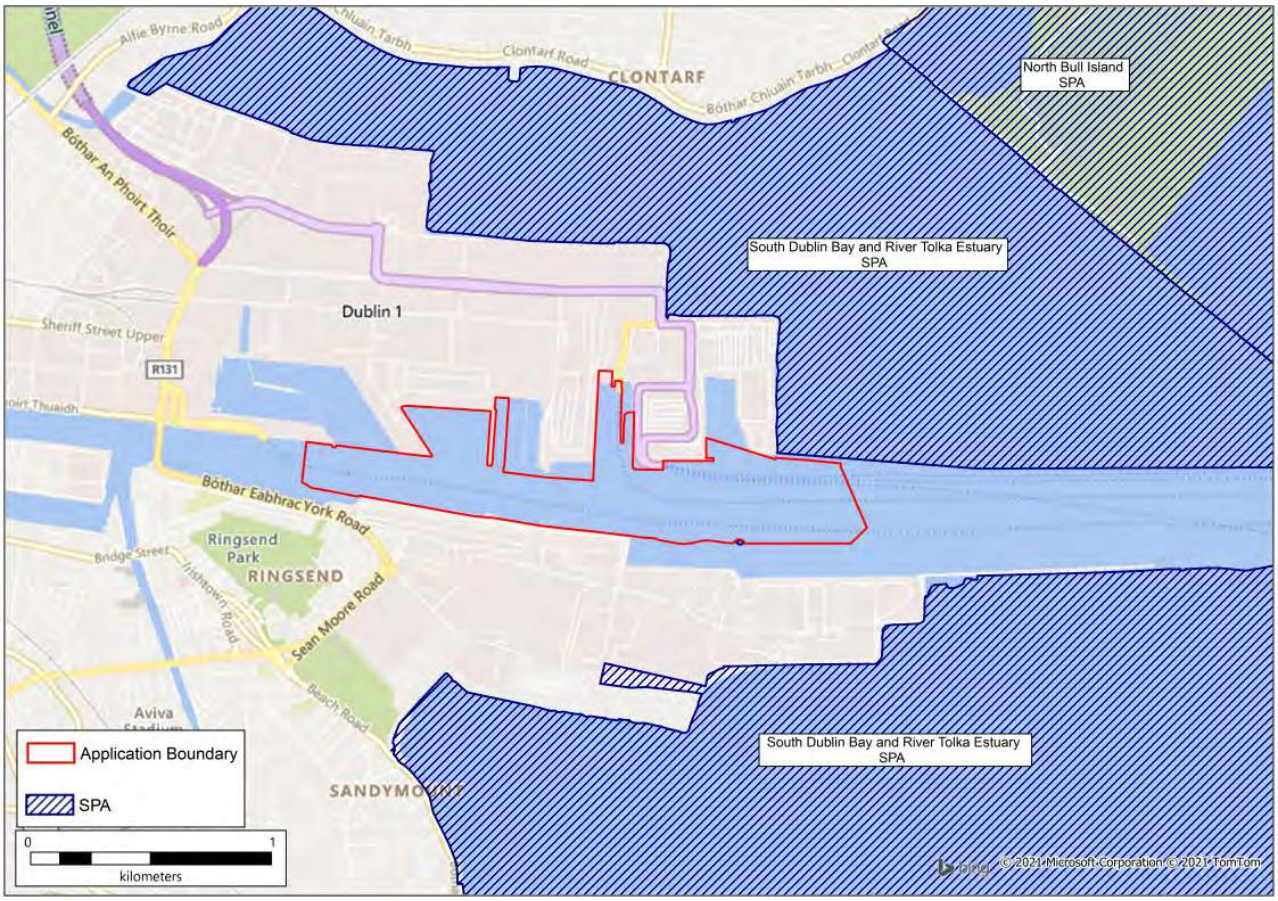


Figure 7-32 Location of Proposed Project in relation to Special Protection Areas

Wintering Birds

South Dublin Bay, Bull Island and the River Tolka Estuary support large numbers of wintering waders and waterfowl, which form the Special Conservation Interests of both the South Dublin Bay and River Tolka Estuary SPA and the North Bull Island SPA. Data provided to RPS by Birdwatch Ireland for the various sub-sites subject to survey in the winter of 2019 to 2020 has been used to establish the current ornithological baseline in the relevant areas likely to be affected by the proposed capital dredging project.

The total recorded numbers of waterbirds recorded wintering across the sub-sites are set out below in Table 7-22. In total the subsites were recorded to support a total of 22,381 birds in the winter period 2019-2020 (adding peak counts). When black-headed gull is discounted the total was 12,599 birds across this period.

Table 7-22 iWEBS species totals for the Dublin Bay and River Tolka Estuary across the winter 2019-2020. (Qualifying interests of the SPAs in Dublin Bay are indicated by an asterisk (*))

Species	Oct	Nov	Dec	Jan	Feb	Mar	Peak 2019/20	Peak 2018/19	Peak 2017/18
Bar-tailed Godwit* (BA)	633	498	1606	749	1725	331	1725	1175	1538
Black-headed Gull* (BH)	1956	845	1940	9782	3625	1254	9782	2898	4467
Black-tailed Godwit* (BW)	1015	38	843	586	142	966	1015	798	349
Cormorant (CA)	77	22	10	22	7	17	77	52	75
Common Gull (CM)	96	25	40	357	65	416	416	590	235
Common Tern (CN)	0	0	0	0	0	0	0	7	0
Curlew* (CU)	223	24	73	273	194	211	273	297	480
Common Scoter (CX)	49	0	32	16	15	0	49	43	275
Dunlin* (DN)	377	369	1766	3338	2942	312	3338	5006	4400
Little Egret (ET)	16	7	2	3	2	4	16	5	15
Great Black-backed Gull (GB)	17	29	13	9	17	20	29	49	52
Great Crested Grebe (GG)	238	9	23	154	59	61	238	172	291
Greenshank (GK)	11	6	6	5	10	4	11	11	14
Goldeneye (GN)	0	0	1	5	2	1	5	7	0
Golden Plover* (GP)	3	0	0	18	0	0	18	1233	4300
Guillemot (GU)	24	0	9	1	1	34	34	36	58
Grey Plover* (GV)	36	3	12	31	4	0	36	23	56
Gannet (GX)	0	0	0	0	0	1	1		
Grey Heron (H.)	34	7	12	7	1	9	34	32	91
Herring Gull (HG)	614	237	439	1965	696	1887	1965	1671	2192
Knot* (KN)	1341	833	1393	2260	3256	2768	3256	3873	4680
Lapwing (L.)	3	0	0	0	0	0	3	0	0
Lesser Black-backed Gull (LB)	2	0	0	0	0	15	15	5	16
Mallard (MA)	0	18	0	0	0	0	18	3	4
Moorhen (MH)	0	0	1	2	2	2	2	2	2
Mute Swan (MS)	1	0	0	0	3	4	4	1	6
Mediterranean Gull (MU)	1	0	0	1	1	0	1	3	47
Great Northern Diver (ND)	1	0	1	1	0	0	1	0	0
Oystercatcher* (OC)	1179	1707	1252	1225	928	612	1707	1872	1821

Species	Oct	Nov	Dec	Jan	Feb	Mar	Peak 2019/20	Peak 2018/19	Peak 2017/18
Light-bellied Brent Goose* (PB)	173	74	727	415	921	739	921	481	2069
Purple Sandpiper (PS)	0	0	0	0	0	0	0	9	1
Razorbill (RA)	0	0	0	0	0	5	5	8	0
Red-throated Diver (RH)	9	0	0	1	1	1	9	5	7
Redshank* (RK)	990	589	226	603	327	825	990	743	699
Red-breasted Merganser (RM)	19	11	18	42	26	63	63	29	24
Ringed Plover* (RP)	56	8	36	16	62	0	62	38	24
Shag (SA)	13	0	9	11	0	0	13	10	9
Snipe (SN)	0	0	5	3	0	0	5	19	52
Sanderling* (SS)	43	101	8	215	101	62	215	208	205
Shelduck* (SU)	2	0	10	44	9	39	44	59	100
Teal* (T.)	48	13	32	110	39	75	110	147	120
Sandwich Tern (TE)	0	0	0	0	0	0	0	32	31
Turnstone* (TT)	109	19	69	83	37	56	109	53	62
Black Guillemot (TY)	4	0	0	2	5	14	14	15	57
Wigeon (WN)	1	0	0	26	19	44	44	38	31
Totals	**9414**	**5492**	**10614**	**22381**	**15244**	**10852**	**22381**	**15469**	**18790**

The findings of wintering bird monitoring surveys undertaken of Dublin Bay and River Tolka Estuary clearly indicate the relative importance of the surveyed areas for wintering waterfowl. It is noted however that the proposed capital dredging works will take place within a small sub-set of the surveyed sub-sites. Dredging work will take place within the Alexandra Basin and Liffey Channel sub-sites, with the dumping to take place offshore and outside of the surveyed areas with vessels travelling via the Liffey Channel sub-site to access the dump site location. The findings of the wintering bird survey 2016/17 to 2019/20 for the Alexandra Basin and Liffey Channel sub-sites are set out at Table 7-23.

Table 7-23 iWEBS Wintering Bird Survey Results for the Alexandra Basin and Liffey Channel Sub-sites 2016/17-2019/20 (Qualifying interests of the SPAs in Dublin Bay are indicated*)

Sub-site	Species	Month in which 2019/20 peak count was recorded	Peak Count Winter 2019/20 (Month Recorded)	Peak Count Winter 2018/19	Peak Count Winter 2017/18	Peak Count Winter 2016/17
Alexandra Basin	Black Guillemot (TY)	March	11	n/a	n/a	n/a
	Black-headed Gull* (BH)	January	45	130	n/a	48
	Cormorant (CA)	Jan/Mar	1	n/a	n/a	n/a
	Herring Gull (HG)	January	16	30	19	21
	Light-bellied Brent Goose* (PB)	January	28	60	n/a	74
Liffey Channel	Black Guillemot (TY)	Oct/Jan/Feb	2	n/a	n/a	12
	Bar-tailed Godwit* (BA)	n/a	n/a	5	n/a	n/a
	Black-headed Gull* (BH)	January	1163	593	487	275
	Black-tailed Godwit* (BW)	March	14	4	6	n/a
	Common Gull (CM)	October	47	105	59	207
	Cormorant (CA)	October	9	13	9	10

Sub-site	Species	Month in which 2019/20 peak count was recorded	Peak Count Winter 2019/20 (Month Recorded)	Peak Count Winter 2018/19	Peak Count Winter 2017/18	Peak Count Winter 2016/17
	Curlew (CU)	n/a	n/a	n/a	n/a	1
	Eider (E.)	n/a	n/a	1	n/a	
	Great Black-backed Gull (GB)	n/a	n/a	12	8	1
	Great Crested Grebe (GG)	December	7	19	14	13
	Great Northern Diver (ND)	n/a	n/a	n/a	1	n/a
	Grey Heron (H.)	October	1	n/a	n/a	n/a
	Guillemot (GU)	October	5	n/a	5	n/a
	Herring Gull (HG)	March	601	320	43	10
	Kittiwake (KI)	n/a	n/a	n/a	3	1
	Light-bellied Brent Goose* (PB)	n/a	n/a	n/a	n/a	12
	Mediterranean Gull (MU)	October	1	2	n/a	1
	Oystercatcher* (OC)	December	4	1	n/a	2
	Purple Sandpiper (PS)	n/a	n/a	n/a	1	n/a
	Redshank* (RK)	October	1	2	1	2
	Red-breasted Merganser (RM)	n/a	n/a	8	n/a	n/a
	Red-throated Diver (RH)	October	1	n/a	n/a	n/a
	Sanderling* (SS)	January	45	160	49	42
	Shag (SA)	Oct/Jan	2	4	8	2
	Teal* (T.)	January	73	88	35	55
	Turnstone* (TT)	October	10	3	8	7
	Wigeon (WN)	March	12	17	23	18

From the above findings it appears that the Alexandra Basin sub-site supports a relatively limited range of wintering waterbird species in limited numbers. Use of the sub-site by any particular species appears sporadic across the years and this was borne out in the monthly data across the survey seasons in 2019/20. Several species do appear to utilise this sub-site on a consistent basis, those being black-headed gull, herring gull and light-bellied brent goose, of these both black-headed gull and light-bellied brent goose represent special conservation interest species of the nearby South Dublin Bay and River Tolka Estuary SPA and North Bull Island SPA.

The Liffey Channel sub-site supports a greater range of species at higher numbers with consistent use by relatively large numbers of black-headed gull, common gull, herring gull, sanderling and teal, in addition to lower numbers of black-tailed godwit, cormorant, great crested grebe, redshank, shag, turnstone and wigeon and sporadic use by other species.

The Alexandra Basin and Liffey Channel sub-sites both support use by populations of waterbirds associated with nearby European sites and as such may provide some limited function as supporting habitat for these species. Other sub-sites are spatially separated from the proposed capital dredging project and as such the potential for the proposals to give rise to any significant effects on these more distant sites is considered to be relatively minimal given the nature of the proposed works.

Non-breeding Waterbirds

The area immediately to the north of Berth 53, which lies outside of but within 50m of the proposed capital dredging area, is covered by shallow water at most stages of the tidal cycle. However, intertidal substrate is exposed in this area when the tide falls below about 0.25m OD. At levels in excess of this no intertidal area is exposed. On the lowest spring tides, both a gravel zone and a sandflat area are exposed (Figure 7-33).



Figure 7-33 Waterbirds feeding on intertidal exposure north of the Berth 53 site (Tide level 0.01m OD) 21 March 2019 (Photo: Richard Nairn)

The following is a summary of existing knowledge of the bird numbers within 200 metres of the Berth 53 site between 2018 and 2019, based on the surveys described above, which were undertaken in order to inform planning submissions in respect of the previously permitted MP2 Project. The most abundant and regular species here are Black-headed Gull and Herring Gull. Other species occur irregularly or in small numbers (Table 7-24). None of the species that were recorded on the site reached a peak number which was above the thresholds for all-Ireland importance (Burke *et al.* 2018).

Table 7-24 Waterbirds recorded in the area within 200m of Berth 53 during extreme low tides on 8 dates in 2018 and 2019. Qualifying interests of the SPAs in Dublin Bay are indicated*)

Date	01/02/18	02/02/18	31/03/18	10/10/18	21/01/19	22/01/19	20/02/19	21/03/19	Peak number
Survey times	16:45-18:30	17:20-18:40	17:45-19:15	05:45-07:00	16:40-17:30	17:30-18:30	17:20-18:30	16:55-18:00	
Low tide time	17:45	18:30	18:15	06:30	17:17	17:57	17:42	17:25	
Low tide height (m)	0.20	0.20	0.23	0.25	0.20	0.24	0.05	0.01	
Black-headed Gull*	0	0	2	0	0	0	0	400	400
Black-tailed Godwit*	43	0	0	0	0	0	0	1	43
Common Gull	0	0	3	0	0	0	0	35	35
Cormorant	0	0	1	0	0	0	0	0	1
Curlew*	5	0	0	0	0	0	0	0	5
Great Black-backed Gull	0	0	19	0	0	0	5	10	19
Great Crested Grebe	0	0	1	0	0	0	0	0	1
Grey Heron	2	0	0	0	0	0	0	0	2
Herring Gull	260	0	68	0	70	0	81	290	290
Oystercatcher*	15	0	4	0	0	0	1	0	15
Pale-bellied Brent Goose*	0	0	0	0	0	0	2	2	2
Redshank*	0	0	0	0	0	0	0	1	1
Total	325	0	98	0	70	0	89	739	739

** Qualifying Interests for the Special Protection Areas: South Dublin Bay and River Tolka Estuary; North Bull Island*

Breeding Black Guillemot Population

Black Guillemots are seabirds that nest in crevices within the quays and other structures of Dublin Port between Poolbeg and Butt Bridge on the River Liffey. Most of the nest sites are in either disused drainage pipes or the superstructure beneath ro-ro ramps. These nest locations are required to be well above the highest tide level to be suitable for the birds. The population of Black Guillemots in Dublin Port has been monitored consistently since 2013 (Table 7-25). The proposed Capital Dredging Project will not involve redevelopment of quays and basins and as such will not affect nest sites of this species. Temporary artificial nest sites have been installed in the Dublin Port Oil Jetty to replace any nest sites which are unavailable during the construction of the previously consented ABR Project (Figure 7-34).



Figure 7-34 Pair of Black Guillemots in nestbox 2017. (Photo: Richard Nairn)

Table 7-25 Estimated total number of individual Black Guillemots in Dublin Port in April-May 2013-2019

No	Port Sector	2013	2014	2015	2016	2017	2018	2019	Mean	Peak
1	Talbot Bridge to East Link Bridge	9	14	12	5	7	4	3	8	14
2	North Quay Extension	3	0	0	0	4	0	3	1	4
3	Alexandra Basin West	16	10	14	11	15	10	15	13	16
4	Alexandra Basin East	17	19	11	12	12	10	4	12	19
5	Oil Berths	4	1	3	0	2	0	7	2	7
6	Stena Berths 50A to 51A	6	0	11	0	4	0	2	3	11
7	Irish Ferries Berths 49 to 49A	0	1	0	2	0	0	0	0	2
8	Seatruck Berths 52 to 53	3	0	0	2	1	6	5	2	6
9	ESB Outfall to Sludge Jetty	12	9	16	16	13	11	2	11	16
10	Berths 41-47	11	8	11	8	7	6	6	8	11
11	Poolbeg Marina	1	0	0	0	0	0	1	0	1
Total individual birds		**82**	**62**	**78**	**56**	**65**	**47**	**48**		

The areas of the Port that will be directly affected by the proposed capital dredging project are sectors 3, 4, 5, 6, 7, 8, 9 and 10. The total number of breeding Black Guillemot in these areas was estimated at 48 in 2019 (mean 63 over the period 2013-2019). The population of Black Guillemot in Dublin Port has declined over the period 2013-2019 (Table 7-25). Because the birds move out to the Irish Sea during the non-breeding season the decline is likely to be due to the increased frequency of winter storms which affects survival and recruitment of birds to the population in the following breeding season.



Figure 7-35 Subsites of the Port for the Black Guillemot census (see Table 7-25 for key to sub-sites). The numbers refer to individual birds censused in 2019

Breeding Tern Populations

Two species of terns Common Tern *(Sterna hirundo)* and Arctic Tern *(Sterna paradisaea)* breed in Dublin Port. The tern colony currently occupies four separate subsites entirely on artificial structures (Figure 7-36). Total nesting populations on each of these structures in 2019 are given in Table 7-26.



Figure 7-36 Location of four subsites of Dublin Port tern colony in 2019

Table 7-26 Nest numbers on structures comprising the breeding tern colony at Dublin Port in 2019[4]

Structure	Total Nests 2019
CDL Dolphin	97
ESB Dolphin	261
Pontoon 1	83
Pontoon 2	204
Total colony	**645**

A comparison between total number of nests in each of the sub-sites over the seven years 2013-2019 is given inTable 7-27. The number of nests in the overall colony had declined in 2016 due to the partial collapse of the ESB Dolphin and possible disturbance on the CDL Dolphin but this was partly buffered by the provision of the two DPC pontoons. The ESB Dolphin was reconstructed on 2017 but the number of nests in the port colony in 2017 was treated as a minimum figure as no census was undertaken on the ESB Dolphin in that year.

Table 7-27 The total number of Common and Arctic Tern nests at each of the structures in Dublin Port between 2013 and 2019

Subsite	2013	2014	2015	2016	2017	2018	2019
CDL Dolphin	25	76	58	0	24	105	97
ESB Dolphin[2]	418	427	416	382	n/a	152	261
Pontoon TP1[3]	1	38	73	7	84	132	83
Pontoon TP2[4]	-	-	1	114	305	203	204
Total colony	**444**	**541**	**548**	**503**	**(413)[2]**	**592**	**645**

How birds use the proposed development site

The proposed capital dredging extent, as set out at Chapter 3 of the EIAR, encompasses various areas of the Liffey Channel and surrounding basins and berths. Vessel movements to and from the proposed dump site will travel via the Liffey Channel.

These areas have been recorded to support a range of wintering bird species including populations of bird species which are SCIs for the nearby South Dublin Bay and River Tolka Estuary SPA and North Bull Island SPA. And while these areas are likely to provide supporting habitat for foraging and loafing birds associated with these SPAs it is considered that other similar opportunities for these species are present in the locality.

While no terrestrial works are proposed as part of the project and no construction will therefore be necessary it is noted that the movement of dredging vessels in proximity to the berths and structures would likely take place in close proximity to a range of port structures including old drainage pipes in the quay walls and in some of the Ro-Ro ramps which are likely to be utilised by black guillemot for the purposes of nesting.

The average breeding population in the areas potentially affected by the proposed capital dredging project was 63 over the period 2013 to 2019, with the results form 2019 being significantly lower at 48. The birds are

[4] Data on breeding tern populations was collected by BirdWatch Ireland as part of the Dublin Bay Birds Project which is funded by Dublin Port Company. The nest census is carried out in May-June each year.

generally present around the nest sites in the port infrastructure from March to August. Outside the breeding season they disperse to forage in wider areas of the Irish Sea and are largely absent from the Port.

Both Common Tern and Arctic Terns nest on several artificial structures within the port (Tables 7-26 and 7-27). The nearest of these structures is approximately 30m from the proposed capital dredging area at Berth 48. During the breeding season (May to August) the birds nest in dense colonies on these structures. Their main foraging areas are in the wider area of Dublin Bay but occasionally the birds forage in the wake of ships moving through the port where prey items are brought to the surface by the movement of the ships.

Non-breeding waterbirds use the area of intertidal habitat to the north of Berth 53, which lies outside of the proposed capital dredging area, in several different ways. This depends largely on the time of year and tidal level, although factors such as weather conditions and disturbance are undoubtedly important. At some low spring tides, when some intertidal sediment is exposed for short periods, flocks of waders and gulls select this area for feeding. The visits by waterbird flocks are generally short and infrequent due to the limited period of exposure (usually a maximum of 1-2 hours per occasion, occurring up to 40 days per year). Most of the extreme low tide periods in winter months occur in darkness or poor light. Waterbirds do not use the site at other parts of the tidal cycle (median or high tides) or on other dates when spring tides do not occur. There are no high tide roosts within or close to the proposed site.

A low tide roost occurs across the River Liffey channel, at the cooling water outfall from ESB's Poolbeg Power Station located at the base of the Great South Wall in the Liffey Channel, where a small area of mudflat is exposed at low-tide (refer Figure 7-31).

7.3.3 Likelihood of Significant Impacts on Birds

Direct Impacts

The proposed Dublin Harbour Capital Dredging Project will not have potential to give rise to direct impacts upon nesting birds of any species. This conclusion is drawn in light of the nature of the works which do not comprise any terrestrial elements with potential to result in the loss of any nesting habitat for waterbirds and the timing of the works, which will take place between October and March inclusive. As such, the works will take place outside of the nesting period for species such as black guillemot, common tern and arctic tern.

The proposed capital dredging project will not have potential to give rise to the loss of any areas of habitat utilised by wintering and non-breeding bird species, such as intertidal mudflats, as dredging works will result in the deepening of existing channels of significant depth within Dublin Port only.

Potential effects upon avifauna arising as a result of the proposals are therefore limited to indirect effects discussed below.

Indirect Impacts

There is a potential for moderate indirect disturbance from dredging activity in the berths and river channel. As discussed above, given the timing of the works, no indirect disturbance to breeding bird species, such as black guillemot, common tern or artic tern will occur. Potential for indirect disturbance is therefore limited to that of populations of wintering bird species which utilise the areas to be dredged between October and March. A dredging disturbance study in autumn 2019 revealed that waterbirds were not disturbed when roosting within 150m of dredging activities (refer Appendix 7-2 Poolbeg Outfall Dredging Disturbance Study). It is considered

that the likelihood of significant effects arising as a result of both noise and visual disturbance during dredging operations is low, in the context of the existing levels of shipping activity and associated noise and visual disturbance which occur within Dublin Port on a daily basis.

It is also considered that there is some limited potential for indirect effects upon non-breeding waterbirds arising as a result of the accidental release of pollutants, such as petrochemicals, from dredge vessels, into the estuarine and marine waters of Dublin Bay. Again the likelihood of such a risk giving rise to a significant effect is considered to be low.

It should be noted that the likely impacts on qualifying interests of the South Dublin Bay and River Tolka Estuary SPA and North Bull Island SPA are addressed in the Natura Impact Statement submitted with the application for consent, however, for the sake of completeness, the species that are qualifying interests of the SPAs in Dublin Bay are indicated in Table 7-23.

7.3.4 Description of Likely Significant Impacts

Potential Impacts upon Wintering Birds

No direct impacts upon wintering birds, such as killing, injury or the direct loss of habitat are predicted as a result of the proposed capital dredging project. This conclusion is drawn in light of the nature of the project which will not involve the removal or loss of any areas of intertidal habitat utilised by wintering bird species and furthermore will involve only the operation of dredge vessels in areas which are known to be utilised by a range of wintering bird species and which are already subject to high volumes of shipping traffic.

Any potential effects are therefore indirect arising as a result of aerial noise and visual disturbance and through water quality and habitat deterioration effects associated with the accidental release of petrochemical fuels into the estuarine and marine environment.

Aerial Noise and Visual Disturbance

The proposed capital dredging works will have potential to give rise to potential for aerial noise and visual disturbance to populations of wintering birds which may be present in proximity to the proposed dredge zones. These zones lie within the Birdwatch Ireland monitoring sub-sites discussed above namely the Alexandra Basin and Liffey Channel sub-sites. These sub-sites have been shown to support a range of wintering bird species, including a number of species which represent special conservation interests for the nearby Dublin Bay SPAs.

Cayford (1993) has defined disturbance as ‘any discrete event in time that disrupts ecosystems, communities or populations, where disruption refers to a change in behaviour, physiology, numbers or survival’. Smit and Visser (1993) define disturbance as ‘any situation in which a bird behaves differently from its preferred behaviour’. There are many published studies on the effects of human disturbance to waterbirds (see for example Davidson & Rothwell 1993) including those species that are recorded as wintering within the Alexandra Basin and Liffey Channel sub-sites. However, quantifying the effects of disturbance on populations can be problematic because of the difficulty in isolating key variables. One method used is to take a behavioural measure such as feeding rate (which is highly correlated with the dependent measure being sought) and make the assumption that a reduction in feeding opportunity might reduce feeding rates, thus affecting body condition and consequently survival or productivity.

Anthropogenic noise can cause disturbance to birds in a variety of ways although some noises produce no reaction in birds, even at close range and some species are more sensitive than others to loud noises (Ortega 2012). There are two recognised levels of response to disturbance: effects and impacts (Robinson and Pollitt, 2002).

- Effects can be seen as observed responses (behavioural and/or distributional) by a bird to a given disturbance. Examples of this include birds changing their feeding behaviour, taking flight or being more vigilant. In these circumstances, although technically disturbed, birds may be able to use the same or alternative sites without any major negative effects on their energy budget, and ultimately on the survival of individuals (Gill et al. 2001).
- Impacts in this context imply a reduction in body condition, productivity or survival and are therefore of primary conservation concern as they may result in an adverse effect at the population level, if enough individuals are affected. Whether disturbance results in an impact depends largely on the availability of alternative sites and the energetic costs of displacement (Goss-Custard et al. 1995).

The effects of noise from proposed dredging activity may affect birds by two different pathways:

- Aerial noise may be heard by birds such as geese, ducks, waders, seabirds, grebes and herons and some gulls, while they are foraging, roosting, swimming or flying close to the construction site.
- Underwater noise may be heard by certain bird species that forage by diving or plunge-diving. This includes cormorants, shags, grebes, mergansers, auks, gannets, terns and any other species that feed on fish or shellfish near the seabed.

The sounds that birds hear can be divided into non-threatening sounds, to which birds may be habituated; and threatening sounds. Examples of non-threatening sounds are wave noise on a beach or constant traffic noise. Threatening sounds include impulsive sounds such as an explosion or gunfire. Noise arising though dredging is a repetitive noise that is not threatening to birds and to which they are likely to habituate rapidly.

IECS (2007) showed that birds were found in general, to accept a wide range of steady state noise level from 55dB(A), up to 85dB(A), and that complete exclusion within up to 250 m from the source of the noise was considered very unlikely. Evidence presented by Cutts *et al*. (2009) from repair work to a pipeline in the Humber Estuary has shown that disturbed birds (within 100m) are likely to return within a short time frame once disturbance ceases, potentially within 30 minutes, and with no evidence of effects on numbers during surveys the following week, emphasising the short-term nature of any impacts.

Waders using Mutton Island in Galway Bay were studied over a period of 5 years, during and after the construction, including pile-driving, of a major sewage treatment plant which was situated between 150m and 200m from the main high tide roost. The waders became more concentrated on the undeveloped part of the island but otherwise showed no negative effects of disturbance. Numbers of birds using the roost were higher towards the end of the period as human disturbance decreased due to controls on access to the island and because of a high wall around the construction site which screened construction workers from the birds (Nairn 2005).

The above information indicates that any aerial noise arising as a result of the project is unlikely to give rise to significant effects upon bird populations, as habituation is likely to be rapid due to the steady-state nature of the

produced noise. Furthermore given that the proposed capital dredging will occur within and be restricted exclusively to the operational port area, its berths and navigation channel where small and large seagoing vessels arrive and depart, turn and berth many times each day it is considered that there is no potential for disturbance to the overwintering birds arising through aerial noise or visual disturbance associated with the proposed dredging and disposal works as dredge vessels simply represent additional ships in this context. Any arising aerial noise or visual disturbance will simply be masked by background levels associated with ongoing shipping to which it is presumed that existing bird populations must already be accustomed. This conclusion is also drawn in light of the fact that dredging operations, including capital and maintenance dredging have been ongoing within Dublin Port for some years and that this work does not appear to have given rise to a noticeable reduction in the supported populations of wintering waterbirds within the Alexandra Basin or Liffey Channel monitoring sub-sites.

No significant impacts are therefore predicted as a result of aerial noise and visual disturbance to overwintering bird populations as a result of the project.

Water Quality and Habitat Deterioration: Pollution Incidents

There is a risk involved with any vessel activity in the marine environment that a pollution incident might arise through spillage 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 release of such pollutants into the marine environment could give rise to temporary impacts upon wintering bird populations through localised environmental toxicity, in addition to impacts upon prey species the abundance of which may be reduced following a pollution incident.

It is considered that the risk of a significant effect arising through such a spillage or leak are low due to the volumes of water in which these inputs would be dispersed, which include the flows arising from the River Liffey in addition to tidal flows within the estuary and the wider Dublin Bay. It is likely that any inputs would therefore be distributed to background levels fairly rapidly and that any potential effects would be temporary in nature and of a very low magnitude.

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.

7.3.5 Mitigation Measures

The following key mitigation measures apply to the Capital Dredging Scheme to minimise the impact of the proposed works on avian ecology:

- Measures set out to avoid pollution at to water quality leading to habitat deterioration as outlined in the water quality chapter (Chapter 9) will be fully implemented.
- the capital dredging scheme will be confined to the winter months (October – March) when the terns have migrated from the site.

Subject to the implementation of such measures it is considered that any potential effects will be fully mitigated.

In addition, DPC will also continue to undertake a programme to monitor winter wetland birds in the adjacent European Sites at the South Dublin Bay and River Tolka Estuary Special Protection Area. This monitoring programme will continue throughout the construction phase and for a period of two years after the completion of such works, with monthly surveys from October to March. The results of this monitoring programme will be submitted to Dublin City Council at 12-monthly intervals to maintain a public record.

7.3.6 Residual Impacts

In circumstances where the mitigation measures outlined in section 7.3.5 are fully implemented, there are no residual impacts predicted.

7.3.7 Potential Cumulative Impacts

In considering the potential cumulative impacts it is noted that other dredging projects, including Dublin Port Maintenance Dredging 2022-2029 will take place annually at alternate times of year from the proposed capital dredging project and as such there is no potential for additive cumulative impacts in combination with the project.

The MP2 project will require a total of 424,644m^3 of capital dredging and will overlap with the 2022-2029 capital dredging as both will see spoil disposal within the October-March window. However, dredging will not run concurrently, i.e., only one dredger will operate at any one time. To put the volumes of spoil into perspective, even if all of the 500,000m^3 of the 2022-2029 capital dredging was disposed of in the same year as the 424,644 m^3 of the MP2 Project it would still be less than a single year of the ABR capital dredging just completed. However, the likelihood is that both projects will be staggered across several years due to considerations related to the associated quayside construction sequencing. Potential cumulative impacts are therefore considered to be *de minimus*.

Overall, the potential cumulative effect as outlined above will not alter any of the conclusions in this EIAR with regard to the predicted residual significance of impacts described. There are no additional, additive, incremental, associated, or connected effects resulting in synergistic impacts above a magnitude already predicted in the EIAR.

Given the lack of envisaged residual impacts arising as a result of the project following the implementation of mitigation measures, with such potential pre mitigation impacts limited to the accidental release of chemical pollutants, it is not considered that the project would have potential to give rise to any significant cumulative impacts upon avifauna, when considered alongside other projects in the area, including those schemes listed at Section 3.7 of the EIAR.

7.3.8 Conclusions

In conclusion the site proposed for Capital Dredging Works has been subject to significant surveys and monitoring to establish a robust baseline for the supported populations of waterbirds, including wintering bird surveys, black guillemot surveys and nesting tern surveys.

This baseline has been assessed against the proposed project to ascertain whether significant impacts upon birds are likely to arise.

Potential significant effects are limited to water quality and habitat deterioration effects arising as a result of the accidental spillage or leakage of chemical pollutants into marine and estuarine waters.

Subject to the implementation of standard mitigation measures to ensure that the risks of such an occurrence are minimised it is not envisaged that the proposed project will have potential to give rise to any significant impacts, cumulative or otherwise, upon bird populations which are known to utilise the site and the surrounding locality.

8 LAND, SOILS, GEOLOGY & HYDROGEOLOGY

This chapter comprises an appraisal of the existing ground conditions within Dublin Harbour and addresses the potential effects of the Dublin Harbour Capital Dredging Project on Land, Soils, Geology & Hydrogeology of the site and surrounding areas. The assessment is based on the development as described in Chapter 3 of the EIAR. Where potential adverse impacts are identified, the assessment identifies mitigation measures that will be implemented to prevent, reduce or offset potential adverse effects, or enhance potential beneficial effects where possible.

8.1 Assessment Methodology

This section describes the methodology which has been used in the assessment of Land, Soils, Geology and Hydrogeology which may impact, or be impacted by, the Dublin Harbour Capital Dredging Project.

8.1.1 Guidance

The methodology outlined within the following guidance documents was used in the assessment:

- Institute of Geologists of Ireland (IGI) 'Guidelines for the preparation of Soils Geology and Hydrogeology Chapters of Environmental Impact Statements' (2013);
- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports, Environmental Protection Agency, Draft, August 2017; and
- The National Roads Authority's guidelines; 'Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes', published in 2008. These guidelines aim to provide guidance on the assessment of geological, hydrological and hydrogeological impacts through the EIA process.

The following sources of information were used in the compilation of this assessment:

- Environmental Protection Agency Map viewer - http://gis.epa.ie/Envision/;
- Geological Survey of Ireland Spatial Resources;
- http://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228;
- Environmental Protection Agency Radon Map - http://www.epa.ie/radiation/radonmap;
- Model Procedures for the Management of Land Contamination, Contaminated Land Report 11, Defra and Environment Agency, September 2004;
- Irish Aquifer Properties – A Reference Manual and Guide, Environmental Protection Agency and Geological Survey Ireland, March 2015;
- Geology in Environmental Impact Statements, The Institute of Geologists in Ireland, 2002
- Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes, National Roads Authority, 2008;
- Internet based aerial photography.

8.1.2 Assessment of Significance

8.1.2.1 Sensitivity of Receptor

Effects of the development on land, soils, geology and hydrogeology receptors have been assessed taking into account sensitivity of the receptor and magnitude of the effect. The sensitivity of the receptors is determined according to the methodology shown in Table 8-1.

Table 8-1 Sensitivity of receptor (Amended from 'NRA Guidelines on procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes')

Sensitivity	Criteria	Typical Examples
Very High	Attribute has a high quality and rarity on regional or national scale.	• Geology: World Heritage Sites; sites protected under EU wildlife legislation (SAC, SPA, SSSI, Ramsar site) or • Geological features that are rare on a regional or national scale. • Surface waters; River, wetland or surface water body ecosystem protected by EU legislation.
High	Attribute has a high quality and rarity on Local scale.	• Geology: Regional important geological sites. • Soils; Well drained and/or high fertility soils. • Surface water; Ecosystem protected by national legislation. • Groundwater; Regionally important potable water source supplying >2500 homes, groundwater vulnerability is classified as high; principal aquifer providing a regionally or locally important resource or supporting site protected under wildlife legislation.
Medium	Attribute has a medium quality and rarity on local scale.	• Soils: Moderately drained and/or moderate fertility soils. • Groundwater: Local potable water source supplying >50 homes, moderate classification of groundwater vulnerability; secondary aquifer providing water for agricultural or industrial use with limited connection to surface water.
Low	Attribute has a low quality and rarity on local scale	• Soils: Poorly drained and/or low fertility soils. • Groundwater: Local potable water source supplying <50 homes, deep secondary aquifer with poor water quality not providing baseflow to rivers.
Neutral	Very low importance and rarity on local scale.	• Geology: No rock exposures. • Soils: Urban classified soils. • Groundwater: Non-aquifer/Unproductive Strata

For the purposes of this assessment it is considered that Regionally Important (R) Aquifers are Principal Aquifers; Locally Important (L) Aquifers are Secondary Aquifers and Poor (P) Aquifers are Unproductive Strata. Different classifications exist for each of the aquifer types, as listed below:

Regionally Important (R) Aquifers:

- Karstified bedrock (Rk) where Rkc represents an aquifer dominated by conduit flow and Rkd represents an aquifer dominated by diffuse flow
- Fissured bedrock (Rf)
- Extensive sand and gravel (Rg)

Locally Important (L) Aquifers:

- Bedrock which is generally moderately productive (Lm)
- Bedrock which is moderately productive only in local zones (Ll)
- Sand & gravel (Lg)

- Locally important karstified bedrock (Lk)

Poor (P) Aquifers:

- Bedrock which is generally unproductive except for local zones (Pl)
- Bedrock which is generally unproductive (Pu)

8.1.3 Impact Assessment

The magnitude of a potential effect is independent of the sensitivity of the feature. The magnitude considers the scale of the predicted change to the baseline condition taking into account its duration (i.e. the magnitude may be moderated by the effects being temporary rather than permanent, short term rather than long term) and whether the effect is direct or indirect. Definitions for impact magnitude are described in Table 8-2.

Table 8-2 Criteria to determine the magnitude of effect (Amended from 'NRA Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes')

Magnitude	Criteria	Typical Examples
Major Adverse	Total loss or major alteration to key features of the baseline conditions such that post development character / composition of baseline condition will be fundamentally changed.	• Irreversible loss of high proportion of local high fertility soils. • Changes to aquifer or unsaturated zone **resulting** in extensive change to existing water supply springs and wells, river baseflow or ecosystems. • Loss of, or extensive change, to nationally important geological features.
Moderate Adverse	Loss or alteration to one or more key features of the baseline conditions such that post development character / composition of baseline condition will be materially changed.	• Irreversible loss of moderate proportion of local high fertility soils. • Changes to aquifer or unsaturated zone resulting in moderate change to existing water supply springs and wells, river baseflow or ecosystems. • Permanent loss of, regionally important geological features, or substantial changes to nationally important geological features.
Minor Adverse	Results in some measurable change in attributes quality or vulnerability compared to baseline conditions. Changes arising from the alteration will be detectable but not material; the underlying character / composition of baseline condition will be similar to the pre-development situation.	• Irreversible loss of small proportion of local high fertility soils and/or high proportion of local low fertility soils • Changes to aquifer or unsaturated zone resulting in minor change to water supply springs and wells, river baseflow or ecosystems. • Loss of, or extensive change, to locally important geological features.
Neutral	Very little change from baseline conditions. Change is barely distinguishable approximately to a "no change" situation.	• No measurable impact upon surface waters or groundwater. • No measurable impact on geological features. • No measurable impact on soils.
Beneficial	Benefit to, or addition of, key characteristics, features or elements compared to baseline conditions.	• Improvement to geological features.

8.1.4 Significance Criteria

The significance of a specific potential effect is derived from both the sensitivity of the feature and the magnitude of the effect, and can be then determined using the matrix presented in Table 8-3 (has been amended from 'NRA Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for

National Road Schemes'). Effects can be beneficial, adverse or neutral and their significance Very Large, Large, Moderate, Slight or Neutral or an intermediary designation as cases dictate based on professional judgement. The significance of an impact should also be qualified based on the likelihood of an effect occurring (using a scale of certain, likely or unlikely) and the confidence in the accuracy of the assessment.

Professional judgement can be used to vary the category where specific circumstances dictate, for example due to the vulnerability or condition of the receptor.

Table 8-3 Assessment of Significance Matrix (Amended from 'NRA Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes')

Sensitivity of Attribute	Magnitude of Effect				
		Major	**Moderate**	**Minor**	**Neutral**
	High	Major	Minor/Moderate	Minor/Moderate	Neutral
	Medium	Major	Moderate	Minor	Neutral
	Low	Minor/Moderate	Minor	Neutral	Neutral
	Neutral	Neutral	Neutral	Neutral	Neutral

8.1.5 Significance of Residual Effects

The significance of effects for land, soils, geology and hydrogeology has been assessed initially without taking mitigation measures into account. Residual effects (effects that remain once mitigation measures are taken into consideration) are then identified. Temporary effects are considered in the construction period whilst permanent effects are discussed in the operational phase, albeit that the effect may first occur during construction.

8.2 Receiving Environment

8.2.1 Land

Land is defined in Section 2 of the Planning and Development Act 2000, as amended as including "any structure and any land covered with water (whether inland or coastal)".

The Guidelines on the Information to be contained in Environmental Impact Assessment Reports (Draft, August 2017) published by the Environmental Protection Agency [EPA] state that the amended Directive introduces Land as a prescribed environmental factor. Recital 9 gives context to this addition, showing that it relates to the issue of 'land take'. This change aligns the Directive with proceedings of the United Nations Conference on Sustainable Development (Rio de Janeiro, 2012) and with Commission strategy.

The baseline characteristics of the Dublin Harbour Capital Dredging Project in relation to Land are set out as follows:

- Land-take, sustainable availability of Land
- Quantity of land used

- Removal of productive land from potential agricultural or other beneficial uses
- Location and physical characteristics of the land
- Existing Land use
- Land-use during construction and operation

Land-take, sustainable availability of land: The Dublin Port Masterplan 2040, reviewed 2018, recognises the finite availability of land for port related activity. Dublin Port lies immediately adjacent to the South Dublin Bay and Tolka Estuary SPA and the Masterplan commits to no further Port expansion within the Tolka Estuary. Instead, the Masterplan focuses on the redevelopment of existing brownfield lands, berthing pockets and navigation channel in order to provide for the 77.2m gross tonnes projected by 2040. The Dublin Harbour Capital Dredging Project supports these significant infrastructure developments by providing sufficient water depth within Dublin Harbour's navigation channel, basins and berths for the safe movement of vessels to and from the port. As detailed in Chapter 2, the Dublin Harbour Capital Dredging Project has been carefully devised by DPC to ensure that:

- The proposed development will not result in land take (i.e. the removal of productive land from potential agricultural or other beneficial uses) instead, the proposal selected for development make optimum use of the Port's finite resources of river berths and quayside lands
- The proposed configuration reflects and responds to assessments of the potential environmental impact of different options to achieve the project's objectives
- The chosen project option best meets all applicable environmental and ecological requirements
- The project can be constructed in a way that minimises the impact on existing port operations
- The proposed project is consistent with the principles of proper planning and sustainable development
- The project makes provision for future population growth and a concomitant increase in demand for port infrastructure at the location closest to where the need for additional capacity arises

Quantity of land used: Dublin Port is the largest Port in Ireland, situated in Dublin on Ireland's Eastern Coastline. The Northern Lands and Southern Lands of Dublin Port (Dublin Port Estate) comprise an area of 265 ha of land entirely within the ownership of Dublin Port Company. The entire Port Estate comprises 309 ha, including the lands at the Dublin Inland Port. The Dublin Harbour Capital Dredging application site area is 27 ha (excluding the area of the licenced offshore disposal site).

Removal of productive land from potential agricultural or other beneficial uses: The Dublin Harbour Capital Dredging will take place in the marine environment only and will not result in the removal of productive land from potential agricultural or other beneficial uses.

Location and physical characteristics of the land: The Dublin Harbour Capital Dredging Project comprises capital dredging works within the Dublin Harbour area of Dublin Port. The proposed area to be dredged lies entirely within the Foreshore of the inner Liffey Channel between the Northern Lands and the Southern Lands of Dublin Port.

Existing Land use: The existing land uses within the footprint of the Dublin Harbour Capital Dredging Project comprise the manoeuvring and berthing of vessels, the handling of Ro-Ro and Lo-Lo cargo, HGV traffic

distributing cargo to and from Dublin Port and the movement of ferry passengers arriving and departing to/from Dublin Port

Land-use during construction: The Dublin Harbour Capital Dredging Project will not require any temporary land-take during construction. The capital dredging operations will be restricted to the winter seasons (October to March) over the duration of the requested eight year Foreshore Licence and Dumping at Sea Permit. It should be noted that the order of dredging activity may change depending on the priority required by the Harbour Master to ensure the safe navigation of vessels entering and leaving the port.

Land-use during operation: The Dublin Harbour Capital Dredging Project is designed to provide port infrastructure which will improve the efficiency of port operations and thereby increase the throughput of both cargo and passengers. The future land uses within the footprint of the Dublin Harbour Capital Dredging Project will not significantly change.

8.2.2 Soils

8.2.2.1 Regional Soils

The soil underlying the Dublin Harbour Capital Dredging Project comprise a mixture of clay, silt, sand, gravel and cobbles. The landside soils, as illustrated in Figure 8-1, (National Soils Map of Ireland) indicates that the Dublin Port Estate is characterized as “made ground”.

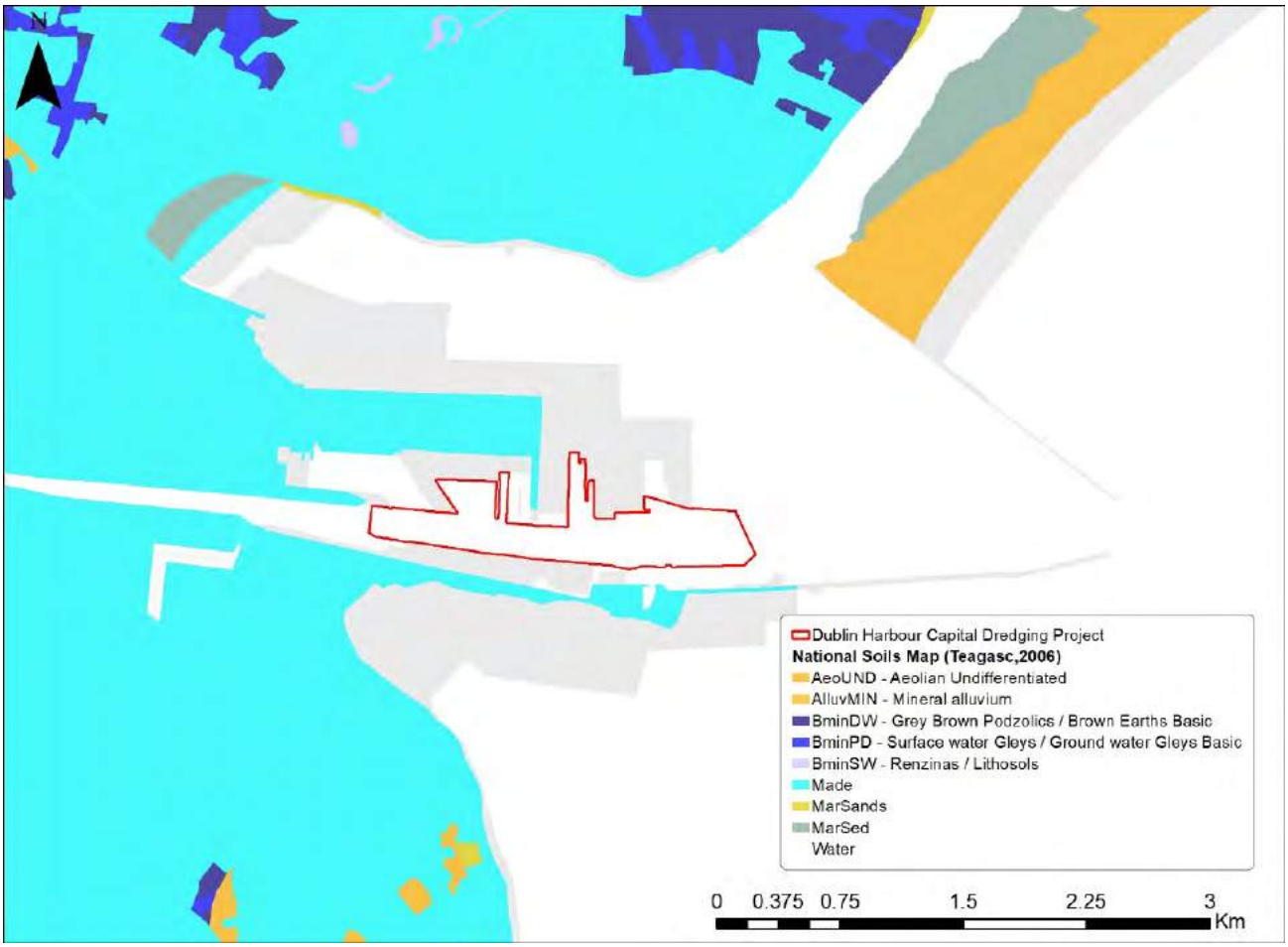


Figure 8-1 National Soils Map of Ireland (Teagasc/GSI, 2006)

The Quaternary geological period extends from about 1.5 million years ago to the present day and can be sub-divided into the Pleistocene Epoch, which covers the Ice Age period and which extended up to 10,000 years ago, and the Holocene Epoch, which extends from that time to the present day. The Quaternary geology of Ireland – Sediments Map shows the sediments mapped within 1 metre of the surface which were laid down during the quaternary period; Bedrock at or close to the surface; water bodies or made ground. The quaternary geology underlying the Dublin Port Estate as illustrated in Figure 8-2, (National Quaternary Geology Map of Ireland) indicates that the landside subsoils is also characterized as being Urban or made ground.

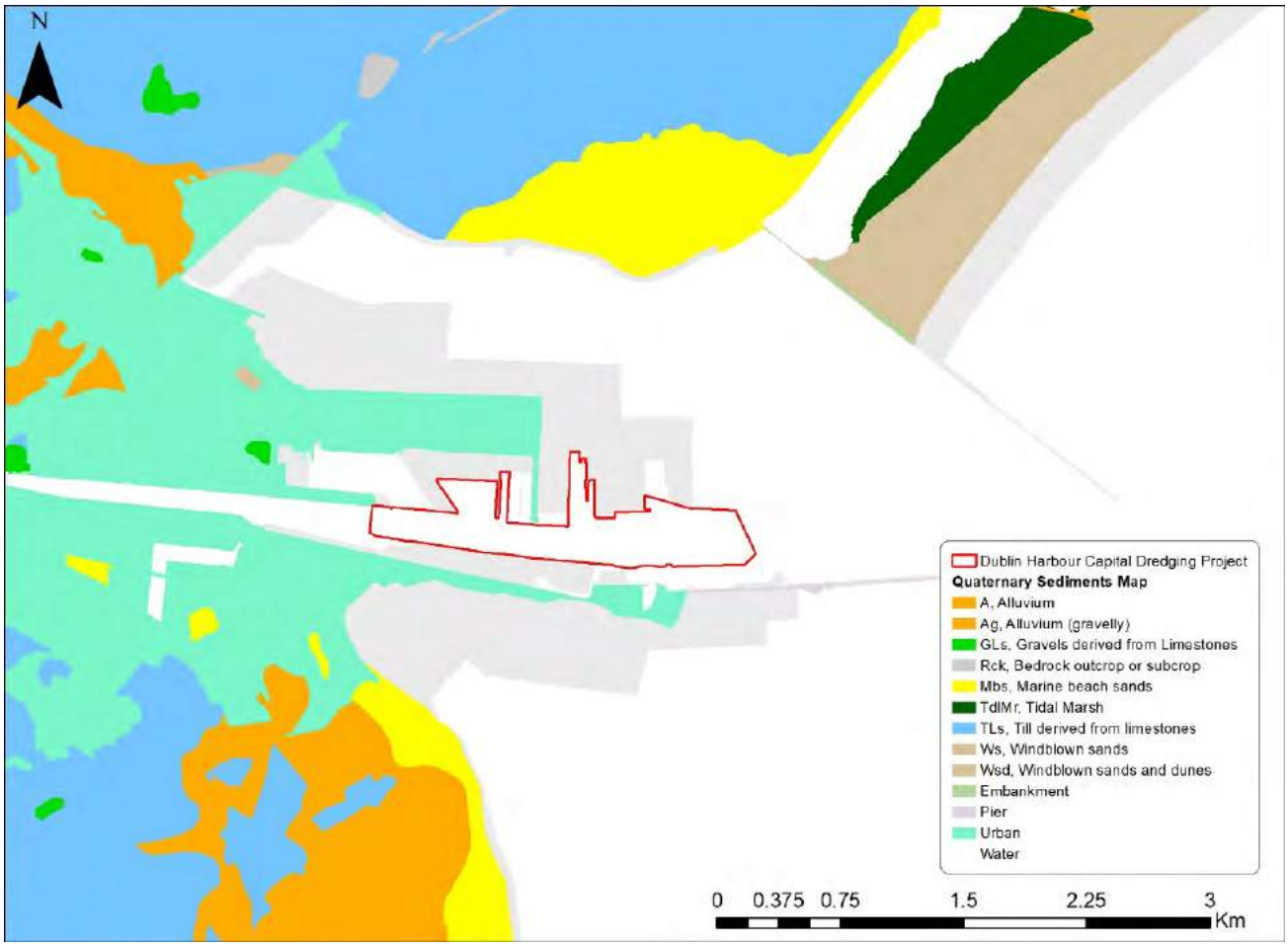


Figure 8-2 National Quaternary Geology Map of Ireland (Teagasc/GSI, 2006)

8.2.2.2 Sediment Chemistry and Eco-toxicity

Sediment Analysis 2020

Dublin Port Company (DPC) consulted with the Marine Institute regarding their plans to submit both Foreshore Licence and Dumping at Sea Permit applications for the Dublin Harbour Capital Dredging Project. The Marine Institute issued a Sampling & Analysis Plan (SAP) to DPC on 27th March 2020. The Marine Institute's SAP 2020 comprised the following:

- A total of 31 surface sediment samples for sediment chemistry analysis (See Figure 8-3).
- Provision was made for additional eco-toxicological testing, depending on the sediment chemistry results

DPC commissioned Hydromaster Ltd to undertake the sediment chemistry sampling and analysis programme as set out in the SAP 2020. Hydromaster undertook the fieldwork on 15th – 16th April 2020, retrieving the surface samples for laboratory analysis. Samples were successfully collected, and sub sampled from all but one location

(30). At this location, only large rocks were able to be obtained. These were provided to the lab for visual inspection, but no physio-chemical analysis was able to be carried out. Additionally at location (21) only one large cobble was able to be collected after multiple grab attempts on location. Therefore the vessel was moved to location (32) and a sample was successfully collected. This may be used as a proxy for location (21).

The sediment samples were analysed for the parameters set out in the SAP 2020 by Socotec, an accredited laboratory which is based in Burton-upon-Trent in the UK. The Sampling and Analysis Plan (SAP 2020) and Hydromaster's Sediment Chemistry Sampling Report is presented in Appendix 8-1 and Appendix 8-2.

Sediment Analysis 2018

Further sediment sampling information of relevance was collected in August 2018 as part of the MP2 Project. Five samples were taken in the vicinity of the approach channel and berthing pocket at Berth 53 (S18, S21, S27, S29 and S30).

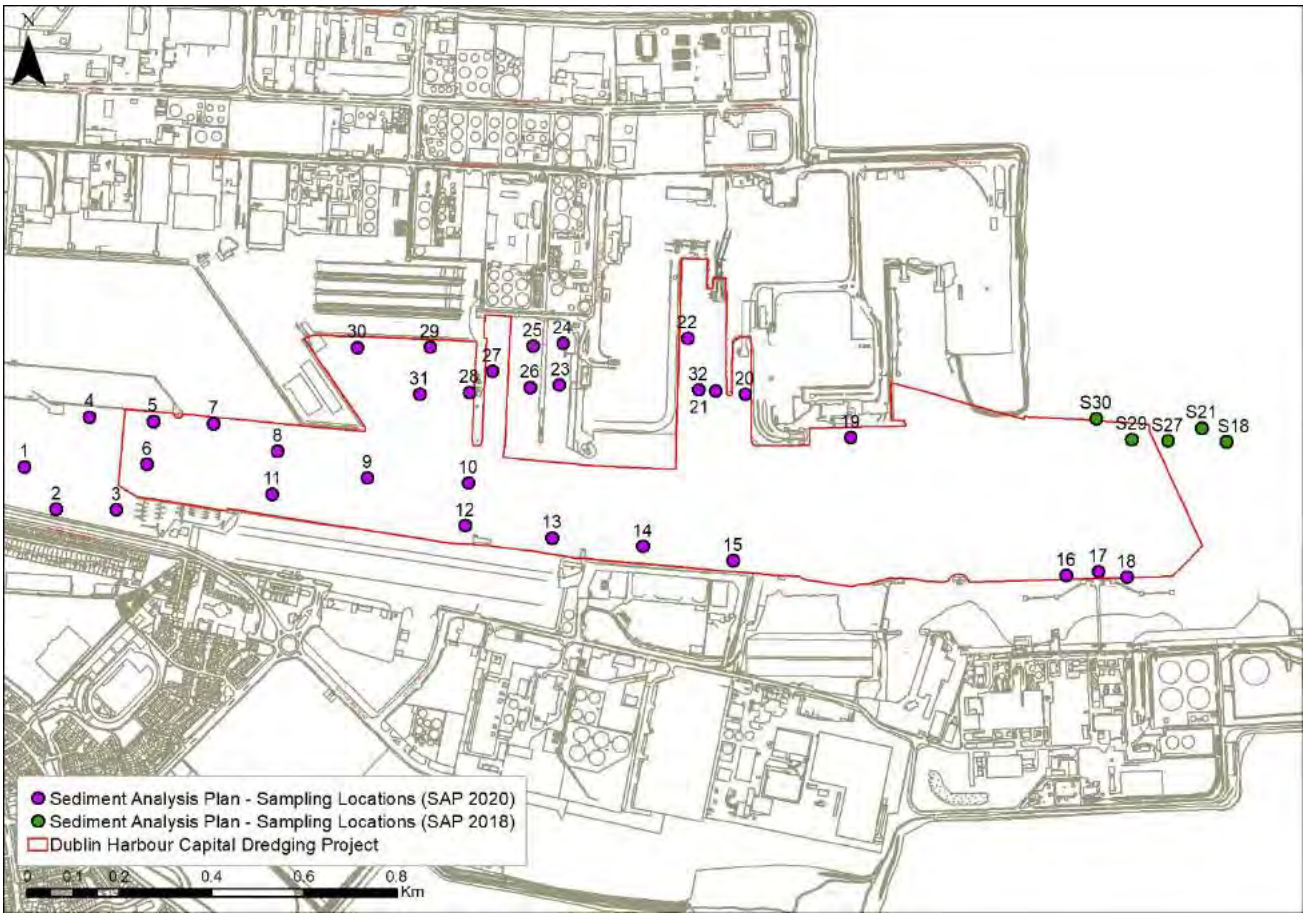


Figure 8-3 Marine Institute Sediment Analysis Plan 2020 - Sampling Locations

Results of the 2020 Sediment Chemistry Analysis

The detailed results of the 2020 sediment chemistry analysis from the analysing laboratory are provided in Appendix 8-3 and the results in the format requested by the Marine Institute are provided in Appendix 8-4. Contaminant concentrations were compared to action levels set out in *Guidelines for the Assessment of Dredge Material for Disposal in Irish Waters*, Marine Institute, Marine Environment and Health Series, No. 24, 2006 (Table 8-4). The lower level values for Arsenic and Nickel have been adjusted to align with the latest EPA guidance.

Table 8-4 Sediment Quality Classification (Marine Institute 2006)

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

The results of the Sediment Sampling and Analysis Plan 2020 are presented in Table 8-5. The following observations can be made from the sediment analysis results:

- The sediments in the inner harbour are dominated by silts.
- The sediment chemistry results show very low level contamination (above the lower Class 2 guideline) of Arsenic, Cadmium, Copper, Lead, Nickel and Zinc at a number of sample locations within Dublin Harbour which is typical of industrial port sediment. Notably no elevated levels of Mercury were recorded.
- There were no TBT / DBT results recorded above the lower guideline limit.
- Localised, slightly elevated levels of PCBs were found, the highest value was recorded at sample location 8.
- Localised, slightly elevated levels of Hydrocarbons (PAH and TEH) were found, the highest value was recorded at sample location 5.
- The remaining sample parameters are all below the lower guideline levels and would therefore be categorised as Class 1 (uncontaminated).
- None of the 31 samples have any parameters above the upper guideline limit.

The results of all the sediment chemistry analysis carried out in April 2020 were forwarded to the Marine Institute for their interpretation, in combination with other relevant data held by the Marine Institute. The Marine Institute expressed concern over PCBs and PAH levels that are marginally above the lower guideline limit and recommended that further investigative work be undertaken comprising eco-toxicological testing to ensure that the sediments have no biological effect and thereby suitable for disposal at sea.

The provision for eco-toxicological testing had been set out in the SAP 2020. The Marine Institute set out the detailed sampling and analysis plan requirements of the eco-toxicological testing on 31st July 2020 as described next.

Results of the 2018 Sediment Chemistry Analysis

Sediment sampling information in this area was collected in August 2018 as part of the MP2 Project. Five samples were taken in the vicinity of the approach channel to Berth 52 and berthing pocket at Berth 53 (S18, S21, S27, S29 and S30).

- Samples 18, 21 and 27 returned contaminant concentrations below Lower Level 1 for all contaminants and would therefore be categorised as Class 1 (uncontaminated).
- Samples 25, 29 and 30 returned a TEH concentration marginally above the Lower Level 1
- Sample 30 returned a Nickel concentration of 61.8mg/kg which is above the Upper Level Value of 60mg/kg and a TEH concentration marginally above the Lower Action Level. The sediment chemistry at Sample Location S30 has a high level of Nickel (Class 3) making it unsuitable for disposal at sea. The likely cause of the contamination is historic disposal of cables at this location. The Dublin Harbour Capital Dredging Project has been engineered to avoid the requirement for capital dredging at this location.

The results of the Sediment Sampling and Analysis Plan 2018 are presented in Table 8-6. The full results of the sediment chemistry sampling and analysis were provided to the Marine Institute who examined the results in detail in combination with other relevant data held by the Marine Institute. The Marine Institute confirmed that they would have no objection to the disposal of this sediment at the licenced offshore disposal site located at the approaches to Dublin Bay west of the Burford Bank. The marine sediments can therefore be classified as Class 1 (Uncontaminated: no biological effects likely).

Table 8-5 Sediment Chemistry Results 2020 compared against MI Guidelines (Sampling location 1 – 10)

Parameter	Units (Dry Wt)	Results - 2020										Guideline Values	
		new 1	new 2	new 3	new 4	new 5	new 6	new 7	new 8	new 9	new 10	Lower Level	Upper Level
		surface	surface	surface	surface	surface	surface	surface	surface	surface	surface		
Arsenic	mg kg^{-1}	16.4	23.7	34.8	36.3	35.4	12.8	13.1	17.1	16.2	14.9	20	70
Cadmium	mg kg^{-1}	1.2	0.9	1.1	1.3	1.1	0.9	0.7	1.2	1.2	0.9	0.7	4.2
Chromium	mg kg^{-1}	79.7	95.6	79.7	77.2	85.8	98	111	101	103	82.3	120	370
Copper	mg kg^{-1}	45.1	39.2	42	38.1	32.2	27.5	23.6	28.9	15.7	22.8	40	110
Lead	mg kg^{-1}	70	50.4	61.8	71.2	53.9	48.9	110	78	10.6	29.8	60	218
Mercury	mg kg^{-1}	0.17	0.02	0.04	0.07	0.07	0.09	0.07	0.11	0.01	0.01	0.2	0.7
Nickel	mg kg^{-1}	33	17.3	25.6	33.1	30.1	25.4	20	27	33.2	24.3	40	60
Zinc	mg kg^{-1}	252	118	201	183	149	136	117	145	62	116	160	410
(TBT + DBT)	mg kg^{-1}	0.0474	0.032	0.1	0.034	0.04	0.023	0.023	0.08	0.01	0.01	0.1	0.5
g-HCH (Lindane)	ug kg^{-1}	0.18	0.14	<0.1	<0.1	0.11	0.21	<0.1	<0.1	<0.1	<0.1	0.3	1
PCB 028	ug kg^{-1}	1.8900	0.9300	1.4400	2.5300	1.8900	1.6900	1.5700	2.5900	1.4400	1.0900	1	180
PCB 052	ug kg^{-1}	1.4600	0.5300	0.9500	2.0300	1.3900	1.1200	1.5800	1.8000	0.8100	0.6200	1	180
PCB 101	ug kg^{-1}	0.9500	0.4000	1.0000	1.2300	1.1900	0.7900	1.5600	1.6500	0.5600	0.4200	1	180
PCB 118	ug kg^{-1}	1.1000	0.5000	1.1400	1.3000	1.4000	0.9300	1.8000	1.5800	0.5300	0.5200	1	180
PCB 138	ug kg^{-1}	1.1800	0.4700	1.2700	1.2900	1.6400	0.8400	1.4200	3.1900	0.8600	0.4800	1	180
PCB 153	ug kg^{-1}	1.37	0.47	1.24	1.47	1.79	1.01	1.33	3.8	1.14	0.55	1	180
PCB 180	ug kg^{-1}	0.65	0.22	0.53	0.64	0.81	0.45	0.45	2.44	1.46	0.26	1	180
Σ (7 PCBs)	ug kg^{-1}	8.6000	3.5200	7.5700	10.4900	10.1100	6.8300	9.7100	17.0500	6.8000	3.9400	7	1260
Hexachlorobenzine	ug kg^{-1}	0.28	0.12	0.26	0.1	0.19	0.13	0.1	0.1	0.1	0.1	0.3	1
Acenaphthene	ug kg^{-1}	32.4	46.2	43.9	45.2	89.3	15.2	19.6	17.1	9.11	14	-	-
Acenaphthylene	ug kg^{-1}	77.7	40.8	91.7	104	432	51.9	40.7	86.4	41.3	38.5	-	-

Parameter	Units (Dry Wt)	Results - 2020										Guideline Values	
		new 1	new 2	new 3	new 4	new 5	new 6	new 7	new 8	new 9	new 10	Lower Level	Upper Level
		surface	*surface*	*surface*	*surface*	*surface*	*surface*	*surface*	*surface*	*surface*	*surface*		
Anthracene	ug kg^{-1}	120	95	123	135	531	76.7	81.3	107	60.4	52.2	-	-
Benzo (a) anthracene	ug kg^{-1}	334	193	308	329	1340	198	173	265	103	115	-	-
Benzo (a) pyrene	ug kg^{-1}	448	269	432	427	1580	278	252	404	213	183	-	-
Benzo (b) fluoranthene	ug kg^{-1}	403	271	380	409	1070	241	212	317	174	168	-	-
Benzo (ghi) perylene	ug kg^{-1}	333	184	302	294	818	196	166	271	138	136	-	-
Benzo (k) fluoranthene	ug kg^{-1}	201	103	178	207	620	127	126	160	72	76.9	-	-
Chrysene	ug kg^{-1}	368	217	250	265	1240	207	185	245	113	123	-	-
Dibenz (a,h) anthracene	ug kg^{-1}	70.6	42.3	69.6	68	203	44.8	33.1	56.8	28.1	31.6	-	-
Flourene	ug kg^{-1}	69.1	65	86.9	99.7	285	43	40.8	57.7	30.5	40.1	-	-
Fluoranthene	ug kg^{-1}	519	353	468	533	1700	301	259	283	118	146	-	-
Indeno (1,2,3–cd)	ug kg^{-1}	323	184	302	299	823	203	169	283	141	132	-	-
Naphthalene	ug kg^{-1}	71.6	44.5	80.8	91.2	179	40.7	36.1	59.2	28	36.5	-	-
Phenanthrene	ug kg^{-1}	270	248	222	247	378	155	131	139	74.5	88.4	-	-
Pyrene	ug kg^{-1}	603	436	698	642	2800	354	378	510	255	232	-	-
Σ (16 PAH)	ug kg^{-1}	4243.68	2791.92	4036.16	4195.2	14088.49	2532.43	2302.7	3261.3	1599.01	1613.3	4000	-
Total Extractable Hydrocarbons	g kg^{-1}	0.385	0.277	1.07	0.644	1.17	0.598	0.312	0.372	0.267	0.342	1	

Table 8-5 Sediment Chemistry Results 2020 compared against MI Guidelines (Sampling location 11 – 20)

Parameter	Units (Dry Wt)	Results - 2020										Guideline Values	
		new 11	new 12	new 13	new 14	new 15	new 16	new 17	new 18	new 19	new 20	Lower Level	Upper Level
		surface	*surface*	*surface*	*surface*	*surface*	*surface*	*surface*	*surface*	*surface*	*surface*		
Arsenic	mg kg^{-1}	18	32.7	28.7	24.9	19.5	15.6	14.3	11.3	14.6	14.6	20	70
Cadmium	mg kg^{-1}	1.1	1	0.9	1.3	0.9	0.8	0.9	0.9	0.6	0.9	0.7	4.2
Chromium	mg kg^{-1}	90	81.1	78	81.8	78.3	81.4	94.8	80.8	91.6	83	120	370
Copper	mg kg^{-1}	62.3	34.6	37.9	22.3	26.1	34.1	34	29	19.9	24.7	40	110
Lead	mg kg^{-1}	51.8	35	32	26.4	33.6	39.5	43.6	41.6	15.2	39.7	60	218
Mercury	mg kg^{-1}	0.06	0.02	0.01	0.01	0.06	0.04	0.08	0.06	0.01	0.02	0.2	0.7
Nickel	mg kg^{-1}	29.2	34.1	43	32.3	30.6	28	29.1	28.6	24.7	29.2	40	60
Zinc	mg kg^{-1}	151	124	117	103	112	127	154	133	95	121	160	410
(TBT + DBT)	mg kg^{-1}	0.028	0.021	0.019	0.01	0.01	0.01	0.01	0.01	0.01	0.032	0.1	0.5
g-HCH (Lindane)	ug kg^{-1}	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	1
PCB 028	ug kg^{-1}	1.2500	0.8700	0.6000	0.2200	0.5700	0.7600	0.6700	0.6700	0.1700	1.5500	1	180
PCB 052	ug kg^{-1}	0.8500	0.5500	0.3900	0.1600	0.4000	0.5800	0.5500	0.5500	0.1100	1.1000	1	180
PCB 101	ug kg^{-1}	0.5900	0.3700	0.2600	0.1000	0.2800	0.3600	0.3500	0.3100	0.0800	0.9900	1	180
PCB 118	ug kg^{-1}	0.6500	0.4400	0.3400	0.1300	0.3800	0.4300	0.4300	0.4300	0.0800	1.1700	1	180
PCB 138	ug kg^{-1}	0.6900	0.4700	0.3400	0.1400	0.3600	0.3700	0.4500	0.4100	0.0800	0.9300	1	180
PCB 153	ug kg^{-1}	0.79	0.48	0.38	0.14	0.41	0.51	0.49	0.41	0.08	1.08	1	180
PCB 180	ug kg^{-1}	0.38	0.25	0.19	0.08	0.21	0.28	0.26	0.19	0.08	0.47	1	180
Σ (7 PCBs)	ug kg^{-1}	5.2000	3.4300	2.5000	0.9700	2.6100	3.2900	3.2000	2.9700	0.6800	7.2900	7	1260
Hexachlorobenzine	ug kg^{-1}	0.17	0.1	0.1	0.1	0.1	0.1	0.1	0.13	0.1	0.1	0.3	1
Acenaphthene	ug kg^{-1}	24	30.6	15.2	20.3	20.2	12.4	18.4	20.9	2.69	38.4	-	-
Acenaphthylene	ug kg^{-1}	63.8	51.9	47.9	59.4	94.2	39.6	121	41.9	3.01	72.3	-	-

Parameter	Units (Dry Wt)	Results - 2020										Guideline Values	
		new 11	new 12	new 13	new 14	new 15	new 16	new 17	new 18	new 19	new 20	Lower Level	Upper Level
		surface	*surface*	*surface*	*surface*	*surface*	*surface*	*surface*	*surface*	*surface*	*surface*		
Anthracene	ug kg^{-1}	88.3	70.5	37.6	45.2	82.4	45.6	100	48.7	6.21	111	-	-
Benzo (a) anthracene	ug kg^{-1}	215	176	101	116	235	139	276	137	17.2	283	-	-
Benzo (a) pyrene	ug kg^{-1}	288	226	145	167	319	197	387	215	22.6	361	-	-
Benzo (b) fluoranthene	ug kg^{-1}	252	222	153	148	256	167	304	196	24.9	349	-	-
Benzo (ghi) perylene	ug kg^{-1}	212	163	117	123	207	150	261	158	15.6	264	-	-
Benzo (k) fluoranthene	ug kg^{-1}	113	93.3	65.4	75.3	120	102	176	108	10.8	126	-	-
Chrysene	ug kg^{-1}	232	183	124	139	248	195	291	168	22	308	-	-
Dibenz (a,h) anthracene	ug kg^{-1}	48.7	32.8	27.4	26.5	52.5	34	63.9	37	3.73	55.3	-	-
Flourene	ug kg^{-1}	63.3	59.6	49	50.4	64.6	35.9	68.7	41	4.4	78.3	-	-
Fluoranthene	ug kg^{-1}	327	275	145	160	261	211	296	195	23.5	412	-	-
Indeno (1,2,3–cd)	ug kg^{-1}	215	171	120	121	202	158	271	171	14.9	257	-	-
Naphthalene	ug kg^{-1}	63.9	53	54.9	53.5	57.2	43.2	67.6	62.7	5.02	77.4	-	-
Phenanthrene	ug kg^{-1}	160	150	95.5	104	141	118	154	154	10.4	230	-	-
Pyrene	ug kg^{-1}	421	309	181	220	385	258	459	249	33.1	460	-	-
Σ (16 PAH)	ug kg^{-1}	2787.17	2266.8	1479	1628.7	2745.2	1905.8	3314.7	2003.33	220.16	3482.8	4000	-
Total Extractable Hydrocarbons	g kg^{-1}	0.367	0.489	0.357	0.387	0.433	0.437	0.443	0.526	0.0818	0.819	1	

Table 8-5 Sediment Chemistry Results 2020 compared against MI Guidelines (Sampling location 22– 32)

Parameter	Units (Dry Wt)	Results - 2020										Guideline Values	
		new 22	new 23	new 24	new 25	new 26	new 27	new 28	new 29	new 31	new 32	Lower Level	Upper Level
		surface	*surface*	*surface*	*surface*	*surface*	*surface*	*surface*	*surface*	*surface*	*surface*		
Arsenic	mg kg^{-1}	13.8	15.8	12.7	17.4	21.4	19.1	19.9	18	10.9	10.7	20	70
Cadmium	mg kg^{-1}	1.1	0.9	1	1.1	0.9	0.9	0.9	1	0.9	0.8	0.7	4.2
Chromium	mg kg^{-1}	86.5	85.1	78.8	81.9	78.8	81.3	77.9	78.3	85.7	88.9	120	370
Copper	mg kg^{-1}	42.5	39.9	47.8	34.6	30	31.9	32.5	31.1	29.3	46.3	40	110
Lead	mg kg^{-1}	24.4	44.8	57.2	41.9	36.8	38.7	40.6	39.4	48.5	18.6	60	218
Mercury	mg kg^{-1}	0.01	0.05	0.04	0.05	0.04	0.03	0.05	0.02	0.11	<0.01	0.2	0.7
Nickel	mg kg^{-1}	27	35.6	36	33	32.8	33.1	32.1	31.9	26.5	28.4	40	60
Zinc	mg kg^{-1}	99	150	176	143	129	144	141	134	137	92	160	410
(TBT + DBT)	mg kg^{-1}	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.0474	0.01	0.1	0.5
g-HCH (Lindane)	ug kg^{-1}	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	1
PCB 028	ug kg^{-1}	0.4100	1.2100	1.3400	1.0800	0.7100	0.7300	0.9900	0.9400	3.7300	0.3100	1	180
PCB 052	ug kg^{-1}	0.3000	0.8000	0.7600	0.6500	0.4600	0.4400	0.6800	0.5900	2.2400	0.2300	1	180
PCB 101	ug kg^{-1}	0.1900	0.5200	0.7200	0.4800	0.3400	0.3600	0.4600	0.3900	1.5300	0.1300	1	180
PCB 118	ug kg^{-1}	0.2000	0.7300	0.9100	0.6900	0.4500	0.4600	0.6700	0.4900	1.6900	0.1900	1	180
PCB 138	ug kg^{-1}	0.2400	0.6600	1.1700	0.6000	0.5100	0.4700	0.6100	0.5200	1.7400	0.1900	1	180
PCB 153	ug kg^{-1}	0.26	0.71	1.21	0.74	0.55	0.51	0.69	0.58	1.93	0.17	1	180
PCB 180	ug kg^{-1}	0.1	0.41	0.68	0.38	0.29	0.24	0.37	0.31	0.95	0.08	1	180
Σ (7 PCBs)	ug kg^{-1}	1.7000	5.0400	6.7900	4.6200	3.3100	3.2100	4.4700	3.8200	13.8100	1.3000	7	1260
Hexachlorobenzine	ug kg^{-1}	0.1	0.15	0.1	0.11	0.11	0.12	0.14	0.14	0.1	0.1	0.3	1
Acenaphthene	ug kg^{-1}	45.2	18	16	9.36	15	12.2	12.4	13.5	21.4	9.23	-	-
Acenaphthylene	ug kg^{-1}	36.7	35.6	49.2	28.2	31.9	29.9	32.7	49	78.3	14.2	-	-

Parameter	Units (Dry Wt)	Results - 2020										Guideline Values	
		new 22	new 23	new 24	new 25	new 26	new 27	new 28	new 29	new 31	new 32	Lower Level	Upper Level
		surface	*surface*	*surface*	*surface*	*surface*	*surface*	*surface*	*surface*	*surface*	*surface*		
Anthracene	ug kg^{-1}	100	53.7	66.9	35	43.9	44	48.5	66.8	100	21.7	-	-
Benzo (a) anthracene	ug kg^{-1}	298	145	162	94.4	112	126	123	141	230	115	-	-
Benzo (a) pyrene	ug kg^{-1}	292	202	266	137	155	162	175	205	352	229	-	-
Benzo (b) fluoranthene	ug kg^{-1}	269	189	243	122	146	158	170	205	302	253	-	-
Benzo (ghi) perylene	ug kg^{-1}	174	159	197	115	128	129	144	163	251	212	-	-
Benzo (k) fluoranthene	ug kg^{-1}	138	94.8	134	70.5	71.9	82.2	84.4	91.7	159	108	-	-
Chrysene	ug kg^{-1}	314	170	181	115	133	143	145	164	236	186	-	-
Dibenz (a,h) anthracene	ug kg^{-1}	45.3	34.1	44.5	23.2	27.9	25.7	27.9	35.1	56.8	50.4	-	-
Flourene	ug kg^{-1}	51.7	36.7	45.6	25.9	30.9	32	35.7	39.9	57.9	17.9	-	-
Fluoranthene	ug kg^{-1}	593	229	219	153	165	179	180	190	294	185	-	-
Indeno (1,2,3–cd)	ug kg^{-1}	182	148	197	110	128	132	144	160	259	218	-	-
Naphthalene	ug kg^{-1}	86.5	47.3	55.5	36.6	45.7	50.7	58.6	58.5	56.6	22.3	-	-
Phenanthrene	ug kg^{-1}	355	139	135	82.4	107	110	117	123	164	71.2	-	-
Pyrene	ug kg^{-1}	546	295	333	175	199	222	215	240	425	193	-	-
Σ (16 PAH)	ug kg^{-1}	3526.5	1996.35	2344.8	1332.67	1540.31	1637.82	1713.34	1945.64	3043.1	1906.03	4000	-
Total Extractable Hydrocarbons	g kg^{-1}	0.366	0.292	0.498	0.52	0.337	0.385	0.351	0.403	0.615	0.281	1	

Table 8-6 Sediment Chemistry Results 2018 compared against MI Guidelines

Parameter	Units (Dry Wt)	Results - 2018						Guideline Values	
		S18	S21	S25	S27	S29	S30	Lower Level	Upper Level
		surface	*8.0m*	*surface*	*surface*	*surface*	*surface*		
Arsenic	*mg kg^{-1}*	6.4	8.8	6.4	6.5	7.8	2.9	20	70
Cadmium	*mg kg^{-1}*	0.2	0.3	0.3	0.2	0.3	0.3	0.7	4.2
Chromium	*mg kg^{-1}*	32.4	31.8	27.1	33.5	41.0	17.8	120	370
Copper	*mg kg^{-1}*	18.0	8.2	21.3	19.1	20.0	23.6	40	110
Lead	*mg kg^{-1}*	23.2	10.2	22.5	25.2	27.7	25.6	60	218
Mercury	*mg kg^{-1}*	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.7
Nickel	*mg kg^{-1}*	18.0	19.4	15.9	19.0	20.4	61.8	40	60
Zinc	*mg kg^{-1}*	74.2	45.4	75.9	82.9	90.9	94.7	160	410
(TBT + DBT)	*mg kg^{-1}*	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.5
g-HCH (Lindane)	*ug kg^{-1}*	0.1	0.1	0.1	0.1	0.1	0.1	0.3	1
PCB 028	*ug kg^{-1}*	0.2	0.1	0.3	0.2	0.8	0.4	1	180
PCB 052	*ug kg^{-1}*	0.1	0.1	0.2	0.1	0.3	0.2	1	180
PCB 101	*ug kg^{-1}*	0.1	0.1	0.1	0.1	0.3	0.2	1	180
PCB 118	*ug kg^{-1}*	0.1	0.1	0.1	0.1	0.3	0.2	1	180
PCB 138	*ug kg^{-1}*	0.1	0.1	0.1	0.2	0.4	0.2	1	180
PCB 153	*ug kg^{-1}*	0.1	0.1	0.2	0.2	0.4	0.3	1	180
PCB 180	*ug kg^{-1}*	0.1	0.1	0.1	0.1	0.4	0.2	1	180
Σ (7 PCBs)	*ug kg^{-1}*	0.7	0.0	1.1	1.0	2.8	1.8	7	1260
Hexachlorobenzine	*ug kg^{-1}*	N/A	N/A	N/A	N/A	N/A	N/A	0.3	1
Acenaphthene	*ug kg^{-1}*	7.4	<1	7.7	4.6	13.5	14.2	-	-
Acenaphthylene	*ug kg^{-1}*	4.9	<1	7.9	3.8	13.8	6.7	-	-
Anthracene	*ug kg^{-1}*	15.6	1.2	25.2	13.1	39.8	27.9	-	-
Benzo (a) anthracene	*ug kg^{-1}*	52.5	1.0	69.6	43.8	123.0	89.6	-	-
Benzo (a) pyrene	*ug kg^{-1}*	66.2	<1	86.8	55.1	148.0	102.0	-	-
Benzo (b) fluoranthene	*ug kg^{-1}*	72.8	4.3	85.7	65.0	153.0	117.0	-	-
Benzo (ghi) perylene	*ug kg^{-1}*	61.5	3.0	67.3	54.5	131.0	97.9	-	-
Benzo (k) fluoranthene	*ug kg^{-1}*	36.6	<1	45.2	31.9	78.1	58.8	-	-
Chrysene	*ug kg^{-1}*	43.1	<3	52.1	33.8	88.8	69.7	-	-

Parameter	Units (Dry Wt)	Results - 2018						Guideline Values	
		S18	S21	S25	S27	S29	S30	Lower Level	Upper Level
		surface	*8.0m*	*surface*	*surface*	*surface*	*surface*		
Dibenz (a,h) anthracene	*ug kg^{-1}*	13.1	<1	14.8	11.4	27.6	20.5	-	-
Flourene	*ug kg^{-1}*	13.4	<5	15.5	11.1	26.5	21.1	-	-
Fluoranthene	*ug kg^{-1}*	91.4	2.1	109.0	67.6	175.0	162.0	-	-
Indeno (1,2,3–cd)	*ug kg^{-1}*	57.0	1.1	63.9	50.1	117.0	87.7	-	-
Naphthalene	*ug kg^{-1}*	23.8	<5	27.6	22.0	45.8	33.5	-	-
Phenanthrene	*ug kg^{-1}*	74.2	8.1	77.7	50.7	119.0	124.0	-	-
Pyrene	*ug kg^{-1}*	96.2	2.4	136.0	70.9	194.0	160.0	-	-
Σ (16 PAH)	*ug kg^{-1}*	729.6	23.2	892.0	589.4	1493.9	1192.6	4000	-
Total Extractable Hydrocarbons	*g kg^{-1}*	0.6	0.0	1.3	0.4	1.1	1.6	1	

Sediment Chemistry Trends 2006 - 2020

Sediment chemistry trends within Dublin Port's navigation channel was investigated for the period between 2006 and 2020 in order to provide context to the 2020 sampling results described above.

Sediment chemistry data was collated from the results of previous Sampling and Analysis Plans for both capital and maintenance dredging campaigns undertaken within the Dublin Port navigation channel. Sampling points varied in number and location from year to year, however, sufficient data was available to allow comment on the general status of sediment chemistry and trends in recent years.

Typically, the most important contaminants associated with dredged material include organotin compounds, heavy metals, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs) and oils (OSPAR, 2004). The contaminant suite included in the present data analysis comprises the following cataminant groups: 9 Metals (including TBT+DBT); Sum of PCBs (including 7 PCB congeners); 2 Orgaonchlorine pesticides; Sum of PAHs (including 16 individual PAH compounds); Total extractable hydrocarbons (TEH).

The sampling locations have been split into the following three zones:

- North Wall Quay Extension (NWQE) – Navigation channel between Tom Clarke Bridge and Western Oil Jetty (this equates to Area A excluded from the ABR Project Dumping at Sea Permit S0024-01)
- Inner Liffey Channel – Navigation channel between the Western Oil Jetty and the Bull Walls
- Dublin Bay

All sampling points were selected as part of Sample & Analysis Plans (SAP) established by the Marine Institute, and can be deemed representative of the areas of the navigation channel to be dredged in DPC's ABR Project capital dredging programme, and maintenance dredging programmes.

Mean annual concentrations for each metal are plotted in Figure 8-4. Values are grouped by year and also presented separately for each zone. These plots allow an examination of trends over the 15 year period covered by the data. They also show gross spatial trends over the sampling zones distinguished i.e. North Wall Quay Extension, Inner Liffey Channel and Dublin Bay. The upper and lower guideline values are also shown as a guide although they have no statutory relevance for classification of the mean annual values presented.

It is important to note that there are no missing values within the dataset. In some cases, values are below the limit of detection and are given a zero value. This is particularly evident for Organotin (TBT + DBT) where values were below the limit of detection within the Inner Liffey Channel and Dublin Bay in both 2019 and 2020.

The data shows a clear reduction in sediment metal contaminant levels from North Wall Quay Extension through the Inner Liffey Channel, and into Dublin Bay over time. The trend is evident in virtually all years but is less pronounced in sediments with lower levels of contaminants that are closer to baseline concentration levels.

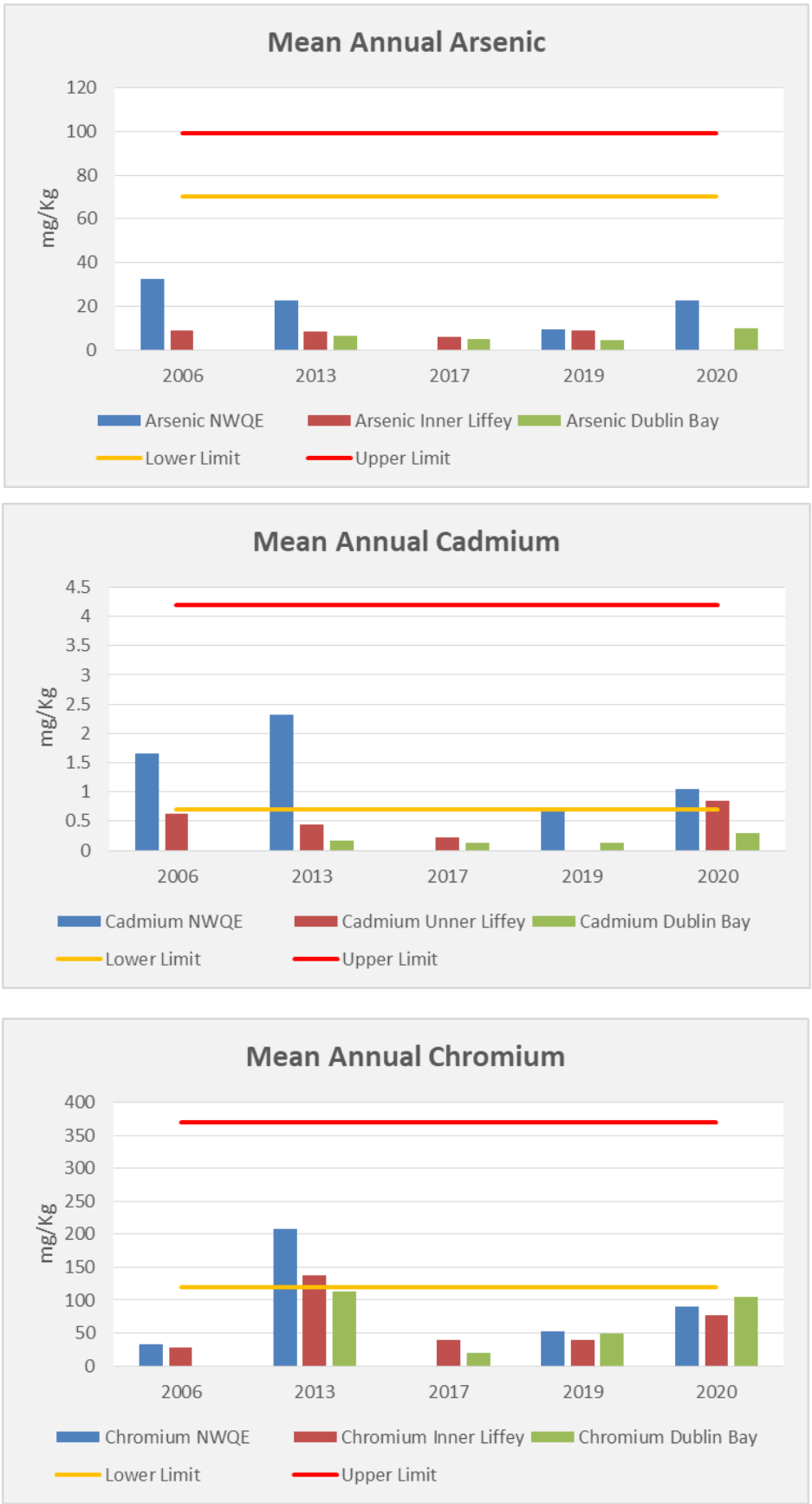


Figure 8-4 Mean Annual concentrations of metals by year and by sampling zone. Lower and upper limits where relevant are indicated by amber and red horizontal lines

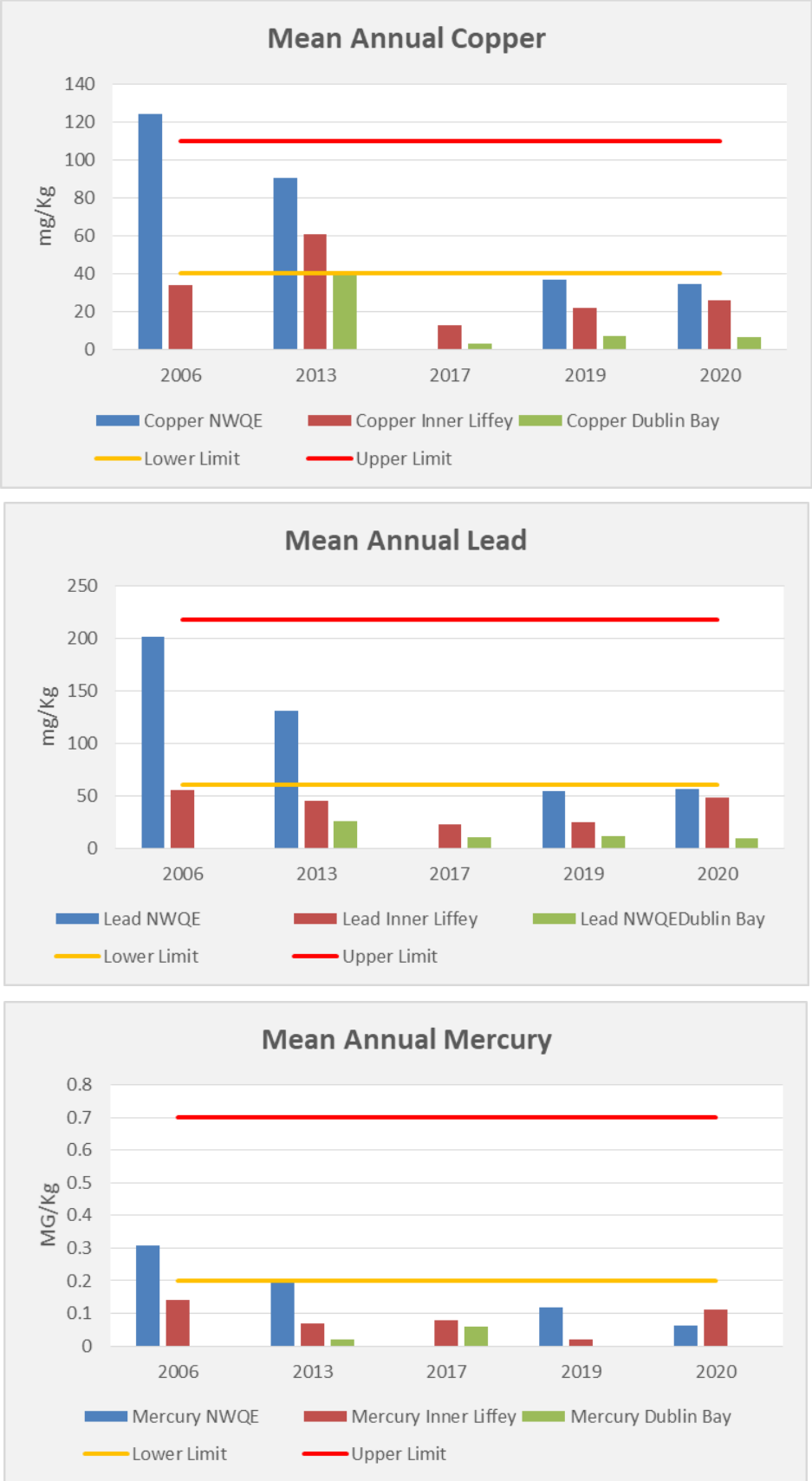


Figure 8-4 Cont'd Mean Annual concentrations of metals by year and by sampling zone. Lower and upper limits where relevant are indicated by amber and red horizontal lines

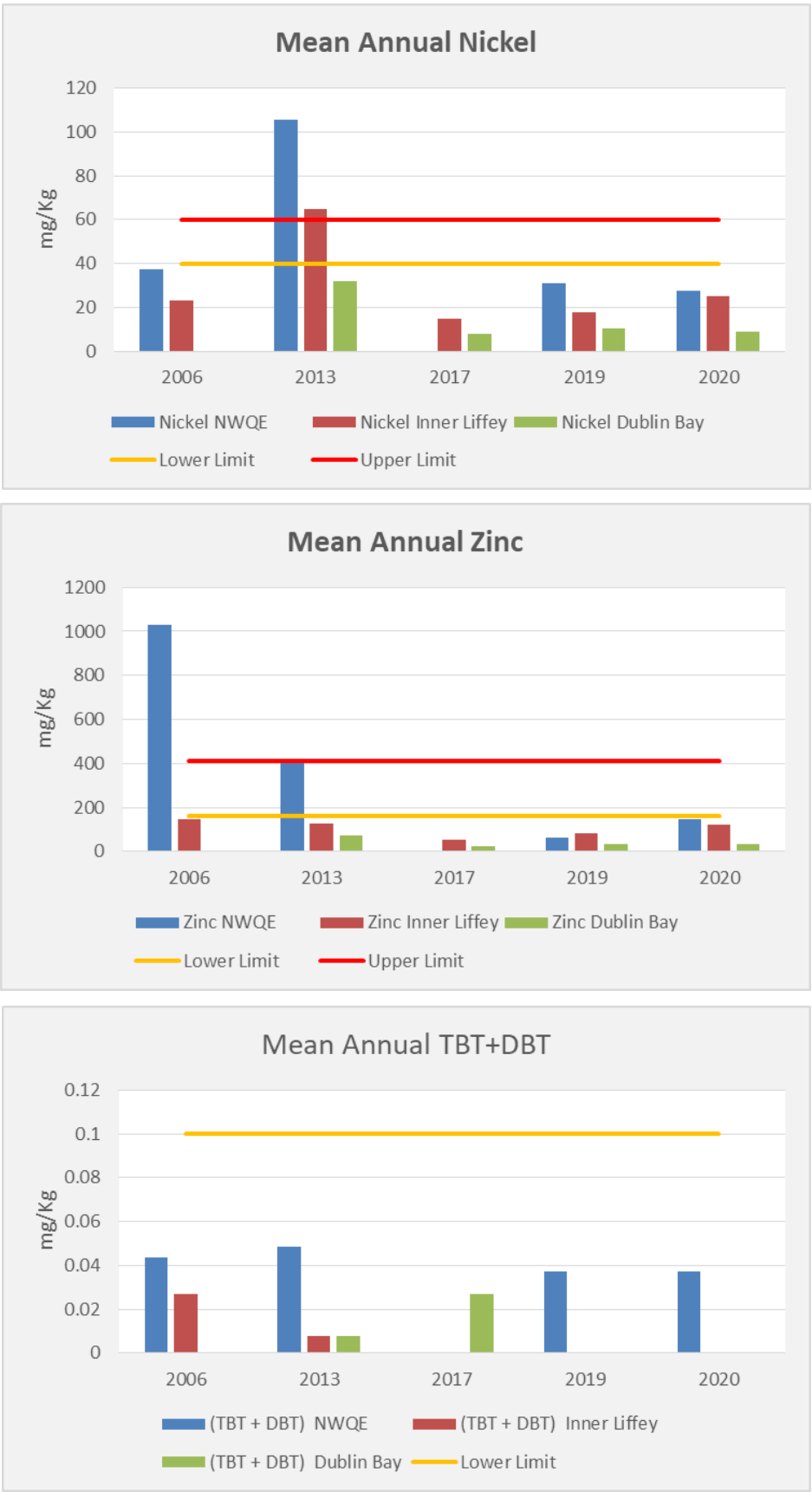


Figure 8-4 Cont'd Mean Annual concentrations of metals by year and by sampling zone. Lower and upper limits where relevant are indicated by amber and red horizontal lines

Metal concentrations have generally reduced in sediments over the period reported. This is particularly evident in the case of samples from the North Wall Quay Extension zone.

Lead (Pb) and Zinc (Zn) that historically had point sources in Alexandra Basin West in the North Wall Quay Extension zone show significant decreases in mean annual concentration. Lead drops from a mean annual concentration of just over 200 mg/kg in 2006 to approximately 55 mg/kg in 2020. Zinc drops from a mean annual concentration of over 1000 mg/kg to below 150 mg/kg in the same period.

Copper (Cu) and Mercury (Hg) also show reducing trends. Copper falls from a 2006 mean annual concentration (124 mg/kg) which is above the upper limit, to 34 mg/kg in 2020, which is below the lower limit. Mercury falls from a maximum mean annual concentration of 0.3 mg/kg in 2006 to 0.06 mg/kg in 2020.

Cadmuim (Cd), Cromium (Cr) and Nickel (Ni) show increased levels in 2013, particularly in the NWQE zone where Nickel mean annual concentration is above the upper limit value. Thereafter they fall to values near, or below the lower limit in 2020.

Mean annual concentrations of Arsenic (As) and Organtin (TBT+DBT) are well below the lower limit throughout the period and do not show pronounced trends.

Mean annual concentrations for the other main groups of contaminants (PCBs and PAHs) are plotted in Figure 8-5. Again, values are grouped by year and also presented separately for each zone. These plots allow an examination of trends over the 15 year period covered by the data. They also show gross spatial trends over the sampling zones distinguished i.e. North Wall Quay Extension, Inner Liffey Channel and Dublin Bay. The upper and lower guideline values are also shown as a guide although they have no statutory relevance for classification of the mean annual values presented.

Sum of PCBs shows a modest decrease in mean annual concentration over the 2006 to 2020 period. In the North Wall Quay Extension and Inner Liffey Channel zones, values were just above the lower limit at the begining of the interval and fall to near or below the lower limit by 2020.

Sum of PAHs shows a substantial decrease, but the initial high value in 2006 is based on a single sample. The remaining mean annual concentrations are at or below the lower limit value.

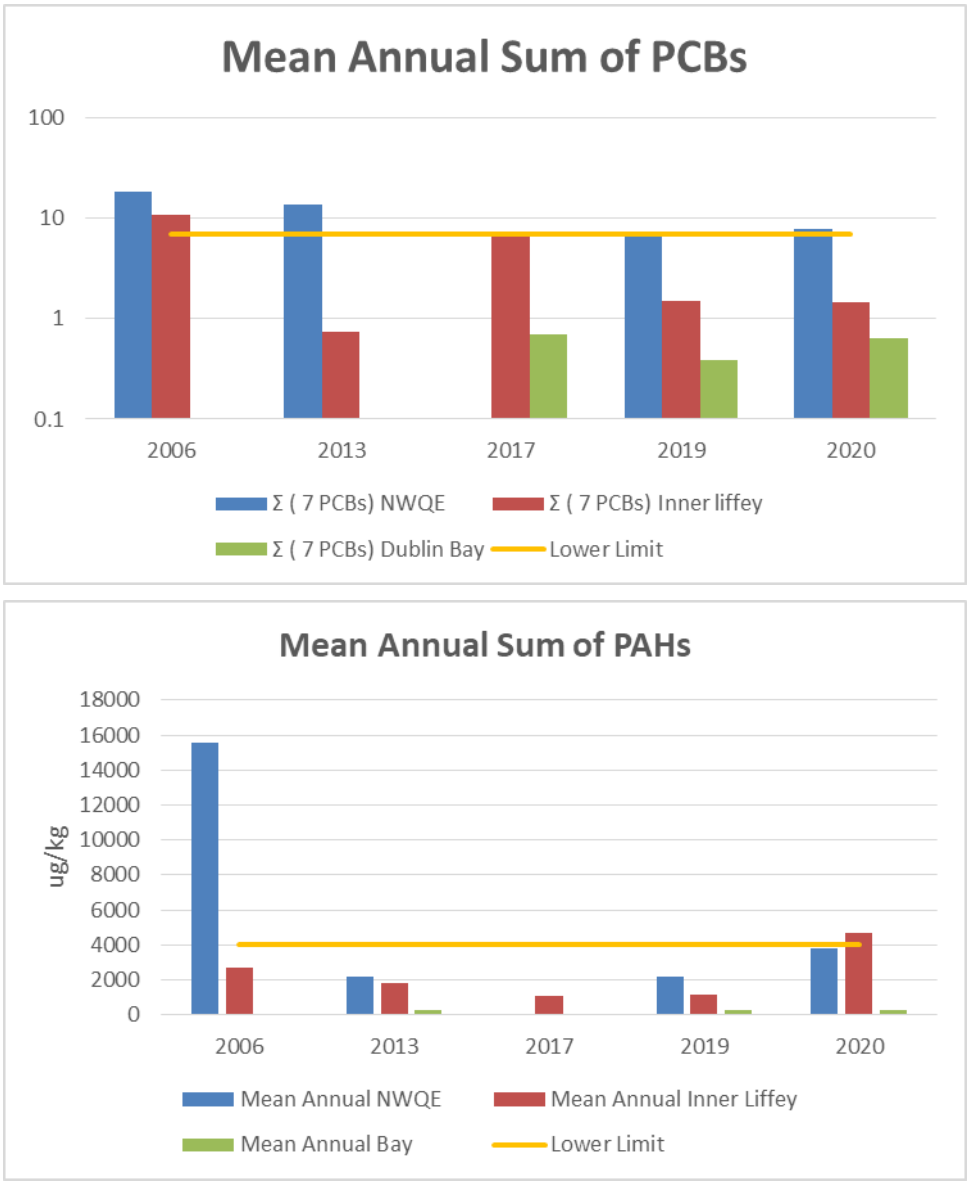


Figure 8-5 Mean Annual concentrations of Sum of PCBs (above) and Sum of PAHs (below) by year and by sampling zone. The lower limit is indicated by the amber horizontal lines

North Wall Quay Extension is the zone with highest initial contaminant levels and where downward trends are most evident. In an effort to summarise temporal trends with respect to the main contaminant groups, the mean annual concentrations of metals, PCBs and PAHs have been indexed to the initial 2006 value. Subsequent years are expressed as a proportion of the 2006 concentration. Scaling in this manner allows a mean contaminant index to be computed based on these groups as shown in Figure 8-6. It indicates that the overall sediment contaminant load has reduced from 2006 to 2020, principally during the period from 2006 to 2019 and plateauing thereafter. The mean annual contaminant load in 2020 due to metals, PCBs and PAHs is less than half that measured in 2006.

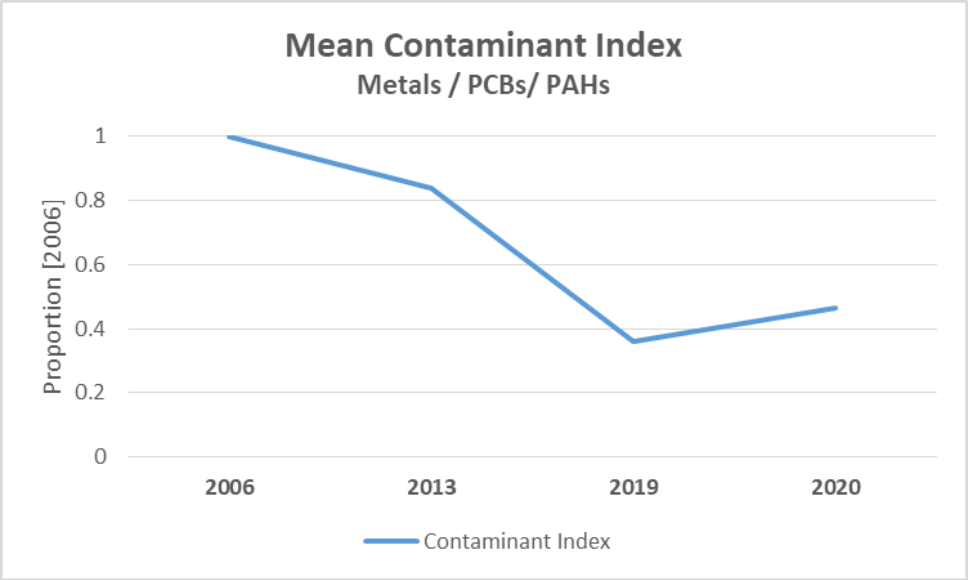


Figure 8-6 Annual index of combined sediment contaminant load over the period of record. Load is indexed to 2006 for each year

The reasons for the significant improvement in sediment quality within the Dublin Port navigation channel over time is likely to be due to the following contributary factors:

- The construction of the Alexandra Basin Redevelopment (ABR) Project has now effectively removed the source of lead and zinc contamination within Alexandra Basin West which has likely migrated into the navigation channel. New ore loading facilities have been put in place which effectively eliminates the loss of lead and zinc ore to the receiving waters.
- The ship maintenance and repair facilities at Graving Dock #2 have now been removed and the graving dock closed-off from Alexandra Basin West and infilled. The potential source of contaminants from the shot-blasting of ship's hulls, notably copper and TBT, has therefore been eliminated.
- The legacy issue of contaminated sediments within Alexandra Basin West is being addressed through a process of removing the contaminated sediments, treatment and re-using the treated material for infill. This work is being undertaken in accordance with an Industrial Emissions Licence issued by the EPA.
- There has been a general improvement in water quality within the navigation channel as reported under the EU Water Framework Directive (WFD). The Liffey Estuary Lower water body is now classified as *Good* between 2013 and 2018, upgraded from *Moderate* in the previous reporting period. Effective catchment management within the Liffey thereby appears to be yielding positive results with less pollutants now likely to be entering the Dublin Port navigation from the upstream catchment.

The full results of the 2006-2020 Trend Analysis are presented in Appendix 8-7.

Eco-Toxicological Sampling effort 2020

The Marine Institute set out the detailed sampling and analysis plan requirements of eco-toxicological testing on 31st July 2020, based on their assessment of the sediment chemistry results. The Eco-Toxicological Sampling and Analysis Plan 2020 is presented in Appendix 8-5. A total of six locations were selected for eco-toxicological testing.

DPC commissioned Aquatic Services Unit (ASU), University College Cork under the management of Ger Morgan to undertake the eco-toxicological testing in accordance with the extent and specification set by the Marine Institute. The ASU detailed report is presented in Appendix 8-6 and summarized below.

Subtidal sediment sampling using a 0.05m^2 stainless steel Van-Veen grab at selected sites in Dublin Port was carried out on 7th September 2020 by Hydromaster personnel and delivered the same day to ASU. Sediment from 6 sites was collected for toxicity testing using the 10-day polychaete whole sediment method. *Hediste diversicolor* was the species used for the bioassay. Elutriates of the sediment were also tested using the bioluminescent bacteria *Vibrio fischeri* with the Microtox system by ENVA Ltd. in Cork. The positions of the sediment garb samples are shown Figures 8-7. Note that the positions of Sites 2 and 3 had to be moved slightly from that specified by the Marine Institute to alternative positions as the original sites contained only very coarse substrate. Testing commenced on 11th September 2020 and ended on 21st September 2020. Testing was carried out in accordance with ASTM (2013) and Microtox guidelines.

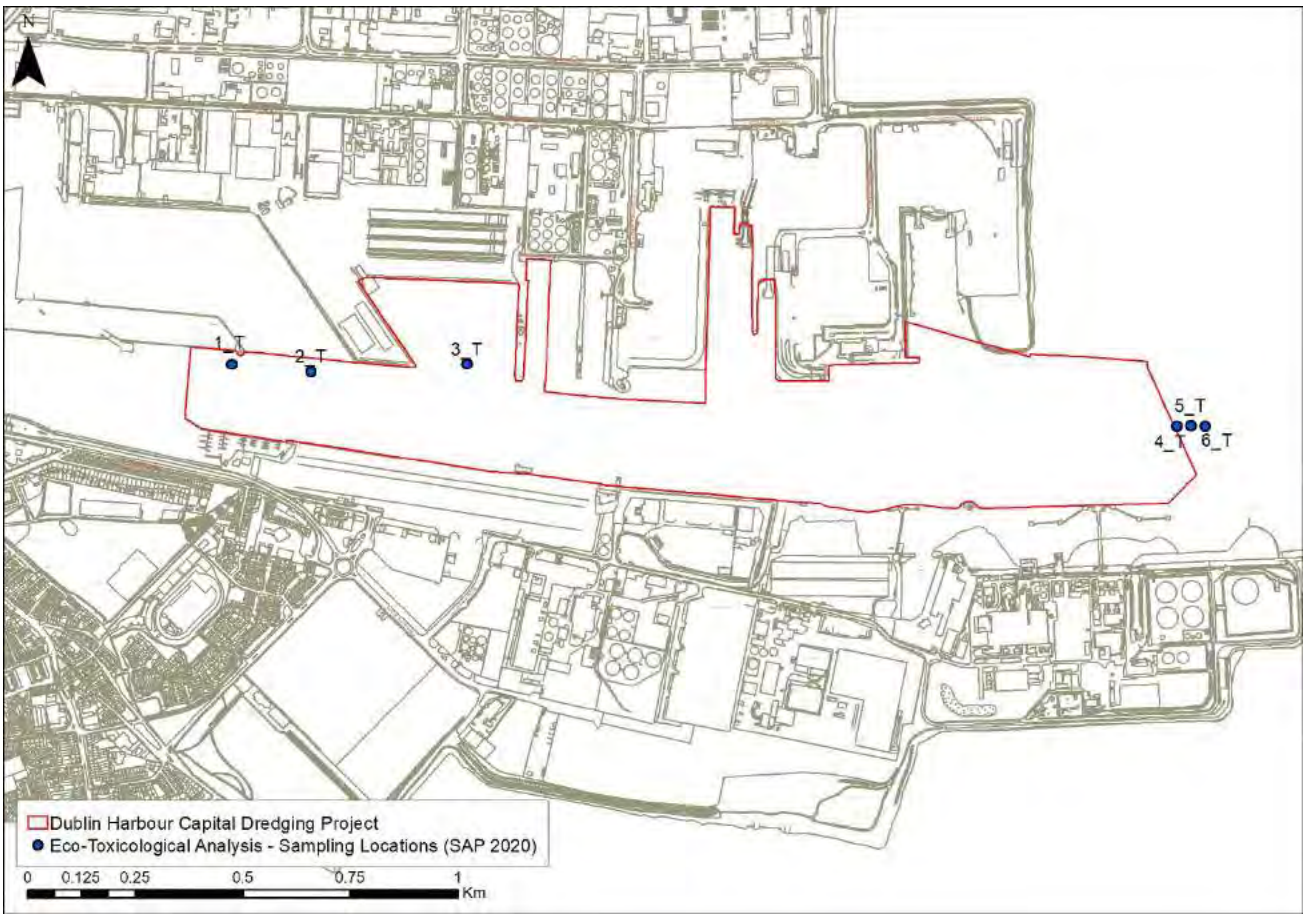


Figure 8-7 Eco-toxicological Testing Locations (SAP 2020)

10-day Polychaete bioassay Results

Test conditions were satisfactory with greater than 90% survival in the control chambers. Chemical parameters such as dissolved oxygen, pH, salinity and temperature were within the ranges defined in the ASTM guidelines throughout the testing period. Kruskal-Wallis test showed that the null hypothesis was accepted: i.e. that the mean survival rate did not differ between the control, reference or the six test site samples. Mean survival in the test sediments ranged from 92% at Sites 2 and 4 to 100% in sediment from Sites 1, 3, 5 and 6 as shown in Figure 8-8.

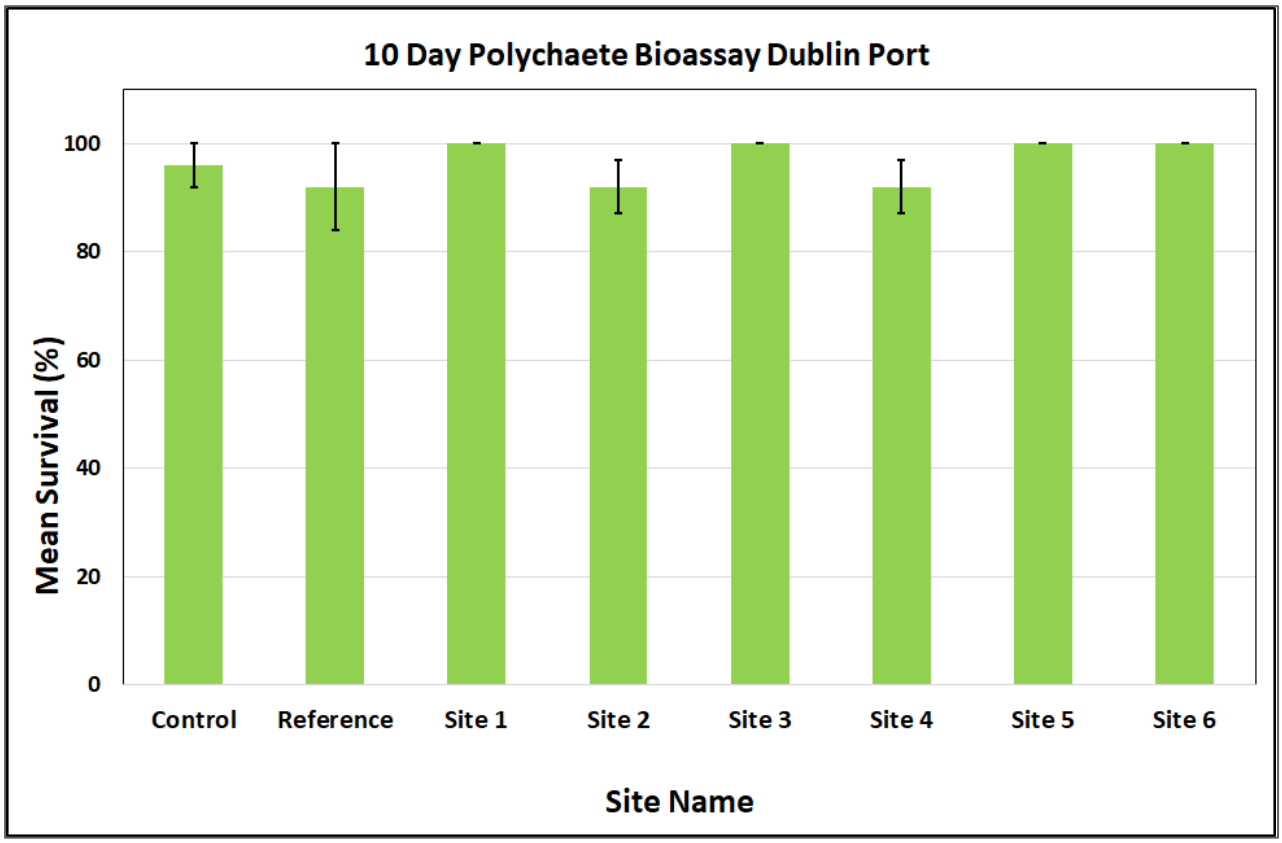


Figure 8-8 10-day Polychaete bioassay results (Error bars represent standard error of the mean)

Porewater & Elutriate Ammonia Results

Total ammonia in sediment porewater has been shown to confound toxicity tests by adding to the toxicity of sediments which may cause toxicity by themselves (Pinza et al., 1996). However, this does not appear to have been an issue in this case where the survival rates in the test sediments was comparable or higher to that in the reference and control sediments.

Elutriate Testing Results

Exposure of the marine bacterium *Vibrio fischeri* to elutriate samples from any of the Dublin Port test sites did not produce any significant toxicity as compared to the controls. Exposure of the bacteria to the elutriates caused a stimulatory effect on light production. This effect was observed for all Dublin Port sites and the Reference site. The Control sediment's elutriate sample produced minor decreases in light production at concentrations up to 22.5 % elutriate as compared to the Microtox control. The highest concentration tested 45% produced a neutral effect on light production i.e. 99.94% compared the 100% for the Microtox control. This bio stimulatory effect

exhibited by all the Dublin Port test sediments and the Reference sediment was shown to generally increase in a dose dependent manner and increased exposure time, levelling off or decreasing slightly at 45% elutriate concentration as shown in Figure 8-9. This effect ranged from an increase of between 108 (Site 4) and 126 (Site 6) percent light production as compared to the Mictotox Test Control (100%).

This bio stimulatory response has been reported previously for sediment elutriate samples using the Microtox method. A study carried out investigating the toxicity of Irish marine sediments recorded similar findings for sediment samples collected from Alexandra Basin in Dublin Port (Mackin et al., 2008). This bio stimulatory effect, also described as hormesis that can occur following exposure to sub inhibitory levels of toxicants, was also evident in the Microtox testing undertaken on Dublin Port samples in 2019 (ASU, 2019).

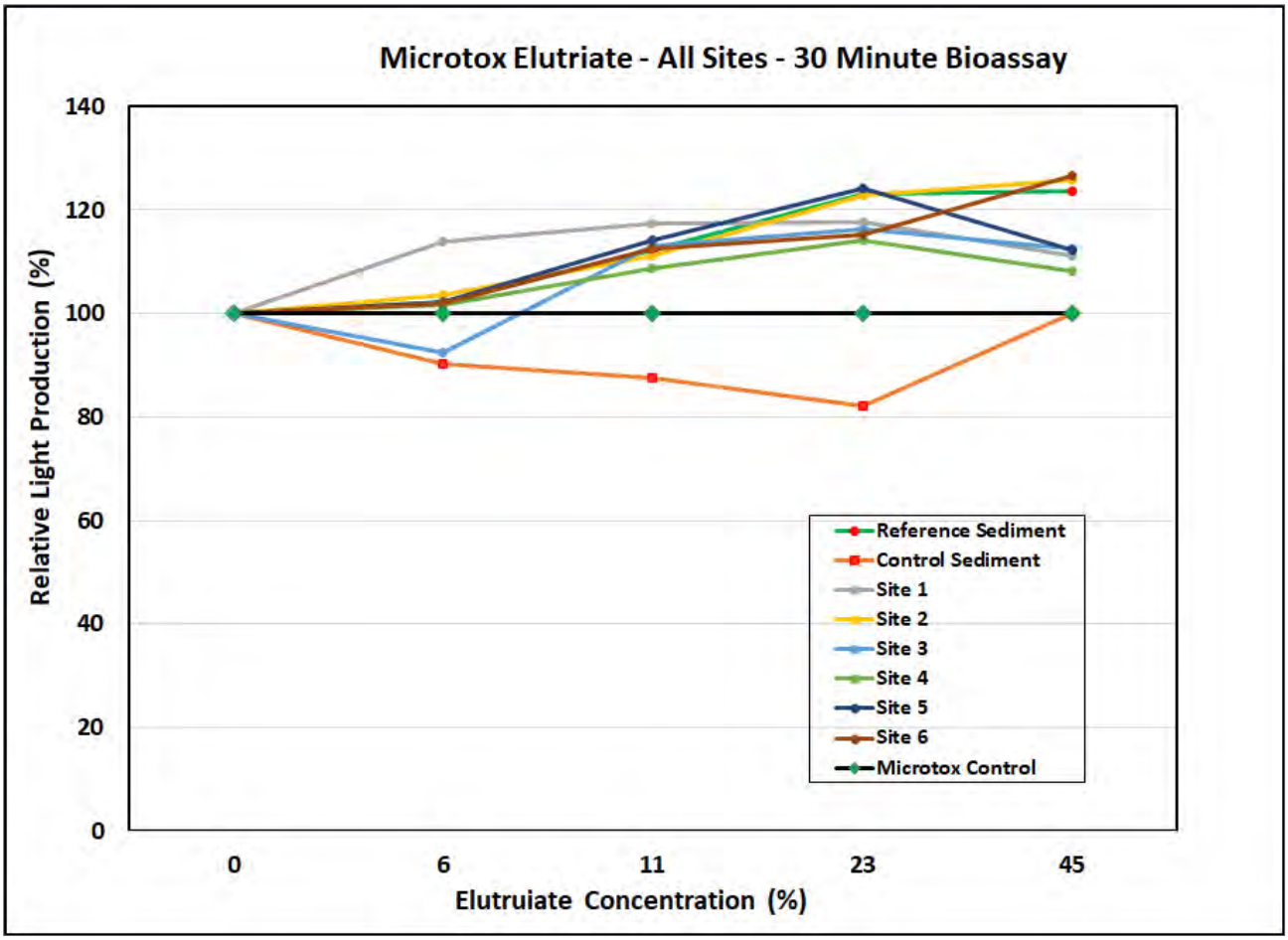


Figure 8-9 Relative light production of the marine bacterium Vibrio fischeri following 30 mins exposure to elutriate samples

Summary and Discussion

The toxicity of selected sites from Dublin Port were assessed for toxicity using the 10-Day polychaete whole sediment bioassay and Microtox elutriate test. Exposure of marine polychaetes to all 6 test samples from Dublin Port produced very low mean rates of mortality which did not differ significantly from Control and Reference sediments. Exposure of the Microtox bacteria, *Vibrio fischeri*, to elutriate samples made from Dublin Port samples did not produce any significant toxicity as compared to the Microtox test controls. Hormesis or bio

stimulation was recorded for all sites tested from Dublin Port. This effect has been reported previously for samples from Alexandra Basin.

Conclusion

The eco-toxicological test results have shown that the marine sediments to be dredged have no significant biological effect and can therefore be considered as Class 1 material (Uncontaminated: no biological effects likely) and thereby suitable for disposal at sea. The results of all the eco-toxicological tests carried out in September 2020 were forwarded to the Marine Institute for their interpretation, in combination with other relevant data held by the Marine Institute.

Following their assessment, the Marine Institute confirmed that the sediment sampling programmes in April 2020 for sediment chemistry and in October 2020 for eco-toxicity are adequate for a Dumping at Sea permit application assessment. This assessment will be carried out after the application is submitted.

8.2.2.3 Radiological Testing

With regard to radioactivity, radiological analysis was carried out in the area to be dredged in 2007 and 2009 in accordance with IAEA-TEC-DOC-1375, determining the suitability of materials for disposal at sea under the London convention 1972: A radiological assessment procedure. The measurements made at the time were found to be de minimis, indicating that the dumping of these materials at sea will not result in a radiological hazard (EPA, May 2017).

DPC undertook additional sampling and radiological analysis within Dublin Harbour in 2018. The sample locations and laboratory test results are presented in Figure 8-10 and Table 8-7 repectively.The EPA Laboratory Test Report is included in Appendix 8-8. The analysis was undertaken by the Office of Radiation Protection and Environmental Monitoring, EPA. The results indicate that dumping of these materials at sea will not result in a radiological hazard

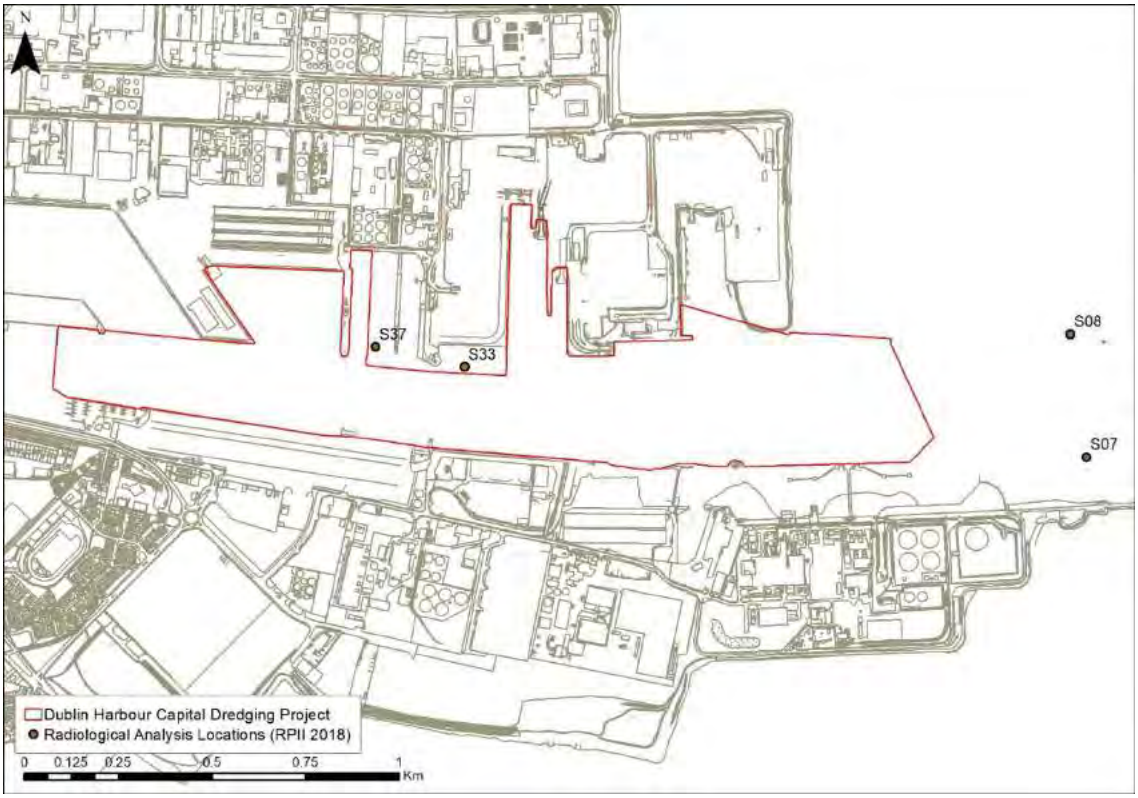


Figure 8-10 Radiological Analysis Locations (2018)

Table 8-7 Results of Radiological Analysis (2018)

ORP Reference	Client Reference	Nuclide	Activity Concentration (Bq/kg, dry)*
ES1800428	S1 Sample 7	K-40 I-131 CS-134 Cs-137 Am-241 Ra-226 Ra-228	440 ± 51 Nd Nd 12.7 ± 1.4 4.7 ± 0.6 18.1 ± 3.1 21.0 ± 3.3
ES1800429	S1 Sample 18	K-40 I-131 CS-134 Cs-137 Am-241 Ra-226 Ra-228	389 ± 45 Nd Nd 7.3 ± 0.8 3.2 ± 0.4 14.4 ± 2.5 15.4 ± 2.5
ES1800430	S1 Sample 33	K-40 I-131 CS-134 Cs-137 Am-241 Ra-226 Ra-228	419 ± 47 Nd Nd 19.0 ± 2.0 4.8 ± 0.9 20.7 ± 5.5 18.6 ± 3.0
ES1800431	S1 Sample 37	K-40 I-131 CS-134 Cs-137 Am-241 Ra-226 Ra-228	419 ± 48 Nd Nd 23.2 ± 2.3 5.3 ± 0.6 19.3 ± 3.3 19.3 ± 3.0

8.2.3 Geology

8.2.3.1 Regional Geology

Bedrock is the solid rock at or below the land surface. Over much of Ireland, the bedrock is covered by materials such as soil and gravel. The Bedrock map shows what the land surface of Ireland would be made up of if these materials were removed. As the bedrock is commonly covered, bedrock maps are an interpretation of the available data.

The bedrock underlying the Dublin Harbour Capital Dredging Project is not defined. However, as illustrated in Figure 8-11 the GSI Bedrock Geology of Ireland Map (100K) shows that bedrock in the greater Dublin region consists of Dinantian Upper Impure Limestone which is part of the Lucan Formation. The formation comprises dark-grey to black, fine-grained, occasionally cherty, micritic limestones that weather paler, usually to pale grey. There are also rare, dark, coarser grained, calcarenitic limestones, which are sometimes graded, present. The formation ranges from 300m to 800m in thickness and is Carboniferous. There are no faults mapped in the vicinity of the site. No bedrock outcrops were identified on the site.

Ground investigations undertaken as part of the Alexandra Basin Redevelopment Project have shown that the Limestone rock head level in the vicinity of the Dublin Harbour Capital Dredging Project are at circa -35m Chart Datum (CD).

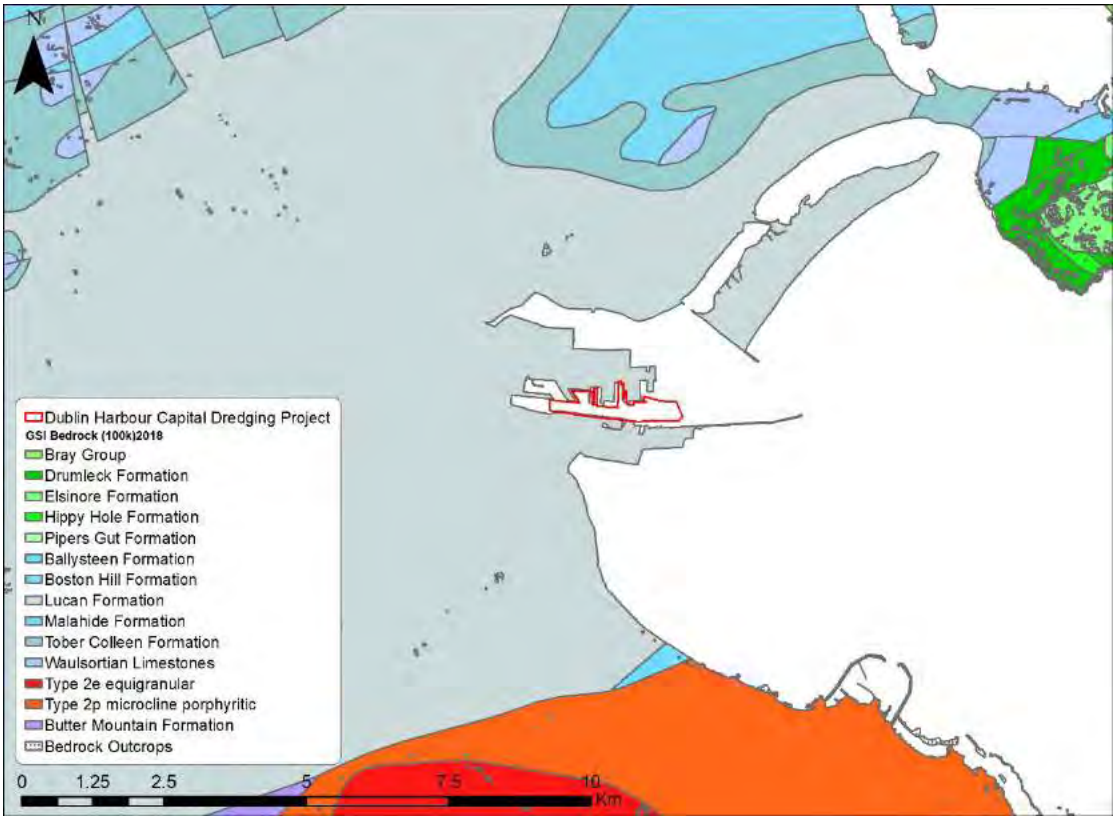


Figure 8-11 GSI 100K Bedrock Geology of Ireland Map (2018)

8.2.4 Hydrogeology and Groundwater Vulnerability

8.2.4.1 Regional Hydrogeology

The bedrock aquifers underlying the Dublin Harbour Capital Dredging Project are not defined according to the GSI National Bedrock Aquifer Classification Map based on the manmade nature of Dublin Port. However, as illustrated in Figure 8-12 the Bedrock aquifer in the surrounding area have been defined as a LI – locally important bedrock aquifer, described as bedrock which is moderately productive only in local zones. LI aquifers are those in which fissure permeability is generally low due to a poorly connected network of fractures, fissures and joints. Generally, the lack of connection between the limited fissures results relatively poor aquifer storage and flow paths that may only extend a few hundred metres.

Aquifer vulnerability is a term used to represent the intrinsic geological and hydrogeological characteristics that determine the ease with which groundwater may be contaminated generally by human activities. Due to the nature of the flow of groundwater through bedrock in Ireland, which is almost completely through fissures/ fractures, the main feature that protects groundwater from contamination, and therefore the most important feature in the protection of groundwater, is the subsoil (which can consist solely of or of mixtures of peat, sand, gravel, glacial till, clays or silts). The GSI does not have data regarding aquifer vulnerability at the Dublin Harbour Capital Dredging Project due to the majority of the Dublin Port being reclaimed from the Liffey Estuary. However, as illustrated in Figure 8-13, aquifer vulnerability in the neighboring area of Dublin Port is classified as ‘Low’ (L). Based on previous onsite investigations undertaken in Dublin Port, overburden depth to bedrock has been shown to be > 16 mbgl which would confirm the GSI site categorization of “Low”. Groundwater at the site is expected to be brackish / saline and unsuitable for potable supply.

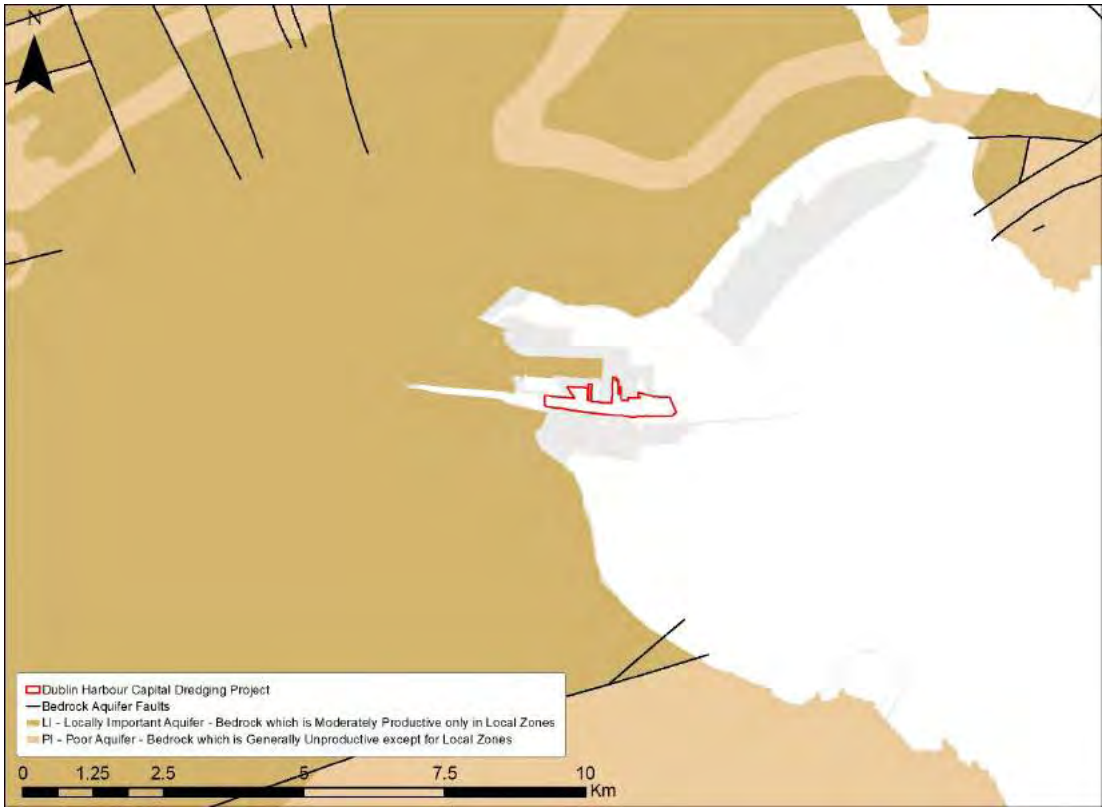


Figure 8-12 GSI Bedrock Aquifer Classification of Ireland Map



Figure 8-13 GSI Aquifer Vulnerability Map of Ireland

8.2.4.2 Groundwater Quality

Article 8 of the Water Framework Directive requires the establishment of programmes of monitoring for groundwater. The groundwater monitoring programmes primarily focus on providing information that can be used to assess the environmental status of groundwater bodies. Additionally, the groundwater monitoring programmes will provide information to assess whether the environmental objectives of Article 4 of the Water Framework Directive (WFD) are being met, thereby supporting the overall environmental and management objectives within a River Basin District (RBD).

The National WFD Groundwater Monitoring Programme is implemented by the Environmental Protection Agency. The monitoring is used to assess the general state of groundwater quality and groundwater levels / flows in Ireland. Thereafter, groundwater monitoring data are used to help determine the status of groundwater in the Ireland. In turn this information is used to help protect groundwater used for public and private drinking water supplies and is also used to help protect associated surface water and ecological receptors.

The Dublin Harbour Capital Dredging Project lies within the 'Dublin Urban' groundwater body (EA-G-008). This water body has achieved and maintained 'good' status since the 2007-2012 WFD Monitoring Cycle as reported in 2019. The EPA classifies the Dublin Urban' groundwater body with a Ground Waterbody Risk score of 'not at risk'.

8.2.5 Designated Sites

8.2.5.1 EU Designated Sites

Natura 2000 is a European network of important ecological sites. The EU Habitats Directive (92/43/EEC) places an obligation on Member States of the EU to establish the Natura 2000 network. The network is made up of Special Protection Areas (SPAs), established under the EU Birds Directive (79/409/EEC), and candidate Special Areas of Conservation (cSACs), established under the Habitats Directive itself.

The Capital Dredging loading activities associated with the Dublin Harbour Capital Dredging Project does not lie within any Natura 2000 site (i.e. SPA or cSAC). The licenced disposal site lies within the Rockabill to Dalkey SAC which is designated for the marine Annex I qualifying interest reefs and the Annex II species *Phocoena phocoena* (Harbour porpoise). It should also be noted that all possible significant effects on Natura 2000 or "European" sites have been considered in detail in the Appropriate Assessment Screening Report and Natura Impact Statement submitted with the application for development consent in respect of the Dublin Harbour Capital Dredging Project. These reports have concluded beyond reasonable scientific doubt that the capital dredging programme as proposed will not result in adverse effects on the integrity of any European site

8.2.5.2 Sites of Geological Interest

As illustrated in Figure 8-14, there are no sites of geological importance located within or in close proximity to the Dublin Harbour Capital Dredging Project. The closest site of Geological importance is North Bull Island located approximately 1.5 km north-east of the Dublin Harbour Capital Dredging Project. The sand flats and the associated beach, dune, lagoon and slack features are of interest for reasons of coastal geomorphology in

recognition of an active sedimentation system created inadvertently through the construction of the Bull Wall which was completed in 1825 (GSI, 2014).

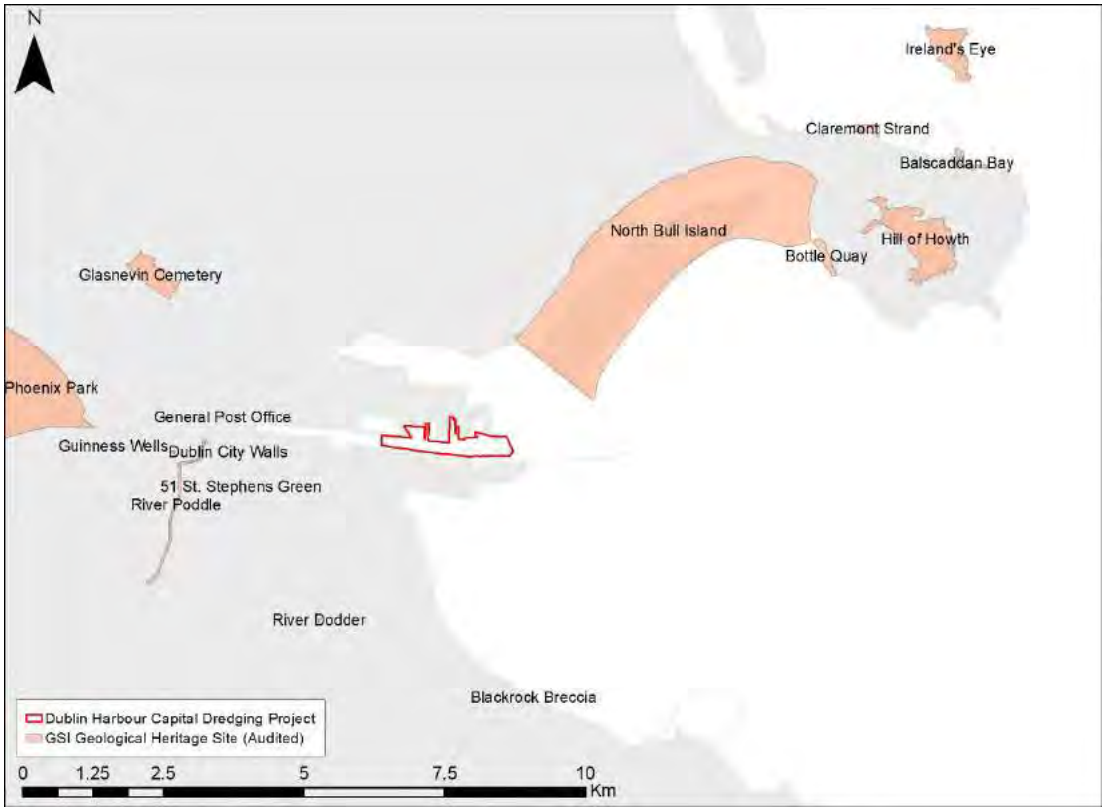


Figure 8-14 Sites of Geological Heritage

8.2.6 Summary

8.2.6.1 Land

- The Dublin Harbour Capital Dredging Project will not result in land take (i.e. the removal of productive land from potential agricultural or other beneficial uses) instead, the proposal selected for development makes optimum use of the Port's finite resources of river berths and quayside lands.
- The existing land uses within the footprint of the Dublin Harbour Capital Dredging Project comprise the manoeuvring and berthing of vessels, the handling of Ro-Ro and Lo-Lo cargo, HGV traffic distributing cargo to and from Dublin Port and the movement of ferry passengers arriving and departing to/from Dublin Port.
- The Dublin Harbour Capital Dredging Project is designed to provide port infrastructure which will improve the efficiency of port operations. The future land uses within the footprint of the Dublin Harbour Capital Dredging Project will not change.

8.2.6.2 Soils

- The soil underlying the Dublin Harbour Capital Dredging Project comprise a mixture of clay, silt, sand, gravel and cobbles.

- The National Soils Map of Ireland and the National Quaternary Geology Map of Ireland indicates that the soils making up the landside Dublin Port Estate Dublin Port are characterized as “made ground”.
- DPC undertook sediment chemistry sampling and analysis and eco-toxicity testing in accordance with the Maine Institutes Sediment Analysis Plans (2020). The sediment chemistry and eco-toxicological testing results have confirmed that the material to be dredged is suitable for disposal at sea.
- DPC undertook sampling and radiological analysis within Dublin Harbour in 2018. The results indicate that dumping of these materials at sea will not result in a radiological hazard

8.2.6.3 Geology

- There are no sites of geological importance located within or in close proximity to the Dublin Harbour Capital Dredging Project.
- The Bedrock Geology of Ireland Map (100K) shows that bedrock in the greater Dublin region consists of Dinantian Upper Impure Limestone which is part of the Lucan Formation. The formation comprises dark-grey to black, fine-grained, occasionally cherty, micritic limestones that weather paler, usually to pale grey. There are no faults mapped in the vicinity of the site.
- The depth to bedrock is mapped as 15-25 m on the GSI GeoUrban viewer. No rock is required to be dredged by the Dublin Harbour Capital Dredging Project.

8.2.6.4 Hydrogeology

- The bedrock aquifers in the vicinity of the Dublin Harbour Capital Dredging Project have been defined as a LI – locally important bedrock aquifer.
- Aquifer vulnerability is classified as ‘Low’ (L). Groundwater at the site is expected to be brackish / saline and unsuitable for potable supply.
- The Dublin Harbour Capital Dredging Project lies within the ‘Dublin Urban’ groundwater body (EA-G-008). This water body has achieved and maintained ‘good’ status since the 2007-2012 WFD Monitoring Cycle as reported in 2019. The EPA classifies the Dublin Urban’ groundwater body with a Ground Waterbody Risk score of ‘not at risk’.

8.3 Likelihood of Impacts

The likelihood of environmental impacts arising due to the Dublin Harbour Capital Dredging Project loading and disposal at sea activities is assessed in relation to the dredging and disposal operations. The potential impacts on Land, Soils, Geology and Hydrogeology have been identified for assessment.

The significance of any environmental effect is rated based on the magnitude of the impact and the importance of the attribute as detailed in Section 8.1. Based on the criteria detailed in NRA Guidelines the sensitivity of the Soils, Geology and Hydrogeology are considered to be Neutral due to their very low importance and rarity on a local scale.

For the purposes of this assessment the main impacts to Land, Soils, Geology and Hydrogeology is the mobilisation of contaminated sediment caused by capital dredging operations within the loading area and the creation of pathways in which potentially contaminated soils/sediment and/or groundwater can migrate downwards to the groundwater body. Such impacts can prevent the achievement of WFD objectives and could result in the deterioration of status in extreme circumstances.

8.4 Description of Likely Significant Impacts

8.4.1 Land

As the Dublin Harbour Capital Dredging will take place in the marine environment only, the magnitude of the potential impacts to land is considered to be *neutral*. The localised significance of the environmental effect is therefore *neutral* in the absence of mitigation based on the *neutral sensitivity* of the receiving environment.

8.4.2 Soil

Marine sediments are not, in themselves polluting substances. However, they can be a sink for contaminants that end up in our harbours and ports, mainly from anthropogenic sources such as sewage discharges, marine traffic, industrial wastewater and historically poor environmental management. Contaminants in sediments can act as a source of long-term environmental pollution. Certain substances can bio accumulate in benthic organisms resulting in bio magnification at higher levels in the food chain. Some widespread pollutants such as polychlorinated biphenyls (PCB's) are no longer in use but due to their persistence they can still be detected in marine sediments.

As shown in the results of the sediment analysis, the sediment chemistry results show very low level contamination (above the lower Class 2 guideline) of Arsenic, Cadmium, Copper, Lead, Nickel and Zinc at a number of sample locations within Dublin Harbour which is typical of industrial port sediment. Notably no elevated levels of Mercury were recorded.

There were no TBT / DBT results recorded above the lower guideline limit and only localised, slightly elevated levels of PCBs and Hydrocarbons (PAH and THE) were found. The remaining sample parameters are all below the lower guideline levels and would therefore be categorised as Class 1 (uncontaminated).

Eco-toxicological testing of the sediments confirmed they had no biological effect and thereby suitable for disposal at sea.

The magnitude of the potential impact from the mobilisation of contaminated suspended sediment due to dredging is considered to be *neutral*. The localised significance of the environmental effect is therefore *neutral* in the absence of mitigation based on the *neutral sensitivity* of the receiving environment.

8.4.3 Geology

As described in Chapter 3, the Dublin Harbour Capital Dredging Project aims to deepen the Navigation channel and berthing pockets from -7.8m CD to a depth of -10m CD. There are no faults mapped in the vicinity of the site and no bedrock outcrops were identified on the site. Previous ground investigations undertaken as part of the Alexandre Basin Redevelopment (ABR) Project have shown that the Limestone rock head level in the vicinity

of the Dublin Harbour Capital Dredging Project are at circa -35m Chart Datum (CD) which is 25m below the design dredge level of -10m CD.

The magnitude of the potential impacts associated with the creating a pathway in which potentially contaminated soils/sediment and/or groundwater can migrate downwards to groundwater is considered to be *neutral*. The localised significance of the environmental effect is therefore *neutral* in the absence of mitigation based on the *neutral sensitivity* of the receiving environment.

8.4.4 Hydrogeology and Groundwater Vulnerability

The Dublin Harbour Capital Dredging Project will take place in the marine environment only, therefore the magnitude of the potential impacts to groundwater is considered to be *neutral*. The localised significance of the environmental effect is therefore *neutral* in the absence of mitigation based on the *neutral sensitivity* of the receiving environment.

8.5 Mitigation Measures

8.5.1 Construction Phase Mitigation Measures

No specific mitigation measures with regard to land, soils, geology and hydrogeology are proposed during the construction phase. Mitigation measures are identified in Chapter 9 with respect to surface water quality.

8.5.2 Operational Phase Mitigation Measures

No specific mitigation measures with regard to lands, soils, geology and hydrogeology are proposed during the operational phase. Mitigation measures are identified in Chapter 9 with respect to surface water quality.

8.6 Residual Impacts

No residual impacts are predicted during the construction or operational phase of Dublin Harbour Capital Dredging Project.

8.7 Potential Cumulative Impacts

Potential cumulative impacts may arise from the Dublin Harbour Capital Dredging Project when combined with other existing and/or approved projects. In accordance with the European Commission (2017) and EPA Draft Guidelines (2017), existing and/or approved projects with the potential for cumulative impacts have been identified. Cumulative impact assessments have been undertaken in this section for relevant pressures that could potentially give rise to cumulative impact. Each development with the potential to impact on the water environment has been considered through a review of the environmental supporting information for the existing or approved developments.

8.7.1 Dublin Port Company ABR Project

The Alexandra Basin Redevelopment (ABR) Project is the first major infrastructure project to be brought forward for planning and other consents from the Dublin Port Masterplan 2012 to 2040, reviewed 2018. An Bord Pleanála granted permission for the ABR Project on 8th July 2015 (29N.PA0034).

The ABR Project comprises a number of engineering works set out in DPC's Masterplan document, mainly:

- Works at Alexandra Basin West including construction of new quays and jetties, remediation of contamination on the bed of the basin, capital dredging to deepen the basin and to achieve the specified depths of -10m Chart Datum (CD) at the new berths.
- Infilling of the Basin at Berths 52 & 53 and construction of a new river berth with a double tiered Ro-Ro ramp.
- Deepening of the fairway and approach to Dublin Port to increase the ruling depth from -7.8m CD to -10.0m CD.

The dredging elements of the ABR project were completed in March 2021, therefore no cumulative effects are expected.

8.7.2 Dublin Port Company MP2 Project

The MP2 Project complements the ABR Project in providing capacity for growth in the Ro-Ro and Lo-Lo modes on the north side of the port and at its eastern end in addition to providing suitable infrastructure for increasing numbers of ferry passengers. The MP2 Project obtained planning permission in July 2020 and applications have been made for Foreshore and Dumping at Sea consent.

The works proposed as part of the MP2 Project are summarised as follows:

- Construction of a new Ro-Ro jetty (Berth 53) for ferries up to 240m in length on an alignment north of the Port's fairway and south and parallel to the boundary of the South Dublin Bay & River Tolka SPA (004024).
- A reorientation of the already consented Berth 52 (ABP Ref. 29N.PA0034). Berth 52 is also designed to accommodate ferries up to 240m in length. The works will also comprise an amendment to the consented open dolphin structure (ABP Ref. 29N.PA0034) to create a closed berthing face at the eastern end of Berth 49.
- A lengthening of an existing river berth (50A) to provide the Container Freight Terminal with additional capacity to handle larger container ships. These works will include the infilling of the basin east of the now virtually redundant Oil Berth 4 on the Eastern Oil Jetty. These works will also include dredging to a standard depth of -11.0m CD which is a proposed amendment to the channel dredging as permitted under the ABR Project (ABP Ref. 29N.PA0034).
- As part of the infilling of Oil Berth 4, it is proposed to redevelop Oil Berth 3 as a future deep-water container berth (standard depth of -13.0m CD) for the Container Freight Terminal. This will facilitate the change of use of the berth from petroleum importation to container handling when the throughput of petroleum products through Dublin Port declines as a result of national policies to decarbonise the economy.

- The dredging of a berthing pocket to a standard depth of -13.0m CD at Oil Berth 3 will require stabilisation of the existing quay wall at Jetty Road. It is not proposed to use this quay wall for the berthing of vessels.
- Dredging at the proposed Berth 53 and channel widening to a standard depth of -10.0m CD which is a proposed amendment to the channel dredging as permitted under the ABR Project (ABP Ref. 29N.PA0034).
- Consolidation of passenger terminal buildings, demolition of redundant structures and buildings, and removal of connecting roads to increase the area of land for the transit storage of Ro-Ro freight units as a Unified Ferry Terminal (UFT). Works include reorganisation of access roads; two proposed check in areas comprising a total of 14 check lanes; proposed set down and parking area for the existing Terminal 1 building; proposed pedestrian underpass to access the existing Terminal 1 building; three proposed toilet blocks and a proposed ESB Substation. These works will comprise amendments to consented developments with planning reference numbers 3084/16 & 3638/18, and the ABR Project (ABP Ref. 29N.PA0034).
- A heritage zone adjacent to Berth 53 and the Unified Ferry Terminal set down area. This will comprise an alteration to consented development planning reference 3084/16.

The MP2 Project EIAR concluded that construction and operation of the MP2 Project will not have any significant, negative impacts on the soils, geology and hydrogeology within the area. As there are no negative impacts associated with either the MP2 Project and the Dublin Harbour Capital Dredging Project, no cumulative impacts are considered likely.

8.7.3 Dublin Port Company – Dublin Port Maintenance Dredging 2022-2029

Dublin Port Company (DPC) need to carry out regular maintenance dredging of the navigation channel, basins and berthing pockets in order to maintain their declared charted depths and hence provide safe navigation for vessels to and from the Port. The loading of dredged material will be restricted to those areas of the navigation channel, basins and berthing pockets which contain sediments which are suitable for disposal at sea (Class 1 : uncontaminated, no biological effects likely). It is proposed to dispose of the dredged sediments at the existing licensed offshore disposal site located at the entrance to Dublin Bay to the west of the Burford Bank, (6.75 km from the lighthouse at the end of the Great South Wall). The approximate amount of material to be dredged is 300,000 cubic metres per annum and it consists mostly of silt and sand with elements of clay, gravel and cobbles. Dredging will be carried out by a trailer suction hopper dredger and support vessels. It is proposed to undertake the maintenance dredging and disposal at sea operations within the period April to September each year between 2022 and 2029. The dredging campaign within each of these periods is expected to last approximately 4-6 weeks, depending on weather conditions.

Given the maintenance dredging will be undertaken during the period April – September each year and the capital dredging will be undertaken during the period October – March each year, overlap between the two projects is avoided. Furthermore, neither project is expected to result in significant negative impact on soils, geology and hydrogeology, thereby no cumulative impacts are therefore considered likely.

8.8 Conclusions

Baseline land, soil, geology and hydrogeology within the receiving environment was established through review of Geological Survey Ireland national datasets, historical borehole data and monitoring data used to establish water quality status in the context of the EU Water Framework Directive (WFD). Soil sampling and analysis was also undertaken in accordance with the Marine Institutes Sediment Analysis Plans (SAPs) 2020 and supplemented with existing data collected in 2018.

The eco-toxicological test results have shown that the marine sediments to be dredged have no significant biological effect and can therefore be considered as Class 1 material (Uncontaminated: no biological effects likely) and thereby suitable for disposal at sea.

Using baseline data, an assessment of the Dublin Harbour Capital Dredging Project was conducted to determine the likelihood of significant impacts on land, soils, geology and hydrogeology using the criteria for rating significance and magnitude as set out in the National Roads Authority (NRA) publication "*Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes*" (NRA, 2008). No mitigation measures to reduce impacts were considered necessary. No residual impacts are predicted during the construction or operational phase of Dublin Harbour Capital Dredging Project.

9 WATER QUALITY

This chapter of the EIAR assesses the potential impact of the Dublin Harbour Capital Dredging Project on water quality within the receiving environment. Existing water quality in the vicinity of the proposed development is established based on available water quality information. The likelihood for significant negative impacts on water quality is determined and mitigation measures to reduce impacts are proposed, where necessary. The assessments are based on the project description detailed in Chapter 3.

9.1 Assessment Methodology

Baseline water quality within the receiving environment has been established through the review of national monitoring data used to establish water quality status in the context of the EU Water Framework Directive (WFD) and supporting environmental standards. Recent high frequency monitoring data collected during the DPC Alexandra Basin Redevelopment (ABR) Project has also been considered.

An assessment has then been made of the Dublin Harbour Capital Dredging Project and associated disposal at sea activities to determine the likelihood for significant impacts on water quality using criteria for rating significance and magnitude set out in the National Roads Authority (NRA) publication “Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes” (NRA, 2008). The significance of impact on surface water quality likely to occur during the Dublin Harbour Capital Dredging Project are determined using a predominantly qualitative methodology supported, where appropriate, by quantitate assessment. The assessment is a consideration of a combination of receptor sensitivity (Table 9-1) and the potential magnitude of the impact on the water environment (Table 9-2), in order to determine significance (Table 9-3).

Table 9-1 Criteria for Rating Receptor Sensitivity (NRA, 2008)

Value (Sensitivity)	Typical Descriptors
Extremely High	Attribute has a high quality or value on an international scale. Examples: River, Wetland or surface water body ecosystem protected by EU legislation. I.e. designated under the Habitats, Birds, Shellfish, Bathing Water or Freshwater Fish, Drinking Water or Nitrate Directives.
Very High	Attribute has a high quality or value on a regional or national scale. Examples: River, Wetland or surface water body ecosystem protected by national legislation (NHA status), Regional important potable water source supplying >2500 homes, nationally important amenity site for wide range of leisure activities, Quality Class A (Biotic Index Q4, Q5), Flood plain protecting more than 50 residential or commercial properties from flooding.
High	Attribute has a high quality or value on a local scale. Examples: Salmon fishery, locally important potable water source supplying >1000 homes, Quality Class B (Biotic Index Q3-4), Flood plain protecting 5 to 50 residential or commercial properties from flooding, Locally important amenity site for wide range of leisure activities.
Medium	Attribute has a medium quality or value on a local scale. Examples: Coarse fishery, Local potable water source supplying >50 homes, Quality Class C (Biotic Index Q3, Q2-3), Flood plain protecting between 1 and 5 residential or commercial properties from flooding.
Low	Attribute has a low quality or value on a local scale. Examples: Locally important amenity site for small range of leisure activities, Local potable water source supplying <50 homes, Quality Class D (Biotic Index Q2, Q1), Flood plain protecting 1 residential or commercial property from flooding. Amenity site used by small numbers of local people.

Table 9-2 Criteria for Rating the Magnitude of Impact (NRA, 2008)

Magnitude of Impact	Criteria	Typical Examples
Large Adverse	Results in loss of attribute and /or quality and integrity of attribute	Loss or extensive change to a water body or water dependent habitat.
		Increase in predicted peak flood level >100mm.
		Extensive loss of fishery
		Extensive reduction in amenity value
		Potential high risk of pollution to water body from routine run-off
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	Increase in predicted peak flood level >50mm
		Partial loss of fishery
		Potential medium risk of pollution to water body from routine run-off
		Partial reduction in amenity value
Minor Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	Increase in predicted peak flood level >10mm
		Minor loss of fishery
		Potential low risk of pollution to water body from routine run-off
		Slight reduction in amenity value
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	Negligible change in predicted peak flood level Negligible loss of amenity value Negligible loss of fishery

The approach to assessing the significance of impacts comprises assigning each impact to one of the four categories of magnitude as outlined in Table 9-1 and enables different characteristics to be assessed based upon the same scale.

Table 9-3 Criteria for Rating the Significance of Environmental Impacts (NRA 2008)

Importance of Attribute	Magnitude of Impact			
	Negligible	Minor	Moderate	Large
Extremely High	Imperceptible	Significant	Profound	Profound
Very High	Imperceptible	Significant / Moderate	Profound / Significant	Profound
High	Imperceptible	Moderate / Slight	Significant / Moderate	Severe / Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight / Moderate

The significance determination and assessment of the potential likely environmental effects of each component of the Dublin Harbour Capital Dredging Project has been made based on the matrix presented in Table 9-3 and defined in Table 9-4.

Table 9-4 Defining Impact Significance (NRA, 2008)

Impact Level	Attribute Importance				
	Extremely High	Very High	High	Medium	Low
Profound	Any permanent impact on attribute	Permanent impact on significant proportion of attribute			
Significant	Temporary impact on significant proportion of attribute	Permanent impact on small proportion of attribute	Permanent impact on significant proportion of attribute		
Moderate	Temporary impact on small proportion of attribute	Temporary impact on significant proportion of attribute	Permanent impact on small proportion of attribute	Permanent impact on significant proportion of attribute	
Slight		Temporary impact on small proportion of attribute	Temporary impact on significant proportion of attribute	Permanent impact on small proportion of attribute	Permanent impact on significant proportion of attribute
Imperceptible			Temporary impact on small proportion of attribute	Temporary impact on significant proportion of attribute	Permanent impact on small proportion of attribute

To conclude the assessment, mitigation measures are proposed to reduce, avoid and prevent these likely significant effects, where appropriate. This enables a "with mitigation" assessment to be made of any residual impact as a result of the Dublin Harbour Capital Dredging Project and/or in combination with other projects in the vicinity of Dublin Port.

9.2 Receiving Water Environment

A desk-based assessment of surface water quality in the vicinity of the Dublin Harbour Capital Dredging Project was conducted. The sources of the water quality information summarised include:

- Water Framework Directive water body status information arising from Irelands National Water Framework Directive Monitoring Programme, 2019 – 2021 (EPA, 2021) supported by water quality information available on the EPAs online Water Framework Directive Application (www.catchments.ie and https://gis.epa.ie/EPAMaps/).
- Protected areas datasets including:
  - bathing water quality information outlined in the EPA's most recent bathing water quality report, Bathing Water Quality in Ireland, A Report for the Year 2019 (EPA, 2020);
  - information on Nutrient Sensitive Areas as outlined in the EPA's most recent Urban Waste Water Treatment Report (2020);
  - Register of Protected Areas (under Article 6 of the Water Framework Directive) for water dependent habitats and species in the SAC and SPA networks held by the EPA.
  - Department of Environment, Community and Local Government - Marine Strategy Framework Programme of Measures Summary Report (2016);

  - Water Quality in Ireland 2013-2018 (2019)

- Site specific water quality monitoring data that was made available by DPC's Monitoring Programme (ongoing for the ABR Project), these data sets are reported in DPC's annual environmental returns/baseline state of the environment reporting.
- Sediment Plume Monitoring Data collected at the dump site to enable the horizontal and vertical extent of the sediment plume generated by the permitted dumping activity (under the ABR Project) at different stages of the tide to be measured.
- Earth Observation Data.

9.2.1 Study Area Water Bodies

For the purposes of monitoring and assessing the quality of surface waters, all rivers, lakes, coastal inter-basins, estuaries, and coastal waters (within 1 nautical mile of the shoreline) have been divided into management units called "water bodies". The condition of each water body must be reported to the European Commission in the form of ecological status and chemical status. Ground water bodies are similarly delineated with status identified. Surface water bodies are grouped into sub-catchments for the purposes of water management, of which there are 583 nationally, which are further grouped into catchment management units of which there are 46 based on the hydrometric areas used by public authorities.

As illustrated in Figure 9-1, the Dublin Harbour Capital Dredging Project is located within the 'Liffey Estuary Lower' transitional water body. The 'Tolka Estuary' (EA_090_0200) transitional water bodies and 'Dublin Bay' coastal water body (EA_090_0000) are situated to the northeast and east of the dredging works.

The Lower Liffey Estuary which is a macro-tidal estuary (mean high water spring tides are 5.10 m above CD and mean low water spring tides are 0.6 m above CD at Dublin North Wall) and highly salinity stratified. The Lower Liffey Estuary is a constantly changing and dynamic water body with high levels of anthropogenic activity, tidal flushing, wastewater treatment plant and cooling water discharges, and fresh water inflows from the Liffey itself along with the Dodder, Camac, Poddle and Tolka. The Royal Canal and the Grand Canal also discharge to the Liffey catchment. All waterbodies are grouped into the 'Liffey and Dublin Bay Catchment' (HA09) of the Irish River Basin District.

The Dublin Harbour Capital Dredging Project also lies within the 'Dublin Urban' groundwater body (EA-G-008). This water body has achieved and maintained 'good' status since the 2013-2018 WFD Monitoring Cycle as reported in 2019. Due to the limited scale of geotechnical activities in the application area, there are no likely significant water quality effects on groundwater expected and these have therefore not been assessed further in this Section. This is supported by the assessment presented in Chapter 8 which addresses Land, Soils, Geology and Hydrogeology.

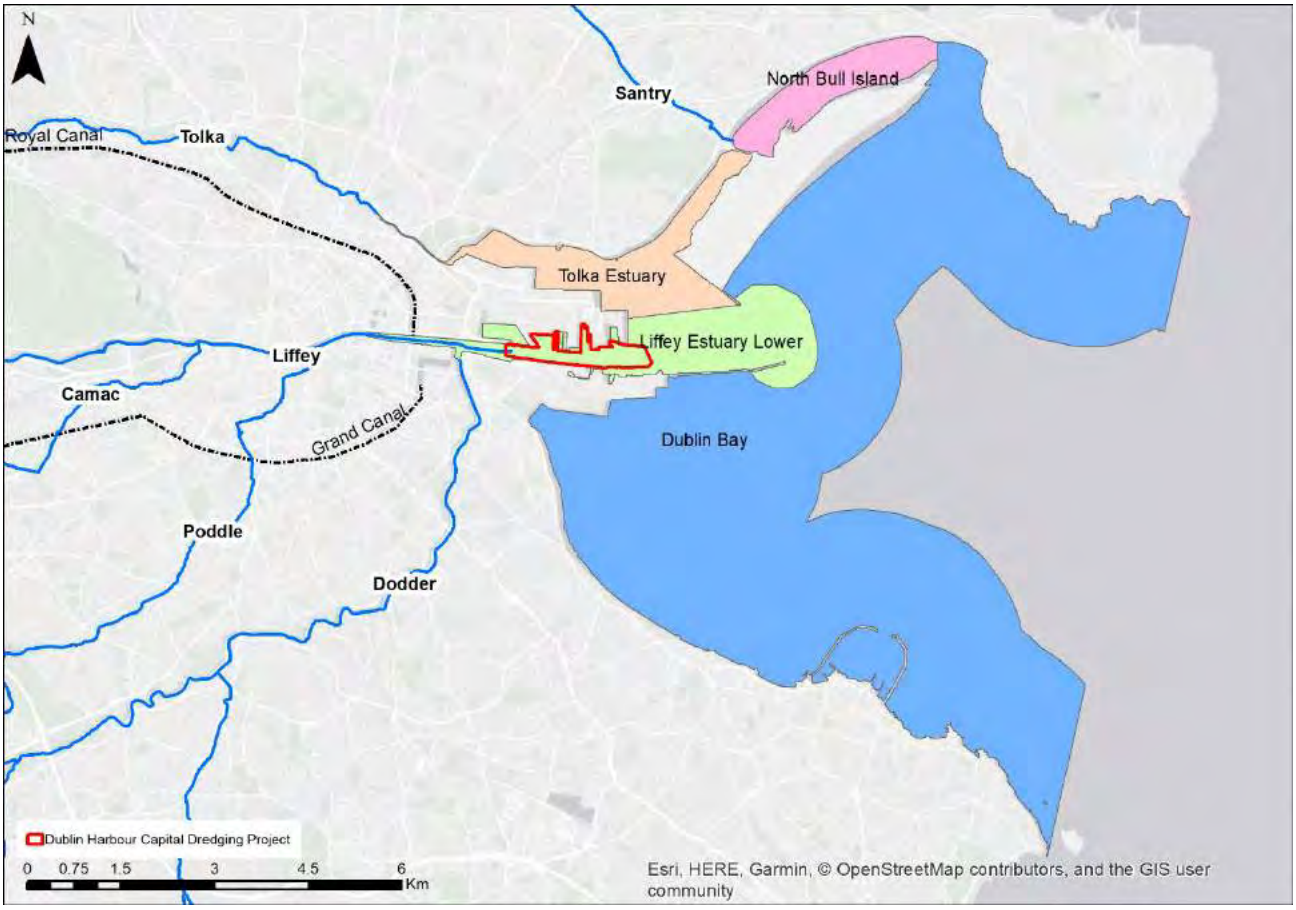


Figure 9-1 Site Location in the Context of the Wider Surface Water Environment

9.2.2 Water Framework Directive

Directive 2000/60/EC establishing a framework for Community action in the field of water policy (the Water Framework Directive), and transposing regulations, European Communities (Water Policy) Regulations, 2003 (S.I. No. 722 of 2003), as amended establish a legal framework for the protection, improvement and sustainable management of rivers, lakes, transitional waters (estuaries), coastal waters (to a distance of one nautical mile) and groundwater.

For the purposes of monitoring and assessing the quality of surface waters, all rivers, lakes, coastal inter-basins, estuaries, and coastal waters (within 1 nautical mile of the shoreline) have been divided into management units called “water bodies”. The condition of each water body must be reported to the European Commission in the form of ecological status and chemical status. For the purposes of water management these water bodies are grouped into sub-catchments, of which there are 583 nationally, which are further grouped into catchment management units of which there are 46 based on the hydrometric areas used by public authorities.

The fundamental objectives of the WFD are to maintain “high status” of waters where it exists, prevent deterioration in the existing status of waters and achieve at least “good status” in relation to all waters by the end of the current river basin management cycle (2021) unless subject to extended deadlines. A water body must achieve both good ‘ecological status’ and good ‘chemical status’ before it can be considered to be at good overall status. An assessment of the risks to the achievement of these objectives for water bodies has been undertaken by the EPA through the extensive characterisation of water bodies and the key pressures acting

upon them. This will allow the development of a programme of measures to allow the achievement of the WFD objectives.

The Programme of Measures (POMs) outlines the steps that will be taken to meet WFD objectives as applicable to each water body. This Programme is contained within an overarching River Basin Management Plan (RBMP). These measures will require implementation at a strategic level but also on regional and local level through the establishment of a Regional Integrated Catchment Management Programme.

Environmental Quality Standards (EQS) for classifying surface water status are established in the European Communities Environmental Objectives (Surface Waters) Regulations, 2009 (SI No. 272 of 2009) as amended. These regulations set standards for biological quality elements, physico-chemical conditions supporting biological elements (including general conditions and specific pollutants), priority substances and priority hazardous substances.

As shown in Figure 9-2 the 'ecological status' of a water body is established according to compliance with the EQSs for biological quality elements, physico-chemical conditions supporting biological elements and relevant pollutants and hydromorphological quality element. The 'chemical status' of a water body is established according to compliance with the EQSs for priority substances and priority hazardous substances (SI No. 272 of 2009).

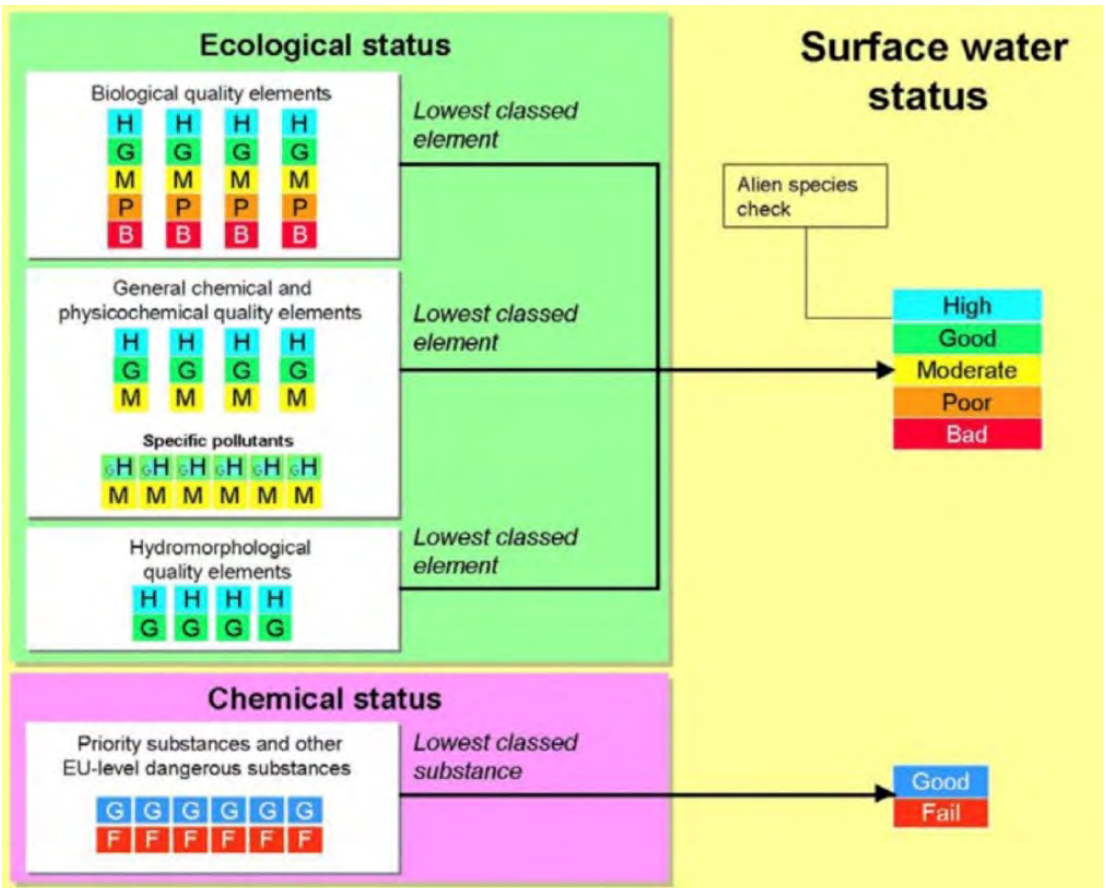


Figure 9-2 Elements of the Water Framework Directive Status

As well as achieving good ecological and chemical status, a water body must achieve compliance with standards and objectives specified for protected areas, which include areas designated by the Bathing Water Directive; the Urban Waste Water Treatment Directive; the Shellfish Waters Directive; the Habitats Directive

and the Birds Directive. Waters bodies that are compliant with WFD standards, but that contain protected areas that are non-compliant with protected area standards are downgraded to 'less than good' status.

9.2.2.1 EPA Water Quality Report 2013-2018

The EPA Water Quality Report 2013-2018 was published in 2019 and provides an update on the status and trends of Irish water following the completion of the first six year cycle of the Water Framework Directive for 2013 to 2018. The water quality information in relation to transitional and coastal waters outlined in this report is sourced from the national monitoring programme undertaken by the EPA as well as other organisations including the Marine Institute, Inland Fisheries Ireland (IFI), the Sea Fisheries Protection Authority (SFPA), and the Radiological Protection Institute of Ireland (RPII). In addition, assessments of the conservation status of protected areas carried out by National Parks and Wildlife Service (NPWS) were also taken into account.

The WFD status classification between 2007 and 2018 for the water bodies potentially affected by the proposed development is shown in Table 9-5 and Figure 9-3. In summary the Liffey Estuary Lower and Tolka Estuary transitional water bodies have been reported as "moderate" between 2007 and 2015 with the River Liffey showing an improvement in status to "good" in 2018. The Dublin Bay coastal water body was reported as "moderate" in the 2007-2009 WFD monitoring cycle and in 2010-2012 it was reported as "good" and has since maintained that status, as reported 2019.

Table 9-5 WFD Status (2009-2018)

WFD Status 2007-2018	Liffey Estuary Lower	Tolka Estuary	Dublin Bay
	EA_090_0300	EA_090_0200	EA_090_0000
Overall WFD Water Quality Status 2007-2009	Moderate	Moderate	Moderate
Overall WFD Water Quality Status 2010-2012	Moderate	Moderate	Good
Overall WFD Water Quality Status 2010-2015	Moderate	Moderate	Good
Overall WFD Water Quality Status 2013-2018	Good	Moderate	Good

A further breakdown of the ecological and chemical elements for the 2013-2018 WFD cycles is shown in Table 9-2. The Liffey Estuary Lower water body has overall improved status from "moderate" in the 2010-2015 monitoring cycle to "good" in the 2013-2018 monitoring cycle. The change is status is a result of the improvement of Ecological Status (Moderate to Good) and Hydromorpholgical Conditions (Poor to Moderate).

The Tolka Estuary has retained 'moderate' status throughout all monitoring intervals since 2007. During the 2013-2018 monitoring cycle, the Tolka Estuary transitional water body only achieved good status or above in "Other determinant for nutrient conditions and other determinant for oxygenation conditions.

The Dublin Bay coastal water body has improved from "moderate" in the 2007-2009 monitoring interval to "good" in the 2010-2015 monitoring cycle. This resulted from an increase in Biological Status from "moderate" to "good" due to improving Invertebrate Status, notwithstanding the deterioration in Supporting Chemistry Conditions, including Oxygenation Conditions, from "high" to "good" status. During the 2013-2018 monitoring cycle the Dublin Bay coastal water body maintained a classification of "Good" in both the Ecological and Chemical Indicators

This assessment of likely significant effects on water quality has been undertaken having regard to the necessity to comply with the WFD and in doing so ensuring that the Dublin Harbour Capital Dredging Project does not prevent the achievement of the WFD objectives for these water bodies in subsequent RBMP cycles.

Table 9-6 WFD Status Breakdown (2013-2018)

WFD Status 2013-2018			Liffey Estuary Lower	Tolka Estuary	Dublin Bay
			EA_090_0300	EA_090_0200	EA_090_0000
Ecological Status	Biological Status	Phytoplankton Status	Good	Not Available	High
		Invertebrate Status	Not Available	Moderate	High
		Angiosperm Status	Not Available	Moderate	Good
		Macroalgae Status	Not Available	Moderate	Good
	Supporting Chemistry Conditions	Oxygenation Conditions	Good	Moderate	High
		Other determinant for oxygen conditions	High	High	High
		Nutrients Condition	Good	Moderate	Good
		Other determinants for Nutrient Conditions	High	Good	High
		Specific Pollutants Conditions	Pass	Not Available	Pass
	Hydro-morphology	Hydro-morphological Conditions	Moderate	Moderate	Good
	Ecological Status (2013 – 2018)		Good	Moderate	Good
Chemical Status	Chemical Surface Water Status (2013 – 2018)		Good	Not Available	Good
Overall WFD Water Quality Status 2013-2018			Good	Moderate	Good

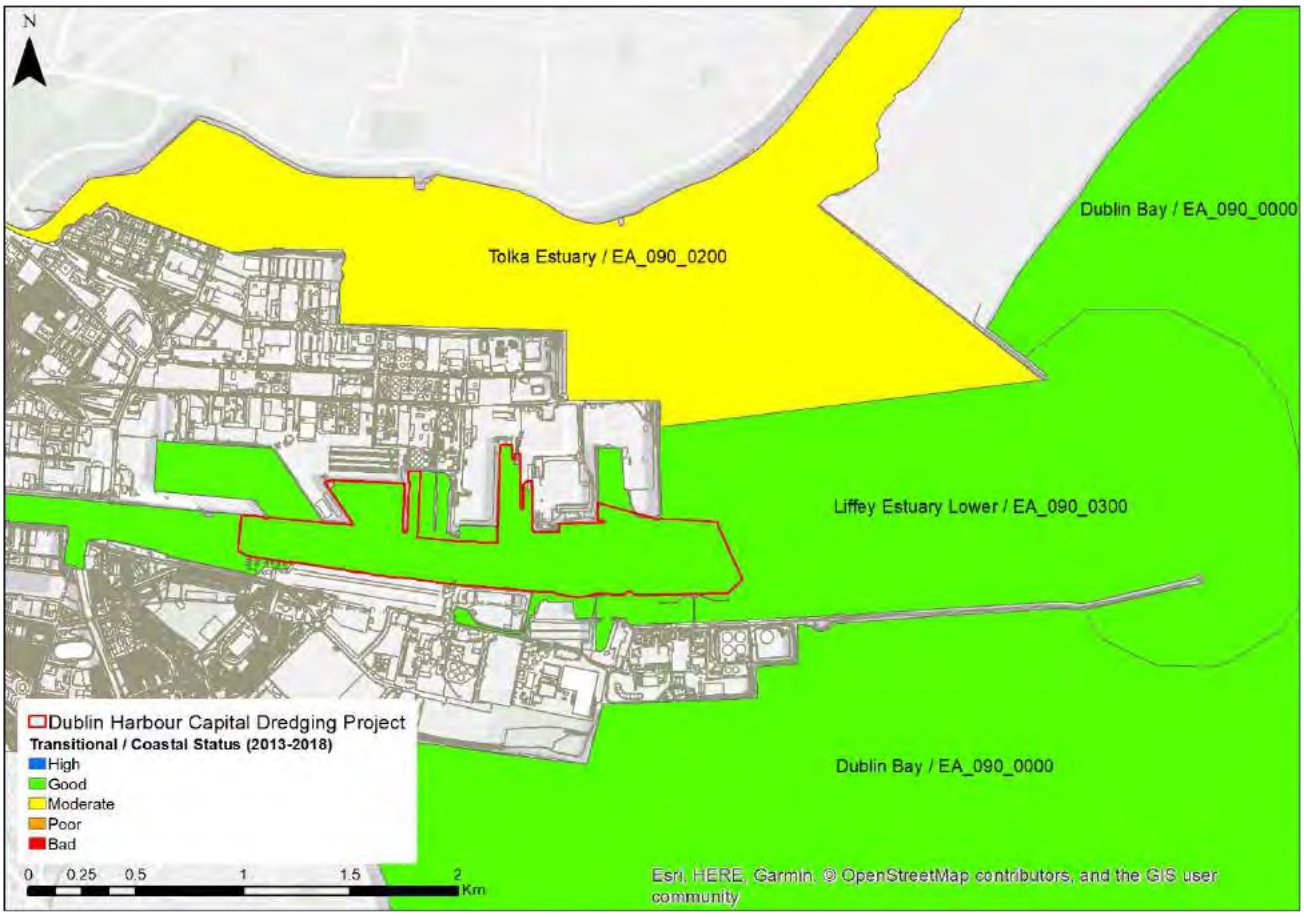


Figure 9-3 Water Framework Directive water body status

9.2.3 Protected Areas

A significant proportion of the area of Dublin Bay and adjacent coastline is protected under existing EU legislation requiring special protection due to the sensitivity to pollution or particular environmental importance. All of the areas requiring special protection in the Irish River Basin District have been identified by the EPA, mapped and listed in a national register of protected areas (required under Article 6 of the WFD Directive). The register of protected areas includes:

- areas designated for the abstraction of water for human consumption (Drinking Water Protected Areas);
- areas designated for the protection of economically significant aquatic species, i.e. Freshwater Fish and Shellfish;
- bodies of water designated as recreational waters, including areas designated as bathing waters;
- nutrient-sensitive areas, including areas identified as Nitrate Vulnerable Zones under the Nitrates Directive or areas designated as sensitive under Urban Waste Water Treatment Directive; as well as
- areas designated for the protection of habitats or species where the maintenance or improvement of the status of water is an important factor in their protection including relevant Natura 2000 sites (Special Protection Areas (SPAs); and candidate Special Areas of Conservation (cSACs)).

These protected areas have their own monitoring and assessment requirements to determine their condition. They are often assessed for additional pollutants or requirements relevant to their designation. Protected areas within the Dublin Port area include areas of Nutrient Sensitive Waters, Bathing Water and Natura 2000 sites.

9.2.3.1 Nutrient Sensitive Waters

The Urban Waste Water Treatment Regulations 2001, as amended (which transpose the Urban Wastewater Treatment Directive (91/271/EEC) into Irish law and update the Environmental Protection Agency Act, 1992 (Urban Waste Water Treatment) Regulations 1994, as amended) list nutrient sensitive waters in the Third Schedule. The Liffey Estuary from Islandbridge weir to Poolbeg Lighthouse, including the River Tolka basin and South Bull Lagoon has been designated as a nutrient sensitive area (Figure 9-4). Ringsend WWTP currently discharges into the Lower Liffey Estuary immediately adjacent to the area to be dredged during the Dublin Harbour Capital Dredging Project.

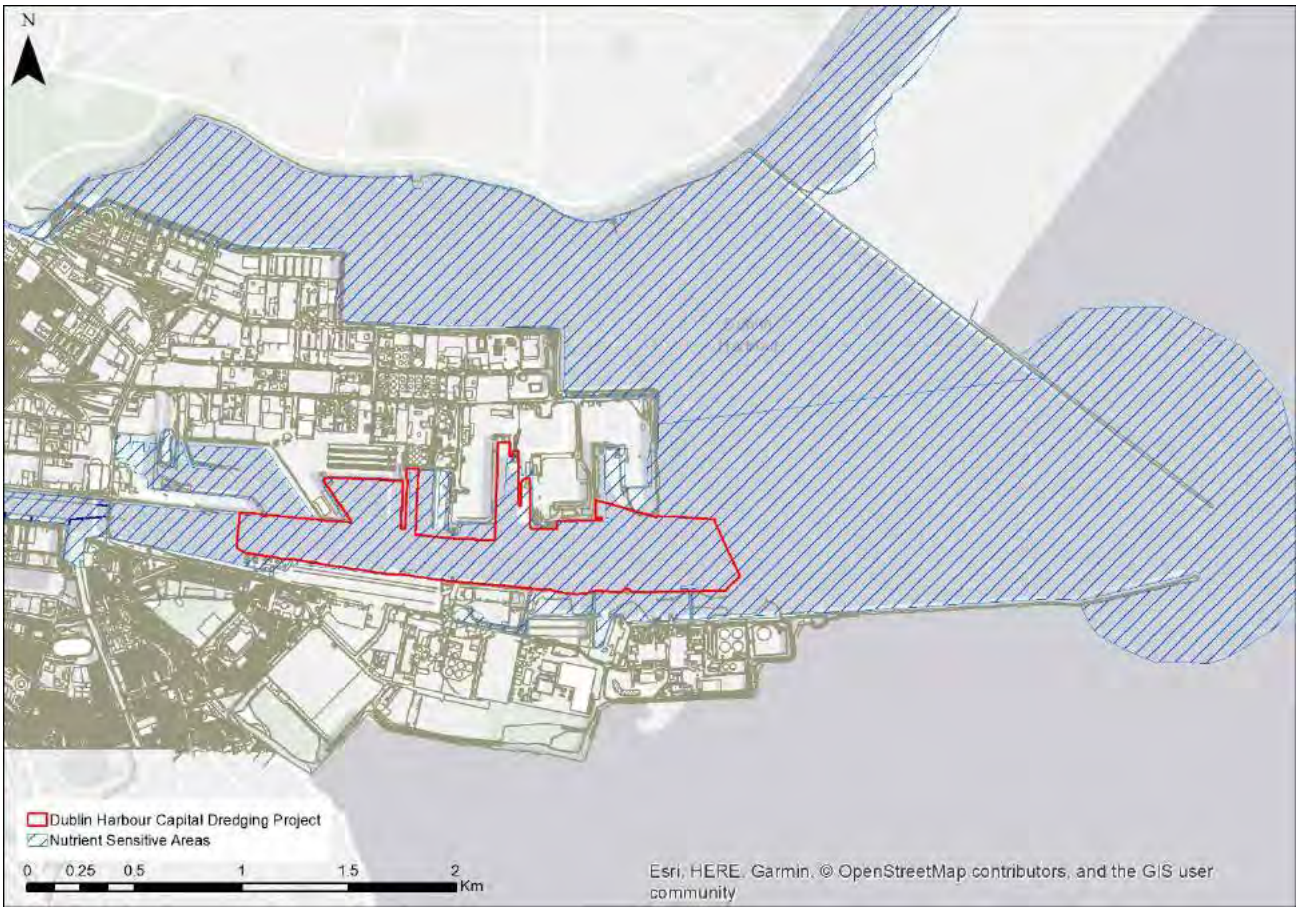


Figure 9-4 Nutrient Sensitive Areas

9.2.3.2 Bathing Waters

The Bathing Water Directive (2006/7/EC) came into force in March 2006, and was transposed into Irish law by the Bathing Water Quality Regulations, 2008, as amended. The previous 1976 Directive was repealed with effect from 31 December 2014. Since 2014, the annual water quality classification (rating) of a beach or lake has been based on water quality results covering a four-year period rather than a single previous season's data. Water quality at beaches and lakes is classified as Excellent; Good, Sufficient or Poor (Table 9-7). This approach is common across all EU Member States and there is a requirement to ensure that bathing waters are of 'Sufficient' standard or better. Any 'Poor' bathing water requires a programme of adequate management measures to be implemented. A minimum of 16 samples are required for formal annual assessment.

Table 9-7 Annual Assessment Criteria for Bathing Waters

Parameter	Excellent	Good	Sufficient
E. coli (Freshwater)	500*	1000*	900**
E. coli (Coastal)	250*	500*	500**
Intestinal enterococci (freshwater)	200*	400*	330**
Intestinal enterococci (Coastal)	100*	200*	185**

*based on 95-percentile value **based on 90-percentile value

The WFD designated bathing areas within Dublin Bay are located outside of Dublin Port. They are Dollymount Strand, Sandymount Strand, Merrion Strand and Seapoint. Most recently (2020), Seapoint and Dollymount have been classified as Excellent; Sandymount was classified as Sufficient and Merrion Strand was classified as Poor (Figure 9-5). Both Merrion and Sandymount Strands are considered vulnerable to pollution. The likely pollution sources are identified as arising from surface water inflows, drainage misconnections from domestic properties and fouling by large numbers of birds that roost on the extensive areas of exposed sand at these sites. Seabird droppings have as much as 10 million E.coli bacteria per gram so it is possible that they may be contributing to a decline in quality, particularly as microbiological standards have become stricter and bird numbers appear to be increasing. In addition to the waters which Ireland has formally identified to the EU as bathing waters there are many locations around the country which are monitored by local authorities because swimming or recreational activities are known to take place. As Merrion Strand was classified as Poor for the last five years (2015-2020), it has be declassified as a designated bathing water as of the 1st of June 2020.

As illustrated in Figure 9-5, there are three non-designated bathing areas within Dublin Harbour that are also monitored by Dublin City Council (DCC). They are: Shelley Banks, Half Moon and North Bull Wall. Results published on the DCC website (https://www.dublincity.ie/bathingwater), indicate that bathing water quality at the North Bull Wall was “poor” at the beginning of 2020, although this was prior to the beginning of the official bathing season (1 June to 15 September). During the bathing season quality improved and has been classified as “excellent” in 15 of 23 samples, and satisfactory or better in 19 samples. Similarly, the Half Moon and Shelley Banks bathing areas had varied classifications of poor to good at the beginning of 2020 but have since improved and were classified as “excellent” status in 23 of 24 samples between March and September 2020.

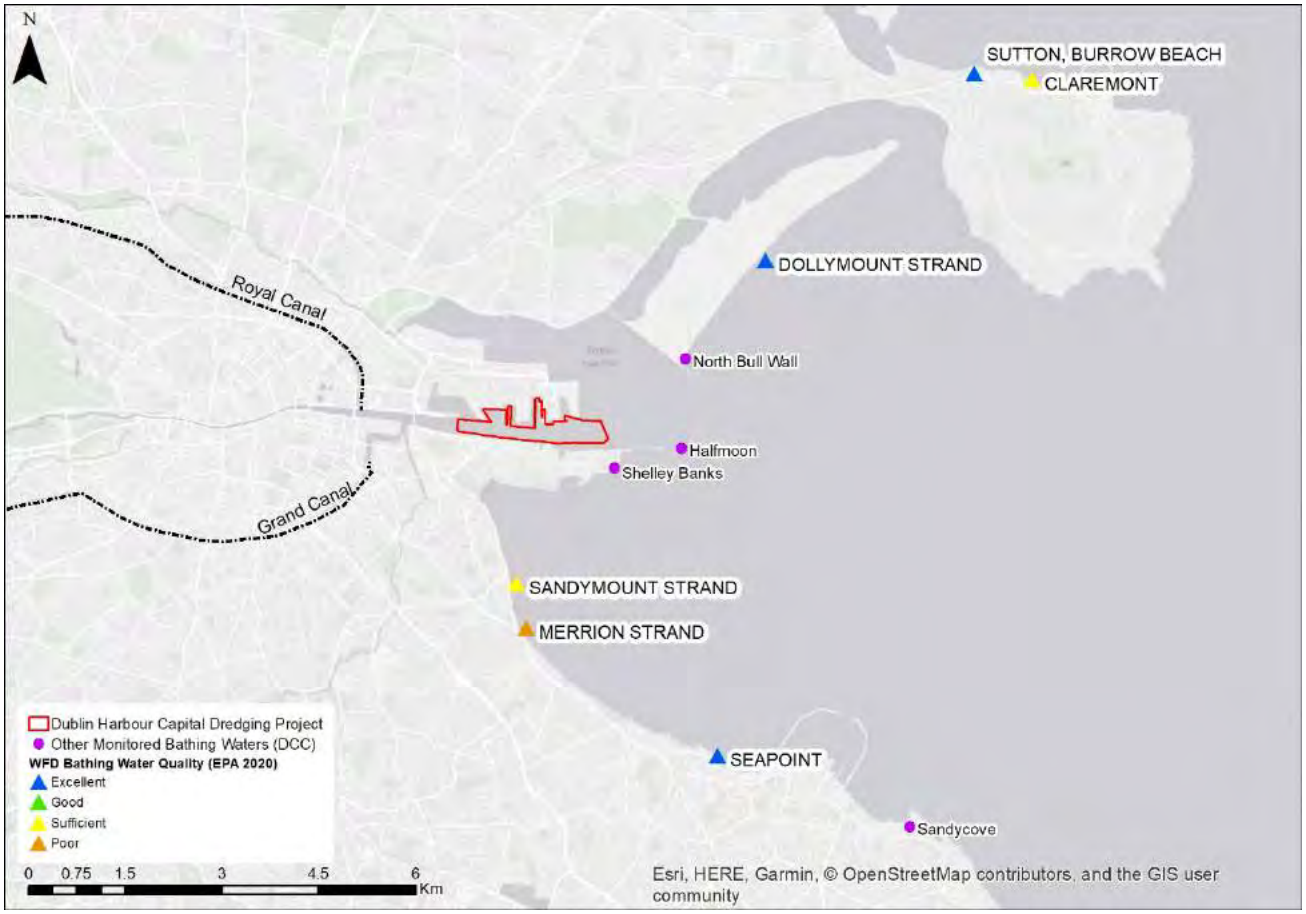


Figure 9-5 Bathing Water Quality in the Dublin Area 2020 (EPA, 2020)

9.2.3.3 Natura 2000 Protected Areas

Natura 2000 is a European network of important ecological sites. The EU Habitats Directive (92/43/EEC) places an obligation on Member States of the EU to establish the Natura 2000 network. The network is made up of Special Protection Areas (SPAs), established under the EU Birds Directive (79/409/EEC), and cSACs, established under the Habitats Directive itself.

As illustrated in Figure 9-6 the Capital Dredging loading activities associate with the Dublin Harbour Capital Dredging Project do not lie within any Natura 2000 site (i.e. SPA or cSAC). The outermost section of the navigation channel within Dublin Bay does however lie within the Rockabill to Dalkey SAC (Figure 9-6). The licenced disposal site also lies within the Rockabill to Dalkey SAC which is designated for the marine Annex I qualifying interest reefs and the Annex II species Phocoena phocoena (harbour porpoise). It should also be noted that all possible significant effects on Natura 2000 or “European” sites have been considered in detail in the Appropriate Screening Report and Natura Impact Statement submitted with the application for development consent in respect of the Dublin Harbour Capital Dredging Project. These reports have concluded beyond reasonable scientific doubt that the capital dredging project as proposed will not result in adverse effects on the integrity of any European site.

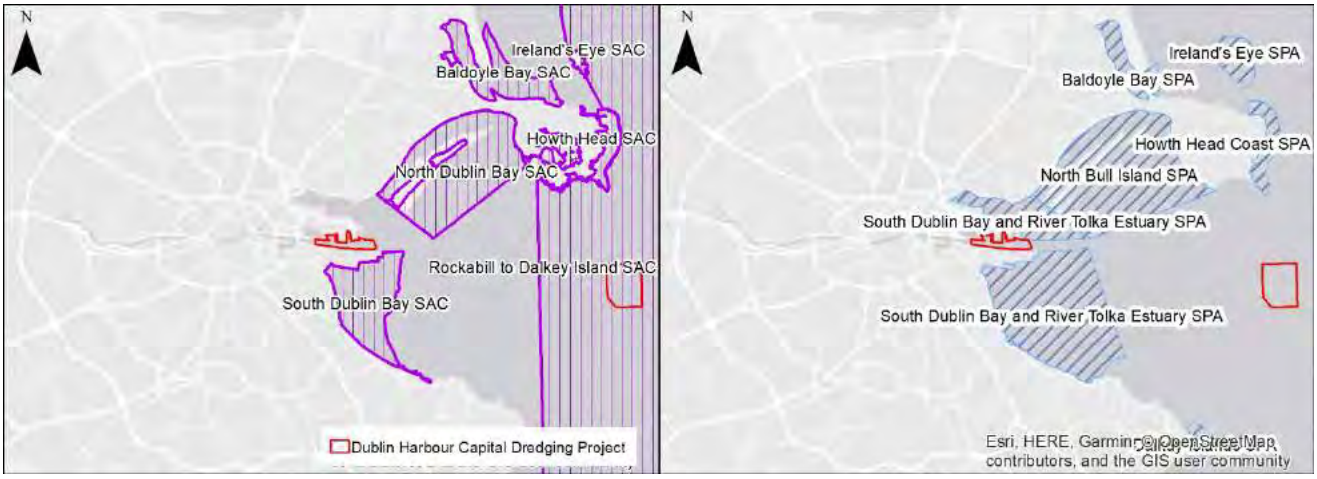


Figure 9-6 Natura 2000 Designated Sites

9.2.4 Marine Strategy Framework Directive Environmental Status

The Marine Strategy Framework Directive (MSFD) (2008/56/EC) was formally adopted by the European Union in June 2008 and is transposed into Irish law by the European Communities (Marine Strategy Framework) Regulations 2011, as amended. The overarching aim of the Directive is to protect Europe's marine waters by applying an ecosystem-based approach to the management of human activities while enabling the sustainable use of the marine environment for present and future generations. The Directive establishes a legal framework for the development of marine strategies designed to achieve Good Environmental Status (GES) in the marine environment by the year 2020. The marine strategy involves defining GES, setting environmental targets and indicators, implementing monitoring programmes for ongoing assessment, and developing and implementing programmes of measures to achieve or maintain GES.

GES is defined as 'the environmental status of marine waters where these provide ecologically diverse and dynamic oceans and seas which are clean, healthy and productive within their intrinsic conditions, and the use of the marine environment is at a level that is sustainable, thus safeguarding the potential for uses and activities by current and future generations'.

The assessment of GES is undertaken by reference to qualitative descriptors which define overarching objectives in respect of key socio-economic or ecological aspects of the marine environment. These specifically require the consideration of the following:

- biodiversity;
- non-indigenous species;
- exploited fish and shellfish;
- food webs;
- human-induced eutrophication;
- sea-floor integrity;
- alteration of hydrographical conditions;
- contaminants in water and seafood;
- marine litter; and
- the introduction of energy including underwater noise.

To date, the Department of Housing, Planning and Local Government and the Marine Institute have undertaken an Initial Assessment constituting a comprehensive review of the physical, chemical and biological characteristics of the marine area, as well as the human pressures acting upon it developed a comprehensive set of environmental targets and associated indicators. A monitoring programme has been established along with a Programme of Measures for the on-going assessment of the environmental status of marine waters which will support the meeting of the environmental targets set out in Article 10 (MSDF), leading to the achievement (or maintenance) of Good Environmental Status (GES).

The implementation of the programme of measures and monitoring programme is ongoing, however the extent of achievement of GES has not been established for individual water bodies. Therefore this water quality assessment relies on the WFD water quality assessment to ensure that the Dublin Harbour Capital Dredging Project will not cause conflict with the MSFD.

9.2.5 ABR Project - Capital Dredging Water Quality Monitoring

9.2.5.1 Inner Liffey Channel Water Quality Monitoring

DPC is carrying out extensive monitoring of water quality at Dublin Port as part of the Alexandra Basin Redevelopment (ABR) Project. Four water quality monitoring stations have been established at locations within the Inner Liffey channel (Figure 9-7). The sites chosen represent ambient surface water quality in the Liffey Estuary Lower and in the Tolka Estuary. The monitoring station at the Tolka Estuary is mounted on an OSIL Micro Field buoy. At the East Link, Poolbeg Sludge Jetty and North Bank Light stations the monitoring apparatus has been secured to permanent in-river structures.

Each of the four water quality parameters (Turbidity, Temperature, Dissolved Oxygen (DO) and Salinity) is measured every 15 minutes at the monitoring locations. In addition, water level is measured at the Poolbeg Sludge Jetty and shows tidal cycles. Measurements are made using a Hydrolab Multiparameter HL4 Sonde with integrated sensors, and results are transmitted to a land-based data station for validation, processing and reporting.

Cleaning, maintenance and calibration of the sonde probes occur on a monthly basis or as required by sonde performance. During data validation, obvious data anomalies due to instrument fouling or instrument malfunction are removed before presenting summary results.

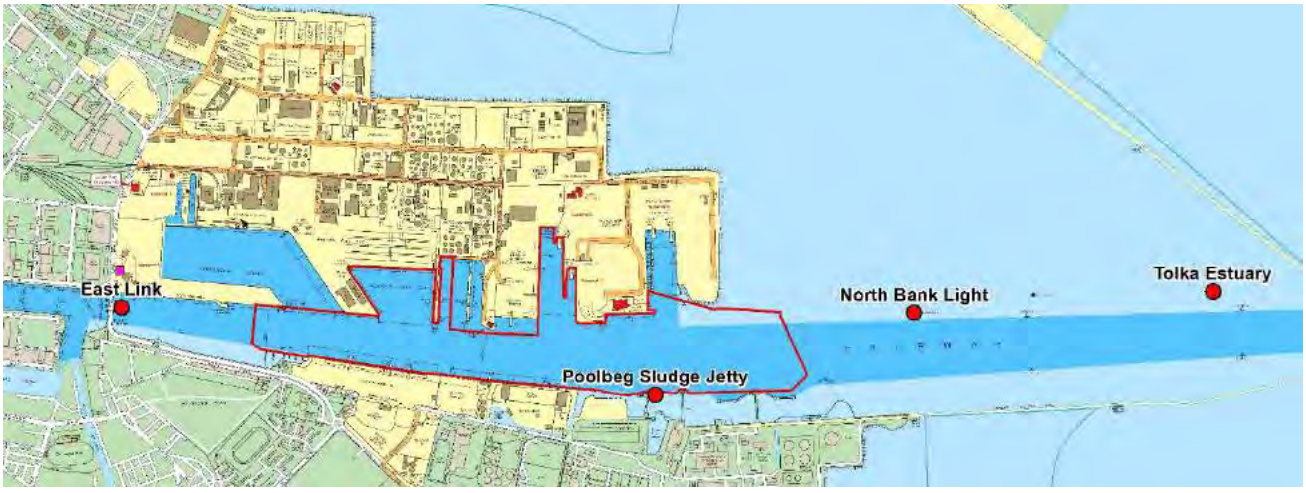


Figure 9-7 Water quality monitoring stations in the Dublin Port area

Turbidity and Total Suspended Solids

Turbidity is monitored as a proxy for total suspended solids (TSS) in water due to the ease and frequency with which it can be measured. Turbidity is a measure of the cloudiness or haziness of water caused by material suspended in the water such as soil particles, sediment, or small floating algae. Particles are often small and can remain in suspension in the water for lengthy periods. Turbidity can be caused by natural events such as flooding, algal growth, water currents, wind and wave action as well as human activities.

Turbidity is measured in NTU (Nephelometric Turbidity Units), which is a measure of the amount of light scattered by particles in suspension. It is readily measured on site and can be used to give a rapid estimate of the total amount of suspended solids in the water. Measuring the total suspended solids concentration requires taking water samples for filtration, weighing and drying in the laboratory.

The relationship between turbidity and suspended solids in water is site specific. It is influenced by the type of sediment in suspension, its colour, shape and reflectivity. Therefore a sediment sample from the Liffey at East Link Bridge was taken and used to establish a relationship between turbidity and suspended solids for the Dublin Harbour area. The sediment consisted of sandy silt and suspensions were prepared from this sample to provide turbidity in the range 0 to 150 NTU. Turbidity (NTU) and TSS (mg/l) were measured for 75 suspensions to allow construction of a calibration curve (Figure 9-8).

This relationship can be used to estimate total suspended solids from turbidity readings at the monitoring stations in the Dublin Harbour area. Based on this relationship a factor of 2.5 is used to convert NTU to TSS mg/l.

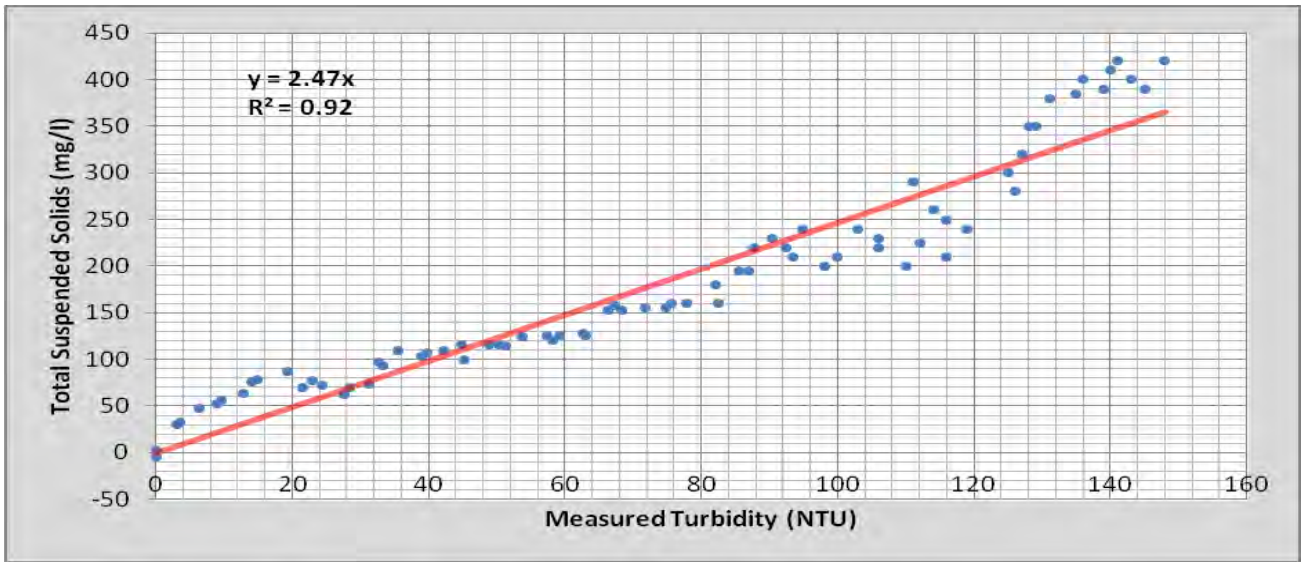


Figure 9-8 Relationship established between Turbidity and Total Suspended Solids (inner Liffey channel)

Dissolved Oxygen, Temperature and Salinity

The amount of oxygen dissolved in the water is reported as milligrams per litre (mg/l). Aquatic animals breathe using the oxygen dissolved in the water. The level is therefore critically important, particularly for fish. Salmon and trout begin to be affected by low oxygen levels at about 6 mg/l (around 50% saturation), and at dissolved oxygen levels below 1.7 mg/l death of some adult fish is likely.

Temperature is one of a number of factors that can affect oxygen levels in water. When freshwater is saturated with oxygen it can hold about 12.7 mg/l of oxygen at a temperature of 5°C; this reduces to 9.1 mg/l at 20°C.

High temperatures also promote more rapid microbiological breakdown of organic wastes and this can also use up oxygen in the water.

Other factors, including salinity and atmospheric pressure, can also affect dissolved oxygen levels. For example seawater holds about 20% less oxygen than freshwater when saturated, and algae produce oxygen during the daylight hours when they are photosynthesising but use it up during darkness when respiring. These factors produce daily and tidal rhythms of higher and lower dissolved oxygen levels.

Salinity is measured in PSU (practical salinity units). Full seawater has a salinity of about 35 PSU, while freshwater has a value close to zero. As well as influencing the type of animals and plants that occur in the water, salinity affects many aspects of the water's chemistry and physical properties (including the amount of oxygen dissolved in the water as demonstrated above).

Water Quality Records (Inner Liffey Channel)

In a highly dynamic environment such as the Liffey estuary, including Dublin Harbour, it is important to realise that water parameters can fluctuate rapidly in response to tides, changing currents, fluctuating depths and changing proportions of source water i.e. fresh and saline waters. Turbidity in particular is a highly variable measurement. Particles causing turbidity are continuously suspended and moved in strong fluctuating and alternating currents and by vessel traffic. Large vessels entering, turning and leaving Dublin Port have been shown to have a pronounced effect on turbidity readings by re-suspending river bed material and creating an artificial vertical mixing of the water body. There may also be inputs of turbid river water from upstream due to events such as flooding following heavy rain and storm water discharges.

Short lived transient events that are of a very local nature are detected in the high frequency turbidity measurements made at the monitoring stations. These may appear as a single, or several successive elevated 15-minute measurements. These small scale events, perhaps even due to pieces of debris passing the sensor in the current, are of no environmental significance in the context of monitoring potential impacts of the ABR Project.

It must also be remembered that marine locations are hostile and aggressive environments in which to deploy immersed monitoring equipment. Although the procured equipment is robust, routinely serviced and calibrated, it is inevitable that equipment will occasionally malfunction or yield unreliable data due to fouling (Figure 9-9) or damage. Standby spare sondes are rotated to service as required but on occasion access to the site may be delayed due to weather and sea conditions. During data validation, obvious data anomalies due to instrument fouling, calibration effects or malfunction are removed before presenting summary results.



Figure 9-9 Fouling of East Link sonde after 3 weeks deployment in August 2019

Summary statistics for each full data set are set out in Table 9-8. Maximum and minimum values are given for each parameter; these obviously reflect extreme values rather than being representative of general ambient water quality. The percentile values listed give a more robust indication of the true distribution of the measurements, and clearly most of the measurements (90% of them) lie between the 5 percentile and 95 percentile values listed. Figure 9-10 to Figure 9-13 presents 12-hour median values for turbidity, salinity, dissolved oxygen and temperature at the ABR Project Inner Liffey channel Monitoring stations between January 2018 and March 2021. The reasons for data gaps shown in each parameter have arisen mainly due to equipment malfunction and fouling of sensors. Periods of Capital Dredging Loading Activity carried out under the Alexandra Basin Redevelopment Project (ABR) is also presented. Periods when dredging were carried out during the ABR project are listed in Table 9-9, along with the wet tonnes of dredged sediments and the number of loading and dumping trips in each calendar month between January 2018 and March 2021.

Table 9-8 Summary statistics for dissolved oxygen (DO), Salinity, Temperature and Turbidity at ABR Project River Sonde Monitoring Stations between January 2018 and March 2021

Eastlink	DO (mg/l)	Salinity (PSU)	Temperature (°C)	Turbidity (NTU)
Mean	7.9	31.4	11.3	2.3
Max	14.5	35.0	22.2	146.0
Min	1.5	0.0	1.3	0.0
5%-ile	5.8	27.3	6.3	0.0
95 %-ile	9.8	33.6	17.0	9.0
n	107,971	107,860	111,328	110,574
Poolbeg Sludge Jetty	**DO (mg/l)**	**Salinity (PSU)**	**Temperature (°C)**	**Turbidity (NTU)**
Mean	8.2	31.7	12.5	5.3
Max	14.6	36.9	25.5	196.0
Min	0.0	0.0	3.2	0.0
5%-ile	6.1	24.5	7.2	0.0
95 %ile	9.8	34.9	18.2	23.0
n	87,509	81,048	88,010	86,441
North Bank Light	**DO (mg/l)**	**Salinity (PSU)**	**Temperature (°C)**	**Turbidity (NTU)**
Mean	8.5	32.2	11.6	4.1
Max	14.1	36.5	20.8	163.0
Min	2.5	9.2	0.9	0.0
5%-ile	6.8	24.5	6.2	0.0
95 %ile	10.2	35.4	17.0	16.0
n	88,386	87,095	88,544	86,722
Tolka Estuary	**DO (mg/l)**	**Salinity (PSU)**	**Temperature (°C)**	**Turbidity (NTU)**
Mean	9.1	31.3	11.3	5.1
Max	15.0	36.9	20.9	149.8
Min	2.1	9.8	4.0	0.0
5%-ile	7.9	25.7	6.4	0.0
95 %ile	10.4	34.7	17.3	17.6
n	74,406	71,783	75,663	70,193

Water Quality Trends (January 2018 – March 2021)

In general, salinity remained relatively high at all sites, between 24.5 and 35.4 PSU. However, on some occasions significant freshwater influences are obvious, such as at East Link during major storm events when riverine freshwater inputs increase.

Temperature shows the expected seasonal trend. The temperature at the Poolbeg site is slightly higher compared to the other three sites, the higher temperatures here probably reflecting the influence of the nearby cooling water stream.

Turbidity is very variable, particularly at Poolbeg where very high spikes of turbidity are sometimes measured. However, 95% of turbidity measurements are <9.0 NTU at the East Link Monitoring Station and <23.0 NTU at Poolbeg, North Bank and Tolka Estuary. Many of the higher turbidity readings recorded are transient and local and do not represent events of any environmental significance or diagnostic value in assessing potential impacts.

As noted, turbidity can be volatile at the Poolbeg Jetty Monitoring Station. This appears to be mainly due to site characteristics and tidal effects particularly during low spring tides. In addition, turbidity at all sites may be elevated during storm conditions. Investigations during elevated turbidity events have confirmed that ABR Project activities are not the cause of these events. Comparisons of mean turbidity during periods of 'dredging' and 'no dredging' activity showed that here is little difference between absolute values and no apparent pattern i.e. no consistent increase in mean turbidity during dredging episodes as reflected in the plots presented in Figures 9-10 to 9-13. Measured turbidity results demonstrate that dredging campaigns between 2018 and 2021 did not cause any discernible increase in turbidity within the Inner Liffey channel.

Finally, mean dissolved oxygen levels generally range between 7.9 and 9.1 mg/l. The mean dissolved oxygen values clearly indicate that oxygen levels are consistently close to saturation levels and no extended periods of oxygen sag or impacts of any dredging activities are obvious.

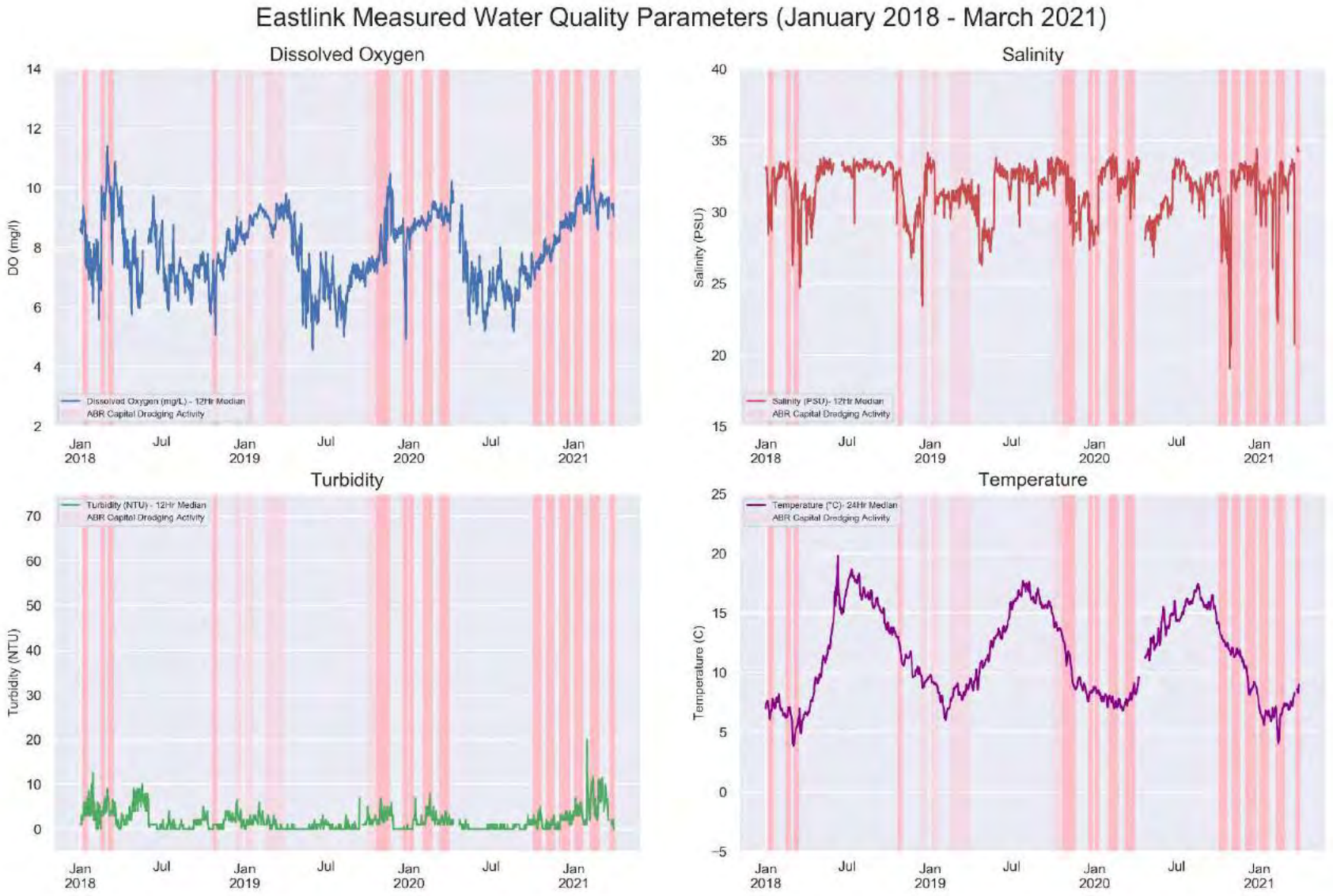


Figure 9-10 East Link Bridge Monitoring Station - Water Quality Data (12 Hour Median)

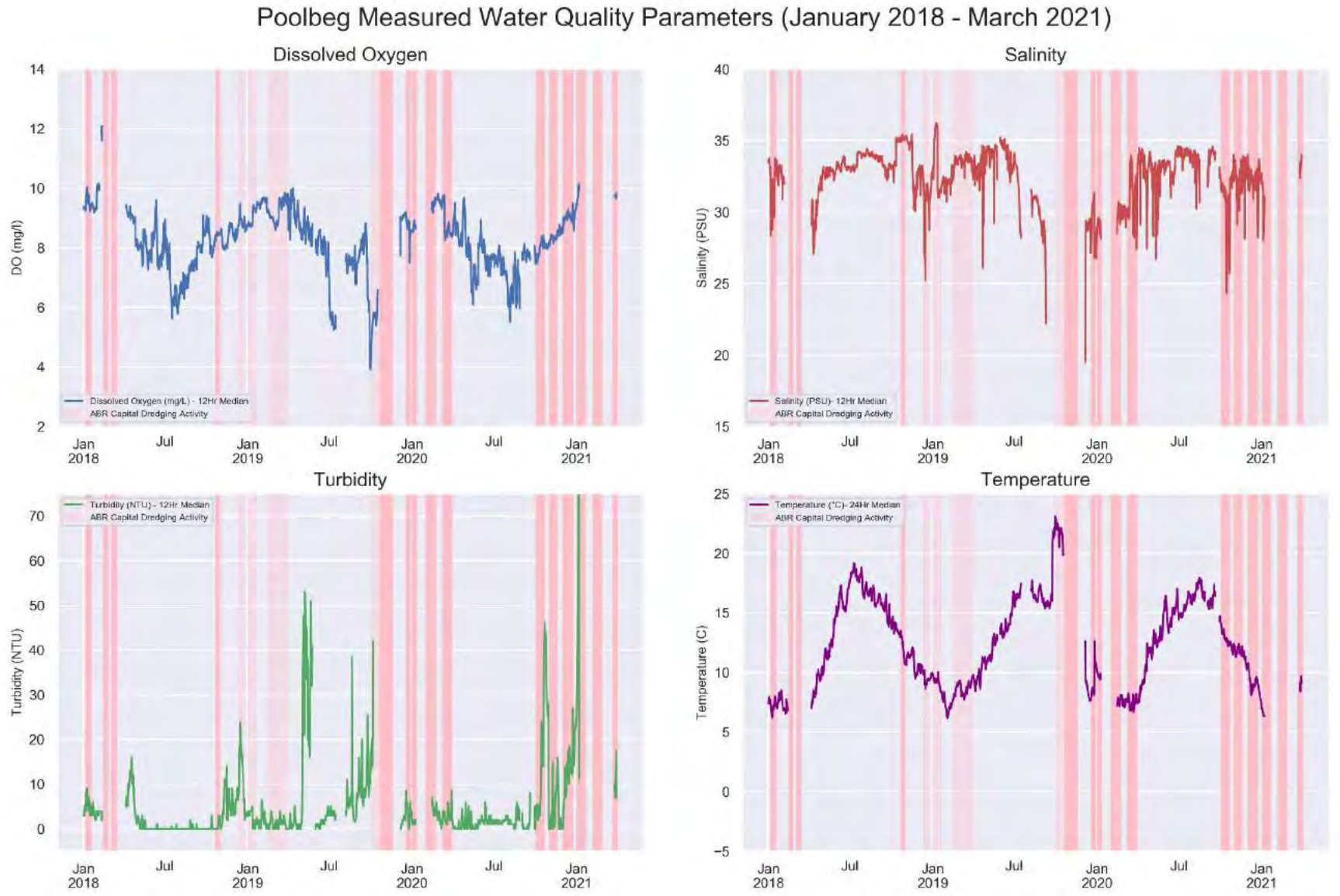


Figure 9-11 Poolbeg Monitoring Station - Water Quality Data (12 Hour Median)

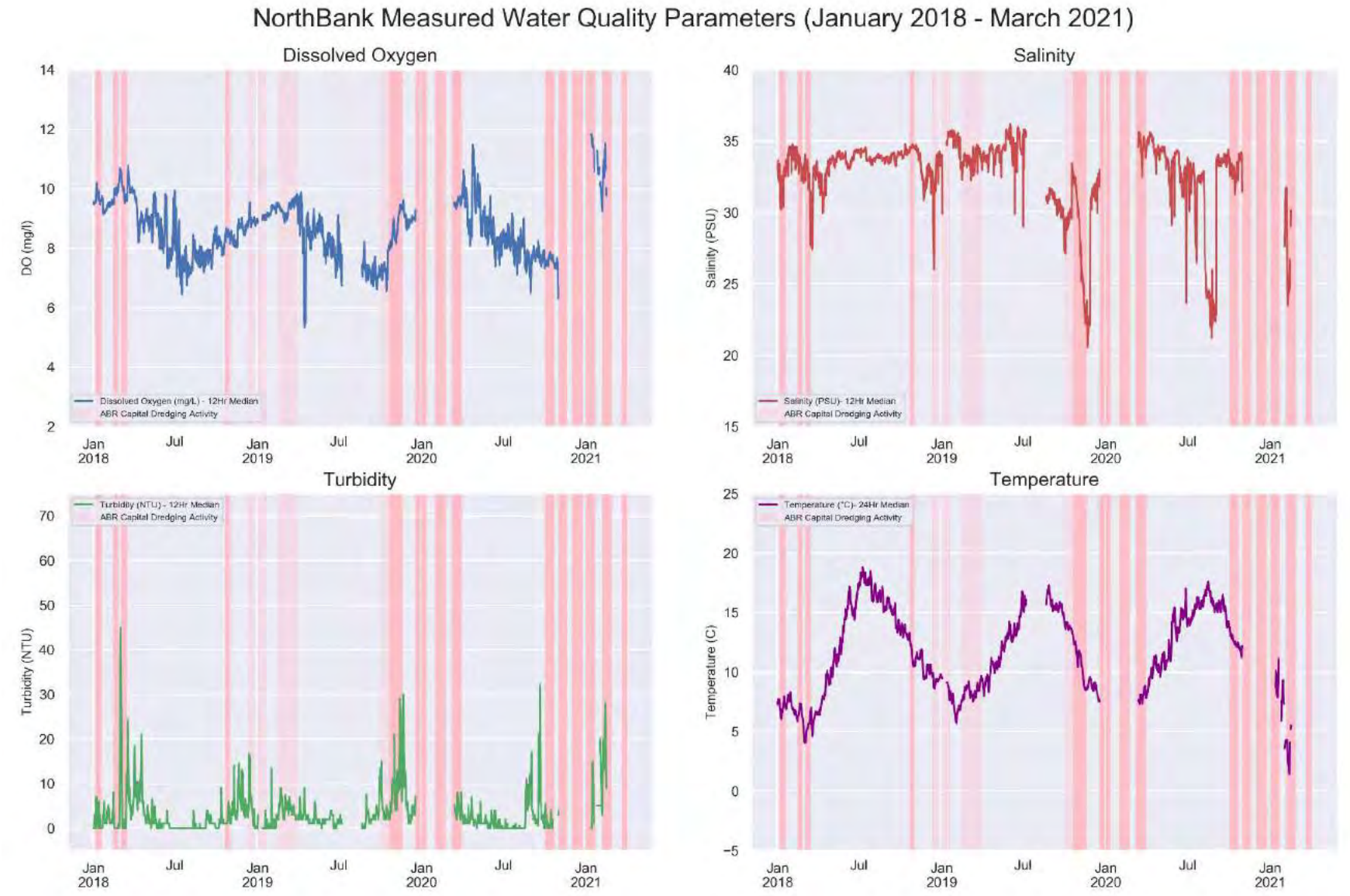


Figure 9-12 North Bank Monitoring Station - Water Quality Data (12 Hour Median)

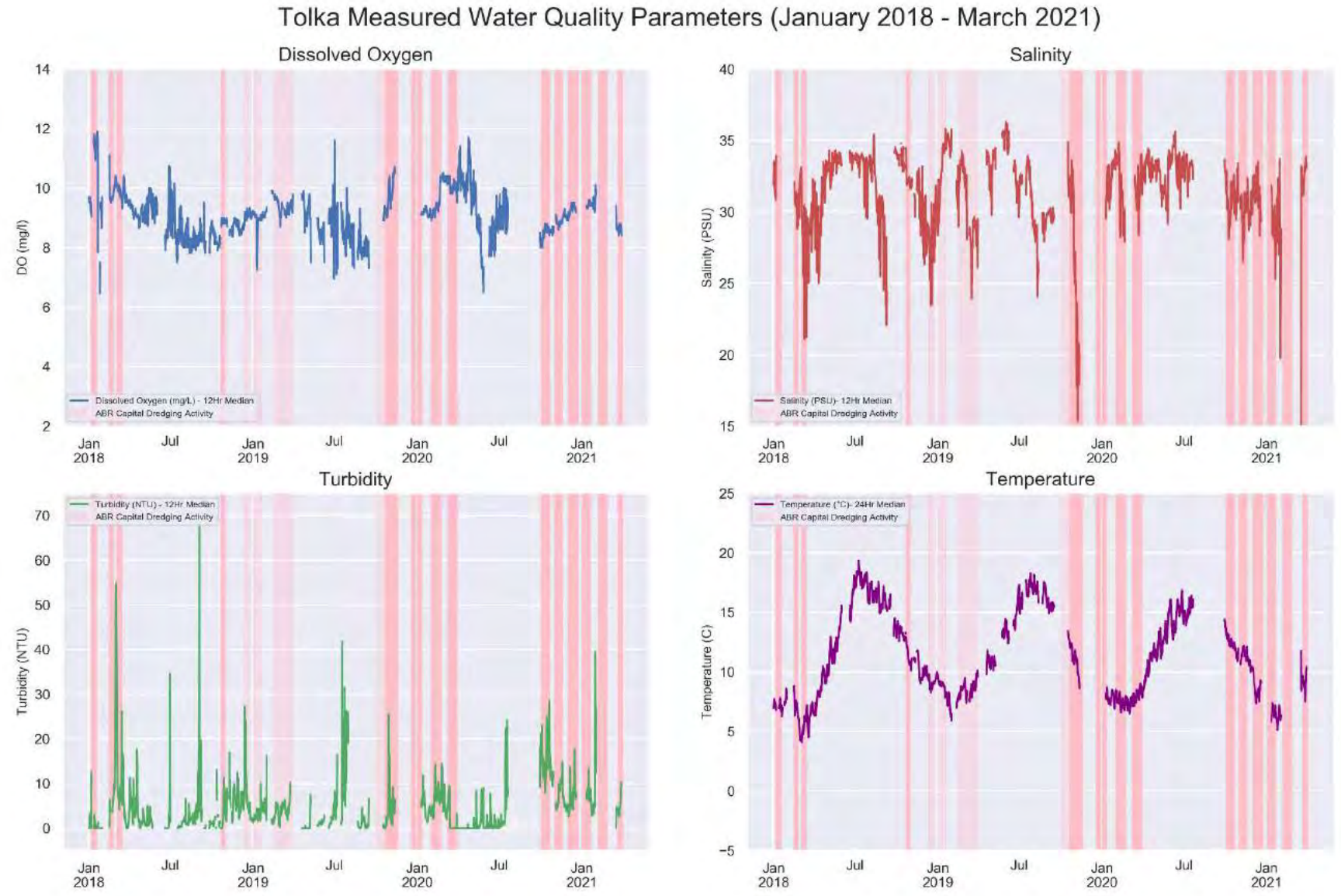


Figure 9-13 Tolka Estuary Monitoring Station - Water Quality Data (12 Hour Median)

Table 9-9 Details of ABR Dredging Activities

Dredging Campaign	Start Date	End Date	Dredging Location	Tonnes (wet weight) per month	No of Loads in Calender Month
ABR Season 1	6 Jan 2018	17 Jan 2018	Outer Approach Channel	291,999	126
	15 Feb 2018	23 Feb 2018	Outer Approach Channel	291,999	93
	4 Mar 2018	14 Mar 2018	Outer Approach Channel	279,304	178
ABR Season 2	22 Oct 2018	29 Oct 2018	Outer Approach Channel	257,036	63
	1 Nov 2018	11 Nov 2018	Outer Approach Channel	274,412	63
	12 Dec 2018	22 Dec 2018	Outer Approach Channel	231,187	54
	2 Jan 2019	17 Jan 2019	Outer Approach Channel	210,091	55
	17 Feb 2019	25 Feb 2019	Outer Approach Channel	193,813	56
	1 Mar 2019	10 Mar 2019	Outer Approach Channel	198,830	63
ABR Season 3	21 Oct 2019	31 Oct 2019	Outer Approach Channel	232,891	69
	1 Nov 2019	18 Nov 2019	Outer Approach Channel	185,148	120
	19 Dec 2019	28 Dec 2019	Outer Approach Channel	200,950	60
	1 Jan 2020	10 Jan 2020	Outer Approach Channel	283,607	53
	1 Feb 2020	21 Feb 2020	Inner Liffey Channel	277,934	177
	9 Mar 2020	27 Mar 2020	Inner Liffey Channel	258,529	200
ABR Season 4	3 Oct 2020	20 Oct 2020	Inner Liffey Channel	269,492	195
	1 Nov 2020	17 Nov 2020	Inner Liffey Channel	277,129	209
	1 Dec 2020	22 Dec 2020	Inner Liffey Channel	261,786	221
	2 Jan 2021	19 Jan 2021	Inner Liffey Channel	272,788	239
	6 Feb 2021	25 Feb 2021	Inner Liffey Channel	156,454	169
	22 Mar 2021	31 Mar 2021	Outer Approach Channel	104,658	85
			Total	**5,010,037**	**2,548**

Water Quality Trends during ABR Capital Dredging (2020)

During 2020, capital dredging was generally undertaken in the area inside the breakwater walls, i.e. Dublin Harbour and Inner Channel. A statistical summary of the turbidity monitoring results (January 2020 – December 2020) is presented in Table 9-10. Average annual turbidity is less than 10 NTU at all sites. Mean daily turbidity data for each monitoring site is plotted in Figure 9-14, and it is apparent that in general turbidity is relatively low throughout the monitoring period.

Table 9-10: Summary statistics for turbidity (NTU) measured at 15 min intervals from January 2020 to December 2020

Turbidity (NTU)	East Link	Poolbeg	Tolka Estuary	North Bank
Mean	1.6	5.4	5.5	3.0
Max	101.0	125.0	88.7	100.0
Min	0.0	0.0	0.0	0.0
95%ile	6.0	24.0	18.0	12.0
Variance	8.7	71.7	48.1	28.3
Number of Values	33644	29828	25762	20893

Capital dredging associated with the ABR Project was confined to the winter season (October to March) to minimize any potential environmental impacts. As shown in Table 9-9 above, capital dredging in 2020 took place in January (1st – 9th), February (1st – 23rd), March (9th - 28th), October (03rd – 20th), November (1st - 17th) and December (1st – 23rd). Table 9-11 compares the mean turbidity recorded during periods when dredging was ongoing, and periods when no dredging activity was taking place.

Mean turbidity is slightly higher during dredging periods, however there is little difference in absolute turbidity values for both periods. The greatest difference in mean turbidity at any site during dredging and non-dredging periods is only 2.3 NTU at the Tolka Estuary site. It should also be borne in mind that dredging occurs during the winter months (October to March) when sea conditions can lead to naturally increased turbidity.

Table 9-11: Summary statistics for comparison of turbidity means (NTU) during dredging and non-dredging periods in 2020

Mean Turbidity (NTU)	East Link	Poolbeg	Tolka Estuary	North Bank
Dredging Ongoing	2.1	6.3	7.6	3.7
No Dredging	1.6	5.3	5.3	3.0

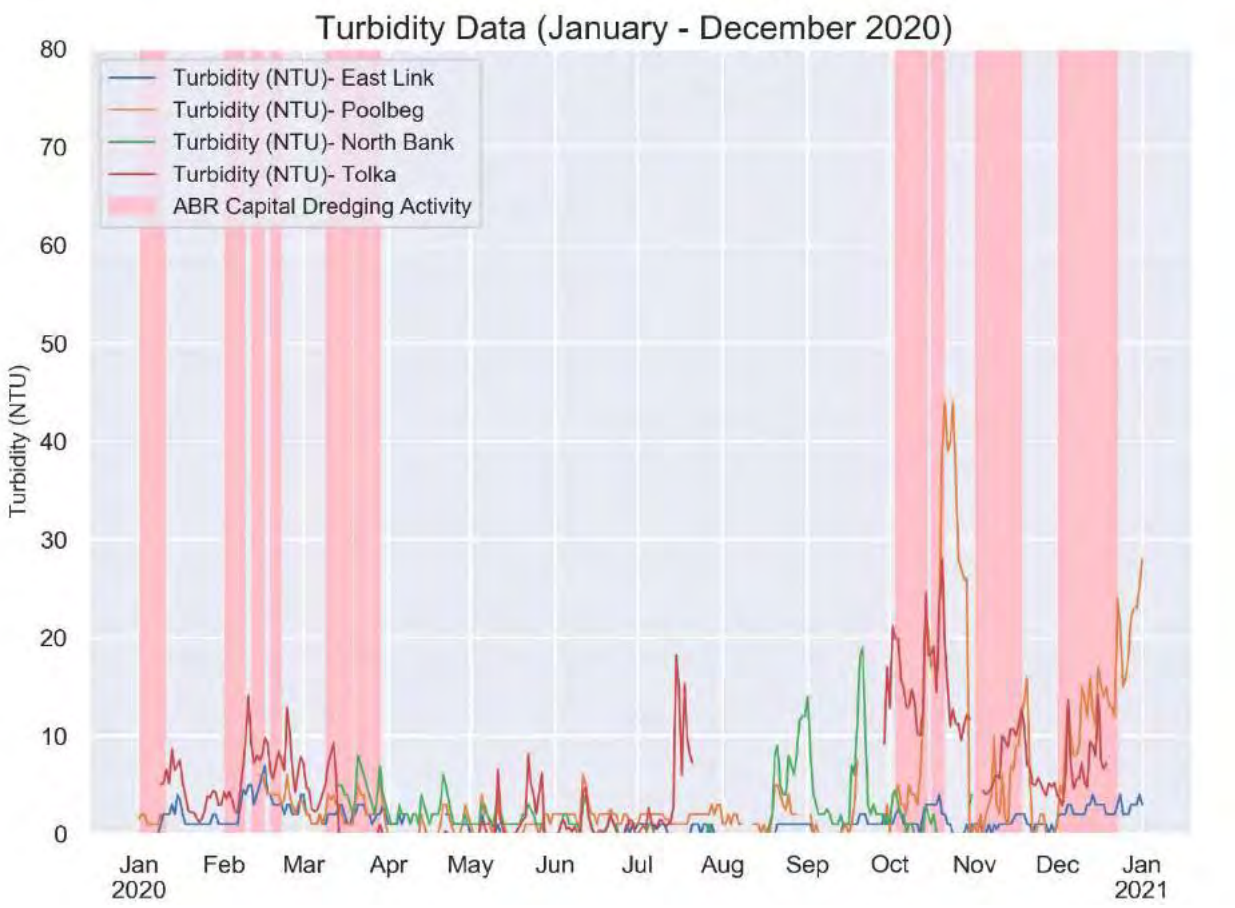


Figure 9-14 Mean daily turbidity (NTU) measured at each monitoring site during 2020

Between February 2020 and December 2020, dredging was exclusively confined to the area inside the breakwater walls, i.e. Dublin Harbour and Inner Channel. The sediments in the inner harbour are dominated by silts, by contrast Sediments in the outer channel are predominantly fine sands. As such additional environmental mitigation measures apply to dredging of silt. No over-spilling of the vessel is allowed while loading is carried out in the Inner Liffey channel inside the breakwater walls.

Figure 9-14 and Figure 9-15 illustrate the turbidity and dredging activity during the January-March 2020 and the October-December 2020 winter dredging campaigns. As shown in Table 9-10, the number of loading events and days of operation has increased during these months (most notably during the month of March). This is due to the additional mitigation imposed on dredging of silts i.e. smaller loads and no overspill of the hopper.

Therefore the removal of the permitted tonnage of dredge material and dumping it at the spoil grounds is a more gradual process.

January to March 2020

The peak in turbidity in mid-January occurs after the January dredging campaign was completed. It coincides with the arrival of Storm Brendan (13th January) with wind gusts up to 135km/h and wave heights of 4.5m measured at the dump site in Dublin Bay. Turbidity returns to low levels for the remainder of January and into early February. Further peaks in turbidity are seen from the middle to end of February. The increase begins during a break in dredging activity, and coincides with the onset of Storm Ciara (8-9th February). Ciara was followed closely by Storm Dennis (15th February) and then Storm Jorge (29th February). This succession of storms generated wave climates in Dublin Bay with peaks from 2.6m to 4m in height. Throughout this period the increase in turbidity is most pronounced at the Tolka Estuary monitoring site. This is the most exposed of the inner Liffey sites. Note that storms have resulted in damage to monitoring equipment on some occasions and may hamper access to monitoring sites for maintenance and calibration works. Storm and sea conditions also resulted in cessation of dredging activities on occasions.

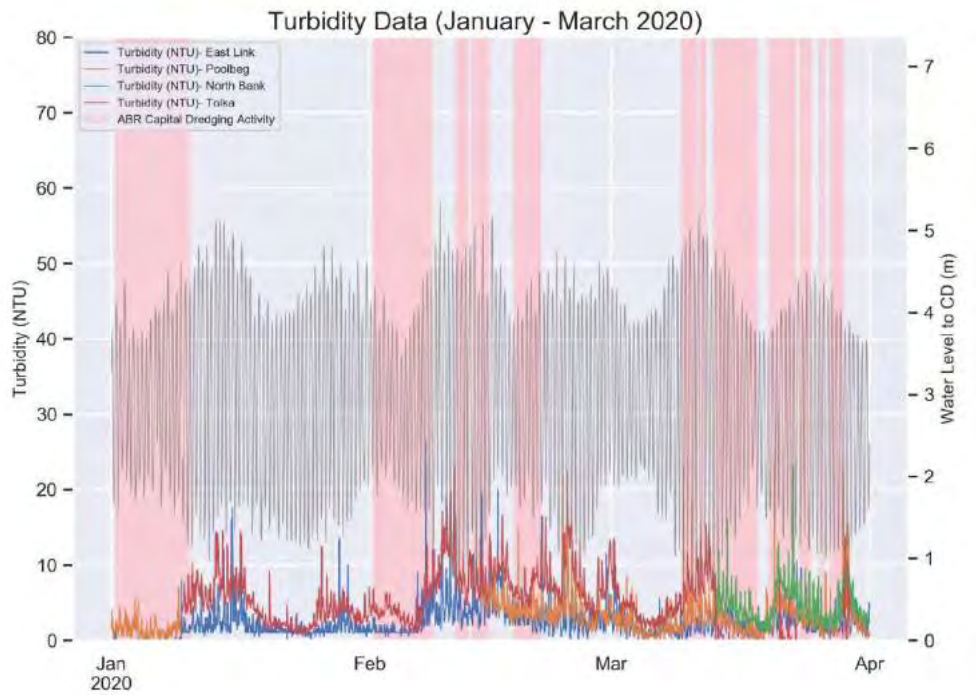


Figure 9-15 Turbidity at monitoring sites January - March 2020. Dredging events are shown by vertical bars and tidal height by the top grey curve (right hand scale in m).

October to December 2020

Turbidity fluctuated greatly throughout the months of October particularly at the Poolbeg site. The high turbidity values recorded generally occurred during periods when dredging operations were not ongoing. Turbidity dropped to low values immediately after the service visit on the 30th October and clearly biofouling was the cause of elevated turbidities in the latter part of the month. Storm Aiden, the first storm of the 2020/2021 winter season hit Ireland on the 30th of October 2020 bringing wet and windy conditions. Further peaks in turbidity are seen from the middle of November. The fluctuations in turbidity recorded at the Poolbeg and Tolka sites were generally occurring during periods of high spring tides. The increase in Turbidity towards the end of December coincide with a trough of low pressure moving in from the northwest and bringing strong winds and gusts of 37 knots.

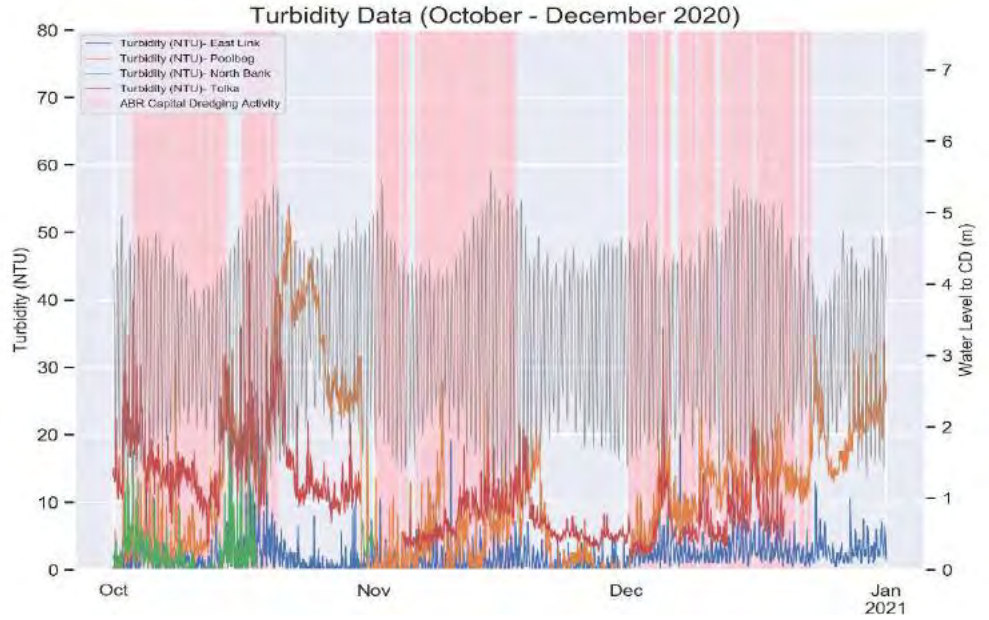


Figure 9-16 Turbidity at monitoring sites October - December 2020. Dredging events are shown by vertical bars and tidal height by the top grey curve (right hand scale in m).

Figure 9-17 presents turbidity from the 1st to the 6th December 2020 in greater detail to illustrate recorded turbidity values while capital dredging operations were ongoing within the inner channel of Dublin Harbour. The graph shows low turbidity before onset of the December dredging campaign. When dredging has started there is little discernible change in the turbidity curves, and turbidity remains generally below 10 NTU throughout a period when almost 40 loading operations took place in the inner channel. Turbidity increases at Poolbeg and Tolka Estuary from midday on the 4th December, and continues to increase during an 18 hour break in dredging from 16.05 on 4th December until 10.44 on the 5th December. Dredging recommenced on the 5th December at 10:44 with loading situated 2.5km upstream of Tolka Estuary and turbidity falls thereafter throughout the ensuing dredging operations.

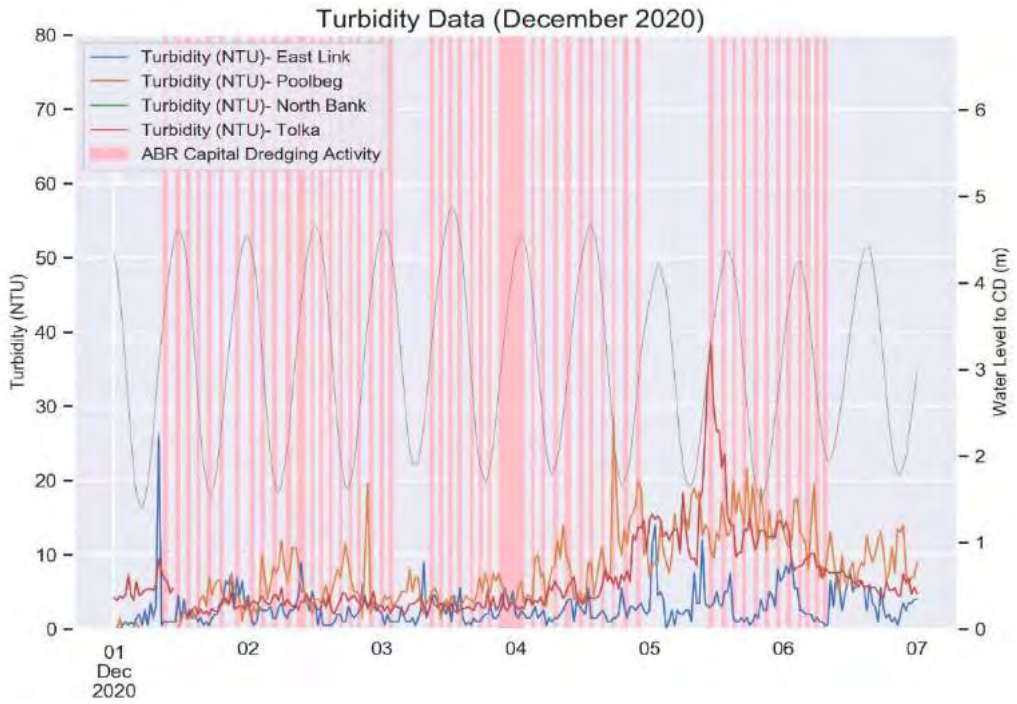


Figure 9-17 Turbidity and dredging activity from 1st December 2020 to 7th December 2020

Summary

In summary, high frequency turbidity measurements during 2020 demonstrate that turbidity level was generally low within the Inner Liffey channel. And even though the 2020 capital dredging campaign was substantially within the Inner Liffey channel, with some 1180 loading operations in this area, it did not cause any discernible or sustained increase in turbidity. Suspended solids have also remained close to baseline levels at all sites in the inner Liffey channel throughout the dredging season.

Eight named storms impacted Ireland in 2020. These, and other weather events of smaller magnitude are seen to have contributed to turbidity increases during the year. Combined with dissolved oxygen records, turbidity monitoring shows that water quality in the inner Liffey channel has remained satisfactory throughout 2020.

9.2.5.2 Dublin Bay Turbidity Monitoring

During the ABR Project dredging campaigns, turbidity is measured in the outer bay area using four CoastEye Monitoring Buoys. The buoys are shown in Figure 9-18 on the deck of the Commissioners of Irish Light vessel the ILV Granuaile at the time they were launched. Three of the buoys are positioned at the dump site (to the north, in the middle, and to the south). A fourth buoy is located about 2.5km to the northeast of Dalkey. This fourth buoy gives an indication of the background conditions in Dublin Bay away from any spoil dumping and dredging activities. All the buoys are moored in about 20m water depth. Their locations are shown in Figure 9-19.



Figure 9-18 Coasteye monitoring buoys on board the ILV Granuaile for deployment in Dublin Bay

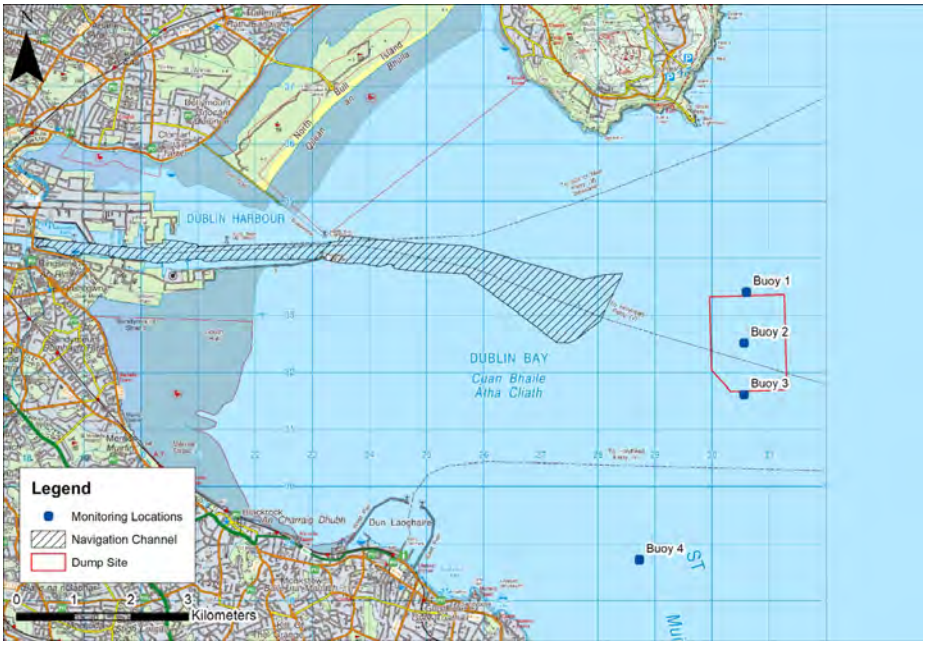


Figure 9-19 Locations of the Coasteye buoys at the dump site (buoys 1 to 3) and background site (buoy 4)

Turbidity and Total Suspended Solids

Turbidity is measured at 15 minute intervals at all buoys (B1 to B4) using 12 Seapoint Turbidity Sensors. Data is served out through the CoastEye marine data web portal. Data recording at each buoy began in September 2017 and has been ongoing since then. Gaps in the data record may occur due to biofouling of sensors (Figure 9-20), to equipment damage or malfunction e.g. failure of sensor wipers, or to occasional loss of signal for transmission of data. Data anomalies and obvious drift due to fouling of sensors are removed before reporting. However, in the interests of retaining all potentially valid data, small scale anomalies or values early in data drift, are retained.



Figure 9-20 Biofouling on the top turbidity sensor on Buoy 2 in July 2020

As described previously, the relationship between turbidity and suspended solids in water is site specific. Therefore, sediment from outside the breakwaters was sampled and used to establish a relationship between turbidity and suspended solids for the outer Bay area. The sediment consisted of fine sand and suspensions were prepared from this sample to provide turbidity in the range 0 to 150 NTU. Turbidity (NTU) and TSS (mg/l)

were measured for 75 suspensions to allow construction of the blue calibration curve in Figure 9-21. The previous calibration curve for fine river sediments is also shown for comparison (red curve). Total suspended solids (TSS) (mg/l) is estimated at 1.61 times the turbidity (NTU) for the approach channel sediments (fine sand). The correlation coefficients squared show very good relationships in both calibration series (r2 > 0.90). These relationships are site/sediment-specific but allow an estimate of TSS based on recorded turbidity.

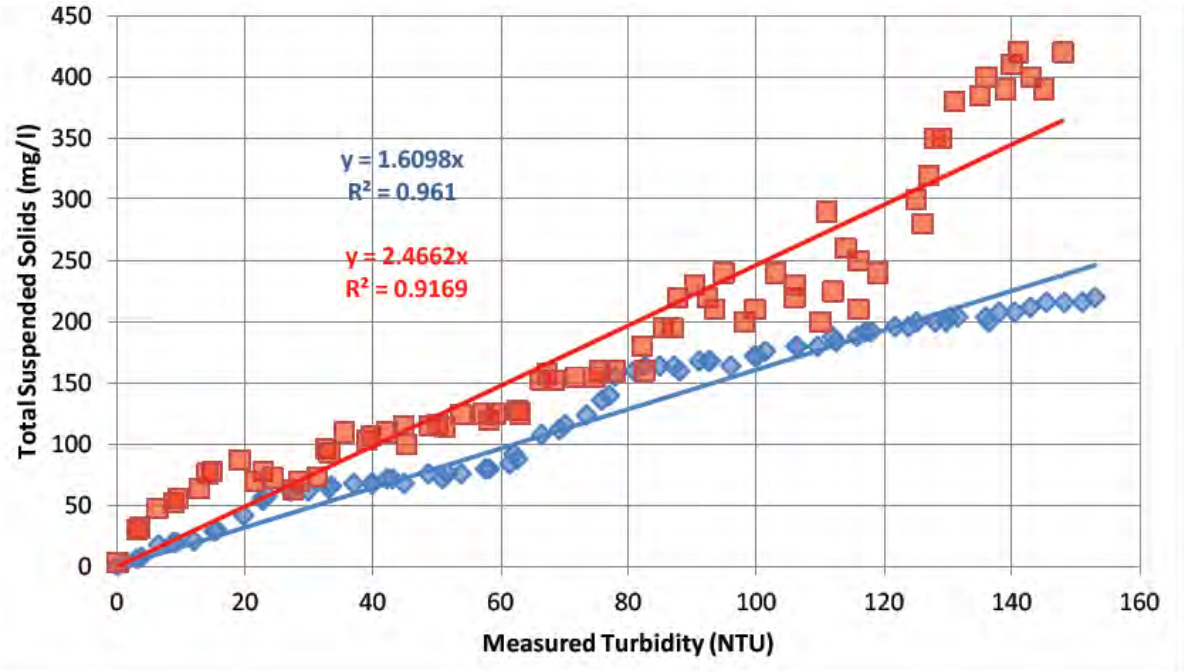


Figure 9-21: TSS versus Turbidity for suspensions of river bed silt sediment (red) and approach channel fine sand sediment (blue). Equations & r2 values in corresponding colours for each series

Water Quality Records (Dublin Bay)

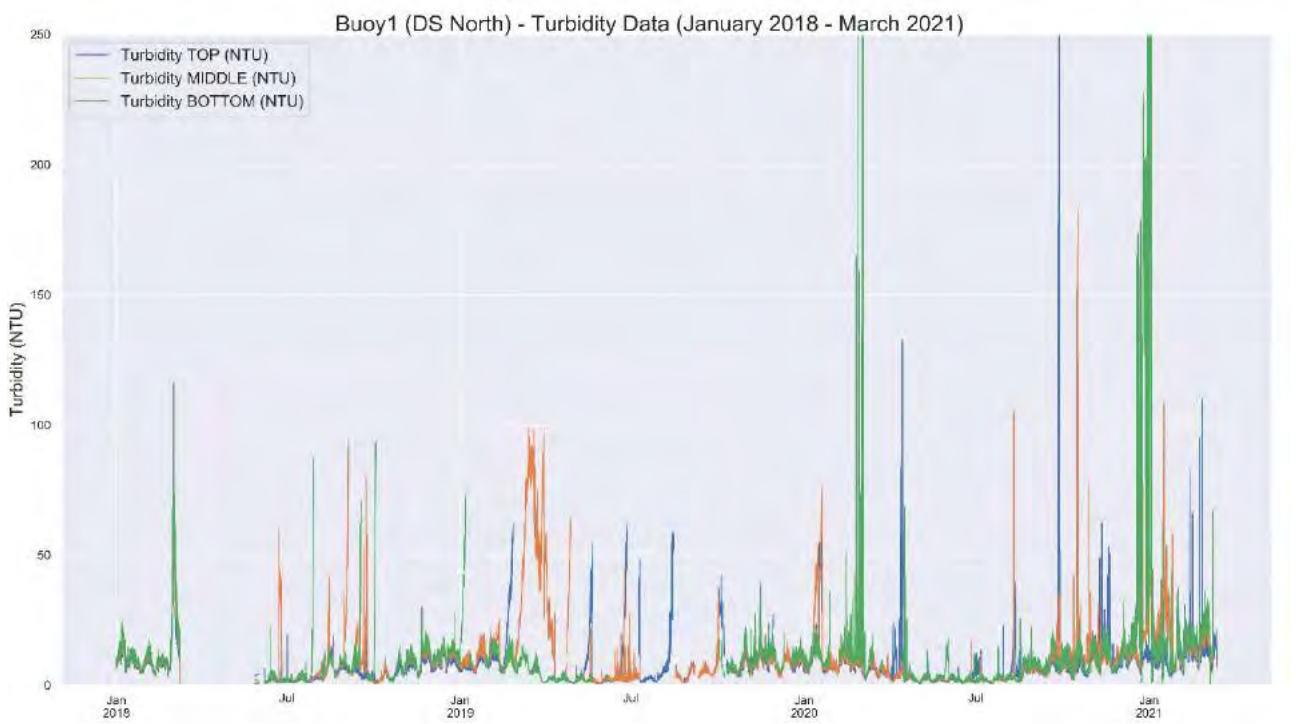
A substantial number of validated records have been logged for each depth sensor since monitoring began in September 2017. The maximum potential number of 15 minute records on a full year basis is 35,000. Between January 2018 and March 2021, the number of records achieved in the validated datasets ranged from 39,719 (34%) at Buoy 4 Top sensor to 74,515 (64%) at Buoy 1 Mid sensor. While obvious gross data anomalies are removed during data validation, some elements of drift in data due to progressive fouling of sensors remains.

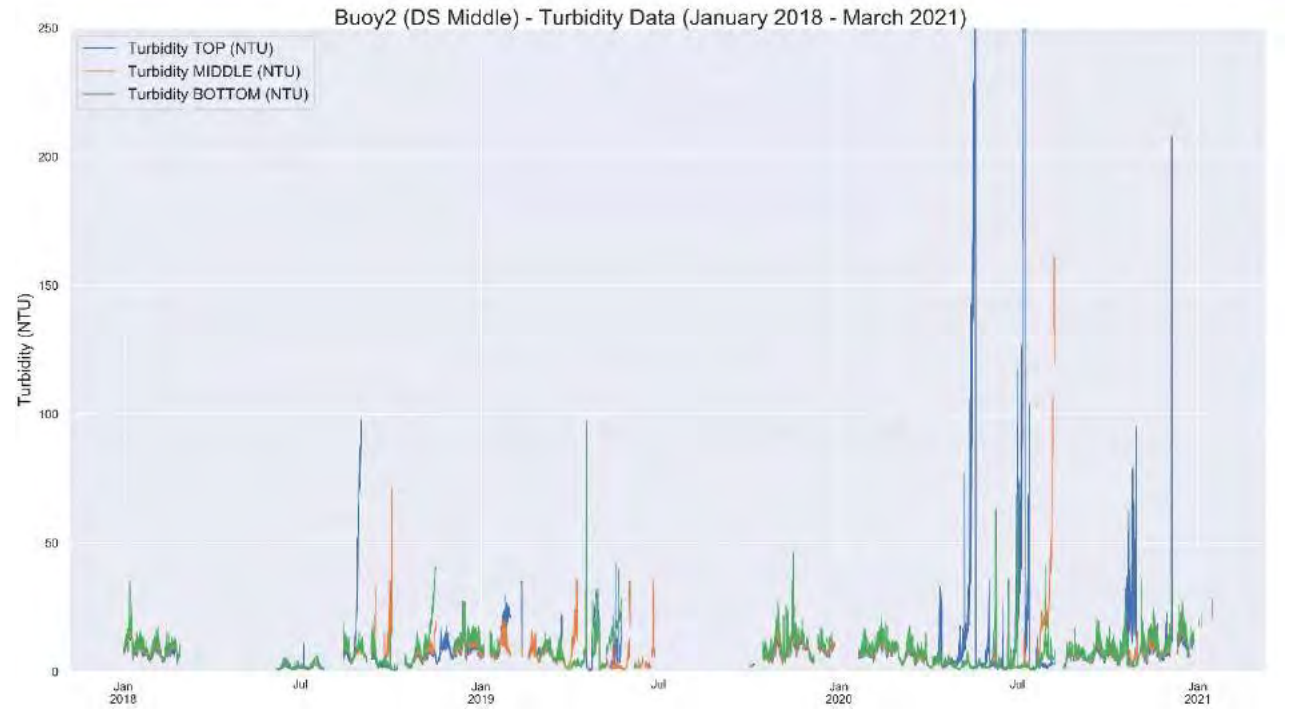
Table 9-12 Summary statistics for turbidity data (NTU) recorded at four Coasteye Buoys in Dublin Bay between January 2018 and March 2021

		Top	Mid	Bottom
Buoy 1 (DS North)	**Mean**	8.1	11.0	11.7
	90% ile	13.6	19.3	16.0
	No. of Observations	72,969	74,515	61,221
Buoy 1 (DS Middle)	**Mean**	10.1	7.2	7.9
	90% ile	15.4	12.9	15.0
	No. of Observations	47,141	45,852	45,132
Buoy 3 (DS South)	**Mean**	15.9	8.7	10.6
	90% ile	21.6	16.4	19.1
	No. of Observations	66,143	74,951	71,580

Buoy 4 (Control)	**Mean**	12.7	7.9	7.7
	90% ile	14.6	12.6	14.1
	No. of Observations	52,663	52,820	39,719

Figure 9-22 show plots of the turbidity data at each depth over the January 2018 to March 2021 period for each buoy. Turbidity tends to increase very slightly near the bottom at each site (Table 9-13) by 1 to 3 NTU on average. However, trends at each depth are similar. Turbidity tends to be higher and more variable over the winter month (October – March) and therefore suggests that natural seasonal factors affecting both control and dumping sites are significant drivers of these turbidity fluctuations.





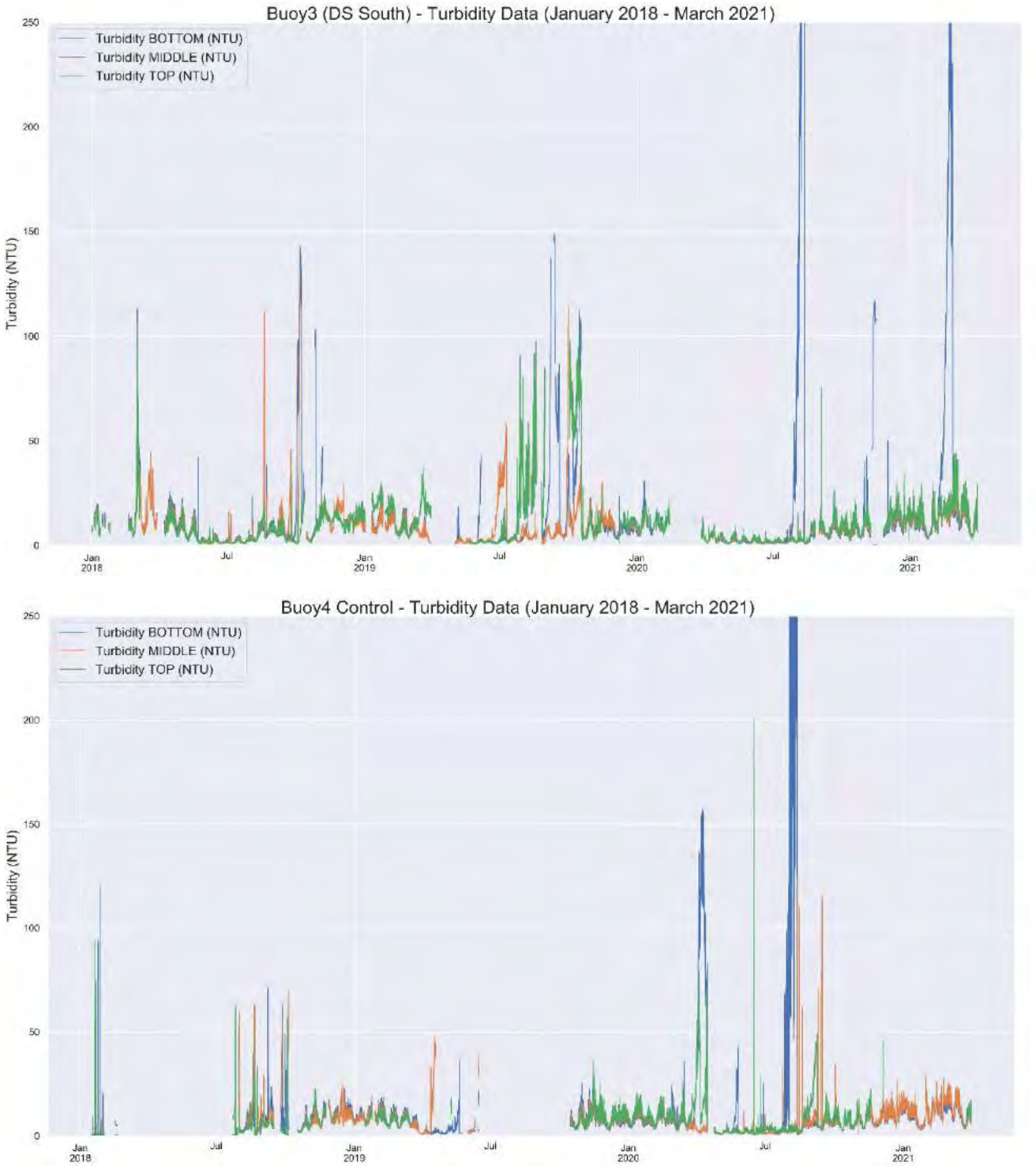


Figure 9-22 Plots of turbidity at all depths and mean turbidity from March 2019 to March 2020

Table 9-13 Mean Turbidity (NTU) recorded at each depth for Buoys 1 to 4. Numbers in brackets are the number of data observations between January 2018 and March 2021

MEAN TURBIDITY (NTU)	Top	Mid	Bottom
Buoy 1 (DS North)	8.1 (72,969)	11.0 (74,515)	11.7 (61,221)
Buoy 2 (DS Middle)	10.1 (47,141)	7.2 (45,852)	7.9 (45,132)
Buoy 3 (DS South)	15.9 (66,143)	8.7 (74,951)	10.6 (71,580)
Buoy 4 (Control)	12.7 (52,663)	7.9 (52,820)	7.7 (39,719)

Mean turbidity is a robust estimate of the central tendency at each site, and is less subject to short-term random variance of little environmental significance. Therefore mean turbidity is used in comparisons of dredging activity and turbidity. The turbidity at each depth over the January 2018 to March 2021 period is also plotted as daily median for each buoy in Figure 9-23.

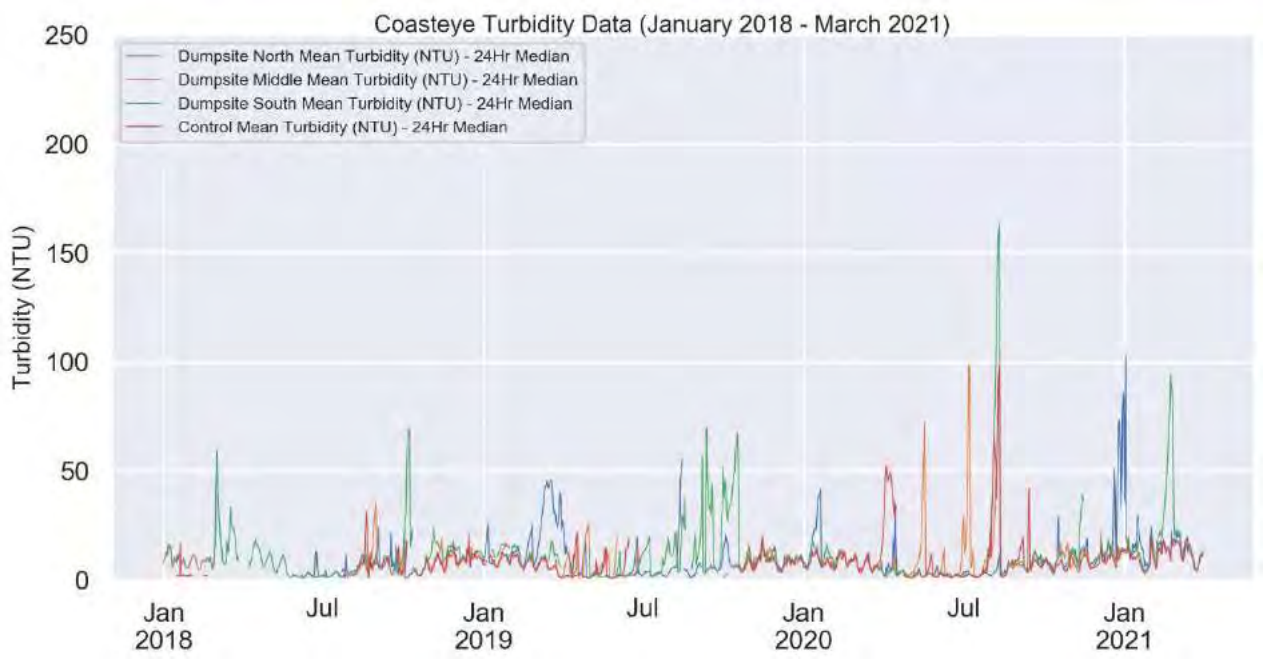


Figure 9-23 Coasteye data plotted as mean daily turbidity at each buoy

Table 9-14 compares mean turbidity in relation to capital dredging and non-capital dredging seasons between January 2018 and March 2021. The overall mean turbidity at each site ranges between 8.3 NTU and 11.7NTU. The control site (Buoy 4) is similar to all sites at the spoil grounds (Buoys 1-3).

Turbidity at times of dredging and dumping events (October – March) is compared to turbidity outside those intervals (April – September). Turbidity in the April to September is lower at three of the four sites. The natural seasonal factors, winter sea conditions and the prevalence of winter storms are largely responsible for this apparent difference.

When turbidity during the winter season only (October to March) is compared for dredging and non-dredging intervals, mean turbidity has been higher at two sites (Buoy 1 and Buoy 3) at times when no dredging and dumping occurred and marginally less at the control site (Buoy 4).

Table 9-14 Mean turbidity at Buoys 1 to 4 during winter and summer seasons (2018 – 2021) and during dredging and no dredging intervals. Figures in brackets are the number of data observations

MEAN TURBIDITY (NTU)	Buoy 1 (DS North)	Buoy 2 (DS Mid)	Buoy 3 (DS South)	Buoy 4 (Control)
Overall	10.0 (80,982)	8.3 (51,068)	11.7 (79,502)	9.5 (56,265)
April to September	5.6 (36,805)	7.3 (22,648)	8.4 (38,655)	11.2 (17,733)
October to March	13.7 (44,177)	9.0 (28,420)	14.7 (40,847)	8.7 (38,532)
October to March (No Dredging/ Disposal)	14.3 (23,813)	8.4 (15,142)	15.4 (22,078)	8.5 (19,453)
October to March (Dredging/ Disposal)	13.0 (20,364)	9.7 (13,278)	13.9 (18,769)	8.9 (19,079)

Water Quality Trends during ABR Capital Dredging Campaign (2020)

As detailed above (Section 9.2.5.1), Capital Dredging under the Alexandra Basin Redevelopment was generally confined to the inner Channel and Dublin Harbour. The sediments in the inner harbour were found to be predominantly silts. Turbidity is measured every 15 minutes in the outer bay area using four CoastEye Monitoring Buoys. There were between 15,000 and 24,000 validated data records have been logged for each depth sensor during 2020, and these turbidity data are summarised in Table 9-15. Mean turbidity is less than 10 NTU for all sensors, and 90% of data are less than 16 NTU in all instances.

Turbidity levels at the 3 monitoring stations at the dump site (B1 to B3) are compared to the control site (B4) which has a similar water depth but remote from the influence of any plume arising from the dumping activity. Data are presented in several summary formats to elucidate relationships between sites, dredging activities and seasonal patterns.

Table 9-15 Summary statistics for turbidity data (NTU) recorded at four Coasteye Buoys in Dublin Bay January to December 2020

		Top	Mid	Bottom
Buoy 1 (DS North)	**Mean**	7.4	8.2	8.3
	90% ile	13.8	14.9	15.8
	No. of Observations	23609	23704	19756
Buoy 1 (DS Middle)	**Mean**	8.7	6.6	7.7
	90% ile	15.3	12.7	14.4
	No. of Observations	17592	17956	18502
Buoy 3 (DS South)	**Mean**	6.8	5.4	6.4
	90% ile	14.3	11.9	13.5
	No. of Observations	19714	18169	15996
Buoy 4 (Control)	**Mean**	7.9	6.0	6.7
	90% ile	15.7	11.7	12.6
	No. of Observations	20503	23133	21392
Data Range	**Mean**	1.9	2.8	1.9

The turbidity data measured at all three depths at each buoy is illustrated in Figure 9-24 for the January to March campaigns and Figure 9-25 for October to December dredging campaigns. The vertical pink bars in each plot indicate the time of dumping event at the spoil grounds. All times of turbidity measurement, start of dumping, and tidal height are rounded and assigned to the nearest 15 minute interval. Tidal height has not been rigorously calibrated and should be taken as approximate.

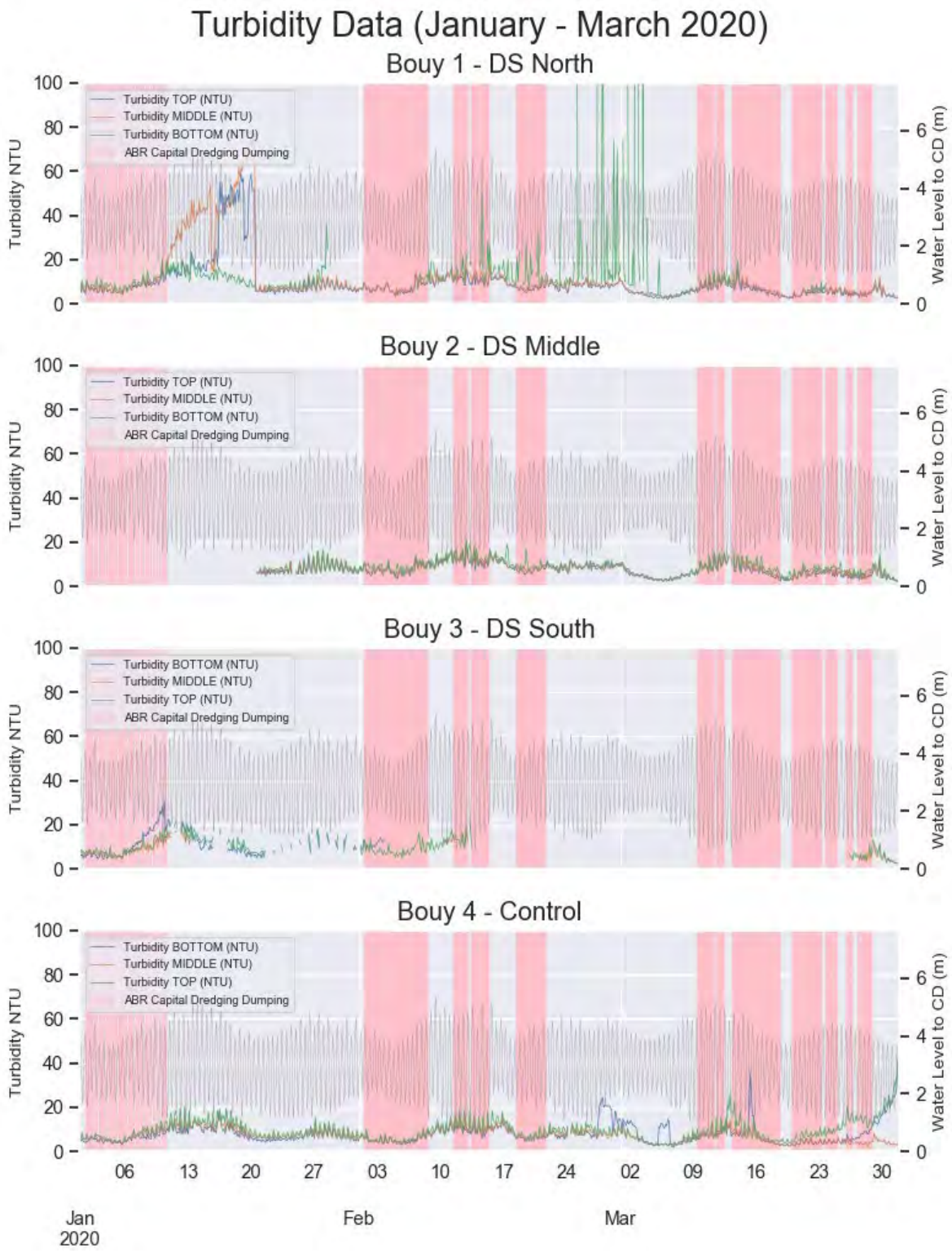


Figure 9-24 Turbidity recorded at monitoring Buoys in Dublin Bay (January to March)

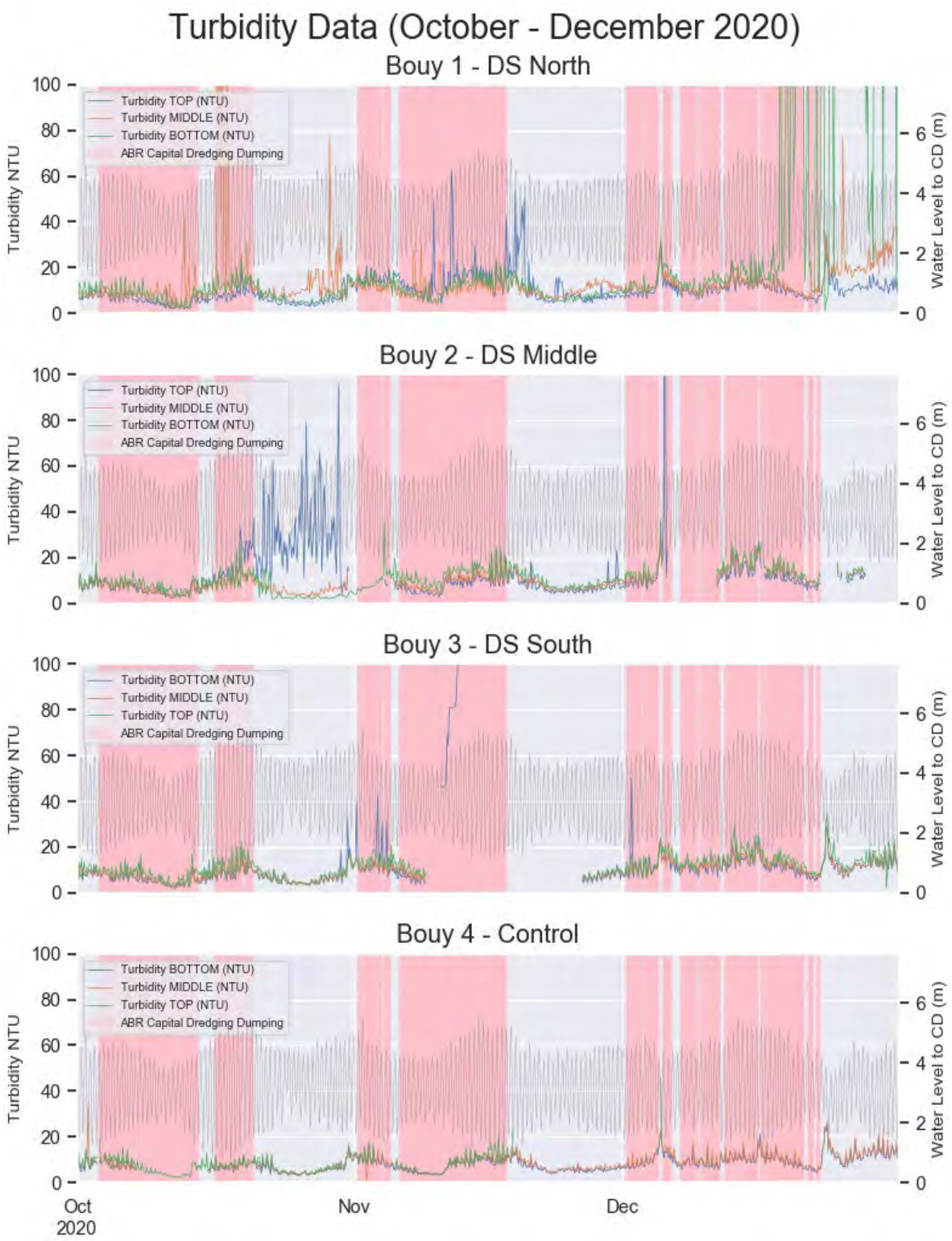


Figure 9-25 Turbidity recorded at monitoring Buoys in Dublin Bay (October to December)

Cyclical periods of relatively lower turbidity and reduced variance are interspersed with periods of relatively higher turbidity and increased variance at all monitoring sites. Such patterns relate to spring and neap tides during the lunar cycles. The time of occurrence of spring and neaps tides are illustrated as Water Level and the correlation with turbidity is obvious. Turbidity also fluctuates with each tidal cycle as current speeds increase and decrease and change direction. This is shown by high frequency oscillations in the turbidity curves.

The close correspondence between turbidity measured at Buoys 1 to 3 with that at Buoy 4 is evident throughout the months displayed. Some periods of drift can be seen, notably during January 2020 when Buoy 1 (DS North) shows drift. This is after the January dredging campaign had ended, and is most probably due to fouling, possibly exacerbated by Storm Brendan (January 13th – 14th).

The close correspondence of turbidity at Buoy 4 (Control) with that at the dump site clearly indicates that dredging has not significantly impacted turbidity in Dublin Bay. This is further confirmed by a comparison of mean turbidity at each buoy and depth in Table 9-16.The data shows a maximum range of 1.9 NTU, 2.8 NTU and 1.9 NTU in mean turbidity measured at the top, middle and bottom sensors respectively compared across all 4 buoys. Turbidity is compared for days with and without dredging activity at each site and at each water depth in Table 9-16. Given the natural seasonal differences in turbidity mentioned above, the comparison is made for the winter months only i.e. October to March. All of the mean turbidity records in Table 9-16 lie within a range of 5.8 NTU. Based on TSS and turbidity models presented above (Figure 9-19), this is equivalent to a maximum difference of approximately 9.3 – 14.3 mg/l TSS. In addition, for the 12 comparisons made (4 buoys x 3 depths), turbidity is higher during no-dredge days in eight cases, and lower in only 4 cases.

Table 9-16 Mean turbidity during dredging and no-dredging periods for the winter season only. Cells shaded green indicate that turbidity measured at this sensor has been higher when there was no dredging taking place.

Winter Only	Dredge	No Dredge	Dredge	No Dredge	Dredge	No Dredge
	Top	Top	Middle	Middle	Bottom	Bottom
Buoy 1	9.5	10.3	10.6	12.6	13.2	12.5
Buoy 2	9.4	10.4	10.0	8.5	13.5	10.0
Buoy 3	10.5	10.7	8.7	9.0	11.6	11.0
Buoy 4	8.4	9.1	8.2	8.3	7.7	8.3
Range	2.1	1.6	2.4	4.3	5.8	4.2

In summary, the measured turbidity results demonstrate that dredging campaigns during 2020 did not cause any significant or sustained increase in turbidity above recorded background levels. Increases in turbidity are also evident at times when no dredging was occurring.

There are other important drivers of turbidity in Dublin Bay, including seasonal differences and tidal influences. The results show the spring – neap – spring tidal cycles and wave action during storm events are the dominant causes of the natural variations in turbidity which exist in Dublin Bay.

9.2.5.3 Sediment Plume Validation Modelling

Dumping at Sea Permit S0024-01, Condition 4.11 of the ABR Capital Dredging Programme requires that 'the permit holder shall carry out sediment plume monitoring in the vicinity of the dumping activity during the first dumping campaign and thereafter as may be required by the Agency.' Sediment plume monitoring was carried out previously and reported in the Annual Environmental Report (AER) 2017 submitted to the EPA under Dumping at Sea Permit S0024-01. It concluded that there was no discernible impact of dumping of the fine sands making up the seabed of Dublin Bay on turbidity and that the released dredge spoil did not create a

significant dredge plume within the surface waters. Sediment appears to settle rapidly and proximally to the release point within the dumping site.

In 2020 dredging moved to the inner harbour area where silts dominate. Therefore monitoring of the sediment plume was repeated during the year 3 capital dredging campaign to validate the sediment dispersal model and to determine differences or potential impact associated with dumping of silts. As part of sediment plume monitoring, extensive turbidity data, in both vertical and horizontal spatial dimensions was recorded during several dumping events. Analysis of the data has provided evidence that the dumping of the sediment from the Inner Liffey channel at the licenced offshore disposal site located at the entrance to Dublin Bay had no measurable significant effect on turbidity levels outside the dump site (see Chapter 9 Coastal Processes)

Earth Observation

Earth observation (EO) data are used to monitor coastal water attributes and contribute to regional water quality monitoring. TechWorks Marine have been involved in a project funded by European Union Framework Programme and the European Space Agency to utilise satellite EO data for regional water quality monitoring in the coastal zone. Data collected at the Coasteye monitoring buoys in Dublin Bay has been used to calibrate EO data for the prediction of turbidity. Turbidity predicted by EO data is compared to observations made in Dublin Bay at the Coasteye monitoring buoys. Figure 9-26 shows the satellite image of Dublin Bay for the 10th September 2019. The figures inset show the turbidity measured at Buoy 1 to the north of the dumpsite and at Buoy 4, the control site. There is excellent agreement between satellite and field observations of turbidity. The data are within circa 0.3 NTU to 1.2 NTU of one another, and EO data therefore provides a robust predictor of actual turbidity.

Earth observation imagery allows the entire area of the bay to be captured simultaneously, and the spatial distribution of turbidity values to be visualised. Satellite generated turbidity values at a resolution of 3x3m are colour coded in Figure 9-26 from blue (Low – 0.6 NTU) to red (High – 30 NTU). Black shapes are areas with cloud cover that could not have turbidity values assigned. Cloud cover is a significant constraint on the use of EO data under Irish conditions.

The sequence of images below (Figure 9-27) show satellite predicted turbidity in Dublin Bay on four days from 26th August to the 20th September 2019. These were days on which cloud cover was low over the bay, and it was also a period when no dredging occurred. The images therefore represent ‘natural’ conditions within the bay under varying weather and tidal states.

On 26th August 2019 turbidity is low throughout the bay except for the shallow fringes where the highest turbidity occurs. This is a feature of all images and results from wave action and suspended material in shallow waters along the coast. It is particularly prominent along the extensive strands from Sandymount to Merrion, but also visible along Dollymount and especially at the northern recurve of Bull Island and in the north lagoon.

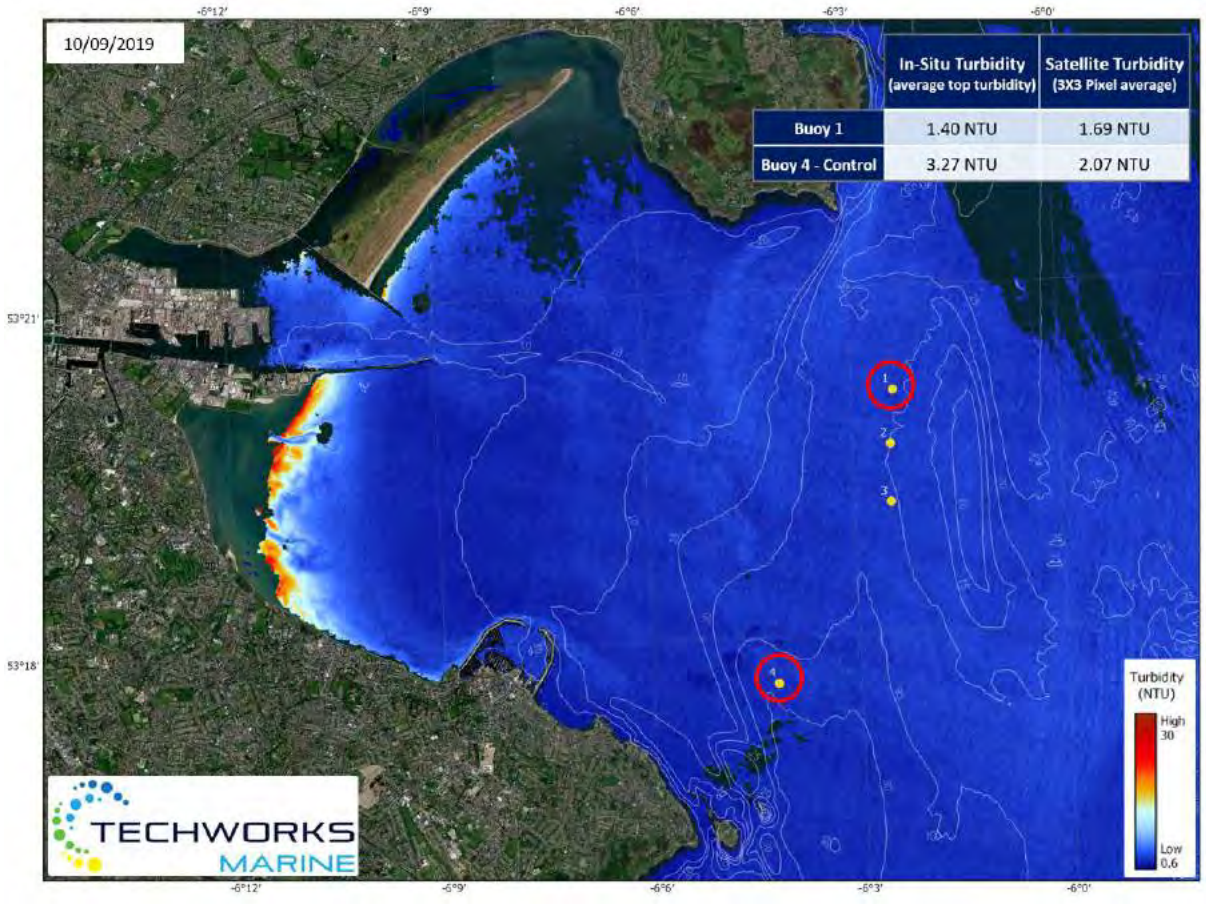
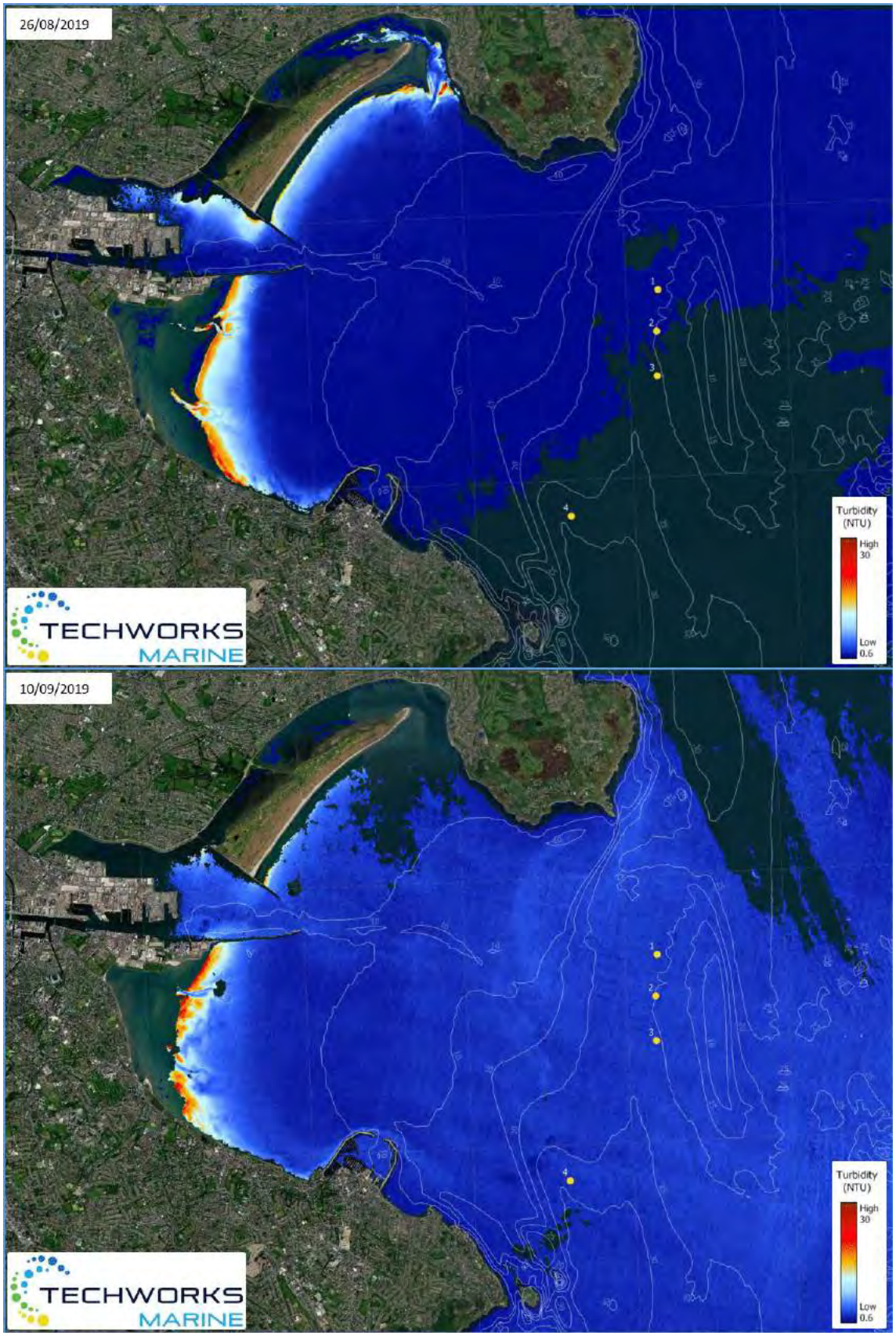


Figure 9-26 EO image of Dublin Bay on 10th September 2019 showing satellite predicted turbidity and simultaneous data from the Coasteye Monitoring Buoys B1 and B4

On the 10th September 2019 some areas of slightly raised turbidity, appearing as wispy white bands, are visible in the Bay and Liffey Estuary. A plume can be seen emanating from the Poolbeg Wastewater Treatment plant at the western end of the Great South Wall. It exits the inner Liffey channel and moves southwards in the bay. A second plume may be distinguished moving south across the mouth of Dun Laoghaire harbour. A body of water with elevated turbidity is also evident at the Nose of Howth and extending into the northern Dublin Bay area.

On the 18th and the 20th September 2019 turbidity is higher in the outer Bay waters and at the mouth of the Bay east of the Burford Bank. Eddies are obvious, particularly north of Dalkey Island. Turbidity measurement does not distinguish inert sediment from planktonic algal blooms, and some of the turbidity observed could be algal biomass after the extended period of clear sunny weather in September. The Tolka Estuary and south lagoon at Bull Island are also seen as sources of turbidity in the image of the 20th September 2019.

None of the observed turbidity events are associated with dredging operations. They clearly show the dynamic nature of Dublin Bay and the multiple sources of turbidity that may contribute to turbidity measurements at the licenced dump site located at the approaches to Dublin Bay. Recurring patterns of turbidity are obvious in response to point sources of turbidity and the configuration of circulation within the bay.


26/08/2019
Turbidity (NTU)
High 30
Low 0.6
TECHWORKS MARINE
10/09/2019
Turbidity (NTU)
High 30
Low 0.6
TECHWORKS MARINE

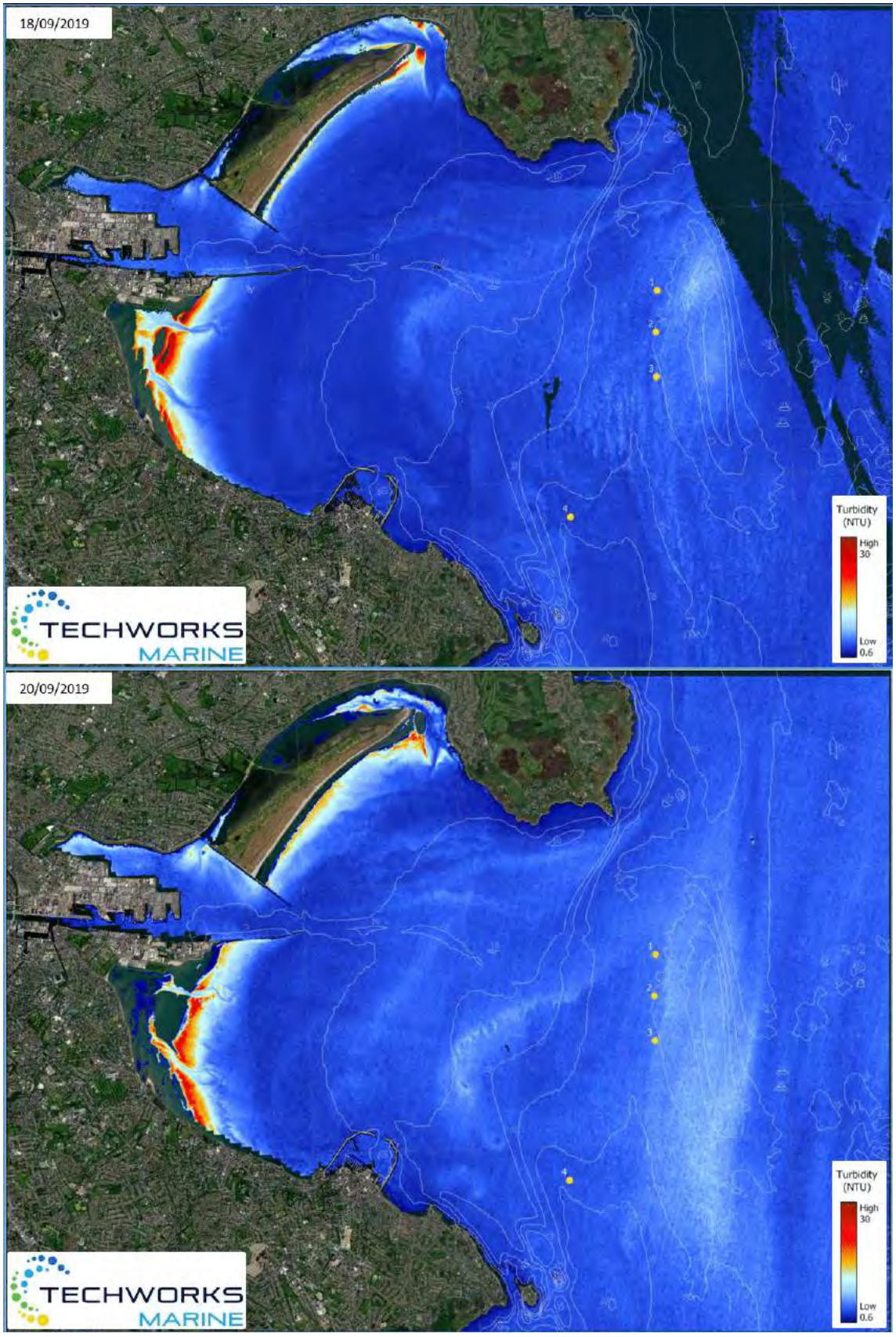


Figure 9-27 EO image of Dublin Bay on four days during August and September 2019

9.2.6 Water Quality Summary

A review of available WFD monitoring information for the water bodies in the immediate vicinity of the proposed capital dredging activity has concluded:

- The Overall WFD Water Quality between 2013-2018 for the Liffey Estuary Lower, Tolka Estuary and Dublin Bay is Good, Moderate and Good respectively;
- The WFD bathing areas within Dublin Bay are located outside Dublin Port. They are Dollymount Strand, Sandymount Strand, Merrion Strand and Seapoint. Most recently (2020), Seapoint and Dollymount have been classified as Excellent; Sandymount was classified as Sufficient and Merrion Strands was classified as Poor. As Merrion Strand was classified as Poor for the last five years (2015-2019), it was declassified as a designated bathing water in 2020.There are also three Non-designated bathing areas within Dublin Harbour that are monitored by Dublin City Council. They are: Shelly Banks, Half Moon and North Bull Wall. Based on the latest published results on the DCC website, the North Bull Wall Causeway on the River Liffey, was classified as being “poor” quality at the beginning of 2020 but has since improved and has generally been classified as being “excellent” quality status between March and September 2020. Similarly, the Half Moon and Shelley Banks bathing areas had varied classifications of poor - good at the beginning of 2020 but has since improved and was classified as “excellent” status between March and September 2020.
- High frequency water quality monitoring as part of the ABR Project at various locations in the port has shown that water quality has been satisfactory during the monitoring period between January 2018 and March 2021.
  - In general, salinity remained relatively high at all sites, between 24.5 and 35.4 PSU. However, on some occasions significant freshwater influences are obvious, such as at East Link during major storm events when riverine freshwater inputs increase.
  - Temperature shows the expected seasonal trend. The temperature at the Poolbeg site is slightly higher compared to the other three sites, the higher temperatures here probably reflecting the influence of the nearby cooling water stream.
  - Dissolved oxygen levels generally range between 7.9 and 9.1 mg/l. The mean dissolved oxygen values clearly indicate that oxygen levels are consistently close to saturation levels and no extended periods of oxygen sag or impacts of any dredging activities are obvious.
  - Turbidity is very variable, particularly at Poolbeg where very high spikes of turbidity are sometimes measured. However, 95% of turbidity measurements are <9.0 NTU at the East Link Monitoring Station and <23.0 NTU at Poolbeg, North Bank and Tolka Estuary. Many of the higher turbidity readings recorded are transient and local and do not represent events of any environmental significance or diagnostic value in assessing potential impacts. As noted, turbidity can be volatile at the Poolbeg Jetty Monitoring Station. This appears to be mainly due to site characteristics and tidal effects particularly during low spring tides. In addition, turbidity at all sites may be elevated during storm conditions. Investigations during elevated turbidity events have confirmed that ABR Project activities are not the cause of these events. Comparisons of mean turbidity during periods of 'dredging' and 'no dredging' activity showed that here is little difference between absolute values and no apparent pattern i.e. no

consistent increase in mean turbidity during dredging episodes as reflected in the plots presented in Figures 9-10 to 9-13. Measured turbidity results demonstrate that dredging campaigns in 2018 and 2020 did not cause any discernible increase in turbidity within the Inner Liffey channel.

  - Between February 2020 and December 2020, dredging was exclusively confined to the area inside the breakwater walls, i.e. Dublin Harbour and Inner Channel. The sediments in the inner harbour are dominated by silts, by contrast Sediments in the outer channel are predominantly fine sands. Mean daily turbidity data for each monitoring site within remained relatively low throughout the monitoring period with average turbidity <10NTU at all sites

- Monitoring in Dublin Bay between January 2018 and March 2021 has confirmed that water clarity as measured by turbidity levels has been good. Average turbidity is less than 16 NTU for all sensors, and 90% of data was less than 22 NTU. Water clarity has been similar at background and dump site monitoring locations. Data collected during dredging campaigns provides evidence that the loading and disposal of dredge material at the Dublin Bay Spoil Ground had no measurable effect on water clarity at the dump site. Water clarity is strongly influenced by tidal and storm events. Peaks in turbidity may be observed outside of dredging and dumping intervals, and also at the control sites.
- Extensive turbidity data collected as part of a sediment plume monitoring programme was recorded during several dumping events. Analysis of the data has provided evidence that the dumping of the sediment at the licenced dump site had no measurable significant effect on turbidity levels outside the dump site.
- Earth observation data is a powerful adjunct to buoy based monitoring. The large-scale simultaneous views of the bay show elevated turbidity in response to multiple sources and recurring patterns or plumes. Such data confirms the dynamic nature of turbidity in the bay under natural conditions in the absence of any dredging operations. It confirms the pivotal role of currents and circulation patterns in the bay in determining turbidity at specific locations.

9.3 Likelihood of Impacts

The likelihood of environmental impacts arising due to the Dublin Harbour Capital Dredging Project loading and disposal at sea activities is assessed in relation to the dredging and disposal operations. The potential impacts on water quality have been identified for assessment.

The significance of any environmental effect is rated based on the magnitude of the impact and the importance of the attribute as detailed in Section 9.1. Based on the criteria detailed in NRA Guidelines the Dublin Bay coastal water body, the Liffey Estuary Lower and Tolka Estuary water bodies are considered to be of "extremely high" importance due to its designation under the Urban Waste Water Treatment Directive (91/271/EEC) and proximity to the South Dublin Bay and Tolka Estuary SPA designated under EU Birds Directive (79/409/EEC). The Liffey Estuary Upper is considered to be of "very high" importance due to its quality and value on a regional scale.

The Dublin Harbour Capital Dredging Project has the potential to directly impact upon the ‘Liffey Estuary Lower’ transitional water body (EA_090_0300) and ‘Dublin Bay’ coastal water body (EA_090_0000) given the location of the dredging loading and disposal operations. The potential to indirectly impact upon the adjacent 'Tolka

Estuary' (EA_090_0200) 'and Liffey Estuary Upper' river water body (EA_090_0400), transitional water bodies has also been considered.

9.3.1 Potential Impacts

For the purposes of this assessment the main impacts to water quality is mobilised suspended sediment caused by capital dredging operations within the loading area and the disposal of spoil at the offshore disposal site. Increases in suspended sediments and turbidity levels from dredging and disposal operations may under certain conditions have adverse effects on water quality, water dependant habitats and aquatic ecology through physical disturbance and also through reduced light penetration into the water column leading to the potential reduction in photosynthesis activity and a decrease in dissolved oxygen (DO) levels. Such impacts can prevent the achievement of WFD objectives and could result in the deterioration of status in extreme circumstances

For capital dredging and disposal operations, the extent of these environmental affects is near-field and temporary generally only lasting as long as dredging operations are taking place.

9.4 Description of Likely Significant Impacts

9.4.1 Capital Dredging & Disposal Operations

Dredging operations will cause temporary suspension and release of sediments at the loading sites. Spoil disposal operations will also give rise to temporary sediment plumes at the licenced dump site at the approaches to Dublin Bay. Dredging loading operations have been designed to minimise the disturbance and escape of material at the seabed and during removal through the water column. Proposed individual loading operations are of relatively short duration and intermittent in nature. It is envisaged that disposal operations occur at the licenced dump site which is naturally dispersive for fine sediments. Nevertheless, significant amounts of dredge material will be removed and deposited at the dump site over a relatively extended period.

The magnitude of the potential impact from suspended sediment due to dredging and disposal is considered to have a *minor adverse* risk to water quality. The localised significance of the environmental effect is therefore *significant adverse* in the absence of mitigation based on the *extremely high sensitivity* of the receiving environment.

9.5 Mitigation Measures

In absence of mitigation, the capital dredging and disposal works have the potential to have Significant Adverse impacts on the aquatic environment.

With these considerations in mind, detailed mitigation has been incorporated into the design of the proposed capital dredging campaigns to minimise its potential impact on the water environment. This section details the mitigation measures that will be employed on site during each capital dredging campaign.

9.5.1 Capital Dredging & Disposal Operations

Suspended sediment, including cobbles, gravels, sands, silts and mud is the single main pollutant to the aquatic environment generated by the proposed capital dredging campaigns. In this instance, the primary source of

suspended sediments will arise during the loading and dumping operations. The adoption of appropriate sediment controls during capital dredging is essential to prevent increased suspended sediment concentrations.

Dublin Port Company has recently completed the fourth and final winter capital dredging campaign (October 2020 – March 2021) as part of the ABR Project. The four winter dredging campaigns have been fully compliant with the requirements of all the development consents, as confirmed by high resolution environmental monitoring results reported in the Annual Environmental Reports (AERs) 2017, 2018, 2019 and 2020 submitted to the EPA. The monitoring included year-round real-time measurement of water quality parameters within the inner Liffey channel and Dublin Bay at eight monitoring stations and at various water depths. This was supplemented by sediment plume and hydrographic monitoring that validated Plume Dispersal Modelling.

A Dredging Management Plan was developed for the ABR Project and is set out in Alexandra Basin Redevelopment Project Construction Environmental Management Plan (CEMP) Rev. F August 2018. The mitigation proposed for dredging operations in the Dublin Harbour Capital Dredging Project has been informed by the ABR Project monitoring and experience working in the same locations. The following key relevant mitigation measures will apply to each dredging campaign:

- The capital dredging activity will be carried out during the winter months (October – March) to negate any potential impact on salmonid migration (particularly smolts) and summer bird feeding, notably terns, in the vicinity of the dredging operations.
- No over-spilling from the dredger will be permitted while the dredging activity is being carried out within the inner Liffey channel (Dublin Harbour).
- The dredger's hopper will be filled to a maximum of 4,100 cubic metres (including entrained water) to control the volume of sediment released at the dumping site.
- Full time monitoring of Marine Mammals within 500m of loading and dumping operations will be undertaken in accordance with the measures contained in the Guidance to Manage the Risk to Marine Mammals from Man-Made Sound Sources in Irish Waters (NPWS 2014).
- A documented Accident Prevention Procedure will be put in place prior to commencement
- A documented Emergency Response Procedure will be put in place prior to commencement
- A full record of loading and dumping tracks and record of the material being dumped will be maintained for each trip.
- Dumping will be carried out through the vessel's hull.
- The dredger will work on one half of the channel at a time within the inner Liffey channel to prevent the formation of a silt curtain across the River Liffey.

In circumstances where the above mitigation measures are employed during the Dublin Harbour Capital Dredging Project, the potential impact to receiving water environment will be *negligible* thus reducing the significance of environmental effect to *Imperceptible*.

9.5.2 Water Quality Monitoring

In addition to the mitigation measures listed above, DPC are committed to maintaining the water quality monitoring system that has been designed to ensure robust protection of the marine environment and for users of the inner Liffey channel during the Dublin Harbour Capital Dredging Project.

- It is proposed to maintain the four river water quality monitoring stations already in position for the ABR Project
- The specification is based on state of the art 24/7 real time monitoring with water quality monitoring sensors giving high resolution data with respect to the following parameters
  - Turbidity
  - Dissolved Oxygen
  - Temperature
  - Salinity
- Water level is also measured at one monitoring station to provide information on tidal state. Turbidity is measured as a surrogate for suspended solids. Site specific tests have previously been undertaken by the ABR Project to define the relationship between Turbidity and suspended solids,
- A data acquisition and transfer system is being used to enable the transmission of high resolution data at approximately 15 minute intervals.
- The following trigger levels that will prompt investigation are proposed:
  - Dissolved Oxygen level falling below 6 mg/l.
  - Peak Suspended Solids level rising more than 100mg/l above background (Based on the Turbidity v Suspended Solids relationship previously established this is equivalent to an Turbidity increase of 40 NTU above background)
- The Dissolved Oxygen trigger level has been selected to safeguard fish-life.
- The monitoring network infrastructure has been in place since 2016 and will continue for the duration of the construction phase of the MP2 Project and during the Dublin Harbour Capital Dredging Project.
- This monitoring system has already generated a robust water quality baseline within the inner Liffey channel with the ability to identify water quality trends. The continuation of the monitoring system will serve to further strengthen the knowledge of water quality trends, a key indicator of the health of the marine environment.
- The water quality data currently being collected is circulated to Dublin City Council on a monthly basis. It is proposed that this transfer of information continues for the duration of the Dublin Harbour Capital Dredging Project
- The data collected is also being shared with research organisations (Dublin City University, Maynooth University and University College Cork).

9.5.3 Dublin Port Company Environmental Management System

The operational phase of the Dublin Harbour Capital Dredging Project will be subject to Dublin Port's existing Environmental Management System (EMS) which is accredited to ISO 14001 standard and the Port Environmental Review System (PERS) which has gained Dublin Port designation as an 'Ecoport' at European level. The EMS is supported by a comprehensive suite of Standard Operating Procedures (SOP) providing mitigation of all environmental aspects identified and mechanisms to ensure effective implementation.

SOPs have been prepared for oil and chemical spill responses, mineral oil handling, waste handling, monitoring and maintenance of surface water interceptors and handling of drain cleaning waste. Controls are in place for transport, handling and storage of hazardous materials, ship cargo, dry bulk material, surface water runoff, fuelling and bunkering of vessels and ship discharges. Site audits promote best practice and ensure compliance with the EMS requirements.

9.6 Residual Impacts

Thus, in circumstances where the appropriate mitigation measures are fully implemented during the Dublin Harbour Capital Dredging Project as outlined above, the impact of on the water quality in the area will be imperceptible.

Accordingly, the Dublin Harbour Capital Dredging Project will not have a significant effect on the water quality of the receiving waters. It can therefore be concluded that the capital dredging project is compliant with the requirements and environmental objectives of the EU Water Framework Directive and the other relevant water quality objectives for these water bodies.

9.7 Potential Cumulative Impacts

Potential cumulative impacts may arise from the Dublin Harbour Capital Dredging Project when combined with other existing and/or approved projects. In accordance with the European Commission (2017) and EPA Draft Guidelines (2017), existing and/or approved projects with the potential for cumulative impacts have been identified. Cumulative impact assessments have been undertaken in this section for relevant pressures that could potentially give rise to cumulative impact. Each development with the potential to impact on the water environment has been considered through a review of the environmental supporting information for the existing or approved developments.

9.7.1 Dublin Port Company ABR Project

The Alexandra Basin Redevelopment (ABR) Project is the first major infrastructure project to be brought forward for planning and other consents from the Dublin Port Masterplan 2012 to 2040, reviewed 2018. An Bord Pleanála granted permission for the ABR Project on 8th July 2015 (29N.PA0034).

The ABR Project comprises a number of engineering works set out in DPC's Masterplan document, mainly:

Works at Alexandra Basin West including construction of new quays and jetties, remediation of contamination on the bed of the basin, capital dredging to deepen the basin and to achieve the specified depths of -10m Chart Datum (CD) at the new berths.

Infilling of the Basin at Berths 52 & 53 and construction of a new river berth with a double tiered Ro-Ro ramp.

Deepening of the fairway and approach to Dublin Port to increase the ruling depth from -7.8m CD to -10.0m CD.

The most relevant element of the ABR Project in considering potential cumulative impacts on water quality is the capital dredging operations required to deepen the fairway and approaches to Dublin Port. The dredging elements of the ABR project were completed in March 2021, therefore no cumulative effects are expected.

9.7.2 Dublin Port Company MP2 Project

The MP2 Project complements the ABR Project in providing capacity for growth in the Ro-Ro and Lo-Lo modes on the north side of the port and at its eastern end in addition to providing suitable infrastructure for increasing numbers of ferry passengers. The MP2 Project obtained planning permission in July 2020 and applications have been made for Foreshore and Dumping at Sea consent.

The works proposed as part of the MP2 Project are summarised as follows:

Construction of a new Ro-Ro jetty (Berth 53) for ferries up to 240m in length on an alignment north of the Port's fairway and south and parallel to the boundary of the South Dublin Bay & River Tolka SPA (004024).

A reorientation of the already consented Berth 52 (ABP Ref. 29N.PA0034). Berth 52 is also designed to accommodate ferries up to 240m in length. The works will also comprise an amendment to the consented open dolphin structure (ABP Ref. 29N.PA0034) to create a closed berthing face at the eastern end of Berth 49.

A lengthening of an existing river berth (50A) to provide the Container Freight Terminal with additional capacity to handle larger container ships. These works will include the infilling of the basin east of the now virtually redundant Oil Berth 4 on the Eastern Oil Jetty. These works will also include dredging to a standard depth of -11.0m CD which is a proposed amendment to the channel dredging as permitted under the ABR Project (ABP Ref. 29N.PA0034).

As part of the infilling of Oil Berth 4, it is proposed to redevelop Oil Berth 3 as a future deep-water container berth (standard depth of -13.0m CD) for the Container Freight Terminal. This will facilitate the change of use of the berth from petroleum importation to container handling when the throughput of petroleum products through Dublin Port declines as a result of national policies to decarbonise the economy.

The dredging of a berthing pocket to a standard depth of -13.0m CD at Oil Berth 3 will require stabilisation of the existing quay wall at Jetty Road. It is not proposed to use this quay wall for the berthing of vessels.

Dredging at the proposed Berth 53 and channel widening to a standard depth of -10.0m CD which is a proposed amendment to the channel dredging as permitted under the ABR Project (ABP Ref. 29N.PA0034).

Consolidation of passenger terminal buildings, demolition of redundant structures and buildings, and removal of connecting roads to increase the area of land for the transit storage of Ro-Ro freight units as a Unified Ferry Terminal (UFT). Works include reorganisation of access roads; two proposed check in areas comprising a total of 14 check lanes; proposed set down and parking area for the existing Terminal 1 building; proposed pedestrian underpass to access the existing Terminal 1 building; three proposed toilet blocks and a proposed ESB Substation. These works will comprise amendments to consented developments with planning reference numbers 3084/16 & 3638/18, and the ABR Project (ABP Ref. 29N.PA0034).

A heritage zone adjacent to Berth 53 and the Unified Ferry Terminal set down area. This will comprise an alteration to consented development planning reference 3084/16.

The most relevant element of the MP2 Project in considering potential cumulative impacts on water quality is the capital dredging operations required to deepen berthing pockets and localised widening of the navigation channel. The capital dredging operations to be undertaken as part of the MP2 Project will occur in the same water body (Liffey Estuary Lower) and the disposal of dredge spoil will use the same licenced dump site at the approaches to Dublin Bay.

Potential cumulative impacts associated with water quality from the loading areas are considered low. Overlap between the capital dredging project and MP2 Project is limited to the dredging of areas immediately adjacent to Berth 52, with dredging of the seabed to -10.0m CD. Although dredging from the capital dredging project will be undertaken during the same time period as the MP2 Project, dredging would be carried out sequentially, with no overlap occurring between the dredge works of both projects. The sequential nature of the dredging activities minimises the potential for impacts on water quality within and immediately adjacent to the footprint of the proposed works.

While there is a degree of overlap between the capital dredging project and MP2 Projects, with both projects expected to use the disposal area between October and March each season, the volumes for disposal are comparatively low. The combined total of sediment to be disposed from both the MP2 Project and Dublin Harbour Capital Dredging Project over the full period of both projects is 942,000m^3 of sands and muds. It is expected that the combined maximum to be disposed of per dredging season will be 300,000m^3. Once mitigation measures are undertaken for the disposal of sediment at sea, then the cumulative impacts associated with the disposal of these volumes of sediment at the Burford Bank dump site is expected to be low.

9.7.3 Dublin Port Company – Dublin Port Maintenance Dredging 2022-2029

Dublin Port Company (DPC) need to carry out regular maintenance dredging of the navigation channel, basins and berthing pockets in order to maintain their advertised charted depths and hence provide safe navigation for vessels to and from the Port. The loading of dredged material will be restricted to those areas of the navigation channel, basins and berthing pockets which contain sediments which are suitable for disposal at sea (Class 1 : uncontaminated, no biological effects likely). It is proposed to dispose of the dredged sediments at the existing licensed offshore disposal site located at the entrance to Dublin Bay to the west of the Burford Bank, (6.75 km from the lighthouse at the end of the Great South Wall). The approximate amount of material to be dredged is 300,000 cubic metres per annum and it consists mostly of silt and sand with elements of clay, gravel and cobbles. Dredging will be carried out by a trailer suction hopper dredger and support vessels. It is proposed to undertake the maintenance dredging and disposal at sea operations within the period April to September each year between 2022 and 2029. The dredging campaign within each of these periods is expected to last approximately 4-6 weeks, depending on weather conditions.

In terms of impact assessment, dredging undertaken as part of the Dublin Port Maintenance Dredging 2022-2029 (Application Ref: FS007132) will occur within the same water body (Liffey Estuary Lower) and the dumping of dredge spoil will use the same licenced dump site at the approaches to Dublin Bay. The proposed Dublin Port Maintenance Dredging Programme (2022-2029) will be undertaken during the summer months (April to September). DPC intend to undertake the capital dredging required for the Dublin Harbour Capital Dredging

Project during the winter months (October to March). This temporal separation will mitigate cumulative effects on water quality.

9.8 Conclusions

Baseline water quality within the receiving environment was established through review of national monitoring data used to establish water quality status in the context of the EU Water Framework Directive (WFD) and supporting environmental standards. Recent high-frequency monitoring data collected during Dublin Port Company's ABR Project was also reviewed.

Using this robust baseline water quality database, an assessment of the Dublin Harbour Capital Dredging Project loading and dumping activities was conducted to determine the likelihood of significant impacts on water quality using the criteria for rating significance and magnitude as set out in the National Roads Authority (NRA) publication “Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes” (NRA, 2008) and appropriate mitigation measures to reduce impacts were proposed, where necessary.

In circumstances where the appropriate mitigations measures are fully implemented during the Dublin Harbour Capital Dredging Project, the impact on water quality will be imperceptible. The loading and dumping activities are therefore not expected to have a significant effect on the water quality of the receiving waters.

It can therefore be concluded that the Dublin Harbour Capital Dredging Project is compliant with the requirements and environmental objectives of the EU Water Framework Directive and the other relevant water quality standards.

10 AIR QUALITY & CLIMATE CHANGE

This chapter of the EIAR assesses the potential impacts to air quality and climate arising from or associated with the Dublin Harbour Capital Dredging Project. This chapter should be read in conjunction with the site layout plans and project description (Chapter 3).

Potential effects to air quality and climate may arise during the proposed dredging mainly through the proposed dredging operations and all activities have been examined to identify those that have the potential for significant impacts to atmosphere. Each of these potential sources have been evaluated using standard procedures and the measures to reduce, avoid and prevent these likely significant effects are proposed, where they are necessary. Thereafter, the likely significant residual effects of the project on air quality and climate are predicted.

This chapter has been prepared in accordance with the following guidance documents:

- Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment;
- The European Commission Environmental Impact Assessment of Projects Guidance on the preparation of the Environmental Impact Assessment Report (2017);
- The European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. No. 296 of 2018);
- The EPA Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR) (2017); and
- The DHPLG published the revised Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (August 2018).
- Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes (Rev. 1), NRA, (2011).

10.1 Assessment Methodology

10.1.1 Baseline Air Quality

The current state of the environment in terms of baseline air quality has been determined from the data from the EPA monitoring Zone A (Dublin) network to determine compliance with relevant ambient air legislation.

In terms of regional baseline air quality, the EPA data reported for compliance with the Convention on Long Range Transboundary Air Pollution (CLRTAP), and the National Emissions Ceiling Directive (NEC) is referenced.

In addition to the EPA monitoring, DPC carry out a series of ambient air quality monitoring tests within the environs of the port. The monitoring was undertaken in the period 2014 - 2019 at a series of 18 locations (as shown in Figure 10-1) in the environs of the port. This monitoring is employed in this assessment to demonstrate the spatial variation in the Port and in the wider Dublin area in conjunction with the data from the EPA network.

The likely evolution of this baseline in future years without the proposed development (i.e. the “Do-Nothing” scenario is also presented.



Figure 10-1 DPC Air Monitoring Locations

10.1.2 Baseline Climate

Existing climatic data for the study area has been derived from the Met Éireann historical database (https://www.met.ie/climate-ireland/1981-2010/dublin.html). The nearest meteorological station to the port is the Met Éireann Station in Dublin Airport which lies approximately 9km to the north. The 30-year averages from the station at Dublin Airport from 1981 to 2010 are employed to determine the existing baseline.

The description of the evolving baseline climate on a national level is derived from the EPA Report ‘A Summary of the State of Knowledge on Climate Change Impacts for Ireland’ (2017) and the ‘Ensemble of regional climate model projections for Ireland’, (EPA 2015).

The existing carbon foot-printing of Dublin Port is derived from the annual Sustainability Report prepared by DPC on its operations. DPC publishes an annual Sustainability Report to track and record progress on the ports environmental responsibilities. As part of the 2015 Sustainability Report, DPC commenced a carbon footprint inventory of all port emission sources. This is to generate awareness in the maritime community for the need for action regarding greenhouse gas emissions and to make available information on the effects on climate change. This information allows DPC to establish initiatives and set ambitious targets to reduce emissions. The

latest published report is the Sustainability Report 2017 and this is employed to present the current baseline GHG emissions from the port.

The likely evolution of this baseline in future years without the proposed development (i.e. the "Do-Nothing" scenario is also presented.

10.1.3 Construction Phase Impacts

The following are the potential impacts to air quality and climate associated with the construction phase of the proposed development:

- Emissions to atmosphere from marine vessels such as the dredger and associated vessels;
- Potential for dust impacts during dredging and material handling; and
- Potential for release of fugitive odours during dredging.

The following have been scoped out of further assessment in this EIAR given the absence of potential for significant adverse impact:

- All dredging and materials handling will be undertaken within the vessels with a limited requirement for any road traffic. Road traffic will be restricted to occasional service vehicles to the site compound for bunkering and removal of skips and private car use will be limited to circa 10 dredging contractor staff. As such, there will be no perceptible traffic impact on the national road network and hence the potential for impacts from emissions to atmosphere from road transport are considered negligible and scoped out of further assessment in this EIAR.
- Climate resilience and adaption are key considerations for new infrastructure development. However, given the temporary nature of the proposed dredging, there is no potential for significant adverse impact for climate adaption and this has been scoped out of further assessment.

The methodologies employed for each of the scoped in impacts are presented in the following sections.

10.1.3.1 Vessel Emissions

The total dredge volume is estimated to be 500,000m^3 (including contingency) with this material to be extracted in the months of October to March each year for an eight year timeframe. The capital dredging works will be carried out on a 24 hours basis using a trailing suction hopper dredger (TSHD) and/or a backhoe dredger.

Vessel emissions associated with the proposed dredging have been quantified using the emission factors presented in the EMEP/EEA Emission Inventory Guidebook 2019, Section 1.A.3.d.i Navigation (shipping). The impact of these emissions on residential property in the area is assessed via a simple air dispersion model using the US EPA approved AERMOD Prime model (Version 19191).

10.1.3.2 Construction Dust

Construction dust has the potential to cause local impacts through dust nuisance at the nearest sensitive receptors and also to sensitive ecosystems. Construction activities such as dredging may generate quantities of dust, particularly in dry weather conditions. The extent of any dust generation depends on the nature and moisture content of the dust (soils, peat, sands, gravels, silts etc.) and the nature of the activity. In addition, the

potential for dust dispersion and deposition depends on local meteorological factors such as rainfall, wind speed and wind direction.

The potential for dust emissions from the construction phase of the project, specifically dredging is addressed qualitatively in accordance with the NRA/TII Guidelines for the *Treatment of Air Quality during the Planning and Construction of National Road Schemes* (Rev. 1) (NRA 2011; referred to hereafter as the TII Guidelines).

10.1.3.3 Fugitive Odours

The main potential odour from the construction stage relates to the potential for fugitive odours from the dredging operation, particularly hydrogen sulphide, which can be particularly offensive.

- DPC undertook maintenance dredging campaigns within the port's navigation channel and berthing pockets in 2012, 2016, 2017, 2018 and 2020. Hydrogen sulphide was not encountered in the port during any of these dredging campaigns.
- During the 2003 dredging of Berths 32 and 33 within Alexandra Basin West, a long reach excavator on a pontoon was used and the dredge material was brought onto the quay wall and processed for shipment to Germany. Again, hydrogen sulphide was not encountered.

Despite the low risk of encountering odours, a series of odour mitigation measures have been presented to minimise the impact of this operation and to prevent any nuisance in the unlikely event that they are encountered.

10.1.4 Operation Stage Impacts

There are no significant changes to the existing operations, processes and activities at the port proposed by the proposed development and hence there are no predicted significant adverse impacts to air quality and climate from this phase.

Maintenance dredging will be at a lower intensity and duration to the capital dredging and hence the impact presented from this capital dredging will also cover the proposed maintenance dredging.

10.1.5 Assessment Criteria

10.1.5.1 Combustion Gases/Particulates (such as from dredging plant)

Combustion material is considered the principal risk of pollution to the atmosphere. In May 2008, all previous European Directives on air quality were replaced with a revised Directive on ambient air quality and cleaner air for Europe (2008/50/EC) which has been transposed into Irish legislation as the Air Quality Standards Regulations 2011 (S.I. 180 of 2011), as amended. These limits as specified in these Regulations are presented in Table 10-1 and represent the main assessment criteria for the operation phase of the Capital Dredging Project.

The 2011 Regulations specify limit values in ambient air for sulphur dioxide (SO_2), lead, benzene, particulate matter (PM_{10} and $PM_{2.5}$), carbon monoxide (CO), nitrogen dioxide (NO_2) and oxides of nitrogen (NO_x). These limits are mainly for the protection of human health and are largely based on review of epidemiological studies on the health impacts of these pollutants. In addition, there are limits that apply to the protection of the wider

environment (ecosystems and vegetation). All predicted concentrations from the proposed dredging are compared to the air quality limits to determine the extent of any impact on receptors.

Table 10-1 Limits as Specified in Air Quality Standards Regulations 2011 (S.I. 180 of 2011)

Pollutant	Criteria	Value
Nitrogen Dioxide	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	200 µg/m^3 NO_2
	Annual limit for protection of human health	40 µg/m^3 NO_2
	Annual limit for protection of vegetation	30 µg/m^3 NO + NO_2
Benzene	Annual limit for protection of human health	5 µg/m^3
Carbon Monoxide	Maximum daily 8-hour running mean	10 mg/m^3
Lead	Annual limit for protection of human health	0.5 µg/m^3
Sulphur Dioxide	Hourly limit for protection of human health - not to be exceeded more than 24 times/year	350 µg/m^3
	Daily limit for protection of human health - not to be exceeded more than 3 times/year	125 µg/m^3
	Annual limit for protection of vegetation	20 µg/m^3
Particulate Matter PM_{10}	24-hour limit for protection of human health - not to be exceeded more than 35 times/year	50 µg/m^3 PM_{10}
	Annual limit for protection of human health	40 µg/m^3 PM_{10}
Particulate Matter $PM_{2.5}$	Annual target value for the protection of human health	20 µg/m^3 $PM_{2.5}$

In addition to the statutory limits for the protection of human health listed in Air Quality Standards Regulations (S.I. 180 of 2011), the World Health Organisation (WHO) has published a set of air quality guidelines for the protection of human health. The key publication is the "*WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulphur dioxide, Global update 2005 Summary of risk assessment*". The WHO guidelines are based on reducing the risk to human health and in some cases the levels differ from the EU statutory limits as these limits are based on balancing health risks with technological feasibility, economic considerations and various other political and social factors in the EU.

The 2005 WHO guidelines are presented in Table 10-2 and illustrate that while the NO_2 levels are analogous to those in S.I. 180 of 2011 (excluding the tolerance levels for the 1-hour averages), the annual average PM_{10} and $PM_{2.5}$ levels specified by the WHO are half those specified in the legislation. The WHO note that these are the lowest levels at which total, cardiopulmonary and lung cancer mortality have been shown to increase with more than 95% confidence in response to long-term exposure to $PM_{2.5}$. The EPA has called for movement towards the adoption of these stricter WHO guidelines as the legal standards across Europe and in Ireland.

Table 10-2 WHO 2005 Air Quality Guidelines

Pollutant	Criteria	Value
Nitrogen Dioxide (NO_2)	Hourly level for protection of human health	200 μg/m^3 NO_2
	Annual level for protection of human health	40 μg/m^3 NO_2
Sulphur Dioxide (SO_2)	10 minute level for protection of human health	500 μg/m^3
	Daily level for protection of human health	20 μg/m^3
Particulate Matter (PM_{10})	24-hour level for protection of human health	50 μg/m^3 PM_{10}
	Annual level for protection of human health	20 μg/m^3 PM_{10}
Particulate Matter ($PM_{2.5}$)	24-hour level for protection of human health	25 μg/m^3 $PM_{2.5}$
	Annual level for protection of human health	10 μg/m^3 $PM_{2.5}$

10.1.5.2 Construction Dust

During the construction phase, dust from the extraction, placement and/or re-suspension of dredged material is considered a risk of pollution to the atmosphere. However, there is no legislative limit for total suspended particles, so the guidelines presented by the German Government TA Luft guidance are employed. Under this guidance, it is a requirement to maintain monthly dust levels below the guideline of 350mg/m^2/day as an annual average at sensitive receptors.

10.1.5.3 Odours

Like construction dusts there is no legislative limit for odours in Ireland and standard industry guidelines are typically applied. The Odour Impact Assessment Guidance for EPA Licensed Sites (AG5) is a procedure offers a consistent and systematic approach to the assessment of odours on and in the local area of facilities and installations licenced by the EPA. This sensory assessment is used to determine if an odour has potential to cause nuisance.

This will be supplemented with chemical testing as required. In this case, an odour marker compound such as hydrogen sulphide will be used to determine odour nuisance during the dredging works. Hydrogen sulphide (H_2S) is one of the key odour compounds that can cause odour nuisance impacts. H_2S is a colourless, flammable, extremely hazardous gas with a “rotten egg” odour. It occurs naturally in crude petroleum and natural gas. In addition, H_2S is produced by bacterial breakdown of organic materials and may be released during dredging works if there is organic material disturbed in the bed of the inner Liffey channel.

There are no statutory limits for the protection of human health for H_2S so guidelines are applied. Two thresholds are employed in this assessment – the threshold for odour nuisance and the threshold for health impacts as presented in Table 10-3 (source WHO “Air Quality Guidelines for Europe”, 2000).

Table 10-3 Health and Odour Guidelines H_2S

Parameter	Averaging Period	Guideline	Source
Health Effects	24 hours	150 μg/m^3	World Health Organisation
Odour Annoyance	30 minutes	7 μg/m^3	World Health Organisation

10.1.5.4 Climate

CO_2 emissions have a climate warming effect which is global. This is regardless of their rate of release, location or the weather when they are released into the atmosphere. This is unlike pollutants that affect local air quality where the rate of release, location and prevailing weather, as well as the amount of pollutant, determines the local concentrations and the impact. Local ambient concentrations of CO_2 are not relevant and there are no limits or thresholds that can be applied to particular sources of carbon emissions – any amount of CO_2 released into the atmosphere will contribute to climate warming, the extent of which is determined by the magnitude of the release. Although CO_2 emissions are typically expressed as kilogrammes or tonnes per year, there is a cumulative effect of these emissions because CO_2 emissions have a warming effect which lasts for 100 years or more. In relation to climate, there is no project specific assessment criteria, but the proposed dredging will be assessed against the targets set out in the Climate Action Plan 2019 and supporting policies.

10.1.6 Potential for Cumulative Impacts

There are a number of other projects within Dublin Port and the general Dublin area that have potential for cumulative and in-combination effects associated with the proposed Capital Dredging Project. These are described in Chapter 3 of this EIAR and include the following elements of the Dublin Port Masterplan 2040:

- The DPC Alexandra Basin Redevelopment (PL29N.PA0034) including the dredging of: 470,000m^2 of contaminated material to a depth of -10.0m Chart Datum (CD) over an area of 194,000m^2 within the redeveloped Alexandra Basin West and its remediation.
- The DPC MP2 Project (ABP-304888-19) including the dredging of berthing pockets Berth 53, Berth 50A, Oil Berth 3 and localised channel widening.
- The DPC Eight Year Maintenance Dredging Programme 2022-2029 including the maintenance dredging of the navigation channel, basins and berthing pockets in order to maintain their advertised charted depths and hence provide safe navigation for vessels to and from the Port.

The consideration of cumulative impact of the proposed development on top of the wider Masterplan developments within the port are addressed within this chapter.

10.2 Existing Environment

10.2.1 Receiving Environment

The site of the proposed development comprises seven distinct dredging zones within Dublin Harbour (excluding the area of the licenced offshore disposal site). There are sensitive receptors (houses, commercial operations) located in the area and these receptors vary in distance from the proposed development. There is a potential that receptors may experience a change in air quality and the extent of these changes in air quality is identified in this assessment. The nearest sensitive residential receptors to the proposed development are the residential dwellings on Pigeon House Road and Coastguard Cottages to the south of the channel.

Ecological receptors can be affected by deposition of air pollutants such as nitrogen oxides and sulphur dioxide. The nearest sensitive ecological sites to the proposed development are the South Dublin Bay and River Tolka Estuary SPA (Site Code 004024) and the South Dublin Bay SAC (Site Code 000210).

10.2.2 Existing Sources in the Area

The main existing sources of pollution to air quality in the area around Dublin Port are from road traffic, rail traffic, shipping traffic, space heating, industrial emissions and fugitive emissions from fuel/gas storage.

The road network around Dublin Port is centred on the East Wall Road (R131) which connects the East Link Toll Bridge to the south with the Dublin Port Tunnel to the north and forms the western boundary of the port. This road is heavily trafficked, especially at peak times. In addition to this regional road there is a network of internal roads within Dublin Port Estate including the Alexandra Road, the Tolka Quay Road and the Promenade Road which mainly serve HGVs entering and leaving the port.

Irish Rail operates the rail line which runs along Alexandra Road with a number of spurs off this main line. Trains are diesel fired with some localised emissions.

Port operations including shipping emissions (both docked emissions and at sea emissions) and land operations (cranes, trucks, etc.) also give rise to combustion emissions. These emissions are dependent on the fuel employed, the size of the vessel and the duration of the operations.

There are four facilities located in Dublin Port that are licensed by the EPA:

- ESB North Wall Generating Station (IE Licence P0579-03). North Wall generating station has one operating generating unit, an open cycle gas turbine CT5, with a total maximum electricity generating capacity of 115 MW. CT5 is normally fired on natural gas supplied from the national gas network with distillate oil used as a secondary fuel. In 2017 the plant operated for 988 hours only. The plant discharges to atmosphere via one combustion stack (A1-2) and in 2017 the plant discharged a total of 53.707 tonnes of NO_x/NO_2.
- Indaver Waste Transfer Station (Waste Licence W0036-02) which accepts and exports hazardous waste from Ireland to Britain and other European countries for recovery, disposal or treatment. This facility also houses a solvent blending facility which allows for the specific blending of solvents to derive a fuel from this waste. There are no major emissions to atmosphere from this facility.
- Irish Tar & Bitumen Suppliers (IPC Licence P0086-01) who carry out the chemical manufacture of glues, bonding agents and adhesive. The plant has two main emissions to atmosphere each of which discharge NO_x, SO_x and CO.
- Dublin Waste to Energy Limited (IE Licence Register W0232-01) who hold a licence to burn up to 600,000 tonnes of non-hazardous waste and to recover energy in the form of steam and electricity for export to the national grid. There are two main emission points from this facility, one for each incinerator line that both discharge a series of gaseous and particulate combustion emissions through twin stacks at a height of 105 metres.

As the Dublin conurbation is subject to a ban on smoky coal under the Air Pollution Act, 1987 (Marketing, Sale and Distribution of Fuels) Regulations (1998-2011), the space heating in the area (both residential and commercial) will be based on gas, oil, biomass and non-bituminous coals. Consequently, the levels from space heating in the area are not elevated.

10.2.3 Baseline Air Quality

10.2.3.1 Policy

Ireland's National Clean Air Strategy is currently under development by the Department of Environment, Climate and Communications (DECC). The strategy will outline and develop the approach for the implementation and delivery of the targets as set out in the European Union (EU) Clean Air Package. The EU Clean Air Package contains policies and legislative proposals aimed at updating and modernising EU Clean Air Legislation, including; a new Clean Air Programme for Europe, a revised National Emissions Ceilings Directive (NEC Directive), and a new Directive aimed at reducing pollution from medium-sized combustion installations.

The National Clean Air Strategy will provide a strategic policy framework, that will identify and promote integrated measures for the reduction of air pollution and the promotion of cleaner air whilst informing policy and contributing to wider national objectives. The National Clean Air Strategy Consultation has taken place and the strategy is awaiting publication which is expected in 2021.

Ireland has seen improvements in air quality over past decades through the implementation of policy measures at EU and national levels, such as the Smoky Coal Ban in urban areas in the 1990's.

In relation to wider shipping emissions and air quality, MARPOL Annex VI sets out a progressive reduction globally in emissions of SOx, NOx and particulate matter and the introduction of emission control areas (ECAs) to reduce emissions of those air pollutants further in designated sea areas. While Dublin Port is not an ECA the main shipping destinations from Dublin Port (such as the North Sea, English Channel and North America are designated as ECAs and hence these emission standards apply to ships within Dublin Port. These measures are expected to have a significant beneficial impact on the atmospheric environment and on human health, particularly for those people living in port cities and coastal communities.

10.2.3.2 Regional Air Quality

The EPA monitor a number of key pollutants with emission ceilings (limits) for which Ireland has compliance commitments under the National Emissions Ceiling Directive (Directive (EU) 2016/2284). The national emissions data for the period 2014 to 2018 are presented in Table 10-4 along with the relevant limits for 2019, 2020-2029 and 2030.

Ireland is currently in compliance with all 2019 limits (by availing of the flexibilities allowed in National Emission Ceilings Directive) but the EPA data indicates that while NMVOC and PM data is projected to comply with future targets, additional measures, principally those relating to electrification in the transport sector, are required to bring NOx emissions into compliance with the 2030 ceiling.

Table 10-4 Emissions of relevant pollutants under the NEC

Pollutant	Nitrogen oxides (NO_x) (kilotonnes)	Non-methane volatile organic compounds (NMVOCs) (kilotonnes)	Particulate Matter ($PM_{2.5}$) (kilotonnes)
2014	59.292	49.438	13.419
2015	60.138	48.376	13.298
2016	60.720	47.231	12.663
2017	58.353	46.273	11.979
2018	56.832	47.254	12.043
2019 Ceiling	65	55	NA
2020-2029 Ceiling	66.836	56.335	15.606
2020 Ceiling	40.626	51.077	11.229

Note: NO_X and NMVOC figures are the adjusted emission estimates reported by the EPA[1]

10.2.3.3 Local Air Quality

Air quality legislation in Ireland deals with air quality by means of "zones" based on population. For Ireland, four zones are defined, and the main areas defined in each zone are:

- Zone A: Dublin Conurbation.
- Zone B: Cork Conurbation.
- Zone C: Other cities and large towns comprising Galway, Limerick, Waterford, Clonmel, Kilkenny, Sligo, Drogheda, Wexford, Athlone, Ennis, Bray, Naas, Carlow, Tralee, Dundalk, Navan, Letterkenny, Celbridge, Newbridge, Mullingar, Balbriggan, Greystones, Leixlip and Portlaoise.
- Zone D: Rural Ireland, i.e. the remainder of the State excluding Zones A, B and C.

The Capital Dredging Project is located in Dublin 1 in the jurisdiction of Dublin City Council therefore the site lies within EPA Air Quality Zone A (Dublin Conurbation). The EPA air quality monitoring network for Zone A has been reviewed and suitable representative data is presented to identify the background air quality in the area of the works. A summary of the EPA monitoring carried out in Zone A (Dublin Conurbation) is presented in the following sections. The EPA monitoring network in Dublin, includes the local authority networks, a number of city centre locations (e.g. Coleraine Street, Winetavern Street, etc.) as well as suburban stations (e.g. Rathmines, Blanchardstown, etc.). There are a wide number of stations in the Dublin area tested for various pollutants and there is variation each year regarding the locations and pollutants monitored at these locations. Presented in this section are the annual averages of all stations in Zone A. The averages are considered representative of the wider Dublin area and the site of the Capital Dredging Project.

The EPA released a stand-alone report *'Urban Environmental Indicators: Nitrogen dioxide levels in Dublin'* in July 2019 which presented the findings of a 10 month survey of diffusion tubes around the city in 2017. The report also includes details of dispersion modelling of NO_2 in Dublin which indicate that while the majority of the

[1] https://www.epa.ie/pubs/reports/air/airemissions/irelandsairpollutantemissions2018/EPA-Air-Pollutant-Emissions-website.pdf

city is well below the annual EU limit for NO_2, there are some areas which show modelled exceedances above this limit – including the M50 corridor and the exits to the Port tunnel.

Nitrogen Dioxide (NO_2)

Nitrogen Dioxide (NO_2) is classed as both a primary and a secondary pollutant. As a primary pollutant NO_2 is emitted from all combustion processes (such as a gas/oil fired boiler or a car engine). As a secondary pollutant NO_2 is derived from atmospheric reactions of pollutants that are themselves, derived mainly from traffic sources. The results of the EPA Dublin network monitoring for the period 2009 to 2019 are presented in Table 10-5. The average results indicate compliance with the limits for the protection of human health (Table 10-1) with the trend indicating a generally reducing ambient level over the fifteen-year period in Dublin. This compliance level is to some extent a result of Ireland's location in Western Europe where there is a strong prevailing westerly wind, high rainfall levels and low sunshine levels that allows for the rapid dispersion of pollutants and generally good air quality. In addition, at EU level there is legislation driven improvements to vehicles in terms of both engine performance and fuel specification (known as the Auto Oil Program) which has also helped in the reduction in pollutants over the past decade.

Table 10-5 Results of NO_2 monitoring carried out by the EPA in Zone A

Year	Annual Mean NO_2 ($\mu g/m^3$)	Annual No. of NO_2 Values Exceeding Hourly Limit for Protection of Human Health >200$\mu g/m^3$	Annual Mean NOx ($\mu g/m^3$)
2009	28	2	55
2010	26	0	46
2011	25	1	46
2012	23	1	42
2013	19	1	33
2014	19	6	33
2015	20	0	34
2016	24	1	43
2017	21	1	38
2018	27	0	50
2019	24	0	45
Limit	40 Annual Limit for Protection of Human Health	18 No of samples not to exceed the year)	30 (Annual limit for protection of vegetation)
WHO Guideline	40	-	-

In addition to the EPA monitoring, DPC carries out a series of ambient air quality monitoring tests within the environs of the port to monitor ongoing trends and issues related to the port operation. The results of the monitoring of nitrogen dioxide (NO_2) in the period 2014 to 2019 are presented in Table 10-6.

The table illustrates that there were a number of levels higher than the EU annual average limit value at a number of monitoring stations (noted in yellow) in all years monitored. With the exception of one of these (A14 at the R131), all others where elevated levels were detected were within the footprint of the Dublin Port operation

north of the Liffey and all are located in close proximity to the main port road network. The predominant source of this NO_2 in the port is road traffic and in particular the high volume of HGVs. The elevated levels at A14, which is close to the residential areas of York Road and Pigeon House Road, are likely to be related to road traffic on the R131 and East Link Toll Bridge. Road traffic at lower speeds in proximity to the toll barrier will generate higher emissions that traffic operating at more efficient speeds.

At the other four locations south of the Liffey (A15 to A18) the annual averages are more in line with the levels reported by the EPA in Dublin City Centre (Winetavern Street and Coleraine Street). These locations are more representative of background Dublin air as these are not directly adjacent to major roads within the port.

Table 10-6 Results of ambient NO_2 monitoring undertaken in Dublin Port

Ref.	Location	Average NO_2 ($\mu g/m^3$)				
		2014/2015	2016	2017	2018	2019
A1	Junction of Promenade Road and Bond Road	50.28	38.85	47.84	40.21	44.13
A2	Junction of Promenade Road and 1 Branch Road South	48.44	30.97	30.54	29.85	39.02
A3	North east perimeter of the Port	41.11	27.23	42.83	28.68	33.15
A4	Alexandra Road (Port entrance)	52.29	45.55	42.67	46.09	51.35
A5	Junction of Alexandra Road and 3 Branch Road South	52.95	38.24	38.26	42.06	42.78
A6	Junction of Alexandra Road and 2 Branch Road North	43.63	37.93	41.23	37.39	49.94
A7	Junction of Alexandra Road and Terminal Road North	55.38	32.99	47.45	35.60	43.64
A8	Alexandra Road Extension (eastern boundary of Port)	47.05	31.35	47.74	31.77	36.12
A9	Port lands adjacent to Tom Clarke Bridge	47.28	44.40	53.18	39.45	49.03
A10	Ocean Pier	45.17	36.03	41.22	31.07	32.24
A11	Breakwater Road South	44.11	37.20	40.96	35.66	41.55
A12	Adjacent to Berth 52	41.55	25.20	44.27	31.33	37.25
A13	Alexandra Road Extension (eastern boundary of Port)	48.72	30.30	43.63	31.43	43.41
A14	R131 (East Link Toll Booth)	48.26	36.85	44.08	41.41	44.16
A15	Southern shore of Estuary (adjacent to Hammond Lane)	35.12	29.05	27.66	29.73	29.56
A16	South Bank Road	30.65	25.58	30.70	28.49	29.39
A17	Coast road at Poolbeg Beach	30.16	20.17	28.02	19.79	22.60
A18	Coast road at Sean O'Casey Park	22.36	20.22	19.45	17.94	20.33
Annual Average Limit for the Protection of Human Health		**40**				
WHO Guideline		**40**				

Particulate Matter (PM_{10} and $PM_{2.5}$)

Particulate Matter (PM_{10} and $PM_{2.5}$) may be emitted as a primary pollutant from road vehicle exhausts, which is the main source in urban areas. In rural areas, sources will include traffic, agricultural activities and natural processes such as sea salt aerosol. Also point sources such as combustion, i.e. domestic fires, industrial boilers etc. are primary sources of PM_{10}. PM_{10} may also be formed as secondary pollutants from the condensation or reaction of chemical vapours in the atmosphere. Particulate Matter ($PM_{2.5}$) has similar effects on health as PM_{10}, however, $PM_{2.5}$ is a better indicator of anthropogenic (man-made) emissions. The results of the EPA network for the period 2009 to 2019 are presented in Table 10-7. As with NO_x, the PM_{10} and $PM_{2.5}$ data for Zone A shows compliance with the human health limits presented in Table 10-1. All sites in the Dublin area have been in full compliance with the human health limits for the past fifteen years and show a slight gradual decrease in annual emissions which is due to the legislation driven improvements in fuel and engine technology. It is also noted that since 2012 the aggregated Zone A data also shows no levels above the WHO guidelines for air quality (Table 10-2) which are significantly lower than the statutory limits.

Table 10-7 Results of PM_{10} and $PM_{2.5}$ monitoring carried out by the EPA in Zone A

Year	Annual Mean PM_{10} ($\mu g/m^3$)	Annual no. of PM_{10} Values Exceeding 24 Hour Limit for Protection of Human Health >50$\mu g/m^3$	Annual Mean PM2.5 ($\mu g/m^3$)
2009	16	3	10
2010	16	4	11
2011	15	9	11
2012	14	2	10
2013	17	56	10
2014	15	22	8
2015	14	39	6
2016	14	9	9
2017	12	20	8
2018	20	3	8
2019	15	6	9
Limit	**40**	**35**	**25**
WHO Guideline	**20**	**-**	**10**

Monitoring for fine particulate matter (PM_{10} and $PM_{2.5}$) was undertaken by DPC at two locations within the port since 2014 and the annual average results of this monitoring are shown in Table 10-8. The results show that the levels of both pollutants within the port are below the limits for the protection of human health (refer Table 10-1) but are typically above the corresponding WHO guidelines (refer Table 10-2). However, the levels within the port are markedly higher that the EPA recorded levels in the greater Dublin area (Zone A) as shown in Table 10-7. This is likely as a direct result of the high volumes of diesel powered vehicles and HGVs operating within the port that are known to be higher emissions of particulate matter than the wider vehicle fleet in the public roads across Dublin. Sea salt aerosol would also be significant at coastal areas such as at the port. The ESB

generating station would not be a significant source as particulate emissions from natural gas combustion are negligible.

Table 10-8 Results of ambient PM_{10} and $PM_{2.5}$ monitoring undertaken in Dublin Port

Ref.	Location	Average PM_{10} (µg/m^3)					Average $PM_{2.5}$ (µg/m^3)				
		2014 /15	2016	2017	2018	2019	2014 /15	2016	2017	2018	2019
D5	Breakwater Road South	26.4	26.4	24.8	27.9	23.7	17.4	14.0	6.8	12.2	17.8
D6	Port lands adjacent to Tom Clarke Bridge	28.2	31.4	34.6	29.8	23.6	16.9	18.3	11.0	11.4	14.3
Annual Average Limit for the Protection of Human Health		40					20				
WHO Guideline		20					10				

Sulphur Dioxide (SO_2)

The largest sources of SO_2 emissions are as a primary pollutant from fossil fuel combustion at power plants and other industrial facilities. Smaller sources of SO_2 emissions include industrial processes such as extracting metal from ore, and the burning of high sulphur containing fuels by locomotives, large ships, and non-road equipment. SO_2 is linked with a number of adverse effects on the respiratory system.

The levels in SO_2 in Dublin over the period 2009 to 2019 are presented in Table 10-9. The levels are low and less than 20% of the limit for the protection of human health (refer Table 10-1). These levels are decreasing annually and are low largely as a result of the ban on smoky coal under the Air Pollution Act, 1987 (Marketing, Sale and Distribution of Fuels) Regulations (1998-2011).

In addition, the sulphur content of fuels for road, non-road and marine fuels are heavily regulated through the following:

- SI 155 of 2011 - European Communities Act, 1972 (Environmental Specifications for Petrol, Diesel Fuels and Gas Oils for use by non-road mobile machinery, including inland waterway vessels, agricultural and forestry tractors, and recreational craft) Regulations 2011.
- SI No.119 of 2008 - Sulphur Content of Heavy Fuel Oil, Gas Oil and Marine Fuels.
- SI 156 of 2011 - European Communities Act 1972 (Sulphur Content of Heavy Fuel Oil, Gas Oil, and Marine Fuels) (Amendment) Regulations 2011.

Table 10-9 Results of SO_2 monitoring carried out by the EPA in Zone A

Year	Annual Mean SO_2 (µg/m^3)	Annual no. of SO_2 Values Exceeding 24 Hour Limit for Protection of Human Health >125µg/m^3	Annual no. of SO_2 Values Exceeding 1 Hour Limit for Protection of Human Health >350µg/m^3
2009	2.7	0	0
2010	2.5	0	0
2011	2.4	0	0
2012	2.0	0	0
2013	2.4	0	0

Year	Annual Mean SO_2 ($\mu g/m^3$)	Annual no. of SO_2 Values Exceeding 24 Hour Limit for Protection of Human Health >125$\mu g/m^3$	Annual no. of SO_2 Values Exceeding 1 Hour Limit for Protection of Human Health >350$\mu g/m^3$
2014	3.6	0	0
2015	1.6	0	0
2016	1.2	0	0
2017	1.7	0	0
2018	3.3	0	0
2019	1.4	0	0
Limit	20 (Annual limit for the protection of vegetation)	3 (No of samples not to exceed per year)	24 (No of samples not to exceed per year)

The results of the DPC monitoring of sulphur dioxide (SO_2) in the period 2014 to 2019 are presented in Table 10-10. The SO_2 data around the port shows that all levels are well below the EU limit for the protection of ecosystems (refer Table 10-1). This is largely as a result of recent statutory driven reductions in the sulphur content of road fuels, shipping fuels and some home heating fuels. As such, there is a general downward trend in ambient SO_2 in recent years.

There is also less spatial variation in the data with a largely uniform dataset. The stations at the coast along the mouth of the estuary (A11, A12, A13, A15 and A17) show slightly higher levels than the others indicating a potential source of SO_2 within this area. There are no major sources of SO_2 associated with the port given the above restrictions on fuel specification and type. While there is a generating station adjacent to the site, this is powered by natural gas with low sulphur emissions.

It is notable that the levels in the port area are generally higher than those recorded by the EPA in Dublin City Centre as shown in Table 10-9.

Table 10-10 Results of ambient SO_2 monitoring undertaken in Dublin Port

Ref.	Location	Average SO_2 ($\mu g/m^3$)				
		2014/2015	2016	2017	2018	2019
A1	Junction of Promenade Road and Bond Road	1.85	0.98	1.07	1.62	1.71
A2	Junction of Promenade Road and 1 Branch Road South	1.78	1.84	4.34	2.42	2.60
A3	North east perimeter of the Port	2.56	2.41	2.55	2.59	1.66
A4	Alexandra Road (Port entrance)	1.69	2.26	1.17	2.30	1.69
A5	Junction of Alexandra Road and 3 Branch Road South	2.66	3.07	1.56	3.82	3.18
A6	Junction of Alexandra Road and 2 Branch Road North	3.78	4.04	4.03	6.52	5.34
A7	Junction of Alexandra Road and Terminal Road North	4.33	3.18	3.55	4.17	2.86
A8	Alexandra Road Extension (eastern boundary of Port)	2.40	2.52	3.29	2.85	2.12

Ref.	Location	Average SO_2 ($\mu g/m^3$)				
		2014/2015	2016	2017	2018	2019
A9	Port lands adjacent to Tom Clarke Bridge	1.46	2.34	1.10	2.24	1.89
A10	Ocean Pier	3.28	2.59	2.07	3.32	2.92
A11	Breakwater Road South	5.19	3.45	3.19	5.55	5.94
A12	Adjacent to Berth 52	5.07	3.34	1.53	1.74	1.64
A13	Alexandra Road Extension (eastern boundary of Port)	5.87	2.00	2.64	3.19	1.94
A14	R131 (East Link Toll Booth)	1.81	1.77	1.17	2.12	1.71
A15	Southern shore of Estuary (adjacent to Hammond Lane)	3.59	2.34	1.32	2.68	1.76
A16	South Bank Road	1.31	1.77	1.06	2.54	1.05
A17	Coast road at Poolbeg Beach	4.84	2.08	4.27	3.19	2.51
A18	Coast road at Sean O'Casey Park	1.25	1.34	1.19	1.67	1.44
Annual Average Limit for the Protection of Human Health		20				

Carbon Monoxide (CO)

Carbon monoxide is produced from the partial oxidation of carbon-containing compounds (i.e. organic fuels such as coal, oil, petrol, diesel, wood, etc.) during the combustion process. CO forms when there is not enough oxygen to produce carbon dioxide (CO_2). As such, CO is a primary pollutant from all combustion process including vehicle exhausts, shipping exhausts, domestic heating, etc. The extent of CO emissions depends on the fuel type and the combustion conditions. Once inhaled. CO is quickly absorbed into the bloodstream from the lungs. Then it combines with haemoglobin in the blood to form carboxyhaemoglobin. This reduces the ability of the blood to carry oxygen around the body and it robs the heart, brain and other vital organs of oxygen.

Annual average levels of CO in Dublin are presented in Table 10-11. Recent levels are less than 10% of the limit value (refer Table 10-1) and show a gradual decrease annually. CO will be emitted by the natural gas generating station in Dublin Port as well as from the road/rail/shipping activities.

Table 10-11 Results of CO monitoring carried out by the EPA in Zone A

Year	Annual Mean CO (mg/m^3)	Annual no. of CO Values Exceeding Hourly Limit for Protection of Human Health >$10mg/m^3$
2009	0.3	0
2010	0.3	0
2011	0.3	0
2012	0.4	0
2013	0.3	0
2014	0.3	0
2015	0.2	0

Year	Annual Mean CO (mg/m^3)	Annual no. of CO Values Exceeding Hourly Limit for Protection of Human Health >10mg/m^3
2016	0.3	0
2017	0.3	0
2018	0.2	0
2019	0.3	0
Limit	10 (8-hour limit for protection of human health)	No of Samples not to exceed per year

Volatile Organic Compounds (VOCs)

VOCs such as benzene (a known human carcinogen) are emitted directly from petrol fuelled vehicles. Other VOCs are also emitted from petrol exhausts (toluene, ethylbenzene, xylenes). VOCs have varying sources and properties and only benzene has a limit for the protection of human health in the legislation (Table 10-1). The EPA monitor for benzene and other VOCs in Rathmines and these results are presented in Table 10-12. Benzene levels in Dublin are low and well below the limit for the protection of human health and have remained low for the last ten years. Levels of the other VOCs in Dublin have also remained stable in the last seven years but there is no limit designated as the standard for the protection of human health. Existing sources of VOCs from the current operations at Dublin Port include road/rail and shipping traffic as well as fuel/solvent handling and storage from the adjoining Seveso sites.

Table 10-12 Results of VOC monitoring carried out by the EPA in Zone A

Year	Annual Mean Benzene (µg/m^3)	Annual Mean Toluene (µg/m^3)	Annual Mean Ethylbenzene (µg/m^3)	Annual Mean m/p-Xylene (µg/m^3)	Annual Mean o-Xylene (µg/m^3)
2009	0.8	2.7	-	3.0	0.4
2010	0.8	2.3	0.3	0.5	0.1
2011	1.6	3.6	0.4	1.5	0.5
2012	1.2	3.5	0.5	1.8	0.4
2013	0.94	1.9	0.31	1.48	0.35
2014	0.94	2.07	0.28	1.61	0.41
2015	0.92	1.88	0.16	0.8	0.22
2016	1.01	2.07	0.20	0.93	0.22
2017	0.92	2.30	0.22	1.29	0.29
2018	0.30	0.59	0.06	0.27	0.15
2019	0.26	0.53	0.05	0.23	0.32
Limit	5 (Annual limit for protection of human health)	NA	NA	NA	NA

General Dusts

Monitoring for dusts (general particulate matter) was undertaken by DPC at four locations within the port between 2014 and 2019 and the results of this monitoring are shown in Table 10-13. The results of the monitoring in the port area north of the Liffey (D1, D2 and D4) show levels below the TA Luft Guideline for dust nuisance which would indicate that dust levels within the port are not currently causing an adverse impact.

The location on the south of the estuary (D3) shows a level considerably higher than the guideline in 2014/2015 indicating a potential adverse dust impact in this area. It is noted that the Hammond Lane and Ecocem sites are in close proximity to this monitoring station and these operations may contribute to the dust levels recorded.

Table 10-13 Results of dust deposition monitoring undertaken in Dublin Port from 2014 to 2019

Ref.	Location	Annual Average Dust Deposition Rate (mg/m^2/day)				
		2014/2015	2016	2017	2018	2019
D1	3 Branch Road South	221	241	266	176	206
D2	Ocean Pier	220	280	287	286	295
D3	Southern shore of Estuary	528	483	404	325	360
D4	Junction of Alexandra Road and 2 Branch Road North	292	301	300	257	330
TA Luft Guideline for non-hazardous dusts		350				

10.2.4 Baseline Climate

10.2.4.1 Climate Policy Summary

The National Policy Position on Climate Action and Low Carbon Development was published on the 23 April 2014. The policy sets a fundamental national objective to achieve transition to a competitive, low-carbon, climate-resilient and environmentally sustainable economy by 2050. The policy states that Greenhouse Gas (GHG) mitigation and adaptation to the impacts of climate change are to be addressed in parallel national strategies – respectively through a series of National Mitigation Plans and a series of National Climate Change Adaptation Frameworks.

The National Policy Position envisages that development of National Mitigation Plans will be guided by a long-term vision of low carbon transition based on the following:

- An aggregate reduction in CO_2 emissions of at least 80% (compared to 1990 levels) by 2050 across the electricity generation, built environment and transport sectors; and
- In parallel, an approach to carbon neutrality in the agriculture and land-use sector, including forestry, which does not compromise capacity for sustainable food production.

Further to the National Policy Position, the Climate Action and Low Carbon Development Act 2015 (No. 46 of 2015) was enacted on the 10th of December 2015. The Climate Act sets out the proposed national objective to transition to a low carbon, climate resilient and environmentally sustainable economy by the end of 2050.

In July 2017, Ireland's first National Mitigation Plan was published. The aim of this plan is to set Ireland on the pathway to achieve the required level of decarbonisation. It should be noted that this plan was quashed by the Supreme Court in 2020 and is no longer national policy.

On the 19 January 2018, Ireland's first statutory National Adaptation Framework (NAF) was published, which has been developed under the Climate Action and Low Carbon Development Act 2015. The aim of the NAF is to build upon the work carried out under Ireland's first non-statutory National Climate Change Adaptation Framework (NCCAF) which was published in 2012. The NCCAF framework aimed to ensure that adaptation actions are carried out across key sectors and at local level to reduce the country's vulnerability to climate change. The NAF outlines a governmental and societal approach to climate adaptation in Ireland, setting out a national strategy to reduce the vulnerability of the Ireland to the adverse effects of climate change and to take advantage of positive impacts.

On 14 May 2018, the European Council adopted a regulation on GHG emission reductions, the EU effort Sharing Regulation, which sets out 2030 targets for member states. The starting point is an average of 2016 - 2018 emissions with binding emission reduction targets of 30% compared to 2005 levels.

Ireland's National Energy and Climate Plan (NECP) 2021 to 2030 has been prepared to incorporate all planned policies and measures that were identified up to the end of 2019 and which collectively deliver a 30% reduction by 2030 in non-ETS greenhouse gas emissions (from 2005 levels).

In June 2019, the government of Ireland published the Climate Action Plan 2019 which identified the nature and scale of the challenges faced by Ireland in terms of climate change, and the commitments and actions required to tackle climate disruption.

The Climate Action and Low Carbon Development (Amendment) Bill 2020 was published in 2020 which will commit the State, in law, to move to a climate resilient and climate neutral economy by 2050.

In terms of shipping and climate change, globally emissions from maritime transport accounts for 3% of the global emissions, but are expected to represent 5% of the global emissions in 2050, due to expected growth of the world economy and associated transport demand. As such, the recent amendment to the EU Emissions Trading System (ETS) Directive, by Directive (EU) 2018/410 of the European Parliament and the Council, emphasises the need to act on shipping emissions as well as all other sectors of the economy. Since the 1st January 2018, large ships over 5,000 gross tonnage loading or unloading cargo or passengers at ports in the European Economic Area (EEA) have to monitor and report their related CO_2 emissions and other relevant information.

10.2.4.2 National Climate

The weather in Ireland is influenced by the Atlantic Ocean, resulting in mild, moist weather dominated by maritime air masses. The prevailing wind direction is from a quadrant centred on west-southwest. These are relatively warm winds from the Atlantic and frequently bring rain. Easterly winds are weaker and less frequent and tend to bring cooler weather from the northeast in spring and warmer weather from the southeast in summer. The site of the Capital Dredging Project on the east coast would experience a higher frequency of easterly winds than more inland locations or those on the west coast.

The nearest meteorological station to the area is the Met Éireann Station in Dublin Airport which lies approximately 9km north of the subject site. The 30-year averages from the station at Dublin Airport are presented in Table 10-14.

Table 10-14 30-year Average Meteorological Data from Dublin Airport (Annual Values from 1981-2010, source: www.met.ie)

Parameter	30-year Average
Mean Temperature (0C)	9.8
Mean Relative Humidity at 0900 UTC (%)	83.0
Mean Daily Sunshine Duration (hours)	3.9
Mean Annual Total Rainfall (mm)	758.0
Mean Wind Speed (knots)	10.3

The prevailing wind direction for the area is between west and southwest as presented in the windrose for Dublin Airport Met Station for 1942 to 2010 in Figure 10-2. Northerly winds tend to be very infrequent (less than 5%) with easterly winds marginally more frequently (5-10%). Wind characteristics are typically moderate with relatively infrequent gales (average only 8.2 days with gales per annum).

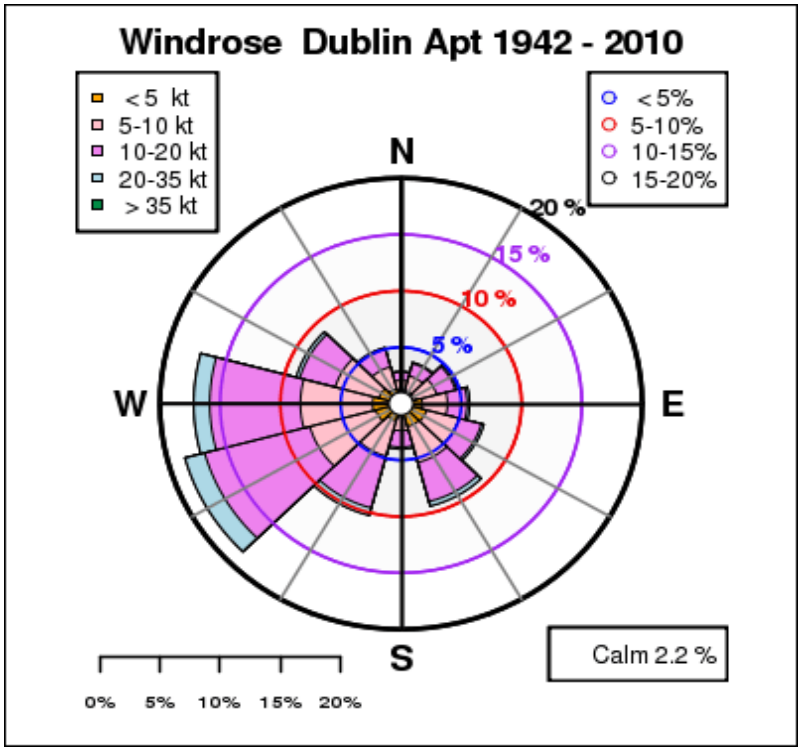


Figure 10-2 Windrose for the Dublin Airport Met Station 1942 to 2010 (source: www.met.ie)

As a direct result of global climate change the baseline climate in Irelands is predicted to undergo some change with observed and projected physical climate changes predicted including the following:

- Increase in average temperature (surface air temperature, sea surface temperature);
  - Projections for mid-century indicate an increase of 1–1.6°C in mean annual temperatures
  - The largest increases will be seen in the east of the country.
  - Warming is enhanced for the extremes (i.e. hot or cold days), with the warmest 5% of daily maximum summer temperatures projected to increase by 0.7–2.6°C.
  - The coldest 5% of night-time temperatures in winter are projected to rise by 1.1–3.1°C.

  - The number of frost days is projected to decrease by over 50%.

- Changes in precipitation patterns;
  - Significant decreases in average precipitation amounts are projected for the spring and summer months as well as over the full year.
  - These drier conditions are projected to be more pronounced in the summer, with “likely” reductions in rainfall ranging from 0% to 20%
  - The frequencies of heavy precipitation events show notable increases (approximately 20%) over the year, and in the winter and autumn months.
  - The number of extended dry periods (is also projected to increase substantially by mid-century. The projected increases in dry periods are largest for summer, with “likely” values ranging from 12% to 40%.
- Ongoing mean sea level rise;
- Changes in the character of weather extremes such as storms, flooding, sea surges and flash floods.
  - The overall number of North Atlantic cyclones is projected to decrease by approximately 10%. The projected decrease in overall cyclone activity is consistent with a projected increase in average mean sea-level pressure of approximately 1.5 hPa for all seasons by mid-century.

10.2.4.3 Dublin Port Carbon Footprint

DPC publishes an annual Sustainability Report to track and record progress on the ports environmental responsibilities. As part of the 2017 Sustainability Report, DPC commenced a carbon footprint inventory of all port emission sources. This is to generate awareness in the maritime community for the need for action regarding greenhouse gas emissions and to make available information on the effects on climate change. This information allows DPC to establish initiatives and set ambitious targets to reduce emissions. The calculated footprint for the period 2009 to 2017 is presented in Table 10-15.

The 2017 results indicate that the main emission sources are electricity use (at 36% of the total) and transport fuels (at 51% of the total) followed by space heating (at 13%). Emissions associated with electricity use are largely stable in the period from 2009 to 2015 with reductions in 2016 and 2017 which is very positive relative to the growing throughput in the port indicating some decoupling of the emissions. However, the emissions from transport fuels are generally increasing in line in this period with the increased throughput at the port and the contribution of transport related GHG to the port’s footprint is increasing.

The trend in the period 2009 to 2017 shows a significant degree of fluctuation with annual emissions within the range 3,800 to 4,600 tonnes of CO_2 per annum. The overall trend shows a downward trajectory as a result of the reduced electricity and gasoil emissions which offset the observed increases in transport emissions.

Table 10-15 Dublin Port Company Carbon Footprint 2009-2017

Category	Energy Type	Unit	2009	2010	2011	2012	2013	2014	2015	2016	2017
Electricity	Net Electricity Imports	Tonne CO_2	2,103	2,307	2,044	2,240	2,054	1,845	1,873	1,795	1,398
Gas	Natural Gas	Tonne CO_2	59	73	60	79	167	139	149	155	130
Heating Oils	Kerosene	Tonne CO_2	20	21	20	10	20	20	21	32	37
	Gasoil	Tonne CO_2	614	573	687	626	434	361	395	360	340
Transport Fuels		Tonne CO_2	1,165	1,598	1,205	1,253	1,541	1,648	1,899	1,848	1,981
Transport Biofuels		Tonne CO_2	0	0	0	0	0	0	0	0	0
Total Tonnes CO_2 Emissions		Tonne CO_2	3,962	4,573	4,015	4,209	4,216	4,013	4,337	4,189	3,886
Throughput		`000 Tonne`s	26,50	28,11	28,11	27,98	28,84	30,85	32,83	-	36.42

DPC and Sustainable Energy Authority of Ireland (SEAI) signed a joint energy efficiency agreement in 2012. As a member of the Public Sector Energy Partnership Programme, the agreement means that DPC and SEAI will work in partnership to achieve a target of 33% energy efficiency improvements by 2020 relative to its baseline year of 2009. As of December 2017, DPC has achieved a 24.3% improvement in energy performance. In order to meet the 2020 target of a 33% energy efficiency improvement DPC needs to achieve a 4.3% improvement each year, between 2018 and 2020 across its major energy consumers.

10.2.5 'Do-Nothing' Scenario

The EIA Regulations require a description of the relevant aspects of the current state of the environment (baseline scenario) as well as and an outline of the likely evolution thereof without the development. In this EIAR this scenario is referred to as the 'Do-Nothing' Scenario and the evolution of the air quality and climate baseline in the absence of the proposed development is presented within this section.

The baseline air quality trends shown for the Dublin area from 2009 to 2019 show a very slight gradual decline for all pollutants on an annual basis. These gradual decreases are based on the implementation of a series of national and EU driven policies and legislation on emissions from road traffic, industrial emissions and space heating. The EPA reports do highlight the main challenges of reducing air pollution from key sources such as particulate matter emissions from solid fuel burning (e.g. peat, coal and wood) in the residential sector and NOx emissions from vehicles in the transport sector.

In the future, the Government's proposed "National Clean Air Strategy" for Ireland is expected to propose further policy solutions to address the major public health and environmental challenges posed by air pollution to Ireland which is anticipated to enable the further improvements in ambient air quality with the objective of achieving compliance with the WHO Guidelines.

Ongoing reductions is tailpipe emissions from the Auto Oil program will lead to a continual reduction in emissions per fleet vehicle in Ireland as newer Euro 6/VI vehicle, hybrids and electric vehicles replace older vehicles. This

decrease may be offset by the increased number of vehicles in the fleet and/or a reduction on the efficiency on the road network.

Industrial, energy and space heating emissions are expected to show a gradual decrease through greater regulation from a range of EU and national policies, targets and strategies on emissions reductions and demand management.

Within the Dublin Port area, the ambient air quality levels presented for the period 2015 to 2019 show a trend of a largely stable baseline with little or no significant increase/decrease in ambient air quality levels monitored.

In the absence of the proposed development, the evolving baseline DPC carbon footprint is predicted to continue the trends presented in Table 10-15 with a general increase on transport related emissions as a result of increased throughput associated with the port Masterplan.

In terms of the evolving national baseline, the EPA estimate emissions to 2030 using two scenarios as follows:-

- "With Existing Measures" - scenario assumes that no additional policies and measures beyond those already in place by the end of 2018 are implemented. Under this scenario, transport emissions are projected to decrease by 7.6% over the period 2019 – 2030 to 11.2 Mt CO_{2eq}.
- "With Additional Measures" – scenario assumes implementation of the With Existing Measures scenario in addition to implementation of planned government policies and measures adopted after the end of the 2018. Importantly, this includes Ireland's 2019 Climate Action Plan. Under the With Additional Measures scenario, transport emissions are projected to decrease by 37.8% over the period 2019 to 2030 to 7.6 Mt CO_{2eq}.

The main policy instruments impacting transport emissions are the Biofuels Obligations Scheme and uptake of electric vehicles. Based on these trends, the transport sector is facing a challenge in achieving the emissions reductions set out in the National Policy Position.

10.3 Impact Assessment

10.3.1 Construction Stage

10.3.1.1 Vessel Emissions (Regional Impact)

The proposed capital dredging works will be carried out using a trailing suction hopper dredger (TSHD) and/or a backhoe dredger. The dredging will be limited to the winter period (October-March). The dredger will operate 24 hours per day during each dredging campaign within the lifetime of the project, set at eight years. Assuming a typical fuel consumption of a dredger at circa 12 tonnes per day of diesel, the estimated annual emissions from the proposed dredging operation are shown in Table 10-16. Also shown in the table for context are the % contribution of these emissions to the national emissions targets shown in Table 10-4. The results show that relative to the emissions ceilings, the proposed dredging works will have **negligible** impact on regional and national air quality.

Table 10-16 Estimated Annual Shipping Emissions from the Proposed Development

Scenario	Total NO_x per annum (tonnes)	Total VOCs per annum (tonnes)	Total TSP per annum (tonnes)
Capital Dredging Project	344	12	7
As a % of 2020-2029 Ceiling	0.51%	0.02%	0.04%
As a % of 2030 Ceiling	0.85%	0.02%	0.06%

The long-term development of the Port was established by the Dublin Port Masterplan 2012-2040 which was published in February 2012 and then reviewed and updated in June 2018. Under the Masterplan shipping volumes at the port are predicted to increase annually at an average annual growth rate of 3.3% from 2010 to 2040.

The total cargo shipping volumes from the overall Masterplan in 2040 are presented in Table 10-17. The total predicted increase in capacity over the 30 years under the 2040 Masterplan is 77.2 million tonnes by 2040 relative to the 28.9 million tonnes in 2010. The results indicate that the proposed dredging will cumulatively add a further 1% on top of the projected annual shipping emissions associated with the Masterplan 2040. Cumulatively, these emissions are considered to be a **permanent slight adverse impact** and transboundary in nature.

Table 10-17 Cumulative Shipping Emissions

Scenario	Total NO_x per annum (tonnes)	Total VOCs per annum (tonnes)	Total TSP per annum (tonnes)
Capital Dredging Project	344	12	7
Masterplan 2040	27,593	984	527

EU Directives are in force which relate to the content of sulphur in marine gas oil (EU Directive 93/12 and EU Directive 1999/32) and the content of sulphur in heavy fuel oil used in SECA (EU-Directive 2005/33).

The Marine Environment Protection Committee (MEPC) of IMO has approved amendments to Marpol Annex VI in October 2008 in order to strengthen the emission standards for NO_x and the sulphur contents of heavy fuel oil used by ship engines.

The current Marpol 73/78 Annex VI legislation on NO_x emissions, formulated by IMO (International Maritime Organisation) is relevant for diesel engines with a power output higher than 130 kW, which are installed on a ship constructed on or after 1 January 2000 and diesel engines with a power output higher than 130 kW which undergo major conversion on or after 1 January 2000.

The Marpol Annex VI, as amended by IMO in October 2008, considers a three tiered approach as follows:

- Tier I: diesel engines (> 130 kW) installed on a ship constructed on or after 1 January 2000 and prior to 1 January 2011;
- Tier II: diesel engines (> 130 kW) installed on a ship constructed on or after 1 January 2011;
- Tier III (1): diesel engines (> 130 kW) installed on a ship constructed on or after 1 January 2016.

Given the existing legal requirements around fuel and emissions for shipping, the extent of emissions per vessel are gradually reducing and will continue to reduce in future years. As such, the analysis presented in Table 10-17 should be considered a conservative worst case estimate.

10.3.1.2 Vessel Emissions of Greenhouse Gases

In relation to climate change, the emissions of greenhouse gases are not covered within the National Emissions Ceiling and are not included in Table 10-16. However, like all combustion, the use of diesel in the dredger will generate greenhouse gases (as CO_2) and this emission has been estimated based on the procedures presented in the IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 3 Mobile Combustion – Navigation. Based on the projected diesel use as outlined above, the total greenhouse gas generated has been estimated based on the default Tier 1 emission factors for diesel oil a. The total greenhouse gases generated per annum from the dredger equate to 13,590 tonnes per annum and this is considered a **permanent slight adverse impact** for climate.

The cumulative impact of the proposed dredging in combination with the generation of greenhouses gases from the wider Masterplan are presented in Table 10-18. This includes both the proposed development coupled with emissions reported in the baseline and for the construction and operation of the wider masterplan. The total greenhouse gases generated up to 2040 equates to 326,690 tonnes per annum and this is considered a **permanent moderate adverse impact** for climate.

Table 10-18 Cumulative Greenhouse Gas Emissions

Source	Emissions	Number of events	Cumulative Emissions
Current Baseline (from 2017 footprint)	3,886 per annum	20 years to 2040	77,720
Proposed Dredging GHG emissions	13,590 tonnes per annum	8 years	108,720
Construction Greenhouse Gases for the MP2 Project	38,090 tonnes for all construction	1 construction event	38,090
MP2 Road Traffic	5,108 tonnes per annum	20 years to 2040	102,160
Cumulative Impact to 2040			326,690

10.3.1.3 Vessel Emissions (Local Impact)

From a local air quality perspective, the nearest proposed dredging area to sensitive receptors is through the main navigation channel and Berth 41. Dredging in this area is circa 140 metres from the nearest sensitive properties on Pigeon House Road and a screening air dispersion model has been prepared to determine the local impact of the dredging missions on the properties located on Pigeon House Road. The results are presented in Table 10-19 with the results compared with the EU limits (Table 10-1) and WHO Guidelines (Table 10-2). The results indicated that even with the dredger located within the closest area to these properties, the temporary air quality impacts to residents on the Pigeon House Road will remain within the EU limits and the WHO guidelines and this impact will not be significant. Given the transient and temporary nature of this air quality exposure, the overall impact is classed as **temporary slight adverse impact**.

Also included within Table 10-19 is the cumulative impact from the wider Dublin Port Masterplan. This information has been taken from the EIAR for the MP2 Project which sets out the impact to air quality from road traffic. The information presented relates to the additional impact from MP2 road traffic for properties along Pigeon House Road. As shown, the cumulative impact of the temporary dredging coupled with the full MP2 traffic is **temporary slight adverse impact** relative to the current baseline conditions.

Table 10-19 Local Impact from Dredging on Pigeon House Road

Pollutant	Criteria	Background	Dredging Impact (including background)	MP2 Project (Road Traffic)	EU limit	WHO Guideline
Nitrogen Dioxide (µg/m^3)	Maximum 1-hour	24	91	NA	200	200
	Annual average		29	+0.23	40	40
Particulate Matter PM_{10} (µg/m^3)	Maximum 24-hour	15	16.7	NA	50	50
	Annual average		15.1	0.09	40	20
Particulate Matter $PM_{2.5}$ (µg/m^3)	Annual average	9	9.1	NA	20	10

10.3.1.4 Vessel Emissions (Impact on Biodiversity)

The principal pollutants of concern which originate from road developments are the nitrogen oxides (NOx), in terms of impact on sensitive ecosystems. Nitrogen oxides (NOx) may have a positive or negative impact by acting as a fertiliser or a phytotoxicant. Effects are mainly on vegetation growth, photosynthesis, and nitrogen assimilation/metabolism.

The nearest sensitive ecological site to the proposed dredging is the South Dublin Bay and River Tolka Estuary SPA (Site Code 004024) which has a number of qualifying interests including wetland and waterbirds. The proposed dredging in Berth 52 will be directly adjacent to the boundary of the SPA, albeit for a temporary basis.

The results of the local monitoring undertaken in the Dublin area indicates that levels of NO_x in the last decade of the order of 42µg/m^3 which is above the annual NOx limit for the protection of vegetation of 30µg/m^3 (Table 10-1). The determination of an additional NO_x loading from the proposed dredging has been undertaken to assess the impact to these sensitive ecological areas.

Using the procedures outlined in the TII Guidelines, an assessment of nitrogen deposition on the SAC has been undertaken. Table 10-20 presents the results in terms of nitrogen deposition on the SAC as a result of the proposed dredging at Berth 52. The predicted nitrogen deposition levels indicate levels of approximately 2.8kg(N)/ha/year. This deposition level is compared to the UNECE critical loads for nitrogen as presented in the TII Guidelines. The UNECE critical load for nitrogen in moist to wet dune slacks is 10-25 kg(N)/ha/year. These results indicate that the temporary levels of nitrogen deposition on the SPA are less than 30% of the critical load as set by UNECE and the results of this deposition on biodiversity is considered negligible.

Table 10-20 Predictions of Nitrogen Deposition at Sensitive Ecosystems

Ecosystem	Baseline NO_2 Concentration (µg/m^3)	Proposed development NO_2 Concentration (µg/m^3)	Nitrogen Deposition with Proposed Development kg(N)/ha/year
South Dublin Bay and River Tolka Estuary SPA	24	28	2.8
UNECE Critical Load (kg(N)/ha/year) – Moist to Wet Dune Slacks			10-25
UNECE Critical Load (kg(N)/ha/year) – Pioneer and low-mid salt marshes			30-40

10.3.1.5 Construction Dust

In accordance with the TII Guidelines, where there are construction activities at a development site, there is a risk that dust may cause an impact at sensitive receptors in close proximity to the source of the dust generated. These distances are presented in Table 10-21 (source TII Guidelines, May 2011 Revision).

Table 10-21 TII Assessment Criteria for the Impact of Dust Emissions from Construction Activities, (with standard mitigation in place)

Source		Potential Distance for Significant Effects (Distance from Source)		
Scale	Description	Soiling	PM_{10}	Vegetation Effects
Major	Large Construction sites, with high use of haul routes.	100m	25m	25m
Moderate	Moderate Construction sites, with moderate use of haul routes.	50m	15m	15m
Minor	Minor Construction sites, with minor use of haul routes.	25m	10m	10m

It is important to note at the outset that one of the principal factors affecting dust generation and dust deposition relates to moisture content. Moisture increases the mass of a dust particle meaning particles are less friable and hence, less prone to dust dispersion. In most construction projects, the principal means of dust suppression is through maintaining a high moisture level on dust particles. In the case of the proposed works at Dublin Port, all dredged material will inherently have high moisture content and hence a lower risk of dust impact.

The dredging operations are considered very low risk for dust impacts given that this material will have very high moisture content (circa 50% by weight). This is also the case for the transport of this material. As such, these operations are considered to have negligible dust impacts and are not considered further in this assessment.

The area of the construction site of the Capital Dredging Project is categorised as “major” and hence, as per the TII Guidelines, any receptor within 100 metres of the site has the potential for adverse effects from construction dusts. Given the nature of the port and the distance to and sensitive receptors, there are no properties located within this impact zone. As a consequence, construction dust from the Capital Dredging Project will be **negligible** for the duration of the works.

The dispersion model presented in the EIS for the ABR Project illustrated that the operation of the dredge spoil treatment facility, coupled with infilling and general site construction for that project will not have an adverse impact on sensitive receptors in the area around Dublin Port. All concentrations of dust and metals will remain within the relevant limits and guidelines for the protection of human health. In all cases the results showed only a marginal increase on the existing background levels in the area as a result of these works.

Both of the construction phases of the Capital Dredging Project and ABR Project will run concurrently and hence there is potential for cumulative impact relating to construction dust. However, given the marginal to negligible impacts presented in both analyses, the cumulative impact of construction dust is considered **negligible**. Furthermore, DPC are required to carry out dust deposition monitoring within the port to demonstrate compliance with the TA Luft Guideline (350mg/m^2/day) under Schedule B.3 of the IE Licence (P1022-01).

10.3.1.6 Construction Odour

There is a relatively low potential for odour generation and nuisance to occur during the construction phase. The potential exists where decayed organic material has the potential to release sulphurous compounds (such as H_2S) or where solvent contamination is uncovered.

Both of these sources will potentially be released under water during the dredging operations. Low levels or organic solvents are predicted in the dredged material and any vapour released will quickly condense into the liquid phase and either dissolve in the water (such as water soluble solvents such as alcohols) or form a residue on the water surface where not water soluble (such as aromatics). In both cases the impact to air quality and climate is considered **negligible.**

10.3.2 Operation Phase

There are no predicted direct impacts to air quality and climate associated with the operation phase of the proposed dredging.

10.3.3 Mitigation Measures

10.3.3.1 Vessel Emissions

A number of EU Directives and the requirements of the Marpol Convention regulate the fuels and emissions employed in the shipping industry. These requirements will remain in practice throughout the operation of the Capital Dredging Project.

10.3.3.2 Construction Dust

The following precautionary measures will be undertaken to minimise the potential nuisance caused by dust at the nearest sensitive receptors and on sensitive ecosystems:

- A dust minimisation plan will be put in place based upon the industry guidelines in the Building Research Establishment document entitled 'Control of Dust from Construction and Demolition Activities'.
- Monthly monitoring of dust deposition levels each month for the duration of construction for comparison with the guideline of 350mg/m^2/day (for non-hazardous dusts). This monitoring will be carried out at a minimum of four locations at sensitive receptors around the proposed works. Where dust levels are measured to be above this guideline, the mitigation measures in the area will be reviewed as part of a Dust Minimisation Plan.

10.3.3.3 Construction Phase - Odour

An Odour Management Plan (OMP) will be put in place based upon the guidance presented in the Environment Agency of England and Wales "*Odour Management Guidance*" (H4 Guidance, 2011) and the EPA "*Odour Impact Assessment Guidance for EPA Licensed Sites*" (Guidance Note AG5, 2010). These will includes measures designed to:

- Employ appropriate methods, including monitoring and contingencies, to control and minimise odour pollution;

- Prevent unacceptable odour pollution at all times; and
- Reduce the risk of odour releasing incidents or accidents by anticipating them and planning accordingly.
- The OMP will include a procedure for complaint recording and investigation to ensure that all complaints received at the site are suitably addressed.

10.3.4 Residual Impacts

10.3.4.1 Construction Phase

The quantification of the generation of total vessel emissions on a regional basis shows that relative to the emissions ceilings, the proposed dredging works will have **negligible** impact on regional and national air quality.

In relation to greenhouse gases, emissions from the dredger equate to 13,590 tonnes per annum and this is considered a **permanent slight adverse impact** for climate.

At a local level, given the transient and temporary nature of this air quality exposure, the overall local air quality impact from the dredger on the Pigeon House Road residents is classed as **temporary slight adverse impact**.

The potential for nitrogen deposition on the nearest sensitive ecological site shows that the levels are well below the critical load and the results of this deposition on biodiversity is considered **negligible**.

On implementation of the dust minimisation plan and ongoing monitoring the impact of construction dust from the proposed Capital Dredging Project on the community is considered **negligible**.

The residual odour impact of the prosed the dredging operations is considered **negligible**. Once the measures proposed in the Odour Management plan are implemented during this operation.

10.3.4.2 Operation Phase

There are no predicted direct impacts to air quality and climate associated with the operation phase of the proposed dredging.

10.4 Conclusions

The current state of the environment in terms of baseline air quality has been determined from the data from the EPA monitoring Zone A (Dublin) network to determine compliance with relevant ambient air legislation. In addition to the EPA monitoring, DPC carry out a series of ambient air quality monitoring tests within the environs of the port. This monitoring is employed in this assessment to demonstrate the spatial variation in the Port and in the wider Dublin area in conjunction with the data from the EPA network.

Results of the baseline monitoring indicates that recent levels in the Greater Dublin Area are below the statutory limits for the protection of human health and also below the WHO guidelines for the protection of human health. It is noted that monitoring undertaken by DPC within the Port footprint show levels that are higher than the Greater Dublin Area average and, in some cases, levels exceed both the statutory limits and the WHO guidelines.

There are sensitive receptors (houses, commercial operations) located in the area and these receptors vary in distance from the proposed development. There is a potential that receptors may experience a change in air

quality and the extent of these changes in air quality is identified in the air quality assessment. The nearest sensitive residential receptors to the proposed dredging are the residential dwellings on Pigeon House Road and Coastguard Cottages circa 140 metres to the south of the nearest point of dredging.

An assessment of the implications for total emissions from the dredger vessel has been undertaken to determine the impact on both a regional/national basis as well as on a local basis. On a regional/national level, the total estimated emissions per annum from the dredger have been compared with the national emissions ceilings limits and the results indicate that the impact of the vessel will be negligible. In relation to emissions of greenhouse gases from the dredger these are considered to be a permanent slight adverse impact.

At a local level, an assessment of the change in exposure to air pollution for the properties located close to the dredging on Pigeon House Road, indicates that for the temporary timeframe whereby the dredging is undertaken close to the properties, the local air quality impact will be temporary and slight adverse impact.

The principal pollutants of concern which originate from road developments are the nitrogen oxides (NOx), in terms of impact on sensitive ecosystems. Nitrogen oxides (NOx) may have a positive or negative impact by acting as a fertiliser or a phytotoxicant. Effects are mainly on vegetation growth, photosynthesis, and nitrogen assimilation/metabolism.

The nearest sensitive ecological site to the proposed dredging is the South Dublin Bay and River Tolka Estuary SPA (Site Code 004024) which has a number of qualifying interests including wetland and waterbirds. The proposed dredging in Berth 52 will be directly adjacent to the boundary of the SPA, albeit for a temporary basis. An assessment of nitrogen deposition on the SAC has been undertaken and the results indicate that the temporary levels of nitrogen deposition on the SPA are less than 30% of the critical load as set by UNECE and the results of this deposition on biodiversity is considered negligible.

Construction dust has the potential to cause local impacts through dust nuisance at the nearest sensitive receptors and also to sensitive ecosystems. Given the nature of the port and the distance to sensitive receptors, there are no properties located within the dust risk impact zone and it is concluded that construction dust from the Capital Dredging Project will be negligible for the duration of the works.

The main potential odour from the construction stage relates to the potential for fugitive odours from the dredging operation. Despite the low risk of encountering odours, a series of odour mitigation measures have been presented to minimise the impact of this operation and to prevent any nuisance in the unlikely event that odours are encountered. The residual odour impact of the dredging operations is considered negligible.

11 TERRESTRIAL NOISE & VIBRATION

This chapter of the EIAR assesses the potential impact of the capital dredging on terrestrial noise and vibration in the receiving environment. The likely significant effects of the project caused by terrestrial noise and vibration are examined and measures to reduce, avoid and prevent these likely significant effects are proposed, where they are necessary.

The proposed dredging will be similar in nature to the type of dredging that has been completed on many occasions at the port in the past. Like previous dredging activities, the work will be completed on a 24/7 basis. There are no records of complaint at the port related to previous dredging activities undertaken at the port.

A full description of the proposed development is included in Chapter 3 of this EIAR.

11.1 Assessment Methodology

11.1.1 Relevant Noise Guidance Documents

NRA Guidelines for the Treatment of Noise and Vibration in National Road Schemes (2004)

This guidance document is primarily concerned with setting out the design criteria in relation to noise from new road schemes in Ireland, however, it also provides reference material in terms of suitable noise and vibration threshold limits for construction activities.

The NRA Guidelines indicate noise levels typically deemed to be acceptable for the construction phase of road schemes (See Table 11-1). These values are indicative only and more stringent limits may be applied where pre-existing noise levels are low.

Table 11-1 Maximum Permissible Noise Levels at the Façade of Dwellings during Construction

Days & Times	$L_{Aeq\ (1\ hr)}$ dB	$L_{pA(max)slow}$ dB
Monday to Friday (07:00 – 19:00hrs)	70	80
Monday to Friday (19:00 – 22:00hrs)	60*	65*
Saturday (08:00 – 16:30hrs)	65	75
Sunday Bank Holidays (08:00 – 16:30hrs)	60*	65*

* Construction activity at these times. Other than that required in respect of emergency works, will normally require explicit permission of the relevant local authority.

This guidance has been used for the assessment as it is an appropriate reference document for assessing a short-term activity such as dredging.

NRA Good Practise Guidance for the Treatment of Noise during the Planning of National Road Schemes (2014)

The purpose of this good practice guidance is to expand and supplement the advice already provided in the NRA Guidelines for the Treatment of Noise and Vibration in National Road Schemes (2004).

The good practice guidance is based on two studies completed by Atkins and Trinity College Dublin, which evaluated the effectiveness of the NRA Guidelines (2004). The studies included consideration of the Constraints

Studies, Route Selection Studies, present practice in other countries both in Europe and beyond, recently published revisions to the UK DMRB and noise research on the design and effectiveness of noise barriers.

The good practice guidance has been used in tandem with the NRA Guidelines (2004) to inform portions of the assessment that are covered within these guidance documents.

British Standard BS5228:2009+A1:2014 Noise and Vibration Control on Construction and Open Sites

This British standard consists of two parts and covers the need for protection against noise and vibration of persons living and working in the vicinity of construction and open sites. The standard recommends procedures for noise and vibration control during construction operations and aims to assist architects, contractors and site operatives, designers, developers, engineers, local authority environmental health officers and planners.

Part 1 of the standard provides a method of calculating noise from construction plant, including:

- Tables of source noise levels;
- Methods for summing up contributions from intermittently operating plant;
- A procedure for calculating noise propagation;
- A method for calculating noise screening effects; and
- A way of predicting noise from mobile plant, such as haul roads.

The standard also provides guidance on legislative background, community relations, training, nuisance, project supervision and control of noise and vibration.

The ABC method outlined in Section E3.2 has been used for the purposes of determining whether the predicted noise levels from the construction activities will result in any significant noise impact at the nearest noise sensitive properties.

Table 11-2 outlines the applicable noise threshold limits that apply at the nearest noise sensitive receptors. The determination of what category to apply is dependent on the existing baseline ambient (LAeq) noise level (rounded to the nearest 5dB) at the nearest noise sensitive property. For weekday daytime, if the ambient noise level is less than the Category A threshold limit, the Category A threshold limit (i.e. 65dB) applies. If the ambient noise level is the same as the Category A threshold limit, the Category B threshold limit (i.e. 70dB) applies. If the ambient noise level is more than the Category A threshold limit, the Category C threshold limit (i.e. 75dB) applies. The applicable limits that apply at each of the sensitive receptors included in the construction phase noise model are presented and discussed in Section 11.3.

Table 11-2 Noise Threshold Limits at Nearest Sensitive Receptors

	Threshold Limits [dB(A)]		
	Category A	Category B	Category C
Night-time (23:00 - 07:00)	45	50	55
Evening and Weekends (19:00 - 23:00 Weekdays, 13:00-23:00 Saturdays, 07:00-23:00 Sundays)	55	60	65
Weekday daytime (07:00-19:00) and Saturdays (07:00-13:00)	65	70	75

As with the NRA guidelines, this guidance has been used for the assessment as it is an appropriate reference document for assessing a short-term activity such as dredging.

British Standard 8233:2014 Sound Insulation and Noise Reduction for Buildings – Code of Practise

BS8233:2014 provides guidance values for a range of ambient noise levels within residential and commercial/industrial properties as shown in Table 11-3.

Table 11-3 Internal Ambient Noise Levels for Living Spaces

Activity	Location	07:00 – 23:00	23:00 – 07:00
Resting	Living Room	35 dB $L_{Aeq,16hr}$	-
Dining	Dining Room/Area	40 dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,\ 8hr}$

The standard allows for a further relaxation in standards of up to 5dB where "development is considered necessary or desirable". In relation to external amenity areas such as gardens and patios, the standard states that it is desirable that external noise does not exceed 50 dB LAeq,T with an upper guideline value of 55 dB LAeq,T.

This guidance document has been used as reference for the internal standard ambient noise levels to be achieved inside residential properties.

World Health Organisation (WHO) – Guidelines for Community Noise

In 1999, the World Health Organisation (WHO) proposed guidelines for community noise. In this guidance, a LAeq threshold daytime noise limit of 55 dB is suggested for outdoor living areas in order to protect the majority of people from being seriously annoyed. A second daytime limit of 50 dB is also given as a threshold limit for moderate annoyance.

The guidelines suggest that an internal LAeq not greater than 30 dB for continuous noise is needed to prevent negative effects on sleep. This is equivalent to a façade level of 45 dB LAeq, assuming open windows or a free-field level of about 42 dB LAeq. If the noise is not continuous, then the internal level required to prevent negative effects on sleep is a LAmax, fast of 45 dB. Therefore, for sleep disturbance, the continuous level as well as the number of noisy events should be considered.

The Night Noise Guidelines for Europe was published in 2009 on the back of extensive research completed by a WHO working group. Considering the scientific evidence on the threshold of night noise exposure indicated by Lnight, outside as defined in the Environmental Noise Directive (2002/49/EC), an Lnight, outside of 40dB should be the target of the night noise guideline (NNG) to protect the public, including the most vulnerable groups such as children, the chronically ill and the elderly. An interim target of 55dB is recommended where the NNG cannot be achieved. These guidelines are applicable to Member States of the European Region and may be considered as an extension to the previous WHO Guidelines for Community Noise (1999).

In 2012, the WHO published the Methodological Guidance for Estimating the Burden of Disease from Environmental Noise. This document outlines the principles of quantitative assessment of the burden of disease from environmental noise, describes the status in terms of the implementation of the European Noise Directive and reviews evidence on exposure-response relationships between noise and cardiovascular diseases.

This guidance document has been used as reference for the standard internal/external ambient noise levels to be achieved for residential properties.

11.1.2 Relevant Vibration Guidance

Limits of transient vibration, above which cosmetic damage could occur, are given numerically in Table 11-4 (Ref: BS5228-2:2009+A1:2014, Annex B, Table B2, Page 38). Minor damage is possible at vibration magnitudes which are greater than twice those given in Table 11-4, and major damage to a building structure can occur at values greater than four times the tabulated values (definitions of the damage categories are presented in BS7385-1:1990, 9.9).

Table 11-4 Transient Vibration Guide Values for Cosmetic Damage (Ref BS5228-2:2009+A1:2014)

Type of Building	Peak Particle Velocity (PPV) (mm/s) in Frequency Range of Predominant Pulse	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures. Industrial and heavy commercial buildings.	50 mm/s at 4 Hz and above	50 mm/s at 4 Hz and above
Unreinforced or light framed structures. Residential or light commercial buildings.	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above.

British Standard BS 7385 (1993) Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration indicates that cosmetic damage should not occur to property if transient vibration does not exceed 15mm/s at low frequencies rising to 20mm/s at 15Hz and 50mm/s at 40Hz. These guidelines refer to relatively modern buildings and therefore, these values should be reduced to 50% or less for more sensitive buildings.

The NRA Guidelines for the Treatment of Noise & Vibration in National Road Schemes recommends that vibration is limited to the values set out in Table 11-5 in order to ensure that there is little or no risk of even cosmetic damage to buildings. These values and the values indicated in Table 11-4 are used as guidance for monitoring vibration levels from the construction phase of the MP2 Project.

Table 11-5 Recommended Vibration Level Thresholds for NRA Schemes

Allowable Vibration Velocity (Peak Particle Velocity) at the Closest Part of Any Sensitive Property to the Source of Vibration, at a Frequency of:		
Less than 10Hz	10 to 50 Hz	50 to 100 Hz (and above)
8mm/s	12.5mm/s	20mm/s

This guidance provides the relevant vibration threshold limits that must be adhered to during the dredging activities.

11.1.3 Assessment Methodology for Determining Noise Impacts

General Significance Criteria

Table 11-6 contains the general significance criteria that have been used for determining the level of impact associated with the capital dredging. Where feasible, the significance criteria have been used in the various assessments included in this chapter having regard to the sensitivity of receptors.

Table 11-6 Criteria to Define the Sensitivity of Receptors

Sensitivity	Description	Examples of receptors
High	Receptors where occupants or activities are particularly susceptible to noise	Residential Quiet areas for outdoor recreation Religious institutions (e.g. churches and cemeteries) Schools during the daytime
Medium	Receptors moderately sensitive to noise, where it may cause some distraction or disturbance	Offices Restaurants Sports grounds where noise is not a normal part of the event (e.g. golf courses and tennis courts)
Low	Receptors where distraction or disturbance from noise will have minimal effect	Commercial buildings not occupied during operational hours Factories and working environments with existing high noise levels Sports grounds and facilities where noise levels are a normal part of activity

The majority of receptors which have the potential to be affected by noise and vibration impacts arising due to the capital dredging works are the residents of dwellings in the vicinity of the existing port. Residents are deemed to be highly sensitive. The significance of the effect is determined as a function of the sensitivity of the receptor and the magnitude of impact it is exposed to. This is set out in Table 11-7.

Table 11-7 Matrix for Determining Significance of Effect for Receptors of High Sensitivity

Magnitude of Impact (beneficial or adverse)	Significance of effect for receptors of high sensitivity
Major	Large or very large
Moderate	Moderate or large
Minor	Slight
Negligible	Slight
No impact	Neutral

Effects are considered to be significant when identified as likely to have Moderate, Large or Very Large effect.

Dredging Noise

The NRA Guidelines for the Treatment of Noise & Vibration on National Road Schemes (2004) British Standard BS 5228:2009+A1:2014 Noise and Vibration Control on Construction and Open Sites are the standard noise guidance documents for assessing construction phase noise impacts. On account of the similarity with construction activities and shorter term nature of dredging, these guidance documents have been used for the purposes of assessing this activity. Section 11.1.2 contains a brief description of these guidance documents.

The appropriate noise threshold limits for construction phase activities are outlined in Table 11-1 and Table 11-2. These guidance documents do not apply significance criteria for noise impacts other than outlining permissible threshold limits for noise as outlined in these tables.

Vibration

In terms of significance criteria, British Standard BS 5228:2009+A1:2014 provides guidance on the effects of vibration levels on residential receptors. Table B1 of Annex B provides an outline of vibration levels and associated effects; this is reproduced in Table 11-8 below. An additional column has been added to the Table to link these vibration levels to the equivalent significance criteria as outlined in Table 11-7.

Table 11-8 Guidance on Effects of Vibration Levels on Sensitive Receptors

Vibration Level	Effect	Significance Criteria (See Table 11-7)
0.14 - 0.3 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.	Neutral
0.3 - 1.0 mm/s	Vibration might be just perceptible in residential environments	Minor Adverse Effect
1.0 - 10.0 mm/s	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.	Moderate Adverse Effect
>10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level.	Major Adverse Effect

11.1.4 Methodology for Noise Monitoring

Baseline data was collected using one unattended monitoring location at the Marina, which is adjacent to the nearest noise sensitive properties at Coastguard Cottages / Pigeon House Road. The noise monitoring location is illustrated in Figure 11-1. Noise monitoring was undertaken continuously in one hour logging periods over the entire month of August 2020.

The noise monitoring was completed using A Rion NL-32 Class 1 Sound Level Meter with associated outdoor kit (outdoor casing, Rion WS-03SO1 Windscreen head assembly, Rion EC-04 2m Extension Cable & Rion NC-74 Class 1 Acoustic Calibrator). This instrumentation conforms to the requirements for integrating averaging sound level meters (Type 1) as specified in BS EN 60804. The sound level meter was accurately calibrated before use.

Measurements were made at a height of 1.2 – 1.5m above ground level. The weather conditions were in accordance with the requirements of BS7445: Description and Measurement of Environmental Noise and ISO 1996: Acoustics - Description, Measurement and Assessment of Environmental Noise.

The following parameters were recorded during each monitoring period:

L_{Aeq} The continuous equivalent A-weighted sound pressure level. This is an “average” of the sound pressure level.

L_{Amax}	This is the maximum A-weighed sound level measured during the sample period.
L_{Amin}	This is the minimum A-weighted sound level measured during the sample period.
L_{A10}	This is the A-weighted sound level that is exceeded for noise for 10% of the sample period.
L_{A90}	This is the A-weighted sound level that is exceeded for 90% of the sample period.

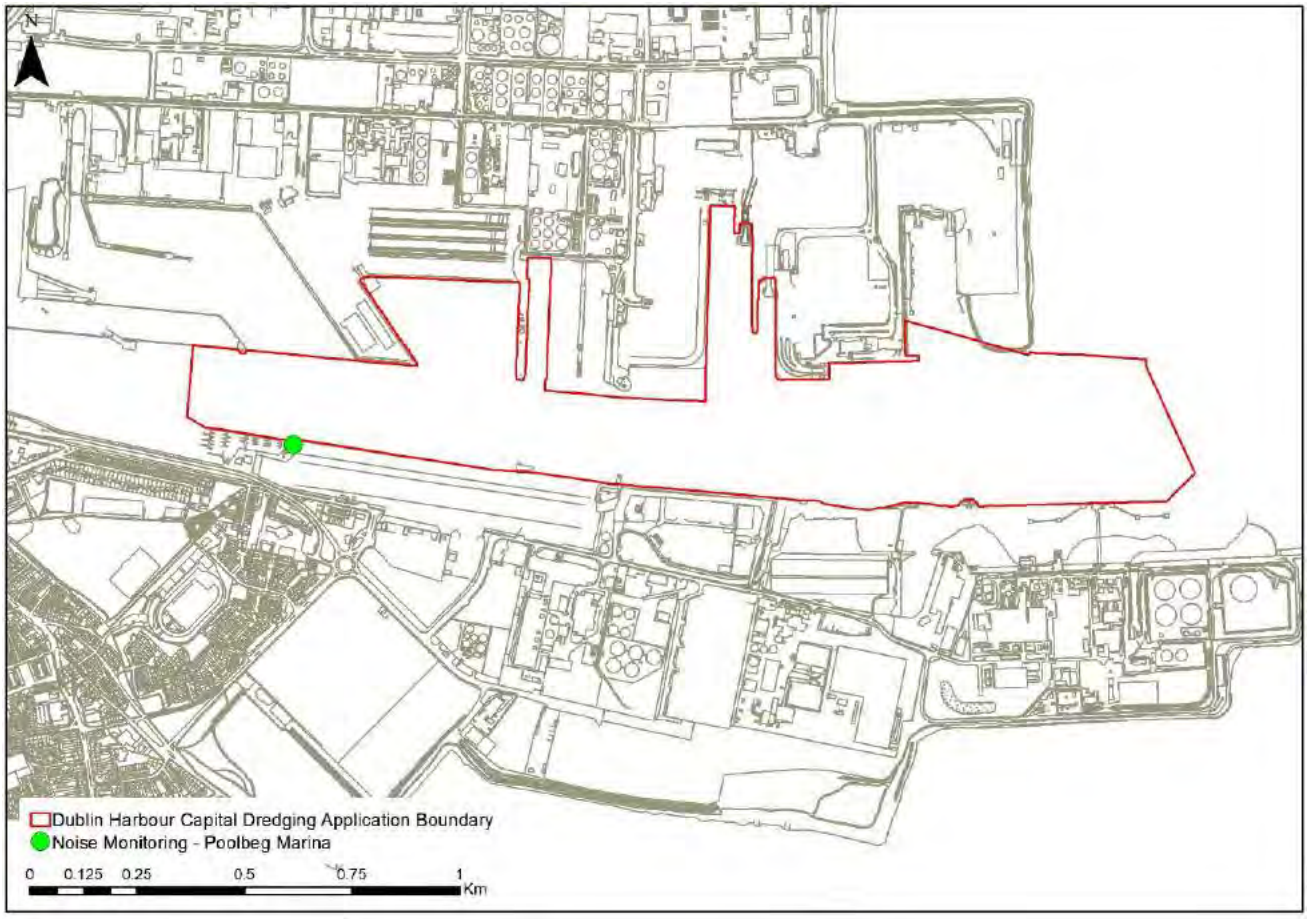


Figure 11-1 Noise Monitoring Location

11.2 Receiving Environment

11.2.1 Baseline Noise Survey

Section 11.1.4 provides a description of the noise monitoring methodology, including the noise monitoring location used. Figure 11-2 provides a graphical representation of the ambient noise levels (i.e. LAeq) recorded in one hour measurements during the daytime over a one month period (August 2020). This provides a large database to observe the change in ambient noise levels over a significant period of time. Figures 11-3 and Figure 11-4 illustrate the same information for the evening (i.e. 19:00 – 23:00) and night-time periods (i.e. 23:00 – 07:00) for the same month,

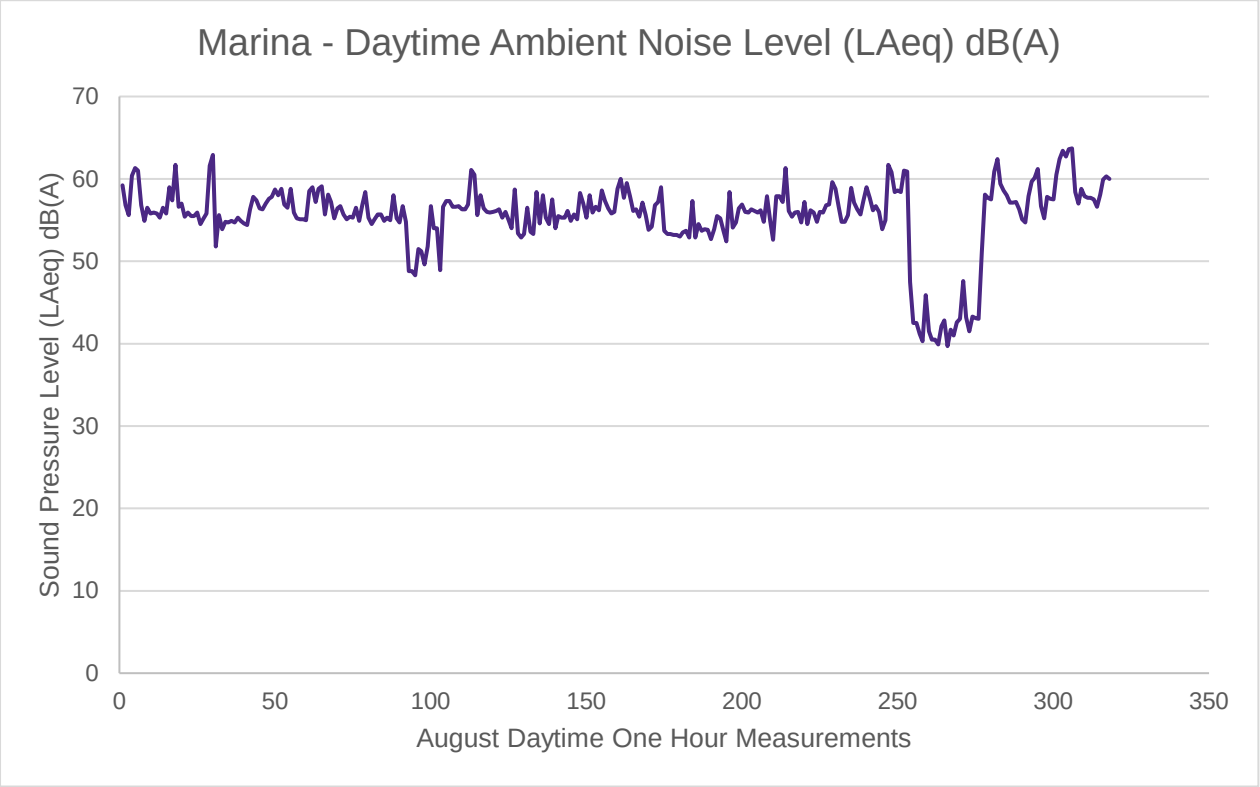


Figure 11-2 Daytime Noise Monitoring Data Recorded in August 2020 at the Marina

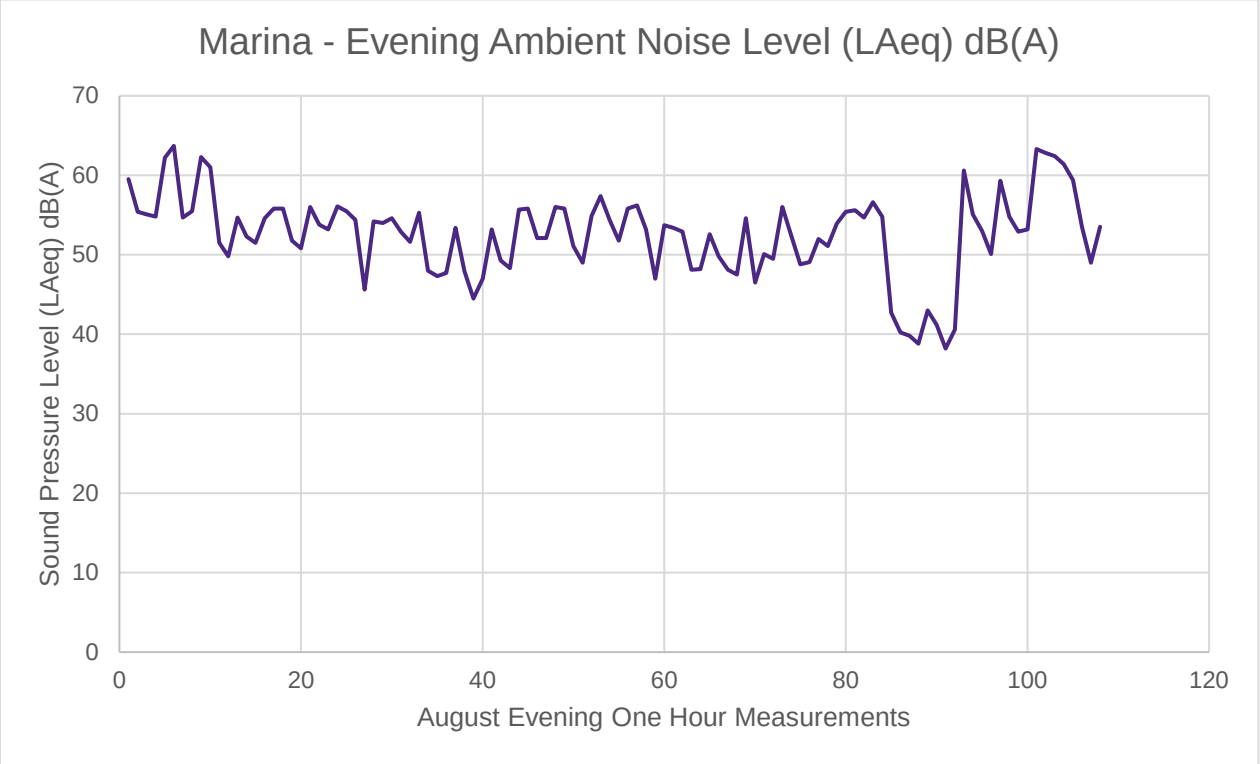


Figure 11-3 Evening Noise Monitoring Data Recorded in August 2020 at the Marina

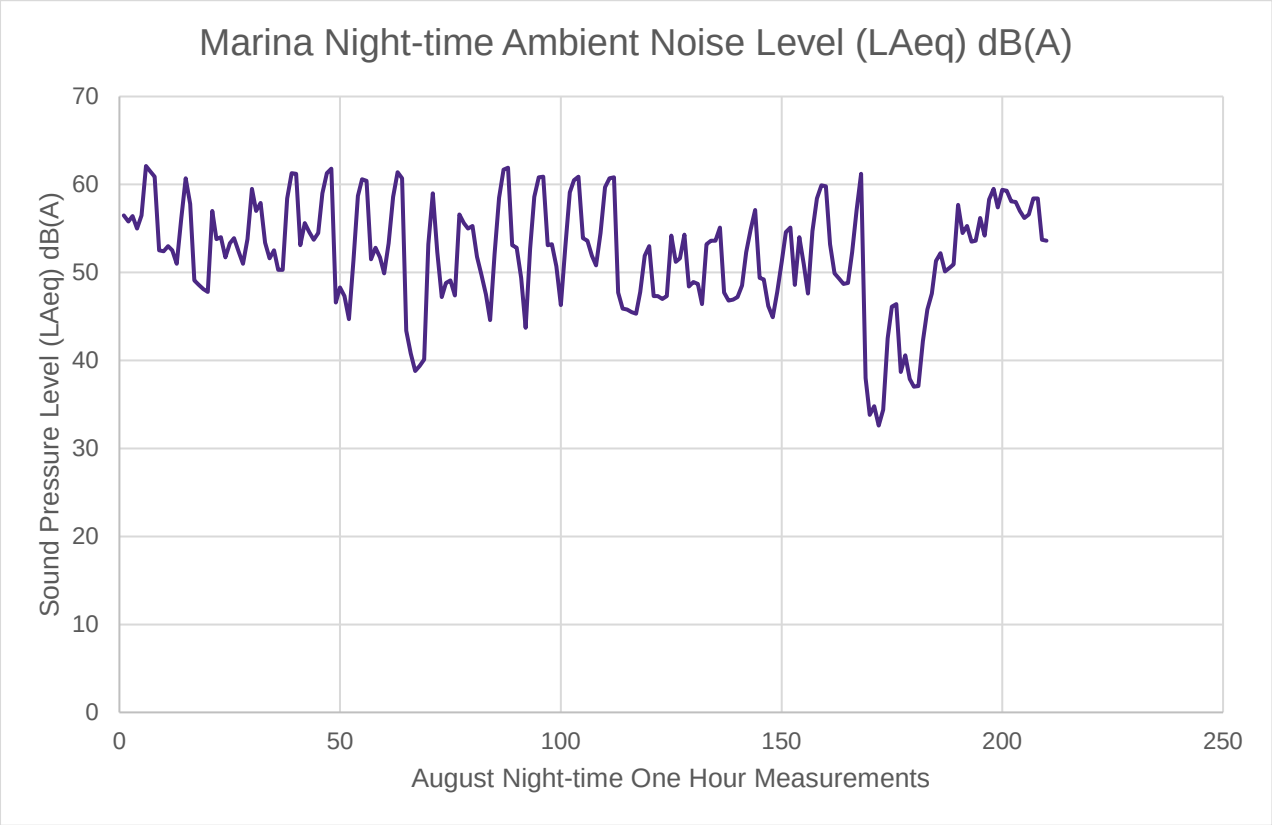


Figure 11-4 Night-time Noise Monitoring Data Recorded in August 2020 at the Marina

Figure 11-2 illustrates that daytime ambient noise levels recorded at the Marina are below 60dB(A) LAeq for greater than 90% of the measurement period. For the evening period, ambient noise levels are predominantly between 50 and 60dB(A). Figure 11-4 indicates that night-time ambient noise levels are also concentrated between 50 and 60dB(A). The noise monitoring location at the Marina is representative of the nearest noise sensitive properties at Coastguard Cottages and along Pigeon House Road.

As outlined in Section 11.1, the BS5228:2009+A1:2014 details a series of noise threshold limits based on the existing ambient noise levels recorded. On the basis of the recorded noise levels at the Marina during the baseline survey, the appropriate noise threshold limits for the dredging works using this methodology would be 65dB(A) for daytime, 60dB(A) for evening and 55dB(A) for the night-time period.

11.2.2 Noise Monitoring of Dredging Activity

In addition to the baseline noise monitoring survey detailed in Section 11.2.1, noise monitoring was conducted during periods when previous maintenance dredging was taking place at the port in September 2020. This activity afforded an opportunity to monitor noise levels while these activities were taking place with a view to determining the effects of the activities on measures noise levels. Figure 11-5 illustrates noise levels measured between 10th and 17th September 2020 when dredging activities were taking place. In the figure overleaf, the green lines represent the periods when dredging activities were taking place.

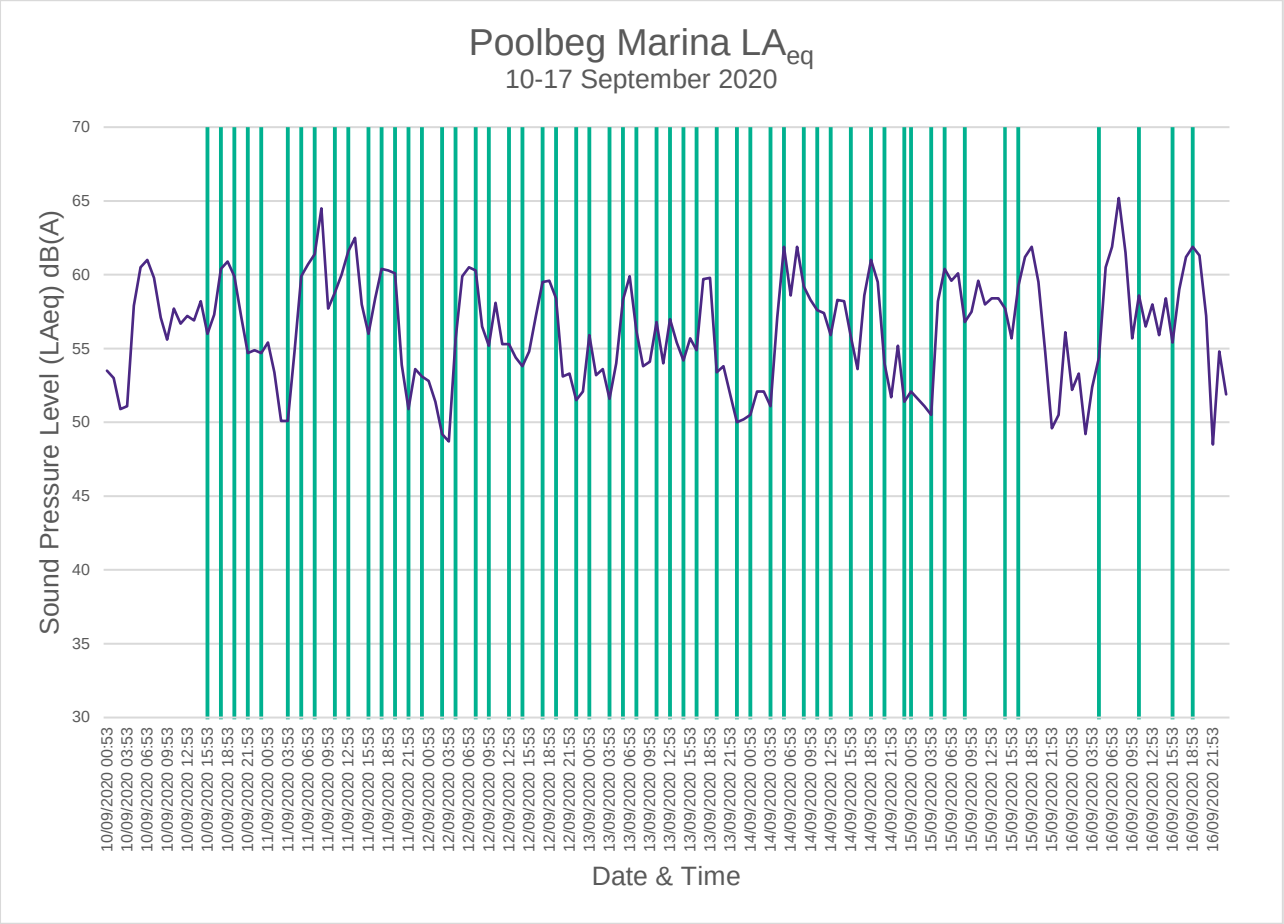


Figure 11-5 Noise Monitoring Data in September when Dredging Activities were Taking Place

The correlation of the noise monitoring data with the maintenance dredging activities that took place in September as illustrated in Figure 11-5 shows no pattern of elevated noise levels during periods when dredging was taking place. In general, the pattern of noise levels recorded during this period is similar to the pattern of recorded noise levels presented in the baseline survey completed in August 2020 (See Figures 11-2 – 11-4).

11.3 Likelihood of Impacts

11.3.1 Noise Assessment of Previous Dredging

Figure 11-5 presents noise monitoring from a period between 10th and 17th September 2020 when maintenance dredging activities were taking place in the same general area of the port as that which is proposed as part of this consent application. The figure demonstrates that periods when dredging activities were taking place do not correlate with periods of elevated ambient noise levels. In addition to this, comparison of the data from Figure 11.5 when dredging was taking place show no significant difference in the pattern of recorded ambient noise levels to the ambient noise levels recorded during the baseline survey (Figures 11.2 – 11.4).

11.3.2 Worst-Case Noise Assessment of Proposed Dredging

Section 11.3.1 provides an assessment of the data from dredging activities that took place within the port in September. This section contains an assessment of worst-case predictions of dredging noise from the proposed development.

The dredging process consists of a number of noise-emitting activities based on the different stages of sediment extraction, sediment transport and sediment disposal. Each of stages involves a number of noise emitting activities, which all combined make it difficult to define an accurate reference noise level to characterise the noise levels from an individual dredging activity.

The dredger to be used as part of the proposed development will be similar the dredger types previously used in the port by Boskalis over several years of capital dredging that has taken place at the port, including the dredging that was undertaken in September 2020 (See Figure 11-5). Over the last number of years, Boskalis have used a number of backhoe (e.g. Manu Pekki) and split hopper barges (e.g. Cork Sand & Long Sand) for capital dredging at the port.

Based on what dredger is used and what stage of activity is taking place, a worst case reference noise level in the range of 110 – 120 dB sound power level (L_W) at source is assumed. The nearest portion of the proposed dredging to the nearest noise sensitive receptors will be the nearest part of the main navigation channel to the properties at Pigeon House Road / Coastguard Cottages. The nearest distance between proposed dredging activity and the nearest property is approximately 150m.

On the basis of worst-case dredging taking place at the nearest point of dredging to the nearest property at Coastguard Cottages, a worst-case prediction of 58-68dB(A) is derived assuming no barrier attenuation between the dredging and the nearest property. This prediction is very much a worst-case derived level as some level of barrier attenuation will be in place in actuality. This worst-case predicted noise level will exceed some of the BS5229:2009+A1:2014 derived noise threshold limits for day (65dB), evening (60dB) and night-time (55dB) as presented in Section 11.2 if mitigation measures are not in place.

The worst-case assessment of dredging noise including in this section show there is potential for noise impacts during sensitive periods if appropriate mitigation measures are not in place. Section 11.5 provides a description of appropriate mitigation measures to ensure that there is no exceedance of the relevant noise threshold limits at the nearest noise sensitive properties.

11.3.3 Vibration

Dredging does not generate the same level of vibration as other typical construction activities such as piling or blasting. Based on the significant distance (i.e. minimum of approximately 150m) between the nearest part of the proposed dredging and the nearest sensitive receptors on Pigeon House Road / Coastguard Cottages, vibration levels at the nearest property from the proposed dredging will be less than the neutral impact level of 0.3 mm/s PPV as outlined in Table 11-8.

11.3.4 Potential Cumulative Noise Impacts

The assessment included in this chapter shows that there is potential for noise impacts from worst-case dredging activities at the nearest properties if the appropriate mitigation measures are not in place. The most significant potential for noise impacts from the proposed development will be during sensitive periods of the day (night-time and evening), when there will be no other proposed activities from other projects to generate a cumulative impact. The daytime dredging activities may take place at the same time as daytime construction activities associated with the ABR project, however there will be no significant cumulative noise impact from

both activities taking place at the same time as the ABR Project construction activities were predicted to be substantially below the relevant daytime noise threshold limits at the nearest properties.

11.4 Description of likely significant impacts

Section 11.3 contains a description of the noise and vibration impact assessment for the proposed capital dredging. This section contains an evaluation of the likely significance of impacts associated with the proposed dredging using the criteria of significance as described in Section 11.1.

11.4.1 Dredging Noise

Section 11.3 present the worst-case construction noise levels associated with the proposed capital dredging project. Section 11.3.2 indicates that there is potential for worst-case scenario to exceed the relevant BS5228:2009+A1:2014 threshold limit if worst-case dredging noise takes place on the nearest portion of the main navigation channel to the properties at Pigeon House Road / Coastguard Cottages during the most sensitive times of day (particularly night-time). In these circumstances, there is potential for a short-term moderate/major impact in accordance with the significance criteria outlined in Table 11-7.

However, it is anticipated that for the majority of dredging activities that noise levels will be below and most significantly below the relevant noise threshold limits as specified in BS5228:2009+A1:2014. This is also consistent with the noise monitoring data from the September 2020 dredging activities where it was observed that dredging activities did not elevate measured ambient noise levels (See Figure 11-5). On this basis, the magnitude of the potential impact is negligible and neutral for the majority of the dredging works in accordance with the significance criteria outlined in Table 11-7.

On the basis of the above assessment of likely significant impacts, Section 1.5 outlines mitigation measures to ensure that short-term worst-case dredging scenarios do not generate moderate/major noise impacts at the nearest properties to the proposed development.

11.4.2 Dredging Vibration

Dredging vibration levels will be neutral in accordance with the magnitude levels and significance criteria outlined in Table 11-8.

11.5 Mitigation Measures

Section 11.3 contains an assessment of the noise impact associated with the capital dredging proposals at the nearest noise sensitive properties. The assessment of the worst-case predicted construction noise levels using the ABC Method (BS5228:2009+A1:2014) and the NRA Guidelines (2004) indicates that there is potential for worst-case dredging noise levels to be above the relevant threshold limits included in these guidance documents under worst-case scenario.

As part of the planning for the dredging works activities, careful consideration will be given to the timing of works in the area of the main navigation channel closest to the nearest sensitive receptors on Pigeon House Road / Coastguard Cottages (See Figure 11-6 for indicative area). The works will be programmed so as to avoid the

worst-case dredging activities taking place in this area during the most sensitive times of day, particularly night-time (23:00 – 07:00).

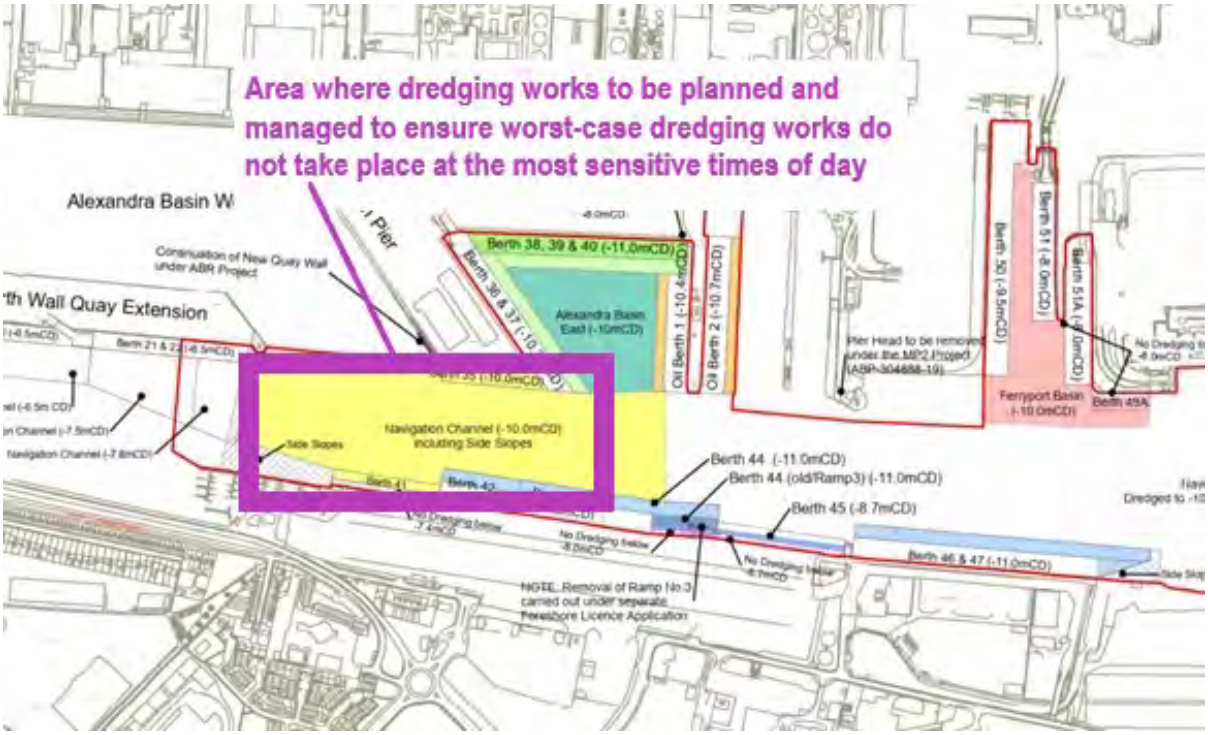


Figure 11-6 Sensitive Area where Dredging Works will be Planned to Avoid Worst-case Works at Sensitive Time Periods

British Standard BS5228:2009+A1:2014 – Noise and vibration control on construction and open sites: Part 1 - Noise outlines a range of measures that can be used to reduce the impact of construction phase noise on the nearest noise sensitive receptors. All some of the noise issues associated with construction sites are similar to those of a dredging activities, this guidance will be adhered to as part of the proposed development. Some of the proposed best practice measures from this guidance include:

- ensuring that mechanical plant and equipment used for the purpose of the works are fitted with effective exhaust silencers and are maintained in good working order;
- careful selection of quiet plant and machinery to undertake the required work where available;
- all major compressors will be ‘sound reduced’ models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use;
- any ancillary pneumatic percussive tools will be fitted with mufflers or silencers of the type recommended by the manufacturers;
- machines in intermittent use will be shut down in the intervening periods between work;
- ancillary plant such as generators, compressors and pumps will be placed behind existing physical barriers, and the direction of noise emissions from plant including exhausts or engines will be placed away from sensitive locations, in order to cause minimum noise disturbance.
- Handling of all materials will take place in a manner which minimises noise emissions;
- Audible warning systems will be switched to the minimum setting required by the Health & Safety Authority;

A complaints procedure will be operated throughout the dredging activities and all efforts will be made to address any noise issues that may arise at the nearest noise sensitive properties.

Dublin City Council's Air Quality Monitoring and Noise Control Unit have developed a 'Good Practice Guide for Construction and Demolition'. Some of the advice presented in this document is relevant to the proposed dredging activities. This document is consistent with the construction phase guidance documents referenced in this chapter and will be adhered to in addition to the mitigation measures outlined in this section.

Vibration

As outlined in Section 11.3, the proposed dredging activities are not likely to result in any significant vibration effects at the nearest sensitive properties.

British Standard BS5228:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and open Sites - Part 2: Vibration includes a range of measures for the reduction of vibration associated with various construction activities. The mitigation measures included in British Standard BS5228:2009+A1:2014, will be implemented to reduce vibration levels from the dredging activities to the lowest possible levels.

Continued Monitoring

DPC are committed to continuous terrestrial noise monitoring to be undertaken for the duration of the construction works in accordance with BS7445: Description and Measurement of Environmental Noise.

- All measurements will be made using Type 1 precision digital sound levels meters and associated hardware. The following parameters will be recorded as a minimum: LAeq, LAmax, LAmin, LA10 & LA90.
- The number and location of noise meters will be agreed with Dublin City Council. These will operate for the entire duration of the construction phase. A permanent secure noise monitoring station has previously been established at the marina adjacent to Pigeon House Road as part of the ABR Project. It is representative of nearest sensitive noise receptors and may prove to be an appropriate location for the Dublin Harbour Capital Dredging Project subject to approval as above.
- All data will be collected and analysed on a weekly basis and the analysed data will be fed back to DPC and the Contractors with a view to reviewing the compliance of construction phase activities in the context of any relevant conditions in planning approval if granted, and the thresholds/requirements included in the draft Noise Management Plan. This will also include any liaison requirement with Dublin City Council in this regard.
- Any noise nuisance issues associated with the capital dredging operations will be immediately assessed and analysed in relation to the recorded noise levels and all correspondence with DPC, the Contractor, Dublin City Council and the residents will be conducted with the appropriate level of urgency. This will include the appropriate liaison with DPC and the Contractor to control activities to ensure that the construction phase activities are in line with any relevant planning conditions and the CEMP.
- Interim synoptic reports will be produced on a regular basis, usually calendar months, and submitted to Dublin City Council and the project liaison group.
- Summary data and graphical outputs for each year of the construction phase will form part of an Annual Environmental Report. The data will be prepared in an analytical output that will aim to provide a concise

representation of the construction phase noise levels from the port and will aim to avoid presentation of lengthy datasets.

11.6 Residual Impacts

There will be no significant noise or vibration residual effects associated with the Dublin Harbour Capital Dredging Project.

11.7 Monitoring

Noise surveys will be conducted during the dredging works in accordance with BS7445: Description and Measurement of Environmental Noise. It is proposed that continuous noise measurements will be recorded at the existing DPC noise monitoring site adjacent to Poolbeg Marina for the duration of the dredging works. All measurements will be made using Type 1 precision digital sound levels meters and associated hardware. The following parameters will be recorded as a minimum: L_{Aeq}, L_{Amax}, L_{Amin}, L_{A10} & L_{A90}.

This monitoring programme will ensure that noise from dredging works will be within the noise threshold limits as outlined in Table 11-1 and Table 11-2 throughout the construction phase.

All data will be collected and analysed on a weekly basis and the analysed data will be fed back to DPC and the Contractors on a weekly basis with a view to reviewing the compliance of construction phase activities.

Any noise nuisance issues associated with the dredging works will be immediately assessed and analysed in relation to the recorded noise levels and all correspondence with DPC, the Contractor, Dublin City Council and residents will be conducted with the appropriate level of urgency. This will include the appropriate liaison with DPC and the Contractor to control activities to ensure that the construction phase activities are in line with the consents.

11.8 Conclusion

A detailed baseline noise monitoring survey was completed at a location representative of the nearest properties to determine the noise environment in the vicinity of the proposed redevelopment. This baseline noise monitoring survey was used as a basis for determining the likely noise impact associated with the proposed dredging activities.

The Noise and Vibration Assessment was completed with reference to a range of relevant Irish and international noise and vibration guidance documents.

Worst-case dredging noise levels from the proposed development completed at the most sensitive locations and most sensitive times have the potential to exceed the relevant noise threshold limits outlined in the relevant noise guidance documents if the appropriate mitigation measures are not in place. Noise mitigation measures are included in the EIAR to ensure that dredging noise impacts are reduced to the lowest possible levels and within the relevant threshold limits. There will be no significant vibration impact associated with the proposed development on account of the distance between the activities and the nearest sensitive receptors.

12 UNDERWATER NOISE

This Chapter of the EIAR presents an assessment of the likely underwater noise impacts associated with Dublin Harbour Capital Dredging Project within the port area, the River Liffey and the offshore disposal site at the entrance to Dublin Bay. A detailed description of the Dublin Harbour Capital Dredging Project is provided in Chapter 3 of this EIAR.

The Dublin Harbour Capital Dredging Project comprises capital dredging works contained to the area within Dublin Harbour shown in Figure 1-4 and Figure 1-5 (Chapter 1). It is proposed to dispose of the dredge spoil at the licenced offshore disposal site located to the west of the Burford Bank at the approaches to Dublin Bay as shown in Figure 1-6. The proposed capital dredging works will be restricted to the winter period (October – March). The potential effect of underwater noise on Biodiversity, Flora and Fauna is addressed in Chapter 7.

12.1 Underwater Noise Overview

Noise is defined as unwanted sound. Underwater noise arising from capital dredging has the potential to impact human activities such as diving and has the potential to impact on marine mammals and fish which are listed for protection under the EU Habitats Directive and Council Regulation. There are no recreational dive sites in the port area or near the disposal site so any potential underwater noise impact on human divers can be ruled out.

Similarly there are no significant effects on diving birds as the probability of interaction is extremely unlikely. Based on comparisons to human hearing underwater and an understanding of avian hearing physiology, hearing is not a useful mechanism for birds underwater (Dooling & Therrien, 2012). An assessment of the effect of underwater noise on diving birds has been screened out for these reasons.

Underwater noise is quantified in frequency (Hertz) and intensity (decibels). The decibel (symbol: dB) is a unit of measurement used to express the ratio of one value of a physical property to another on a logarithmic scale. It can be used to express a change in value (e.g., +1 dB or −1 dB) or an absolute value. In the case of underwater noise absolute values, it expresses the ratio of an underwater sound pressure to a reference value of 1 micropascal (µPa).

When used in this way, the decibel symbol is appended to indicate the reference value, for example, 180 dB re 1 µPa. The level in decibels is entirely dependent on the reference level. It is important to note that the reference level for airborne noise is different and the acoustic impedance of air and water are also different. This leads to a significant difference in decibel levels for the same sound pressure level. Decibel levels in water are significantly higher and cannot be compared directly to decibel levels in air.

Another important consideration in relation to noise is that it is not a persistent pollutant, once the noise source ceases noise levels drop very quickly to pre-existing levels. The natural underwater soundscape is not silent, biological sounds from fish and marine mammals are mixed with sounds from waves and surface noise, current flow and turbulence and rain and storm noise. The ambient noise levels in coastal water, bays and harbours are subject to wide variations, particularly with breaking waves. Wind speed determines wave activity and underwater noise levels significantly. An increase of 7.2 dB in underwater noise levels was found by Piggott (1965) to result from the doubling of wind speed.

The Capital Dredging Project is described in detail in Chapter 3. The principal underwater noise impacts will arise from the following activities:

- Dredging of the navigation channel, basins and berthing pockets;
- Disposal of the dredged material at the licenced dump site at the entrance to Dublin Bay located to the west of the Burford Bank.

12.2 Assessment Methodology

This underwater noise assessment comprises of a description of the receiving environment, a description of likely significant impacts, recommendations for remedial measures, a statement of residual impacts and monitoring proposals. The methodology used for this assessment is consistent with best practice for underwater noise assessments and includes interaction with the benthic & fisheries and marine mammal specialists.

Dublin Bay has been monitored and underwater noise levels reported on several occasions. The shipping traffic noise levels are determined by the proximity to passing vessels. Construction and dredging noise occur sporadically from maintenance activities and in recent years from the construction of the ABR Project. This assessment is based on reporting of a number of measurements which describe the receiving environment, followed by a description of the activities likely to give rise to underwater noise. The potential impacts are described and evaluated. Mitigation measures are recommended along with monitoring requirements.

12.2.1 Receiving Environment

Underwater noise levels can be divided into three typical categories:

1. Background noise level (no dominant sound, low noise level);
2. Biological noise level (louder sounds not attributable to anthropogenic sources); and
3. Anthropogenic noise (louder sounds attributable to human activity such as shipping traffic or construction).

Dublin Bay is home to Dublin Port and Dun Laoghaire Harbour along with a number of smaller harbours and marinas. Marine traffic includes: large cargo ships, passenger cruise ships, large ferry vessels, fast ferries, trawlers and leisure traffic. The main shipping channels from the Irish Sea are north and south of the Burford Bank towards the Great South Wall light and into the dredged shipping channel on the eastern approaches to the port up the River Liffey as far as the East-Link/Tom Clarke Bridge.

The central port area from Berth 53 to the Alexandra Basin West is heavily trafficked on a daily basis. This working area in Dublin Port is relatively noisy in comparison to the greater Dublin Bay area. Noise in the port area comes from shipping and a multitude of industrial sources. The port is accessed via the dredged channel which extends some 2.5 km from the Great South Wall light to Berth 53. The channel is approximately 200 m wide and is currently 8-10 m deep. This narrow shallow channel has the effect of confining noise from the port within that area and a short section of the channel and the River Liffey upstream.

All traffic to and from port uses the dredged navigation channel to the eastern end of the Great South Wall and then heads either north or south of the Burford Bank. West of the Great South Wall light in the dredged channel, noise levels are elevated in the navigation channel as a vessel passes but again fade quickly. The outer Dublin

Bay area is also a shallow water area (<30 m deep) and underwater sound does not propagate efficiently, resulting in short elevations in noise levels while a vessel is passing by.

12.2.2 Sensitivity of the Receiving Environment

The receiving environment during the construction phase is an enclosed section of a busy port. Existing underwater noise levels in the area are elevated in the presence of shipping traffic but noise attenuates quickly due to absorption by the mud on the seabed. From an underwater noise perspective any sources of additional noise will be confined to an area close to the source and attenuate rapidly.

The site is noise sensitive due to the proximity of marine species including fish; Salmon, River Lamprey, Sea Lamprey, Eel, Smelt and Shad, and marine mammals, primarily the resident seal population and Harbour Porpoise associated with the nearby Special Area of Conservation. The underwater noise impact thresholds used in this chapter are set out generally in Popper et al. (2014), NPWS (2014), NOAA (2013) and Finneran & Jenkins (2012).

The outer part of Dublin Bay is a popular recreational diving location, with scenic dives at Scotsman's Bay, Sandycove, Muglins Rock, Dalkey Island and Irelands Eye. Popular wreck sites include the Queen Victoria and other wreck sites further out. The closest of these sites (Scotsman's Bay) is located some 6 km from the end of the Great South Wall, which is in turn 2 km from the nearest dredging activity.

Noise levels from dredging and construction in the port will be contained in the dredged channel close to the source and will not propagate out to the wider bay area. Shipping entering or leaving the port will result in localised increases in noise levels in the outer bay.

12.2.3 Strive Report (2011)

Underwater noise levels were measured at locations around Ireland, including Dublin Bay and reported for the EPA by Beck et al. (2012). For Dublin Bay, the noise monitoring equipment was located on the -10m CD contour line on two sites, north and south of the main shipping channel. Weather conditions at each location during the measurements were fair weather with winds of less than 10 knots. Background noise levels are expected to be higher in adverse weather conditions.

The results were reported as broadband (5 Hz to 20 kHz) RMS values. At the northern side of Dublin Bay, noise levels were between 125 dB and 135 dB re 1 µPa across all frequency bands whereas at the southern site the noise levels were marginally higher, while still remaining below 140 dB re 1 µPa. At the northern site, the low-frequency components (below 100 Hz) were about equal for all noise whereas at the southern end the biological and background noise levels do not appear to have these low-level frequency components. There were significant temporal variations, related to shipping activity and what appears to be an elevated noise level during night hours when compared with daytime.

Shipping noise is dependent on the level of shipping traffic. It is similar to road traffic in the sense that a busy international shipping channel is like a motorway, i.e. has a constantly high level. For the majority of Irish waters shipping noise is like road traffic noise on a rural road. As a car/ship goes by there is an elevated level and the noise returns to background levels quickly thereafter.

12.2.4 ABR Project

The Alexandra Basin Redevelopment (ABR) Project (29N.PA0034) is currently underway in the port. During the course of construction underwater noise levels were measured in 2017 and reported Table 12-1. The background noise levels are higher than those reported for the outer Dublin Bay area in Section 12.2.3. Elevated levels due to shipping were similar to the outer bay area in that the levels rose for the short period when the ship was passing.

Table 12-1 Underwater noise levels measured in the port area 2017

Source	North Wall Light		ESB Dolphin	
	SPL_{max} dB re 1µPa @ 1m	SEL dB re 1µPa²-s	SPL_{max} dB re 1µPa @ 1m	SEL dB re 1µPa²-s
Background	150	<132	140	110-120
Shipping	165	150	165	150
Piling	180	140	-	-

12.2.5 2017 Piling Noise 2020

Further monitoring was carried out while piling and dredging were taking place in October and November 2020. During pauses in the piling and dredging activity background noise levels were measured in the centre of the navigation channel at Berth 35. The background noise levels are shown in Table 12-2.

Table 12-2 Underwater noise levels measured in the port area 2020

Source	Berth 35	
	L_{peak} dB re 1µPa @ 1m	SEL dB re 1µPa²-s
Background 6th October 2020	115-130	100-110
Background 6th October 2020	135-140	120-125

Baseline noise levels are consistently 100-130 dB re 1 µPa in the area, a level at which no adverse impacts will arise. Shipping traffic or construction activity increase the noise levels over short periods. Measurements to date of shipping noise and construction noise indicate that while there may be some potential short-term disturbance to marine mammals close to specific sources, no injury thresholds are exceeded.

12.3 Likelihood of Impacts

Dublin Port has been in operation for over 300 years with motorised vessels for over 100 years. The North Quay Wall was constructed 150 years ago and the port area has centred on the two Alexandra Basins throughout this time. The level of motorised traffic has increased but there is no extended period with continuous traffic/noise. Underwater noise levels related to the capital dredging will increase temporarily and revert to shipping traffic related noise once completed.

Sound transmission in shallow water is highly variable and site specific because it is strongly influenced by the acoustic properties of the bottom and surface as well as by variations in sound speed within the water column (Richardson et. al., 1995). With shallow water sound transmission, the combination of environmental factors

makes it difficult to develop accurate theoretical models. The theory must be combined with site-specific empirical data to obtain reliable propagation predictions.

There are two main impacts to be assessed: dredging and spoil dumping.

12.3.1 Dredging

The extent of dredging operations is discussed in Chapter 3 Project Description. Dredging will be carried out using a Trailing Suction Hopper Dredger (TSHD) and/or a backhoe dredger. Other ancillary equipment will include a survey vessel and bed- leveller to remove peaks and troughs created by the dredger. The most significant underwater noise source will be the TSHD. The TSHD is smaller than many of the vessels using the port but is characterised by the pumping noise and material transport through the suction pipe.



Figure 12-1 TSHD Waterway operating in Dublin Port

The operation comprises of the vessel moving into position and lowering the suction pipe. Material is pumped into the vessel as it transits a specific path, generally finishing in a west to east direction. The suction pipe is hauled on board and the vessel heads off to the spoil ground.

12.3.2 Dumping

The dredged material is disposed of at the licenced dump site at the entrance to Dublin Bay located to the west of the Burford Bank. The TSHD arrives from the port and carries out a watch for marine mammals or any hazards that might impede the dumping. Once the all-clear is given the doors underneath the vessel open and the material is discharged to the seabed. This is completed in a matter of minutes as the dredge spoil is not consolidated.

Once discharged the dredger returns to the port to repeat the process. Dredging continues on around the clock basis subject to weather and other constraints.

12.3.3 Underwater Noise Sources

Source levels for underwater noise sources are quoted in dB re µPa at 1 metre. This is a 'notional' figure extrapolated from far field measurements as it is not practicable to measure sound levels at one metre from an active source such as a ship. Measurements are taken in what is known as the far field and extrapolated back to a notional 1 metre from the idealised point source. It is usual to take measurements at several hundred metres or kilometres in deep water and extrapolate the measured levels to what has become known as a 1 m source level. This is illustrated in Figure 12-2.

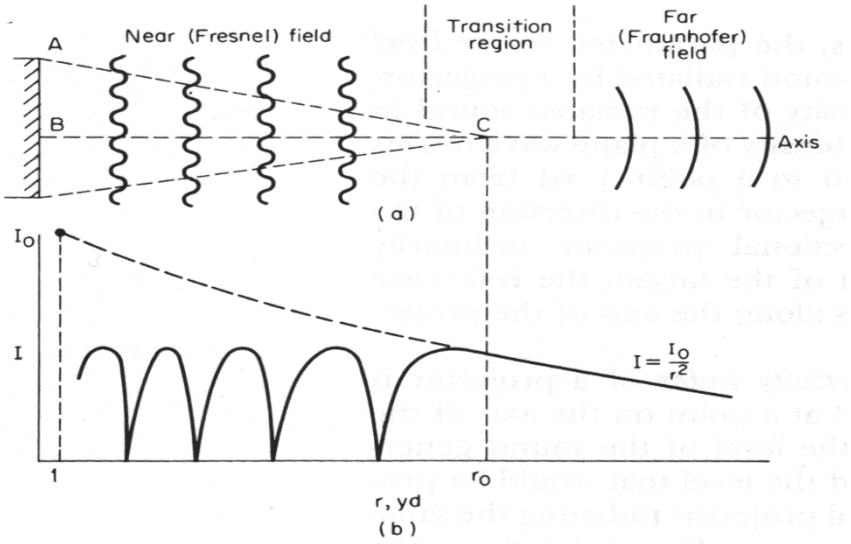


Figure 12-2 Underwater Noise source level fields (Urich 1983, fig. 4)

The actual underwater sound level in the near (Fresnel) field produces an undulating (solid line) curve which arises from destructive interference. The extrapolated (dashed line) curve indicates a much higher theoretical source level which does not arise in practice.

This extrapolation leads to apparently high values for the source level and can lead to erroneous conclusions about the impact on marine mammals and fish for the following reasons:

- Far field source levels do not apply in the near field where the sources do not add coherently; sound levels in the near field are, in fact, lower than would be expected from far field estimates.
- Source level calculations are generally based on theoretical point sources with sound propagating equally in all directions. This is an idealised source which is not replicated in real world conditions. The majority of published data for underwater sources is based on deep water measurements. Sound propagation in shallow water is significantly more complex and sounder does not propagate as efficiently as it would in deep water.

A table of typical underwater noise levels is set out below in Table 12-3.

Table 12-3 Table of typical underwater noise levels

Source	SPL dB re:1µPa @ 1m	SEL dB re: 1µPa^2-s	Sound Duration seconds	Peak Frequency Hertz	Bandwidth Hertz
Super Tanker 337m long @ 18 knots	185	-	constant	23	5-100
Dredging (Suction/Hopper dredge)	177	-	constant	80-200	20-8,000
Tug vessel (while towing)	145-170	-	constant	-	37-5,000
Fishing vessel (12m long @ 7 knots)	150	-	constant	300	250-1000

The operation of dredgers on silty material results in underwater noise levels in the same range as shipping traffic. While the dredger is operating suction equipment, it is travelling at slow speed. Shipping traffic in the area is usually larger vessels, generally travelling at higher speeds or manoeuvring using thruster engines.

RPS has carried out underwater noise measurements from two dredging operations in Dublin Port.

Underwater Noise Monitoring during dredging at Dublin Port 14th July 2016

The TSHD 'Freeway' (LOA 91.2 m, beam 19 m, Gross Tonnage 4,320T) was dredging the channel of silty sand and dumping the material at the licenced dump site at the approaches to Dublin Bay. Port activity was high and with other boats passing by during the operation and it was not possible to completely isolate the dredging noise. Nonetheless two measurements were taken during dredging operations and one measurement was taken at the disposal site. The results of the measurements are shown in Table 12-4

Table 12-4 Noise Level Results for Dredging Operations and Dumping

Activity	Time [UTC]	Station	Range	dB re 1 µPa SPL_{PEAK}	dB re 1 µPa^{2}s SEL
Dredging	14/07/2016 12:24:30	A	268	146.03	133.6
	14/07/2016 12:37:00	B	213	151.65	138.0
Dumping	14/07/2016 13:25:00	C	90	153.03	142.7

Underwater Noise Monitoring during dredging at Dublin Port 3rd November 2020

The TSHD 'Waterway' (LOA 97.7 m, beam 23m, Gross Tonnage 5,395T) was dredging in the central port area. A measurement was made during a pass-by with the closest point of approach at 60 metres. Noise levels at that point are shown in Figure 12-3. The peak noise level was 163 dB re 1 µPa and the SEL was 144 dB re 1 µPa^{2}s. These levels are in line with the measurements taken in 2016 and significantly below the injury thresholds for fish or marine mammals.

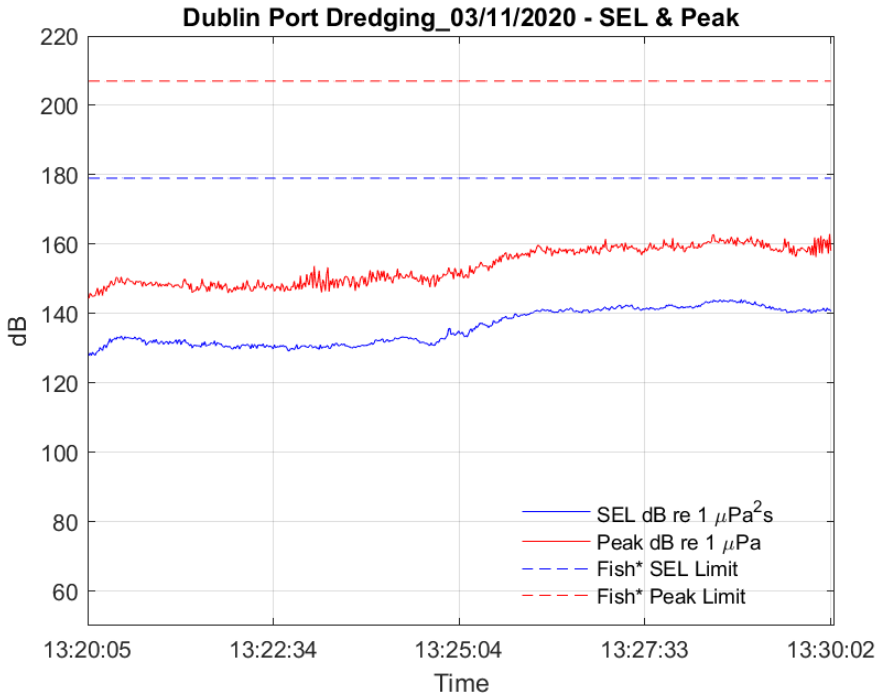


Figure 12-3 Noise levels during pass-by of TSHD Waterway

12.4 Description of likely significant impacts

The criteria used to assess the significance of the underwater noise impacts is presented in Table 12-5. Underwater noise criteria are the subject of ongoing research. In many cases, species specific data is sparse or does not currently exist and has to be extrapolated from similar species. The criteria are selected from best international practise and publications. The threshold for mustelids is taken from the only available guideline which provides a threshold for sea otters because there is no published threshold for the Eurasian otter.

Table 12-5 Underwater Noise Impact Criteria

Category	Impact Type	Threshold dB	Criteria	Data Source
Human Diver	Annoying but not harmful	160 dB re: 1µPa SPL_{Peak}	Peak	Norro et al (2010)
	Just audible	145 dB re: 1µPa SPL_{RMS}	RMS	Parvin et al. (2002)
Fish	Mortality of fish eggs and larvae	210 dB re 1µPa^{2}s	SELcum	Popper *et al*., (2014)
		207 dB re: 1µPa SPL_{Peak}	Peak	Popper *et al*., (2014)
	Mortality/ PTS in adult fish*	207 – 219 dB re 1µPa^{2}s	SELcum	Popper *et al*., (2014)
		207 – 213 dB re: 1µPa SPL_{Peak}	Peak	Popper *et al*., (2014)
	Recoverable injury in adult fish*	203 – 216 dB re 1µPa^{2}s	SELcum	Popper *et al*., (2014)
		207 – 213 dB re: 1µPa SPL_{Peak}	Peak	Popper *et al*., (2014)
	Temporary Threshold Shift (TTS)	186 dB re 1µPa^{2}s	SELcum	Popper *et al*., (2014)
Cetaceans	Permanent Threshold Shift (PTS) [SPLPeak]	230 dB re: 1µPa SPL_{Peak}	Peak	NPWS (2014)
		198 dB re 1µPa^{2}s	SEL	NPWS (2014)
	Behaviour effects	160 dB re: 1µPa SPL_{RMS}	RMS	NOAA (2013)

Category	Impact Type	Threshold dB	Criteria	Data Source
Pinnipeds	Permanent Threshold Shift (PTS) [SPLPeak]	218 dB re: 1µPa SPL_{Peak}	Peak	NPWS (2014)
		186 dB re 1µPa^2s	SEL	NPWS (2014)
Mustelids (Sea Otters)	Permanent Threshold Shift (PTS)	220 dB re 1µPa^2s	SEL	Finneran & Jenkins (2012)

12.4.1 Underwater Noise Sources

The underwater noise sources for the capital dredging programme will be similar to the TSHDs used in 2016 and 2020. The source levels are not such to cause injury to marine mammals or fish. As can be seen in Table 12-5 there is potential for behavioural effects of marine mammals.

12.4.2 Underwater Noise Impacts

The scale of the capital dredging is described in Chapter 3. The underwater noise levels are such that they could cause behavioural effects in marine mammals at a range of 60-90 metres. Such behavioural effects are also likely to occur due to vessel presence at the same range. No injury to a marine mammal of fish species will arise due to underwater noise.

As can be seen from this description, the dredging activity, while carried out continuously over an extended period will only impact a relatively small footprint at any one time. The extent of any impact will therefore be limited spatially and remain below a threshold of injury.

12.4.3 Potential Cumulative Effects

Construction work is currently underway for the ABR Project which is due to be completed by 2025 and the MP2 Project is scheduled to start in 2022, subject to the granting of Foreshore and Dumping at Sea consent. There is a potential overlap with the ABR Project and MP2 Project. The port is carrying on normal operations which includes shipping traffic and port activities. Maintenance dredging is also carried out at Dublin Port. The proposed capital dredging works will be restricted to the winter period (October – March). Maintenance dredging will be restricted to the summer period (April – September). The cumulative impact of maintenance dredging noise and capital dredging noise will therefore not arise. Table 12-6 shows a summary of the likely underwater noise impacts from capital dredging in Dublin Port

Table 12-6 Summary of Underwater Noise Impacts

Impact	Magnitude	Sensitivity	Significance
Underwater noise while dredging	Below injury threshold Limited possibility of behavioural response	Annex II Species	Negligible

12.5 Mitigation Measures

The impact from underwater noise is quite limited, based on the measured underwater noise levels for similar scale works being carried out in 2016 and 2020.

The underwater noise levels arising during capital dredging will not result in harm to marine mammals or fish. Specific mitigation measures and compliance with NPWS (2014) guidelines suggest the use of a MMO on board

the vessel to keep a watch for marine mammal activity. This should avoid the risk of injury to marine mammals from a vessel strike and ensure that the waters in the immediate vicinity of the vessel are free from marine mammals prior to deposition of the dredged material at the dump site. No specific mitigation for underwater noise is recommended.

12.5.1 Monitoring

Underwater noise monitoring has been carried out on two previous occasions and indicated that underwater noise levels from dredging activity will not result in any significant environmental impacts. The proposed capital dredging is of a similar scale using similar equipment and methodology. No specific monitoring of underwater noise levels is required in these circumstances.

12.6 Conclusions

Site specific underwater noise levels have been measured during dredging in Dublin Port and at the disposal site. These measurements clearly indicate that dredging noise levels are low and the proposed capital dredging works at Dublin Port will not cause any significant environmental impact.

13 MATERIAL ASSETS – COASTAL PROCESSES

This Chapter of the EIAR assesses the potential impact of the Dublin Harbour Capital Dredging Project on the coastal processes within the inner Liffey channel and Dublin Bay areas by means of an extensive numerical modelling programme. It includes information on the tidal regime and the inshore wave climate in order to assess the potential impacts of dredging within the dredge loading areas and dumping activities at the licenced offshore disposal site located at the approaches to Dublin Bay to the west of the Burford Bank.

13.1 Dredging Operations

The location of the proposed areas to be dredged (loading areas) and the existing licenced offshore dump site are presented in Figure 1-5 and Figure 1-6 (Chapter 1).

The total estimated dredge volume is estimated to be 500,000m^3 over the eight year period. This equates to 825,000 Tonnes (wet weight). The material to be dredged comprises clays, silts, sands and gravels with occasional cobbles; no dredging of rock is required. Capital dredging works will be restricted to the winter period October – March inclusive.

13.2 Assessment Methodology

13.2.1 Modelling Methodology

RPS used the MIKE 21/3 hydrodynamic numerical modelling software package, developed by DHI, to assess the potential impact of the capital dredging on the coastal processes of the inner Liffey channel (Dublin Harbour) and Dublin Bay. This was achieved by developing two and three dimensional numerical models of the Dublin Bay area.

These models were used in conjunction with hydrographic survey data and site-specific water quality monitoring data to assess the impacts of the dredging operations in context of the following coastal processes:

- The dispersion and settlement of sediment plumes generated during dredging operations; and
- The dispersion of sediment material disposed of at the spoil site.

To conclude the assessment, mitigation measures are proposed to reduce impacts, where appropriate. This enables a “with mitigation” assessment to be made of any residual impact as a result of the capital dredging campaigns and/or in combination with other projects in the vicinity of Dublin Port and the offshore disposal site.

13.2.2 Coastal Process Modelling Software

A suite of coastal process models, based on the MIKE software developed by DHI, was used to assess the potential impact of the Dublin Harbour Capital Dredging Project on the coastal processes within the inner Liffey channel and Dublin Bay.

The MIKE system is a state of the art, industry standard, modelling system, based on a flexible mesh approach. This software was developed for applications within oceanographic, coastal and estuarine environments.

A brief synopsis of the MIKE system and modules used for this assessment is outlined overleaf:

1. **MIKE 21 & MIKE 3 Flow Model FM system** - Using these flexible mesh modelling systems, it is possible to simulate the mutual interaction between currents, waves and sediment transport by dynamically coupling the relevant modules in both two and three dimensions. Hence, a full feedback of the bed level changes on the waves and flow calculation can be included.

2. **The Hydrodynamic module** –This module is capable of simulating water level variations and flows in response to a variety of forcing functions in lakes, estuaries and coastal regions. The HD Module is the basic computational component of the MIKE 21 and MIKE 3 Flow Model systems providing the hydrodynamic basis for the Sediment Transport and Spectral Wave modules

3. The Hydrodynamic module solves the two/three-dimensional incompressible Reynolds averaged Navier-Stokes equations subject to the assumptions of Boussinesq and of hydrostatic pressure. Thus the module consists of continuity, momentum, temperature, salinity and density equations. When being used in three dimensions, the free surface is taken into account using a sigma coordinate transformation approach whereby the vertical layer is divided equally into a discrete number of layers.

4. **The Spectral Wave module** – This module simulates the growth, decay and transformation of wind-generated waves and swell in offshore and coastal areas and accounts for key physical phenomena including wave growth by wave action, dissipation, refraction, shoaling and wave-current interaction.

5. **The Sediment Transport module** - The Sediment Transport Module simulates the erosion, transport, settling and deposition of cohesive sediment in marine and estuarine environments and includes key physical processes such as forcing by waves, flocculation and sliding. The module can be used to assess the impact of marine developments on erosion and sedimentation patterns by including common structures such as jetties, piles or dikes. Point sources can also be introduced to represent localised increases in current flows as a result of outfalls or ship movements etc.

13.2.3 Coastal Process Models and Data Sources

The model used to assess the impact of the capital dredging on the coastal processes was developed from the RPS' present-day Dublin Bay model. RPS' present-day Dublin Bay Model was created using flexible mesh technology to provide detailed information on the coastal processes within the inner Liffey channel (Dublin Harbour) and Dublin Bay. The model has mesh sizes varying from 250,000 m^2 (equivalent to 500m x 500m squares) at the outer boundary of the model down to a very fine 225 m^2 (equivalent to 15m x 15m squares) along the approach channel and around the harbour channel (as presented in Figure 13-1). The bathymetry of this model was developed using data gathered from a hydrographic survey of the Dublin Port and Tolka estuary undertaken in 2017. It was supplemented with data from the Irish National Seabed Survey, INFOMAR and other local surveys collated by RPS for the Irish Coastal Protection Strategy Study (ICPSS, 2003). The extent, mesh structure and bathymetry of this model is illustrated in Figure 13-1.

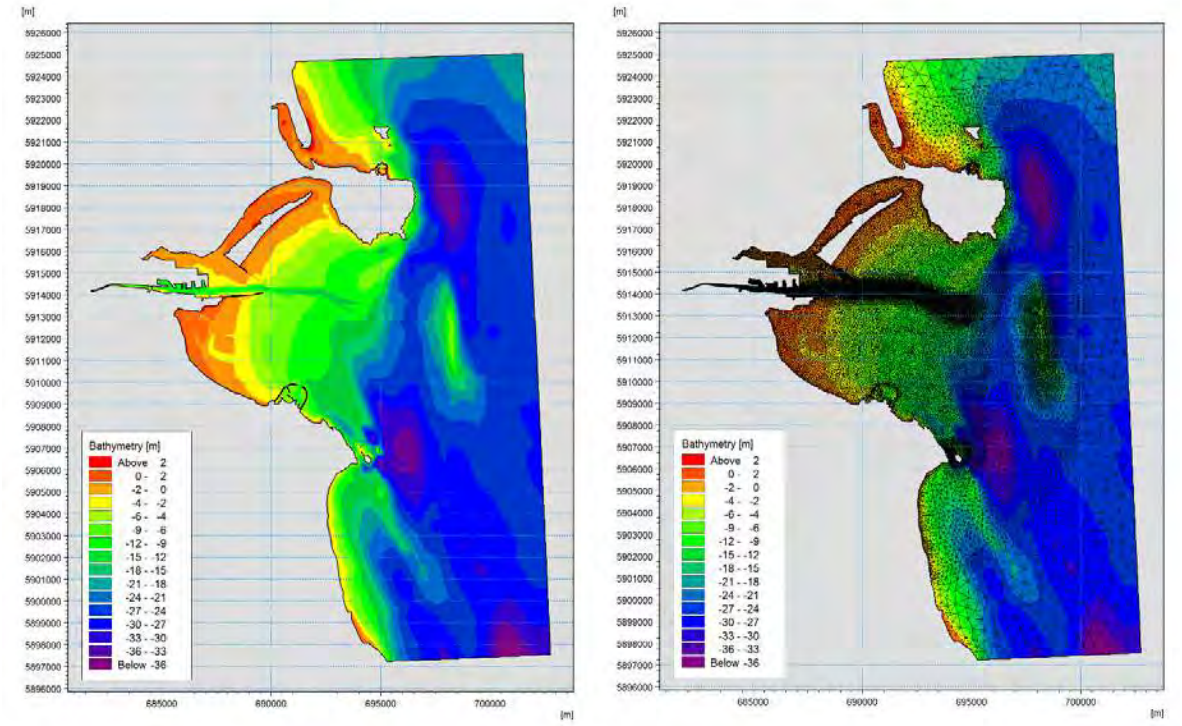


Figure 13-1 Extent and bathymetry of the Dublin Bay model (left) and the mesh structure of the Dublin Bay model (right)

The Dublin Bay model was then updated to produce 3D models that represent the project scenario (in this case, the post-Alexandra Basin Redevelopment (ABR) Project layout within Dublin Port and Dublin Bay). This model was used to appraise the impact of the capital dredging loading and dumping operations.

As illustrated in Figure 13-3, the offshore boundary of the post ABR Project scenario model extends from the Ben of Howth to Dalkey and includes the Dublin Bay area. This 3D model is comprised of five discrete vertical sigma layers and was used to assess the sediment plumes generated during the various dredging operations within Dublin Port. The bathymetry of post ABR project in the Dublin Port area is illustrated in Figure 13-2.



Figure 13-2 Bathymetry of the Dublin Port post ABR model – levels illustrated to Mean Sea Level

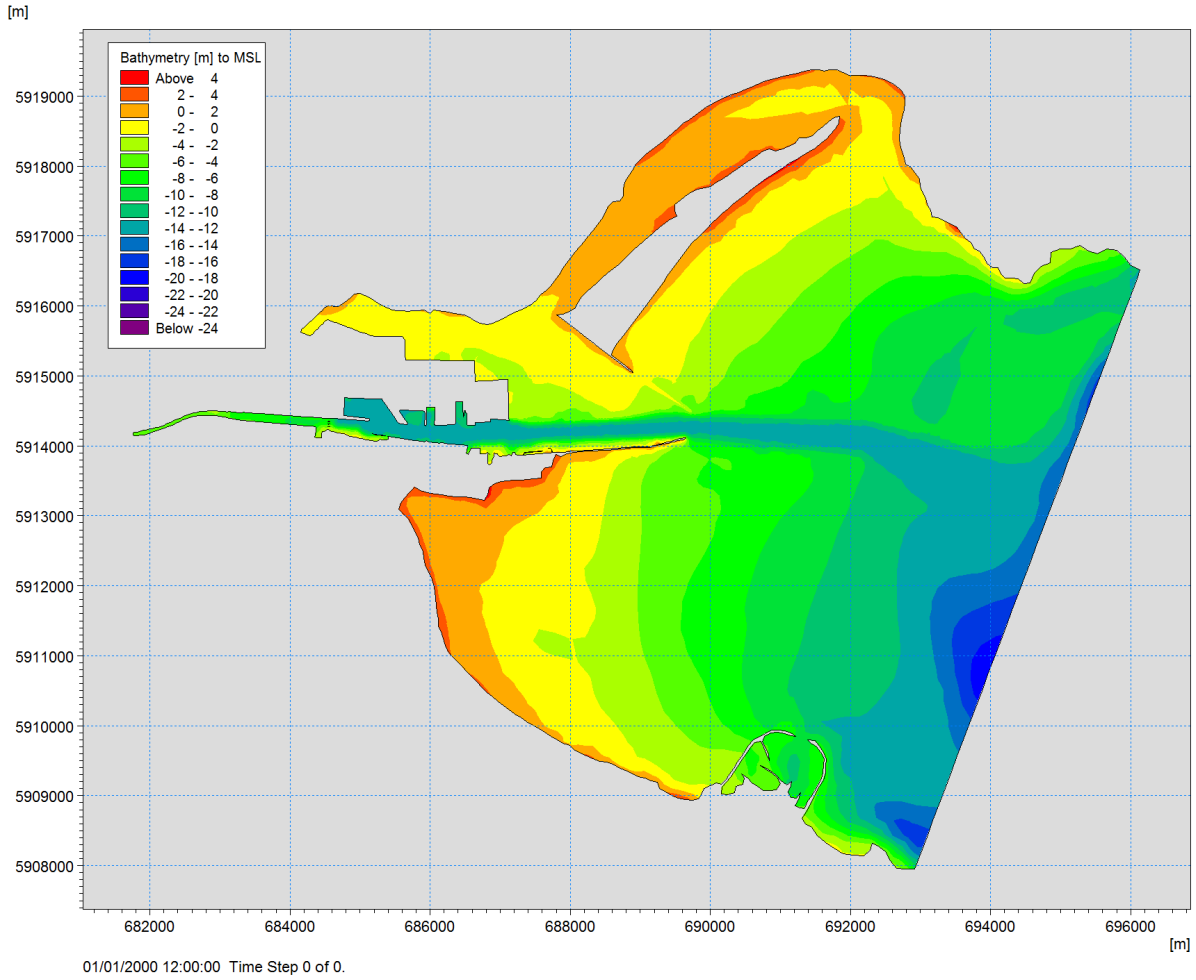


Figure 13-3 Extent and bathymetry of the 3D Dublin Port post ABR model

In addition to the bathymetric survey of Dublin Port and the Tolka estuary area, a comprehensive sediment sampling and Particle Size Analysis (PSA) campaign was also commissioned in 2017. Information from this survey was used to inform input parameters for the sediment transport simulations.

The 2017 survey data was complemented by current meter data recorded by two Acoustic Doppler Current Profilers (ADCPs) which were deployed in June 2013 as part of the ABR Project. These devices accurately record current speed, current direction and water depth. One ADCP device was located in the harbour channel in close proximity to Buoy 16 and the other device to the north of the approach channel. The devices were deployed for over one month to record full spring and neap tidal cycles. Tidal current meter data recorded by an ADCP device that was deployed 500m west of Burford bank as part of previous study undertaken by DHI was also made available to this study (DHI, 2010).

The extent of the 2017 survey and location of the two ADCP devices that were deployed at part of the ABR project is illustrated in Figure 13-4. Tidal current meter and surface elevation data from these hydrographic surveys was used to calibrate and validate the present-day Dublin Bay model.

Current velocities are also being continuously recorded at the centre of the dump site since September 2017. These recordings have also been used to validate the Dublin Bay model (reported in the Annual Environmental Report (AER) 2017 to the EPA under Dumping at Sea Permit S0024-01).

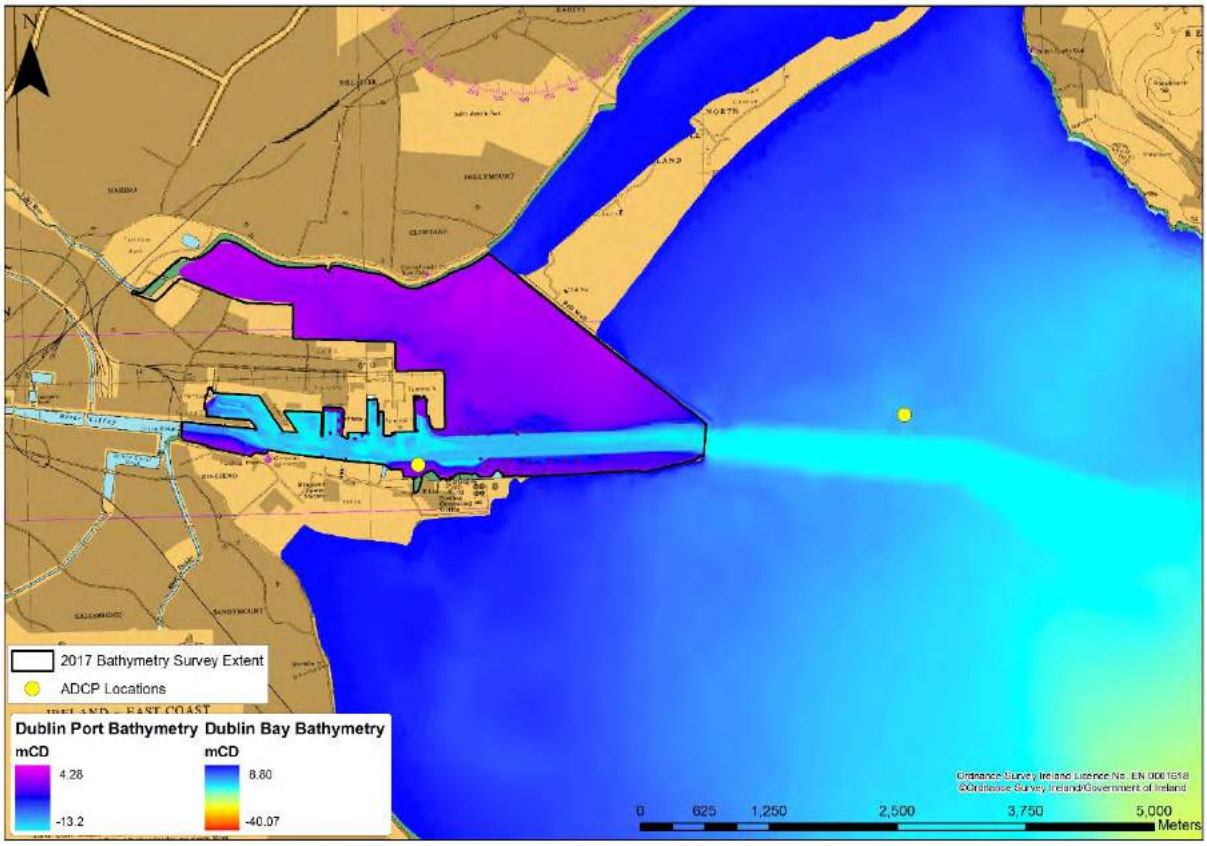


Figure 13-4 Location and coverage of the 2017 Bathymetric Survey

13.1.1.1 Boundary Conditions

The tidal boundary conditions for the baseline scenario model was taken from RPS' ICPSS tidal surge model. This model was developed using flexible mesh technology with the mesh size (model resolution) varying from circa 24km along the offshore Atlantic boundary to circa 200m around the Irish coastline. The extent and bathymetry of the ICPSS tidal surge model is presented in Figure 13-5.

All open sea boundaries were applied to the model as Flather boundaries whereby temporarily and spatially varying water level and current velocities are specified along the boundary. Flather boundaries are one of the most efficient boundary condition methods to downscale coarse model simulations to higher resolution areas as it avoids instabilities commonly associated with water level boundaries.

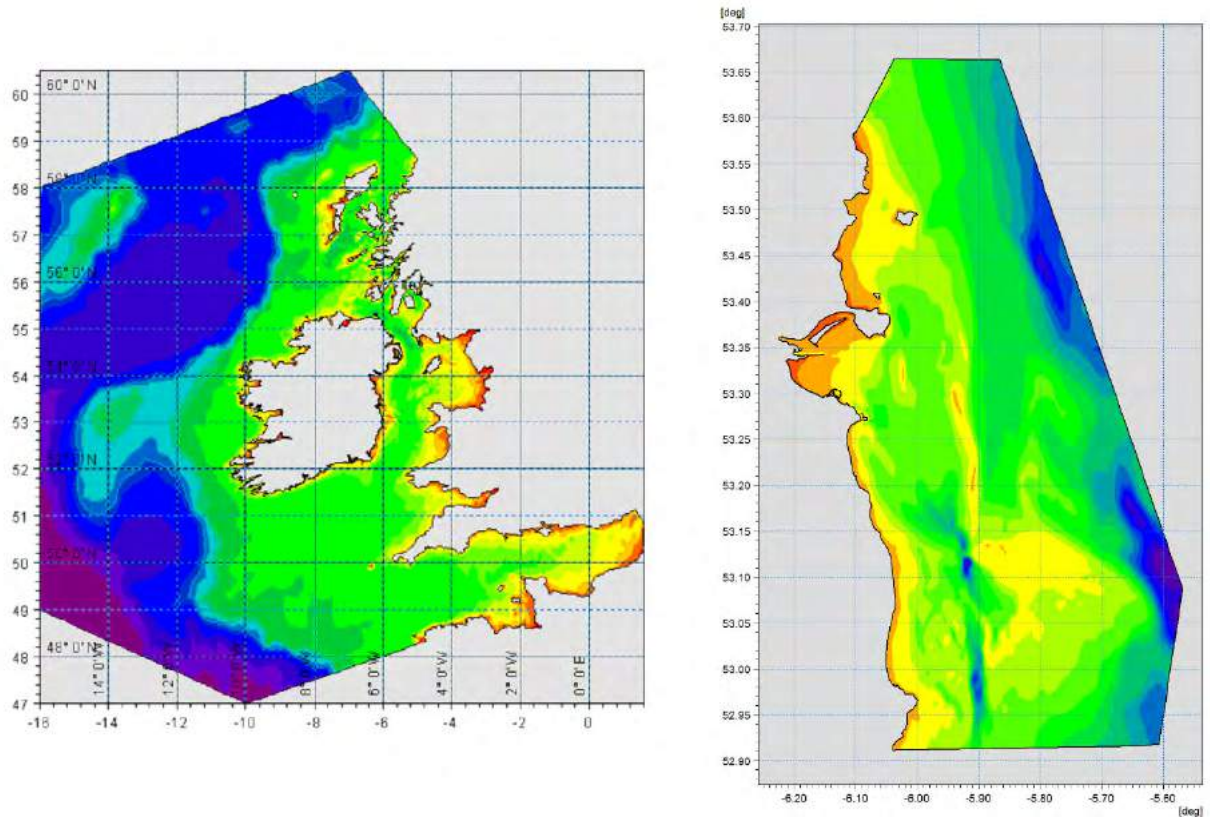


Figure 13-5 Extent and bathymetry of the ICPSS tidal surge model (left) and east coast wave model (right)

13.1.1.2 River Flows

The mean annual river flow values presented in Table 13-1 for the Liffey, Dodder and Tolka were used in the numerical model simulations of the tidal regime. Mean winter river flows were used to model the dispersion and fate of sediment plumes arising from the capital dredging works as they represent the worst-case scenario with regards to the plume extent. Both the mean winter and annual river flows used for various rivers are presented in Table 13-1.

Table 13-1 Mean annual discharge rates from the Liffey, Dodder and Tolka used in the coastal process models

Source	Mean annual discharge rate (m^3/s)	Mean winter discharge rate (m^3/s)
Liffey	15.6	25.0
Dodder	2.3	2.6
Tolka	1.4	1.6

13.3 Receiving Environment

In this section of the report, the post ABR Project tidal and wave patterns within the inner Liffey channel and Dublin Bay are presented. This is undertaken with reference to both the simulated model data and, where applicable, hydrographic survey data (see Section 13.2.3) and site specific water quality monitoring data made available by DPC's Monitoring Programme (ongoing for the ABR Project).

13.3.1 Tidal Regime at Dublin Port

The MIKE 21 Hydrodynamic module described in Section 13.2.2 was used in conjunction with the project scenario (ABR Project works in place) to derive baseline tidal regime information at Dublin Port.

Typical tidal flow patterns for a spring ebb and spring flood tide are presented in Figure 13-6 and Figure 13-7. These tidal flow diagrams illustrate that the current speeds in the central navigation channel are marginally higher during mid-ebb conditions relative to mid-flood conditions owing to the contribution of flow from the Liffey, Dodder and Tolka.

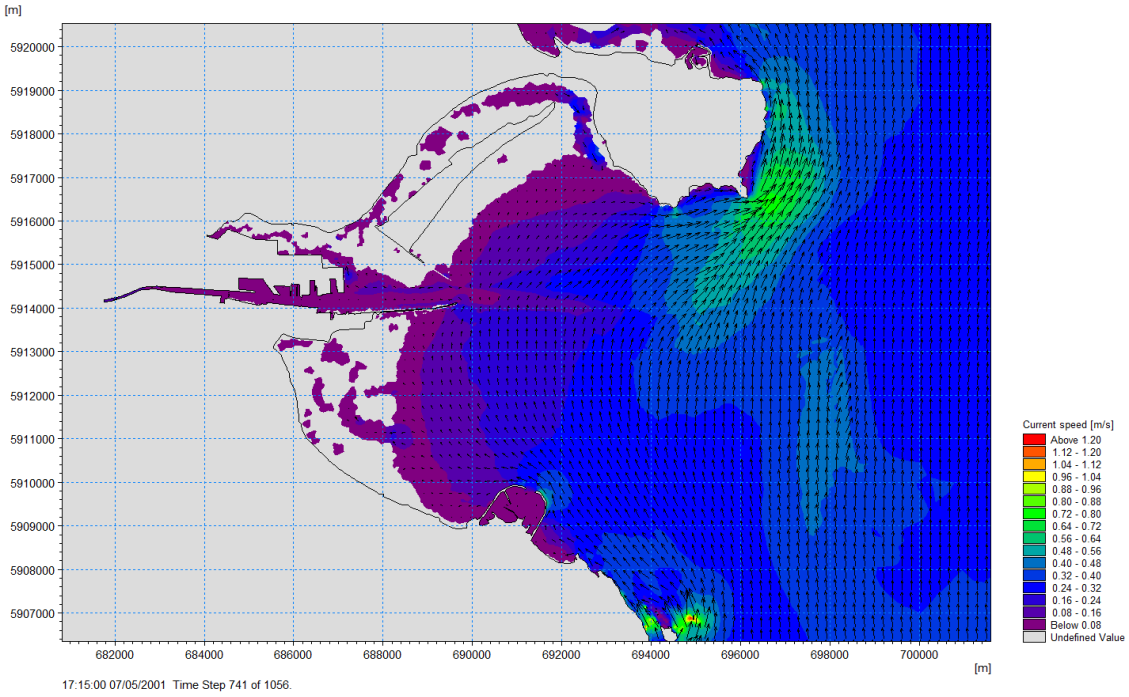


Figure 13-6 Typical spring mid ebb tidal flow patterns – Post ABR Project

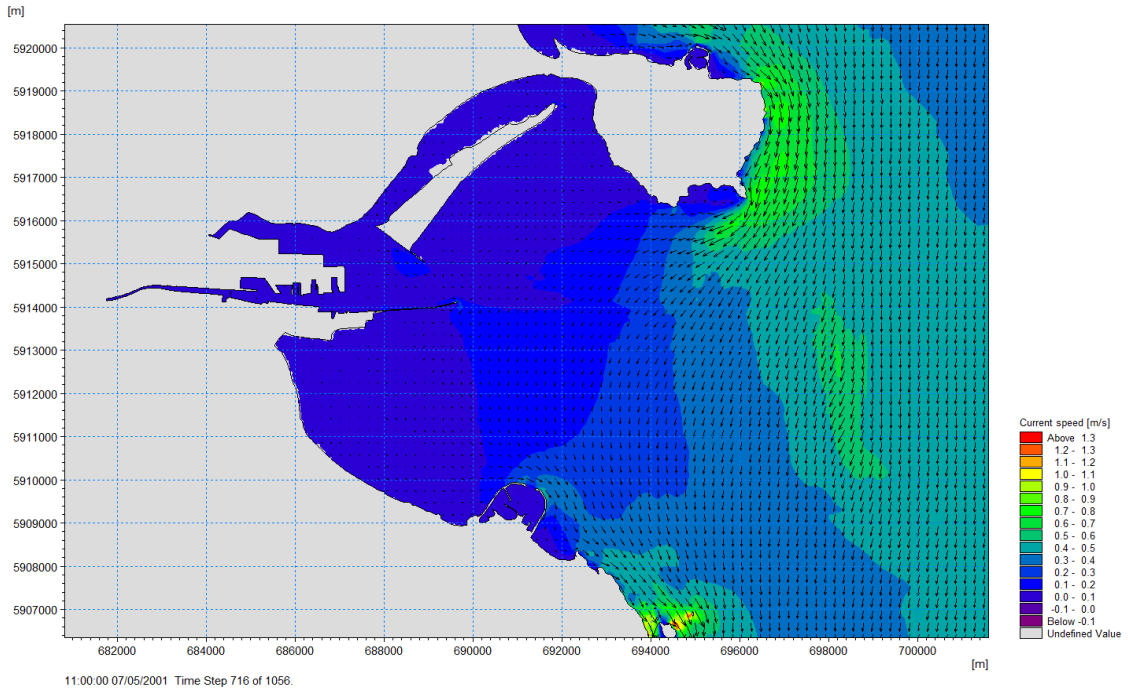


Figure 13-7 Typical spring mid flood tidal flow patterns – Post-ABR project

13.3.2 Wave Climate at Dublin Port

Offshore wave data for points at 5.66ºW, 55.50ºN and 5.66ºW, 55.25ºN were taken from the UK Met Office European wave model used as a source to select the largest event for each of the north east, east and south east directions. The three hourly data included wind wave and swell wave components in the form of the significant wave height, mean wave period, peak wave period and mean wave directions. The offshore wave climate data used in the wave transformation simulations are summarised in Table 13-2.

The MIKE 21 Spectral Wave module described in Section 13.2.2 was used in conjunction with the project scenario model to transform the offshore wave conditions for the north easterly, easterly and south easterly storm events into the nearshore.

It should be noted that the Spectral Wave module was considered the most appropriate method to assess the inshore wave climate as the alternative Boussinesq wave harbour disturbance model does not account for wind wave generation. This an important factor for areas such as the Clontarf frontage where the wave climate is dominated by wind waves generated over short fetches.

Figure 13-8, Figure 13-9 and Figure 13-10 present the inshore wave heights in Dublin Bay at spring high tide during north easterly, easterly and south easterly storm events respectively. It will be seen from these figures that based on these simulations the largest waves that propagate into Dublin Port occur during easterly storm events at spring high water.

Wave climate is being continuously recorded at the centre of the dump site since September 2017. These recordings have also been used to validate the predictions of storm waves entering Dublin Bay (reported in the Annual Environmental Report (AER) 2020 to the EPA under Dumping at Sea Permit S0024-01).

Table 13-2 Offshore wave climate data used to simulate the inshore wave climate

Storm Event	Significant wave height (m)	Peak wave period (s)	Mean wave direction (ºN)
North Easterly	4.6	8.9	29
Easterly	4.1	8.8	98
South Easterly	5.4	10.4	148

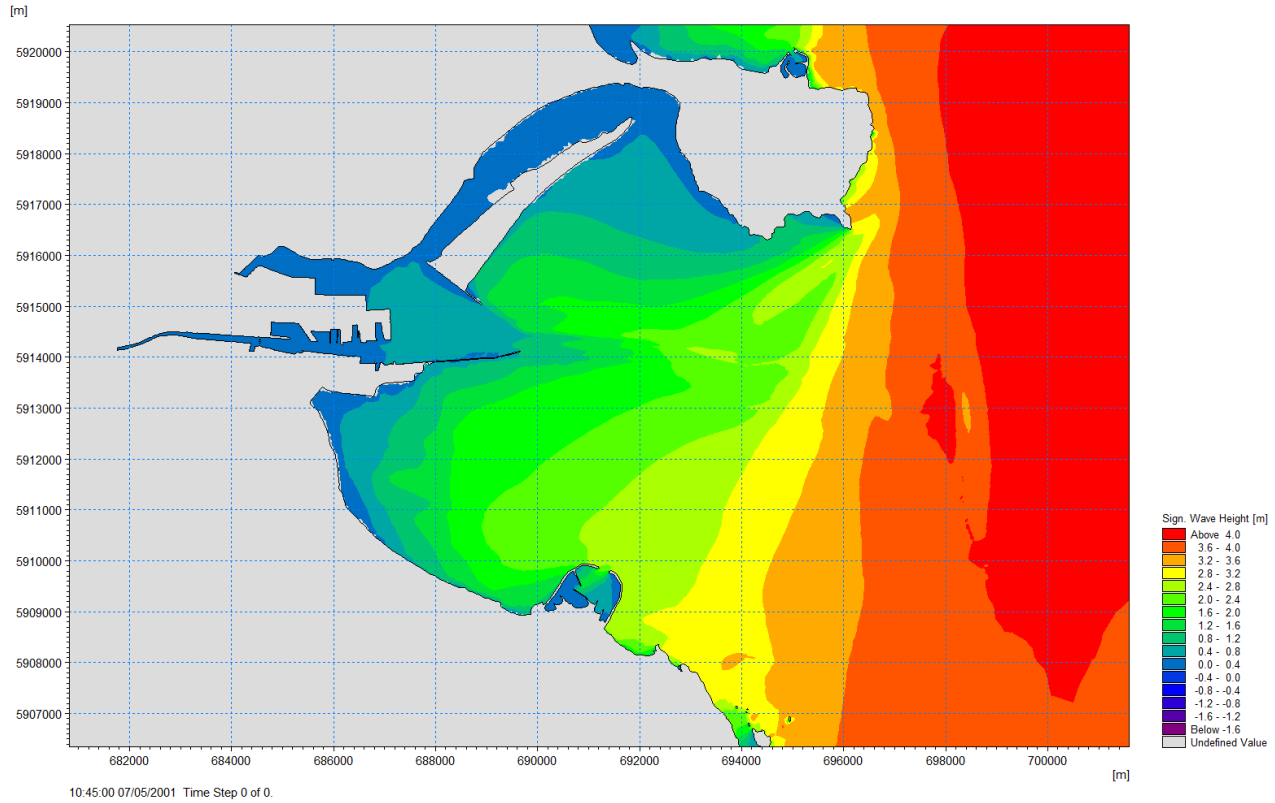


Figure 13-8 North Easterly storm wave heights at spring high water – Post-ABR project

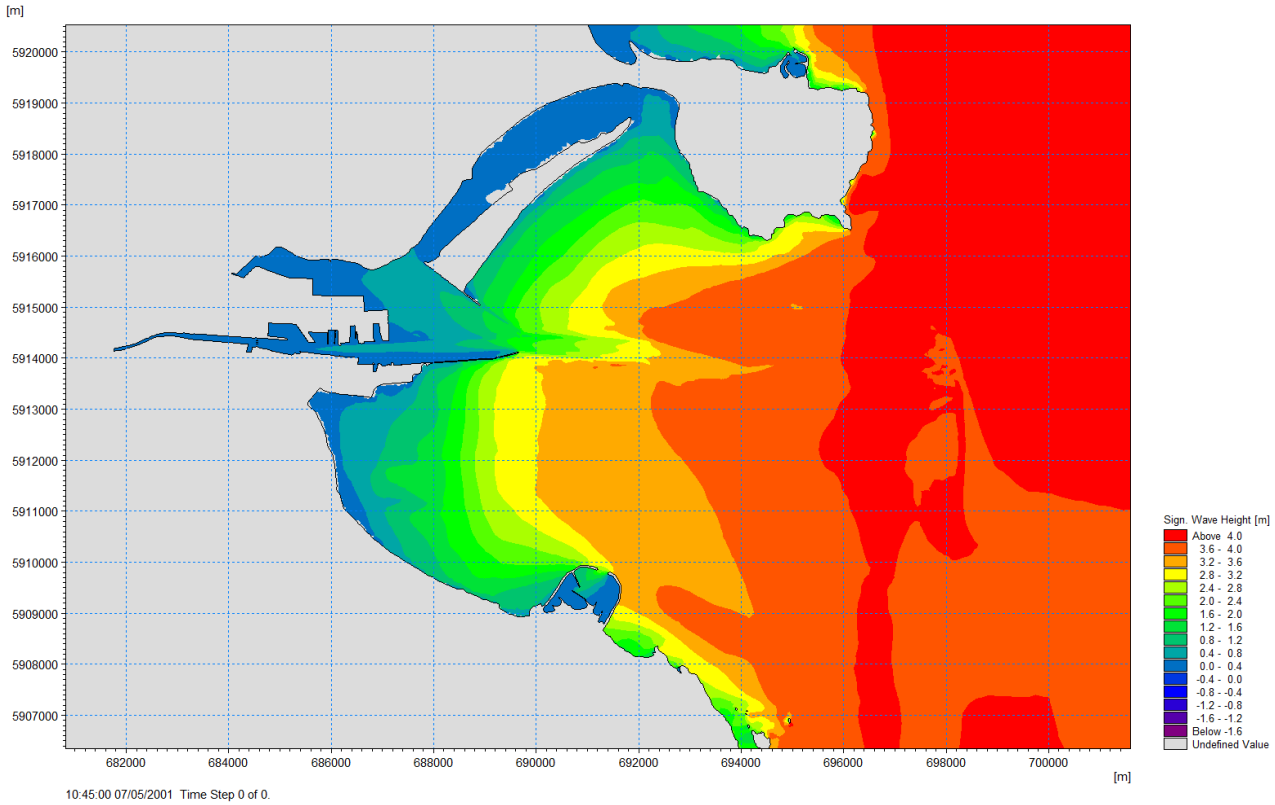


Figure 13-9 Easterly storm wave heights at spring high water – Post-ABR project

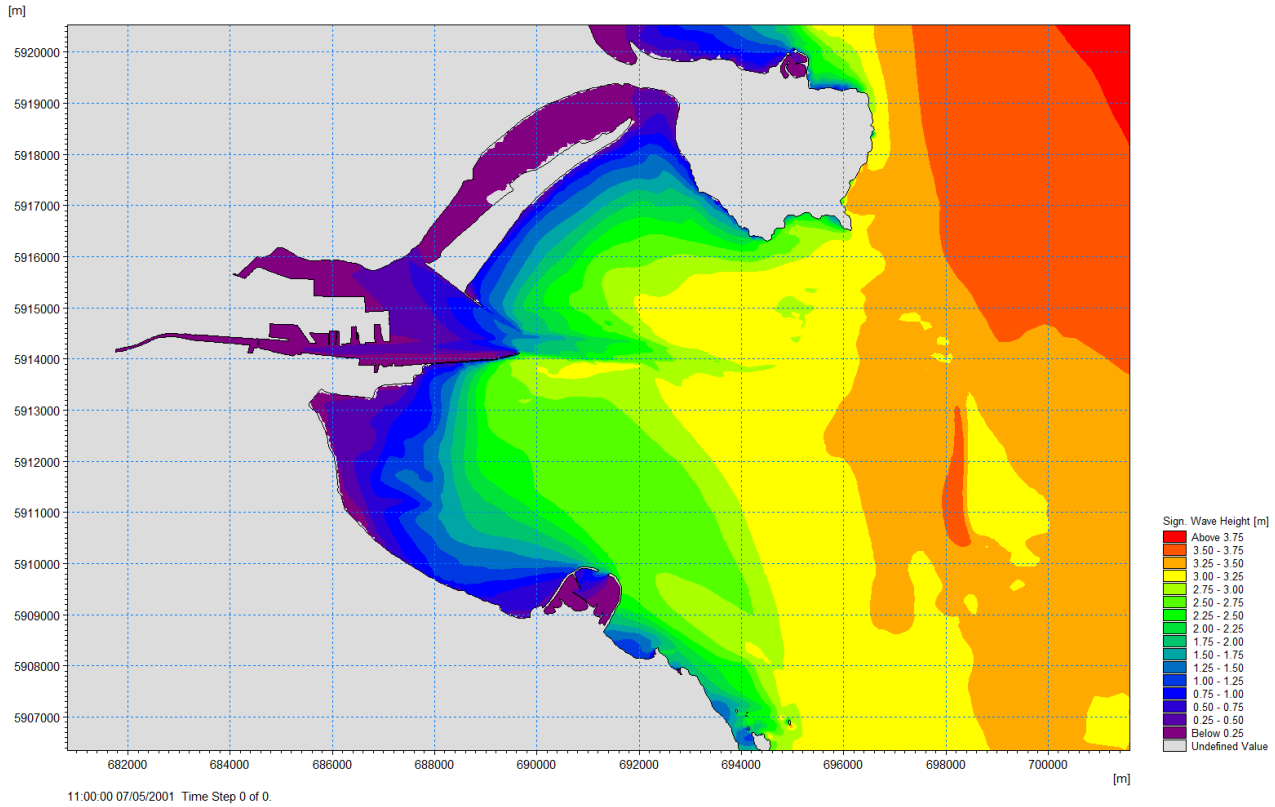


Figure 13-10 South Easterly storm wave heights at spring high water – Post-ABR project

13.4 Likelihood of Impacts

The impact on coastal processes arising from the dredging and dumping at sea activities associated with the Dublin Port Capital Dredging Project is assessed in relation to dredging and disposal operations. The assessment has been informed by a robust numerical modelling programme and, where applicable, hydrographic survey data (see Section 13.2.3) and site specific water quality monitoring data made available by Dublin Port Company's Monitoring Programme (ongoing for the ABR Project).

The following elements have been assessed for their potential to impact water quality and coastal processes:

- Dredging and Disposal:
  - Dredging works in the navigation channel, basins and berthing pockets.
  - Impact of dredging on cooling water intakes / outfalls near to capital dredging operations.
  - Disposal of dredge spoil at the licenced disposal site.

13.4.1 Potential Impacts of Dredging and Disposal Operations

Temporary impacts on water quality have the potential to occur during the dredging operations. Mobilised suspended sediment released through loading and dumping activities are the principal potential sources of environmental impact. The potential impacts from the increase in background suspended sedimentation concentrations and deposition levels as a result of the dredging and disposal operations during the proposed capital dredging are assessed in Section 13.5.

13.5 Description of Potential Impacts

13.5.1 Potential Impacts as a result of dredging operations

The Dublin Harbour Capital Dredging Project consists of the dredging of the Navigation Channel (inner harbour), berthing pockets and basins. The total estimated dredge volume is estimated to be 500,000m^3 consisting of clays, silts, sands and gravels with occasional cobbles, no dredging of rock is required.

Notwithstanding application of extensive mitigation measures, the process of dredging unavoidably causes disturbance of sediment on the channel bed and dispersal of material in the water column. Disposal of dredge spoil at the licenced dump site at the approaches to Dublin Bay also results in sediment release. These losses in the form of a suspended sediment plume within the water column may have potential impacts on water quality, and marine life (refer to Chapter 7 Biodiversity, Flora and Fauna and Chapter 9 Water Quality).

It should also be noted that chemical sediment analysis and eco-toxicological testing has shown that the sediments to be dredged from the Port's navigation channel and basins are suitable for conventional dumping at sea (refer to Chapter 8).

13.5.2 Assessment of Potential Impacts

Extensive water quality monitoring using real time turbidity measurements has been undertaken in previous dredging campaigns (as reported in the Annual Environmental Reports for 2017 to 2020 submitted to the EPA under Dumping at Sea Permit S0024-01). This survey data demonstrates that during disposal of dredged fine sands at the licenced dump site, the fine sand falls rapidly to the seabed and any sediment plume is short lived and is not dispersed widely.

Sediments to be dredged from Dublin Harbour as part of the capital dredging will be finer containing a significant silt fraction. Therefore, plume modelling was undertaken for the silt fractions with silt losses of 1% at the dredger head being introduced as a sediment source in the bottom layer of the model. The other key parameters relating to the dredging simulations presented in the following Sections are set out in Table 13-3.

As the Liffey channel in Dublin Port is influenced by several fresh water river inflows and by thermal inputs from three power station cooling water systems, stratification of the water column occurs under certain tidal conditions in the Liffey channel, particularly in the central section of the harbour. Therefore, the plume modelling simulations were undertaken using the MIKE 3 Hydrodynamic model described in Section 13.2.3. This model was coupled with the Sediment Transport module and included temperature and salinity effects. The Tolka, Liffey and Dodder river flows were taken as the winter average flows (Table 13-1). The power station flow and temperature characteristics used in the model are shown in Table 13-4.

In line with the current Dredging Management Plan developed for the ABR Project and as set out in *Alexandra Basin Redevelopment Project Construction Environmental Management Plan (CEMP) Rev. F August 2018*, no over-spill from the dredger's hopper was included in any of the model simulations. Other key relevant mitigation measures that will apply to each dredging campaign are presented in Section 13.7.

Table 13-3 Dredging simulation input parameters

Parameter	Value
Trailer Suction Hopper Dredger capacity	4,100 m^3
Ratio of sediment/entrained water during loading	0.3
Average density of material inside hopper	1.65 t/m^3
Average Trip Frequency between Dublin Port and Disposal site	3.0 hours
Average Time to Fill Dredger Hopper	1.5 hours
Time to release load	90 seconds
Overspill Trailer Suction Hopper Dredger head	0%
Sediment loss at Trailer Suction Hopper Dredger head	1% of silts

Table 13-4 Power Station discharge and temperature characteristics, Dublin Harbour

Source	Discharge m^3/s	ΔT degree C	Outlet	Intake
Synergen/Covanta	7.6	6.6	Surface layer	Mid depth
Poolbeg/Ringsend WwTP	18.7	7.1	Surface layer	Surface layer

As illustrated in Figure 1-5 (Chapter 1) the dredging zones are

- Zone 1 – Navigation Channel (Inner Dublin Harbour)
- Zone 2 – South Port Berths
- Zone 3 – Alexandra Basin East
- Zone 4 – Oil Berths
- Zone 5 – Ferryport Basin
- Zone 6 – Riverside Berth 52/53
- Zone 7 – Berth 48/Oil jetty

The hydraulic conditions observed within three Zones 1, 4 and 7 were found to be representative of Dublin Harbour. Individual simulations were run to simulate dredging operations within Dublin Harbour. The output from these simulations is presented in the following sections.

The potential impact of dredging on existing outfalls and power station cooling systems was also modelled. Each simulation was run for a duration of one month to represent the full dredging operation in each area.

13.1.1.3 Zone 1– Navigation Channel (Inner Dublin Harbour)

The impact of the silt dispersion on the suspended sediment concentration is shown by a series of sediment plume diagrams presented in Figure 13-11 to Figure 13-14. These figures represent the dispersion of silt material at times of low water, mid flood, high water and mid ebb at a time during the dredging operation when the suspended sediment concentrations in the Tolka estuary were at their highest values.

It will be seen from these figures that apart from the area around the dredger itself, the Total Suspended Solids concentrations will peak at about 30 mg/l above background. The mean value over the whole of the dredging period will be less than 16 mg/l above background.

The predicted deposition of the silt fractions lost to the water column at the end of the dredging campaign is presented in Figure 13-15. This Figure shows that only an imperceptible amount of silt is deposited outside the harbour channel resulting in a maximum deposition depth of less than 0.2µm which is not measurable in the field.

It can, therefore, be concluded that the dredging operations required for the Zone 1 will not result in any significant impact to either the water quality in terms of suspended sediments, or the nearby environmentally designated areas in terms of sediment deposition. No further mitigation is required.

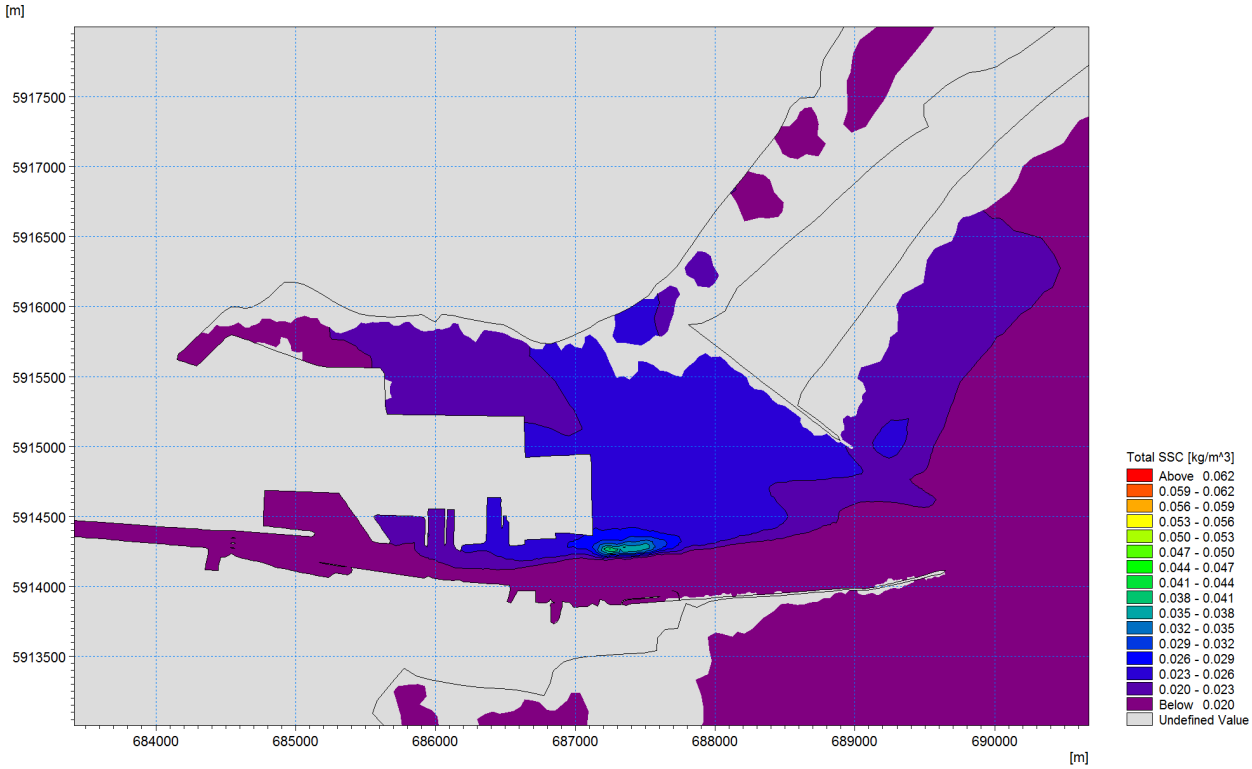


Figure 13-11 Suspended sediment concentration plume at time of low water

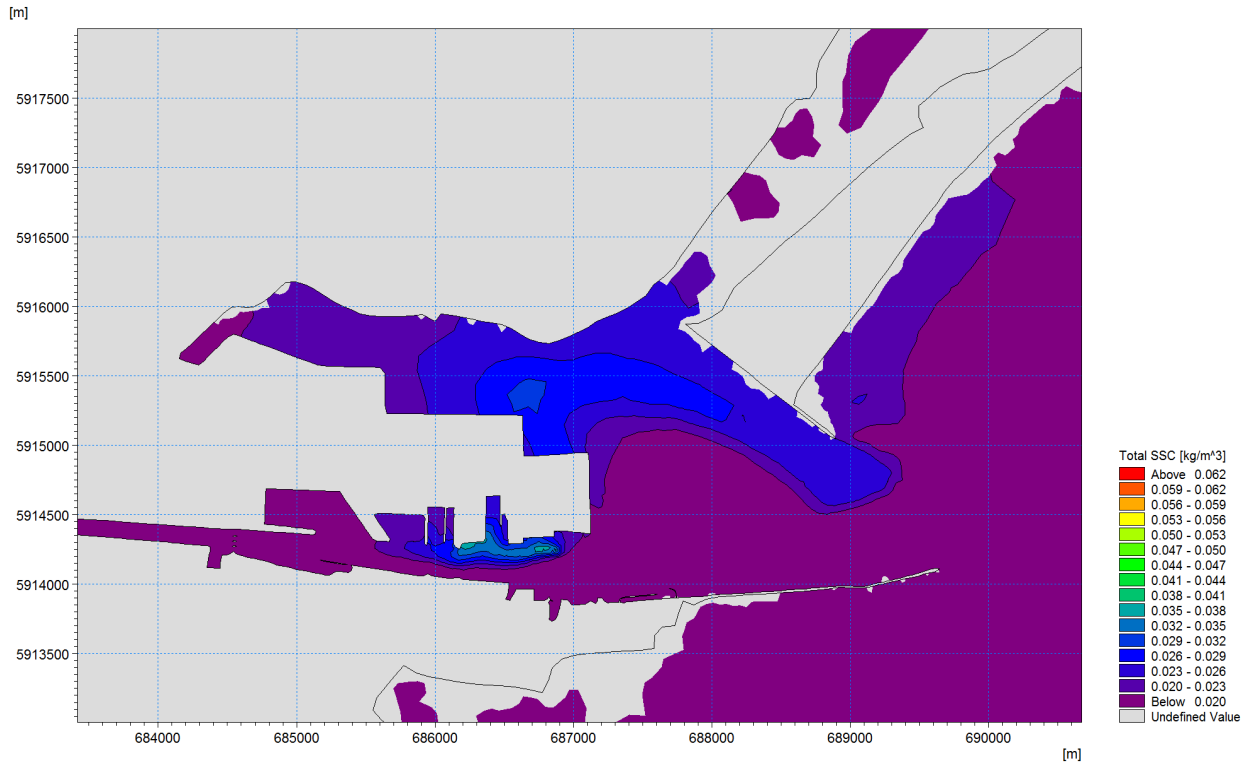


Figure 13-12 Suspended sediment concentration plume at time of mid flood

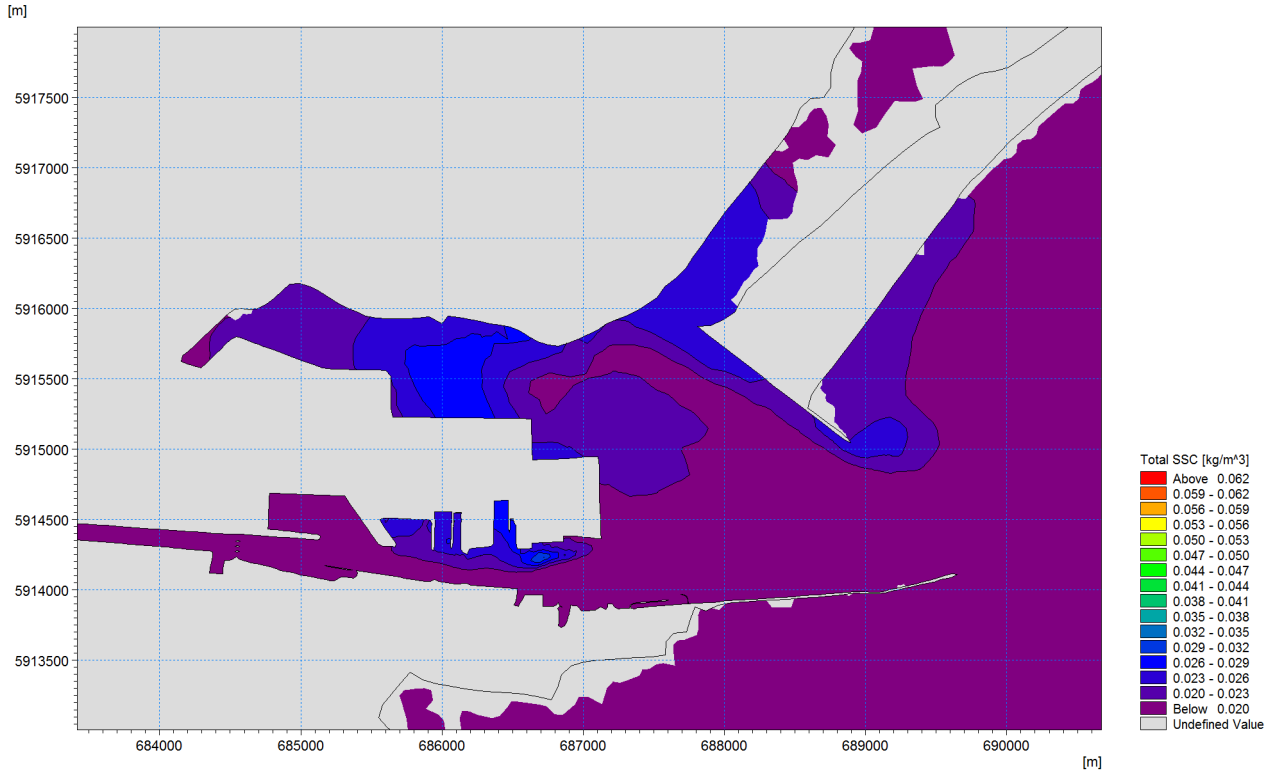


Figure 13-13 Suspended sediment concentration plume at time of high water

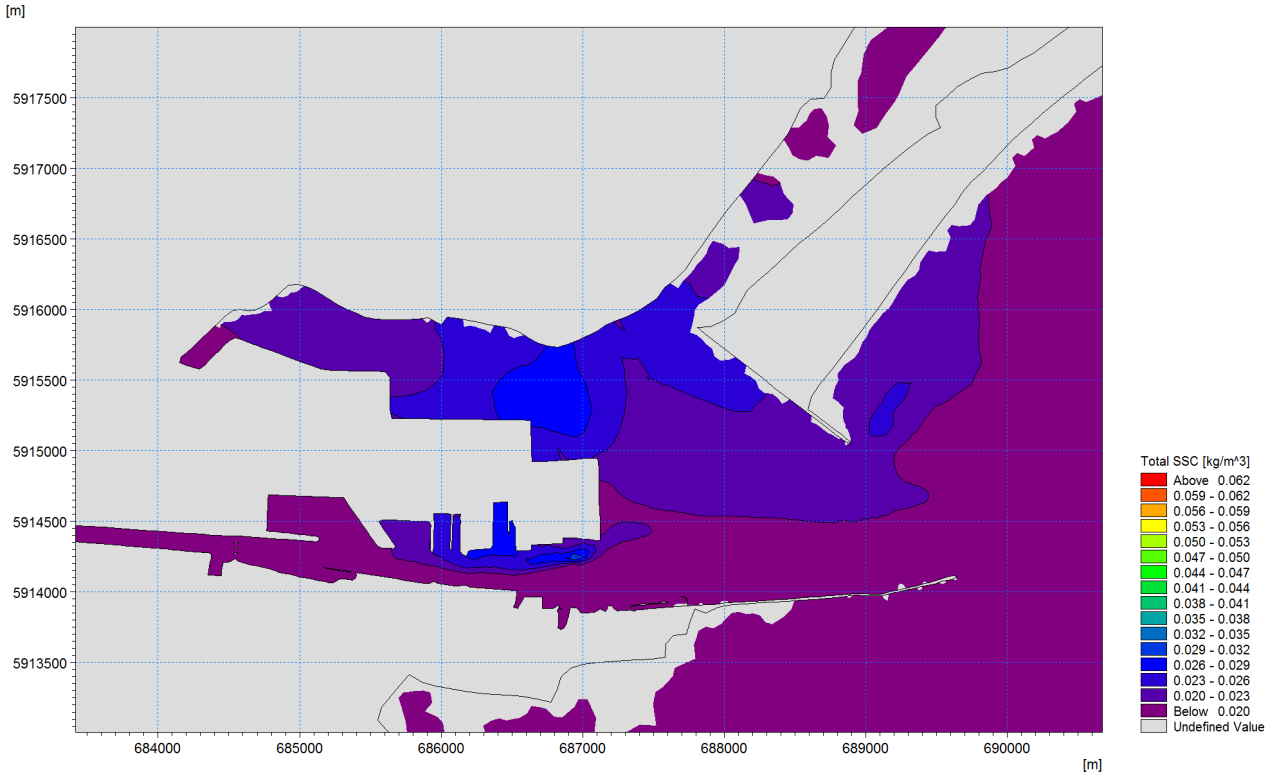


Figure 13-14 Suspended sediment concentration plume at time of mid ebb

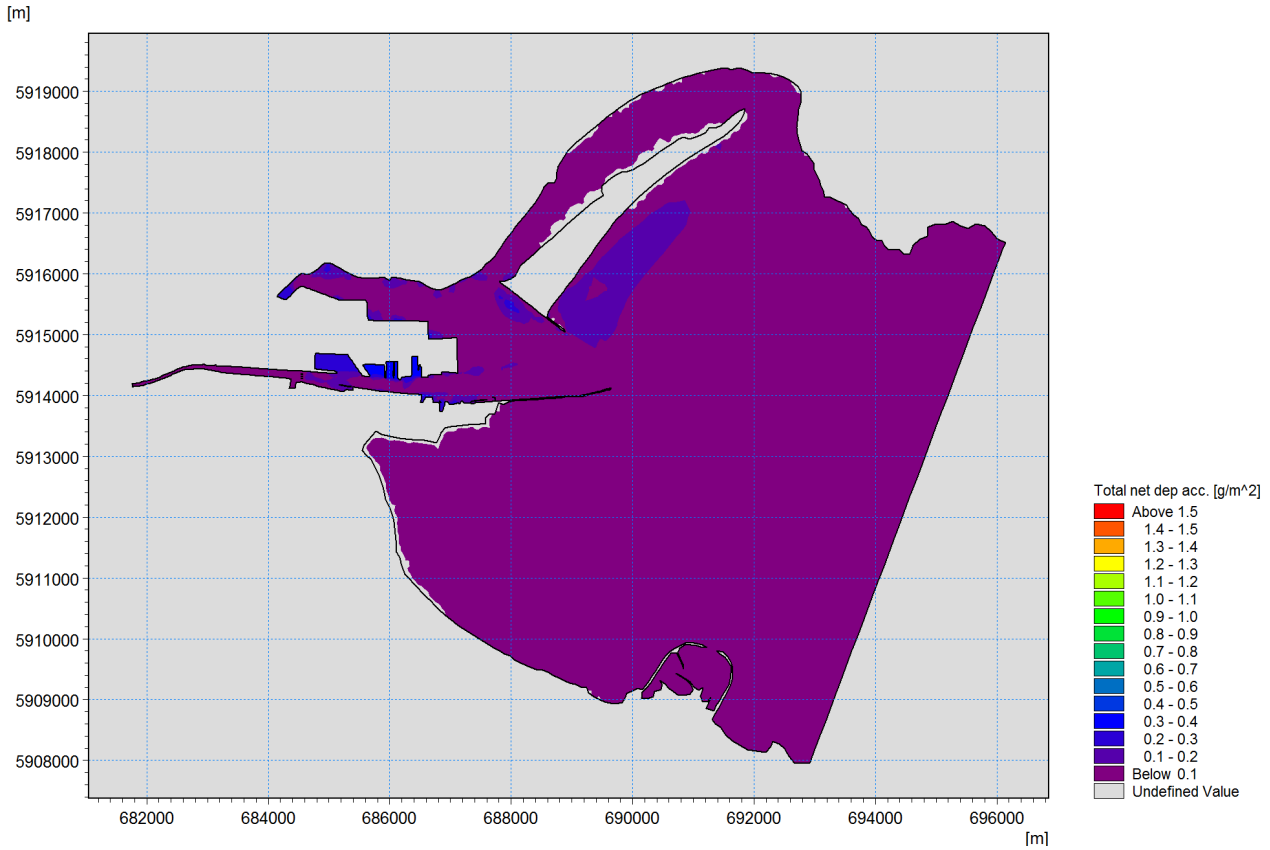


Figure 13-15 Total silt deposition after capital dredging of the middle section of the Liffey channel, Dublin Harbour

13.1.1.4 Zone 4 – Oil Berths

The impact of the silt dispersion on the suspended sediment concentration is shown by a series of plume diagrams presented in Figure 13-16 to Figure 13-19 . These figures represent the dispersion of silt material at times of low water, mid flood, high water and mid ebb at a time during the dredging operation when the suspended sediment concentrations may be expected to be at their highest values (i.e. when the dredger is active at the site).

It will be seen from these figures that the suspended sediment concentration plumes are confined to within the Oil Berths and the northern half of the navigation channel. The sediment concentrations of the plumes are generally less than 35 mg/l beyond the immediate source point. While there is a relatively small and very local predicted increase in suspended solids due to dredging within the Oil Berths, this is well within the background range experienced at these locations during normal port operations.

The predicted deposition of the silt fractions lost to the water column during the dredging of the Oil Berths at the end of the simulated dredging campaign is presented in Figure 13-20. This Figure shows that the quantity of material deposited outside of the dredge area is generally less than 8g/m^2 and that the deposition of sediment is generally confined to within the immediate area of the dredging operation.

It can, therefore, be concluded that the dredging operations required for the Zone 4 - Oil Berth will not result in any significant impact to either the water quality in terms of suspended sediments, or the nearby environmentally designated areas in terms of sediment deposition. No further mitigation is required.

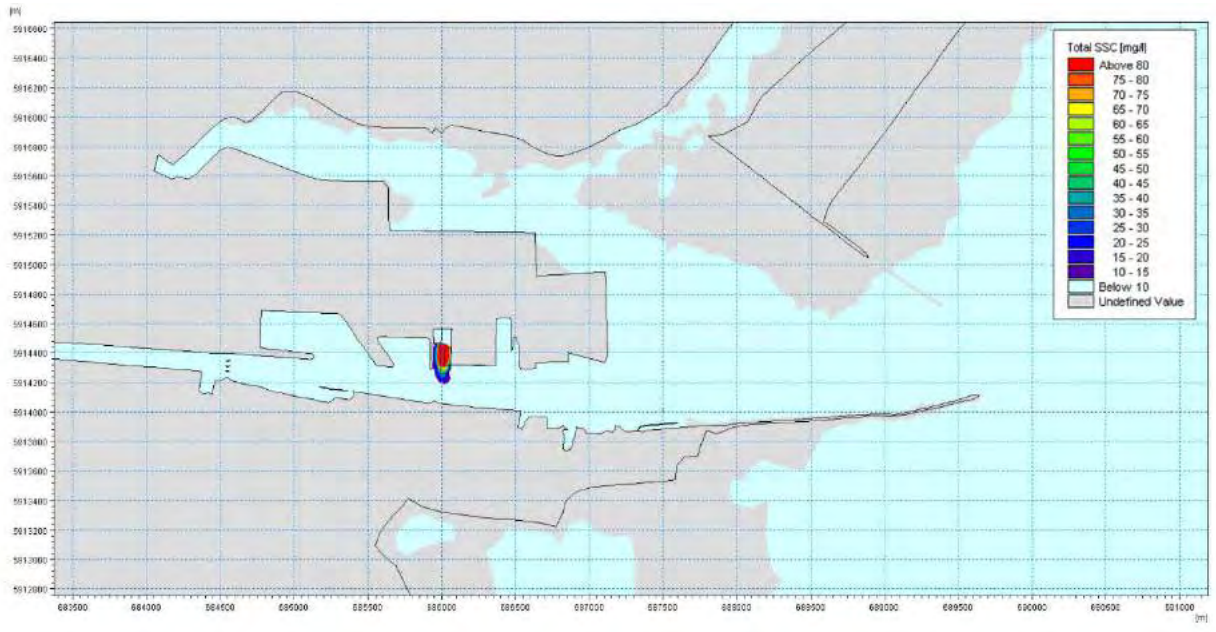


Figure 13-16 Suspended sediment concentration plume in the bottom layer during a typical low water phase of a spring tidal cycle whilst dredging within the Oil Berth

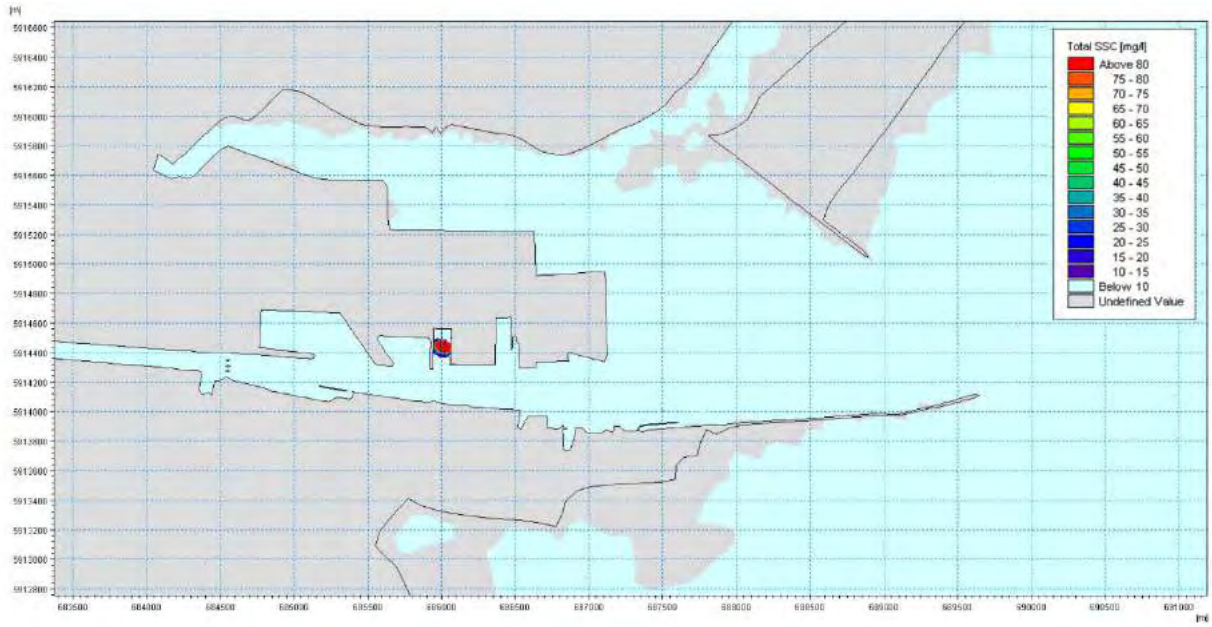


Figure 13-17 Suspended sediment concentration plume in the bottom layer during a mid flood phase of a spring tidal cycle whilst dredging within the Oil Berth

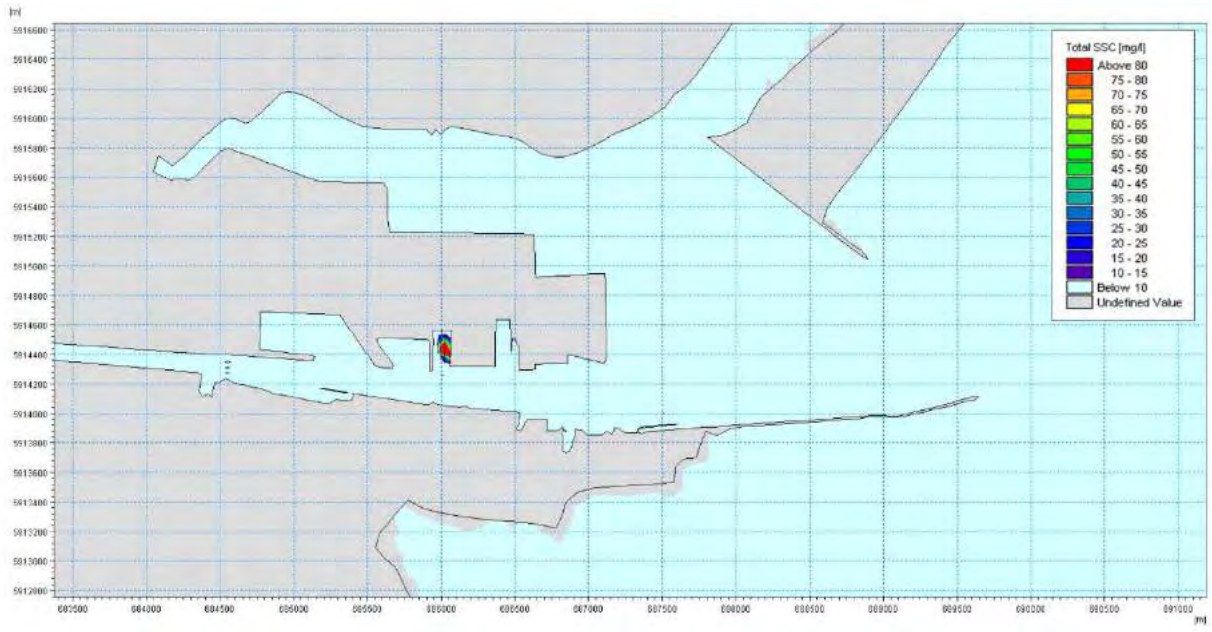


Figure 13-18 Suspended sediment concentration plume in the bottom layer during a typical high water phase of a spring tidal cycle whilst dredging within the Oil Berth

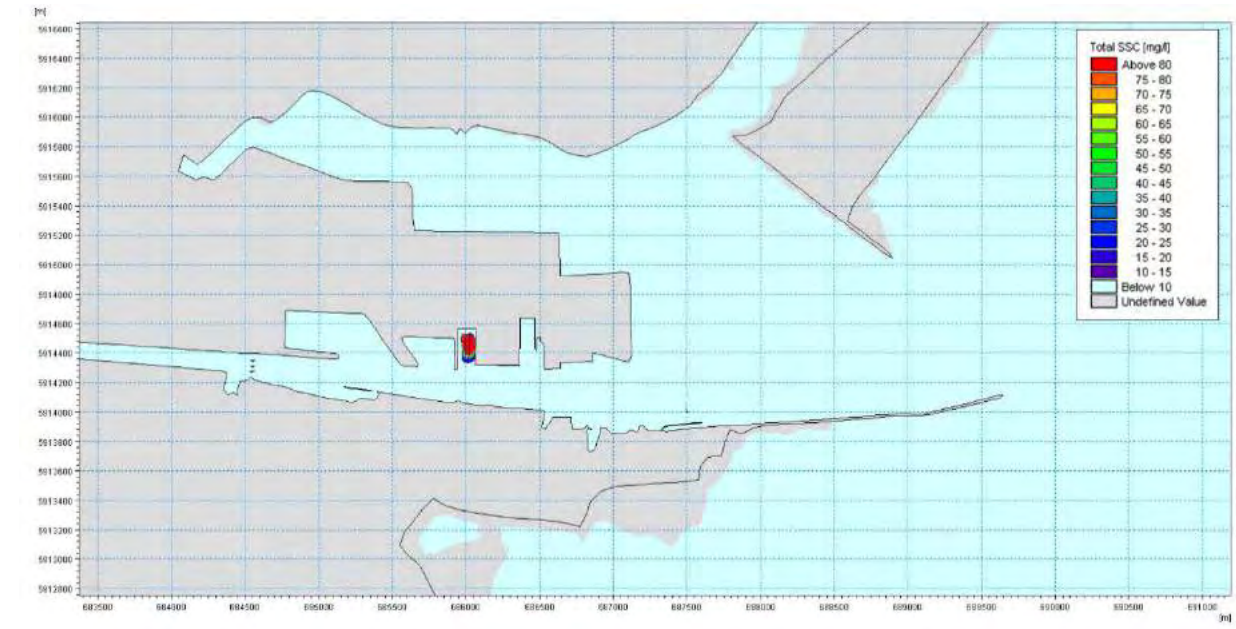


Figure 13-19 Suspended sediment concentration plume in the bottom layer during a typical mid ebb phase of a spring tidal cycle whilst dredging within the Oil Berth

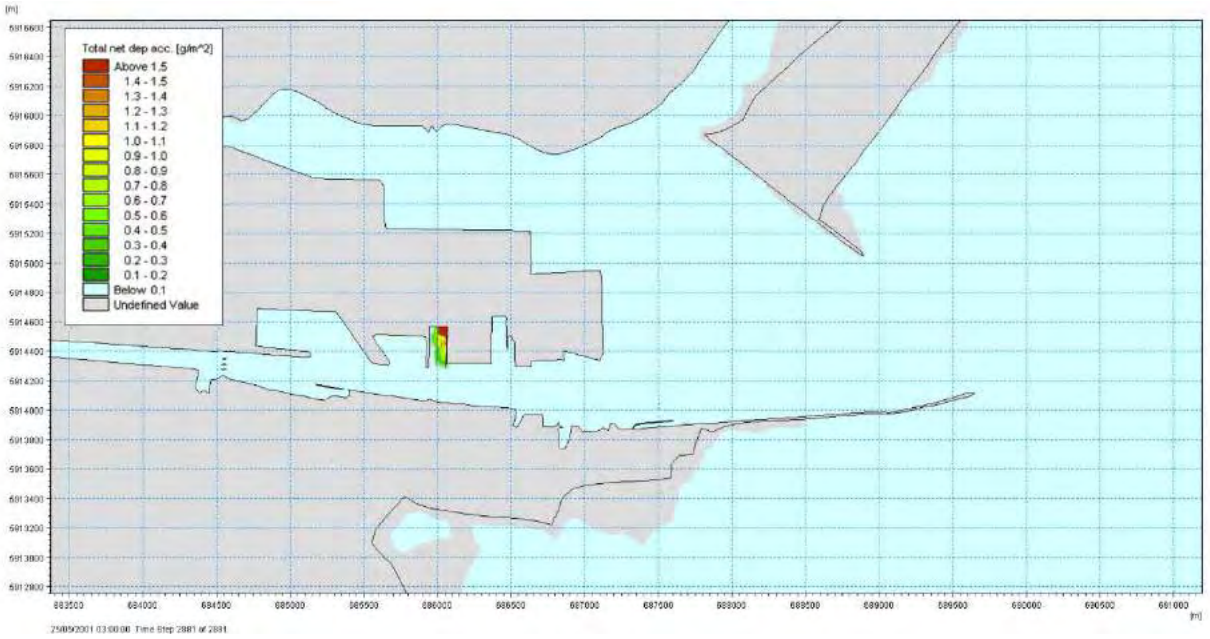


Figure 13-20 Deposition of sediment following the dredging operations within the Oil Berth

13.1.1.5 Zone 7 – Sludge / Oil Jetty

The impact of the silt dispersion on the suspended sediment concentration is shown by a series of plume diagrams presented in Figure 13-21 to Figure 13-24. These Figures represent the dispersion of silt material at times of low water, mid flood, high water and mid ebb at a time during the dredging operation when the suspended sediment concentrations may be expected to be at their highest values (i.e. when the dredger is active at the site).

It will be seen from these figures that the suspended sediment concentration plumes are confined to the southern half of the navigation channel. The sediment concentration of the plumes is generally less than 25 mg/l beyond the immediate dredge area. This is a relatively small and very local predicted increase in suspended solids due to the channel dredging works and is well within the background range experienced at

this location during normal Port operations. The lateral extent of the 10mg/l plume envelope is generally less than 600m under most tidal conditions.

The predicted deposition of the silt fractions lost to the water column during the channel dredging works at the end of a simulated dredging campaign is presented in Figure 13-25. This Figure shows that the quantity of material deposited outside of the dredge area is generally less than 0.30g/m^2 and that the deposition of sediment is generally confined to within the immediate area of the dredging operation.

It can, therefore, be concluded that when considered in terms of background conditions, the dredging operations required for the dredging works within Zone 6 will not result in any significant impact to either the water quality in terms of suspend sediments, or the nearby environmentally designated areas in terms of sediment deposition. No further mitigation is required.

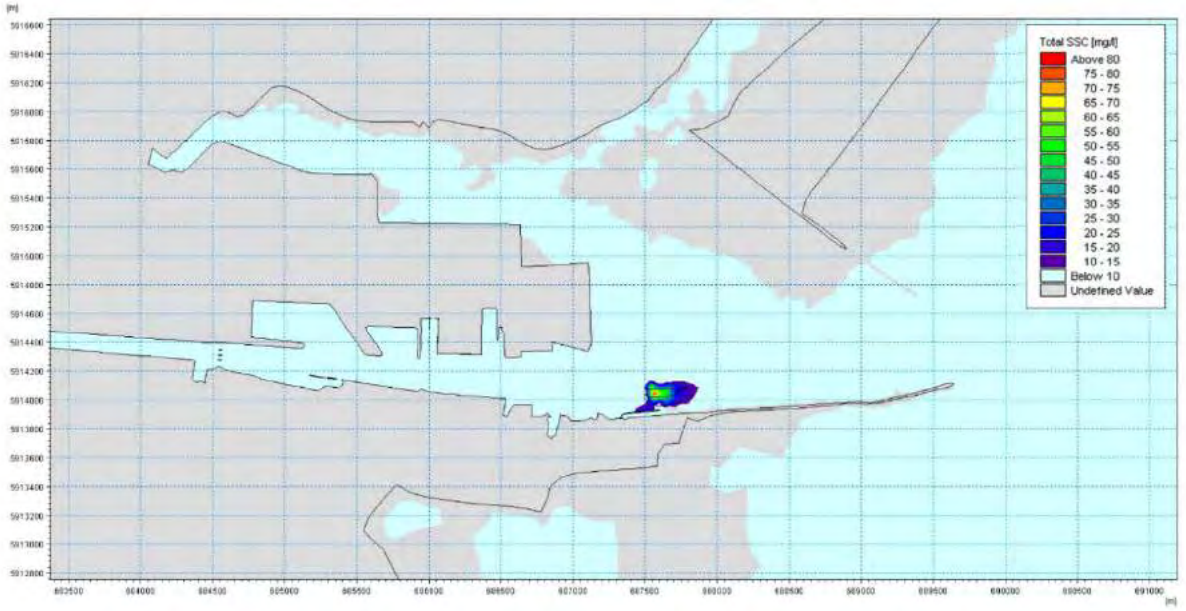


Figure 13-21 Suspended sediment concentration plume in the bottom layer during a typical low water phase of a spring tidal cycle during the capital dredging works

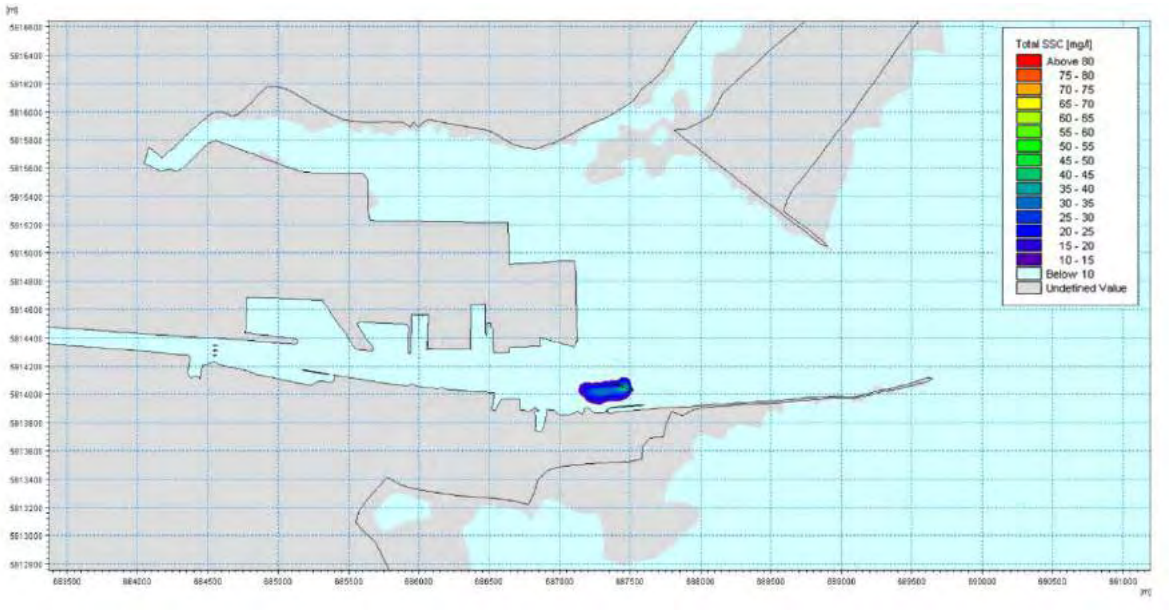


Figure 13-22 Suspended sediment concentration plume in the bottom layer during a typical mid flood phase of a spring tidal cycle during the capital dredging works

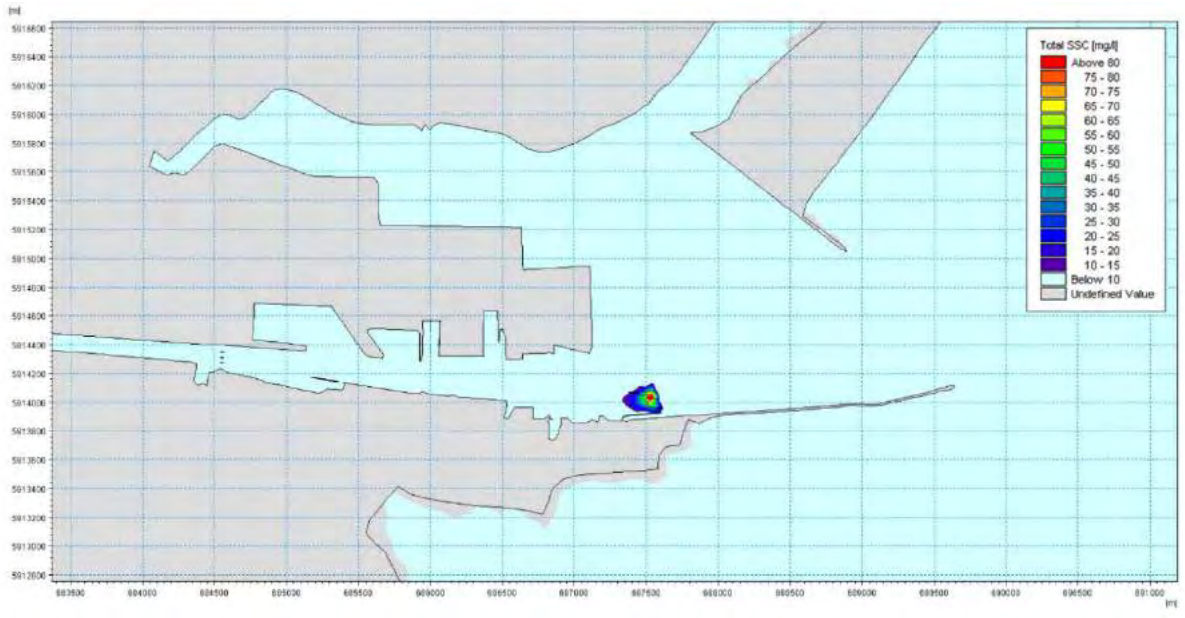


Figure 13-23 Suspended sediment concentration plume in the bottom layer during a typical high water phase of a spring tidal cycle during the capital dredging works

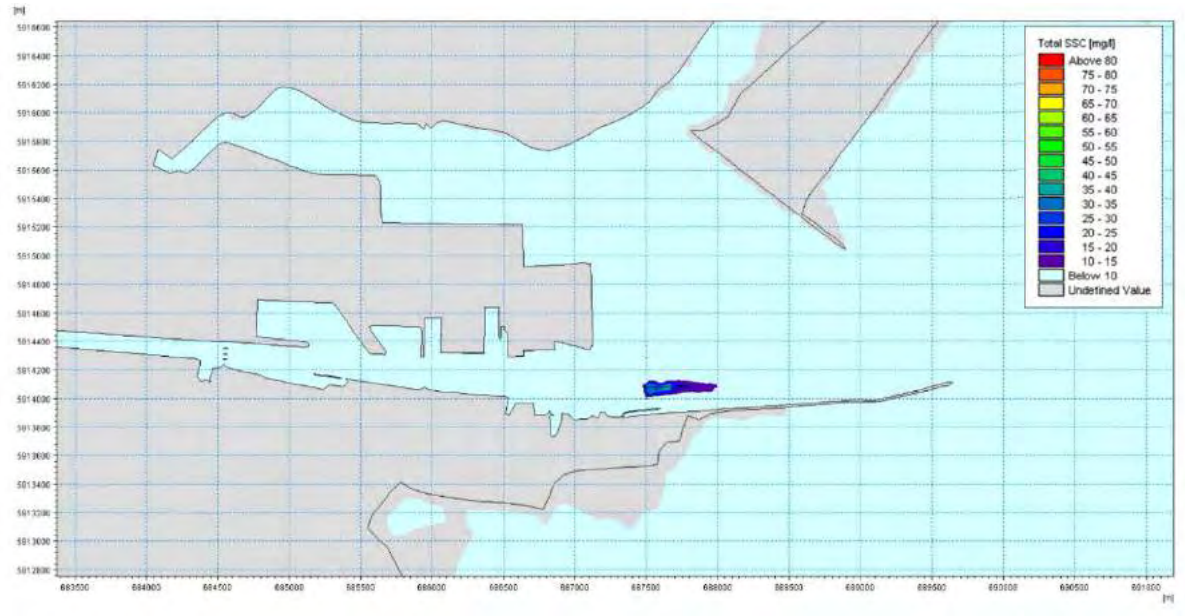


Figure 13-24 Suspended sediment concentration plume in the bottom layer during a typical mid ebb phase of a spring tidal cycle during the capital dredging works

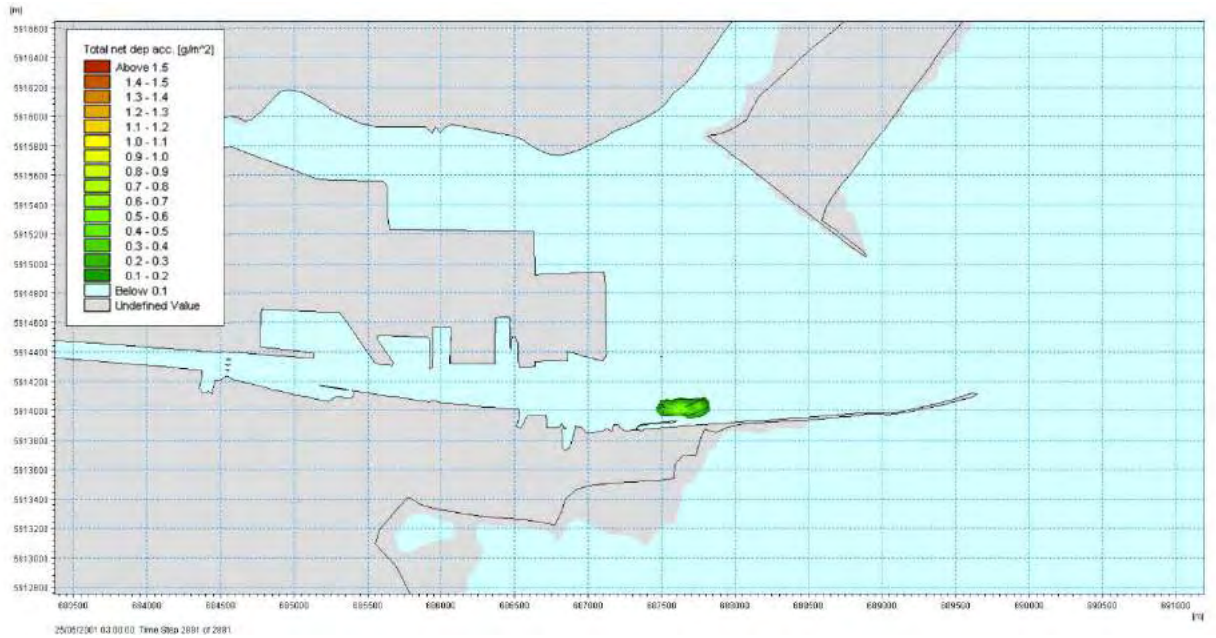


Figure 13-25 Deposition of sediment following the capital dredging works

13.1.1.6 Impact of dredging operations on existing outfalls and power station cooling water systems

Water from the Liffey is currently abstracted by three industrial plants within Dublin Harbour

- Synergen (Dublin Bay Power Plant).
- Covanta Waste to Energy Plant.
- ESB (Poolbeg) Generating Station.

The ESB (North Wall) Generating Station is no longer operational. The cooling water discharge from Synergen and Covanta re-enters the River Liffey via a combined discharge stream located to the west of the Poolbeg Sludge Jetty. The cooling water discharge from the ESB (Poolbeg) Generating Station re-enters the River Liffey via a combined discharge stream with Irish Water's Ringsend Waste Water Treatment Plant located to the north of the ESB (Poolbeg) Generating Station. High levels of suspended solids in cooling water has the potential to impact upon the plants cooling system and may result in an increase in operation and maintenance costs.

The location of the three water abstraction points are presented in Figure 13-26 together with a 100m potential zone of influence.

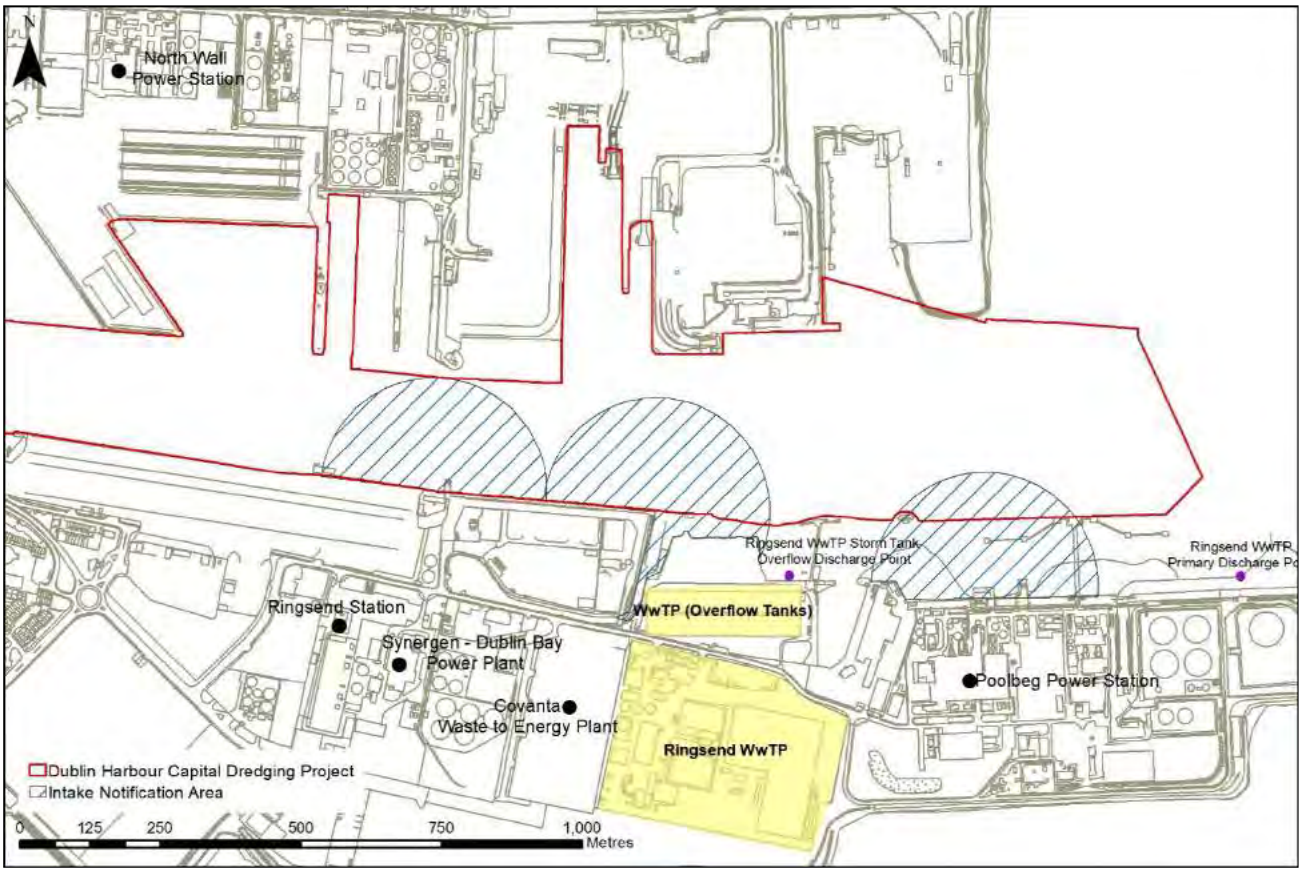


Figure 13-26 Locations of cooling water intakes in Dublin Harbour

In order to determine if the capital dredging operations would potentially impact upon any of these cooling water intake systems, RPS analysed the modelling results from the dredging simulations described in the previous section. This information was then used to calculate the peak and average suspended sediment concentrations due to dredging at each point of interest illustrated in Figure 13-26. The predicted peak and average suspended sediment concentrations above background level are presented in Table 13-5. Also included in the table for comparison are the peak and average background suspended sediments levels recorded during the ABR Project monitoring programme between 2017 to 2020 (Tom Clarke Bridge Control Site).

The results of the simulations show that the increased levels of suspended sediment concentrations at the cooling water intakes are generally very small by comparison with background levels in the Liffey Estuary. It was concluded that these increased levels are unlikely to have any effect on the quality of the water abstracted from the River Liffey in terms of suspended solids content.

Table 13-5 Peak and average Suspended Sediment Concentrations at the three cooling water intakes, Dublin Harbour

Intake	Dredging Location	Peak Suspended Solids Concentration (mg/l)	Average Suspended Solids Concentration over 1 month (mg/l)
ESB (Poolbeg) Generating Station	Oil Berth 3/Berth 50A	4.86	1.83
	Berth 53	3.37	1.06
	Channel Dredging Works	29.15	2.51
Synergen (Dublin Bay Power Plant)	Oil Berth 3/Berth 50A	6.23	2.30
	Berth 53	4.31	1.23
	Channel Dredging Works	7.10	1.58
Covanta Waste to Energy Plant	Oil Berth 3/Berth 50A	6.23	2.30
	Berth 53	4.31	1.23
	Channel Dredging Works	7.10	1.58
Comparison with ABR Project Monitoring Programme Results 2017-2020 representing Background Levels		**150**	**24.5**

13.1.1.7 Potential impact of disposal of the dredge material at the licenced offshore disposal site

A programme of sediment chemistry and eco-toxicological testing within the inner Liffey channel and Dublin Bay has shown that that the sediments to be dredged from the Port's navigation channel, berths and basins are suitable for conventional dumping at sea (subject to the granting of a Dumping at Sea Permit by the EPA). The closest and preferred licenced offshore disposal site is located at the approaches to Dublin Bay to the west of the Burford Bank as presented in Figure 13-27. This disposal option is preferred because it keeps the sand element of the dredge material within the natural Dublin Bay sediment cell.

The disposal of sediments at sea has the potential to cause a temporary increase in suspended sediments and turbidity levels during the disposal operations. Under certain conditions, this could have adverse effects on marine biota (for example, through siltation of benthic communities), result in changes to sediment structure, or interfer with feeding due to reduced visibility.

To assess the impact of the disposal operations at the licenced offshore disposal site, a coupled MIKE 21 Hydrodynamic and Sediment Transport model was used to determine the dispersion of the sediment material during the disposal operations.

It was assumed that the Trailer Suction Hopper Dredge would discharge a maximum hopper load of 4,100 m^3 per dredge trip over the disposal site every *c.* 3 hours. Key parameters relating to the sediment dumping simulations are outlined in Table 13-6.

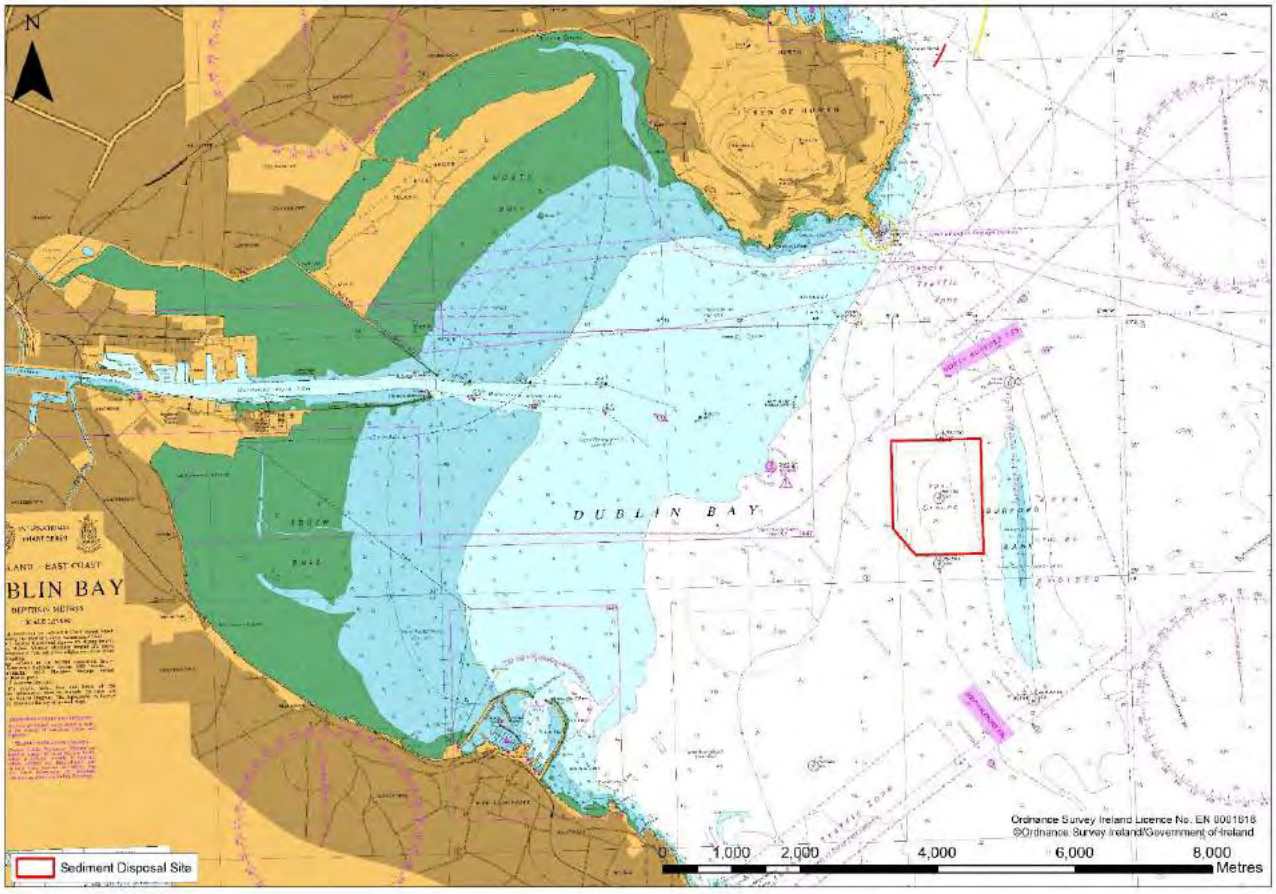


Figure 13-27 Location of the licenced dredged spoil disposal site

Table 13-6 Disposal simulation input parameters

Parameter	Value
Trailer Suction Hopper Dredger capacity	4,100 m³
Ratio of sediment/entrained water during loading	0.3
Average density of material inside hopper	1.65 t/m^3 (wet weight)
Average Trip Frequency between Dublin Port and Disposal site	3.0 hours
Average Time to Fill Dredger Hopper	1.5 hours
Time to release load	90 seconds

The model simulations were run for the disposal of the dredged material over the course of a complete lunar month, which includes the full range of spring and neap tidal flow conditions. The characteristics of the sediment modelled in this simulation are equivalent to those used in the dredging simulations described in the previous section of this report. As such, the sediment material was characterised by three discrete fractions with mean diameters of 200µm, 20µm and 3µm, with each fraction constituting 1/3 of the total volume of silt to be dredged.

The sediment material was introduced into the surface of the model as a point source that moved across the dump site area during the disposal operation. The model then simulated the dispersion, settlement, and re-erosion of each fraction of the silt in response to the tidal currents throughout the model area.

The coarser fraction of the sediment, i.e. the sand fraction that had a mean grain size of 200µm, was found to behave differently relative to the two finer silt fractions that had mean grain diameters of 20µm and 3µm. The sand fraction remained on the dump site, whereas the two finer silt fractions were carried away by the tidal currents.

The results of the simulations are given in terms of maximum total suspended sediment concentrations envelope in Figure 13-28. This Figure depicts the maximum level of the suspended sediment concentration which occurs in each cell at any time during the simulation and is thus an envelope covering all the sediment plume excursions. It will be seen from Figure 13-29 that the sediment plume outside the area of the dump site is less than 200mg/l and does not extend further than 750m to the north or south of the dump site.

Based on these results, it can be concluded that the disposal operations associated with the capital dredging will not result in any significant increases to the background level of suspended sediments and will not, therefore, impact the existing water quality in the greater Dublin Bay area.

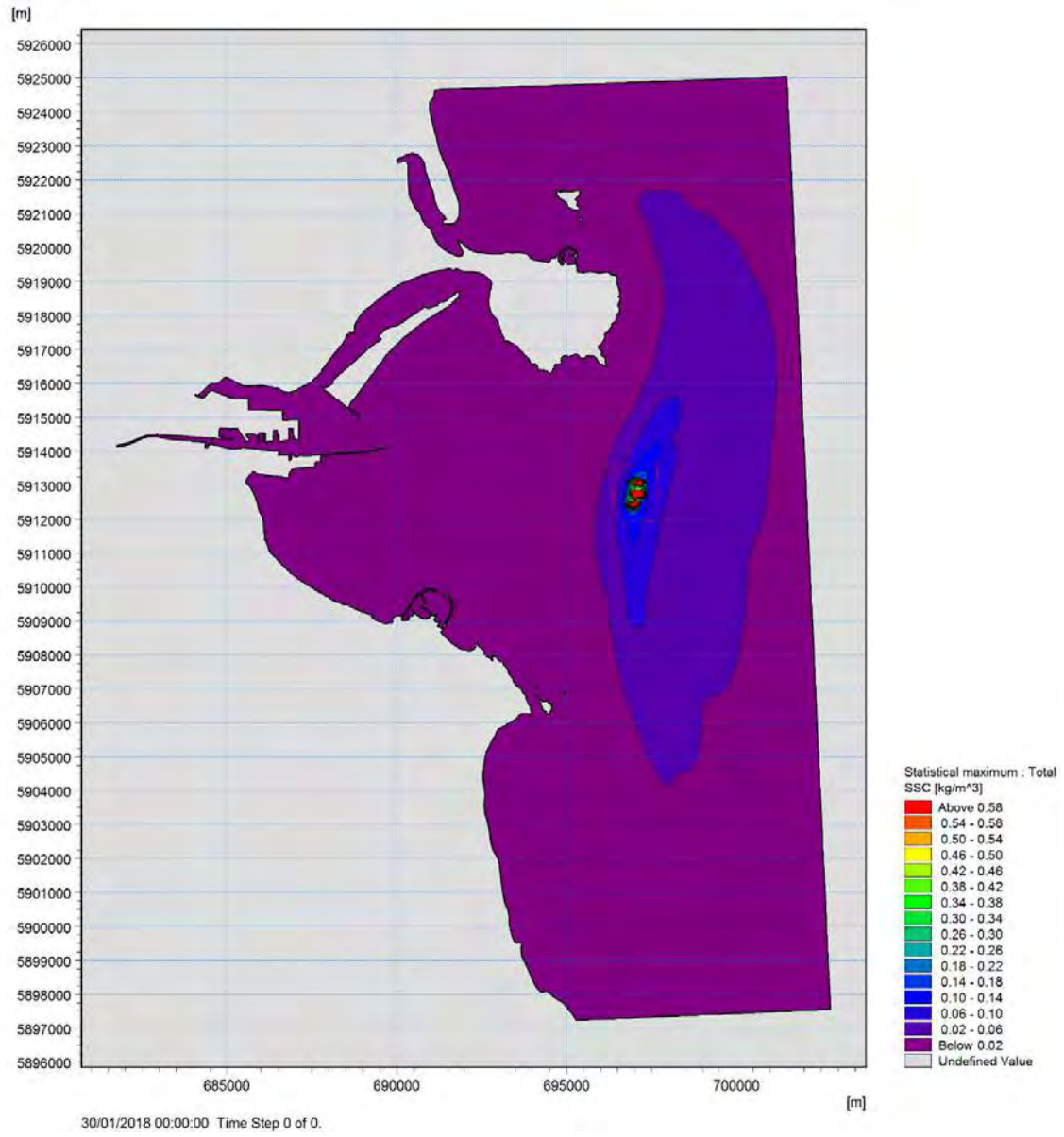


Figure 13-28 Maximum Total Suspended Solids Concentration envelope using a Trailer Suction Dredger dumping hopper load of 4,100m³ at 3 hourly intervals on average

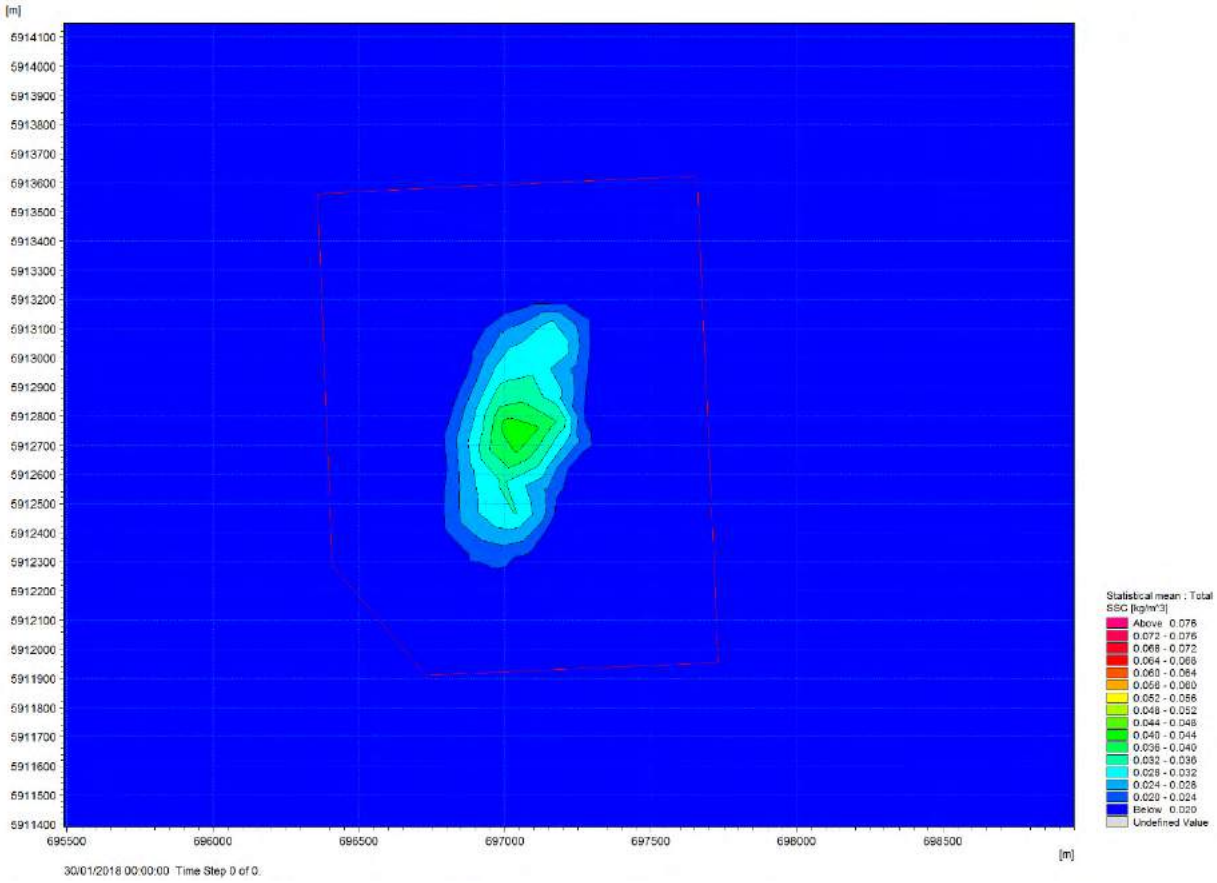


Figure 13-29 Mean Total Suspended Solids Concentration envelope using a Trailer Suction Dredger dumping hopper load of 4,100m^3 at 3 hourly intervals on average

13.6 Model Validation

13.6.1 Sediment Plume Validation Modelling – Dumping Operations

Condition 4.11 of Dumping at Sea Permit S0024-01 (ABR Project) requires DPC to carry out sediment plume monitoring in the vicinity of the dumping activity and to use the results to demonstrate that the models accurately depict the dispersion and fate of the dredging plumes.

Sediment plume monitoring was undertaken during the first dredging campaign which was focussed on the dredging of fine sands in Dublin Bay. The results are reported in the Annual Environmental Report (AER) 2017 submitted to the EPA. The sediment plume monitoring concluded that there was no discernible impact of dumping of the fine sands making up the seabed of Dublin Bay on turbidity and that the released dredge spoil did not create a significant dredge plume within the surface waters. Sediment appeared to settle rapidly and proximally to the release point within the dumping site. This behaviour was predicted by the computational modelling of the sediment plume.

Sediment plume monitoring was also undertaken during the third dredging campaign when dredging operations moved to the inner harbour area (February-March 2020) where silts dominate. An extensive plume monitoring programme was undertaken by Hydromaster Ltd during March 2020 recording the spatial extent of the sediment plumes, in both vertical and horizontal dimensions, during a series of dumping events.

Analysis of the measured data provided evidence that the dumping of silts at the licenced offshore disposal site had no measurable long term effect on turbidity levels outside the dump site or even within the dump site within

a very short time period of the dredger releasing its load. Hydromaster's full report is presented in Appendix 13-1 of this Report.

RPS undertook an extensive modelling programme to validate the numerical modelling parameters used in the Coastal Processes Risk Assessment based on Hydromaster's monitoring data. In summary, this assessment found that:

- The sediment was specified correctly in the Coastal Processes Risk Assessment and that the numerical modelling parameters used for this technical assessment were valid and fit for purpose.
- Simulated turbidity levels were generally found to be well within the surface and mid-point envelope of recorded turbidity levels for all dump events.
- Turbidity levels beyond the immediate vicinity of the dump site did not generally exceed the background turbidity levels recorded when there was no dumping. This is confirmed by the Hydromaster survey tracks presented in Appendix 13-1.
- Sediment plumes did not disperse into the inner Dublin Bay area.
- The tidal conditions at the dump site are fully dispersive for material dominated by silt.

The RPS Model Validation Report is presented in Appendix 13-2. Both the Hydromaster Sediment Plume Monitoring Report and RPS Model Validation Report have been submitted to the EPA as a Licensee Return and are available to the public to view on the EPA Website.

13.6.2 Sediment Plume Validation Modelling – Loading Operations, inner Liffey channel

Condition 4.11 of Dumping at Sea Permit S0024-01 (ABR Project) requires DPC to carry out turbidity monitoring within the inner Liffey channel during captal dredging operations. Monitoring results are to be used to demonstrate that the model predictions of turbidity (a surrogate for Total Suspended Solids) were not exceeded.

Capital dredging under Dumping at Sea Permit S0024-01 took place during 2020. An analysis of the monitoring results was undertaken and reported in the Water Quality chapter of this EIAR (Chapter 9). The results of the analysis demonstrated that the model predictions of the sediment plume concentrations were not exceeded.

13.7 Mitigation Measures

Dublin Port Company has completed four winter dredging seasons (October 2017 – March 2018, October 2018 – March 2019, October 2019 – March 2020, October 2020 – March 2021) as part of the ABR Project. This dredging campaign was fully compliant with the requirements of the Dumping at Sea, Foreshore and Planning Consents as confirmed by high resolution environmental monitoring results reported in the Annual Environmental Reports (AERs) for 2017, 2018, 2019 and 2020 submitted to the Office of Environmental Enforcement (OEE) under Dumping at Sea Permit S0024-01.

A Dredging Management Plan was developed for the ABR Project and is set out in *Alexandra Basin Redevelopment Project Construction Environmental Management Plan (CEMP) Rev. F August 2018*. The mitigation proposed for capital dredging operations has been informed by the ABR Project monitoring and

experience working in the same locations. Mitigation measures set by the EPA under Dumping at Sea Permit S0004-02 (Dublin Port Maintenance Dredging 2020-2021) have also informed the current proposal.

The following mitigation measures will apply to each capital dredging campaign:

- Loading will be carried out by a backhoe dredger or trailing suction hopper dredger (TSHD).
- The capital dredging activity will be restricted to the winter period, October – March inclusive, to avoid overlap with ongoing maintenance dredging campaigns.
- No over-spilling from the vessel will be permitted while the dredging activity is being carried out within the inner Liffey Channel.
- The TSHD pumps will be switched off while the drag head is being lifted and returned to the bottom as the dredger turns between successive lines of dredging to minimise the risk of fish entrainment.
- The dredger's hopper will be filled to a maximum of 4,100 cubic metres (including entrained water) to control suspended solids released at the dumping site.
- Full time monitoring of Marine Mammals within 500m of loading and dumping operations will be undertaken in accordance with the measures contained in the Guidance to Manage the Risk to Marine Mammals from Man-Made Sound Sources in Irish Waters (NPWS 2014).
- A documented Accident Prevention Procedure is to be in place prior to commencement.
- A documented Emergency Response Procedure is to be in place prior to commencement.
- A full record of loading and dumping tracks and record of the material being dumped will be maintained for each trip.
- Dumping will be carried out through the vessel's hull.
- The dredger will work on one half of the channel at a time within the inner Liffey channel to prevent the formation of a silt curtain across the River Liffey.
- When any dredging is scheduled to take place within a 100m radius of the cooling water intakes, the relevant stakeholders will be notified so that precautionary measures can be taken if deemed necessary.

Further to adoption of the above mitigation measures during the Dublin Harbour capital dredging and disposal operations, the potential risk to the receiving water environment will be negligible thus reducing the significance of environmental impact to imperceptible.

13.7.1 Residual Impact

In circumstances where the proposed mitigation measures are fully implemented, there will be no residual impact on the coastal processes within the inner Liffey channel (Dublin Harbour) and Dublin Bay.

13.8 Conclusion

Output from an extensive numerical modelling programme in conjunction with site specific water quality monitoring data and survey data have been used to assess the Dublin Harbour Capital Dredging Project and determine the likelihood of significant impacts on the coastal processes within the inner Liffey channel and Dublin Bay due to dredging and dumping at sea activities.

The computational modelling study predicts the following levels of Total Suspended Solids (TSS) as a result of sediment plumes arising during the dredging operations within the inner Liffey channel:

- The Peak Total Suspended Solids concentration, outside the immediate vicinity of the dredger, arising from dredging within the navigation channel is expected to be in the range 25-30mg/l above baseline levels.
- The Peak Total Suspended Solids concentration, outside the immediate vicinity of the dredger, arising from dredging within the basins is expected to be circa 35mg/l above baseline levels. This slightly higher TSS level was expected due to the lower tidal currents experienced within the more sheltered basins compared to the main flow within the Liffey itself.
- The overall mean rise in Total Suspended Solids over the duration of the dredging campaign is predicted to be less than 10 ml/g above baseline levels.

The computational modelling study predicted the following levels of Total Suspended Solids (TSS) as a result of sediment plumes arising from the disposal of dredge spoil from capital dredging activity within the inner Liffey channel (predominantly silts):

- The sediment plume outside the area of the dump site is expected to result in a TSS of less than 200mg/l and not to extend further than 750m to the north or south of the dump site.
- The disposal operations associated with capital dredging will not result in any significant increases to the background level of suspended sediments.

On the basis that the recommended mitigations measures are fully implemented during the Dublin Harbour Capital Dredging Project, the operations will not result in any significant impact to either water quality in terms of suspended sediments, or the nearby environmentally designated areas in terms of sediment deposition.

14 CULTURAL HERITAGE

This chapter of the Environmental Impact Assessment Report (EIAR) presents the assessment of the potential impacts of the Dublin Harbour Capital Dredging Project on cultural heritage assets. Specifically, this chapter considers the potential impact of the proposed development below the High Water Mark (HWM) and includes detailed recommendations for the mitigation of any effects on cultural heritage assets potentially impacted upon within the area of the proposed development.

The archaeological aspects of the cultural heritage assessment were undertaken by Dr Niall Brady and Rex Bangerter of the Archaeological Diving Company Ltd (ADCO).

The cultural heritage appraisal includes a comprehensive review of existing records and maps and the undertaking of project-related survey and site inspections below the waterline, under licence from the Department of Housing, Local Government and Heritage's (DHLGH) National Monuments Service (NMS).

14.1 Assessment Methodology

Desk-based assessment included a review of existing cartographic sources; the archival records maintained by the National Monuments Service that deal with pre-1750 sources and post-1750 sources; Dublin Port's accessible archives, and ADCO's own records from previous work conducted in the Port area since 2014.

A marine geophysical survey was commissioned separately to include the sea area of the Dublin Harbour Capital Dredging Project footprint where it extends beyond that of the survey completed in 2014 for the Alexandra Basin Redevelopment (ABR) Project and in 2019 for the MP2 Project. The specification required a similar set of comprehensive data acquisition, to maintain consistency between data sets and to ensure similar high standards of outputs, updated to take account of new technologies. The survey was completed in August 2020 by Hydromaster, whose report is included in Appendix 14-1.

Underwater inspections licensed by the National Monuments Service were completed in October 2020 by ADCO. The work focussed on a list of anomalies detected in the marine geophysical survey.

The results of these elements are brought together in this chapter to understand the cultural heritage environment, to appraise the potential impacts and to present appropriate mitigation within the context of the Dublin Harbour Capital Dredging Project.

14.2 Existing environment

14.2.1 Cartographic sources

The history of Dublin Bay and the development of the city and its port are well documented by series of historic maps and sea charts. As the city grew, the wide channel of the River Liffey's estuary was the subject of attempts to improve navigation and access to the commercial centre. The Port moved downriver and eastwards from its origins in the Wood Quay area. The present location of the Port remained open water for many centuries in Dublin's development. As charted by the Dutch military engineer, Bernard de Gomme, in his map of the City and Suburbs of Dublin in 1673, much of the estuary remained hazardous to shipping, as indicated by complex sand flats, while various attempts to overcome these restrictions are also recorded and

include the planned (but never realized) construction of a large star-shaped fort out on Ringsend Spit (Figure 14-1). The presence of the spit helps to explain the slight angle in what became the Great South Wall (begun in 1715 and completed in 1795), which mirrored the easterly alignment of the channel on the seaward side of the spit.

When the cartographer John Rocque prepared his map of the City Harbour and Environs in 1757, he provided a detailed perspective on the various sand flats and constraints on shipping, which suggests the extent to which the prosperous city was expanding (Figure 14-2). It is an important source of information that provides detailed insight to maritime works along the estuary's mouth. Rocque records a series of navigation markers that highlight the shallows on the north and south sides of the channel, as far east as what was then the termination point of the Great South Wall, at what became Pigeon House Fort. The markers appear to be constructed on a basic timber tripod frame, with a more substantial construction close to the terminus of the Wall. This more robust marker, shown with a heap of stone at its base, may highlight the former tip of the Ringsend Spit that was mapped by de Gomme eighty years earlier. The channel at this location in 1757 was much straighter, which suggests a programme of extensive dredging had occurred in the intervening time. A formal buoy, the 'West Buoy' marks the Port side of the harbour entrance further to the east, while a floating buoy or 'Light Ship' marks the starboard side; both of which foreshadow the North Bull light and Poolbeg lighthouse respectively today.

Reclamation of the intertidal areas on the north side of the Liffey downstream of the city was well under way by 1757, and the North Lotts was laid out and parcelled into blocks terminating at 'East Quay', which is on the line of East Wall Road today. The site of the future Port remained an undeveloped wedge-shaped sandflat to the east, while further east Rocque's map records the names of individual sand banks, such as 'Brown's Patch', and highlights the extensive footprint of the Clontarf oyster beds.

In contrast, the south side was much more developed, with construction of the South Wall well underway. The wall made landfall in the west at Ringsend Point, and had two slipways: Macarel's Slip gave access north into the channel and seems to be on the same location of the later Coastguard slip, east of the present-day Poolbeg Yacht Club; while George's Slip gave access south of the wall onto Sandymount. To the east of the Wall and running at an angle aligned East-Northeast were 'The Piles', which represent Dublin Corporation's first attempt (completed in 1731) to secure the shipping channel by building a timber breakwater out into the bay along the south bank of the River Liffey. The Piles are recorded as a parallel line of timber-post couplets. The Piles recorded by Rocque would soon be replaced fully, during the 1760s, by a solid wall that is the Great South Wall today, completed in 1796.

The ships recorded by Rocque are substantial three-masted ocean-going vessels, as one might expect to service the city. The ships are shown within the area of the Piles, but do not reach substantially further upriver. This is in contrast to Rocque's 1756 map of the City and Suburbs of Dublin, which shows a wealth of shipping along the city's quays but does not map the area downriver of North Wall Quay and Rogerson's Quay. The point to take from this variation is that on the 1757 map Rocque conveys an indication of the constraints on shipping, insofar as the deep water vessels did not extend onto the shallower waters upriver and west of the Clontarf Pool. In their place, smaller vessels and ferries were used to convey merchandise into and out of the city. Rocque's representation is a cartographic convention, used to indicate variation in seabed levels and consequently factors that affect navigation.

As indicated on Figure 14-2, which shows an overlay of the present-day port on top of Rocque's 1757 map, the development area for the Dublin Harbour Capital Dredging Project occupies an area that includes much of the mudflat known as Brown's Patch, and the adjacent deep water space of Clontarf Pool and the former Clontarf oyster bed on the north side of the channel. The area on the south side of the channel touches on a location referred to as The Pacquet Moorings, where cross-channel ships would lie at anchor, and the location of the 'Quarantine Sloop'; the deepening of Berths 46, 47 and 48 to –11m CD will extend into part of this space.

The mapping of Dublin harbour and Bay attracted a host of different hydrographers, many of whom were commissioned to assist in developing measures to improve navigation along the Liffey. George Semple's charts of 1762 may be cited in this regard, as can the map of the Bay by Captain Bligh in 1800, who was appointed by the Admiralty to report on the Bay, the harbours within it and the problems of shallowness in the approaches to Dublin.[1] By 1837, the Ordnance Survey produced the first metrically accurate maps at 6-inch-to-the-mile scales, and established a new standard for mapping the landscape (Figure 14-3). Reclamation works had begun on the seaward side of East Wall road, extending the Port onto the mudflats. The construction of the Patent Slip is recorded, along with a narrow line of buildings to the south, heralding the advance of the deep water basin. The developments on the south side of the river were also much in evidence, and the map shows the extension of the Great South Wall eastwards, replacing the timber Piles and terminating at the Poolbeg light house. Pigeon House Fort (completed by 1800) is also constructed, along with its harbour (completed by 1793) on the north side.

Commander Langdon's 'Ireland. Dublin Bar and the River Liffey to Carlisle Bridge' (Admiralty Chart 1447) shows soundings in feet and inches taken between 1878 and 1880 across Dublin Bar outside the harbour, and along the approach channel to what is today O'Connell Bridge (Figure 14-4). Langdon also records a series of navigation beacons and maps the mud and sandflats that continued to define the estuary prior to the reclamation works of the twentieth century.

From this point on, it is possible to see the developing port emerge. The blocky rectangular form of the deep water port is recorded on Admiralty Chart 1468, which also provides accurate soundings along the channel, reaching out across Dublin Bar to the east of Poolbeg (Figure 14-5).

By 1907, many of the principal features of the deep water port were established, and Ordnance Survey mapping records the shipbuilding yard, Graving Dock 1 and North Quay Extension within the deep water facility of Alexandra Basin, while the Breakwater defined the eastern extent of the Basin and marks the entrance to the Port (Figure 14-6). On the south side of the channel, Pigeon House Harbour has been partially infilled to serve as an Outfall Works for Dublin Corporation while further east a slipway is indicated on the Great South Wall along with a series of buildings that are not yet recorded as those of the former lifeboat complex they would become. The main channel of the river shows few features in itself, but tidal sands and muds are indicated along the southern shore.

The historic cartographic information available for the project area helps to convey the consistent process of development and the maps that survive make them a useful set of archives to work with.

[1] Gerard Daly, 'Captain Bligh in Dublin, 1800-1801', *Dublin Historical Record* 44.1 (1991): 20-33, at p. 23.



Figure 14-1 Detail from Bernard de Gomme's Map of 1673, "City and Suburbs of Dublin", showing the river mouth area.



Figure 14-2 Detail from John Rogue's Map of 1756, "A survey of the City Harbour and Environs of Dublin, with approximate location of development boundary superimposed



Figure 14-3 Extracts from OS First Edition (1843) map with approximate location development boundary superimposed. Source OSI Historic Map Archive

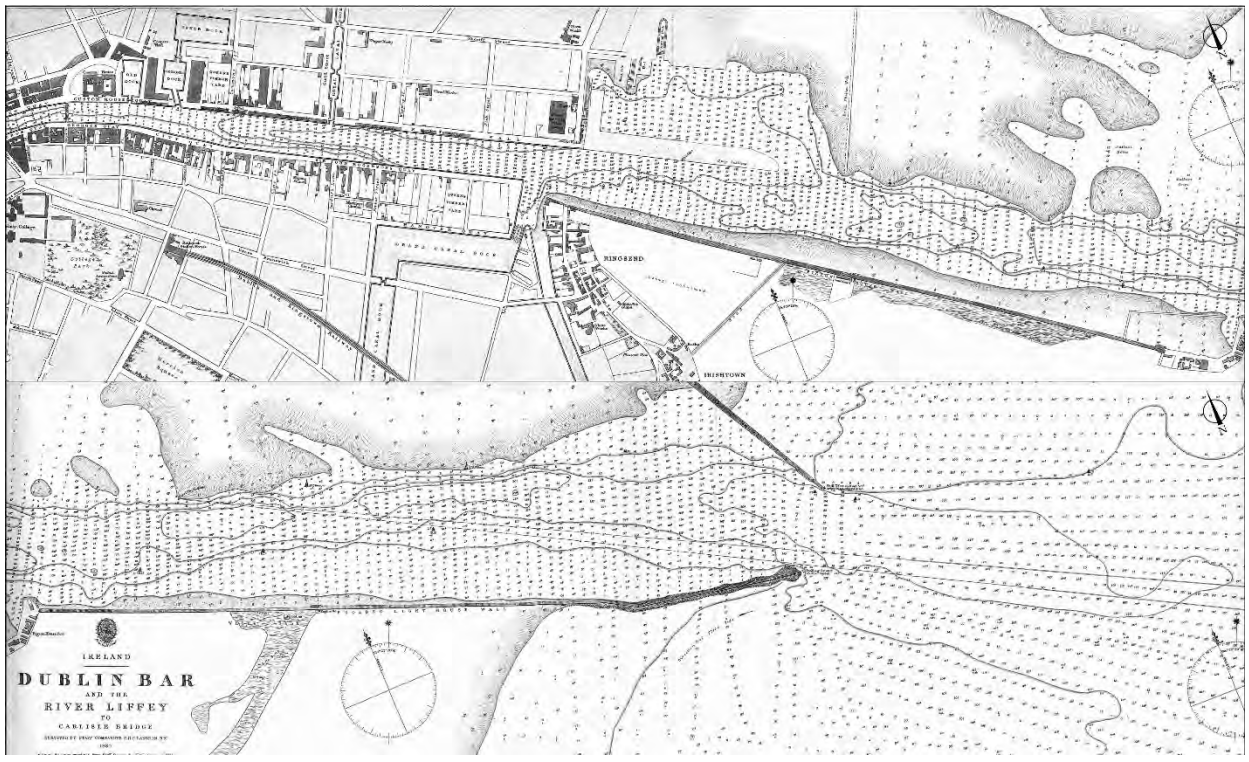


Figure 14-4 Detail from Commander Langdons Chart of 1880 "Dublin Bar & the River Liffey to Carlisle Bridge". Source: UKHO Surveyed by Staff Commander C.H.C Langdon,1880, Chart No.1447

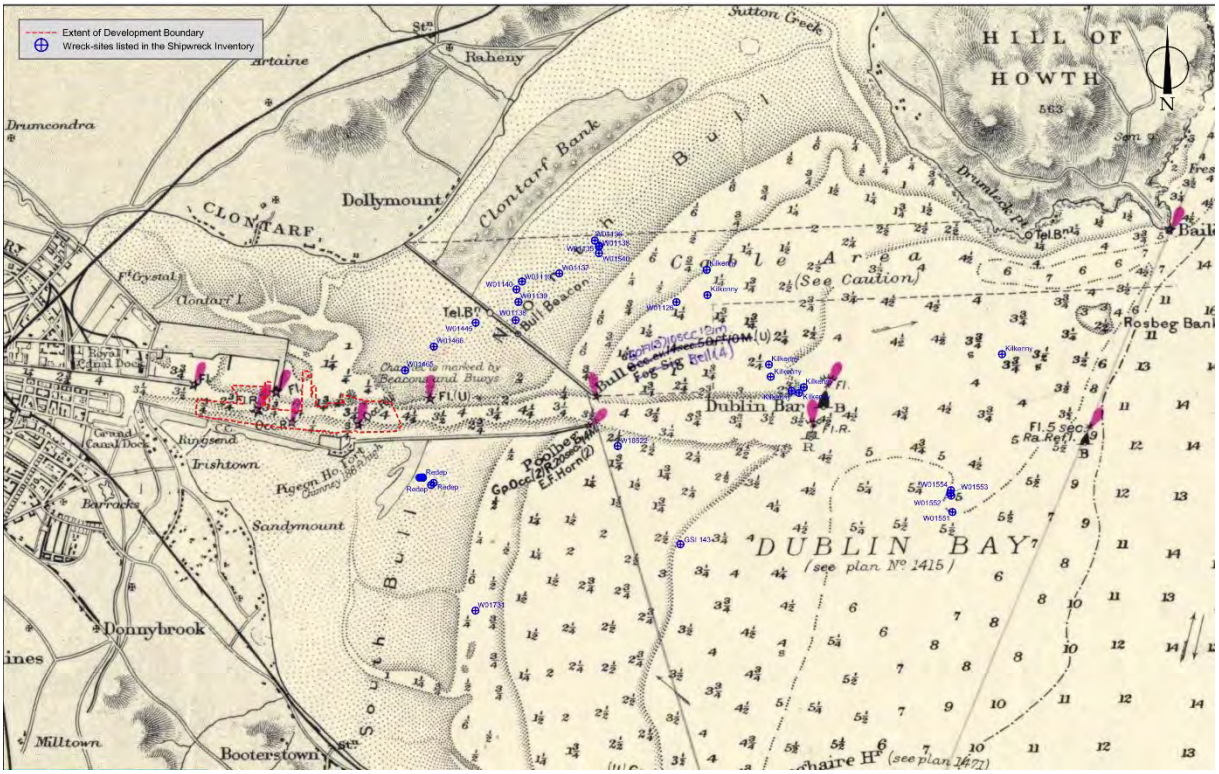


Figure 14-5 Detail from Admiralty Chart No.1468 (1883) with 1965 additions and approximate extent of the project boundary superimposed. Source: Admiralty Chart no 1468, Wicklow to Skerries Island with Dublin Bay, 1883. Shipwreck sites taken from the DCHG Inventory



Figure 14-6 Extract from OS 25-inch Edition (1907) map depicting the principle features of the deepwater facility comprising Alexandra Basin

14.2.2 Known monuments and features

The known monuments and features of cultural heritage interest in the vicinity of the Dublin Harbour Capital Dredging Project are indicated on Table 14-1 and Figure 14-7, and all are located outside the project footprint and are related to Port infrastructure. They include the eastern breakwater and lighthouse on the north side of the channel, and the Great South Wall and Pigeon House harbour and fort complex on the south side of the channel, along with a number of wreck sites and smaller structures. None of these locations, however, will be impacted by the Dublin Harbour Capital Dredging Project, whose footprint is concerned only with the underlying riverbed of the active channel and basins.

Table 14-1 Known archaeological and industrial heritage sites within and in proximity to the Dublin Harbour Capital Dredging Project.

Reference	Site type	Status	Impacts from Dublin Harbour Capital Dredging Project
North side of Channel			
DCIHR 19-09-002	Breakwater	Buried Terminus is a standing structure	None
DCIHR 19-09-003	Breakwater Lighthouse	Removed	None
W01465	Wreck	300m N of Berth 53	None
W01466	Wreck	600m N of Berth 53	None
South side of Channel			
RMP DU019-027, RPS 6794	Blockhouse, Pigeon House Fort	Remnants survive	None
RMP DU019-028	Battery	Swimming pool	None
RMP DU019-029002, DCIHR 19-09-010, RPS 6797, RPS 6798	Sea wall Great South Wall to Poolbeg Lighthouse	Upstanding	None
RPS 6793	St Catherine's Hospital and surviving boundary walls, Pigeon House Rd	Remnants survive	None
RPS 6795	Former Pigeon House Hotel, Pigeon House Rd		None
DCIHR 18-12-151	Syphon House	Derelict	None
DCIHR 18-12-152	Dublin Main Drainage Pumping Station, Pigeon House Rd	Upstanding	None
DCIHR 19-09-001	Boat slip, Pigeon House Rd		None
DCIHR 19-09-004	Outfall works, Pigeon House Rd		None
DCIHR 19-09-005	Lifeboat House, Pigeon House Rd		None
DCIHR 19-09-006, NCEHD 3271, RPS 6796	Electricity works/Power Station, Pigeon House Rd	Upstanding	None
DCIHR 19-09-007	Cooling water intake dolphin ramp, Dublin Harbour	Upstanding	None
DCIHR 19-09-007	Lifeboat House, South Wall	Ruined	None

Reference	Site type	Status	Impacts from Dublin Harbour Capital Dredging Project
DCIHR 19-09-009	Sluice House, South Wall	Upstanding	None
DCIHR 19-09-011	Slip, South Wall	Upstanding	None
DCIHR 19-09-012	Landing slip, Pigeon House Rd		None
DCIHR 19-09-015	Poolbeg Generating Station chimneys, Pigeon House	Upstanding	None

Note*: RMP-Record of Monuments and Places; RMP-Record of Protected Structures; DCIHR-Dublin City Industrial Heritage Record; NCEHD-National Civil Engineering Database; W-Historic Shipwreck Inventory.*

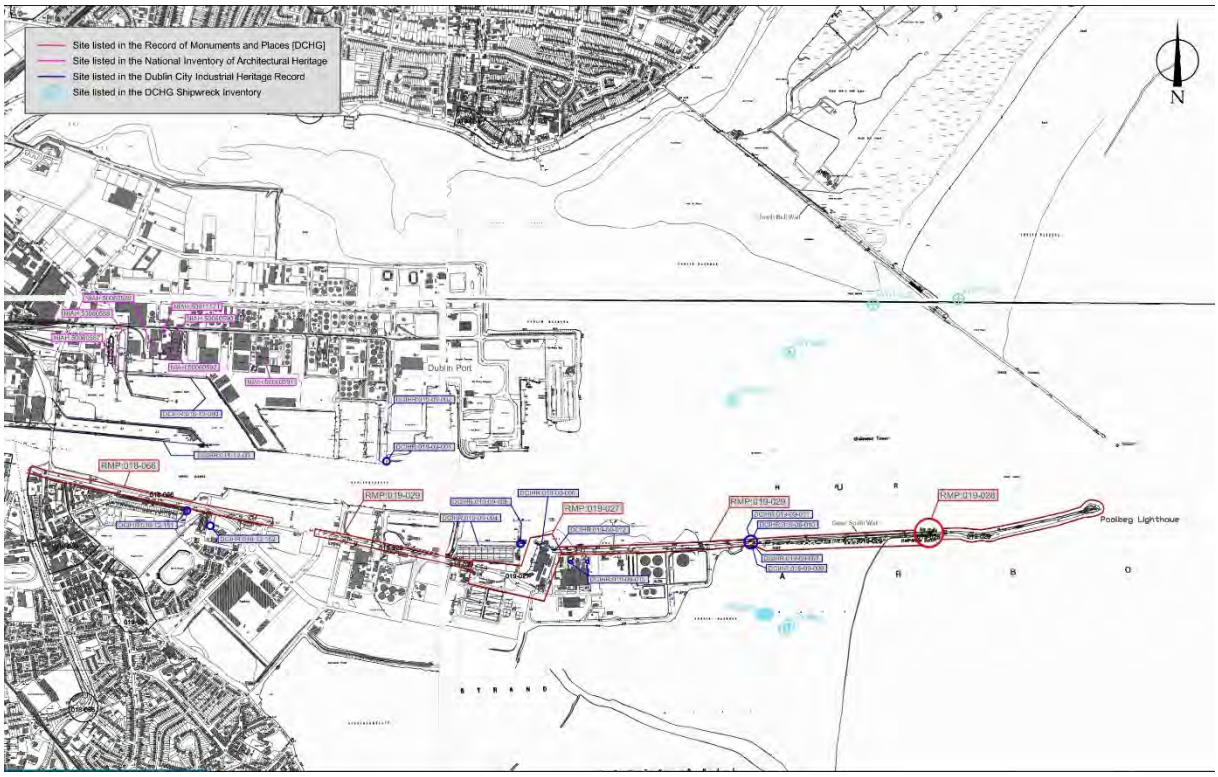


Figure 14-7 Extract from OS Third Edition Map with Cultural Heritage Assets located in proximity to the propose development highlighted. Source RMP mapping based on OS 6-inch third edition map sheets 2198, 3199, 3264 and 3265

14.2.3 New Observations

The new observations are based on the results of the following work completed for the Dublin Harbour Capital Dredging Project:

- Marine geophysical survey
- Underwater archaeological inspection

Marine Geophysical Survey

A marine geophysical survey was commissioned for the Dublin Harbour Capital Dredging Project to assess the archaeological potential of the seabed in those locations that extended beyond the area surveyed in 2013 for the ABR Project and beyond that surveyed in 2018 for the MP2 project (Appendix 14-1). The new survey

included Alexandra Basin East (ABE), the Oil Berths 2 and 3, and the Ferryport or Berths 50, 51 and 51A on the north side of the channel, and the navigation channel next to Berth 48 between Buoys 11 and 12 on the south side of the channel (Figure 14-8). The work comprised multi-beam survey and magnetometry survey. Line-spacing was at 20m intervals following the long axis of each survey pocket. The results provide a robust and comprehensive suite of information that compares well with that acquired in 2013 and 2018, and shows suitable levels of overlap that is enhanced by the multi-beam data sets.

A series of sixteen targets were detected; fourteen by the multi-beam survey, and two by the magnetometer survey.

No defined anomalies indicative of shipwreck were identified, and the series of acoustic anomalies appear to be associated with port activities. The locations that were subsequently diver-truthed are reported on below.

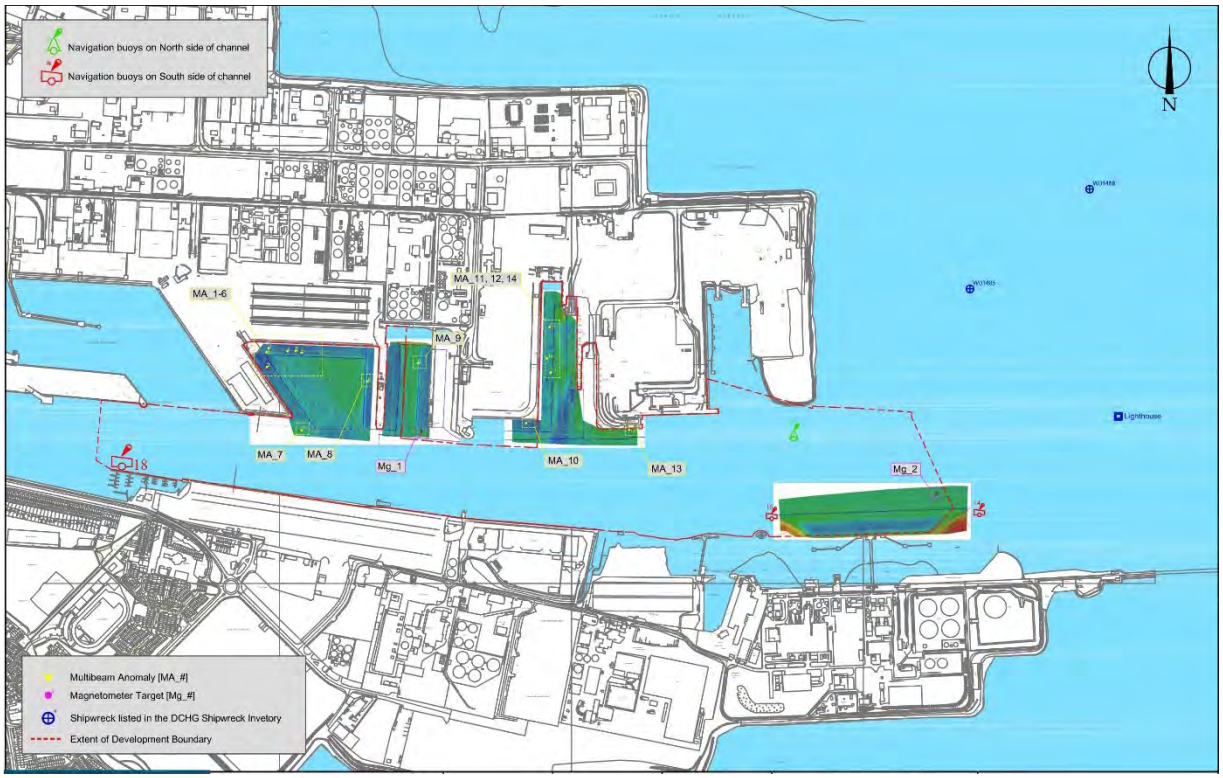


Figure 14-8 OS Background Mapping with location of Multibeam Anomalies 1-13 and Magnetometer Targets 1-2 superimposed

Underwater Inspection

A programme of underwater inspection was carried out to inspect the acoustic targets observed in the marine geophysical survey. Not all sixteen targets were considered necessary to inspect. In some instances, the acoustic image clearly defined a modern object, in two cases the target had been dived previously as part of the ABR Project dive work, and as part of the MP2 Project dive work. The dive work in October 2020 was limited to six inspections (Figure 14-9). The observations are presented in Table 14-2. In no instance were any of the targets determined to be of archaeological interest.

Table 14-2 Underwater inspection observations of acoustic anomalies identified.

Ref	ITM - Easting	ITM Northing	Location	Hydromaster interpretation	ADCO dived pre-2020	ADCO dive 2020	ADCO Observation
T04	719149	734463	ABE	Debris, 7.4m long	No	No	In all likelihood, fender/tyre from quayside works. Access was prohibited due to vessel traffic
T06	719186.9	734458.9	ABE	Tyre with long debris	No	No	In all likelihood, fender/tyre from quayside works. Access was prohibited due to vessel traffic
T09	719503.8	734429.9	Oil Berth	Tyre	No	Yes	Tyre
T13	720085	734246	Nav Ch	Boulders, 1.7m area	No	Yes	Rock armour protection added to base of quay
MG2	720922.1	734068.2	Nav Ch	Anomaly	No	Yes	Not of archaeological interest

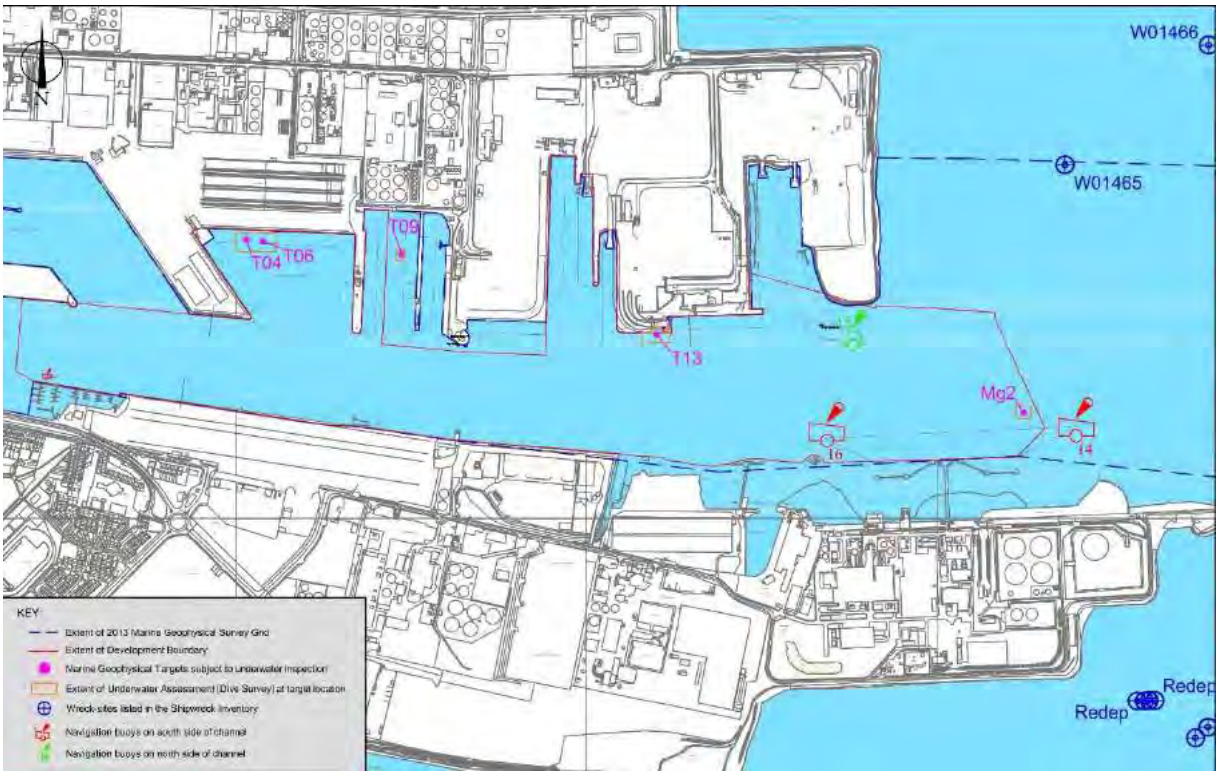


Figure 14-9 Location of the five marine geophysical targets that were subject to Underwater Inspection by ADCO.

14.2.4 Conclusions

The existing knowledge base highlights the historical associations of the seascape that the Dublin Harbour Capital Dredging Project is associated with the development of the port area as a berthing area of ferries since the eighteenth century. The area has remained open water, with reclamation taking place from the

1700s, to create the Great South Wall on the south side of the Liffey, and the more recent port works that occupy the north side of the approach channel.

14.3 Likelihood of effects

Capital dredging is required to deepen the seabed in Alexandra Basin East, Oil Berths 2 and 3, the Ferryport or Berths 50, 51 and 51A, and the riverside Berth 52 on the north side of the channel; the Navigation Channel at the entrance to Alexandra Basin; and at Berths 43, 44, 57, 46, 47 and 48 on the south side of the channel. The total volume of material to be dredged will be 500,000m^3 and includes a siltation tolerance/ contingency to account for material which has settled in Dublin Harbour in the period between successive maintenance dredging campaigns and the commencement of the capital dredging campaign. A trailing suction hopper dredger and/or a backhoe dredger will carry out the dredging work. Dredged spoil will be disposed of at the licenced dump site used by DPC at the approaches to Dublin Bay on the west side of the Burford Bank.

The extension of capital dredging represents direct and permanent impacts on what appears to be previously un-dredged depths. Much of the area is within existing berth pockets, where the dredging will deepen such locations. The work commissioned to further inform the cultural heritage risk for the Dublin Harbour Capital Dredging Project has conducted a series of comprehensive surveys (marine geophysical survey, and archaeological underwater inspection, as outlined in this chapter), and this work did not identify significant materials of archaeological importance. The proposed dredging provides the opportunity to further examine the potential, and this will be done by archaeological monitoring of the dredging works at construction time, and recording by record any observations made at that point.

14.4 Cumulative impacts

The areas within Dublin Harbour subject to the proposed capital dredging works overlap, in plan view, with annual maintenance dredging campaigns proposed under the Dublin Port Maintenance Dredging Project 2022-2029. Maintenance dredging is designed to maintain the existing charted depths within Dublin Port and therefore do not overlap with the proposed capital works in terms of depth. Consequently there is no cumulative impact between the two projects.

Capital Dredging associated with the MP2 Project will also take place within the same timeframe as the Dublin Harbour Capital Dredging Project. The areas to be dredged under both projects adjoin but do not overlap. The same marine archaeology mitigation measures will apply to both projects. Consequently there is no cumulative impact between the two projects.

14.5 Mitigation measures

The following archaeological monitoring and management measures will be undertaken:

Retaining a project archaeologist/s. An archaeologist experienced in maritime archaeology will be retained by Dublin Port Company for the duration of the relevant works.

Archaeological licences will be required to conduct the on-site archaeological works. Licence applications require the inclusion of detailed method statements, which outline the rationale for the works, and the means by which the works will be resolved. Licence applications take a minimum of four weeks to process through

the Department, and advance planning is required to ensure that the necessary permits are in place before site works commence. It is anticipated that the following licence types will be required: Excavation, to cover monitoring and investigations works; Detection, to cover the use of metal-detectors; and Dive Survey, to cover the possibility of having to conduct underwater inspections. Since 2017, Excavation licence applications must be accompanied by a letter from the client on their letterhead 'confirming that sufficient funds and other facilities are available to the archaeologist to complete the archaeological excavation, post-excavation, and preliminary and final reports (including specialist reports)'. Dublin Port Company has confirmed that sufficient funds and other facilities as required will be made available to the project archaeologist to complete all reports required.

Archaeological monitoring will be carried out by suitably qualified and experienced maritime archaeological personnel licensed by the Department of Housing, Local Government and Heritage. Archaeological monitoring is conducted during all seabed disturbances associated with the development. The monitoring will be undertaken in a safe working environment that will facilitate archaeological observation and the retrieval of objects that may be observed and that require consideration during the course of the works. The monitoring will include a finds retrieval strategy that is in compliance with the requirements of the National Museum of Ireland.

The time scale for the construction phase will be made available to the archaeologist, with information on where and when ground disturbances will take place.

Discovery of archaeological material. In the event of archaeologically significant features or material being uncovered during the construction phase, machine work will cease in the immediate area to allow the archaeologist/s to inspect any such material.

Archaeological material. Once the presence of archaeologically significant material is established, full archaeological recording of such material will be recommended. If it is not possible for the construction works to avoid the material, full excavation will be recommended. The extent and duration of excavation will be a matter for discussion between the client and the licensing authorities.

Archaeological team. It is recommended that the core of a suitable archaeological team be on standby to deal with any such rescue excavation. This would be complimented in the event of a full excavation.

Archaeological dive team. It is recommended that an archaeological dive team is retained on standby for the duration of any in-water disturbance works on the basis of a twenty-four or forty-eight hour call-out response schedule, to deal with any archaeologically significant/potential material that is identified in the course of the seabed disturbance activities.

A site office and facilities will be provided by Dublin Port Company on site for use by archaeologists.

Secure wet storage facilities will be provided on site by the Dublin Port Company to facilitate the temporary storage of artefacts that may be recorded during the course of the site work.

Buoying/fencing of any such areas of discovery will be necessary if discovered and during excavation.

Machinery traffic during construction will be restricted to avoid any identified archaeological site/s and their environs.

Spoil will not be dumped on any of the selected sites or their environs.

Post-construction project report and archive. It is a condition of archaeological licensing that a detailed project report is lodged with the Department of Housing, Local Government and Heritage within 12 months of completion of site works. The report should be to publication standard and should include a full account, suitably illustrated, of all archaeological features, finds and stratigraphy, along with a discussion and specialist reports. Artefacts recovered during the works need to meet the requirements of the National Museum of Ireland.

These measures are subject to the approval of the National Monuments Service at the Department of Housing, Local Government and Heritage. DPC has and will continue to engage with the Department of Housing, Local Government and Heritage.

14.6 Residual impacts

It is unlikely that dredging works will encounter archaeological materials since these works will take place on riverbed that has also been dredged albeit to shallower levels than are being proposed.

The dredging works to be carried out will be capital dredging activity that will extend into seabed that has not previously been dredged. The potential for this work to uncover and expose previously unrecorded archaeological material, and principally shipwreck, exists, and the protocols are in place to ensure that any new discoveries will be fully and properly resolved.

14.7 Conclusions

The EIAR has identified, recorded and assessed the cultural heritage assets and potential impacts associated with the Dublin Harbour Capital Dredging Project. Existing records and newly-commissioned work present a robust baseline of information above and below the waterline.

The principal cultural heritage constraint identified is the potential for new discovery as a resulting the dredging work.

Archaeological monitoring of seabed disturbance activities will take place across the Dublin Harbour Capital Dredging Project area, ensuring that a robust record is maintained and that any new archaeological observations are resolved fully.

15 POPULATION & HUMAN HEALTH

This Environmental Impact Assessment Report (EIAR) chapter applies a broad socio-economic model of health that encompasses conventional health impacts such as disease, accidents and risk, along with wider socio-economic health determinants vital to achieving good health and wellbeing.

This chapter draws from and builds upon detailed project information and the wider technical disciplines within the EIAR (most notably, Chapter 10: Air Quality and Climate and Chapter 11: Terrestrial Noise and Vibration) to communicate the potential influence upon human health. For the sake of brevity, this chapter does not seek to repeat text or replicate data from the wider EIAR chapters. Furthermore, this chapter is supported by Appendix 15-1: Human Health Baseline.

15.1 Assessment Methodology

15.1.1 Relevant Policy and Guidance

The Environmental Protection Agency's Draft Guidelines on the Information to be contained in EIAR (EPA Ireland, 2017), highlights the amendments to Article 3(1) of amended European Union (EU) Environmental Impact Assessment (EIA) Directive which states that:

> *"The environmental impact assessment shall identify, describe and assess in an appropriate manner, in light of each individual case, the direct and indirect significant effects of a project on the following factors: a) population and human health; […]"*

Moreover, Annex IV, paragraph 5(d) requires an EIAR to contain:

> *"A description of the likely significant effects of the project on the environment resulting from, inter alia, 'the risks to human health'".*

When outlining the scope of environmental factors covered by the EIA Directive within the European Commission's guidance on the preparation of the Environmental Impact Assessment Report (European Commission, 2017), "population and human health" is defined as follows:

> *"Human health is a very broad factor that would be highly Project dependent. The notion of human health should be considered in the context of the other factors in Article 3(1) of the EIA Directive and thus environmentally related health issues (such as health effects caused by the release of toxic substances to the environment, health risks arising from major hazards associated with the Project, effects caused by changes in disease vectors caused by the Project, changes in living conditions, effects on vulnerable groups, exposure to traffic noise or air pollutants) are obvious aspects to study. In addition, these would concern the commissioning, operation, and decommissioning of a Project in relation to workers on the Project and surrounding population."*

Additionally, when describing the likely significant effects of a project, the European Commission's guidance poses the following questions to consider:

> *"Have the primary and secondary effects on human health and welfare described and, where appropriate, been quantified? (e.g. health effects caused by the release of toxic substances to the environment, health risks arising from major hazards associated with the Project, effects caused by changes in disease vectors caused by the Project, changes in living conditions, effects on vulnerable groups)."*

It is important to ensure that methods employed in a particular human health assessment are proportionate and tailored to meet the assessment requirements of the project in question, which can differ considerably depending on the scale and nature of a proposal and are further influenced by local context and varying community circumstance.

In Ireland and the UK, there is a large body of guidance on Health Impact Assessment (HIA) generally and in the context of development planning. This draws from expert evidence and government policy regarding the importance of integrating public health into the planning system (IPH Ireland, 2009; Department of Health, 2010; Marmot, et al., 2010; West Midlands Public Health Observatory, 2007; Chadderton, et al., 2012; Ross, et al., 2012). Such guidance has been applied to inform the development of a bespoke human health EIAR chapter, where the scope, focus and assessment protocols are tailored to what is proposed; local circumstance and the specific decision-making process in which it is intended to inform.

The assessment methodology follows a source-pathway-receptor model to identify and assess human health effects that are plausible and directly attributable to the proposed development. As shown in Table 15-1, a hazard source itself does not constitute a health risk. It is only when there is a hazard source, a receptor and a pathway of exposure that there is any potential risk to human health. The same is true for potential health benefits where a positive influence must be present alongside a pathway of exposure and a receptor for there to be a potential health improvement.

Where a source-pathway-receptor linkage exists, it is then the nature of the specific hazard source or positive influence; the magnitude of impact via the pathway of exposure; and the sensitivity of the receptor that will determine what level of health risk or benefit is predicted, if any.

Table 15-1 Example of Source-Pathway-Receptor Model for Human Health Effects

Source	Pathway	Receptor	Plausible Health Impact	Explanation
X	✓	✓	No	There is not a clear source from where a potential health impact could originate.
✓	X	✓	No	The source of a potential health impact lacks a means of transmission to a population.
✓	✓	X	No	Receptors that would be sensitive or vulnerable to the health outcome are not present.
✓	✓	✓	Yes	Identifying a source, pathway and receptor does not mean a health outcome is a likely significant effect; health impacts should be assessed (describing what effect will occur and its likelihood) and likely health effects are then evaluated for significance.

When defining potential health determinants associated with a proposed development, it is also useful to consider three broad domains of public health practice: health protection (i.e. environmental objective thresholds set to be protective of health); health promotion (i.e. ways in which to support healthy lifestyles, improve socio-economic status and address inequality); and health care (i.e. provision, effectiveness and equity of access to healthcare services).

In this instance, the assessment provides qualitative and quantitative analysis of potential human health effects, and has been prepared using specialist knowledge and professional experience gained through carrying out studies for other projects.

15.1.2 Assessment Scope

The Dublin Harbour Capital Dredging Project brings forward for consent key elements of the capital dredging works required to create the required depth of the navigation channel, basins and berthing pockets. Given the nature of the proposed application, with very little land-based activity and limited interaction with communities, the scope of health determinants assessed comprises:

- changes in air quality; and
- changes in noise exposure.

There are no operational phase health determinants of the proposed development.

15.1.3 Study Area

Environmental health determinants (such as changes to air quality and noise exposure) are likely to have a local impact where potential change in hazard exposure is limited by physical dispersion characteristics. As a result, and where available, the study area for health-specific baseline statistics relating to human health effects focus on the electoral divisions (EDs) immediately adjacent to the proposed development (i.e. North Dock B and Pembroke East A, as shown in Figure 15-1). Dublin City and Ireland averages are then used as comparators. Where data for EDs are not available, statistics relating to Dublin City are collected using the Ireland average as a comparator.

Socio-economic health determinants (such as employment and related income generation) have a wider geographic scope of influence than environmental health determinants. The willingness to commute significant distances to work indicates that the study area for socio-economic baseline statistics relating to human health effects should have a wider focus (i.e. Dublin City), using the Ireland average as a comparator.

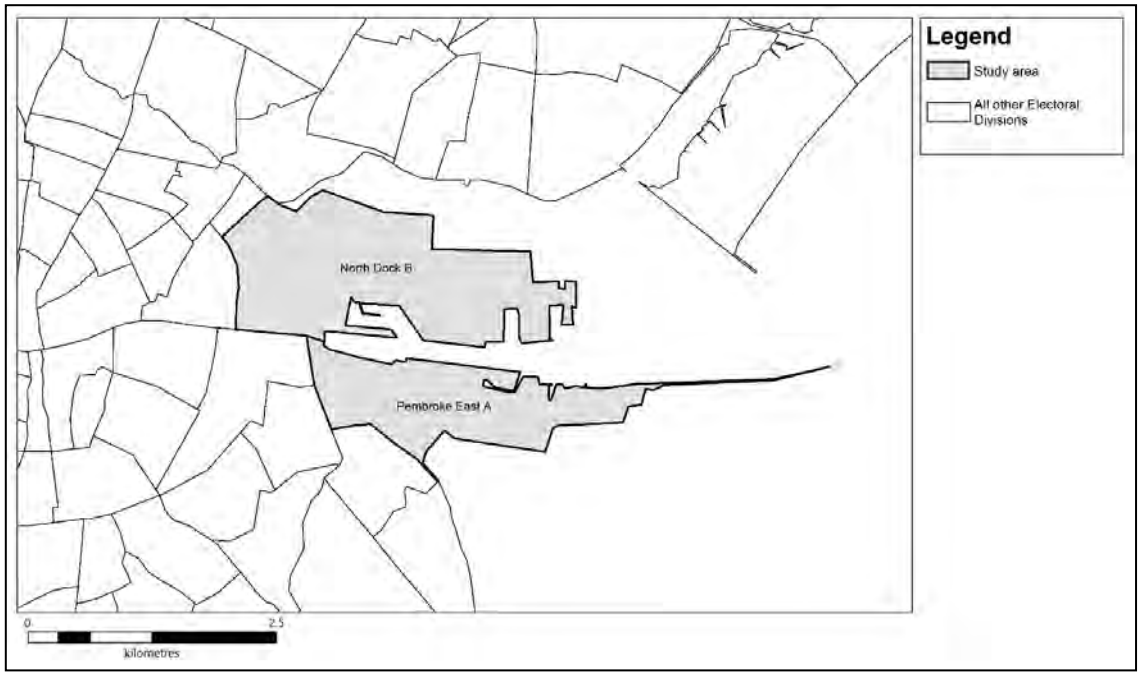


Figure 15-1 Environmental Health Determinant Study Area

15.1.4 Assessment Criteria and Assignment of Significance

The assessment of significance of effect is a professional judgement based on the sensitivity of the receptor and the magnitude of any impact (see Table 15-2).

Receptor Sensitivity

Within a defined population, individuals will range in level of sensitivity due to a range of factors such as age, socio-economic deprivation and the prevalence of pre-existing health conditions which could become exacerbated. These individuals can be considered particularly vulnerable to changes in environmental and socio-economic factors (both adversely and beneficially) whereby they could experience disproportionate effects when compared to the general population.

As an example, the elderly, young children and individuals with chronic pre-existing respiratory conditions would be more sensitive to adverse changes to air quality, with the potential for emergency admission to hospital more likely than for someone of working age who has good respiratory health. On the other hand, an individual who has been unemployed for a long period of time would benefit more from employment opportunities generated by the proposed development in comparison to an individual who is already employed.

On this basis, a precautionary approach has been applied by assuming that the population within the study area is of uniformly high sensitivity.

Magnitude of Impact

The terms in Table 15-2 have been used to describe the magnitude of predicted impacts.

Table 15-2 Definitions of Magnitude

Magnitude	Typical Descriptors
High	Change in environmental or socio-economic factor sufficient to result in a major change in baseline population health or socio-economic circumstance (adverse or beneficial)
Medium	Change in environmental and socio-economic factor sufficient to result in a moderate change in baseline population health or socio-economic circumstance (adverse or beneficial)
Low	Change in environmental and socio-economic factor sufficient to result in a minor change in baseline population health or socio-economic circumstance (adverse or beneficial)
Negligible	Change in environmental and socio-economic factor below that for which it is possible to result in any manifest health outcome at a population level but may impact at an individual level (adverse or beneficial)
No Change	No opportunity for change in health outcome or socio-economic circumstance (adverse or beneficial)

Significance of Effects

Informed by the individual health assessment protocols conducted, a combination of receptor sensitivity and the magnitude of impact (as defined in the assessment) have been applied to form a professional judgement as to the significance of effect, using the matrix shown in Table 15-3.

Table 15-3 Significance of Effects

Source	Magnitude of Impact			
	Negligible	**Low**	**Medium**	**High**
Negligible	Negligible	Negligible or minor	Negligible or minor	Minor
Low	Negligible or minor	Negligible or minor	Minor	Minor or moderate
Medium	Negligible or minor	Minor	Moderate	Moderate or major
High	Minor	Minor or moderate	Moderate or major	Major

15.1.5 Limitations of the Assessment

The human health assessment partially draws from and builds upon the technical outputs from inter-related technical disciplines, namely: Chapter 10: Air Quality and Climate and Chapter 11: Terrestrial Noise and Vibration.

As a consequence, the assumptions and limitations of those assessments also apply to any information used in this chapter (e.g. for modelling work undertaken). It is, however, considered that the information available provides a suitable basis for an assessment of human health for the purposes of this EIAR.

15.2 Receiving Environment

15.2.1 Existing Baseline Conditions

Different communities have varying susceptibilities to health impacts and benefits as a result of social and demographic structure, behaviour and relative economic circumstance. The aim of the following information is to summarise the human health baseline provided in Appendix 15-1, which puts into context the local health and socio-economic circumstance of the communities living in the study area (North Dock B and Pembroke East A Electoral Divisions) using regional (Dublin County or Dublin City) and national (Ireland) averages as

relevant comparators. Where Electoral Division-level information is not available, data for Dublin County or Dublin City has been collected as a representative alternative geography.

It should be noted that the statistics outlined below only includes data up to 2016. As such, there is no potential for misrepresentation associated with the Covid-19 pandemic.

Demography, Socio-economic Circumstance and Deprivation

The population within the study area is relatively youthful, where there is a higher proportion of 20 to 39 year olds in comparison to the national average.

The proportion of the population who are employed is higher than the Dublin City and national average. Consistent with this, the proportion of the population within the study area who are unemployed is lower than the Dublin City and national average. Income in Dublin has been consistently higher than the national average since 2011 and has been gradually increasing, in line with the national trend.

The majority of the study area population work in the "commerce and trade" industry. This is followed by "professional services" and "transport and communications" industries. There is a higher proportion of those working in "commerce and trade" and "transport and communications" compared to the Dublin City and national averages, but a lower proportion of those working in "professional services compared to the Dublin City and national averages.

Regarding deprivation, most recent statistics show that the population living within North Dock B is categorised as “Affluent”, with a relative score of +11 (where the minimum is -39.9 and the maximum is +40.3). The population living within Pembroke East A are categorised as “Marginally Above Average”, with a relative score of +2. The average score for the study area is +7.

Life Expectancy and Physical Health

In Dublin, male and female life expectancy have been increasing since 2002. Both male and female life expectancy in Dublin has been similar to the national average since 2002, following the same trend and increasing at very similar rates.

In Dublin City and County, all-age all-cause mortality has been increasing at a steady rate. Since 2009, all-age all-cause mortality has remained consistently below the national average. Mortality rate from cancer within Dublin City and County fluctuates year-on-year since 2009, following the national trend but generally has remained below the national average. Mortality rate from respiratory diseases within Dublin City and County has remained relatively static since 2009 but is consistently lower than the national average. Mortality rate from circulatory diseases within Dublin City and County has also remained relatively static since 2009 and is consistently lower than the national average.

Hospital admission rate for all causes has been increasing in Dublin City since 2011 and has remained consistently below the national average since 2010. Hospital admissions for circulatory diseases have remained relatively static over the years and have also remained consistently below the national average since 2010. In Dublin City, the trend for hospital admissions relating to diseases of the respiratory system is similar to the national average and have shown a general increase in Dublin City since 2010.

Mental Health

The suicide mortality rate and intentional self-harm has been consistently lower in Dublin City and County compared to the national average since 2009 and has been decreasing since 2011.

Since 2010, there has been a consistently higher proportion of the Dublin City population who are in receipt of benefits for depression or anxiety; while this decreased in Dublin City between 2014 and 2015, the rate of hospital admissions relating to depression or anxiety increased over the same time period.

Lifestyle and Behavioural Factors

Drug-related hospital admissions in Dublin City have been increasing since 2011 and have remained consistently higher than the national average.

Alcohol-related hospital admissions in Dublin have been increasing since 2010 to a level which is higher than the national average, although the trends remain similar. The alcohol-related mortality rate in Dublin City and County has shown an overall decrease since 2009, to a level which is lower than the national average, although the trends remain similar.

Smoking-related mortality rate in Dublin City and County has shown an overall increase since 2009 but has remained consistently lower than the national average.

The proportion of the population in Dublin who are either overweight or obese is slightly lower than the national average.

Conclusion

Overall, health and wellbeing circumstance in the study area is generally better or similar to the national average. However, it is noted that this does not exclude the possibility that some individuals would not conform to this overall profile, and pockets of inequality may exist.

15.2.2 Future Baseline Conditions

As it is challenging to predict the future human health baseline with high confidence, trends are analysed as part of the current baseline to provide insight into likely future local community circumstance. For the purpose of this assessment, the present-day baseline human health data is used, in effect comparing two parallel situations in which the predicted with and without development scenarios were happening in the present day.

15.3 Consultation

The consultation process relating to the Dublin Harbour Capital Dredging Project is summarised in Chapter 5. The process comprised several stages, using varied overlapping methods aimed at gaining input from the statutory consultees, stakeholders and the general public to inform the consenting process, and further refine the scope and focus of the health assessment.

The potential impact from the proposed development on human health was not a common concern raised during the consultation process. As an example, in their initial response via email (dated 27/11/20), the relevant Health and Safety Executive representative did not state any human health concerns.

15.4 Appraisal of Significance

15.4.1 Construction Phase

Human Health Effects from Changes in Air Quality

Construction dust

Human health effects associated with dust emissions relate to nuisance from a reduction in local amenity. As stated in Chapter 10: Air Quality and Climate, dust generation and deposition relate to moisture content whereby moisture increases the mass of a dust particle meaning particles are less friable and hence, less prone to dust dispersion.

On the basis that all dredged material will inherently have high moisture content (circa 50% by weight), the dredging operations and the transport of dredged material are considered very low risk for dust impacts.

Construction odour

Human health effects associated with odour emissions relate to nuisance from a reduction in local amenity. As stated in Chapter 10: Air Quality and Climate, there is potential for odour where decayed organic material has the potential to release sulphurous compounds or where solvent contamination is uncovered. As such, the potential community exposure is limited.

However, the odour impact is predicted to be negligible in air quality terms on the basis that the low levels of organic solvents predicted in the dredged material, and any vapour released would quickly condense into the liquid phase, either dissolving in the water or forming a residue on the water surface. As such, the potential community exposure is limited.

Vessel emissions (local impact)

As stated in Chapter 10: Air Quality and Climate, the proposed capital dredging works will be carried out using a trailing suction hopper dredger (TSHD) and/or a backhoe dredger. The dredging will be limited to the winter period (October-March). The dredger will operate 24 hours per day during each dredging campaign within the lifetime of the project, set at eight years.

At the closest sensitive receptor (Pigeon House Road), air pollution concentrations would remain below the relevant EU and WHO objective thresholds set to be protective of the environment and health. The absolute change in annual average NO_2 and PM_{10} concentrations associated with the proposed dredging activities at the closest residential receptor is predicted to be 5 µg/m^3 and 0.1 µg/m^3, respectively.

The results from the air quality assessment and baseline health data from all-cause mortality and emergency hospital admissions for Dublin City and County (detailed in Appendix 15-1: Human Health Baseline), were applied using the World Health Organisation (WHO) Health Risks of Air Pollution in Europe (HRAPIE) risk ratios (HRAPIE, 2013) to quantitatively assess the potential human health effects associated with the proposed dredging activities, if any.

To set potential risk into context, the population and health assessment applies a worst-case hypothetical scenario where half the population living in Pembroke East A (a total of 2,539 people) would reside at the closest sensitive receptor. The method is precautionary on the basis that:

- population exposure is grossly overestimated – in reality, predicted changes in concentration would not affect half the population living in Pembroke East A; and
- $PM_{2.5}$ concentration is grossly overestimated – evidence indicates that $PM_{2.5}$ presents a greater hazard than particles with a larger aerodynamic diameter (i.e. PM_{10}). While $PM_{2.5}$ is a subset of PM_{10} (and as such the concentration of $PM_{2.5}$ is always lower than for PM_{10}), for the purpose of assessment, all PM_{10} has been considered as $PM_{2.5}$ and the higher $PM_{2.5}$ concentration-response factor has been applied.

As shown in Table 15-4, even in this worst-case hypothetical scenario which grossly overestimates population exposure, the change in air pollutant concentration remains orders of a magnitude lower than what is required to quantify any measurable adverse effect on local population and health outcomes (i.e. less than 1 case per year), and does not materially alter the local health baseline.

Table 15-4 Health outcome effects associated with changes in air quality

Health outcome	Pollutant	Number of cases per year
All-cause mortality (30+ population)	NO_2	0.2
	PM	0.01
Total all-cause mortality		**0.2**
Hospital admissions (respiratory disease)	NO_2	0.6
	PM	0.01
Hospital admissions (cardiovascular disease)	PM	0.01
Total hospital admissions		**0.6**

Significance conclusion

Overall, dust impacts are highly unlikely due to the high moisture content of dredged material. Odour impacts are predicted to be negligible in air quality terms due to the quick condensation of vapour released, and no measurable adverse health outcomes are predicted at the population level due to changes in local air quality (NO_2 and PM). On this basis, the magnitude of impact on human health would be negligible, and the significance of effect would be minor adverse (not significant).

Human Health Effects from Changes in Noise Exposure

As stated in Chapter 11: Terrestrial Noise and Vibration, dredging would be completed on a 24/7 basis where the process consists of a number of noise-emitting activities based on the different stages of sediment extraction, sediment transport and sediment disposal.

Prior to mitigation and assuming no barrier attenuation between the dredging and the closest sensitive receptor (Coastguard Cottages), worst-case noise levels of 58-68dB(A) are predicted, which would exceed some of the noise level threshold limits for day (65dB), evening (60dB) and night-time noise (55dB).

However, this prediction is very much a worst-case level, as in reality, some level of barrier attenuation would exist. Furthermore, mitigation measures would be implemented which include: application of best practice

measures; and careful consideration to the timing of works in the area closest to the nearest sensitive receptors to avoid particularly noisy dredging activities taking place in this area during the most sensitive times, particularly night-time (23:00-07:00).

Overall, it is anticipated that noise levels would be either below or significantly below the relevant noise threshold limits for the majority of dredging activities. Noise monitoring data from previous dredging activities at the site (September 2020) substantiate this statement, whereby it was observed that dredging activities did not exceed measured ambient noise levels. It should also be noted than there are no records of complaint at the port related to previous dredging activities undertaken at the port.

Overall, changes in noise exposure associated with dredging activities are not anticipated to adversely impact health and wellbeing outcomes at the population level. On this basis, the magnitude of impact on human health would be negligible, and the significance of effect would be minor adverse (not significant).

15.5 Mitigation Measures

Construction and operational mitigation measures would focus on environmental precursors to adverse health and wellbeing outcomes, thereby providing the opportunity for intervention to prevent any manifest health outcome. On this basis, no further health-specific mitigation measures are considered necessary.

15.6 Residual Impacts

On the basis that no further health-specific mitigation is proposed, residual effects remain the same as for Section 15.4 (Appraisal of Significance).

15.7 Cumulative Impact

15.7.1 Human Health Effects from Changes in Air Quality

As stated in Chapter 10: Air Quality and Climate, there is potential for cumulative air quality impacts due to road traffic associated with the MP2 Project, which would contribute an additional 0.23 µg/m^3 of NO_2 and 0.09 µg/m^3 of PM. However, this contribution would not change the conclusions of the quantitative health assessment undertaken in Section 15.4, and would remain not significant.

15.7.2 Human Health Effects from Changes in Noise Exposure

As stated in Chapter 11: Terrestrial Noise and Vibration, daytime dredging activities may take place at the same time as daytime construction activities associated with the Alexandra Basin Redevelopment (ABR) Project and MP2 Project. However, no significant cumulative noise impacts from both activities taking place at the same time are anticipated on the basis that ABR Project and MP2 Project construction activities were predicted to be substantially below the relevant daytime noise threshold limits at the nearest properties. As such, no associated cumulative human health effects are anticipated.

15.8 Monitoring

Where necessary, monitoring would focus on environmental precursors to any health impact, thereby enabling a monitoring regime that enables intervention before any manifest health outcome. The necessity of such

monitoring would be established within the relevant technical disciplines, namely Chapter 10: Air Quality and Climate and Chapter 11: Terrestrial Noise and Vibration.

15.9 Summary of Effects

Table 15-5 provides a summary of potential human health effects prior to and following any proposed mitigation measures and monitoring.

Table 15-5 Summary of Effects

Description of impact	Magnitude of impact	Sensitivity of receptor	Significance of effect	Remedial and mitigation measures	Residual effect	Proposed monitoring
Changes in air quality	Negligible	High	Minor adverse (not significant)	No health-specific mitigation measures proposed.	Minor adverse (not significant)	No health-specific monitoring proposed.
Changes in noise exposure	Negligible	High	Minor adverse (not significant)	No health-specific mitigation measures proposed.	Minor adverse (not significant)	No health-specific monitoring proposed.

15.10 Conclusions

Overall, even when applying worst-case hypothetical scenarios, no adverse human health effects from air quality and noise determinants associated with the proposed development are anticipated.

16 CUMULATIVE EFFECTS & ENVIRONMENTAL INTERACTIONS

This chapter presents a summary of the assessment of cumulative effects and environmental interactions which have been examined within the individual technical assessment chapters (Chapters 6 – 15).

16.1 Cumulative Effects

Cumulative effects address long-term changes that may result from the construction and operation of the proposed development in combination with other developments in the area.

Cumulative assessment is undertaken to ensure that the combined effects of the proposed development and other influences are assessed together, and not as individual aspects of the environmental assessment.

Cumulative effects are defined as changes to the environment that are caused by an action in combination with other actions, arising from:

- the interaction between existing and/or approved Projects in the same area; as required by Annex IV, Section 5 (e) of the EIA Directive; and
- the interaction between the various impacts within a single Project.

The Dublin Harbour Capital Dredging Project has been brought forward for consent from the Dublin Port Masterplan 2040, reviewed 2018. The overall Masterplan has already been subject to Strategic Environmental Assessment (SEA) as part of the Masterplan Review in 2018. This chapter details the project level cumulative assessment of the Dublin Harbour Capital Dredging Project in combination with the consented aspects of the Masterplan to date, notably the two Strategic Infrastructure Developments comprising the ABR Project and MP2 Project.

The EU Guidance on the preparation of the Environmental Impact Assessment Report states that it is important to consider effects, not in isolation, but cumulatively, as this may show that individually analysed impacts can become significant when they are added together, or with, other effects.

Cumulative effects can occur at different temporal and spatial scales. The spatial scale can be local, regional or global, while the frequency or temporal scale includes past, present and future impacts on a specific environment or region.

The methodology for selecting the relevant projects (listed in Chapter 3, Section 3.7) is presented in Section 16.1.1.

The experts leading each of the technical assessments (as presented in Chapters 6 to 15), have defined significance thresholds and criteria for the cumulative effects assessment, using professional judgement and consideration of the relevant standards and guidelines via a collaborative approach, involving all the interested parties in the process of data collection and analysis, to determine whether in-combination effects gives rise to additional levels of significance.

The overall summary of the assessment of the likely cumulative effects, and interactions, between the Dublin Harbour Capital Dredging Project and other projects in the vicinity of Dublin Port is presented in Section 16.1.2, along with appropriate mitigation measures to address any identified cumulative effects.

16.1.1 Methodology

The following guidelines and publications were considered when determining the other projects to be considered for their potential to generate cumulative effects with the Dublin Harbour Capital Dredging Project.

- European Commission (EC) Guidelines for the Assessment of Indirect and Cumulative Impacts (1999);
- European Commission (EC) Guidance on the preparation of the Environmental Impact Assessment Report (2017); and
- Draft Guidelines on the Information to be contained in Environmental Impact Assessment Reports (EPA, 2017).
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment, 2018.
- UK Planning Inspectorate (PINS) Advice Note 17: Cumulative effects assessment relevant to national significant infrastructure projects. Version 1, 2015.

The different developments considered as part of this cumulative assessment were identified through a desk study that identified developments, in close proximity to the Dublin Harbour Capital Dredging Project and with the potential to interact with it. The resulting selected developments, listed in Table 16-2 comprise of:

- Projects within Dublin Port that are listed on the local planning authority website.
- Projects at construction stage within the Dublin Port area;
- Dublin Port Company Projects that are at an advanced stage of planning; and
- Other Projects which have the potential to result in a cumulative impact at the licenced offshore disposal site.

The period up to the end of May 2021 was considered for the purposes of identifying existing and/or approved projects.

Stage 1 - Identification of “Existing and/or Approved Projects”

The first stage in determining cumulative effects entailed the identification of a long list of projects in the locality that exist or have been approved for planning. Existing and/or approved projects have the potential to have an impact in combination with the Dublin Harbour Capital Dredging Project based on available information. This stage involved a desktop study to review all existing and/or approved projects that are located in close proximity to the Dublin Harbour Capital Dredging Project application boundary and, those that fall outside of the application boundary but still have the potential to interact with the Dublin Harbour Capital Dredging Project.

This review was carried out using the local authority planning web portals, relevant DPC frameworks including the DPC Masterplan 2040 and any other sources to identify other projects that have the potential to interact with the Dublin Harbour Capital Dredging Project.

Once the long list was established, a "Tier 1 or 2" rating was assigned to each project to indicate the level of certainty associated with its implementation. Table 16-1 shows the classification of Tier 1 and Tier 2 projects. This table was derived from the Planning Inspectorate Advice Note 17 (2015).

Table 16-1 Tier 1 and Tier 2 Classification for Existing and/or Approved Projects

Tier	Planning Stage	Decreasing level of detail likely to be available
1	Currently under construction or construction complete.	
	Planning Permission Granted but permitted application(s) not yet implemented	
	Planning Application(s) submitted but not yet determined by planning authority	
2	Identified in relevant Development Plan (and emerging Development Plans – with appropriate weight being given as they move close to adoption) recognising that much information on any relevant proposals will be limited	
	Identified in other plans and programmes (as appropriate) which set the framework for future development consents/approvals, where such development is reasonably likely to come forward.	

The long list was then scrutinised to identify which of the projects fell within the Dublin Harbour Capital Dredging Project zone of influence, which, for the purposes of this assessment, were those projects within the Dublin Port area.

The spatial extent of each planning application boundary was assessed in relation to the Dublin Harbour Capital Dredging application boundary using GIS Analysis. This analysis determined whether the different projects fell within or outside the application boundary. This determination was used to screen out projects where there was no spatial overlap with the Dublin Harbour Capital Dredging Project or where no source-pathway-receptor linkage with the marine environment was considered likely.

This derived a "short list" of potentially applicable projects for further assessment during Stage 2 of the process.

Stage 2 – Shortlisting

Stage 2 of this assessment process involved applying inclusion or exclusion criteria to the list of existing and/or approved projects to determine whether they had any potential to give rise to cumulative effects with respect to the following criteria:

- Temporal Scope – is there any temporal overlap and potential for interaction between the Dublin Harbour Capital Dredging Project due to the relative construction, operation and decommissioning programmes of other projects?
- Scale and Nature of the other existing and/or approved projects - Due to the scale and nature of the other projects, are they likely to interact with the Dublin Harbour Capital Dredging Project to result in a cumulative effect? Statutory definitions of major development and EIA screening thresholds were considered in determining issues of scale.

- Other Factors - such as the nature and/or capacity of the receiving environment, that would make significant cumulative effects with 'other developments' more or less likely. A source-pathway-receptor approach was used to inform the assessment of other factors.

The identification and short list process is documented in Appendix 16-1. Professional judgement and consultation with chapter authors was used in applying theses thresholds. The reasons for excluding any development from further consideration is recorded. If the potential for any existing and/or approved project to give rise to significant cumulative effects was identified, those were taken forward to Stage 3 of the process.

Stage 3 – Information Gathering and Assessment of Cumulative Effects

For the shortlisted developments, all available information was compiled to inform the assessment of cumulative effects. The relevant data was sourced from websites of the relevant planning authorities and included information such as:

- The design and location of the existing and/or approved project;
- The proposed programme of construction, operation and decommissioning (if applicable);
- Compilation and review of relevant environmental assessments and planning reports that set out baseline data and effects arising from the other developments and;
- A review of the mitigation measures that will be applied to the Dublin Harbour Capital Dredging Project to ensure they are sufficient to remove any cumulative effects when considered in combination with the other developments.

When determining the significance of the cumulative effects of the Dublin Harbour Capital Dredging Project and other existing and/or approved projects, consideration was given to the following factors:

- The Spatial and Temporal interactions between the Dublin Harbour Capital Dredging Project and other projects;
- The identification of potential for cumulative effects by environmental topics and to establish if a potential linkage exists using the source-pathway-receptor model;
- The type and duration of the impact - will it be temporary or permanent;
- The value and resilience of the receptor affected; and
- Mitigation measures that will be employed and the likelihood of their success.

16.1.2 Assessment of Cumulative Effects

Stage 1 & 2 Identification and shortlisting of existing and/or approved projects

The identification and short list process is documented in Appendix 16-1. This process included a review of all successful applications for permission within the Dublin Port area using planning application spatial data obtained from the National Planning Application Database (data.gov.uk). Many of the successful Dublin Port Company applications prior to 2019 were discounted from this assessment on the basis that construction has already occurred and any impacts have already been taken into account as baseline data used to assess the

Dublin Harbour Capital Dredging Project. Figure 16-1 illustrates all the successful planning applications within Dublin Port Company lands since 2015. Appendix 16-1 contains the full list of successful planning applications considered, details of each planning proposal and its current status. The reasons for excluding any existing or approved projects from further consideration is also documented.

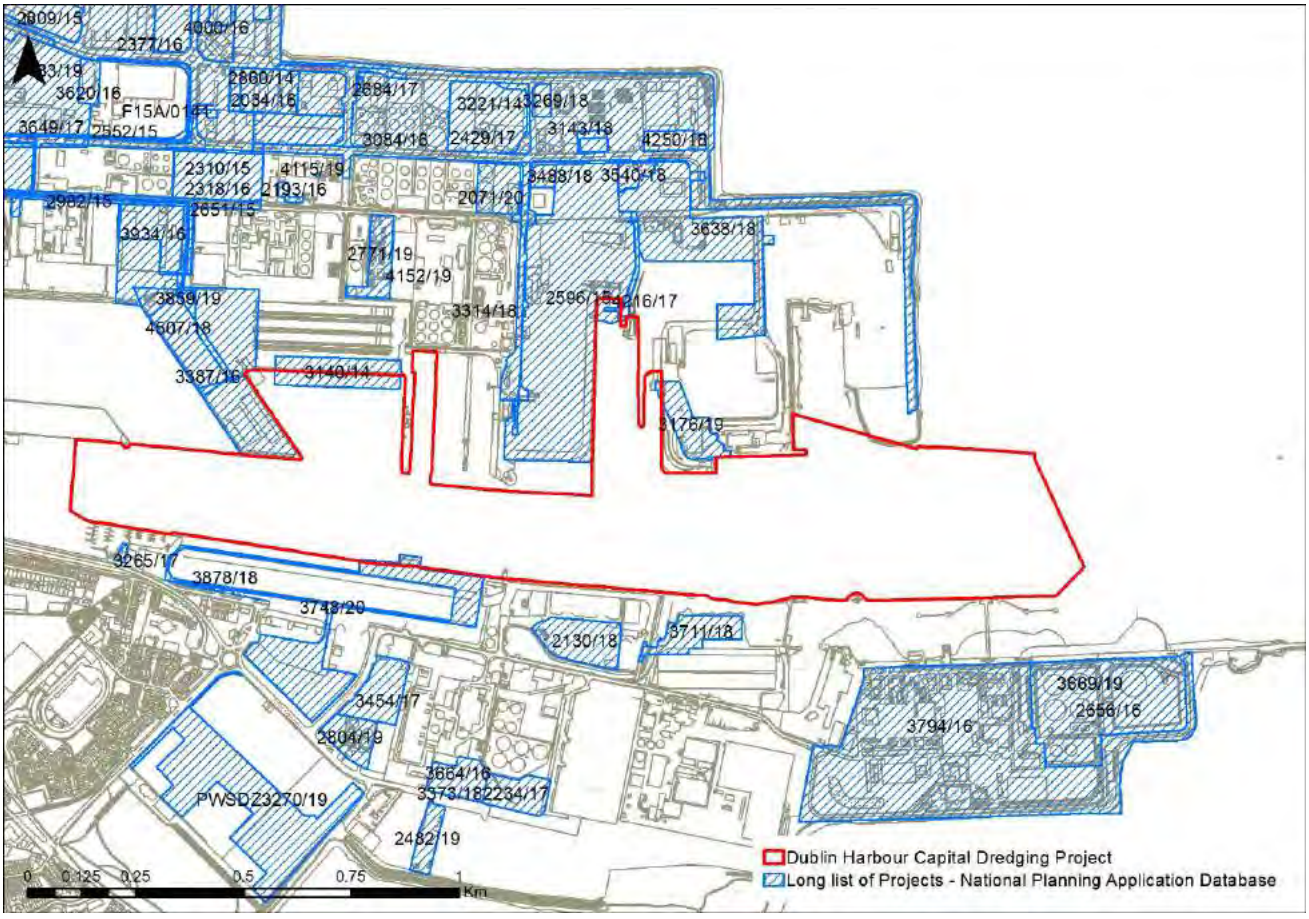


Figure 16-1 Long list of successful planning applications (National Planning Application Database)

Stage 3 Information Gathering and Assessment of Cumulative Effects

Figure 16-2 and Figure 16-3 illustrate the shortlisted developments that have been brought forward to Stage 3 for further assessment. Table 16-2 shows a matrix of the shortlisted projects and environmental topics where the potential for cumulative effects exist.

Table 16-3 provides a brief description of each planning proposal, information on the potential effect on the receiving receptor when considered in combination with the Dublin Harbour Capital Dredging Project and highlights the mitigation measures that have been employed to reduce any significant cumulative effects (such as temporal mitigations, if required).

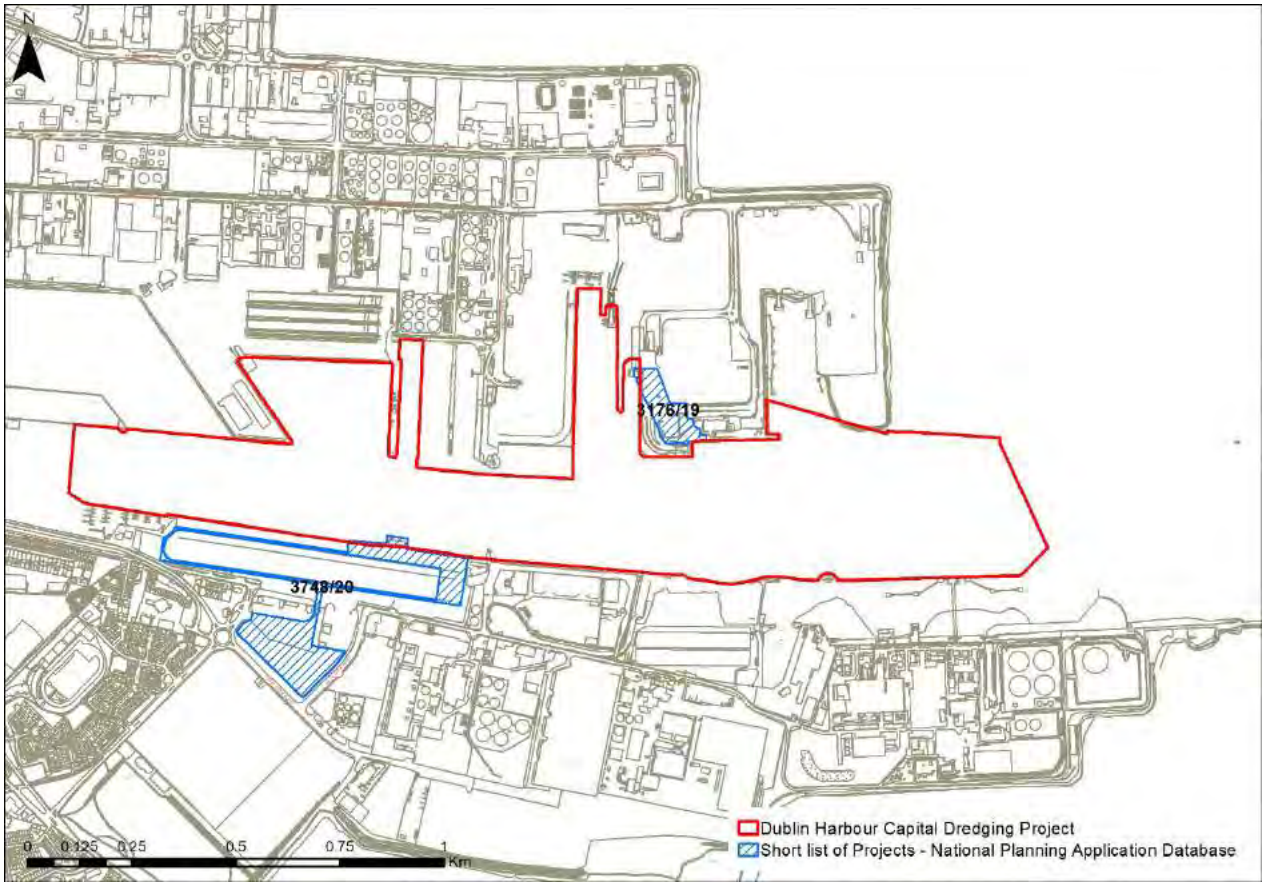


Figure 16-2 Short list of successful planning applications (National Planning Application Database)

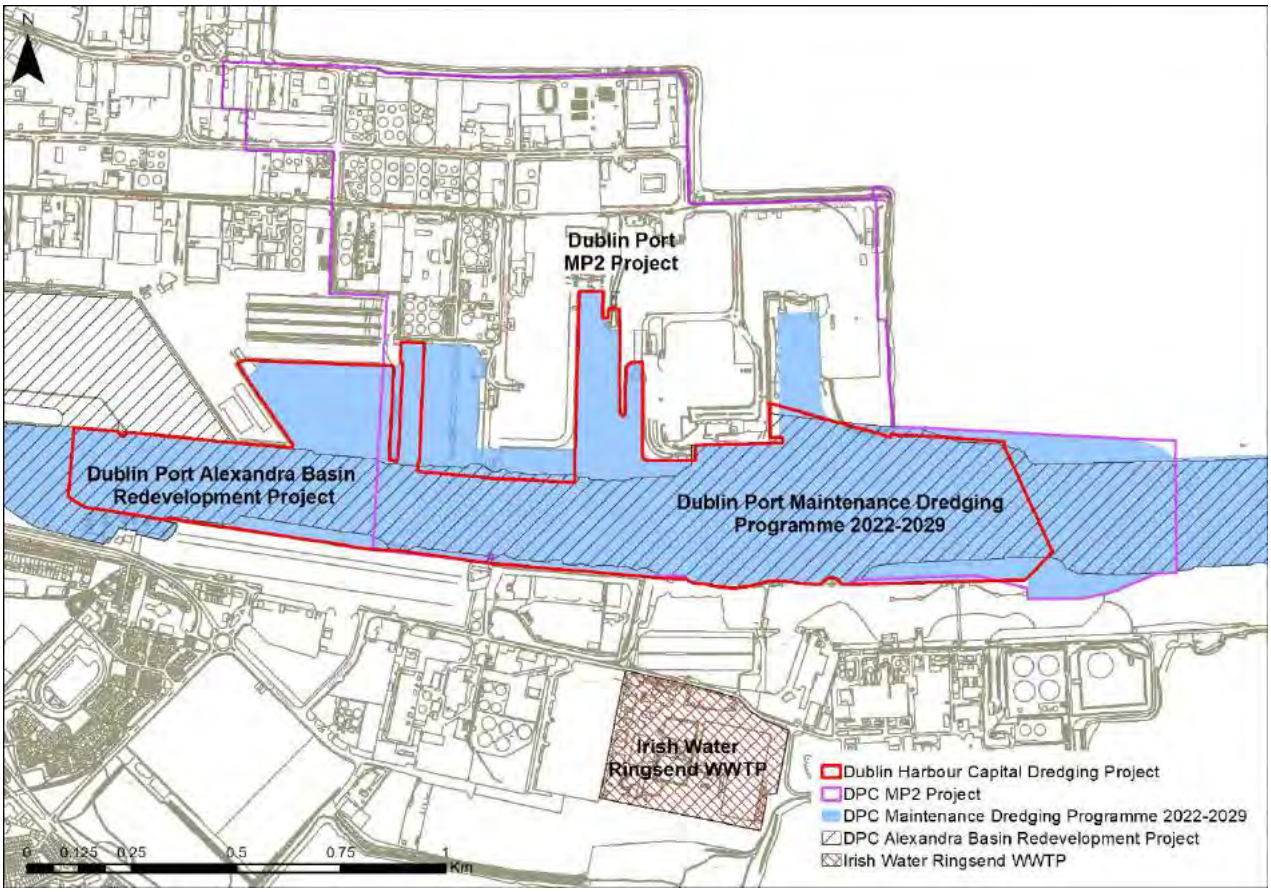


Figure 16-3 Short list of other successful planning applications / pending submissions

Table 16-2 Summary Matrix showing potential cumulative effects by environmental topic between the Dublin Harbour Capital Dredging Project and other existing and/or approved projects in the vicinity of Dublin Port

	Risk of Major Accidents	Biodiversity	Land Soils, Geology & Hydrogeology	Water Quality	Air & Climate	Noise & Vibration	Underwater Noise	Coastal Processes	Archaeology & Cultural Heritage	Population & Human Health
Dublin Port Maintenance Dredging Programme (2022 - 2029) – FS007132		✓		✓					✓	
MP2 Project – ABP304888-19		✓		✓					✓	
Alexandra Basin Redevelopment (ABR) – ABP Reg. Ref. PL29N.PA0034		✓		✓						
Irish Water – Ringsend WwTP –Upgrade Project BP Ref. PL29S.301798		✓		✓						
Berth 49 Approach and Ramp. Reg. Ref 3176/19		✓								
Demolition of Ramp No3 and supporting structures Reg Ref 3748/20		✓		✓						
The Howth Yacht Club Marina Extension		✓								

✓ Potential for interaction between the Dublin Harbour Capital Dredging Project and existing and/or approved projects

Table 16-3 Description of potential cumulative effect between the Dublin Harbour Capital Dredging Project and existing and/or approved projects within Dublin Port

Project	Cumulative Interaction
Dublin Port Maintenance Dredging Programme (2022 - 2029) – FS007132	**Project Description** Dublin Port Company (DPC) need to carry out regular maintenance dredging of the navigation channel, basins and berthing pockets in order to maintain their advertised charted depths and provide safe navigation for vessels to and from the Port. The loading of dredged material will be restricted to those areas of the navigation channel, basins and berthing pockets which contain sediments which are suitable for disposal at sea (Class 1 : uncontaminated, no biological effects likely). Confirmation of the suitability of the dredged sediments for disposal at sea is made through a programme of sediment chemistry sampling and analysis and eco-toxicological testing. It is proposed to dispose of the dredged sediments at the existing licenced offshore disposal site located at the entrance to Dublin Bay to the west of the Burford Bank, (6.75 km from the lighthouse at the end of the Great South Wall). The maximum amount of material to be dredged is 300,000 m^3 per annum and it consists mostly of silt and sand with elements of clay, gravel and cobbles. Dredging will be carried out by a trailer suction hopper dredger and support vessels. It is proposed to undertake the maintenance dredging and disposal at sea operations within the period April to September each year between 2022 and 2029. An additional closed period will operate within the Inner Liffey channel upstream of Berth 49, including the main channel and channel side berths but not including the basins between 1st April and 14th May to protect migrating Atlantic salmon smolts and River lamprey. The dredging campaign within each of these periods is expected to last approximately 4-6 weeks, depending on weather conditions. The foreshore application was submitted to the Department of Housing, Local Government and Housing in February 2021 for consent. The decision is pending. **Potential Cumulative Effects** Potential cumulative effects associated with the Dublin Harbour Capital Dredging Project in combination with Dublin Port Maintenance Dredging Campaign 2022-2029 are:

Project	Cumulative Interaction
	• Cumulative effects on Biodiversity • Cumulative effects on Water Quality • Cumulative effects on Cultural Heritage Cumulative effects on Biodiversity: The cumulative effects on biodiversity that might occur when considering the Dublin Port Maintenance Dredging Programme 2022-2029 in combination with the Dublin Harbour Capital Dredging Project are impacts to water quality and habitat deterioration and Benthic Biodiversity & Fisheries *Water Quality & Habitat Deterioration:* The Dublin Harbour Capital Dredging Project could undermine the conservation targets set for overwintering birds at the South Dublin Bay & River Tolka Estuary SPA and/or the North Bull Island SPA in the absence of mitigation. The impact could arise if suspended sediment plumes were to travel into those areas and reduce the range, timing or intensity of use of areas by the target species. To mitigate against such impacts, the dredging and dumping of material at sea for the Dublin Port Maintenance Dredging programme is proposed to occur at alternate times of year (April – September) compared to the Dublin Harbour Capital Dredging Project (October-March), and not concurrently. The rates of dredging and disposal have been assessed as part of the ABR Project and MP2 Project and also used for maintenance dredging predictions. The modelled spatial extent of dredge or disposal plumes, their predicted suspended solid concentrations and predicted rates of sedimentation at proximate shorelines is not expected to increase as a result of the Dublin Harbour Capital dredging and disposal activities because they are not undertaken concurrently. No cumulative effects are predicted to occur. *Benthic Biodiversity* In terms of the benthos within the loading areas, the potential for cumulative impact is considered low. The main areas of the Dublin Harbour Capital Dredging Project are already subject to regular maintenance dredging activities with the exception of the area of navigation channel between the North Wall Quay Extension and the Wester Oil Jetty. The benthic communities in these areas are similar to those identified in the areas which have been dredged in the recent past and have shown good levels of recovery following dredging. Areas which have been previously maintenance dredged and are earmarked for dredging as part of the Dublin Port Capital Dredging Project are

Project	Cumulative Interaction
	expected to recover quickly following cessation of dredging in those areas. The same mode of recovery is expected in the areas which are only subjected to capital dredging under the Dublin Harbour Capital Dredging Project. In terms of the benthos within the disposal areas, the Burford Bank dump site is currently being used by Dublin Port Company to dispose of sediments from maintenance dredging as well as capital dredging works. It should be noted that there will be no overlap between the capital dredge programme and the maintenance dredging works. The disposal of sediment at the site between October and March is expected to delay recovery in areas where dredge spoil is disposed. However, due the dispersive nature of the site, as well as the nature of the benthos at the dump site, recovery is expected to commence immediately, and full recovery is expected to occur rapidly once all dredge spoil disposal has ceased on site. Accordingly, cumulative impacts are expected to be low at the disposal site. *Fisheries* In terms of fish entrainment, there is the potential for cumulative impacts on eel (glass eel and silver eel), adult salmon and river lamprey, even though it isn't expected that any of these species will be impacted at a population level. No impacts to salmon smolts are expected as both campaigns avoid peak out-migration of this life stage of the species. Negligible cumulative impacts are anticipated in terms of the risk of adult salmon entrainment as the vast majority of salmon will usually have run up the Liffey by the time the capital dredging begins in October. In the case of glass eel, the very dispersed distribution of this life stage as it advances upstream carried by tidal movements would suggest that only a very small portion of the population is likely to be exposed to entrainment during either maintenance or capital dredging. The silver eel could be exposed to entrainment toward the end of the maintenance dredging season (September), and at the beginning of the capital dredging season (October/November) depending on the flow conditions and water temperatures. However, the very confined suction width of the dredge intake (3-4m) relative to the width of the channel 150-450m, combined with the stop-start nature of the dredging cycle would suggest that only a very limited number of silver eel are likely to be entrained. Cumulative impacts to eels as a result of both projects will only arise if the dredging activity is undertaken at the end of the maintenance dredge window and the beginning of the capital dredge window and, if this coincides with a concentrated run of eels during those months.

Project	Cumulative Interaction
	Moreover, the fact that eels in the North East Atlantic are considered a single population and that unlike salmon, they do not home to rivers (as they spawn at sea), any cumulative impact on the species in the Liffey, will not impact on future recruitment to that river. Cumulative effects on Cultural Heritage: Maintenance dredging is designed to maintain the existing charted depths within Dublin Port and therefore do not overlap with the proposed capital works in terms of depth. Consequently there is no cumulative impact between the two projects.
MP2 Project ABP304888-19	**Project Description** DPC was granted planning permission on July 1st 2020, under Section 37E of the Planning and Development Act 2000, as amended, for the MP2 Project comprising the following elements (subject to conditions): • Construction of a new Ro-Ro jetty (Berth 53) for ferries up to 240m in length on an alignment north of the Port's fairway and south and parallel to the boundary of the South Dublin Bay & River Tolka SPA (004024). • A reorientation of the already consented Berth 52 (ABP Ref. 29N.PA0034). Berth 52 is also designed to accommodate ferries up to 240m in length. The works also comprise an amendment to the consented open dolphin structure (ABP Ref. 29N.PA0034) to create a closed berthing face at the eastern end of Berth 49. • A lengthening of an existing river berth (50A) to provide the Container Freight Terminal with additional capacity to handle larger container ships. These works will include the infilling of the basin east of the now virtually redundant Oil Berth 4 on the Eastern Oil Jetty. These works also include dredging to a standard depth of -11.0m CD which is a proposed amendment to the channel dredging as permitted under the ABR Project (ABP Ref. 29N.PA0034). • As part of the infilling of Oil Berth 4, Oil Berth 3 will be redeveloped as a future deep-water container berth (standard depth of -13.0m CD) for the Container Freight Terminal. This will facilitate the change of use of the berth from petroleum importation to container handling when the throughput of petroleum products through Dublin Port declines as a result of national policies to decarbonise the economy.

Project	Cumulative Interaction
	• The dredging of a berthing pocket to a standard depth of -13.0m CD at Oil Berth 3 will require stabilisation of the existing quay wall at Jetty Road. It is not proposed to use this quay wall for the berthing of vessels. • Dredging at the proposed Berth 53 and channel widening to a standard depth of -10.0m CD which is a proposed amendment to the channel dredging as permitted under the ABR Project (ABP Ref. 29N.PA0034). • Consolidation of passenger terminal buildings, demolition of redundant structures and buildings, and removal of connecting roads to increase the area of land for the transit storage of Ro-Ro freight units as a Unified Ferry Terminal (UFT). Works include reorganisation of access roads; two proposed check in areas comprising a total of 14 check lanes; proposed set down and parking area for the existing Terminal 1 building; proposed pedestrian underpass to access the existing Terminal 1 building; three proposed toilet blocks and a proposed ESB Substation. These works comprise amendments to consented developments with planning reference numbers 3084/16 & 3638/18 (detailed in section 3.6.2.5 and 3.6.2.6 below), and the ABR Project (ABP Ref. 29N.PA0034). • A heritage zone adjacent to Berth 53 and the Unified Ferry Terminal set down area. This comprises an alteration to consented development planning reference 3084/16. The MP2 Project is now being implemented by Dublin Port Company with construction of Berth 52/53 expected to commence in 2022 (subject to the granting of a Foreshore Licence and Dumping at Sea Permit). **Potential Cumulative Effects** Potential cumulative effects associated with the Dublin Harbour Capital Dredging Project in combination with the MP2 Project are: • Cumulative effects on Water Quality as a result of dredging and disposal of sediments at the offshore disposal site. • Cumulative effects on the Biodiversity • Cumulative effects on Cultural Heritage

Project	Cumulative Interaction
	Cumulative effects on Water Quality: The most relevant element of the MP2 Project in considering potential cumulative impacts on water quality is capital dredging. Both projects require capital dredging operations in the same water body (Liffey Estuary Lower) and spoil dumping at the same licenced dump site at the approaches to Dublin Bay, west of the Burford Bank. The potential for cumulative impacts associated with water quality are considered low in that the only area where the Dublin Harbour Capital Dredging Project and the MP2 Project adjoin is limited to the dredging of the riverside Berths 52 and 53 and the Oil Basin. Although the Dublin Harbour Capital Dredging works will be undertaken during the same time period as the MP2 Project, dredging would be carried out sequentially, with no overlap occurring between the dredge works of both projects. The sequential nature of the dredging activities minimises the potential for impacts on water quality within and immediately adjacent to the footprint of the proposed works. Both the Dublin Harbour Capital Dredging Project and the MP2 Project will use the licenced offshore dump site between October and March each season, however, the volumes for disposal are comparatively low. The combined total of sediment to be disposed from both the MP2 Project and Dublin Harbour Capital Dredging Project over the full period of both projects is 942,000m^3 of similar material (mix of clay, silt, sand, gravel and cobbles). It is expected that the combined maximum to be disposed of per dredging season will be circa 300,000m^3. The sequential nature of the loading and dumping activity, using the same suite of mitigation measures, will result it no significant cumulative impact. Cumulative effects on Biodiversity: The cumulative effects on biodiversity that might occur when considering the MP2 Project in combination with the Dublin Harbour Capital Dredging Project are impacts to benthic biodiversity & fisheries. *Benthic Biodiversity* The nature of the seabed at Dublin Port, which is regularly exposed to disturbance events, such as maintenance dredging and benthic disturbance from vessel movements, means the cumulative impact of these projects would be considered minor, adverse and temporary. The Dublin Harbour Capital Dredging Project and MP2 Projects intend to use the disposal area between October and March each season. Once mitigation measures are undertaken for the disposal of sediment at sea, the cumulative impacts associated with the disposal of these volumes of sediment at the Burford Bank dump site is expected to be low.

Project	Cumulative Interaction
	It is expected that the cumulative impacts on Benthic Biodiversity will be at worst minor, adverse and temporary. *Fisheries* The potential cumulative impacts on fisheries are expected to be very minor for salmon because of the relatively small proportion of either adult or smolts migrating during the October-March window and also for eel for the same reasons outlined previously when considering the cumulative effects of the Dublin Port Maintenance Dredging Programme 2022-2029. The potential cumulative impacts on the Annex II fish migration will be for inwardly migrating river lamprey which may give rise to a minor cumulative increase in the risk of entrainment of the species in years where significant amounts of dredging for both projects occur in the same October-March window. This is thought very unlikely to have an impact at the population level for the Liffey lamprey for the following main reasons: (i) juveniles of the species remain in freshwaters for 6-7 years maturing before migrating to sea which means that in any given year the bulk of the population resides within the freshwater realm, (ii) the spawning migration is spread over 4-6 months, thereby spreading the risk and (iii) aspects of the dredging process i.e. the spatially restricted entrainment effect relative to the width of the Liffey channel and the stop-start nature of the loading process combine to minimise the number of lamprey likely to be entrained by the dredger. It is expected that the cumulative impacts on fisheries will be at worst minor, adverse and temporary. Cumulative effects on Cultural Heritage: Capital Dredging associated with the MP2 Project will also take place within the same timeframe as the Dublin Harbour Capital Dredging Project. The areas to be dredged under both projects adjoin but do not overlap. The same marine archaeology mitigation measures will apply to both projects. Consequently there is no cumulative impact between the two projects.
Alexandra Basin Redevelopment (ABR) – ABP Reg. BP. Ref. PL29N.PA0034	**Project Description** DPC was granted planning permission subject to conditions (ABP Reg. Ref. PL29N.PA0034) in July 2015 for the redevelopment of Alexandra Basin, Berths 52 and 53 and dredging of the channel of the River Liffey together with associated works in Dublin Port. Elements of the proposed development can be summarised as follows: *Alexandra Basin West:* • The infilling of graving Dock No. 2 having an area of 6,055sq.m;

Project	Cumulative Interaction
	• The excavation and restoration of historic Graving Dock No. 1; • The demolition of the bulk jetty having an area of 3,200sq.m; • A section of North Wall Quay extension having an area of 21,700sq.m; • Extension of Alexandra Quay West of 130m in length; • New 273 m long Ro-Ro jetty and provision of three Ro-Ro ramps; and • The dredging of: 470,000sq.m of contaminated material to a depth of -10.0m Chart Datum (CD) over an area of 194,000sq.m within the redeveloped Alexandra Basin and its remediation. *Berth 52 and 53:* • The demolition of existing berths 52 and 53; • Jetty at Berth 52 having an area of 500sq.m; • Concrete Dolphin at Berth 53 having an area of 500sq.m; • The construction of: A new river berth at Berths 52/53, 300m long; New 75 m mooring jetty at new river berth; New 40 m long mooring jetty to extend existing berth 49, 50m long; • The infilling of the Terminal 5 Ro-Ro basin, an area of 45,650sq.m; Raising of existing levels by 1.4 m over an area of 95,000sq.m; and Dredging of new river berth to -10.0m CD. *Liffey Channel:* • Construction of a marina protection structure to a height of +7.0m CD and a length of 220m on the south side of the river channel. • Dredging of the shipping channel to a depth of -10m CD from a point 55m to the east of the East link bridge, to a location in the vicinity of Dublin Bay, a total distance of 10,320m. The ABR Project is now being implemented by DPC.

Project	Cumulative Interaction
	Potential Cumulative Effects The principal pathways of cumulative effect that might occur with the Dublin Port Capital Dredging Project in combination with the ABR Project are impacts to water quality and habitat deterioration during dredging operations. The Dublin Harbour Capital Dredging Project is proposed to commence in 2022 and the capital dredging element of the ABR Project was completed in March 2021, therefore no cumulative effects are expected.
Irish Water – Ringsend Wastewater Treatment Plant Upgrade Project - BP Ref. PL29S.301798	**Project Description** Irish Water submitted a planning application for strategic infrastructure development to the Board seeking permission to further progress the upgrade of the Ringsend Wastewater Treatment Plant (WwTP) on 6th June 2018. The application sought permission for works required to facilitate the use of Aerobic Granular Sludge (AGS) technology, to omit the previously permitted long sea outfall tunnel and to upgrade the sludge treatment facilities at Ringsend, Dublin 4, and to provide for a Regional Biosolids Storage Facility in Newtown, Dublin 11. The Board granted permission for the proposed development on the 24th April 2019. **Potential Cumulative Effects** Potential cumulative effects associated with the Dublin Port Capital Dredging Project in combination with the Ringsend WWTW Upgrade are: • Cumulative effects on Biodiversity Cumulative effects on Biodiversity: A screening for appropriate assessment and NIS was prepared for this submission. These documents were reviewed and concluded that further evaluation and analysis predicted that: Water quality in Inner Dublin Bay will be enhanced because of a reduction in nutrient load once the proposed development is operational; it is unlikely that the food resource of waterbirds in the Tolka Estuary will be negatively affected; reductions in nutrients in the receiving waters resulting from the proposed development will not have any impacts on fish populations in Dublin Bay; disturbance and displacement of certain qualifying SPA feature species during construction may occur; accidental spillage of hazardous substances resulting in water quality deterioration of the Liffey Channel and

Project	Cumulative Interaction
	hydrologically connected areas during construction may occur and; significant dust deposition on the grasslands to the south of the site that form part of the South Dublin Bay and River Tolka Estuary SPA may occur. Measures intended to avoid or reduce these potentially significant effects on the European sites were proposed as part of the Stage Two Appropriate Assessment, and there will be no adverse effect on the integrity of any European site as a result. The Ringsend WwTP Upgrade project is sufficient spatially separated from the Dublin Harbour Capital Dredging Project to prevent any significant cumulative visual or noise disturbance effects on waterbirds. With the measures proposed to avoid or reduce the significant pollution effects predicted for both the WwTP Upgrade Project and the Dublin Harbour Capital Dredging Project are taken into consideration, there will be no cumulative effects.
Berth 49 Approach and Ramp Reg. Ref. 3176/19	**Project Description** The development will consist of: a c.189m long, c.10m wide approach way and ramp; 1 no. office and staff facilities building (c.193 sq.m and 7.7m in height); 1 no. control kiosk (c.6sq.m and 2.3m in height); 1 no. control cabin (c.20sq.m and 2.3m in height); new lighting (including 18 no. lighting columns 10m high); demolition of 5 no. existing staff facilities buildings with a combined area of c.329sq.m; building 1 has an area of c.198sq.m, building 2 has an area of c.10.7sq.m, building 3 has an area of c.35.5sq.m, building 4 has an area of c.42.4sq.m, building 5 has an area of c.42.4sq.m; and associated site works to include 15 no. tug parking spaces, drainage, utility services, fencing 2.4m in height and pedestrian gate 2.4m in height on a site of approx. 1.3 hectares. **Potential Cumulative Effects** • Cumulative effects on Biodiversity Cumulative effects on Biodiversity: A screening for appropriate assessment and NIS was submitted with this application, and it was reviewed. The report did not predict any aerial or underwater noise, lighting or visual disturbance effects or habitat loss effects. The possibility of likely significant water quality and habitat deterioration effects on the wetland habitats of the Tolka estuary as a resource for the regularly occurring breeding and non-breeding waterbirds of South Dublin Bay & River Tolka Estuary SPA and North Bull Island SPA that utilise it could not be excluded at screening stage. A subsequent Stage Two appraisal (NIS) of the implications of the proposed

Project	Cumulative Interaction
	development was undertaken to determine if it would adversely affect the integrity of the European sites concerned. A number of mitigation measures were required in order to address likely significant water quality effects associated with the proposed development. The Berth 49 Ramp development is anticipated to be constructed and operational before the proposed capital dredging activities commence. Only construction stage pollution prevention measures were applied in the NIS. At operational phase the ramp forms part of the existing waterside port infrastructure to facilitate ongoing port operations. It will result in no more emissions to the aerial or marine environment than the various existing operations and activities within Port Estate. It will not result in any disturbance to those SPA feature species located in the South Dublin Bay and River Tolka Estuary SPA. The Dublin Harbour Capital Dredging Project will therefore not result in any effects upon biodiversity and as such when both projects are considered together, no cumulative effects are expected.
Demolition of Ramp No.3 and Supporting Structures 3748/20	**Project Description** The disused Ramp No. 3, its supporting structures are located in the South Port area within the existing MTL container freight terminal. The Ramp No.3 was constructed in circa 1974 and consists of a structural steel girder ramp supported on two gravel filled concrete caissons on the west end and one gravel-filled concrete caisson on the east end. The ramp and supports have been subject to a number of vessel collisions over its lifetime which have affected the condition of the structure and its interface to the quay. DPC was granted planning permission on the 20th January 2020 for the the demolition and removal of Ramp No.3 and its support structure; and all associated ancillary site development works. **Potential Cumulative Effects** • Cumulative effects on Biodiversity • Cumulative effects on Water Quality Cumulative effects on Biodiversity: A screening for appropriate assessment and NIS was submitted with this application, and it was reviewed. The report did not predict any aerial disturbance effects or habitat loss effects. The possibility of likely significant effects on water quality and underwater noise disturbance on the South Dublin Bay & River Tolka Estuary SPA and Rockabill to Dalkey Island SAC and those that utilise it could not be excluded at screening stage. A subsequent Stage Two appraisal (NIS) of the implications of the proposed

Project	Cumulative Interaction
	development was undertaken to determine if it would adversely affect the integrity of the European sites concerned. A number of mitigation measures were required in order to address likely significant water quality effects on the intertidal wetland areas of the Tolka Estuary as a resource for the regularly occurring migratory waterbirds of South Dublin Bay & River Tolka Estuary SPA that use it; and the possibility of likely significant Underwater Disturbance effects on the harbour porpoise community of Rockabill to Dalkey Island SAC. Accordingly, it was concluded beyond reasonable scientific doubt, that the demolition of the Ramp No3 Ramp and supporting structures would not adversely affect the integrity of any European site. The demolition of the Ramp No.3 and supporting structures is anticipated to be completed before the Dublin Harbour Capital Dredging Project activities. The Dublin Harbour Capital Dredging Project will therefore not result in any effects upon biodiversity and as such when both projects are considered together, no cumulative effects are expected. Cumulative effects on Water Quality: The demolition of the Ramp No.3 and supporting structures is anticipated to be completed before the Dublin Harbour Capital Dredging Project activities. The Dublin Harbour Capital Dredging Project will therefore not result in any effects on Water Quality when both projects are considered together, no cumulative effects are expected.
The Howth Yacht Club –Dredging and Disposal.	**Project Description** Only Howth Yacht Club (HYC) and Dublin Port Company currently hold Dumping at Sea Permits for use of the licenced dump site located at the approaches to Dublin Bay, west of the Burford Bank. HYC currently holds of a Dumping at Sea Permit (Ref. No. S0010-01) to load and dump a maximum of 120,000 tonnes of dredged material from Howth Marina over a one year period. In its application documents, HYC estimated a maximum daily quantity for dumping of 1,200 tonnes and 800 tonnes in each load. It also suggested a spring or winter commencement and campaign duration of six months. This volume of material is equivalent to approximately 6% of the annual permitted quantity of material that may be dumped at this site by Dublin Port Company under Dumping at Sea Permit S0024-01. While dumping by DPC is restricted to the winter months (October to March), no such restriction applies to HYC activities. Dumping will however be subject to the approval of the Dublin Port Harbour Master and dumping activity will not be permitted by the Harbour Master for DPC and HYC operations simultaneously. The rates of dumping at sea will therefore not exceed those predicted in the model described in the coastal

Project	Cumulative Interaction
	processes assessment and the model predictions remain valid. When both projects are considered together, no cumulative effects are expected.

16.2 Environmental Interactions within Dublin Harbour Capital Dredging Project

The potential interaction between environmental aspects, arising from within the Dublin Harbour Capital Dredging Project were considered, again to ensure that the combination of impacts was correctly examined and that any required mitigation measures were included.

Each technical chapter of the EIAR details, individual environmental baseline information and identifies the significant potential and residual construction and operational effects/impacts of the proposed development. In addition, the potential for other environmental interactions are identified and the relevant impact either on, or from, these other aspects is analysed via data exchange during assessment review by the relevant experts.

This Chapter summarises the significance of these interactive and inter-related impacts within the Dublin Harbour Capital Dredging Project. Table 16-5 shows a matrix of potential interactions between each technical chapter of this EIAR with a detailed description of each interaction presented in Table 16-6.

While many potential inter-relationships and inter-actions have been identified, it is anticipated that the discrete environmental mitigation measures included in the Dublin Harbour Capital Dredging Project (and outlined in the relevant sections of the EIAR) will minimise or off-set potential for significant effects due to interactions.

Table 16-4 Matrix to show Interactions between Technical Chapters 6-15 (KEY✓ Potential interaction between technical chapters)

	Biodiversity	Land, soils, Geology & Hydrogeology	Water Quality	Air Quality & Climate	Terrestrial Noise & Vibration	Underwater Noise	Coastal Processes	Archaeology & Cultural Heritage	Population & Human Health
Chapter 7- Biodiversity									
Chapter 8- Land, Soils, Geology & Hydrogeology	✓								
Chapter 9- Water Quality	✓	✓							
Chapter 10- Air Quality & Climate		✓							
Chapter 11- Terrestrial Noise & Vibration	✓								
Chapter 12 - Underwater Noise	✓								
Chapter 13- Coastal Processes		✓	✓						
Chapter 14- Archaeology & Cultural Heritage									
Chapter 15 – Population & Human Health		✓	✓	✓	✓		✓		

Table 16-5 Summary of potential interactions between technical chapters

Chapter	Interaction
Chapter 7 – Biodiversity, Flora & Fauna	The most significant interactions in relation to Biodiversity, Flora & Fauna are considered to be Land, Soils, Geology & Hydrogeology, Water Quality and Noise and Vibration. Consideration of each are provided in relevant chapters within the EIAR with appropriate mitigation measures included. ***Land, Soils, Geology & Hydrogeology*:** An inter-relationship exists between Marine Ecology and Land, Soil, Geology, Hydrogeology. The Dublin Harbour Capital Dredging has the potential to cause the re-suspension of seabed sediments leading to a potential impact on water quality and benthic ecology. Extensive marine sediment sampling and analysis was undertaken as part of this project. This included the targeted collection of soil samples in accordance with Marine Institutes Sampling Analysis Plan. The results of laboratory analysis indicate that all sediments planned for capital dredging have been categorised as "Class 1" non-hazardous soils. Therefore the risk of disturbing potentially hazardous sediments causing deterioration to water quality and marine ecology is very low, and where it does arise appropriate water quality mitigation measures have been proposed. In addition to the potential impacts assessed in Chapter 8, the impact of the dredging and disposal operations has been assessed in Chapter 7 Biodiversity, Flora & Fauna, Chapter 9 Water Quality and Chapter 12 Coastal Process. The findings of each assessment has indicated that provided the implementation of mitigation measures as listed in Chapter 7, 9 and 12, no impacts to water quality and marine ecology are expected. ***Water Quality***: An interaction link between Biodiversity, Flora & Fauna and Water Quality exists, The interaction link is as follows: • Avian & Aquatic ecology is dependent on surface water quality; • Surface water quality can be affected during capital dredging operations through an increase in suspended sediment concentrations. Suspended sediment can have a negative impact on water quality, water dependant habitats and aquatic ecology particularly in areas immediately adjacent to the River Liffey Lower and River Tolka Estuary.

Chapter	Interaction
	Chapter 9 Water Quality has assessed the impact of capital dredging operations on water quality, with the implementation of the mitigation measures (listed in each chapter), the potential impact to receiving water environment will be reduced to negligible thus reducing the significance of environmental effect to Imperceptible and therefore reducing the risk to avian & aquatic ecology. ***Terrestrial Noise & Vibration:*** An interaction link between Biodiversity, Flora & Fauna and Noise & Vibration exists. Terrestrial noise generated during the Dublin Harbour Capital Dredging Project has the potential to impact on avian species and their foraging areas. An assessment of potential impacts of noise on terrestrial biodiversity, avian ecology and designated sites has been carried out based on project specific baseline noise surveys, supported by acoustic monitoring data collected as part of the ABR project. The findings of the biodiversity assessment concludes that with the implementation of the mitigation measures during dredging operation to reduce the effects of biodiversity, significant residual effects are not predicted. ***Underwater Noise & Vibration:*** An interaction link between Biodiversity, Flora & Fauna and Underwater Noise exists. Underwater noise generated during the Dublin Harbour Capital Dredging Project has the potential to impact on marine species and their foraging areas. An assessment of potential impacts of on benthic biodiversity & fisheries, marine mammals and designated sites has been carried out based on project specific baseline noise surveys and supported by underwater noise data collected as part of the ABR project. The findings of the biodiversity assessment concludes that with the implementation of the mitigation measures during dredging operation to reduce the effects of biodiversity, significant residual effects are not predicted.
Chapter 8 – Soils & Geology & Hydrogeology	The most significant interactions in relation to Land, Soils, Geology & Hydrogeology are considered to be Biodiversity, Flora & Fauna, and Water Quality. Consideration of each are provided in relevant chapters within the EIAR with appropriate mitigation measures included. ***Biodiversity, Flora & Fauna:*** An inter-relationship exists between Land, Soils, Geology & Hydrogeology and Biodiversity Flora & Fauna. Avian & aquatic ecology is dependent on surface water quality and surface water quality can be affected during dredging operations. Dredging operations can cause temporary suspension and release of seabed sediments at the loading sites. Similarly, dumping operations will also give rise to temporary sediment plumes at the licensed dumping site in Dublin Bay. These operations can cause a localised negative impact on water quality, water dependant habitats and aquatic ecology. As indicated in Chapter 8 all sediments planned for capital dredging

Chapter	Interaction
	have been categorised as “Class 1” non-hazardous soils. Therefore the risk of disturbing potentially hazardous sediments causing deterioration to water quality and marine ecology is considered very low, and where it does arise appropriate water quality mitigation measures have been proposed. ***Water Quality***: An inter-relationship link between Land, Soils, Geology & Hydrogeology and Water Quality. The link relates specifically to demolition and dredging operations resulting in the localised deterioration of Water Quality due to an increase in suspended sediments in the water column. The impact of the dredging operations has been assessed in Chapter 9 using extensive water quality data that is been collected as part of the ABR project. The findings of the Water Quality assessment has confirmed that with the implementation of the mitigation measures during dredging operations, the potential impact to receiving water environment will be reduced to negligible thus reducing the significance of environmental effects to Imperceptible. ***Air Quality & Climate:*** The construction and operational phases of the development have the potential to generate impacts in terms of air quality upon local population centres. The main potential impacts relates to dust and odour generation arising during dredging activities, particularly in dry weather conditions. The potential impacts for nuisance Dust and Odours have been assessed in Chapter 10 and the impacts are considered negligible. A number of mitigation measures will be employed during construction including the preparation of a dust minimisation plan and odour management plan. ***Coastal Processes:*** An inter-relationship exists between Soils, Geology & Hydrogeology and Coastal Processes. The potential impacts on soils and the geological environment relates to the erosion and mobilisation of sediment during dredging operations and disposal operations. Dredging loading operations will cause temporary suspension and release of sediments at the loading sites. Dumping operations will also give rise to temporary sediment plumes at the licensed dumping site in Dublin Bay. It should be noted that chemical analysis has shown that the sediments to be dredged from the Port’s navigation channel and basins are suitable for conventional dumping at sea (see Chapter 8). A series of sediment transport simulations were undertaken as part of this study to simulate the dredging operations and disposal at the licenced disposal site. The dredge simulations have illustrated that the increase in suspended sediment during dredging operations is

Chapter	Interaction
	generally confined to within the immediate area of the dredging operations and concluded that the dredging operations required will not result in any significant impact to either the water quality in terms of suspended sediments. The disposal simulations in combination with monitoring data collected as part of the ABR projects has concluded that the disposal operations associated with the Dublin Harbour Capital Dredging Project will not result in any significant increases to the background level of suspended sediments and will therefore not impact the existing water quality in the greater Dublin Bay area. Chapter 12 lists a number of mitigation measures that will be applied during each dredging campaign of Dublin Harbour Capital Dredging Project. With the implementation of those mitigation measures during capital dredging and disposal operations, the potential risk to receiving water environment will be negligible thus reducing the significance of environmental impact to Imperceptible.
Chapter 9 – Water Quality	The most significant interactions in relation to Water Quality are considered to be Biodiversity, Flora & Fauna, Coastal Processes, Population & Human Health, Soils, Geology & Hydrogeology and Waste. Consideration of each are provided in relevant chapters within the EIAR with appropriate mitigation measures included. ***Biodiversity Flora & Fauna*:** The interaction link between Water Quality and Biodiversity, Flora and Fauna is; marine habitats and biodiversity is dependent on water quality; a deterioration in water quality as a result of suspended sediment levels or pollutants has potential to impact on marine habitats and the species that depend on them. The impact dredging operations has been assessed in Chapter 9 using extensive water quality data collected during the dredging operations that have occurred during the ABR project. The findings of the Water Quality assessment has confirmed that assuming the mitigation measures are employed during dredging operations, the potential impact to receiving water environment will be reduced to negligible thus reducing the significance of environmental effect to Imperceptible. Therefore, in circumstances where there is no impact to water quality, no impacts to marine habitats and the species that depend on them are predicted. ***Land, Soils, Geology & Hydrogeology***: An inter-relationship link between Water Quality and Land, Soils, Geology & Hydrogeology exists. The link relates specifically to the erosion and mobilisation of sediment during dredging operations resulting in the localised deterioration of Water Quality due to an increase in suspended sediments in the water column. The impact of dredging operations on water quality has been

Chapter	Interaction
	assessed using extensive water quality data collected during the dredging operations that have occurred during the ABR project. The findings of the Water Quality assessment has confirmed that with the implementation of mitigation measures during dredging operations, the potential impact to receiving water environment will be reduced to negligible thus reducing the significance of environmental effect to Imperceptible. ***Coastal Processes*:** An inter-relationship between water environment and coastal processes exists. The interaction link potential relates to: the mobilisation of sediment during dredging and disposal operations. A series of coastal model simulations combined with monitoring data collected as part of the ABR have concluded that the dredging and disposal operations associated with the Dublin Harbour Capital Dredging Project will not result in any significant impact to water quality in terms of suspended sediments. ***Population & Human Health:*** An interaction link between Population & Human Health and Water Quality/Coastal Processes exists. The main interaction between Human Health & Population and Water Quality relates to the potential impact of the Dublin Harbour Capital Dredging Project on recreational bathing water. The bathing areas in the immediate vicinity of the Dublin Harbour Capital Dredging Project are: Dollymount Strand, Sandymount Strand, Merrion Strand and Seapoint. The potential impact of the Dublin Harbour Capital Dredging Project on water quality has been undertaken as part of this study. Baseline water quality within the receiving environment was established through review of national monitoring data used to establish water quality status in the context of the EU Water Framework Directive (WFD) and supporting environmental standards. High-frequency monitoring data, collected during Dublin Port Company's ABR Project was also reviewed. Using baseline water quality data and site specific water quality model simulation outputs (Chapter 13), an assessment of the Dublin Harbour Capital Dredging Project was conducted to determine the likelihood of significant impacts on water quality using the criteria for rating significance and magnitude as set out in the National Roads Authority (NRA) publication "*Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes*" (NRA, 2008) and appropriate mitigation measures to reduce impacts were proposed, where necessary. The assessment concluded that: the proposed works are compliant with the requirements and environmental objectives of the EU Water Framework Directive and the other relevant water quality objectives for these water bodies and; In circumstances where the appropriate mitigations measures are fully implemented during the dredging operations the impact of the proposed development on the water quality in

Chapter	Interaction
	the area will be imperceptible. The Dublin Harbour Capital Dredging Project is therefore not expected to have a significant effect on the water quality of the receiving waters.
Chapter 10 – Air Quality & Climate	The most significant interactions in relation to Air Quality & Climate to are considered to be Population & Human Health. Consideration of each are provided in relevant chapters within the EIAR with appropriate mitigation measures included. ***Land, Soils, Geology & Hydrogeology:*** The dredging of sediment have the potential to generate impacts on air quality. The main potential impacts relates to dust and odour generation arising during dredging activities, particularly in dry weather conditions. The potential impacts for nuisance Dust and Odours have been assessed in Chapter 10 and the impacts are considered negligible. A number of mitigation measures will be employed during construction including the preparation of a dust minimisation plan and odour management plan. ***Population & Human Health:*** The main interaction relates to the potential decrease in Air Quality as a result of dredging operations. As highlighted in Chapter 10, construction dust has the potential to cause local impacts through dust nuisance at the nearest sensitive receptors and also to sensitive ecosystems. Construction activities such as dredging may generate quantities of dust, particularly in dry weather conditions. The extent of any dust generation depends on the nature and moisture content of the dust (soils, peat, sands, gravels, silts etc.) and the nature of the activity. In addition, the potential for dust dispersion and deposition depends on local meteorological factors such as rainfall, wind speed and wind direction. Fugitive odours during dredging operations can have an impact. The assessment of potential impacts on Air quality and climate change concluded that given the nature of the port and the distance to sensitive receptors, there are no properties located within the dust risk impact zone and it is concluded that construction dust from the Capital Dredging Project will be negligible for the duration of the works. The assessment also concluded that despite the low risk of encountering odours, a series of odour mitigation measures have been presented to minimise the impact of this operation and to prevent any nuisance in the unlikely event that odours are encountered. The residual odour impact of the Dublin Harbour Capital Dredging operations is considered negligible.

Chapter	Interaction
Chapter 11 – Noise & Vibration	The most significant interactions in relation to Noise & Vibration are considered to be Biodiversity, Flora & Fauna and Population & Human Health. Consideration of each are provided in relevant chapters within the EIAR with appropriate mitigation measures included. ***Biodiversity Flora & Fauna:*** An interaction between Noise & Vibration exists with Biodiversity, Flora & Fauna. Airborne and underwater noise generated during the Dublin Port Capital Dredging Project has the potential to impact on avian species and their foraging areas. An assessment of potential impacts of terrestrial biodiversity and avian ecology has been carried out based on project specific baseline noise surveys, supported by acoustic monitoring data collected as part of the ABR project. The findings of the biodiversity assessment concludes that with the implementation of the mitigation measures (as listed in Chapter 7) during construction and operational phases to reduce the effects of airborne and underwater noise on benthic ecology, marine mammals and waterbirds, significant residual effects are not predicted. ***Population & Human Health:*** An interaction link between Noise & Vibration and Population and Human Health exists. Noise and vibration generated from the Dublin Harbour Capital Dredging Project has the potential to impact upon local population centres. An assessment of terrestrial noise was undertaken using worst case scenario noise level combined with noise data collected as part of the ABR project. The assessment concluded that the noise levels are not expected to exceed the existing levels with the implementation of the proposed mitigation measure during the Dublin Harbour Capital Dredging Project.
Chapter 12 – Underwater Noise	The most significant interactions in relation to Underwater Noise are considered to be Biodiversity, Flora & Fauna and Population & Human Health. Consideration of each are provided in relevant chapters within the EIAR with appropriate mitigation measures included. ***Biodiversity Flora & Fauna:*** An interaction between Noise & Vibration exists with Biodiversity, Flora & Fauna. Airborne and underwater noise generated during the Dublin Port Capital Dredging Project has the potential to impact on avian and marine species and their foraging areas. An assessment of potential impacts of on benthic biodiversity & fisheries; terrestrial biodiversity; marine mammals and designated sites has been carried out based on project specific baseline underwater noise surveys. The findings of the biodiversity assessment concludes that

Chapter	Interaction
	with the implementation of the mitigation measures (as listed in Chapter 7) during construction and operational phases to reduce the effects of airborne and underwater noise on benthic ecology, marine mammals and waterbirds, significant residual effects are not predicted.
Chapter 13 – Coastal Processes	The most significant interactions in relation to Coastal Processes are considered to be Land, Soils Geology and Hydrogeology, Water Quality and population & Human Health. Consideration of each are provided in relevant chapters within the EIAR with appropriate mitigation measures included. ***Soils, Geology & Hydrogeology:*** An inter-relationship exists between Coastal Processes and Soils, Geology & Hydrogeology. The potential impacts on soils and the geological environment relates to the erosion and mobilisation of sediment during dredging operations and disposal operations. Dredging loading operations will cause temporary suspension and release of sediments at the loading sites. Dumping operations will also give rise to temporary sediment plumes at the licensed dumping site in Dublin Bay. It should be noted that chemical analysis has shown that the sediments to be dredged from the Port's navigation channel and basins are suitable for conventional dumping at sea (see Chapter 8). Chapter 13 describes the series of sediment transport simulations that were undertaken as part of this study to simulate the dredging operations and disposal at the licenced disposal site. The dredge simulations have illustrated that the increase in suspended sediment during dredging operations is generally confined to within the immediate area of the dredging operations and concluded that the dredging operations required will not result in any significant impact to either the water quality in terms of suspended sediments, or the nearby environmentally designated areas in terms of sediment deposition. The disposal simulations in combination with monitoring data collected as part of the ABR projects has concluded that the disposal operations associated with Dublin Harbour Capital Dredging Project will not result in any significant increases to the background level of suspended sediments and will therefore not impact the existing water quality in the greater Dublin Bay area. Chapter 13 lists a number of mitigation measures that will be applied during each dredging campaign of the Dublin Harbour Capital Dredging Project. With the implementation of those mitigation measures during capital dredging and disposal operations, the potential risk to receiving water environment will be negligible thus reducing the significance of environmental impact to Imperceptible.

Chapter	Interaction
	Water Quality / Population & Human Health: There is a potential inter-relationship between water quality and coastal processes. The impact of the dredging operations combined with coastal processes has the potential to impact on water quality at water intakes and outfalls as listed below: • Water from the Liffey is abstracted by 4 power plants within the Dublin Port area. The water is abstracted as part of the electricity generation process and/or for cooling water components. High levels of suspended solids in cooling water has the potential to impact upon the plants cooling system and may result in an increase in operation and maintenance costs. • The Ringsend Waste Water Treatment Plant is located on the southern bank of the River Liffey. This plant discharges treated effluent into the Liffey Estuary via a cooling water discharge channel to the north east of Poolbeg Power Station whilst a storm water overflow pipe is located to the north of the storm tanks about 800m upstream. High levels of suspended solids and the ingress of settling material during periods of low flow may have the potential to impact the operational performance of this pipe. A review of dredging simulation results showed that that the increased levels of suspended sediment concentrations at the power station intakes and Ringsend Waste Water Treatment Plant (WwTP) outfall are generally very small by comparison with background levels in the Liffey Estuary and are unlikely to have a significant effect on the quality of intake waters at power stations in terms of suspended solids content. In addition when any dredging is scheduled to take place within a 500m radius of the intakes the relevant stakeholders are notified so that precautionary measures can be taken if deemed necessary.
Chapter 15- Population & Human Health	The most significant interactions in relation to Population & Human Health are considered to be; Land Soils Geology & Hydrogeology / Air Quality & Climate, and Noise & Vibration. Consideration of each are provided in relevant chapters within the EIAR with appropriate mitigation measures included. ***Land Soils, Geology & Hydrogeology / Air Quality & Climate:*** The construction and operational phases of the development have the potential to generate impacts in terms of air quality upon local population centres. The main potential impacts relates to dust and odour generation arising during dredging activities, particularly in dry weather conditions. The potential impacts for nuisance Dust and Odours have

Chapter	Interaction
	been assessed in Chapter 10 and the impacts are considered negligible. A number of mitigation measures will be employed during construction including the preparation of a dust minimisation plan and odour management plan. ***Water Quality / Coastal Processes:*** An interaction link between Population & Human Health and Water Quality/Coastal Processes exists. The main interaction between Human Health & Population and Water Quality relates to the potential impact of the Dublin Harbour Capital Dredging Project on recreational bathing water. The bathing areas in the immediate vicinity of the Dublin Harbour Capital Dredging Project are: Dollymount Strand, Sandymount Strand, Merrion Strand and Seapoint. The potential impact of the Dublin Harbour Capital Dredging Project on water quality has been undertaken as part of this study. Baseline water quality within the receiving environment was established through review of national monitoring data used to establish water quality status in the context of the EU Water Framework Directive (WFD) and supporting environmental standards. High-frequency monitoring data, collected during Dublin Port Company's ABR Project was also reviewed. Using baseline water quality data and site specific water quality model simulation outputs (Chapter 13), an assessment of the Dublin Harbour Capital Dredging Project was conducted to determine the likelihood of significant impacts on water quality using the criteria for rating significance and magnitude as set out in the National Roads Authority (NRA) publication "*Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes*" (NRA, 2008) and appropriate mitigation measures to reduce impacts were proposed, where necessary. The assessment concluded that: the proposed works are compliant with the requirements and environmental objectives of the EU Water Framework Directive and the other relevant water quality objectives for these water bodies and; In circumstances where the appropriate mitigations measures are fully implemented during the dredging operations the impact of the proposed development on the water quality in the area will be imperceptible. The Dublin Harbour Capital Dredging Project is therefore not expected to have a significant effect on the water quality of the receiving waters. ***Noise & Vibration:*** An interaction link between Noise & Vibration and Population and Human Health exist. Noise and vibration generated from the Dublin Harbour Capital Dredging Project has the potential to impact upon local population centres. An assessment of construction

Chapter	Interaction
	noise was undertaken using worst case scenario noise level combined with noise data collected as part of the ABR project. The assessment concludes that the noise levels are not expected to exceed the existing levels with the implementation of the proposed mitigation measures.

16.3 Assessment Summary and Conclusion

16.3.1 Cumulative Effect between the Dublin Harbour Capital Dredging Project and Projects in the same area

The potential cumulative effects of consented schemes proximate to the Dublin Harbour Capital Dredging Project were assessed. Relevant projects were selected and the Project team defined significance thresholds and criteria for assessment. These were based on professional judgement, alongside relevant standards and guidelines, to determine whether in-combination effects gives rise to additional levels of significance.

The most significant proximate Project identified was the Dublin Port Maintenance Dredging Programme 2022-2029. The potential cumulative effects with the Dublin Harbour Capital Dredging Project were to Biodiversity and Water Quality. The potential cumulative effects resulting from dredging and disposal operations required the inclusion of mitigation measures to temporarily separate operations. This means that the dredging element of the Dublin Harbour Capital Dredging Project will not overlap with Dublin Port Maintenance Dredging Programme 2022-2029, thus reducing potential impacts to water quality, habitat deterioration, underwater noise and biodiversity.

Another significant interaction is the MP2 Project and the capital dredging operations required to deepen berthing pockets and localised widening of the navigation channel. The capital dredging operations to be undertaken as part of the MP2 Project will occur in the same water body (Liffey Estuary Lower) and the disposal of dredge spoil will use the same licenced dump site at the approaches to Dublin Bay. The potential cumulative effects with the Dublin Harbour Capital Dredging Project were impacts to water quality due to the potential overlap of dredging operations at the areas immediately adjacent to Berth 52. The potential cumulative impact required the inclusion of mitigation measures to carry out the dredging sequentially, with no overlap occurring between the dredge works of both projects. The sequential nature of the dredging activities minimises the potential for impacts on water quality within and immediately adjacent to the footprint of the proposed works.

16.3.2 Interactions between the various impacts within the Dublin Harbour Capital Dredging Project.

The potential interactions between environmental aspects arising from within the Dublin Harbour Capital Dredging Project were also assessed. Each technical chapter within the EIAR identifies and analyses the potential for other environmental interactions. These chapters also detail environmental baseline information and identify the significant potential and residual construction and operational effects/impacts of the Dublin Harbour Capital Dredging Project. The cumulative assessment identified several potential inter-relationships and interactions. Additional mitigation measures were included to minimise and/or off-set the potential for significant effects resulting from such interactions.

For example, an interaction link exists between Water Quality and Human Beings. Dredging operations has the potential to impact on water quality at cooling water intakes. Four power plants within the Dublin Port area abstract water from the Liffey for cooling water. High levels of suspended solids in cooling water has the potential to impact upon the plants cooling system and may result in an increase in operational and maintenance costs. A review of dredging simulation results showed that that the increased levels of suspended

sediment concentrations at the power station intakes are generally very small by comparison with background levels in the Liffey Estuary. It is therefore unlikely to have a significant effect on the quality of intake waters at power stations in terms of suspended solids content. Precautionary mitigation measures have been included as an additional safeguard. If dredging is scheduled to take place within a 500m radius of the intakes, the relevant stakeholders are notified so that additional measures can be taken if deemed necessary.

This Chapter of the EIAR has addressed all significant potential cumulative effects and environmental interactions of the Dublin Harbour Capital Dredging Project. Mitigation measures resulting from the individual assessments, and the assessment of cumulative effects are summarized in Chapter 17 of the EIAR. The application of these mitigation measures will ensure no significant environmental impact, either as a standalone project or when considered in combination with other projects proximate to the site.

17 SUMMARY OF MITIGATION MEASURES & CONCLUSIONS

17.1 Summary of Mitigation Measures

DPC seeks to achieve the highest possible standards of environmental management during the Dublin Harbour Capital Dredging Project. A summary of all mitigation measures and monitoring requirements proposed within the Environmental Impact Assessment Report (EIAR) are contained in this Chapter of the EIAR followed by the main conclusions of the environmental appraisals.

17.1.1 Dublin Harbour Capital Dredging Project Mitigation Measures

The EIAR assesses the likely significant effects of the Dublin Port Capital Dredging Project on the environment arising from the capital dredging operations. Integration of the engineering design team with the consenting and environmental team from an early stage in the project has enabled mitigation by design to be used, causing many likely significant effects to be eliminated or reduced to an acceptable level during the preliminary design stage. Following an examination, analysis and evaluation of the direct and indirect significant effects of the project in relation to the receiving environment, additional mitigation measures and monitoring programmes have been recommended which will be fully implemented during the Dublin Harbour Capital Dredging Project.

Table 17-1 summarises the mitigation measures and monitoring programmes recommended within the EIAR during the Dublin Harbour Capital Dredging Project. All mitigation measures proposed within the NIS have been captured by the EIAR.

Table 17-1 Mitigation measures and monitoring recommended within the EIAR

Potential Impact	Summary of Proposed Mitigation
Chapter 6 RISKS OF MAJOR ACCIDENTS & DISASTERS	
Potential for loss of life or injury to employees, Contractors, visitors and local residents. Potential for damage to the environment. Potential for damage to the facilities, plant and equipment of DPC, its commercial partners, tenant companies and neighbours.	• The design of the Dublin Harbour Capital Dredging Project has been informed by a COMAH land use planning assessment, the purpose of which was to examine the development in the context of the Health and Safety Authority's COMAH land use planning guidance. Based on this conservative assessment, it is considered that the final design layout of the Dublin Harbour Capital Dredging Project would satisfy the HSA's criteria under its land use planning guidelines. The Dublin Harbour Capital Dredging Project will therefore not increase the risk of major accidents and disasters. • To remain vigilant, DPC has developed a comprehensive Emergency Management Plan that caters for the range of accident and emergency events that may occur within its estate (or that may occur outside of the estate and that are likely to have a direct knock on effect). • In the event of an incident, DPC would activate its plan accordingly, in which case people would be directed away from the source of the hazard.

Potential Impact	Summary of Proposed Mitigation
	• DPC's Emergency Management Plan competencies are continuously enhanced through participation in training and exercises at different levels. • In addition, Dublin Bay, the approaches to the Port and the shipping channel are monitored at all times by Vessel Traffic Services (VTS). All vessels are advised regarding works, developments or issues that are ongoing in the Dublin Port area of jurisdiction. Prior to any dredging a DPC "Notice to Mariners" is sent out to all shipping informing them about the planned work and dates. During the dredging operation the vessel traffic is supervised and controlled.
Chapter 7 BIODIVERSITY, FLORA & FAUNA	
Precautionary measures will be undertaken to minimise the risk of injury or disturbance to marine ecology, including fisheries, in the area of operations	• The following key mitigation measures apply to the Capital Dredging Scheme to minimise the impact of the proposed works on marine ecology – No over-spilling at the surface of the dredger for all dredging activities within the inner Liffey Channel will be permitted; – The dredger will work on one half of the channel at a time within the inner Liffey channel to prevent the formation of a silt curtain across the River Liffey; – The dredging of sediments within the navigation channel will be carried out during the winter months (October – March) to negate any potential impact on salmonid migration (particularly smolts) and summer bird feeding, notably terns, in the vicinity of the dredging operations; – A trailer suction head dredger (TSHD) or Back-hoe dredger will be used for the capital dredging works. When operating in the River Liffey Channel, the TSHD pumps will be switched off when the drag head is being lifted and returned from the bottom as the dredger turns between successive lines of dredging to minimise the risk of fish entrainment; – A maximum of 4,100m³ of sediment and entrained water will be loaded into the dredger's hopper for each loading/dumping cycle. – Dredge spoil will be disposed at the dump site in as even a distribution as possible, maintaining a maximum disposal layer of 10-15cm per disposal event. Disposal events should be spread evenly across the site to minimise the build-up of large amounts of sediment in certain areas. – It is important that every effort be made to maintain the elver trap and salmon counter at Islandbridge in operation all year around, as the data being provided from these is extremely valuable in providing trend information on these valuable migratory species (i.e., eel, salmon and lamprey).

Potential Impact	Summary of Proposed Mitigation
Precautionary measures will be undertaken to minimise the risk of injury or disturbance to marine mammals in the area of operations	• The following precautionary measures will be undertaken to minimise the risk of injury or disturbance to marine mammals in the area of operations in line with National Parks and Wildlife Service (NPWS) Guidelines (2014) – A trained and experienced Marine Mammal Observer (MMO) will be put in place during the loading and dumping operations. The MMO will scan the surrounding area to ensure no marine mammals are in a pre-determined exclusion zone in the 30-minute period prior to operations. The NPWS exclusion zone is 500m for dredging works. – Noise-producing activities will only commence in daylight hours where effective visual monitoring, as performed and determined by the MMO, has been achieved. Where effective visual monitoring is not possible, the sound-producing activities will be postponed until effective visual monitoring is possible. Visual scanning for marine mammals (in particular harbour porpoise) will only be effective during daylight hours and if the sea state is WMO Sea State 4 (≈Beaufort Force 4 conditions) or less. – If there is a break in dredging activity for a period greater than 30 minutes then all pre-activity monitoring measures and ramp-up (where this is possible) will recommence as for start-up. – Once normal operations commence, there is no requirement to halt or discontinue the activity at night-time, nor if weather or visibility conditions deteriorate, nor if marine mammals occur within a radial distance of the sound source that is 500m for dredging activities. – Any approach by marine mammals into the immediate (<50m) works area will be reported to the National Parks and Wildlife Service. • The MMO will keep a record of the monitoring using a 'MMO form location and effort (coastal works)' available from the National Parks and Wildlife Service (NPWS) and submit to the NPWS on completion of the works. • In line with best international practice, a combination of visual and acoustic mitigation techniques will be used to ensure there are no significant impacts on all Annex II marine species, including harbour porpoise, grey seal and harbour seal. Static Acoustic Monitoring (SAM) through the deployment of CPODs will be used. SAM monitoring sites will be established and maintained throughout the project and for two years post-construction. This technique is to complement and not replace visual techniques. The deployment of a SAM system will complement and extend the extensive database currently being collected as part of the ABR Project environmental monitoring programme.

Potential Impact	Summary of Proposed Mitigation
	• Monthly counts of seals hauled out on Bull Island will be undertaken to ensure there is no long-term impact of capital dredging activities at Dublin Port on this important haul out site and to contribute to increasing knowledge of seals using this UNESCO World Heritage site.
Precautionary measures will be undertaken to minimise the risk of injury or disturbance to birds in the area of capital dredging operations	• Measures set out to avoid pollution to water leading to habitat deterioration as outlined in the water quality chapter will be fully implemented. • The following precautionary measures will also be undertaken to minimise the risk of injury or disturbance to nesting and breeding birds in the area of operations – Breeding Terns – the capital dredging scheme will be confined to the winter months (October – March) when the terns have migrated from the site. • DPC will also continue to undertake a programme to monitor winter wetland birds in the adjacent European Sites at the South Dublin Bay and River Tolka Estuary Special Protection Area. This monitoring programme will continue throughout the dredging operations and for a period of two years after the completion of such works, with monthly surveys from October to March. The results of this monitoring programme will be submitted to Dublin City Council at 12-monthly intervals to maintain a public record.
Chapter 8 LAND, SOILS, GEOLOGY, HYDROGEOLOGY	
No specific mitigation measures with regard to Land, Soils, Geology and Hydrogeology are proposed during Dublin Harbour Capital Dredging Project. Mitigation measures are identified in Chapter 9 with respect to surface water quality.	
Chapter 9 WATER QUALITY	
Impacts to Water Quality arising from Suspended Sediment and Sedimentation	The mitigation proposed for dredging operations in the Dublin Harbour Capital Dredging Project has been informed by the ABR Project monitoring and experience working in the same locations. The following key relevant mitigation measures will apply to each dredging campaign: • The capital dredging activity will be carried out during the winter months (October – March) to negate any potential impact on salmonid migration (particularly smolts) and summer bird feeding, notably terns, in the vicinity of the dredging operations. • No over-spilling from the dredger will be permitted while the dredging activity is being carried out within the inner Liffey channel (Dublin Harbour).

Potential Impact	Summary of Proposed Mitigation
	• The dredger's hopper will be filled to a maximum of 4,100 cubic metres (including entrained water) to control the volume of sediment released at the dump site. • Full time monitoring of Marine Mammals within 500m of loading and dumping operations will be undertaken in accordance with the measures contained in the Guidance to Manage the Risk to Marine Mammals from Man-Made Sound Sources in Irish Waters (NPWS 2014). • A documented Accident Prevention Procedure will be put in place prior to commencement • A documented Emergency Response Procedure will be put in place prior to commencement • A full record of loading and dumping tracks and record of the material being dumped will be maintained for each trip. • Dumping will be carried out through the vessel's hull. • The dredger will work on one half of the channel at a time within the inner Liffey channel to prevent the formation of a silt curtain across the River Liffey. In addition to the mitigation measures listed above, DPC are committed to maintaining the water quality monitoring system that has been designed to ensure robust protection of the marine environment and for users of the inner Liffey channel during the Dublin Harbour Capital Dredging Project. • It is proposed to maintain the four water quality monitoring stations already in position for the ABR Project • The specification is based on state of the art 24/7 real time monitoring with water quality monitoring sensors giving high resolution data with respect to the following parameters – Turbidity – Dissolved Oxygen – Temperature – Salinity • Water level is also measured at one monitoring station to provide information on tidal state. Turbidity is measured as a surrogate for suspended solids. Site specific tests have previously been undertaken by the ABR Project to define the relationship between Turbidity and suspended solids. • A data acquisition and transfer system is being used to enable the transmission of high resolution data at approximately 15 minute intervals. • The following trigger levels that will prompt investigation are proposed:

Potential Impact	Summary of Proposed Mitigation
	– Dissolved Oxygen level falling below 6 mg/l. – Peak Suspended Solids level rising more than 100mg/l above background (Based on the Turbidity v Suspended Solids relationship previously established this is equivalent to an Turbidity increase of 40 NTU above background) • The Dissolved Oxygen trigger level has been selected to safeguard fish-life. • The monitoring network infrastructure has been in place since 2016 and will continue for the duration of the construction phase of the MP2 Project and during the Dublin Harbour Capital Dredging Project. • This monitoring system has already generated a robust water quality baseline within the inner Liffey channel with the ability to identify water quality trends. The continuation of the monitoring system will serve to further strengthen the knowledge of water quality trends, a key indicator of the health of the marine environment. • The water quality data currently being collected is circulated to Dublin City Council on a monthly basis. It is proposed that this transfer of information continues for the duration of the construction phase of the MP2 Project and during the Dublin Harbour Capital Dredging Project • The data collected is also being shared with research organisations (Dublin City University, Maynooth University and University College Cork)
Operational phase of the Dublin Harbour Capital Dredging Project on Water Quality.	The operational phase of the Dublin Harbour Capital Dredging Project will be subject to Dublin Port's existing Environmental Management System (EMS) which is accredited to ISO 14001 standard and the Port Environmental Review System (PERS) which has gained Dublin Port designation as an 'Ecoport' at European level. The EMS is supported by a comprehensive suite of Standard Operating Procedures (SOP) providing mitigation of all environmental aspects identified and mechanisms to ensure effective implementation. SOPs have been prepared for oil and chemical spill responses, mineral oil handling, waste handling, monitoring and maintenance of surface water interceptors and handling of drain cleaning waste. Controls are in place for transport, handling and storage of hazardous materials, ship cargo, dry bulk material, surface water runoff, fuelling and bunkering of vessels and ship discharges. Site audits promote best practice and ensure compliance with the EMS requirements.
Chapter 10 AIR QUALITY & CLIMATE	
Capital dredging works have the potential to result in local impacts through dust nuisance at the nearest	• The following precautionary measures will be undertaken to minimise the potential nuisance caused by dust at the nearest sensitive receptors and on sensitive ecosystems

Potential Impact	Summary of Proposed Mitigation
sensitive receptors and also to sensitive ecosystems	– A dust minimisation plan will be put in place based upon the industry guidelines in the Building Research Establishment document entitled 'Control of Dust from Construction and Demolition Activities'. – Monthly monitoring of dust deposition levels will be undertaken for the duration of dredging for comparison with the guideline of 350mg/m^2/day (for non-hazardous dusts). This monitoring will be carried out at a minimum of four locations at sensitive receptors around the proposed works. Where dust levels are measured to be above this guideline, the mitigation measures in the area will be reviewed as part of a Dust Minimisation Plan.
The potential exists for odour generation and nuisance to occur during the construction phase.	• An Odour Management Plan (OMP) will be put in place based upon the guidance presented in the Environment Agency of England and Wales "Odour Management Guidance" (H4 Guidance, 2011) and the EPA "Odour Impact Assessment Guidance for EPA Licensed Sites" (Guidance Note AG5, 2010). These will includes measures designed to: – Employ appropriate methods, including monitoring and contingencies, to control and minimise odour pollution; – Prevent unacceptable odour pollution at all times; and – Reduce the risk of odour releasing incidents or accidents by anticipating them and planning accordingly. – The OMP will include a procedure for complaint recording and investigation to ensure that all complaints received at the site are suitably addressed.
Potential impact on future shipping emissions on Air Quality & Climate.	A number of EU Directives and the requirements of the Marpol Convention regulate the fuels and emissions employed in the shipping industry. These requirements will remain in practice throughout the operation of the Dublin Harbour Capital Dredging Project and may be replaced with more stringent emission limits.
Chapter 11 NOISE & VIBRATION	
There is the potential for noise impacts associated with the construction phase of the proposed development at the nearest noise sensitive receptors.	• The following precautionary measures will be undertaken to minimise the potential nuisance caused by terrestrial noise & vibration at the nearest sensitive receptors and on sensitive ecosystems. *British Standard BS5228:2009+A1:2014 – Noise and vibration control on construction and open sites: Part 1 - Noise* outlines a range of measures that will be used to reduce noise impacts at the nearest noise sensitive receptors. The measures, which will be applied, include: – Ensuring that mechanical plant and equipment used for the purpose of the works are fitted with effective exhaust silencers and are maintained in good working order,

Potential Impact	Summary of Proposed Mitigation
	– Careful selection of quiet plant and machinery to undertake the required work where available, – All major compressors will be 'sound reduced' models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use, – Any ancillary pneumatic percussive tools will be fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use, – Any ancillary pneumatic percussive tools will be fitted with mufflers or silencers of the type recommended by the manufacturers, – Machines in intermittent use will be shut down in the intervening periods between work, – Ancillary plant such as generators, compressors and pumps will be placed behind existing physical barriers, and the direction of noise emissions from plant including exhausts or engines will be placed away from sensitive locations, in order to cause minimum noise disturbance, – Handling of all materials will take place in a manner which minimises noise emissions, – Audible warning systems will be switched to the minimum setting required by the Health and Safety Authority, – A complaints procedure will be operated by the Contractor throughout the construction phase and all efforts will be made to address any noise issues at the nearest noise sensitive properties.
Continued Noise Monitoring	• DPC is committed to the continuous monitoring of terrestrial noise for the duration of the construction works in accordance with BS7445: Description and Measurement of Environmental Noise. – All measurements will be made using Type 1 precision digital sound levels meters and associated hardware. The following parameters will be recorded as a minimum: LAeq, LAmax, LAmin, LA10 & LA90. – A permanent secure noise monitoring station has previously been established at the marina adjacent to Pigeon House Road as part of the ABR Project and will be operated continuously during the Dublin Harbour Capital Dredging Project. – All data will be collected and analysed on a weekly basis and the analysed data will be fed back to the Dredging Contractor with a view to reviewing compliance of the dredging activities against the thresholds/requirements included in Table 11-1 and Table 11-2 of Chapter 11 of this EIAR. – Any noise nuisance issues associated with the dredging works will be immediately assessed and analysed in relation to the recorded

Potential Impact	Summary of Proposed Mitigation
	noise levels and all correspondence with DPC, the Contractor, Dublin City Council and residents will be conducted with the appropriate level of urgency. This will include the appropriate liaison with DPC and the Contractor to control activities to ensure that the construction phase activities are in line with the consents.
Chapter 12 UNDERWATER NOISE	
The impact from underwater noise is quite limited, based on the measured underwater noise levels for similar scale works being carried out in 2016 and 2020. The underwater noise levels arising during capital dredging will not result in harm to marine mammals or fish. Specific mitigation measures and compliance with NPWS (2014) guidelines suggest the use of a MMO on board the vessel to keep a watch for marine mammal activity. This should avoid the risk of injury to marine mammals from a vessel strike and ensure that the waters in the immediate vicinity of the vessel are free from marine mammals prior to deposition of the dredged material at the dump site. No specific mitigation for underwater noise is recommended.	
Chapter 13 COASTAL PROCESSES	
Impacts to Water Quality arising from Suspended Sediment and Sedimentation	The mitigation proposed for dredging operations in the Dublin Harbour Capital Dredging Project has been informed by the ABR Project monitoring and experience working in the same locations. The following key relevant mitigation measures will apply to each dredging campaign: • The capital dredging activity will be carried out during the winter months (October – March) to negate any potential impact on salmonid migration (particularly smolts) and summer bird feeding, notably terns, in the vicinity of the dredging operations. • No over-spilling from the dredger will be permitted while the dredging activity is being carried out within the inner Liffey channel (Dublin Harbour). • The dredger's hopper will be filled to a maximum of 4,100 cubic metres (including entrained water) to control the volume of sediment released at the dump site. • Full time monitoring of Marine Mammals within 500m of loading and dumping operations will be undertaken in accordance with the measures contained in the Guidance to Manage the Risk to Marine Mammals from Man-Made Sound Sources in Irish Waters (NPWS 2014). • A documented Accident Prevention Procedure will be put in place prior to commencement • A documented Emergency Response Procedure will be put in place prior to commencement • A full record of loading and dumping tracks and record of the material being dumped will be maintained for each trip.

Potential Impact	Summary of Proposed Mitigation
	• Dumping will be carried out through the vessel's hull. • The dredger will work on one half of the channel at a time within the inner Liffey channel to prevent the formation of a silt curtain across the River Liffey.
Chapter 14 CULTURAL HERITAGE (including Industrial & Archaeological)	
Archaeological monitoring and management measures during capital dredging operations.	• Retaining an Archaeologist: An archaeologist experienced in maritime archaeology will be retained for the duration of the relevant works. • Archaeological Licences: Archaeological licences will be required to conduct the on-site archaeological works. Licence applications require the inclusion of detailed method statements, which outline the rationale for the works, and the means by which the works will be resolved. • Archaeological Monitoring: Monitoring will be carried out by suitably qualified and experienced maritime archaeological personnel licensed by the Department of Housing, Local Government and Heritage. Archaeological monitoring is conducted during all seabed disturbances associated with the development. The monitoring will be undertaken in a safe working environment that will facilitate archaeological observation and the retrieval of objects that may be observed and that require consideration during the course of the works. The monitoring will include a finds retrieval strategy that is in compliance with the requirements of the National Museum of Ireland. • Time Scale: The time scale for the construction phase will be made available to the archaeologist, with information on where and when ground disturbances will take place. • Discovery of Archaeological Material: In the event of archaeologically significant features or material being uncovered during the construction phase, machine works will cease in the immediate area to allow the archaeologist/s to inspect any such material. • Archaeological Material: Once the presence of archaeologically significant material is established, full archaeological recording of such material will be recommended. If it is not possible for the construction works to avoid the material, full excavation will be recommended. The extent and duration of excavation will be a matter for discussion between the client and the licensing authorities. • Archaeological team: It is recommended that the core of a suitable archaeological team be on standby to deal with any such rescue excavation. This would be complimented in the event of a full excavation. • Archaeological Dive Team: It is recommended that an archaeological dive team is retained on standby for the duration of any in-water disturbance works on the basis of a twenty-four or forty-eight hour call-out response schedule, to deal with any archaeologically

Potential Impact	Summary of Proposed Mitigation
	significant/potential material that is identified in the course of the seabed disturbance activities. • A Site Office: A site office and facilities will be provided by DPC on site for use by archaeologists. • Secure Wet Storage: Secure wet storage facilities will be provided on site by DPC to facilitate the temporary storage of artefacts that may be recorded during the course of the site work. • Buoying/Fencing: Buoying/fencing of any such areas of discovery will be necessary if discovered and during excavation. • Machinery Traffic: Machinery traffic during construction will be restricted to avoid any identified archaeological site/s and their environs. • Spoil: Spoil will not be dumped on any of the selected sites or their environs. • Post-construction Project Report and Archive: It is a condition of archaeological licensing that a detailed project report is lodged with the Department of Housing, Local Government and Heritage within 12 months of completion of site works. The report should be to publication standard and should include a full account, suitably illustrated, of all archaeological features, finds and stratigraphy, along with a discussion and specialist reports. Artefacts recovered during the works need to meet the requirements of the National Museum of Ireland. These measures are subject to the approval of the National Monuments Service at the Department of Housing, Local Government and Heritage. DPC has and will continue to engage with the Department of Housing, Local Government and Heritage.
Chapter 16 POPULATION & HUMAN HEALTH	
Embedded mitigation measures	• Monitoring of dust, odour and noise during the capital dredging operations will act as precursors to any health impact, thereby enabling a monitoring regime that enables intervention before any manifest adverse health outcome.
Chapter 17 CUMULATIVE EFFECTS & ENVIRONMENTAL INTERACTIONS	
Interaction with the MP2 Project capital dredging works	• Capital dredging for the Dublin Harbour Capital Dredging Project and MP2 Project will be programmed to be sequential, that is, only one dredger will be allowed to operate within the inner Liffey channel (Dublin Harbour) at any one time. All capital dredging will be restricted to the winter months (October to March).

17.1.2 Implementation of Construction Phase Mitigation Measures

DPC intends to appoint a specialist Dredging Contractor to undertake the Dublin Harbour Capital Dredging Project. The mitigation measures set out in the EIAR sets out the **minimum requirements** which will be adhered

to during the capital dredging operations. The mitigation measures will form part of the Contract Documents for the construction stage to ensure that the Contractor undertakes the works required to implement the mitigation measures.

17.1.3 Dublin Harbour Capital Dredging Operational Phase

The existing land uses within the footprint of the Dublin Harbour Capital Dredging Project comprise the manoeuvring and berthing of vessels, the handling of Ro-Ro and Lo-Lo cargo, the movement of ferry passengers arriving and departing to/from Dublin Port and the import and export of bulk cargo including petroleum products.

The Dublin Harbour Capital Dredging Project is designed to complement the ABR Project and MP2 Project to provide sufficient depth of water to accommodate the range of vessels using Dublin Port.

The future land uses within the footprint of the Dublin Harbour Capital Dredging will therefore not significantly change and consequently operational mitigation measures are largely based on the following:

- Integration of the new port infrastructure with existing operational plans and procedures;
- Integration with port-wide monitoring programmes to establish environmental trends in order to support future initiatives to enhance the environment or take corrective action, if required; and
- Integration with the strategic objectives of the Dublin Port Masterplan 2040, reviewed 2018.

17.2 Conclusions

This Environmental Impact Assessment Report (EIAR) has been prepared by RPS on behalf of Dublin Port Company (DPC) for the Dublin Harbour Capital Dredging Project for which development consent is sought.

This EIAR will be used to support the relevant assessments to be carried out by the respective competent authorities on all relevant applications for development consent.

The primary objective of the EIAR is to identify the baseline environmental context of the proposed development, predict potential beneficial and/or adverse effects of the development and propose appropriate mitigation measures where necessary

The EIAR has been prepared in accordance with the requirements of EU Directives and Irish law regarding Environmental Impact Assessment (including the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018) and European Commission Environmental Impact Assessment of Projects Guidance on the preparation of the Environmental Impact Assessment Report (Directive 2011/92/EU as amended by 2014/52/EU) (European Commission, 2017)

The environmental appraisals have benefitted from the environmental monitoring programme which is currently in place for the construction of the Alexandra Basin Redevelopment (ABR) Project, the first Strategic Infrastructure Development brought forward to planning from the Dublin Port Masterplan 2040, and which is currently at the construction stage of development.

The site-specific scientific data collected to date was used to support the preparation of the EIAR for the Dublin Harbour Capital Dredging Project and serves to illustrate the depth of understanding of the environment in and around Dublin Port, including the inner Liffey channel (Dublin Harbour) and Dublin Bay.

The preparation of the EIAR was further assisted by the extensive environmental datasets collated during the preparation of the Strategic Environmental Assessment (SEA), for the purposes of the review of the Dublin Port Masterplan during 2017 and 2018.

Additional survey work has been undertaken in order to provide up-to-date baseline information to support the environmental assessments, in addition to the site-specific information from the existing databases from official sources.

The key conclusions of the EIAR are set out below:

17.2.1 Need for the Dublin Harbour Capital Dredging Project

Dublin Port is the largest and most important port in the country. The combination of reasonable depth of water, proximity to the largest concentration of population on the island and excellent access to the national road and rail networks gives Dublin Port its importance in both the EU TEN-T network and in the national port system.

In common with other important parts of national infrastructure, there has been significant underinvestment in Dublin Port for many decades. For example, for 31 years from 1979 to 2010 Dublin Port & Docks Board and latterly Dublin Port Company (DPC) sought permission to expand the port by infill into Dublin Bay opposite Clontarf rather than optimising existing quays and lands.

A new direction for the development of the Port was established by the Dublin Port Masterplan 2012-2040 published in February 2012.

The Masterplan was reviewed and updated and the current version is the Dublin Port Masterplan 2040 Reviewed 2018, published in June 2018.

Between the publication of the original Masterplan in 2012 and the updated version in 2018, the challenges facing the Port changed significantly due to a number of factors:

- Rapid economic recovery after the 2008 recession led to large growth in cargo volumes from 28.1m gross tonnes in 2011 to 38.0m gross tonnes in 2018, an increase of 35.2%.
- The country's population increased by 6.2% from 4.6m in 2011 to 4.9m in 2018.
- Following the referendum in the UK concerning Brexit in June 2016 and the UK's decision to leave the EU in January 2020, the patterns of trade have already begun to change with increased growth on services between Dublin and ports in Continental Europe such as Rotterdam, Zeebrugge and Cherbourg.

The Dublin Port Masterplan approach of redeveloping existing brownfield sites which are already in operation, to deliver strategic infrastructure projects such as the ABR Project and MP2 Project is not straightforward. The areas where much needed infrastructural improvements is required are in daily use and throughput volumes are expected to grow to 77.2 million tonnes by 2040.

DPC is currently constructing the ABR Project by way of discrete work packages designed to allow existing customers' growing businesses to continue with minimum disruption. The same approach will be necessary for the already consented MP2 Project.

The Dublin Harbour Capital Dredging Project supports these significant infrastructure developments by providing sufficient water depth within Dublin Harbour's navigation channel, basins and berths for the safe

movement of vessels to and from the port. The same constraints are applicable whereby the project will need to be delivered through a series of discrete work packages to minimise disruption to existing port activities.

The experience of recent years suggests that there can be unforeseen circumstances which impact on the timing of planned project works in Dublin Port. In such circumstances, it is very difficult to predict when individual works packages within the Dublin Harbour Capital Dredging Project should commence.

Because of such uncertainties, DPC requires an 8 year Foreshore Licence and associated Dumping at Sea Permit to provide the required flexibility to deliver the capital dredging project at the optimum times within that timeframe.

DPC estimates that the total cost of implementing the Dublin Port Masterplan 2040 will be in the order of €1.7 billion (2020 prices). In the shorter term, DPC has a €1 billion ten year capital expenditure programme from 2019 to 2028. By any standards, the scale of the infrastructural development challenge in Dublin Port is enormous.

In this dynamic environment, the construction timescales for individual projects within the overall Masterplan development programme are liable to change in response to circumstances. This is an inevitable consequence of DPC's preferred sustainable approach to the brownfield development of the existing Dublin Port estate rather than the less sustainable greenfield development at another location where construction timelines could be far shorter and more certain. DPC's choice of the brownfield approach rather than a greenfield approach is founded on DPC's commitment to the principles of proper planning and sustainable development.

The framework of the Dublin Port Masterplan (including the 2018 review) and the related Strategic Environmental Assessment (SEA) and Natura Impact Statement (NIS) in conjunction with the Environmental Impact Assessment Report (EIAR) and the NIS at the project level of the Dublin Harbour Capital Dredging Project provide a robust basis for DHLGH and the EPA to complete all relevant environmental assessments to facilitate consents of 8 years duration.

The environmental appraisals presented in this EIAR have taken into account the environmental implications of an 8-year consent and conclude that there is no environmental impediment to the granting of an 8-year consent. A summary is presented below:

- The environmental appraisals have been undertaken within the context of the Strategic Environmental Assessment (SEA) prepared for the Dublin Port Masterplan which is based on an assessment of incremental time periods from 2018 to 2040.
- The footprint of the Dublin Harbour Capital Dredging Project lies entirely within Dublin Harbour (no capital dredging is proposed within Dublin Bay). There are no benthic habitats, flora & fauna of conservation value within the application boundary of the site. Prolonged capital dredging activities over an 8-year period will therefore have no impact on biodiversity, flora & fauna as no natural changes are expected within that period of time.
- The Dublin Harbour Capital Dredging Project has been engineered to ensure that any potential impact on the surrounding Natura 2000 sites is at a *de minimis* level. The capital dredging period of 8-years has been assessed in the biodiversity, flora & fauna appraisals.

- No prolonged nuisance to the local communities is expected as a result of an 8-year capital dredging period because of the relatively low noise emissions generated by the dredging operations and the distance separation from the dredging operations and the nearest noise sensitive receptors
- It is however accepted that marine sediments not dredged within the first 5 years of the consent would need be subject to further sediment chemistry sampling and analysis, and eco-toxicological testing, if required, in accordance with OSPAR Guidelines. DPC accept that this should be conditioned by the Foreshore Licence and Dumping at Sea Permit.

17.2.2 Project Description

The Dublin Harbour Capital Dredging Project is being proposed against a background where capital dredging has been recently completed within the ABR Project (March 2021) to deepen Dublin Port's navigation channel to -10.0m CD, from the Western Oil Jetty in Dublin Harbour to the -10.0m CD contour in Dublin Bay. Moreover, the Dublin Port Masterplan 2040 has confirmed that -10.0m CD will be the final depth of the navigation channel at Dublin Port.

The Dublin Harbour Capital Dredging Project is designed to provide:

- Deepening of the navigation channel from -7.8m CD to -10.0m CD between the North Wall Quay Extension and the Western Oil Jetty, including deepening of riverside Berth 35 (Ocean Pier) to -10.0m CD and widened to 50m.
- Deepening of Alexandra Basin East from -7.8m CD to -10.0m CD with Berths 36 and 37 widened to 50m and Berths 38, 39 and 40 deepened to -11.0m CD and widened to 50m.
- Deepening of the Oil Basin from -7.8m CD to -10.7m CD with Berths OB1 and OB2 widened to 50m.
- Deepening of the Ferryport Basin from -7.8m CD to -10.0m CD.
- Deepening of riverside Berth 52 to -10.0m CD following construction of the new Berth 52 quay under the MP2 Project (ABP-304888-19).
- Widening of South Port Berths 42, 43, 44, 45, 46 and 47 to 50m.
- Removal of ridge between the navigation channel and the Poolbeg Oil Jetty (Berth 48) to -10.0mCD.

The Dublin Harbour Capital Dredging Project has been carefully devised by DPC to ensure that:

- It is consistent with the Dublin Port Masterplan 2040
- The proposals selected for development make optimum use of the Port's finite resources of river berths and quayside lands
- The proposed configuration reflects and responds to assessments of the potential environmental impact of different options to achieve the project's objectives
- The chosen project option best meets all applicable environmental and ecological requirements
- The project can be constructed in a way that minimises the impact on existing port operations
- The proposed project is consistent with the principles of proper planning and sustainable development

- The project makes provision for future population growth and a concomitant increase in demand for port infrastructure at the location closest to where the need for additional capacity arises

17.2.3 Examination of Alternatives

At strategic level, the Masterplan identified that the Dublin Harbour Capital Dredging Project is a key element of its implementation, underpinning the Masterplan's fundamental approach of providing capacity in Dublin Port for the 77.2m gross tonnes projected by 2040 by maximising the utilisation of Dublin Port's brownfield lands. The assessment process in support of the Masterplan identified that the development in this area of the Port is the most sustainable approach and the desired approach from a strategic point of view.

The Dublin Harbour Capital Dredging Project is concluded to be an essential step in achieving the Port's ambitious throughput objective.

At detailed design level the evolution of the proposed capital dredging works was considered to achieve the Dublin Harbour Capital Dredging Project's objective of loading and disposing of 500,000m^3 of marine sediments.

A number of alternative loading options were examined including the use of a range of mechanical and hydraulic dredgers. The preferred option identified was the use of a backhoe dredger and/or a Trailing Suction Hopper Dredger. No over-spill will be permitted whilst loading within the inner Liffey channel (Dublin Harbour). The quantity of dredged material entering the water column as a sediment plume is therefore expected to be similar for both types of dredger. Monitoring undertaken during the ABR Project has shown that loading operations within Dublin Harbour has had no significant impact on water quality.

A number of disposal options were also examined including: do-nothing; beneficial re-use; disposal on land; incineration and disposal at sea. The preferred option identified was a combination of disposal at sea and re-use with computational modelling undertaken to determine appropriate method, rate, timing and location of these activities. A sediment chemistry and eco-toxicological sampling and analysis programme confirmed the sediments had no biological effect and thereby suitable for the safe disposal at sea. No significant environmental impacts of this design choice were identified.

17.2.4 Scoping Consultation

The development proposals advanced in the Dublin Harbour Capital Dredging Project reflect the significant levels of consultation that have taken place since 2017 on the future of Dublin Port.

The various submissions and comments made in relation to the Dublin Harbour Capital Dredging Project have been fully considered by the consultants in the preparation of the EIAR and by the applicants in the design of the scheme. Every effort has been made to address all concerns raised and, where possible, mitigation measures have been proposed to minimise the environmental impact of the Dublin Harbour Capital Dredging Project.

Detailed scoping has been undertaken in respect to the Dublin Harbour Capital Dredging Project. DPC "informally" or voluntarily scoped the contents of an EIAR by engaging in consultations with prescribed and other authorities, bodies and stakeholders and through public consultation, in accordance with the European Commission's 2017 "Environmental Impact Assessment of Projects Guidance on Scoping" and the EPA's Environmental Impact Assessment Reports, Draft Guidelines (August 2017).

Through the scoping process which has been carried out in the preparation of this EIAR, the issues which are likely to be important during the environmental impact assessment have been identified. The scoping process has identified the sources or causes of potential environmental effects, the pathways by which the effects can happen, and the sensitive receptors, which are likely to be affected, and has defined the appropriate level of detail for the information to be provided in the EIAR.

17.2.5 Risk of Major Accidents

The assessment of the risk of major accidents and disasters concludes that, from a COMAH perspective, the potential direct and indirect risks arising from the Dublin Harbour Capital Dredging Project satisfy the Health and Safety Authority's COMAH land use planning guidance. It is also concluded that other, non-COMAH direct and indirect major accident and disaster risks arising from the Dublin Harbour Capital Dredging Project are not significantly different from the current risks.

DPC has developed a comprehensive emergency management plan that caters for the range of accident and emergency events that may occur within its estate (or that may occur outside the estate and that have a direct, knock-on effect), and this plan is provided to the other relevant stakeholders, including An Garda Síochána, Dublin City Council, Transport Infrastructure Ireland, and the Principal Response Agencies. In the event of an incident at a COMAH establishment that could impact on people at other facilities in the Port, or on road traffic entering or exiting the Port, DPC will activate its Emergency Management Plan, in which case people would be directed away from the source of the hazard.

17.2.6 Biodiversity, Flora & Fauna

The assessment of Biodiversity, Flora & Fauna identifies, describes and assesses in an appropriate manner, the direct and indirect significant effects of the Dublin Harbour Capital Dredging Project on biodiversity, flora and fauna. It contains a description of the marine and avian biodiversity features within and surrounding the site of proposed development, followed by an assessment of the potential and likely significant effects of the proposed development alone and cumulatively with other consented projects on marine and avian biodiversity features and designated sites.

In accordance with the requirements of the EIA Directive 2014/52/EU, particular attention has been given to species and habitats protected under Council Directives 92/43/EEC and 2009/147/EC, Habitats Directive Annex habitats and species and Birds Directive species. A Natura Impact Statement (NIS) has been prepared on behalf of the applicant to document Habitats Directive stage 1 and stage 2 appraisals.

The assessment of benthic biodiversity and fisheries features concludes that the proposed Dublin Harbour Capital Dredging Project is expected to have only a temporary and minor adverse impact on the benthos within the footprint of the dredging works. Areas earmarked to be dredged will have their benthos temporarily removed, but due to the nature of the benthos present, recovery is expected to occur rapidly following cessation of dredging activities. The area is subjected to regular maintenance dredging, and the benthos that has developed there is typical of muddy areas subject to episodic stress events. The benthos within the footprint of the Burford Bank disposal site is expected to undergo a cycle of temporary impact (during disposal) followed by partial recovery before the next disposal event until the completion of the capital dredging programme, followed by

complete recovery expected to occur within 2 years of the cessation of the project. Overall, these impacts can be classified as temporary to short-term, minor and adverse.

The proposed capital dredging is expected to have only a negligible impact on salmon (adults or smolts) in the Liffey, mainly due to the minor seasonal overlap between migration of the species and the dredging activity. Eel, mainly outward migrating silver could potentially be exposed to entrainment by the dredging but that will not impact future recruitment of the species into the Liffey and the entrainment of glass eel is expected to have a negligible impact on the Liffey population. The potential for entrainment of river lamprey during the project is probably highest of the migratory high conservation species. However, aspects of its biology and migratory strategy are likely to result in the impact at worst being minor, adverse and short-term, with minimal effect at the population level in the Liffey. Impacts on the general non-conservation migratory and resident fish populations in the study area are expected to be at worst minor, adverse and temporary. The impact of dredge spoil disposal at the dump site is not expected to have any adverse impact on the protected porpoise population in the Rockabill to Lambay Island SAC by virtue of the tiny proportion of the SAC constituted by the dump site and the fact that fish will still feed at the site during or immediately after disposal events so that there will effectively be no dredging related diminution in the porpoises' fish diet as a result. Mitigation has been proposed where necessary and there is no significant residual environmental impact upon benthic biodiversity and fisheries features with effective implementation of the proposed mitigation measures.

The assessment of marine mammal features concluded that Dublin Bay and approaches to the port are important for marine mammals including the regular occurrence of Grey and Common (Harbour) seals and Harbour porpoise. Recent dredging associated with the ABR Project and ongoing maintenance dredging has provided an excellent understanding of the marine mammal community exposed to dredging and dumping and the likely effects. Irish Whale and Dolphin Group (IWDG) recommend full implementation of the NPWS Guidelines to minimise the acoustic impacts of dredging to enable the dredging campaign to be carried out which will result in no significant impacts to marine mammals or on the conservation objectives of the Rockabill to Dalkey Island SAC.

The assessment of avian features concludes that potential for significant effects are limited to water quality and habitat deterioration effects arising as a result of the accidental spillage or leakage of chemical pollutants into marine and estuarine waters. Subject to the implementation of standard mitigation measures to ensure that the risks of such an occurrence are minimised it is not envisaged that the proposed project will have potential to give rise to any significant impacts, cumulative or otherwise, upon bird populations which are known to utilise the site and the surrounding locality.

17.2.7 Land, Soils, Geology & Hydrogeology

Baseline land, soil, geology and hydrogeology within the receiving environment was established through review of Geological Survey Ireland national datasets, historical borehole data and monitoring data used to establish water quality status in the context of the EU Water Framework Directive (WFD). Soil sampling and analysis was also undertaken in accordance with the Marine Institutes Sediment Analysis Plans (SAPs) 2020.

The eco-toxicological test results have shown that the marine sediments to be dredged have no significant biological effect and can therefore be considered as Class 1 material (Uncontaminated: no biological effects likely) and thereby suitable for disposal at sea.

Using baseline data, an assessment of the Dublin Harbour Capital Dredging Project was conducted to determine the likelihood of significant impacts on land, soils, geology and hydrogeology using the criteria for rating significance and magnitude as set out in the National Roads Authority (NRA) publication “Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes” (NRA, 2008). No mitigation measures to reduce impacts were considered necessary. No residual impacts are predicted during the construction or operational phase of Dublin Harbour Capital Dredging Project.

17.2.8 Water Quality

Baseline water quality within the receiving environment was established through review of national monitoring data used to establish water quality status in the context of the EU Water Framework Directive (WFD) and supporting environmental standards. Recent high-frequency monitoring data collected during Dublin Port Company's ABR Project was also reviewed.

Using this robust baseline water quality database, an assessment of the Dublin Harbour Capital Dredging Project loading and dumping activities was conducted to determine the likelihood of significant impacts on water quality using the criteria for rating significance and magnitude as set out in the National Roads Authority (NRA) publication “Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes” (NRA, 2008) and appropriate mitigation measures to reduce impacts were proposed, where necessary.

In circumstances where the appropriate mitigations measures are fully implemented during the Dublin Harbour Capital Dredging Programme, the impact on water quality will be imperceptible. The loading and dumping activities are therefore not expected to have a significant effect on the water quality of the receiving waters.

It can therefore be concluded that the capital dredging programme is compliant with the requirements and environmental objectives of the EU Water Framework Directive and the other relevant water quality standards.

17.2.9 Air Quality & Climate Change

The current state of the environment in terms of baseline air quality has been determined from the data from the EPA monitoring Zone A (Dublin) network to determine compliance with relevant ambient air legislation. In addition to the EPA monitoring, DPC carry out a series of ambient air quality monitoring tests within the environs of the port. This monitoring is employed in this assessment to demonstrate the spatial variation in the Port and in the wider Dublin area in conjunction with the data from the EPA network.

Results of the baseline monitoring indicates that recent levels in the Greater Dublin Area are below the statutory limits for the protection of human health and also below the WHO guidelines for the protection of human health. It is noted that monitoring undertaken by DPC within the Port footprint show levels that are higher than the Greater Dublin Area average and, in some cases, levels exceed both the statutory limits and the WHO guidelines.

There are sensitive receptors (houses, commercial operations) located in the area and these receptors vary in distance from the proposed development. There is a potential that receptors may experience a change in air quality and the extent of these changes in air quality is identified in the air quality assessment. The nearest

sensitive residential receptors to the proposed dredging are the residential dwellings on Pigeon House Road and Coastguard Cottages circa 140 metres to the south of the nearest point of dredging.

An assessment of the implications for total emissions from the dredger vessel has been undertaken to determine the impact on both a regional/national basis as well as on a local basis. On a regional/national level, the total estimated emissions per annum from the dredger have been compared with the national emissions ceilings limits and the results indicate that the impact of the vessel will be negligible. In relation to emissions of greenhouse gases from the dredger these are considered to be a permanent slight adverse impact.

At a local level, an assessment of the change in exposure to air pollution for the properties located close to the dredging on Pigeon House Road, indicates that for the temporary timeframe whereby the dredging is undertaken close to the properties, the local air quality impact will be temporary and slight adverse impact.

The principal pollutants of concern which originate from road developments are the nitrogen oxides (NOx), in terms of impact on sensitive ecosystems. Nitrogen oxides (NOx) may have a positive or negative impact by acting as a fertiliser or a phytotoxicant. Effects are mainly on vegetation growth, photosynthesis, and nitrogen assimilation/metabolism.

The nearest sensitive ecological site to the proposed dredging is the South Dublin Bay and River Tolka Estuary SPA (Site Code 004024) which has a number of qualifying interests including wetland and waterbirds. The proposed dredging at Berth 52 will be directly adjacent to the boundary of the SPA, albeit for a temporary basis. An assessment of nitrogen deposition on the SAC has been undertaken and the results indicate that the temporary levels of nitrogen deposition on the SPA are less than 30% of the critical load as set by UNECE and the results of this deposition on biodiversity is considered negligible.

Construction dust has the potential to cause local impacts through dust nuisance at the nearest sensitive receptors and also to sensitive ecosystems. Given the nature of the port and the distance to sensitive receptors, there are no properties located within the dust risk impact zone and it is concluded that construction dust from the Capital Dredging Project will be negligible for the duration of the works.

The main potential odour from the construction stage relates to the potential for fugitive odours from the dredging operation. Despite the low risk of encountering odours, a series of odour mitigation measures have been presented to minimise the impact of this operation and to prevent any nuisance in the unlikely event that odours are encountered. The residual odour impact of the prosed the dredging operations is considered negligible

17.2.10 Terrestrial Noise & Vibration

A detailed baseline noise monitoring survey was completed at a location representative of the nearest properties to determine the noise environment in the vicinity of the proposed redevelopment. This baseline noise monitoring survey was used as a basis for determining the likely noise impact associated with the proposed dredging activities.

The Noise and Vibration Assessment was completed with reference to a range of relevant Irish and international noise and vibration guidance documents.

Worst-case dredging noise levels from the proposed development completed at the most sensitive locations and most sensitive times have the potential to exceed the relevant noise threshold limits outlined in the relevant noise guidance documents if the appropriate mitigation measures are not in place. Noise mitigation measures

are included in the EIAR to ensure that dredging noise impacts are reduced to the lowest possible levels and within the relevant threshold limits. There will be no significant vibration impact associated with the proposed development on account of the distance between the activities and the nearest sensitive receptors.

17.2.11 Underwater Noise

The impact from underwater noise is quite limited, based on the measured underwater noise levels for similar scale works being carried out in 2016 and 2020.

The underwater noise levels arising during capital dredging will not result in harm to marine mammals or fish. Specific mitigation measures and compliance with NPWS (2014) guidelines suggest the use of a MMO on board the vessel to keep a watch for marine mammal activity. This should avoid the risk of injury to marine mammals from a vessel strike and ensure that the waters in the immediate vicinity of the vessel are free from marine mammals prior to deposition of the dredged material at the dump site. No specific mitigation for underwater noise is recommended.

Underwater noise monitoring has been carried out on two previous occasions and indicated that underwater noise levels from dredging activity will not result in any significant environmental impacts. The proposed capital dredging is of a similar scale using similar equipment and methodology. No specific monitoring of underwater noise levels is required in these circumstances. These measurements clearly indicate that dredging noise levels are low and the proposed capital dredging works at Dublin Port will not cause any significant environmental impact.

17.2.12 Material Assets - Coastal Processes

RPS used the MIKE 21/3 hydrodynamic numerical modelling software package, developed by DHI, to assess the potential impact of the capital dredging on the coastal processes of the inner Liffey channel (Dublin Harbour) and Dublin Bay. This was achieved by developing two and three dimensional numerical models of the Dublin Bay area.

These models were used in conjunction with hydrographic survey data and site-specific water quality monitoring data to assess the impacts of the dredging operations in context of the following coastal processes:

- The dispersion and settlement of sediment plumes generated during dredging operations; and
- The dispersion of sediment material disposed of at the spoil site.

To conclude the assessment, mitigation measures are proposed to reduce impacts, where appropriate. This enables a “with mitigation” assessment to be made of any residual impact as a result of the capital dredging campaigns and/or in combination with other projects in the vicinity of Dublin Port and the offshore disposal site.

Output from an extensive numerical modelling programme in conjunction with site specific water quality monitoring data and survey data have been used to assess the Dublin Harbour Capital Dredging Project and determine the likelihood of significant impacts on the coastal processes within the inner Liffey channel and Dublin Bay due to dredging and dumping at sea activities.

The computational modelling study predicts the following levels of Total Suspended Solids (TSS) as a result of sediment plumes arising during the dredging operations within the inner Liffey channel:

- The Peak Total Suspended Solids concentration, outside the immediate vicinity of the dredger, arising from dredging within the navigation channel is expected to be in the range 25-30mg/l above baseline levels.
- The Peak Total Suspended Solids concentration, outside the immediate vicinity of the dredger, arising from dredging within the basins is expected to be circa 35mg/l above baseline levels. This slightly higher TSS level was expected due to the lower tidal currents experienced within the more sheltered basins compared to the main flow within the Liffey itself.
- The overall mean rise in Total Suspended Solids over the duration of the dredging campaign is predicted to be less than 10 ml/g above baseline levels.

The computational modelling study predicted the following levels of Total Suspended Solids (TSS) as a result of sediment plumes arising from the disposal of dredge spoil from capital dredging activity within the inner Liffey channel (predominantly silts):

- The sediment plume outside the area of the dump site is expected to result in a TSS of less than 200mg/l and not to extend further than 750m to the north or south of the dump site.
- The disposal operations associated with capital dredging will not result in any significant increases to the background level of suspended sediments.

On the basis that the recommended mitigations measures are fully implemented during the Dublin Harbour Capital Dredging Project, the operations will not result in any significant impact to either water quality in terms of suspended sediments, or the nearby environmentally designated areas in terms of sediment deposition.

17.2.13 Cultural Heritage

The EIAR has identified, recorded and assessed the cultural heritage assets and potential impacts associated with the Dublin Harbour Capital Dredging Project. Existing records and newly-commissioned work present a robust baseline of information above and below the waterline.

The principal cultural heritage constraint identified is the potential for new discovery as a resulting the dredging work.

Archaeological monitoring of seabed disturbance activities will take place across the Dublin Harbour Capital Dredging Project area, ensuring that a robust record is maintained and that any new archaeological observations are resolved fully.

17.2.14 Population & Human Health

The population and health construction and operational phase assessments looks at the potential impact on health from: changes in emissions to air; changes in exposure to noise; and changes to socio-economic factors (such as employment and the economy).

Human health effects associated with dust emissions relate to nuisance from a reduction in local amenity. Dust generation and deposition relate to moisture content whereby moisture increases the mass of a dust particle meaning particles are less friable and hence, less prone to dust dispersion. On the basis that all dredged material will inherently have high moisture content (circa 50% by weight), the dredging operations and the transport of dredged material are considered very low risk for dust impacts.

Human health effects associated with odour emissions relate to nuisance from a reduction in local amenity. There is potential for odour where decayed organic material has the potential to release sulphurous compounds or where solvent contamination is uncovered. As such, the potential community exposure is limited. However, the odour impact is predicted to be negligible in air quality terms on the basis that the low levels of organic solvents predicted in the dredged material, and any vapour released would quickly condense into the liquid phase, either dissolving in the water or forming a residue on the water surface. As such, the potential community exposure is limited.

Human health effects associated with vessel emissions relate to nuisance from a reduction in local amenity. The proposed capital dredging works will be carried out using a trailing suction hopper dredger (TSHD) and/or a backhoe dredger. The dredging will be limited to the winter period (October-March). The dredger will operate 24 hours per day during each dredging campaign within the lifetime of the project, set at eight years.

At the closest sensitive receptor (Pigeon House Road), air pollution concentrations would remain below the relevant EU and WHO objective thresholds set to be protective of the environment and health. The absolute change in annual average NO_2 and PM_{10} concentrations associated with the proposed dredging activities at the closest residential receptor is predicted to be 5 µg/m^3 and 0.1 µg/m^3, respectively.

Overall, dust impacts are highly unlikely due to the high moisture content of dredged material. Odour impacts are predicted to be negligible in air quality terms due to the quick condensation of vapour released, and no measurable adverse health outcomes are predicted at the population level due to changes in local air quality (NO_2 and PM). On this basis, the magnitude of impact on human health would be negligible, and the significance of effect would be minor adverse (not significant).

Overall, even when applying worst-case hypothetical scenarios, no adverse human health effects from air quality and noise determinants associated with the proposed development are anticipated.

17.2.15 Cumulative Effects & Environmental Interactions

The potential cumulative effects of consented schemes nearby the Dublin Harbour Capital Dredging Project were assessed. Relevant projects were selected and the Project team defined significance thresholds and criteria for assessment. These were based on professional judgement, alongside relevant standards and guidelines, to determine whether in-combination effects gives rise to additional levels of significance.

The most significant nearby Project identified was the Dublin Port Maintenance Dredging Programme 2022-2029. The potential cumulative effects with the Dublin Harbour Capital Dredging Project were to Biodiversity and Water Quality. The potential cumulative effects resulting from dredging and disposal operations required the inclusion of mitigation measures to temporarily separate operations. This means that the dredging element of the Dublin Harbour Capital Dredging Project will not overlap with Dublin Port Maintenance Dredging Programme 2022-2029, thus reducing potential impacts to water quality, habitat deterioration, underwater noise and biodiversity.

Another significant interaction is the MP2 Project and the capital dredging operations required to deepen berthing pockets and localised widening of the navigation channel. The capital dredging operations to be undertaken as part of the MP2 Project will occur in the same water body (Liffey Estuary Lower) and the disposal of dredge spoil will use the same licenced dump site at the approaches to Dublin Bay. The potential cumulative

effects with the Dublin Harbour Capital Dredging Project were impacts to water quality due to the overlap of dredging operations at the areas immediately adjacent to Berth 52. The potential cumulative required the inclusion of mitigation measures to carry out the dredging sequentially, with no overlap occurring between the dredge works of both projects. The sequential nature of the dredging activities minimises the potential for impacts on water quality within and immediately adjacent to the footprint of the proposed works.

The potential interactions between environmental aspects arising from within the Dublin Harbour Capital Dredging Project were also assessed. Each technical chapter within the EIAR identifies and analyses the potential for other environmental interactions. These chapters also detail environmental baseline information and identify the significant potential and residual construction and operational effects/impacts of the Dublin Harbour Capital Dredging Project. The cumulative assessment identified many potential inter-relationships and inter-actions. Additional mitigation measures were included to minimise and/or off-set the potential for significant effects resulting from such interactions.

For example, an interaction link exists between Water Quality and Human Beings. Dredging operations has the potential to impact on water quality at cooling water intakes. Four power plants within the Dublin Port area abstract water from the Liffey for cooling water. High levels of suspended solids in cooling water has the potential to impact upon the plants cooling system and may result in an increase in operational and maintenance costs. A review of dredging simulation results showed that that the increased levels of suspended sediment concentrations at the power station intakes are generally very small by comparison with background levels in the Liffey Estuary. It is therefore unlikely to have a significant effect on the quality of intake waters at power stations in terms of suspended solids content. Precautionary mitigation measures have been included as an additional safeguard. If dredging is scheduled to take place within a 500m radius of the intakes, the relevant stakeholders are notified so that additional measures can be taken if deemed necessary.

This Chapter of the EIAR has addressed all significant potential cumulative effects and environmental interactions of the Dublin Harbour Capital Dredging Project. Mitigation measures resulting from the individual assessments, and the assessment of cumulative effects are summarized in Section 17.1 of the EIAR. The application of these mitigation measures will ensure no significant environmental impact, either as a standalone project or when considered in combination with other projects proximate to the site.

17.2.16 Concluding Remarks

Overall, the authors of the EIAR believe that the Dublin Harbour Capital Dredging Project complies with the principles of proper planning and sustainable development, and that the EIAR has objectively demonstrated not to adversely affect the environment in all its facets, including the integrity of Natura 2000 sites.

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