Iarnród Éireann
Irish Rail

Rosslare ORE Hub

EIAR Environmental Topic Chapters

Chapter 8:

Coastal Processes

venterra | GDG Gavin & Doherty Geosolutions
Nicholas O'Dwyer an RSK company
Co-funded by the European Union

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LIST OF ABBREVIATIONS

ADCP	Acoustic Doppler Current Profiler
CAP25	Climate Action Plan 2025
CFD	Computational Fluid Dynamics
CSD	Cutter Suction Dredger
cSPA	Candidate Special Protection Area
ECMWF	European Centre for Medium-Range Weather Forecasts
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EMODnet	European Marine Observation and Data Network
EPA	Environmental Protection Agency
GDG	Gavin & Doherty Geosolutions
GSI	Geological Survey Ireland
ICWWS	Irish Coastal Wave and Water Level Modelling Study
INFOMAR	Integrated Mapping for the Sustainable Development of Ireland's Marine Resource
IPCC	Intergovernmental Panel on Climate Change
MFI	Mobilisation Frequency Index
NMPF	National Marine Planning Framework
NPWS	National Parks and Wildlife Service
OPW	Office of Public Works
ORE	Offshore Renewable Energy
RoRo	Roll-On Roll-Off
RP	Return Period
RSES	Regional Spatial and Economic Strategy
SAC	Special Area of Conservation
SC	Subcatchment
SMI	Sediment Mobilisation Index
SPA	Special Protection Area
SSC	Suspended Sediment Concentration
TSHD	Trailing Suction Hopper Dredger
UKTAG	UK Technical Advisory Group
WFD	Water Framework Directive

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8 COASTAL PROCESSES

8.1 INTRODUCTION

Iarnród Éireann – Irish Rail is applying for development permission for the Rosslare Offshore Renewable Energy Hub (hereafter the 'Proposed Development'), located immediately adjacent and to the northwest of the existing Rosslare Europort at Rosslare Harbour in County Wexford, which is operated by Iarnród Éireann. The Proposed Development includes capital dredging to achieve navigable depths for vessels delivering ORE components; land reclamation to create a storage area for these components; and construction of two new berths to facilitate loading and unloading of ORE components. The land reclamation works include infilling the existing small boat harbour, after the construction of a new small boat harbour. The Proposed Development also includes the installation of a new slipway and facility for local clubs, such as the Sea Scouts.

The purpose of the Proposed Development is to provide a facility for the efficient handling and storage, marshalling, staging and integration of ORE components to facilitate installation of offshore wind energy projects by ORE developers and operators. The Proposed Development is designed to provide facilities that accommodate a wide range of infrastructure uses, both for current requirements and anticipated future needs. For instance, the Proposed Development could be used for traditional port activities if required, including during periods of reduced ORE-related activity. Refer to EIAR Chapter 6: Project Description for further detail.

This chapter of the Environmental Impact Assessment Report (EIAR) presents the assessment of the likely significant effects of the Proposed Development on Coastal Processes receptors arising from the construction and operational phases of the Proposed Development, both alone and cumulatively with other projects. The scope of this chapter was determined following issue of a scoping report to the following topic-relevant stakeholders (see EIAR Chapter 4: Scoping and Consultation for full details of consultation):

- Wexford County Council

The assessment presented in this chapter is informed by the following EIAR technical chapters/appendices:

- Chapter 7: Geology, Soils, Hydrogeology and Contamination
- Chapter 9: Water Quality and Flood Risk
- Chapter 24: Climate
- Technical Appendix 8: Coastal Processes

Coastal Processes encompass the natural physical processes that shape and influence the nearshore marine environment, including the cyclic nature of waves, tides, and tidal currents, sediment transport, suspended sediments, and the resulting sedimentary processes and morphology. The construction of man-made structures, such as quays and breakwaters, has the potential to alter the flow of water and the patterns and characteristics of waves and currents, leading to changes in seabed and coastline composition and morphology.

This chapter comprises the following elements:

- Summary of relevant policy and guidance
- Data sources
- Summary of consultations with relevant stakeholders
- Methodology followed in assessing the impacts of the Proposed Development
- Description of the baseline coastal processes in the receiving environment
- Assessment of likely effects arising from the construction and operation of the Proposed Development
- Identification of further mitigation measures and/or monitoring requirements
- Summary of residual impact assessment determinations

8.1.1 RELEVANT LEGISLATION AND GUIDELINES

The EIAR was prepared in adherence to the EIA Directive and the relevant Irish and EU legislation. This compliance is comprehensively outlined in Chapter 1: Introduction and Methodology with relevant policy and legislation described in Chapter 2: Legislation and Policy Context.

Policy and guidance related to this chapter is presented in Table 8.1.

Table 8.1: Coastal Processes: relevant Legislation, Policy and Guidance

Legislation, Policy and Guidance	Reference	Scale	Relevance
EIA Directive (2014/52/EU)	European Union, 2014	EU	EU Directive on the assessment of the effects of certain public and private projects on the environment
Maritime Area Planning Act, 2021	The government of Ireland, 2021	Ireland	Provides the legal framework for planning and managing activities within the maritime area of Ireland.
National Marine Planning Framework (NMPF)	DHLGH, 2021a	Ireland	National Marine Planning Framework sets out the strategic vision and objectives for marine planning and management across the country's maritime territories.
Marine Planning Policy Statement	DHLGH, 2019	Ireland	Strategic document that sets out the government's policy approach to marine planning and management. It provides guidance and objectives for the sustainable use of marine resources.

Legislation, Policy and Guidance	Reference	Scale	Relevance
Regional Spatial and Economic Strategy (RSES) for the Southern Region	Irish Southern Regional Assembly, 2020	Ireland (Southern Region)	Under section 29(g) of Planning and Development Act 2024, Regional Spatial and Economic Strategies must also include a strategy relating to climate change adaptation and mitigation that is consistent with national policies, and a strategy relating to marine and coastal matters which facilitates the coordination of land-sea interactions for coastal planning authorities.
National Ports Policy, 2013	The government of Ireland, 2013	Ireland	Provides the overarching policy framework for the governance and future development of Ireland's State port network.
Guidelines on the information to be contained in Environmental Impact Assessment Reports.	EPA, 2022	Ireland	Outlines the scope and content that should be included in an EIA report for projects that may impact the environment, including the marine environment.
Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial, Freshwater, Coastal and Marine. Version 1.2	CIEEM, 2022	UK and Ireland	Provides guidelines to properly address EIA for various environments, including coastal and marine ecosystems.
OPW Guidelines for Coastal Erosion Risk Management Measures	OPW, 2014	Ireland	Provides guidelines to assess the impact and risk of coastal erosion and lists mitigation measurements.
Advice to Inform Development of Guidance on Marine, Coastal and Estuarine Physical Processes Numerical Modelling Assessments. Report No 208.	NRW, 2017	Wales	Provides recommendations and advice on the development of guidance for conducting site-specific analysis and numerical modelling assessments of physical processes in marine, coastal, and estuarine areas.
Guidance on Best Practice for Marine and Coastal Physical Processes Baseline Survey and Monitoring Requirements	NRW, 2018	Wales	Provides recommendations on conducting baseline surveys to gather essential data on marine geology, oceanography, coastal

Legislation, Policy and Guidance	Reference	Scale	Relevance
to Inform EIA of Major Development Projects. Report No 243.			processes, and other physical parameters.
Guidance Note. Marine Physical Processes Guidance to inform Environmental Impact Assessment (EIA). GN041.	NRW, 2000	Wales	Provides advice and recommendations on how to assess marine physical processes as part of an EIA for various development projects in the marine environment.
Sectoral Marine Plan: Regional Local Guidance	Scottish Government, 2020	Scotland	Sectoral marine plan with strategic guidelines for marine development and management in specific sectors, such as renewable energy, fisheries, aquaculture, shipping, tourism, conservation, and more.
CIRCA C584 Coastal and Marine Environmental Site Guide	CIRIA, 2003	UK	Includes guidelines for baseline descriptions of various coastal and marine sites, such as estuaries, beaches, coral reefs, rocky shores, and marine protected areas. Each site description may include details about the physical characteristics, ecological features, and notable environmental attributes.

8.2 ASSESSMENT METHODOLOGY

8.2.1 STATEMENT OF COMPETENCE

This chapter of the EIAR was prepared by Diogo Neves (PhD) Senior Metocean Engineer and Laura Ecenarro Díaz-Tejeiro Senior Engineer from Gavin and Doherty Geosolutions Ltd. (GDG). Diogo is a graduate in Geophysics – Meteorology and Oceanography with a master's in physical Oceanography and a PhD in Civil Engineering. He worked for 10 years in the Ports and Harbours division at the National Laboratory of Civil Engineering in Lisbon (LNEC) (PT) regarding wave propagation and wave-structure interaction studies. He fulfilled the position of geophysical data processor and data scientist at Bibby Hydromap Ltd. (UK) for two years. He was also the Head of Sea Technologies Unit for the Institute of Science and innovation in Mechanical and Industrial Engineering (INEGI) at Oporto (PT) for two years. He was involved in several types of projects involving Coastal/Offshore studies (Wave propagation, Sediment/constituent transport, Coastal Protection) and the Development of new marine technology studies (Marine devices, Wave energy, Floating platforms, Moorings, Computational Fluid Dynamics (CFD)). He has more than 60 publications in scientific journals and conferences. His skills range between coastal/offshore engineering, Hydrodynamics, CFD, and data analysis.

Laura is a Senior Engineer with over seven years of experience in international projects mainly related to ports, coastal infrastructure and marine terminals. She has wide experience working in multidisciplinary projects within the oil and gas industry, being part of a team responsible for the design of marine facilities and the definition of port operations. She has recent experience in renewable energy projects: working on the design of NH_3/H_2/CO_2 import and export berths as well as collaborating in offshore wind projects. Her academic background provides an accurate knowledge of coastal dynamics, wave climate, numerical modelling (wave generation, propagation and nearshore interaction) and overall coastal management.

The chapter has been checked by Mohammed Alaa Almoghayer (PhD), senior offshore project manager and reviewed by Shauna Creane (BSc. (Hons) Geoscience, PhD in Civil and Environmental Engineering), senior marine geoscientist and Joey O'Connor (BSc. (Hons) Marine Science, MSc. Engineering in the Coastal Environment) (all GDG).

Independent peer review of this chapter and EIAR Technical Appendix 8: Coastal Processes has been undertaken by Partrac Ltd. Partrac provides the owners and developers of complex engineering and environmental projects in challenging marine environments with high-quality, science-led metocean and geo-surveys. The Partrac team comprises PhD grade specialists, with expertise in advanced metocean analysis, coastal processes, coastal modelling, geomorphology and flow-sediment-structure interactions. It delivers desktop projects and studies for major blue-chip clients which include metocean design criteria, seabed morphodynamic assessments, scour and seabed mobility studies, physical marine environment chapters for EIAR and site characterisation studies.

8.2.2 PRE-APPLICATION CONSULTATION

Following the EIA scoping consultation with topic relevant stakeholders, the Project Team continued to engage with key agencies and stakeholders during preparation of the EIAR and the application for development permission. See EIAR Chapter 4: Scoping and Consultation for further details of the consultations undertaken.

8.2.3 COASTAL PROCESSES STUDY AREA

Iarnród Éireann intends to develop the proposed port infrastructure within a marine area adjacent to and immediately to the north and west of the existing Rosslare Europort, in County Wexford on the south-east coast of Ireland, which will be reclaimed to support the development of offshore wind farms in the Celtic and Irish Seas (Figure 8.1). The Proposed Development is almost entirely in the maritime area with a small area of terrestrial development within the Rosslare Europort lands at, and adjacent to, the existing small boat harbour at Ballygeary where the Proposed Development adjoins the existing port lands (refer Chapter 6: Project Description of the EIAR).

The Coastal Processes Study Area for this chapter encompasses the coastal and shallow marine area of the existing Rosslare Europort (Figure 8.1) and a buffer area of 25 km which extends from Cullenstown Beach to the (south-western extent) to Morriscastle Beach (northern extent), and from approximately the Mean High Water (MHW) line along the coast seawards (Figure 8.2). The Coastal Processes Study Area includes the locations of site-specific marine surveys (geophysical surveys, benthic grab samples and metocean instrumentation locations), the Project Development Boundary and the numerical modelling boundary. The Coastal Processes Study Area also includes Natura 2000 sites in the vicinity of the Project Development (Figure 8.2).

The total area of the Coastal Processes Study Area covers 3,417.28 km^2.

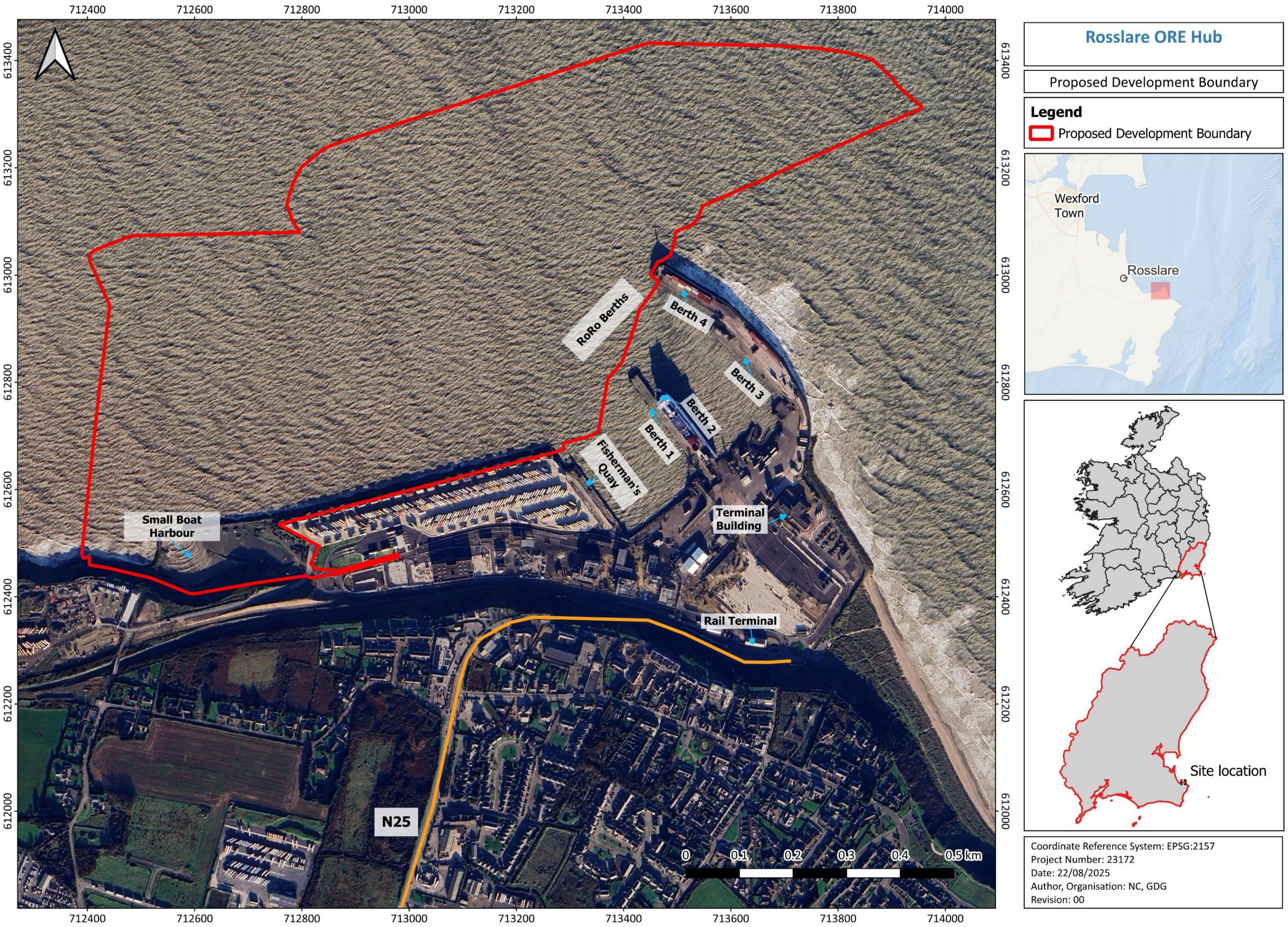


Figure 8.1: Location of Rosslare Europort and overview of the proposed Rosslare Europort ORE Hub Proposed Development Boundary

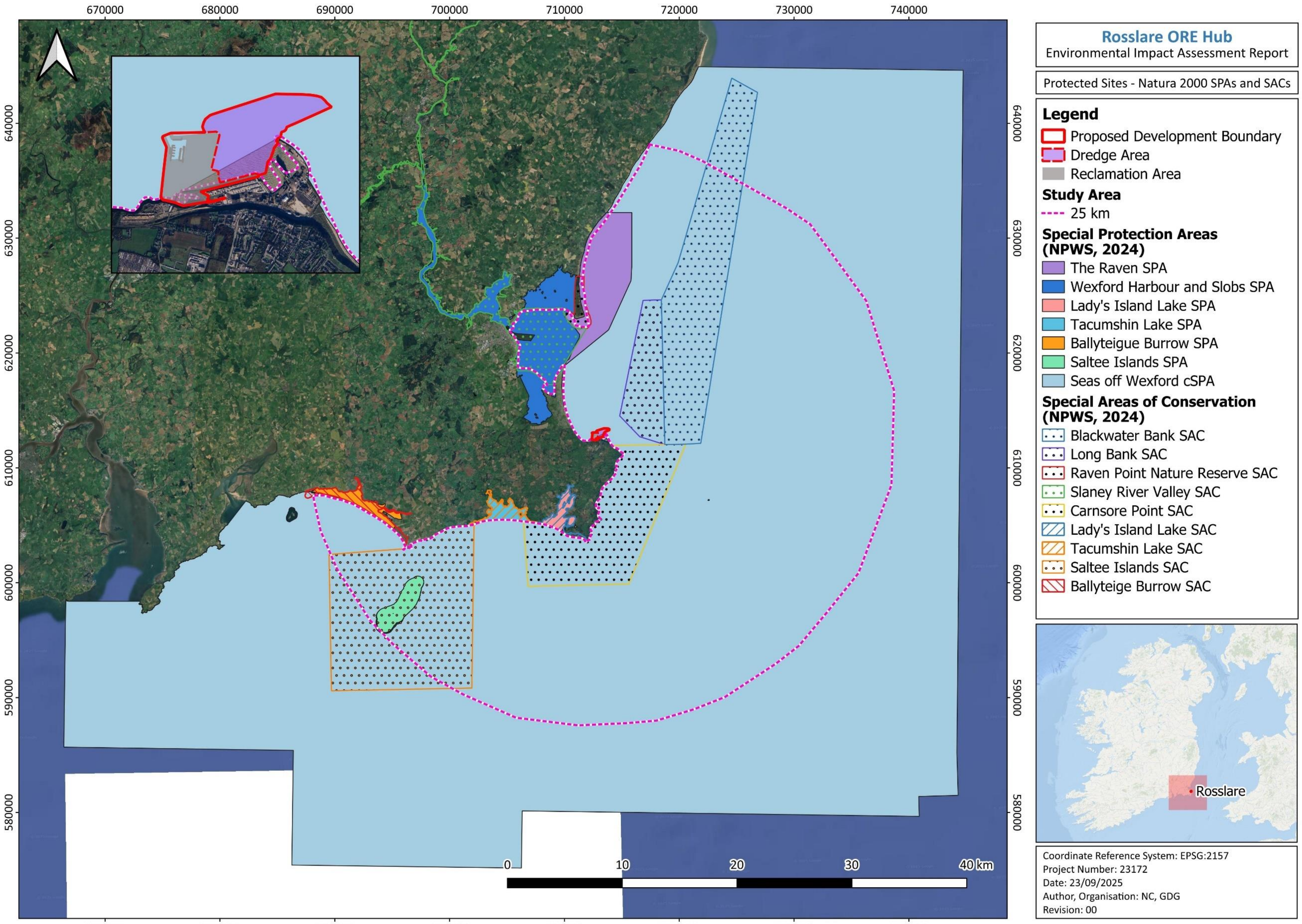


Figure 8.2: Coastal Processes Study Area and European sites

8.2.4 DATA SOURCES TO INFORM BASELINE

This chapter integrates data from various sources, including desktop reviews, public databases, site-specific surveys, and numerical modelling to describe baseline conditions in the Coastal Processes Study Area.

8.2.4.1 KEY COMPONENTS OF THE BASELINE

Field Surveys

Field surveys include metocean measurements, geotechnical investigations, and geophysical studies, which are critical for understanding the physical and environmental conditions of the Coastal Processes Study Area.

The site-specific surveys (as summarised in Table 8.3) include the following:

- **Metocean Measurement Surveys:** Table 8.2 shows the locations of the deployed metocean buoy systems. Each buoy had a wave sensor (SeaView SVS-603 HR) and an ADCP (Acoustic Doppler Current Profiler) to measure current data (Nortek Signature 500 AD2CP). The data were used to calibrate and validate the numerical modelling and in EIAR Technical Appendix 8: Coastal Processes.

Table 8.2: Deployment coordinates of metocean buoys

Buoy	Depth	Deployment Locations Decimal Degrees		Deployment Locations Degrees & Decimal Minutes	
Item	**(m)**	**Latitude**	**Longitude**	**Latitude**	**Longitude**
RH-WB001 (North Buoy)	6-7	52.26323° N	6.34034° W	52° 15.7922’ N	06° 20.418’ W
RH-WB002 (South Buoy)	5-6.5	52.25798° N	6.32991° W	52° 15.4788’ N	06° 19.7946’ W

- **Geotechnical Surveys:** These surveys provide critical data for understanding the geological properties of the Coastal Processes Study Area, including the definition and accuracy of geological depth profiles. Of the 41No. marine boreholes collected from the Study Area, data collected from 28No. marine boreholes within the proposed dredging area were used to inform the dredging dispersal modelling, specifically by providing detailed information on the composition and distribution of marine seabed materials. Borehole depth of penetration varied from 7 m to 30 m below seabed depending on the geological composition of the borehole location. More information on borehole sampling and testing undertaken, including dates of sampling and sample locations, is presented in EIAR Technical Appendix 7: Ground Investigation Report.

Table 8.3 presents the site surveys performed during this project stage, which results have been considered within the EIAR. Further information is provided in the EIAR Technical Appendix 8: Coastal Processes of the EIAR.

Table 8.3: Site specific surveys

Metocean Surveys				
Type of Data	**Instrument**	**Variables**	**Unit**	**Time range**
Wave data	SeaView SVS-603 HR	Significant Wave Height (Hs) (m) Maximum Wave Height (Hmax) Peak Period (Tp) Mean Zero crossing period (Tz) Maximum Period (Pmax) Mean Wave Period (T01) Mean Wave Direction (Mean_Wave_Dir) Peak Wave Direction (Peak_Wave_Dir)	m m s s s s o o	December 2023 – March 2024
Current data	Nortek Signature 500 AD2CP	Current Speed per bin Current Direction per bin Heading Pitch and Roll	m/s o o o	December 2023 – March 2024

Geotechnical and Geophysical Surveys		
Type of Data	**Variables**	**Time range**
Marine Boreholes	41No. marine locations for soil characterisation	November 2023 - January 2024
Cone Penetration Tests	27No. marine locations for soil characterisation	November 2023 - January 2024
Land-based boreholes	4No. land locations for soil characterisation	November 2023 - January 2024
Geophysical surveying	Vertical distribution of soil layers	November 2023 - January 2024
Geotechnical laboratory testing	Geotechnical characteristics of soil	November 2023 - January 2024

Desktop: Public Datasets and Literature

A wide range of public datasets and scientific literature was utilised to supplement the site-specific data. These sources provide regional and historical context, covering aspects such as bathymetry, geology, sediment transport, and metocean conditions. Table 8.4 and Table 8.5 summarise these datasets and references to ensure transparency and traceability.

Environmental Parameters

The baseline is divided into subsections focusing on specific environmental parameters, such as:

- **Coastal Geomorphology and Features:** Encompasses the study of coastal landforms, their formation through erosional and depositional processes driven by forces like waves and tides, and coastal erosion risks
- **Bathymetry and Seabed Features:** Describes the underwater topography including water depths and seabed composition
- **Tidal Currents and Water Levels**: Highlights tidal regimes, current velocities, and storm surge projections
- **Waves**: Discusses wave conditions, including average and extreme scenarios
- **Wind**: Provides wind speed and direction data, supported by wind rose diagrams and joint probability tables
- **Sediment Mobility**: Explains sediment dynamics, including mobilisation of sediment from the seabed into suspension in the water column and subsequent transport of sediment particles

The public datasets and literature pertinent to the Proposed Development, which have been utilised to inform this EIAR, are outlined in Table 8.4 and Table 8.5.

Table 8.4: Summary of datasets considered for the baseline characterisation

Data Source	Coverage	Data Provision
European Marine Observation and Data Network (EMODnet) (EMODnet, 2020)	European Waters	Bathymetry; Geology; Seabed Substrate
INFOMAR 0	Irish Waters	Bathymetry; Geology
British Geological Survey (2023)	UK and adjacent European waters	Sediment mapping
British Oceanographic Data Centre, and the Marine Institute	UK, Ireland and adjacent European waters	Tides, Water levels, Currents, salinity, Fronts
Met Eireann	Ireland and Adjacent European Waters	Metocean
Copernicus Climate Change Service (C3S) through the ECMWF	Global	Metocean
European Atlas of the Seas	European Waters	Metocean
Global Wind Atlas	Global	Wind

Data Source	Coverage	Data Provision
Marine Atlas	Ireland	Multidisciplinary
Data.Gov.ie	Ireland	Multidisciplinary
Marine Institute	Ireland	Metocean
Geological Survey Ireland (GSI)	Ireland	Geology
Office of Public Works (OPW)	Ireland	Administrative Areas

Table 8.5: Scientific literature considered for the baseline characterisation

Title	Source	Year	Author
United Kingdom offshore regional report: the geology of the Irish Sea. London	British Geological Survey	1995	Jackson D.I., Jackson A.A., Evans D., Wingfield R.T.R., Barnes R.P., and Arthur M.J.
The Geology and Structure of the Celtic Sea	Elsevier Oceanography series	1979	Blundell D.
Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.	Cambridge University Press. doi:10.1017/9781009325844.	2022	Pörtner, H.-O., D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, et al. (eds.)
The tidal dynamics of the Irish and Celtic Seas	Journal of Geophysical Research, vol. 56, pp. 159–197	1979	Robinson I.S.
DTI Strategic Environmental Assessment Area 6, Irish Sea, seabed and surficial geology and processes	British Geological Survey Commissioned Report CR/05/057	2005	Holmes R. and Tappin D.R.
Record of anthropogenic impact on the Western Irish Sea mud belt	Anthropocene, vol. 9, pp. 56–69	2015	Coughlan M., Wheeler A. J., Dorschel B., Lordan C., Boer W., Gaever P. V., Haas H.D., and Mörz T.
Scour Potential Evaluation of the Western Irish Sea Mud Belt (SCOPE)	Gavin and Doherty Geosolutions Ltd.	2018	Gavin and Doherty Geosolutions Ltd.

Title	Source	Year	Author
Whitehouse, R., "Scour at Marine Structures: A Manual for Practical Applications	ICE	1998	Whitehouse R.
A new seabed mobility index for the Irish Sea: Modelling seabed shear stress and classifying sediment mobilisation to help predict erosion, deposition, and sediment distribution	Continental Shelf Research	2021	Coughlan M., Guerrini M., Creane S., O'Shea M., Ward S.L., Van Landeghem K.J.J., Murphy J., Doherty P.
Geological seabed stability model for informing Irish offshore renewable energy opportunities	Advances in Geosciences. 54. 55-65	2020	Peters J. L., Butschek F., O'Connell R., Cummins V., Murphy J., and Wheeler A.J.
The Irish Seabed load parting zone: Is it a mid-sea hydrodynamic phenomenon or a geological theoretical concept?	Estuarine, Coastal and Shelf Science	2021	Creane S., O'Shea M., Coughlan M., Murphy J.
Development and Dynamics of Sediment Waves in a Complex Morphological and Tidal Dominant System: Southern Irish Sea	Geosciences	2022	Creane S., O'Shea M., Coughlan M., Murphy J.

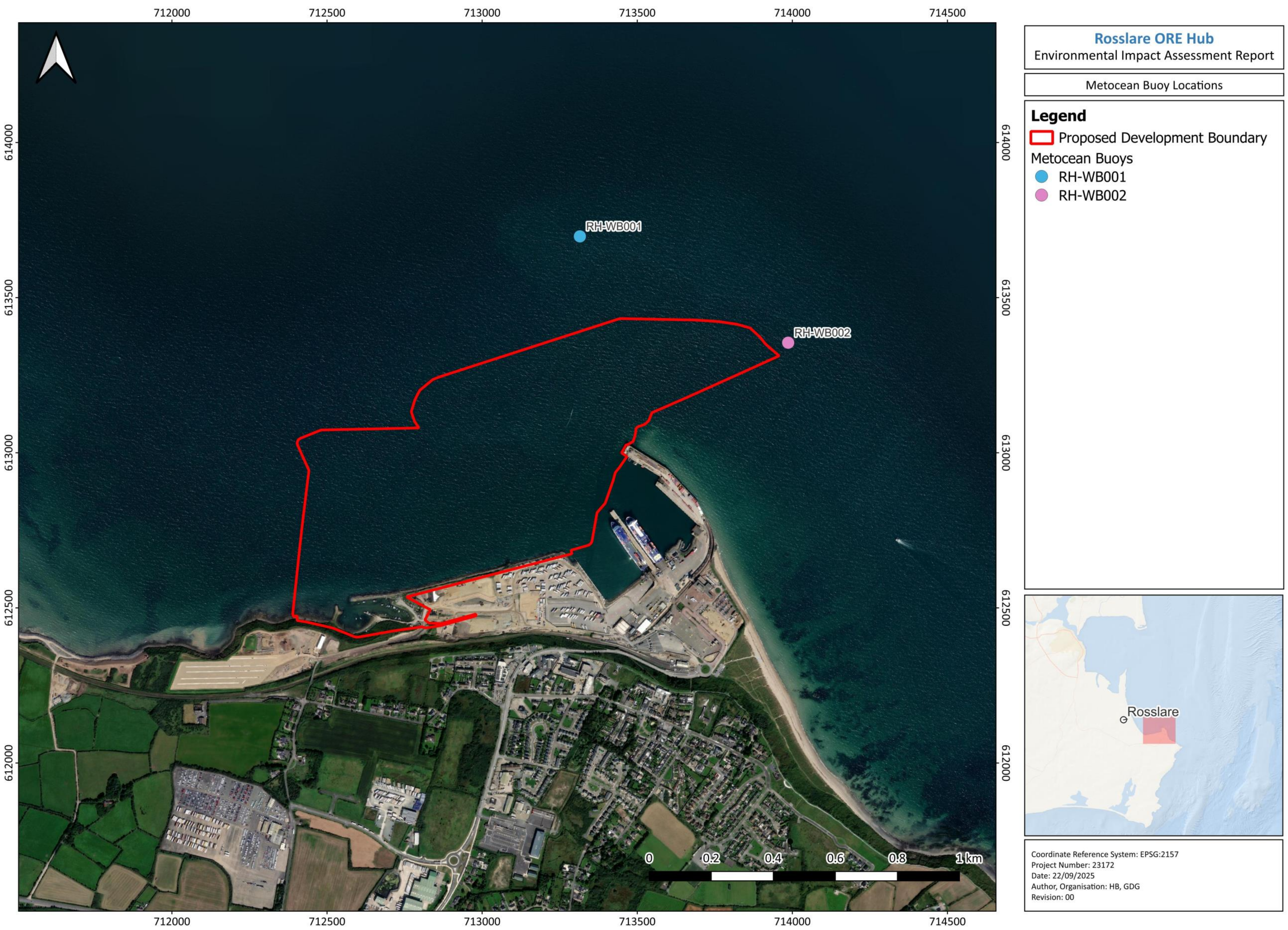


Figure 8.3: Metocean Buoy locations

8.2.5 NUMERICAL MODELLING

Numerical modelling of hydrodynamics, waves and sediment transport processes has been performed in support of the EIAR (see EIAR Technical Appendix 8: Coastal Processes of Volume 3 of this EIAR). The main purpose of the modelling was to inform the assessment of the potential for changes to the baseline coastal and marine physical environment and associated processes that may result as a consequence of the construction and subsequent operation of the Proposed Development.

The studies that have been performed, the results of which are presented in this chapter are:

1) Wave propagation assessment: calibration and validation of a spectral wave model. The model was then utilised for the assessment of how the Proposed Development may affect the transformation of wave conditions from offshore to nearshore in the vicinity of the Proposed Development. Model utilised: DHI MIKE21 SW.
2) Hydrodynamic study: calibration and validation of hydrodynamic model (currents and water levels). The model was then utilised for the Sediment Transport Assessment and the Dredging Dispersal Study. Model utilised: DHI MIKE21 FM.
3) Sediment transport study performed to evaluate the potential for changes in the current sediment transport patterns as a result of the Proposed Development. Model utilised: DHI MIKE21 FM coupled with Sand Transport Module.
4) Dredged sediment dispersal study performed to evaluate the dispersion, and ultimate depositional footprint of suspended sediments (sediment plumes) that are liberated into the water column during dredging and disposal (reclamation) operations for the proposed development. Model utilised: DHI MIKE21 FM coupled with Mud Transport Module.

Offshore regional bathymetry data for the Irish Sea (Figure 8.4) was derived from the European Marine Observation and Data Network (EMODnet) data, which has a resolution of 1/16 * 1/16 arc minutes (approximately 115 m grid) (EMODnet, 2020). In the Irish sector of the Irish Sea, this dataset was combined with higher resolution bathymetry data, ranging from 2 m to 10 m, collected by the Integrated Mapping for the Sustainable Development of Ireland's Marine Resource (INFOMAR) programme. The data was obtained through the INFOMAR Interactive Web Data Delivery System (IWDDS), which is an online platform which provides open and free access to Ireland's marine datasets. INFOMAR data is levelled to the lowest astronomical tide (LAT), according to a Vertical Offshore Reference Frame (VORF) datum. For model input, the EMODnet data was kept referenced to Mean Sea Level (MSL) whereas INFOMAR data was converted from LAT to Malin ordnance datum (OD).

The Proposed Development was defined based on site-specific survey data available at this stage (GDG, 2024). These geotechnical and geophysical surveys were undertaken in 2022 and 2023 (Table 8.3). The bathymetry data has a resolution of 5 m grid and has been converted to Malin ordnance datum (OD) for modelling purposes. Additionally, to represent the future port development, the proposed Dredge Area has been included.

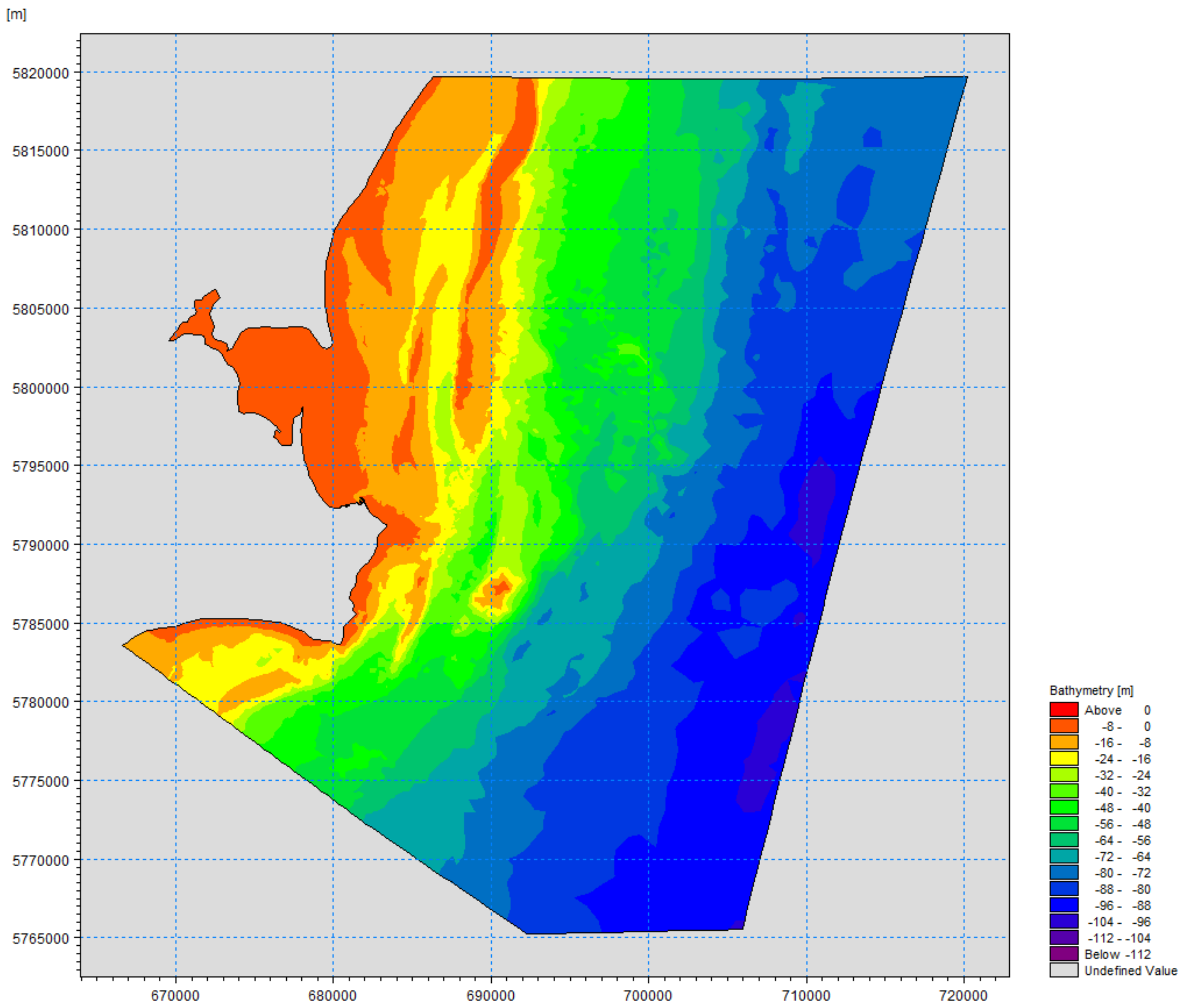


Figure 8.4: Bathymetry within the Model Boundaries

A triangular mesh was utilised in the numerical models, covering an approximate area of 2,400 km². The mesh resolutions vary according to the desired precision level for the simulations: a mesh resolution of 2 km is set in offshore regions where water depth exceeds 75mMSL, while in shallower areas near to the Rosslare Europort, mesh resolution increases to approximately 20 m.

An overall view of the model mesh is presented in Figure 8.5.

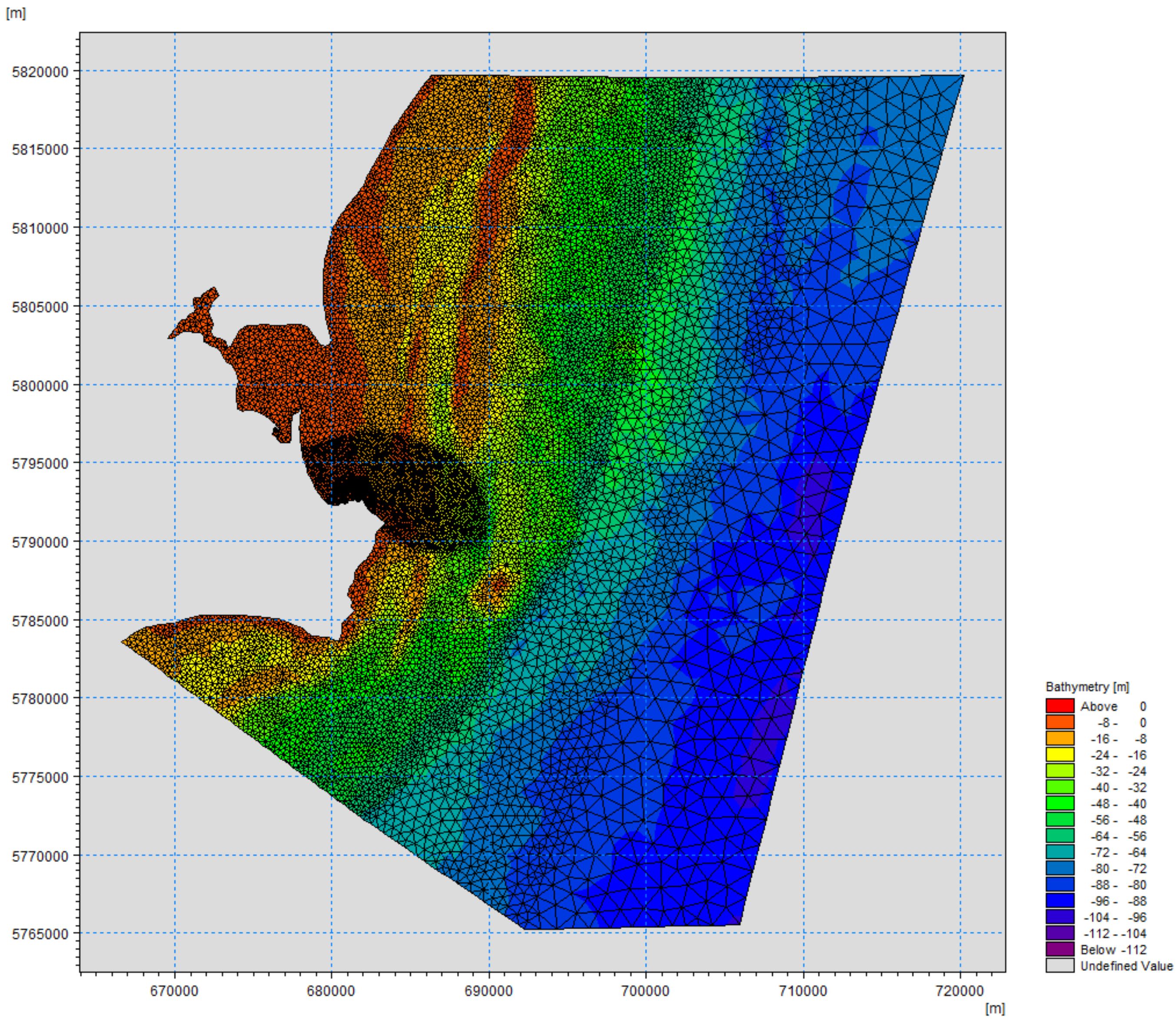


Figure 8.5: Model Mesh - Overall Model Domain

8.2.6 ASSESSMENT OF SIGNIFICANCE OF EFFECTS

The significance of potential effects considers the sensitivity of the receptor to the impact and the magnitude of impact upon the receptor, as set out in Chapter 1: Introduction and Methodology and by the EPA Guidelines (2022).

As defined in Section 1.10.6, the magnitude of an impact reflects the scale of environmental change. Table 8.6 presents the classification criteria for impact magnitude. Receptor sensitivity is used to define the susceptibility to the impact. Table 8.7 presents the classification criteria for the sensitivity of the receptor, which combines the capacity of the receptor to accommodate change and its intrinsic value.

Table 8.6: Magnitude of impact

Category	Definition
Negligible	No detectable change, or change is within the natural variation
Minor	Small temporary change from the baseline
Moderate	Partial loss or change to one or more key components of the baseline condition which may be temporary or permanent
Major	Near complete loss or large change to one or more key components of the baseline condition which is permanent.
Severe	Permanent loss of one or more components of the baseline condition

Table 8.7: Sensitivity of the receptor

Category	Definition
Very high	Receptors or features of the receptor which are international designations for nature and geological heritage. The receptor has no capacity to accommodate change.
High	Receptors or features of the receptor which are national designations for nature and geological heritage. The receptor has no capacity to accommodate change.
Moderate	Receptors or features of the receptor which are regional heritage designations for nature and geological heritage. The receptor has very low or partial capacity to accommodate change.
Low	Receptors or features of the receptor which are of local value for nature and geological heritage. The receptor has partial capacity to accommodate change.
Negligible	Non designated receptors or full capacity to accommodate change.

The assessment of significance of effects on coastal processes considers the magnitude of potential impacts, the sensitivity of the receptors, and the resulting effects. Impacts refer to the changes caused by the Proposed Development, while effects describe the consequences of these changes on specific coastal processes related receptors (e.g., coastal geomorphology).

For example, a low-magnitude impact, such as localised changes in sediment transport rates, may result in negligible effects on low-sensitivity receptors (e.g., seabed) but could have more significant effects on highly sensitive receptors (e.g., eroding dune).

The assessment follows the methodology outlined in Chapter 1: Introduction and Methodology, ensuring that both the scale of impacts and the vulnerability of receptors are considered when determining the overall significance of effects. Table 8.8 presents the significance of effects matrix applied when assessing significance of effects on sensitive receptors.

For the Coastal Processes receptors considered in this chapter, effects with a moderate or major significance are considered 'significant' in EIAR terms.

Table 8.8: Significance of effect

Sensitivity		Magnitude			
		High	Medium	Low	Negligible
	Very High	Profound	Very Significant	Significant	Moderate
	High	Very Significant	Significant	Moderate	Slight
	Medium	Significant	Moderate	Slight	Not Significant
	Low	Moderate	Slight	Slight	Imperceptible
	Negligible	Slight	Not Significant	Imperceptible	Imperceptible

8.2.7 MITIGATION

As discussed in Chapter 1: Introduction and Methodology, three types of mitigation measures are considered in this chapter.

- Primary mitigation
- Secondary mitigation
- Tertiary mitigation

8.2.8 DIFFICULTIES AND UNCERTAINTIES

While this chapter provides a detailed description of the coastline and nearshore environment, it is acknowledged that certain data gaps exist. For example, precise long-term measurements of erosion rates and sediment transport volumes are limited. Other limitations are listed as follows:

- The inherent uncertainty of climate change projections, which may influence factors such as sea level rise, the frequency and intensity of storm events, and the extent of coastal erosion.
- Some level of uncertainty associated with the model results, which simplify complex real-world systems. However, this has been minimised by a good calibration and validation of the model output.
- The availability and quality of baseline data for coastal areas, which can affect the accuracy and comprehensiveness of the assessment.

Numerical modelling with measured data used to validate and calibrate the numerical models has been used to fill gaps in the available baseline data and the assessment is deemed robust and adequate for the purpose of this chapter and assessing the impacts from the Proposed Development.

8.3 BASELINE: COASTAL PROCESSES IN RECEIVING ENVIRONMENT

8.3.1 ENVIRONMENTAL SETTING

The immediate receiving environment of the Proposed Development at Rosslare Europort consists of a variety of industrial infrastructure, marine and terrestrial habitats. Situated on Ireland's southeastern coast in County Wexford, Rosslare Europort is a major commercial port with robust connections to Ireland, the UK, and mainland Europe. This area is highly developed, with existing port facilities including ferry berths, cargo handling areas, and a small boat harbour, all protected by substantial rock armour revetment and breakwater armour units designed to shield the harbour from coastal conditions. The N25 and N11 road networks provide access to the port, and the Irish Rail line runs parallel to the site, reinforcing its industrial character.

The surrounding landscape is predominantly industrial, with minimal green space and natural features. The coastline is largely artificial, with hardstanding, paved areas, and structures linked to port operations. The small strip of scrub and grassland adjacent to the port is also strongly influenced by human activity.

8.3.2 EUROPEAN SITES

Special Areas of Conservation (SACs) are prime wildlife conservation areas considered to be important on a European as well as a national level. The EU Habitats Directive lists certain habitats and species that must be protected within SACs. Special Protection Areas (SPAs) are designated under the EU Birds Directive for the protection of listed rare and vulnerable bird species and regularly occurring migratory bird species and wetlands, especially those of international importance. Together, SACs and SPAs form the Natura 2000 network of European Protected Sites.

The Proposed Development Boundary overlaps with the Seas off Wexford cSPA. Wexford Harbour and Slobs SPA is within 6.3 km (4.4 km straight line distance) of the Proposed Development Boundary and SACs with marine Annex I habitats as QIs within 5 km of the Proposed Development Boundary include Long Bank, Carnsore Point and Blackwater Bank SACs. There are a number of SACs designated for Annex II species in close proximity to the Proposed Development, with Carnsore Point SAC and Blackwater Bank SAC both designated for the Annex II species Harbour porpoise which was added as a QI in March 2024 (NPWS 2024a & NPWS 2024b). Slaney River Valley SAC is 6.6 km from the Proposed Development Boundary and includes Annex I habitats and Annex II species including Harbour seal as a marine mammal QI. Note potential impacts on Natura 2000 sites are considered in Chapter 11: Benthic Ecology, Chapter 12: Fish and Turtle Ecology, Chapter 13: Marine Mammals, Chapter 14: Ornithology and Chapter 15: Commercial Fisheries and Aquaculture. A Natura Impact Statement was also carried out and accompanies this EIAR.

8.3.3 COASTAL GEOMORPHOLOGY AND FEATURES

The coastline within the Coastal Processes Study Area is recognised as being at high risk of erosion, as highlighted by the requirement in the Climate Action Plan (Climate Ireland, 2025) for the GSI to publish the first Coastal Change Assessment report for the east coast to estimate potential future changes to Ireland’s coastline and impact on coastal communities in 2025.

Increased storminess and sea level rise due to climate change are the primary factors contributing to increased rates of erosion and flooding (RPS, 2019a). The coastline in the vicinity of the Proposed Development is diverse, comprising sandy beaches, rocky outcrops, and areas of anthropogenic modification. Rosslare Europort itself represents a significant anthropogenic feature, with existing port infrastructure, including quays, breakwaters, and a small boat harbour, influencing local coastal processes. The coastline to the north of the port, including Rosslare Strand, is predominantly sandy, transitioning to areas of mixed sediment and rocky outcrops moving southward towards Greenore Point and Carnsore Point. Notably, the eastern vicinity of Rosslare Europort, facing St. Helen's, features a significant accumulation of rock and boulders.

The Coastal Processes Study Area also includes the nearby Wexford Harbour estuary, located to the northwest of Rosslare Europort. This estuary is a key geomorphological feature, with tidal flows and sediment transport processes contributing to the dynamic nature of the coastline. The estuary supports a range of habitats and is subject to ongoing sediment deposition and erosion, which are influenced by both natural processes and human activities (NPWS, 2011).

Historical rates of coastal erosion in the Coastal Processes Study Area have been documented with retreat rates of up to 2.0 to 2.5 m/year, as identified in regional studies such as at the clay cliffs to the south of Rosslare at Rosetown (RPS, 2019b). Longshore sediment transport patterns along Rosslare Strand are predominantly northward along the coastline, driven by prevailing wave and current conditions. Human interference with natural sediment processes has occurred for nearly two centuries. Anthropogenic activities in the Coastal Processes Study Area include the construction and operation of Rosslare Europort, recreational use of nearby beaches such as Rosslare Strand, and historical land reclamation efforts e.g., the north and south slobs between 1845 and 1855. These activities have altered the natural dynamics of the coastline, contributing to changes in sediment distribution and coastal morphology, including coastal erosion.

Beach erosion has resulted in a reduction in the beach area and damage to properties and infrastructure backing the beach. To partially mitigate the erosion along the northern section of Rosslare Strand, the Department of Marine commissioned the construction of thirteen (13) rock groynes and one (1) terminal groyne at the northern end of the spit between the mid-1970s and mid-1990s alongside a beach nourishment scheme (RPS, 2019b). These structures effectively reduced the overall rate of erosion along much of the Strand, however, monitoring of the shoreline has indicated that localised sections between the groynes are still suffering from episodic coastal erosion.

No recent formal intervention has been undertaken along the southern part of the beach with the result that this is now the most vulnerable section of the coastline at Rosslare. However, in December 2021, Wexford County Council appointed Nicholas O'Dwyer Ltd Consulting Engineers to develop, design, and construct a Coastal Erosion and Flood Relief Scheme (CEFRS) (OPW’s National

Flood Information Portal, 2023), that is technically, socially, environmentally, and economically acceptable, for the community of Rosslare. The appointment will cover all five stages which comprises of preliminary design to statutory consents, to detailed design, tendering, construction and handover; at the time of writing the project is at the optioneering stage. The coastline remains highly dynamic, with ongoing natural processes of erosion, sediment transport, and deposition.

A walkover survey was conducted as part of the baseline assessment to characterise the coastline in the vicinity of the Proposed Development (see EIAR Technical Appendix 8: Coastal Processes). Observations from the walkover confirmed the presence of sandy beaches to the northwest (Rosslare Strand), transitioning to rocky outcrops and mixed sediments closer to the port (Figure 8.6) and a sandy beach with rock outcrops, cobbles and a vegetated cliff line to southeast (Figure 8.7 and Figure 8.8) towards Greenore Point and Carnsore Point. The survey also identified areas of active erosion, particularly along the sandy stretches of the coastline, where dune systems are retreating due to wave action and storm events (Figure 8.9).

Figure 8.6: Walkover Survey - Rocky outcrops and mixed sediments to west of Small Boat Harbour towards Rosslare Strand

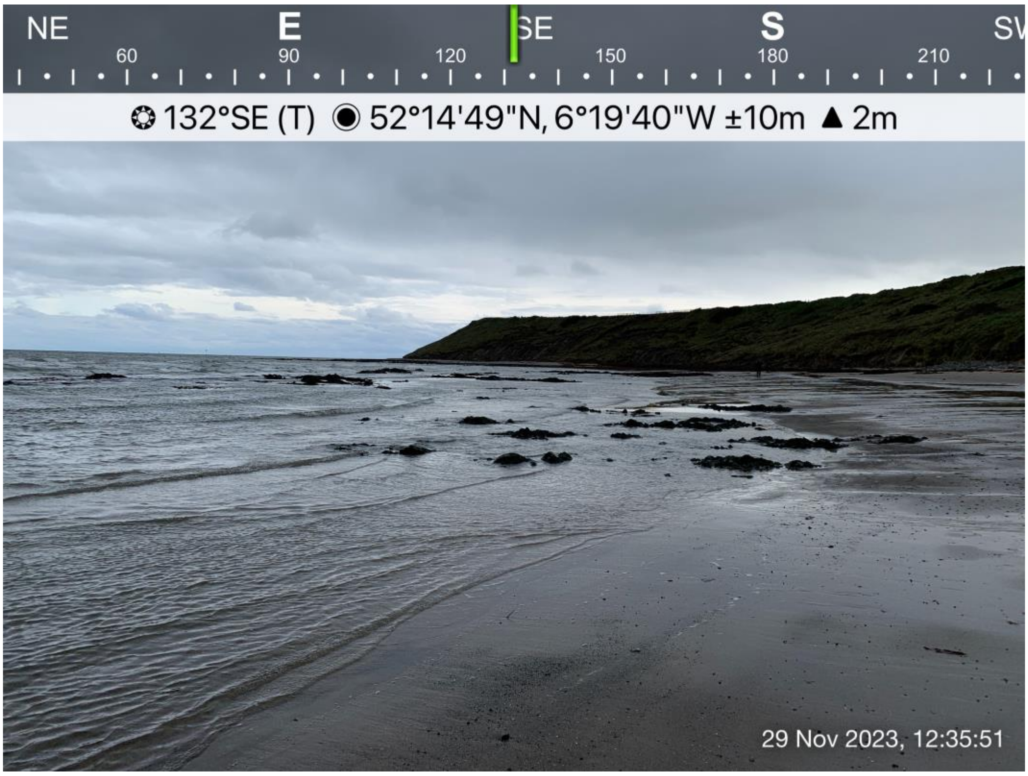


Figure 8.7: Walkover Survey - Sandy beach with rocky outcrops and coarse sediments to east of Rosslare Harbour towards Greenore Point

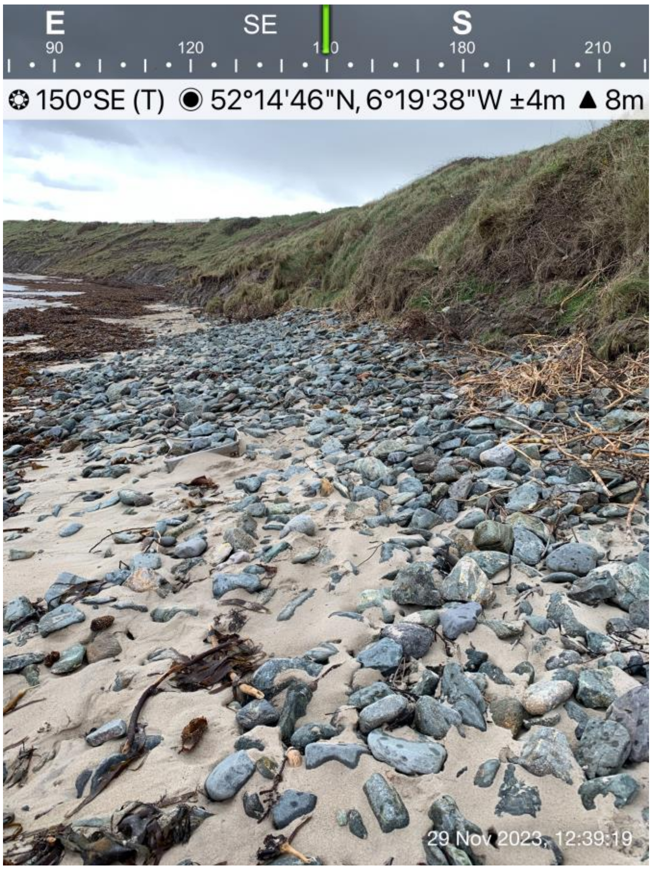


Figure 8.8: Walkover Survey - Cobbles, sand and vegetated cliff to east of Rosslare Harbour

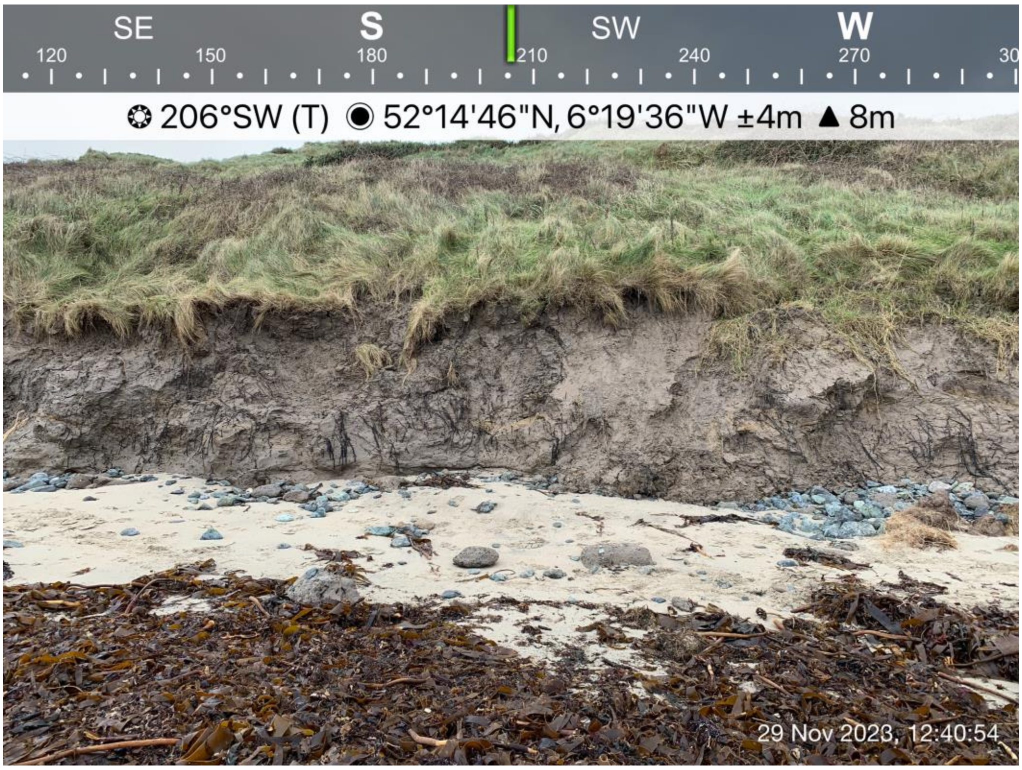


Figure 8.9: Walkover Survey - Eroding cliff line to east of Rosslare Harbour

8.3.4 BATHYMETRY AND SEABED FEATURES

The Coastal Processes Study Area exhibits varying water levels ranging from 0 mMSL to approximately -90 mMSL. The regions nearest to the shoreline (west) feature the shallowest water depths. In the vicinity of Rosslare Port, typical water depths range from 0 mMSL to -14 mMSL, as illustrated in Figure 8.10. Seabed slope within the Coastal Processes Study Area ranges from 0° to 30° (Figure 8.11). The slope along the coastal region from shore to offshore within the Coastal Processes Study Area averages 3.6%. However, in areas further offshore, approximately 10 km from the shore, the slopes become steeper, averaging around 6%.

The Proposed Development is situated near several notable sandbanks that play a significant role in the region's coastal and marine dynamics. Among these are the Long Bank and the Lucifer-Blackwater Bank complex (Figure 8.12). The Long Bank is a prominent offshore sandbank extending parallel to the coastline, acting as a natural barrier that influences wave patterns and sediment transport in the area. The Lucifer-Blackwater Bank complex comprises a series of interconnected sandbanks, which are dynamic features shaped by strong tidal currents and sediment deposition. These sandbanks contribute to the intricate seabed morphology, supporting diverse marine habitats and influence navigation and offshore activities near Rosslare.

The seabed in the vicinity of the Proposed Development is comprised of sand and coarse sediment with pockets of rock and mud. Sand and coarse sediment dominate the majority of the area surrounding the Proposed Development (Figure 8.12).

8.3.5 TIDAL CURRENTS AND WATER LEVELS

The tidal regime in the Irish Sea, including the Rosslare area, is influenced by the presence of a degenerate amphidromic point pinpointed on the east coast of Ireland, geographically located between Cahore Point and Courtown. An amphidromic point is a location where the tidal range is near zero, and tidal waves rotate around it in a counterclockwise direction in the Northern Hemisphere. This regional feature significantly impacts tidal patterns, with tidal ranges increasing with distance from the amphidromic point. In the Rosslare area, which is situated approximately 70 km south of this point, the tidal range is more pronounced compared to areas closer to the amphidromic point. This regional dynamic contributes to the semi-diurnal tide regime observed locally, with two high tides and two low tides occurring each day.

The tidal flow in the Rosslare Port area exhibits a rectilinear pattern, with currents flowing predominantly in a southwest direction during the ebb tide and in a northeast direction during the flood tide (Coughlan et al., 2021). There is no clear indication of tidal dominance, as the ebb and flood currents are relatively well balanced in terms of speed and duration. Sediment transport and other tidal-driven processes in the area are likely influenced equally by both ebb and flood tides, resulting in a more symmetrical tidal regime.

Modelled mean annual depth-averaged current speeds calculated in Coughlan et al. (2021) are displayed in Figure 8.13. Further information on currents speeds at Rosslare Port is provided by project-specific hydrodynamic modelling outputs (EIAR Technical Appendix 8: Coastal Processes), whereby modelled mean and maximum depth-averaged current speeds over a one month period are shown in Figure 8.14 and Figure 8.15.

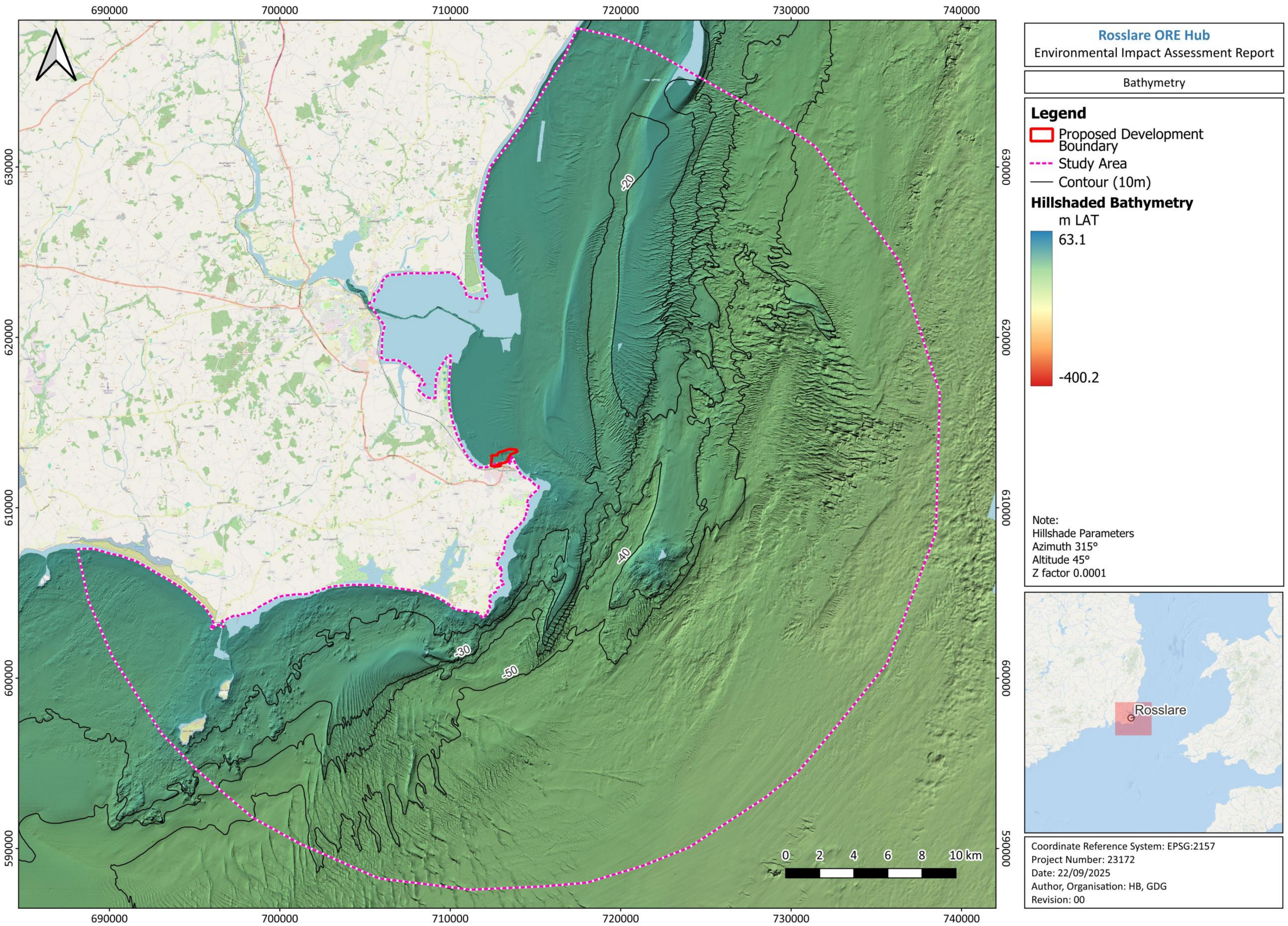


Figure 8.10: Bathymetry for the defined Coastal Processes Study Area (EMODnet, 2020)

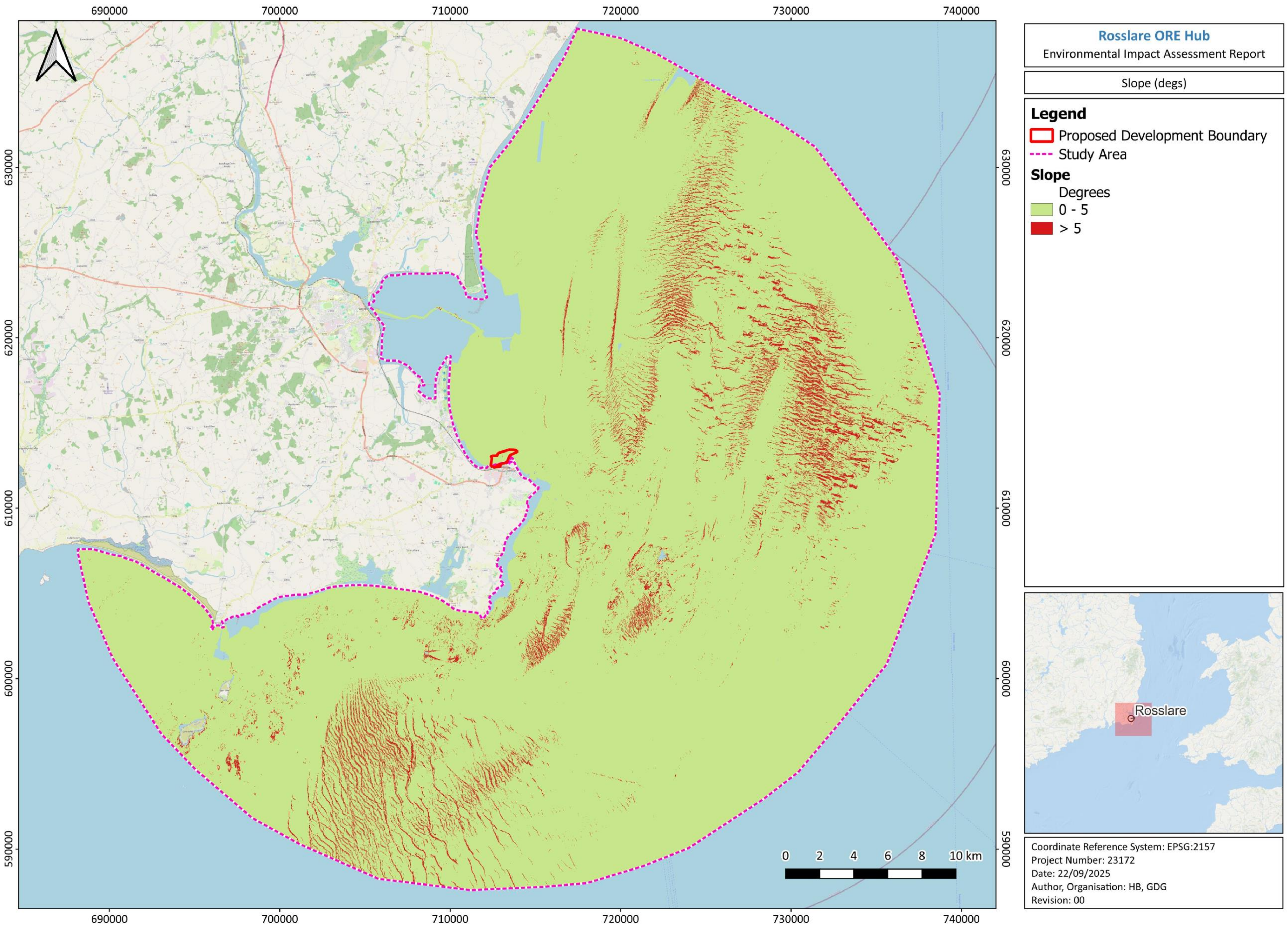


Figure 8.11: Seabed slope within the Coastal Processes Study Area (converted from EMODnet, (2020))

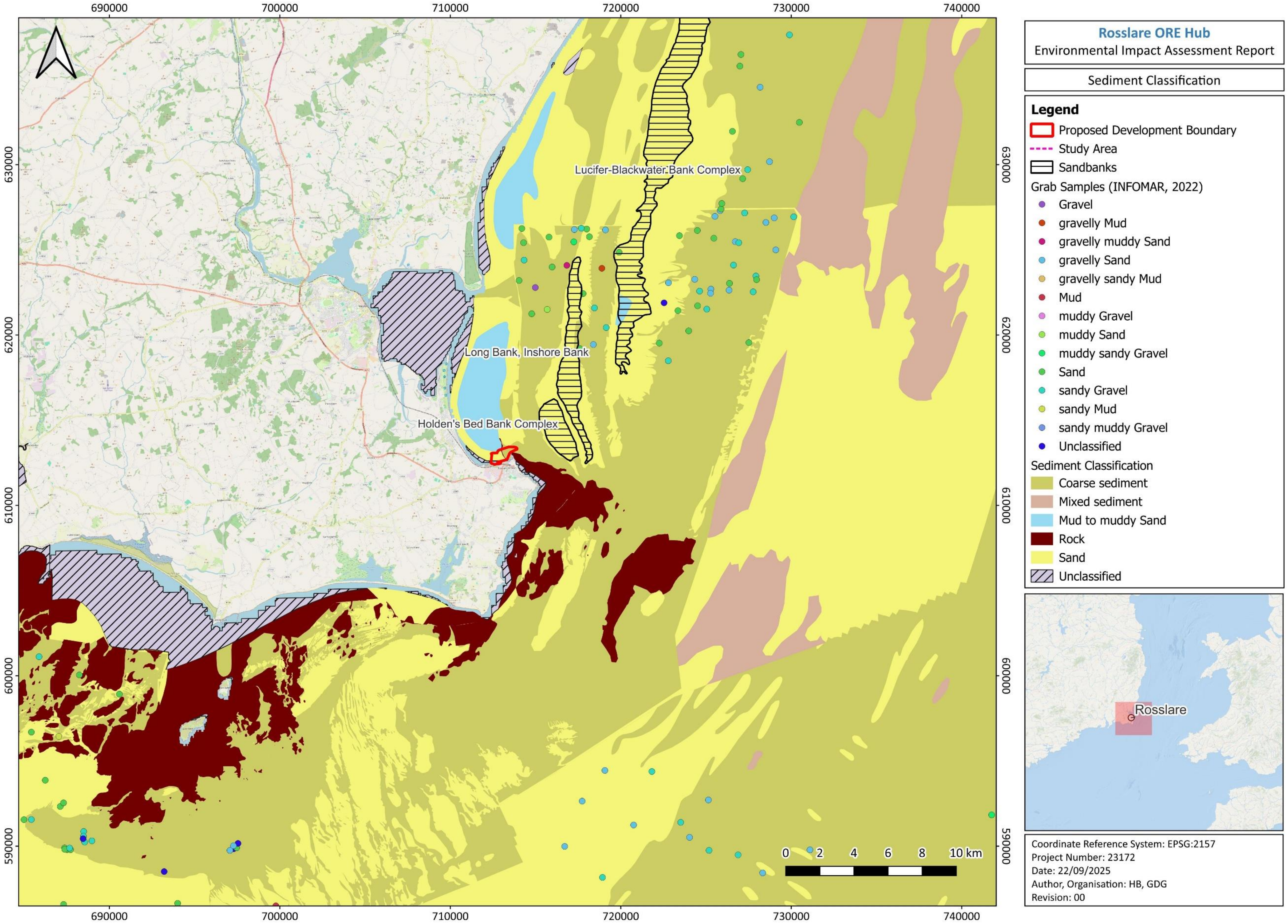


Figure 8.12: Coastal seabed substrate of the Rosslare Europort adjacent area, INFOMAR (2020; 2023)

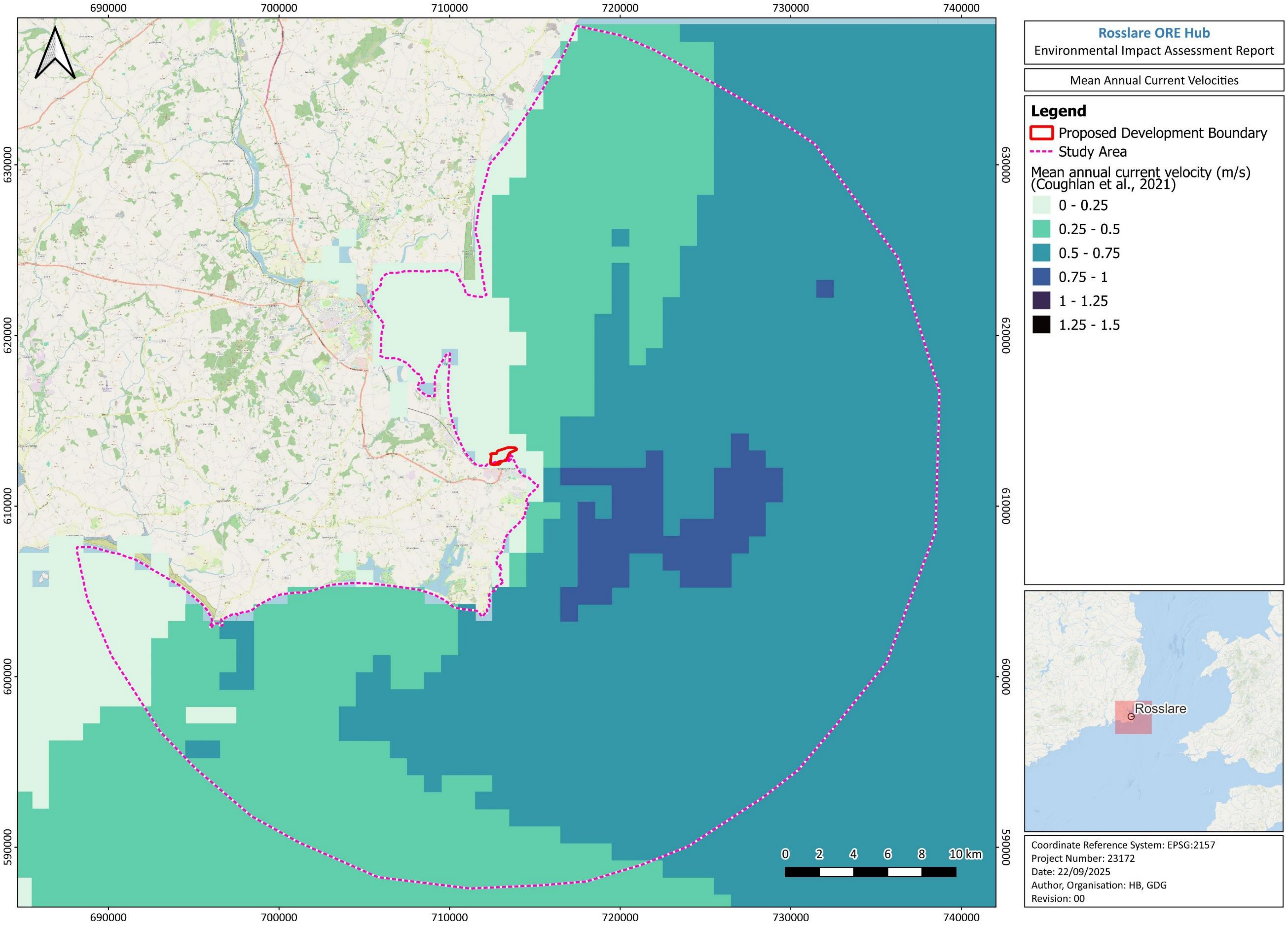


Figure 8.13: Mean annual current velocity for the wider Rosslare Port Coastal Processes Study Area (Coughlan et al., 2021)

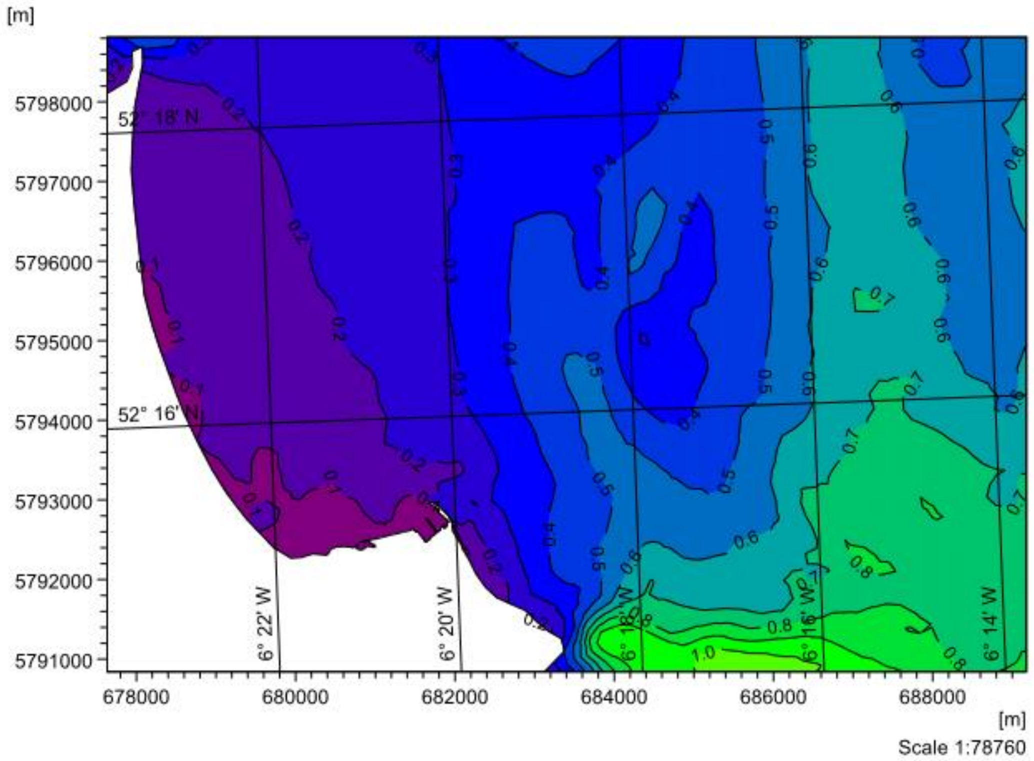


Figure 8.14: Modelled mean depth-averaged current speed over one month period for Rosslare Port Coastal Processes Study Area

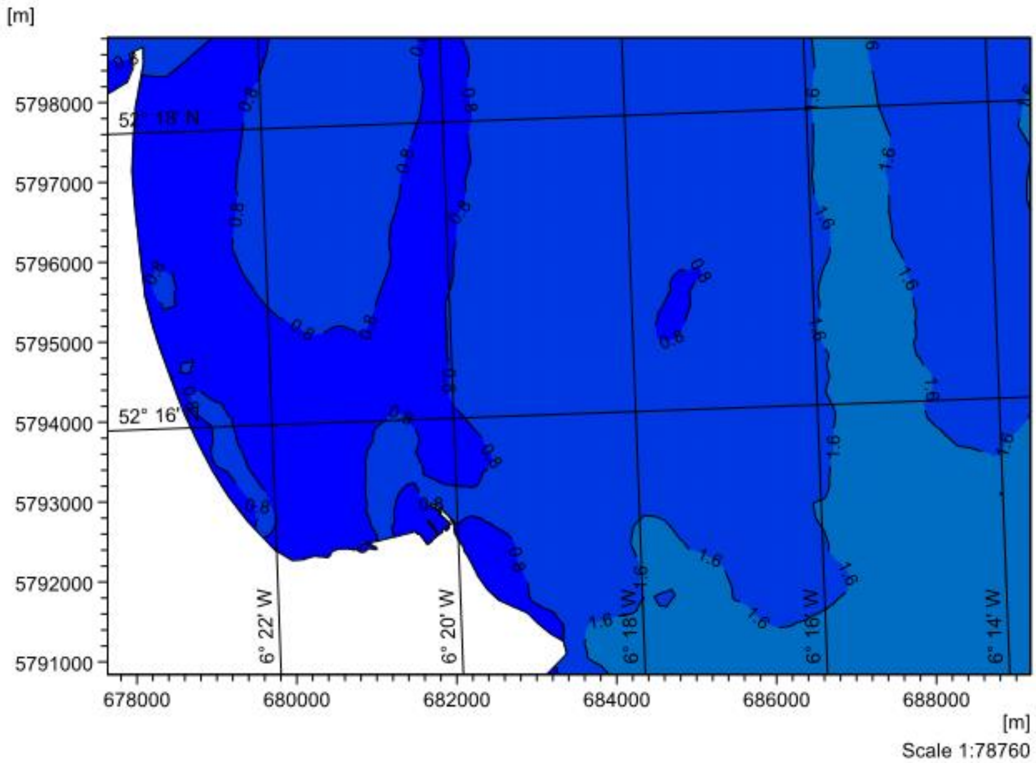


Figure 8.15: Modelled maximum depth-averaged current speed over one month period for Rosslare Port Coastal Processes Study Area

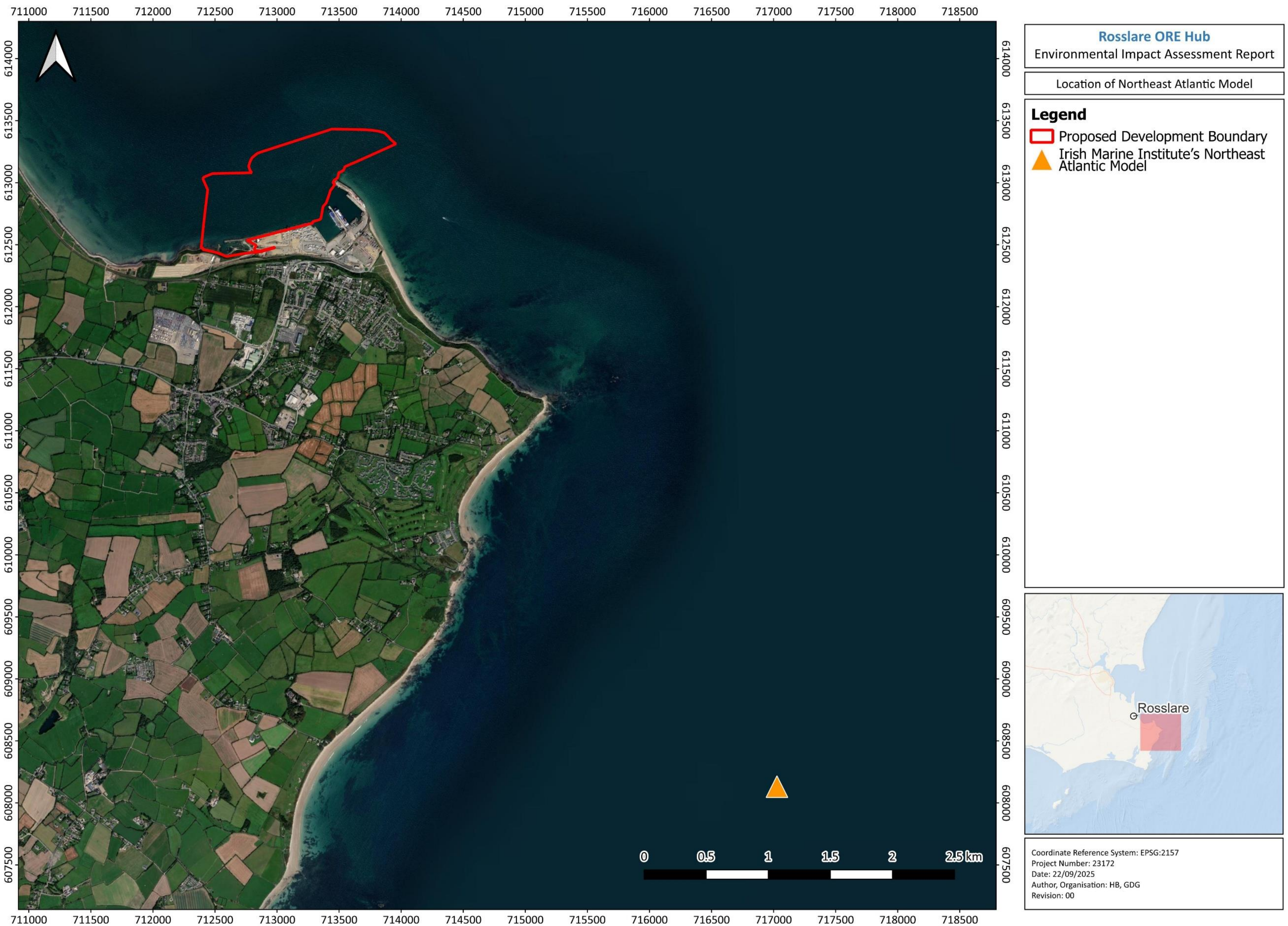


Figure 8.16: Location of Irish Marine Institute's Northeast Atlantic Model

A 10-year timeseries of depth-averaged currents in the vicinity of the Rosslare Port Area (52.2125° N, 6.2875° W) was also acquired from the Irish Marine Institute's Northeast Atlantic Model (Figure 8.16). The main tidal flow characteristics are highlighted in Figure 8.17. The rectilinear flow is evident in a southwest and northeast direction displaying current speeds up to 1.1 m/s.

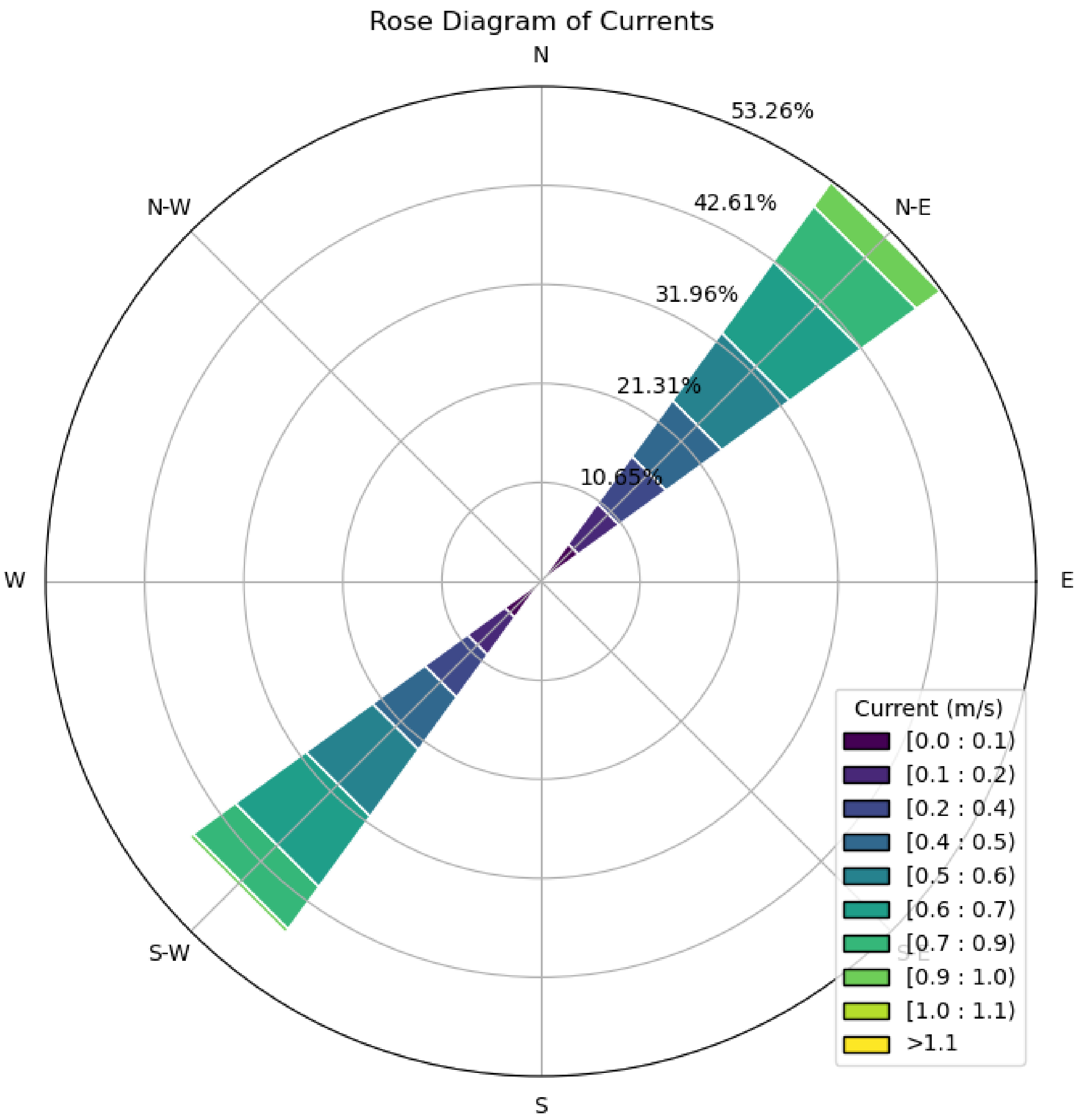


Figure 8.17: Depth-averaged current rose representing the main flow intensity and direction in Rosslare Port Area (Figure 8.15) (Source: Marine Institute NEATL modelling results)

The in-situ metocean measurement survey from the buoys listed in Table 8.2 provide values that align with the Marine Institute's NEATL modelling results. Figure 8.18 and Figure 8.19 show the measured current speed and direction.

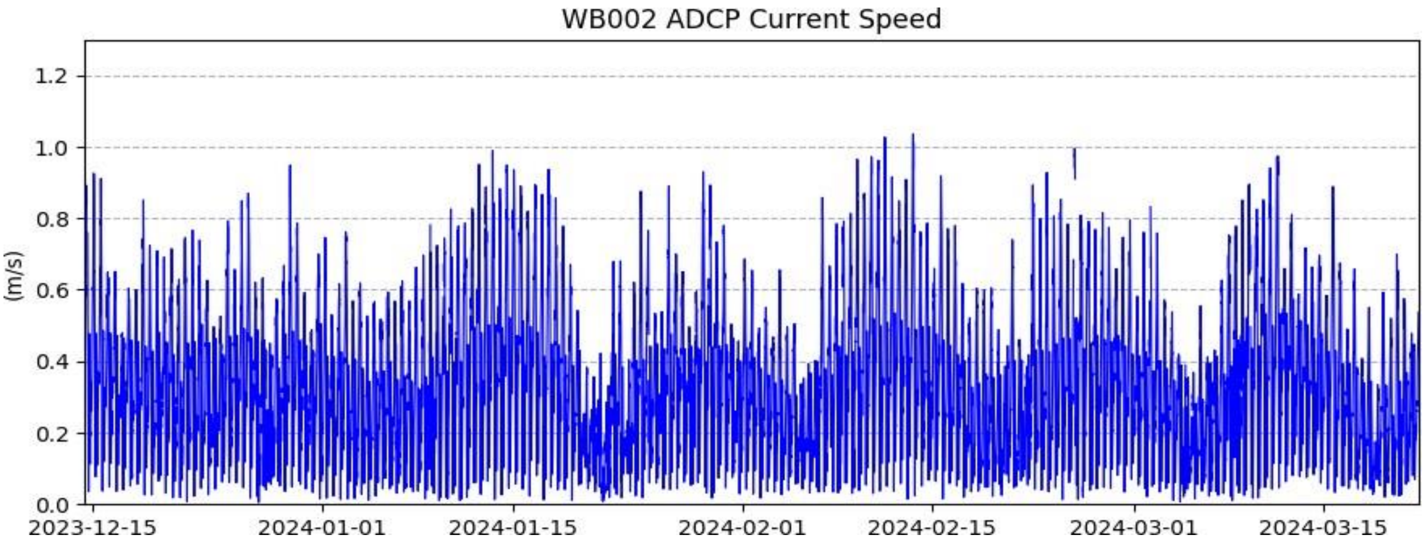


Figure 8.18: Measured current speed from the metocean survey

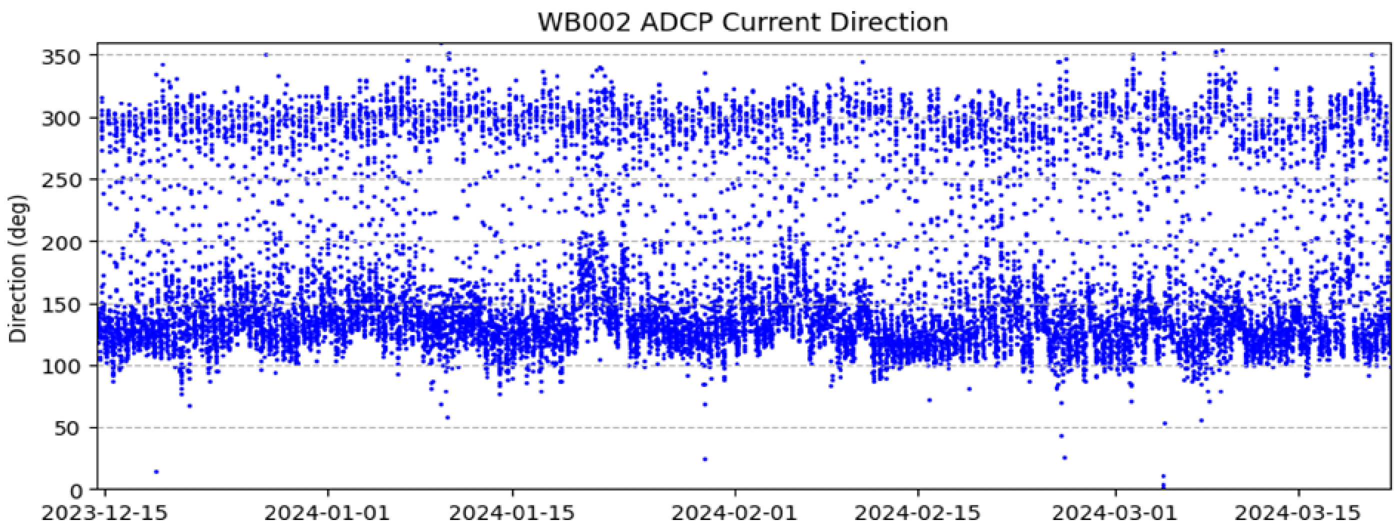


Figure 8.19: Measured current direction from the metocean survey

Due to the influence of the amphidromic system, water levels in the Rosslare area are shaped by the interaction of tidal waves propagating through the Irish Sea. These regional-scale processes set the context for the local tidal characteristics, which are further detailed in Table 8.9.

Rosslare Europort is characterised by a semi-diurnal tide regime: it registers two high tides and two low tides every day. Table 8.9 provides the tidal levels considered for the marine infrastructure design. These levels have been estimated with the MIKE21 Tide Prediction Tool and considering the predicted astronomical levels between 2025 and 2075. The estimates are derived from a constituent analysis of the recorded water levels obtained from the Rosslare tide gauge[1] (located at 52.254600,-6.334861) during the period from April 2020 to April 2022 (Ireland's Digital Ocean, 2020-2022).

Table 8.9: Tidal level characteristics for the Rosslare Port area

Reference Level	Highest Astronomical Tide (HAT) (m)	Mean High Water Springs (MHWS) (m)	Mean High Water Neaps (MHWN) (m)	Mean Sea Level (MSL) (m)	Mean Low Water Neaps (MLWN) (m)	Mean Low Water Springs (MLWS) (m)	Lowest Astronomical Tide (LAT) (m)
Chart Datum (mCD)	2.6	2.3	1.80	1.5	1.1	0.7	0.3

The storm surge related to extreme events is defined based on the information provided in the ICWWS 2018 Report. Figure 8.20 presents the storm surge values defined for Rosslare port and associated with a return period up to 1000 years. Based on the least favourable confidence intervals, the sea level due to storm surge for return periods ranging from 50 to 100 years is projected to increase by approximately 0.9 m to 1.0 m.

[1] https://www.marine.ie/site-area/data-services/real-time-observations/tidal-observations-1?instrumentname=Rosslare

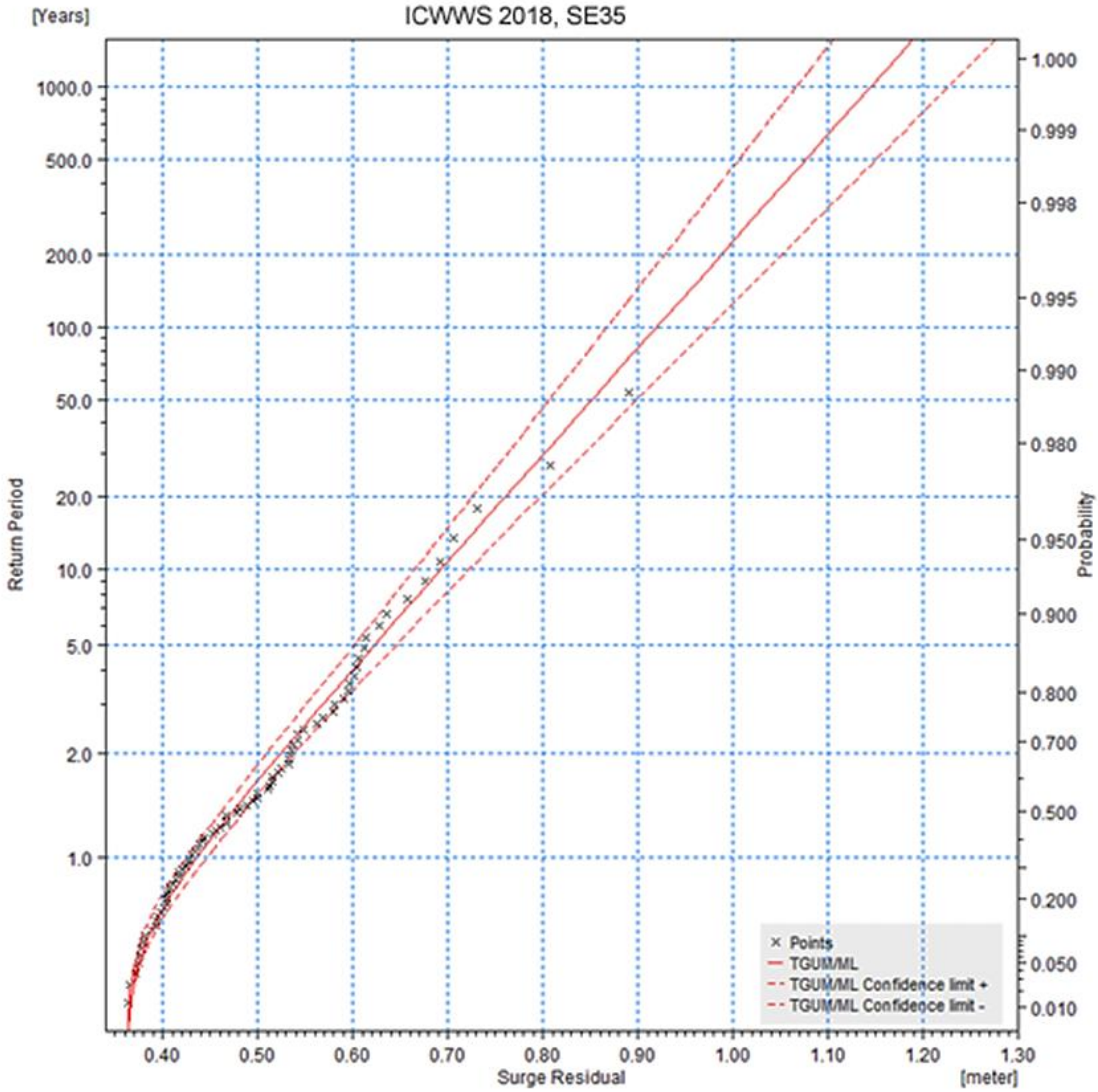


Figure 8.20: Extreme Storm Surge water levels for Rosslare Port (ICWWS, 2018)

The potential regional changes in mean sea level and wave climate are predicted based on the projected rise in water levels. Projections from the Intergovernmental Panel on Climate Change (IPCC) (2022) indicate a mean sea level rise in the Irish Sea of 0.41 m between 2030 and 2080 and 1.0 m by 2100 (Figure 8.21).

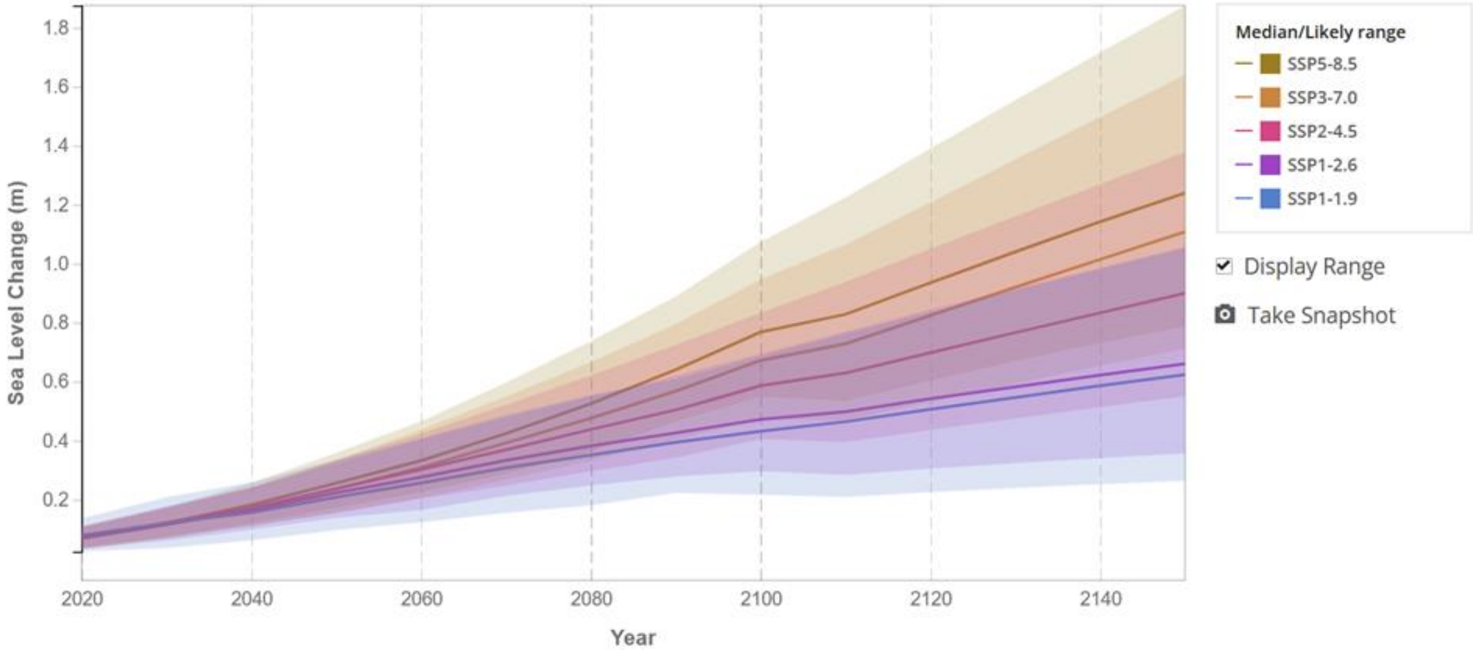


Figure 8.21: Sea Level Rise Projection for the Irish Sea (IPCC, 2022)

The anticipated consequences of mean sea level rise primarily include increased frequency and intensity of impacts from extreme weather events, slight landward movement of the high-water line, and accelerated coastal erosion due to wave shoaling effects.

8.3.6 WAVES

8.3.6.1 AVERAGE CONDITIONS

In the Irish Sea, waves are predominantly generated by local winds, although there are occasional contributions from distant wind systems, which give rise to the presence of swell waves. The wave conditions in the Coastal Processes Study Area show that the prevailing wave direction is south-southwest. It is important to note that the wave fetch, which is the distance over water that the wind blows in a single direction, creating waves, spans hundreds of kilometres in that direction. The south and southwestern boundaries of the Coastal Processes Study Area are therefore exposed to open ocean wave propagation patterns and larger fetch areas, and consequently produce more energetic wave conditions with wave heights reaching maximum values of Hs = 9.6 m and longer wave periods up to 21.6 s. The boundaries of the Irish Sea (North boundary) restrict the fetch area in other directions, resulting in wave periods from the north and east rarely exceeding 14 seconds.

The mean annual distribution of wave heights in the offshore area of Rosslare Port (Marine Institute, 2005), is shown in Figure 8.22. The average wave height (Hs) in the offshore region of the Coastal Processes Study Area is between 0.75 m and 1.5 m.

The transition of swell waves from deep offshore waters to shallower coastal areas leads to changes in wave dynamics caused by interactions between offshore deep-water waves and the seabed. These interactions give rise to various phenomena in shallow water, including shoaling, refraction, diffraction, wave breaking (resulting in wave energy loss), wave energy loss due to bottom friction, and nonlinear coastal reflections that generate infra-gravity waves. Hence, numerical wave modelling and site-specific measurements were conducted to gain comprehensive insights into the shallower regions encompassing the nearshore areas of the Rosslare Port area.

Four different data points are used to define input offshore wave climate for the refined numerical wave modelling of the nearshore areas near the Proposed Development. Figure 8.23 shows the location of the 4 offshore data points. Note that the period of time considered in the definition of offshore wave conditions is from 1979 to 2022. Hourly data was extracted for significant wave height (H_s) and peak wave period (T_p), mean wave direction (°) and mean wind direction (°).

Waves in the south of the Irish Sea are predominantly driven by swell waves coming from the WSW-S sector, propagating from the Northern Celtic Sea. The predominant wave directions provided in the offshore ERA5 points (providing hourly estimates of climate variables, from the European Centre for Medium-Range Weather Forecasts' Copernicus programme) considered for the wave modelling are within the sectors WSW and SWS as shown in Figure 8.24 and Figure 8.25.

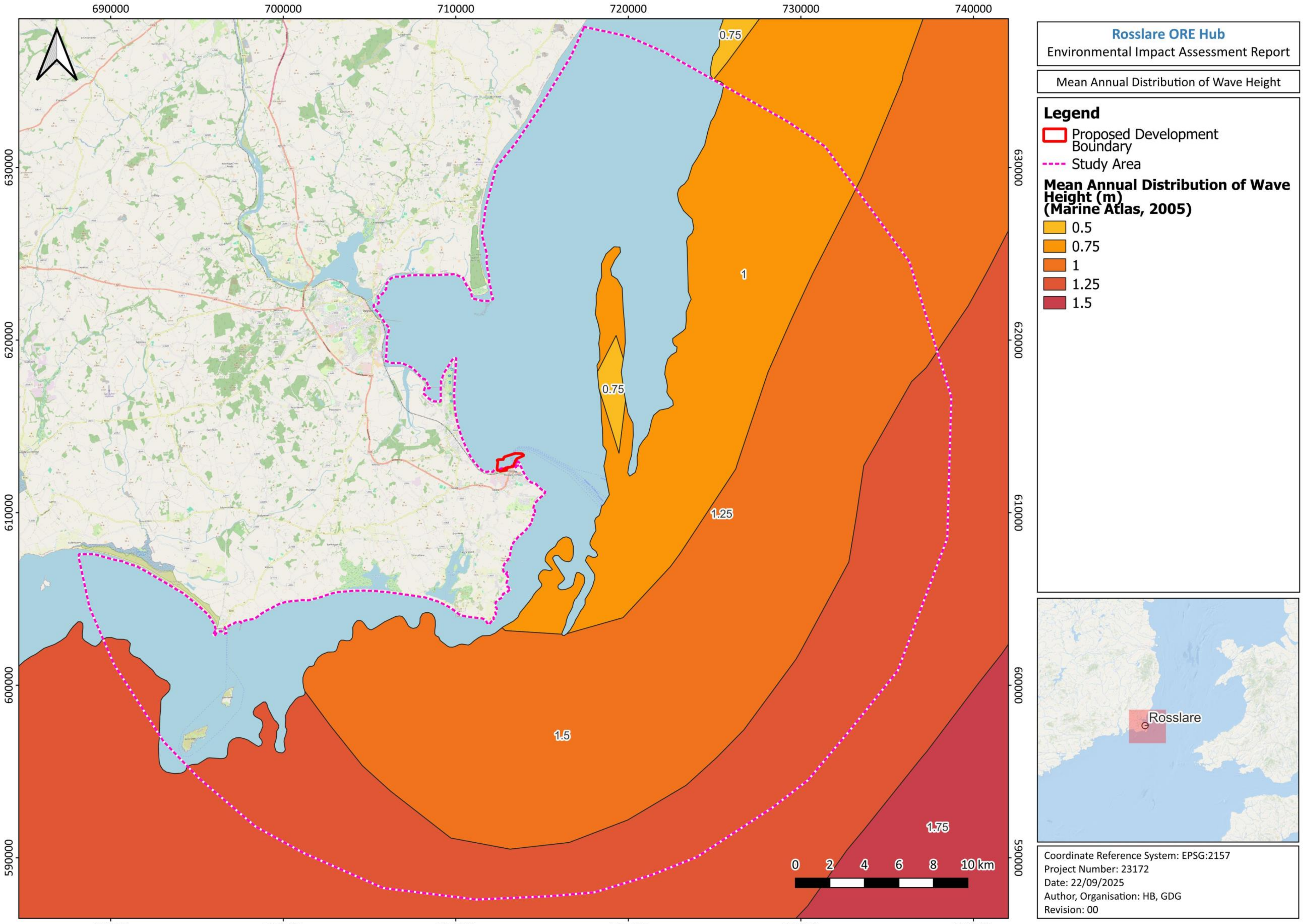


Figure 8.22: Mean Annual Wave Heights

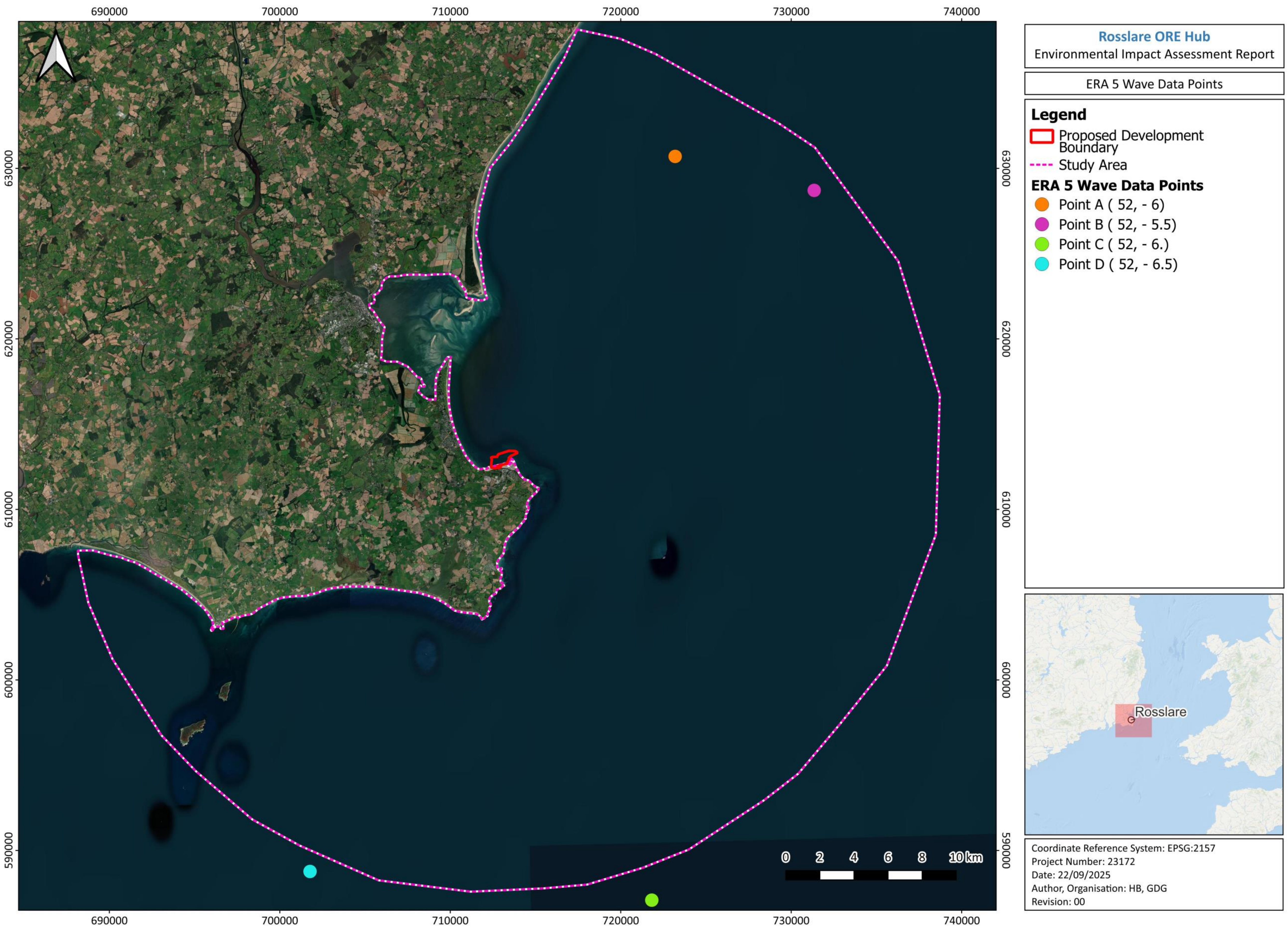


Figure 8.23: Offshore ERA5 wave data point locations

As observed from both Figure 8.24 and Figure 8.25, WSW-S waves are associated with a variety of wind-seas and swells (T_p>10s) whereas waves coming from the north are associated with lower wave periods which indicates they are predominantly caused by local wind. The northerly wave component has a higher incidence at points located at higher latitudes (A and B). Wave periods greater than 10 seconds typically indicate swell waves, which are generated by distant weather systems and have travelled long distances, losing energy but maintaining longer periods over their journey. In contrast, waves with shorter periods (e.g., Tp < 10 s) are generally associated with locally generated wind-seas, which are formed by wind blowing over a limited fetch area and are characterised by shorter wavelengths and higher frequencies.

A significant decrease in the maximum significant wave height (maxH_s) is observed as waves propagate into the Irish Sea. Near the boundary between the Celtic Sea and the Irish Sea (points C and D), Hs reaches approximately 10 m, while at points A and B, it decreases to around 8 m. A similar trend is noted for the peak wave period (T_p), with a higher proportion of large values occurring at the entrance to the Irish Sea (points C and D) compared to the northern boundary of the Coastal Processes Study Area (points A and B).

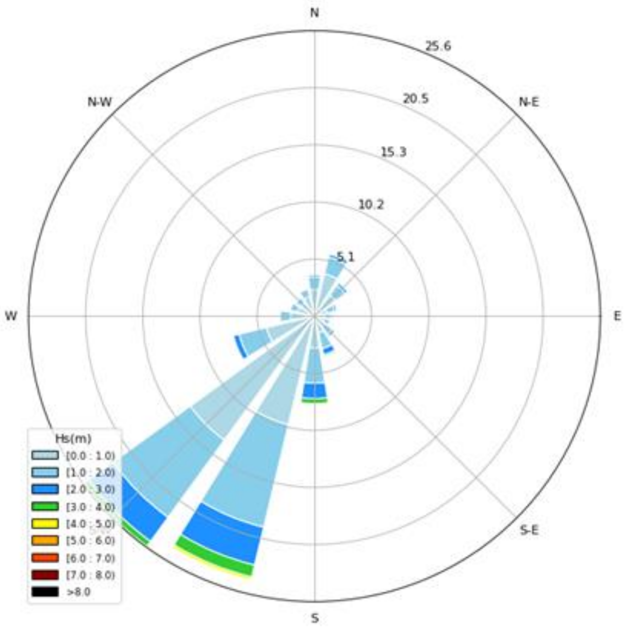
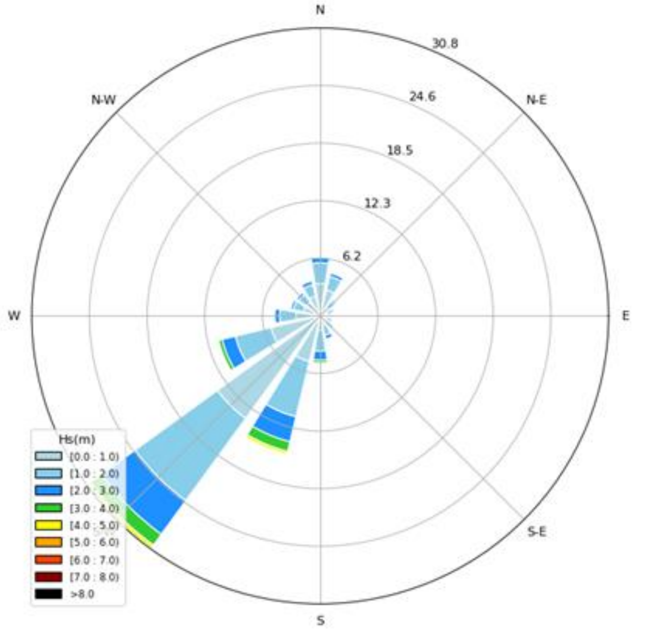
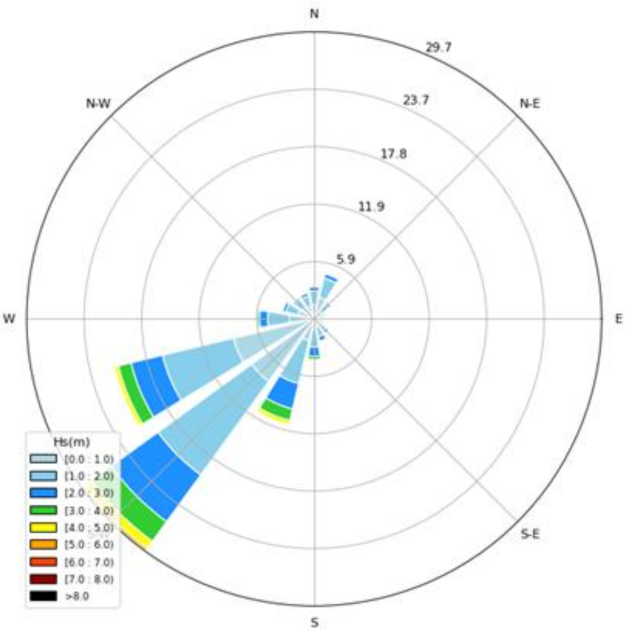
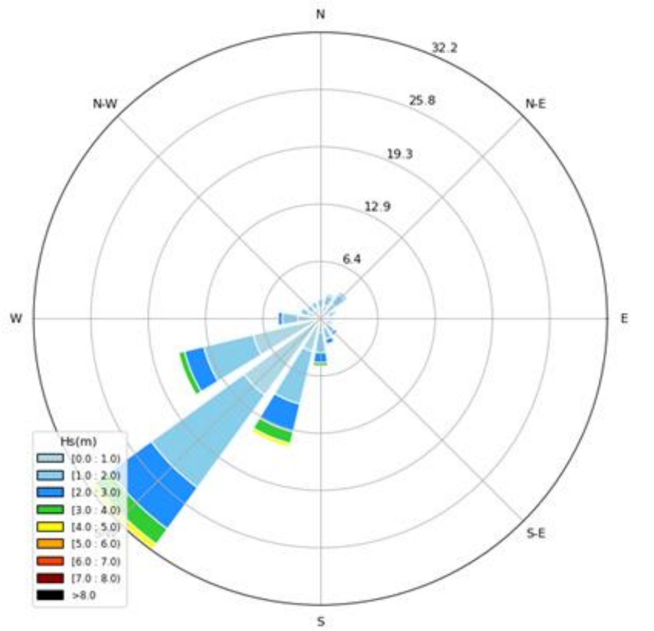
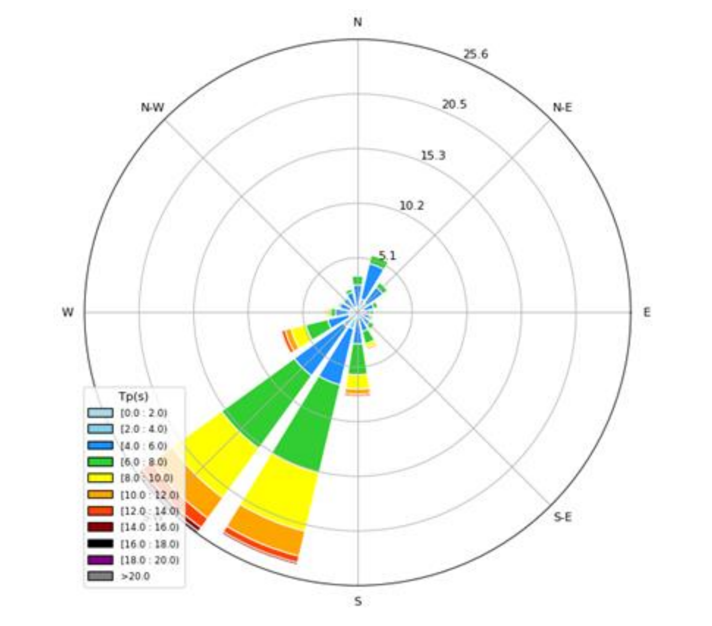
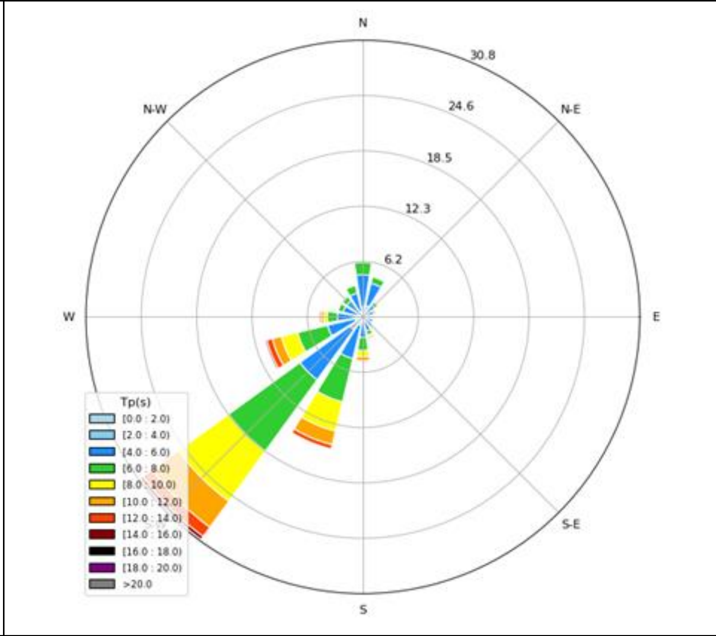
ERA5 Point A (52.5, -6)	ERA5 Point B (52.5, -5.5)
	
ERA5 Point C (52, -6)	**ERA5 Point D (52.5, -6.5)**
	

Figure 8.24: Wave roses for Hs – Offshore ERA5 data points (1979 – 2022)

ERA5 Point A (52.5, -6)	ERA5 Point B (52.5, -6)
	

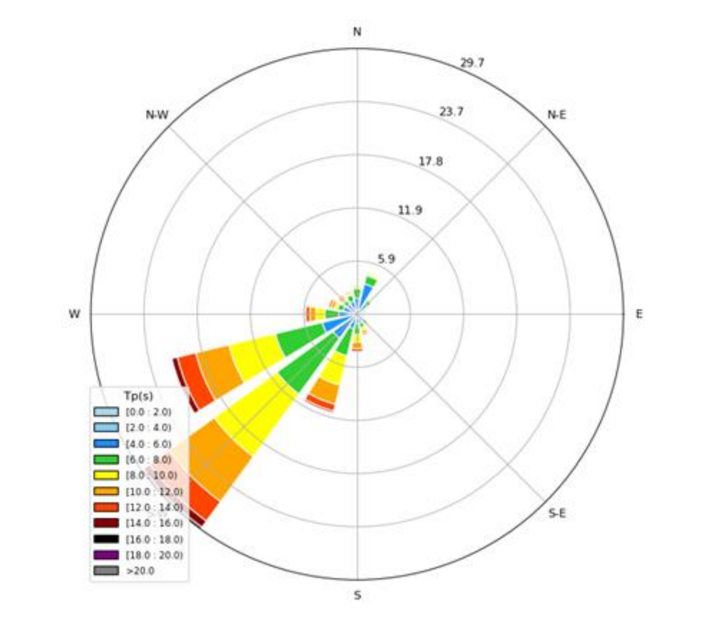
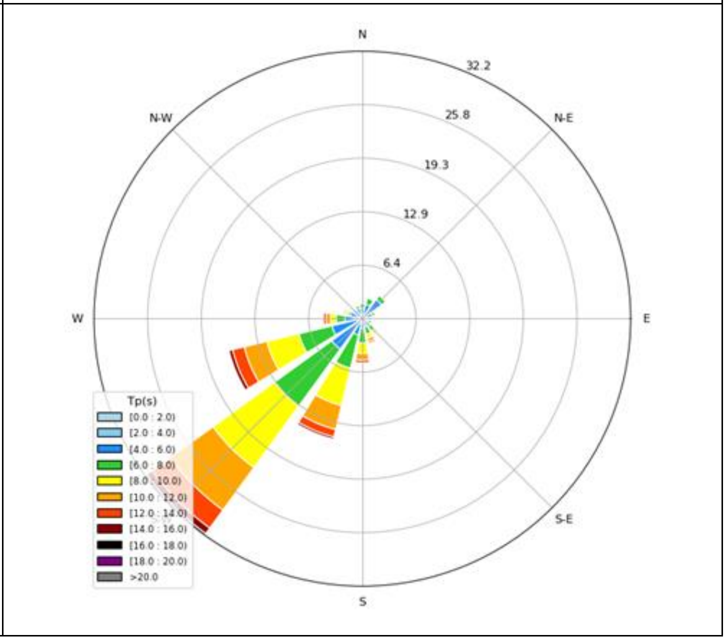
ERA5 Point C (52.5, -6)	ERA5 Point D (52.5, -6)
	

Figure 8.25: Wave roses for Tp – Offshore ERA5 data points (1979 – 2022)

The maximum and average H_s and T_p values obtained in the selected offshore ERA5 wave data points are presented in Table 8.10.

Table 8.10: Offshore Data Points - Maximum and Average H_s and T_p (1979-2022)

ERA5 Data Point	Hs (m)		Tp (s)	
	Max	Mean	Max	Mean
A (52.5, -6.0)	7.8	1.2	21.6	6.8
B (52.5, -5.5)	8.5	1.3	21.7	6.8
C (52, -6.0)	9.6	1.6	21.6	8.2
D (52, -6.5)	9.4	1.5	21.6	8.1

Further information on the wave climate closer to the shore is available from site-specific measurements conducted between December 2023 and March 2024 (Figure 8.26, Figure 8.27 and Figure 8.29). This indicates a H_S of up to 2m (Figure 8.26) and peak wave periods of > 14 s (Figure 8.27) with the waves approaching the port predominately from East-North-East over this time period.

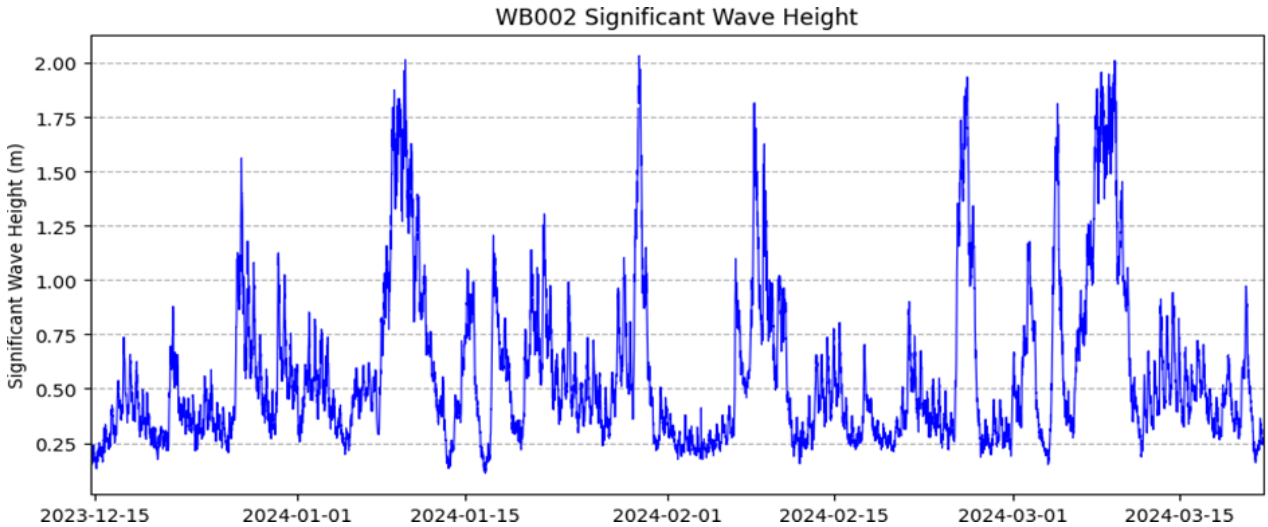


Figure 8.26: Time series plot of Wave Buoy (WB002) significant wave height - Hs (m) from the metocean survey

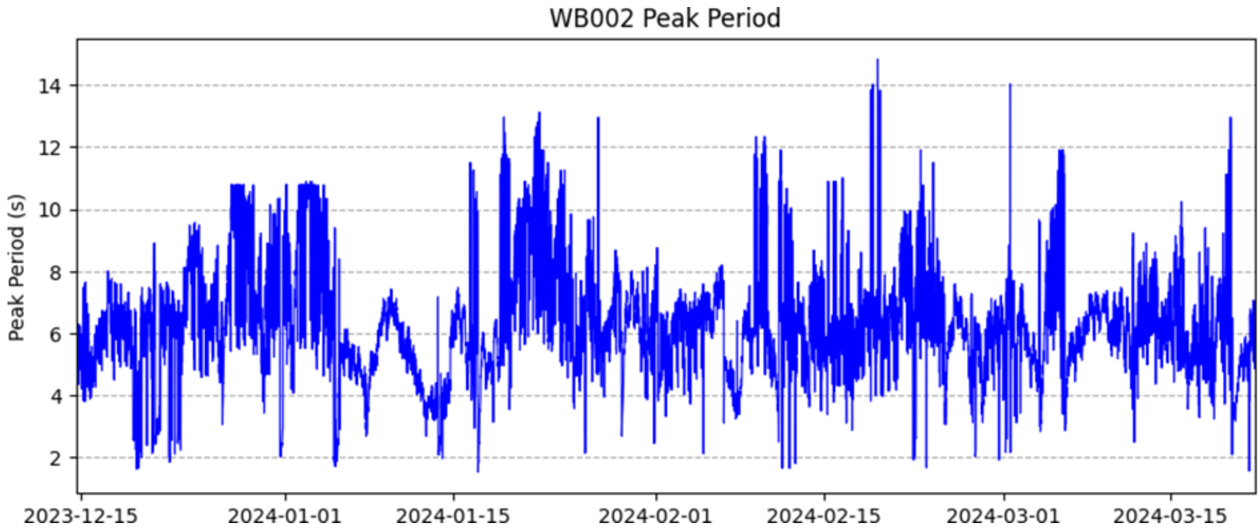


Figure 8.27: Time series plot of Wave Buoy (WB002) peak period - Tp (s) from the metocean survey

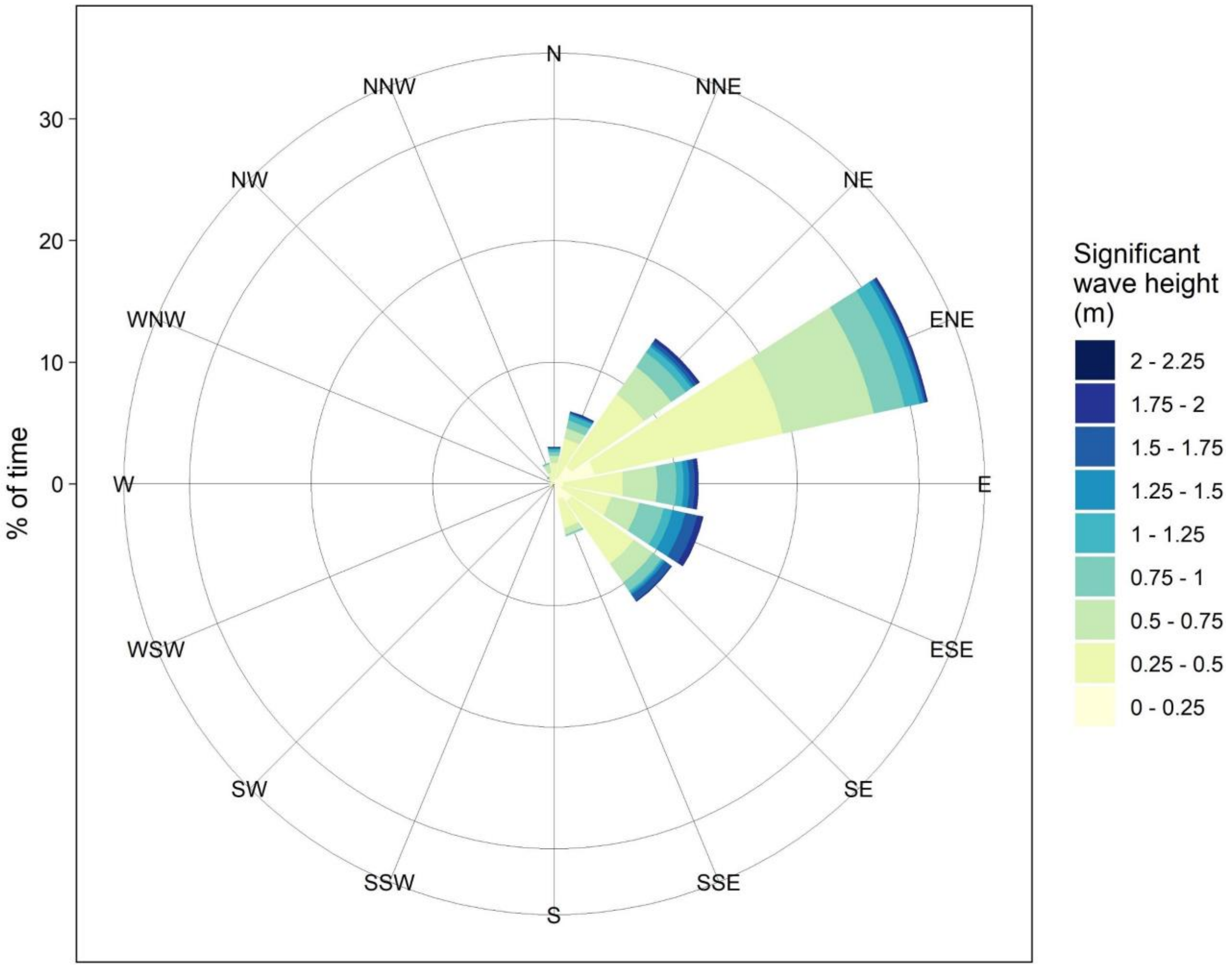


Figure 8.28: Wave rose plot of significant wave height and mean wave direction measured by Wave Buoy WB002 between December 2023 and March 2024

8.3.6.2 EXTREME ANALYSIS

As described in EIAR Technical Appendix 8, extreme wave events have been modelled using the Generalised Extreme Value (GEV) method. A return period[2] (RP) of 100-years was used and the number of extreme events considered in the analysis was defined based on the model output distribution best fit and expert judgement. The resultant extreme offshore wave conditions are presented in Table 8.11.

Table 8.11: Extreme significant wave heights (H_s) per return period in the offshore locations (in metres)

ERA 5 Point	2-Year	10-Year	20-Year	50-Year	100-Year
A (52.5, -6)	6.1	6.9	7.4	8.0	8.5
B (52.5, -5.5)	6.1	7.3	7.8	8.4	8.9
C (52, -6)	7.1	8.5	9.0	9.7	10.1
D (52, -6.5)	6.5	7.9	8.5	9.3	9.9

8.3.6.3 NUMERICAL MODELLING

Numerical modelling of wave conditions was performed using the ERA5 data (Copernicus, 2025) as the offshore wave climate input to obtain wave conditions at the Proposed Development by using a combination of MIKE21 SW model (Spectral Waves) and MIKE21 BW (Boussinesq Waves).

Wave propagation modelling was undertaken with the MIKE21 SW software package, developed by the Danish Hydraulics Institute, incorporating the Spectral Wave (SW) method (DHI, 2017). The model considered the action due to tidal level, wind and incoming waves, and was calibrated with in-situ metocean data obtained during the survey undertaken in the project site between December 2023 and March 2024. For more detailed information refer to EIAR Technical Appendix 8: Coastal Processes.

The following scenarios have been simulated in the wave propagation study:

- Simulation of 21 years of hourly wave data were propagated from offshore to the vicinity of the project site, covering the years from 2002 to 2022, inclusive. The objective of this scenario was to acquire a robust wave dataset in the vicinity of the Proposed Development site in order to evaluate extreme conditions.
- Simulation of the period between December 2023 and March 2025 for calibration purposes.
- Simulation of two extreme events to compare the results obtained for the present scenario and for the future proposed port development: a 50 yr Return Period (RP) storm coming from the North and another coming from the South.

[2] The return period is the estimated average time between events, and is the inverse of the average frequency of occurrence.

Wave conditions near Rosslare Harbour

This section summarises the wave conditions obtained near the port through long-term wave propagation analysis (21 years) carried out with MIKE21 SW. Two points of interest have been selected to characterise wave conditions in the project site as shown in Table 8.12 and in Figure 8.28.

Table 8.12: Wave propagation results points coordinates

Point	Water Depth (m ODMalin)	LAT/LONG	UTM (Zone 29)
A	≈10	52.264°, -6.326°	682500.00 m E, 5793800.00 m N
B	≈6	52.262°, -6.340°	681500.00 m E, 5793500.00 m N

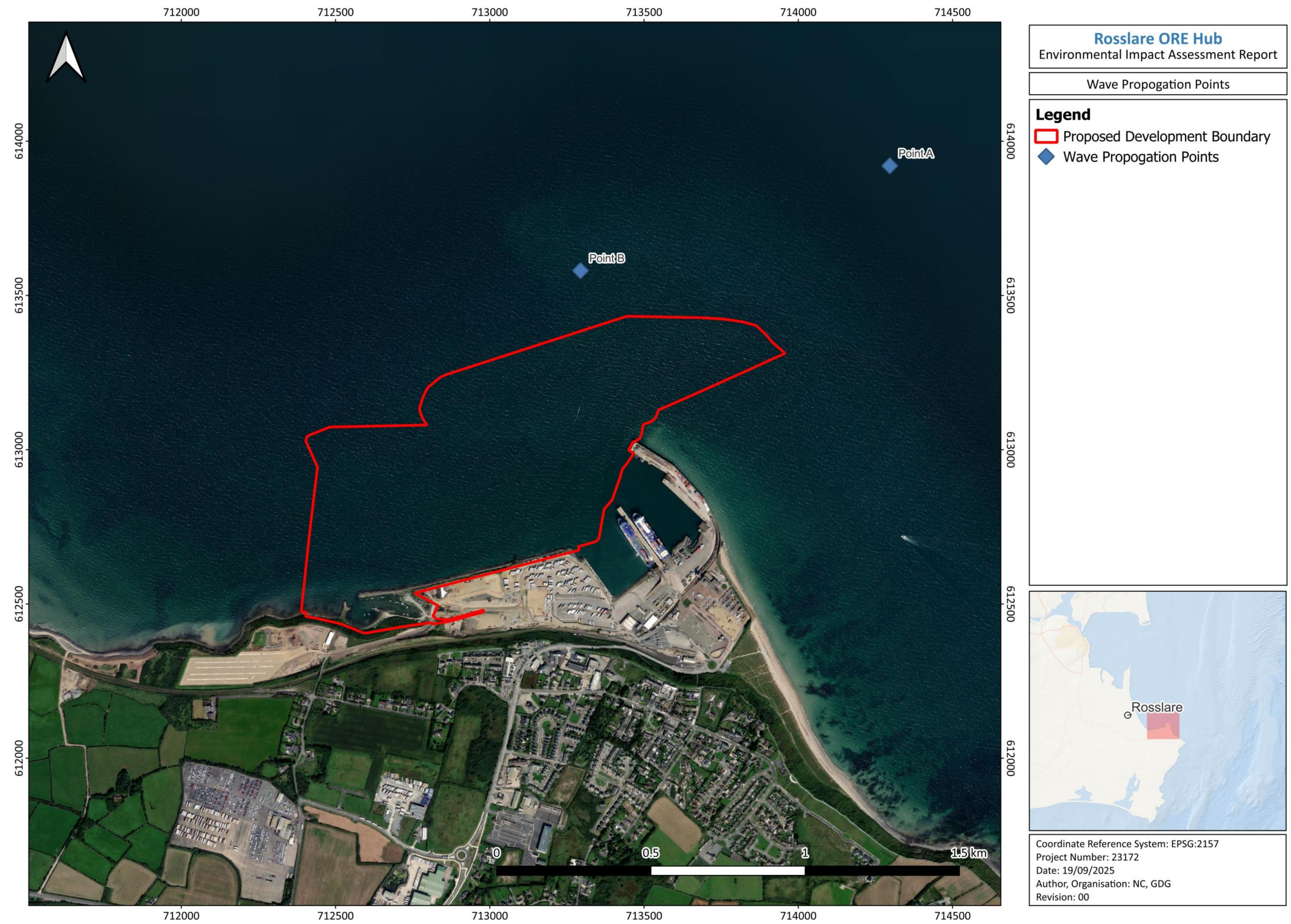


Figure 8.29: Location of the nearshore modelled points of interest

Average Regime at Point A to the Northeast of the Proposed Development

The analysis conducted for Point A, located northeast of the port, is detailed in this section. As shown in Figure 8.30, both the significant wave height rose and the peak period rose illustrate that waves at Point A primarily come from the sector covering from east (E) to east-southeast (ESE), while occurrences of waves from the northeast (NE) and southwest (SW) are comparatively less frequent.

Westerly waves are associated with more energetic sea conditions, characterised by a more significant presence of long wave periods (up to 20 s) and high significant wave heights (above 2 m). These conditions result from offshore swells diffracting as they propagate within the Irish Sea and enter shallower waters as illustrated by an extracted model timestep in Figure 8.31.

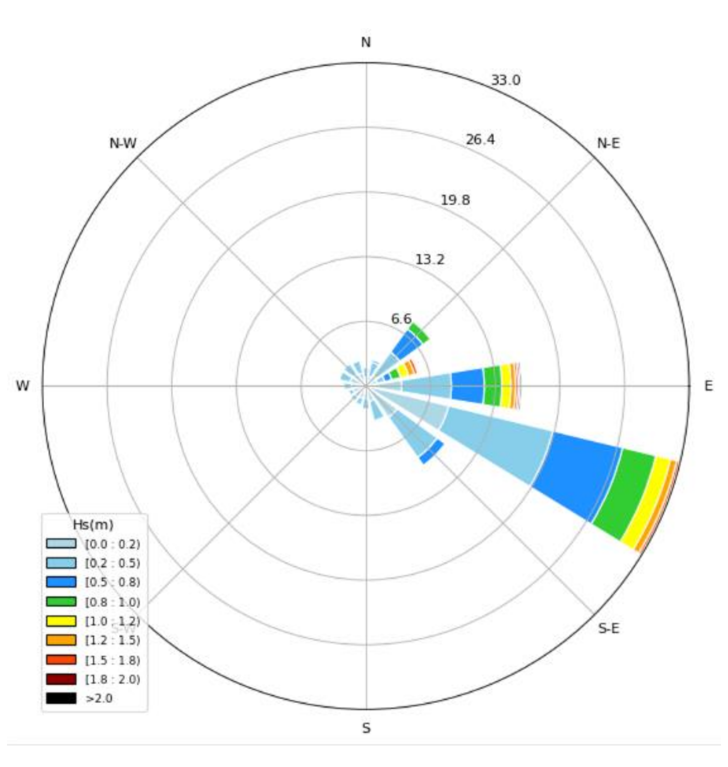
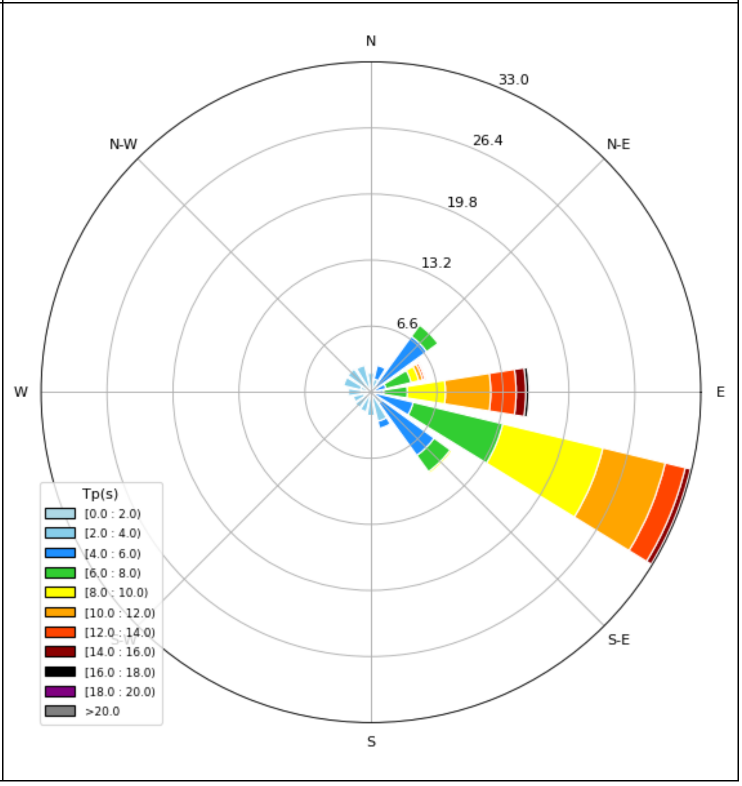
Wave Rose	Peak Period Rose
	

Figure 8.30: Point A – NE Rosslare Port – significant wave height and peak period rose diagrams (2002-2022)

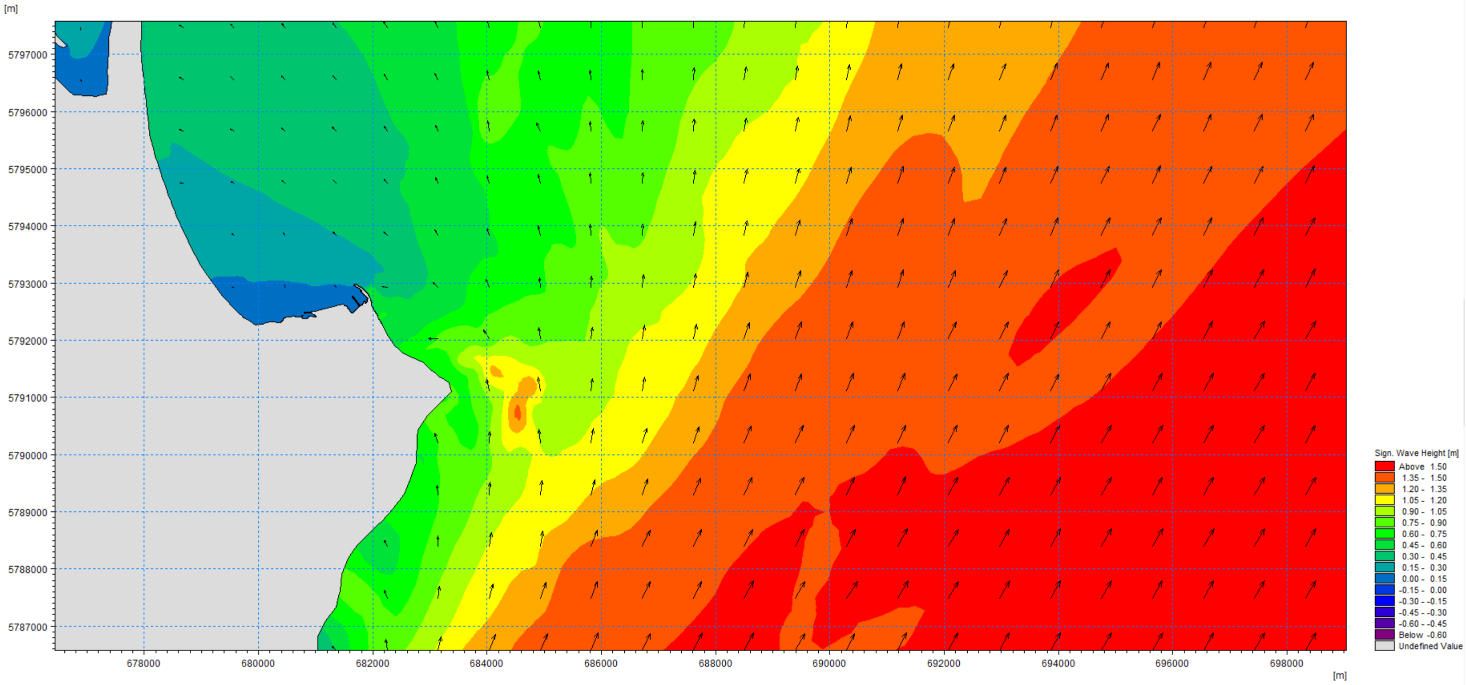


Figure 8.31: Snapshot of significant wave height and mean wave direction during a south-westerly wave event to illustrate the nature of wave diffraction in the Rosslare Harbour regional area

Regarding the combination of wave height and peak period, prevailing conditions are characterised by wave heights below 1 m coupled with peak periods of up to 12 s as illustrated Figure 8.32. When analysed individually, significant wave heights below 1 m and peak periods of up to 10 s are associated with an occurrence probability of approximately 90%.

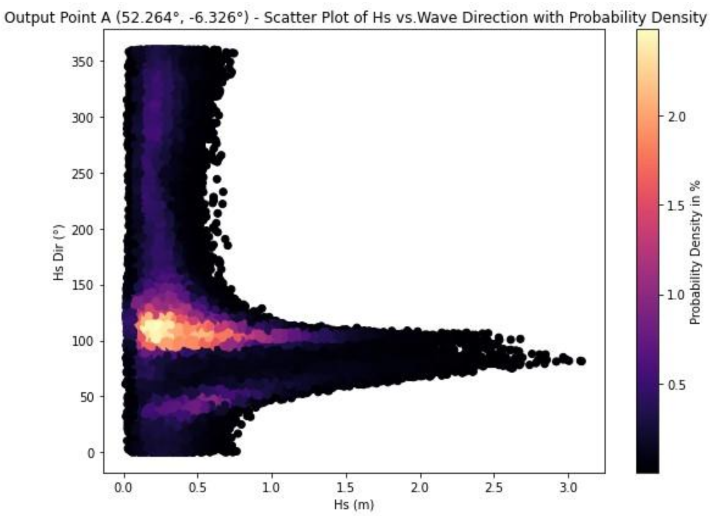
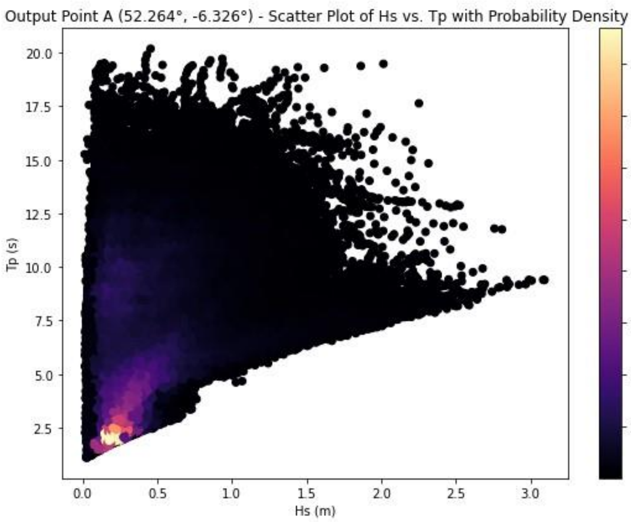
Wave Height vs Wave Direction	Wave Height vs Peak Period
	

Figure 8.32: Point A – NE Rosslare Port – Scatter Plots (Hs vs Dir, left) (Hs vs Tp, right) (2002-2022)

Average Regime at Point B to the north of the Proposed Development

The wave rose and the peak period rose presented in Figure 8.33 reveal a prevalence of easterly waves with a reduced occurrence of waves from other directions, particularly within the first and second sectors. In comparison with Point A, there is a clear reduction in the southeasterly (SE) wave component due to the shielding effect provided by Rosslare Port along with wave diffraction and refraction resulting from bathymetric changes.

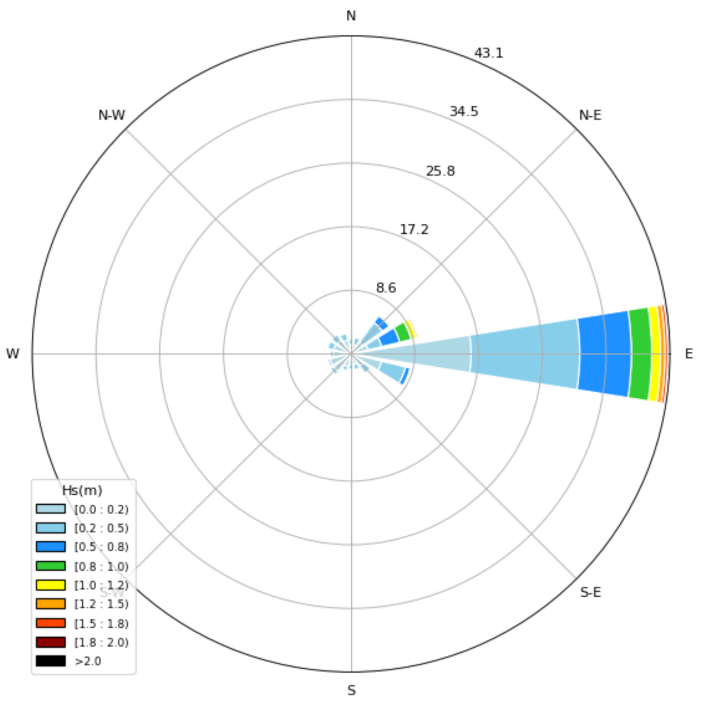
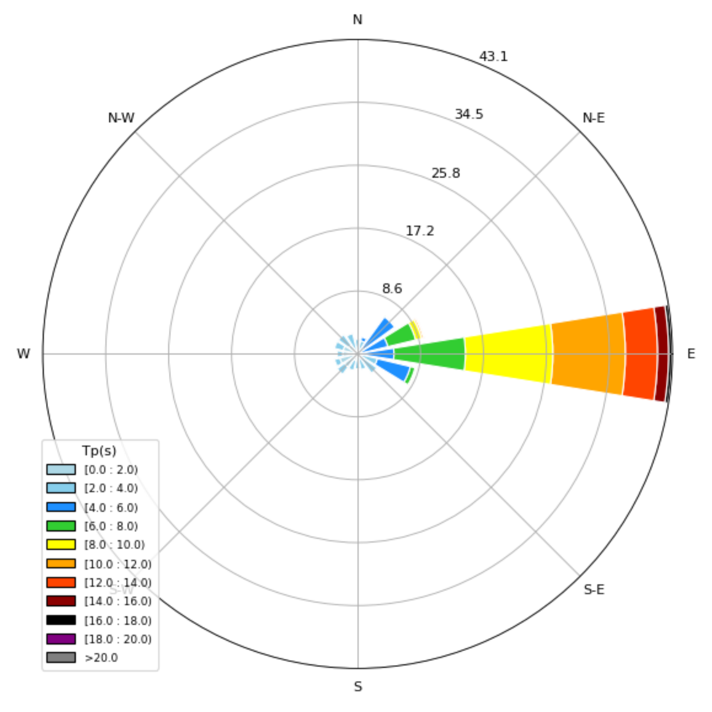
Wave Rose	Peak Period Rose
	

Figure 8.33: Point B – N Rosslare Port - Wave Rose and Peak Period Rose (2002-2022)

In terms of the combination of wave height and peak period, prevailing conditions remain the same as estimated in Point A (H_s < 1 m and T_p < 12 s). When analysed individually, wave heights below 1 m are associated with a probability of occurrence of 96.5% whereas peak periods up to 12 s have a probability of incidence of approximately 90% (Figure 8.34).

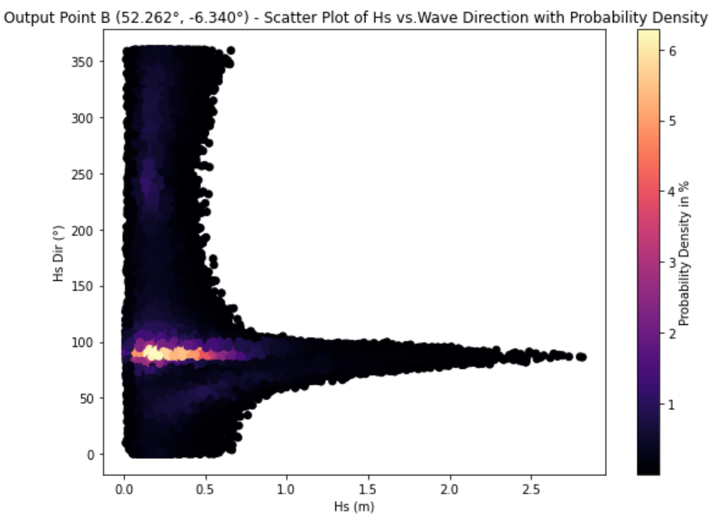
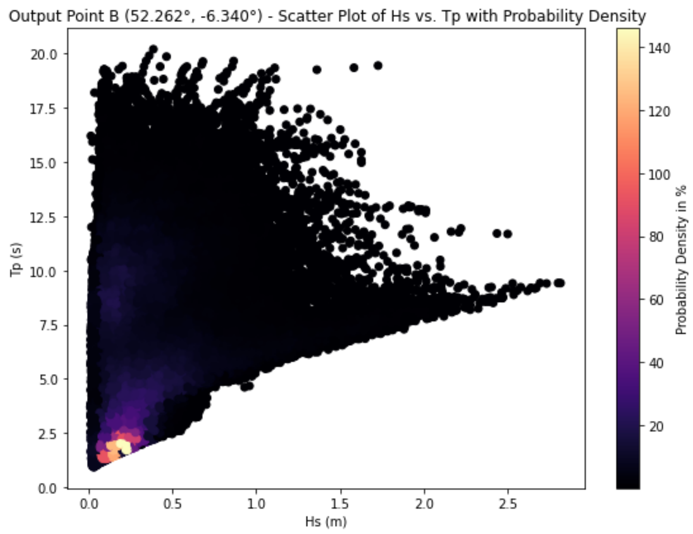
Wave Height vs Wave Direction	Wave Height vs Peak Period
	

Figure 8.34: Point B – N Rosslare Port – Scatter Plots (Hs vs Dir, left) (Hs vs Tp, right) (2002-2022)

8.3.7 SEDIMENT MOBILITY

Net sediment transport in the Irish Sea is primarily influenced by a bedload parting zone[3], also referred to as the "head" of sediment transport pathways. This zone is located in the central Irish Sea, roughly between Ardanary on the Irish coastline and Anglesey on the UK coastline (Figure 8.35). Sediment tends to move northward and southward away from this central tidal zone and its associated bedload parting area (Creane *et al.,* 2021).

[3] Bedload partings are classified as a special case of scour zone, in which local bottom-stress maxima coincide with divergent patterns in sand transport.

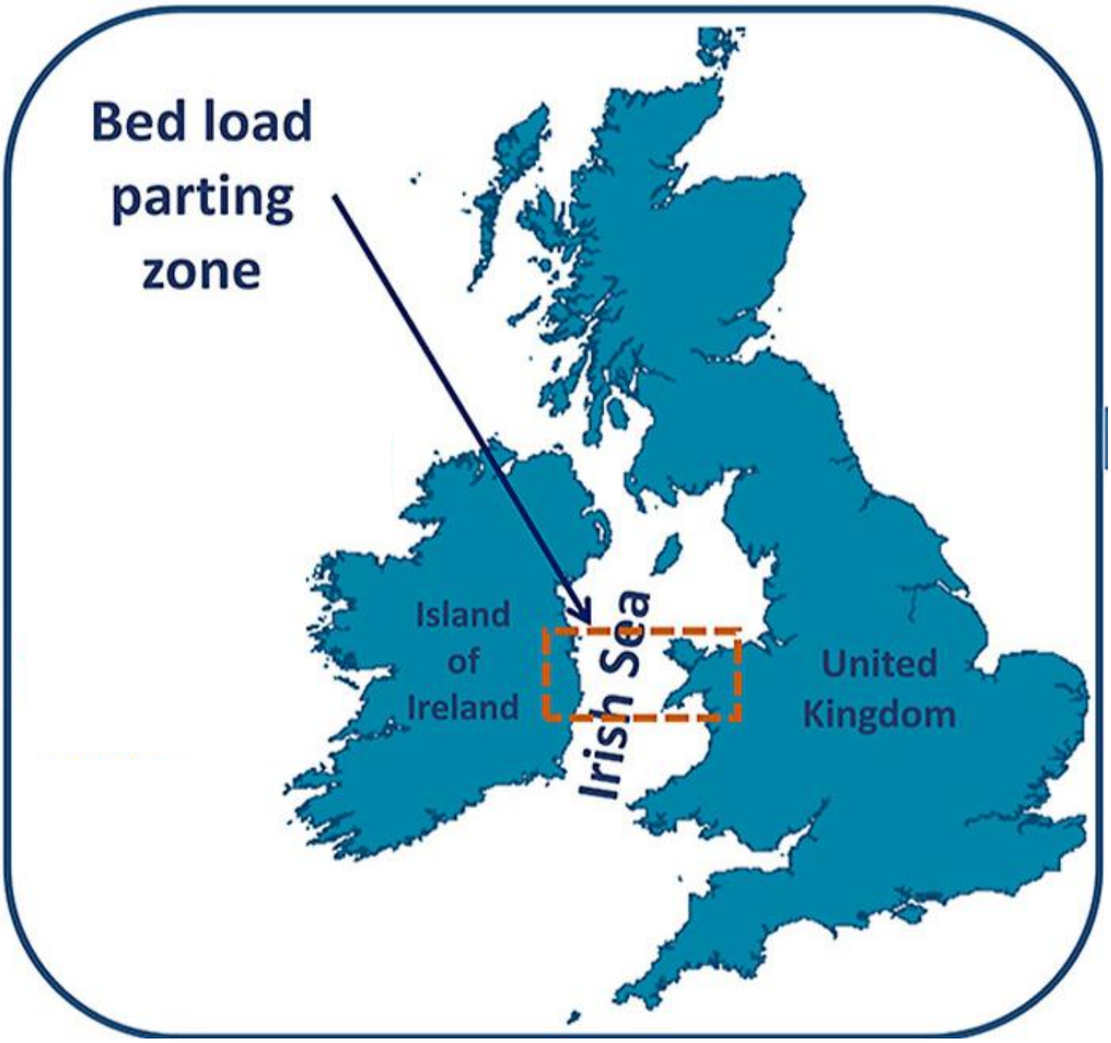


Figure 8.35: Location of Irish Sea bed load parting zone (Creane et al., 2021)

The sediment transport between Arklow Bank and the Lucifer–Blackwater and Holden's Bed–Long Bank complexes, located north of Rosslare, demonstrates sediment migration and recycling between these banks (Creane *et al.,* 2022). Longshore sediment transport patterns north of Rosslare Port, run northward along Rosslare Strand. In this region there is a historical issue with beach and coastal erosion. Currently, a Coastal Erosion and Flood Relief Scheme is being led by Nicholas O'Dwyer Ltd Consulting Engineers, appointed by Wexford County Council. Further information is outlined in section 8.4.6.

Coughlan et al. (2021) developed a Mobilisation Frequency Index (MFI) for the Irish Sea, which calculates the percentage of time over a one-year period that the critical bed shear stress is exceeded due to tidal currents, waves, or a combination of both. Figure 8.36 illustrates that in the Coastal Processes Study Area, both tidal currents and waves are the primary forces driving seabed mobility, as reflected in the MFI analysis. On average, sediment in the Irish Sea is observed to mobilise approximately 35% of the time throughout the year. Near Rosslare Port, the MFI is notably higher, around 60%. This higher level of sediment mobilisation can be attributed to factors such as exposure to south swells, tidal currents, and sandy sediment, which are more pronounced compared to the average conditions in the Irish Sea.

Typically, the range of values for the Sediment Mobilisation Index (SMI) in the Irish Sea is 0-3 (Coughlan *et al.,* 2021). In the Rosslare Port area, the values are relatively high, ranging between 1.5 and 3. This shows that there is a higher chance of seabed mobilisation in this area. A high SMI value of 4 is evident at the Northern Bank of the River Slaney mouth at the Raven SPA (Figure 8.37).

The southwestern region of the Irish Sea experiences an average spring peak tidal flow of approximately 1 m/s, with areas offshore Carnsore Point exhibiting higher velocities, exceeding 2 m/s (Coughlan *et al.,* 2021). At a local level, intricate flow patterns commonly arise due to complex changes in underwater topography, leading to flow separation. This phenomenon creates temporary eddies and vortices that can trap sediments and form seabed sedimentary structures (Coughlan *et al.,* 2021). The distortion in tidal patterns primarily stems from the propagation of tidal currents into shallower waters. These tidal influences, along with sediment transport induced by waves and the presence of sand in the area, naturally contribute to significant seabed mobility, particularly in sandy regions within the Coastal Processes Study Area outlined in this report.

Limited studies have been conducted in the area to quantify suspended sediment concentrations. One notable study is the Irish Sea Marine Aggregates Initiative (IMAGIN), a collaborative project between Ireland and Wales focused on the sustainable management of marine aggregate resources. Small scale models at approximately 500m resolution were developed within the larger Irish Sea model to investigate specific environmental aspects of marine aggregate extraction with one model developed for the eastern Irish seaboard (Sutton, 2008). Hydrodynamic and sediment transport boundary conditions for both small scale models were provided from the large-scale Irish Sea model domain on an hourly basis; the models predict that the Coastal Processes Study Area exhibits lower suspended sediment concentrations, when compared to other parts of the Irish Sea, typically ranging from 0 to 1 mg/l (Figure 8.38).

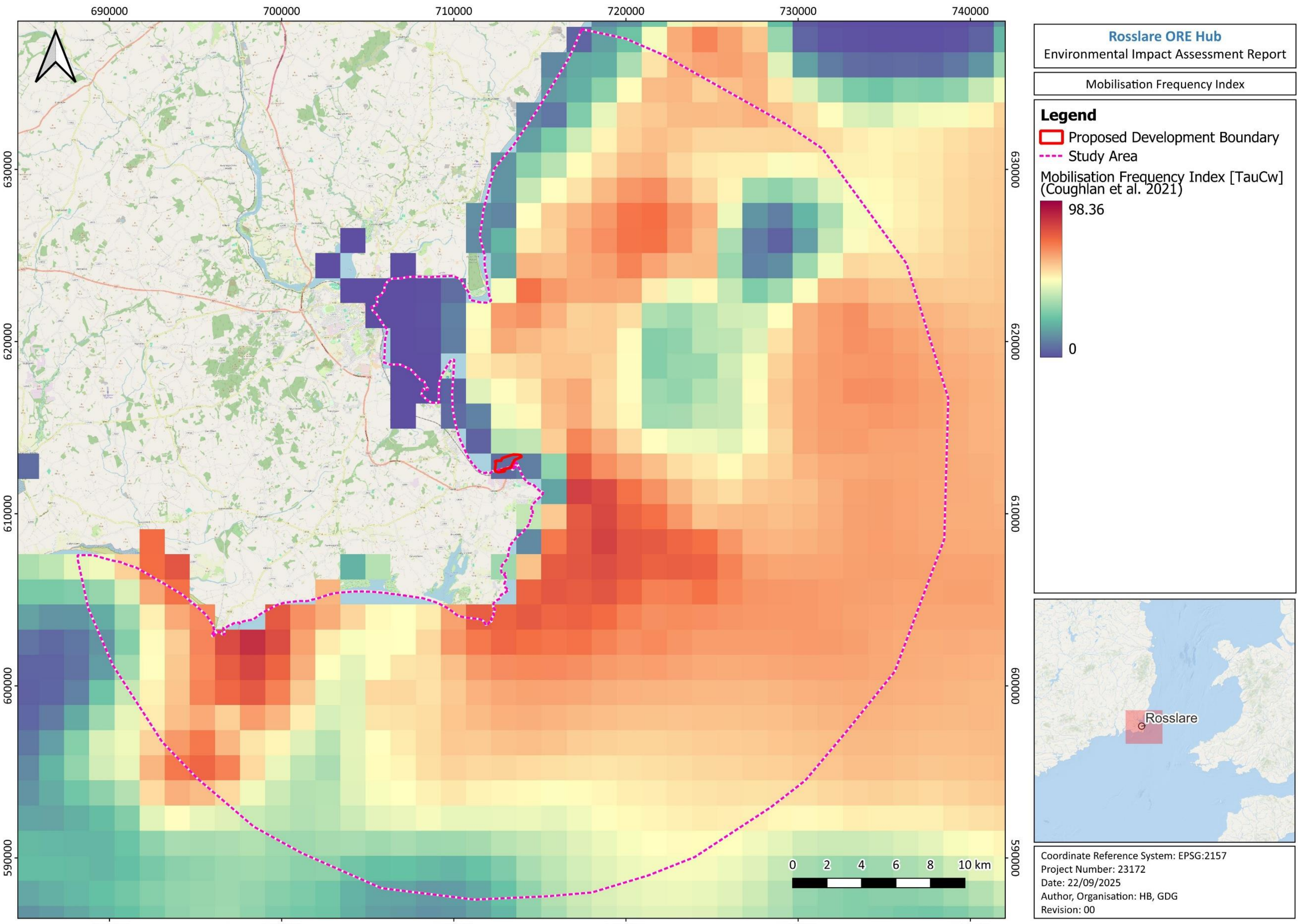


Figure 8.36: Mobilisation Frequency Index (MFI) for the for the Rosslare Port Coastal Processes Study Area (Coughlan *et al.*, 2021)

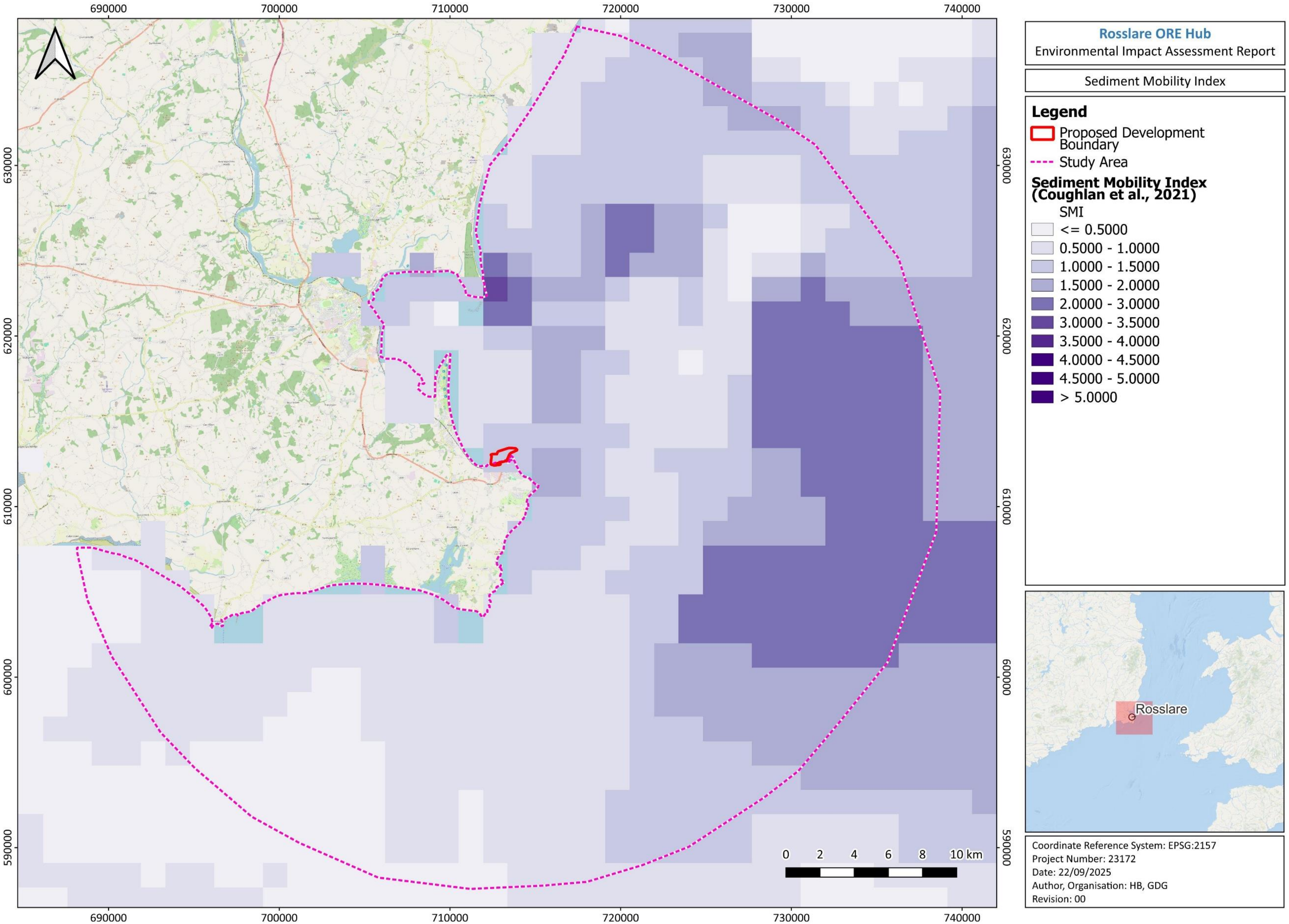


Figure 8.37: Sediment Mobilization Index (SMI) for the for the Rosslare Port Coastal Processes Study Area (Coughlan *et al.*, 2021

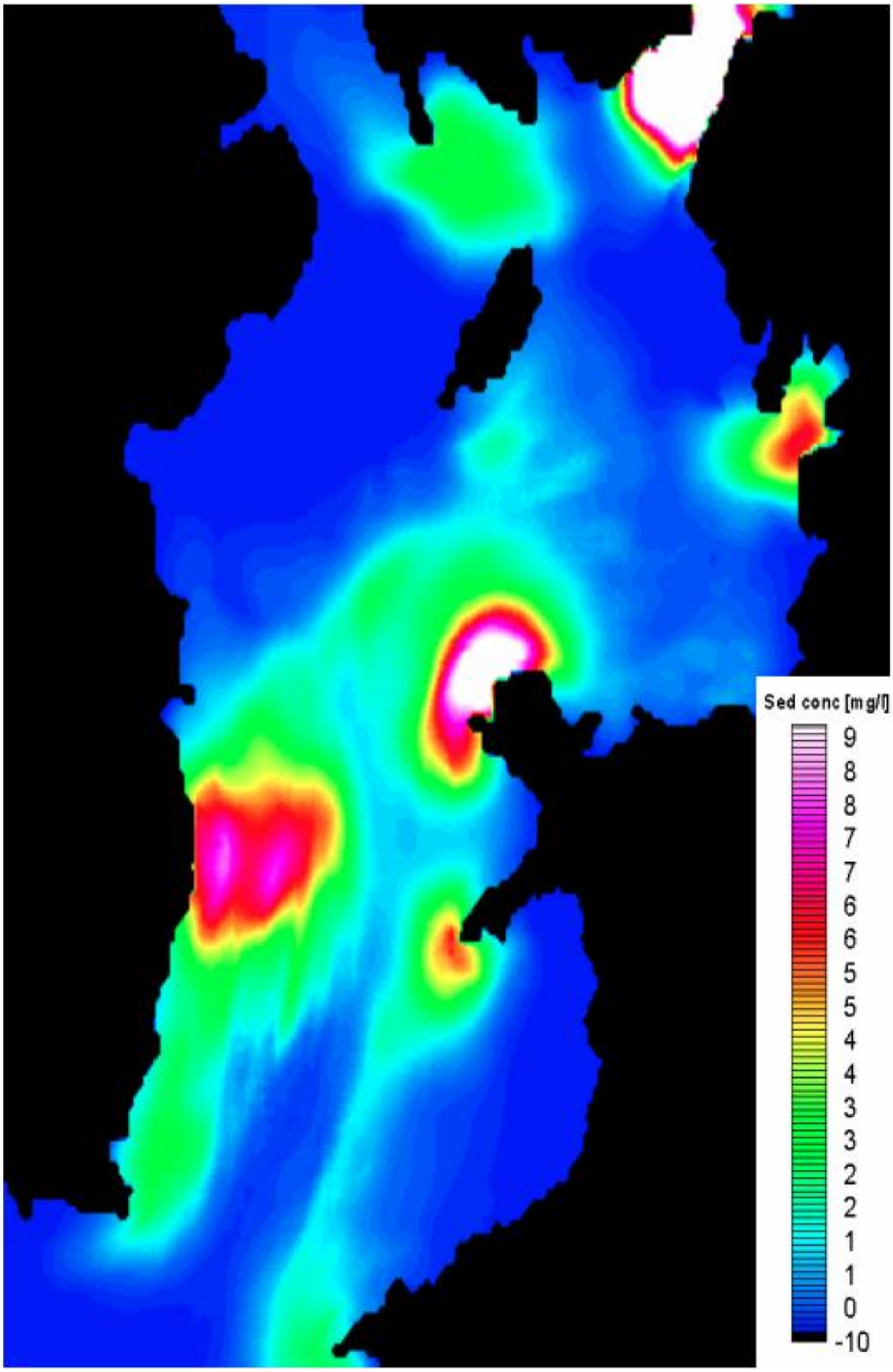


Figure 8.38: IMAGIN modelled suspended sediment concentrations in Irish Sea and Celtic Sea (Sutton, 2008)

As detailed in EIAR Technical Appendix 8: Coastal Processes, project-specific numerical modelling carried out using the MIKE 21 Flow Model Flexible Mesh (FM) developed by DHI was conducted to analyse sediment transport, incorporating the primary flows in the region, including tides, river flow, and waves. Sediment properties were derived from data collected during localised project specific campaigns.

8.3.8 TURBIDITY

Table 8.13 from UK TAG (2014) provides suspended sediment concentration ranking definitions in mg/l for Water Framework Directive assessment of turbidity. For context, Cole *et al*. (1999) report average mean levels of turbidity of 1-110 mg/l around the English and Welsh coasts while Devlin *et al*. (2008) suggest that coastal waters are typically 3-24.1 mg/l, estuarine (or transitional) waters, 8.2-73.8 mg/l and offshore waters 9.3 mg/l. It is therefore assumed that turbidity in the dredge and reclamation areas is typically 'intermediate' (i.e., in the 10-100 mg/l category).

Table 8.13: UK TAG (2014) turbidity/suspended sediment concentration ranking definitions

Water Turbidity	Definition
>300 mg/l	Very turbid
100-300 mg/l	Medium turbidity
10-100 mg/l	Intermediate turbidity
<10 mg/l	Clear

8.4 ASSESSMENT OF EFFECTS

This section identifies the potential environmental impacts on the coastal processes in the Zone of Influence of the Proposed Development during the construction and operational phases of the Proposed Development.

The Coastal Processes Study Area is the Zone of Influence for the assessment.

This section evaluates the significance of effects on coastal processes receptors from the Proposed Development during the construction and operational phases, as well as the "Do-Nothing" scenario. The primary mitigation measures outlined in Section 8.4.2 are considered in the determination of significance of the effects assessed.

The potential interactions between coastal processes and other environmental factors including impacts such as bed level changes and increased suspended sediment concentrations which could result in changes to habitat extent, water quality and impacts on prey availability and prey acquisition on ecological receptors, are assessed within Chapter 9: Water Quality and Flood Risk, Chapter 11: Benthic Ecology, Chapter 12: Fish. Shellfish and Turtle Ecology, Chapter 13: Marine Mammals, Chapter 14: Ornithology and Chapter 15: Commercial Fisheries and Aquaculture and summarised in Chapter 25: Interactions.

8.4.1 “DO-NOTHING” SCENARIO

Should the Proposed Development not be constructed then there would be no changes made to existing coastal processes.

The tidal, wave and sediment transport regimes in the area would continue to follow existing trends as a result of the ‘Do-Nothing’ scenario, with maintenance dredging at the port expected to be required as frequently as is currently experienced.

8.4.2 PRIMARY MITIGATION

Details of primary mitigation incorporated into the design of the Proposed Development (i.e., measures designed to avoid or reduce the environmental impact of the Proposed Development) which are relevant to coastal processes are set out in Chapter 6: Project Description and summarised as follows:

- A balance of volumes between dredging and reclamation was sought to avoid disposal of dredged material to sea and make most efficient beneficial use of the resulting dredge spoil; all dredge material will be used for the reclamation with none disposed of at sea. Disposal of dredge spoil within the reclamation area will be undertaken within bunded lagoons with minimal spillover of fines controlled through the use of a weir box.
- Dredging works are expected to be carried out on a 24 hours per day, 7 days per week, working basis to reduce the overall duration of the works.
- No dredging is required to provide for marine access to the new small boat harbour, as it has been located in sufficiently deep water to avoid the requirement for capital dredging and to minimise future dredging requirements during operation.
- Both Offshore Renewable Energy (ORE) berths have a concrete deck supported on steel piles driven and drilled into the underlying rock strata. The open deck allows for installation of a rock armoured revetment beneath both quay decks that will absorb incoming waves and minimise reflection of waves towards the existing RoRo berths.
- Maintenance dredging of the existing Rosslare Europort will not occur at the same time as capital dredging for the Proposed Development.

8.4.3 TERTIARY MITIGATION

No requirement for tertiary mitigation has been identified.

8.4.4 CONSTRUCTION PHASE

Due to the temporary duration and limited spatial scale of the construction phase activities, impacts on the wave and tidal regime from construction phase activities are not scoped in for assessment.

The following potential construction phase impact has been identified for assessment:

- Changes to water and sediment quality (increase in suspended sediment concentration) from dredging and reclamation area infilling

8.4.4.1 CHANGES TO WATER AND SEDIMENT QUALITY (INCREASE IN SUSPENDED SEDIMENT CONCENTRATION)

As described in detail in Chapter 6: Project Description, dredging and reclamation works are planned to be conducted over three stages. Once the perimeter bunds are constructed using imported rockfill (Stage 1), dredging is expected to proceed from soft overlying sediments to stiffer underlying sediments using a Trailer Suction Hopper Dredger (TSHD) and backhoe dredger or to combine these elements using a Cutter Suction Dredger (CSD) (Stage 2 and 3).

The proposed dredging works have the potential to increase concentrations of suspended solids and cause a reduction in water quality in the vicinity of the proposed works.

The receptors relevant to these potential impacts are the seabed and water column (note potential impacts on ecological receptors including Natura 2000 sites are considered in Chapter 11: Benthic Ecology, Chapter 12: Fish and Turtle Ecology, Chapter 13: Marine Mammals, Chapter 14: Ornithology and Chapter 15: Commercial Fisheries and Aquaculture of this EIAR).

Dredging Dispersion Modelling undertaken to predict changes to suspended sediment concentration is described below and detailed in EIAR Technical Appendix 8. Three stages of dredging and disposal operations were modelled, representing the construction of the outer boundary of the reclamation area, the dredging of the navigation channel, and the disposal of the dredged material into the reclamation area as described in Chapter 6: Project Description.

The modelled stages are:

- Stage 1: The reclamation bund will be constructed within 4 months using imported rockfill, deployed by a construction barge.
- Stage 2: Two months dredging and reclamation by using either a TSHD or a CSD, depending on seabed conditions.
- Stage 3: Eight months dredging and reclamation by backhoe dredger or CSD.

Model set-up allowed for dredging sediment dispersion to be modelled at two locations within the outermost and innermost areas of the dredge area. As the material will not be dumped at sea and instead will be reused to provide infill within the boundary of the reclamation area, disposal sediment dispersion was modelled at the seaward boundary of the northern part of the reclamation area, at the weir box. Figure 8.39 shows the dredging and disposal locations considered for numerical modelling of the 3 stages.

The reclamation area will resemble a lagoon with infilling spoil filling dozed in or spoil pumped into it from one side. As described in Chapter 6: Project Description, the displaced seawater will be allowed to escape via a weir-box that will control the discharge of water from the seaward end of the lagoon. During periods of peak water inflow (such as from pumped discharge from the vessel), the weir-box can be raised to retain dirty water and minimise loss of fines into the open water. Conversely, during low inflow times, the weir can be lowered to release more of the clean water after longer settlement has been allowed to occur. This ensures that the cleanest possible release of water into the sea is permitted.

Note that the dredging and disposal cycles were planned without any temporal gaps between stages, representing a worst-case scenario for sediment dispersal and accumulation.

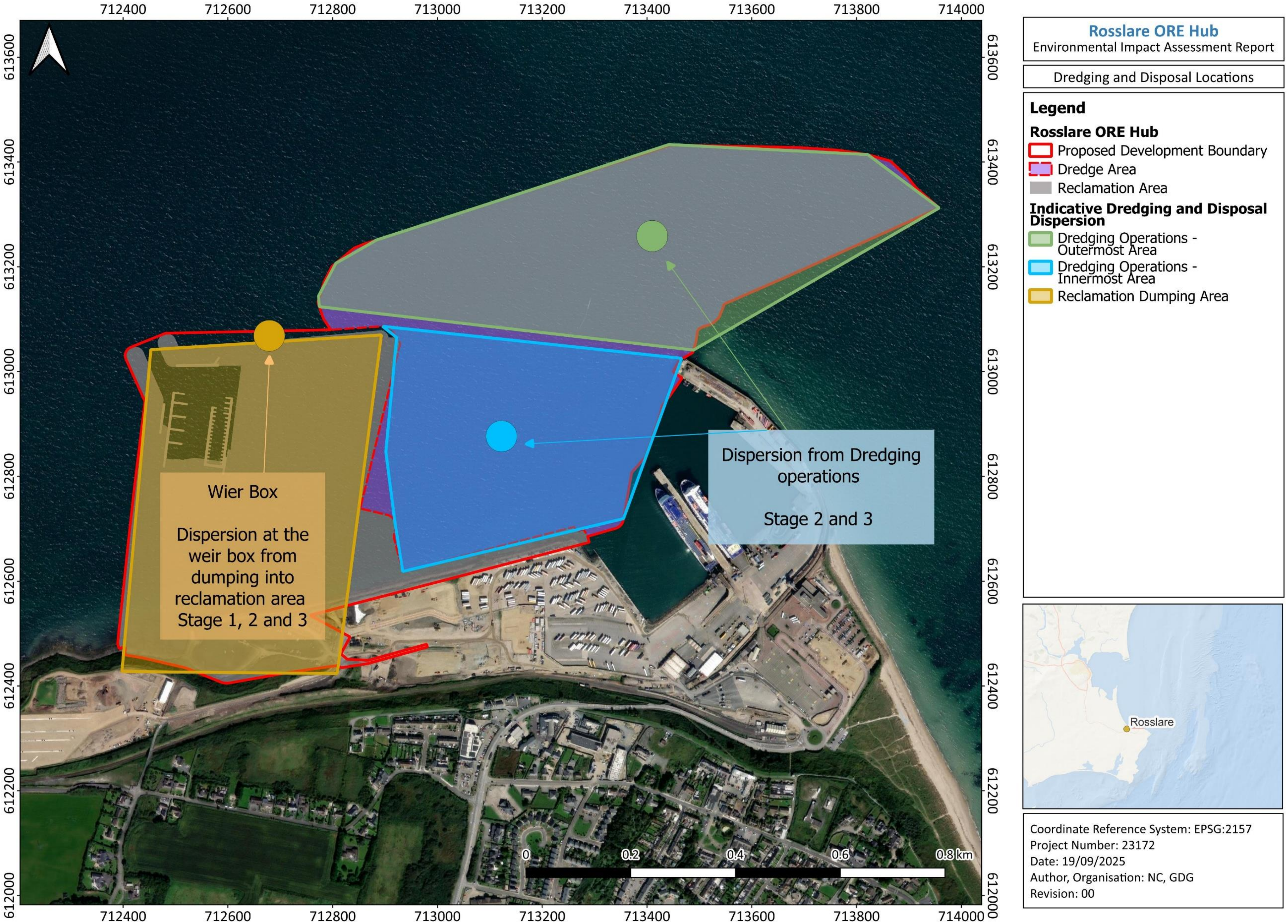


Figure 8.39: Dredging and dumping locations considered for the sediment dispersal

The spill rates associated with disposal in the reclamation area and dredging activities (Stages 2 and 3) considered in the modelling represent the percentage of dredged material that disperses into the wider environment beyond the containment boundaries through the weir box for all disposal activities and at the point of dredging for dredging activities. Table 8.14 outlines the spill rates for both dredging and disposal activities for each stage. These spill rates are based on the dispersal of material into the wider environment and do not represent the rate of material loss from the barge itself. Material characteristics for each stage are provided in Table 8.16, Table 8.17 and Table 8.18.

Perimeter Bund stage accounts for spills from the reclamation area rockfill, Stage 2 involves a 1% spill rate from TSHD, and Stage 3 includes a 3% loss during mechanical dredging.

The spill rate used for modelling disposal of dredged material at the reclamation area which moves through the weir box and disperses into the surrounding environment is also 1%.

Table 8.14: Spilling rates for both dredging and disposal activities at each stage

Stages	Disposal Spilling rate	Dredging Spilling rate
Stage 1 Perimeter Bund	1 %	n/a
Stage 2	1 %	1 %
Stage 3	1 %	3 %

Model results were extracted from eleven (11) locations, including three locations within 200 metres of Rosslare Europort (Points 1, 2, and 3) and three locations 2.0 km seaward (Points 4, 5, and 6). Note the Point 2 represents the weir-box location and overlaps with the Seas Off Wexford cSPA. Results from additional locations were extracted to predict potential impacts on the six closest other Special Protection Areas (SPAs) and Special Areas of Conservation (SPAs and SACs) including the Seas off Wexford cSPA which partially overlaps with the Proposed Development. These additional points represent the closest point of each of these Natura 2000 sites to Rosslare Europort. Table 8.15 provides a list of the results from the extracted points.

Table 8.15: Point locations for the extracted numerical results

Point Number	Name	Easting (m)	Northing (m)
Point 1	Nearshore West	679481	5793210
Point 2	Nearshore Centre/Seas Off Wexford SPA	680981	5793210
Point 3	Nearshore East	682481	5793210
Point 4	Offshore West	679481	5795010

Point Number	Name	Easting (m)	Northing (m)
Point 5	Offshore Centre	680981	5795010
Point 6	Offshore East	682481	5795010
Point 7	Carnsore Point SAC	683241	5791984
Point 8	Wexford Harbour and Slobs SPA	678383	5799453
Point 9	The Raven SPA	680168	5802163
Point 10	Blackwater Bank SAC	687009	5792050
Point 11	Long Bank SAC	683043	5794430

The dredging dispersion model results predict trends in suspended sediment concentration (SSC) and bed thickness changes across the three stages of dredging and disposal at Rosslare Europort. These variations are driven by differences in the duration and intensity of the operations at each stage.

Stage 1 (3-month disposal period):

The SSC reached a maximum of 0.23 mg/L at the nearshore eastern point of Rosslare Harbour, with peak concentrations of 7 mg/L at the weir box at the outer boundary of the reclamation area, which overlaps with the Seas off Wexford cSPA. The SSC values were largely confined to the immediate vicinity of the port, and concentrations decreased significantly to negligible levels beyond Rosehill Bay Beach and Greenore Point. For other SAC and SPA locations, maximum SSC values remained low, with the highest observed at Carnsore Point SAC at 1.45 mg/L. Bed thickness changes during Stage 1 were also limited, with a maximum change of 8 cm near the disposal site and negligible changes (below 0.01 cm) at distances beyond 1 km from the port. The sediment material for Stage 1 is provided in Table 8.16.

Table 8.16: Sediment material considered for Stage 1

Sediment type	Volume (m^3)	Fraction (%)	D50 (mm)
Coarse Silt	200,000	50	0.04675
Fine Sand	200,000	50	0.1875

Stage 2 (2-month dredging and disposal period):

In this stage, the maximum SSC observed near the project site increased to 2.43 mg/L, with peak concentrations of 15 mg/L at the weir box location on the outer boundary of the reclamation area, which overlaps with the Seas off Wexford cSPA. The SSC plume extended slightly further compared to Stage 1, reaching up to 1.5 km west to Rosehill Bay Beach and 2.5 km southeast to Greenore Point. Nevertheless, the SSC values remained minimal beyond these points. Other SACs and SPAs experienced small increases in SSC, with the highest value of 5.16 mg/L observed at Carnsore Point SAC. Bed thickness changes showed an increase, with the largest change of 6 cm near the disposal site which overlaps with the Seas Off Wexford SPA. The sediment material considered for Stage 2 is provided in Table 8.17.

Table 8.17: Sediment Material considered for Stage 2

Sediment type	Volume (m^3)	Fraction (%)	D50 (mm)
Clay	225,500	21	0.00135
Silt	115,500	41	0.02675
Sand	165,000	30	0.535
Gravel	44,000	8	13.5

Stage 3 (8-month dredging and disposal period):

Stage 3, the longest period, produced the highest SSC values, with concentrations reaching 20 mg/L near the weir box location, which overlaps with the Seas off Wexford cSPA. SSC levels remained concentrated in the area around Rosslare Harbour and decreased significantly south of Greenore Point and west of Rosehill Bay Beach, similar to earlier stages. Other SAC and SPA locations experienced slightly elevated SSC levels compared to Stages 1 and 2, with the highest value predicted at these sites for Carnsore Point SAC at 9.96 mg/L. This stage saw a more pronounced dispersion of sediment due to the longer duration of operations generating bed thickness changes that are negligible showing a maximum of only 0.02 cm in the harbour area. The sediment material considered for Stage 3 is provided in Table 8.18.

Table 8.18: Sediment Material considered for Stage 3

Sediment type	Volume (m^3)	Fraction (%)	D50 (mm)
Clay	340,000	40	0.0018
Fine Silt	510,000	60	0.0117

The SSC values increased progressively with each stage, reflecting the longer dredging periods and disposal volumes. However, in all stages, the highest SSC concentrations were confined to the immediate vicinity of Rosslare Harbour and Seas off Wexford cSPA, with minimal impact on other SAC and SPA areas. Stage 3 had the highest overall SSC values due to its extended duration, but the dispersion patterns remained similar to those observed in earlier stages, with significant reductions in concentration beyond key geographical points like Greenore Point, Rosehill Bay Beach and Rosslare Strand Beach.

Bed thickness changes followed a similar pattern, with the largest changes consistently located near the disposal site, while negligible changes occurred beyond the port's influence. Stage 3 resulted in lower bed thickness changes due to its duration and the finer material being dispersed.

SSC values rise progressively with each dredging stage (Stage 1, 2 and 3) but remained highest near the Proposed Development. Stage 3, with a longer duration, showed the highest SSC, however, dispersion consistently decreased past Greenore Point and Rosehill Bay Beach. Bed thickness changes were largest at the weir box and negligible beyond the 1 km of the modelled activities. Given the sediment characteristics of the dredged material and the dredging and disposal areas, numerical modelling indicates that increases in SSC created by the dredging and disposal activities will be highly localised and temporary. Overall, the magnitude of the impact of sediment discharge and dispersal on water and sediment quality from dredging activities is expected to be low within the immediate dredging and disposal area (i.e., at the weir box) and negligible beyond a 1 km radius of the Proposed Development. The seabed and water column have low sensitivity to change, therefore, the changes to water and sediment quality as a result of the dredging and reclamation activities for the Proposed Development are expected to be of slight significance and therefore are not significant in EIA terms.

8.4.5 OPERATIONAL PHASE

The following potential impacts of the operational phase of the Proposed Development:

- Changes to tidal regime due to presence of new port infrastructure
- Changes to wave climate due to presence of new port infrastructure
- Changes to sediment transport due to presence of new port infrastructure

It should be noted that future maintenance dredging will be subject to separate environmental assessment and licencing and as such is not considered further in this part of the assessment.

8.4.5.1 CHANGES TO TIDAL REGIME (DUE TO PRESENCE OF NEW PORT INFRASTRUCTURE)

This assessment considers differences in tidal current speed and direction between the baseline and the operational phase of the Proposed Development (i.e., after the introduction of the Proposed Development infrastructure) and is based on a full two-week spring-neap cycle[4] of simulation (see EIAR Technical Appendix 8: Coastal Processes).

The receptors relevant to this potential impact are coastal and nearshore geomorphology seabed features at the Proposed Development and at Rosslare Strand.

As shown in Figure 8.40, the influence of the Proposed Development on the present current regime is limited to the direct vicinity of the Proposed Development, where the maximum current speed is reduced by 0.4 m/s in some areas with respect to the existing situation.

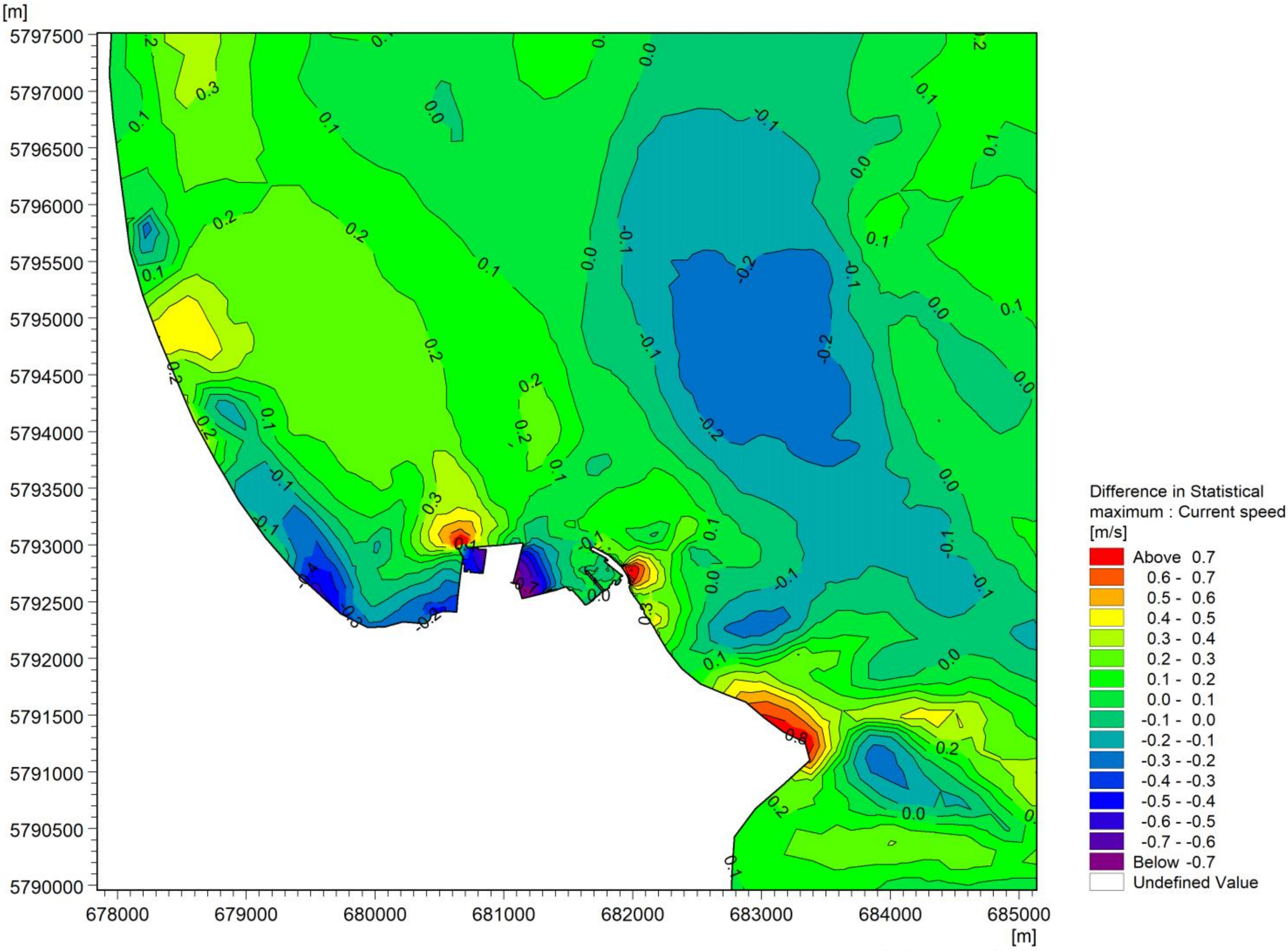


Figure 8.40: Difference in statistical maximum depth- average current speed obtained over a spring-neap cycle between base case and operational case

[4] Spring tides occur twice each lunar month. Seven days after a spring tide, **neap tides** occur. A spring-neap cycle lasts 2 weeks and includes one set of spring tides and one set of neap tides.

The impact of this reduction in maximum current speed is considered to be of medium magnitude within 1 km of the Proposed Development and the seabed features within 1 km of the Proposed Development which comprise the coastal and nearshore geomorphology receptors are considered to be of high sensitivity to this impact, therefore, the changes to tidal regime as a result of the presence of new port infrastructure is expected to be of significant significance and therefore is significant in EIA terms .

The impact of the reduction in maximum current speed is considered to be of negligible magnitude beyond 1 km from the proposed Development Boundary and as such no effects on coastal and nearshore geomorphology receptors, including Rosslare Strand, are anticipated beyond 1 km from the Proposed Development Boundary.

In terms of directionality, the Proposed Development is predicted to result in localised changes to the existing flood tide current flow direction in the Coastal Processes Study Area near the western boundary of the port development (Figure 8.41).

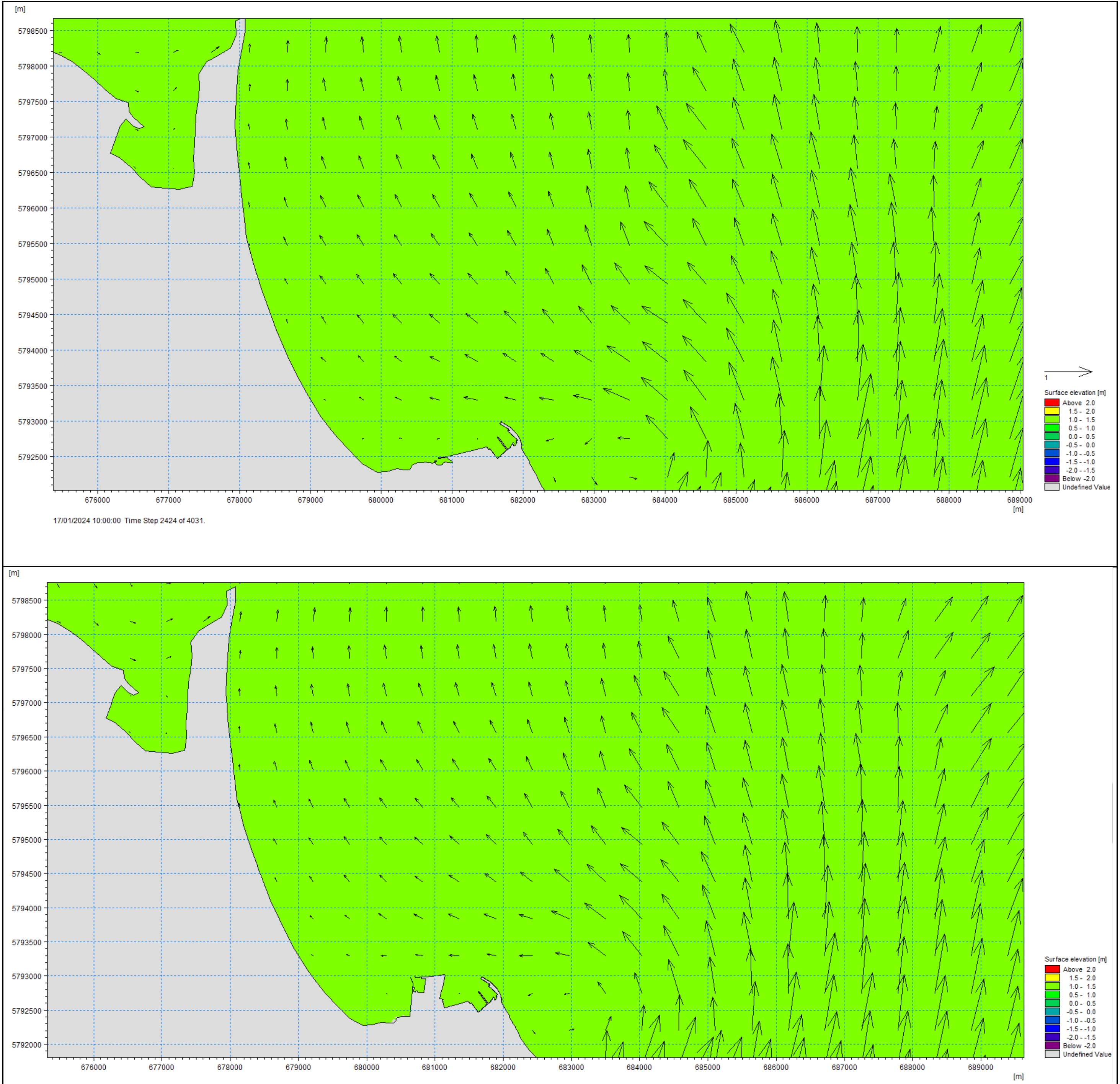


Figure 8.41: Surface elevation and direction modelled during flood tide in 17/1/2024 (Present results on the top and operational phase results on the bottom)

The impact of these changes in tidal current direction is considered to be of low magnitude and the coastal and nearshore geomorphology receptors are considered to be of medium sensitivity to this impact, therefore, the changes to tidal regime as a result of the presence of new port infrastructure is expected to be of slight significance and therefore is not significant in EIA terms.

8.4.5.2 CHANGES TO WAVE CLIMATE (DUE TO PRESENCE OF NEW PORT INFRASTRUCTURE)

The receptors relevant to this potential impact are coastal and nearshore geomorphology at the Proposed Development and at Rosslare Strand.

Two extreme wave events have been simulated to evaluate the potential changes in wave conditions near the Coastal Processes Study Area due to the presence of the proposed port development (note extreme tidal effects have not been considered in this analysis).

1) Extreme 50-yr Return Period (RP) offshore wave coming from the North; wave conditions on northern model boundaries have been considered according to the extreme wave conditions obtained for ERA5 points presented in Table 8.11 (specifically for points A & B). No forcing factors have been considered in the remaining boundaries.
2) Extreme 50-yr RP offshore wave coming from the South; wave conditions on the southern model boundaries have been considered according to the extreme wave conditions obtained for ERA5 points presented in Table 8.11 (specifically for points C & D). No forcings have been considered in the remaining boundaries.

Figure 8.42 and Figure 8.43 present the differences in average significant wave height predicted between the baseline and the operational phase for the extreme conditions described above.

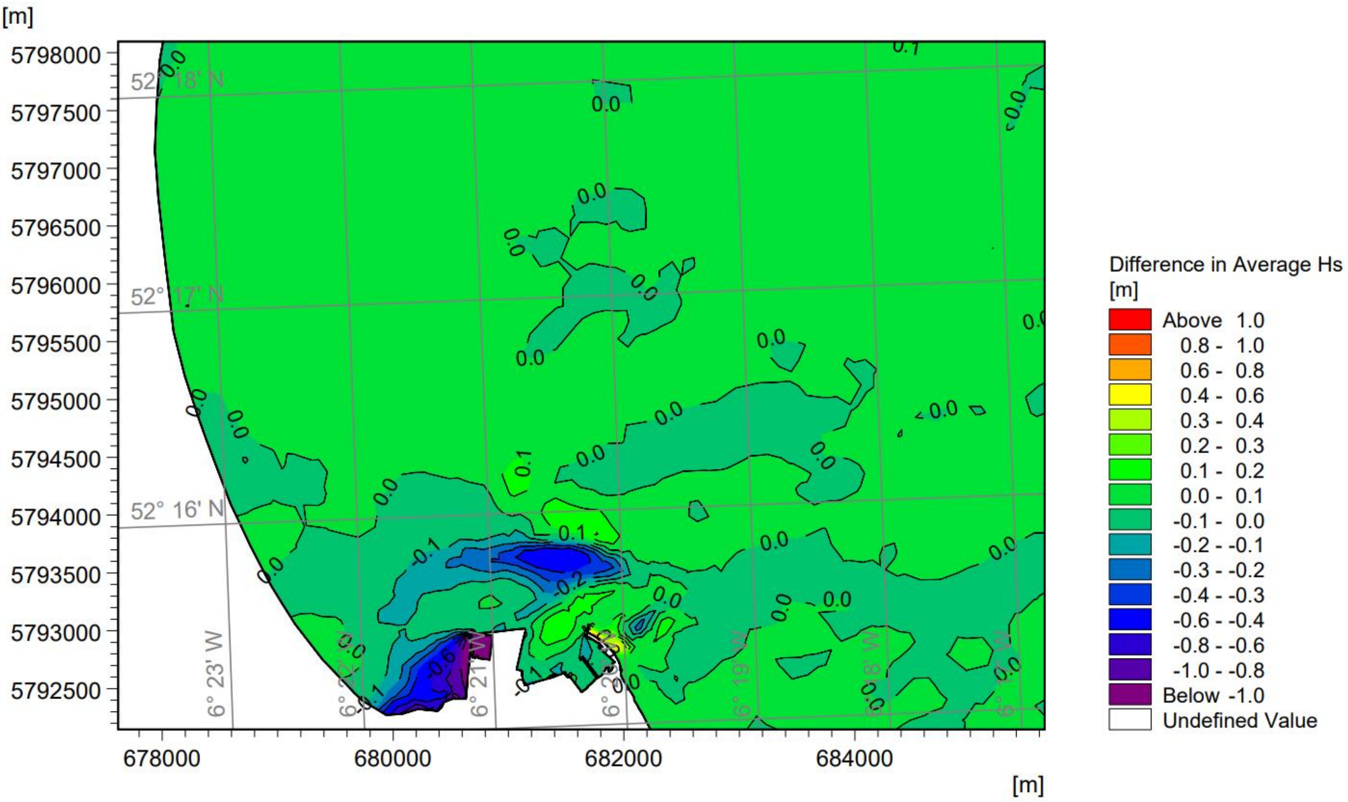


Figure 8.42: Difference in average significant wave height (Hs) between the present scenario and the future scenario considering an extreme incoming wave from the North

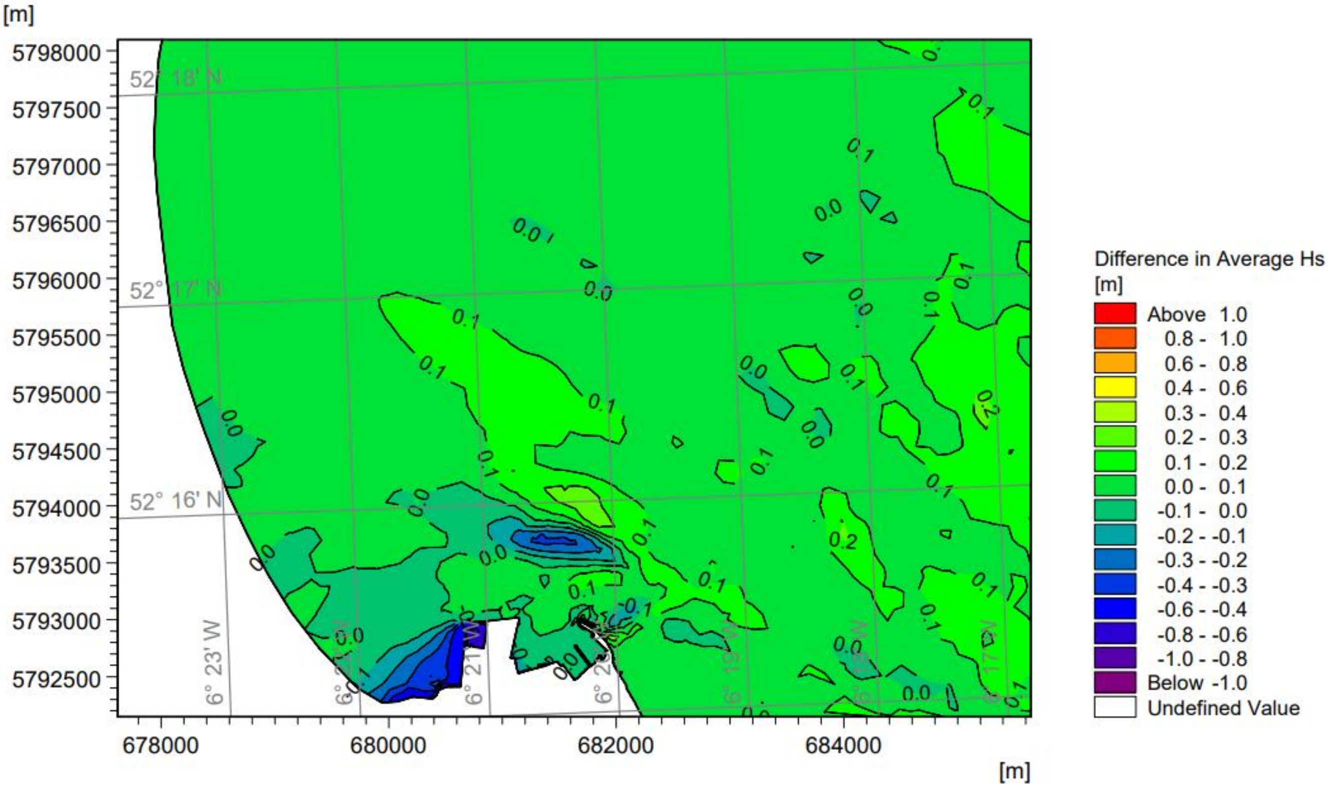


Figure 8.43: Difference in average significant wave height (Hs) between the present scenario and the future scenario considering an extreme incoming wave from the South

As shown in blue in Figure 8.42 and Figure 8.43, changes to the existing wave conditions as a result of the Proposed Development are predicted to be most pronounced near to the Proposed Development in both scenarios modelled. Areas showing a notable difference in significant wave height, such as north of the access channel and west of the proposed port, are predicted to experience a reduction in present wave conditions.

The impact of these predicted changes to wave conditions is considered to be of medium magnitude within 1 km of the Proposed Development and the seabed features within 1 km of the Proposed Development which comprise the coastal and nearshore geomorphology receptors are considered to be of high sensitivity to this impact, therefore, the changes to, to wave conditions as a result of the presence of new port infrastructure is expected to be of significant significance and therefore is significant in EIA terms .

The impact of the predicted changes to wave conditions is considered to be of negligible magnitude beyond 1 km from the proposed Development Boundary and as such no effects on coastal and nearshore geomorphology receptors, including Rosslare Strand, are anticipated beyond 1 km from the Proposed Development Boundary.

8.4.5.3 CHANGES TO SEDIMENT TRANSPORT (DUE TO PRESENCE OF NEW PORT INFRASTRUCTURE)

This assessment considers changes to sediment transport between the baseline and the operational phase of the Proposed Development (i.e., from immediately after the introduction of the Proposed Development infrastructure) and is informed by modelling of seabed level change and suspended sediment concentrations based on one month of hydrodynamic conditions recorded in January 2022 (see EIAR Technical Appendix 8: Coastal Processes).

The receptors relevant to potential impacts associated with changes to sediment transport, including changes to rates of erosion and deposition, are coastal and nearshore geomorphology seabed features at the Proposed Development and at Rosslare Strand.

Maximum Bed Level Change

Table 8.19 and Figure 8.44 show the results of the comparison of maximum bed level change for the baseline and the operational phase of the Proposed Development

In summary:

- The baseline port layout results in greater sediment accumulation at the eastern extremity of the breakwater compared to with the inclusion of the operational phase of the Proposed Development.
- The maximum bed level change for a representative winter month reveals a difference of approximately 2.0 m in sediment accumulation, with the baseline layout showing 3 m of accumulation and the operational phase layout showing 1 m at the eastern breakwater's tip.
- The baseline layout shows a maximum bed level change of about 0.5 m on the western side of the port
- The operational phase layout shows a maximum accumulation of approximately 0.5 m along the south-eastern stretch adjacent to the eastern breakwater.

Note that these represent maximum values throughout the whole month. The sediment transport modelling conducted for this study provides no evidence of changes in sediment accumulation or erosion at Rosslare Strand when comparing the baseline port layout to the operational phase layout.

Table 8.19: Maximum bed level change predicted over 1-month of hydrodynamic modelling using wave and tidal conditions recorded in January 2022

Location	Baseline Layout	Operation Phase Layout	Difference	Increase/Decrease
Eastern Breakwater	3 m	1 m	2 m	Decrease
Western side of Port	0.5 m		0.5 m	Decrease
Adjacent to Eastern breakwater		0.5 m	0.5 m	Increase

Maximum Suspended Sediment Concentration Change

The results of the modelling of maximum SSC for the baseline layout and with the inclusion of the operational phase of the Proposed Development are shown in Figure 8.45. In contrast to the baseline layout, the inclusion of the operational phase of the Proposed Development generates lower suspended sediment concentrations on both the eastern and western sides of the port.

The impact of the predicted changes to sediment transport as a result of the presence of the new port infrastructure is considered to be of low magnitude and the coastal and nearshore geomorphology receptors are considered to be of high sensitivity to this impact, therefore, the changes to sediment transport as a result of the presence of new port infrastructure is expected to be of moderate significance and therefore is not significant in EIA terms.

The modelling results suggest that the presence of the Proposed Development will result in lower maintenance dredging requirements for the Rosslare Port area.

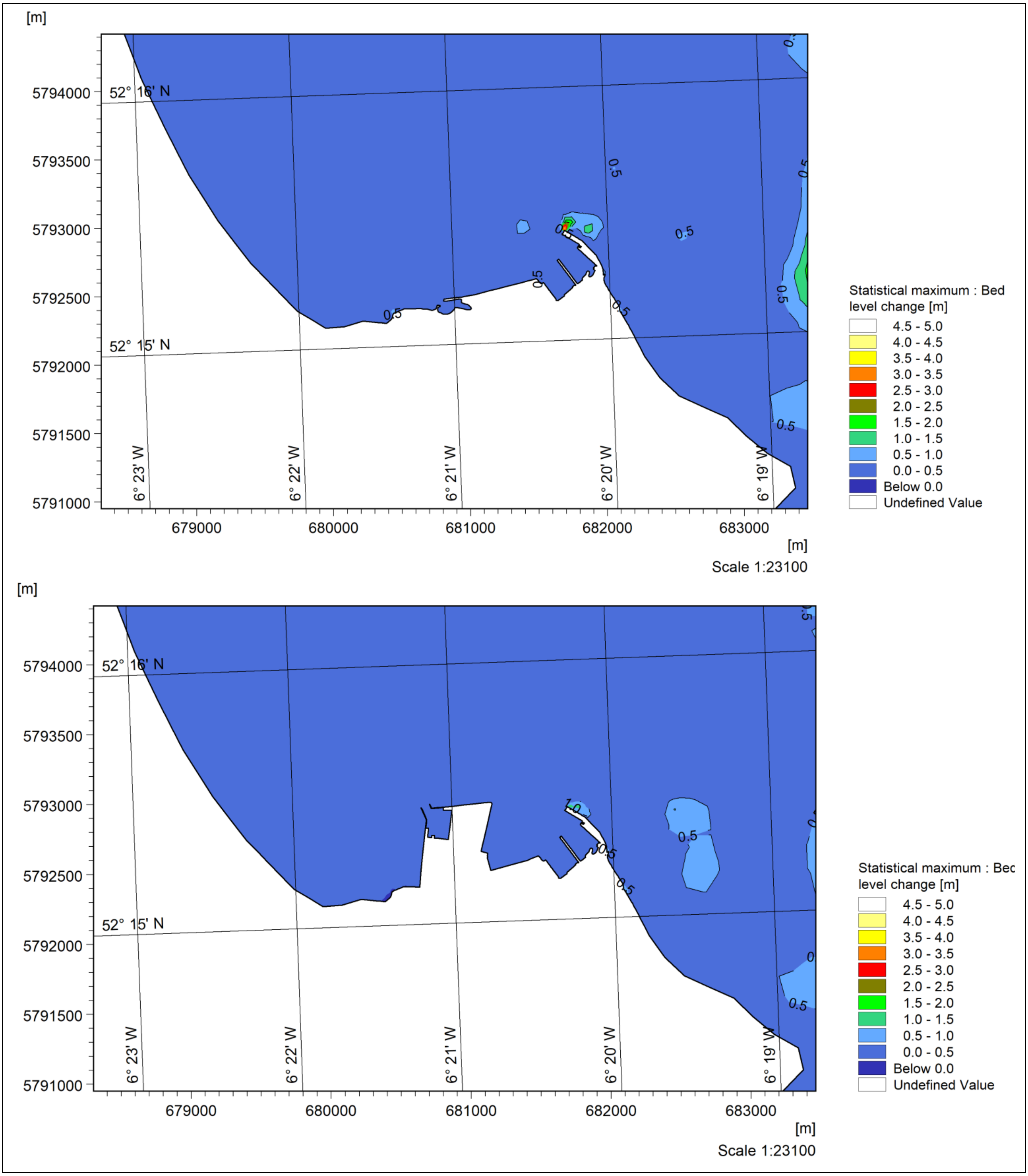


Figure 8.44: Statistical Maximum of Bed Level Change for current port layout (top) and future project layout (bottom)

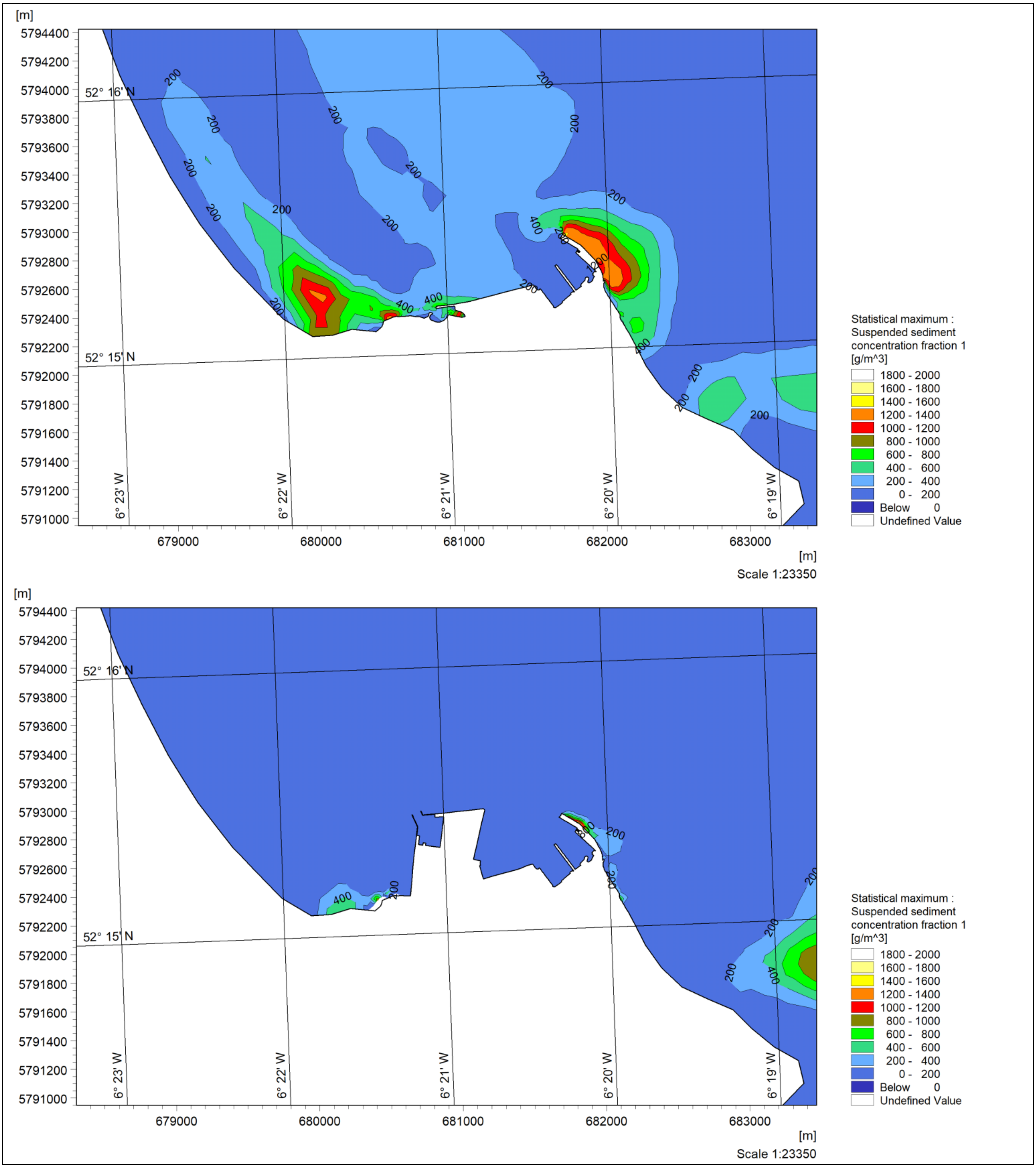


Figure 8.45: Statistical Maximum of Suspended Sediment Concentration (SSC) for current port layout (top) and future project layout (bottom)

8.4.6 CUMULATIVE EFFECTS AND OTHER INTERACTIONS

8.4.6.1 CUMULATIVE EFFECTS

Potential cumulative effects may arise from the Proposed Development when combined with other projects where the zones of influence overlap spatially and/or temporally. In accordance with the EPA Guidelines (2022), projects with the potential for cumulative effects have been identified. These include projects within the Coastal Processes Study Area and those offshore projects which are located a greater distance from the Rosslare Europort. Note for Coastal Processes receptors, given the dynamic nature of these receptors only projects with zones of influence which overlap spatially and temporally have been considered as likely to result in cumulative effects.

For the purpose of Coastal Processes receptors, the following existing and future planned developments were identified as those that may give rise to cumulative effects in conjunction with the Proposed Development:

- Existing projects within Rosslare Europort:
  - Permission for an extension to the existing Berth 3, the replacement of the existing linkspan at Berth 3 with a new linkspan and support structures, and the demolition and removal of the existing Berth 4 linkspan within Rosslare Europort (Planning ref: 20211672)
  - Maintenance dredging at Rosslare Europort and Ballygeary Harbour, Co. Wexford (Planning ref: S0016-02): note Rosslare Europort confirm maintenance dredging of the existing Rosslare Europort will not occur at the same time as capital dredging for the Proposed Development
- Future planned developments which may give rise to cumulative effects in conjunction with the Proposed Development:
  - Rosslare Coastal Erosion and Flood Relief Scheme. The scheme is currently in Stage 1 Options Assessment, Scheme Development and Preliminary Design. Stage 4 Construction is anticipated Q4 2027 to Q1 2029 (https://www.floodinfo.ie/frs/en/rosslare/home/).
  - Coastal works associated with the existing railway line. These are currently under construction & likely to be completed ahead of the construction phase of the Proposed Development (https://www.irishrail.ie/en-ie/about-us/iarnrod-eireann-projects-and-investments/ECRIPP)
  - Future Maintenance Dredging at Rosslare Europort

Based on the review of the identified projects, none of the projects are likely to have a temporal and spatial overlap with the Proposed Development with the exception of the Berth 3 extension and future Maintenance Dredging at Rosslare Europort.

The Berth 3 extension works will not impact coastal processes receptors, therefore there is no pathway for the Berth 3 extension and Proposed Development to lead to cumulative impacts on Coastal Processes receptors.

Future Maintenance Dredging at Rosslare Europort will overlap spatially and temporally with the operational phase of the Proposed Development. Please note while future maintenance dredging plans for Rosslare Europort are not available at the time of making this application, future maintenance dredging plans for Rosslare Europort will be subject to separate environmental assessment and licencing, which will consider cumulative effects with the operational phase of the Proposed Development. The modelling results suggest that the presence of the Proposed Development will result in lower maintenance dredging requirements for the Rosslare Port area.

Potential cumulative effects from the Proposed Development in combination with other projects or plans are therefore considered not likely to result in significant effects to coastal processes receptors in EIA terms.

8.4.6.2 ASSESSMENT OF TRANSBOUNDARY IMPACTS

The Zone of Influence of potential impacts on Coastal Processes receptors does not extend beyond the limits of Ireland’s EEZ. As such, transboundary impacts are not considered possible, and no transboundary effects are anticipated with respect to Coastal Processes as a result of the Proposed Development.

8.5 SECONDARY MITIGATION MEASURES FOR COASTAL PROCESSES

8.5.1 CONSTRUCTION PHASE

8.5.1.1 CHANGES TO WATER AND SEDIMENT QUALITY (INCREASE IN SUSPENDED SEDIMENT CONCENTRATION) FROM DREDGING AND RECLAMATION AREA INFILLING

Dredging and reclamation area infilling may lead to an increase in suspended sediment levels within the water column. Close monitoring of turbidity in real-time using turbidity monitors within Rosslare Europort will be undertaken to identify any increased SSC that arises.

Background suspended sediment concentrations in the vicinity of the Proposed Development are expected to have a UKTAG ‘intermediate turbidity’ ranking (i.e., 10-100 mg/l). According to the MarESA approach, which applies pressure definitions developed by the OSPAR Intercessional Correspondence Group on Cumulative Effects (ICG-C) (OSPAR, 2011) and pressure benchmarks based on Tillin *et al*. (2010) (subsequently revised by Tillin & Tyler-Walters, 2015; 2014a&b) in liaison with UK Statutory Nature Conservation Bodies (SNCBs), a change of UKTAG suspended sediment concentration rank for over a year constitutes a 'pressure' for marine habitats/species. The next UKTAG SSC’s rank up from ‘intermediate’ is ‘medium turbidity’ (100-300 mg/l).

If SSC increases deviate above the maximum medium turbidity level (i.e. ,300 mg/l), the weir box will be raised in steps, to its maximum elevation to control release of suspended sediment. Should this action not be sufficient, a thorough review of construction techniques will be undertaken by the contractor undertaking the works to identify areas for enhancement and prevent recurrence. Steps to prevent recurrence shall include reconfiguring the settlement lagoon/weir box and stopping dredging for periods of time.

8.5.2 OPERATIONAL PHASE MITIGATION MEASURES

8.5.2.1 CHANGES TO TIDAL REGIME, WAVE CLIMATE AND SEDIMENT TRANSPORT DUE TO PRESENCE OF NEW PORT INFRASTRUCTURE.

Where monitoring (see Section 8.8 below) identifies areas of increased accretion or erosion at or above maximum levels predicted by the sediment modelling described in this chapter, the applicant will liaise with Wexford County Council and the OPW to ensure appropriate management measures such as beach recharge/nourishment are put in place to counteract any adverse impacts of accretion or erosion at the Rosslare Bay sediment cell scale.

8.6 RESIDUAL EFFECTS

No significant residual effects in EIA terms are anticipated due to the construction phase of the Proposed Development. The proposed turbidity monitoring and management outlined above will ensure there are no significant residual effects from the construction phase of the Proposed Development.

Potential significant effects in EIA terms are anticipated within 1km of the Proposed Development due to changes in wave climate and tidal regime owing to the presence of new port infrastructure in the operational phase of the Proposed Development. The proposed management of any areas of increased accretion and erosion outlined above mitigates the significance of these potential effects to minor, and therefore there will be no significant residual effects, in EIA terms, from the operational phase of the Proposed Development.

8.7 SUMMARY OF EFFECTS

The assessment described in this chapter has identified that the Proposed Development may result in effects of negligible, minor and moderate significance to Coastal Processes receptors, particularly in the immediate vicinity of the Proposed Development (i.e., within 1 km of the Proposed Development Boundary) related to increased SSC during construction activities (negligible significance) and the operational phase (minor significance) and to reduced tidal current speeds (minor significance) and reduced significant wave heights (moderate significance) during the operational phase.

Close monitoring and management, as needed, of turbidity during construction will ensure no significant effects arise for seabed and water column receptors from changes to water and sediment quality as a result of the proposed dredging and reclamation activities and that there are no significant residual effects from the construction phase of the Proposed Development.

Effects on Rosslare Strand from long-term changes in tidal and wave regimes and sediment transport due to the Proposed Development were assessed to be of minor significance and therefore not significant in EIA terms. Effects on the immediate vicinity of the Proposed Development (i.e. within 1 km of the Proposed Development Boundary) from these changes were assessed to be of moderate significance and therefore significant in EIA terms. Monitoring of changes in bathymetry and coastal topography will inform management, which the applicant will undertake in close liaison with Wexford County Council and the OPW to ensure appropriate management measures are put in place as needed. The proposed monitoring and management measures mitigate the significance of these potential effects to minor, and therefore there will be no significant residual effects, in EIA terms, from the operational phase of the Proposed Development.

No significant cumulative effects with other projects are anticipated in the context of Coastal Processes receptors.

8.8 MONITORING

8.8.1 CONSTRUCTION PHASE

The works contractor will implement monitoring of turbidity in real-time using turbidity monitors within Rosslare Europort to identify any increased SSC that arises and will implement control as stated in section 8.5.1 if the SSC limit of 300mg/l is breached at the monitored locations.

Monitoring will comprise one offshore buoy in a typically up-current location and another buoy in a typically down-current location corresponding to locations to the east of the dredged boundary and the north-west of the dredged boundary to detect increased SSC from dredging activities and release of sediment from the reclamation area through the weir-box. The tide tends to flow east to north-west and vice-versa between flood to ebb. The buoys will be positioned approximately 300m outside the boundary of dredging and outside of regular navigation routes for RoRo vessels and construction plant. The background reading will be read from the up-current monitoring buoy and the assessment of turbidity will be read from the down-current monitoring buoy. Up-current and down-current positions must be swapped between flood and ebb tidal cycles.

This limiting control value of SSC will be correlated with Notional Turbidity Units (NTU) for samples of sediment initially recovered from the site prior to commencement. This allows instantaneous readings to be taken with real-time NTU meters on the monitoring buoys which are matched to suspended sediment values. The buoys will be set to relay real-time events (including trigger values) and warn the contractor of high values of suspended sediment.

8.8.2 OPERATIONAL PHASE

The works contractor will conduct a pre-construction bathymetric survey of the seabed in and surrounding Rosslare Europort and a topographic survey of the beaches immediately to the northwest and southeast of Rosslare Europort to form the baseline for post-construction monitoring.

The applicant will conduct regular post-construction monitoring using bathymetric and topographic surveys of the seabed in Rosslare Europort and the beaches immediately to the northwest and southeast of Rosslare Europort (i.e. within 1 km of the Proposed Development Boundary).

Monitoring will incorporate adaptive management strategies, involving regular reviews and updates to monitoring plans as needed, and results will be shared with Wexford County Council and the OPW.

Table 8.20: Assessment Summary

Potential Effect	Construction/ Operation	Beneficial/ Adverse/ Neutral	Extent (Site/Local/ National/Transboundary)	Short term/Long term	Direct/Indirect	Permanent/ Temporary	Reversible/ Irreversible	Significance of Effect (according to defined criteria)	Proposed mitigation	Residual Effects (according to defined criteria)
Changes to Water and sediment quality (increase in suspended sediment concentration)	Construction	Adverse	Site	Short term	Direct	Temporary	Reversible	Not Significant	If SSC increases deviate above the maximum medium turbidity level (i.e. ,300 mg/l), the weir box will be raised in steps, to its maximum elevation to control release of suspended sediment. Should this action not be sufficient, a thorough review of construction techniques will be undertaken by the contractor undertaking the works to identify areas for enhancement and prevent recurrence.	Not significant
Changes to tidal regime (current speed) due to presence of new port infrastructure	Operation	Adverse	Site	Long term	Direct	Permanent	Reversible	Significant	Where monitoring identifies areas of increased accretion or erosion, the applicant will liaise with Wexford County Council and the OPW to ensure appropriate management	Not significant

Potential Effect	Construction/ Operation	Beneficial/ Adverse/ Neutral	Extent (Site/Local/ National/Transboundary)	Short term/Long term	Direct/Indirect	Permanent/ Temporary	Reversible/ Irreversible	Significance of Effect (according to defined criteria)	Proposed mitigation	Residual Effects (according to defined criteria)
									measures are put in place.	
Changes to tidal regime (current direction) due to presence of new port infrastructure	Operation	Adverse	Site	Long term	Direct	Permanent	Reversible	Not significant	As above	Not significant
Changes to wave climate due to presence of new port infrastructure	Operation	Adverse	Site	Long term	Direct	Permanent	Reversible	Significant	As above	Not significant
Changes to sediment transport due to presence of new port infrastructure	Operation	Adverse	Site	Long term	Direct	Permanent	Reversible	Significant	As above	Not significant

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