ENVIRONMENTAL IMPACT ASSESSMENT REPORT

The Burrow CFERM scheme



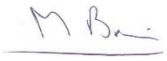
IBE1820
10th June 2024

rpsgroup.com

Document status

Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
D01	Draft for client review	Various	KC	MB	14/08/2023
D02	Draft Final	Various	KC	MB	24/10/2023
D03	Final for issue	Various	KC	MB	10/06/2024

Approval for issue

Malcolm Brian  10th June 2024

The report has been prepared for the exclusive use and benefit of our client and solely for the purpose for which it is provided. Unless otherwise agreed in writing by R P S Group Limited, any of its subsidiaries, or a related entity (collectively 'RPS') no part of this report should be reproduced, distributed or communicated to any third party. RPS does not accept any liability if this report is used for an alternative purpose from which it is intended, nor to any third party in respect of this report. The report does not account for any changes relating to the subject matter of the report, or any legislative or regulatory changes that have occurred since the report was produced and that may affect the report.

The report has been prepared using the information provided to RPS by its client, or others on behalf of its client. To the fullest extent permitted by law, RPS shall not be liable for any loss or damage suffered by the client arising from fraud, misrepresentation, withholding of information material relevant to the report or required by RPS, or other default relating to such information, whether on the client's part or that of the other information sources, unless such fraud, misrepresentation, withholding or such other default is evident to RPS without further enquiry. It is expressly stated that no independent verification of any documents or information supplied by the client or others on behalf of the client has been made. The report shall be used for general information only.

Prepared by:

RPS

Kristopher Calder BSc (Hons) MSc C.Sci MCIWEM C.WEM AMICE
Technical Director - Water Environment and Flood Risk Management

Elmwood House
74 Boucher Road, Belfast
Co. Antrim BT12 6RZ

T +44 2890 667 914
E kristopher.calder@rps.tetratech.com

Prepared for:

Fingal County Council

Kevin Halpenny
Senior Parks & Landscape Officer
Parks & Green Infrastructure Division

Fingal County Council, County Hall, Main Street,
Swords, Co. Dublin, K67 X8Y2

T +353 1 890 5000
E customercareunit@fingal.ie

Contents

ABBREVIATIONS ..... **XVIII**

1 INTRODUCTION **1-1**
1.1 Context 1-1
1.2 Purpose of the EIAR 1-1
1.3 Function of the EIAR 1-2
1.4 The Proposed Development 1-2
1.5 Methodology & Structure of the EIAR 1-3
1.5.1 EIAR Content 1-3
1.5.2 Assessment of Environmental Effects 1-4
1.5.3 Structure of the EIAR 1-8

2 NEED FOR THE PROJECT **2-1**
2.1 Project Rationale 2-1
2.1.1 Introduction 2-1
2.1.2 Feasibility report findings 2-2
2.1.3 Interim Coastal Protection Measures 2-10
2.2 Spatial Planning Policy 2-12
2.2.1 Project Ireland 2040: National Planning Framework 2-12
2.2.2 National Marine Planning Framework 2021 2-12
2.2.3 Fingal Development Plan 2023 – 2029, Interim Publication 2-14
2.2.4 National Adaptation Framework, Planning for a Climate Resilient Ireland 2-16
2.2.5 Flood Risk Management, Climate Change Sectoral Adaptation Plan 2-20
2.2.6 Rogerstown Special Area of Conservation 2-21

3 PROJECT DESCRIPTION **3-1**
3.1 Location of Project and Site Characteristics 3-1
3.2 Proposed Development 3-3
3.2.1 Flood Embankments at Burrow Road & Marsh Lane 3-6
3.2.2 Flood Wall at Marsh Lane 3-7
3.2.3 Fishtail groyne structures 3-7
3.2.4 Beach renourishment 3-8
3.3 Outline Construction Method Statement 3-11
3.3.1 Advance Works 3-11
3.3.2 Construction of Flood Embankments 3-11
3.3.3 Construction of the Flood Wall 3-12
3.3.4 Implementing Back Drainage for Flood Defences 3-13
3.3.5 Construction of Fishtail Groyne Structures 3-13
3.3.6 Beach renourishment campaign 3-14
3.4 Construction Management and Constraints 3-15
3.4.1 Site Compound and Working Areas 3-15
3.4.2 Access Routes for Construction 3-16
3.4.3 Management of Materials and Plant 3-16
3.4.4 Impact on Properties 3-17
3.4.5 Working Within the Estuary 3-17
3.4.6 Other Possible Contracts or Construction Works in the Area 3-17
3.4.7 Phasing and Sequencing and Flood Risk Management Constraints 3-18
3.4.8 Long-Term Operations and Maintenance 3-18
3.4.9 Other Considerations 3-19
3.5 Preliminary Construction Programme 3-20
3.5.1 Traffic Management 3-21
3.5.2 Utility Diversions 3-21
3.5.3 Site Establishment and Clearance 3-21
3.5.4 Flood Wall 3-21

3.5.5 Flood Embankments 3-21
3.5.6 Back Drainage 3-22
3.5.7 Seabee/ Rock Armour Groynes 3-22
3.5.8 Beach Renourishment 3-22
3.5.9 Reinstatement 3-22

4 CONSIDERATION OF ALTERNATIVES 4-1
4.1 Introduction 4-1
4.2 Examination of Strategic Level Alternatives 4-2
4.2.1 Fingal Development Plan 2023 – 2029, Interim Publication 4-2
4.2.2 Hold the Line 4-4
4.2.3 Managed Realignment 4-4
4.2.4 Managed Retreat 4-4
4.3 Examination of Project Level Alternative Options 4-5
4.3.1 Initial appraisal of “Hold the Line” options 4-6
4.3.2 Multi-Criteria Analysis of “Hold the Line” Options 4-15
4.3.3 Alternative “Hold the Line” Option – Rock Armour Revetment 4-19
4.4 Summary of Consideration of Alternative Options 4-21

5 PROJECT SCOPING & CONSULTATION 5-1
5.1 Introduction 5-1
5.1 Screening 5-1
5.2 Scoping 5-2
5.2.1 Scoping Approach 5-2
5.2.2 Scoping Responses 5-2
5.3 Public Consultation 5-9
5.4 Summary 5-9

6 COASTAL PROCESSES 6-1
6.1 Introduction 6-1
6.2 Authority of author 6-1
6.3 Assessment Methodology 6-1
6.3.1 Modelling Methodology 6-1
6.3.2 Coastal Process Modelling Software 6-2
6.3.3 Coastal Process Models and Data Sources 6-3
6.4 Receiving Environment 6-8
6.4.1 Tidal Regime at the Burrow (Baseline scenario) 6-8
6.4.2 Wave Climate at the Burrow (Baseline scenario) 6-11
6.4.3 Sediment Transport at the Burrow (Baseline scenario) 6-14
6.5 Impact Assessment 6-16
6.5.1 Construction Phase Impacts 6-16
6.5.2 Operational Phase Impacts 6-23
6.6 Mitigation Measures 6-35
6.6.1 Construction Phase Mitigation Measures 6-35
6.6.2 Operational Phase Mitigation Measures 6-36
6.6.3 Monitoring 6-36
6.7 Residual Effects 6-38
6.8 Potential Cumulative Impacts 6-39
6.9 Conclusions 6-40

7 NOISE & VIBRATION 7-1
7.1 Introduction 7-1
7.2 Authority of author 7-1
7.3 Assessment Methodology 7-1
7.3.1 Baseline 7-2
7.3.2 Noise and Vibration Guidance 7-2
7.3.3 Consultation 7-5

7.3.4 Assessment Criteria and Assignment of Significance 7-5
7.3.5 Significance of Effects 7-7
7.4 Baseline Environment 7-9
7.4.1 Baseline Noise Monitoring Survey 7-10
7.4.2 Background Vibration Monitoring Survey 7-11
7.4.3 Construction Noise Receptors 7-11
7.5 Description of Likely Significant Effects 7-11
7.5.1 Assessment of Construction Effects 7-11
7.5.2 Assessment of Operational Effects 7-15
7.6 Interactions 7-15
7.7 Mitigation and Monitoring 7-15
7.7.1 Construction Phase Mitigation 7-15
7.7.2 Construction Phase Mitigation Vibration 7-19
7.7.3 Operational Phase Mitigation 7-19
7.8 Potential Cumulative Effects 7-19
7.8.1 Construction Phase 7-19
7.8.2 Operational Phase 7-19
7.9 Residual Impacts 7-19
7.9.1 Construction Phase 7-19
7.9.2 Operational Phase 7-20
7.9.3 Decommissioning Phase 7-20
7.10 Summary of Effects 7-20
7.11 Limitations of Assessment 7-20

8 FLOOD RISK 8-1
8.1 Introduction 8-1
8.2 Authority of author 8-1
8.3 Assessment Methodology 8-1
8.4 Receiving Environment 8-1
8.4.1 Present Day Flood Risk 8-2
8.4.2 Climate Change Flood Risk 8-2
8.4.3 Past Flood Events 8-4
8.4.4 Flood Zones 8-4
8.5 Impact Assessment 8-4
8.5.1 Construction Phase 8-4
8.5.2 Operational Phase 8-4
8.6 Mitigation Measures 8-6
8.6.1 Construction Phase 8-6
8.6.2 Operation Phase 8-6
8.7 Residual Effects 8-6
8.8 Potential Cumulative Impacts 8-7
8.9 Conclusions 8-7

9 WATER QUALITY 9-1
9.1 Introduction 9-1
9.2 Authority of author 9-1
9.3 Assessment Methodology 9-1
9.4 Receiving Environmental 9-4
9.4.1 Project Area Water Bodies 9-4
9.4.2 Nutrient Sensitive Waters 9-13
9.4.3 EPA Water Quality in 2022: An indicators Report 9-15
9.4.4 Water Quality Model Simulations 9-16
9.4.5 Marine Strategy Framework Directive Environmental Status 9-16
9.5 Likelihood of Impacts 9-18
9.5.1 Potential Construction Phase Impacts 9-18
9.5.2 Potential Operational Phase Impacts 9-19

9.6 Description of Likely Significant Impacts 9-19
9.6.1 Construction Phase Impacts 9-19
9.6.2 Operational Phase Impacts 9-21
9.6.3 Impact Matrix (Absence of Mitigation) 9-22
9.7 Mitigation Measures 9-22
9.7.1 Construction Phase Mitigation Measures 9-23
9.7.2 Operational Phase Mitigation Measures 9-25
9.8 Residual Impacts 9-25
9.9 Potential Cumulative Impacts 9-26
9.10 Conclusions 9-26

10 SOILS, GEOLOGY & CONTAMINATION 10-1
10.1 Introduction 10-1
10.2 Authority of author 10-1
10.3 Assessment Methodology 10-1
10.3.1 Relevant Guidance 10-1
10.3.2 Human Health Risk Assessment 10-2
10.3.3 European Union Legislation 10-3
10.3.4 Significance of Effects 10-4
10.3.5 Impact Assessment 10-6
10.4 Receiving Environment 10-7
10.4.1 Solid Geology 10-7
10.4.2 Drift Geology 10-8
10.4.3 Hydrogeology 10-9
10.4.4 Groundwater Vulnerability 10-9
10.4.5 Surface Water 10-10
10.4.6 Summary of Preliminary Risk Assessment 10-11
10.4.7 Ground Investigation 10-12
10.5 Impact Assessment 10-15
10.5.1 Construction Phase 10-15
10.5.2 Operational Phase 10-15
10.5.3 Inter-relationships 10-15
10.6 Mitigation Measures 10-15
10.7 Residual Effects 10-15
10.8 Potential Cumulative Impacts 10-16
10.9 Conclusions 10-16

11 ARCHAEOLOGY & CULTURAL HERITAGE 11-1
11.1 Introduction 11-1
11.2 Authority of author 11-1
11.3 Assessment Methodology 11-1
11.3.1 Desktop Review 11-1
11.3.2 New Intertidal Archaeology Survey 11-3
11.4 Receiving Environment 11-3
11.4.1 Cartographic sources 11-3
11.4.2 Recorded monuments and features 11-8
11.4.3 New intertidal archaeology survey 11-11
11.5 Impact Assessment 11-18
11.6 Mitigation Measures 11-19
11.6.1 Pre-construction Phase Mitigation Measures 11-19
11.6.2 Construction Phase Mitigation Measures 11-20
11.6.3 Operational Phase Mitigation Measures 11-21
11.7 Residual Effects 11-21
11.8 Potential Cumulative Impacts 11-21
11.9 Conclusions 11-21

12 MARINE BIODIVERSITY 12-1
12.1 Authority of author 12-1
12.2 Assessment Methodology 12-1
12.2.1 Magnitude 12-1
12.2.2 Sensitivity, value, or importance 12-2
12.2.3 Significance 12-3
12.3 Receiving Environment 12-4
12.3.1 Intertidal and subtidal benthic habitats 12-4
12.3.2 Fish and shellfish 12-9
12.3.3 Nursery and spawning grounds 12-12
12.3.4 Marine mammals 12-12
12.3.5 Designated sites 12-14
12.3.6 Important Ecological Features (IEFs) 12-15
12.4 Likelihood of Impacts 12-18
12.4.1 Construction phase 12-18
12.4.2 Operational and Maintenance phase 12-19
12.5 Description of Likely Significant Impacts 12-21
12.5.1 Construction 12-21
12.5.2 Operational and Maintenance 12-28
12.5.3 Summary of the assessment of effects 12-30
12.6 Mitigation Measures 12-31
12.7 Residual Impacts 12-31
12.8 Potential Cumulative Impacts 12-31
12.8.1 Construction 12-32
12.9 Conclusions 12-33

13 TERRESTRIAL & COASTAL BIODIVERSITY 13-1
13.1 Introduction 13-1
13.2 Authority of author 13-1
13.3 Assessment Methodology 13-2
13.3.1 Ecological Impact Assessment 13-2
13.3.2 Relevant Guidance and Legislation 13-2
13.3.3 Study Area 13-4
13.3.4 Baseline 13-4
13.3.5 Assessment Criteria and Assignment of Significance 13-6
13.3.6 Habitats Directive Appraisals 13-10
13.4 Baseline Scenario 13-10
13.4.1 Designated Sites and Features of Natural Heritage Importance 13-10
13.4.2 Desk Study 13-13
13.4.3 Annex I Habitats 13-13
13.4.4 Phase 1 Habitat Survey 13-22
13.4.5 Protected Species 13-33
13.4.6 Birds 13-33
13.5 Description of Likely Significant Effects 13-35
13.5.1 Assessment of Construction Phase Effects 13-35
13.5.2 Assessment of Operational Phase Effects 13-64
13.5.3 Assessment of Cumulative Effects 13-68
13.6 Mitigation Measures 13-72
13.6.1 Designated Sites and Features of Natural Heritage Importance 13-72
13.6.2 Habitats 13-74
13.6.3 Birds 13-75
13.7 Summary of Effects & Conclusion 13-76

14 TRAFFIC & TRANSPORTATION 14-1
14.1 Introduction 14-1
14.2 Authority of author 14-1

14.3 Assessment Methodology 14-1
14.3.1 Planning Policy Context and Relevant Guidance 14-1
14.3.2 Study Area 14-1
14.4 Receiving Environment 14-1
14.4.1 Baseline Transport Conditions 14-3
14.4.2 Existing Road Network 14-3
14.5 Impact Assessment 14-4
14.5.1 Construction Phase 14-4
14.5.2 Operational Phase 14-6
14.6 Mitigation Measures 14-6
14.7 Residual Effects 14-6
14.8 Potential Cumulative Impacts 14-7
14.9 Conclusions 14-7

15 AIR QUALITY & CLIMATE 15-1
15.1 Introduction 15-1
15.2 Authority of author 15-2
15.3 Assessment Methodology 15-2
15.3.1 Baseline 15-2
15.3.2 Legislation and Guidance 15-4
15.3.3 Construction Stage Impacts 15-10
15.3.4 Operational Stage Impacts 15-11
15.3.5 Assessment Criteria and Assignment of Significance 15-11
15.3.6 Significance of Effects 15-13
15.4 Receiving Environment 15-14
15.4.1 Air Quality 15-14
15.4.2 Climate 15-17
15.5 Impact Assessment 15-24
15.5.1 Construction Phase 15-24
15.5.2 Operational Phase 15-27
15.5.3 Inter-relationships 15-27
15.6 Mitigation Measures 15-28
15.6.1 Greenhouse Gases 15-29
15.6.2 Climate Change Resilience 15-29
15.6.3 Monitoring 15-29
15.7 Residual Effects 15-29
15.7.1 Construction Phase 15-29
15.7.2 Operational Phase 15-30
15.8 Potential Cumulative Impacts 15-30
15.9 Conclusions 15-30

16 WASTE MANAGEMENT 16-1
16.1 Introduction 16-1
16.2 Authority of author 16-1
16.3 Assessment Methodology 16-1
16.3.1 Assessment Criteria and Assignment of Significance 16-1
16.3.2 Legislation and Guidance 16-4
16.4 Receiving Environmental 16-10
16.4.1 Current Operational Overview 16-10
16.4.2 Characteristics of Current Wastes 16-10
16.4.3 Current Method of Management/ Receiving Environment 16-10
16.5 Impact Assessment 16-16
16.5.1 Construction Phase Impacts 16-17
16.5.2 Operational Phase Impacts 16-22
16.6 Mitigation Measures 16-22
16.6.1 Construction Phase Mitigation Measures 16-22

16.6.2 Operational Phase Mitigation Measures 16-26
16.7 Residual Effects 16-26
16.8 Potential Cumulative Impacts 16-28
16.9 Conclusions 16-29

17 MATERIAL ASSETS & LAND USE 17-1
17.1 Introduction 17-1
17.2 Authority of author 17-1
17.3 Assessment Methodology 17-2
17.3.1 Baseline 17-2
17.3.2 Relevant Guidance 17-2
17.3.3 Assessment Criteria and Assignment of Significance 17-3
17.3.4 Significance of Effects 17-4
17.4 Receiving Environment 17-5
17.4.1 Overview 17-5
17.4.2 Existing Land Use 17-5
17.4.3 Adjoining Land Use 17-6
17.4.4 Land with Development Potential 17-7
17.4.5 Material Assets 17-8
17.5 Impact Assessment 17-9
17.5.1 Construction Phase 17-9
17.5.2 Operational Phase 17-11
17.6 Mitigation Measures 17-12
17.6.1 Construction 17-12
17.6.2 Adjoining Land Uses 17-12
17.6.3 Operation 17-12
17.7 Residual Effects 17-12
17.8 Potential Cumulative Impacts 17-12
17.9 Conclusions 17-13

18 LANDSCAPE & VISUAL 18-1
18.1 Introduction 18-1
18.2 Authority of author 18-1
18.3 Assessment Methodology 18-1
18.3.1 General Approach 18-1
18.3.2 Identifying Effects 18-2
18.3.3 Study Area 18-2
18.3.4 Assessment Criteria 18-2
18.3.5 Landscape Impact Assessment 18-3
18.3.6 Landscape Sensitivity 18-3
18.3.7 Magnitude of Landscape Impacts 18-5
18.3.8 Visual Impact Assessment 18-6
18.3.9 Photographs, Photomontages and Zone of Theoretical Visibility (ZTV) 18-8
18.3.10 Magnitude of Visual Impacts 18-8
18.3.11 Significance of Effects 18-9
18.3.12 Cumulative Landscape & Visual Effects 18-11
18.4 Receiving Environment 18-12
18.4.1 General Overview 18-12
18.4.2 Landscape Character Assessment Fingal County Development Plan 2023 – 2029 18-12
18.4.3 Landscape Policies Fingal County Development Plan 2023 – 2029 18-13
18.4.4 Landscape Designations Fingal County Development Plan 2023 – 2029 18-14
18.5 Proposed Development 18-14
18.6 Landscape Impacts 18-15
18.6.1 Landscape Character Type Impacts 18-15
18.6.2 Landscape Designation Impacts 18-20
18.7 Visual Impacts 18-21

18.7.1 Protected Views 18-28
18.7.2 Visual Impacts on Residential Properties 18-28
18.7.3 Significance of Landscape & Visual Effects 18-29
18.8 Remedial & Mitigation Measures 18-31
18.9 Residual Effects 18-31

19 POPULATION AND HUMAN HEALTH 19-1
19.1 Introduction 19-1
19.2 Authority of author 19-1
19.3 Assessment Methodology 19-1
19.3.1 Relevant policy and guidance 19-1
19.3.2 Approach 19-3
19.3.3 Study Area 19-5
19.3.4 Assessment criteria and assignment of significance 19-6
19.3.5 Limitations to the assessment 19-11
19.4 Receiving Environment 19-11
19.4.1 Existing baseline conditions 19-11
19.4.2 Future baseline conditions 19-12
19.5 Description of Likely Significant Effects 19-12
19.5.1 Construction phase 19-12
19.5.2 Operation phase 19-16
19.6 Mitigation Measures 19-17
19.7 Residual Effects 19-17
19.8 Potential Cumulative Impacts 19-17
19.9 Conclusions 19-17

20 MAJOR ACCIDENTS & DISASTERS 20-1
20.1 Introduction 20-1
20.2 Authority of Author 20-1
20.3 Assessment Methodology 20-1
20.3.1 Key Definitions 20-1
20.3.2 Guidance and Legislation 20-2
20.3.3 Study Area 20-3
20.3.4 Receptor Identification 20-4
20.3.5 Risk Assessment Methodology 20-5
20.4 Receiving Environment 20-8
20.5 COMAH Establishments 20-8
20.6 Natural Events 20-9
20.6.1 Introduction 20-9
20.6.2 Earthquakes 20-9
20.6.3 Lightning Strikes 20-11
20.6.4 Flooding 20-12
20.6.5 Extreme Weather Events 20-12
20.6.6 Summary 20-14
20.7 Potential Effects 20-15
20.7.1 Do-Nothing Scenario 20-15
20.7.2 Construction Phase 20-15
20.7.3 Operation Phase 20-15
20.7.4 Risk Assessment 20-16
20.8 Mitigation Measures 20-27
20.9 Residual Effects 20-27
20.10 Potential Cumulative Impacts 20-27
20.11 Conclusions 20-27

21 CUMULATIVE EFFECTS 21-1
21.1 Introduction 21-1

21.1.1 Cumulative Effects 21-1
21.2 Assessment Methodology 21-2
21.3 Proposed Flood Relief Scheme at Rush 21-3
21.4 Assessment of Likely Significant Effects 21-4
21.4.1 Environmental Interactions between the Proposed Development and other Projects 21-4
21.4.2 Environmental Interactions within the Proposed Development 21-4

22 SUMMARY OF MITIGATION MEASURES 22-1

23 CONCLUSIONS 23-1
23.1 Need for the Proposed Development 23-1
23.2 Summary of Environmental Impacts 23-2
23.2.1 Coastal Processes 23-2
23.2.2 Noise & Vibration 23-2
23.2.3 Flood Risk 23-2
23.2.4 Water Quality 23-2
23.2.5 Soils & Geology 23-2
23.2.6 Cultural Heritage and Marine Archaeology 23-2
23.2.7 Marine Biodiversity 23-3
23.2.8 Terrestrial and Coastal Biodiversity 23-3
23.2.9 Traffic and Transportation 23-3
23.2.10 Air Quality and Climate 23-3
23.2.11 Waste Management 23-4
23.2.12 Material Assets 23-4
23.2.13 Landscape & Visual 23-4
23.2.14 Population & Human Health 23-4
23.2.15 Major Accidents & Disasters 23-5

24 BIBLIOGRAPHY & REFERENCES 24-1
Chapter 1 – Introduction 24-1
Chapter 2 – Need for the Project 24-1
Chapter 3 – Project Description 24-1
Chapter 4 – Consideration of Alternatives 24-1
Chapter 5 – Project Scoping & Consultation 24-2
Chapter 6 – Coastal Processes 24-2
Chapter 7 – Noise & Vibration 24-2
Chapter 8 – Flood Risk 24-3
Chapter 9 – Water Quality 24-3
Chapter 10 – Soils, Geology and Contamination 24-4
Chapter 11 – Archaeology 24-5
Chapter 12 – Marine Biodiversity 24-5
Chapter 13 – Terrestrial and Coastal Biodiversity 24-9
Chapter 14 – Traffic and Transportation 24-9
Chapter 15 – Air Quality & Climate 24-9
Chapter 16 – Waste Management 24-10
Chapter 17 – Material Assets and Land Use 24-10
Chapter 18 – Landscape and Visual 24-10
Chapter 19 – Population & Human Health 24-10
Chapter 20 – Major Accidents & Disasters 24-11

Tables

Table 1.1: Description of Effects 1-5
Table 1.2 EIAR Chapter Structure Breakdown 1-10
Table 1.3 List of Contributors to EIAR Chapters 1-11
Table 2.1: Summary of economic appraisal results for various erosion and flooding threshold scenarios with sensitivity analysis of upper and lower property price estimates (JCA, 2024) 2-6
Table 2.2: Summary of observed and projected climate changes and impacts for Ireland (NAF *Planning for a Climate Resilient Ireland*, 2018) 2-18
Table 3.1: Detailed drawings for the Proposed Development at the Burrow available in Appendix 3A. 3-6
Table 3.2: Summary of the extent, footprint and construction volumes for the flood embankments at Burrow Road and Marsh Lane. 3-7
Table 4.1: Coastal Flood and Erosion Risk Management objectives and global weightings 4-17
Table 4.2: Multi-Criteria Analysis (MCA) of the Coastal Flooding and Erosion Risk Management options for the Burrow 4-18
Table 5.1 Topics initially proposed to be scoped out during the scoping process. 5-4
Table 5.2 Summary of comments and actions required from An Bord Pleanála Scoping Opinion. 5-6
Table 5.3: A summary of the submissions received during the consultation period, relevant to the Proposed Development. 5-10
Table 6.1: 1 in 200-year offshore wave climate data used to simulate the inshore wave climate. 6-11
Table 6.2: Distribution of sediment fractions that characterise the proposed beach renourishment material. 6-18
Table 6.3: Beach renourishment simulation input parameters. 6-19
Table 7.1: Threshold of Potential Significant Effect at Nearest Sensitive Receptors. 7-3
Table 7.2: Guidance on effects of vibration levels. 7-4
Table 7.3: Transient vibration guide values for cosmetic damage. 7-5
Table 7.4: Receptor Sensitivity (Ref: TAN Assessment of Noise). 7-6
Table 7.5: Matrix for Determining Significance of Effect for Receptors of High Sensitivity. 7-7
Table 7.6: Magnitude of Impact: Construction Noise Daytime (Ref: BS 5228 Part 1). 7-8
Table 7.7: Magnitude of Impact: Construction Noise Night-time (Ref: BS 5228 Part 1). 7-8
Table 7.8: Matrix Used for the Assessment of the Significance of the Effect. 7-9
Table 7.9 Summary of Baseline Noise Monitoring Survey. 7-10
Table 7.10: Construction Plant Noise Levels (REF: BS 5228:2009+A1:2014). 7-14
Table 9.1: Criteria for Rating Receptor Sensitivity (NRA, 2008). 9-2
Table 9.2: Criteria for Rating the Magnitude of Impact (NRA, 2008). 9-2
Table 9.3: Criteria for Rating the Significance of Environmental Impacts (NRA 2008). 9-3
Table 9.4: Defining Impact Significance (NRA, 2008). 9-3
Table 9.5: WFD Status (2007-2021). 9-8
Table 9.6: WFD Status Breakdown (2016-2021). 9-9
Table 9.7: Annual Assessment Criteria for Bathing Waters. 9-10
Table 9.8: Status of Individual Samples during the 2022 Monitoring Season. 9-12
Table 9.9 Potential Impact Rating Matrix (in the absence of mitigation). 9-22
Table 9.10 Residual Impacts (with mitigation). 9-26
Table 10.1: Sensitivity of Receptor. 10-4
Table 10.2: Criteria to Determine the Magnitude of Effect. 10-6
Table 10.3: Assessment of Significance Matrix. 10-7
Table 10.4: Summary of Likely Environmental Effects on Soils and Geology. 10-16
Table 11.1: Principal sources to inform known Marine Archaeology 11-1
Table 11.2: Recorded archaeological sites and features within and in proximity to the development area. 11-9
Table 11.3: Features of archaeological interest recorded within and in proximity to the development area. 11-17
Table 12.1: Impact Magnitude Criteria. 12-2
Table 12.2: Definition of terms relating to the sensitivity of the receptor (CIEEM, 2018). 12-3
Table 12.3: Assessment of Significance (CIEEM, 2018). 12-3

Table 12.4: Desktop sources which have informed habitat types for the Burrow. 12-4
Table 12.5: Intertidal species & habitats identified in the proximity of the Burrow from desktop data sources. 12-5
Table 12.6: Benthic habitat types present within the vicinity of the Proposed Development. 12-8
Table 12.7: Desktop sources which have informed fish and shellfish ecology within the vicinity of the Proposed Development. 12-9
Table 12.8: Desktop sources which have informed marine mammal presence within the vicinity of the Proposed Development. 12-12
Table 12.9: Marine mammals potentially present within the vicinity of the Proposed Development. 12-14
Table 12.10: Defining criteria for Important Ecological Features (IEFs). 12-16
Table 12.11: IEF benthic habitats within the vicinity of Proposed Development area. 12-17
Table 12.12: IEF fish, shellfish, and marine mammals within the vicinity of Proposed Development area. 12-18
Table 12.13: Summary of assessed impacts. 12-20
Table 12.14: Sensitivity of benthic habitats to abrasion/ disturbance of the substrate, and to sedimentation. 12-22
Table 12.15: Sensitivity of benthic habitats to physical change to another seabed type. 12-24
Table 12.16: Summary of the assessment of effects. 12-30
Table 12.17: Scoping justifications for CEA (where B = benthic, FSF = fish and shellfish, MM = marine mammals). 12-31
Table 13.1: Ecological Valuation Criteria for Ecological Features. 13-7
Table 13.2: Magnitudes of Effect upon Ecological Features. 13-9
Table 13.3: Designated Sites & Features of Natural Heritage Importance. 13-12
Table 13.4: Construction Phase Impacts to Rogerstown Estuary Qualifying Annex I Habitats. 13-36
Table 13.5: Comparison of Bird Survey Results Within the Working Area, Study Area and Rogerstown Estuary SPA 13-48
Table 13.6: TTS- and PTS-onset thresholds for marine mammals exposed to non-impulsive noise. 13-52
Table 13.7: Recorded Numbers of SCI tern species associated with the Rockabill SPA. 13-56
Table 13.8: Cumulative Losses (temporary and permanent) to Annex I Habitat within Rogerstown Estuary SAC. 13-70
Table 13.9: Summary Table of Likely Environmental Effects on Natural Heritage and Biodiversity Pre and Post Mitigation. 13-78
Table 14.1: ATC Traffic Count Data - Two-way Traffic Flows (5-day average). 14-3
Table 14.2: Proposed Traffic Flows During Construction - Two-way Traffic Flows (5-day average). 14-6
Table 15.1: Observed changes in Irelands Climate (from NAF). 15-4
Table 15.2: Limits specified in Air Quality Standards Regulations 2011 (S.I. 180 of 2011). 15-5
Table 15.3: WHO 2005 Air Quality Guidelines. 15-6
Table 15.4: Pollutants Measured in 2020 and their Adherence to EU Legal Limit Values and WHO Air Quality Guideline Values. 15-7
Table 15.5: Definitions of Sensitivity or Value. 15-12
Table 15.6: Definitions of Magnitude. 15-12
Table 15.7: Total Rainfall data in mm for Dublin Airport. 15-23
Table 15.8: Mean temperature in degrees Celsius for Dublin Airport. 15-23
Table 15.9: TII Assessment Criteria for the Impact of Dust Emissions from Construction Activities (with standard mitigation in place). 15-24
Table 16.1: Importance or Sensitivity Matrix Definitions. 16-2
Table 16.2: Magnitude of Impact Definitions. 16-3
Table 16.3: Assessment of Significance Matrix. 16-3
Table 16.4: Overall Significance of Effect. 16-4
Table 16.5: Licenced Soil Recovery Facility Capacities in the EMR 2018. 16-11
Table 16.6: Inert Landfill Capacities in the EMR 2018[32]. 16-11
Table 16.7: Permitted Soil Recovery Facility Capacities in the EMR 2018[32]. 16-11
Table 16.8: Registered Soil Recovery Facility Capacities in the EMR 2018[32]. 16-11
Table 16.9: Soil Recovery Facilities in Ireland 2021. 16-12
Table 16.10: Operational facilities accepting inert waste in Ireland. 16-14
Table 16.11: Operational Municipal Waste Landfills in Ireland. 16-15

Table 16.12 Phases where waste will likely arise. 16-16
Table 16.13: Volume of material required to be excavated and imported for the flood embankments at Burrow Road and Marsh Lane. 16-18
Table 16.14: Enabling Works Impact Assessment Summary. 16-18
Table 16.15: Applicable List of Waste (LoW) Summary. 16-19
Table 16.16: Potential materials management during the Construction Phase. 16-20
Table 16.17: Construction Phase Impact Assessment Summary. 16-21
Table 16.18: Operational Phase Impact Assessment Summary. 16-22
Table 16.19: Summary of Impacts 16-27
Table 16.20: Potential interactions between the Proposed Development and other proposed projects. .. 16-28
Table 17.1: Example Definitions of Sensitivity or Value. 17-3
Table 17.2: Example Definitions of Magnitude. 17-3
Table 17.3: Assessment of Significance for land use and material assets. 17-4
Table 17.4: Assessment of Significance Matrix. 17-4
Table 17.5: Summary of Likely Environmental Effects on Land Use and Material Assets. 17-13
Table 18.1 Landscape Sensitivity 18-5
Table 18.2 Magnitude of Landscape Impact 18-6
Table 18.3: Visual Resource Sensitivity 18-7
Table 18.4 Magnitude of Visual Impact 18-9
Table 18.5: Significance of Effect Criteria 18-10
Table 18.6: Significance of Effects Matrix 18-11
Table 18.7: Estuary Landscape Character Type; Predicted Impacts 18-16
Table 18.8: Coastal Landscape Character Type; Predicted Impacts 18-18
Table 18.9: Areas of High Amenity; Predicted Impacts 18-20
Table 18.10: Landscape Impacts; Predicted Impacts 18-21
Table 18.11: Viewpoint 1 – Burrow Road 18-21
Table 18.12: Viewpoint 2 – R126 (Quay Road) 18-23
Table 18.13: Viewpoint 3 – Rush Beach 18-24
Table 18.14: Viewpoint 4 – Burrow Road 18-26
Table 18.15: Viewpoint 5 – Marsh Lane 18-27
Table 18.16 Significance of Landscape Character Effects 18-30
Table 18.17 Significance of Landscape & Visual Effects on Planning Policy Designations 18-30
Table 18.18 Summary of Viewpoint Assessment 18-30
Table 18.19 Significance of Visual Effects on Residential Properties 18-31
Table 19.1: Source-pathway-receptor model 19-4
Table 19.2: Scoping exercise results 19-4
Table 19.3: Sensitivity descriptors 19-7
Table 19.4: Magnitude descriptors 19-9
Table 19.5: Significance of effect matrix 19-11
Table 19.6: Summary of construction noise levels 19-13
Table 19.7 Summary of effects 19-18
Table 20.1 Key definitions adopted for the purpose of this assessment (IEMA, 2020) 20-2
Table 20.2 Risk Classification Table - Likelihood (DEHLG, 2010) 20-6
Table 20.3 Risk Classification Table - consequence (DEHLG, 2010) 20-6
Table 20.4 Risk Matrix (DEHLG, 2010) 20-7
Table 20.5 Wind Speed Data for Dublin Airport (2014 to 2023) 20-13
Table 20.6 Risk Register – Construction Phase 20-15
Table 20.7 Risk Register – Operation Phase 20-16
Table 20.8 Risk Assessment 20-17
Table 21.1 Potential interactions between the Proposed Development and other projects. 21-5
Table 21.2 Proposed Development environmental interactions. 21-10
Table 22.1: Summary of proposed mitigation and monitoring measures per individual topic chapter. 22-1

Figures

Figure 1.1: Chart Showing Typical Classifications of the Significance of Effects (EPA, 2022) 1-7
Figure 2.1: Aerial view of the residential property (inside of red box) that was demolished following the extreme winter period of 2018. 2-1
Figure 2.2: Projected coastal change along the Burrow over the next 50years 2-4
Figure 2.3: Coastal flooding at the Burrow based on present day climate conditions (i.e. no sea level rise or coastal change) 2-7
Figure 2.4: Coastal flooding at the Burrow based on +0.25 m sea level rise and c.2m/yr of coastal retreat 2-8
Figure 2.5: Coastal flooding at the Burrow based on +0.25 m sea level rise and c.4m/yr of coastal retreat 2-9
Figure 2.6: General layout of the temporary interim coastal protection measures along the Burrow – Dec 2018. 2-10
Figure 2.7: Perched beach held behind the seabee units. 2-11
Figure 3.1: Location of the project site at the Burrow, Fingal, County Dublin. 3-2
Figure 3.2: Southerly aerial view of the beach at the Burrow (2019). 3-2
Figure 3.3: Northerly aerial view of the beach at the Burrow (2019). 3-3
Figure 3.4: Overview of the Proposed Development at the Burrow, including Site Boundary and Working Areas. 3-5
Figure 3.5: Cross-section of a typical embankment at Marsh Lane and Burrow Road. 3-9
Figure 3.6: Cross section of a typical flood wall at Marsh Lane. 3-9
Figure 3.7: Cross section of a typical fishtail groyne structure and beach renourishment levels. 3-10
Figure 3.8: Preliminary construction programme for the Burrow CFERM scheme 3-20
Figure 4.1: Typical section view of a vertical seawall. 4-6
Figure 4.2: The long-term impact of a seawall. 4-7
Figure 4.3: Typical section view of a rubble mound revetment. 4-8
Figure 4.4: Example of fishtail groynes at Clacton-on-Sea (© Google Earth). 4-8
Figure 4.5: Aerial view of a fishtail groyne field at Clacton-on-Sea. 4-9
Figure 4.6: Typical beach configurations with detached nearshore breakwaters. 4-10
Figure 4.7: Typical section of an embankment with an optional hard defence on a sandy dune system (adapted from DHI, 2017) 4-11
Figure 4.8: Typical section of a re-nourished beach profile. 4-12
Figure 4.9: A typical section of a perched beach consisting of beach fill supported by a submerged sill. 4-13
Figure 4.10: Sand trap fencing at a beach in Co. Clare 4-14
Figure 4.11: Over steepened dune faces along the Burrow, Portrane 4-14
Figure 4.12: Typical section of a re-profiled dune face stabilised with sand trap fencing and the planting of marram grass. 4-15
Figure 4.13: Alternative “Hold the Line” coastal management plan for the Burrow Option – Embankments, Seawalls and Rock Revetments 4-20
Figure 6.1: Extent and bathymetry of the outer Irish Seas model used to derive inshore tidal and spectral wave boundary condition data for the detailed pre and post project models of Rogerstown Estuary. 6-4
Figure 6.2: Extent and bathymetry of the detailed pre-project Rogerstown Estuary model. 6-4
Figure 6.3: Detailed illustration of pre-project Rogerstown Estuary model bathymetry. 6-5
Figure 6.4: Detailed illustration of post-project Rogerstown Estuary model bathymetry. 6-5
Figure 6.5: Detailed mesh structure of the pre- and post-project Rogerstown Estuary models within the vicinity of the Proposed Development. 6-6
Figure 6.6 Extent of RPS’ Tide and Storm Surge Forecast model used to generate model boundaries. 6-7
Figure 6.7: Typical spring mid-flood tidal patterns – Pre-project scenario. 6-9
Figure 6.8: Typical spring high water tidal patterns – Pre-project scenario. 6-9
Figure 6.9: Typical spring mid-ebb tidal patterns – Pre-project scenario. 6-10
Figure 6.10: Typical spring low water tidal patterns – Pre-project scenario. 6-10
Figure 6.11: Location of the M2 wave buoy in relation to Portrane. 6-12

Figure 6.12: Inshore significant wave heights during a 1 in 200-year return period storm event from the north east – Pre-project scenario. 6-12
Figure 6.13: Inshore significant wave heights during a 1 in 200-year return period storm event from the east – Pre-project scenario. 6-13
Figure 6.14: Inshore significant wave heights during a 1 in 200-year return period storm event from the southeast – Pre-project scenario. 6-13
Figure 6.15: Magnitude of daily average total sediment transport during calm conditions – Pre-project scenario. 6-15
Figure 6.16: Magnitude of daily average total sediment transport during an arduous storm event – Pre-project scenario. 6-15
Figure 6.17: Particle size distribution of proposed beach renourishment material from the licenses Boskalis Area 457 in Liverpool Bay, Eastern Lane. 6-18
Figure 6.18: Maximum total suspended sediment concentration during the entire beach renourishment campaign. 6-20
Figure 6.19: Example of beach renourishment material being pumped ashore as a “slurry” mixture. 6-21
Figure 6.20: Mean total suspended sediment concentration during the entire beach renourishment campaign. 6-22
Figure 6.21: Deposition of sediment following the beach renourishment campaign. 6-22
Figure 6.22: Typical spring mid flood tidal flow patterns during operation. 6-24
Figure 6.23: Typical spring high water flow patterns during operation. 6-24
Figure 6.24: Typical spring mid ebb tidal flow patterns during operation. 6-25
Figure 6.25: Typical spring low water flow patterns during operation. 6-25
Figure 6.26: Difference in typical spring mid flood tidal flow patterns during operation. 6-26
Figure 6.27: Difference in typical spring high water tidal flow patterns during operation. 6-26
Figure 6.28: Difference in typical spring mid ebb tidal flow patterns during operation. 6-27
Figure 6.29: Difference in typical spring low water tidal flow patterns during operation. 6-27
Figure 6.30: Inshore significant wave heights during a 1 in 200-year return period storm event from the northeast – post-project scenario. 6-29
Figure 6.31: Inshore significant wave heights during a 1 in 200-year return period storm event from the easterly – post-project scenario. 6-29
Figure 6.32: Inshore significant wave heights during a 1 in 200-year return period storm event from the south easterly – post-project scenario. 6-30
Figure 6.33: Difference significant wave heights during a 1 in 200-year return period storm event from the northeast as a result of the Proposed Development. 6-30
Figure 6.34: Difference significant wave heights during a 1 in 200-year return period storm event from the east as a result of the Proposed Development. 6-31
Figure 6.35: Difference significant wave heights during a 1 in 200-year return period storm event from the southeast as a result of the Proposed Development. 6-31
Figure 6.36: Magnitude of daily average total sediment transport during calm conditions – post-project scenario. 6-33
Figure 6.37: Magnitude of daily average total sediment transport during an arduous storm event – post-project scenario. 6-34
Figure 6.38: Difference in magnitude of daily average total sediment transport during calm conditions as a result of the Proposed Development. 6-34
Figure 6.39: Difference in magnitude of daily average total sediment transport during storm conditions as a result of the Proposed Development. 6-35
Figure 6.40: Location of the active dredge zone, Area WGL 457, in Liverpool Bay from which beach renourishment material is currently assumed to be sourced from. (© The Crown Estate, 2019) 6-39
Figure 8.1: Coastal flood extents map from Rogerstown CFERM Study (Present day). 8-2
Figure 8.2: Coastal flood extents map from Rogerstown CFERM (MRFS 2050, 2m/yr erosion). 8-3
Figure 8.3: Coastal flood extents map from Rogerstown CFERM (MRFS2050, 4m/yr erosion). 8-3
Figure 8.4: Flood extents with Proposed Development (0.5% AEP, MRFS 2050). 8-5
Figure 9.1: Site Location in the Context of the Wider Surface Water Environment. 9-5
Figure 9.2: Elements of the Water Framework Directive Status. 9-6

Figure 9.3: Water Framework Directive Water Body Status 2016-2021. 9-7
Figure 9.4: Bathing Water Quality in the Dublin Area 2022 (EPA, 2023). 9-11
Figure 9.5: Nutrient Sensitive Areas and Shellfish Waters. 9-13
Figure 9.6: Natura 2000 Designated Sites. 9-14
Figure 10.1: Solid Geology (taken from GSI) 10-8
Figure 10.2: Drift Geology (taken from GSI). 10-8
Figure 10.3: Bedrock Aquifer (taken from GSI). 10-9
Figure 10.4: Groundwater Vulnerability (taken from GSI). 10-10
Figure 10.5: Surface Water Features (taken from GSI). 10-10
Figure 10.6: Ground Investigation Locations and WS29 location (taken from Ground Investigations Ireland, Ground Investigation Report, May 2022) 10-14
Figure 11.1: The Down Survey of 1656-58, showing the Burrow on the barony map of Balrudderry 11-4
Figure 11.2: The Down Survey of 1656-58, showing the Burrow on the parish map of Lusk and Portrane in the barony of Nethercross 11-5
Figure 11.3: Detail from the Ordnance Survey First Edition 6-inch series showing the landscape *c.*1840. 11-6
Figure 11.4: Detail from the Ordnance Survey Third Edition 6-inch series showing the landscape *c.*1911. 11-7
Figure 11.5: Archaeological assets adjacent to and within project area, with proposed impacts overlaid. 11-10
Figure 11.6: Detail view looking east along parapet wall on Marsh Lane. 11-11
Figure 11.7: Archaeological assets DU008-028 and DU008-029 adjacent to and within project area, with proposed impacts overlaid. 11-12
Figure 11.8: (left) view along Marsh Lane looking south at stone parapet wall. (right) View looking at nature of disturbed ground along Marsh Lane 11-13
Figure 11.9: (left) view looking north into the enclosed space that is DU008-028. (right) view looking east into the space that is DU008-028 11-13
Figure 11.10: (left) view looking north along west shore of the Burrow and (right) detail view of shoreline 11-14
Figure 11.11: (left) view looking north at north end of the Burrow. (right) view looking east along base of localised rock armour protection 11-14
Figure 11.12: (left) view of ruined concrete panels that served as coastal protection along north shore. (right) View looking south along remains of ferry jetty. 11-15
Figure 11.13: View of sand dune façade at north end of the Burrow, and detail view of clay stratum at its base. 11-15
Figure 11.14: Views of coastal defence works along the eastern shore of the Burrow. 11-16
Figure 11.15: Views of the ruined outfall and former town dump along the eastern shore of the Burrow. 11-16
Figure 11.16: View of sea wall running along Quay Road. 11-17
Figure 12.1: Habitat types present within the vicinity of the Proposed Development. 12-7
Figure 12.2: Designated sites within the vicinity of the Proposed Development. 12-15
Figure 13.1: Designated Sites. 13-11
Figure 13.2: Annex I Habitat Survey – North-West. 13-18
Figure 13.3: Annex I Habitat Survey – North-East. 13-19
Figure 13.4: Annex I Habitat Survey – South-East. 13-20
Figure 13.5: Annex I Habitat Survey – South-West. 13-21
Figure 13.6: Extended Phase I Habitat Survey – South-West. 13-29
Figure 13.7: Extended Phase I Habitat Survey – North-West. 13-30
Figure 13.8: Extended Phase I Habitat Survey – South-East. 13-31
Figure 13.9: Extended Phase I Habitat Survey – North-East. 13-32
Figure 13.10: Annex I Habitat and Impacts of the Proposed Development (North-West) 13-37
Figure 13.11: Annex I Habitat and Impacts of the Proposed Development (South-West) 13-38
Figure 13.12: Annex I Habitat and Impacts of the Proposed Development (North-East) 13-39
Figure 13.13: Annex I Habitat and Impacts of the Proposed Development (South-East) 13-40
Figure 14.1: Site boundary at the Burrow with access routes and compound locations. 14-2
Figure 14.2: Site Location and ATC Survey Locations at Burrow, Fingal, County Dublin. 14-2
Figure 14.3: Proposed Construction Route. 14-5
Figure 15.1: EPA Monitoring Sites (EPA, 2020). 15-15
Figure 15.2: Air Quality Levels at Station 55. Dublin Airport, Swords, Co. Dublin. 15-15

Figure 15.3: Air Quality Levels at Station 61 in Swords Council Depot, Co. Dublin. 15-16
Figure 15.4: Share of Total Emissions in Fingal. 15-16
Figure 15.5: Timeline of Major Climatic Events in Fingal. 15-18
Figure 15.6: Dublin Annual Average Sea Level 2000-2016. 15-19
Figure 15.7: Summary of Observed Global Climate Change *(Source: IPCCAR5 Summary).* 15-20
Figure 15.8: Past Climate Events and Trends. 15-21
Figure 15.9: Fingal County Council's Five Climate Action Plan Areas. 15-22
Figure 15.10: Action Plan Targets. 15-22
Figure 15.11: Air Quality Sensitive Receptors. 15-25
Figure 15.12: Burrow Construction Access Route and Working Area 15-26
Figure 16.1: Circular Economy Approach (Regional Waste Management Planning Offices, 2023). 16-5
Figure 16.2: Location of Licenced Soil Recovery Facilities (including un-commenced). 16-13
Figure 17.1: Boardwalk coastal walking route along the Burrow which was lost to coastal erosion in *c.* 2013. 17-7
Figure 17.2: Fingal Development Plan 2023-2029 - Map 1: Sheet No.7 – Donabate/ Portrane. 17-8
Figure 19.1 Deprivation analysis 19-8
Figure 20-1: Major Accidents and Disasters Study Area 20-4
Figure 20.2 Historical & Recorded Seismic Events since 1980 20-9
Figure 20.3 SHARE European Earthquake Catalogue (1900 to 2006) 20-10
Figure 20.4 European Seismic Hazard Map 20-11
Figure 20.5 Annual Detected Lightning Flash Density (2008 – 2017)[45] 20-12
Figure 20.6 Wind Rose for Dublin Airport (2014 – 2023) 20-14
Figure 21.1 Location of the Proposed Development in relation to the Rush FRS Project. 21-3

ABBREVIATIONS

Term	Definition
AADT	Annual Average Daily Traffic
AASL	Annual Average Sea Level
ABP	An Bord Pleanála
ADCO	Archaeological Diving Company Ltd
AEP	Annual Exceedance Probability
AONB	Areas of Outstanding Natural Beauty
AQA	Air Quality Assessment
AQG	Air Quality Guidelines
AQS	Air Quality System
ASU	Aquatic Service Unit
ATC	Automatic Traffic Count
BAP	Biodiversity Action Plan
BCT	Bat Conservation Trust
BGL	Below Ground Level
BSI	British Standards Institution
BT	British Telecom
BTO	British Trust for Ornithology
CAFE	Clean Air for Europe
CAMS	Copernicus Atmosphere Monitoring Service
CAP	Climate Action Plan
CCTV	Closed Circuit Television
CD	Chart Datum
CDP	County Development Plan
CDW	Construction and Demolition Waste
CEA	Cumulative Effects Assessments
CEMP	Construction and Environmental Management Plan
CFERM	Coastal Flooding and Erosion Risk Management
CFRAM	Catchment Flood Risk Assessment and Management
CIEEM	Chartered Institute of Ecology and Environmental Management
CIEH	Chartered Institute of Environmental Health
CMLI	Chartered Member of the Landscape Institute
CIRIA	Construction Industry Research and Information Association
CITES	Convention on the International Trade in Endangered Species of Flora and Fauna
CIWEM	Chartered Institute of Water and Environmental Management
CL:AIRE	Contaminated Land: Applications in Real Environments
CLEA	Contaminated Land Exposure Assessment
CLVIA	Cumulative Landscape and Visual Impact Assessment
CSMP	Coastal Monitoring Survey Programme
CSTP	Celtic Sea Trout Project
CTMP	Construction Traffic Management Plan
DAERA	Department of Agriculture, Environment and Rural Affairs
DAOWFL	Dublin Array Offshore Wind Farm Limited
DECC	Department of the Environment, Climate and Communications
DECLG	Department of the Environment, Community and Local Government
DEHLG	Department of the Environment Heritage and Local Government

Term	Definition
DHI	Danish Hydraulic Institute
DHPLG	Department of Housing, Planning and Local Government
DIN	Dissolved Inorganic Nitrogen
DMRB	Design Manual for Roads and Bridges
DPER	Department of Public Expenditure and Reform
DSAS	Digital Shoreline Analysis System
EA	Environment Agency
ED	Electoral Division
ECMWF	European Centre for Medium Range Forecasts
EEA	European Environment Agency
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EIC	Environmental Industries Commission
EMR	Eastern-Midlands Region
EPA	Environmental Protection Agency
EPS	European Protected Species
ERP	Emergency Response Plan
ESB	Electricity Supply Board
EU	European Union
EUNIS	European Nature Information System
EVA	Extreme Value Analysis
EWC	European Waste Catalogue
FCC	Fingal County Council
FCS	Favourable Conservation Status
FSF	Fish and Shellfish
GAC	Generic Assessment Criteria
GDA	Greater Dublin Area
GES	Good Environmental Status
GHG	Greenhouse Gases
GII	Ground Investigations Ireland
GIS	Geographic Information System
GLVIA	Guidelines for Landscape and Visual Impact Assessment
GPP	Guidance for Pollution Prevention
GPS	Global Positioning System
GSI	Geological Survey of Ireland
HD	Hydrodynamic
HEFS	High End Future Scenario
HGV	Heavy Good Vehicle
HIA	Health Impact Assessment
HRA	Habitats Regulations Assessment
HV	High Voltage
IAQM	Institute of Air Quality Management
ICES	International Council for the Exploration of the Sea
ICWWS	Irish Wave and Water level Study
IEEM	Institute of Ecology and Environmental Management
IEMA	Institute Environmental Management and Assessment
IEF	Important Ecological Features

Term	Definition
IEMA	Institute of Environmental Management and Assessment
IFI	Inland Fisheries Ireland
IGI	Institute for Geologists Ireland
INFOMAR	Integrated Mapping for the Sustainable Development of Ireland's Marine Resource
IPCC	Intergovernmental Panel on Climate Change
IPH	Institute of Public Health
IROPI	Imperative Reasons of Overriding Public Interest
ISMP	Invasive Species Management Plan
ISO	International Organization for Standardization
IUCN	International Union for Conservation of Nature
LCA	Landscape Character Assessment
LCRM	Land Contamination Risk Management
LCT	Landscape Character Type
LQM	Land Quality Management
MCA	Multi-Criteria Analysis
MHWS	Mean High Water Springs
MM	Marine Mammals
MMO	Marine Mammal Observer
MNR	Marine Nature Reserve
MRFS	Medium Range Future Scenarios
MRP	Molybdate Reactive Phosphorus
MSFD	Marine Strategy Framework Directive
MSL	Mean Sea Level
MSP	Marine Spatial Plan
MV	Medium Voltage
NAF	National Adaptation Framework
NAP	National adaptation plan
NBDC	National Biodiversity Data Centre
NCCAF	National Climate Change Adaptation Framework
NHA	National Heritage Area
NIAH	National Inventory of Architectural Heritage
NIEA	Northern Ireland Environment Agency
NIS	Natura Impact Statement
NSM	National Monuments Service
NML	Noise Monitoring Location
NMI	National Museum of Ireland
NMPF	National Marine Planning Framework
NNR	National Nature Reserves
NO_X	Nitrogen Oxide
NPF	National Planning Framework
NPO	National Policy Objectives
NPWS	National Parks and Wildlife Service
NRA	National Roads Authority
NSR	Nearest Sensitive Receptor
NUTS	Nomenclature of Territorial Units for Statistics
NWCPO	National Waste Collection Permit Office
OD	Ordnance Datum

Term	Definition
OGP	Office of Government Procurement
OPW	Office of Public Works
OSPAR	The Convention for the Protection of the Marine Environment of the North-East Atlantic (the 'OSPAR Convention')
PAG	Project Appraisal Guidelines
PCM	Project Cycle Management
PDA	Planning and Development Act
PEAB	Preliminary Ecological Appraisal for Bats
PMG	Project Management Guidelines
PMM	Project Manager's Manual for Major National Roads
PPG	Pollution Prevention Guidelines
PPV	Peak Particle Velocity
PRA	Preliminary Risk Assessment
PTS	Permanent Threshold Shift
QI	Quality Indicator
RBMP	River Basin Management Plan
RCM	Regional Climate Modelling
RMP	Record of Monuments and Places
RPS	Record of Protected Structures
RWMP	Resource Waste Management Plan
SAC	Special Area of Conservation
SCI	Special Conservation Interest
SEPA	Scottish Environmental Protection Agency
SHW	Specification for Highway Works
SMR	Sites and Monuments Record
SOM	Soil Organic Matter
SPA	Special Protection Area
SPT	Standard Penetration Test
SSC	Suspended Sediment Concentrations
SSSI	Sites of Special Scientific Interest
SWMP	Site Waste Management Plan
TAN	Technical Advice Note
TBC	To Be Confirmed
TGN	Technical Guidance Note
TII	Traffic infrastructure Ireland
TLB	Tractor Loader Backhoe
TPH	Total Petroleum Hydrocarbons
TSHD	Trailer Suction Hopper Dredger
TSSF	Tide and Storm Surge Forecast
TTMP	Temporary Traffic Management Plan
TTS	Temporary Threshold Shift
USGS	United States Geological Survey
WEEE	Waste Electrical and Electronic Equipment
WFD	Water Framework Directive
WFP	Waste Facility Permit
WHO	World Health Organisation
WMO	World Meteorological Organisation

1 INTRODUCTION

1.1 Context

This Environmental Impact Assessment Report (EIAR) has been prepared by RPS on behalf of Fingal County Council (FCC) in support of development consent applications for the proposed construction of coastal flood and erosion protection works at the Burrow in Fingal, County Dublin, hereafter referred to as the 'Proposed Development'.

An initial Feasibility Study was undertaken in 2018, and a Coastal Flood and Erosion Risk Management (CFERM) Optioneering Report was prepared in 2020, addressing concerns and exploring solutions for managing coastal erosion and coastal flooding at the Burrow. A summary of the Optioneering Report is included in Chapter 4.3 which covers the criteria for assessing alternative options in terms of the environment.

Following consultation with the Office of Public Works (OPW) and the National Parks and Wildlife Service (NPWS) during the CFERM study in 2020, FCC commissioned RPS to prepare a Scoping Report to assist in developing a roadmap for Environmental Impact Assessment (EIA) and to inform future application to procure consent for the Proposed Development at the Burrow.

1.2 Purpose of the EIAR

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

The primary objectives of the EIAR are to identify the baseline environmental context of the Proposed Development, predict potential beneficial and/ or adverse effects of the Proposed Development and propose appropriate mitigation measures where necessary. In preparing this EIAR, the following legal provisions and guidelines were considered:

- The requirements of EU Directives and Irish law regarding Environmental Impact *Assessment (including* the European Union *(Planning and Development) (Environmental Impact Assessment)* Regulations 2018).
- European Commission Environmental Impact Assessment of Projects Guidance on the preparation of the Environmental Impact Assessment Report (Directive 2011/92/EU as amended by 2014/52/EU) (European Commission, 2017).
- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (Environmental Protection Agency, May 2022).

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

- Guidelines for Planning Authorities and An Bord Pleanála (APB) on carrying out Environmental Impact Assessment, 2018.

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

1.3 Function of the EIAR

This EIAR describes the effects, if any, which the Proposed Development, if carried out, would have on the environment, and includes the information specified in Annex IV of the Environmental Impact Assessment Directive. The EIAR was prepared on behalf of the applicant and presents the output of the Environmental Impact Assessment and contains information regarding:

- The Proposed Development.
- The likely significant effects of the Proposed Development.
- The baseline scenario.
- Reasonable proposed alternatives.
- The features and measures to avoid, prevent, reduce or offset significant adverse effects.
- Any additional information specified in Annex IV of the EIA Directive.
- The Non-Technical Summary.

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

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

1.4 The Proposed Development

The Proposed Development is described in detail in Chapter 3, and comprises the following elements:

- Construction of a *c.*190m long earth embankment at the end of Burrow Road.
- Construction of a combination of a *c.*130m long sheet piled flood wall and a *c.*200m embankment along Marsh Lane.
- Installation of back drainage behind the proposed defences with associated outfalls.
- Installation of non-return valves to existing outfalls to prevent backflow of water from the estuary.
- The construction of seven fishtail (or 'Y' shaped) groynes structures in combination with a beach renourishment scheme. These groyne structures will help control the longshore and cross-shore transport elements of the prevailing littoral drift along *c.*1.3km of the coastline at the Burrow.

- Each groyne will extend seaward for approximately 70m at a spacing of *c.*175m to create seven sediment sub-cells along the Burrow. The total footprint of the proposed groynes will equate to *c.*1.36 hectares.
- The beach renourishment will involve transporting dredged material from a licenced marine aggregate extraction site (presently assumed to be Liverpool Bay) to the Burrow and pumping the material ashore to fill each of the seven sediment sub-cells created by the fishtail groyne structures.

1.5 Methodology & Structure of the EIAR

The main aim of this EIAR is to provide information on the Proposed Development and its potential impacts to the public, prescribed bodies and the competent authority. To this end, Article 3(1) of the EIA Directive requires that significant effects are identified, assessed, and described in an 'appropriate manner'.

Article 5(1) of the EIA Directive sets out the information that should be presented in an EIAR to enable stakeholders and authorities to form opinions and make decisions regarding the project. While there are no formal requirements concerning the format and the presentation of the report, this EIAR clearly sets out the methodological considerations and reasoning behind the identification and assessment of likely significant effects.

1.5.1 EIAR Content

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

- **A description of the project**: this is an introduction to the project and includes a description of the location of the project, its characteristics, including land use requirements during construction and operational phases, as well as estimates of the expected residues, emissions, and waste produced during the construction and operational phases.
- **Baseline scenario:** a description of the relevant aspects of the current state of the environment, and the likely evolution thereof, without the implementation of the project, based on the availability of environmental information and scientific knowledge.
- **Environmental factors affected:** a description of the environmental factors likely to be significantly affected by the project, including consideration of climate change mitigation and adaptation, biodiversity, natural resource sustainability, and the risks of major accidents and disasters.
- **Effects on the environment:** a description of the likely significant effects of the project on the environment. Such significant effects can be direct or indirect, secondary, cumulative, transboundary, short-term, medium-term or long-term, permanent or temporary, and positive or negative.
- **Assessment of alternatives:** a description of the studied reasonable alternatives to the project, with an indication of the main reasons for the selection of the option chosen, including a comparison of environmental effects.

- **Mitigation measures:** a description of the measures envisaged to avoid, prevent, reduce and, where possible, offset any identified significant adverse effects on the environment, including a determination of the effectiveness of such measures, their reliability and certainty, as well as the commitment to ensuring their practical implementation and monitoring of results.
- **Monitoring:** a description of any measures proposed to monitor significant adverse effects on the environment and/or measures taken to mitigate them.
- **Non-Technical Summary:** an easily accessible summary of the content of the EIAR presented without technical jargon, hence understandable to anybody without a background in the environment or the project.
- **Quality of the EIAR:** the experts responsible for preparing the EIAR are required to be competent.

1.5.2 Assessment of Environmental Effects

1.5.2.1 Assessment Methodology

The assessment of whether the Proposed Development is likely to have a significant effect on the environment has been undertaken through a variety of methods:

- Professional judgment and experience based on published guidance criteria.
- Assessment of both temporary and permanent effects (direct, indirect, secondary and residual).
- Assessment of interaction and cumulative effects.
- Assessment of duration and reversibility of these effects.
- Assessment against local, regional and national planning policy.
- Consultation with statutory and non-statutory consultees.

Significance criteria are based on the type of potential consequences, the probability of the consequence occurring and the magnitude of the consequence. Table 1.1 identifies the scale used to evaluate the significance of the effect, thus providing a consistent approach throughout the EIAR. Each chapter identifies significant effects relevant to a specific topic having regard to this scale derived from the baseline environment (high/ medium/ low/ negligible sensitivity of receptors) and description of effect (character/ magnitude/ duration/ probability and consequences), as displayed in Figure 1.1.

Table 1.1: Description of Effects

Effect	Definition
Quality of Effects	**Positive** A change which improves the quality of the environment (for example, by increasing species diversity, or improving the reproductive capacity of an ecosystem, or by removing nuisances or improving amenities).
	Neutral No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error
	Negative/ Adverse A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem, or damaging health or property or by causing nuisance).
Significance of Effects	**Imperceptible** An effect capable of measurement but without significant consequences.
	Not Significant An effect which causes noticeable changes in the character of the environment but without significant consequences.
	Slight Effects An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
	Moderate Effects An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
	Significant Effects An effect which, by its character, magnitude, duration or intensity, alters a sensitive aspect of the environment.
	Very Significant An effect which, by its character, magnitude, duration or intensity, significantly alters most of a sensitive aspect of the environment.
	Profound Effects An effect which obliterates sensitive characteristics.
Extent and context of effects	**Extent** Describes the size of the area, the number of sites and the proportion of a population affected by an effect.
	Context Describes whether the extent, duration or frequency will conform or contrast with established (baseline) conditions
Probability of effects	**Likely** Effects that can reasonably be expected to occur because of the planned project if all mitigation measures are properly implemented.
	Unlikely Effects that can reasonably be expected not to occur because of the planned project if all mitigation measures are properly implemented.
Duration and Frequency	**Momentary Effects** Effects lasting from seconds to minutes.

Effect	Definition
	Brief Effects Effects lasting less than a day.
	Temporary Effects Effects lasting less than a year.
	Short-term Effects Effects lasting one to seven years.
	Medium-term Effects Effects lasting seven to fifteen years.
	Long-term Effects Effects lasting fifteen to sixty years.
	Permanent Effects Effects lasting over sixty years.
	Reversible Effects Effects that can be undone, for example through remediation or restoration
	Frequency of Effects Describes how often the effect will occur (once, rarely, occasionally, frequently, constantly – or hourly, daily, weekly, monthly, annually).
Types of Effects	**Indirect Effects (a.k.a. Secondary or Off-site Effects)** Effects on the environment, which are not a direct result of the project, often produced away from the project site or because of a complex pathway.
	Cumulative Effects The addition of many minor or insignificant effects, including effects of other projects, to create larger, more significant effects.
	'Do-nothing Effects' The environment as it would be in the future should the subject project not be carried out.
	'Worst-case' Effects The effects arising from a project in the case where mitigation measures substantially fail.
	Indeterminable Effects When the full consequences of a change in the environment cannot be described.
	Irreversible Effects When the character, distinctiveness, diversity or reproductive capacity of an environment is permanently lost.
	Residual Effects The degree of environmental change that will occur after the proposed mitigation measures have taken effect.
	Synergistic Effects Where the resultant effect is of greater significance than the sum of its constituents (e.g. combination of SO_x and NO_x to produce smog).

Source: *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (Environmental Protection Agency, May 2022).*

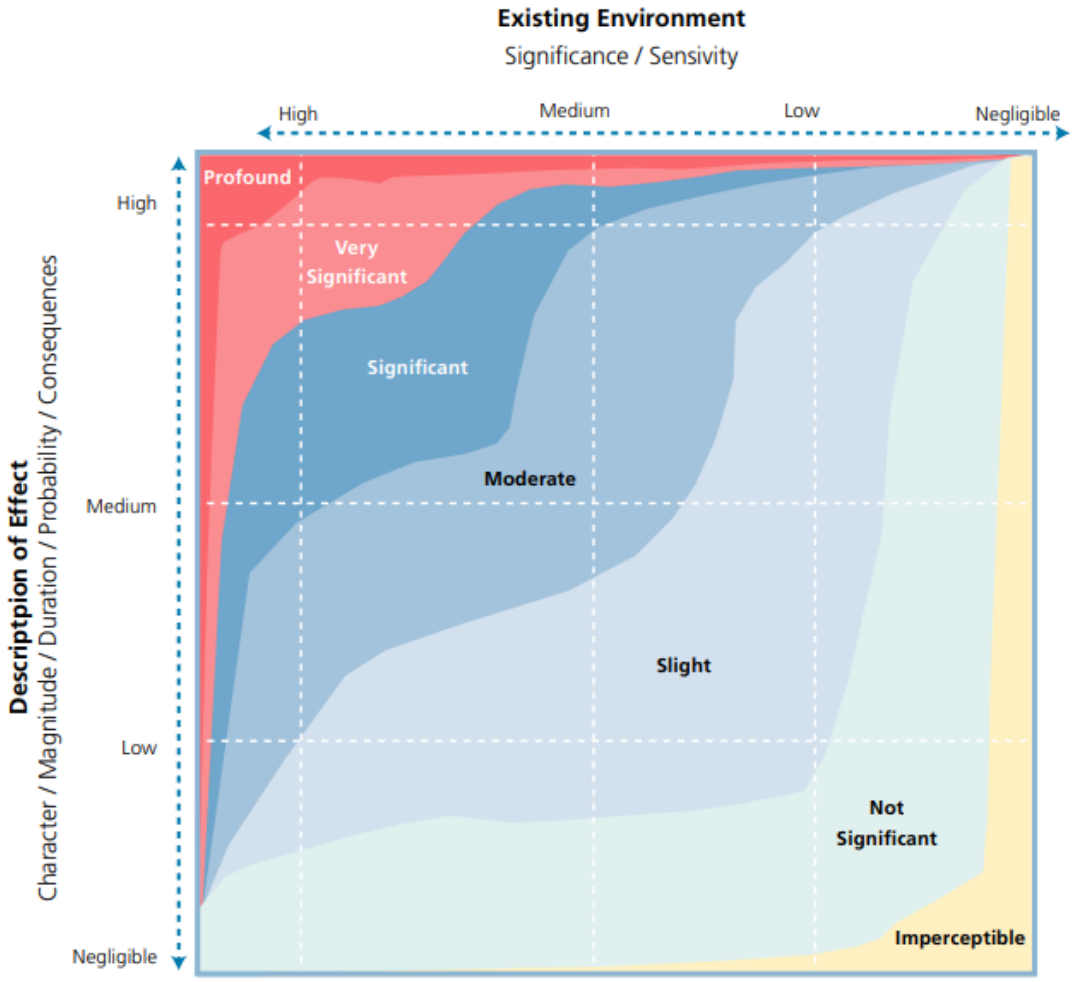


Figure 1.1: Chart Showing Typical Classifications of the Significance of Effects (EPA, 2022)

The cumulative effects of the Proposed Development, in conjunction with other proposed projects, are considered within each topic chapter. Relevant developments considered within the cumulative assessments include those which are:

- Under construction.
- Permitted, but not yet implemented.
- Submitted, but not yet determined.
- Identified in the Local Development Plan (and emerging Local Development Plans), recognising that much of the information for any relevant proposals is limited.

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

Each chapter further considers whether there are significant cumulative effects which are likely to arise because of interactions between topic chapters and/or as a result of the Proposed Development.

1.5.2.2 Mitigation and/or Compensation Measures

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

The description of mitigation measures includes details regarding the specific adverse effects for which measures are proposed, an assessment of the expected effectiveness, reliability and certainty of the measures, and any commitments regarding their implementation and future monitoring.

1.5.2.3 Monitoring

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

Such monitoring measures may arise owing to legislative requirements and/or directly in response to the anticipated effects of the Proposed Development upon environmental factors.

1.5.2.4 Conclusion on Likely Significant Effects

A conclusion by the authors of the EIAR on the likely significant effects of the Proposed Development on the environment, taking into account the results of the examination of the information presented in the EIAR is provided. In addition, a summary of the key impacts and mitigation and monitoring measures associated with the Proposed Development is provided, along with a discussion of cumulative impacts, interactions and inter-relationships between environmental topics. These will inform the reasoned conclusion to be made by the competent authority in conducting the EIA.

1.5.3 Structure of the EIAR

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

- Is presented in a clear structure with a logical sequence that describes, inter alia, existing baseline conditions, predicted impacts (nature, extent and magnitude), scope for mitigation, proposed mitigation measures, the significance of unavoidable/residual impacts for each environmental factor.
- Contains a table of contents at the beginning of the document.
- Comprises a description of the consent procedure and how the EIA fits within it.
- Reads as a single document with appropriate cross-referencing and is concise, comprehensive and objective.
- Is written in an impartial manner without bias.
- Includes a full description and comparison of the alternatives studied.
- Makes effective use of diagrams, illustrations, photographs and other graphics to support the text.

- Uses consistent terminology with a glossary.
- References all information sources used.
- Has a clear explanation of complex issues.
- Contains a good description of the methods used for the studies of each environmental factor.
- Covers each environmental factor in a way which is proportionate to its importance.
- Provides evidence of effective consultations.
- Provides a basis for effective consultations to come.
- Makes a commitment to mitigation (with a programme) and to monitoring.
- Contains a Non-Technical Summary which does not contain technical jargon.
- Contains, where relevant, a reference list detailing the sources used for the description and assessments included in the EIAR.

This EIAR is broken down into the Chapters described in Table 1.2 overleaf. The advantage of using this format is that it is easy to examine each environmental topic and it facilitates easy cross-reference to specialist studies undertaken as part of the assessment.

Each topic of environmental assessment is considered in a separate chapter and is drafted by relevant specialists (Table 1.3).

The EIAR is presented in three volumes, as follows:

- **Volume I** EIAR Non-Technical Summary
- **Volume II** EIAR Main Document
- **Volume III** EIAR Appendices

The following companies were involved in the preparation of the EIAR:

- RPS – Lead Environmental consultants.
- ADCO – Archaeology and Cultural Heritage.
- Savills – Population and Human Health.

The production of the EIAR has been co-ordinated by RPS. The responsibility and qualifications of the lead author for each chapter are detailed in Table 1.3.

Table 1.2 EIAR Chapter Structure Breakdown

Chapter Number	Chapter Title	Additional Information
N/A	Abbreviation of Terms	Abbreviation of terms
Chapter 1	Introduction	Introduction to the project, purpose and function of the EIAR and methodology and structure of the EIAR.
Chapter 2	Need for the Project	Description of the current baseline conditions at the Burrow and the objectives of the Proposed Development.
Chapter 3	Project Description	Description of the Proposed Development being assessed through this EIAR. Includes a description of the site location.
Chapter 4	Consideration of Alternatives	Summary of alternative options explored as part of the project. Includes strategic level and project level options.
Chapter 5	Project Scoping and Consultation	Summary of EIA Scoping and consultation was undertaken to date.
Chapter 6	Coastal Processes	These Chapters address specific environmental factors and provide a description of the existing environment, the likelihood of effects, the significance of effects, remedial and mitigation measures, residual impacts and monitoring measures. The specific environmental factors considered, following Environmental Impact Assessment Scoping as described in Chapter 5 of this report.
Chapter 7	Noise and Vibration	
Chapter 8	Flood Risk	
Chapter 9	Water Quality	
Chapter 10	Soils, Geology & Contamination	
Chapter 11	Archaeology and Cultural Heritage	
Chapter 12	Marine Biodiversity	
Chapter 13	Terrestrial & Coastal Biodiversity	
Chapter 14	Traffic and Transportation	
Chapter 15	Air Quality and Climate	
Chapter 16	Waste Management	
Chapter 17	Material Assets and Land Use	
Chapter 18	Landscape and Visual	
Chapter 19	Population and Human Health	
Chapter 20	Major Accidents & Disasters	
Chapter 21	Cumulative Effects	Summary of the assessment of cumulative effects which may arise from adjacent or nearby developments together with those predicted for the Proposed Development as well as the environmental interactions which have been examined within the individual technical assessment chapters.
Chapter 22	Mitigation Measures	A summary of all mitigation measures proposed within this EIAR for all topics.
Chapter 23	Conclusions	Summary and Conclusions.
Chapter 24	Bibliography and References	List of references for each of the chapters of the EIAR.

Table 1.3 List of Contributors to EIAR Chapters

Chapter of EIAR	Lead Author(s)	Company	Subject	Qualifications
Chapter 1	Kristopher Calder Malcolm Brian Adrian Bell	RPS	Introduction	BSc (Hons) MSc C.Sci MCIWEM C.WEM AMICE
Chapter 2		RPS	Need for Project	
Chapter 3		RPS	Project Description	BSc (Hons), PhD, CEng, C.WEM, MCIWEM, MIEI
Chapter 4		RPS	Assessment of Alternatives	
Chapter 5		RPS	Project Scoping & Consultation	BSc CEng FIEI FIAE MICE MIStructE
Chapter 6		RPS	Coastal Processes	
Chapter 7	Catriona Cooper	RPS	Noise and Vibration	BSc, IOA CIEH
Chapter 8	Diane McGinnis	RPS	Flood Risk	BSc, PG Dip, MCIEH, MIoA, MIAQM
Chapter 9	Mark Magee	RPS	Water Quality	BSc MSc CSci C.WEM MCIWEM
Chapter 10	Joseph McGrath	RPS	Soils, Geology & Contamination	BSc MSc MCIWEM C.WEM CSci MIEnvSc
Chapter 11	Niall Brady	ADCO	Archaeology and Cultural Heritage	BA MA PhD FSA
Chapter 12	Chris Barrett	RPS	Marine Biodiversity	BSc, PhD
Chapter 13	Sam O'Hara	RPS	Terrestrial & Coastal Biodiversity	BSc (Hons), MCIEEM
Chapter 14	Stephen Houlihan	RPS	Traffic and Transportation	BSc, MSc, MCIHT, MTPS
Chapter 15	Stephen McAfee	RPS	Air Quality and Climate	BSc MSc, C.Sci, AIEMA, IAQM
Chapter 16	Ciara Devine	RPS	Waste Management	BSc MSc MCIWM
Chapter 17	Kieron McAuley	RPS	Material Assets and Land Use	BSc, MSc
Chapter 18	Stuart Anderson	RPS	Landscape and Visual	BSc BTEC PGDip
Chapter 19	Tara Barratt	Savills	Population & Human Health	BSc, MSc, AIEMA
Chapter 20	AmyJo Regan	RPS	Major Accidents & Disasters	BSc (Hons), MSc MCIWEM
Chapter 21	Kristopher Calder Malcolm Brian	RPS	Cumulative Effects & Environmental Interactions	BSc (Hons) MSc C.Sci MCIWEM C.WEM AMICE
Chapter 22		RPS	Mitigation Measures	
Chapter 23		RPS	Conclusions	BSc (Hons), PhD, CEng, C.WEM, MCIWEM, MIEI
Chapter 24		RPS	Bibliography & References	

2 NEED FOR THE PROJECT

This chapter of the EIAR documents the need for the Proposed Development and examines this in the context of relevant spatial planning policy having regard to international, national, regional, and local policy objectives.

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

2.1 Project Rationale

2.1.1 Introduction

In February 2018 RPS were commissioned by FCC to assess the feasibility of a localised, small-scale coastal defence scheme to reduce the coastal flood risk that exists in the Rogerstown Estuary area. The scope of this initial commission was to develop a socially and environmentally sustainable scheme to reduce the risk of coastal flooding throughout the study area.

Following Storm Emma and several other arduous storm events in the winter period of 2017/2018 the position of the shoreline along the Burrow retreated by more than 20m in some areas. As a result of this extensive erosion, one private residential property had to be abandoned and subsequently demolished. The location of this former property is illustrated in Figure 2.1. Many other nearby properties continue to remain at imminent risk of coastal erosion.

In recognition of the on-going risk of coastal erosion risk across the Burrow, the scope of RPS' commission was updated to include an assessment of the coastal erosion risk and to develop a suitable and sustainable coastal management plan to mitigate these risks in addition to the coastal flood risk.



Figure 2.1: Aerial view of the residential property (inside of red box) that was demolished following the extreme winter period of 2018.

Based on this revised commission, RPS subsequently undertook a detailed Coastal Erosion and Flood Risk Management (CFERM) study in line with a series of study objectives developed by the OPW as specified in Schedule A.1 of the CFERM guidance[2]. The objectives of this study can be summarised as to:

1. Review and assess existing information.
2. Identify information gaps and arrange for necessary additional field surveys.
3. Address surveys of existing coastal protection structures and other surveys.
4. Undertake an assessment of existing coastal processes and coastline evolution.
5. Prepare detailed current and future coastal change maps.
6. Prepare a detailed risk assessment.
7. Undertake a preliminary environmental assessment.
8. Undertake an options and feasibility assessment.
9. Prepare a Coastal Flood and Erosion Risk Management plan (CFERMp).
10. Produce an economic assessment of benefits and costs.

2.1.2 Feasibility report findings

The following sections of this chapter presents a summary of the findings of the Rogerstown Estuary CFERM study and subsequent updates. The full Risk Assessment and Optioneering reports produced for this study are provided in Appendix 2.A and 2.B respectively.

2.1.2.1 Historical coastal change

To better understand the coastal processes along the Burrow, RPS undertook a review of historical maps and orthophotography acquired from Ordnance Survey Ireland. This data comprised mapping from between 1973 and 2019 and provided insight into the evolution of the beach over a *c.*50-year period. Using historical trend analyses software developed by United States Geological Survey (USGS), RPS quantified the rate of coastal change along the Burrow. An update to the CFERM study since 2020 found that average rates of erosion ranged between -0.09m and -2.90m per year along the beach frontage at the Burrow. Maximum rates of erosion along the same section of beach frontage varied between -0.17m and -4.88m per year with the larger figures occurring in more recent times.

2.1.2.2 Coastal Erosion Assessment

Coastal erosion is an important natural phenomenon that has been occurring uninterrupted for millions of years (until recent human intervention). Erosion plays a fundamental role in redistributing sediment throughout a coastal system and contributes to the formation of a variety of coastal landscapes, many of which have now been designated as special habitats owing to their unique environmental characteristics.

Excessive erosion, however, can result in significant negative impacts in areas where there is not enough hinterland to accommodate the ongoing exchange of sediment and the potential retreat of the shoreline. This is

[2] https://www.gov.ie/en/publication/b15dd0-technical-specifications-and-guidance-notes/

particularly problematic in urbanised areas where important infrastructure, sites of cultural heritage and/or public amenities are at risk.

Using the Digital Shoreline Analysis System (DSAS), a tool produced by the US Geological Society (USGS, 2018) to assess coastal change, the extent of future coastal retreat over the next 50 years was estimated based on incremental sea level rise in line with the **Medium Range Future Scenario (MRFS)** whereby sea levels are expected to rise by +0.50m by 2100.

In summary, the output of this assessment found that coastal erosion over the next 50 years could result in between 17 and 234 buildings being lost to erosion. The extent of the projected coastal change over the next 50 years is illustrated in Figure 2.2.

RPS are acutely aware that the response to storm events post 2013 indicates a potential “turning point” in the coastal processes along the Burrow and that the erosion rates calculated as part of the Historical Trend Analyses prior to 2013 may not reflect recent observations. However, without sufficient long-term high-resolution data it is not possible to determine if these events are unique outliers or the beginning of a new long-term trend.

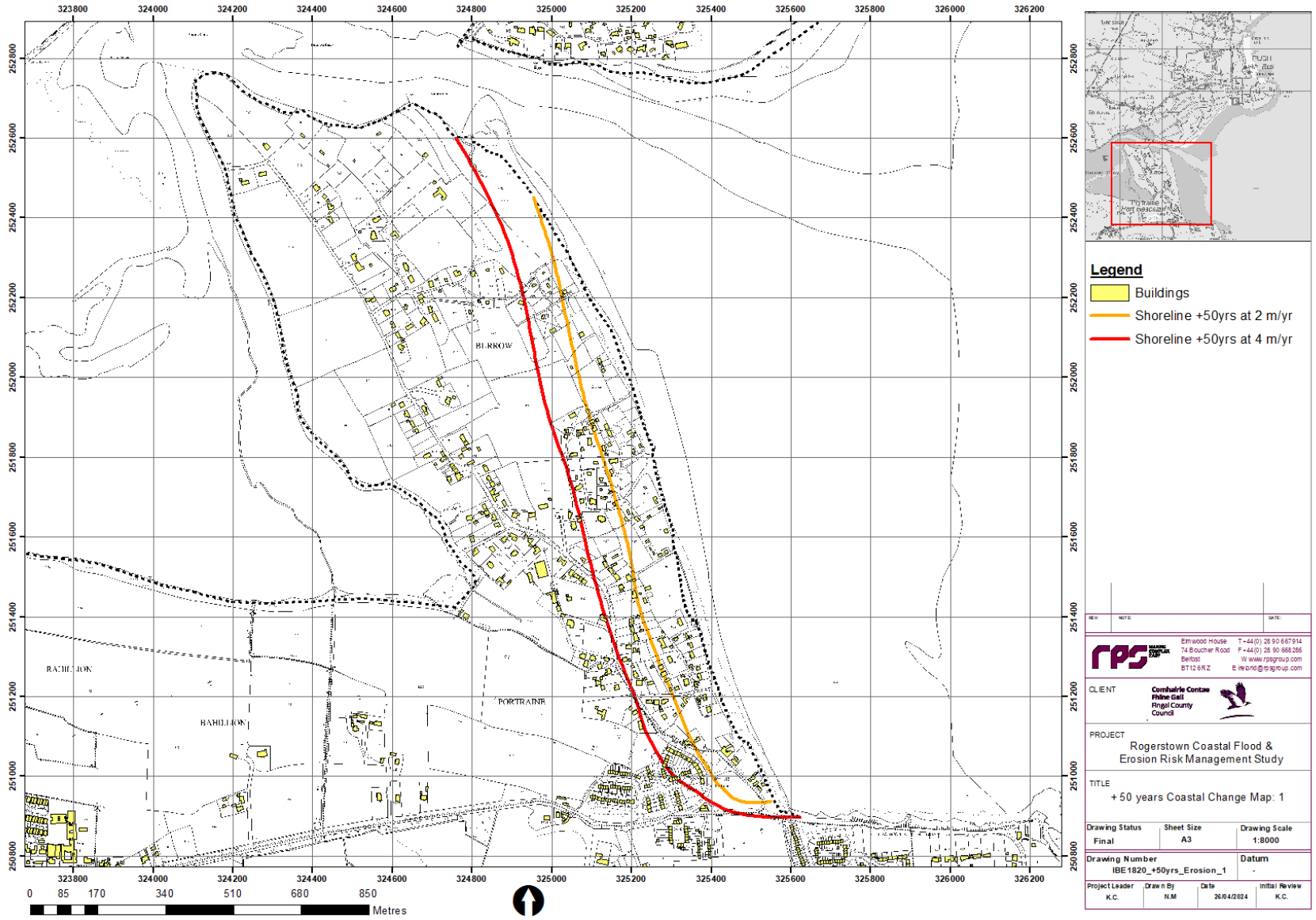


Figure 2.2: Projected coastal change along the Burrow over the next 50years

2.1.2.3 Coastal Flooding Assessment

As part of the CFERM study, RPS undertook a coastal flood risk assessment to quantify the potential for flooding from both combined tide and surge (i.e. flood mechanism 1) and wave overtopping (i.e. flood mechanism 2) under a range of return period and climate change conditions.

Based on present day climate conditions, the assessments undertaken have found that up to 9 buildings would be at risk of coastal flooding during a present day 1 in 200-year return period storm event. The projected flood extents across the Burrow for the 1 in 10 year (10% AEP), 1 in 200 year (0.5% AEP) and 1 in 1000 year (0.1% AEP) return period storm events under present day climate conditions is presented in Figure 2.3.

As with the coastal erosion assessment, coastal flooding was also assessed based on the MRFS future climate scenario conditions in 50 years time. The flood extents for these scenarios are illustrated in Figure 2.3 and Figure 2.4 and Figure 2.5 respectively.

In summary, the coastal flood risk assessment found that:

- The number of buildings at risk during a 1 in 200-year return period could increase from 9 under present day conditions to 82 or 29[3] over the next 50 years depending on the rate of erosion.
- The coastal flood risk at the Burrow will be greatly exacerbated by the erosion of the existing dune system which currently acts as a natural flood barrier to the lower-lying hinterland.
- Coastal flooding could affect up to 50 buildings during a relatively modest 1 in 2-year storm event in 50 years' time only +0.25m of sea level rise.

When compared to the number of buildings affected by coastal erosion it is evident that coastal flooding poses a lower risk to the Burrow over the long term. However, it is important to recognise that the erosion of the existing dune system, including the shifting and fixed dune habitats that form part of the Rogerstown SAC along the Burrow, significantly increases the coastal flood risk by creating additional flood routes into the hinterland.

2.1.2.4 Development of Coastal Management Plan

Having identified the coastal erosion and flooding risks to the Burrow described above, an extensive optioneering exercise was undertaken to develop a sustainable coastal management strategy to mitigate these risks. This process included an initial appraisal of all management options, a multi-criteria assessment and an economic appraisal.

The preferred coastal management zone strategy for the Burrow was identified as "Hold the Line". The preferred option and thus the Proposed Development comprises a combination of soft and hard engineering measures. Specifically, groyne structures and beach renourishment to mitigate the risk of coastal erosion and a series of embankments and a flood wall to mitigate the risk of coastal flooding. Further information about the Proposed Development is provided in Chapter 3. Alternative coastal management strategies and options are discussed in Section 4.3.

[3] The number of properties affected by flooding under the 4m/yr erosion scenario drops as many properties are lost to erosion.

2.1.2.5 Economic appraisal

An initial economic appraisal was undertaken to ascertain the economic damages associated with the coastal flood and erosion risks identified. The damage assessment methodology followed the guidance in "The Benefits of Flood and Coastal Defence: A Manual of Assessment Techniques" (Middlesex University, 2005). Based on this appraisal, the net present value of a scheme for the Burrow ranged between € -4.6 mil and € +80.8 mil depending on the assumed erosion rate and threshold for flooding.

This economic appraisal accounted for direct damages to land and property and applied standard OPW allowances for indirect damages to residential properties and for emergency services attendance but did not account for other damages/ disruptions which could enhance the benefit of any scheme, including:

- Recreational gains and losses or intangible losses (i.e. loss of community etc).
- Road Traffic Disruption,
- Vehicle Damage,
- Post scheme increases in property values,
- Future development benefits.

As summarised in Table 2.1, the economic appraisal considered a range of erosion and flooding thresholds and three discount rates and concluded that based on a 50-year life the proposed scheme would yield a Benefit Cost Ratio of greater than unity for 8 out of the 12 scenarios considered.

Table 2.1: Summary of economic appraisal results for various erosion and flooding threshold scenarios with sensitivity analysis of upper and lower property price estimates (JCA, 2024)

			Property value - €520,000			
Scenario		Test Discount Rate	Present Value benefit (PVb) (€)	Present Value cost (PVc) (€)	Net Present Value (€)	Benefit Cost Ratio (BCR)
A	2m/year erosion, No property flooding Threshold	3.5/4%	63,449,501	58,930,067	4,519,434	1.077
A3	2m/year erosion, No property flooding Threshold	3%	77,410,688	67,946,940	9,463,748	1.139
A5	2m/year erosion, No property flooding Threshold	5%	51,677,542	56,303,933	-4,626,391	0.918
B	2m/year erosion, 200mm property flooding Threshold	3.5/4%	55,420,176	58,930,067	-3,509,891	0.940
B3	2m/year erosion, 200mm property flooding Threshold	3%	67,481,954	67,946,940	-464,986	0.993
B5	2m/year erosion, 200mm property flooding Threshold	5%	45,240,699	56,303,933	-11,063,234	0.804
C	4m/year erosion, no property flooding Threshold	3.5/4%	123,524,693	58,930,067	64,594,626	2.096
C3	4m/year erosion, no property flooding Threshold	3%	148,765,811	67,946,940	80,818,872	2.189
C5	4m/year erosion, no property flooding Threshold	5%	102,573,562	56,303,933	46,269,628	1.822
D	4m/year erosion, 200mm property flooding Threshold	3.5/4%	116,077,924	58,930,065	57,147,859	1.970
D3	4m/year erosion, 200mm property flooding Threshold	3%	139,516,023	67,946,940	71,569,083	2.053
D5	4m/year erosion, 200mm property flooding Threshold	5%	96,622,438	56,303,136	40,319,302	1.716

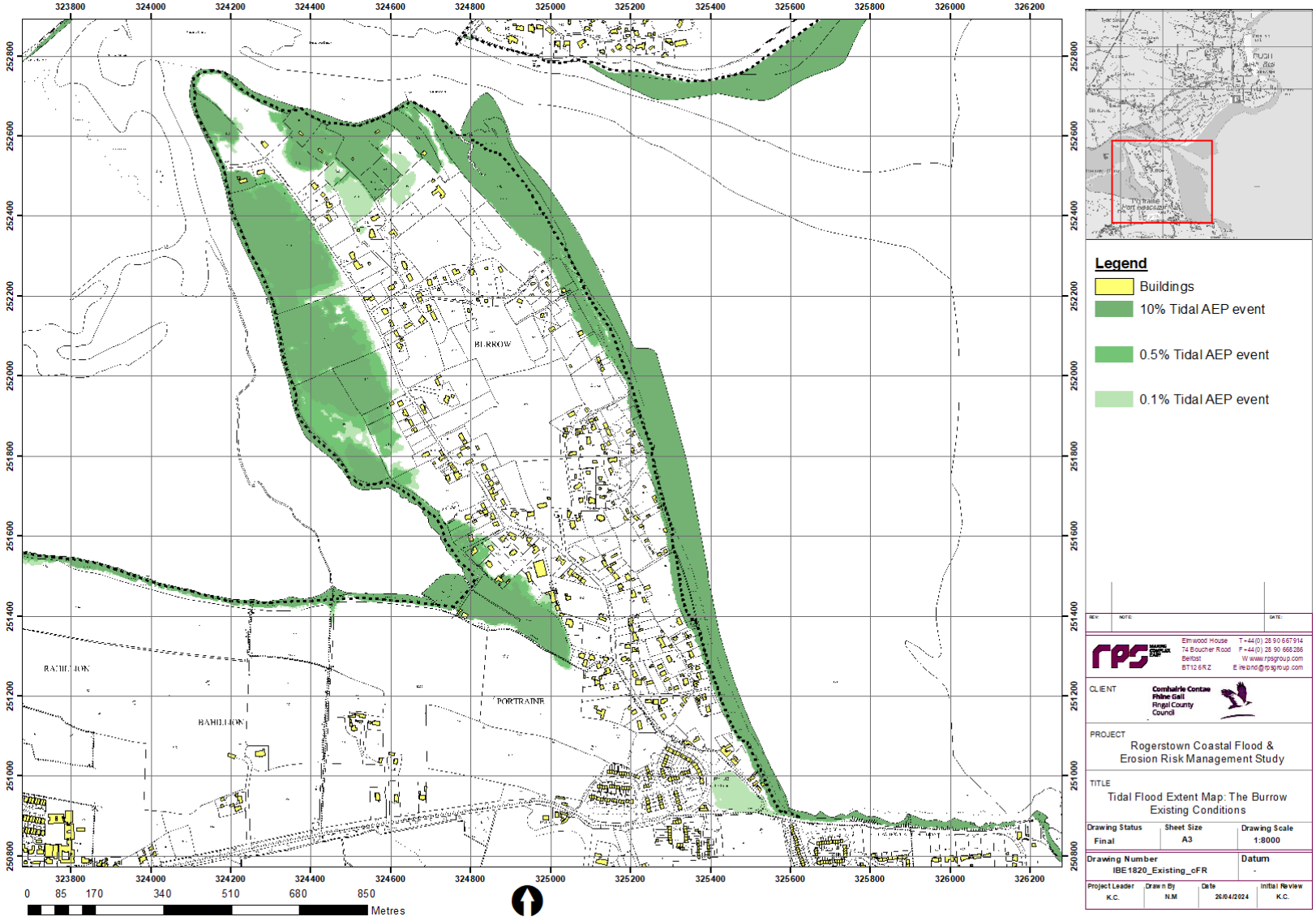


Figure 2.3: Coastal flooding at the Burrow based on present day climate conditions (i.e. no sea level rise or coastal change)

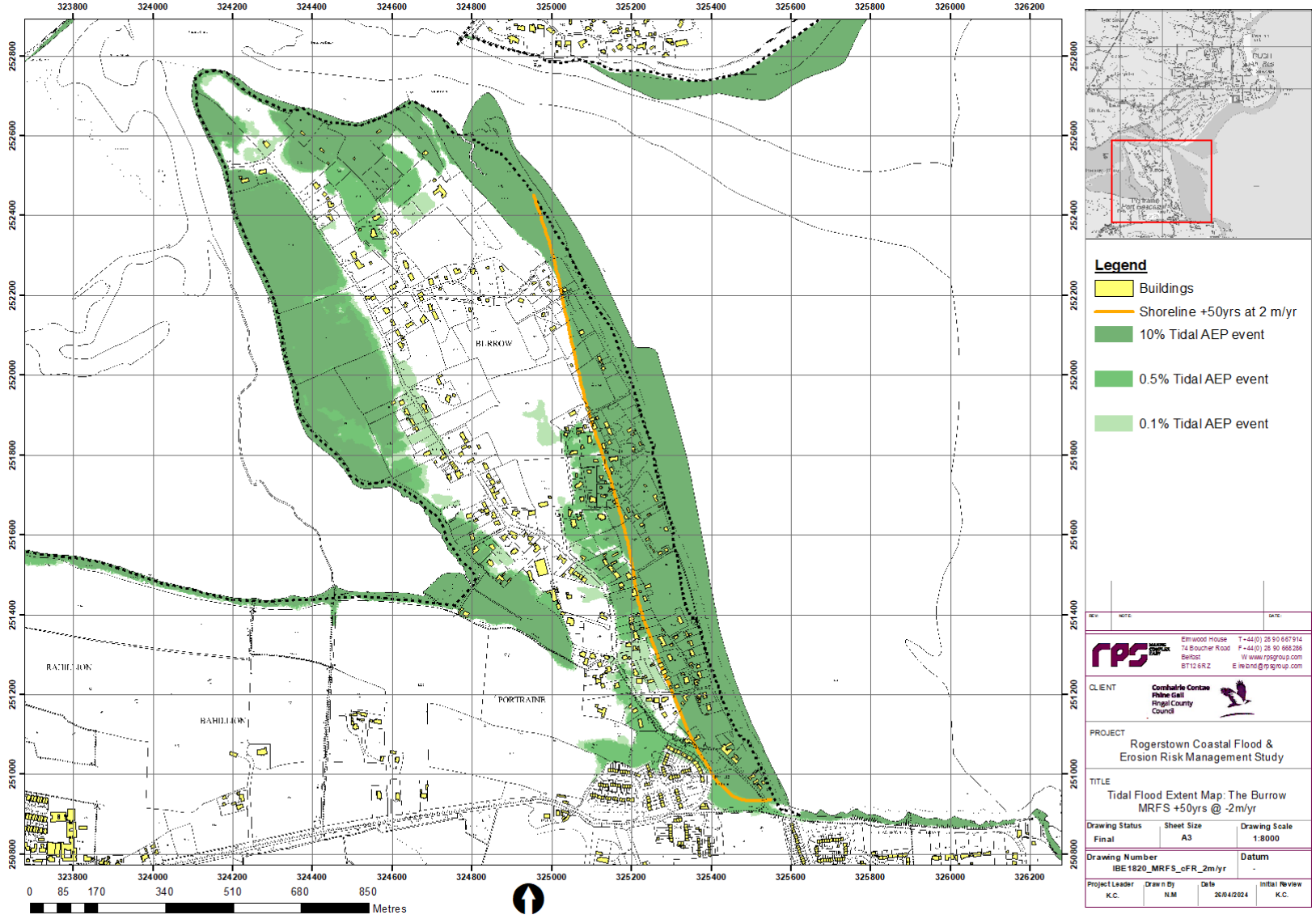


Figure 2.4: Coastal flooding at the Burrow based on +0.25 m sea level rise and c.2m/yr of coastal retreat

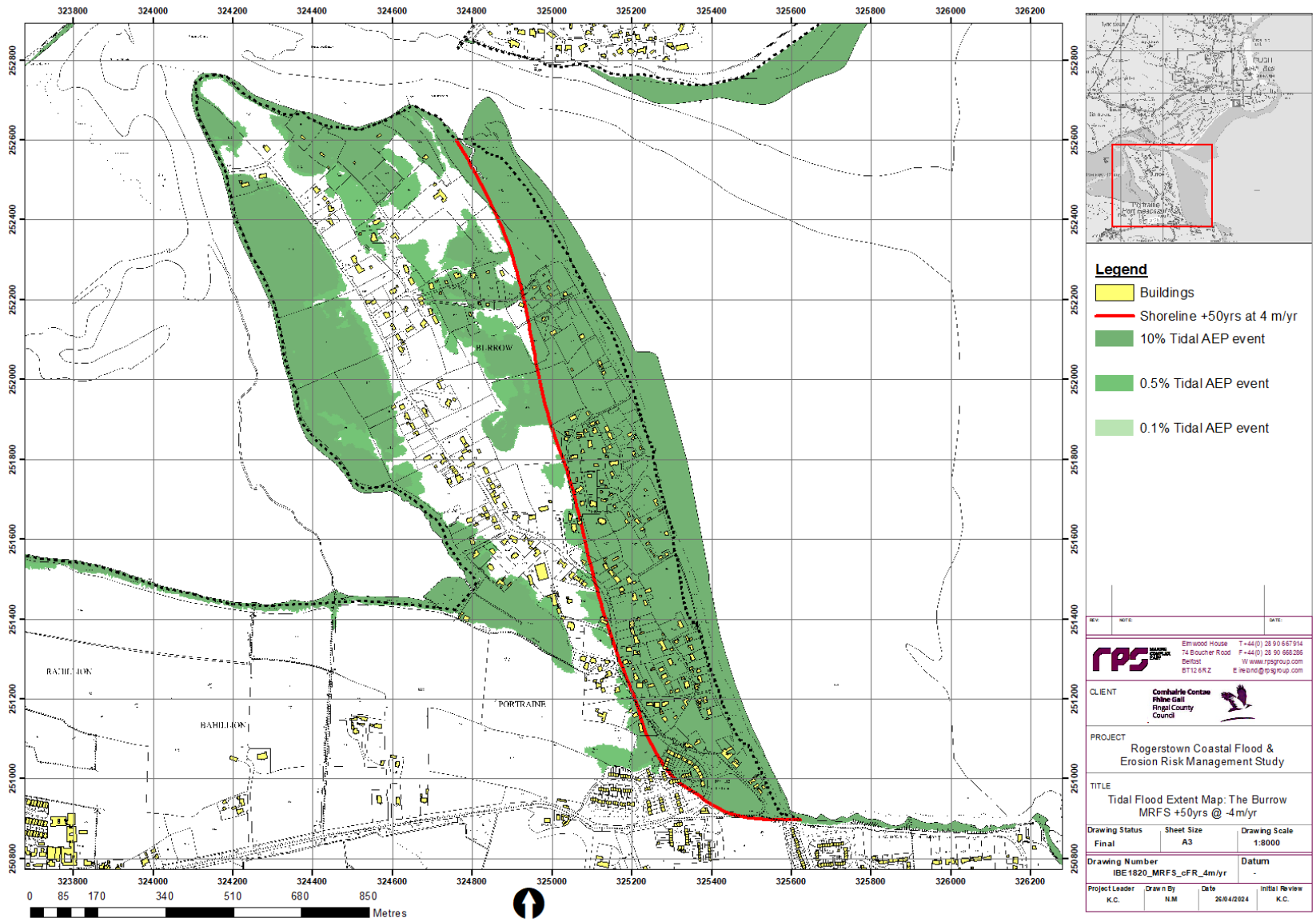


Figure 2.5: Coastal flooding at the Burrow based on +0.25 m sea level rise and c.4m/yr of coastal retreat

2.1.3 Interim Coastal Protection Measures

In response to acute coastal erosion during the 2018 winter period, FCC commissioned an interim coastal protection solution to mitigate the effect of coastal erosion where properties were considered at greatest risk until a more long-term management scheme, the Proposed Development, could be implemented.

To this end, a wave attenuation array comprised of concrete seabee units was designed to dissipate incident wave energy prior to the waves impacting on the dune line. Through physical hydraulic modelling testing, these interim measures were found to reduce the incident wave energy behind the array by *c.*70% (RPS, 2018).

Following the successful hydraulic testing, FCC proceeded to implement the interim coastal protection solution in late 2018. The wave attenuation array consisted of *c.*355 individual pre-cast seabee units each weighing approximately 4.2T placed along *c.*260m of the foreshore region in three individual rows as illustrated in Figure 2.6.

A Habitats Directive stage one screening appraisal for appropriate assessment (RPS, 2018) concluded that this interim coastal protection solution:

- Was not directly connected with or necessary to the management of any European site.
- Would not give rise to potential significant effects on the Qualifying Interests or Special Conservation Interests of any European site.
- Would not give rise to potential in-combination or cumulative effects with the other projects considered.



Figure 2.6: General layout of the temporary interim coastal protection measures along the Burrow – Dec 2018.

Whilst extensive coastal monitoring demonstrated that the interim coastal protection solution performed as intended by reducing erosion rates behind the seabee units by *c.*50%, undefended regions of the coastline continued to retreat. In response to this risk, an emergency meeting was held between FCC, the Office of Public Works (OPW) and the National Parks and Wildlife Service (NPWS) in February 2020. During this meeting it was agreed that notwithstanding the ongoing work to develop and consent a long-term coastal management strategy, the most appropriate response would be to extend the interim coastal protection works further north.

The interim coastal protection works comprise of *c.*1,300 units, and extends for *c.*925m along the coastline of the Burrow. Whilst these interim works have reduced coastal erosion by *c.*50% and led to the seasonal formation of a perched beach formation behind the units as illustrated in Figure 2.7, the coastline along the Burrow continues to retreat under extreme storm events, albeit at a reduced rate.

Upon removal of these interim protection works, the rate of coastal erosion along the Burrow will return to the rates experienced prior to these measures being implemented *c.*2m per year as experienced along unprotected regions of the shoreline. This would significantly exacerbate the current coastal erosion risk posed to many private residential properties which are already considered at imminent risk.

Given that the temporary seabees units do not deliver the required Standard of Protection, the Proposed Development to which this EIAR relates has been designed to provide a more sustainable and effective long-term coastal management solution for the Burrow.



Figure 2.7: Perched beach held behind the seabee units.

2.2 Spatial Planning Policy

This section of the EIAR considers national, regional and local policy documents there were considered during the design of the Proposed Development. These documents include:

- Project Ireland 2040: National Planning Framework.
- National Marine Planning Framework 2021.
- Fingal Development Plan 2023 – 2029, Interim Publication.
- National Adaptation Framework, Planning for a Climate Resilient Ireland.
- Flood Risk Management, Climate Change Sectoral Adaptation Plan.

2.2.1 Project Ireland 2040: National Planning Framework

The National Planning Framework (NPF) is the Government's high-level strategic plan for shaping the future growth and development the country out to the year 2040. It is a framework to guide public and private investment, to create and promote social opportunities, and to protect and enhance the environment. The document estimates that by 2040 the population in Ireland will have increased by *c.* one million. The document recognises that this population growth will require significantly more new jobs and homes, and that failure to plan for this growth would be detrimental to the built and natural environment, society and the economy.

As a framework document, the NPF defines a process by which more detailed planning documents must follow spatial planning, infrastructure planning, social and economic planning. It also outlines certain principles that these plans will have to follow, for example around sustainability, creativity and community.

In relation to the coastal environment, the NPF estimates that 40% of Ireland's population lives within 5km of the coast. However, there are key issues for planning and flood risk assessment, especially in managing the ongoing development of cities in towns in context of climate change and increasing sea levels and erosion pressures. This is recognised in the following National Policy Objectives (NPO)s:

- **NPO 41a**: Ensure that Ireland's coastal resource is managed to sustain its physical character and environmental quality.
- **NPO 41b**: In line with the collective aims of national policy regarding climate adaptation, to address the effects of sea level changes and coastal flooding and erosion and to support the implementation of adaptation responses in vulnerable areas.

The Proposed Development aligns with these objectives in that it has been designed with regard to climate change and provides a sustainable coastal management plan to a very vulnerable area whilst retaining the physical and environmental quality of the site.

2.2.2 National Marine Planning Framework 2021

In line with the requirements of EU Directive 2014/89/EU, the Minister for Housing, Local Government and Heritage formally established the National Marine Planning Framework (NMPF) on 20th May 2021. Considered a comprehensive new approach to marine planning across the three main areas of forward planning,

development management and marine planning enforcement, the NMPF is intended as the marine equivalent to the National Planning Framework. The purpose of this framework is to enable the Government to:

- Set a clear direction for managing our seas.
- Clarify objectives and priorities.
- Direct decision makers, users, and stakeholders towards strategic, plan-led, and efficient use of our marine resources.

Marine Spatial Planning is a process that brings together multiple users of the ocean to make informed and coordinated decisions about how to use marine resources sustainably. It is a process by which the relevant public authorities analyse and organise human activities in marine areas to achieve ecological, economic, and social objectives. A Marine Spatial Plan (MSP) – in Ireland known as the NMPF – is the outcome of that process.

The NMPF:

- Is a national plan for Ireland's seas, setting out, over a 20-year horizon, how we want to use, protect and enjoy our seas.
- The NMPF sits at the top of the hierarchy of plans and sectoral policies for the marine area. The plan has been informed by existing sectoral plans and will, in turn, be used to inform future cycles of those plans in an ongoing feedback loop.
- It will become the key decision-making tool for regulatory authorities and policy makers into the future in several ways, including decisions on individual authorisation applications, which will have to secure the objectives of the plan, similar to the way that terrestrial plans form part of the decision-making toolkit in the on-land planning process.

The NMPF is relevant to the Proposed Development as it sets out objectives that are related to the coastal environment and any development thereof. In particular, the document states that any proposal must demonstrate that they will, in order of preference a) avoid, b) minimise, or c) mitigate:

- Significant adverse impacts on species adaptation or migration, or on natural native habitat connectivity.
- Significant adverse impacts on marine or coastal natural capital assets, or, if it is not possible to mitigate significant adverse impacts on marine or coastal natural capital assets proposals must set out the reasons for proceeding.
- Significant disturbance to, or displacement of, highly mobile species.

In respect to coastal flooding and erosion management proposals, the NMPF states that:

- Proposals should demonstrate how they avoid contribution to adverse changes to physical features of the coast.
- Enhance, restore or recreate habitats that provide a flood defence or carbon sequestration ecosystem services where possible.
- Where potential significant adverse impacts upon habitats that provide a flood defence or carbon sequestration ecosystem services are identified, these must be in order of preference and in

accordance with legal requirements: a) avoided, b) minimised, c) mitigated, d) if it is not possible to mitigate significant adverse impacts, the reasons for proceeding must be set out.

In context of the Proposed Development, these requirements are fulfilled by means of this Environmental Impact Assessment Report.

2.2.3 Fingal Development Plan 2023 – 2029, Interim Publication

The Fingal Development Plan 2023 - 2029 sets out the Council's proposed policies and objectives for the development of the County over the Plan period. The Development Plan seeks to develop and improve, in a sustainable manner, the social, economic, environmental and cultural assets of the County. The plan was prepared in accordance with the requirements of the Planning and Development Act, 2000 (as amended), higher tier international, national and regional level plans, ministerial guidelines and with regard to local level strategies and plans.

The plan is underpinned by four key cross cutting themes; climate action, healthy place-making and sustainable development, social inclusion and high-quality design. In context of climate action, the plan contains provisions dealing with climate change mitigation and adaptation, in areas including, but not limited to, flood risk management, coastal management and green infrastructure. In respect of Coastal Management, policies described in this plan include:

- **Policy CAP31 – Coastal Monitoring:** Monitor coastal erosion and accretion along Fingal's coastline to identify locations at risk of coastal erosion and flooding.
- **Policy CAP32 – Coastal Protection:** Ensure the provision of appropriate coastal protection measures in locations at risk of coastal erosion and flooding.
- **Policy CAP33 – Coastal Zone Management:** Support coastal zone management measures for adapting to climate change which include restoration of degraded ecosystems, increased flood resilience, water quality improvement, habitat conservation and provision of amenities for the residents of and visitors to Fingal.
- **Policy CAP34 – Engagement with Key Stakeholders:** Continue to work with national and regional authorities and other key stakeholders with regard to flood defence required to protect vulnerable urban areas from worst case scenario sea level rises in the coming decades.

The Proposed Development is considered critical in helping FCC achieve these Coastal Management polices by 2029.

The plan recognises that considered management and enhancement of watercourses including rivers and streams, riverine floodplains and wetland areas and coastal areas liable to flooding can provide effective measures to help manage flooding and improve the quality of water:

- **Policy GINHP7 – Protection:** Protect and enhance the natural, historical, amenity and biodiversity value of the County's watercourses, flood plains, riparian corridors, wetlands and coastal area though long-term and liaison with relevant Prescribed Bodies where appropriate.

- **Objective GINHO12 – Green Infrastructure Requirements:** Ensure the provision of new green infrastructure addresses the requirements of functional flood storage, the sustainable management of coastal erosion, and links with provision for biodiversity, Sustainable Drainage Systems (SuDS) and provision for parks and open space wherever possible and appropriate.
- **Objective GINHO16 – Coastal**: Ensure the green infrastructure strategy for Fingal protects the County's natural coastal defences, such as beaches, sand dunes, salt marshes and estuary lands, and promotes the use of soft engineering techniques as an alternative to hard coastal defence works wherever possible.

As described in Chapter 3, a fundamental element of the Proposed Development is a beach renourishment scheme which has been designed to enhance the natural coastal flood and erosion protection afforded by the existing beach and dune habitat along the Burrow.

The latest Development Plan for Fingal also includes a section dedicated solely to "*The Coast and Coastal Protection*". This section recognises that it is important that the coast is managed and developed in a way which protects and enhances its natural and cultural heritage and its landscape. It further states that the future economic, tourism, recreational and energy resource potential of the coast will need to be balanced with the requirement to protect its natural heritage, water quality and attractions.

In context of coastal protection and erosion, the plan sets out the following objectives:

- **Objective GINHO68 – Coastal Erosion:** Where coastal erosion is considered a threat to existing properties, explore the technical and economic feasibility of coastal adaptation and coastal retreat management options.
- **Objective GINHO69 – Coastal Defence Works:** Employ soft engineering techniques as an alternative to hard coastal defence works, *wherever possible*.
- **Objective GINHO70 – Identification of Coastal Protection Works:** Identify, prioritise and implement necessary coastal protection works subject to the availability of resources, whilst ensuring a high level of protection for natural habitats and features, and ensure due regard is paid to visual and other environmental considerations in the design of any such coastal protection works.
- **Objective GINHO71 – Erosion Risk Management:** Undertake erosion risk management studies for high-risk areas so that the long-term erosion risks to property can be clearly identified long before the risk may be expected to occur.
- **Objective GINHO72 – Coastal Erosion Policy:** Develop a coastal erosion policy for Fingal based on best international practice to outline how the Council will deal with existing properties at risk of erosion and how future coastal erosion problems will be managed having regard to national climate change legislation, mitigation and adaptation policies, and the need to protect the environment.

As described in sections 2.1.2.2 through to 2.1.2.5, there is a clear need for the Proposed Development to mitigate the extensive coastal flooding and erosion risk posed to the Burrow. The Proposed Development represents a sustainable combination of soft and hard engineering techniques which has been identified as best providing protection for natural habitats and features that also pays due regard to visual and other environmental

consideration in its design. As such, the Proposed Development is considered critical in helping FCC achieve the coastal protection and erosion objectives **GINHO68** to **GINHO72**.

In respect of achieving policy **GINHP29** which aims to protect the special character of the coast by preventing inappropriate development along the coast, the plan provides the following objectives.

- **Objective GINHO73 – New Development and the Coast:** Prevent inappropriate development along the coast, particularly on the seaward side of coastal roads. New development for which a coastal location is required shall, wherever possible, be accommodated within existing developed areas.
- **Objective GINHO74 – Pattern of Coastal Development:** Strictly control the nature and pattern of development within coastal areas and ensure that it is designed and landscaped to the highest standards and sited appropriately so as not to detract from the visual amenity of the area. Development shall be prohibited where the development poses a significant or potential threat to coastal habitats or features, and/or where the development is likely to result in altered patterns of erosion or deposition elsewhere along the coast.
- **Objective GINHO75 – Prohibition of Coastal Development:** Prohibit development along the coast outside existing urban areas where such development could not be adequately safeguarded over the lifetime of the development without the need to construct additional coastal defences.
- **Objective GINHO76 – Development and Risk of Coastal Erosion:** Prohibit new development outside urban areas within the areas indicated on Green Infrastructure maps, which are within 100m of coastline at risk from coastal erosion, unless it can be objectively established based on the best scientific information available at the time of the application, that the likelihood of erosion at a specific location is minimal taking into account, inter alia, any impacts of the Proposed Development on erosion, or deposition.
- **Objective GINHO77 – National Marine Planning Framework:** Comply with the policies and objectives of the National Marine Planning Framework as it relates to the area between the mean high-water mark and the near shore with respect to the planning and resource management of the marine area.

The Proposed Development aligns with these objectives in that it has been designed and landscaped based on best scientific information available at the time and to the highest standard with the objective of stabilising and enhancing the coastal environment along the Burrow.

2.2.4 National Adaptation Framework, Planning for a Climate Resilient Ireland

Arising from the 2012 National Climate Change Adaptation Framework (NCCAF), the National Adaptation Framework (NAF) was developed and approved in accordance with Section 5 of the Climate Action and Low Carbon Development Act 2015. In accordance with the 2015 Act, this NAF specifies the national strategy for the application of adaptation measures in different sectors and by local authorities in their administrative areas to reduce the vulnerability of the State to the negative effects of climate change and to avail of any positive effects that may occur.

The NAF therefore sets out the context to ensure local authorities, regions and key sectors can assess the key risks and vulnerabilities of climate change, implement climate change resilience actions and ensure climate adaption considerations are mainstreamed into all local, regional and national policy making.

The structure of the NAF is split into four separate chapters which address the following topics:

- **Chapter 1** provides a summary of observed and projected climate change globally as well as the international and European policy drivers for adaptation to climate change. This chapter also presents several observed and projected climate change impacts in Ireland and a summary of the impacts that may arise in Ireland as a result.
- **Chapter 2** sets out the progress on climate change adaptation planning in Ireland to date, including work undertaken at sectoral and local government level and initiatives engaging civil society and research.
- **Chapter 3** provides guiding principles for adaptation at national level and steps to create an enabling environment for adaptation planning. It sets out the sectors for which adaptation plans under the NAF are proposed, along with proposals for local authority or regional level adaptation strategies.
- **Chapter 4** outlines how the Framework will be implemented with revised Governance and reporting arrangements and actions and supporting objectives to be progressed.

The NAF document is very comprehensive and contains a significant volume of information that is of relevance to the Proposed Development. Key information from each chapter has been presented in the following sections.

2.2.4.1 NAF, Chapter 1

In respect of future climate change, it is acknowledged that:

- Warming of the global climate system is unequivocal and it is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century.
- The rate of sea level rise since the mid-19th century has been larger than the mean rate during the previous two millennia. Over the period 1901 to 2010, global mean sea level rose by 0.19m (0.17 to 0.21m).
- Regional Climate Modelling (RCM) simulations have projected:
    - A sea level rise of c.55-60cm to 2100 (based on medium scale climate warming scenarios) (Dunne et al., 2008; Lowe et al., 2009).
    - Changes in mean sea level predicted will be the primary driver in magnifying the impacts of changing storm surge and wave patterns in coastal areas.
    - Heavy rainfall events will increase in winter and autumn (Nolan, 2015).
    - Wind and extreme events: the energy content of the wind is projected to decrease during spring, summer and autumn. The projected decreases are largest for summer, with values ranging from 3% to 15% (Nolan, 2015).

- Storms affecting Ireland will decrease in frequency, but increase in intensity, with increased risk of damage (Nolan, 2015).

These changes are projected to continue and increase over the coming decades (Gleeson et al, 2013; Nolan, 2015). Projected changes include temperature rise, changes in the frequency and intensity of extreme weather events; increased flows to river catchments; ongoing sea level rise; and changes in precipitation patterns and regimes. Observed and projected climate changes and impacts are also outlined in Table 2.2.

Table 2.2: Summary of observed and projected climate changes and impacts for Ireland (NAF *Planning for a Climate Resilient Ireland*, 2018)

Parameter	Observed	Projected	Example of Biophysical Impacts
Temperature	▪ Average temperatures have increased by 0.8°C since 1900, an average of 0.07°C per decade. ▪ The number of warm days (over 20°C) has increased while the number of cold days (below 0°C) has decreased.	▪ Projections indicate an increase in average temperatures across all seasons (0.9-1.7°C). ▪ The number of warm days is expected to increase and heat waves are expected to occur more frequently.	▪ Incidences of cold stress are likely to decrease while incidences of heat stress will increase. ▪ The duration of the growing season will increase, occurring earlier and extending farther.
Precipitation	▪ Increase in average annual national rainfall of approximately 60mm or 5% in the period 1981-2010, compared to the 30-year period 1961-1990. ▪ The largest increases are observed over the west of the country.	▪ Significant reductions are expected in average levels of annual, spring and summer rainfall. ▪ Projections indicate a substantial increase in the frequency of heavy precipitation events in Winter and Autumn (approx. 20%).	▪ The increased occurrence of dry spells will result in increased pressure on water supply. ▪ An increase in the frequency of extreme precipitation events will result in increased fluvial and pluvial flood risk.
Wind Speed and Storms	▪ No long-term change in average wind speed or direction can be determined with confidence. ▪ The number and intensity of storms in the North Atlantic has increased by approx. three storms per decade since 1950.	▪ Projections indicate an overall decrease in wind speed and an increase in extreme wind speeds, particularly during winter. ▪ The number of very intense storms is projected to increase over the North Atlantic region. Projections suggest that the winter track of these storms may extend further south and over Ireland more often.	▪ Increases in extreme wind speeds may impact on wind turbines and the continuity of power supply. ▪ Infrastructure will be at risk due to the increased occurrence of intense storms (e.g. winter 2013/2014).
Sea Level and Sea Surface Temperature	▪ Historically, sea level has not been measured with the necessary accuracy to determine sea level changes around Ireland. However, measurements from Newlyn, in southwest England, show a sea level rise of 1.7cm per decade since 1916. These measurements are considered to be representative of the situation to the South of Ireland. ▪ Sea surface temperatures have increased by 0.85°C since 1950, with 2007 the warmest year in Irish coastal records.	▪ Sea levels will continue to rise for all coastal areas, by up to 0.8 m by 2100. The south of Ireland will likely feel the impacts of these rises first. ▪ Sea surface temperatures are projected to continue warming for the coming decade. For the Irish Sea, projections indicate a warming of 1.9°C by the end of the century.	▪ Significant increase in areas at risk of coastal inundation and erosion. ▪ Increased risk to coastal aquifers and water supply. ▪ Change in distribution fish species; ▪ Implications for fisheries and aquaculture industries.

The NAF document emphasises how these changes, will in turn, impact many key socio, economic and environmental sectors in different ways which will require appropriate and relevant sectoral responses within the context of this Framework. Just two negative sectoral impacts arising from climate change have been summarised below:

- **Coastal areas:** Coastal erosion and flooding currently pose a serious risk to Ireland's coastal areas and this is particularly the case as Ireland's major cities and key pieces of infrastructure are located on the coast. **Key impacts include inundation of coastal areas, increase in the intensity of cyclones which will result in more extreme storm activity and an increase in coastal erosion.**

- **Human health and wellbeing:** Increase in extreme events will have significant impacts on health and wellbeing including risk of physical injuries/death, mental health effects from loss and displacement, such as from flooding and waterborne infectious diseases.

These impacts are recognised at the Burrow and emphasise the need of the Proposed Development to mitigate these risks.

2.2.4.2 NAF, Chapter 2

Chapter 2 presents progress to date in Ireland in planning for climate change and developing climate resilience. It discusses the link between climate adaptation and current emergency planning responses to extreme weather events as well as several other issues.

It is stated that of the projected six-fold projected increase in damages from flooding for the EU by 2050, about one-third is accounted for by increased flood risk due to climate change and two-thirds by the effects of anticipated socio-economic change (Jongman et al., 2014). A similar rate of increase in Ireland would see direct damages from flooding of roughly €1.15 billion per year by 2050 should appropriate adaptation measures not be introduced.

This is reflective of conditions at the Burrow, whereby economic damages associated with coastal flooding and erosion is expected to increase from €6.5 mil up to €75.5 mil by 2100 subject to future climate change as described in section 2.1.2.5 of this EIAR.

2.2.4.3 NAF, Chapter 3

The key elements of the new National Adaptation Framework for delivering climate resilience are described in several sub-sections throughout this chapter. These sub-sections include but are not limited to the legislative and policy context for the Framework, a guiding set of principles for adaption, future research priorities and the reporting and implementation arrangements to ensure delivery.

There is a strong emphasis on promoting climate resilience. Climate resilience can be defined as the capacity of a system, whether physical, social or ecological, to absorb and respond to climate change and by implementing effective adaptation planning and sustainable development (including governance and institutional design) to reduce the negative climate impacts while also taking advantage of any positive outcomes. This will allow the system to either return to its previous state or to adapt to a new state as quickly as possible.

It is recognised through the ongoing development of Ireland's Capital Investment Plan that climate resilience will require significant capital investment and evaluation of public expenditure. A key objective of the Plan is to illuminate the role of public capital investment in helping to achieve national climate action goals. These actions include those aimed at increasing flood resilience and adapting to climate change. The plan specifically identifies flood defences and adapting to new climate conditions.

These actions are in-line with the objectives of the Proposed Development.

2.2.4.4 NAF, Chapter 4

Chapter 4 outlines how the NAF will be implemented and governed at both national and local level. Naturally, much of this chapter deals with legislative and statutory issues at a high level. For further information on these issues, readers are referred to Chapter 4 of the *NAF Planning for a Climate Resilient Ireland* document.

2.2.5 Flood Risk Management, Climate Change Sectoral Adaptation Plan

This Plan has been prepared under the National Adaptation Framework (Depart. of Communications, Climate Action and Env., 2018), and updates its predecessor by considering new information available on climate change and its potential impacts. The purpose of the Plan in respect to flood risk management is to:

- Outline the potential impacts of climate change on flooding and flood risk management in Ireland.
- Identify the objectives for an effective and sustainable approach to adaptation as part of flood risk management for the future.
- Promote a coordinated approach to adaptation:
    - within the flood risk management sector and sustainable flood risk management measures in other sectors, and,
    - across the policies and actions of other Sectors including Local Authorities.
- Recommend any further actions required to meet the objectives for adaptation.

The long-term goal adopted by the OPW on climate adaptation for flooding and flood risk management is "*promoting sustainable communities and supporting our environment through the effective management of the potential impacts of climate change on flooding and flood risk*". To deliver this goal, the OPW has identified the following adaptation objectives:

Objective 1: Enhancing our knowledge and understanding of the potential impacts of climate change for flooding and flood risk management through research and assessment.

Objective 2: Adapting flood risk management practice to effectively manage the potential impact of climate change on future flood risk.

Objective 3: Aligning adaptation to the impact of climate change on flood risk and flood risk management across sectors and wider Government policy.

The Proposed Development at the Burrow aligns with these objectives in that it provides a sustainable solution to an immediate flood risk and for the effective management of potential impacts of climate change on flooding and flood risk at the Burrow.

2.2.6 Rogerstown Special Area of Conservation

Rogerstown Estuary is located north of Donabate in Co. Dublin and separated from the sea by a sand and shingle bar. The site is selected for the following habitats and/or species listed on Annex I / II of the E.U. Habitats Directive:

- [1130] Estuaries
- [1140] Tidal Mudflats and Sandflats
- [1310] Salicornia Mud
- [1330] Atlantic Salt Meadows
- [1410] Mediterranean Salt Meadows
- [2120] Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes)
- [2130] Fixed coastal dunes with herbaceous vegetation (grey dunes)

One of the conservation objective targets of this site is to ensure "*No decline, or change in habitat distribution, subject to natural processes*". Given that there is unequivocal evidence the climate is changing as a result of human induced global warming, the current acceleration of coastal erosion at the Burrow is not considered entirely natural. Recognising the elevated risk of habitat loss due to human induced climate change, the Proposed Development is considered critical to preserving what is left of the designated shifting and fixed dune habitats at the Burrow.

3 PROJECT DESCRIPTION

This chapter of the EIAR describes the Proposed Development and provides information on the project site, design, size, and other relevant features.

3.1 Location of Project and Site Characteristics

The Proposed Development is located at the Burrow which is a sandy spit that separates the outer Rogerstown Estuary from the Irish Sea as illustrated in Figure 3.1. The Burrow is fronted by a wide sandy beach as illustrated in Figure 3.2 and Figure 3.3 and is bordered by rock headlands at Rush to the north and Portrane to the south.

The nature of the spit and beach is strongly influenced by the tidal action of the estuary and waves approaching the shoreline from the Irish Sea. Lambay Island, which lies around 5km east of the beach, also influences both the wave and tidal conditions. The beach at the Burrow is around 1.8km long, with a bathing area at the southern end that has been awarded Blue Flag status. It is a popular recreational location that offers many amenities to the public and tourists throughout the year.

The site is of HIGH conservation value owing to the range of Annex I species and the Annex II habitats for which it is designated as a Special Protection Area (Rogerstown Estuary SPA; Site Code: 004015) and Special Area of Conservation (Rogerstown Estuary SAC; Site Code: 00208), a Natural Heritage area, a Ramsar Conservation Wetland and a Statutory Nature Reserve. A considerable amount of unplanned development has also occurred over the years. This is recognised in the Fingal County Development Plan 2017-2023, where the gradual removal of temporary homes is encouraged, whilst the replacement with permanent dwellings is discouraged.

For more than a decade, the Burrow has been adversely affected by episodes of acute coastal erosion which were in turn driven by extreme storm events. In 2018, Storm Emma and a succession of other events resulted in the shoreline retreating by more than 20m along some sections of the Burrow. The coastal retreat during this period was so severe that a private residential property had to be abandoned and demolished some months later.

Before the installation of interim coastal protection works in 2018 which were designed to slow the rate of erosion until a more sustainable long-term protection solution could be developed, the rate of erosion along the Burrow coastline typically ranged between 2 – 3 metres per year. The interim coastal protection works, i.e. the concrete seabee units which are shown in Figure 3.3 have effectively reduced erosion rates since they were installed. However, much of the coastline remains vulnerable to erosion, particularly during periods of high tide or surge activity when waves can propagate over the units and freely attack the coastline.



Figure 3.1: Location of the project site at the Burrow, Fingal, County Dublin.



Figure 3.2: Southerly aerial view of the beach at the Burrow (2019).



Figure 3.3: Northerly aerial view of the beach at the Burrow (2019).

3.2 Proposed Development

In February 2018 RPS were commissioned by FCC to assess the feasibility of a sustainable coastal flood protection scheme to reduce the flood risk that exists across the Burrow. Following Storm Emma and several other arduous storm events that occurred in the winter of 2017/2018, the position of the shoreline at Burrow retreated by more than 20m in some areas. Consequently, the scope of the RPS commission was extended to include for the development of interim emergency coastal protection works (Seabees) and a longer-term erosion management solution. The interim measures were installed until such time that the longer-term solution, this Proposed Development as identified in the CFERM study could be implemented.

The Proposed Development builds on the preferred option as identified in the CFERM study (RPS, 2020). It should be noted that this study also identified a preferred Flood Relief Scheme (FRS) for Rush South which is located on the northern side of the Rogerstown Estuary. However, this scheme is being considered independently given that the Proposed Development for the Burrow and the preferred scheme at Rush do not rely upon one another, with each addressing specific risks (i.e. erosion and flooding at the Burrow and only flooding at Rush South). Nevertheless, the cumulative effects of both schemes are assessed in each technical chapter as per requirements of the EIA Directive and national legislation.

The Proposed Development for the Burrow is split into three areas, the northern extent of the spit at the end of Burrow Road, at Marsh Lane, and along Portrane beach. Subject to detailed design, the Proposed Development consists of the following main elements:

- Construction of a *c.*190m long earth embankment at the end of Burrow Road.
- Construction of a *c.*130m long sheet piled flood wall and a *c.*200m earth embankment along Marsh Lane.

- Installation of back drainage behind the proposed defences with associated outfalls.
- Installation of non-return valves to existing outfalls to prevent backflow of water from the estuary.
- The construction of seven fishtail (or 'Y' shaped) groynes structures in combination with a beach renourishment scheme at Portrane Beach. These groyne structures will help control the longshore and cross-shore transport elements of the prevailing littoral drift along *c.*1.3km of the coastline of the Burrow.
    - Each groyne will extend seaward by approximately 70m at a spacing of *c.*175m to create seven sediment sub-cells along the Burrow. The total footprint of the proposed groynes will equate to *c.*1.36 hectares.
    - The beach renourishment will involve transporting dredged material from a licenced marine aggregate extraction site (presently assumed to be Liverpool Bay) to the Burrow and pumping the material ashore to fill each of the seven sediment sub-cells created by the fishtail groyne structures.

The location and extent of the Proposed Development is illustrated in Figure 3.4 overleaf. Typical cross-sections and further information regarding the flood embankments, flood walls and beach elements are presented in Figure 3.5 to Figure 3.7 respectively. Further information on each of these elements is presented in the following sections of this chapter. It should be included that the "Working Area" as defined in relevant drawings also includes the area seaward of Portrane beach whereby the dredger may operate during the beach nourishment works.

The primary objectives of the Proposed Development are to:

- Provide effective coastal flood protection during a 0.5% Annual Exceedance Probability (AEP) event based on the Medium Range Future Scenario (MRFS) whereby sea levels are expected to rise by +0.50m by 2100.
- Mitigate the ongoing coastal retreat along the beach frontage.
- Restore and enhance the recreational value of the natural beach amenity which has significantly deteriorated over recent years due to an overall loss of sand material from the beach.
- Enhance and protect the fixed and shifting dune systems that are qualifying features of the Rogerstown SAC which have been deteriorated by chronic and acute erosion over recent years.

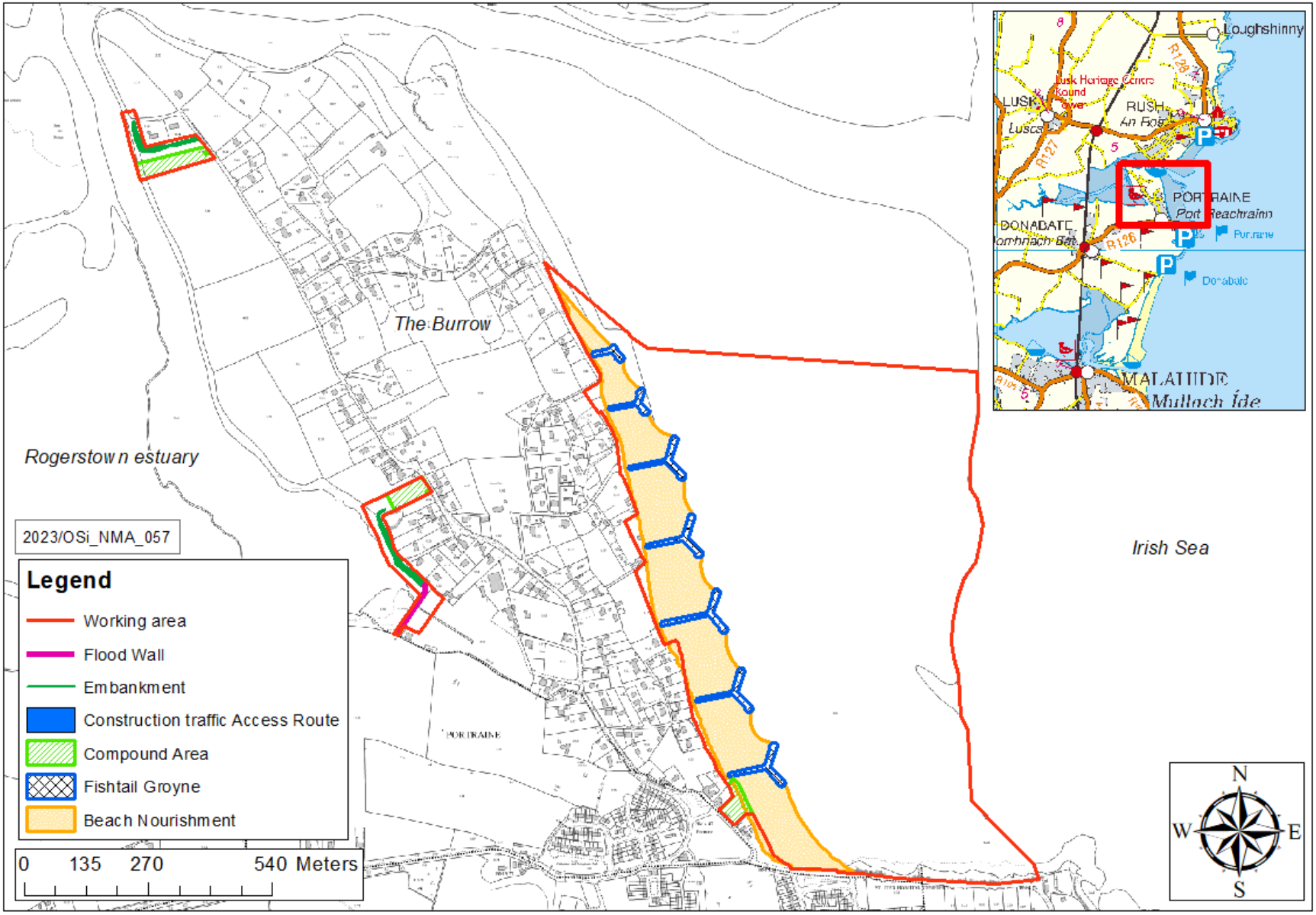


Figure 3.4: Overview of the Proposed Development at the Burrow, including Site Boundary and Working Areas.

A list of detailed drawings which are available for reference in Appendix 3A is presented in Table 3.1 below.

Table 3.1: Detailed drawings for the Proposed Development at the Burrow available in Appendix 3A.

Drawing Number	Description
IBE1820-OD-B-001	Burrow Site Location Plan
IBE1820-OD-B-002	Burrow Site Access and Working Area
IBE1820-OD-B-003	Burrow Site Access and Working Area Sheet 1 of 3
IBE1820-OD-B-004	Burrow Site Access and Working Area Sheet 2 of 3
IBE1820-OD-B-005	Burrow Site Access and Working Area Sheet 3 of 3
IBE1820-OD-B-006	Burrow Location of Services Burrow Embankment
IBE1820-OD-B-007	Burrow Location of Services Marsh Lane Wall & Embankment
IBE1820-OD-B-008	Burrow Embankment Plan and Section
IBE1820-OD-B-009	Burrow Embankment Plan and Long Section
IBE1820-OD-B-010	Marsh Lane Wall Plan and Section A-A
IBE1820-OD-B-011	Marsh Lane Wall Plan and Section B-B
IBE1820-OD-B-012	Marsh Lane Wall Plan and Long Section
IBE1820-OD-B-013	Marsh Lane Embankment Plan and Sections
IBE1820-OD-B-014	Portrane Beach Groynes and Nourishment Plan
IBE1820-OD-B-015	Portrane Beach Groynes and Nourishment Section Details Sheet 1 of 2
IBE1820-OD-B-016	Portrane Beach Groynes and Nourishment Section Details Sheet 2 of 2
IBE1820-OD-B-017	Burrow Site Notices

3.2.1 Flood Embankments at Burrow Road & Marsh Lane

The function of the proposed flood embankment structures at Burrow Road and Marsh Lane is to prevent coastal flooding caused by tidal inundation. An overview of the design details for these structures is listed below:

- The embankments will be constructed with 1 in 2.5 side slopes on both sides.
- The embankments will be constructed with a 1m wide crest to allow for easy and safe access to inspect and maintain the embankment.
- The core will be comprised of suitable clay material which will be compacted within a trench to the sub-formation level.
- The embankments will be built up to the design crest level of 4.02mOD using compacted layers of suitable granular full to SHW Series 600.
- The embankments will be covered by topsoil and seeded to promote the growth of vegetation.

A summary of the key metrics associated with the flood embankments is presented in Table 3.2 below. Further information on the design of these embankments is presented **Drawings IBE1820-OD-B-008**, **IBE1820-OD-B-009** and **IBE1820-OD-B-013** in Appendix 3A.

Table 3.2: Summary of the extent, footprint and construction volumes for the flood embankments at Burrow Road and Marsh Lane.

Metric	Marsh Lane Embankment	Burrow Road Embankment	Total
Length **[m]**	200	190	390m
Footprint **[m^2]**	1,580	1,304	2,884m^2
Volume of existing material to excavate **[m^3]**	776	856	1,632m^3
Volume of clay material to import **[m^3]**	198	190	388m^3
Volume of granular fill to import [**m^3**]	1,250	567	1,817m^3

3.2.2 Flood Wall at Marsh Lane

The function of the proposed flood wall structure at Marsh Lane is to tie into the proposed flood embankment (see previous section) and prevent coastal flooding caused by tidal inundation along a section of coastline where there is insufficient space to construct an embankment. An overview of the design details for this structure is listed below:

- The *c.*130m flood wall will consist of sheet piling to the defined defence level of 3.82mOD with a concrete strip foundation to support the cladding on both sides.
- The sheet piling will be completed with coping detail along the crest.
- Based upon preliminary ground investigation work, the toe depth is likely to be in the region of -10mOD. This should be confirmed at the detailed design phase.
- Facing panels or cladding can be implemented if required to give the appearance of a concrete or masonry wall.
- Back drainage will be installed at the dry side of the piled flood wall.

Further information on the design of this structure is presented in **Drawings IBE1820-OD-B-0010** TO **IBE1820-OD-B-012** in Appendix 3A.

3.2.3 Fishtail groyne structures

To limit the loss of beach renourishment material along Portrane beach and to provide wave protection to the coast, the Proposed Development includes the construction of seven fishtail groyne structures along *c.*1.3km of the beachfront. An overview of the design details for these structures is listed below:

- Each groyne structure will extend seaward for approximately 70m, before splitting into a “fishtail” or a “Y-shape”. Each groyne will then extend seaward for an additional *c.*40m at a 120^o angle.
- The core of the *c.* 70m trunk of each groyne will be constructed by re-using the existing seabee units which are already on the beach.
- The landward edge of each groyne structure will be constructed 10m seaward of the coastline to facilitate pedestrian access along the upper foreshore.

- The seabee units will be placed on a bedding layer and a 0.3 – 1.0T underlayer, separated from the beach using a heavy-duty geotextile.
- A single layer of 0.3 – 1.0T rock armour will be placed over the Seabee units at a slope of 1:1.5.
- The fishtail structures will be constructed exclusively of rock fill and rock armour (i.e. no seabee units).
- The filter layer of each fishtail structure will be placed onto and wrapped in a heavy-duty geotextile.
- The crest level of each groyne structure will be constructed to *c.*4.25mOD at the shoreline and slope to *c.*2.85mOD at the seaward side of the fishtails.
- The fishtails will be constructed with a consistent crest level of *c.*2.85mOD.

The total footprint of the seven groyne structures equates to *c.*13,615m^2, whilst approximately 42,000T of rock armour/core material will be required to construct the seven groynes (subject to detailed design).

It should be noted that a similar scheme involving the construction of fishtail groynes and beach renourishment to mitigate coastal erosion was constructed in at Clacton to Holland-on-Sea in the United Kingdom[4]. Since its construction in 2015, the scheme has continued to successfully mitigate the risk of coastal erosion to more than 3,000 properties. Thus, whilst the Proposed Development could be considered unique in an Irish context, examples of this type of scheme can be found the UK and further afield in Europe.

3.2.4 Beach renourishment

Upon completion of the groyne structures, the sub-cell areas will be filled with beach renourishment material imported from a licenced marine aggregate extraction site (presently assumed to be Liverpool Bay). Based on present-day beach levels, it is envisaged that *c.*425,000m^3 of material will be required to achieve the proposed beach levels of *c.* 3.0mOD.

The nourished beach profile within each groyne sub-cell has been designed to provide a *c.*25m flat upper foreshore at *c.*3.0mOD before sloping down to meet existing beach levels.

Further information on the design of the groyne structures and beach renourishment is presented in **Drawings IBE1820-OD-B-014** to **IBE1820-OD-B-016** in Appendix 3A.

[4] https://coastal-management.eu/measure/combination-groynes-and-beach-nourishment-clacton-uk.html

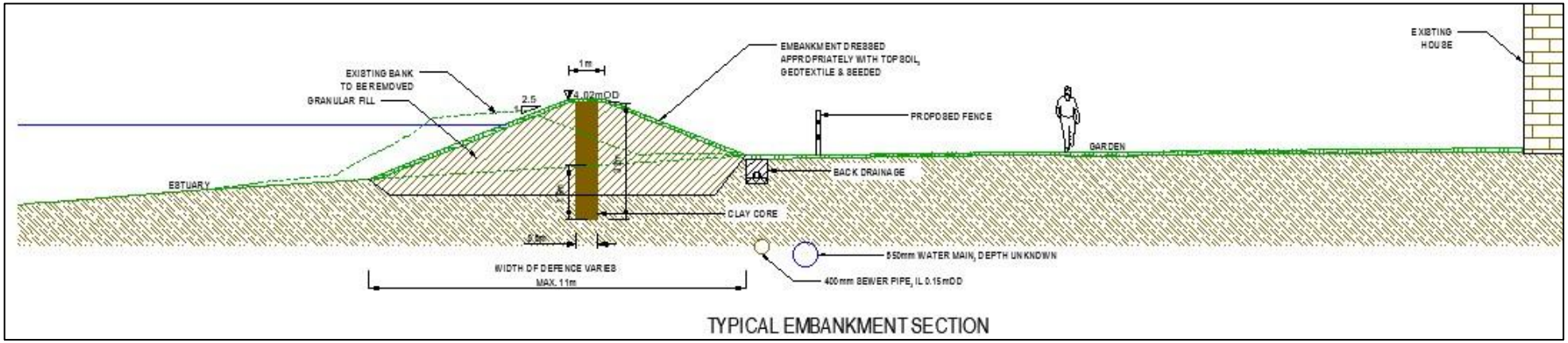


Figure 3.5: Cross-section of a typical embankment at Marsh Lane and Burrow Road.

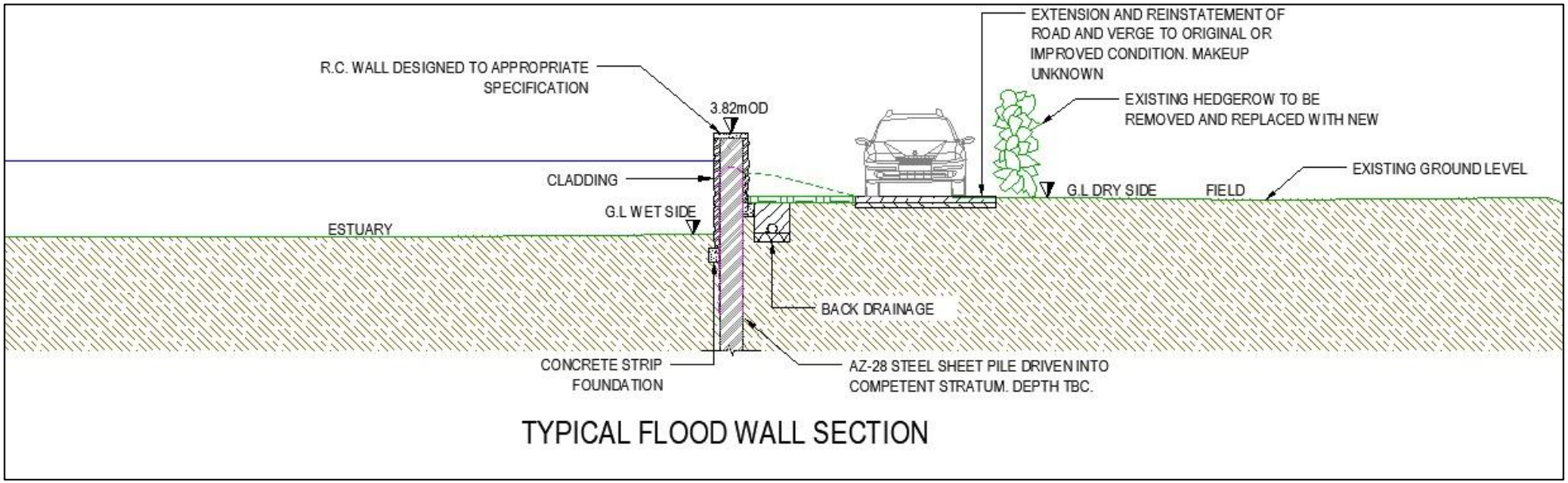


Figure 3.6: Cross section of a typical flood wall at Marsh Lane.

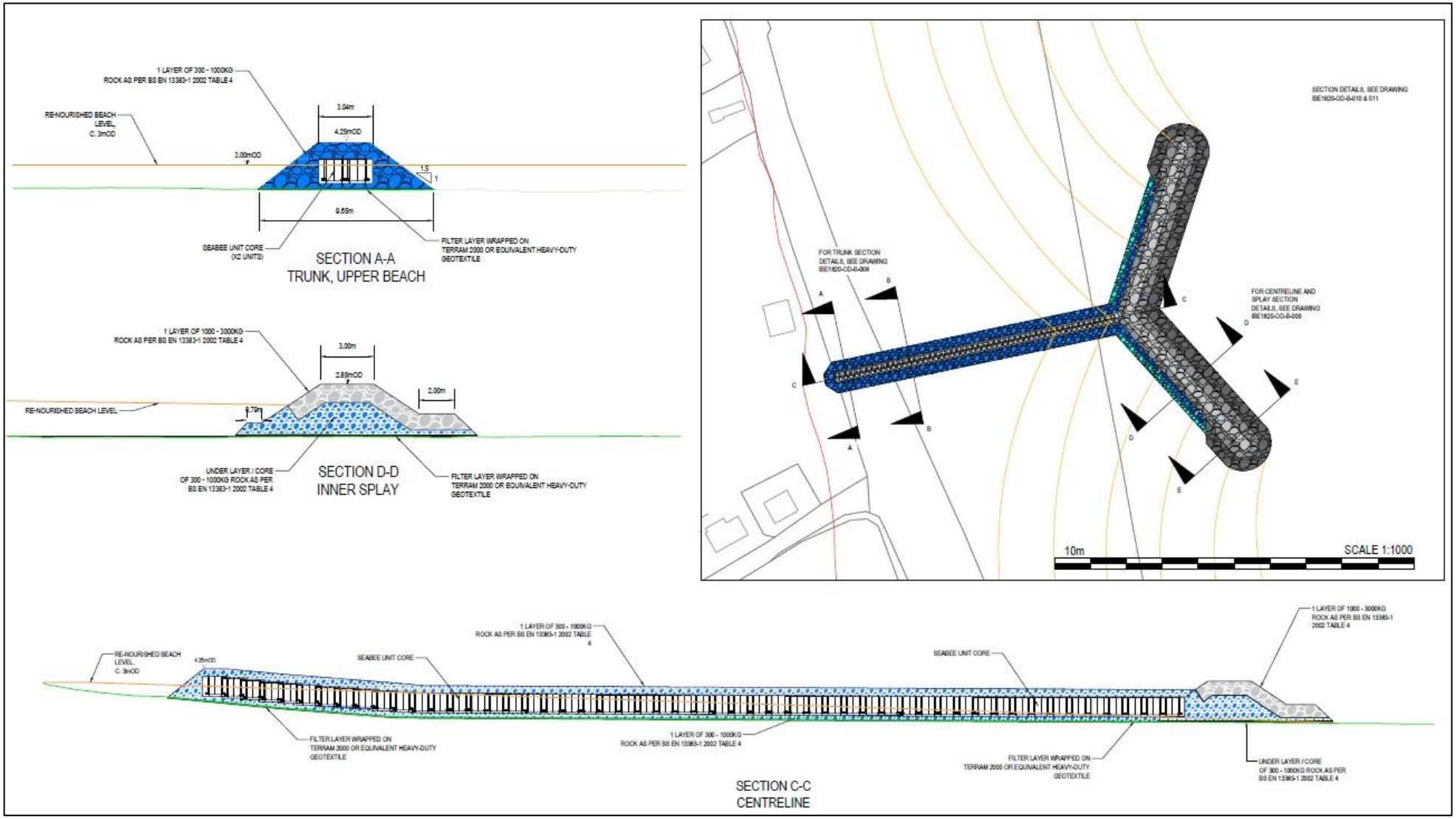


Figure 3.7: Cross section of a typical fishtail groyne structure and beach renourishment levels.

3.3 Outline Construction Method Statement

The various elements of the Proposed Development will likely be delivered over several phases, however, the detail, duration, timing, and programme for each have not yet been confirmed. Key phases are likely to include advance works, construction, operations and future maintenance as outlined below in the following sections.

3.3.1 Advance Works

Advanced works are likely to include, but not be limited to the following:

- Landowner and community liaison, particularly due to the requirement of temporary occupation of gardens at Burrow Road, and the use of roads for access. The progress of the works and working methods should be communicated to residents to avoid complaints, particularly activities such as vibratory pilling or compaction.
- Diversion of utilities where required, including a water main and combined sewer, a CCTV camera, and overhead ESB cables.
- Preparation of site compounds – likely on existing made ground in various locations owing to the number of areas requiring coastal defence works. Where possible, storage of materials shall be outside of the SAC and SPA boundaries. Fuel and plant would be stored as per the requirements of the CEMP.
- Fencing of terrestrial working areas and site compounds to prevent public access and vandalism.
- Traffic management measures on live roads as necessary.
- Pedestrian traffic management measures to close relevant sections of the beach as necessary.

3.3.2 Construction of Flood Embankments

The outline method of construction for the flood embankments of Marsh Lane and Burrow Road is likely to be:

- Install temporary works as required to provide a dry working area.
- Strip and store topsoil for reuse, including removal of any soft spots (depending on the subgrade layer, a separator may have to be placed).
- Remove existing bunds or localised elevated ground features (particularly the existing bluff at Burrow Road).
- Provide temporary haul road as required for access.
- Import and store suitable clay core material by lorry and road. This will be stored within the designated compound areas and brought to required locations using an excavator and dumper.
- Excavate the core trench, place, and compact clay in layers to the sub-formation level.
- Excavate to and grade sub-formation level beyond the footprint, with horizontal benching on relatively flat ground or if necessary, stepping of the profile to resist sliding if the existing ground profile slope is greater than 1 in 5.

- Build-up embankment to crest level in compacted layers using appropriate granular fill to SHW Series 600.
- Trim and profile the shoulders of the slopes to meet the required gradient of 1 to 2.5.
- Place topsoil, sow with grass seed and place a suitable, biodegradable geotextile. The geotextile will protect the embankment from erosion until the establishment of vegetation.
- Excavate and install back drainage at the rear toe of the embankment (see section 3.3.4).
- Install stock proof fencing as the embankments are to be located or partially located in agricultural land where grazing is likely; to prevent damage to the defences.
- Remove the haul road and reinstate the working area.

The locations of the proposed flood embankments are shown in drawing **IBE1820-OD-B-001**, in Appendix 3A.

3.3.3 Construction of the Flood Wall

The outline method of construction for the flood wall at Marsh Lane is likely to be:

- Delivery of piles to the site by articulated lorry or similar along the access route and storage in the appropriate areas shown in drawing **IBE1820-OD-B-004** in Appendix 3A. Piles will need to be stored in the working area before installation.
- Removal of the existing hedgerow between the lane and agricultural field, and establishment of a working area which will facilitate access for dumpers, excavators, concrete lorries and piling rigs. A stoned access route will be established within this area to provide a separate means of access for the residents along Marsh Lane and at the end of Marsh Lane.
- Install temporary works as required on the landside to maintain a minimum flood protection standard during the construction period.
- Establish a stable working platform from which the piling rig can operate. This will partially occupy Marsh Lane itself, in which space is very limited.
- Demolish and remove the existing wall on Marsh Lane, which is in poor condition and is likely to be damaged by vibration impacts.
- Set out the clutch line of piles.
- A crane will hoist piles vertically to be gripped and aligned by the piling rig before being driven to the required depth, and finish at the design top of wall level. A vibratory piling technique will be employed to reduce noise and vibration impacts, as opposed to percussive methods.
- Construct the concrete capping beam to the top of the piles, involving shuttering, steel fixing and concrete pour.
- Install facing panels or cladding if required to give the appearance of a concrete or masonry wall.
- Excavation and installation of back drainage at the dry side of the piled flood wall.

- Removal and reinstatement of the temporary haul road and working area.

To avoid potential impacts to the nearby Atlantic Salt Meadow habitat in this area, construction plant will not be permitted access to the foreshore with all works instead being undertaken from landside. If necessary, access for labourers to the seaward site of the seawall can be temporarily facilitated by laying bog mats, or similar provisions, at the toe of wall. Bog mats should be lifted and laid with every tidal cycle as necessary.

Other considerations including cladding finish to the wall and coping stone details, connection details between the wall and embankment, and outfall details for the existing culvert under the road will be fully specified at the detailed design phase.

Drawings **IBE1820-OD-B-010** to **IBE1820-OD-B-012** in Appendix 3A provides details regarding the alignment and form of the proposed flood wall along Marsh Lane.

3.3.4 Implementing Back Drainage for Flood Defences

Each of the new flood defences will have some degree of cut-off to prevent excessive flow beneath the defences. Along with the above-ground barrier, this adversely restricts the ability of the land behind the defences to drain post-scheme construction.

To facilitate drainage and ensure the land behind the defences does not become waterlogged, it will be necessary to construct a series of land drains behind the defences. These will consist of perforated pipes bedded in no fines granular material and laid parallel to the defence line at the rear toe. Precast concrete manholes or plastic inspection chambers will be provided at regular intervals to facilitate access for maintenance or changes in direction. At suitable locations, the outfalls of the back drain will discharge to the estuary. The outlet pipework will therefore have to pass either beneath embankments or through walls as applicable, with non-return valves installed to prevent backflow.

In the case of the embankments, the outlet pipework will be laid during embankment construction and will have a "collar" which will key into the clay core and prevent a flow path from forming along the line of the drainage pipe. Careful compaction of clay/shoulder material will also be required to minimise this risk.

In the case of piled walls, outlet pipework will be cored through at suitable locations once they have been installed.

Drawings **IBE1820-OD-B-008** through to **IBE1820-OD-B-012** in Appendix 3A show typical back drainage details on the dry side of the flood defence.

3.3.5 Construction of Fishtail Groyne Structures

Drawings **IBE1820-OD-B-014** through to **IBE1820-OD-B-016** in Appendix 3A illustrate the groyne structure details.

Subject to detailed design, the construction methodology of each fishtail groyne structure will involve the following:

- All rock armour material which is currently estimated at *c.* 42,000T (subject to detailed design) will be transported from a quarry (currently anticipated to be at Arklow) using Large Good Vehicles (LGVs) in 20T loads. Upon arrival at the site, material will be offloaded and stored within the adjacent compound facility.

- Material will then be transported from the compound material and placed onto the beach by a suitable-sized excavator/ offroad dump truck.
- An excavator/offroad dump truck will be used to place a *c.*200mm filter layer and 0.30 – 1.0T rock armour underlayer onto heavy-duty geotextile across the footprint of the groyne trunk, starting landward and working seawards.
- Concrete Seabee units which are already on the beach will be lifted and re-positioned along the groyne trunk in an interlocking fashion using an excavator.
- A single layer of 0.3 – 1.0T rock armour will be placed over the Seabee units at a slope of 1:1.5 using a suitable-sized excavator/ offroad dump truck.
- The fishtail sections of the groyne will be constructed in a similar fashion, placing a single layer of primary 1 – 3T rock armour over the bedding and 0.3 – 1.0T underlayer and core layers to achieve the design crest level and elevations using a suitable sized excavator/ offroad dump trucks.

The duration of works will be highly dependent on yield production rates at the elected quarry, but assuming material can be stockpiled on site, it is envisaged that each groyne will take *c.* four months to construct (subject to tide and weather conditions).

It is therefore expected to take *c.*28 working weeks to complete the construction of all seven fishtail groyne structures subject to tidal restrictions and assuming that works can be undertaken outside of normal working hours when required. However, as noted in Section 3.5.7 it is envisaged that this work will be undertaken by two squads in a *c.*17 week period in order to comply with the environmental constraints described in Section 3.4.7.

Subject to quarry production rates, it is expected that rock armour will be delivered to the site at an approximate rate of three trucks per hour throughout an anticipated eight-hour working day. This equates to *c.*90 days of rock armour related deliveries based on a six-day working week.

3.3.6 Beach renourishment campaign

Upon completion of the groyne structures, the sub-cell areas will be filled with imported beach renourishment material. The construction methodology for this element is outlined below.

- Supporting equipment required for the beach renourishment elements including flanged shore pipeline sections, dry plant and ancillary kit will be transported to the site by road, using approved routes and offloaded within a compound or a secure area at the beach.
- The sinker pipeline will be brought in 12m lengths to a suitable location using road transport, where it will be welded into the required length before being floated and laid on the seabed.
- A mooring point, acting as the connection between the dredger and sinker pipeline will be located on the seabed in a water depth of approximately 10m CD, allowing for the safe mooring of the dredger over all states of the tide, and will consist of a length of floating pipeline connected to the steel ‘sinker’ pipe positioned on the seabed.

- The sinker pipeline will be connected to the steel shore pipeline on the beach, with additional 12m lengths of pipeline added as the renourishment progresses and the design profile is achieved.
- It is envisaged that a maximum frontage of 650m can be completed before the sinker pipe has to be relocated to a second position to complete the works. This equates to two individual operations to place/move the sinker pipe.
- Upon setup of ancillary equipment as described above, a fully laden trailer suction hopper dredger (TSHD) will sail to Portrane Beach from the licensed renourishment extraction area (presently assumed to be Liverpool Bay).
- Upon arrival, the TSHD will couple to the connection point, fluidise the material within the hopper and pump it to shore.
- Once on the beach, the material will be profiled using GPS-equipped dry plant (dozers), with the shore pipeline extended as each section of the beach is completed. Once discharged the dredger will uncouple and return to the licenced marine excavation area to dredge the next load.
- It is envisaged that the TSHD will operate “non-tidally”, i.e. working in the most efficient manner to reduce losses. This will introduce a requirement for 24hr working on the beach during unloading operations.

Based on a delivery rate of 95,000m^3 per week, it is envisaged that all *c.*425,000m^3 of material will be transported to Portrane Beach within *c.*6 weeks (accounting for losses during the discharge and measurement processes).

3.4 Construction Management and Constraints

3.4.1 Site Compound and Working Areas

To facilitate the storage of materials, accommodate welfare facilities and site offices it will be necessary to provide sufficient site compounds and working areas within the proximity of the proposed construction works. These would preferably be located adjacent to the main work areas and must be secured adequately. Temporary works will also be required in some areas to prevent the tide from infiltrating the works zone each day during construction.

At Burrow Road, RPS propose the area of land directly south of the proposed embankment location for a site compound. At Marsh Lane, the proposed compound area is to the north of the defence with access directly off Burrow Road. These site compound areas and access routes are illustrated in Figure 3.4 and shown in drawing **IBE1820-OD-B-002** in Appendix 3A.

Adequate working room is required to ensure that the Proposed Development can be built safely with full consideration of the movement of plant, transportation, and storage of materials.

At Burrow Road, working room at the site is restricted on the dry side of the defence due to the private lands of the residents, with a strip of *c.*4m width alongside the proposed embankment toe. On the seaward side, an offset of 15m from the proposed embankment toe into the estuary has been proposed to minimise encroachment onto the foreshore. Whilst some working within the estuary cannot be avoided, no construction plant will be

permitted direct access to the foreshore area. Access for labourers to foreshore can be temporarily facilitated by laying bog mats, or similar provisions. Bog mats should be lifted and laid with every tidal cycle as necessary.

At Marsh Lane, the working area is restricted to the dry side of the proposed defences to limit land take and minimise long-term impacts to the protected salt meadow habitat in the estuary. Whilst some working within the estuary cannot be avoided, no construction plant will be permitted access to the foreshore area seaward of the defence line. Access for labourers to the seaward site of the seawall can be temporarily facilitated by laying bog mats, or similar provisions, at the toe of wall. Bog mats should be lifted and laid with every tidal cycle as necessary.

For the construction of the coastal elements (i.e. groyne structures and beach renourishment), the proposed compound area is within a recreational green space located directly adjacent to Pipers Takeaway. This site has previously been used as a compound and storage area during the construction of the temporary erosion measures that are currently in place on the beach.

As the working areas are greenfield or estuarine in nature, stripping of topsoil or sand deposits and stoning is required as necessary to provide a temporary haul road to facilitate plant movement. Heras fencing panels, or similar, will need to be erected as a site security measure for the duration of the works in terrestrial areas. Upon completion of the works, site compounds and temporary working areas will be re-topsoiled and/or reinstated to the existing condition.

3.4.2 Access Routes for Construction

All terrestrial plant and materials will be brought to Burrow Road via the R126. This will require plant movements on public roads for the duration of the works and therefore consideration must be given to this in the Contractor's traffic management plan. With appropriate controls and good contractor working practices, this can be achieved without significant risk, but it must be thoroughly considered in terms of construction methodology, timeframes, and cost. Site access routes are highlighted in drawing **IBE1820-OD-B-002** in Appendix 3A.

3.4.3 Management of Materials and Plant

Within the confines of the working areas, plant movements will be linear in nature. Materials including clay, sheet piles, reinforcement steel, concrete, shuttering, pipework, and topsoil will require transportation up and down these areas from the construction access points, depending on the location of the defence. This may require stoning of these areas to provide adequate haul roads during all weather conditions.

Due to working within the estuary boundary and proximity to properties, it will be necessary to ensure all machinery is in good condition and well maintained to minimise oil leaks and noise impacts to the adjacent properties as far as possible.

It is proposed that the storage of materials at each site will be within the site compound areas as illustrated in Figure 3.1 and shown on drawing **IBE1820-OD-B-002** in Appendix 3A. It is envisaged that these will be used for storage of topsoil, clay, reinforcement steel, drainage pipes and sheet piles until needed for construction. From there, materials will be transported to the relevant section of defence utilising a range of plant via the constructed haul roads.

In addition to these designated storage areas, it may be necessary to temporarily store materials within the working area immediately before using them for construction. The Contractor may also wish to store stripped topsoil in these locations which would reduce the number of site movements associated with double-handling topsoil. However, these activities will be limited as far as reasonably practicable within working areas that lie within the Rogerstown Estuary boundary, both at Burrow Road and Marsh Lane.

3.4.4 Impact on Properties

There will be a degree of impact on properties in the Burrow. The narrow nature of roads will potentially result in access constraints during the works due to unavoidable traffic management measures that will need to be implemented.

At Burrow Road, the two properties adjacent to the embankment will have a portion of their lands temporarily occupied to construct the embankments, with the property closest to the estuary permanently losing a small section of their garden. The owner of the agricultural field will lose access and use of their lands during the construction phase, and permanent use of the area which will be taken up by the embankment.

Similarly, at Marsh Lane, the end property is likely to temporarily lose access to a portion of their yard as the proposed flood wall must extend beyond their property. Working room on the dry side of the proposed embankment may also encroach upon the rear gardens of properties on Marsh Lane. Additionally, the landowner of the agricultural field proposed for the compound will lose use and access to their lands throughout construction and will experience a small permanent loss where the end of the embankment is located.

The working areas at these interfaces will need to be fenced off using Heras panels or similar, which may need to be covered with netting/tarpaulin for the duration of the works to provide privacy to properties and to minimise the impact of dust during dry periods.

For all properties within the vicinity of the works, it will be necessary to carry out pre-and post-construction condition surveys to ensure no damage is caused either due to work activities or related implementation of traffic management measures.

3.4.5 Working Within the Estuary

Works within the Rogerstown Estuary are unavoidable. Temporary works will be required to prevent coastal waters from interacting with works activities throughout the duration of the scheme. The design of temporary work to ensure the method of temporary flood protection is stable and avoids seepage will be the responsibility of the appointed Contractor.

3.4.6 Other Possible Contracts or Construction Works in the Area

Whilst no formal planning application has yet been submitted, as the lead design and environmental consultants, RPS are aware that it is the aspiration of FCC to submit a separate proposal for the FRS proposed at Rush south.

Subject to detailed design, it is anticipated the duration of the construction phase of this project will be *c.*23 weeks. FCC plan to phase the construction of this scheme ***after*** that of the Proposed Development. As such, there will be no temporal or spatial overlap between the two developments.

However, there remains the potential for both schemes to result in an in-combination effect during the operational phase of both developments. These potential operational in-combination effects are discussed further in Chapter 21.

Aside from this scheme, there are no other known planned construction activities in the area, likely to interact with the Proposed Development.

3.4.7 Phasing and Sequencing and Flood Risk Management Constraints

To mitigate potential aerial noise and visual disturbance effects it will be necessary to restrict the construction phase of Proposed Development to taking place outside of the wintering bird period (October to March). This constraint is described in further detail in Chapter 13. Aside from this environmental constraint there are no specific phasing constraints which need consideration during the construction of the flood elements of this Scheme. However, to reduce sediment losses, it is imperative that the groyne structures are constructed before the importation of sand material and renourishment of the newly created beach cells.

3.4.8 Long-Term Operations and Maintenance

Given that the flood elements of the Proposed Scheme are hard defences there are no unusual or specialist maintenance or operational activities envisaged. A description of envisaged maintenance activities for the flood elements of the Scheme is included below.

- **Walls** – maintenance associated with these will be minimal. Inspections in accordance with standard asset management procedures are likely to be the main activities. Dealing with vandalism in terms of graffiti or damage to coping stones (if provided) can be an issue.
- **Embankments** – these will need regular inspection and should be mowed at least twice annually to prevent the growth of significant vegetation. Inspection activities will need to look for the presence of animal burrowing or damage from livestock although fencing of the defences, where located within agricultural fields should prevent the latter. Access to embankments is easily achieved for both inspection and maintenance purposes.
- **Drainage elements** – non-return valves will need to be checked regularly to ensure they are working as they form a key aspect of the Scheme function. These will be designed in such a way as to provide safe access. This can be within a manhole on the defended side of the defences rather than at the point of the outfall to the river. Back drainage will need to be checked for blockage and rodded if necessary. Manholes/inspection chambers will be provided to enable this to happen. These manholes will be located on private property including residential gardens and agricultural land.

As the beach renourishment element of the coastal scheme on the beach is predominantly a “soft” nature-based solution, sediment material will be gradually lost from between the groyne structures over time and particularly during storm conditions. Consequently, beach levels within these cells will gradually reduce over time and require periodic renourishment.

The frequency of renourishment will be subject to prevailing weather conditions, the physical characteristics of the renourishment material and the detailed design of the groyne structures but, based on the experience of specialist beach renourishment contractors, it is expected that the beach will require renourishment

approximately every *c.* 10 years. The magnitude of renourishment will be subject to the rate of losses during the intervening period but is expected to equate to *c.* 50 % of the initial renourishment volume.

Future beach renourishment campaigns will be undertaken as per the methodology described in Section 3.3.6, with similar costs and environmental impacts being incurred in each instance.

3.4.9 Other Considerations

It should be noted that the following measures will be required of the successful contractor:

- The control of oils and chemicals from plant and those used in the construction process. The Contractor's method statement will need to address this. It will be a requirement to specify the use of modern and well-maintained plant,
- An invasive species management plan should be prepared and include the measures outlined in Section 13.6. This plan should be implemented for the Scheme, to prevent the spread of such species (including common cord-grass) during construction.
- A site-specific pre-construction Site Waste Management Plan (SWMP) will also be prepared and implemented by the appointed Contractor prior to construction. This should be completed in line with the waste management hierarchy, with waste reduction and reuse on site being of primary focus. The appointed Contractor for site preparation, earthworks, piling and construction phases of the works will be contractually obliged to follow the SWMP and relevant legislation.
- A Construction Environmental Management Plan (CEMP) will be developed by the Contractor to be submitted as part of the approvals process. The CEMP will detail how to implement the mitigation measures described in the EIAR and Natura Impact Statement (NIS) which are designed to avoid, minimise, or mitigate adverse construction effects on the environment during the construction of the development, particularly pollution prevention measures necessary to protect the sensitive receiving environment and European Sites. The CEMP will also identify a variety of measures that will be incorporated to mitigate against nuisance to the population including provisions in relation to traffic, noise, and dust on the site.
- Additionally, the Contractor should prepare an emergency response plan (ERP) that describes how instances of the spillage/discharge of sediment and other pollutants will be managed. The emergency response plan should be included as part of the CEMP.

3.5 Preliminary Construction Programme

A preliminary construction programme has been prepared for the Proposed Development at the Burrow which takes into consideration the environmental constraints described in Section 3.4.7 and phasing referred to in the Burrow Outline Buildability Report. As illustrated in Figure 3.8, the overall estimated programme is 23 weeks.

The programme considers the following elements:

- Traffic management,
- Utility diversions,
- Site establishment and clearance,
- Flood wall,
- Flood embankments,
- Back drainage,
- Seabee/ rock armour groynes,
- Beach renourishment,
- Reinstatement.

The programming of these elements is described in the following sections. It should be noted that the predicted timescales are subject to change due to potential detailed design changes, liaison with key stakeholders and the resources assigned to the construction elements by the appointed contractor.

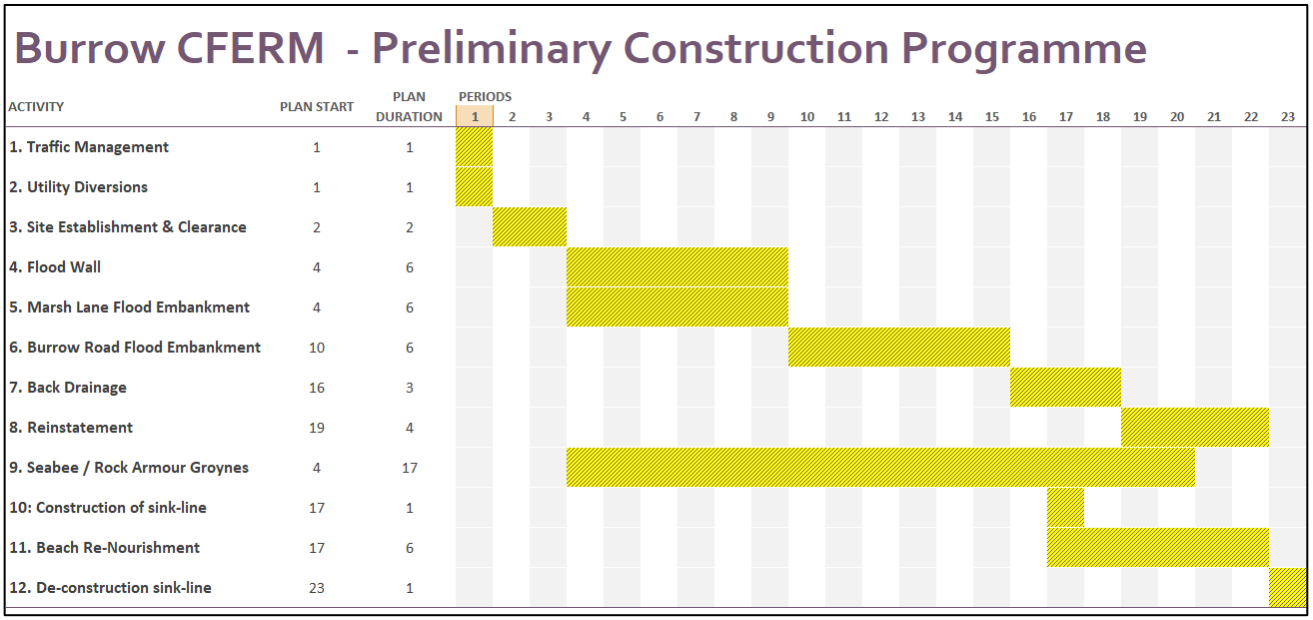


Figure 3.8: Preliminary construction programme for the Burrow CFERM scheme

3.5.1 Traffic Management

Given the proximity to the local road network, traffic management will be ongoing throughout the entirety of the Proposed Development. A period of one week has been programmed to allow for the setup of required measures, although this will ultimately depend on the Contractor's agreed Construction Traffic Management Plan (CTMP) as well as the extent of utility diversions required.

3.5.2 Utility Diversions

The Burrow Outline Buildability Report describes potential utility clashes including the narrow access road at Marsh Lane which will increase the complexity of relocating electric poles and ultimately require the closure of this road. In addition, the water and sewer main that runs along and beneath the proposed embankment in the field at Burrow Road may need diverted as well as the overhead ESB pole at this location.

Taking account of this, a one-week period is allotted in the programme for completing these advanced works, assuming such diversions are required. However, the exact number of utility diversions needed will be further determined at the detailed design phase.

3.5.3 Site Establishment and Clearance

Two weeks have been provisionally included to allow the Contractor to establish a site compound and working areas, complete site clearance, erect temporary works and carry out other relevant activities, as referenced in the Burrow Outline Buildability Report. This timeframe will likely be required due to the distance between the Burrow Road, Marsh Lane and Portrane Beach sites.

3.5.4 Flood Wall

The proposed flood wall at Marsh Lane involves driving approximately 186 piles for a 130m long wall. The progression of this critical item of work will be heavily influenced by local obstructions and general ground conditions across the site, which will not be fully uncovered until the works take place. Piles will be driven and clutched first, with other working squads anticipated to follow in sequence to excavate and pour strip foundations, fabricate formwork, tie reinforcement steel, pour the concrete capping beam and apply the desired cladding or facing panel finishes to both sides of the wall, which totals approximately 16.25m^3 of concrete.

An existing channel emerging beneath the lane and existing wall will be replaced with a new culvert and must also be accommodated; these items will be considered further in the detailed design.

Based on a construction rate of *c.*50m per week, with an allowance of one week for the culvert construction, a total period of four weeks has been programmed for the construction of the flood wall at Marsh Lane.

3.5.5 Flood Embankments

The timeframe for the proposed 190m long embankment at Burrow Road and 200m long embankment at Marsh Lane will depend on local ground conditions . At Burrow Road, approximately 860m^3 of spoil must be cut and removed from the site, and roughly 277m^3 of fill must be imported. This and the general construction of the embankment at Burrow Road is initially programmed to take six weeks.

At Marsh Lane, although the length of the embankment is similar, and less spoil is estimated to require removal (approximately 794m^3), a greater volume of fill totalling approximately 917m^3 must be imported for construction. However, the construction of the embankment and flood wall at this location can occur concurrently subject to resources assigned by the Contractor. Thus, it is estimated that the Marsh Lane embankment will take approximately six weeks to construct.

3.5.6 Back Drainage

Back drainage will be required at the dry side along the entirety of the defences at Burrow Road and Marsh Lane. Given the fact that these drains will also require manholes at regular intervals, four weeks has been programmed for these works.

3.5.7 Seabee/ Rock Armour Groynes

Based on liaison with experienced contractors, it is estimated that under normal circumstances approximately four weeks would be needed to construct each groyne structure. With a total of seven groynes, the total construction period for these elements would equate to *c.* twenty-eight weeks.

However, owing to the environment constraints described in Section 3.4.7, it will be necessary for the appointed contractor to assign two squads to these works so that two groyne structures can be constructed concurrently. Based on this, it is expected that all groyne structures will be constructed within seventeen weeks. This includes for three additional weeks for potential delays caused by adverse weather or tidal conditions.

3.5.8 Beach Renourishment

Having liaised with industry experts, it has been estimated that the beach renourishment works can be completed over the course of a six-week period. This is based on a dredge vessel discharging a 10,500m³ load *c.* nine times per week. This estimation accounts for typical delays due to weather, bunkering, maintenance etc.

It should be noted that the beach renourishment works would start concurrently with the construction of the last two groyne structures.

3.5.9 Reinstatement

This item of work will involve the removal of surplus materials from site, removal of plant and site compounds, reinstatement of verges, road surfaces, the estuary bed, other working areas, and removal of traffic management. Intricate reinstatement details will be developed in the detailed design stage, however provisionally a period of four weeks has been programmed for the reinstatement of the Burrow areas to their prior condition.

4 CONSIDERATION OF ALTERNATIVES

4.1 Introduction

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

Alternatives are defined as different ways of carrying out a Project to meet its agreed objective(s). There are a range of alternative types that can be considered in relation to a Project. These relate to the following:

- Design.
- Technology.
- Location.
- Size.
- Scale.

The assessment of alternatives for this EIAR has been undertaken in accordance with the following guidance documents:

- The EU Commission's *Environmental Impact Assessment of Projects Guidance on the Preparation of the Environmental Impact Assessment Report* (Directive 2011/92/EU as amended by 2014/52/EU).
- The Department of Housing, Planning and Local Government's *Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment* (August 2018).
- *Guidelines on the information to be contained in Environmental Impact Assessment Reports* (EPA, 2022).

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

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

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

4.2 Examination of Strategic Level Alternatives

At a strategic level, the following planning policy document was used to inform the development and selection of the Proposed Development:

- Fingal Development Plan 2023 – 2029, Interim Publication (FCC, 2023).

The following sections of this chapter presents the relevant aims and objectives of this document in context of the Proposed Development.

4.2.1 Fingal Development Plan 2023 – 2029, Interim Publication

The Fingal Development Plan 2023 - 2029 sets out the Council's proposed policies and objectives for the development of the County over the Plan period. The Development Plan seeks to develop and improve, in a sustainable manner, the social, economic, environmental and cultural assets of the County. The plan was prepared in accordance with the requirements of the Planning and Development Act, 2000 (as amended), higher tier international, national and regional level plans, ministerial guidelines and regarding local level strategies and plans.

The plan is underpinned by four key cross cutting themes; climate action, healthy place-making and sustainable development, social inclusion and high-quality design. In the context of climate action, the plan contains provisions dealing with climate change mitigation and adaptation, in areas including, but not limited to, flood risk management, coastal management and green infrastructure. In respect of Coastal Management, policies described in this plan include:

- **Policy CAP31 – Coastal Monitoring:** Monitor coastal erosion and accretion along Fingal's coastline to identify locations at risk of coastal erosion and flooding.
- **Policy CAP32 – Coastal Protection:** Ensure the provision of appropriate coastal protection measures in locations at risk of coastal erosion and flooding.
- **Policy CAP33 – Coastal Zone Management:** Support coastal zone management measures for adapting to climate change which includes restoration of degraded ecosystems, increased flood resilience, water quality improvement, habitat conservation and provision of amenities for the residents of and visitors to Fingal.
- **Policy CAP34 – Engagement with Key Stakeholders:** Continue to work with national and regional authorities and other key stakeholders with regard to flood defence required to protect vulnerable urban areas from worst case scenario sea level rises in the coming decades.

The Proposed Development is therefore critical in helping FCC achieve these Coastal Management aims by 2029.

4.2.1.1 Coastal Zone Management Strategies

The Fingal Development Plan recognises that the coast is an ever-changing dynamic environment, subject to the continuous natural processes of erosion and deposition. While erosion is a normal occurrence in coastal areas, rates of erosion may be accelerated due to storm action, inappropriate development, pressures from

leisure or recreational activities. In addition, the impacts of predicted sea level rise and increase in the frequency of storm surges and high tides due to climate change need to be considered.

The plan recognises that there are several available strategies in respect of coastal zone management best practice. These strategies include:

- **No Active Intervention (i.e. 'Do Nothing')**
  This is a strategy based on the decision not to invest in providing or maintaining any defences. In an area with no defences, this strategy means that the shoreline will continue to evolve naturally. This often means that coastal erosion and or flooding will continue "unchecked".
- **Hold the Line**
  This strategy involves improving or maintaining the standard of protection provided by the existing defence line and can require the construction of new, more robust defences. There may be some residual risk in holding the line such as a steepening of the foreshore or the loss of beach width. Such factors could make this policy unsustainable sooner than anticipated.

  The aim of this strategy is to retain the existing character and form of the coast with minimal disruption, whilst maintaining all existing assets.

  The Proposed Development at the Burrow is based on this coastal zone management strategy.
- **Managed Realignment**
  When a coastline is protected with hard or soft defences, this option involves allowing the coastline to move backwards (or forwards) by realigning the position of existing defences and creating a new line of protection.

  In terms of coastal erosion, this strategy can involve establishing a sacrificial buffer zone where no development is permitted (i.e. a no build zone). For coastal flooding, it will state a minimum elevation above mean sea level for development.
- **Managed Retreat**
  This strategy entails a co-ordinated movement of people and infrastructure away from risks and allowing the coastline to naturally retreat.

Each of these alternative coastal zone management strategies are considered in the following sections of this chapter.

4.2.1.2 No Active Intervention

As noted previously, "No Active Intervention" means that in this case, the local authority would not invest in a coastal zone management strategy. As such, no measures would be implemented to mitigate the significant coastal erosion and flooding risk at the Burrow.

Whilst this strategy would avoid potential environmental impacts in the area, coastal erosion could result in the coastline in this area retreating by up to *c.*88m (±30m) and the subsequent loss of up to *c.*46 buildings by 2100 depending on future climate conditions. Subject to future sea level rise, up to *c.*267 buildings could be affected by coastal flooding during a 1 in 200-year return period event.

Considering the extent and scale of these risks and the subsequent socio-economic impact to the local community of Portrane, a coastal zone management strategy of “No Active Intervention” was not considered a socially sustainable solution and was therefore ruled out.

4.2.2 Hold the Line

Whilst the Proposed Development is based on a coastal zone management strategy of “Hold the Line”, this one strategy is comprised of a long list of hard and soft engineering options. This long list of options and potential “Hold the Line” alternatives is discussed further in Section 4.3.1.

4.2.3 Managed Realignment

Managed realignment involves the landward movement of existing sea defence structures and the promotion of new habitat in front of the new line of defence. The land between the old and new defences then forms a new intertidal zone that can respond to coastal processes.

This coastal zone management strategy was not considered applicable given that there are no permanent sea defences along the coastline of the Burrow.

4.2.4 Managed Retreat

This strategy involves creating a sacrificial buffer zone whereby no further development is permitted (i.e. a no build zone). Managed retreat differs from managed realignment in that the latter involves moving existing hard defences to create a new line of defence.

As opposed to establishing a fixed setback line it is possible to introduce a series of rolling easements whereby the setback line and buffer zone are adjusted over time. But this approach can postpone decision making which often results in more sustainable opportunities being missed.

The alternative managed retreat option is abandonment. Long-term planned abandonment can follow the “No Active Intervention” strategy whereby buildings are regarded as having a fixed life span. When these buildings are at imminent risk of coastal erosion or flooding, no attempt is made to protect them.

Planned abandonment can also be achieved by prohibiting post-storm reconstruction. As with the setback approach described above, landowners directly affected by a policy of abandonment may be compensated through acquisition programmes etc.

Whilst managed retreat would avoid potential environmental impacts in the area, it is important to recognise that the Burrow is effectively one large, low-lying, sandy spit which separates the Rogerstown Estuary from the Irish Sea. As such, if coastal erosion is left unchecked, it is highly likely that the coastline will continue to retreat indefinitely. Given the finite space available at this site, managed retreat is not considered a technically feasible solution. This issue is exacerbated by the low-lying nature of the Burrow which means coastal erosion would accelerate once the existing coastal dune system which acts as a natural buffer is eroded.

From a social perspective, this strategy would result in very significant impacts to the community of Portrane, particularly for those landowners directly affected by managed retreat. This strategy would also result in very significant adverse impacts on the wider local economy in context of the local housing market and valuations of property etc. This is a particularly important consideration given that at present there is no national strategic

policy in Ireland regarding relocation, buy-back, and/or buy-out programs to facilitate compensation of residents, landowners and/or local communities affected by a strategy of managed retreat.

This serious issue was highlighted by a recent study which found that Local Authorities (LAs) in Ireland do not have a written policy outlining how to deal with private property at risk or affected by coastal erosion (MaREI Centre, 2017). Currently there is no clear obligation for LAs to protect private properties from the impact of coastal erosion (Department of Communications Marine and Natural Resources, 2004). Legislation does not clearly state who is ultimately responsible for dealing with private property impacted by coastal erosion (Irish Government, 1963).

Based on the technical, socio-economic and legislative challenges and impacts associated with managed retreat, this coastal zone management strategy was not considered a viable alternative.

4.3 Examination of Project Level Alternative Options

Upon completion of strategic level studies to identify the options available, a project level study of viable alternatives was undertaken. This section of the EIAR describes the project level evolution of the optioneering process that resulted in the identification of the Proposed Development.

Having identified “Hold the Line” as the most sustainable coastal zone management strategy to mitigate the very extensive coastal erosion and flooding risk at the Burrow, RPS undertook an extensive appraisal to examine the feasibility of a long list of hard and soft engineering measures (RPS, 2020). This long list of options included:

- Seawalls
- Revetments
- Embankments
- Groynes
- Dune stabilisation (marram planting, dune regrading etc)
- Beach renourishment
- Perched beaches
- Detached breakwater

As detailed in the Optioneering report (RPS, 2020), each of these options were appraised to produce a short list of options. This initial appraisal was based on the following criteria:

- **The Environment** - The proposed option must not adversely impact the natural environment including existing coastal process. Nor will the proposed option negatively impact nearby environmentally designated areas.
- **Society** - The proposed option must effectively reduce the damages/losses associated with the predicted coastal flood and erosion risk.
- **The Economy** - The cost of constructing and maintaining the proposed option has the potential to be financially viable, i.e. the benefits of an option should outweigh the costs of an option.

4.3.1 Initial appraisal of "Hold the Line" options

4.3.1.1 Seawalls

Seawalls protect banks and bluffs by completely separating land from water. Seawalls are primarily used to resist wave action and if designed correctly can provide effective protection to the hinterland. However, seawalls do not protect the shore in front of them. On the contrary, erosion of the seabed immediately in front of the structure will in most cases be enhanced due to increased wave reflection caused by the seawall. This usually results in a steeper seabed profile which in turn allows larger waves to reach the structure.

A seawall is usually a fixed, inflexible structure. Future sea level rise must be accounted for during the design phase. A typical sectional view of a seawall is presented in Figure 4.1 below.

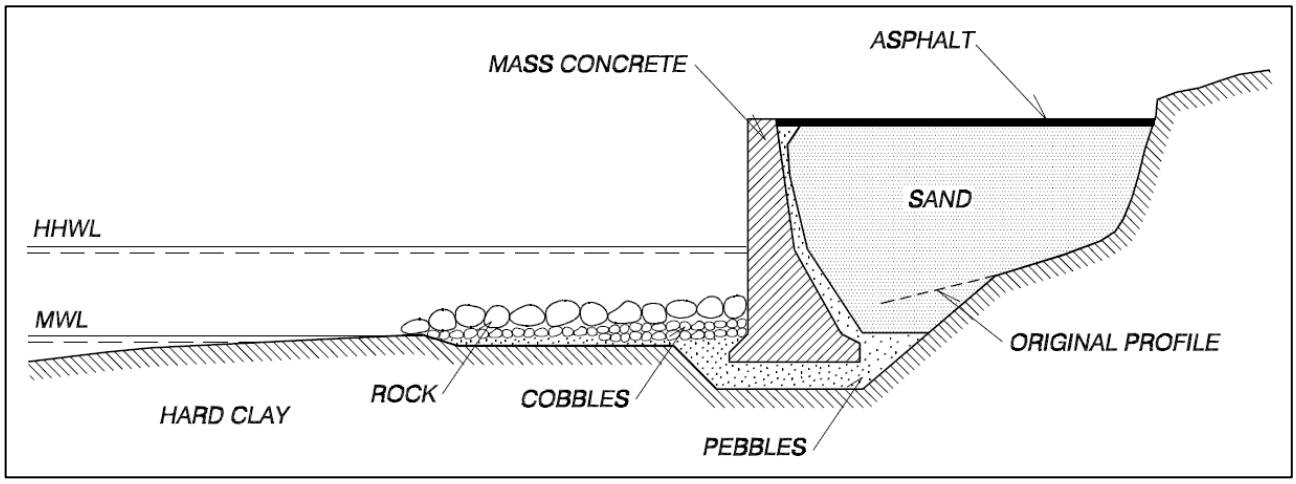


Figure 4.1: Typical section view of a vertical seawall.

When seawalls are used in areas with significant wave action such as the Burrow, they may accelerate beach erosion as much of the wave energy is redirected down toward the toe. This can reduce beach levels and result in coastal squeeze as summarised in Figure 4.2. Furthermore, seawalls will completely arrest the natural beach dune interactions and prevent the release of sediments from the section it protects. This will have a negative impact on the sediment budget along adjacent shorelines.

Due to the reasons outlined above, the construction of a seawall along the beach frontage at the Burrow would be detrimental to the conservation objectives of the nearby environmentally designated areas.

From a social perspective, seawalls are very effective at preventing coastal erosion and other damage due to wave action and storm surge, such as flooding. However, these structures often result in a detrimental impact to nearby environmentally designated areas which is considered further in Section 13.

Initial Appraisal

This option was carried through the initial appraisal process owing to the established coastal protection that seawalls can provide.

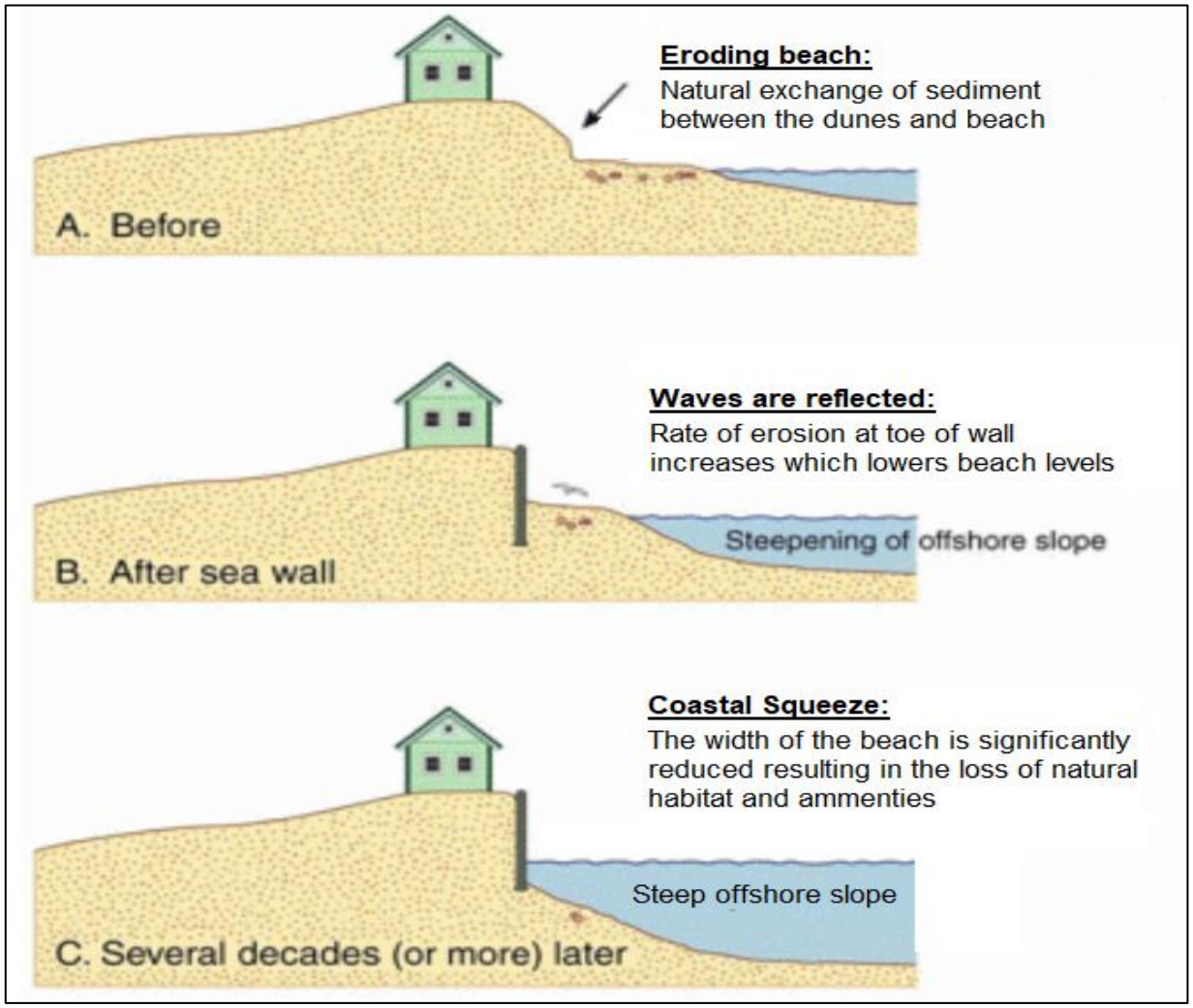


Figure 4.2: The long-term impact of a seawall.

4.3.1.2 Revetments

Revetments are shore parallel sloping defences that dissipate wave energy. Some modern revetments have concrete blocks laid on top of a layer of finer material while rock armour or riprap revetments consist of layers of very hard rock often weighing several tonnes. Riprap has the advantage of good permeability and looks more natural.

A revetment is more flexible than a seawall and is therefore easier to modify in response to future climate change. Although revetments can reduce flood risk by reducing wave overtopping, they do not generally prevent flooding due to storm surge activity.

Whilst a revetment will fix the location of a coastline, it will not prevent erosion of the lower beach profile. Overtime this results in coastal squeeze whereby the beach in front of the revetment will gradually disappears. Furthermore. given that a revetment is designed to interrupt the release of sediment from the section of coastline that it protects, the structure will have a negative impact on the sediment budget along adjacent shorelines.

Initial Appraisal

This option was carried through the initial appraisal process to the established coastal protection that revetments can provide.

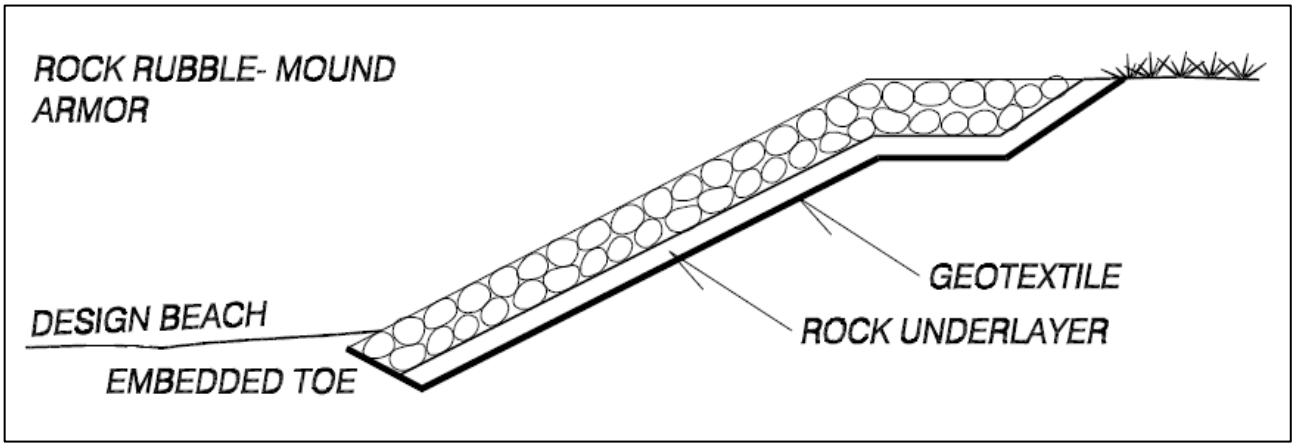


Figure 4.3: Typical section view of a rubble mound revetment.

4.3.1.3 Groynes

Groynes are narrow structures that are usually constructed perpendicular to the shoreline. A single groyne promotes the accretion of beach material on the updrift side but erosion on the down drift side; both effects extend some distance from the structure. Consequently, a groyne system can result in a saw-tooth-shaped shoreline with different beach levels on either side of the groynes.

Groynes create very complex current and wave patterns. However, a well-designed groyne system can slow down the rate of longshore transport and by building up material in the groyne bays, provide some protection of the coastline against erosion.

Occasionally, groynes are constructed to include a specially designed “fishtail” or “Y-head” at their seaward end. The benefit of these features is that they can influence the cross-shore transport processes as well as the longshore transport element of the littoral drift regime. An example of a fishtail groyne system at Clacton-on-Sea is illustrated in Figure 4.4 and Figure 4.5.



Figure 4.4: Example of fishtail groynes at Clacton-on-Sea (© Google Earth).

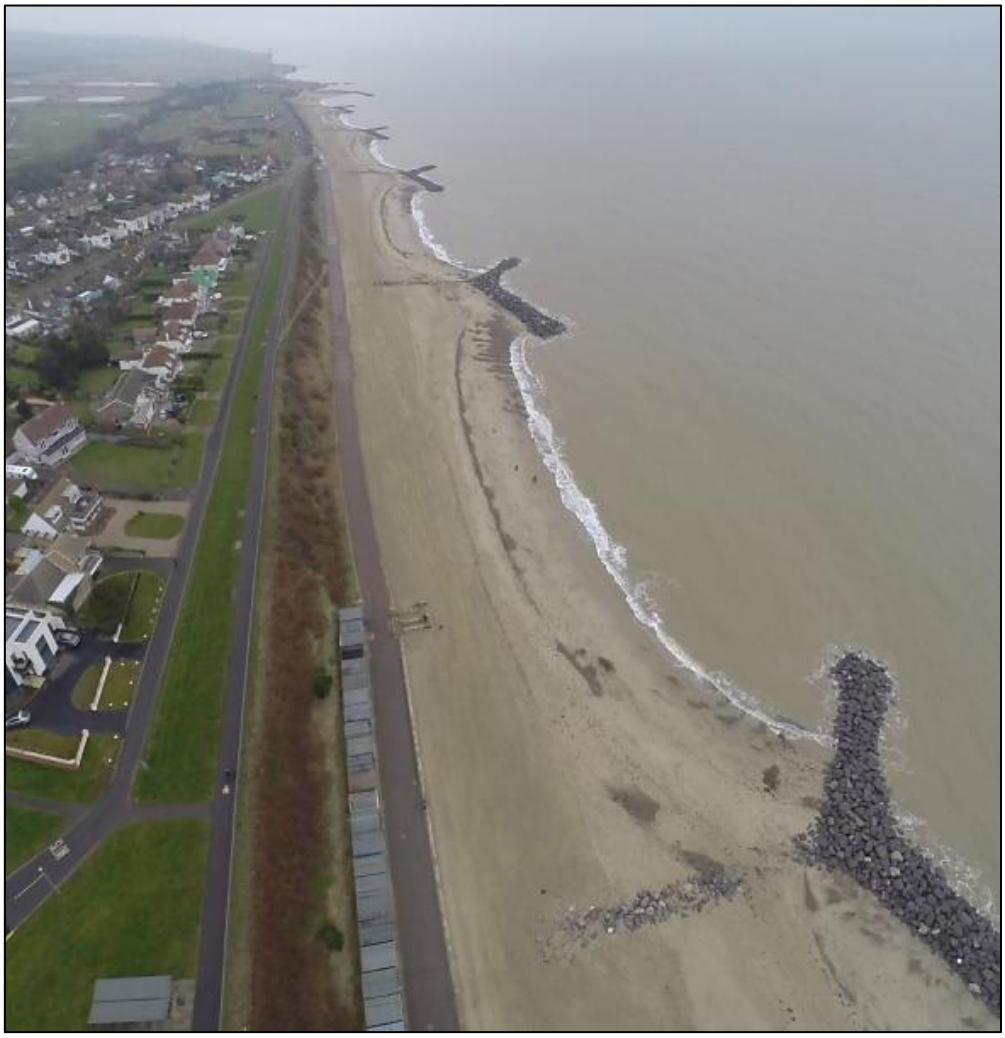


Figure 4.5: Aerial view of a fishtail groyne field at Clacton-on-Sea.

The beach profiles across the Burrow are very flat which means that the width of the littoral zone is greater than most beaches. This is an important feature as it is unlikely that a short groyne field would completely arrest the longshore drift at the sites.

If each groyne field is filled with suitable sand material, the potential to trap sand and thus cause a deficit in the sediment supply updrift is significantly reduced. Despite this, groynes still have the potential to impact the qualifying features of the nearby environmentally designated areas.

From a technical perspective, a well-designed fish-tailed groyne field could be used to control sediment movement along the upper beach at the Burrow and reduce incoming wave energy. This option would need to be complimented with a beach renourishment campaign to ensure each groyne field was full. In combination, groynes and beach renourishment could mitigate the risk of coastal flooding and erosion.

Initial Appraisal

This option was carried through the initial appraisal process owing to the established coastal protection that groynes can provide.

4.3.1.4 Detached Breakwaters

Detached breakwaters are usually built as rubble-mound structures and are usually constructed parallel to the shoreline either inside or outside of the surf-zone. These defences provide shelter from waves, whereby the sediment drift behind the breakwater is decreased and the transport pattern adjacent to the breakwater is modified.

Depending on the physical characteristics of the breakwater and the proximity of the structure to the coastline, breakwaters can result in the formation of salients or tombolos. In both instances, there is an accumulation of sand between the breakwater and coastline, but with tombolos the accumulation of sand will create an emerged beach between the breakwater and coast as summarised in Figure 4.6 below.

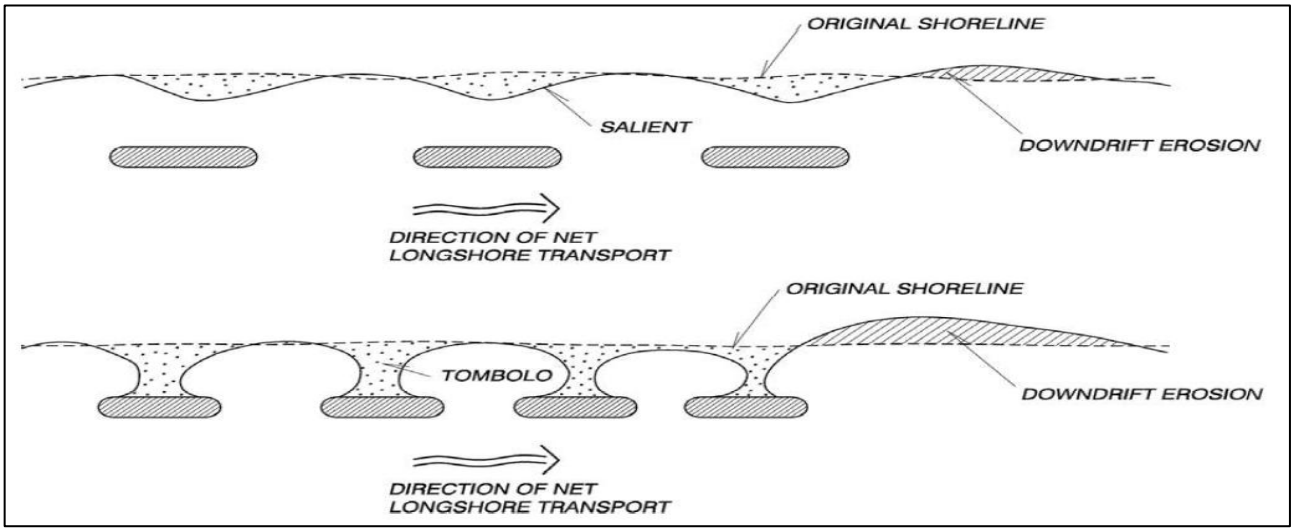


Figure 4.6: Typical beach configurations with detached nearshore breakwaters.

The environmental impact of breakwaters is highly variable and dependent on the size and location of the structure in relation to the coastline and beach profile. Breakwaters generally have an advantage over groynes in they do not obstruct access along the beach, however the accumulation of sand around the breakwater can be un-predictable and result in dangerous currents and wave conditions.

Breakwaters tend to work best along straight coastlines which have a dominant wave direction. As described in Chapter 6, the coastal processes within the study area are complex, particularly between the Burrow and Rush South where the Rogerstown estuary has a strong influence on prevailing conditions. Given these complexities, it would be difficult to ensure a breakwater solution would mitigate the risks associated with coastal erosion. It should be noted that breakwaters do not mitigate coastal flooding due to storm surge activity.

In addition to this, detached breakwaters are generally very expensive to construct and maintain. Constructing a detached breakwater would certainly be more expensive that implementing either a rock revetment or a combined groyne and beach renourishment option along the Burrow.

Initial Appraisal

This option was **not** carried through the initial appraisal process owing to the uncertainty regarding the performance of a detached breakwater in an environment like the Burrow which was considered to outweigh the potential benefit of this very costly option.

4.3.1.5 Embankment

Embankments are onshore structures with the principal function of protecting low-lying areas against flooding. These structures are usually built as a mound of fine materials like sand and clay with a gentle seaward slope that reduces wave run-up and the erosive effect of the waves. The surface of the embankment can be armoured with grass, asphalt, stones, or concrete slabs.

In most instances, embankments are constructed well above the mean high-water mark which means that the structure is often fronted by a low-lying coastal platform. On an eroding shoreline, where dunes form the natural protection of the low hinterland, an embankment can be coupled with the construction of hard coastal defences as summarised in Figure 4.7 below.

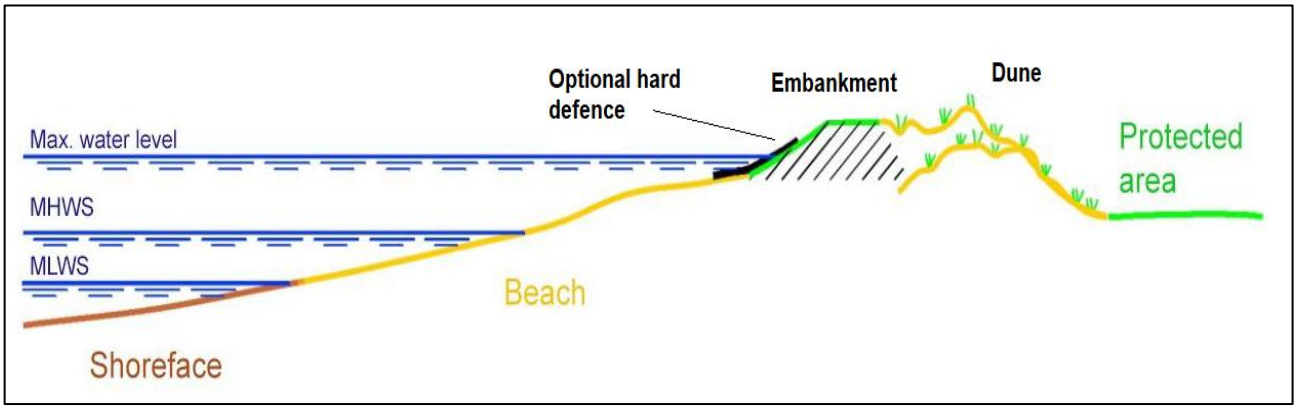


Figure 4.7: Typical section of an embankment with an optional hard defence on a sandy dune system (adapted from DHI, 2017)

The main function of an embankment is to prevent the flooding of a low coastal hinterland, which means that the height of the embankment is the most important design parameter. However, an embankment must also be able to withstand the force of waves during extreme storm conditions.

Given that these structures are most common in areas where the frequency and magnitude of extreme storm events are low, they are best suited to mitigating the risk of flooding in low energy environments.

Initial Appraisal

This option was carried through the initial appraisal process owing to the established coastal flood protection that this option can provide in the right environment.

4.3.1.6 Beach Nourishment

Description

Beach renourishment is considered a *soft engineering* solution to manage coastal erosion. It is important that renourishment material is of similar size and density as the natural beach otherwise it can be easily removed and lost from a coastal system.

A re-nourished beach can reduce incident wave energy and mitigate the threat of erosion. Beach renourishment can also reduce the risk of coastal flooding from wave overtopping and act as a sediment source for areas down drift of the renourishment area.

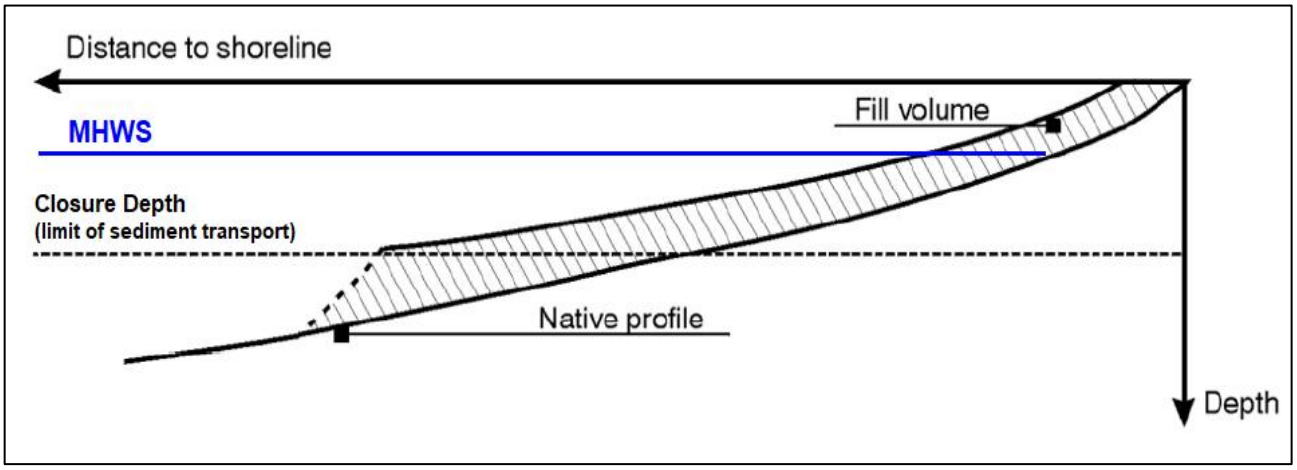


Figure 4.8: Typical section of a re-nourished beach profile.

It is important to recognise that beach renourishment does not eliminate the cause of erosion which will continue to occur along the nourished beach section. This means that renourishment as a stand-alone method to mitigate coastal erosion requires a long-term maintenance effort. Alternatively, the stability of a renourishment scheme can be enhanced with the construction of hard defences to limit the loss of sand.

The success of any renourishment scheme is dependent on the suitability of the renourishment material. The specification of the renourishment material such as the grain size is crucial in determining the overall shape of the coastal profile. In most instances the volume of sand needed to re-nourish a profile increases drastically with decreasing grain size. On the contrary, coarser sand tends to be more stable in terms of longshore sediment losses.

Despite several countries within Europe including the UK, Belgium and the Netherlands having long established practices of marine aggregate extraction for the purposes of beach renourishment (amongst others), Ireland does not have an established offshore dredging industry. As such, sourcing suitable renourishment material can prove difficult.

Initial Appraisal

This option was carried through the initial appraisal process owing to the established coastal protection benefits that this option can provide. However, a beach renourishment scheme without any sediment control structures was not considered a viable option owing to the established high rates of sediment transport along the Burrow.

4.3.1.7 Perched Beach

As illustrated in Figure 4.9 below, a perched beach is retained on an otherwise normal beach profile by a submerged structure parallel to the coast. In principle a perched beach is a simple concept in that the submerged sill structure prevents sand from moving offshore during active wave conditions. However, high waves combined with low tides can result in waves breaking over the sill. This can create strong undertow currents that lead the permanent loss of sand material over the sill.

The concept of a perched beach is most applicable to coastal environments with steep and eroded coastal profiles. On the contrary, perched beaches are not well suited for coasts with oblique wave attack and at locations with large tidal regimes.

From a public safety perspective, strong undertow currents at the sill structure can present a significant non-visible hazard to bathers. In addition to this, stagnant water trapped on the lee side of the sill can result in poor water quality conditions during calm conditions.

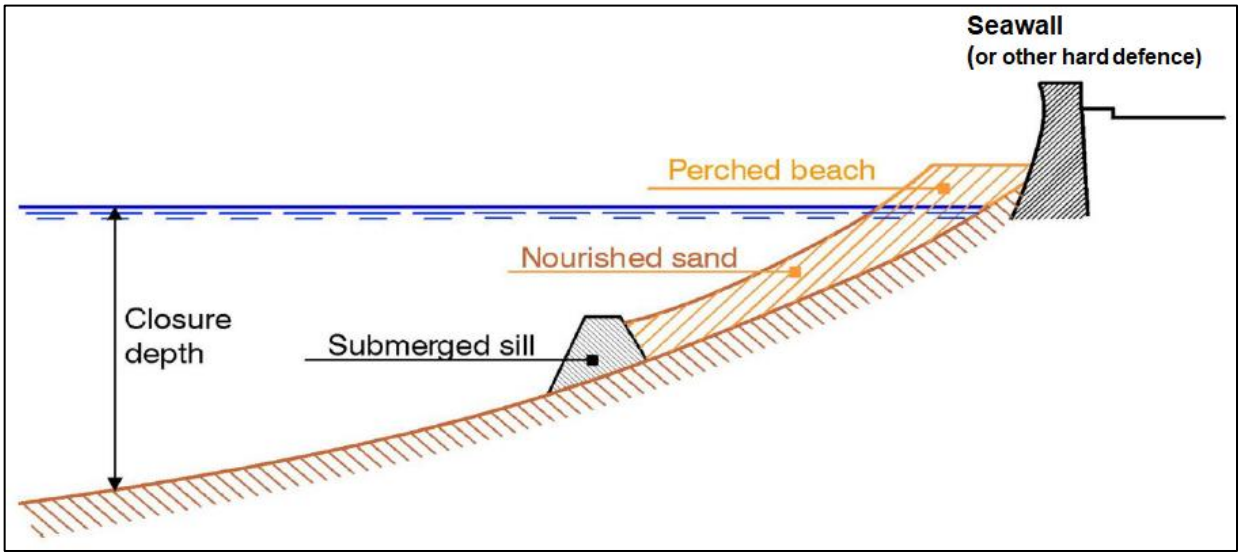


Figure 4.9: A typical section of a perched beach consisting of beach fill supported by a submerged sill.

Initial Appraisal

Given that the Burrow experiences large tidal regimes (i.e. difference between high and low tides) and is also subjected to oblique wave attack (i.e. waves that approach from different angles), a perched beach solution was not carried through the initial appraisal process.

4.3.1.8 Dune Stabilisation

Dune stabilisation is a collection of ***soft engineering*** methods aimed at protecting, preserving and enhancing the natural protection afforded by a beach and its dune systems. These methods include the construction of sand trap fencing, planting of marram grass and re-grading steep dune faces as shown in Figure 4.10.

The effect of installing sand-trap fencing is to trap wind-blown sand and the build-up of dunes. Vulnerable foredunes can also be protected by encouraging the seasonal development of embryo dunes using sand trap fencing. Although dunes will be eroded during winter conditions a useful measure of protection will nonetheless have been afforded to the fore dune and net losses will be reduced.

Where dune faces have become over-steepened through toe erosion or through a continual lowering of beach levels it can be difficult to acquire and retain a reasonable vegetation cover. Steep dunes will be continuously vulnerable to undercutting by wave action; resulting in failure and slumping of the upper dune face as illustrated in Figure 4.11.

Re-profiling the dune to a more stable slope angle (usually around 1 in 2.5) will reduce the extent of damage caused if the toe of the dune is eroded by wave action. The success of dune re-profiling can be enhanced by the planting of marram, seeding, sand trap fencing or preferably a combination of all three.

The aim of adopting these dune stabilisation techniques is to build up the foredune over time before an extreme event. The built-up foredune can then act as a reservoir to feed sand onto the beach during future extreme storm events. Where erosion is active, this buffer provides a short-term defence to assets behind the dunes, possibly only lasting through a single storm event.

Dune stabilisation is applicable in any location where natural dunes occur. This is particularly the case on moderately exposed to exposed sandy coasts with perpendicular or oblique wave and wind attack like the Burrow.

The flexibility of dune systems makes them well suited to accommodate future sea-level rise. However, it is important to accept that some setback of the coastline will occur during extreme storm events and with future climate change. If such setbacks are considered unacceptable dune stabilisation should be supplemented with beach renourishment campaigns.

Initial Appraisal

This option was carried through the initial appraisal process owing to the established coastal protection benefits that this collection of *soft engineering* measures can provide.



Figure 4.10: Sand trap fencing at a beach in Co. Clare



Figure 4.11: Over steepened dune faces along the Burrow, Portrane

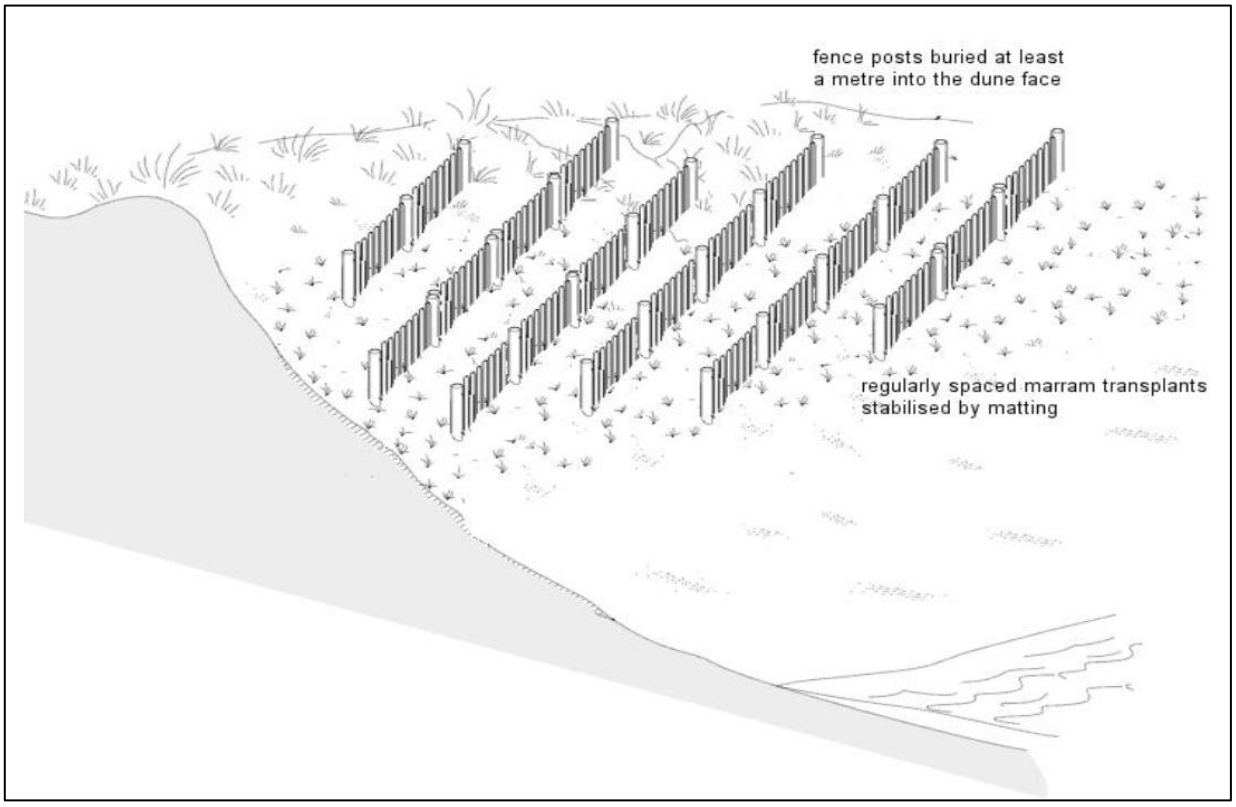


Figure 4.12: Typical section of a re-profiled dune face stabilised with sand trap fencing and the planting of marram grass.

4.3.2 Multi-Criteria Analysis of "Hold the Line" Options

Having derived a short list of options that could be used to develop a scheme in line with a coastal zone management strategy of "Hold the Line" as described in the previous section of this chapter, RPS undertook a Multi-Criteria Assessment (MCA) to objectively score each option in a systematic manner.

MCA is based on a numeric but non-monetarised assessment of options using a range of objectives. Indicators are used to assign scores for each objective based on how well each option meets the requirement for that objective. Weightings are applied globally for each objective, with local weightings applied to reflect the local importance of that objective. Scores for each option are then adjusted according to these weightings.

The sums of the weighted scores represent the preference for a given option. The total weighted scores can be used to inform the decision on the selection of preferred option(s) for a given location and the prioritisation of potential schemes between locations.

4.3.2.1 Criteria, Objectives and Weightings

Each option was assessed against four criteria: Technical, Economic, Social and Environmental. These criteria were originally developed by the OPW as part of the national CFRAM study programme to help achieve the most cost effective and sustainable management of existing and potential future flood and erosion risk.

A set of objectives are associated with each criterion and are an expansion on the requirements of the National Flood Policy Review and the EU Floods Directive. The degree to which an option achieves each objective is an indication of the success of the option; the more the option achieves across all the objectives, the greater preference it will be given.

Each objective focused on a receptor type and how the risk is to be reduced except for the technical objectives which considered how the options would be constructed and operated during their lifetime. In some cases, the receptor type is wide reaching, and sub-objectives are required to focus on a specific group within the receptor type. Table 4.1 overleaf describes the objectives and sub-objectives set for each of the criteria in the MCA.

The **Global Weightings** assigned to each objective in Table 4.1 reflect the importance of the objective in the context of the overall assessment of the suitability of the CFERM option. Global Weightings are fixed nationally to ensure a consistent approach and basis for prioritisation and are intended to represent the 'societal value' for the objective relative to the others, i.e. with those of most weight representing the most important objectives.

The **Local Weightings** assigned to each objective represent the local importance of that objective within the local context. They are very important as they provide scale to the process, whereby if the subject of a given objective is of much greater significance than another in the same location and should have a greater influence on the choice of option, then this can be provided for using appropriate Local Weightings.

Further information on the MCA process, global and local weightings as well as the scoring system can be found in the technical note "Option Appraisal and the Multi-Criteria Analysis (MCA) Framework" (OPW, 2018).

All options with a positive MCA percentage score were carried forward to the final stage of the optioneering process.

Table 4.1: Coastal Flood and Erosion Risk Management objectives and global weightings

Criteria	Objective	Sub-Objective	Global Weighting
Social	Minimise risk to human health and life	Minimise risk to human health and life of residents	27
	Minimise risk to community	Minimise risk to social infrastructure and amenity. Amenities can include but may not be limited to beaches, coastal walks, public parks *etc*).	9
Economic	Minimise economic risk	Minimise economic risk	24
	Minimise risk to transport infrastructure	Minimise risk to transport infrastructure	10
Environmental	Support the objectives of the Habitats Directive	Avoid detrimental effects to, and where possible enhance, Natura 2000 network, protected species and their key habitats, recognising relevant landscape features and stepping-stones.	10
	Protect, and where possible enhance, landscape character and visual amenity	Protect, and where possible enhance, visual amenity, landscape protection zones and views into/ from designated scenic areas.	8
Technical	Ensure CFERM options are operationally robust		20
	Minimise health and safety risks associated with the construction, operation and maintenance of CFERM options		20
	Ensure CFERM options are adaptable to future flood and erosion risk, and the potential impacts of climate change		20

Table 4.2: Multi-Criteria Analysis (MCA) of the Coastal Flooding and Erosion Risk Management options for the Burrow

				Option	Seawalls		Revetments		Groynes		Embankments		Beach Nourishment		Dune Stabilisation	
Criteria	Objective	Sub-Objective	Global Weighting	Local Weightings	Score	Weighted Score	Score	Weighted Score	Score	Weighted Score	Score	Weighted Score	Score	Weighted Score	Score	Weighted Score
Social	Minimise risk to human health and life	Minimise risk to human health incl. properties	**27**	**5**	3	405	3	405	1	135	3	405	3	405	1	135
	Minimise risk to community	Minimise risk to social infrastructure and amenities	**9**	**1**	3	27	3	27	-1	-9	3	27	3	27	3	27
Economic	Minimise economic risk		**24**	**3**	3	216	3	216	2	144	3	216	2	144	1	72
	Minimise risk to transport infrastructure		**10**	**2**	1	20	1	20	1	20	1	20	1	20	1	20
Environment	Support the objectives of the Habitats Directive	Avoid detrimental effects to, and where possible enhance, Natura 2000 network, protected species and their key habitats, recognising relevant landscape features and stepping stones.	**10**	**5**	-5	-250	-5	-250	-5	-250	0	0	-1	-50	1	50
	Protect, and where possible enhance, landscape character and visual amenity within the zone of influence (ZoI)	Protect, and where possible enhance, visual amenity, landscape protection zones and views into/from designated scenic areas within the ZoI	**5**	**5**	-5	-125	-5	-125	-5	-125	-1	-25	-1	-25	-1	-25
Technical	Ensure option is operationally robust		**20**	**5**	3	300	3	300	-1	-100	3	300	1	100	0	0
	Minimise health and safety risks associated with the construction, operation and maintenance of options		**20**	**5**	2	200	2	200	2	200	2	200	-1	-100	-1	-100
	Ensure option is adaptable to future flood and erosion risk, and the potential impacts of climate change		**20**	**5**	1	100	4	400	3	300	4	400	4	400	0	0
Total					**893**		**1193**		**315**		**1543**		**921**		**179**	

4.3.3 Alternative "Hold the Line" Option – Rock Armour Revetment

Based on the outcome of the MCA described in the previous section, an alternative "Hold the Line" option was identified. This option included for the provision of a new *c.*1,250m rock revetment along the toe of the existing dune system to prevent future coastal erosion.

To reduce coastal flooding this option also included the construction of *c.*100m of seawall at Marsh Lane and a *c.*135m wall along a section of the Burrow and Quay roads to reduce wave overtopping. Strategically placed embankments totalling *c.*1,430m were also proposed along the western extend of the Burrow to prevent coastal flooding from the estuary.

A plan view of this alternative "Hold the Line" coastal management plan for the Burrow is illustrated in Figure 4.13 overleaf.

4.3.3.1 Assessment of alternative "Hold the Line" Option

This alternative option was discounted in the optioneering report (RPS, 2020) for the following reasons:

- Mitigating the impact of coastal erosion along the Burrow using only hard defences in the form of a rock armour revetment would interrupt the natural exchange of sediment between the dune system and the foreshore. Overtime, this would have significant environmental impacts including:
    - Beach squeeze, whereby the foreshore area is gradually starved of sediment and results in significant lowering of beach levels. Overtime, this could result in the complete loss of the foreshore as can be witnessed at Courtown, County Wexford whereby only a very narrow section of the beach is useable even at low water.
    - The indefinite interruption of sediment exchange between the dunes and foreshore would impact nearby environmentally designated sites.
- The eventual loss of a useable foreshore area, as would happen without beach renourishment, would significantly impact the public amenity value of Portrane beach and the overall area.
- The alternative rock armour revetment solution would likely increase erosion pressures along adjacent regions of the coastline that were not protected. In the case of the Burrow, this unprotected region to the north is the most environmentally sensitive owing to the presence of embryo dune and grey dune habitat.
- The alternative rock armour revetment solution would not provide the same level of protection against wave overtopping relative to the Proposed Development. This is because the beach renourishment element of the Proposed Development increases the beach profile across the foreshore and in-turn limits incident wave heights. The Y-shape groynes further reduces wave energy by dissipating incident waves before they interact with the coastline.
- The alternative rock armour revetment solution does not address the current deficit in sediment supply to the Rogerstown estuary.

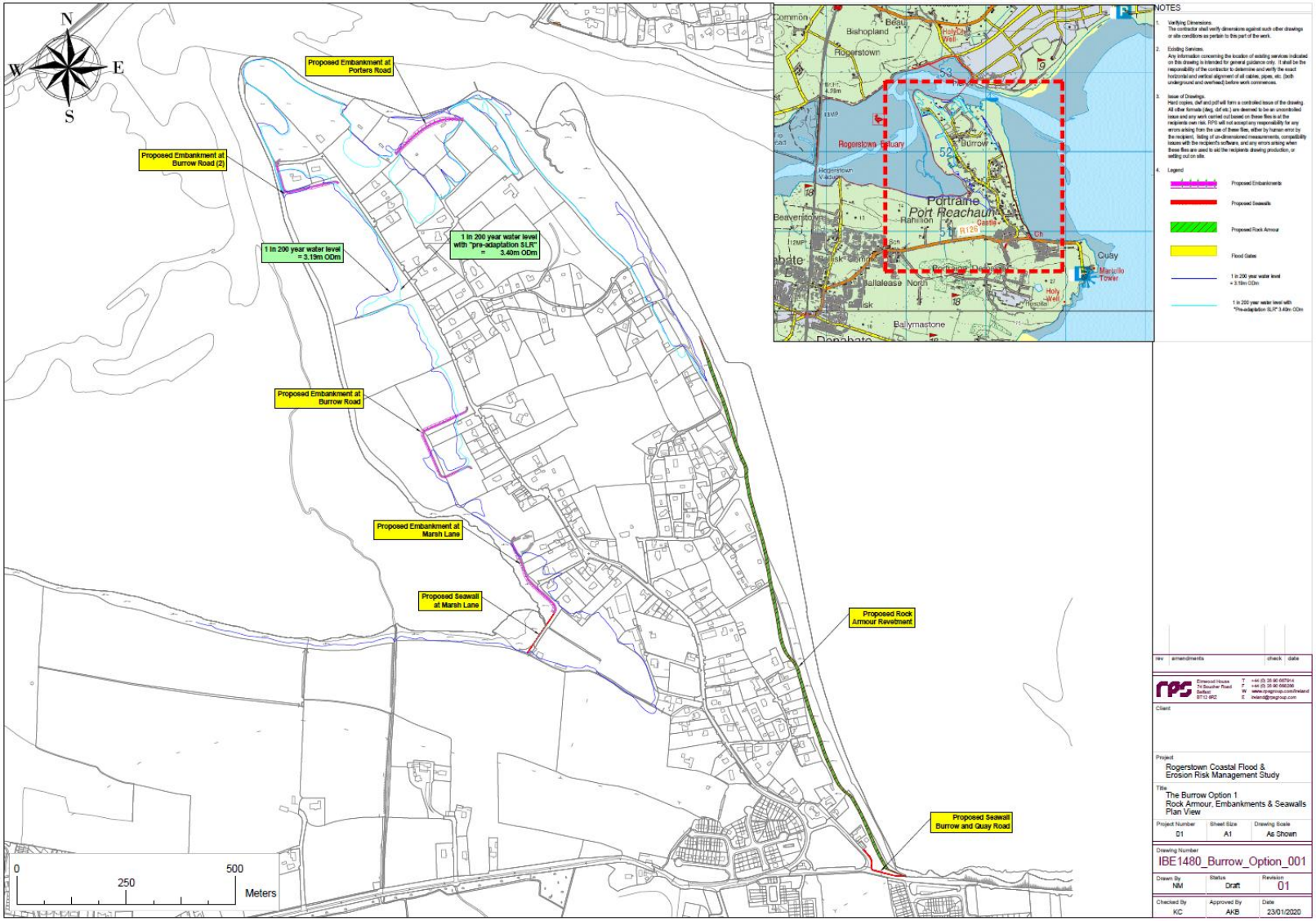


Figure 4.13: Alternative "Hold the Line" coastal management plan for the Burrow Option – Embankments, Seawalls and Rock Revetments

4.4 Summary of Consideration of Alternative Options

At a strategic level, the Fingal Development Plan provides several key aims and objectives in relation to coastal protection and coastal development. Building upon the themes laid out in this plan, the Proposed Development is considered the only option that represents a sustainable and technically effective solution to mitigate the extensive coastal flooding and erosion along the Burrow.

Other coastal zone management strategies were considered including No Active Intervention, Managed Realignment and Managed Retreat. However, these strategies were ruled out on the basis that they did not achieve the project objective of mitigating the coastal flood or erosion risk across the Burrow. Specifically, managed retreat was ruled out for the following reasons:

- As the Burrow is effectively a large, low-lying sandy spit that separates the Rogerstown Estuary from the Irish Sea, there is no natural safe space to retreat to. Coastal erosion would continue to erode the coastline if left unchecked. Furthermore, erosion would likely accelerate once the existing coastal dune system which acts as a natural buffer is eventually eroded.
- From a social perspective, managed retreat would result in very significant adverse impacts to the wider local economy in context of the local housing market and valuations of property and assets.
- There is currently no national strategic policy in Ireland regarding relocation, buy-back, and/or buy-out programs to facilitate compensation of residents, landowners and/or local communities affected by a strategy of managed retreat.

At the project level, an extensive optioneering exercise was undertaken to identify potential alternative “Hold the Line” options. This included a high-level appraisal of a long list of hard and soft coastal engineering measures. A short list of options was then considered as part of a Multi-Criteria Analyses (MCA) to identify feasible options that could be used to develop an overall coastal management plan for the Burrow. Based on this assessment, only one potentially viable alternative option was identified.

An alternative option involved mitigating the coastal erosion risk by constructing a new *c.*1,250m rock revetment along the Burrow coastline *in lieu* of the seven fishtail groynes and beach renourishment as per the Proposed Development was identified. Both the alternative and Proposed Development shared common flood defence measures including embankments and seawalls.

The alternative option was discounted on the basis that it would interrupt the natural exchange of sediment between the dune system and the foreshore and result in significant beach squeeze and impact nearby environmentally designated areas. Beach squeeze can be defined as “ *one form of coastal habitat loss, where intertidal habitat is lost due to the high water mark being fixed by a defence or structure (i.e. the high water mark residing against a hard structure such as a sea wall) and the low water mark migrating landwards in response to Sea Level Rise.”* (Pontee, 2017). Furthermore, the anticipated beach squeeze and loss of foreshore would have a significant and irreversible impact on the public amenity value of Portrane beach and the overall area.

In summary, the Proposed Development is considered the only option that achieves the project objectives of mitigating the significant coastal flooding and erosion risk posed to the Burrow, whilst maintaining the high public amenity of a useable beach area and minimising potential environmental impacts to nearby protected areas.

5 PROJECT SCOPING & CONSULTATION

5.1 Introduction

The Proposed Development has been brought forward for implementation based on the duties of FCC and requirements of the Local Development Plan. A process of early consultation has enabled FCC to solicit opinions on general development options for the Proposed Development and facilitate differing perspectives to be considered in the initial stages of the project.

Scoping for the Proposed Development was undertaken in accordance with the European Commission's 2017 "Environmental Impact Assessment of Projects Guidance on Scoping", which states:

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

The purpose of the EIAR scoping process was to identify issues which were likely to be important during the environmental impact assessment and to eliminate those that were not relevant. The scoping process identified the sources or causes of potential environmental effects, the pathways by which the effects could happen, and the sensitive receptors, which were likely to be affected. It defined the appropriate level of detail for the information to be provided in the EIAR. The primary focus of scoping was to define the most appropriate assessment of significant effects related to the Proposed Development.

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

Consultation with statutory and non-statutory bodies has been undertaken from the project inception by FCC to ensure the considerations of local stakeholders and community groups were taken on board throughout the design process.

5.1 Screening

Section 172 of the Planning and Development Acts 2000 (as amended) states that Environmental Impact Assessment (EIA) must be undertaken by the planning authority or the Board, as appropriate, for an application for consent for a Proposed Development where either:

(a) *the proposed development would be of a class specified in—*

(i) Part 1 of Schedule 5 of the Planning and Development Regulations 2001, and either—

(I) (such development [would equal or exceed, as the case may be,] any relevant quantity, area or other limit specified in that Part,

(II) or no quantity, area or other limit is specified in that Part in respect of the development concerned,

or

(ii) Part 2 [(other than subparagraph (a) of paragraph 2)] of Schedule 5 of the Planning and Development Regulations 2001 and either—

(I) such development [would equal or exceed, as the case may be,] any relevant quantity, area or other limit specified in that Part, or

(II) no quantity, area or other limit is specified in that Part in respect of the development concerned,

or

(b) *(i) the proposed development would be of a class specified in Part 2 of Schedule 5 of the Planning and Development Regulations 2001 but [does not equal or exceed, as the case may be,] the relevant quantity, area or other limit specified in that Part, and*

(ii) it is concluded, determined or decided, as the case may be — that the proposed development is likely to have a significant effect on the environment.

Schedule 5 of the Planning and Development Regulations 2001 – 2018 sets out classes of development for which EIA is required. Part 2 (2) (j) of that schedule relating to 'Infrastructure projects' states that EIA is required for development which comprises:

"(k) Coastal work to combat erosion and maritime works capable of altering the coast through the construction, for example, of dikes, moles, jetties and other sea defence works, where the length of coastline on which works would take place would exceed 1 kilometre, but excluding the maintenance and reconstruction of such works or works required for emergency purposes."

As detailed in the Project Description in Chapter 3, the fishtail groyne structures and beach renourishment scheme will be constructed over *c.*1.3km of the coastline at the Burrow. In addition, the scheme also includes *c.*190m of a new flood embankment and the replacement of an existing *c.*130m flood wall. Thus, the Proposed Development exceeds the threshold of 1 kilometre length of coastline outlined in Part 2(2)(b) and it was consequently screened in for EIA.

5.2 Scoping

5.2.1 Scoping Approach

An EIA Scoping Report, developed by RPS, was submitted to An Bord Pleanála in August 2021, accompanied by a request for a Scoping Opinion. A subsequent EIA Scoping Opinion was received from An Bord Pleanála in February 2022.

5.2.2 Scoping Responses

An Bord Pleanála distributed the EIA Scoping Report to a variety of statutory consultees for a Scoping Opinion. The bodies that the report was sent to were:

- The Department of Agriculture, Food and the Marine.

- The Department of Environment, Climate and Communications.
- Environmental Protection Agency.
- Department of Tourism, Culture, Arts, Gaeltacht, Sports and Media.
- Eastern and Midland Regional Assembly.
- An Tiasce.
- Fáilte Ireland.
- The Heritage Council.
- An Chomhairle Ealaíon.
- The Department of Housing, Local Government and Heritage.

Only two responses were received, one from the Department of Housing, Local Government and Heritage – Development Applications Unit and one from the Department of Agriculture, Food and the Marine – Marine Engineering Unit. Each department outlined whether they agreed or disagreed with the scoping in or out of the various chapters and provided feedback to help improve the development of each of the chapters. Responses from each of the listed consultees were provided to An Bord Pleanála and aided in the formation of their Scoping Opinion.

The scoping report identified the issues that were likely to be important to consider in the environmental impact assessment of the Proposed Development. Additionally, the scoping process identified the sources or causes of potential environmental effects, the pathways by which the effects could happen, the sensitive receptors which were likely to be affected and defined the appropriate level of detail for the information to be provided in the EIAR. Certain environmental topics were scoped out as part of this formal scoping process. The topics proposed to be scoped out at the scoping stage and the reasoning for this are set out in Table 5.1.

Table 5.1 Topics initially proposed to be scoped out during the scoping process.

Topic	Reasons for scoping topic out
SHIPPING & NAVIGATION	Whilst several potential impacts were identified, including collision and grounding of the dredge vessel during beach renourishment and risks to small craft, the likelihood of these occurring were considered low to negligible, and would be mitigated by industry best practice, international collision regulations and promulgation activities. Given the low likelihood and consequence of these hazards, the impacts to shipping and navigation receptors were considered to be minimal.
POPULATION, HUMAN HEALTH, RECREATION & AMENITY	Health, recreation and amenity is a multidisciplinary topic which is influenced by several factors. Generally, an assessment draws from and builds upon key outputs from inter-related technical disciplines, structured into individual health determinants (i.e. activities with the potential to influence health), to inform the overall impact on health and wellbeing. Given the nature of the Proposed Development, the potential impact to Population Human Health, Recreation & Amenity is considered through the assessment of those environmental factors which might lead to effects on human health, including: ▪ Coastal Processes (Chapter 6) ▪ Noise and Vibration (Chapter 7) ▪ Flood Risk (Chapter 8) ▪ Water Quality (Chapter 9) ▪ Traffic and Transportation (Chapter 14) ▪ Air Climate (Chapter 15) ▪ Waste Management (Chapter 16) ▪ Material Assets and Land use (Chapter 17)
MAJOR ACCIDENTS AND DISASTERS	It was recognised that the presence, movement and navigation of vessels during the construction phase, has the potential to result in accidents; collision with other vessels or with natural and/ or manmade features, considered low to negligible, and would be mitigated by industry best practice, international collision regulations and promulgation activities. The potential impact upon the receiving environment as a result of accidental discharge of dangerous substations (oils, fuels, cement and other construction materials) or release of contaminants exposed through excavation works, etc) which could occur during the construction phase is considered through the assessment of Waste Management (Chapter 16).

The Scoping Opinion provided comments regarding the contents and detail to be included in the EIAR. From these, RPS set out the actions required to ensure that the Scoping Opinion would be fully considered in the EIAR, as shown in Table 5.2.

Following the receipt of the Scoping Opinion, RPS shared this with each of the chapter lead authors to ensure all feedback was incorporated into the EIAR and the design of the Proposed Development. The main changes to the structure of the EIAR were:

- The inclusion of additional ecological surveys, including floral and intertidal benthic surveys.
- Scoping in the Population Human Health and Major Accident & Disasters chapters (previously scoped out).

It should be noted that the Scoping Opinion also recommended that the 2016 sub-littoral benthic survey be repeated. However, no such survey was undertaken in 2016. Furthermore, it was the view of RPS' expert Marine Ecology team that this survey would not be required given that works for the Proposed Development would be confined to within the intertidal region of the beach which, in the case of Portrane, is exceptionally wide at *c.*0.70km. For these reasons, a sub-littoral benthic survey was not undertaken to inform this EIAR.

The Department of Housing, Local Government and Heritage (Development Applications Unit for Nature Conservation) requested that the EIA should extend to the area from which the sediments which are to be used for beach nourishment will be sourced. However, as noted in the Project Description, it is proposed that the beach nourishment material will be sourced from a licensed marine aggregate site located in Liverpool Bay.

The environmental impact of extracting marine aggregates from this site has already been extensively examined through a range of scientific documents which were required to support The Crown Estate licensing application process for the extraction of marine sand and gravel resources from the seabed. As such, the consideration of this is limited to the cumulative impact assessment described in Chapter 6, Coastal Processes.

Table 5.2 Summary of comments and actions required from An Bord Pleanála Scoping Opinion.

Chapter Title	Comment	Action Required
General Comments	Include information on the site, design, size and other relevant features of the Proposed Development.	Feedback passed on to chapter author(s)/ the Applicant.
	Proposed Development should be described with scaled drawings, photographs and photomontages.	
	Outline baseline scenario with existing and historical defences in the area.	
	The EIAR should accurately assess the receiving environment in terms of geology, geomorphology and hydrology and a physical description of the site.	
	Impacts should address direct, indirect, secondary, cumulative, short, medium and long-term, permanent, and temporary, and positive and negative effects, as well as interactions between impacts.	
	Chapters shall cover the following environmental factors: ▪ Population and human health; ▪ Biodiversity with attention to species and habitats under the Birds and Habitats Directive. ▪ Land, Soil, Water, Air and Climate. ▪ Material Assets, Cultural Heritage and the Landscape. ▪ Interactions between the above factors.	
	Reference list of sources used in the EIAR.	
	List of contributing technical experts.	
	Assessment of cumulative impacts with existing and permitted developments in the area.	
	Appropriate mitigation measures will be identified, with the responsibility for implementing the mitigation identified.	
	Information should be provided on monitoring of the impacts.	
	The EIA should extend to the area from which the sediments which are to be used for beach nourishment will be sourced.	Not considered necessary due to intention to source material from existing licenced operations. Considered as cumulative impact in Chapter

Chapter Title	Comment	Action Required
Consideration of Alternatives	Consideration of alternatives should be included in the EIAR and outlining the reasons for the Proposed Development in respect to environmental effects and outline the impacts of the Do-Nothing Scenario.	Feedback passed on to chapter author(s)/ the Applicant.
Navigation & Safety	The proposal is unlikely to impact Howth Fishing Harbour.	Scoped out of assessment
Terrestrial Biodiversity	The EIA must fully assess potential effects on flora, fauna and natural habitats of the Burrow including the European Site designations.	Feedback passed on to chapter author(s)/ the Applicant. Updated surveys were completed as recommended.
	Survey extents should create a reliable picture of the ecological baseline scenario.	
	A floral survey is required around flood walls and embankments to protect important species.	
	Breeding bird surveys are to be conducted during April and June.	
	Waterbird surveys are to be conducted to understand the impacts on the SPA.	
	Assess Invasive Species and include ISMP if required.	
Marine Biodiversity	Additional marine surveys are required – in particular repeated intertidal and benthic surveys.	Feedback passed on to chapter author(s)/ the Applicant.
	Assess Invasive Species and include ISMP if required.	
	Potential for enhancement should be assessed.	
	Survey extents should create a reliable picture of the ecological baseline scenario.	
Land Soils, Geology & Hydrogeology	Assess land use with EIAR	
	Provide information on the storage, use and disposal of excavated material including the management of contaminated soil.	
	Assess the impact of excavations upon surface & subsurface services within EIAR.	
	Provide details of the type and nature of materials to be imported to sire during construction including measures to prevent the import of invasive species and contamination.	
Water Quality	Consideration of any impact upon water quality (including WFD objectives) specifically relating to drinking and bathing waters and European sites.	
	No licensed aquaculture sites located nearby.	

Chapter Title	Comment	Action Required
Flood Risk	Clearly outline the assessments undertaken to date.	
Air Quality & Climate Change	Noise, vibration, transport, air quality, amenity, water quality and flood risk should be included in the EIAR in all phases of the development including demolition, excavation, construction and operation.	
Terrestrial Noise & Vibration	Noise and vibration arising from the construction phase should be assessed.	
Coastal Processes	Coastal processes to be assessed in relation to biodiversity.	Feedback passed on to chapter author(s)/ the Applicant.
Material Assets	Consider the impact on marine infrastructure, electrical and telecommunication assets.	
	Material storage and containment should be addressed within the site.	
Traffic and Transport	Outline the type of traffic (including heavy and wide loads) likely to be generated during the development, as well as impacts on junctions and road closures.	
Cultural Heritage	The EIAR should assess the cultural heritage aspects, including marine features.	
Landscape & Visual	Noise, vibration, transport, air quality, amenity, water quality and flood risk should be included in the EIAR in all phases of the development including demolition, excavation, construction and operation.	
Population & Human Health	Noise, vibration, transport, air quality, amenity, water quality and flood risk should be included in the EIAR in all phases of the development including demolition, excavation, construction and operation.	Population human health chapter now scoped in.
	Assessment should include impact on local recreational facilities in the area including access to the beach and amenity.	
Waste	The EIAR will be required to provide information on the nature, quantities and source of materials to be used on site.	Feedback passed on to chapter author(s)/ the Applicant.
	Information on waste volumes and nature of waste materials and the means for disposal or reuse should be provided.	
Cumulative Effects	Assessment of cumulative impacts with existing and permitted developments in the area.	
Major Accidents and Disasters	The EIAR should also provide an assessment arising from the vulnerability of the project to major accidents and disasters that are relevant to the project and considered in context to the environmental factors above.	
Non-Technical Summary	A Non-technical Summary should be included in the EIAR.	

5.3 Public Consultation

As part of the Optioneering Assessment conducted by RPS, public consultation was undertaken to understand the concerns of the local population and to seek feedback on the Proposed Development

Based on initial meetings with statutory and non-statutory stakeholder groups including the OPW, NPWS and the Portrane Coastal Liaison Group in early 2020, public consultation events had been planned for early Q2 of 2020. However, with the emergence of COVID-19 and the subsequent government directive to avoid social contact and adopt a policy of isolation, these public consultation events had to be postponed.

In response, a range of digital and non-digital alternative solutions to engage with the public were developed, including a site-specific website. This included:

- The development and deployment of a virtual consultation space: (https://consultationspace.com/Rogerstown/).
- Forming the Fingal Coastal Liaison Group to provide a forum for discussion of approaches to planning for and dealing with the problems of Coastal Erosion/Flooding. The Coastal Liaison Group is made up of County Councillors, Council Officials and community members from each of the affected areas which are Rush (North Beach and South Beach), Portrane and Sutton.
- The plans and particulars of the proposal were made available for viewing on-line on the FCC website: (https://www.fingal.ie/council/service/fingal-coastal-liaison-group).

In addition to the above, information boards were placed on public display from the 3rd September to 16th October 2020 on the green next to The Brook pub in Portrane, and at Rogerstown Green and Rush South Beach car park in Rush.

Submissions or observations with respect to the proposals could be made from 3rd September to 16th October 2020 either online through the website: http://consult.fingal.ie/en/browse, by email to coast@fingal.ie or in writing to FCC's Planning and Strategic Infrastructure Department.

A total of 515 No. submissions were received within the consultation period. FCC published a report pursuant to this consultation process on the FCC website: (https://www.fingal.ie/council/service/fingal-coastal-liaison-group) in 2021. A summary of the issues raised, and the responses received in respect of the Proposed Development are presented in Table 5.3 overleaf.

5.4 Summary

RPS reviewed and shared all feedback from the Scoping Opinion and consultation process with each of the chapter lead authors to ensure all feedback was incorporated into the EIAR. This feedback resulted in Population & Human Health and Major Accident & Disaster chapters being scoped back into the EIAR structure. Additional ecology surveys were also undertaken based on scoping feedback to further inform the impact assessment of the Proposed Development on terrestrial and coastal biodiversity as reported in Chapter 13.

Table 5.3: A summary of the submissions received during the consultation period, relevant to the Proposed Development.

Theme	Summary of submission	Initial Response from FCC	Consideration in in EIA
The community welcomed plans for the Proposed Development	Many submissions welcomed the proposal for the Proposed Development	Noted, no further action.	No further action.
Concerns of unintended impacts of the Proposed Development on Rush South Beach	Several submissions expressed concerns that the Proposed Development may impact the beach at Rush south. Concern was raised regarding the potential of increasing erosion pressed along Rush south.	Based on analyses to date, the Proposed Development will have no significant impact on the beach at Rush south.	The potential for impacts to adjacent areas is fully explored and quantified in the Coastal Processes chapter of the EIA, i.e. Chapter 6.
Erosion control measures required at Quay Road-Pipers-Brook	Many submissions recommended the provision of emergency protection works between The Brook pub and the Quay Road to protect the beachfront and the businesses in this area. Concern was also expressed that the Proposed Development does adequately protect this same area.	Emergency measures in the form of a rock armour revetment was subsequently installed along this section of road to prevent undermining and future erosion.	The effectiveness of the Proposed Development in reducing wave energy and thus coastal erosion is demonstrated in the Coastal Processes chapter of the EIA, i.e. Chapter 6.
The Seabees (i.e. temporary erosion protection measures) are not working	Concern was expressed that the Seabees are not stopping the erosion of the dunes and that they are making the erosion worse.	An assessment of recent survey data found that erosion rates behind the Seabee units was approximately 50% less than erosion rates in areas not	No further action.

Theme	Summary of submission	Initial Response from FCC	Consideration in in EIA
	Concern was expressed the temporary measures were installed wrong.	protected by the Seabee units. The purpose of the Seabees is to reduce wave energy and coastal erosion, but not to completely stop erosion. Comparisons were made between the layout of the units at the Burrow and in other locations.	
Flooding of Portrane properties not considered in the flood scheme	Two submissions were received from landowners in Portrane that were concerned that their properties were not included in the flood defence scheme.	A new flood embankment is proposed along the northern boundary of one of the properties, while the other property is not considered to require flood defence measures given that the two holiday homes on this site are on stilts.	No further action.
Alternative solutions should be considered	Many submissions suggested using alternative coastal defence measures for Portrane	Reasonable alternative options have been considered and appraised in extensive detail as described in the Rogerstown CFERM Optioneering report.	Reasonable alternatives to the Proposed Development are considered in Chapter 4 of the EIA.

6 COASTAL PROCESSES

6.1 Introduction

This chapter of the EIAR assesses the potential impact of the Proposed Development on the coastal processes in the Rogerstown Estuary and surrounding marine environment, including information about effects on the tidal regime, inshore wave climate and sediment transport regime. The output from this assessment will enable the competent authority to determine the potential impacts on coastal processes.

As this chapter includes information on the tidal regime and transport of sediments within the receiving environment, its findings are also of relevance to the Flood Risk, Water Quality, Flood Risk Assessment and Marine Biodiversity chapters (Chapters 8, 9 and 12 respectively).

The assessment presented in this chapter is based on the project description detailed in Chapter 3 of this EIAR.

6.2 Authority of author

The author, Kristopher Calder, is a Technical Director within RPS and holds a BSc (Hons) in Marine Biology and an MSc (Distinction) in Physical Oceanography and has over ten years of experience in the field of coastal processes and numerical modelling. Kristopher is Chartered Scientist (CSci) and Water and Environment Manager (CWEM) and a full member of the Chartered Institution of Water and Environmental Management (CIWEM) an Associate Member of the Institution of Civil Engineers (AMICE).

The reviewer, Mr Adrian Bell, is a Senior Director within RPS' Coastal Engineering and Environment team and has more than 40 years' experience in the field of coastal engineering. Adrian holds a BSc Civil Engineering (1st Class Hons) and is a Chartered Engineer (CEng), a Fellow of the Institution of Engineers of Ireland (FIEI), a Fellow of the Irish Academy of Engineering (FIAE), a Member of the Institution of Civil Engineers (MICE), a Member of the Institution of Structural Engineers (MIStructE) and a Member of the Permanent International Association of Navigation Congress.

6.3 Assessment Methodology

6.3.1 Modelling Methodology

RPS used the MIKE 21 hydrodynamic numerical modelling software package developed by the Danish Hydraulic Institute (DHI), to address potential coastal processes impacts/ issues. This was achieved by developing a range of two-dimensional numerical models to represent:

- The pre-project scenario.
- The post-project scenario with the flood and erosion protection works at the Burrow in place.

These models were used in conjunction with site specific hydrographic survey and sediment data to assess the potential construction and operational impacts of the Proposed Development in the context of the following coastal processes:

- The tidal regime.
- The inshore wave climate.

- The dispersion of and settlement of beach renourishment material.
- Sediment dynamics and the morphological response within the surrounding area.
- Flood risk to the surrounding area.

The impact of the Proposed Development on these coastal processes has been quantified using difference plots throughout this chapter, i.e. post-project minus pre-project conditions. As such, the extent and magnitude of potential impacts as a result of the Proposed Development were identified and compared against baseline conditions.

To conclude the assessment, mitigation measures are proposed to reduce impacts, where appropriate. This enabled a "with mitigation" assessment to be made of any residual impact as a result of the construction and operational phases of the Proposed Development and/or in combination with other projects in the vicinity of the Rogerstown Estuary. To ensure all potential environmental effects were identified, this included the assessment of the in-combination effects resulting from the construction of flood walls which form part of a Flood Relief Scheme proposed for Rush to the north of the site.

6.3.2 Coastal Process Modelling Software

A suite of coastal process models, based on the MIKE software developed by DHI, was used to assess the potential impact of the Proposed Development on the coastal processes within the Rogerstown Estuary. The MIKE system is an industry-standard, modelling system, utilising a flexible mesh approach. This software was specifically developed for applications within oceanographic, coastal and estuarine environments.

A brief synopsis of the MIKE system and specific modules used for this assessment is outlined below:

1. **MIKE 21 & MIKE 3 Flow Model FM system** - Using these flexible mesh modelling systems, it is possible to simulate the mutual interaction between currents, waves and sediment transport by dynamically coupling the relevant modules in both two and three dimensions. Hence, full feedback on the bed level changes on the waves and flow calculation can be included.
2. **The Hydrodynamic module** –This module simulates water level variations and flows in response to various forcing functions in lakes, estuaries and coastal regions. The Hydrodynamic (HD) Module is the basic computational component of the MIKE 21 and MIKE 3 Flow Model systems, providing the hydrodynamic basis for the Sediment Transport and Spectral Wave modules. The Hydrodynamic module solves the two/ three-dimensional incompressible Reynolds averaged Navier-Stokes equations subject to the assumptions of Boussinesq and hydrostatic pressure. Thus, the module consists of continuity, momentum, temperature, salinity and density equations. When used in three dimensions, the free surface is considered using a sigma coordinate transformation approach whereby the vertical layer is divided equally into a discrete number of layers.
3. **The Spectral Wave module** – This module simulates the growth, decay and transformation of wind-generated waves and swell in offshore and coastal areas and accounts for key physical phenomena including wave growth by wave action, dissipation, refraction, shoaling and wave-current interaction.
4. **The Sediment Transport module -** The Sediment Transport Module simulates the erosion, transport, settling and deposition of non-cohesive sediment in marine and estuarine environments and includes key

physical processes such as forcing by waves, flocculation and sliding. The module can be used to assess the impact of marine developments on erosion and sedimentation patterns by including common structures such as jetties, piles or dikes. Point sources can also be introduced to represent localised increases in current flows as a result of various coastal structures such as revetments, groynes or outfalls.

6.3.3 Coastal Process Models and Data Sources

The models used to assess the impact of the Proposed Development on coastal processes were developed from RPS' existing Irish Sea model. RPS created an east coast model using flexible mesh technology for this study to provide detailed information on the coastal processes around the Rogerstown estuary. The model uses mesh sizes varying from 250,000m^2 (equivalent to 500m x 500m squares) at the outer boundary of the model down to a very fine 400m^2 (equivalent to *c*.20m x 20m squares) within the vicinity of the Rogerstown estuary.

The bathymetry of this model was developed using data recorded by hydrographic and topographic surveys that were undertaken as part of the OPW's Coastal Monitoring Survey Programme (CSMP) between 2021 and 2022. This information was supplemented by data from the Irish National Seabed Survey, INFOMAR and other local surveys collated by RPS for the Irish Wave and Water level Study (ICWWS, 2020). The extent, mesh structure and bathymetry of this model is illustrated in Figure 6.1.

The model outlined above was used to derive tidal and spectral wave boundary conditions for a more detailed model of this Rogerstown estuary that represented the pre-project scenario. This pre-project scenario model was developed using the same bathymetry and topography data but had a much greater cell resolution of *c*.20m^2 (equivalent to *c*.4.5m x 4.5m squares) within the vicinity of the Proposed Development. The overall extent and bathymetry of this model is illustrated in Figure 6.2 whilst the inshore bathymetry detail of this model is illustrated in Figure 6.3.

This pre-project scenario model was subsequently updated to produce a second version that represented the Burrow following the implementation of the Proposed Development, i.e. a post-project scenario model as illustrated in Figure 6.4. The detailed mesh structure which is representative of both models is presented in Figure 6.5

Collectively, these two-dimensional models were used to appraise the impact of the Proposed Development on the existing tidal regime, the inshore wave climate and the sediment transport regime at the Burrow, Rush and wider Rogerstown estuary area.

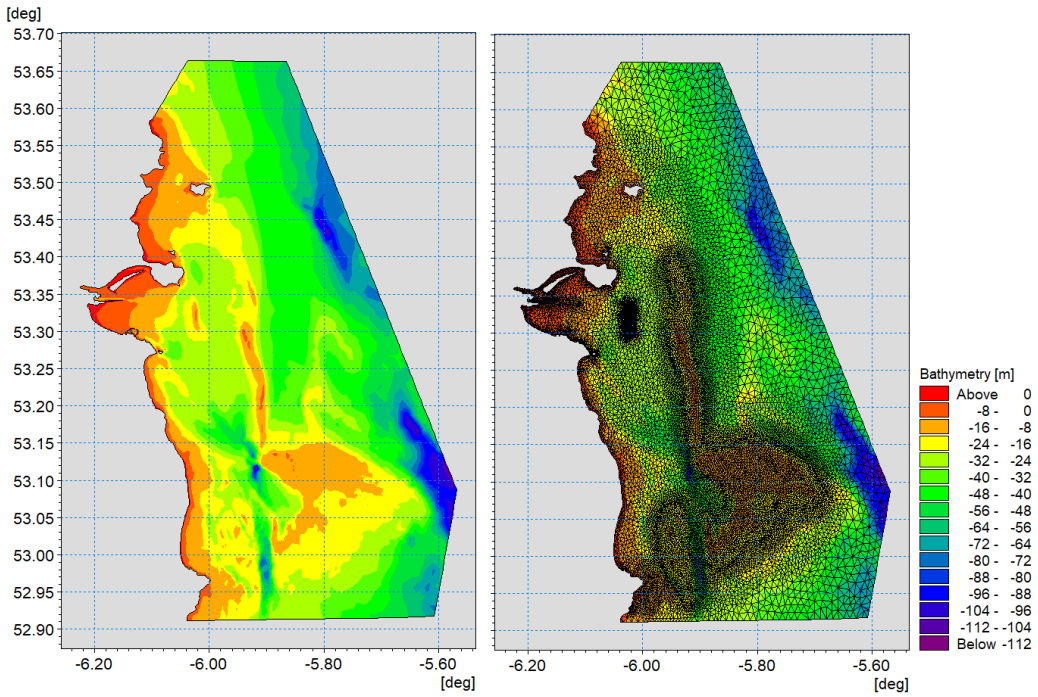


Figure 6.1: Extent and bathymetry of the outer Irish Seas model used to derive inshore tidal and spectral wave boundary condition data for the detailed pre and post project models of Rogerstown Estuary.

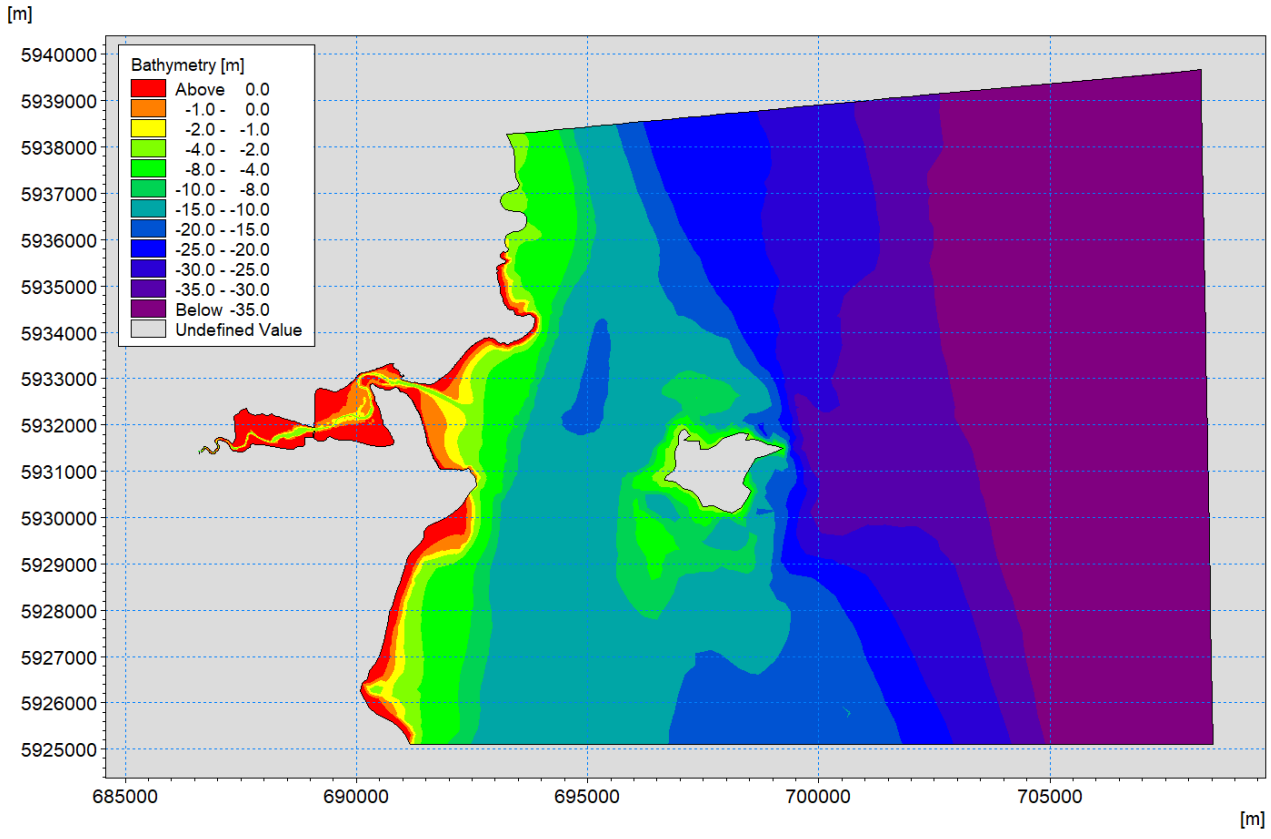


Figure 6.2: Extent and bathymetry of the detailed pre-project Rogerstown Estuary model.

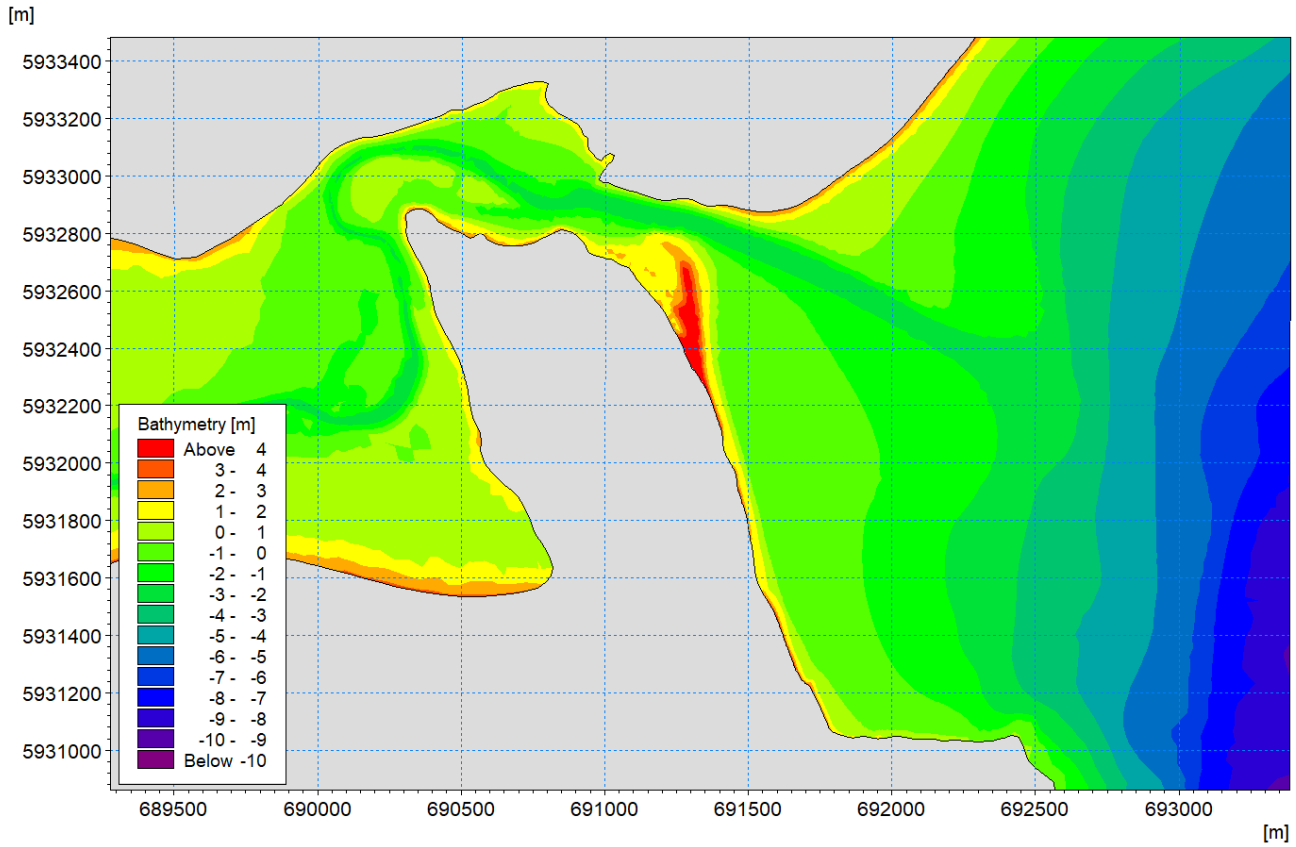


Figure 6.3: Detailed illustration of pre-project Rogerstown Estuary model bathymetry.

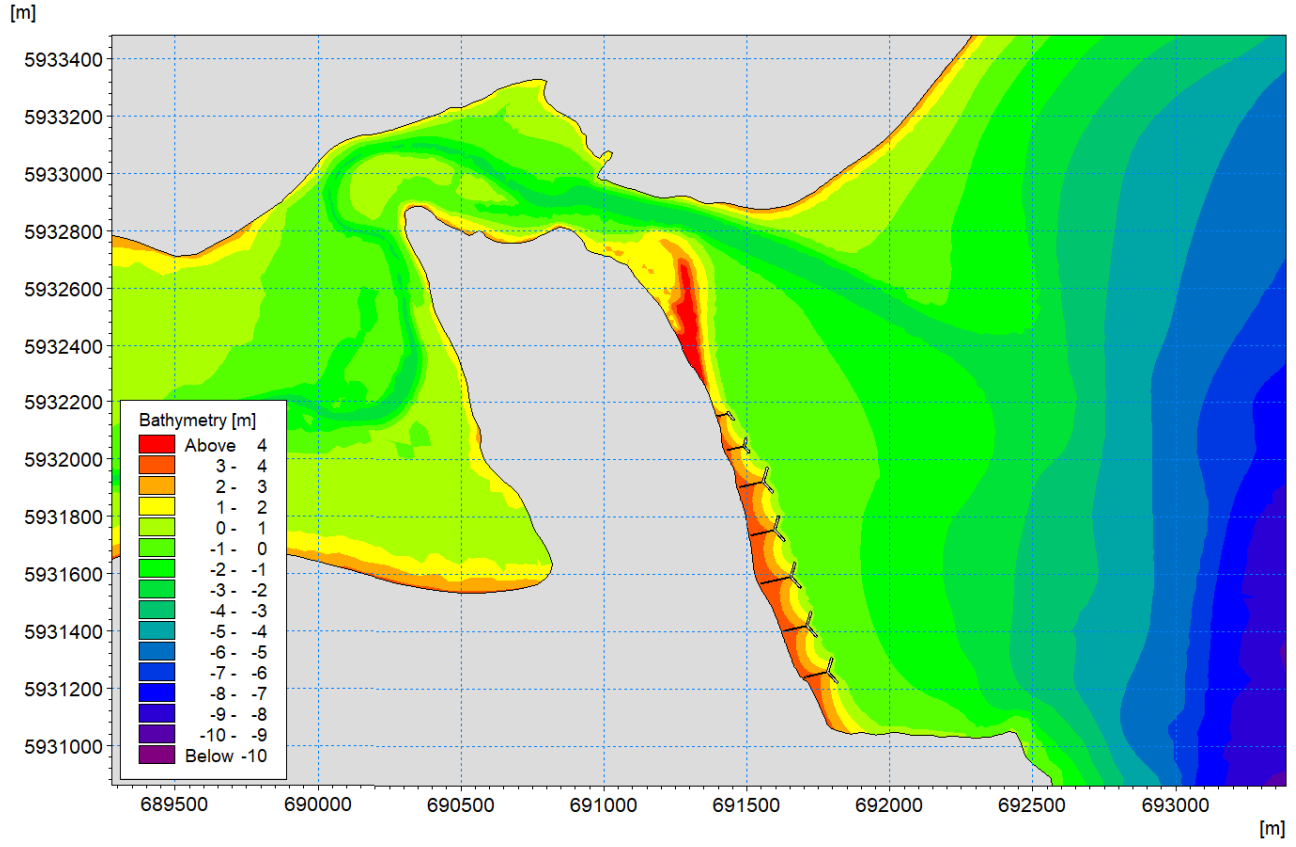


Figure 6.4: Detailed illustration of post-project Rogerstown Estuary model bathymetry.

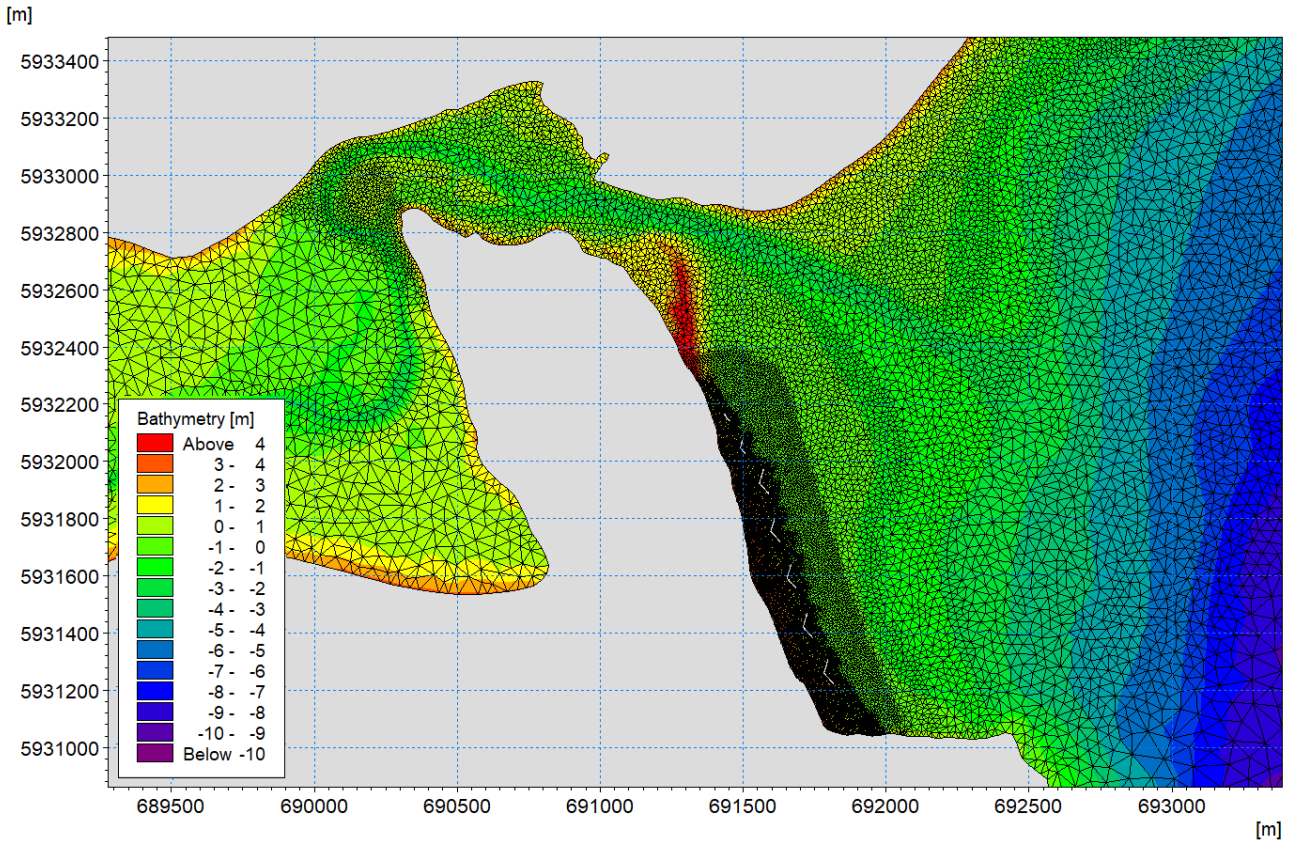


Figure 6.5: Detailed mesh structure of the pre- and post-project Rogerstown Estuary models within the vicinity of the Proposed Development.

6.3.3.1 Boundary Conditions

The tidal boundary conditions for the Irish Seas model were extracted from RPS' Tide and Storm Surge Forecast (TSSF) model. This model was developed using flexible mesh technology with the mesh size (model resolution) varying from circa 24km along the offshore Atlantic boundary to circa 200m around the Irish coastline. The extent and bathymetry of the TSSF model is presented in Figure 6.6.

All open sea boundaries were applied to the model as Flather boundaries whereby temporally and spatially varying water level and current velocities were specified along the boundary. Flather boundaries are one of the most efficient boundary condition methods for downscaling coarse model simulations to higher resolution areas as they avoid instabilities commonly associated with water level boundaries.

Freshwater inputs to the Rogerstown estuary from the surrounding relevant catchments were based on limited hydrometric gauge data from the Ballyboghil and Corduff gauges. Based on this data, mean freshwater flows into the Rogerstown estuary were estimated at 6 cumecs.

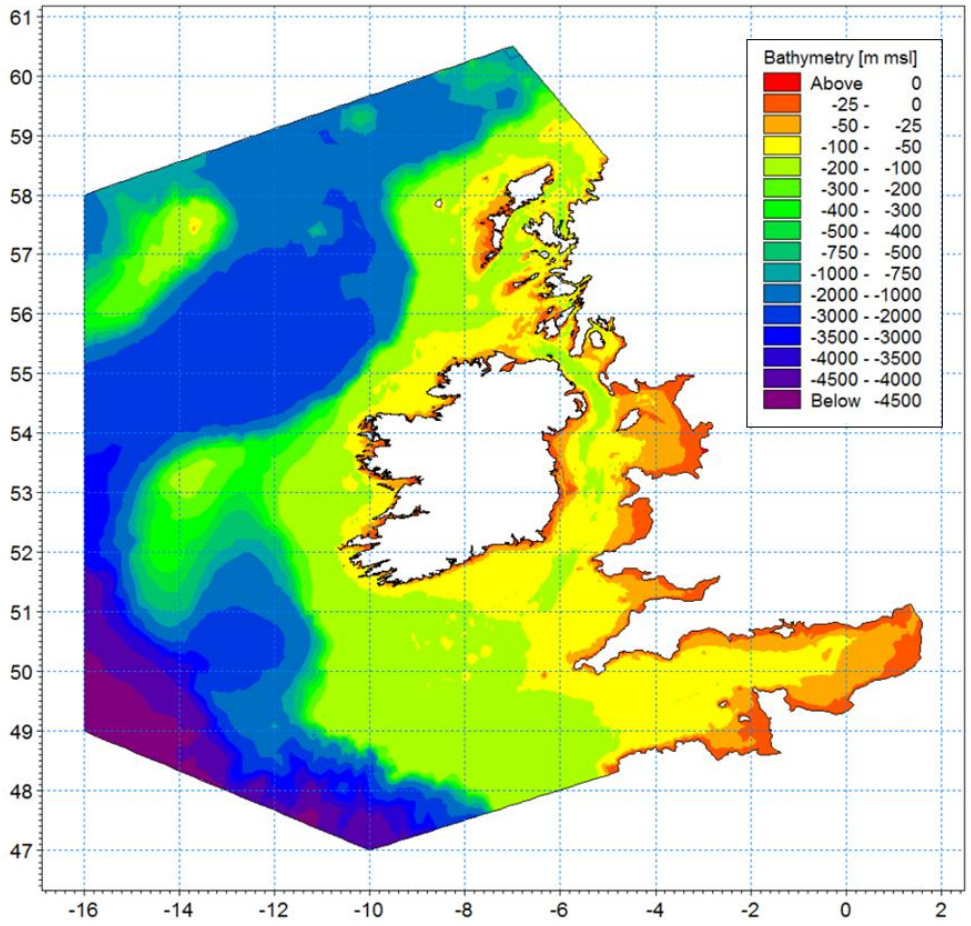


Figure 6.6 Extent of RPS' Tide and Storm Surge Forecast model used to generate model boundaries.

6.4 Receiving Environment

The following coastal processes were evaluated based on a pre-project scenario:

- **Tidal regime:** Current speeds and direction.
- **Wave patterns:** Significant wave heights and directions.
- **Sediment transport:** Magnitude of sediment transport rates under “normal” and storm conditions.

This assessment was undertaken with reference to both the simulated model data and, where applicable, hydrographic survey data (see Section 6.3.3).

It should be noted that Chapter 8 considers the potential impact of the Proposed Development on coastal flood risk.

6.4.1 Tidal Regime at the Burrow (Baseline scenario)

The MIKE 21 Hydrodynamic module described in section 6.3.2 was used in conjunction with the pre-Project scenario 2D model to derive baseline tidal regime information within the Rogerstown Estuary. Typical tidal flow patterns for mid-flood, high water, mid-ebb and low water tides are presented in Figure 6.8 to Figure 6.10.

The length and direction of the vectors displayed on each of the plots shown in Figure 6.8 to Figure 6.10 are proportional to the magnitude of the current velocity at each nodal point in the grid. It will be seen from these figures that the current flows across most of the Burrow and Rush beaches do not generally exceed 0.25m/s during any phase of the spring tidal regime, except along the coastline at high water where current speeds can exceed 0.50m/s.

The most dominant feature during the ebb phase of the typical tidal cycle is the strong tidal jet associated with the water exchange with the Rogerstown Estuary. Figure 6.7 and Figure 6.9 show that even during mid-flood and mid-ebb conditions, the tidal waters almost reach the toe of the dunes along the Burrow.

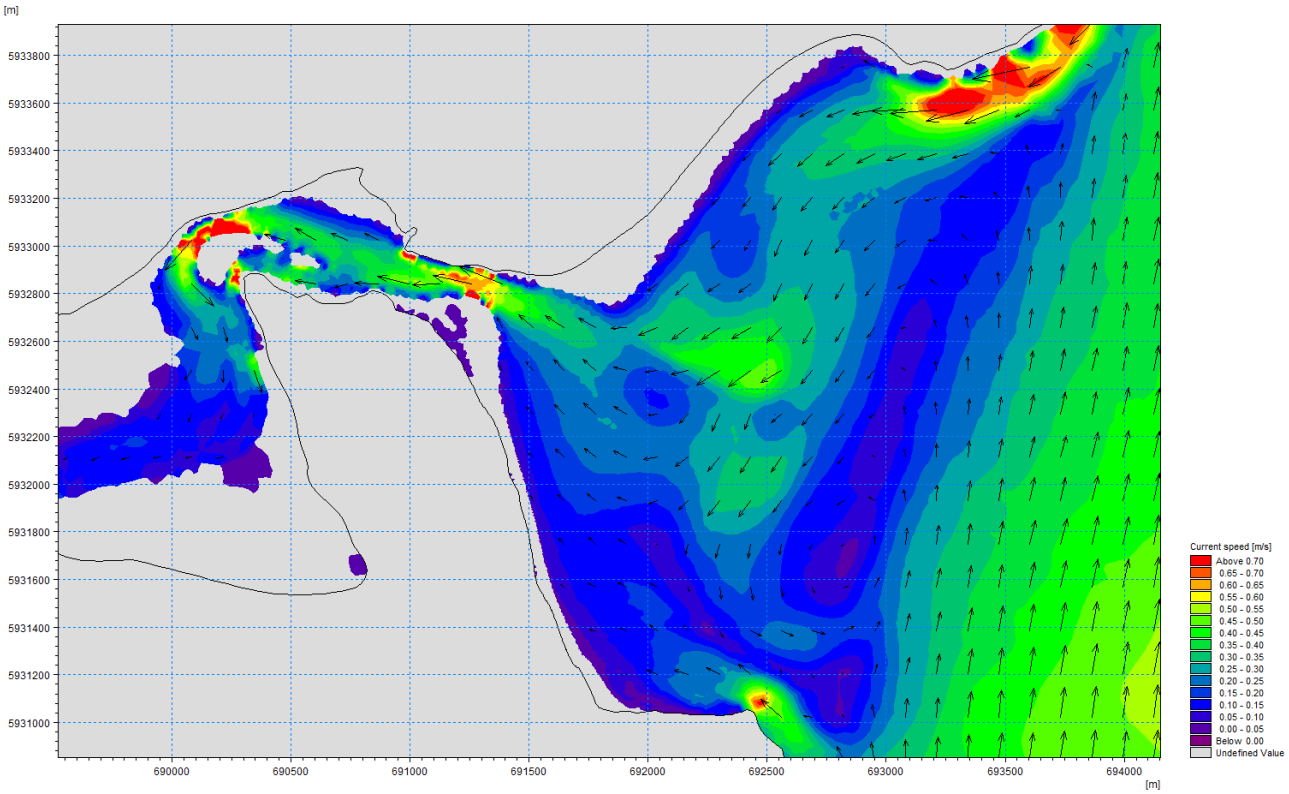


Figure 6.7: Typical spring mid-flood tidal patterns – Pre-project scenario.

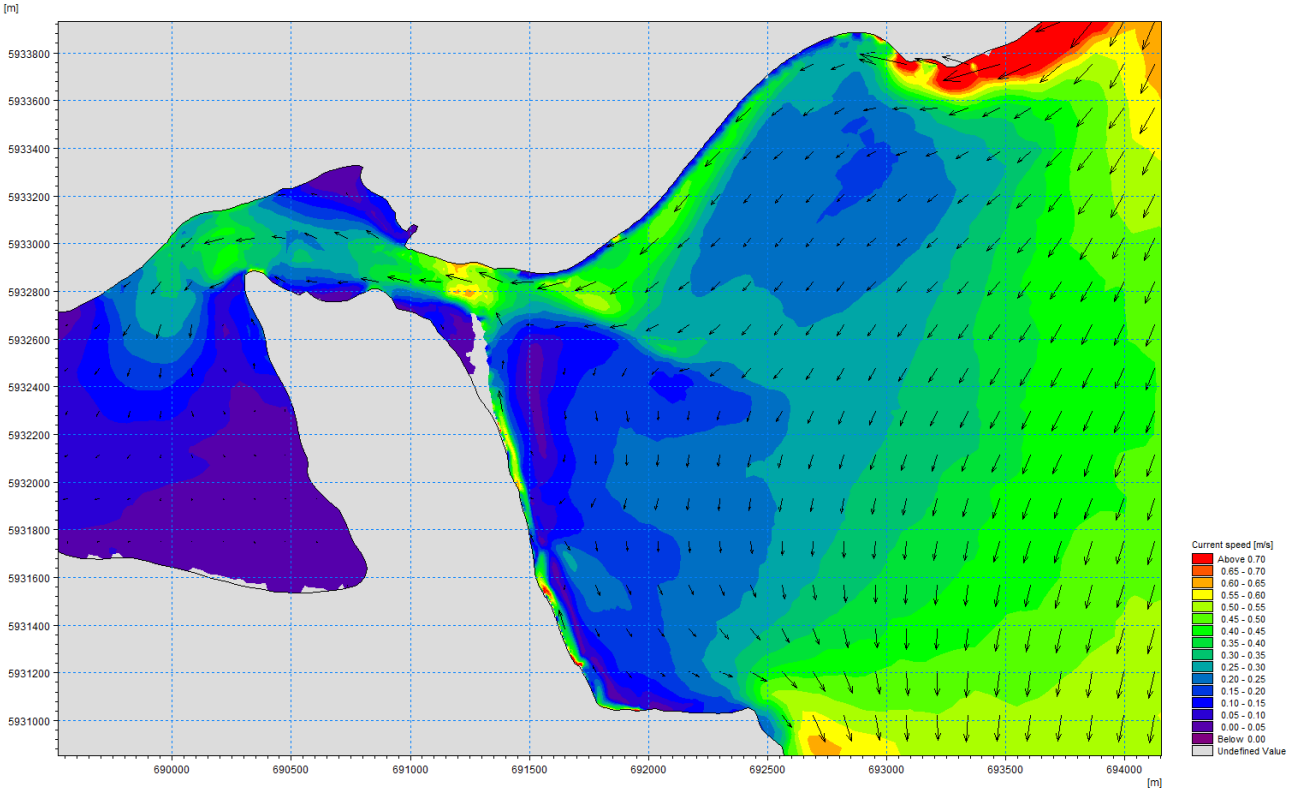


Figure 6.8: Typical spring high water tidal patterns – Pre-project scenario.

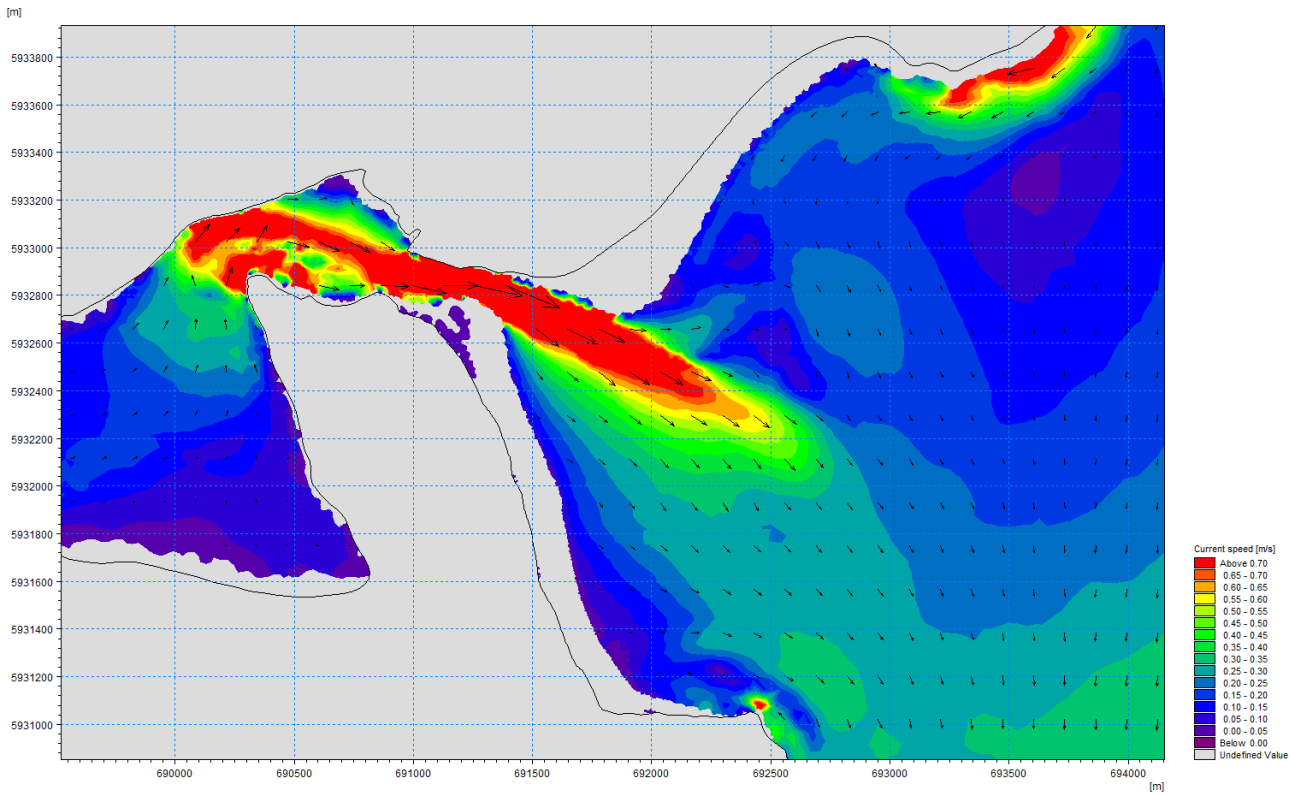


Figure 6.9: Typical spring mid-ebb tidal patterns – Pre-project scenario.

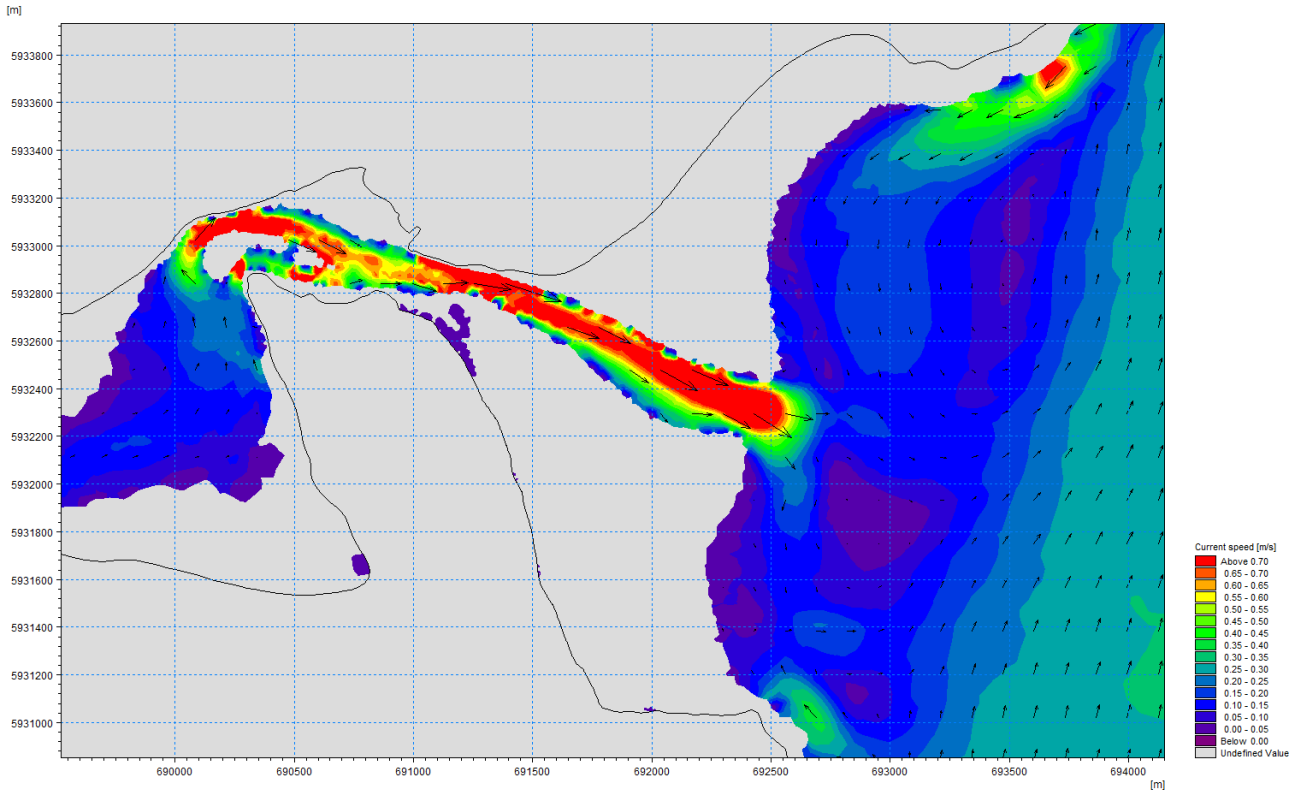


Figure 6.10: Typical spring low water tidal patterns – Pre-project scenario.

6.4.2 Wave Climate at the Burrow (Baseline scenario)

The nearest long-term dataset of recorded offshore wave conditions to the Burrow is for the M2 wave buoy in the Irish Sea. As illustrated in Figure 6.11, the M2 wave buoy is located approximately 45km to the east of Portrane at 53.48°N, 5.42°W. This instrument records various wave parameters including significant wave height, wave direction and wave period and records are available for the period from 2001 to present. For the purposes of the analysis undertaken in this assessment RPS supplemented this information with an additional five-year dataset from 1996 – 2001 extracted from the European Centre for Medium Range Forecasts (ECMWF) wave model.

Using this data, RPS undertook an Extreme Value Analysis (EVA) to derive offshore boundary condition data for relevant directional sectors from the northeast, east and southeast. The EVA was performed by fitting a theoretical probability distribution to the dataset and using a peak over threshold model to select the largest events. A Truncated Gumbel probability distribution was then fitted to the dataset using a Jackknife re-sampling technique to derive a series of return period waves heights for each relevant directional sector.

The MIKE 21 Spectral Wave module described in Section 6.3.2 was used in conjunction with the Pre-project scenario 2D model to transform 1 in 200-year return period offshore wave conditions for the north easterly, easterly and south easterly storm events into the nearshore. These offshore wave conditions are summarised in Table 6.1.

Figure 6.12, Figure 6.13 and Figure 6.14 present the inshore wave heights across the study area during 1 in 200-year return period storm conditions from the north easterly, easterly and south easterly sectors respectively. Each storm event was simulated with a corresponding joint probability water level of 2.82m. It will be seen from these figures that based on these simulations the largest waves that propagate into the area occur during easterly storm events at spring high water.

Table 6.1: 1 in 200-year offshore wave climate data used to simulate the inshore wave climate.

Storm Event	Significant wave height (m)	Peak wave period (s)	Mean wave direction (°N)
North Easterly	6.80	13.14	30
Easterly	4.34	10.49	90
South Easterly	6.29	12.64	150

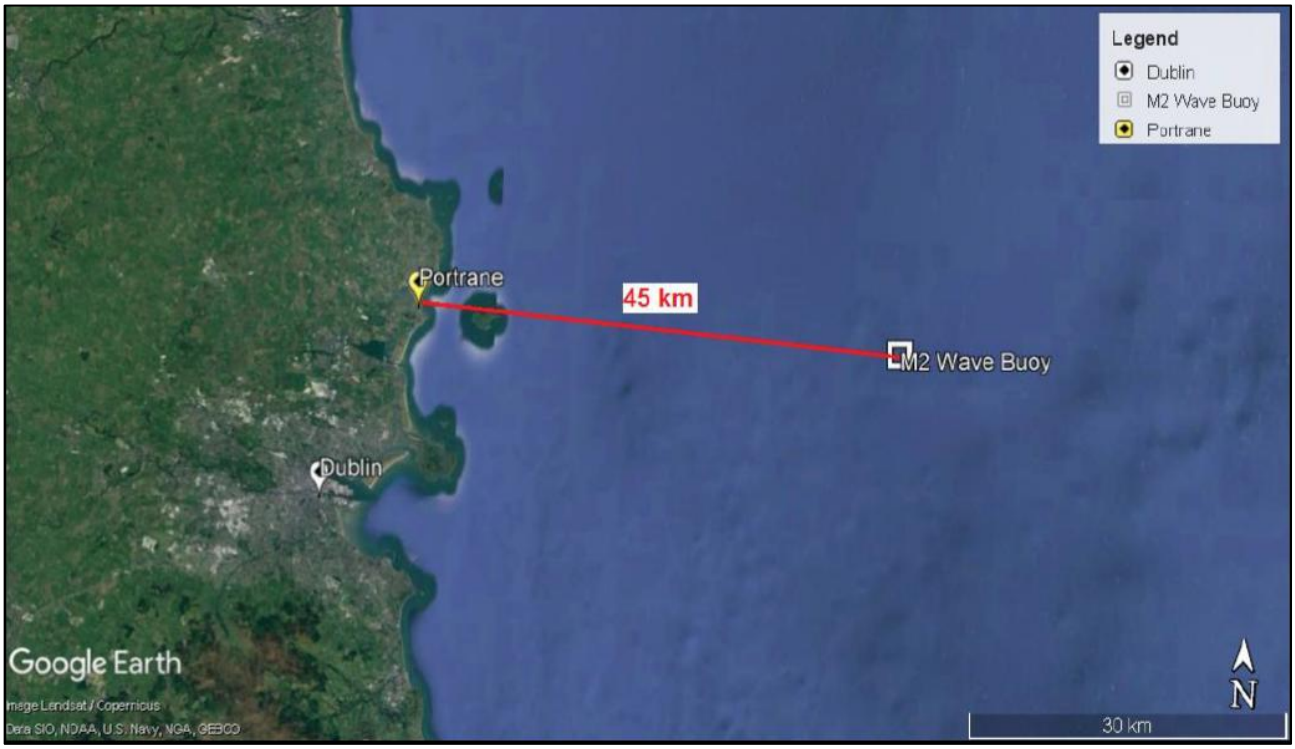


Figure 6.11: Location of the M2 wave buoy in relation to Portrane.

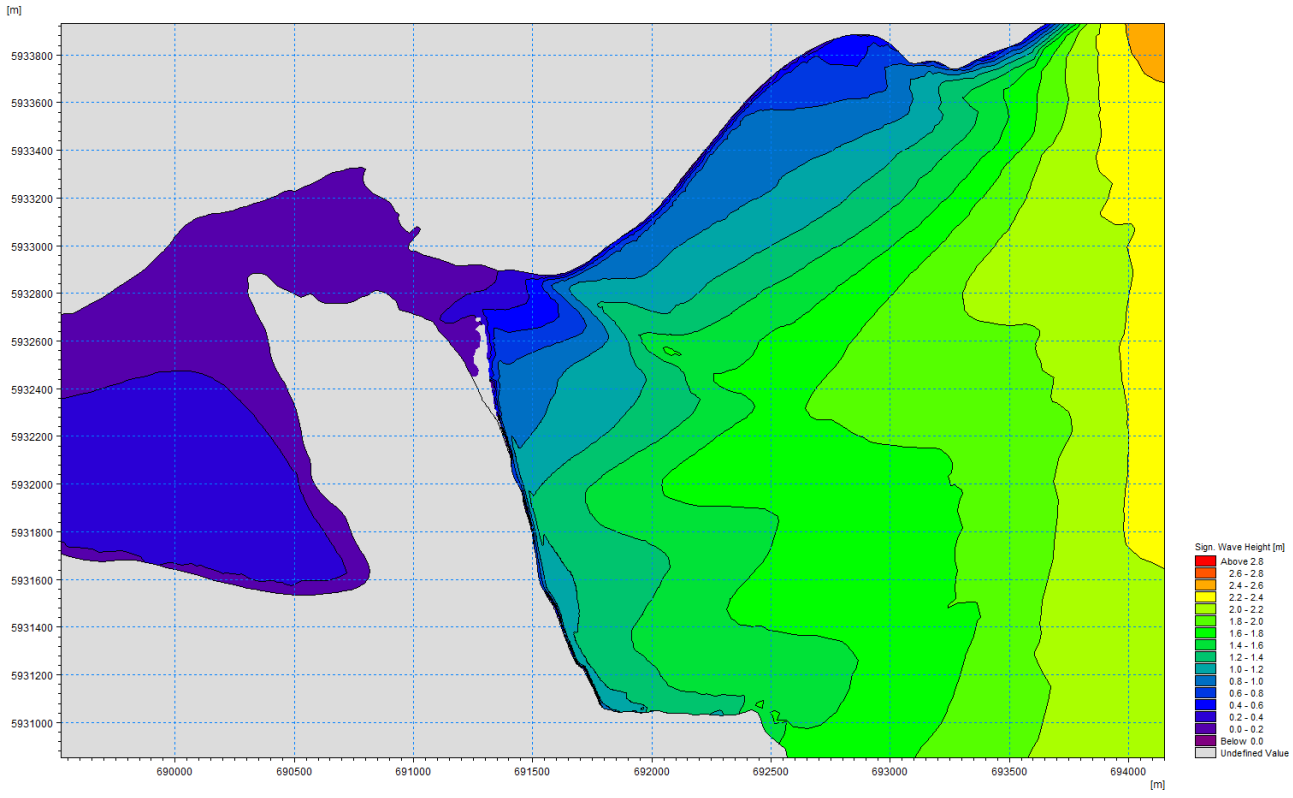


Figure 6.12: Inshore significant wave heights during a 1 in 200-year return period storm event from the north east – Pre-project scenario.

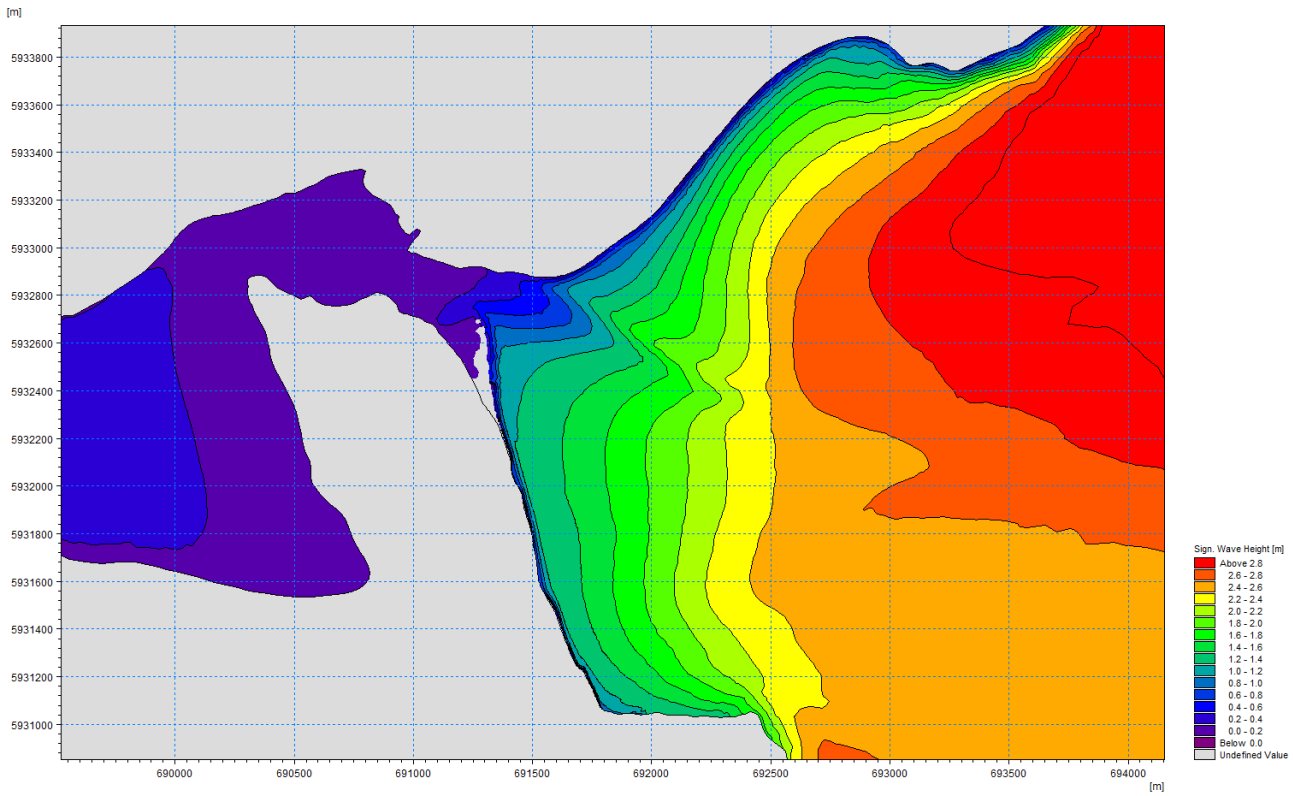


Figure 6.13: Inshore significant wave heights during a 1 in 200-year return period storm event from the east – Pre-project scenario.

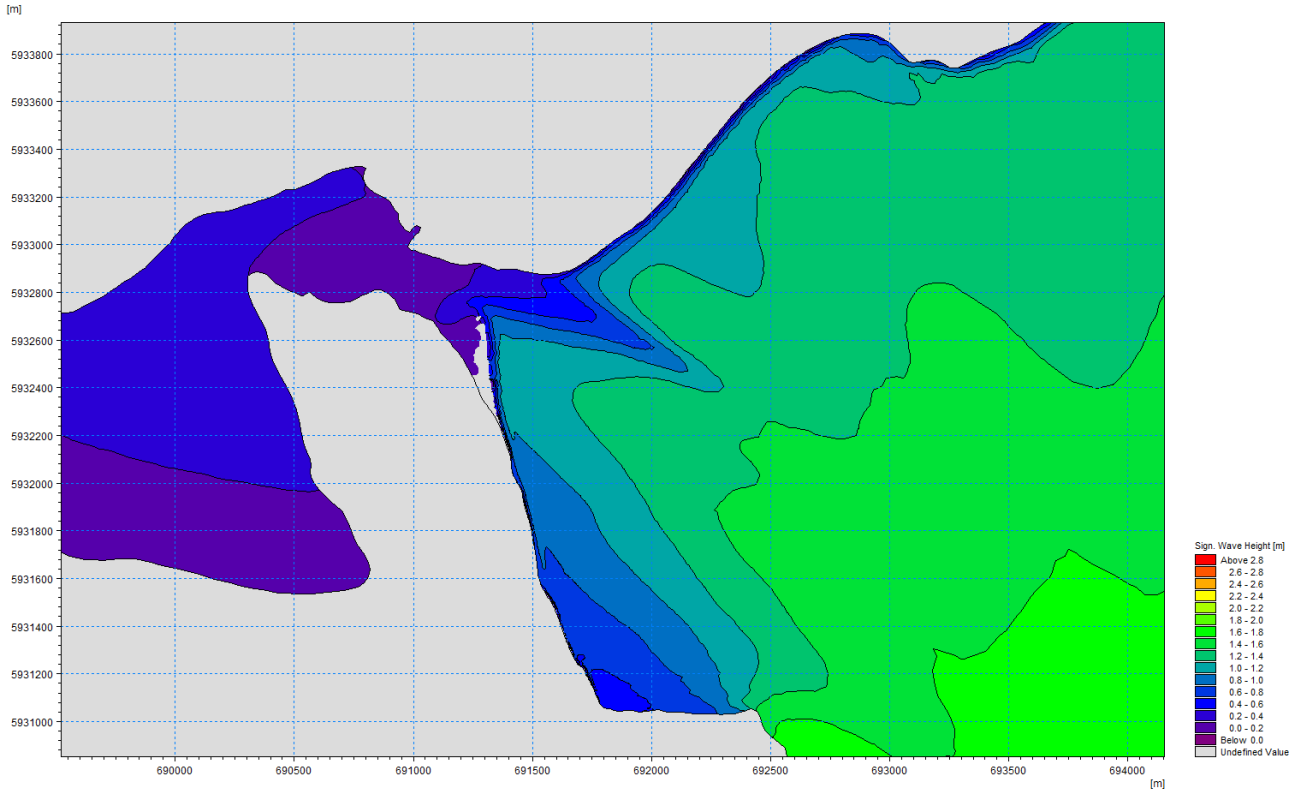


Figure 6.14: Inshore significant wave heights during a 1 in 200-year return period storm event from the southeast – Pre-project scenario.

6.4.3 Sediment Transport at the Burrow (Baseline scenario)

Given that the sediment transport regime around the Rogerstown study area is complex and highly two dimensional, RPS undertook a range of 2D combined tide, wave and sediment transport simulations. The first examined sediment transport during calm conditions with no wave activity, whilst a second simulation examined sediment transport during an arduous storm event. Storm Emma was selected to inform the latter assessment given that it was identified by Met Éireann and the UK Met Office to have contributed to one of the worst winters in recent history.

These simulations were undertaken using the coupled hydrodynamic, spectral wave and sediment transport models described in Section 6.3.2. The tidal boundary conditions for these simulations were derived from the operational Tidal Storm Surge Forecast (TSSF) model which RPS formerly operated on behalf of the OPW whilst the offshore wave and wind conditions were derived from the ECMWF Reanalysis v5 (ERA5) model. ERA5 provides hourly estimates of many atmospheric, land and oceanic climate variables and covers the period from January 1940 to present. ERA5 is produced by the Copernicus Climate Change Service (C3S) at ECMWF.

The daily average magnitude of sediment transport around the Rogerstown estuary area during calm and arduous storm conditions is presented in Figure 6.15 and Figure 6.16, respectively.

As illustrated in Figure 6.15, during calm conditions the dominant feature is the seaward flow coming from the Rogerstown estuary which clearly separates the Burrow from Rush. This strong current of water would also transport any suspended material beyond the nearshore region. There is very little sediment transport under these conditions, with magnitudes typically being less than 0.25m^3 per day per metre width of foreshore (i.e. m^3/day/m). Potential sediment transport is marginally greater along the upper beach area where the magnitude of transport can reach *c.*0.75m^3/day/m.

As demonstrated in Figure 6.16, the sediment transport potential across the Rogerstown Estuary area is significantly greater during storm events. During this storm event, the rate of sediment along the toe of the dunes at the Burrow and Rush reached up to 15m^3/day/m, with sediment moving in a northerly direction. These findings are in-line with anecdotal evidence recorded during Storm Emma which found localised sections of the coastline along the Burrow to have retreated landward by approximately 20m.

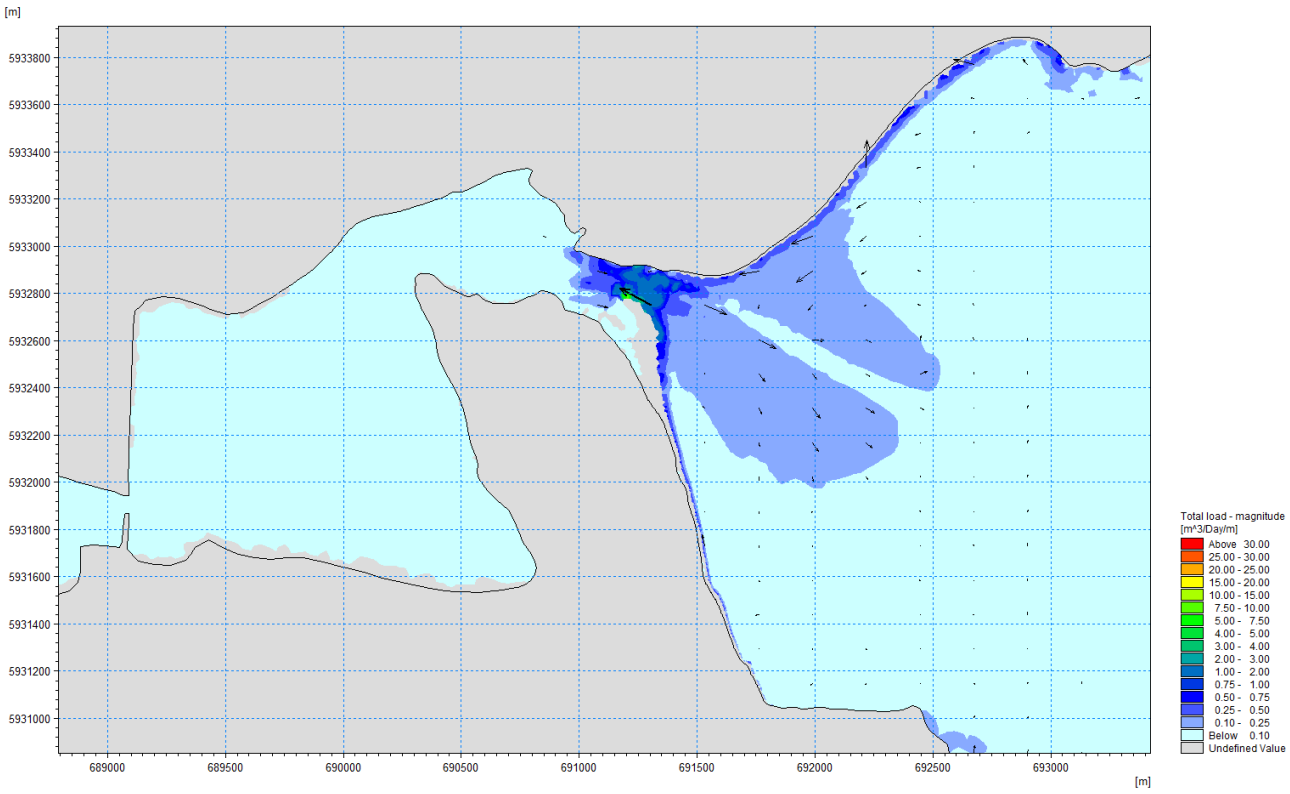


Figure 6.15: Magnitude of daily average total sediment transport during calm conditions – Pre-project scenario.

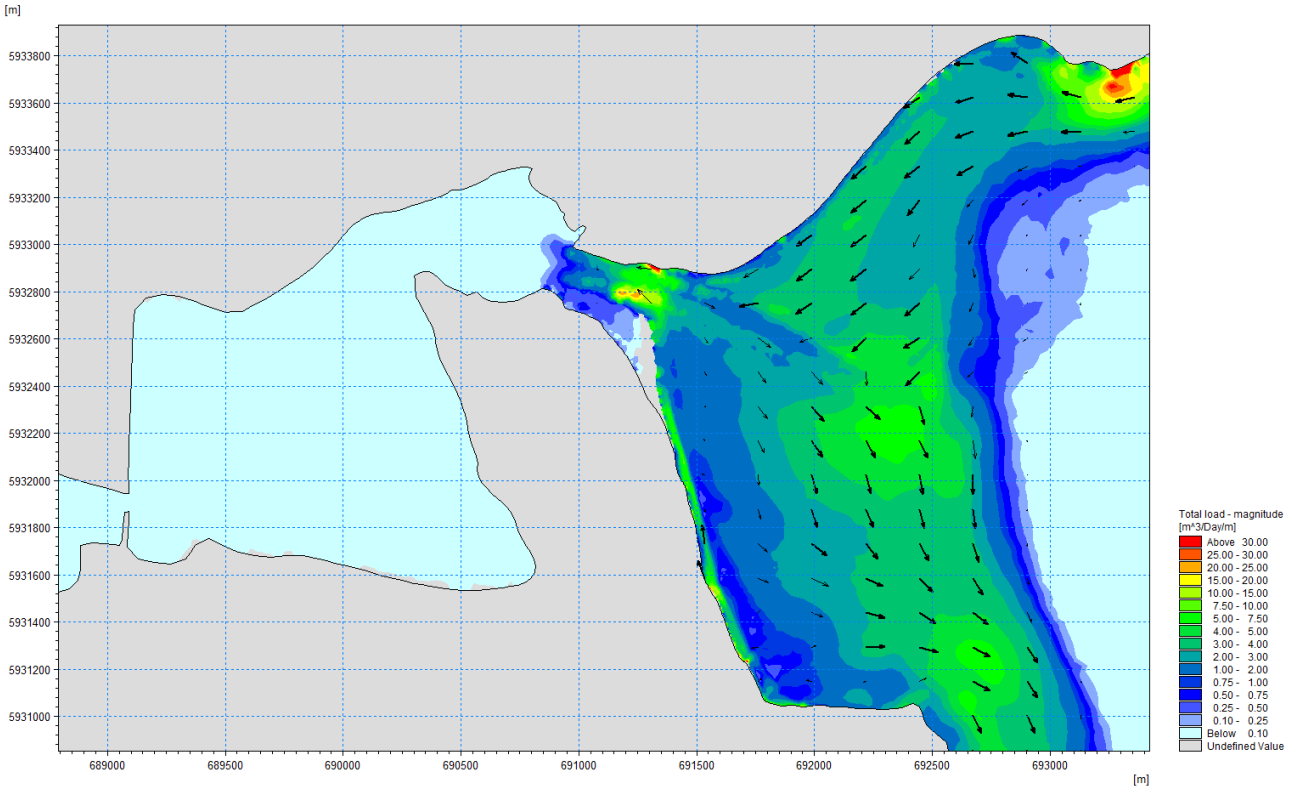


Figure 6.16: Magnitude of daily average total sediment transport during an arduous storm event – Pre-project scenario.

6.5 Impact Assessment

The impact of the Proposed Development on coastal processes was assessed in relation to both the construction phase of the project and the subsequent operational phase. Various elements of construction and operation and the types of impacts on the tidal, wave and sediment transport regimes that they could potentially result in are identified for assessment in the following section.

It should be noted that Chapter 8 considers the potential impact of the Proposed Development on coastal flood risk.

6.5.1 Construction Phase Impacts

The major elements of the construction programme are outlined in Chapter 3. In the context of coastal process, the primary element of the Proposed Development that has the potential to result in construction phase impacts is the beach renourishment phase of the works, when sediment material could be lost to the water column and dispersed by the local tidal regime. Whilst the temporary placement of rock armour and other material on the beach could result in temporary construction phase impacts, these would be significantly less than operational phase impacts in Section 6.5.2.

Thus, temporary impacts on water quality have the potential to occur during the construction phase of the works as mobilised suspended sediment release is the principal potential source of environmental impact. The potential impacts from the increase in background suspended sedimentation concentrations and deposition levels during the construction phase are assessed below.

The proposed rock armour groynes, which will retain the beach renourishment material, are not expected to result in an increase of suspended sediments given that the structures will be constructed on the existing beach profile during periods of low tides and that no underwater excavation works are required for the purposes of foundations.

6.5.1.1 Potential Impacts as a result of beach renourishment works

As described in Chapter 3, the Proposed Development includes beach renourishment works. These works will involve transporting dredged material from a licensed marine aggregate extraction site (presently assumed to be Liverpool Bay) to the Burrow and pumping the material ashore to fill each of the seven sediment sub-cells created by the fishtail groyne structures. The anticipated methodology for this element is outlined below.

- Supporting equipment required for the beach renourishment elements including flanged shore pipeline sections, dry plant and ancillary kit will be transported to site by road, using approved routes and offloaded within a compound or a secure area at the beach.
- A sinker pipeline will be brought in 12m lengths to a suitable location using road transport, where it will be welded into the required length before being floated and laid on the seabed.
- A mooring point, acting as the connection between the dredger and sinker pipeline will be located on the seabed in a water depth of approximately 10mCD, allowing for the safe mooring of the dredger over all states of the tide, and will consist of a length of floating pipeline connected to the steel ‘sinker’ pipe positioned on the seabed.

- The sinker pipeline will be connected to a steel shore pipeline on the beach, with additional 12m lengths of pipeline added as the renourishment progresses and the design profile is achieved.
- It is envisaged that a maximum frontage of 650m will be completed before the sinker pipe has to be relocated to a second position to complete the works. Thus, two individual operations to place/ move the sinker pipe are expected.
- Upon setup of ancillary equipment as described above, a fully laden trailer suction hopper dredger (TSHD) will sail to Portrane beach from the licensed marine aggregate extraction area (presently assumed to be Liverpool Bay).
- Upon arrival, TSHD will couple to the connection point, fluidise the material within the hopper and pump it to shore.
- Once on the beach, the material will be profiled using GPS equipped dry plant (dozers), with the shore pipeline extended as each section of the beach is completed. Once discharged the dredger will uncouple and return to the licenced marine excavation area to dredge the next load.
- It is envisaged that the TSHD will operate “non tidally”, i.e. working in the most efficient manner to reduce losses. This will introduce a requirement for 24hr working on the beach during unloading operations.

Based on a delivery rate of 95,000m^3 per week, it is envisaged that all *c.*250,000m^3 of material could be transported to Portrane beach in a *c.*6-week period (accounting for losses during the discharge and measurement processes).

Notwithstanding the application of extensive mitigation measures, the process of beach renourishment unavoidably results in the loss of sediment material to the water column. Based on discussions with experienced beach renourishment contractors, it is envisaged that sediment losses during the discharging process are normally in the order of 15 – 20%, dependant on local conditions. These losses, in the form of a suspended sediment plume within the water column, may have potential impacts on marine life biodiversity (Chapter 12) and water quality (Chapter 9). The potential impacts arising from these factors has therefore been assessed.

Particle size information provided by Boskalis indicated that the proposed beach renourishment material from Liverpool Bay has a narrow grading with a Dn50 size of 0.30mm, which is equivalent to a medium sand material. However, as illustrated in Figure 6.17, the renourishment material also has a considerable fine sand and coarse sand element. The beach renourishment could therefore be characterized by the three discrete fractions summarised in Table 6.2.

Table 6.2: Distribution of sediment fractions that characterise the proposed beach renourishment material.

Particle classification name	Range of particle diameters (mm)	Fraction proportion (%)
Coarse sand	0.500 – 1.000	*c* .50%
Medium sand	0.250 – 0.500	*c.* 13%
Fine sand	0.125 – 0.250	*c.* 27%

The coupled MIKE21 hydrodynamic and sediment transport modules described in Section 6.3.2 were used to assess the potential dispersion of sediment material arising from the proposed beach renourishment operations at the Burrow. The key parameters relating to the setup of these model simulations are summarised in Table 6.3 . This simulation was run for a total of 8 weeks to account for the full beach renourishment campaign and any subsequent dispersion and settlement of silt material.

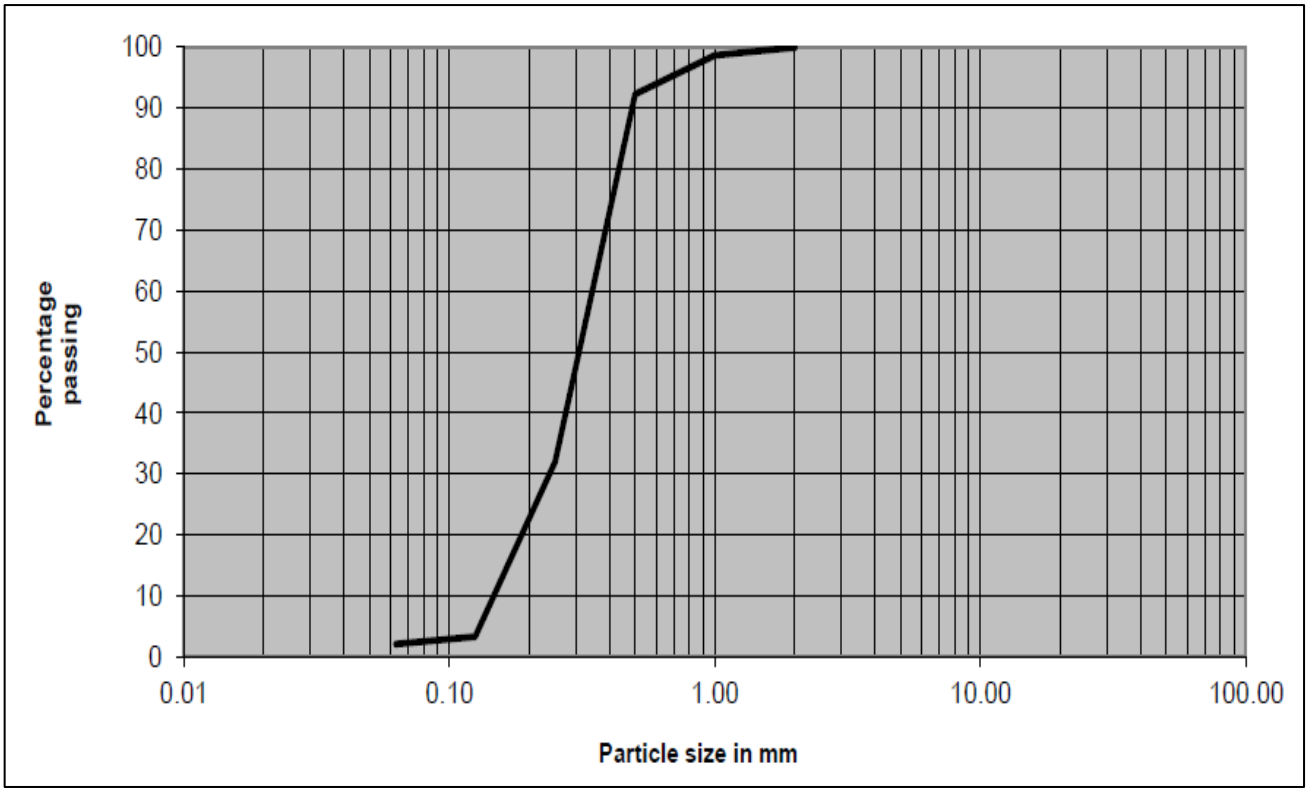


Figure 6.17: Particle size distribution of proposed beach renourishment material from the licenses Boskalis Area 457 in Liverpool Bay, Eastern Lane.

Table 6.3: Beach renourishment simulation input parameters.

Parameter	Value	Unit
Total volume of beach renourishment	425,000	m^3
Estimated volume of losses (based on 20% losses)	50,000	m^3
Capacity of trailer dredger delivering material	10,500	m^3
Duration of each discharge cycle	100	min
Ratio of water and sediment during pumping operations	80:20	
Volume of water pumped during each discharge cycle	52,500	m^3
Rate of discharge	8.75	m^3/s
Estimated volume of sediment loss during each discharge cycle	2,100	m^3
Rate of sediment loss	0.35	m^3/s
Estimated cycle time	16.50	hrs
Estimated duration of beach renourishment works	32.	days

The impact of the material lost from the proposed beach renourishment scheme at the at Burrow on total suspended sediment concentrations (SSCs) is shown by two separate plots. The first, presented in Figure 6.18, illustrates the maximum total SSC which occurs in each cell *at any time* during the simulation and is thus an envelope covering all the sediment plumes excursion. It is important to note that these values may have only occurred for a single timestep in the simulation. It will be seen from this Figure that the maximum SSCs during the beach renourishment campaign can, at times, reach *c.*85,000mg/l within the immediate vicinity of the discharge pipeline. The concentration of the sediment plume envelope decreases to *c.*5,000mg/l within *c.*500m of the discharge points and to less than 5mg/l within *c.*700m of the discharge points.

Importantly, at no point during the simulation are background SSCs increased by more than 2mg/l beyond the immediate vicinity of the foreshore area of the Burrow where the works are being undertaken, including at Rush beach or within Rogerstown estuary.

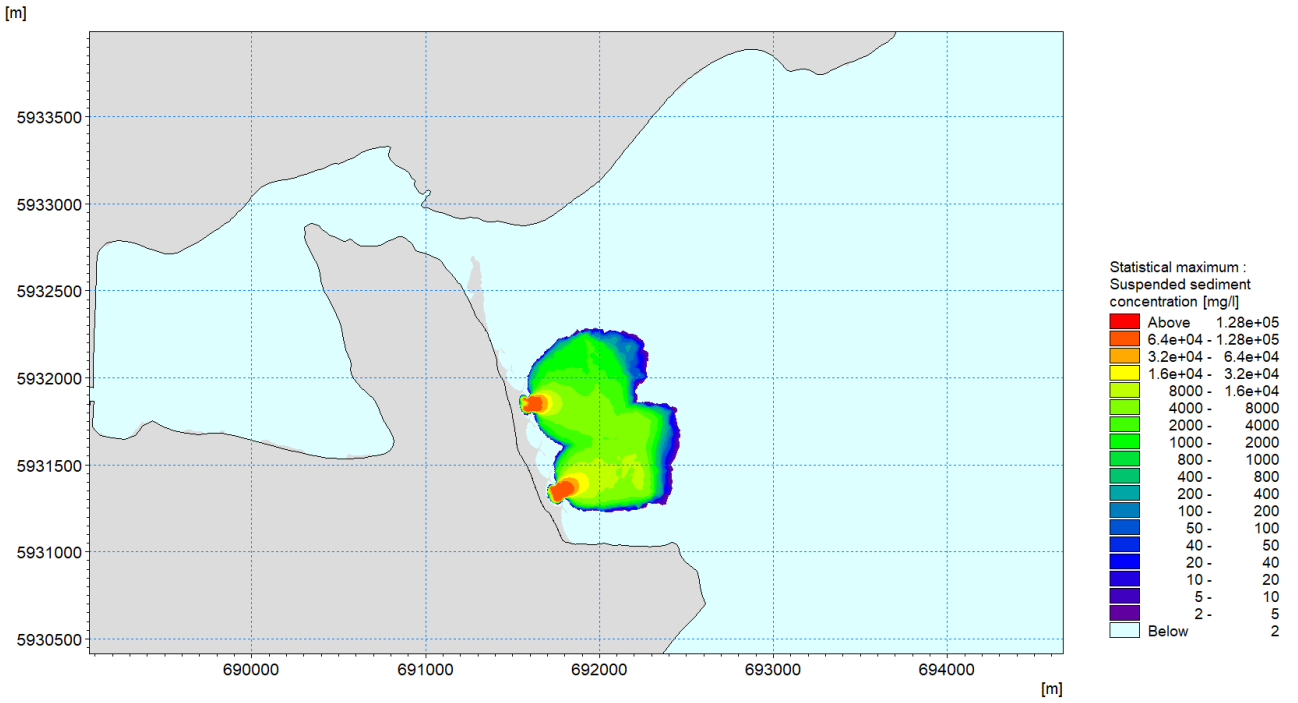


Figure 6.18: Maximum total suspended sediment concentration during the entire beach renourishment campaign.

The very high SSCs illustrated in Figure 6.18 can be attributed to the fact that the renourishment material is transferred from the barge by pumping water through the hopper, which mobilises the sediment material for pumping ashore in the form of a very high concentration sand/water mixture. An example of this process is illustrated in Figure 6.19. However, owing to the very high settling velocity of sand particles, combined with the very shallow conditions across the foreshore, this material quickly settles to the bottom and becomes deposited on the seabed. The localised impact of increased sediment concentrations as illustrated in Figure 6.18 and Figure 6.20 therefore only occurs for *c.*100 minutes every 16.5 hours for the duration of the beach renourishment campaign (*c.*6 weeks).



Figure 6.19: Example of beach renourishment material being pumped ashore as a "slurry" mixture.

The second plot, presented in Figure 6.20, illustrates the mean total SSC over the course of the proposed beach renourishment campaign. As demonstrated by this Figure, the *average* total SSC envelopes do not generally extend for more than *c.*600m beyond the discharge locations and are typically less than 200mg/l. The greatest *average* total SSCs of *c.*4,000mg/l are typically limited to within *c.*200m of the discharge locations.

At no point during the simulation are background SSCs increased by more than 2mg/l beyond the immediate vicinity of the foreshore area of the Burrow, including at Rush beach or within Rogerstown.

The final bed level changes as a result of sediment losses experienced during the proposed beach renourishment campaign are illustrated in Figure 6.21. It will be seen from this Figure that bed level changes do not typically increase by more than 0.20m across the foreshore area at the Burrow, except within the immediate vicinity of the discharge locations whereby bed levels could increase by *c.*1.50m. This magnitude of localised bed level change is typical of this type of beach renourishment operation, however in practice any significant deposits will be recovered to the upper foreshore using mechanical plant such as that illustrated in Figure 6.19 where it is subsequently re-graded.

Importantly, these simulations demonstrate that no beach renourishment material settles onto the seabed beyond the immediate foreshore area at the Burrow. This can be attributed to the lack of any significant silt fraction within the renourishment material, the shallow depths across the foreshore and the high settling velocity associated with all sand fractions of the renourishment material.

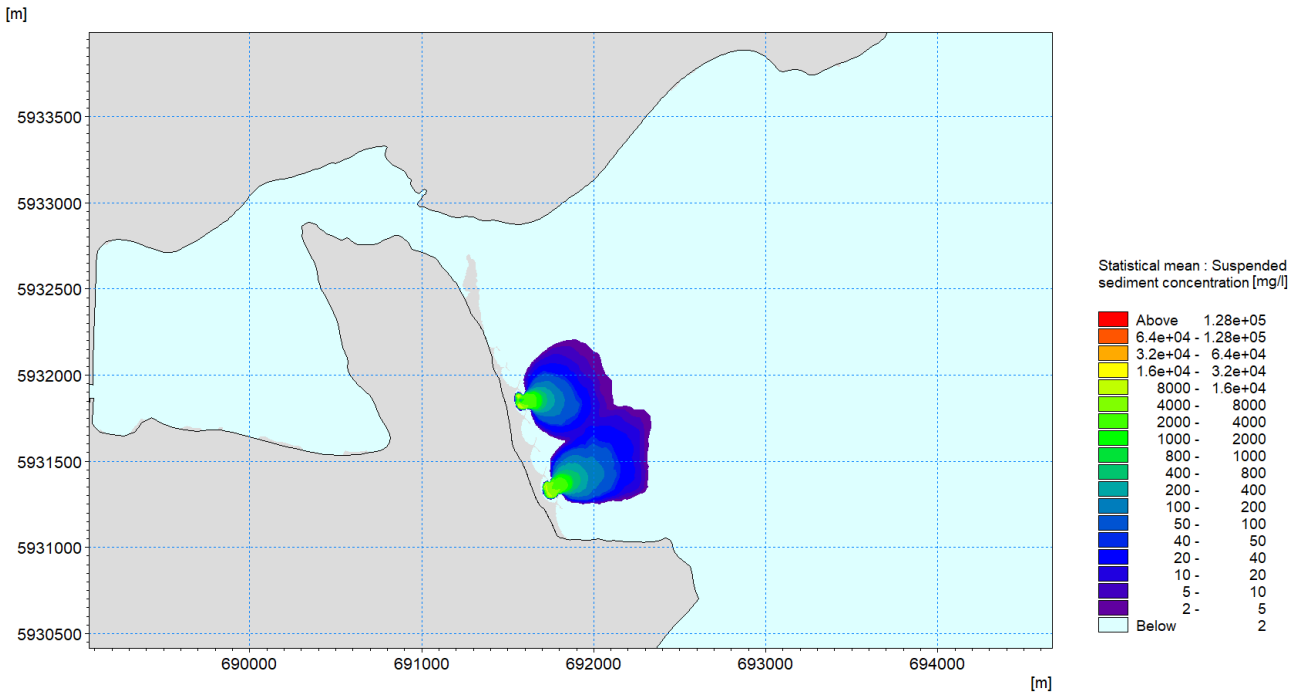


Figure 6.20: Mean total suspended sediment concentration during the entire beach renourishment campaign.

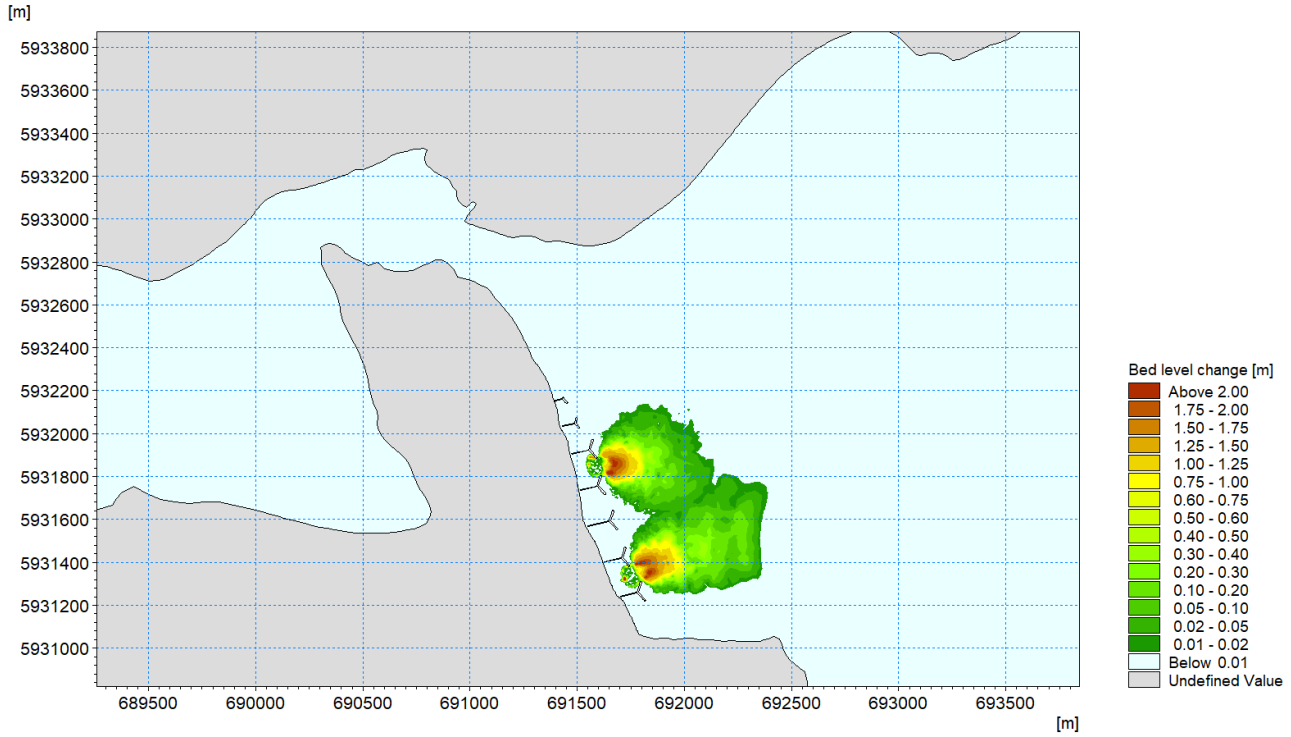


Figure 6.21: Deposition of sediment following the beach renourishment campaign.

6.5.2 Operational Phase Impacts

Coastal management schemes, particularly those such as the Proposed Development, which is intended to reduce coastal erosion, invariably impact on coastal processes, otherwise the schemes would not be effective.

However, it is important to ensure that the Proposed Development does not impact coastal processes beyond the immediate vicinity of the works, which could ultimately increase erosion or flood risk in other areas or impact the natural environment. In the context of the Proposed Development, the following elements have the potential to impact on coastal processes:

- The construction of seven fishtail groyne structures
- The renourishment of the upper beach profile

6.5.2.1 Potential changes to the existing tidal regime

The potential for changes to the tidal regime with the elements of the scheme in place was assessed to identify the potential for operational phase impacts. The MIKE 21 Hydrodynamic module described in Section 6.3.2 was used in conjunction with the post-project scenario 2D model to simulate the tidal regime in the Study Area following the implementation of the Proposed Development.

Typical tidal flow patterns for mid-flood, high water, mid-ebb and low water tides from the Post-project scenario simulations are presented in Figure 6.22 through to Figure 6.25 respectively and can be compared with corresponding pre-scheme plots shown in Figure 6.7 to Figure 6.10.

The difference in modelled current velocities for the pre and post Project simulations have been computed for a one month period, with differences at spring mid-flood, high water, mid-ebb and low water tides presented in Figure 6.26 through to Figure 6.29, respectively. It is during spring tides when the greatest current velocities and thus potential changes would be observed.

These Figures show that the maximum predicted change to the mid-ebb or flood current speeds is less than ±0.40m/s throughout the Study Area and that these changes are generally observed within the vicinity of the proposed groyne field. It will also be observed from these Figures that the changes to the tidal regime are only observable during periods of mid-flood and high water, this is because the water level at other phases of the tide is below both the existing and proposed beach levels, thus there are no changes to flows post-Proposed Development during these times.

Importantly, there are no detectable changes to the tidal regime beyond the immediate vicinity of the Proposed Development, including along Rush beach or within the Rogerstown estuary. It can therefore be concluded that the risk of impact to the tidal regime is negligible.

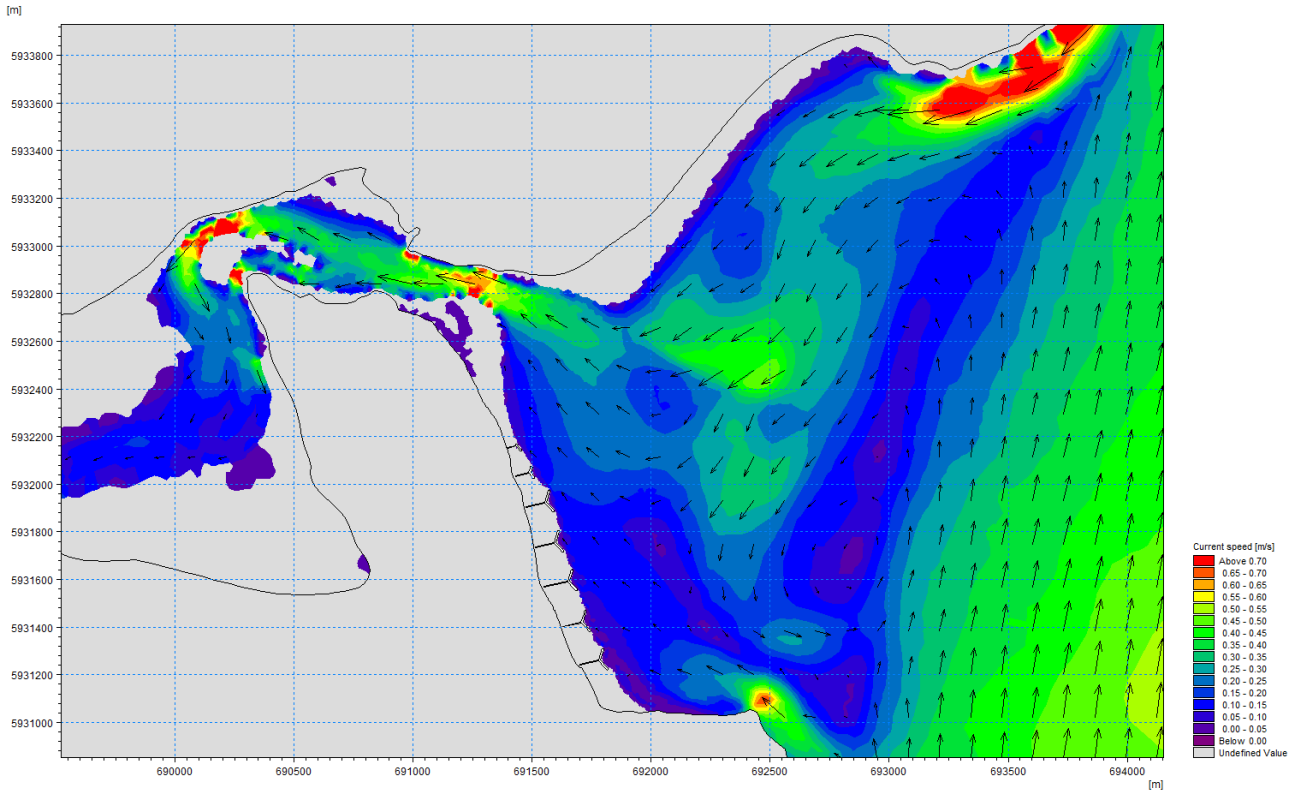


Figure 6.22: Typical spring mid flood tidal flow patterns during operation.

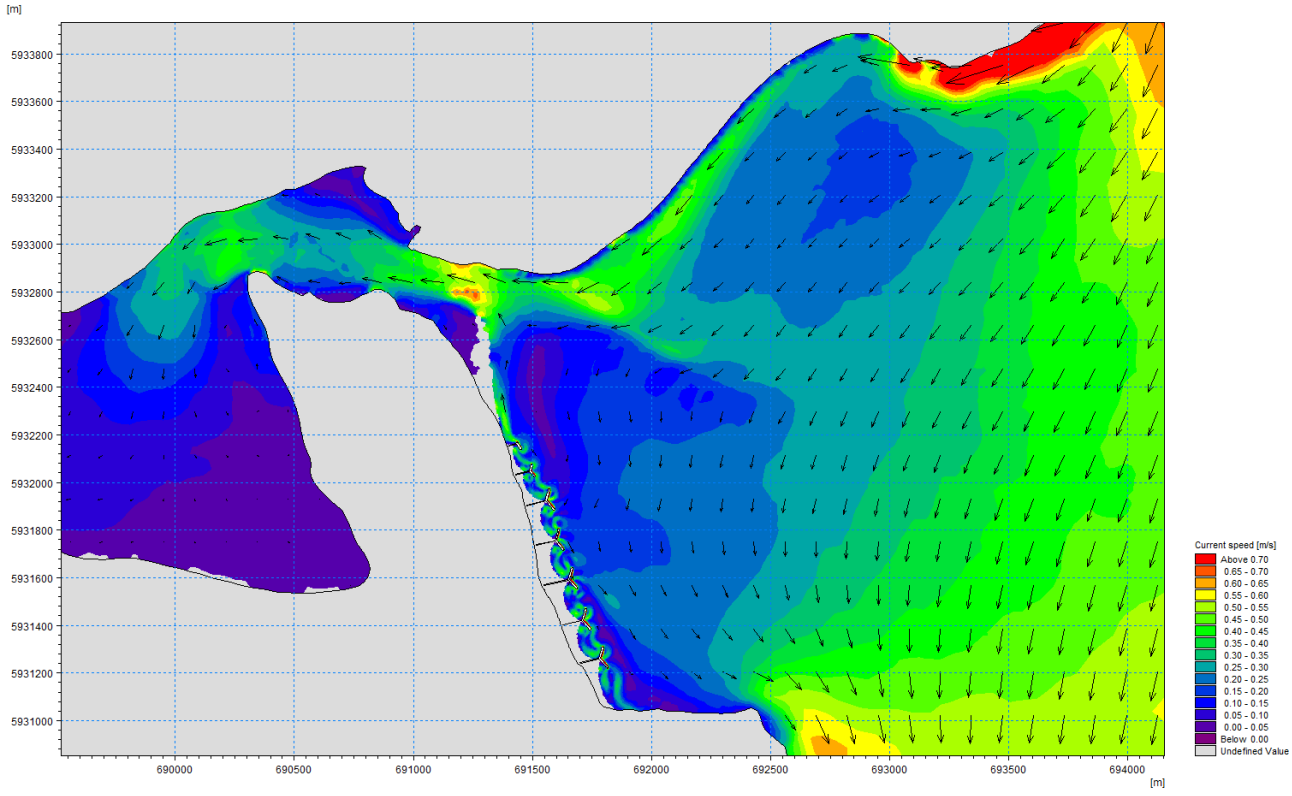


Figure 6.23: Typical spring high water flow patterns during operation.

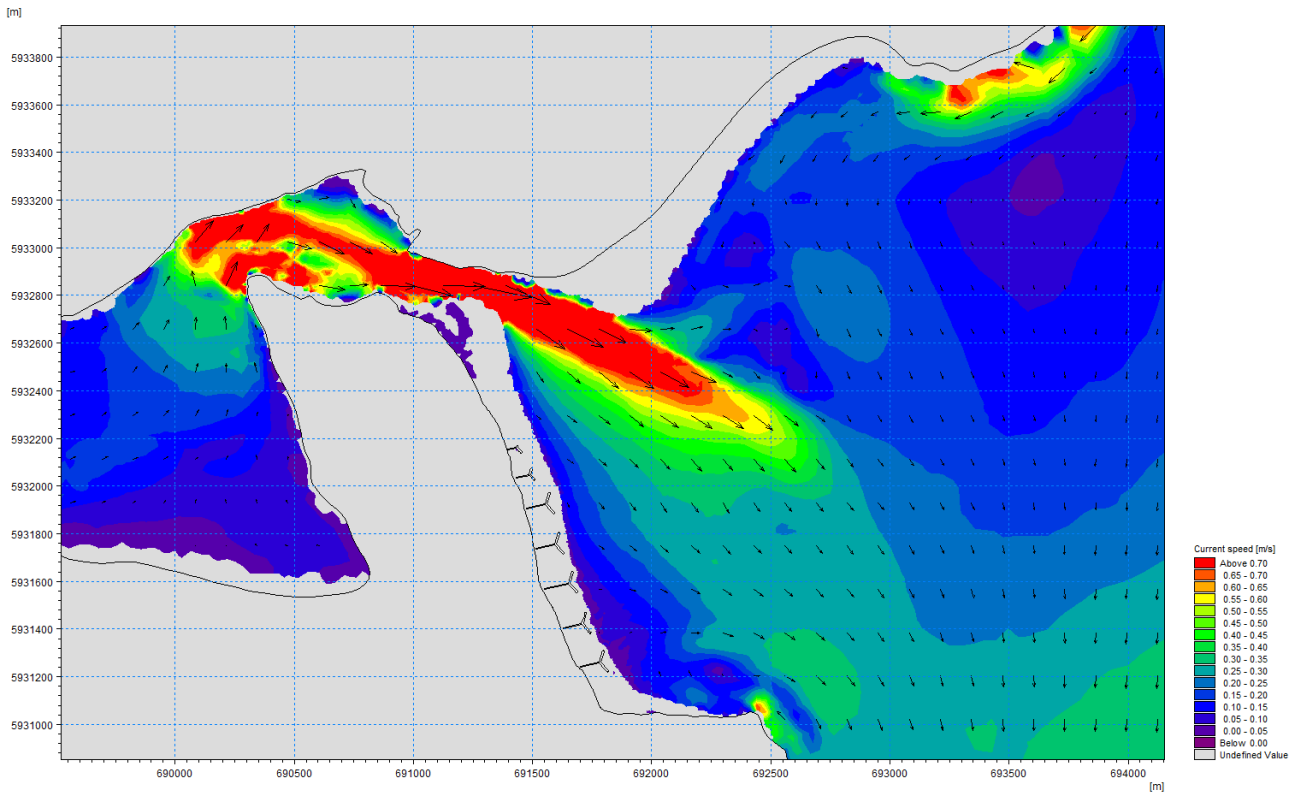


Figure 6.24: Typical spring mid ebb tidal flow patterns during operation.

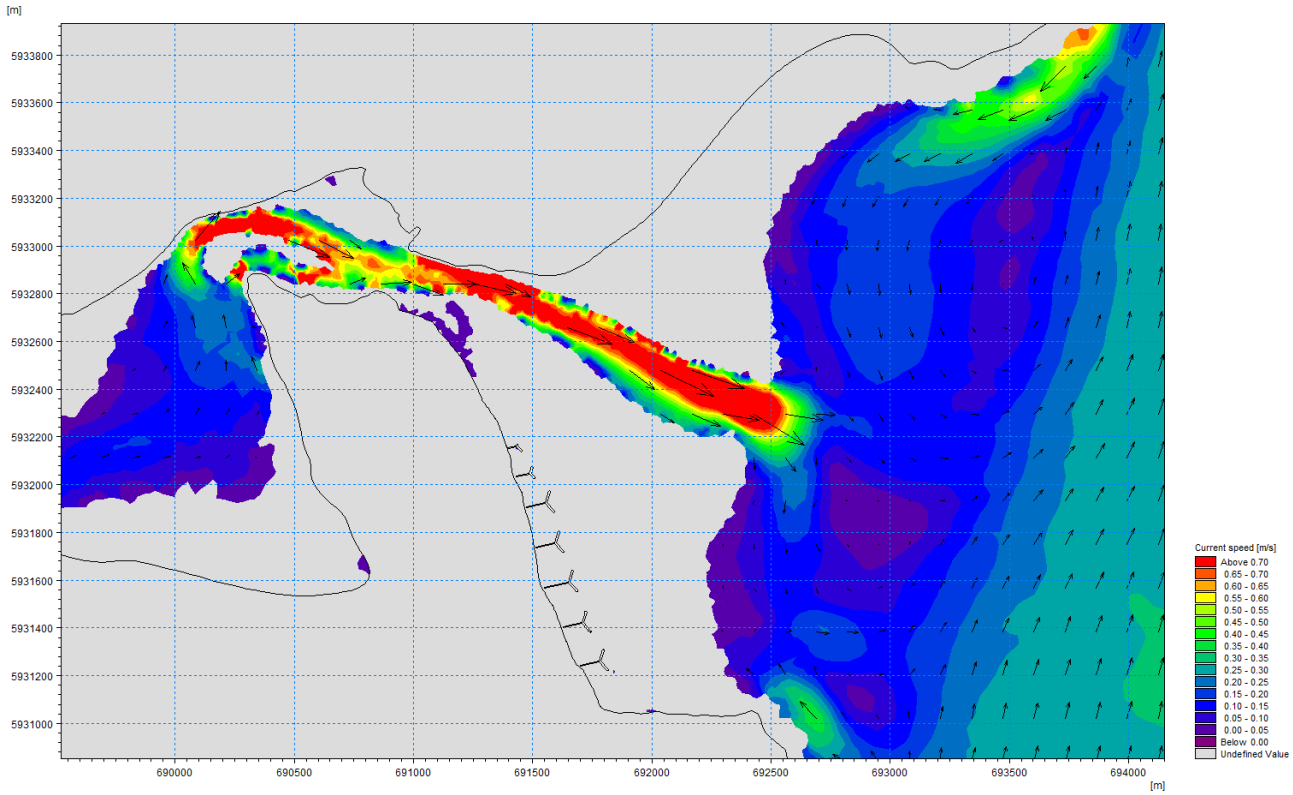


Figure 6.25: Typical spring low water flow patterns during operation.

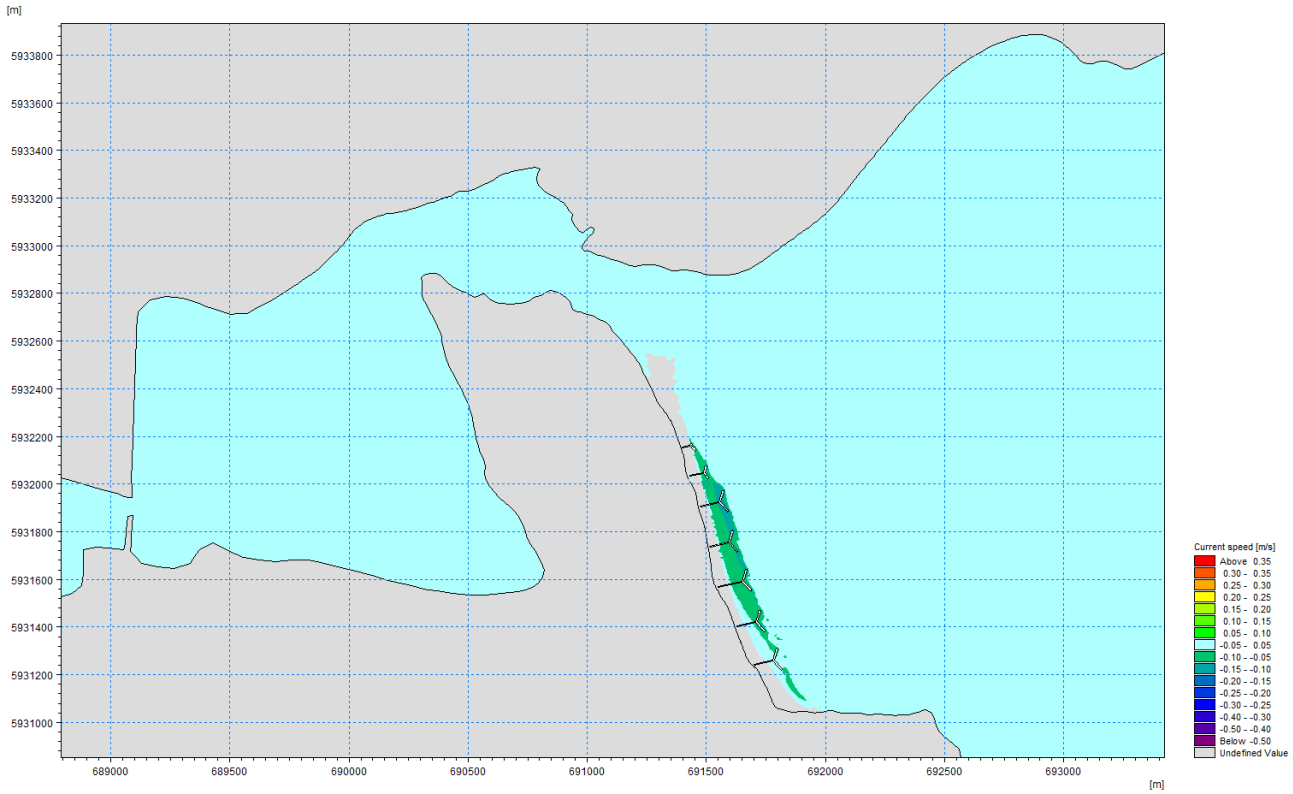


Figure 6.26: Difference in typical spring mid flood tidal flow patterns during operation.

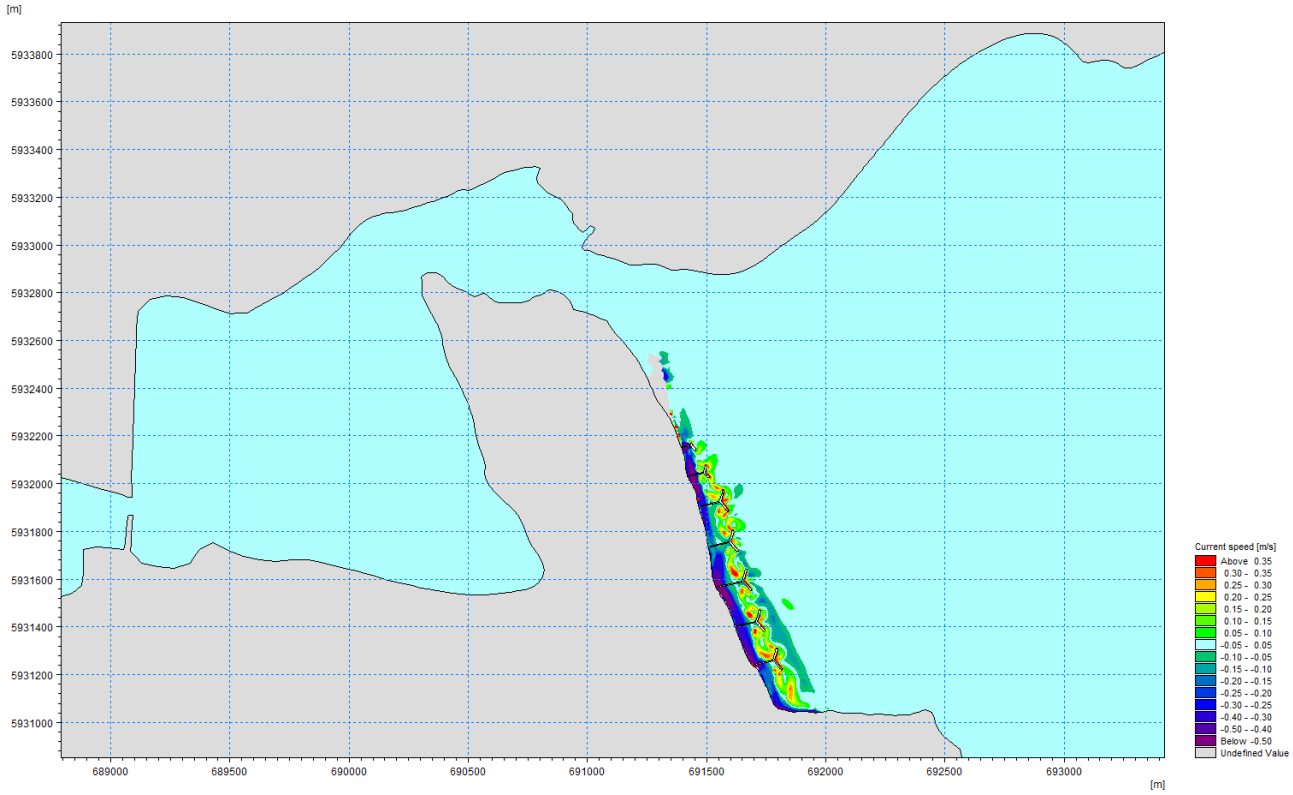


Figure 6.27: Difference in typical spring high water tidal flow patterns during operation.

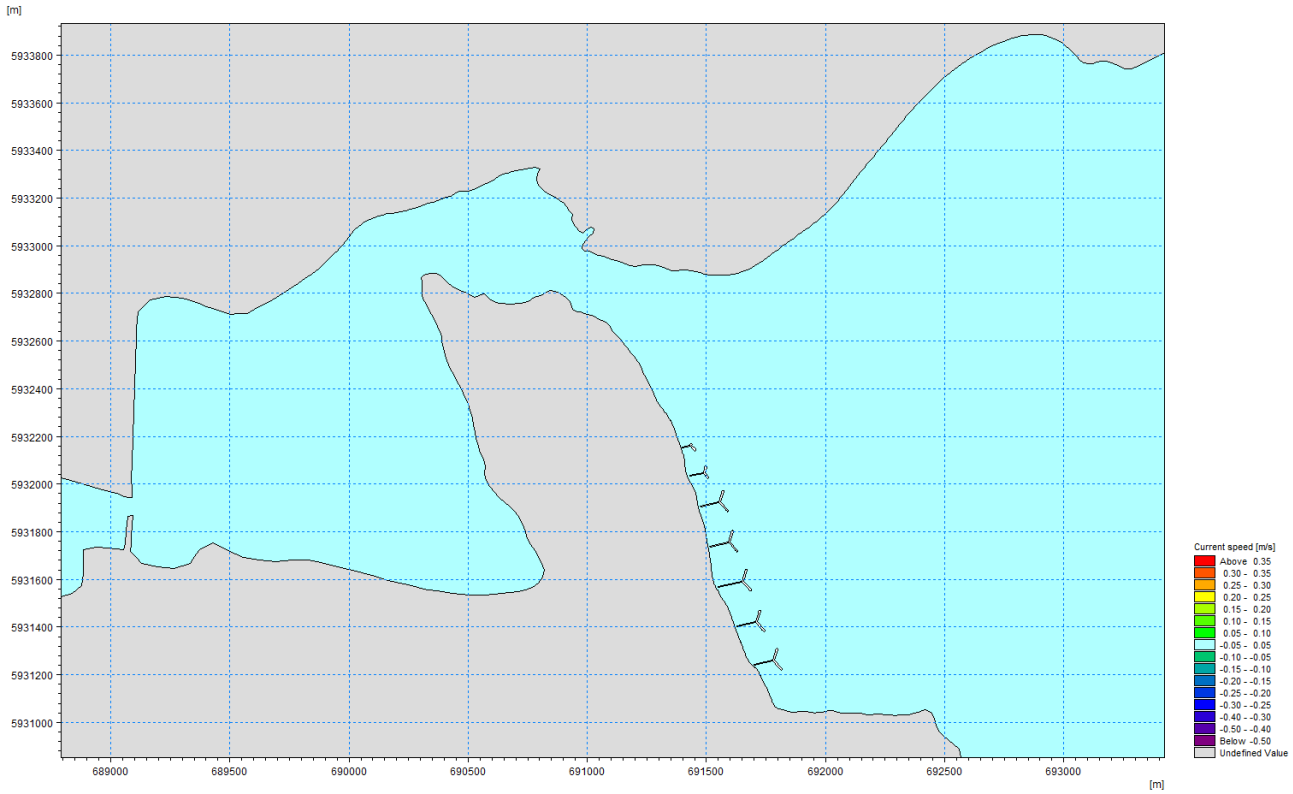


Figure 6.28: Difference in typical spring mid ebb tidal flow patterns during operation.

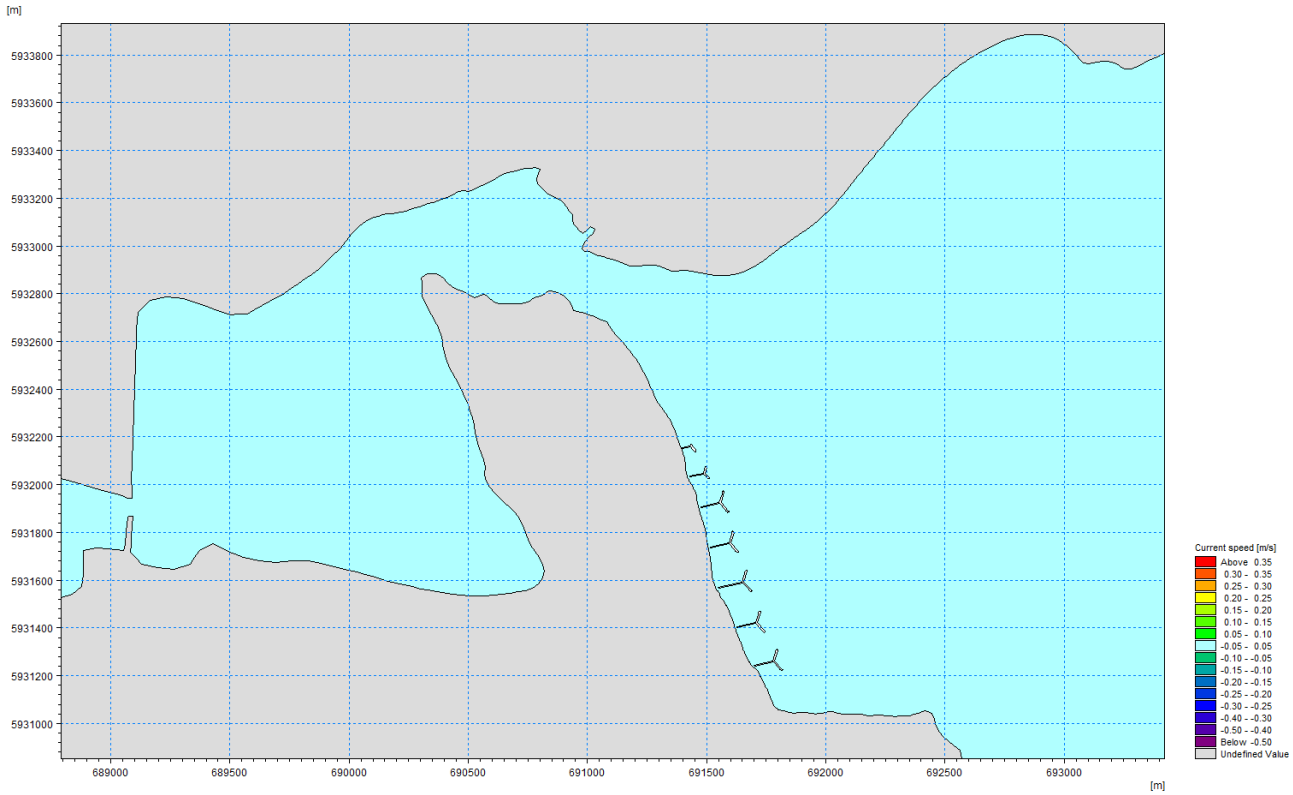


Figure 6.29: Difference in typical spring low water tidal flow patterns during operation.

6.5.2.2 Potential changes to the existing inshore wave climate

The operational phase impacts considered also included potential alteration to wave climate, again some change is to be expected as the purpose of the scheme to provide enhanced protection to the dune frontage at the Burrow. The MIKE 21 Spectral Wave module described in Section 6.3.2 was used in conjunction with the Post-project scenario 2D model to re-run the offshore wave climate simulations based on various wave directions as described in Section 6.4.2.

The simulated inshore wave climate at the coastline based on the post-Project simulations is illustrated in Figure 6.30 to Figure 6.32 for north easterly, easterly and south easterly storm events at spring high tide respectively.

Wave height difference plots are presented for the three storm events in Figure 6.33 to Figure 6.35 to highlight the changes to the inshore wave climate following completion of the Proposed Development. The results show that, during all storm events modelled, the only changes to the wave climate in Study Area are predicted to occur within the immediate vicinity of the Proposed Development. Importantly, the assessment found that there were no discernible changes to the wave climate in surrounding areas, including at Rush beach or within the Rogerstown estuary.

It will be seen from Figure 6.33 to Figure 6.35 that the maximum change to 1 in 200-year return period wave conditions whereby significant wave heights decreased by up to 1.25m occurred directly behind the fishtail groyne structures. This is entirely expected given that a primary purpose of these structures, aside from retaining sediment material, is to dissipate wave energy before they can impact the coastline. Changes to the bathymetry within the fishtail groyne cells also further decreases wave heights in these area by reducing available water depths.

During easterly storm events, wave heights at the Burrow may decrease up to 1.25m owing to changes in bathymetry in this area. During north easterly storm events, wave heights are expected to decrease by up to 1.20m within the vicinity the northern groynes. A smaller reduction of 0.8m is expected during a south easterly storm.

In summary, this assessment found no detectable changes to the inshore wave climate during extreme storm events beyond the immediate vicinity of the Proposed Development, including along Rush beach or within the Rogerstown estuary. It can therefore be concluded that the risk of impact to the inshore wave climate beyond the immediate area of the scheme is negligible.

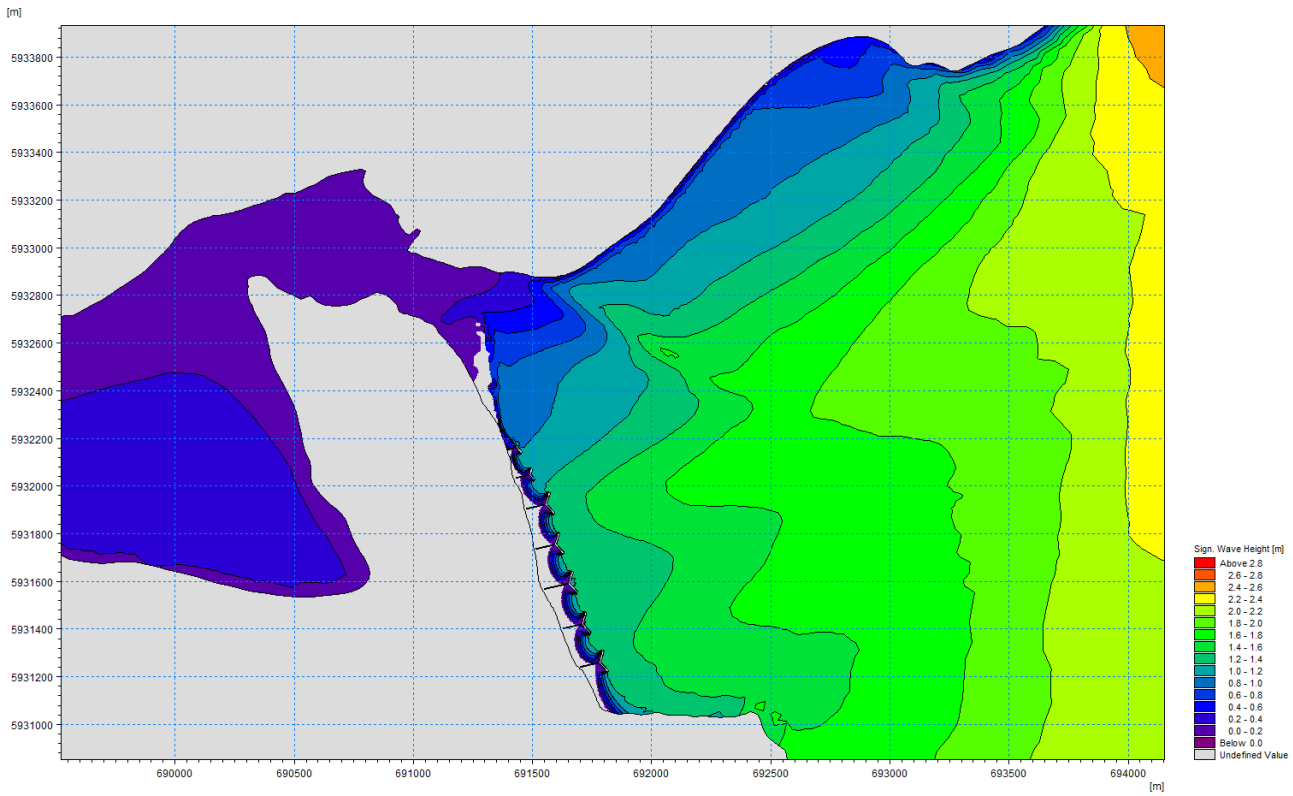


Figure 6.30: Inshore significant wave heights during a 1 in 200-year return period storm event from the northeast – post-project scenario.

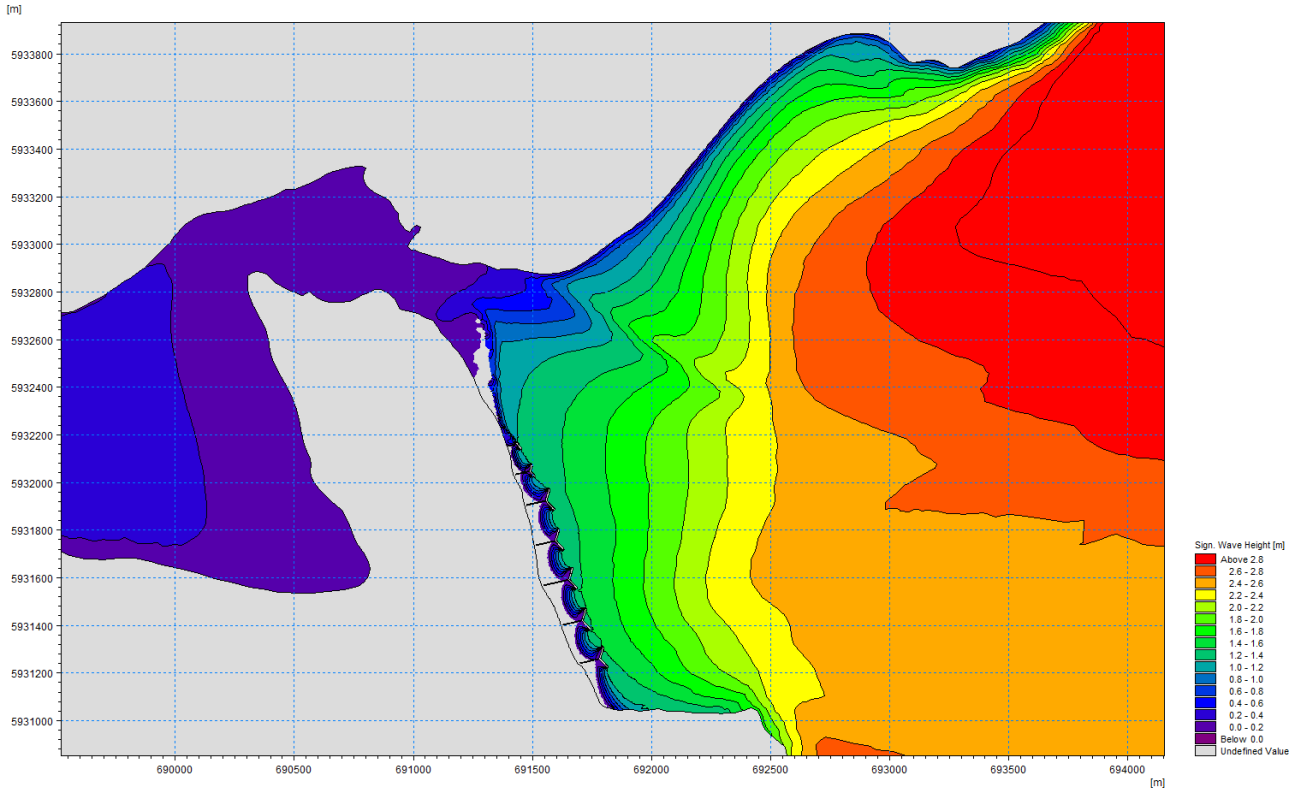


Figure 6.31: Inshore significant wave heights during a 1 in 200-year return period storm event from the easterly – post-project scenario.

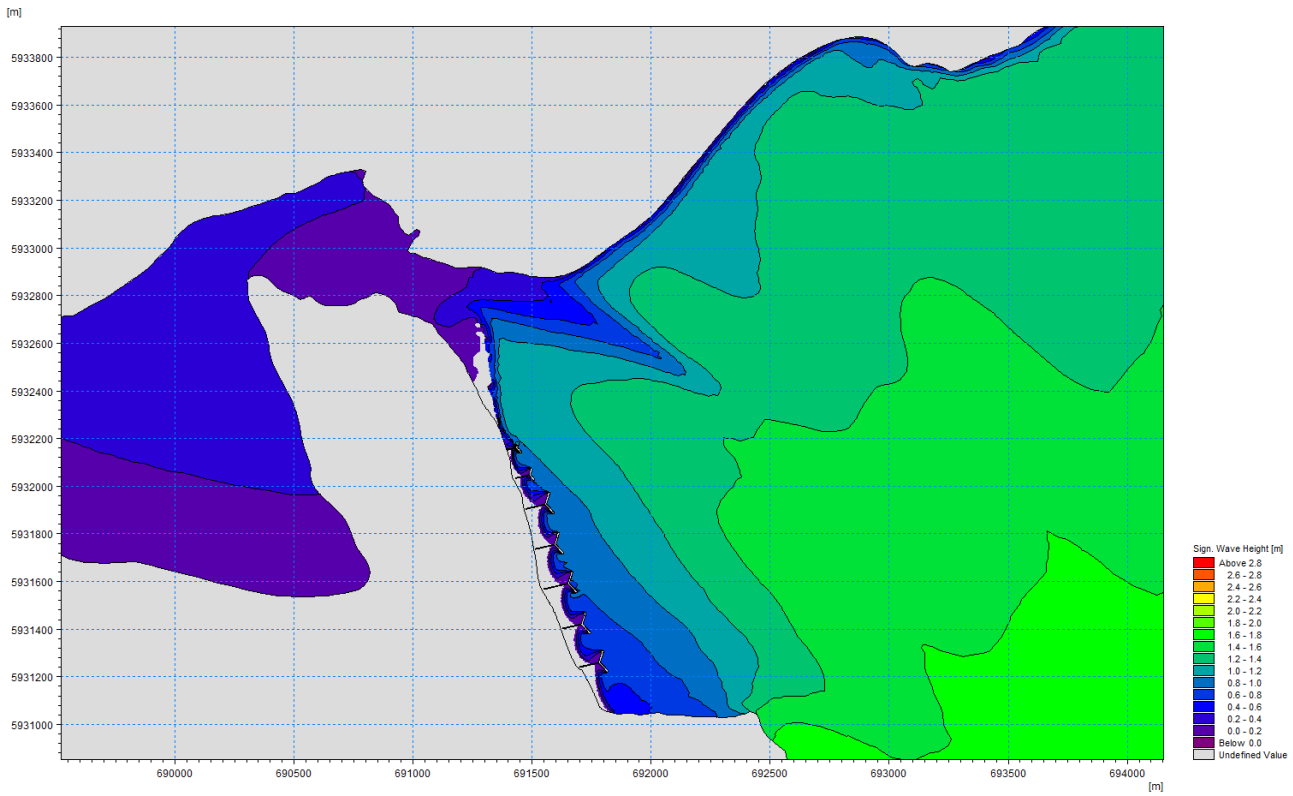


Figure 6.32: Inshore significant wave heights during a 1 in 200-year return period storm event from the south easterly – post-project scenario.

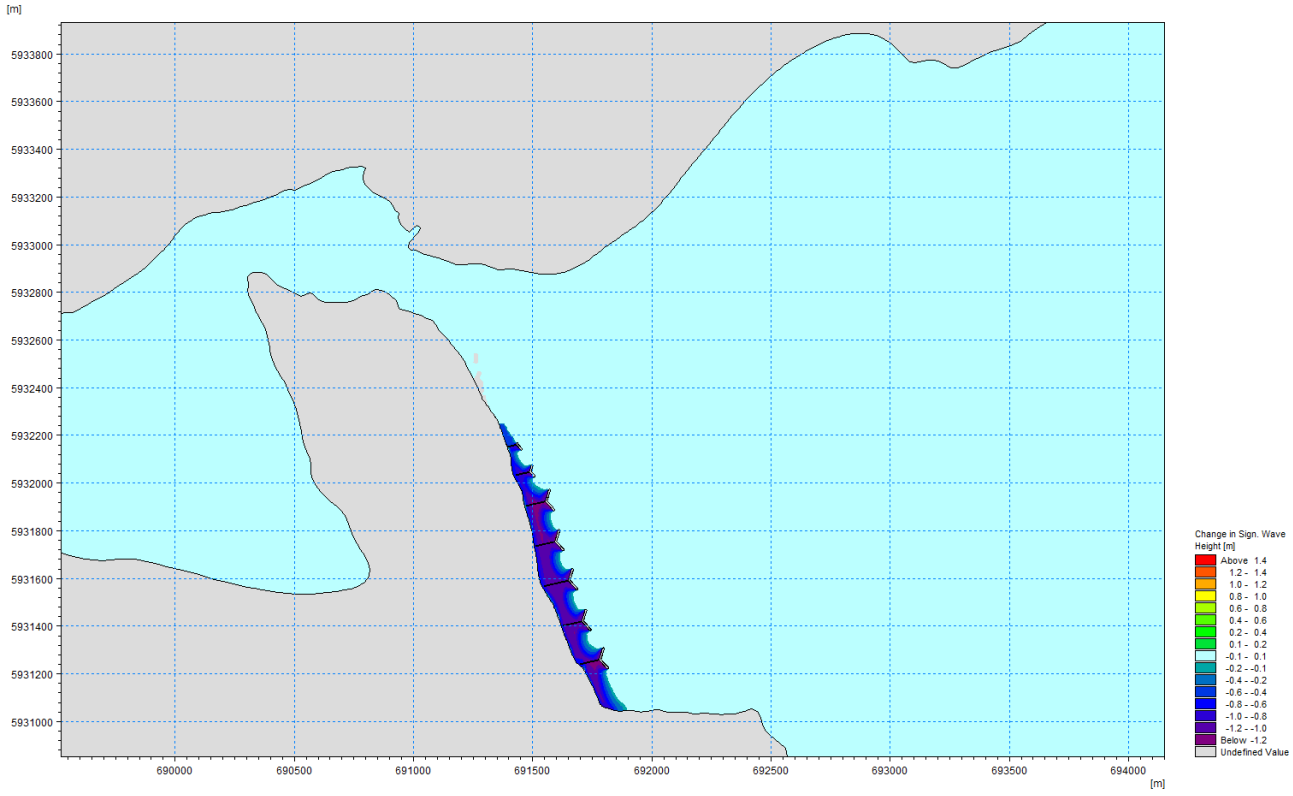


Figure 6.33: Difference significant wave heights during a 1 in 200-year return period storm event from the northeast as a result of the Proposed Development.

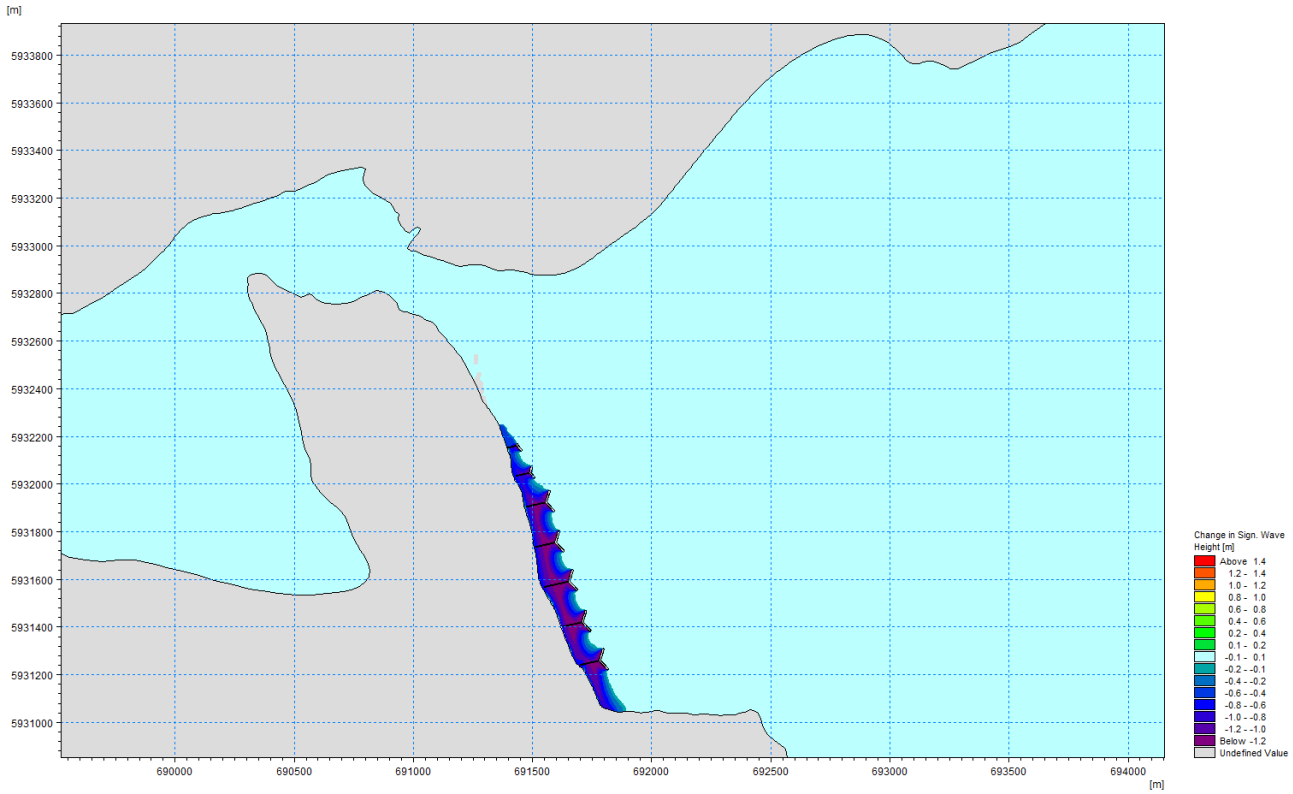


Figure 6.34: Difference significant wave heights during a 1 in 200-year return period storm event from the east as a result of the Proposed Development.

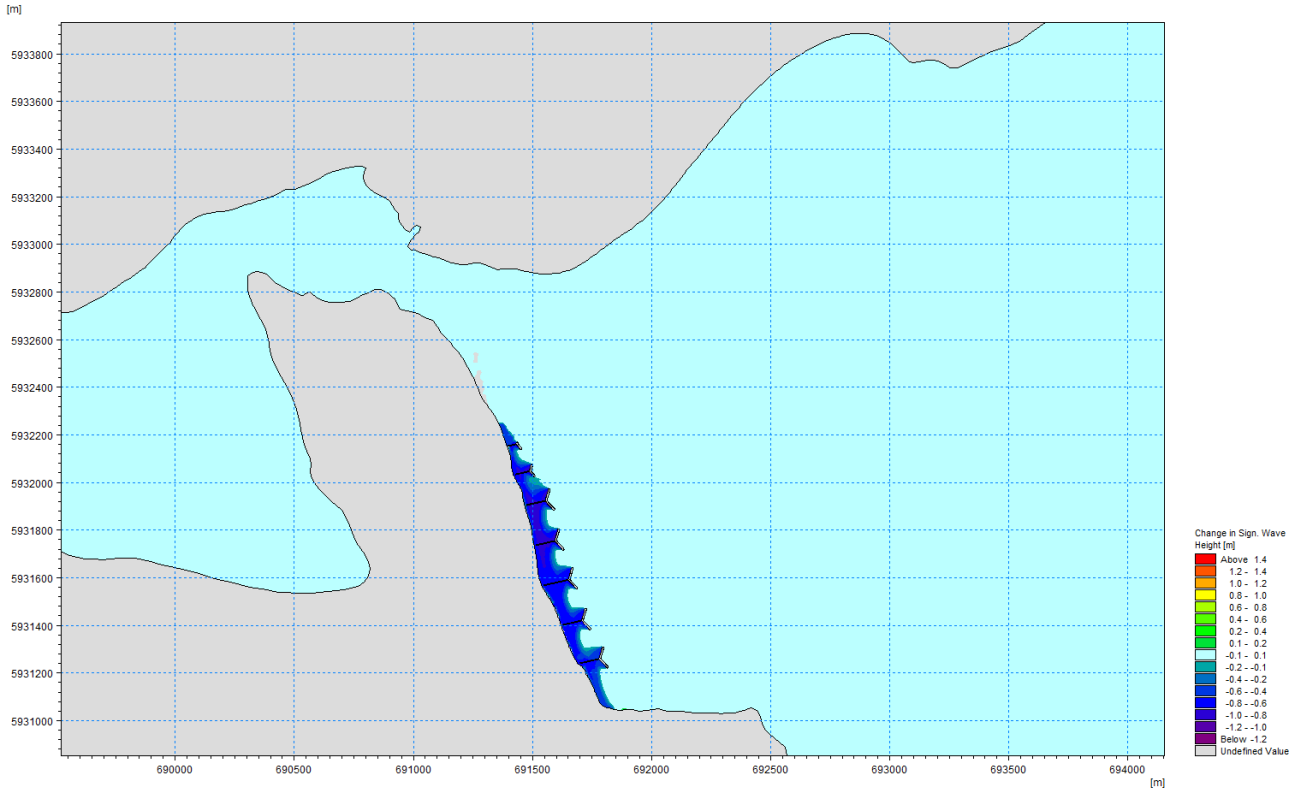


Figure 6.35: Difference significant wave heights during a 1 in 200-year return period storm event from the southeast as a result of the Proposed Development.

6.5.2.3 Potential changes to the sediment transport regime

As stated in Chapter 13 (Terrestrial and Coastal Biodiversity), the Proposed Development is located within to the Rogerstown Estuary Special Protection Area (SPA) and Special Area of Conservation (SAC). It was, therefore, important to consider potential changes to the sediment transport regime as a result of the Proposed Development to determine if these changes could undermine the integrity of these sites.

Sediment on the seabed is transported when it is exposed to large enough forces, or shear stresses, arising from water movements or other external forces e.g., wind over exposed inter-tidal areas. These stresses can result from the tidal current or wave orbital velocities or a combination of both. The relevant parameters for the description of the sediment transport within a coastal environment are therefore derived from the following coastal processes:

1. Wave conditions at the site and the possible variations over the site.
2. Current conditions as well as the variations of current over an area.
3. Water-level conditions, i.e. tide, storm surge and wave set-up.
4. Bathymetry variations in an area.
5. The sediment characteristics over an area.
6. The sources and sinks of sediment, such as rivers or tidal inlets.

Given that the previous sections of this chapter have demonstrated that the Proposed Development will have no significant impact on these processes, it can be deduced that the Proposed Development will not result in a significant impact to the sediment transport regime on Portrane beach, or within the wider Rogerstown Estuary area other than to reduce coastal erosion along the coastline within the immediate vicinity of the scheme.

Nevertheless, it was considered important to demonstrate this by means of numerical modelling. To this end, RPS used to the coupled hydrodynamic, spectral wave and sediment transport models described in Section 6.3.2 to re-assess sediment transport during the same calm and stormy periods that were assessed in Section 6.4.3 but with the Proposed Development in place.

The resulting daily average magnitude of sediment transport around the Rogerstown estuary area during calm and arduous storm conditions with the Proposed Development in place is presented in Figure 6.36 and Figure 6.37 respectively.

Difference plots are presented for both calm and stormy conditions in Figure 6.38 and Figure 6.38 to highlight the changes to the daily average total sediment transport as a result of the Proposed Development. The results show that under calm conditions (see Figure 6.38), there is virtually no difference in the magnitude of total sediment transport except along the northern extent of the Burrow which is characterised by embryo dune habitat. These results are to be expected given that the shear stresses produced by prevailing tidal and wave conditions are generally not sufficient to mobilise bed material under baseline or proposed conditions, hence the negligible difference. The very modest decrease in sediment transport rates at the northern extent of the Burrow are considered beneficial given that this would enhance the natural accretion of sediment in this area and could potentially enhance the development and resilience of embryo foredunes in this area.

It will be seen that there are more notable changes to the daily average total sediment transport as a result of the Proposed Development during storm conditions as illustrated in Figure 6.38. Importantly, there is a significant reduction in sediment transport rates of *c.*4 – 6m^3/m/day along the immediate coastline. This is entirely expected given that a primary purpose of these structures is to dissipate wave energy before it can impact the coastline and thus reduce sediment transport within the fishtail groyne cells. However, it will be seen from Figure 6.38 that there is also an increase of sediment transport rates of *c.*1-2m^3/m/day approximately 50m seaward of the existing coastline. This can be attributed to a change in beach profile in this area from the beach renourishment campaign which causes waves to break further seaward. The shear stresses produced from wave breaking subsequently results in sediment transport in an area where little to no transport occurs under baseline conditions.

Considering the overall net changes to the sediment transport regime under storm conditions, there is a modest net decrease in sediment transport rates within the immediate vicinity of the Proposed Development. These findings are to be expected from a coastal management scheme which has been designed to reduce coastal erosion.

Importantly, there are no detectable changes to sediment transport regime during either calm or storm conditions beyond the immediate vicinity of the Proposed Development, including along Rush beach or within the Rogerstown estuary. It can therefore be concluded that the impact on the wider sediment transport regime is negligible.

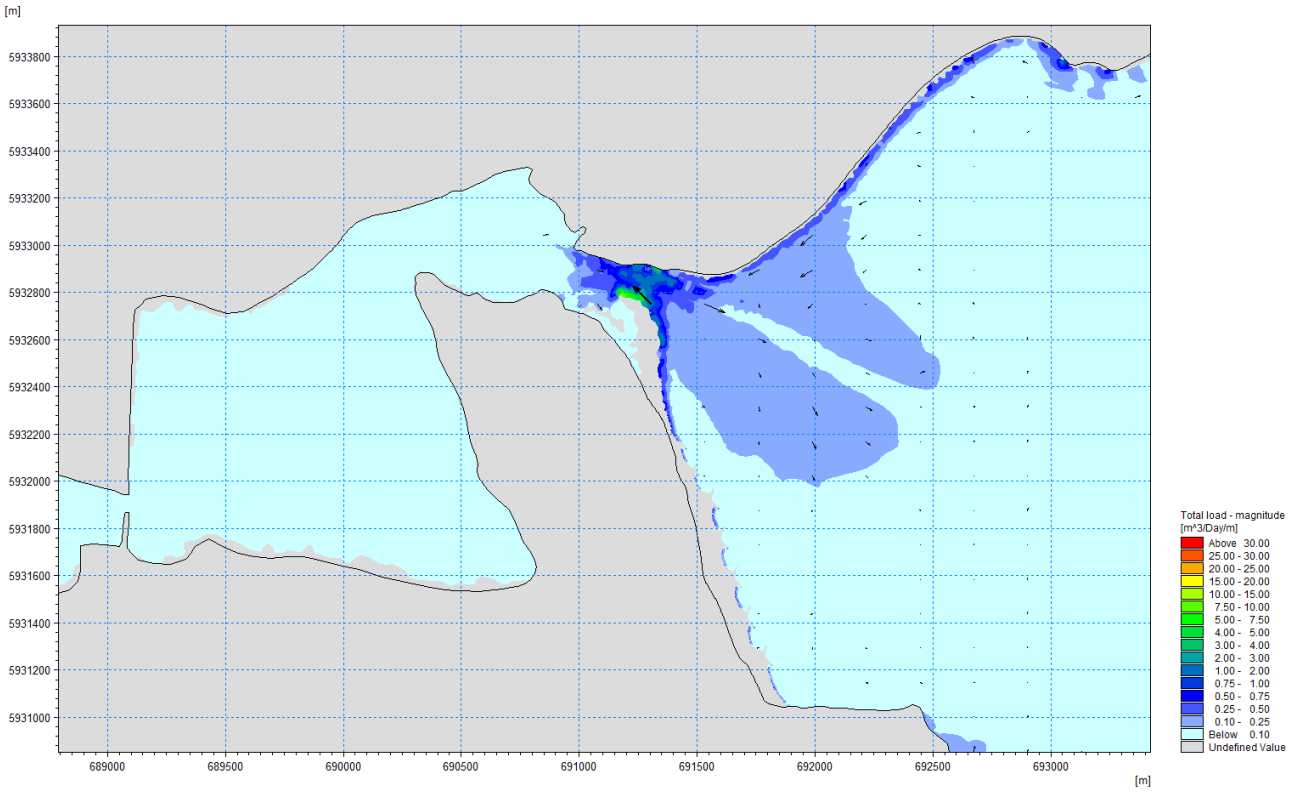


Figure 6.36: Magnitude of daily average total sediment transport during calm conditions – post-project scenario.

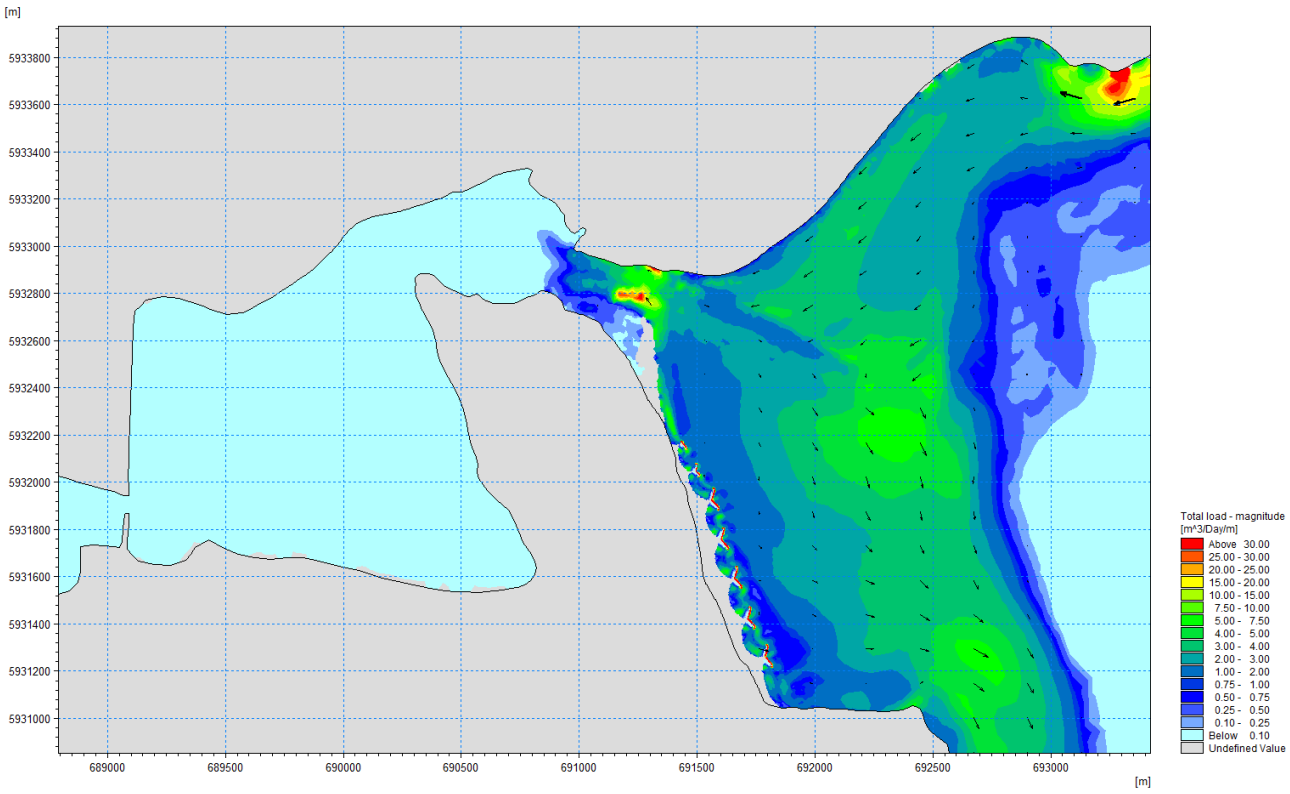


Figure 6.37: Magnitude of daily average total sediment transport during an arduous storm event – post-project scenario.

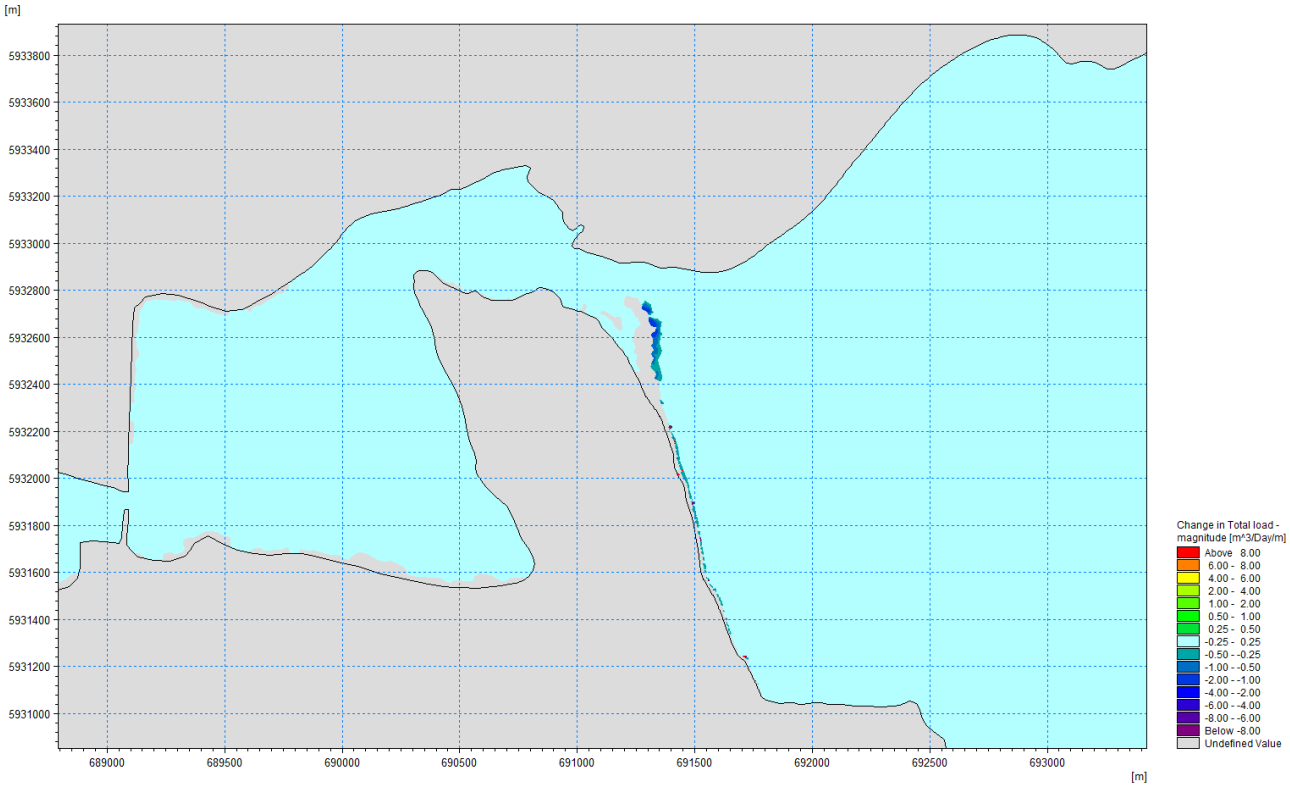


Figure 6.38: Difference in magnitude of daily average total sediment transport during calm conditions as a result of the Proposed Development.

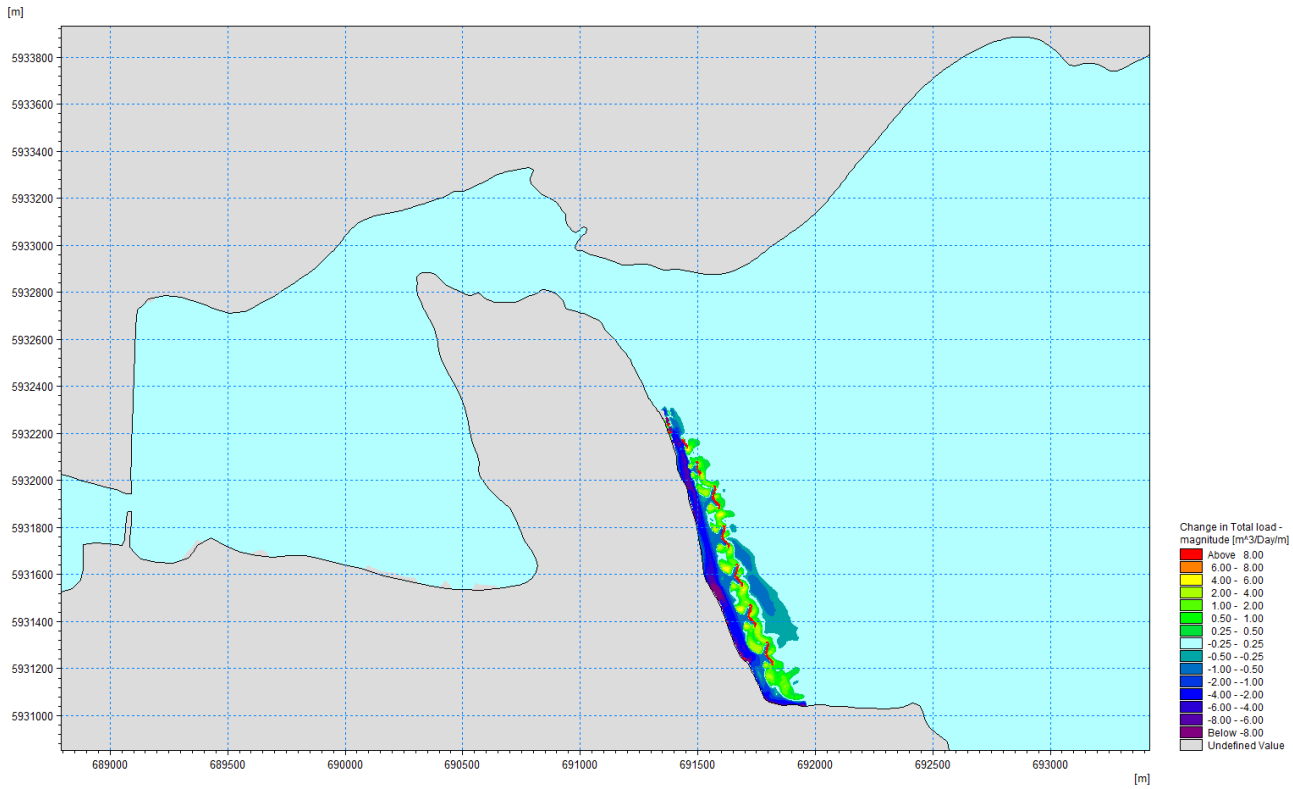


Figure 6.39: Difference in magnitude of daily average total sediment transport during storm conditions as a result of the Proposed Development.

6.6 Mitigation Measures

The Proposed Development has been designed, as far as practical, to minimise the impacts on coastal processes beyond the immediate area the scheme is intended to protect. In context of Coastal Processes, this should include the Construction mitigation measures described in Section 6.6.1.

6.6.1 Construction Phase Mitigation Measures

The following Construction phase mitigation measures should be implemented via a CEMP by the appointed contractor:

- The works associated with the construction of the fishtail groynes should be undertaken at exposed low tides using land-based plant, therefore negating the need to work within the water column (following the guidance published in *Guidance for Pollution Prevention (GPP) 5: Works and maintenance in or near water* (NRW et al, 2018)).
- The construction works required to implement the Proposed Development includes the use of marine and terrestrial plant. As such, there is a risk of water pollution from oil or fuel spillages which could impact water quality. The contractor should therefore include suitable mitigation measures within the CEMP to reduce the risk of spillages. Detailed best practice guidance is provided by the Construction Industry Research and Information Association (CIRIA).
- The CEMP should also include an action plan for responding to storm events and/or extreme tide events. These measures would include daily checks of short/ long range weather and tide forecasts, thresholds for stopping work, and safe storage areas of plant and equipment during storms and high

tides. These steps form a legal requirement as per the Safety, Health and Welfare at Work (Construction) Regulations 2013.

- The beach renourishment activities should only proceed after the construction of the fishtail groynes to reduce the rate of sediment losses to the marine environment.
- It should be noted that the CEMP is considered as secondary rather than primary mitigation and that the assessment of the Proposed Developments potential effects on Coastal Processes, as presented in previous sections of this chapter, is prior to the implemented of the CEMP.

6.6.2 Operational Phase Mitigation Measures

As with any scheme, there will be on-going maintenance activities throughout the life of the scheme which may impact coastal processes. As the beach renourishment element of the Proposed Development is effectively a "soft" nature-based solution, sediment material will be gradually lost from between the groyne structures over time and particularly during storm conditions. As such, beach levels within these cells will gradually reduce overtime and require periodic renourishment.

The frequency of renourishment will be subject to prevailing weather conditions, the physical characteristics of the renourishment material and detailed design of the groyne structures. However, based on numerical modelling and extensive communications with experienced beach renourishment contractors, it is expected that the beach will require renourishment approximately every 5-10 years. The magnitude of renourishment will be subject to the rate of losses during the intervening period but is expected to range between 50 – 75% of the initial renourishment volume.

Future beach renourishment campaigns should be undertaken as per the original construction methodology with similar costs and impacts as described in this chapter being incurred in each instance.

The impacts of climate change can be offset and the effectiveness the scheme maintained by increasing the magnitude of beach renourishment in-line with the rate of future sea level rise. To this end, any future modifications to the Proposed Development should be informed by all available monitoring data and best available climate change science.

6.6.3 Monitoring

As part of the CEMP, the contractor should develop a robust plan to monitor tides and storm events during the construction of the Proposed Development. This should also include an action plan for responding to storm events and/or extreme tide events.

In addition, FCC should develop a robust beach maintenance and management plan to ensure that the Proposed Development is managed and maintained during the operational phase to ensure it continues to provide its coastal defence and amenity function. This may include, but is not limited to:

- Aerial drone surveys across the entire beach area.
- Detailed topographic surveys of fishtail groyne and beach profile elevations.
- Pre and post storm surveys.

- Regular analyses and reporting of monitoring data.

It is understood that the Burrow coastline is currently included the Office of Public Works Coastal Survey and Monitoring Programme (CSMP), which has the following objectives:

- Implementation of a regular survey programme, i.e. spring surveys, autumn surveys and surveys following significant storm events, in selected coastal locations to increase our understanding of coastal change in these areas.
- Monitor, quantify and identify coastal change including:
    - quantification of rates of change of beach and seabed sediment levels.
    - quantification of rates of change of beach and seabed sediment volumes.
    - identification of submerged features that may influence coastal flood or erosion risk, or influence sediment transport processes.
    - identification and monitoring of the coastline, e.g., the vegetation line, etc.
    - identification and quantification of changes in nearshore sediment reservoirs or sinks.
- Inform and support the development and/ or updating of numerical coastal process models (hydrodynamic, tide, wave and/or sediment transport), that may be used to update coastal site risk assessments.
- Inform and support the planning, design and construction of new coastal infrastructure.
- Assist with the assessment of the performance new coastal infrastructure.
- Monitor accelerated rates of coastal erosion that may be associated with climate change.
- Stimulate new research and innovation that may be possible based on the availability of this coastal survey information.

It is recommended that at a minimum, the surveying methods and extent as defined by the CSMP for this region should be included in any monitoring programme developed for the operational phase of the Proposed Development.

6.7 Residual Effects

Notwithstanding the successful implementation of the construction and operation phase mitigation measures described in the previous section, there are likely to remain several residual impacts (i.e. potential adverse environmental impacts that remain after mitigation measures are implemented). These are described and considered below:

- During the construction of the fishtail groynes, machinery would need to track along the foreshore to transport and place rock armour material. This could result in the compaction and/ or mobilisation of sediment material within the vicinity of the Proposed Development.
    - These works should be undertaken at low tide, thus the localised and temporary changes to sediment dynamics on the foreshore are considered unlikely to result in any significant impacts to the sediment transport regime and/or beach dynamics.
    - The construction phase of the Proposed Development could result in short term adverse impacts on beach dynamics due to the temporary placement of rock armour material which is required to construct the fishtail groynes. This could be avoided by ensuring the rock armour is stored within an adjacent terrestrial compound facility. However, given the short temporal duration of any rock armour storage on the beach, it is considered that beach dynamics would quickly return to normal after this is removed. This residual impact is therefore unlikely to result in any significant impacts to the sediment transport regime and/ or beach dynamics.
- Beach renourishment material will be pumped ashore from the dredger located at a suitable offshore depth via a sinker pipeline. The mooring point, acting as the connection between the dredger and sinker pipeline will be located on the seabed to allow for the safe mooring of the dredger over all states of the tide, and will consist of a length of floating pipeline connected to a *c.*2,300m long steel 'sinker' pipe positioned on the seabed.
    - The proposed pipeline fabrication and demobilisation are not considered to have an impact on coastal processes, owing to these phases being above the mean high water spring mark. The operation of the pipeline may result in a temporal and localised impact on seabed dynamics; however, this will be over a short duration and the seabed would quickly return to normal after the pipeline was removed.
- During the pipeline floatation phase, there could be a temporary disruption to vessels or other marine users within the Rogerstown estuary area. It is envisaged that the pipeline would move along the Burrow, thus the disruption would be dependent on the location of the dredger.
- The beach renourishment phase of the construction work could elevate turbidity levels and in-turn reduce the levels of dissolved oxygen within the water column. However as described above due to high settling velocity of sand particles, combined with the very shallow conditions across the foreshore, this material quickly settles to the bottom and becomes deposited on the existing beach.

Assuming that the above mitigation measures are implemented during the construction and operation phases of the Proposed Development, the potential risk of residual impacts to receiving environment is considered negligible thus reducing the significance of environmental impact to imperceptible.

6.8 Potential Cumulative Impacts

The only other relevant marine project located within the vicinity of the Proposed Development is the FRS proposed at Rush south. This scheme primarily involves the replacement and improvement of existing seawalls located on the northern side of Rogerstown Estuary. Given the highly localised and negligible nature of the Proposed Development at the Burrow, impacts as identified above and the anticipated lesser impacts associated with the scheme at Rush, no cumulative coastal processes effects are anticipated during construction and operation of the Proposed Development. The potential for cumulative impacts is further reduced given that it is intended to construct the scheme consecutively as opposed to concurrently.

The scoping response received from ABP recommended that this EIA should extend to include the area from which the sediments which are to be used for beach renourishment. As described in Chapter 3, Project Description, the location of the source beach renourishment material will be subject to detailed design. However, through extensive liaison with Boskalis, a leading global dredging and offshore contractor and maritime services provider, it is currently assumed that this material will be sourced from The Crown Estate's licensed marine extraction site "Area WGL 457" located in Liverpool Bay. The location of this site is illustrated in Figure 6.40. This site is approximately 25km from the Sefton coast and *c.*165km from the location of the Proposed Development.

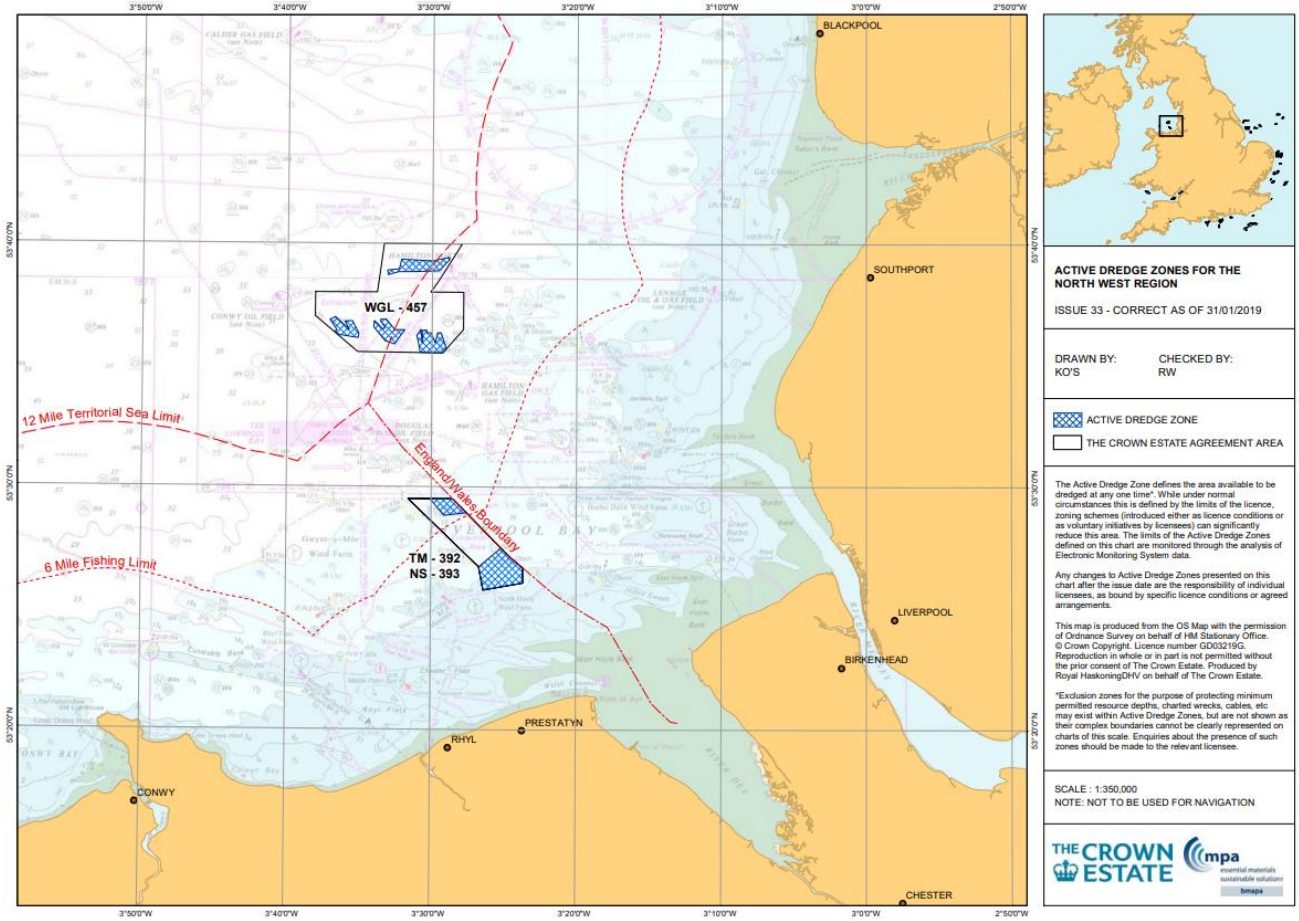


Figure 6.40: Location of the active dredge zone, Area WGL 457, in Liverpool Bay from which beach renourishment material is currently assumed to be sourced from. (© The Crown Estate, 2019)

The environmental impact of extracting marine aggregates from this site has already been extensively examined through a range of scientific documents which were required to support The Crown Estate licensing application process for the extraction of marine sand and gravel resources from the seabed. These documents include:

- Aggregate Production Licence Application, Area 457 Liverpool Bay: Environmental Statement (ERM,2003 (b))
- Aggregate Production Licence Application, Area 457 Liverpool Bay: Vol 1 - Summary of Consultation and Supplementary ES (Appendix A), (ERM, 2003 (b))
- Area 457 (Liverpool Bay) Application Volume 1 Summary of Consultation and Supplementary ES (Appendix A) December 2003, (ERM, 2003 (c))
- Area 457 (Liverpool Bay) Application Volume 2 Supplementary ES (Appendices B, C and D) (ERM, 2003 (d))

These reports confirmed that the extraction of marine aggregates at this location would not interfere with sediment transport processes or result in negative impacts to environmentally designated sites within the Liverpool Bay. The hydraulic report states that there was no potential for coastal impacts to arise from these works because of the distance offshore and the relict nature of the resource which has no connectivity with the beach along the nearest coastline at Sefton (HR Wallingford, 2007). The *current* license commenced in 2014 and is due for renewal in 2025.

Given the lack of a pathways (i.e. the very large distances) from the extraction site to any relevant environmental receptors either in Liverpool Bay, the Sefton coast or the within the Rogerstown Estuary area, the magnitude of in-combination impact of the Proposed Development with the extraction of beach renourishment material is considered imperceptible and therefore non-significant.

6.9 Conclusions

The assessment of coastal processes was based on an extensive numerical modelling programme using RPS' in-house suite of MIKE coastal process modelling software developed by the Danish Hydraulic Institute (DHI). Baseline models were calibrated and verified against a range of project specific hydrographic data and subsequently used to assess the construction and operational impacts of the Proposed Development.

The tidal regime is predicted to remain substantially unchanged after the Proposed Development with changes only being predicted within the vicinity of the proposed groyne fields only. Importantly, there were no detectable changes to the tidal regime beyond the immediate vicinity of the Proposed Development, including along Rush beach or within the Rogerstown estuary.

The assessment of potential changes to the inshore wave climate found that the maximum change in wave heights along the coastline of the Burrow during storm events from the northeast, east and southeast was a decrease of up to 1.25m directly behind the fishtail groyne structures. This is entirely expected given that the primary purpose of these structures, aside from retaining sediment material, is to dissipate wave energy before it can impact the coastline. There were no detectable changes to the inshore wave climate during extreme storm events beyond the immediate vicinity of the Proposed Development, including along Rush beach or within the Rogerstown estuary. It can therefore be concluded that the change to the inshore wave climate is negligible.

The assessment found that the beach renourishment required for the Proposed Development did not result in any significant impact to water quality in terms of suspend sediments, or the nearby environmentally designated areas in terms of sediment deposition.

In respect of sediment transport during the operational phase, it was found that the Proposed Development reduced sediment transport rates along the coastline of the Burrow during storm conditions. This was entirely expected given that a primary purpose of the scheme is to dissipate wave energy and thus reduce sediment transport within the fishtail groyne cells. There was a minor increase of sediment transport rates approximately 50m seaward of the existing coastline, attributable to the modified beach profile causing waves to break further seaward. However overall, the assessment found a minor net decrease in sediment transport rates (and therefore a reduction in sediment deposition) within the immediate vicinity of the Proposed Development during storm conditions. These findings are to be expected from a coastal management scheme which has been designed to reduce coastal erosion.

Importantly, the assessment found no detectable changes to sediment transport regime during either calm or storm conditions beyond the immediate vicinity of the Proposed Development, including along Rush beach or within the Rogerstown estuary.

In circumstances where the mitigation measures are fully implemented during the construction and operational phases, the impact of the Proposed Development on the coastal processes within the Rogerstown Estuary will consist of small scale, low magnitude changes in the tidal regime, sediment transport and wave climate.

The Proposed Development is not expected to act in combination with other developments, including the FRS proposed at Rush south or the extraction of beach renourishment material within Liverpool Bay, to result in any significant impacts to baseline coastal process conditions.

On the basis that the appropriate mitigation measures are fully implemented during the construction and operational phases, the impact of the Proposed Development on coastal processes is considered to be imperceptible.

7 NOISE & VIBRATION

7.1 Introduction

This chapter of the EIAR outlines the noise and vibration impact assessment for the Proposed Development and assesses the potential impacts and likely significant effects of noise and vibration associated with the construction of the Proposed Development.

During the construction phase, there is potential for noise impacts at the nearest noise sensitive properties from the use of associated construction plant and equipment. Please refer to Chapter 13 for details on potential noise impacts on terrestrial and coastal biodiversity. The effect of construction noise has been assessed in full within this noise and vibration chapter. The construction noise targets are set out along with the assessment methodology and results of the construction noise predictions. Construction noise mitigation measures are detailed such that noise targets are met throughout the construction phase.

The specific objectives of the noise and vibration assessment was to:

- Describe the existing noise baseline.
- Define the assessment methodology and significance criteria used in completing the noise and vibration impact assessment.
- Describe the potential effects, including direct, indirect and cumulative effects.
- Describe the mitigation measures proposed to address the likely significant effects.
- Assess the residual effects remaining following the implementation of mitigation.

7.2 Authority of author

The author, Catriona Cooper, is a Senior Associate with RPS with over 20 years of experience in the field of noise and environmental impact assessments. She holds a BSc (Hons) in Environmental Health and a Post Graduate Diploma in Acoustics and Noise Control, Institute of Acoustics. Catriona a full member of the Chartered Institute of Environmental Health (CIEH) and of the Institute of Acoustics (IoA).

7.3 Assessment Methodology

This chapter is supported by the following Volume III Technical Appendices:

- Appendix 7.A: Baseline Noise Monitoring Survey May 2023; and
- Appendix 7.B: Construction Noise Assessment.

Operational noise and vibration affecting noise receptors has been scoped out as there are no known significant vibration sources associated with the operational phase of the Proposed Development, hence there are no significant operational noise or vibration impacts.

Baseline vibration monitoring was not undertaken within the Proposed Development site.

7.3.1 Baseline

The potential noise and vibration impacts were assessed at identified key sensitive receptors including residential, industrial and commercial properties. Sensitive receptors are categorised based on their distance from the activity during construction and operation phases. Distances are taken from the closest point to the Site Boundary.

The existing baseline noise environment was determined through the baseline noise monitoring surveys, both daytime and night-time, at several sensitive receptor locations which were agreed in advance with FCC.

The Study Area for the construction noise and vibration assessment was limited to a 500m radius from the site boundary.

7.3.2 Noise and Vibration Guidance

The noise and vibration impact assessment has followed the methodology set out in Chapter 1, Section 1.5.2. Specific to the noise and vibration impact assessment, the guidance documents described below have also been considered.

7.3.2.1 Institute of Environmental Management and Assessment (IEMA) Guidelines for Environmental Noise Impact Assessment (2014)

IEMA noise impact assessment guidelines address the key principles of noise impact assessment and are applicable to all development proposals where noise effects are likely to occur.

The guidelines provide specific support on how noise impact assessment fits within the EIA process. They cover:

- How to scope a noise assessment.
- Issues to be considered when defining the baseline noise environment.
- Prediction of changes in noise levels as a result of implementing development proposals.
- Definition and evaluation of the significance of the effect of changes in noise levels (for use only where the assessment is undertaken within an EIA).

The guidelines define core methods and techniques, to be used within the noise impact assessment process, and endeavour to highlight their limitations, where relevant. They can be applicable to all stages of a project, from construction through operation to restoration and decommissioning.

7.3.2.2 British Standard BS5228: 2009+A1:2014, Code of Practice of Noise and Vibration Control on Construction and Open Sites Part 1: Noise

This British Standard consists of two parts and covers the control of noise and vibration for persons living and working in the vicinity of construction and open sites. The standard recommends procedures for noise and vibration control during construction operations for architects, contractors and site operatives, designers, developers, engineers, local authority environmental health officers and planners.

This guidance document has been used for the control of construction noise from the Proposed Development.

Part 1 of the standard provides a method of calculating noise from construction plant, including:

- Tables of source noise levels.
- Methods for summing up contributions from intermittently operating plant.
- A procedure for calculating noise propagation.
- A method for calculating noise screening effects.

The standard also provides guidance on legislative background, community relations, training, nuisance, project supervision and control of noise and vibration.

The ABC method outlined in section E3.2 has been used for the purposes of controlling noise. The approach adopted calls for the designation of a noise sensitive receptor into a specific category (A, B or C) based on existing ambient noise levels in the absence of construction noise. This then sets a threshold noise value that, if exceeded at this location, indicates a significant noise impact is associated with the construction activities. BS 5228-1:2009+A1:2014 sets out guidance on permissible noise levels relative to the existing noise environment.

Table 7.1 outlines the applicable noise threshold for potential significant effect at the nearest NSR. The determination of what category to apply is dependent on the existing background ambient (LAeq) noise level (rounded to the nearest 5dB) at the property. For weekday daytime, if the ambient noise level is less than the Category A threshold limit, the Category A threshold limit (i.e. 65dB) applies. If the ambient noise level is the same as the Category A threshold limit, the Category B threshold limit (i.e. 70dB) applies. If the ambient noise level is more than the Category A threshold limit, the Category C threshold limit (i.e. 75dB) applies.

Table 7.1: Threshold of Potential Significant Effect at Nearest Sensitive Receptors.

Assessment category and threshold value period (LAeq)	Threshold value, in decibels (dB)		
	Category A[A]	Category B[B]	Category C[C]
Night-time (23.00 – 07.00)	45	50	55
Evenings and weekends[D]	55	60	65
Daytime (07.00 – 19.00) and Saturdays (07.00 – 13.00)	65	70	75

- NOTE 1 A potential significant effect is indicated if the LAeq,T noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level.
- NOTE 2 If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total LAeq,T noise level for the period increases by more than 3dB due to site noise.
- NOTE 3 Applied to residential receptors only.
- Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.
- Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.

- Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.
- 19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.

7.3.2.3 British Standard BS5228: 2009+A1:2014, Code of Practice of Noise and Vibration Control on Construction and Open Sites Part 2: Vibration

Part 2 of the standard gives recommendations for basic methods of vibration control relating to construction and open sites where work activities/ operations generate significant vibration levels, including industry-specific guidance.

Human beings are known to be very sensitive to vibration, the threshold of perception being typically in the Peak Particle Velocity (PPV) range of 0.14mm/s to 0.3mm/s. Vibrations above these values can disturb, startle, cause annoyance or interfere with work activities. At higher levels they can be described as unpleasant or even painful. In residential accommodation, vibrations can promote concerns about possible structural damage. Guidance on effects of vibration levels is presented in Table 7.2 below.

Table 7.2: Guidance on effects of vibration levels.

Vibration Level	Effect	Effect Level
0.14mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.	Negligible
0.3mm/s	Vibration might be just perceptible in residential environments.	Low
1.0mm/s	It is likely that vibration of this level in residential environments will cause complaint but can be tolerated if prior warning and explanation has been given to residents.	Medium
10mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level.	High

Limits of transient vibration, above which cosmetic damage could occur, are given numerically in Table 7.3 (Ref: BS5228-2:2009+A1:2014). Minor damage is possible at vibration magnitudes which are greater than twice those given in Table 7.3, and major damage to a building structure can occur at values greater than four times the tabulated values.

Table 7.3: Transient vibration guide values for cosmetic damage.

Type of Building	Peak Particle Velocity (PPV) (mm/s) in Frequency Range of Predominant Pulse	
	4Hz to 15Hz	15Hz and above
Reinforced or framed structures. Industrial and heavy commercial buildings.	50mm/s at 4Hz and above	50mm/s at 4Hz and above
Unreinforced or light framed structures. Residential or light commercial buildings.	15mm/s at 4Hz increasing to 20mm/s at 15Hz	20mm/s at 15Hz increasing to 50mm/s at 40Hz and above.

7.3.2.4 ISO 1996-1:2016 Acoustics — Description, Measurement and Assessment of Environmental Noise — Part 1: Basic Quantities and Assessment Procedures

ISO 1996-1:2016 Part 1 provides the framework within which environmental noise should be quantified. ISO 1996-1 provides guidance to quantities and procedures in relation to environmental noise monitoring. ISO 1996-1 states that sound level meters that are used should conform to specifications of Class 1 as given in IEC 61672-1:2013 Electroacoustics - Sound level meters - Part 1: Specifications.

The Class of a noise level meter describes its accuracy as defined by the relevant international standards. Sound level meters are defined by International Standards such as IEC 61672-1:2013. These standards define a wide range of complex accuracy, performance and calibration criteria that instruments must meet to be fit for purpose.

ISO 1996-1 requires all equipment shall be calibrated and the configuration for calibration shall be in accordance with the manufacturer's instructions. A comprehensive recalibration at certain time intervals (annually for field calibrators and every two years for sound level meters) may be prescribed by authorities responsible for the use of the measurement results. A field check shall be made by the user at least before and after each series of measurements, preferably including an acoustic check of the microphone.

7.3.3 Consultation

A consultation response was received from the An Bord Pleanála on 22nd February 2022. This response did not contain any comments in relation to noise and vibration.

7.3.4 Assessment Criteria and Assignment of Significance

7.3.4.1 Likelihood of Impacts

The emphasis of this chapter is on the assessment of the potential effects of the Proposed Development upon the surrounding environment (nearest noise sensitive receptors) during the construction phase.

As detailed in IEMA Guidelines for Environmental Noise Impact Assessment the following terminology and definitions are used:

1. **Noise Impact -** The difference in the acoustic environment before and after the implementation of the proposals (also known as the magnitude of change). This includes any change in noise level and in other characteristics/features, and the relationship of the resulting noise level to any standard benchmarks.
2. **Noise Effect -** The consequence of the noise impact. This may be in the form of a change in the annoyance caused, a change in the degree of intrusion or disturbance caused by the acoustic environment, or the potential for the change to alter the character of an area such that there is a perceived change in quality of life. This will be dependent on the receptor and its sensitivity.
3. **Significance of Effect -**The evaluation of the noise effect and, particularly if the noise impact assessment is part of a formal EIA, deciding whether that impact is significant.

7.3.4.1.1 Receptor Sensitivity/ Value

Sensitive receptors, in the context of noise and vibration, are typically residential premises but can also include schools, places of worship and noise sensitive commercial premises. This is taken from the Scottish Government's Technical Advice Note (TAN) on Assessment of Noise, Table 2.1 Level of sensitivity associated with various examples of noise sensitive receptors. section 2.21 of TAN States:

"There are three levels of sensitivity "high", "medium" and "low". The ranking is primarily based on the relationship between the amenity associated with a NSR and its susceptibility to noise."

TAN Chapter 2, Table 2.1 Level of Sensitivity Associated with Various Examples of Noise Sensitive Receptors provides sensitivity, description and examples of noise sensitive receptors. Therefore, sensitivity of receptors, as defined in TAN has been used as reference criteria for sensitivity of receptors within this chapter.

The sensitivity of receptors to noise and vibration during construction is defined below in Table 7.4.

Table 7.4: Receptor Sensitivity (Ref: TAN Assessment of Noise).

Sensitivity	Description	Examples of Noise Sensitive Receptor (NSR)
High	Receptors where people or operations are particularly susceptible to noise	Residential, including private gardens where appropriate. Quiet outdoor areas used for recreation. Conference facilities. Theatres/ Auditoria/ Studios. Schools during the daytime. Hospitals/ residential care homes. Places of worship.
Medium	Receptors moderately sensitive to noise, where it may cause some distraction or disturbance	Offices. Bars/ Cafes/ Restaurants where external noise may be intrusive. Sports grounds when spectator noise is not a normal part of the event and where quiet conditions are necessary (e.g., tennis, golf, bowls).

Sensitivity	Description	Examples of Noise Sensitive Receptor (NSR)
Low	Receptors where distraction or disturbance from noise is minimal	Buildings not occupied during working hours. Factories and working environments with existing high noise levels. Sports grounds when spectator noise is a normal part of the event. Night Clubs.

Most receptors expected to be affected by noise and vibration impacts from the Proposed Development are residential receptors which are deemed to be of high sensitivity.

The significance of the effect is determined as a function of the sensitivity of the receptor and the magnitude of impact it is exposed to as summarised in Table 7.5.

Table 7.5: Matrix for Determining Significance of Effect for Receptors of High Sensitivity.

Magnitude of Impact (Beneficial or Adverse)	Significance of Effect for Receptors of High Sensitivity
Major	Large or Very Large
Moderate	Moderate or Large
Minor	Slight
Negligible	Slight
No Impact	Neutral

7.3.5 Significance of Effects

7.3.5.1 Magnitude of Impact/ Level of Significance

Construction noise comprises both plant noise and site traffic noise. The construction noise 'of effect' for this assessment is based on the '5dB change' method in BS5228-1:2009 2014 'Code of practice for noise and vibration control on construction and open sites – Part 1: Noise' which is summarised in Table 7.6.

BS 5228:2009+A1:2014 does not contain any significance criteria equivalent to what is presented in Table 7.6, although examples of how limits of acceptability have been applied historically and some examples of assessing significance are presented. In this case Example Method 2, which refers to change of 5dBA in the ambient noise level, has been used to assess the effects at residential receptors.

The magnitude of construction noise Impacts has been determined in accordance with Annex E of BS 5228-1:2009+A1:2014. The significance criteria for assessing noise impact from construction works have been based on example Method 2 contained within Annex E.3.3 of BS 5228-1:2009+A1:2014, as referred indicates that:

"Noise levels generated by site activities are deemed to be potentially significant if the total noise (preconstruction ambient plus site noise) exceeds the pre-construction ambient noise by 5dB or more, subject

to lower cut off values of 65dB, 55dB and 45dB L_{Aeq} period, from site noise alone, for the daytime, evening, and night-time periods, respectively, and a duration of one month or more, unless works of a shorter duration are likely to result in a significant effect."

Noise levels generated by construction activities are deemed to be significant if the total noise (pre-construction baseline plus construction noise) exceeds the pre-construction baseline by more than 5dBA subject to the lower cut-off value of 65dBA noise from construction activities alone.

For the majority of noise sensitive receptors, pre-construction ambient noise levels are relatively low, resulting in the criteria set within the lower cut-off levels given in Table 7.6 and applying the most stringent limits. As such the lower cut-off levels are used throughout the construction assessment for all noise sensitive receptors.

These Tables classify the magnitude of effect based on the sound level difference between the ambient noise level with and without construction. This is calculated by finding the difference between the baseline ambient level and the total level (construction noise plus baseline ambient level) at each location.

Table 7.6: Magnitude of Impact: Construction Noise Daytime (Ref: BS 5228 Part 1).

Sound Level Difference between Ambient Noise and Total Noise (dB, L_{Aeq})	Total Daytime Noise Level (dB $L_{Aeq, 12h}$) (Ambient and Construction Noise)	Magnitude of Impact
< 0dB	< 65dB (lower cut-off level)	Negligible
0 - 5dB	65 - 70dB	Low
5 – 10dB	70 –75dB	Medium
> 10dB	> 75dB	High

Table 7.7: Magnitude of Impact: Construction Noise Night-time (Ref: BS 5228 Part 1).

Sound Level Difference between Ambient Noise and Total Noise (dB, L_{Aeq})	Total Daytime Noise Level (dB $L_{Aeq, 12h}$) (Ambient and Construction Noise)	Magnitude of Impact
< 0dB	< 45dB (lower cut-off level)	Very Low
0 - 5dB	45 - 50dB	Low
5 – 10dB	50 –55dB	Medium
> 10dB	> 65dB	High

On account of the temporary nature of construction activities, higher noise threshold limits apply to construction phase activities compared to permanent operational phase activities.

7.3.5.2 Significance of Effects

Following the identification of receptor importance and magnitude of the effect, it is possible to determine the significance of the impact. TAN Chapter 2 Table 2.6 Significance of Effects provides the framework in determining the level of significance relating the magnitude with the sensitivity of the receptor.

The significance of the effect is determined as a function of the sensitivity of the receptor and the magnitude of impact to which the receptor is exposed. The significance of effects for receptors of high sensitivity are summarised in Table 7.8.

Table 7.8: Matrix Used for the Assessment of the Significance of the Effect.

		Magnitude of Impact			
		Negligible	**Low**	**Medium**	**High**
Sensitivity of receptor	**Negligible**	Imperceptible	Imperceptible or slight	Imperceptible or slight	Slight
	Low	Imperceptible or slight	Imperceptible or slight	Slight	Slight or moderate
	Medium	Imperceptible or slight	Slight	Moderate	Moderate or major
	High/ Particularly Sensitive	Slight	Slight or moderate	Moderate or major	Major or Profound

In line with the guidance:

- Major adverse effects are considered to be significant and should be prevented.
- Moderate adverse effects are significant and should be mitigated, where possible.
- Minor adverse effects are not significant but should be mitigated where possible.
- Negligible adverse effects are not significant and should not require mitigation.

Effects are considered to be significant when identified as likely to have a Moderate, Large or Very Large Effect.

Following initial assessment, if the impact does not require additional mitigation (or none is possible) the residual impact will remain the same. If, however, additional mitigation is proposed an assessment is made of the post-mitigation residual impact.

7.4 Baseline Environment

The primary Study Area for construction noise impact assessment is based upon guidance detailed in DMRB LA111 Noise and Vibration:

"A construction noise study area shall be defined, where the need for further assessment has been established to include all noise sensitive receptors: 1) that are potentially affected by construction noise; in areas where there is a reasonable stakeholder expectation that a construction noise assessment will be undertaken."

DMRB LA111 Noise and Vibration guidance 2019 suggests that "*a study area of 300m from the closest construction activity is normally sufficient to encompass noise sensitive receptors*."

The Study Area for the construction noise and vibration assessment was extended to include noise sensitive receptors within a 500m radius of the Proposed Development.

7.4.1 Baseline Noise Monitoring Survey

A baseline noise monitoring survey consisting of attended noise measurements was conducted within the vicinity of the Proposed Development. The purpose of the noise monitoring survey was to determine the baseline noise levels at the nearest noise sensitive receptors and to assess these levels in accordance with the relevant guidance to determine the following:

- the noise climate in the Noise and Vibration Study Area.
- the applicable BS 5228 construction noise threshold limit in accordance with British Standard BS5228, Code of Practice of Noise Control on Construction and Open sites.

The typical measured ambient (L_{Aeq}) noise level has been used as the baseline for the construction noise assessment.

The noise monitoring location (NML) was chosen to be representative of the nearest construction noise receptors within and near the Proposed Development. The NML is detailed in Volume III, Appendix 7.A, which also includes a photograph of the noise monitoring equipment used. The NML, respective dates of monitoring and equipment used are summarised in Table 7.9.

Table 7.9 Summary of Baseline Noise Monitoring Survey.

Noise Monitoring Location	Description of Noise Monitoring Location	Time/Start Date	Time/End Date	Sound Level Meter
NML 1	Located at the top of Beach Lane and west of the proposed works, adjacent to entrance of mobile home park	09:03 hrs 25/05/3023	10:03 hrs 25/05/2023	Brüel & Kjær Type 2250
		11:43 hrs 25/05/2023	12:43 hrs 25/05/2023	
		14:08 hrs 25/05/2023	15:08 hrs 25/05/2023	
NML 2	Located north west of the proposed works at the top of Burrow Road, adjacent to residential property.	10:32 hrs 25/05/2023	11:32 hrs 25/05/2023	Brüel & Kjær Type 2250
		12:52 hrs 25/05/2023	13:52 hrs 25/05/2023	
		15:30 hrs 25/05/2023	16:30 hrs 25/05/2023	

Measurements were made at a height of 1.2 – 1.5m above ground level. The weather conditions were in accordance with the requirements of ISO 1996: *Acoustics - Description, Measurement and Assessment of Environmental Noise*.

The following parameters were recorded during each monitoring period:

L_{Aeq} The continuous equivalent A-weighted sound pressure level. This is an 'average' of the sound pressure level.

L_{Amax} This is the maximum A-weighed sound level measured during the sample period.

L_{Amin} This is the minimum A-weighted sound level measured during the sample period.

L_{A10} This is the A-weighted sound level that is exceeded for noise for 10% of the sample period.

L_{A90} This is the A-weighted sound level that is exceeded for 90% of the sample period.

The 'A' suffix for the noise parameters denotes the fact that the sound levels have been 'A-weighted' in order to account for the non-linear nature of human hearing. All sound levels in this report are expressed in terms of decibels (dB) relative to $2x10^{-5}$Pa.

A summary of the noise monitoring methodology, instrumentation details and calibration certificates are illustrated in Volume III, Appendix 7.A. In addition, the results of the baseline noise monitoring survey are detailed in Volume III, Appendix 7.A.

7.4.2 Background Vibration Monitoring Survey

Background vibration monitoring was not undertaken as there are currently no vibration sources on site.

7.4.3 Construction Noise Receptors

Noise sensitive receptor locations, referenced as construction noise receptors, were obtained from the following data sources:

- Aerial mapping included Google and Bing aerial maps.

The construction noise receptor locations[5] are detailed within Volume III, Appendix 7.B, together with a list of their identification references (ID's), and location coordinates summarised.

The majority of construction noise receptors identified within the noise and vibration Study Area are residential properties. There are many representative construction noise receptors due to the size of the proposed construction area.

7.5 Description of Likely Significant Effects

7.5.1 Assessment of Construction Effects

Based on the project description presented in Chapter 3, the likely significant noise impacts associated with construction activities were identified.

During the construction phase, the methods of working will comply with all relevant legislation and best practice in reducing the environmental impacts of the proposed works. By their nature, construction phase impacts will be short-term and localised. These impacts will be reduced as far as practicable through compliance with the mitigation measures identified within this EIAR and the relevant industry standards and guidelines.

[5] (N. B. Addresses of the construction noise receptors have not been included due to General Data Protection Regulations (GDPR) and publication of personal data).

The predicted construction noise impacts are assessed in accordance with BS 5228: Noise and Vibration Control on Construction and Open Sites Noise threshold limits. The proposed construction works will consist of construction activities such as earthworks, groyne construction and beach renourishment.

The proposed construction phasing, construction noise receptors ID's eastings and northings, together with applicable BS 5228 noise limits are detailed in Volume III, Appendix 7.B.

BS 5228 defines the day-time period is defined as 07:00 to 19:00 hrs; the evening period as 19:00 to 23:00 hrs and the night-time period as 23:00 to 07:00 hrs. There is potential for day-time, evening and night-time construction works, dependent on the awarded contractor.

It is envisaged that the total time to complete construction works at Burrow will be *c.*23 weeks.

A Construction Environmental Management Plan (CEMP) which will include a Method Statement (MS) will be prepared by the successful Contractor after Contract Award.

7.5.1.1 Preliminary Construction Programme

A preliminary construction programme has been prepared for the Proposed Development at the Burrow which takes into consideration the environmental constraints described in Section 3.4.7 and phasing referred to in the Burrow Outline Buildability Report. The overall estimated construction programme is 23 weeks.

The programme considers the following elements:

- Traffic management,
- Utility diversions,
- Site establishment and clearance,
- Flood wall,
- Flood embankments,
- Back drainage,
- Seabee/ rock armour groynes,
- Beach renourishment, and
- Reinstatement.

7.5.1.2 Construction Activities

The proposed construction activities associated with the Proposed Development considered within the Noise and Vibration assessment are detailed below:

- Bulk earthworks as necessary - excavation and preparatory groundworks at the Burrow to facilitate the construction and positioning of the groyne structures, movement of materials to facilitate the construction of embankments,
- Installation of new seawalls and embankments,

- Groyne Construction, and
- Beach renourishment (Collection, transportation and depositing of dredged sediment to nourish beach).

7.5.1.3 Construction Noise Predictions

A construction Noise Assessment for the Proposed Development is detailed in Volume III, Appendix 7.B. This includes the assumptions for construction noise predictions including the construction noise receptors, construction activities and assumed plant and equipment, construction noise predictions and assessment with BS 5228 construction limit.

The construction noise receptors including ID's, eastings and northings are summarised in Table 7.B.1 and Figure 7.B.1.

To calculate worst-case construction noise predictions and assess construction noise impact the plant and equipment has been assumed for each of the construction activities phase. Typical noise levels for construction activities, bulk earthworks will include excavation, preparatory groundworks and movement of suitable sand materials to site for the purposes of beach renourishment and assumed plant are detailed in Table 7.10.

To assess the worst-case construction noise level from the Proposed Development, the noise level for each of the construction plant detailed in Table 7.10, at a distance of 10m was used. Distances from the construction phase boundaries for each of the construction activities were measured to each of the noise receptors as detailed within Volume III, Appendix 7.B. The cumulative sound pressure level of the assumed plant and equipment is calculated at 10m and, using distance attenuation, predicted at the construction noise receptors.

The attenuation calculation assumes a direct line of sight from the noise source to the receiver without a barrier being considered, which is a worst-case scenario. Construction noise predictions were calculated for each construction activity as detailed in Volume III Appendix 7.B. All construction plant is assumed to be operational at closest point to receptors therefore the worst-case result for each receptor is assessed.

The construction noise predictions for each of the construction activities are deemed to be worst case based on the following:

- Full power operation of each construction activity throughout the construction period (day, evening, and night).
- Ground absorption effects are ignored (ground absorption can provide some attenuation).
- Construction plant is assumed to be operational at closest point to receptors, the worst-case result for each receptor is chosen for the report.
- Predictions are based on the construction plant simultaneously operational, where applicable.

The worst case predicted construction noise levels have been compared to the derived threshold noise limits using ABC Method from British Standard BS 5228 as detailed in Table 7.1.

While it is not possible at this stage to calculate the actual magnitude of construction phase noise emissions to the local environment, it is possible to predict typical noise levels using guidance set out in BS 5228-1: 2009+A1

2014 using proposed activities and assumed plant and equipment. The assumed plant and equipment associated for each proposed construction activity is summarised below in Table 7.10.

Table 7.10: Construction Plant Noise Levels (REF: BS 5228:2009+A1:2014).

Activity	Plant	Reference from Annex C & D BS5228	Quantity	Sound Pressure Level at 10m dB(A)	Cumulative Construction Sound Pressure Level at 10m dB(A)
Bulk Earthworks	360º tracked/wheeled hydraulic excavators	C.4.56	1	83	90
	Dumper	C.4.6	1	79	
	Lorry	C.2.34	1	80	
	Ready-mix concrete lorries	C.4.21	1	77	
	Tipper lorries	C.2.30	1	79	
	Diggers/TLB	C.2.2	1	77	
	Piling Rig	C.3.2	1	87	
Installations of new seawalls and embankments	360º tracked/wheeled hydraulic excavators	C.4.56	1	83	90
	Dumper	C.4.6	1	79	
	Cutter, drills and small tools*	D.2.15	1	84	
		C.4.93		80	
		C.4.95		73	
	Lorry	C.2.34	1	80	
	Generators	C.4.76	1	61	
	Tipper lorries	C.2.30	1	77	
	Diggers/TLB	C.2.2	1	77	
Beach Renourishment	360º tracked/wheeled hydraulic excavators	C.4.56	1	83	87
	Dumper	C.4.6	1	79	
	Lorry	C.2.34	1	80	
	Tipper lorries	C.2.30	1	79	
	Diggers/TLB	C.2.2	1	77	

7.5.1.4 Predicted Effects of Construction Noise

Overall, it is concluded that there is the potential for Moderate to Major significant impacts arising from the Proposed Development during the construction phase without mitigation, however these effects will be temporary in nature.

For this assessment, the construction activities have been considered as continuous activities at the closest location to receptors. The impact at any specific location will be sensitive to the precise location of equipment

and the level of continuous operation of all equipment. Both can be controlled in practice and the potential combined impact can be mitigated by noise control measures and the planning of works so that worst-case noise impacts do not occur simultaneously.

Pre-mitigation, the predicted construction noise impacts are anticipated to result in effects ranging from negligible to major at noise receptors dependent on the construction activity undertaken during the construction of the Proposed Development.

The precise construction strategy to be adopted will be a matter for the contractor, but it is likely that construction noise levels experienced during the construction phase will be similar to the typical construction noise levels indicated in Table 7.10 for the construction plant.

7.5.2 Assessment of Operational Effects

Operational noise has not been assessed as there is no inclusion of new significant noise sources likely to generate perceptible noise levels when the Proposed Development is operational. The Proposed Development will not result in any significant permanent adverse effects on the noise environment within the Study Area.

Operational vibration has not been included as there is no inclusion of new significant vibration sources likely to generate perceptible levels of vibration when the Proposed Development is operational.

7.6 Interactions

In compiling this impact assessment, reference has been made to the project description and project drawings provided by the project co-ordinators. There is the possibility of interactions with several other disciplines considered in the EIAR, particularly Population and Human Health and Biodiversity. Noise levels can impact on human health particularly in those Noise Sensitive Receptors. In addition, noise and physical disturbance have the potential to impact on biodiversity. Such impacts have been assessed and mitigation recommended where necessary in these respective chapters of the EIAR and NIS.

7.7 Mitigation and Monitoring

7.7.1 Construction Phase Mitigation

Appendix 7.B demonstrates that worst-case predicted noise from construction activities may give rise to significant impacts if not carefully managed. This is particularly the case where activities overlap, or particularly noisy activities need to be completed in close proximity to sensitive receptors. Construction scheduling will be planned to minimise any overlap and to carefully control activities when being carried out close to sensitive receptors. Worst case construction noise predictions can be reduced through use of appropriate mitigations as detailed below.

BS 5228-1 states that:

"*…if the site noise level exceeds the appropriate category value, then a potential significant effect is indicated. The assessor then needs to consider other project specific factors, such as the number of receptors affected and the duration and character of the impact, to determine if there is a significant effect*."

These factors have therefore been considered to determine the effect significance.

Construction works associated with the Proposed Development will be temporary and limited in duration. Construction plant and machinery has been assessed as operating for the full working period of the day, i.e. 100% duty cycle. Due to natural pauses in activity and rest breaks equipment will not be fully operational during the entire working day.

Construction works associated with bulk earthworks, installations of new seawalls and embankments are not proposed to occur during night-time or on Sundays, unless for emergency works. Therefore, there will be no associated construction noise impact during these times at construction noise receptors. However, construction works associated with beach renourishment will, due to tidal constraints, occur during evenings and night-time and Sundays with beach renourishment operations commencing on a 24/hr basis from week 17.

The worst-case predictions are based on activities being carried out close to receptors where such activities will be temporary in duration, localised and will be further mitigated by noise control measures implemented by the contractor on site.BS5228:2009+A1:2014 – Noise and vibration control on construction and open sites outlines a range of measures which have now become standard good practice measures that can be used to reduce the impact of construction phase noise and vibration on the nearest receptors. These measures will be applied by the contractor where appropriate during the construction phase of the Proposed Development.

Evening and Night-time Noise Impacts

Evening and night-time noise construction will occur during the beach renourishment activity. Therefore, evening works and night-time works are assessed with BS 5228 evening noise limit if 55dB and night-time noise limit of 45dB at the construction noise receptors.

An assessment of unmitigated worst-case evening and night-time construction indicates that there is the potential for significant impacts at construction noise receptors.

7.7.1.1 Construction Environmental Management Plan

A detailed Construction Environmental Management Plan, including a specific Noise Management Plan will be prepared by final appointed contractor for the Proposed Development. The CEMP and subsequent noise management plan will set out the mitigation measures that will be employed to reduce the noise and vibration impacts of the development during the construction phase.

The Planning Schedule of Conditions should include a requirement for a CEMP & MS prior to construction commencing in the usual manner.

7.7.1.2 Specific Construction Mitigation

BS 5228 outlines several issues associated with noise effects that influence the community reaction to the noise. The duration of site operations, the hours in which specific activities are carried out, the attitude of the public to the site operator and the use of effective mitigation measures are all important considerations in managing construction noise. Construction mitigation measures will be put in place to ensure construction noise levels are attenuated and reduced where necessary.

Construction noise has been predicted on a worst-case scenario, (i.e. with all sources operating all the time close to the receptors). In practical terms, the sources will be distributed throughout the construction working areas and in operation on a cyclical basis, depending on specific tasks.

The contractor will implement a programme of noise management measures that will include engagement with the community on the activities that need to be carried out, the timing and duration of such activities, commitment to specific hours of work and the use of quiet work methods such as the selection of low-noise plant and operating methods. Fingal County Council and potentially affected residents will be kept informed of the works to be carried out and of any proposals for work outside normal hours.

Temporary construction noise barriers can also be used to achieve attenuation of noise levels between ground-based construction plant and the nearest noise sensitive properties where predicted noise levels exceed BS 5228 65dB noise limit from noisier construction activities.

Construction noise barriers are an effective method in construction noise management and control and work best when paired with other best practices such as utilisation of quieter construction plant, effective work activity scheduling, working within construction hours, and ensuring construction plant/equipment is maintained and in good repair. While construction site noise cannot be eliminated, communicating with the residents is crucial to increasing awareness and tolerance. The final CEMP will identify construction barrier locations.

Specific construction good practice measures from BS5228 will be implemented by the contractor as listed below:

1. Ensuring that mechanical plant and equipment used for the purpose of the works are fitted with effective exhaust silencers and are maintained in good working order.
2. Careful selection of quiet plant and machinery to undertake the required work where available.
3. Machines in intermittent use will be shut down in the intervening periods between work.
4. Ancillary plant such as generators, compressors and pumps will be placed behind existing physical barriers, and the direction of noise emissions from plant including exhausts or engines will be placed away from sensitive locations, in order to cause minimum noise disturbance. Where possible, in potentially sensitive areas, temporary construction barriers or enclosures will be utilised around noisy plant and equipment.
5. Handling of all materials will take place in a manner which minimises noise emissions.
6. Audible warning systems will be switched to the minimum setting required by the Health & Safety Authority.

The use of the proposed construction noise mitigation measures will ensure that construction noise levels are controlled to the lowest levels practicable.

Screening at source of potentially affected receptors would ensure that the BS 5228 noise limit is achieved reducing impact to temporary minor adverse impact.

Temporary construction noise barriers will be used to achieve attenuation of noise levels between ground-based construction plant and the nearest noise sensitive properties.

In respect of dredging operations, although it is recognised that the choice of dredgers is likely to be determined by the engineering requirements and the suitability of available equipment, dredging activities should be planned

where possible to reduce the overall source noise level during the works – e.g. limiting night-time works directly adjacent to noise-sensitive properties etc.

Any dredger used for the works will be expected to be fitted with effective engine exhaust silencers, and there will be a requirement placed on the chosen dredger operator to ensure that all engine silencers are effective and reducing engine exhaust noise levels to the lowest reasonably practicable level.

Screening shall be provided nearest to those properties most likely to experience high noise levels from dredging, particularly during more sensitive night-time periods.

7.7.1.3 Construction hours

It is proposed that standard construction working hours for bulk earthworks, installations of new seawalls and embankments will apply as follows:

- Monday to Friday: 08:00 to 19:00.
- Saturdays: 08:00 to 14:00.
- No activities will take place on site on Sundays and Bank Holidays.

Deviation from these times will only be allowed in exceptional circumstances where prior written approval has been received from FCC.

Beach renourishment operations will commence on a 24/hr basis from week 17, starting with renourishment of southern cells. However, beach renourishment only occurs for on average, *c.*100 minutes, every 16.5hrs, i.e. *c.*9 per weeks.

7.7.1.4 Consultation and Communication

Mitigation in the form of timely and effective stakeholder consultation should be outlined within the environmental CEMP. This would ensure that residents are kept informed of on-going and future operations. For example, local residents would be informed by letter drop of proposed works, particularly where these are due to occur outside standard working hours. The letter would include details of proposed cause, start dates and duration of works to be carried out.

All complaints will be recorded by the appointed contractor, who will investigate the circumstances and ensure the necessary corrective measures are taken.

7.7.1.5 Construction Noise & Vibration Monitoring

Prior to the commencement of construction, the contractor will set out and agree a schedule of noise and vibration monitoring with FCC to include the number and locations at which monitoring will be carried out, the frequency and duration of the monitoring and the reporting of results.

Pre-construction structural surveys and vibration monitoring at the closest properties will be carried out during the construction phase.

7.7.2 Construction Phase Mitigation Vibration

A Construction Environmental Management Plan (CEMP) will be prepared by the appointed contractor for the Proposed Development to ensure that the appropriate environmental measures and monitoring are in place during the construction phase. This will be an iterative document and will be revised and updated throughout the construction phase as construction works evolve.

Where piling activities take place in relatively close proximity to buildings, details will be included within the respective Method Statement to limit and measure vibration levels affecting these buildings.

For residential properties, monitoring will be completed to ensure that the relevant vibration guideline limits included in Table 7.2 are not exceeded. For commercial buildings, monitoring will be completed to ensure that the limits for structural damage outlined in Table 7.3 are adhered to.

7.7.3 Operational Phase Mitigation

7.7.3.1 Operational Noise

No operational noise impacts resulting from the operation of the Proposed Development are anticipated. Therefore, no specific mitigation measures are proposed during the Project operation.

7.7.3.2 Operational Vibration

No operational vibration impacts resulting from the operation of the Proposed Development are anticipated. Therefore, no specific mitigation measures are proposed during the Project operation.

7.7.3.1 Operational Monitoring

There will be no requirement for post-construction surveys or monitoring for operational noise or vibration.

7.8 Potential Cumulative Effects

7.8.1 Construction Phase

There are several proposed and permitted developments in the area around the Proposed Development. However, due to the distance of these other developments it is unlikely that cumulative construction noise impacts will arise. Hence cumulative construction impacts are predicted to be temporary minor.

7.8.2 Operational Phase

There are no operational phase impacts predicted with the Proposed Development, therefore cumulative operation noise impacts are not likely.

7.9 Residual Impacts

7.9.1 Construction Phase

Specific noise and vibration control measures are outlined in Section 7.7.1.2 whilst Section 7.7.1.5 sets out the monitoring to be undertaken. Mitigation by careful scheduling of the works, timing of activities and using best practicable means will be implemented such that no significant effects arise, and levels are as low as possible.

Residents will be informed of the timing and duration of activities that may produce high noise or vibration. Elevated levels can be tolerated if prior notification and explanation is given.

Temporary slight adverse impacts due to construction noise have been identified at the closest receptors to proposed construction works. No permanent residual noise and vibration impacts are predicted to arise from the construction of the Proposed Development. With construction mitigation measures in place, construction noise monitoring, and temporary construction noise barrier the noise impacts of construction activities are predicted to be reduced to temporary minor/ moderate. With mitigation measures in place, temporary slight adverse impacts due to construction noise have been identified at the closest receptors to proposed construction works which are not significant.

No significant residual effects will arise.

7.9.2 Operational Phase

No residual impacts or residual significant effects are predicted for the operational stage of the Proposed Development.

7.9.3 Decommissioning Phase

No permanent residual noise and vibration impacts are predicted during decommissioning of the Proposed Development.

7.10 Summary of Effects

An assessment of potential noise effects associated with the Proposed Development has been carried out.

During the construction phase, there is potential for noise impacts at the nearest noise sensitive properties from construction plant and equipment. The effect of construction noise has been assessed in full within this noise and vibration chapter.

The construction noise targets are set out along with the assessment methodology and results of the construction noise predictions. Construction noise mitigation measures are detailed such that noise targets are met throughout the construction phases.

No operational noise or vibration impacts resulting from the operation of the Proposed Development are anticipated. There will be no significant effects arising from the operational phase.

Overall, it is concluded that there is the potential for moderate to major significant impacts arising from the Proposed Development during the construction phase without mitigation, however these effects will be temporary in nature.

A detailed Construction Environmental Management Plan, including a specific Noise Management Plan will be prepared by the appointed contractor for the Proposed Development. With construction mitigation measures as described in this document, construction noise monitoring, and temporary construction noise barriers the noise impacts of construction activities are predicted to be reduced to temporary minor.

7.11 Limitations of Assessment

No difficulties were encountered during the preparation of this EIAR chapter.

Given this project is at the preliminary design phase, only limited construction details are available at this stage. Therefore, the construction noise calculations have used the measured noise levels of typical construction plant and activities as reported in BS 5228-1, Annexes C and D. Assumptions have been made regarding the possible phases of construction, construction plant and methods and also times and durations of activities, based on the indicative construction methodology.

8 FLOOD RISK

8.1 Introduction

This chapter of the EIAR considers the potential impact of the Proposed Development on flood risk within the Study Area. It sets out the methodology employed in the assessment, summarises the baseline flood risk as defined through desk-based assessments, and assesses the potential impact of the Proposed Development and the residual impact following mitigation.

8.2 Authority of author

The author of this chapter, Diane McGinnis, is a Senior Associate with RPS and holds a BEng (1st Class Hons) in Civil & Environmental Engineering and an MSc (Distinction) in Environmental Engineering. Diane has over 20 years of experience in the field of flood risk assessment and management. Diane is a Chartered Engineer with both the Institution of Civil Engineers and Engineers Ireland.

8.3 Assessment Methodology

The assessment comprises the following stages:

- Consideration of the information available on the OPW website to determine the existing flood risk to the site.
- Consideration of the Rogerstown CFERM Study.
- Consideration of the potential interactions between the proposals and the current site conditions, and identification of possible impacts.
- Identification of design solutions to avoid or minimise the potential impacts. Mitigation measures may be proposed during the construction and/ or operational phases of the Proposed Development.
- Assessment of residual impacts, taking account of mitigation measures.
- Evidence of compliance with 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' (2009).

8.4 Receiving Environment

The Proposed Development is located at the Burrow which is a sandy spit that separates the outer Rogerstown Estuary from the Irish Sea.

There are no flood maps available on the OPW website for this area as they are 'Under review'. Baseline flood conditions have therefore been established based on the information provided in the Rogerstown CFERM report prepared by RPS, as this is the most up-to-date information available for the area.

8.4.1 Present Day Flood Risk

A review of the present-day flood maps from the Rogerstown CFERM study shows that there is a notable coastal flood risk at the Burrow. Figure 8.1 shows the current scenario flood extents for the 1 in 10 year (10% AEP), 1 in 200 year (0.5% AEP) and 1 in 1000 year (0.1% AEP) return period storm events. The present day 0.5% AEP water level is 3.19mOD. Under the present-day conditions, up to 9 properties could be flooded at the Burrow during a 0.5% AEP event.

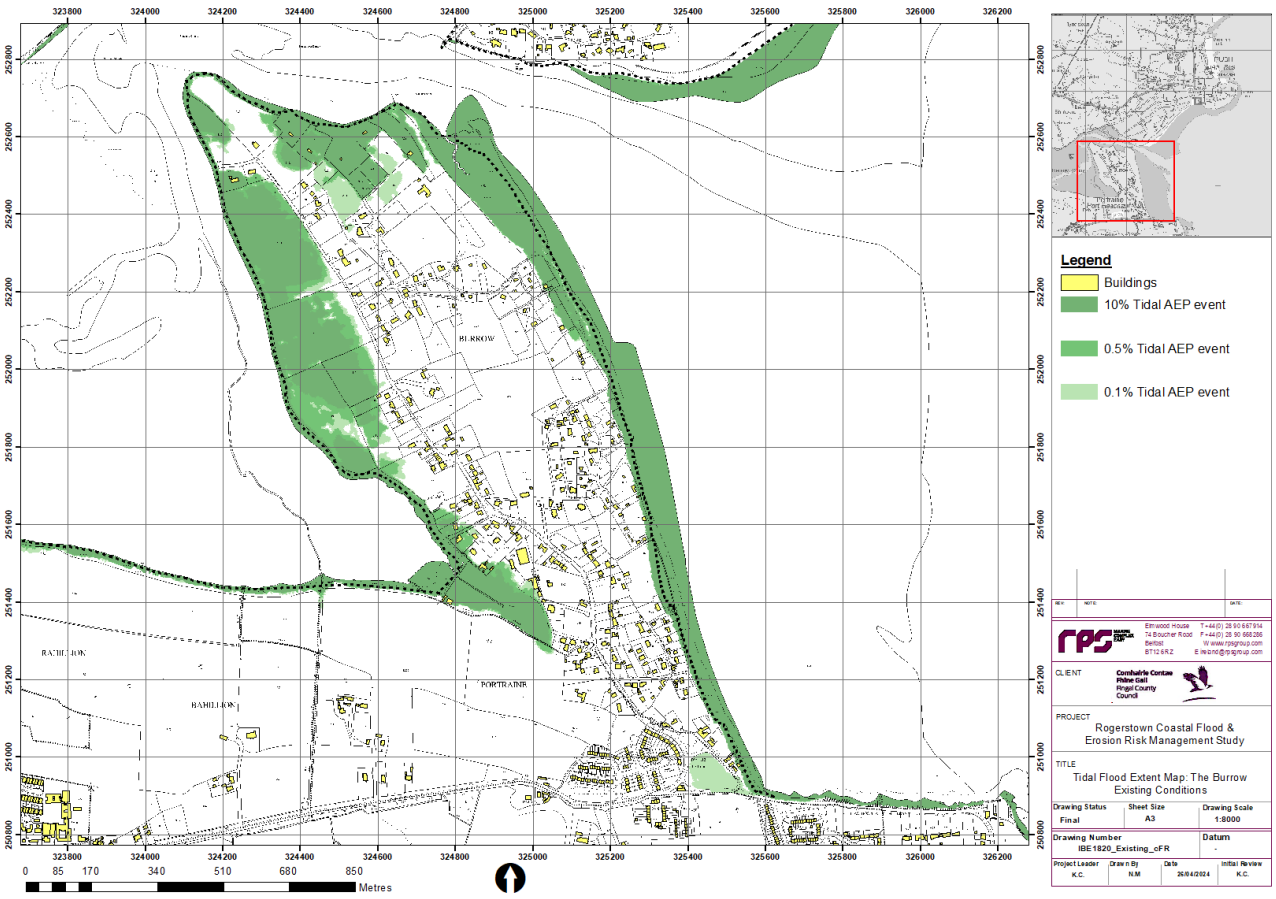


Figure 8.1: Coastal flood extents map from Rogerstown CFERM Study (Present day).

8.4.2 Climate Change Flood Risk

Flood risk at the Burrow will be very sensitive to future sea level rise caused by climate change. The CFERM report assessed the effect of future coastal erosion and sea level rise by 2050. Figure 8.2 and Figure 8.3 illustrate the flood extents in 50 years based on the Mid-Range Future Scenario (MRFS) with corresponding erosion lines and extreme water levels with sea level rise. The figures illustrate the flood extents for the 1 in 10 year (10% AEP), 1 in 200 year (0.5% AEP) and 1 in 1000 year (0.1% AEP) return period storm events. The MRFS 0.5% AEP water level is 3.39mOD. The number of properties at risk of flooding in a 2050 MRFS 0.5% AEP event will be between 82 and 29[6] depending on the rate of erosion.

[6] Higher erosion rates reduce the number of properties affected by flooding as properties are lost due to erosion.

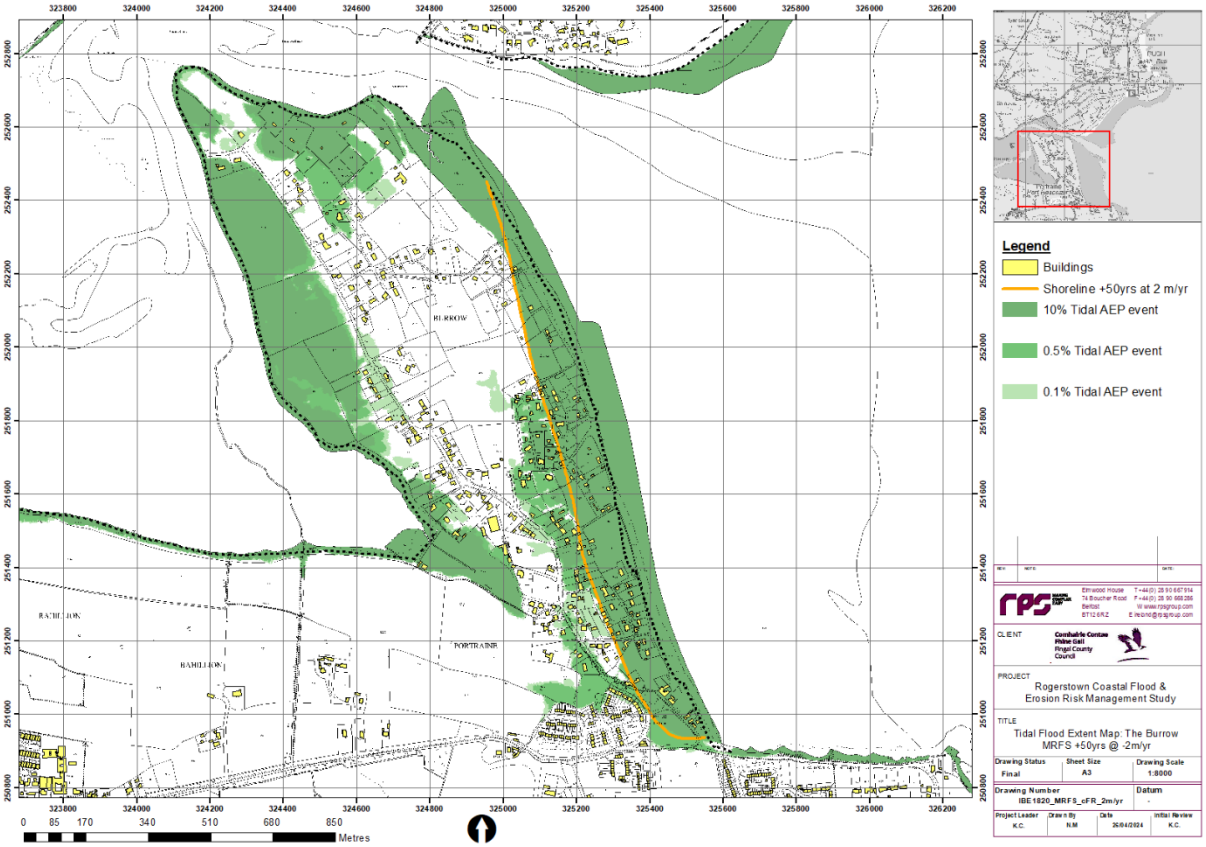


Figure 8.2: Coastal flood extents map from Rogerstown CFERM (MRFS 2050, 2m/yr erosion).

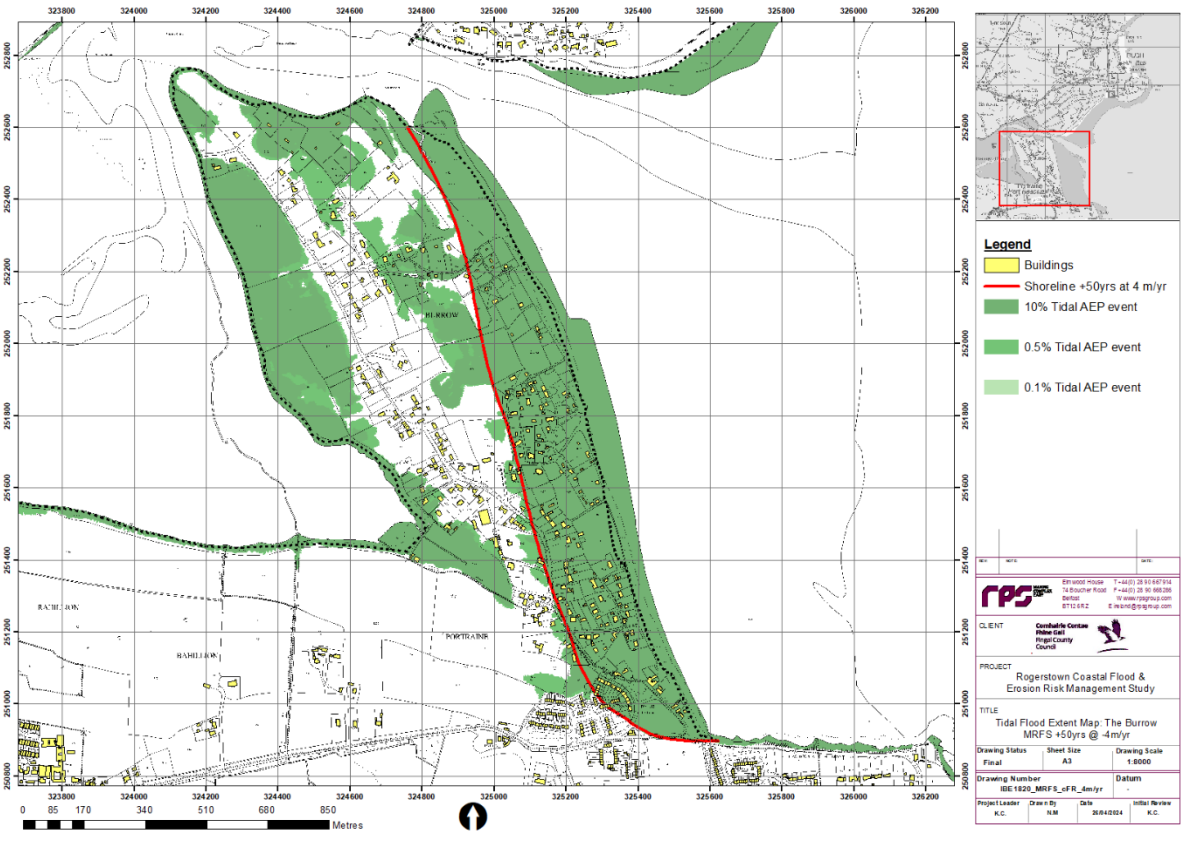


Figure 8.3: Coastal flood extents map from Rogerstown CFERM (MRFS2050, 4m/yr erosion).

8.4.3 Past Flood Events

The Office of Public Works (OPW) gathers and collates data from reported flood events throughout the country. From a review of the OPW's National Flood Hazard Mapping database (www.floodmaps.ie), there are two records within the Study Area described below:

- Event ID-1648 refers to recurring coastal flooding in the Burrow.
- Event ID-1755 refers to a specific event on 1st February 2002. A FCC report notes that '*there were two houses at the edge of the Estuary, where the tide entered the house'*.

8.4.4 Flood Zones

Under the requirements of '*The Planning System and Flood Risk Management Guidelines'*, when considering existing flood risk, it is necessary to assign flood zones to the Proposed Development site. Flood zones are geographical areas within which the likelihood of flooding is in a particular range. There are three types of flood zones defined in the Guidelines:

- **Flood Zone A**: areas where the probability of flooding from rivers and the sea is highest (greater than 1% for river flooding or 0.5% for coastal flooding).
- **Flood Zone B**: areas where the probability of flooding from rivers and the sea is moderate (between 0.1% and 1% for river flooding, and between 0.1% and 0.5% for coastal flooding).
- **Flood Zone C**: Areas where the probability of flooding from rivers and the sea is low (less than 0.1% for both river and coastal flooding).

The zones are based on the current assessment of the 1% and 0.1% fluvial events and the 0.5% and 0.1% tidal events, without the inclusion of climate change factors. Based on the flood map presented in Figure 8.1, the Proposed Development is in Flood Zone A (high probability of flooding).

8.5 Impact Assessment

8.5.1 Construction Phase

Works within the Rogerstown Estuary are unavoidable. During construction, there will be a risk of flooding to the construction works from extreme tidal events that will need to be managed. Impacts would include flooding of the works, flooding of plant and machinery, and a risk to construction workers.

Without mitigation, the magnitude of impact can be considered medium adverse during construction.

8.5.2 Operational Phase

One of the primary objectives of the Proposed Development is to provide effective coastal flood protection. It is necessary to determine that the correct design standard has been used for the Proposed Development, including an allowance for climate change. The design standard used for the Proposed Development was a 0.5% AEP event with 200mm added on for the Medium Range Future Scenario climate change outlook (2050). Freeboard is a height added to the predicted level of flood to take account of the uncertainty in estimating the probability of flooding. A freeboard allowance of 500mm has been included in the design of the proposed

embankments, and an allowance of 300mm has been included in the design of the proposed floodwalls. The crest level of the flood embankments is therefore 3.9mOD, and the crest level of the flood walls is 3.7mOD.

It is necessary to demonstrate that the Proposed Development would not increase the risk from flooding elsewhere. The MRFS 0.5% AEP flood extent with the Proposed Development in place is shown in Figure 8.4. This can be compared with Figure 8.2 and Figure 8.3.

The proposed new groynes, beach renourishment and flood defences will provide the required protection but not increase the risk from coastal flooding elsewhere. Removal of an area of the coastal floodplain will have a negligible effect on the extent of the coastal floodplain, now and in the future, even considering anticipated climate change.

The Proposed Development will not be adversely affected during extreme tidal events as it has been designed for these events.

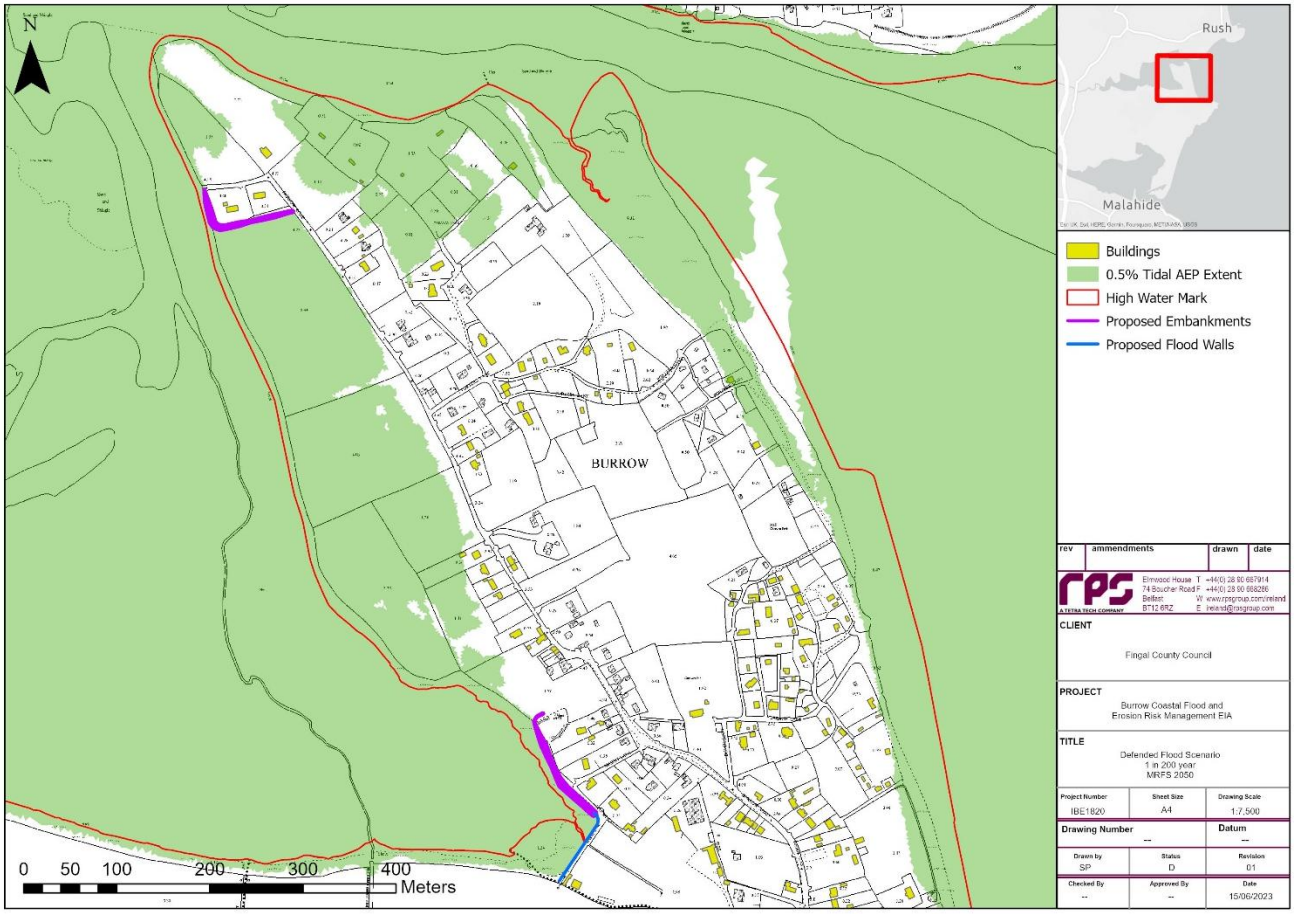


Figure 8.4: Flood extents with Proposed Development (0.5% AEP, MRFS 2050).

It is necessary to consider the impact of the Proposed Development on storm runoff in the area. Each of the new flood defences will have some degree of cut-off to prevent excessive flow beneath the defences. Along with the above-ground barrier, this adversely restricts the ability of the land behind the defences to drain post-construction.

To facilitate drainage and ensure the land behind the defences does not become water-logged, a series of land drains will be constructed behind the defences. These will consist of perforated pipes bedded in no fines granular

material and laid parallel to defences at the rear toe. Precast concrete manholes will be provided at regular intervals to facilitate access for maintenance or changes in direction. At suitable locations, the outfalls of the back drainage will discharge to the estuary. The outlet pipework will therefore have to pass either beneath embankments or through walls as appliable, with non-return valves to prevent backflow.

'*The Planning System and Flood Risk Management Guidelines'* classify different types of development in terms of their vulnerability class (Table 3.1 of the Guidelines). 'Flood control infrastructure' is classed as a 'Water-compatible development'. Table 3.2 of the Guidelines identifies the type of development that would be appropriate to each flood zone and those that would need a Justification Test. 'Water-compatible development' is appropriate in all flood zones and therefore a Justification Test is not required.

Overall, the operation of the Proposed Development would have a very significant beneficial effect upon the Study Area in terms of flood risk, and the residents whom the flood defences would serve.

8.6 Mitigation Measures

8.6.1 Construction Phase

Temporary works may be required to prevent coastal waters interacting with work activities throughout the duration of the construction period. The temporary works design to ensure the method of temporary flood protection is stable and avoids seepage will be the responsibility of the appointed Contractor.

Met Éireann provide a weather warnings alert service which is available on the Met Éireann app or through its website. These warnings can be used during construction to manage the risk of flooding to the works from extreme events.

8.6.2 Operation Phase

One of the primary objectives of the Proposed Development is to provide effective coastal flood protection. Flood protection can therefore be considered as 'Primary mitigation' which is modifications to the location or design of the Proposed Development made during the pre-application phase that are an inherent part of the project, and do not require additional action to be taken.

8.7 Residual Effects

During construction, after considering the mitigation measures if required, the residual effect can be considered slight adverse due to the low probability of damage to construction works.

There will be a residual flood risk as the flood defences may be exceeded by a flood that is greater than that which they were designed to resist. However, the defences have been designed to a good standard of protection as per the requirements of the client and include allowances for climate change and freeboard. The residual risk is therefore low. Overall, the operational residual effects can be deemed to be positive and not significant in terms of flood risk by reducing the risk to properties at the Burrow.

After considering the mitigation proposed during construction, any impact on the working area would likely be temporary and managed through monitoring of the weather forecast.

The residual effect is therefore considered very significant and beneficial by reducing the coastal flood risk in the area to residents.

8.8 Potential Cumulative Impacts

For flood risk, any cumulative effects would come from developments that impact the floodplains that affect the site. This is likely to be a development that takes place within the floodplain in the vicinity of the Proposed Development. To gain planning permission, all new developments must show that they do not increase flood risk elsewhere in compliance with '*The Planning System and Flood Risk Management Guidelines'*. There will therefore be no cumulative impacts on flood risk because of neighbouring developments.

8.9 Conclusions

This assessment has identified that the area is currently at risk of coastal flooding. Based on the flood maps, the site is within Flood Zone A (high probability of flooding) as described in '*The Planning System and Flood Risk Management Guidelines'*. One of the primary objectives of the Proposed Development is to provide effective coastal flood protection.

The Proposed Development would not be adversely affected during extreme tidal events as it has been designed for these events, and therefore provides positive effects. No mitigation measures have been proposed. The proposed new groynes, beach renourishment and flood defences would not increase the risk from coastal flooding elsewhere. Infilling of the coastal floodplain will have a negligible effect on the extent of the coastal floodplain, now or in the future, even considering anticipated climate change.

'*The Planning System and Flood Risk Management Guidelines'* classify different types of development in terms of their vulnerability class. 'Flood control infrastructure' is classed as a 'Water-compatible development'. The Guidelines identifies the type of development that would be appropriate to each flood zone and those that would need a Justification Test. 'Water-compatible development' is appropriate in all flood zones and therefore a Justification Test is not required.

Overall, the long-term operation of the Proposed Development would have a very significant beneficial effect upon the Study Area in terms of flood risk, and the residents whom the flood defences would serve.

9 WATER QUALITY

9.1 Introduction

This chapter of the EIAR assesses the potential impact of the Proposed Development on water quality within the receiving environment and Water Framework Directive (WFD) compliance (Section 9.4). Existing water quality in the vicinity of the project was established based on available water quality information and WFD monitoring programmes. The likely significant effects on water quality of the implementation of the Proposed Development are assessed and measures to reduce, avoid and prevent any likely significant effects are proposed, where necessary.

This assessment was based on the project description detailed in Chapter 3 and has been prepared to identify potential water quality issues that may arise from the development and identify mitigation measures that will be implemented to address any potential impacts.

9.2 Authority of author

The author of this chapter, Mark Magee, is a Technical Director with RPS and holds a BA (Mod) in Natural Sciences and an MSc in Environmental Engineering and has over 20 years of experience in the field of water quality, environmental impact assessment, environmental appraisal of infrastructure projects, hydrology, hydraulic modelling and River Basin Planning. Mark is a Chartered Scientist (CSci), Chartered Environmentalist (CEnv) and a Chartered Water and Environmental Manager (CWEM). He is also a full member of the Chartered Institution of Water and Environmental Management (CIWEM).

9.3 Assessment Methodology

Baseline water quality within the receiving environment has been established through review of national monitoring data used to establish water quality status in the context of the EU Water Framework Directive (WFD) and supporting environmental standards.

An assessment has then been made of the Proposed Development to determine the likelihood for significant impacts on water quality using criteria for rating significance and magnitude set out in the National Roads Authority (NRA) publication "*Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes*" (NRA, 2008).

The significance of impact on surface water quality likely to occur during the construction and operational phases of the development were determined using a predominantly qualitative methodology supported, where appropriate, by quantitative assessment. The assessment is a consideration of a combination of receptor sensitivity (Table 9.1) and the potential magnitude of the impact on the water environment (Table 9.2), in order to determine significance (Table 9.3).

Table 9.1: Criteria for Rating Receptor Sensitivity (NRA, 2008).

Value (Sensitivity)	Typical Descriptors
Extremely High	***Attribute has a high quality or value on an international scale.*** Examples: River, Wetland or surface water body ecosystem protected by EU legislation. i.e. designated under the Habitats, Birds, Shellfish, Bathing Water or Freshwater Fish, Drinking Water or Nitrate Directives, High ecological status or water body with a high status objective.
Very High	***Attribute has a high quality or value on a regional or national scale.*** Examples: River, Wetland or surface water body ecosystem protected by national legislation (NHA status), Regional important potable water source supplying >2500 homes, nationally important amenity site for wide range of leisure activities, Good ecological status (Biotic Index Q4), Flood plain protecting more than 50 residential or commercial properties from flooding.
High	***Attribute has a high quality or value on a local scale.*** Examples: Salmon fishery, locally important potable water source supplying >1000 homes, Moderate ecological status (Biotic Index Q3-4), Flood plain protecting 5 to 50 residential or commercial properties from flooding, Locally important amenity site for wide range of leisure activities.
Medium	***Attribute has a medium quality or value on a local scale.*** Examples: Coarse fishery, Local potable water source supplying >50 homes, Poor ecological quality (Biotic Index Q3, Q2-3), Flood plain protecting between 1 and 5 residential or commercial properties from flooding.
Low	***Attribute has a low quality or value on a local scale.*** Examples: Locally important amenity site for small range of leisure activities, Local potable water source supplying <50 homes, bad ecological quality (Biotic Index Q2, Q1), Flood plain protecting 1 residential or commercial property from flooding. Amenity site used by small numbers of local people.

Table 9.2: Criteria for Rating the Magnitude of Impact (NRA, 2008).

Magnitude of Impact	Criteria	Typical Examples
Large Adverse	Results in loss of attribute and/ or quality and integrity of attribute	Loss or extensive change to a water body or water dependent habitat.
		Increase in predicted peak flood level >100mm.
		Extensive loss of fishery
		Extensive reduction in amenity value
		Potential high risk of pollution to water body from routine run-off
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	Increase in predicted peak flood level >50mm
		Partial loss of fishery
		Potential medium risk of pollution to water body from routine run-off
		Partial reduction in amenity value
Minor Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	Increase in predicted peak flood level >10mm
		Minor loss of fishery
		Potential low risk of pollution to water body from routine run-off
		Slight reduction in amenity value
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	Negligible change in predicted peak flood level Negligible loss of amenity value Negligible loss of fishery

The approach to assessing the significance of impacts comprises assigning each impact to one of the four categories of magnitude as outlined in Table 9.2 enabling different characteristics to be assessed based upon the same scale.

The significance determination and assessment of the potential likely environmental effects of each component of the development has been made based on the matrices presented in Table 9.3 and in Table 9.4.

Table 9.3: Criteria for Rating the Significance of Environmental Impacts (NRA 2008).

Importance of Attribute	Magnitude of Impact			
	Negligible	**Minor**	**Moderate**	**Large**
Extremely High	Imperceptible	Significant	Profound	Profound
Very High	Imperceptible	Significant/ Moderate	Profound/ Significant	Profound
High	Imperceptible	Moderate/ Slight	Significant/ Moderate	Severe/ Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight/ Moderate

Table 9.4: Defining Impact Significance (NRA, 2008).

Impact Level	Attribute Importance				
	Extremely High	**Very High**	**High**	**Medium**	**Low**
Profound	Any permanent impact on attribute	Permanent impact on significant proportion of attribute			
Significant	Temporary impact on significant proportion of attribute	Permanent impact on small proportion of attribute	Permanent impact on significant proportion of attribute		
Moderate	Temporary impact on small proportion of attribute	Temporary impact on significant proportion of attribute	Permanent impact on small proportion of attribute	Permanent impact on significant proportion of attribute	
Slight		Temporary impact on small proportion of attribute	Temporary impact on significant proportion of attribute	Permanent impact on small proportion of attribute	Permanent impact on significant proportion of attribute
Imperceptible			Temporary impact on small proportion of attribute	Temporary impact on significant proportion of attribute	Permanent impact on small proportion of attribute

To conclude the assessment, mitigation measures were identified to reduce, avoid and prevent these likely significant effects, where appropriate. This enabled a “with mitigation” assessment to be made of any residual impact as a result of the construction and operational phases of the Proposed Development and/ or in combination with other existing or approved projects in the vicinity of The Burrow.

9.4 Receiving Environmental

A desk-based assessment of surface water quality in the vicinity of The Burrow application area was conducted. The sources of the water quality information used include:

- Water Framework Directive water body status information arising from the Water Framework Directive monitoring programme. Water Quality in Ireland Report 2016-2021 (2022) supported by water quality information available on the EPAs online Water Framework Directive Application (www.catchments.ie).
- Protected areas datasets including:
  - bathing water quality information outlined in the EPA's most recent bathing water quality report, Bathing Water Quality in Ireland, A Report for the Year 2022 (EPA, 2023a).
  - information on Nutrient Sensitive Areas as outlined in the EPA's most recent Urban Wastewater Treatment Report in 2021 (EPA, 2022a).
  - the existing Register of Protected Areas (under Article 6 of the Water Framework Directive) for water dependent habitats and species in the SAC and SPA networks held by the EPA.
- Department of Environment, Community and Local Government - Marine Strategy Framework Programme of Measures Summary Report (2016); Department of Housing, Local Government and Heritage – Marine Strategy Framework Directive 2008/56/EC, Article 17 update to Ireland's Marine Strategy Part 3: Programme of Measures (Article 13) (2022).
- Water Quality in 2022 – An Indicators Report (EPA, 2023b).
- Water Quality in Ireland 2016 – 2021 (EPA, 2022b).

9.4.1 Project Area Water Bodies

For the purposes of monitoring and assessing the quality of surface waters, all rivers, lakes, coastal inter-basins (small streams draining directly to the marine environment which do not form part of a larger river catchment), estuaries, and coastal waters (within 1 nautical mile of the shoreline) have been divided into management units called "water bodies". The condition of each water body must be reported to the European Commission in the form of ecological status and chemical status. Groundwater bodies are similarly delineated with status identified.

Surface water bodies are grouped into sub-catchments for the purposes of water management, of which there are 583 nationally, which are further grouped into catchment management units of which there are 46 based on the hydrometric areas used by public authorities. As illustrated in Figure 9.1, the Proposed Development at The Burrow is located within two surface water bodies: 'Rogerstown Estuary' transitional water body (EA_050_0100) and 'North-western Irish Sea (HA 08)' coastal water body (EA_020_0000). The 'Ballyboghil_010' (EA_08B012200) river water body is situated upstream of the works.

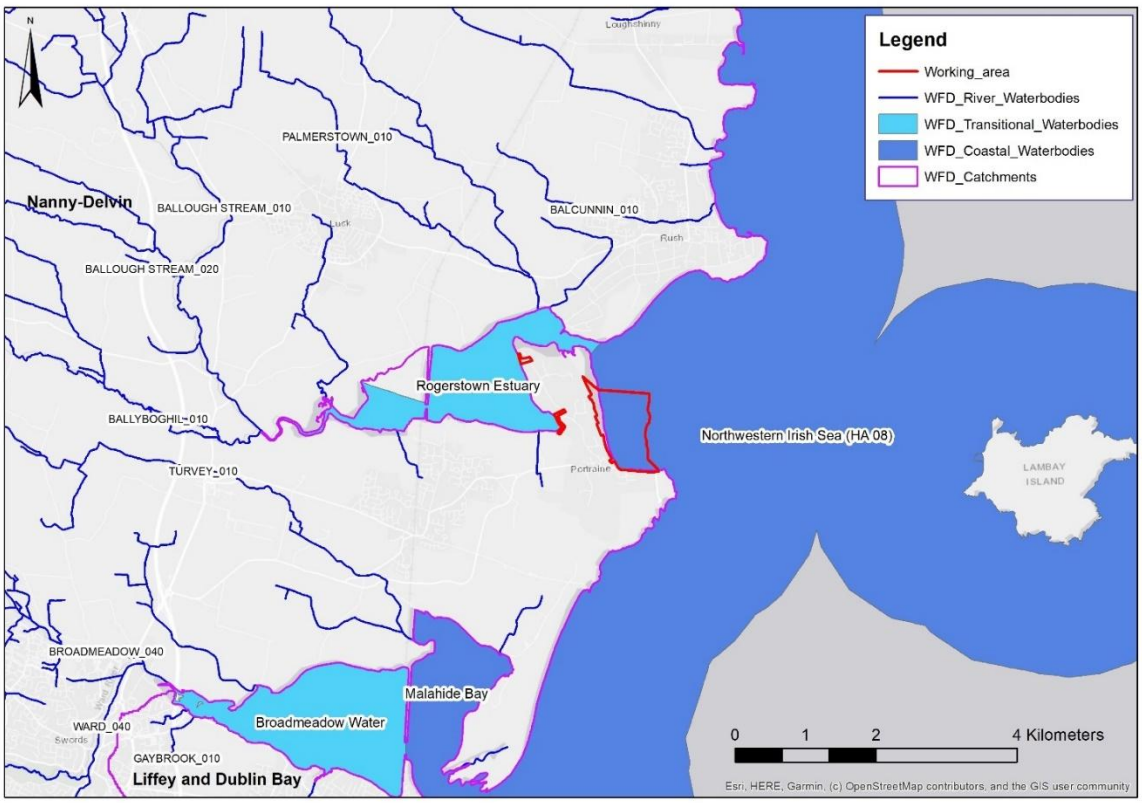


Figure 9.1: Site Location in the Context of the Wider Surface Water Environment.

The Proposed Development also lies within the 'Swords' groundwater body (EA-G-011). This water body has achieved and maintained 'good' status since the 2007-2012 WFD Monitoring Cycle.

Due to the nature of the Proposed Development and the relatively limited scale of geotechnical activities in the application area, there are no likely significant water quality effects on groundwater expected and these have therefore not been assessed further in this chapter. This is supported by the assessment presented in Chapter 10 which addresses Soils, Geology and Contamination.

9.4.1.1 Water Framework Directive Water Body Status

Directive 2000/60/EC establishing a framework for community action in the field of water policy (the Water Framework Directive), and transposing regulations, establishes a legal framework for the protection, improvement and sustainable management of rivers, lakes, transitional waters (estuaries), coastal waters (to a distance of one nautical mile) and groundwater.

The fundamental objectives of the WFD are to maintain "high status" of surface waters where it exists, prevent deterioration in the existing status of waters, and achieve at least "good status" in relation to all waters by the end of the current river basin management cycle (2027) unless subject to extended deadlines. A water body must achieve both good 'ecological status' and good 'chemical status' before it can be considered to be at good overall status. An assessment of the risks to the achievement of these objectives for water bodies has been undertaken by the EPA through the extensive characterisation of water bodies and the key pressures acting upon them. This facilitates the development of a programme of measures to allow the achievement of the WFD objectives.

The Programme of Measures (POMs) outlines the steps that will be taken to meet WFD objectives as applicable to each water body. This Programme is contained within an overarching River Basin Management Plan (RBMP). These measures will require implementation at strategic level but also at regional and local level through the establishment of Regional Integrated Catchment Management Programmes. The Rogerstown Estuary water body which includes the project area was included amongst those 190 prioritised areas for action identified in the 2nd Cycle River Basin Management Plan for Ireland 2018 - 2021 (DHPLG, 2018), it has been categorised as an Area for Restoration.

To date, the Initial Public Engagement phase has been completed and a Desk Study Summary Report produced. The report noted that the Rogerstown Estuary is currently at Bad ecological status based on the smothering of sensitive seagrass by opportunistic macroalgae. The EPA significant pressure characterisation identified septic tanks and agriculture as the pressures and nutrients as the issue. As a result of the EPA characterisation, the desk study review undertaken in 2019 focused on losses of nitrogen from agriculture from the three inputting rivers on permeable soils and subsoils. The desk study will inform the appropriate approach for fieldwork or Local Catchment Assessment. Further information has not been published to date.

It is noted that measures required to ensure compliance with existing legislation will be implemented during this river basin management cycle.

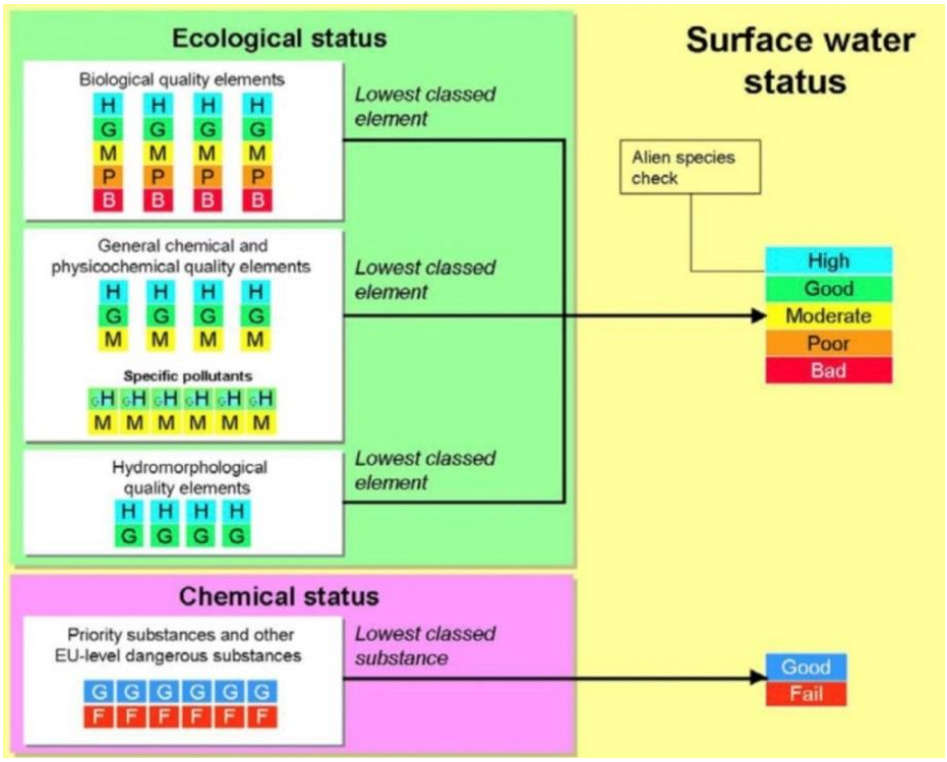


Figure 9.2: Elements of the Water Framework Directive Status.

Environmental Quality Standards (EQSs) for classifying surface water status are established in the European Communities Environmental Objectives (Surface Waters) Regulations, 2009 (SI No. 272 of 2009), as amended. These regulations set standards for biological quality elements, physico-chemical conditions supporting biological elements (including general conditions and specific pollutants), priority substances and priority hazardous substances, as required under the WFD.

As shown in Figure 9.2 the 'ecological status' of a water body is established according to compliance with the EQSs for biological quality elements, physico-chemical conditions supporting biological elements and relevant pollutants and hydromorphological quality elements. The 'chemical status' of a water body is established according to compliance with the EQSs for priority substances and priority hazardous substances.

In addition to achieving good ecological and chemical status, a water body must achieve compliance with standards and objectives specified for protected areas, which include areas designated by the Drinking Water Directive, Bathing Water Directive; the Urban Waste Water Treatment Directive; the Shellfish Waters Directive; the Habitats Directive and the Birds Directive. Waters bodies that are compliant with WFD standards, but that contain protected areas which are non-compliant with protected area standards are downgraded to 'less than good' status.

Based on monitoring information and data from 2016 to 2021, the current WFD status classification of transitional and coastal water bodies potentially affected by the Proposed Development is illustrated in Figure 9.3.

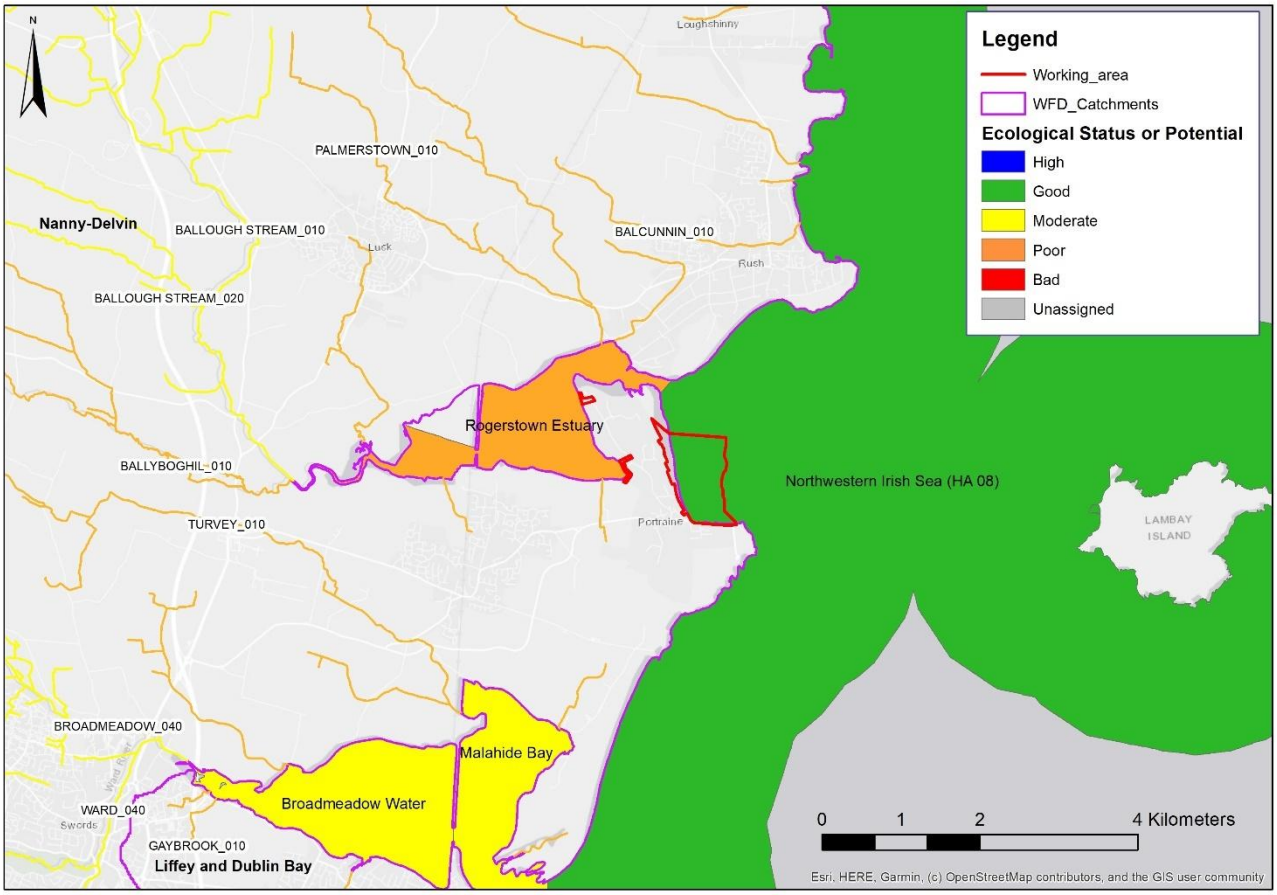


Figure 9.3: Water Framework Directive Water Body Status 2016-2021.

The WFD status classification between 2007 and 2021 is shown in Table 9.5 for each of these water bodies. In summary, the Rogerstown Estuary transitional water body has most recently been reported as "poor", improving from the "bad" status reported in 2013-2018. The North-western Irish Sea (HA 08) coastal water body was reported as "high" in the 2013-2018 WFD monitoring cycle and has now deteriorated to "good" status 2016-2021. The upstream river water body, Ballyboghill_010 recorded "poor" status throughout all monitoring periods.

Table 9.5: WFD Status (2007-2021).

WFD Status 2007-2021	Rogerstown Estuary	Northwestern Irish Sea (HA 08)	Ballyboghil_010
	EA_050_0100	EA_020_0000	EA_08B012200
Overall WFD Water Quality Status (2007-2009)	Moderate	High	Poor
Overall WFD Water Quality Status (2010-2012 - Interim)	Poor	High	Poor
Overall WFD Water Quality Status (2010-2015)	Bad	Good	Poor
Overall WFD Water Quality Status (2013-2018)	Bad	High	Poor
Overall WFD Water Quality Status (2016-2021)	Poor	Good	Poor

A further breakdown of the ecological and chemical elements for the 2016-2021 WFD cycles is shown in Table 9.6. The Rogerstown Estuary water body is currently at "poor" Ecological Status but was at "bad" status in the 2013-2018 monitoring cycle. This resulted from an improvement in Biological Status from "bad" to "poor" due to an improvement in angiosperm status from "bad" to "poor". Chemical surface water status conditions have also improved from "failing to achieve good" status to "good" between the 2013-2018 and 2016-2021 monitoring periods.

The North-western Irish Sea (HA 08) coastal water body has deteriorated from "high" ecological status in the 2013-2018 monitoring cycle to "good" ecological status in the latest monitoring interval due to a deterioration in one of the biological elements i.e. invertebrates.

The upstream Ballyboghil_010 river water body has remained at 'poor' ecological status throughout all monitoring intervals with failures in nutrient conditions and dissolved oxygen in 2010-2015, although dissolved oxygen conditions improved to a pass in the 2013-2018 results, it then declined again to fail in 2016-2021. Biological status has remained "poor" due to invertebrate status throughout all cycles.

This assessment of likely significant effects on water quality has been undertaken having regard to the necessity to comply with the WFD and in doing so ensuring that the Proposed Development does not prevent the achievement of the WFD objectives for these water bodies in subsequent RBMP cycles. The water quality assessment therefore must demonstrate that the Proposed Development will not cause deterioration in the status or prevent the improvement in status, where necessary, under the environmental objectives of the WFD.

Table 9.6: WFD Status Breakdown (2016-2021).

WFD Status 2016-2021			Rogerstown Estuary	Northwestern Irish Sea (HA 08)	Ballyboghil_010
			EA_050_0100	EA_020_0000	08B012200
Ecological Status	Biological Status	Phytoplankton Status	High	High	Not Available
		Other Aquatic Floras Status	Poor	Not Available	Not Available
		Macroalgae Status	Moderate	Not Available	Not Available
		Angiosperm Status	Poor	Not Available	Not Available
		Invertebrate Status	Not Available	Good	Poor
		Fish Status	Not Available	Not Available	Not Available
	Supporting Chemistry Conditions	Oxygenation Conditions	Good	High	Pass
		Nutrients Condition	Good	High	Moderate
		Specific Pollutants	Pass	Not Available	Not Available
	Hydromorphological Quality Element	Hydrology, Morphology, Continuity	Not Available	Good	Not Available
	Ecological Status (2016 – 2021)		**Poor**	**Good**	**Poor**
Chemical Status	Priority substances and other EU-level dangerous substances		Not Available	Not Available	Not Available
	Chemical Status (2016 – 2021)		Good	Not Available	Not Available
Overall WFD Quality Status 2016 - 2021			Poor	Good	Poor

9.4.1.2 Protected Areas

A significant proportion of the Rogerstown Estuary and adjacent coastline is protected under existing EU legislation requiring special protection due to the sensitivity to pollution or particular environmental importance. All of the areas requiring special protection in the Irish River Basin District have been identified by EPA, mapped and listed in a national register of protected areas (required under Article 6 of the WFD Directive). The register of protected areas includes:

- Areas designated for the abstraction of water for human consumption (Drinking Water Protected Areas).
- Areas designated for the protection of economically significant aquatic species, i.e. Freshwater Fish and Shellfish.
- Bodies of water designated as recreational waters, including areas designated as bathing waters.
- Nutrient-sensitive areas, including areas identified as Nitrate Vulnerable Zones under the Nitrates Directive or areas designated as sensitive under Urban Waste Water Treatment Directive.

- Areas designated for the protection of habitats or species where the maintenance or improvement of the status of water is an important factor in their protection including relevant Natura 2000 sites (Special Protection Areas (SPAs); and Special Areas of Conservation (SACs)).

These protected areas have their own monitoring and assessment requirements to determine their condition. They are often assessed for additional pollutants or requirements relevant to their designation. Protected areas within the study area include areas of Bathing Water, Nutrient Sensitive Waters and Natura 2000 sites.

9.4.1.2.1 Bathing Waters

The Bathing Water Directive (2006/7/EC) came into force in March 2006, and was transposed into Irish law by the Bathing Water Quality Regulations, 2008, as amended. The previous 1976 Directive was repealed with effect from 31 December 2014. Since 2014, the annual water quality classification (rating) of a beach or lake has been based on water quality results covering a four-year period rather than a single previous season's data. Water quality at beaches and lakes is classified as Excellent; Good, Sufficient or Poor (Table 9.7). This approach is common across all EU Member States and there is a requirement to ensure that bathing waters are of 'Sufficient' standard or better. Any 'Poor' bathing water requires a programme of adequate management measures to be implemented. A minimum of 16 samples are required for formal annual assessment.

Table 9.7: Annual Assessment Criteria for Bathing Waters.

Parameter	Excellent	Good	Sufficient
E. coli (Freshwater)	500*	1000*	900**
E. coli (Coastal)	250*	500*	500**
Intestinal enterococci (freshwater)	200*	400*	330**
Intestinal enterococci (Coastal)	100*	200*	185**

*based on 95-percentile value **based on 90-percentile value

The bathing areas in the immediate vicinity of the Proposed Development are Rush South Beach, Portrane, the Brook Beach, Rush North Beach, Loughshinny Beach, Donabate Balcarrick Beach, Sutton Burrow Beach, Claremont Beach, Dollymount Strand, Skerries South Beach and Portmarnock Velvet Strand Beach.

Most recently, Rush South Beach, Donabate Balcarrick Beach, Rush North Beach, Portrane the Brook Beach and Portmarnock Velvet Strand Beach have all been classified as Excellent; Dollymount Strand has been classified as Good; Loughshinny Beach, Skerries South Beach and Claremont Beach as Sufficient; and Balbriggan Front Strand Beach as Poor (Figure 9.4). Loughshinny Beach has deteriorated from Good in both the 2018 and 2019 to Sufficient in the 2020 monitoring period onwards, while Skerries South Beach has deteriorated from Good in 2021 to Sufficient in 2022. The Portrane Brook Beach however has improved from Good to Excellent in 2021 to 2022. The remaining sites either showed no change or improved over this interval.

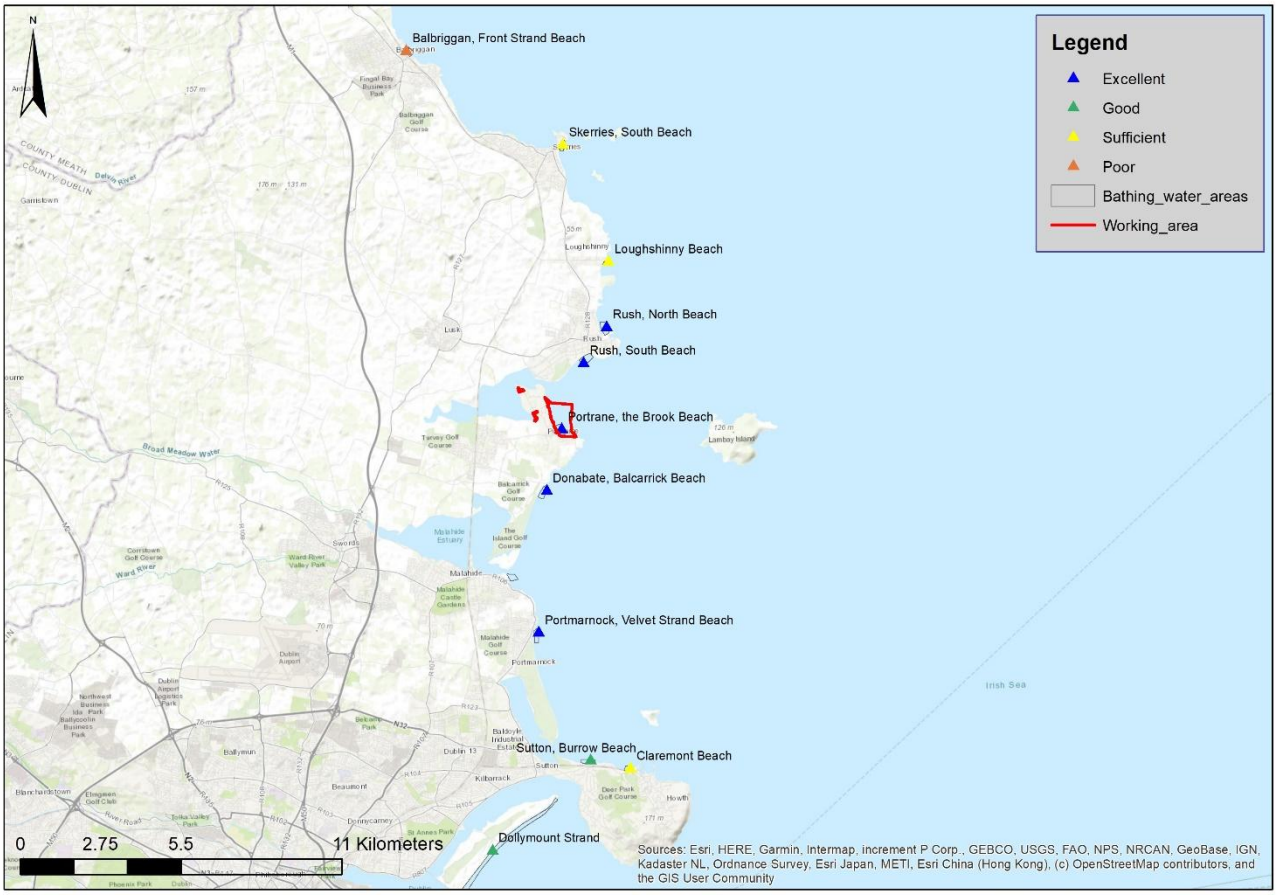


Figure 9.4: Bathing Water Quality in the Dublin Area 2022 (EPA, 2023).

Table 9.8: Status of Individual Samples during the 2022 Monitoring Season.

Sample Date	Dollymount Strand	Claremont Beach	Sutton, Burrow Beach	Portmarnock, Velvet Strand Beach	Balbriggan, Front Strand Beach	Skerries, South Beach	Loughshinny Beach	Rush North Beach	Rush South Beach	Portrane the Brook Beach	Donabate, Balcarrick Beach
23/05/2022 - 31/05/2022	E	E	E	E	E	E	E	E	E	E	E
07/06/2022 - 08/06/2022		E	E	E	E	E	E	E	E	E	E
13/06/2022 - 15/06/2022	E	E	E	E	E	E	E	E	E	G	E
19/06/2022 - 21/06/2022	E										
27/06/2022	E	E	E	E	G	E	E	E	E	E	E
28/06/2022	E										
03/07/2022 - 04/07/2022	E										
11/07/2022	E	E	E	E	E	E	P	E	E	E	E
17/07/2022 - 20/07/2022	E										
25/07/2022	G	S	E	E	P	G	E	E	E	E	E
26/07/2022	E										
08/08/2022	E	E	E	E	E	E	E	E	E	E	E
09/08/2022	E										
14/08/2022 - 15/08/2022	E										
22/08/2022	E	E	E	E	P	G	E	E	E	E	E
23/08/2022	G										
29/08/2022	E										
05/09/2022 - 06/09/2022	E	E	G	E	P	G	E		E	E	E
11/09/2022 - 13/09/2022	G							E			

Key: Blue: Excellent; Green: Good, Yellow: Sufficient; Orange: Poor

Notwithstanding bathing restrictions at Balbriggan Front Strand Beach due to previous poor-quality bathing water, the results for all sites monitored during 2022 have been substantially excellent for individual samples during the 2022 monitoring season (Table 9.8).

9.4.2 Nutrient Sensitive Waters

The Urban Waste Water Treatment Regulations 2001, as amended (which transpose the Urban Wastewater Treatment Directive (91/271/EEC) into Irish law and update the Environmental Protection Agency Act, 1992 (Urban Waste Water Treatment) Regulations 1994, as amended) list nutrient sensitive waters in the Third Schedule.

The Broadmeadow Estuary (Inner) has been designated as a nutrient sensitive area (Figure 9.5).

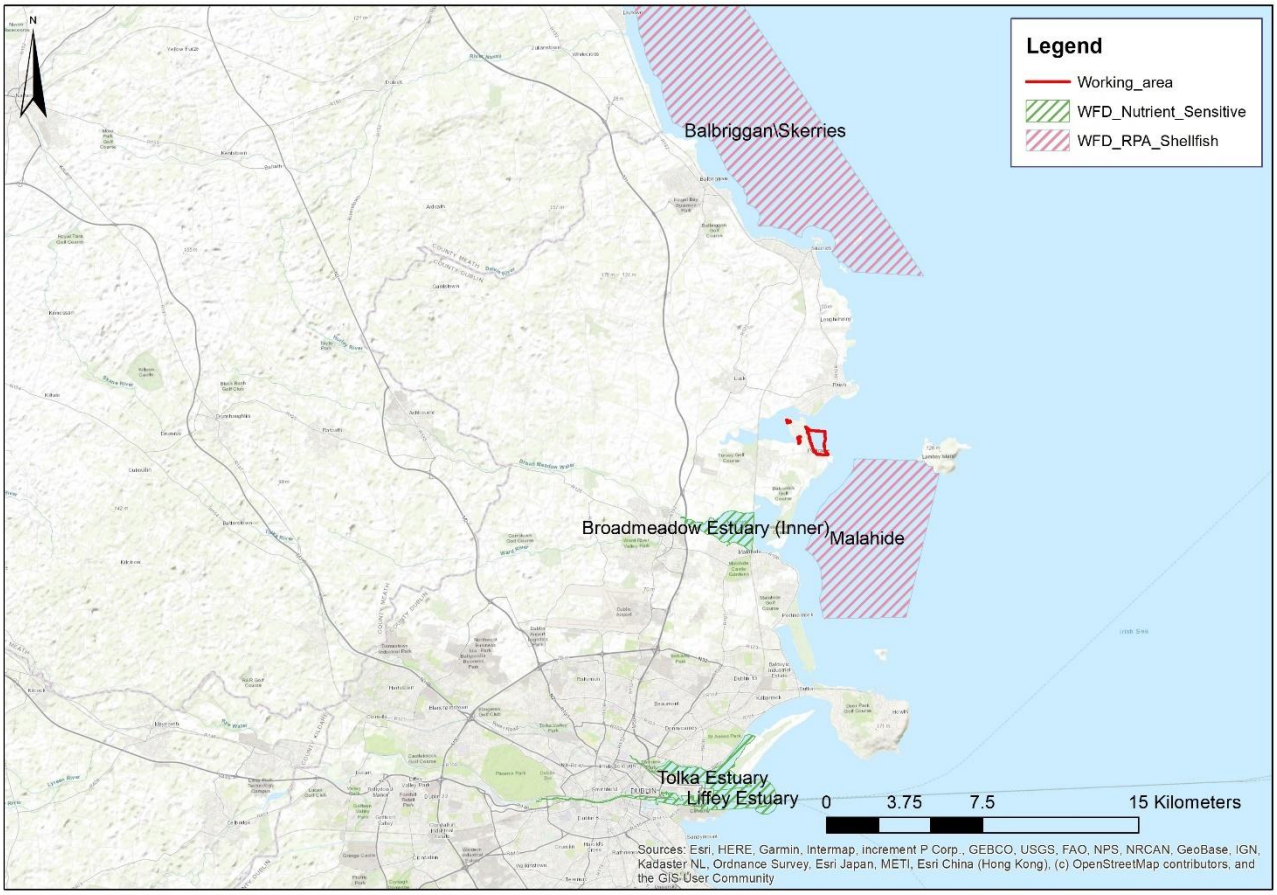


Figure 9.5: Nutrient Sensitive Areas and Shellfish Waters.

9.4.2.1.1 Shellfish Waters

Shellfish waters are designated under the Water Framework Directive (2006/113/EC) and all shellfish protected waters will be assigned an objective under this directive. The Directive is transposed into Irish law under the European Communities (Quality of Shellfish Water) Regulations 2006 (SI No 268 of 2006), which was further amended in 2009. It is essential that 'good' water quality is maintained within these areas to ensure the production of high quality shellfish.

The Proposed Development is located within 10km of the Malahide and Balbriggan/Skerries designated shellfish waters (Figure 9.5).

9.4.2.1.2 Natura 2000 Protected Areas

Natura 2000 is a European network of important ecological sites. The EU Habitats Directive (92/43/EEC) places an obligation on Member States of the EU to establish the Natura 2000 network. The network is made up of Special Protection Areas (SPAs), established under the EU Birds Directive (79/409/EEC), and SACs, established under the Habitats Directive itself.

As illustrated in Figure 9.6, the Proposed Development is within a Natura 2000 site (i.e. SPA or SAC), the Rogerstown Estuary SPA and SAC. The SAC is designated for the following qualifying interests: estuaries, mudflats and sandflats not covered by seawater at low tide, Salicornia and other annuals colonising mud and sand, Atlantic salt meadows *Glauco-Puccinellietalia maritimae*, Mediterranean salt meadows *Juncetalia maritimi*, shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) and mixed coastal dunes with herbaceous vegetation (grey dunes). The potential of likely significant effects from the Proposed Development has been assessed in Chapter 12 Marine Biodiversity and Chapter 13 Terrestrial and Coastal Biodiversity. It should also be noted that, separately and distinctly, potential effects on Natura 2000 or "European" sites have been considered extensively in the Appropriate Assessment Screening Report and Natura Impact Statement submitted with the application for development consent in respect of the project.

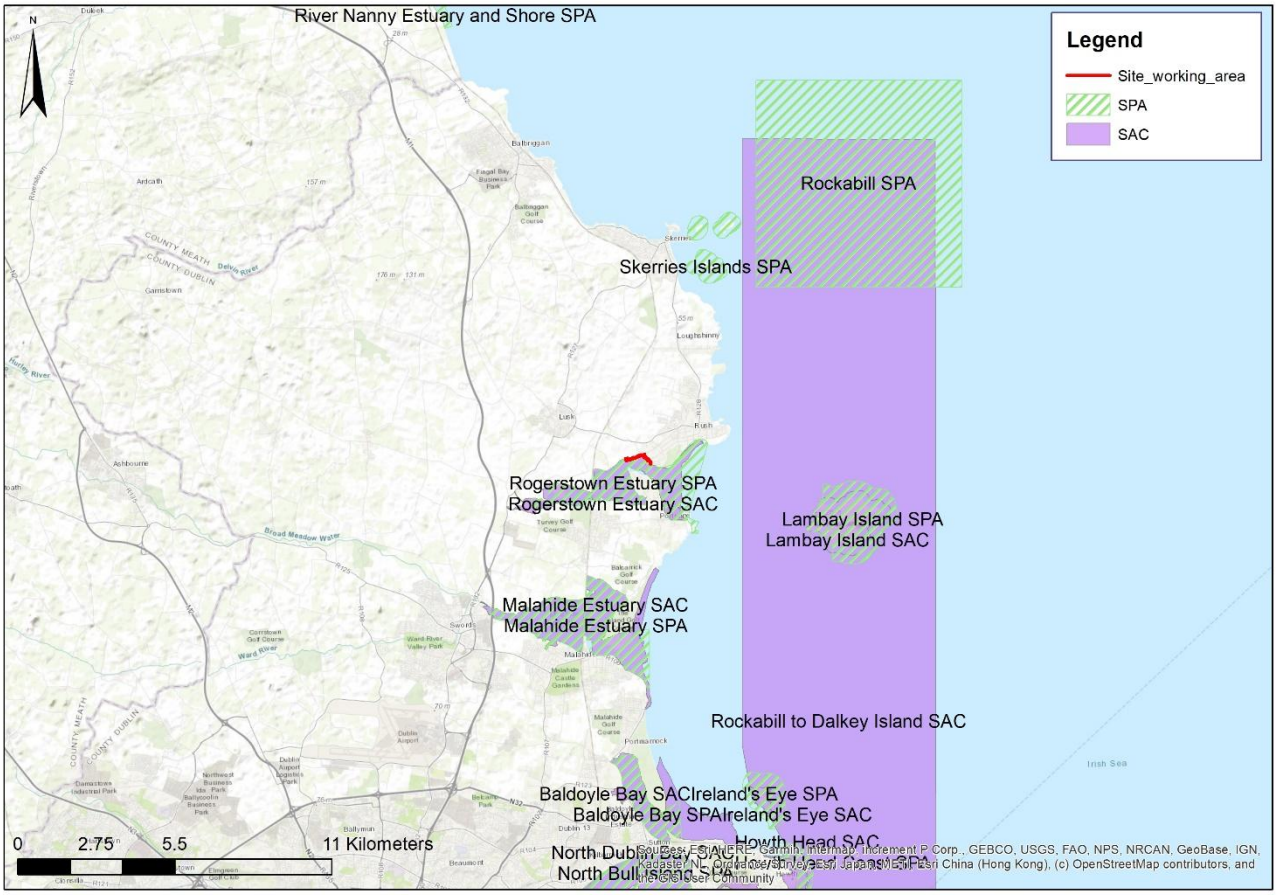


Figure 9.6: Natura 2000 Designated Sites.

The purpose of the water quality assessment contained in this chapter of the EIAR was to inform the NIS and to demonstrate that the development will not cause significant effects on the bathing waters or nutrient sensitive waters and, where necessary, water quality modelling and evaluation against relevant standards, has been undertaken.

9.4.3 EPA Water Quality in 2022: An indicators Report

In 2023, the EPA published the "*Water Quality in 2022 - An Indicators Report*". The intention of the report was to keep decision makers and the public informed by providing timely, scientifically sound information on water quality using a series of water quality indicators. Of the indicators, two relate to Transitional and Coastal Waters located in close proximity to the project;

- Nitrogen in Estuaries and Coastal Waters.
- Phosphate in Estuaries and Coastal Waters.

In this water quality assessment, consideration has been given to the potential effects of the Proposed Development on these environmental indicators.

9.4.3.1 Nitrogen in Estuaries and Coastal Waters

Nitrogen is generally considered the primary limiting nutrient in coastal ecosystems, meaning that the concentration of this nutrient can limit the growth of algae and aquatic plants. Increases in nitrogen can lead to elevated growth of phytoplankton and/ or macroalgae. Levels of Dissolved Inorganic Nitrogen (DIN) are monitored in winter, when levels are expected to be at their seasonal maximum due to the absence of any significant plant or algal growth.

The EPA have defined salinity-dependent thresholds for DIN in transitional and coastal waters, and there is an environmental quality standard for coastal waters. These thresholds range from ≤2.6mg N/l at a salinity of zero to ≤0.25mg N/l at a salinity of 34.5 and are used to assess the water quality of transitional and coastal waters around Ireland. DIN concentrations above the assessment threshold indicate the presence of elevated nitrogen levels from anthropogenic sources. The EPA 2022 indicator report uses the median winter DIN concentration for the period 2020–2022 to assess number of exceedances against the assessment threshold.

The EPA 2022 Indicators Report has reviewed trends in some coastal and transitional water bodies. Rogerstown Estuary has been included in this analysis. The indicator report noted that the DIN concentration percentage trend between 2020 and 2022 recorded values between 49% to 15% below the threshold value indicating that the estuary is currently achieving the required standards for DIN.

9.4.3.2 Phosphorus in Estuaries and Coastal Waters

Phosphorus is important in transitional systems because it is limiting in lower salinity waters. Salinity-dependent thresholds have been defined for phosphorus in transitional and coastal waters and there is an environmental quality standard for transitional waters (S.I. 272, 2009). The assessment threshold is 0.060mg P/l for fresh to intermediate salinity waters and ranges from 0.059–0.040mg P/l for intermediate to full salinity waters. Phosphorus concentrations above these thresholds can indicate excess phosphorus being transported to surface waters due to anthropogenic activity. Levels of Molybdate Reactive Phosphorus (MRP) are monitored in winter when levels are expected to be at their seasonal maximum due to the absence of any significant plant or algal growth. Winter (January–March) phosphorus exceedances give an indication of available nutrients without the influence of biological activity, which mainly occurs during the summer growth period.

The indicator report demonstrated that the Median MRP concentration between 2020 and 2022 for the Rogerstown Estuary water body was 49% to 15% below the threshold of Winter MRP indicating that the estuary is currently achieving the required standards for MRP.

9.4.4 Water Quality Model Simulations

Chapter 6 Coastal Processes details the extensive numerical modelling programme that has been used to assess the Proposed Development and determine the likelihood of significant impacts on the coastal processes within Rogerstown Estuary. The results of the computational modelling have informed the water quality assessment presented in this chapter in the context of the supporting hydro-morphological conditions for the Rogerstown Estuary.

9.4.5 Marine Strategy Framework Directive Environmental Status

The Marine Strategy Framework Directive (MSFD) (2008/56/EC) was formally adopted by the European Union in June 2008 and is transposed into Irish law by the European Communities (Marine Strategy Framework) Regulations 2011, as amended. The overarching aim of the Directive is to protect Europe's marine waters by applying an ecosystem-based approach to the management of human activities while enabling the sustainable use of the marine environment for present and future generations. The Directive established a legal framework for the development of marine strategies designed to achieve Good Environmental Status (GES) in the marine environment by the year 2020. The marine strategy involved defining GES, setting environmental targets and indicators, implementing monitoring programmes for ongoing assessment, and developing and implementing programmes of measures to achieve or maintain GES.

GES is defined as '*the environmental status of marine waters where these provide ecologically diverse and dynamic oceans and seas which are clean, healthy and productive within their intrinsic conditions, and the use of the marine environment is at a level that is sustainable, thus safeguarding the potential for uses and activities by current and future generations*'.

The assessment of GES is undertaken by reference to qualitative descriptors which define overarching objectives in respect of key socio-economic or ecological aspects of the marine environment. These specifically require the consideration of the following:

- biodiversity;

- non-indigenous species;
- exploited fish and shellfish;
- food webs;
- human-induced eutrophication;
- sea-floor integrity;
- alteration of hydrographical conditions;
- contaminants in water and seafood;
- marine litter; and
- the introduction of energy including underwater noise.

To date, an Initial Assessment (constituting a comprehensive review of the physical, chemical and biological characteristics of the marine area, as well as the human pressures acting upon it) has been undertaken (DEHLG, 2013). A comprehensive set of environmental targets and associated indicators is under development. These will be used to demonstrate that GES has been achieved or is being maintained in accordance with the objectives of the MSFD. A monitoring programme will be established by the Department of Housing, Planning and Local Government and the Marine Institute to identify measures which will need to be taken in order to achieve or maintain GES in marine waters and a draft management plan prepared.

To date, the extent of achievement of GES has not been established for individual water bodies, therefore this water quality assessment relies on the WFD water quality assessment to ensure that the Proposed Development will not cause conflict with the MSFD.

9.4.5.1 Summary of Existing Water Quality

A review of available national monitoring information for the water bodies in the immediate vicinity of the Proposed Development application boundary, in combination with real time monitoring results supported by water quality model simulations has concluded:

- Rogerstown Estuary – Poor Ecological Status
- Palmerstown_010 - Poor Ecological Status
- Ballyboghil_010 - Poor Ecological Status
- Ballough Stream_020 – Moderate Ecological Status
- Northwestern Irish Sea (HA 08) – Good Ecological Status

The overall WFD Groundwater Quality status between 2016-2021 is:

- Swords groundwater body (EA-G-011) - Good Quantitative and Qualitative Status

Within the immediate vicinity of the Proposed Development, there are several protected areas under Article 6 of the WFD Directive including areas of Bathing and Recreational Water, Nutrient Sensitive Areas, Shellfish Waters and Water Dependant Natura 2000 sites.

To date, the extent of achievement of GES under the MSFD has not been established for individual water bodies, consequently no further conclusions can be drawn currently in relation to the MSFD, and the WFD water quality assessment is relied on until specific standards are identified.

In 'Water Quality in 2022- An indicators Report' (EPA, 2023) it is stated that the levels of Winter Dissolved Inorganic Nitrogen (DIN) and Molybdate Reactive Phosphorus (MRP) concentration trends have remained stable between 2012 and 2022.

Water quality model simulations undertaken to assess the likely hydro-morphological impact of the proposed structures on the waterbodies ecological status concluded that there will be no significant elevation in suspended solids **outside the immediate zone of the operations**. Water Quality model simulations carried out as part of this study have demonstrated that alterations to the wave environment/ tidal currents/ sediment deposition as a result of the Proposed Development will be considered negligible and therefore not prevent the waterbody from achieving its WFD objectives.

9.5 Likelihood of Impacts

The likelihood of environmental impacts arising due to the Proposed Development was assessed in relation to the construction and operational phases. The elements of construction and operation and the potential impacts on water quality have been identified for assessment.

The assessment has been informed by consultation with a wide range of stakeholders. Consultees included FCC, Inland Fisheries Ireland, Marine Institute, EPA, National Parks and Wildlife Service.

The significance of any environmental effect was rated based on the magnitude of the impact and the importance of the attribute as detailed in Section 9.6.3. Based on the criteria detailed in NRA Guidelines the Rogerstown Estuary transitional water body is considered to be of "extremely high" importance due the proximity to the Rogerstown Estuary SAC and SPA designated under EU Habitats Directive (92/43/EEC) and the Birds Directive (79/409/EEC), respectively. The highest sensitivity receiving watercourse rating was used for the purpose of the overall impact rating, which in this case is "extremely high" for the Rogerstown Estuary due to its proximity to the designated protected areas, Rogerstown Estuary SAC and SPA.

The Proposed Development has the potential to directly impact upon the Rogerstown Estuary transitional water body (EA_090_0300) and the Northwestern Irish Sea (HA 08) (EA_020_0000) coastal water body given the location of the works.

9.5.1 Potential Construction Phase Impacts

The major elements of the construction programme are outlined in Chapter 3 of this EIAR. In summary and for the purposes of this assessment they have been considered as the following types of works:

- Construction of structures (flood wall, outfalls, earthen embankment, groynes), including demolition of existing wall and beach renourishment scheme.

Temporary impacts on water quality have the potential to occur during the construction phase of the works. Mobilised suspended sediment, fuels/ oils, chemicals and cement release through construction activities are the principal potential sources of water quality impact. The following have been considered in this assessment:

- Increased suspended sediment levels due to the accidental release of sediment to the water column during construction of the structures and the intentional release of sediments during beach renourishment works.
- Accidental release of highly alkaline contaminants from concrete and cement during the construction of structures.
- General water quality impacts associated with works machinery, infrastructure and on-land operations including the temporary storage of construction materials, oils, fuels and chemicals.

The impacts in relation to the construction of each component of the works are assessed sequentially in Section 9.6.1.

9.5.2 Potential Operational Phase Impacts

The operational phase impacts of the Proposed Development will include maintenance of the various elements of the proposed coastal management scheme, although this is likely to have minimal impact on water quality. The proposed construction of hard defences and therefore physical changes to the coastline, however, could cause changes to the coastal processes and impact on the hydro-morphological conditions supporting ecological status. However negligible changes to current velocity and inshore wave climate are expected due to the operation of flood walls and have been addressed fully within Chapter 6 of this EIAR.

9.6 Description of Likely Significant Impacts

9.6.1 Construction Phase Impacts

9.6.1.1 Suspended Sediment and Sedimentation

As described in Chapter 3, the Proposed Development involves the construction of approximately 390m of earthen embankment, 130m of sheet piled flood wall, associated back drainage and outfalls, seven Y -shaped groynes and a beach renourishment scheme. These construction phase operations have the potential to cause a temporary increase in suspended sediment due to disturbance of the bed materials causing the resuspension of sediments in the water column leading to the localised reduction in water quality.

Pollution from mobilised suspended solids (silt) is generally the prime concern. Suspended sediment due to run off from stripped construction areas and excavations can have a severe negative impact on water quality, water dependent habitats and aquatic ecology. In areas of moderate to high rainfall or flood events, the potential problems are clearly exacerbated. If allowed to enter surface watercourses this run off can give rise to high suspended solids and detrimental impacts, in particular to fisheries.

Suspended solids may have an effect on:

- Sediment movement through rivers and its settlement onto the riverbed causing formerly clean gravels to become clogged with fine sediment. This prevents oxygen movement into the waters in the riverbed.
- The survival of fish eggs in gravel beds or spawning grounds as a result of deoxygenation caused by silt deposition.
- The survival of plants and algae by smothering.

- The survival of young fish and aquatic invertebrates such as mayfly larvae (Calopteryz sp.) through gill damage from sediment particles.
- The success of angling due to increased turbidity.
- Amenity value through impaired visual appearance.

Given the scale and nature of the works, the magnitude of the impact associated with sediment loading is considered to be large adverse in the context of the freshwater environment, i.e. Ballyboghil_010 river water body. The impacts are less significant for the transitional and coastal water bodies where coastal processes result in significant fluctuations in suspended sediment due to wave climate, tidal cycles and currents particularly during storm events, see Section 6.4.3. Based on the potential impact on the freshwater environment the significance of the environmental effect is therefore profound in the absence of mitigation based on the extremely high sensitivity of the receiving environment.

The highest sensitivity receiving watercourse rating was used for the purpose of the overall impact rating.

9.6.1.2 Concrete and Cement Pollution

The construction works associated with the Proposed Development will include concrete structures. During the construction phase, there is the potential for accidental spillage of cement materials or during the setting of concrete. This could have a significant adverse impact on water quality and a toxic effect on the biological elements resulting in a possible deterioration in the ecological status or compromise the improvement in ecological status through the implementation of the programme of measures included in the River Basin Management Plan.

Fresh concrete and cement are highly alkaline and therefore will affect water quality (particularly in terms of pH) if washed into the water body in sufficient quantity. The impacts in relation to cement and concrete for the construction phase relates to several elements of the Proposed Development.

Given the proximity of works to the aquatic environment and the scale of the works, the magnitude of the potential impacts arising from concrete/ cement entering waters are considered to be large adverse. The significance of the environmental effect is therefore Profound in the absence of mitigation based on the extremely high sensitivity of the receiving environment.

9.6.1.3 Fuel, Oils and Chemicals

The construction works will involve the use of plant and machinery, as well as the associated temporary storage of construction materials, oils, fuels and chemicals. During the construction phase, there is the potential for accidental spillage or release of construction materials (e.g. diesel, oil, chemicals), and although the potential site compounds will not be sited immediately adjacent to the water bodies there is the potential for contaminants to drain into the Irish Sea or Rogerstown estuary in the absence of mitigation.

Given the scale and nature of the works, the magnitude of the impact associated with general construction is considered to be large adverse. The significance of the environmental effect is therefore Profound in the absence of mitigation based on the extremely high sensitivity of the receiving environment.

9.6.2 Operational Phase Impacts

9.6.2.1 Maintenance works

Maintenance work for both the structures to protect against coastal erosion and the associated flood management works will be minimal. Maintenance for the elements involved is detailed below:

- **Walls** – maintenance associated with these will be minimal. Inspections in accordance with standard asset management procedures are likely to be the main activities. Dealing with vandalism in terms of graffiti or damage to coping stones (if provided) can be an issue.
- **Embankments** – these will need regular inspection and should be mowed at least twice annually to prevent the growth of significant vegetation. Inspection activities will need to look for the presence of animal burrowing or damage from livestock although fencing of the defences, where located within agricultural fields should prevent the latter. Access to embankments is easily achieved for both inspection and maintenance purposes.
- **Drainage elements** – non-return valves will need to be checked regularly to ensure they are working as they form a key aspect of the Scheme function. These will be designed in such a way as to provide safe access. This can be within a manhole on the defended side of the defences rather than at the point of the outfall to the river. Back drainage will need to be checked for blockage and rodded if necessary. Manholes/ inspection chambers will be provided to enable this to happen. These manholes will be located on private property including residential gardens and agricultural land.

As the beach renourishment element of the coastal scheme on the beach is predominantly a “soft” nature-based solution, sediment material will be gradually lost from between the groyne structures over time and particularly during storm conditions. As such, beach levels within these cells will gradually reduce over time and require periodic renourishment.

Whilst the frequency of renourishment will be subject to prevailing weather conditions, the physical characteristics of the renourishment material and the detailed design of the groyne structures, it is expected that the beach will require renourishment approximately every 5-10 years. The magnitude of renourishment will be subject to the rate of losses during the intervening period but is expected to range between 50 – 75% of the initial renourishment volume.

There are no perceptible changes in water quality associated with the operation of the new structures. Any increase in suspended sediments due to maintenance as a result of the Proposed Development is assessed to have a negligible impact to water quality. The significance of the effect is therefore imperceptible in the absence of mitigation based on the extremely high sensitivity of the receiving environment.

9.6.2.2 Hydro-morphological Impacts

The proposed structures that protect against coastal erosion have the potential to cause changes in coastal processes and impact on hydro-morphological conditions of the Rogerstown Estuary, therefore potentially impacting on the ecological status. Therefore, should the inclusion of the coastal defence structure within the waterbody impact negatively the hydro-morphology, the waterbody may potential be at risk of deterioration and

be unable to achieve its good ecological status objective under the WFD. Structures may lead to increases or decreases in sediment deposition, and changes to tidal currents and/ or wave climate within the waterbody.

To determine the impact that the proposed structures will have on the waterbodies during the operational phase, an extensive numerical modelling programme was undertaken to assess the Proposed Development and determine the likelihood of significant impacts on the coastal processes within the Rogerstown Estuary. The results of the computational modelling have informed this water quality assessment.

In accordance with the modelling undertaken in Chapter 6 Coastal Processes, the magnitude of the potential impacts arising from hydro-morphological impacts would be small scale, low magnitude changes in the tidal regime, sediment transport and wave climate. The significance of the environmental effect is therefore imperceptible in the absence of mitigation based on the extremely high sensitivity of the receiving environment. On the basis that the appropriate mitigations measures are fully implemented, as outlined in Chapter 6, during the construction and operational phases, the impact of the Proposed Development on coastal processes is considered to be imperceptible.

9.6.3 Impact Matrix (Absence of Mitigation)

The potential impacts outlined in Sections 9.6.1 and 9.6.2 above are rated based on the impact level criteria in Section 9.3 to indicate their potential severity (profound, significant, moderate, slight and imperceptible) in the absence of any mitigation. The assessment reflects the activities and pollutants listed above and the different considerations for construction and operational phases of the Proposed Development.

Table 9.9 Potential Impact Rating Matrix (in the absence of mitigation).

Significance of Environmental Effects	
Construction Phase	**Construction of structures**
Suspended sediments/ sedimentation	Profound
Concrete and cement pollution	Profound
Impacts associated with general construction works	Profound
Operational Phase	**Structures**
Maintenance	Imperceptible
Hydro-morphological impacts associated with structures to protect against coastal erosion (Chapter 6)	Imperceptible

9.7 Mitigation Measures

In the absence of mitigation, the construction of some elements of the Proposed Development has the potential to have Profound negative impacts on the aquatic environment.

The Proposed Development has the potential to have imperceptible impacts on the water environment during the operation stage and therefore mitigation is not necessary.

Mitigation measures will be adopted through the construction phases of the development to minimise the impact of the works on water quality.

9.7.1 Construction Phase Mitigation Measures

9.7.1.1 Construction Phase Best Practice Measures

Mitigation measures will be implemented by the contractor and will include the requirements for best practice and adherence to the following relevant Irish guidelines and recognised international guidelines:

1. Good practice guidelines on the: Control of Water Pollution from Construction Sites: developed by the Construction Industry Research and Information Association (Technical Guidance C532 CIRIA, 2001).
2. Technical Guidance C648: Control of Water Pollution from Linear Construction Projects, (CIRIA, 2006).
3. Netregs Guidance for Pollution Prevention series (GPP), Pollution prevention guidelines (PPGs) in relation to a variety of activities developed by the Environment Agency (EA), the Scottish Environmental Protection Agency (SEPA) and the Northern Ireland Environment Agency (NIEA).
4. GPP2: Above Ground oil storage tanks.
5. GPP3: use and design of oil separators in surface water drainage.
6. GPP5: Works and maintenance in or near water.
7. PPG6: Working at construction and demolition sites.
8. GPP8: Safe Storage and disposal of used oils.
9. GPP13: Vehicle washing and cleaning.
10. GPP20: Dewatering underground ducts and chambers.
11. GPP21: Pollution incident response planning.
12. GPP22: Dealing with spills.
13. Guidelines on Protection of Fisheries During Constructions Works in and Adjacent to Waters (Inland Fisheries Ireland (2016).

9.7.1.2 Suspended Sediment and Sedimentation

Suspended sediment, including all soils, sands and rubble is the single main pollutant to the aquatic environment generated at construction sites and largely arises from the erosion of exposed soils and sediments by surface water runoff. The adoption of appropriate erosion and sediment controls during construction is essential to preventing sediment pollution.

As indicated above the construction works have the potential to result in a localised impact on water quality.

The mitigation and control measures to address the impact from suspended sediments associated with these activities will follow sound design principals and good working practices as listed in the Netregs Guidelines for Pollution Prevention (GPP). In addition to the requirements of best practice and relevant guidelines, the following mitigation measures will be implemented by the contractor during the construction phase:

1. Where preferential surface flow paths occur, silt fencing, or other suitable barriers will be used to ensure silt laden or contaminated surface runoff from the site does not discharge directly to a water body or surface water drain.

2. In the event that dewatering of foundations or drainage trenches is required during construction and/ or discharge of surface water from sumps, a treatment system prior to the discharge will be used; silt traps, settlement skips etc. This measure will allow additional settlement of any suspended solids within storm water arising from the construction areas.

Assuming the above mitigation measures are employed during construction activities, the potential impact to receiving water environment will be reduced to negligible thus reducing the significance of environmental effect to *Imperceptible.*

9.7.1.3 Concrete and Cement Pollution

The impacts in relation to cement and concrete for the Proposed Development are, for the most part (but not limited to); the construction of concrete strip foundations to support the cladding of flood walls and concrete capping beams constructed of poured concrete and the demolition of the existing concrete wall.

The principal risks and related mitigation measures are:

1. Concrete use and production shall adhere to control measures outlined in Guidance for Pollution Prevention (GPP5): Works and maintenance in or near water. Any on-site concrete production will have the following mitigation measures: bunded designated concrete washout area; closed circuit wheel wash etc.; and initial siting of any concrete mixing facilities such that there is no production within a minimum of 10 metres of the aquatic zone.
2. The use of concrete in close proximity to water bodies requires a great deal of care. Fresh concrete and cement are very alkaline and corrosive and can cause serious pollution in water bodies. It is essential to ensure that the use of wet concrete and cement in or close to any water body is carefully controlled so as to minimise the risk of any material entering the water, particularly from shuttered structures or the washing of equipment.
3. Where concrete is to be placed under water or in tidal conditions, specific fast-setting mix is required to limit segregation and washout of fine material/ cement. This will normally be achieved by having either a higher than normal fines content, a higher cement content or the use of chemical admixtures.

In circumstances where the above mitigation measures are employed during demolition, clearing and flood structure construction operations, the potential impact to receiving water environment will be reduced to negligible thus reducing the significance of environmental effect will be reduced to *Imperceptible.*

9.7.1.4 Fuels, Oils and Chemicals

The risk of water quality impacts associated with works machinery, infrastructure and on-land operations (for example leakages/ spillages of fuels, oils, other chemicals and wastewater) will be controlled through good site management and the adherence to codes and practices which limit the risk to within acceptable levels. The following measures will be implemented during construction:

1. A detailed works specific Construction Environmental Management Plan (CEMP) will be prepared by the contractor which will meet the minimum requirements of the outline CEMP and will include detail in respect of every aspect of the works in order to minimise potential impacts and maximise potential benefits associated with the works.

2. Management and auditing procedures, including tool box talks to personnel, will be put in place to ensure that any works which have the potential to impact on the aquatic environment are being carried out in accordance with required permits, licences, certificates and planning permissions.
3. Existing and proposed surface water drainage and discharge points will be mapped on the Drainage layout. These will be noted on construction site plans and protected accordingly to ensure water bodies are not impacted from sediment and other pollutants using measures to intercept the pathway for such pollutants.
4. The use of oils and chemicals on-site requires significant care and attention. The following procedures will be followed to reduce the potential risk from oils and chemicals:
    a. Fuel, oil and chemical storage will be sited on an impervious base within a bund and secured. The base and bund walls must be impermeable to the material stored and of adequate capacity. The control measures in GPP2: Above Ground Oil Storage Tanks and PPG 26 “Safe storage – drums and intermediate bulk containers” will be implemented to ensure safe storage of oils and chemical.
    b. The safe operation of refuelling activities shall be in accordance with PPG 7 “Safe Storage – The safe operation of refuelling facilities”.
    c. Contingency Planning: A project specific Pollution Incident Response Plan will be prepared by the contractor consistent and will be in accordance with PPG 21 Pollution Incident Response Planning. Whilst a major incident is highly unlikely to occur in circumstances where the mitigation measures are implemented, the finalisation of the draft CEMP is considered to be best practice. The contractor's Environmental Manager will be notified in a timely manner of all incidents where there has been a breach in agreed environmental management procedures. Suitable training will be provided by the contractor to relevant personnel detailed within the Pollution Incident Response Plan to ensure that appropriate and timely actions is taken.

In circumstances where the above mitigation measures are employed during construction, the significance of environmental effect to the receiving water environment will be reduced to *Imperceptible.*

9.7.2 Operational Phase Mitigation Measures

The operational phase impacts associated with the Proposed Development have been assessed as imperceptible and therefore mitigation is not required.

9.8 Residual Impacts

In circumstances where the appropriate mitigation measures are fully implemented during the construction phases as outlined in the previous section, the impact of the Proposed Development on the water quality in the area will be imperceptible as indicated in Table 9.10. Accordingly, the Proposed Development will not have a significant effect on the water quality of the receiving waters.

In all the circumstances as outlined, it can therefore be concluded that the Proposed Development is compliant with the requirements and environmental objectives of the EU Water Framework Directive and the other relevant water quality objectives for these water bodies.

Table 9.10 Residual Impacts (with mitigation).

Significance of Environmental Impact	
CONSTRUCTION PHASE	**Demolition works and construction of structures and associated works**
Suspended sediments / Sedimentation	Imperceptible
Concrete and cement pollution	Imperceptible
Fuels, Oils and Chemicals	Imperceptible
OPERATIONAL PHASE	**Structures**
Maintenance	Imperceptible
Hydro-morphology	Imperceptible

9.9 Potential Cumulative Impacts

Potential cumulative impacts may arise from the Proposed Development when combined with other existing and/or approved projects. In accordance with the European Commission Guidance on the preparation of the Environmental Impact Assessment Report (2017) and EPA Guidelines on the Information to be contained in Environmental Impact Assessment Reports (2022), existing and/ or approved projects with the potential for cumulative impacts have been identified. Cumulative impact assessments have been undertaken in this section for relevant pressures that could potentially give rise to cumulative impact. Each development with the potential to impact on the water environment has been considered through a review of the environmental supporting information (where available) for the developments.

The only other relevant marine project located within the vicinity of the Proposed Development is the FRS proposed at Rush south. This scheme primarily involves the replacement and improvement of existing seawalls located on the northern side of Rogerstown Estuary. Given the highly localised and negligible nature of the Proposed Burrow Scheme impacts as identified above and the anticipated lesser impacts associated with the scheme at Rush, no cumulative water quality effects are anticipated during construction and operation of the Proposed Development.

9.10 Conclusions

Baseline water quality within the receiving environment was established through review of national monitoring data used to establish water quality status in the context of the EU Water Framework Directive (WFD) and supporting environmental standards.

Using baseline water quality data and site specific water quality model simulation outputs, an assessment of the Proposed Development was conducted to determine the likelihood of significant impacts on water quality using the criteria for rating significance and magnitude as set out in the National Roads Authority (NRA)

publication "*Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes*" (NRA, 2008) and appropriate mitigation measures to reduce impacts were proposed, where necessary.

In circumstances where the appropriate mitigations measures are fully implemented during the construction phase, the impact of the Proposed Development on the water quality in the area will be imperceptible. The Proposed Development is therefore not expected to have a significant effect on the water quality of the receiving waters.

It can therefore be concluded that the Proposed Development works are compliant with the requirements and environmental objectives of the EU Water Framework Directive and the other relevant water quality objectives for these water bodies.

10 SOILS, GEOLOGY & CONTAMINATION

10.1 Introduction

The chapter of the EIAR assess the potential impact of the Proposed Development on the soils, geology and hydrogeology of the site and surrounding areas. Where potential adverse impacts are identified, the assessment identifies mitigation measures that would be implemented to prevent, reduce or offset potential significant adverse effects, or enhance potential beneficial effects where possible.

This chapter is supported the following Technical Appendices:

- Appendix 10A: The Burrow Coastal Protection Scheme Preliminary Risk Assessment Final May 2021.
- Appendix 10B: Ground Investigations Ireland, Rogerstown Coastal Flood and Erosion Relief Scheme, FCC, Ground Investigation Report, May 2022.

10.2 Authority of author

The author of this chapter, Joseph McGrath, is a Senior Associate with RPS and holds a BSc (1st Class Hons) in Biochemistry and an MSc in Applied Environmental Science and has over 10 years of experience in the field of contaminated land assessment.

Joseph is a Chartered Scientist (C.Sci) and a Chartered Water and Environmental Manager (C.WEM). He is also a full member of the Chartered Institution of Water & Environmental Management (CIWEM) and the Institute of Environmental Science (IES).

10.3 Assessment Methodology

To aid the environmental assessment process, a Preliminary Risk Assessment (PRA) desk study was prepared by RPS to examine the potential for ground contamination to be present on the site (Appendix 10A).

10.3.1 Relevant Guidance

The PRA was prepared with reference to several guidance documents which deal with the investigation and management of risk associated with contaminated land. The PRA was prepared utilising guidance provided by the UK Environment Agency (EA). The UK technical guidance for assessing and managing risks from contaminated land is detailed in ‘Land Contamination Risk Management’ (LCRM) - How to assess and manage the risks from land contamination, October 2020’. This guidance is accepted by the EPA (in the absence of Republic of Ireland Government guidance).

The PRA has been prepared in accordance with the following:

- Land contamination risk management (LCRM) - How to assess and manage the risks from land contamination. Environment Agency, October 2020.
- Redeveloping Land Affected by Contamination – A developers Guide to Planning Considerations and Environmental Responsibilities. DAERA, April 2019.

Underpinning the guidance within LCRM 2020 is a source-pathway-receptor methodology, which is used to identify Significant Pollutant Linkages (SPLs). The following definitions apply:

- **Source:** a contaminant or pollutant that is in, on or under the land and that has the potential to cause harm or pollution.
- **Pathway**: a route by which a receptor is or could be affected by a contaminant.
- **Receptor**: something that could be adversely affected by a contaminant, for example a person, controlled waters, an organism, an ecosystem, or Part 2A receptors such as buildings, crops or animals.

An important thread throughout the overall process of risk assessment is the need to formulate and develop a conceptual model for the site, which supports the identification and assessment of pollutant linkages. Development of the conceptual model forms the main part of the PRA, and the model is subsequently refined or revised as more information and understanding is obtained through the risk assessment process. A risk is present only when a source-pathway-receptor linkage is present and active. Without a pollutant linkage, there is no risk, even if a contaminant is present.

The EIA was undertaken in accordance with the requirements of the following documents:

- Directive 2011/92/EU and its amendment in 2014 by Directive 2014/52/EU.
- EPA Publication, 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports', Environmental Protection Agency, Draft, August 2017.
- 'The Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment', Planning and Local Government, August 2018.
- Institute for Geologists Ireland (IGI) Guidance for the preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements, April 2013.
- 'Geology in Environmental Impact Statements', published by The Institute of Geologists of Ireland in September 2002, has been consulted. This document outlines the main geological issues that should be considered when undertaking an EIA.
- The National Roads Authority, Ireland guidelines; 'Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes', published in 2008. These guidelines aim to provide guidance on the assessment of geological, hydrological and hydrogeological impacts through the EIA process.

10.3.2 Human Health Risk Assessment

Guidance provided by the UK Environment Agency (EA) has been used to form the basis of this assessment.

The EA has published guidance in relation to assessing the potential risk from contaminated land to human health. Science Report SR2 'Human Health Toxicological Assessment of Contaminants in Soil' and Science Report SR3 'Updated Technical Background to the CLEA Model', together with Land contamination risk

management (LCRM) - How to assess and manage the risks from land contamination. Environment Agency, October 2020, provide the most up to date framework for human health risk assessment within the UK.

To assess the human health and environmental risks posed by potential contaminants within the underlying soils, RPS undertook an initial screening of the laboratory results using the 2015 LQM/ CIEH (Land Quality Management/ Chartered Institute of Environmental Health) Suitable 4 Use Levels (S4ULs) (Copyright Land Quality management Limited reproduced with permission; Publication Number S4UL3474, all Rights Reserved) as trigger values. These LQM/ CIEH S4ULs replace the second edition of the LQM/ CIEH Generic Assessment Criteria (GAC) published in 2009. Differences in modelling assumptions and added land uses and substances create the difference between these S4ULs and the previous GAC. These values are provided for six land use classifications:

- Residential with homegrown produce
- Residential without homegrown produce
- Allotments
- Commercial
- Public open space near residential housing
- Public park

For pollutants with no relevant S4ULs, assessment criteria were provided by Soil Guideline Values (SGVs) and CL:AIRE's (Contaminated Land: Applications in Real Environments) GAC. In light of the publication of SR2 and SR3 the Environment Agency published SGVs for a number of contaminants for the following standard land use scenarios assuming a Sandy Loam soil and Soil Organic Matter (SOM) content of 6%:

- Residential
- Allotments
- Commercial

CL:AIRE in association with The Environmental Industries Commission (EIC) and Association of Geotechnical and Geo-environmental Specialists (AGS) published a set of GAC in 2009 for previously unpublished contaminants which are intended to complement the SGVs derived by the Environment Agency. The GACs have been derived predominantly for VOCs and SVOCs using CLEA v1.06 for a number of different Soil Organic Matter contents (1%, 2.5% and 6%).

Public Open Space Near Residential Housing screening values have been used in this assessment as they are most pertinent to the site.

10.3.3 European Union Legislation

European legislation is a significant consideration in assessing the effects of a scheme on the geological and hydrogeological attributes of a site and is outlined below.

The Water Framework Directive (2000/60/EC) establishes a framework for community action in the field of water policy. The Directive introduced new broader ecological objectives as well as aims to prevent the deterioration of all water bodies. The Directive must be considered in any scheme that has the potential to impact on any part of the water environment. The Water Framework Directive has been transposed into Irish law by means of a number of statutory instruments. The European Communities (Environmental Liability) Regulations 2008 (S.I. 547 of 2008) came into force in Ireland in April 2009. EU Directive 2004/35/CE on environmental liability with regard to the prevention and remedying of environmental damage is transposed into Irish law via these regulations. Their purpose is to establish a framework of environmental liability based on the 'polluter-pays' principle, to prevent and remedy environmental damage.

10.3.4 Significance of Effects

Effects of the Proposed Development on soils, geology and hydrogeology receptors have been assessed taking into account the sensitivity of the receptor and the magnitude of the effect. The sensitivity of the receptors is determined according to the methodology described in Table 10.1.

Table 10.1: Sensitivity of Receptor.

Sensitivity	Criteria	Typical Examples
Very high	High importance and rarity on regional or national scale and very limited potential for substitution.	Geology: World Heritage Sites or site protected under EU wildlife legislation (SAC, SPA, SSSI, Ramsar site) or geological features that are rare on a regional or national scale.
High	High importance and rarity on local scale.	Geology: Regionally Important Geological Sites. Soils: Well drained and/ or high fertility soils. Groundwater: Regionally important potable water source supplying >2,500 homes, groundwater vulnerability is classified as high; principal aquifer providing a regionally or locally important resource or supporting site protected under wildlife legislation.
		Future site users: Sensitive land uses proposed such as residential housing with gardens, allotments, schools. Built Environment: Sites of international Importance, World Heritage Sites, Listed Buildings, Scheduled Monuments.
Medium	Attribute has a medium quality and rarity on local scale.	Geology: Regionally Important Geological Sites. Soils: Moderately drained and/ or moderate fertility soils. Groundwater: Local potable water source supplying >50 homes, moderate classification of groundwater vulnerability; secondary aquifer providing water for agricultural or industrial use with limited connection to surface water.

Sensitivity	Criteria	Typical Examples
		Future site users: Moderately sensitive land uses such as residential housing without gardens, commercial developments and open spaces. Built Environment: Sites with local interest for education or cultural appreciation.
Low	Attribute has a low quality and rarity on local scale.	Geology: Rock exposures. Soils: Poorly drained and/ or low fertility soils. Groundwater: Local potable water source supplying <50homes, deep secondary aquifer with poor water quality not providing base flow to rivers.
		Future Site Users: Low sensitivity land use such as Industrial Sites, highways and rail. Built Environment: Infrastructure (e.g. Roads, railways, tramways).
Neutral	Very low importance and rarity on local scale.	Geology: No rock exposures. Soils: Urban classified soils. Groundwater: Non-aquifer/Unproductive Strata.
		Future Site Users: No sensitive land use proposed.

For the purposes of this assessment, it is considered that Regionally Important (R) Aquifers are Principal Aquifers; Locally Important (L) Aquifers are Secondary Aquifers and Poor (P) Aquifers are Unproductive Strata. Different classifications exist for each of the aquifer types, as listed below:

Regionally Important (R) Aquifers:

- Karstified bedrock (Rk) where Rkc represents an aquifer dominated by conduit flow and Rkd represents an aquifer dominated by diffuse flow
- Fissured bedrock (Rf)
- Extensive sand and gravel (Rg)

Locally Important (L) Aquifers:

- Bedrock which is generally moderately productive (Lm)
- Bedrock which is moderately productive only in local zones (Ll)
- Sand & gravel (Lg)
- Locally important karstified bedrock (Lk)

Poor (P) Aquifers:

- Bedrock which is generally unproductive except for local zones (Pl)
- Bedrock which is generally unproductive (Pu)

10.3.5 Impact Assessment

The magnitude of a potential effect is independent of the sensitivity of the feature. The magnitude considers the scale of the predicted change to the baseline condition taking into account its duration (i.e. the magnitude may be moderated by the effects being temporary rather than permanent, short term rather than long term) and whether the effect is direct or indirect. Definitions for impact magnitude are described in Table 10.2.

Table 10.2: Criteria to Determine the Magnitude of Effect.

Magnitude	Criteria	Typical Examples
Major adverse	Total loss or major alteration to key features of the baseline conditions such that post development character/ composition of baseline condition will be fundamentally changed.	Pollution of potable sources of water abstraction. Loss of, or extensive change, to an aquifer, groundwater supported designated wetlands. Loss of, or extensive change, to nationally important geological features.
Moderate adverse	Loss or alteration to one or more key features of the baseline conditions such that post development character/ composition of baseline condition will be materially changed.	Partial loss or change to an aquifer. Partial loss of the integrity of groundwater supported designated wetlands. Permanent loss of, regionally important geological features, or substantial changes to nationally important geological features.
Minor adverse	Results in some measurable change in attributes quality or vulnerability compared to baseline conditions. Changes arising from the alteration will be detectable but not material; the underlying character/ composition of baseline condition will be similar to the pre-development situation.	Measurable impact or aquifer but of limited size or proportion, which does not lead to a reduction in the aquifer status. Minor effects on groundwater supported wetlands. Loss of, or extensive change, to locally important geological features
Neutral	Very little change from baseline conditions. Change is barely distinguishable approximately to a “no change” situation.	No measurable impact upon groundwater. No measurable impact on geological features.
Beneficial	Benefit to, or addition of, key characteristics, features or elements compared to baseline conditions.	Treatment or removal of contaminated soils from site. Improvement to geological features

The significance of a specific potential effect was derived from both the sensitivity of the feature and the magnitude of the effect and was determined using the matrix presented in Table 10.3. Effects can be beneficial, adverse or neutral and their significance Very Large, Large, Moderate, Slight or Neutral or an intermediary designation as cases dictate based on professional judgement. The significance of an impact was also qualified based on the likelihood of an effect occurring (using a scale of certain, likely or unlikely) and the confidence in the accuracy of the assessment. Professional judgement was used to vary the category where specific circumstances dictated, for example due to the vulnerability or condition of the receptor.

Table 10.3: Assessment of Significance Matrix.

Sensitivity of Attribute	Magnitude of Effect			
	Major	**Moderate**	**Minor**	**Neutral**
High	Large/ very large	Moderate/ large	Slight/ moderate	Neutral
Medium	Large	Moderate	Slight	Neutral
Low	Slight/ moderate	Slight	Neutral	Neutral
Neutral	Neutral	Neutral	Neutral	Neutral

The potential significance of these effects was assessed using Table 10.3. The rationale for the assessment of significance is based on the risk assessment process and therefore, takes account of the different sensitivities (importance) of the potential human health and environmental receptors.

10.4 Receiving Environment

10.4.1 Solid Geology

A review of the Geological Survey of Ireland (GSI) web viewer indicates that the solid geology of the Burrow is mostly made up of Argillaceous bioclastic limestone and shale of the Malahide Formation, a portion of the northern area of the site is made up of Calcareous shale, limestone conglomerate of the Tober Colleen Formation. This is observed from the Geological Survey of Ireland (GSI), 1:100,000 mapping in Figure 10.1.

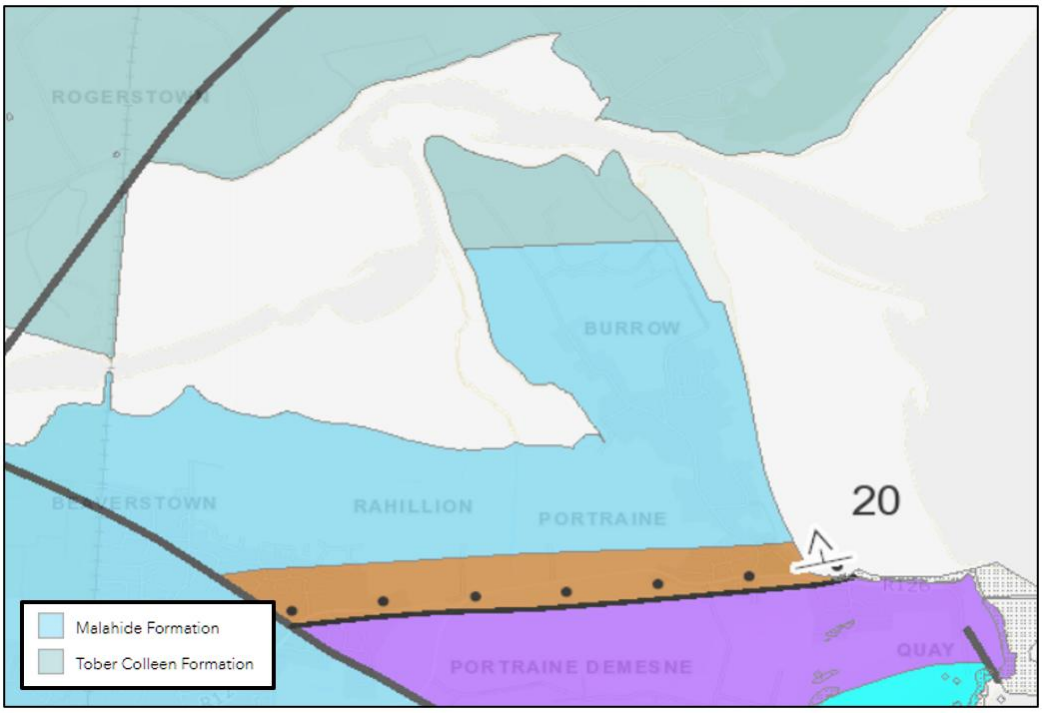


Figure 10.1: Solid Geology (taken from GSI)

10.4.2 Drift Geology

Review of the quaternary sediments map for the area shows that the inner site is made up of marine windblown sands (Figure 10.2). The yellow shade on the eastern flank and to the northwest of the site is made up of estuarine silts and clays.

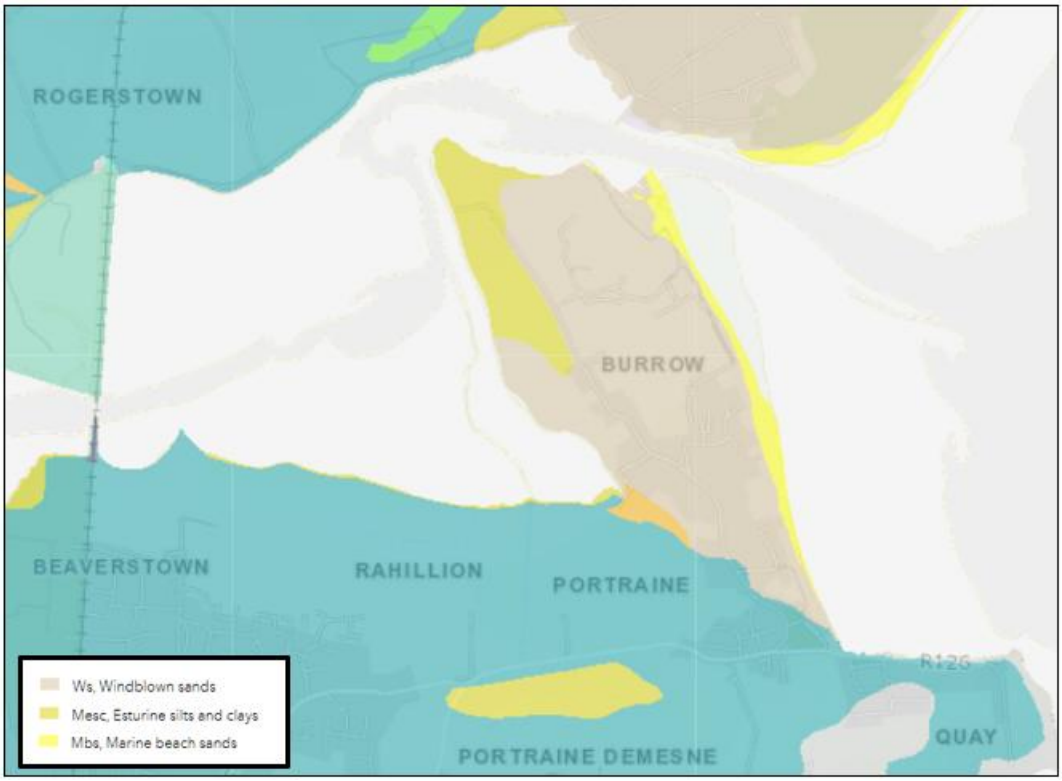


Figure 10.2: Drift Geology (taken from GSI).

10.4.3 Hydrogeology

The GSI map for bedrock aquifers, characterises the mid to southern portion of the site as 'LI' being a locally important aquifer - Bedrock which is moderately productive only in Local Zones (Figure 10.3). The northern portion is characterised as 'PI' being a poor aquifer - Bedrock which is generally unproductive except for local zones.

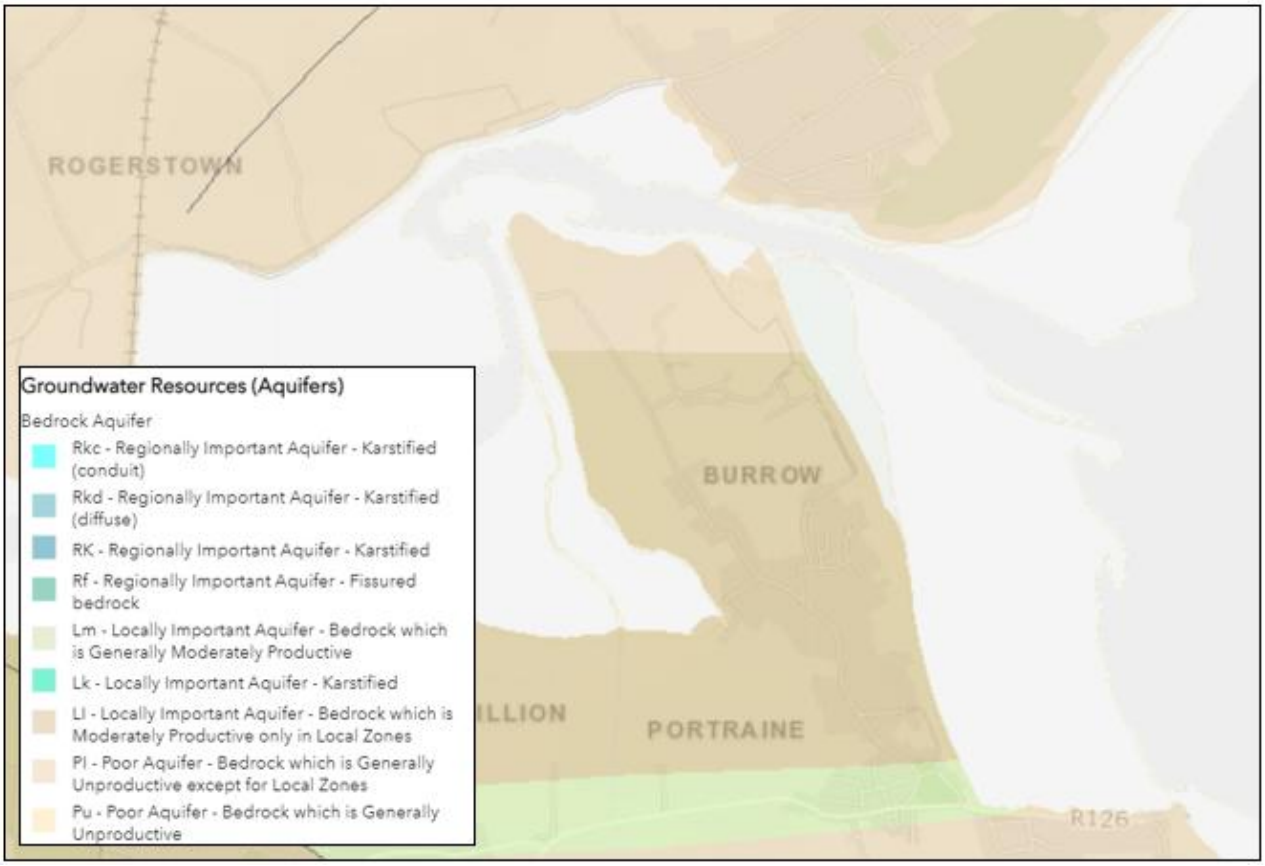


Figure 10.3: Bedrock Aquifer (taken from GSI).

10.4.4 Groundwater Vulnerability

According to the GSI map for groundwater vulnerability, the majority of the site has a high groundwater vulnerability indicating that the natural groundwater may be easily contaminated by human activities (Figure 10.4). A small portion of the site to the west and northwest is classified as being of low vulnerability.

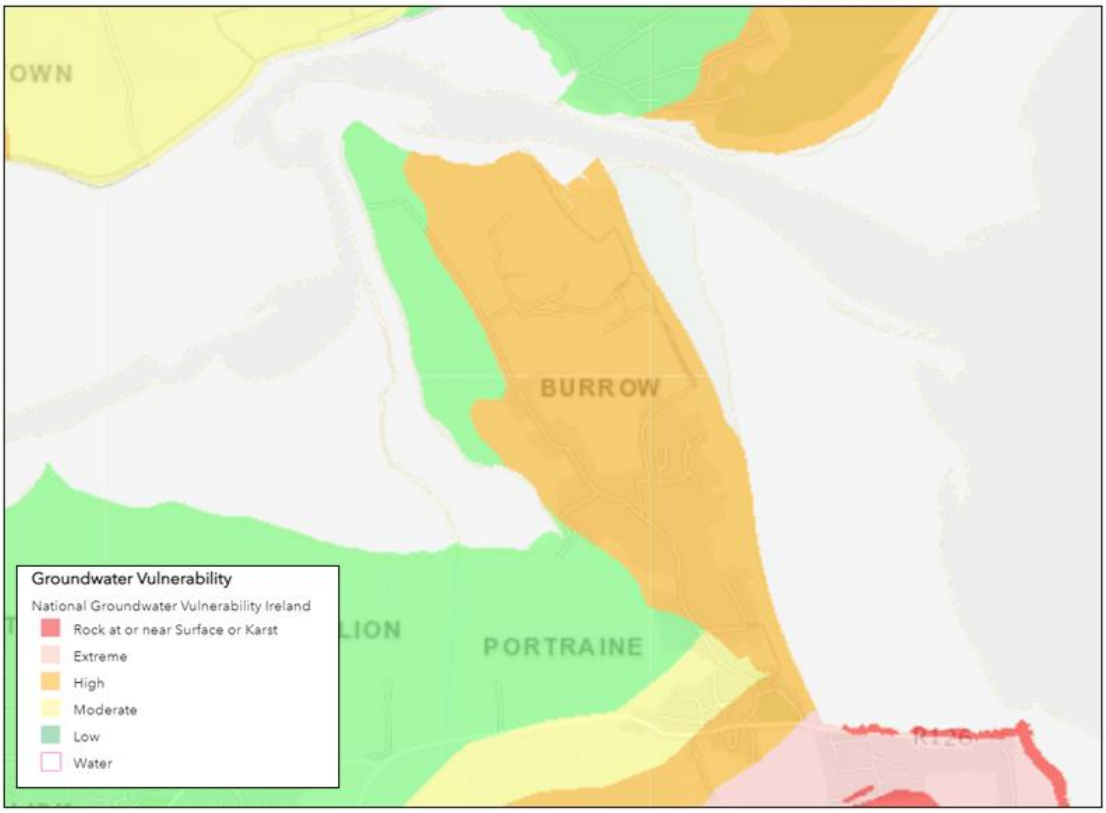


Figure 10.4: Groundwater Vulnerability (taken from GSI).

10.4.5 Surface Water

To the immediate west of the site is the Rogerstown Estuary, and to the immediate east of the site is the Irish Sea. There are no known river surface waters nearby (Figure 10.5).



Figure 10.5: Surface Water Features (taken from GSI).

10.4.6 Summary of Preliminary Risk Assessment

In order to consider potential risks at the site, a conceptual site model was developed, to examine the potential source - pathway - receptor linkages that may exist on the site.

10.4.6.1 On site contamination sources - Current

Current on site land use contamination sources have been identified at the Burrow, a number of above ground fuel storage tanks are present associated with home heating oil. If contamination is present an active pollutant linkage is likely absent due to the site's end use being a coastal flood and erosion protection scheme with the introduction of groynes, beach renourishment, seawalls and embankments. Another possible source of contamination may include made ground beneath any buildings such as residential properties. This made ground is likely of unknown nature and quantity. Made ground underlying the site would have the potential to contain contamination and generate elevated concentrations of ground-borne gases such as methane and/ or carbon dioxide and the depletion of oxygen levels. Due to the end use of the site being a coastal protection scheme the likelihood of ground gas impacting any receptors is low. Ground gas is also unlikely to be a risk given no new buildings are proposed.

10.4.6.2 On-site contamination sources – Historical

A review of historical mapping shows that a portion of the inner site has experienced development over time, mainly in the form of a large number of residential properties of which a proportion have been constructed without planning permission. Lands to the east form the main Portrane beach area which has been undeveloped overtime. There are no historical contaminative land uses on site.

10.4.6.3 Off-site contamination sources – Current

The surrounding land use to the south of the site comprises predominantly commercial and residential properties in the main Portrane townland. Current offsite contamination sources are limited but may be associated with any fuel tanks in the site vicinity. Given the site's end use, the likelihood of hydrocarbon contamination associated with any fuel tanks impacting human health receptors or groundwater/ surface waters is deemed to be minimal.

The site would be subject to a number of coastal protection measures such as beach renourishment, and a suitable sand source would be brought to the site from a licensed dredging programme most likely in Liverpool Bay. The material would be clean and inert, having been tested as part of the dredging programme and will be transported by sea to the Burrow and delivered to the beach by pipe. A source of contamination associated with this dredged material for beach renourishment can be ruled out of this assessment.

10.4.6.4 Off-site contamination sources - Historical

Historically potentially contaminating activities are absent in the area surrounding the site. The south of the site around the area of Portrane has experienced development over time but this is not of a contaminative nature.

10.4.6.5 PRA Conclusion

The desk study has highlighted that no significant pollutant linkages are considered to be present within the Study Area.

10.4.7 Ground Investigation

Ground investigation works were undertaken by Ground Investigations Ireland (GII) between January and March 2022 at the site. The ground investigation comprised the following:

- 26 No. Window Sample Boreholes to recover soil samples.
- 31 No. Dynamic Probes to determine soil strength/density characteristics.
- 7 No. Cable Percussion boreholes to a maximum depth of 10.0m BGL.
- 5 No. Rotary Core Boreholes to a maximum depth of 18.80m BGL (2 as follow on from Cable percussion holes and 3 from base of cable percussion or window sample hole).
- Installation of 4 No. Groundwater monitoring wells.
- Geotechnical and Environmental Laboratory testing.

10.4.7.1 Ground Conditions Encountered

The ground conditions encountered during the investigation are summarised below with reference to in situ and laboratory test results. The full details of the strata encountered during the ground investigation are provided in the exploratory hole logs, within the Rogerstown Coastal Flood and Erosion Relief Scheme Ground Investigation Report, included in Appendix 10B of this EIAR.

The sequence of strata encountered was variable across the project area but generally comprised;

- Topsoil/ Surfacing.
- Made Ground.
- Granular Deposits.
- Cohesive Deposits.
- Bedrock.

10.4.7.2 Topsoil/ Surfacing

Topsoil was encountered in some of the exploratory holes and was present to a maximum depth of 0.3m BGL. Granular deposits were encountered from the surface in window sample holes drilled along Portrane beach.

10.4.7.3 Made Ground

Made Ground deposits were encountered beneath the Topsoil/ Surfacing at some locations on the northern side of the Rogerstown Estuary, generally around the Channel Road and Shore Road and were present to a depth of up to 1.6m BGL. These deposits varied, however they were generally described as brown clayey sandy gravel

or clayey gravelly sand with occasional cobbles and in some places contained occasional fragments of concrete, glass, red brick, glass and plastic.

10.4.7.4 Cohesive Deposits

Alluvial and glacial derived cohesive deposits were encountered in some of the boreholes and window samples across the project area with varying strength deposits encountered.

The presumed glacial derived cohesive deposits were typically described as firm to very stiff brown or dark grey slightly sandy slightly gravelly clay with occasional cobbles. These deposits had some or occasional cobble and boulder content as noted on the exploratory hole logs. The strength of these cohesive deposits varied however typically they were firm or firm to stiff and increased with depth.

The presumed alluvial derived cohesive deposits were described typically as either grey slightly sandy silty clay or grey slightly sandy clayey silt. The secondary sand and gravel constituents varied across the site and with depth. The strength of the alluvial cohesive deposits was typically very soft or soft to firm.

10.4.7.5 Granular Deposits

Granular deposits were encountered within the majority of the holes and were typically described as grey or brown sandy fine to coarse gravel or gravelly fine to coarse sand. The secondary sand/ gravel and silt/ clay constituents varied across the site and with depth while occasional cobble content was also present and noted on the exploratory hole logs.

Based on the standard penetration test (SPT N) values the deposits varied across the different areas ranging from very loose to dense however typically the density increases with depth. Groundwater strikes were noted in some of the boreholes in the granular deposits.

10.4.7.6 Bedrock

In the southern area of the site at the south end of Portrane Beach BH29 encountered weathered rock at a depth of 10.80m BGL and recovered red, extremely weak to weak, fine to coarse grained sandstone. BH05 encountered possible rock at a depth of 18m BGL described as medium strong to strong grey limestone, however this was logged as a possible boulder.

10.4.7.7 Groundwater

Groundwater strikes are noted on the exploratory hole logs where they occurred and where possible drilling was suspended for twenty minutes to allow the subsequent rise in groundwater to be recorded. These exploratory holes did not remain open for sufficiently long periods of time to establish the hydrogeological regime and groundwater levels would be expected to vary with the tide, time of year, rainfall, nearby construction and other factors. For this reason, standpipes were installed in BH02, BH29, BH31 and BH33 to allow the equilibrium groundwater level to be determined.

10.4.7.8 Laboratory analyses

One soil sample was scheduled for laboratory analysis from WS29 as shown in Figure 10.6. Testing for the following parameters was carried out:

- Heavy metals.
- Speciated total petroleum hydrocarbons (TPHs).
- Speciated polycyclic aromatic hydrocarbons (PAHs).
- Speciated polychlorinated biphenyls (PCBs).
- Phenols.
- Inorganics.
- Asbestos screen.

The environmental testing recorded through laboratory analyses recorded minimal contamination levels at the site, through testing of the parameters as stated above. The only minor elevation recorded was that of TPH at WS29. Regarding asbestos, results from the analyses from WS29 indicate No Asbestos Detected (NAD).



Figure 10.6: Ground Investigation Locations and WS29 location (taken from Ground Investigations Ireland, Ground Investigation Report, May 2022)

10.5 Impact Assessment

10.5.1 Construction Phase

The impact of the development on groundwater dynamics is considered to be negligible as there will be no significant earthworks which would impact quantity or flow.

Construction impacts may also include noise, dust, odour and site traffic generation problems as well as potential contamination of water quality arising with the use of fuel storage tanks, vehicles and the use of paints and oils. These impacts have been discussed in their respective chapters.

10.5.2 Operational Phase

The operational impacts of the Proposed Development are considered to be Negligible as the Preliminary Risk Assessment (PRA) has not identified a risk to human health through an active pollutant linkage. No new sources of contamination will be introduced under the proposed coastal protection scheme during operation.

The operational impacts of the Proposed Development on groundwater quality and flow are considered to be negligible as the Proposed Development end use will not include any live activities such as excavation. There may be localised changes of groundwater flow around the sheet piles of the flood walls which would be minor, with groundwater back drainage included in the design to facilitate water flow.

Overall, a medium beneficial effect has been identified for soils and geology due to the reduction of soil erosion along the Burrow coastline.

10.5.3 Inter-relationships

Soils, geology and contamination have the potential to interact with other environmental factors during the construction of the Proposed Development. In particular, mitigation proposed to mitigate soil erosion would also be applicable to preventing impacts on water quality from suspended solids and therefore also biodiversity in the area. This also applies to the mitigation to prevent contamination through oil and fuel spills, which would also mitigate pollution of soils and groundwater. The potential reuse (subject to detailed ground investigation) of excavated soils would reduce the amount of waste produced by the Proposed Development during construction. This is considered further in Chapter 16, Waste Management.

10.6 Mitigation Measures

No specific mitigation measures are proposed for the Proposed Development due to the negligible impact on the environment. Any impact on groundwater quality would be mitigated by the measures outlined in the CEMP, and Chapter 9, Water Quality.

10.7 Residual Effects

After establishing the sensitivity of the baseline environment in Section 10.4, assessing the magnitude of impact during construction and operation, and then considering mitigation measures, no likely significant adverse

effects upon the environment have been identified. A medium beneficial effect has been identified for soils and geology due to the reduction of soil erosion along the Burrow coastline.

10.8 Potential Cumulative Impacts

There are no developments within the surrounding area which may interact with the Proposed Development in terms of geology and soils. Coastal processes have been assessed in a Chapter 6 which addresses cumulative impacts associated with sediment erosion due to the hydrological link. It is envisaged that impacts as a result of interactions between Proposed Development and flood scheme proposed at Rush will be limited and there should be no adverse impacts on soils and geology.

10.9 Conclusions

The summary of environmental effects of the Proposed Development on soils, geology and contamination is presented in Table 10.4. In conclusion, no significant pollutant linkages (SPLs) were identified at the site from the PRA. The follow-on Ground Investigation and environmental sample testing recorded minimal contamination levels at the site with minor elevations in TPH at WS29.

Overall, a medium beneficial effect has been identified for soils and geology due to the reduction of soil erosion along the Burrow coastline.

Table 10.4: Summary of Likely Environmental Effects on Soils and Geology.

Receptor	Sensitivity of receptor	Description of Effect	Duration	Magnitude	Residual Effect	Significant/ Not significant
Construction phase						
Soils and Geology	Low	The coastal protection scheme would require a ground investigation to aid geotechnical design. This would result in a minor loss of soil from excavations and boreholes.	Short term	Minor	Neutral	Not Significant
Construction workers	Medium	Exposure to sub-soil contamination with elevations in TPH in WS29	Short term	Minor	Slight (Adverse)	Not Significant
Operation phase						
Soils and Geology	Low	The Proposed Development will benefit soils, sand retention and coastline preservation of the Burrow.	Medium term	Moderate	Slight (Beneficial)	Not Significant

11 ARCHAEOLOGY & CULTURAL HERITAGE

11.1 Introduction

The Archaeological Diving Company Ltd (ADCO) carried out a cultural heritage impact assessment of the Proposed Development. This chapter describes the principal cultural heritage assets and includes an impact assessment and mitigation strategy to safeguard cultural heritage within the project area.

11.2 Authority of author

The author of this chapter is Niall Brady, Director of The Archaeological Diving Company Ltd, who read Archaeology and Geography for his BA at UCD (1983), Archaeology for his MA at UCD (1986), and Medieval Studies for his PhD at Cornell University (1996). He has been Visiting Assistant Professor in Medieval History at Trinity College, Connecticut (1996-97), and has taught Underwater Archaeology at summer field school courses at Shoals Marine Laboratory, New Hampshire (1992-98). Since returning to Ireland in 1997, he co-founded The Archaeological Diving Company Ltd (1999-present) and led the Discovery Programme's Medieval Rural Settlement Project as project director (2004-10). He was elected Fellow of the Society of Antiquaries (FSA) of London (2006-present). Niall is also national representative for Ireland on the RURALIA committee on rural medieval archaeology; is honorary Newsletter Editor for the Society for Medieval Archaeology; and recently stood down as Honorary Editor for the *Journal of the Royal Society of Antiquaries of Ireland*, having served in this capacity for six volumes.

11.3 Assessment Methodology

11.3.1 Desktop Review

Information on cultural heritage assets within the Study Area was collected through a detailed desktop review of existing studies and datasets. The key data sources, as gathered from an examination that included a review of existing cartographic sources; the archival records maintained by the National Monuments Service (NMS) at the Department of Housing, Local Government and Heritage (DHLGH) that deal with pre-1750 sources and post-1750 sources; Fingal County Council's Record of Protected Structures; the National Museum of Ireland's (NMI) Topographical Files that record artefacts reported to the Museum; the national excavations database, and relevant publications which are indicated in Table 11.1.

Table 11.1: Principal sources to inform known Marine Archaeology

Data Source	Topic Focus
Historic Maps, Ordnance Survey and Admiralty Charts	Landscape and Seascape
Record of Monuments and Places (RMP), also known as the Sites and Monuments Record (SMR)	Terrestrial Archaeology
National Inventory of Architectural Heritage (NIAH)	Terrestrial Archaeology
Fingal County Council RPS	Record of Protected Structures
Topographical Files, National Museum of Ireland	Terrestrial Archaeology

Data Source	Topic Focus
Historic Shipwreck Inventory maintained by the National Monuments Service (NMS) at the Department of Housing, Local Government and Heritage.	Shipwreck, recorded and known
Integrated Mapping for the Sustainable Development of Ireland's Marine Resource' (INFOMAR) project.	Shipwreck, known
Excavations database	Licensed archaeological interventions
Publications	Archaeological information

Historic maps and charts that record the landscape provide an important starting point in archaeological landscape study. Key sources include the seventeenth century Down Survey maps, created as part of the Cromwellian assessment of lands available in Ireland for redistribution to Protestant planters.[7] These maps are supported by accompanying terriers and the Civil Survey, which is the written record of the assessment. The maps record townland names and boundaries and highlight known buildings and known infrastructure, such as roads and bridges.

The Ordnance Survey (OS) in the 1840s created the first metrically accurate maps of Ireland, and the First Edition Six-inch series is an important baseline that records the Irish landscape in detail at a time when large-scale drainage operations were under way across the country. For coastal areas, the First Edition maps provide the basis for monitoring coastal change. Subsequent editions of the OS mapping record the same information, which allows insight to questions around stability and change. The series of historic OS maps form the base maps to the online portals that record archaeological monuments.

The Record of Monuments and Places (RMP) archive, maintained by the NMS and accessible with summary descriptions online, is the principal archaeological record information relating to terrestrial sites.[8] The RMP, also known as the Sites and Monuments Record (SMR), focuses on sites that pre-date 1750 AD and all sites form part of the statutory record of protected sites.

Sites later than *c.*1750 AD are recorded in the National Inventory of Architectural Heritage (NIAH), maintained by the Built Heritage section at the DHLGH. Not all NIAH sites have statutory protection status. FCC's register is based on information first compiled online in 2001.

FCC's Record of Protected Structures (RPS) includes RMP sites as well as selected NIAH sites and carries statutory protection status.

Artefact discoveries reported to the NMI are recorded in that institution's Topographical Files archive.

The Historic Shipwreck Inventory maintained by the NMS is the principal resource for understanding the history of shipwreck off Ireland's coastline, and the Co. Dublin coastline was published by the NMS in 2008.[9] The

[7] https://downsurvey.tchpc.tcd.ie/

[8] https://webgis.archaeology.ie/historicenvironment/

[9] Karl Brady, *Shipwreck inventory of Ireland: Louth, Meath, Dublin and Wicklow* (Dublin: Stationary Office, 2008).

inventory includes recorded shipwreck events as well as the locations of known shipwreck sites. The locations of known shipwreck sites older than 100 years carry statutory protection.

Reports of shipwreck events in Ireland were written down systematically from the mid-1700s and this body of information is an important source for understanding the pattern of historic wrecking from the eighteenth century through to the modern period. The history of shipwreck before the eighteenth century is not well documented.

The records of shipwreck are numerous, but the locations of known shipwrecks are fewer. The Historic Shipwreck Inventory maintains its own register of known shipwreck sites that can be consulted online and is updated to 2018.[10] This is complemented by observations of shipwreck sites made by the Irish National Seabed Survey, INFOMAR, whose online register is updated to 2021.[11] The INFOMAR survey can provide accurate positioning information of known wreck sites that were recorded using older survey techniques.

An important archaeological resource that informs desk-based reviews is the database of previous archaeological interventions licensed by the DHLGH.[12] Accessible online, the resource focuses on archaeological excavations and is not required to include the results of non-excavation interventions, such as marine geophysical surveys and intertidal inspections.

In addition to the above resources, the Heritage Council has developed an online portal that seeks to collate the various accessible data sets to give a holistic overview of known data.[13]

11.3.2 New Intertidal Archaeology Survey

While comprehensive archives exist for archaeological and cultural heritage sites at sea and on land, the intertidal foreshore has not been considered systematically, and it is only in recent years that archaeologists have considered its potential and begun to include the foreshore zone in national surveys. Rogerstown estuary is not a location that has been surveyed in detail previously. To facilitate the walkover inspection required for the current project, an Intertidal Archaeology Survey was completed under licence from the DHLGH, licence reference 21R0183 and 21D0070, the results of which are described in this chapter.

The desktop survey and intertidal survey elements are brought together in this chapter to understand the cultural heritage environment, to appraise the potential impacts and to present appropriate mitigation within the context of the Proposed Development.

11.4 Receiving Environment

11.4.1 Cartographic sources

The Down Survey maps recorded in 1656-58 show the outline of the Burrow quite clearly, and while it is not named in its own right, it is described as a ‘Part of Nethercross’ barony in the barony map for Balrudderry and

[10] Brady, *Shipwreck inventory of Ireland*, pp 448–496; https://dahg.maps.arcgis.com/apps/webappviewer/index.html?id=89e50518e5f4437abfa6284ff39fd640

[11] www.infomar.ie

[12] www.excavations.ie

[13] https://heritagemaps.biodiversityireland.ie/WebApps/HeritageMaps/index.html

a castle and a church are recorded in Portrane[14] to the south (Figure 11.1). The parish map for Lusk and Portrane in the barony of Nethercross provides additional information, adding that the land was college land and that it was referred to as 'Connyburrow' (Figure 11.2). In earlier times, Portrane and the Burrow were part of the archiepiscopal lands of Dublin, and there is a clear reference to a rabbit warren at Portrane *c.*1200, when Archbishop Cumin granted the canons of Holy Trinity, Dublin, one hundred rabbits from his warren at Portrane.[15] The sandy soils in coastal locations were favoured as places in which to establish warrens, where the rabbits would have been relatively free from predators. The written sources, however, do not record where the warren was located. The Down Survey maps also record the Burrow as a main block of land with a narrow finger-like extension on its seaward side that runs north-south parallel to the shore. This feature is still evident today although it is merged more directly with the land block.

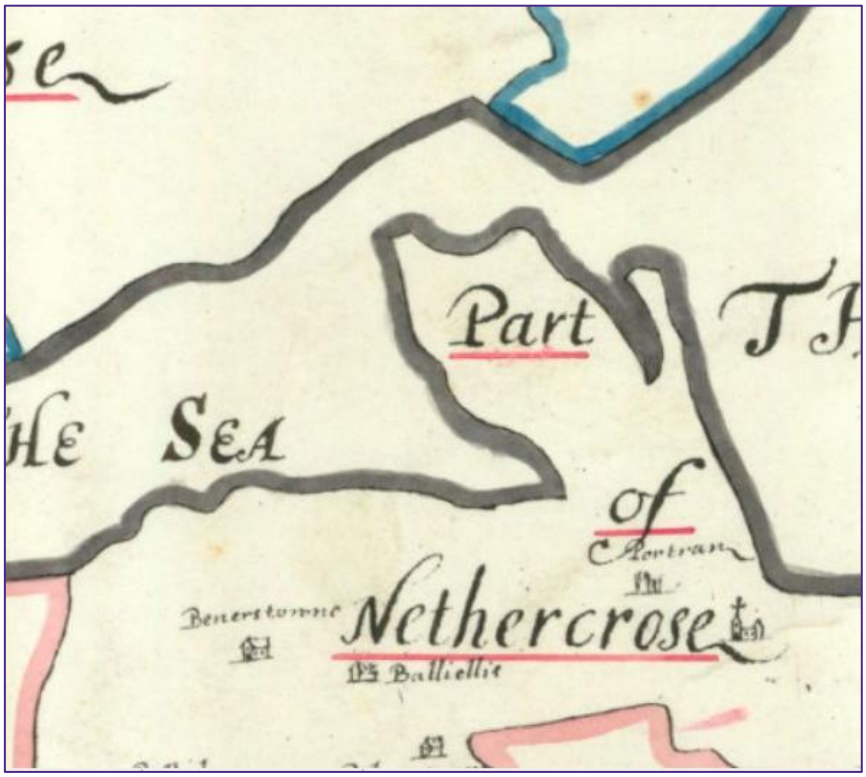


Figure 11.1: The Down Survey of 1656-58, showing the Burrow on the barony map of Balrudderry [16]

[14] Portrane was historically referred to as Portraine

[15] Margaret Murphy and Michael Potterton, *The Dublin Region in the Middle Ages. Settlement, land-use and economy* (Dublin 2010), p. 342.

[16] (*Source:https://downsurvey.tchpc.tcd.ie/down-survey-maps.php#bm=Balrudderry&c=Dublin*)

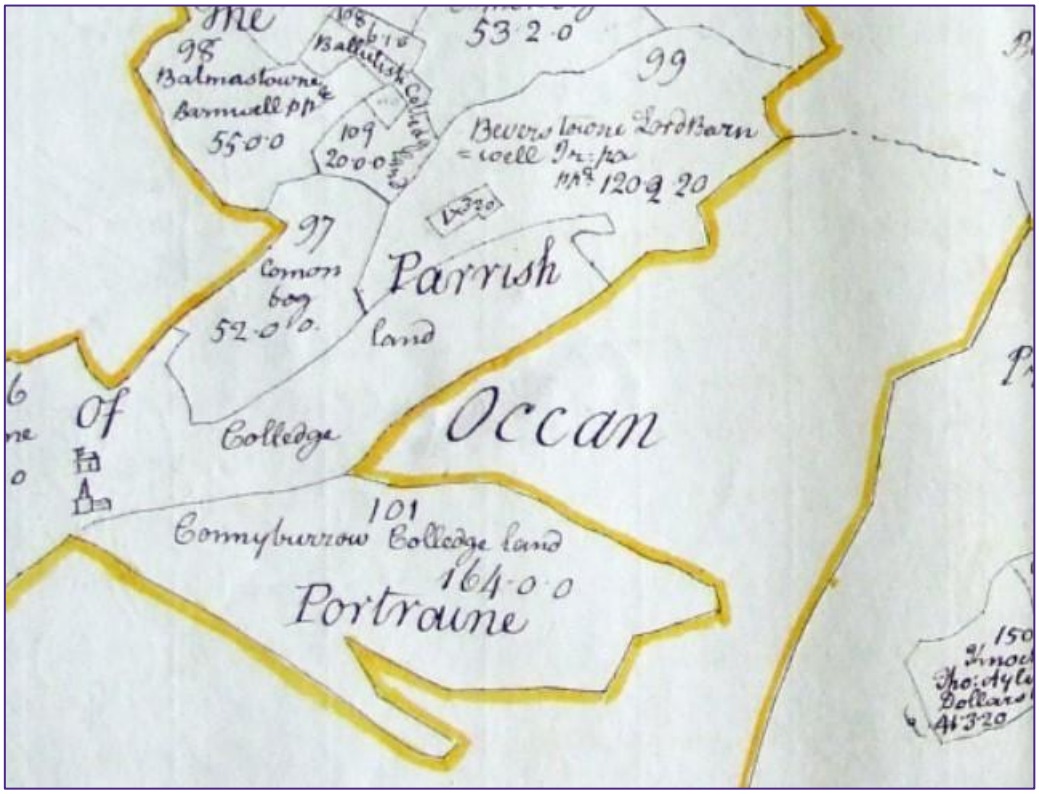


Figure 11.2: The Down Survey of 1656-58, showing the Burrow on the parish map of Lusk and Portrane in the barony of Nethercross[17]

The historic OS maps show the lightly settled nature of the Burrow, with a slightly denser clustering of settlement at its southern end in Portrane townland (Figure 11.3). The presence of two churches, St Muchuda's Well and a castle site, present the principal early archaeological remains and each of these sites is today a registered archaeological monument (RMP DU008-028, -029, 030 and -031, Table 11.2; Figure 11.5).

The Third Edition OS 6-inch map highlights the finger-like extension of land along the northeast side of the Burrow that is recorded on the Down Survey maps, by showing the intervening land area as land that is covered by spring tides.

None of the historic maps record constructed features along the foreshore indicative of fishtraps, quays or shipwreck. The landing point for a ferry that crossed the estuary to a pier in Rush is recorded on the twentieth-century maps, but there is no indication of a formal quayside or jetty at the landing point on the north end of the Burrow.

The site of the R.C. Chapel (DU008-028) recorded on the First Edition map shows the outline of the chapel building while on later maps the building is not recorded; only the footprint for the enclosed space.

[17] (*Source:https://downsurvey.tchpc.tcd.ie/down-survey- maps.php#bm=Nethercross&c=Dublin&p=Lusk+and+Portran*)



Figure 11.3: Detail from the Ordnance Survey First Edition 6-inch series showing the landscape *c.*1840[18].

[18] **(***Source: https://webapps.geohive.ie/mapviewer/index.htmlImpact Assessment***)**

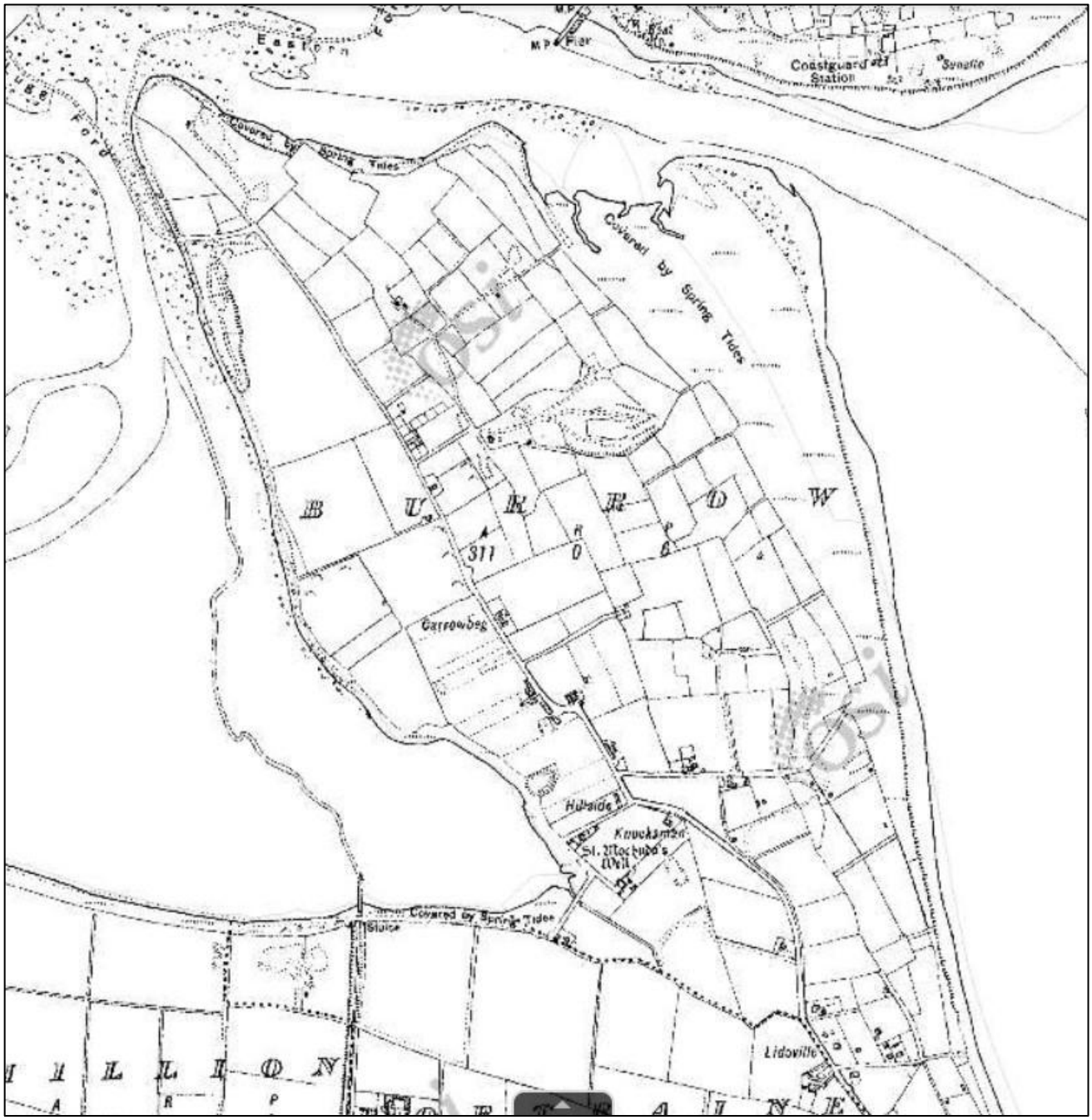


Figure 11.4: Detail from the Ordnance Survey Third Edition 6-inch series showing the landscape *c.*1911[19].

[19] (*Source: https://webapps.geohive.ie/mapviewer/index.htmlImpact Assessment*)

11.4.2 Recorded monuments and features

The recorded monuments in Portrane and Burrow townlands include the medieval-period sites noted above and would be associated with the Archbishop's landholdings at Portrane (Table 11.2; Figure 11.5). Archaeological geophysical investigations conducted under licence 16E0228 over the grounds located adjacent to Stella's Castle, DU008-030, recorded a series of potential archaeological features. Archaeological test excavation has taken place to the east of the castle under licence 12E401, in advance of residential development. No archaeologically significant levels were recorded. Archaeological excavation has also taken place within the graveyard (DU008-03102) of Portrane Church, under licence 02E1451. The work revealed disarticulated human bone, a wall fragment, two deposits of shell and a series of artefacts that includes one stone tool that is probably from early prehistory. The remaining artefacts comprise medieval and post-medieval pieces.

The one known archaeological site that lies within the working area of the Proposed Development is a burial site located in Quay townland, to the east of Portrane townland; site DU008-032. The site lies just east of a small formal burial ground, recorded on the historic OS maps as the 'Asylum Burial Ground'.

While there is a series of entries for Burrow townland in the Topographical Files of the National Museum of Ireland, they refer to remains recovered from Burrow in Sutton. There are no finds recorded for the Burrow or Portrane.

There are no entries in the National Inventory of Architectural Heritage for locations within the development area. The closest site lies to the south and refers to St Ita's Hospital, built in the 1890s, reference NIAH 11330003.

FCC's Record of Protected Structures includes the archaeological sites noted above, as well as a small collection of additional sites. The additional sites lie outside of the working area of the Proposed Development and include a terrace of single-storeyed redbrick cottages that formerly served as the staffing quarters of St Ita's Hospital. The asylum burial ground would have been associated with the hospital.

The potential for shipwreck to be identified at Portrane is highlighted by the large numbers of known wrecks recorded on Portmarnock strand to the south, where a similar but larger sand spit contains the remains of a significant number of timber shipwrecks that are exposed at Low Water Springs. There are five recorded shipwrecking events associated with Portrane, but there are no known shipwrecks to date within the Proposed Development area.

No new sites have come to light as a result of archaeological underwater inspections within Rogerstown estuary carried out by Rex Bangerter of ADCO under licences 05D0009, 05R0006.

Table 11.2: Recorded archaeological sites and features within and in proximity to the development area.

Reference	Site type/ Name	ITM Easting	ITM Northing	Impact from development
DU008-028	Chapel	724669	751675	Adjacent
DU008-029	Holy Well	724723	751538	Adjacent
DU008-030; RPS 521	Tower House	725093	751122	None
DU008-031001; RPS 522	Church	725284	750988	None
DU008-031002	Graveyard	725277	750978	None
DU008-031003	Bullaun Stone	725268	750988	None
DU008-058; RPS 523	House	724957	750928	None
DU008-032	Burial	725868	750895	None
NIAH 11330003	St Ita's Hospital	725183	750695	None
RPS	Terrace of 7 houses	725276	750868	None
W00771	James	Unknown. Rush to Portrane	Unknown. Rush to Portrane	Unknown
W00816	Unknown	Unknown. Portrane Harbour	Unknown. Portrane Harbour	Unknown
W00823	Unknown	Unknown. Portrane. Wreckage washed ashore	Unknown. Portrane. Wreckage washed ashore	Unknown
W00832	Unknown	Unknown. Portrane. Went ashore and wrecked	Unknown. Portrane. Went ashore and wrecked	Unknown
W00838	Unknown	Unknown. Dutch vessel, wrecked	Unknown. Dutch vessel, wrecked	Unknown

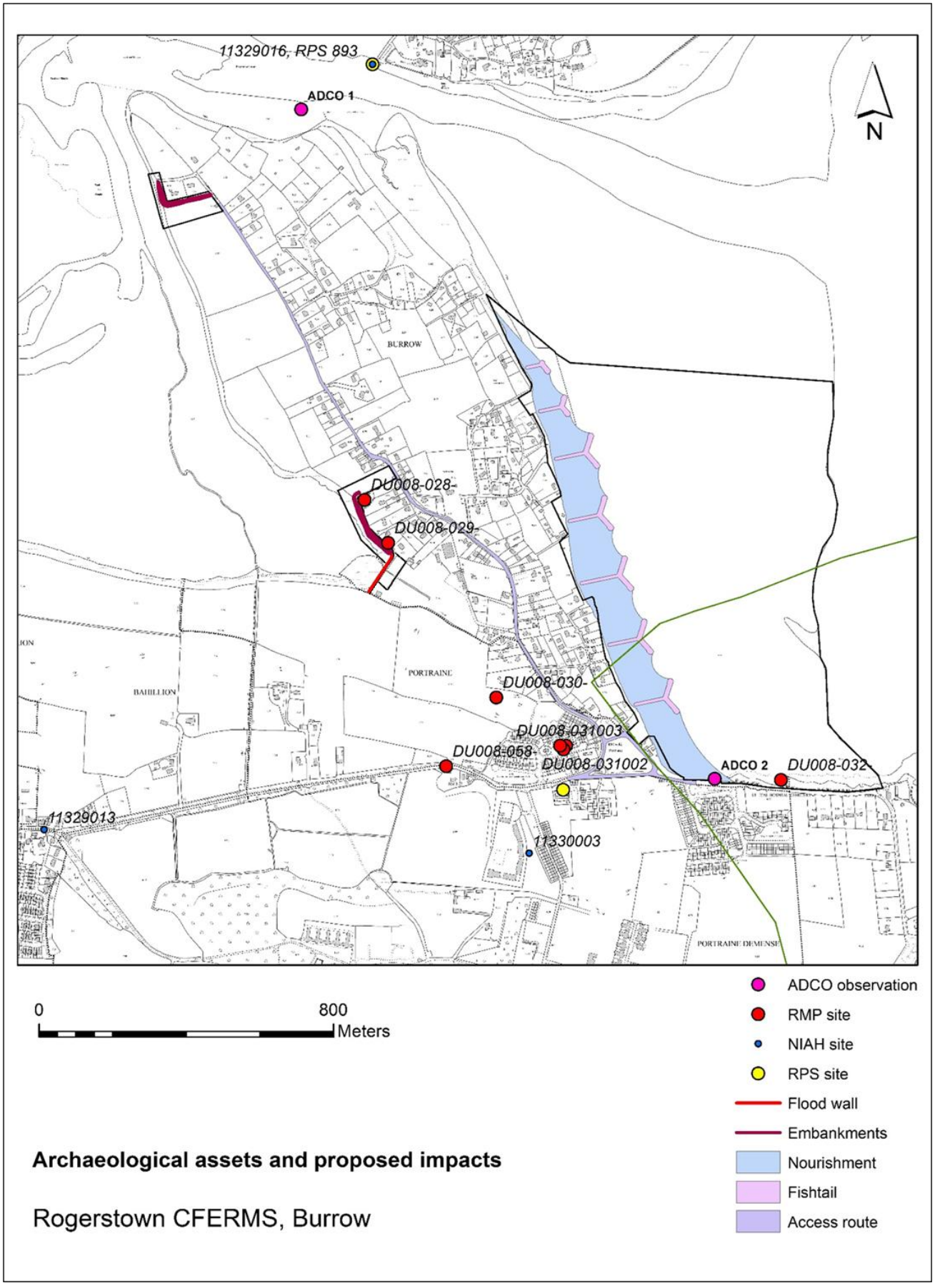


Figure 11.5: Archaeological assets adjacent to and within project area, with proposed impacts overlaid.

11.4.3 New intertidal archaeology survey

An intertidal archaeology survey was carried out at Low Water and focused on the project impact area, extending from the most south-westerly point of the sand spit in the Burrow townland, proceeding north in a clockwise manner to conclude at a south-easterly point in the Quay townland. The survey extended along the foreshore and along the corresponding roadways. No impediments to access were encountered. The observations follow the development footprint presented in Figure 11.5. A series of features were observed in addition to those already described in Table 11.2. These observations are summarised in Table 11.3 and Figure 11.5.

Marsh Lane is the existing road that runs southwest from DU008-029. It is bound by a low poured concrete and stone-tempered parapet wall (Figure 11.6). The wall is probably of early twentieth century construction and includes a culvert at its base to facilitate a tidal stream. A new flood wall will be constructed along here as part of the Proposed Development (Figure 11.7).



Figure 11.6: Detail view looking east along parapet wall on Marsh Lane.

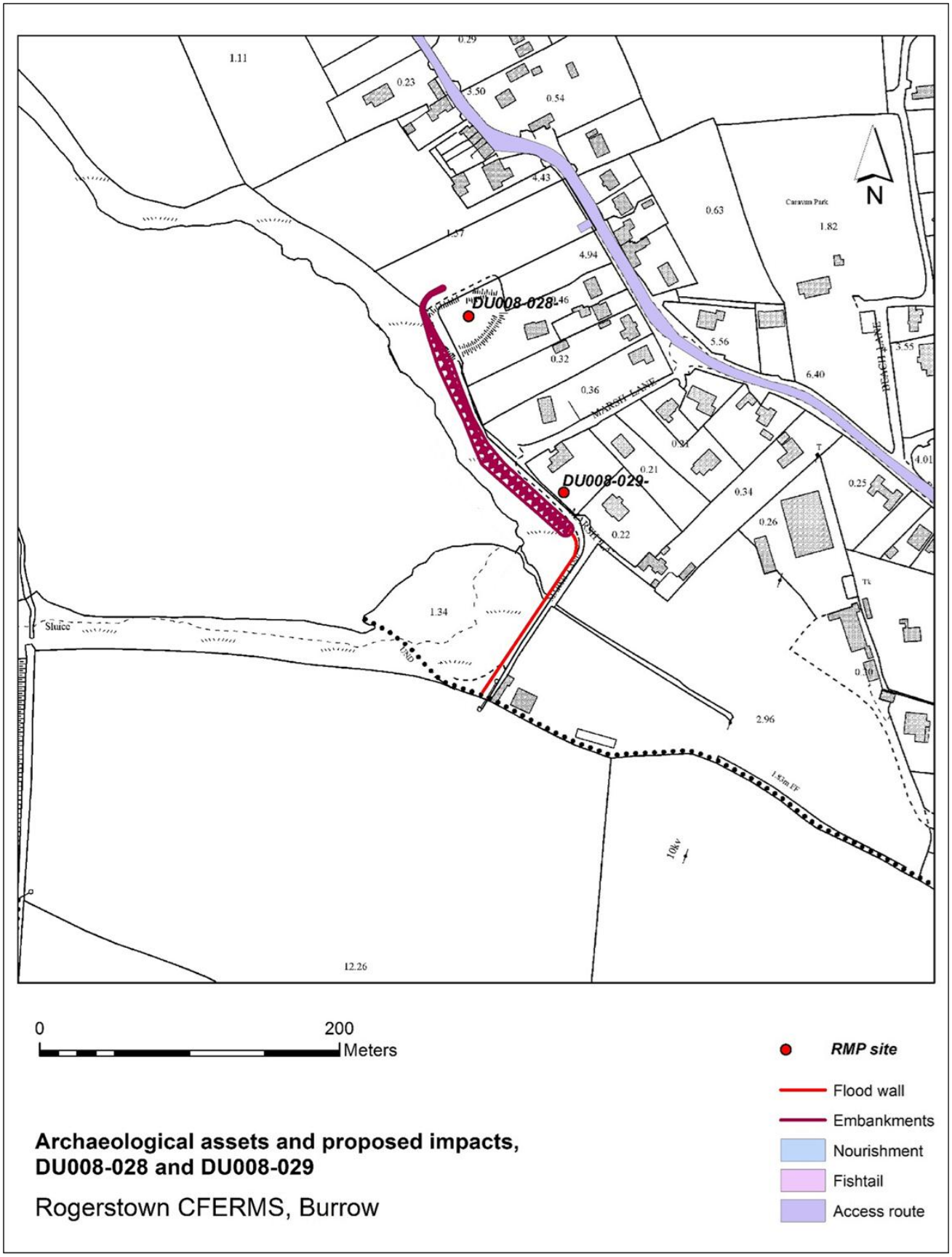


Figure 11.7: Archaeological assets DU008-028 and DU008-029 adjacent to and within project area, with proposed impacts overlaid.

The foreshore to the north along Marsh Lane has a low earthen embankment that runs alongside the lane and offers localised flood protection (Figure 11.8A). The ground is recently disturbed, indicating that there has been impacts along here. It is intended to construct a formal flood embankment that will run north to enclose the perimeter of the former R.C. Chapel site, DU008-028.



Figure 11.8: (left) view along Marsh Lane looking south at stone parapet wall. (right) View looking at nature of disturbed ground along Marsh Lane

The Holy Well site, DU008-029, as positioned by the NMS is located west of Marsh Lane, but FCC's records state that the well is located in the rear garden of a recently renovated house. Holy Well sites tend to move, as the source spring can relocate over time. Given the proximity of the well site to the proposed works, it is recommended that the location be confirmed, and that the project works avoid impacting the site. The current state of overgrowth in this location prevented confirmation of location.

As illustrated in Figure 11.9, the site of the R.C. Chapel, DU008-028, is also quite overgrown and does not permit access to confirm the presence of the chapel building recorded on the First Edition OS map.



Figure 11.9: (left) view looking north into the enclosed space that is DU008-028. (right) view looking east into the space that is DU008-028

At the west side of the Burrow, the foreshore continues to be almost flat with a very gentle slope seaward. Rough grasses and low shrub populate the shoreline, covering over a sandy surface with light shingle as illustrated in Figure 11.10.



Figure 11.10: (left) view looking north along west shore of the Burrow and (right) detail view of shoreline

The foreshore is more clearly defined at the north end of the western shore, where a more pronounced slope is established and where the vegetation cover does not reach below the High Water Mark (HWM). A soft sand surface is populated with shingle as illustrated in Figure 11.11. Localised rock armour protection exists in the vicinity of a residential complex at Burrow Road. The current soil cover at the HWM is a boulder clay till that has been introduced and lies above the rock armour, indicating that there has been localised reclamation in this location. The reclamation stands up to 2m high above the foreshore. The historic OS maps record Lugg Ford crossed the estuary from this location but there is no indication of the ford today.



Figure 11.11: (left) view looking north at north end of the Burrow. (right) view looking east along base of localised rock armour protection

The north shore of the Burrow slopes gently into the estuary channel. It retains a series of now largely ruined concrete panelling that offered coastal protection. It also retains the remains of the former ferry landing jetty that operated across the estuary to the pier head (NIAH 11329016) in Rush townland as illustrated in Figure 11.12. The jetty was constructed on a series of poured concrete-and-stone-tempered piers that supported precast concrete panels. A concrete slab laid on the shore along the west side of the jetty served as a slipway. The jetty and slipway are aligned northwest to southeast. The jetty extends approximately 22m in length, with the slipway

extending further at approximately 32m in length. While the line of the ferry route is recorded on historic OS maps, neither the jetty nor the slipway are recorded, but they do appear on ortho imagery.



Figure 11.12: (left) view of ruined concrete panels that served as coastal protection along north shore. (right) View looking south along remains of ferry jetty.

There were no additional features noted to record around the north end of the sand spit. Along its eastern side, low sand dunes are established measuring between 1m and 2m in height. A grey-coloured clay stratum is visible at the base of the dunes in places that has small stone inclusions as illustrated in Figure 11.13. There was no indication of associated human activity within the stratum, such as charcoal fragments, seashells or stone tools/ lithics that might otherwise indicate the presence of prehistoric-period activity.



Figure 11.13: View of sand dune façade at north end of the Burrow, and detail view of clay stratum at its base.

The remaining extent of the eastern side of the Burrow has a distribution of three lines of octagonal-shaped concrete coastal defence units known as seabees, that are placed on the sandy foreshore at some distance seaward of HWM as shown in Figure 11.14. Residential properties located above the HWM have elements of additional rock armour protection added, and in other locations there are sandbags.



Figure 11.14: Views of coastal defence works along the eastern shore of the Burrow.

Along the southern extent of the Burrow and just north of the former Coastguard Station, broken concrete slabs cover an outfall pipe that traverses the foreshore. This location is also where the town dump was, and its eroding face is exposed above the foreshore, as illustrated in Figure 11.15.



Figure 11.15: Views of the ruined outfall and former town dump along the eastern shore of the Burrow.

Rock armour is placed along the most southerly part of the development area on Portrane Beach. An approximately 100m-long stretch of retaining wall along Quay Road is part of the stone-built retaining wall. This structure, which is illustrated in Figure 11.16 is not recorded on the existing heritage inventories. The wall is constructed from shaped limestone blocks and survives to eight courses above the sand. It has a slightly battered profile, and the pointing appears to employ cement.



Figure 11.16: View of sea wall running along Quay Road.

Table 11.3: Features of archaeological interest recorded within and in proximity to the development area.

Reference	Site type	ITM Easting	ITM Northing	Impact from development
ADCO 1	Jetty and slipway	724564	752717	None
ADCO 2	Sea wall	725688	750898	Indirect

11.5 Impact Assessment

The Proposed Development is described in Chapter 3. Key elements from an archaeological perspective include:

- Sheet piled flood wall and embankment along Marsh Lane.
- Earth embankment at the end of Burrow Road.
- Back drainage behind the proposed defences with associated outfalls.
- Installation of non-return valves to existing outfalls to prevent backflow of water from the estuary.
- Potential utility diversions.
- Reinstatement of road, verge, etc. to former or improved condition, as necessary.
- The construction of 'Y' shaped groynes structures in combination with a beach renourishment scheme. The groyne structures will help control the longshore and cross-shore transport elements of the prevailing littoral drift along *c*.1.3km of the coastline of the Burrow.

The flood wall at Marsh Lane will be constructed as follows:

- The proposed flood wall at Marsh Lane will consist of sheet piling to the defined defence level, with a concrete strip foundation to support cladding on both sides and fixed coping detail to the top of the pile. The toe depth is likely to be in the region of -10mOD.

The demolition of the existing concrete flood wall at Marsh Lane represents a significant direct, negative and permanent impact. It is recommended that the existing wall is recorded by photography and further written record prior to its demolition.

The embankments at Marsh Lane and further north at Burrow Road will be constructed as follows:

- The proposed embankments at the Burrow Road and Marsh Lane will have 1 in 2.5 side slopes on both sides, and a 1m crest width. The base width of the embankments will be 11m and 12m wide, and it is anticipated that excavation is required to 1.5m depth.

There will be no direct impact on either DU008-028 or DU008-029, which are protected structures and both of which lie outside the working area of the Proposed Development. However, care should be taken to ensure that both the R C Chapel site and the Holy Well site are protected from indirect impacts during construction. Should impacts, direct or indirect, be required at either DU008-028 or DU008-029 such works can only proceed with the permission of the NMS and FCC.

The proposed groynes to be constructed along the east side of the Burrow will be constructed as follows:

- Seven fish-tail groyne structures will be constructed along *c*.1.3km of the beach frontage at Portrane.
- Each groyne structure will extend seaward for approximately 70m, before splitting into a "fishtail". The fishtails will extend seaward for an additional *c*.40m at a 120^{o} angle.
- The core of the *c*.70m trunk of the groyne will be constructed by re-using the existing seabee units which are already on the beach. The seabee units will be placed on a bedding player and a 0.3 – 1.0T underlayer which will be separated from the beach using a heavy-duty geotextile.
- The fishtails will be constructed exclusively of rock fill and rock armour, with the filter layer being placed onto and wrapped in a heavy-duty geotextile.
- The crest level of the groyne structures will be constructed to 4.25mOD at the closest point to the shoreline and slope to 2.85mOD at the fishtails. The fishtail sections will be constructed with a consistent crest level of 2.85mOD.

The construction of the groynes represents direct and permanent impacts on the foreshore. However, there is no known shipwreck material or associated archaeological features within the area of the groyne construction and consequently there will be no impacts on known archaeological assets at this location. The potential remains for the construction works to expose previously unrecorded archaeological features, such as buried shipwreck remains or other features that can occur on the foreshore. It recommended that any excavation and seabed/ ground disturbance works are monitored archaeologically to ensure the opportunity is taken to record and recover any material of archaeological interest that may be exposed in the course of the groyne construction.

A programme of beach renourishment will complete the works project:

- Upon completion of the groyne structures, the sub-cell areas will be filled with imported beach renourishment material.
- A Trailer Suction Hopper Dredger will provide the dredged risings for beach renourishment.
- A process involving sinker pipelines and shore pipelines will be employed to pump the risings to the foreshore.

The beach renourishment programme should ensure to avoid impacting on the sea wall, ADCO 2, along Quay Road.

11.6 Mitigation Measures

11.6.1 Pre-construction Phase Mitigation Measures

Prior to construction works commencing, an archaeological photographic record survey of the concrete retaining wall on Marsh Lane should be completed, to provide a permanent record of the wall before it is demolished.

11.6.2 Construction Phase Mitigation Measures

The following mitigation measures will be implemented by the contractor:

- Fencing will be erected at DU008-028 and DU008-029 prior to construction proceeding to ensure that no impacts, direct or indirect, occur at the protected sites. The fencing should be located at least 5m away from the known perimeter of each site.
- Archaeological monitoring will be carried out by suitably qualified and experienced maritime archaeological personnel licensed by DHLGH. Archaeological monitoring is conducted during all terrestrial, inter-tidal/foreshore and seabed disturbances associated with the development.
- The monitoring will be undertaken in a safe working environment that will facilitate archaeological observation and the retrieval of objects that may be observed and that require consideration during the course of the works.
- The monitoring will include a finds retrieval strategy that complies with the requirements of the National Museum of Ireland.
- The time scale for the construction phase will be made available to the archaeologist, with information on where and when ground disturbances will take place.
- In the event of archaeologically significant features or material being uncovered during the construction phase, machine work will cease in the immediate area to allow the archaeologist(s) to inspect any such material.
- Once the presence of archaeologically significant material is established, full archaeological recording of such material will be recommended. If it is not possible for the construction works to avoid the material, full excavation will be recommended. The extent and duration of excavation will be a matter for discussion between the client and the licensing authorities.
- It is recommended that the core of a suitable archaeological team be on standby to deal with any such rescue excavation. This would be complemented in the event of a full excavation.
- Impacts on associated features of cultural heritage interest should be avoided. These include:
    - DU008-028, chapel
    - DU008-029, Holy Well
    - ADCO 2, sea wall
- Should impacts on the above be unavoidable, a full archaeological survey should be conducted prior to impacts and subject to the approval of the NMS at DHLGH, and FCC.

11.6.3 Operational Phase Mitigation Measures

It is not anticipated that archaeological mitigation measures will be required during the operational phase of activities because the archaeological risk will be resolved during the archaeological monitoring that will be carried out during the construction phase.

However, in the event that new archaeological material is exposed during the operational phase, such finds must be reported to FCC and the NMS.

11.7 Residual Effects

It is not anticipated that archaeological material will come to light as a residual effect of the project because the archaeological risk will be resolved during the archaeological monitoring that will be carried out during the construction phase.

However, in the event that new archaeological material is exposed as a result of residual effects, such finds must be reported to FCC and the NMS.

11.8 Potential Cumulative Impacts

It is not anticipated that archaeological material will come to light as a result of potential cumulative impacts because the archaeological risk will be resolved during the archaeological monitoring that will be carried out during the construction phase.

However, in the event that new archaeological material is exposed as a result of residual effects, such finds must be reported to FCC and the NMS.

11.9 Conclusions

This chapter of the EIAR has identified, recorded and assessed the cultural heritage assets and potential impacts associated with construction and operational phases of the Proposed Development at the Burrow. It has identified a series of known features and assets that are located in proximity to but outside the working area of the Proposed Development. This assessment has also identified a series of previously unrecorded features, one of which occurs within the working area of the Proposed Development.

The impact assessment presented in this chapter concluded that the demolition of the existing concrete flood wall at Marsh Lane will result in a direct, negative and permanent impact. It is recommended that the existing wall is recorded by photography and further written record prior to its demolition. This magnitude of this impact is not considered significant.

There will be no direct impact on either DU008-028 or DU008-029, which are protected structures and both of which lie outside the working area of the Proposed Development. However, care should be taken to ensure that both the R C Chapel site and the Holy Well site and are protected from indirect impacts during construction. The construction of the groynes represents direct and permanent impacts on the foreshore. However, as there is no known shipwreck material or associated archaeological features in this area, there will be no impacts on known archaeological assets at this location, and an archaeological monitoring programme will be carried out during construction to ensure that any previously unknown archaeological material that may come to light as a result of the works activities is recorded and resolved.

In circumstances where the mitigations measures described in this chapter are fully implemented during the construction phase, the impact of the Proposed Development on cultural heritage and marine archaeology in the area will be imperceptible.

In summary, the Proposed Development is not expected to have a significant effect on cultural heritage and marine archaeology.

12 MARINE BIODIVERSITY

This chapter of the EIAR considers the key marine biodiversity receptors of relevance to the Proposed Development and considers the potential impacts from the construction, operation and maintenance of the subtidal and intertidal components, up to the Mean High-Water Spring (MHWS) mark on marine biodiversity. Marine biodiversity receptors considered as part of this section include benthic habitats, fish, shellfish and marine mammals.

For the purposes of this marine biodiversity assessment, a study area has been defined to identify potential marine biodiversity receptors which could be impacted by the Proposed Development. This Study Area has been defined based on the Proposed Development's Zone of Influence (ZoI) which encompasses the footprint of the Proposed Development (including intertidal habitats up to the MHWS mark and a buffer of 5km, i.e., the furthest extent within which impacts would be expected, as outlined in the EIA Scoping Report).

12.1 Authority of author

The author of this chapter, Chris Barrett, is a Senior Fisheries Consultant with RPS and holds a BSc (Hons) in Coastal Marine Biology and a PhD in intertidal fish ecology. Chris has ten years of experience in the field of fisheries at the Centre for Environment, Fisheries and Aquaculture Science (Cefas) prior to joining RPS.

12.2 Assessment Methodology

The impact assessment for marine biodiversity was based on the Guidelines for Ecological Impact Assessment in the UK and Ireland – Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2019), and Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA, 2017).

12.2.1 Magnitude

The magnitude of an impact was determined based on an assessment of the following attributes of the impact: spatial extent; duration (i.e. short, medium or long term); frequency; reversibility; and timing. These factors were considered together to determine the likely consequences on ecological functionality and conservation objectives of the marine biodiversity receptors. The overall magnitude was then identified from a four-point scale as presented in Table 12.1. This commonly used approach has been adapted from CIEEM (2018).

Table 12.1: Impact Magnitude Criteria.

Magnitude	Description
High	Total loss or major alteration to key elements/ features of the baseline conditions such that post-development character/ composition of baseline condition will be fundamentally changed.
Medium	Loss or alteration to one or more key elements/ features of the baseline conditions such that post development character/ composition of the baseline condition will be materially changed.
Low	Minor shift away from baseline conditions. Changes arising from the alteration will be detectable but not material; the underlying character/ composition of the baseline condition will be similar to the pre-development situation.
Negligible	Very little change from baseline conditions. Change is barely distinguishable, approximating to a "no change" situation.

12.2.2 Sensitivity, value, or importance

The value of ecological features is dependent upon their biodiversity, social and economic value within a geographic framework of appropriate reference (CIEEM, 2019). The most straightforward context for assessing ecological value is to identify habitats and species that have a specific biodiversity value recognised through international or national legislation or through local, regional or national conservation plans (e.g., Annex I habitats under the Habitats Directive). Not all marine habitats and species fall within the legislative or policy framework and, therefore, evaluation must also assess value according to the functional role of the habitat or species. For example, some features may not be protected under conservation legislation but may be functionally linked to features of high conservation value.

The sensitivity of ecological receptors is defined by an assessment of the combined vulnerability of the receptor to a given impact and the likely rate of recoverability to pre-impact conditions (CIEEM, 2018). Vulnerability is defined as the susceptibility of a habitat, community or species (i.e. the components of a biotope) to damage, or death, from a specific external factor (CIEEM, 2018). Recoverability is the ability of the same features to return to a state close to that which existed before the activity or event which caused change (CIEEM, 2018). It is dependent on its ability to regenerate, regrow, recruit, or recolonise, depending on the extent of damage incurred.

Detailed descriptions on the resistance (or vulnerability) and resilience (or recoverability) of intertidal and subtidal habitats/ biotopes are available on the MarLIN website[20] along with an evidence-based sensitivity assessment (MarESA) for a range of potential pressures. The term 'biological sensitivity' is used hereafter in the benthic ecology assessment to describe such information and is not to be confused with overall sensitivity, which also considers the value of a receptor (see below).

[20] https://www.marlin.ac.uk/sensitivity/sensitivity_rationale

These assessments were combined with the assessed conservation status (i.e. the level of designation/ importance) of the affected receptor as defined in Section 12.3.6 for the marine biodiversity Important Ecological Features (IEFs) considered in this assessment. The overall sensitivity of a receptor to an impact was then defined as presented in Table 12.2.

Table 12.2: Definition of terms relating to the sensitivity of the receptor (CIEEM, 2018).

Sensitivity	Definition
High	Nationally and internationally important receptors with high vulnerability and low to no recoverability. Regionally important receptors with high vulnerability and no ability to recover.
Medium	Nationally and internationally important receptors with medium vulnerability and medium recoverability. Regionally important receptors with medium to high vulnerability and low recoverability. Locally important receptors with high vulnerability and no ability to recover.
Low	Nationally and internationally important receptors with low vulnerability and high recoverability. Regionally important receptors with low vulnerability and medium to high recoverability. Locally important receptors with medium to high vulnerability and low recoverability.
Negligible	Locally important receptors with low vulnerability and medium to high recoverability. Receptor is not vulnerable to impacts regardless of value/ importance.

12.2.3 Significance

The significance of the effect upon marine biodiversity receptors was determined by correlating the magnitude of the impact and the sensitivity of the receptor. The method employed for the marine biodiversity assessment presented in Table 12.3.

Table 12.3: Assessment of Significance (CIEEM, 2018).

Sensitivity	Magnitude of impact			
	Negligible	**Low**	**Medium**	**High**
Negligible	Negligible	Negligible or minor	Negligible or minor	Minor
Low	Negligible or minor	Negligible or minor	Minor	Minor or Moderate
Medium	Negligible or minor	Minor	Moderate	Moderate or Major
High	Minor	Minor or moderate	Moderate or major	Major or substantial

12.3 Receiving Environment

In developing the description of the existing environment, publicly available have informed the baseline characterisation at, or in the vicinity of, the Burrow datasets (see Table 12.4 for intertidal and subtidal habitats, Table 12.7 for fish and shellfish ecology and Table 12.8 for marine mammals). These have been considered alongside a detailed site-specific survey of intertidal habitats in the vicinity of the Proposed Development.

12.3.1 Intertidal and subtidal benthic habitats

12.3.1.1 Desktop data sources

The desktop data sources set out in Table 12.4 were used to inform the baseline characterisation for the Proposed Development.

Table 12.4: Desktop sources which have informed habitat types for the Burrow.

Title	Source	Year	Author
European Marine Observation and Data Network (EMODnet) broad-scale seabed habitat map for Europe.	EMODnet	2020	N/A
Irelands Marine Atlas: Designated Sites	Marine Institute	2020(b)	N/A
National Parks and Wildlife Services website: Designated sites	National Parks & Wildlife Service	2020	N/A
Ecological Study of the Coastal Habitats in County Fingal Phase I&II. Habitats & Flora	FCC	2004	FCC
Saltmarsh restoration study, Rogerstown Estuary North Shore	FCC	2016	Natural Environmental Consultants
Rogerstown Estuary – Coastal Walking and cycling routes constraints study	FCC	2020	Atkins
Environmental constraints study	Crawley	2015	Natural Environmental Consultants

Habitat types within the vicinity of the Burrow are summarised in Table 12.6 and were identified by Aquatic Service Unit (ASU) (2022). Intertidally, the most extensive habitat recorded within the estuary was mudflat which made up the interior of the estuary, where fine sediments can accumulate due to the low energy conditions promoted by the presence of a sand spit at the mouth of the estuary (ASU, 2022). Intertidal plants include green algae (mainly *Enteromorpha* spp. and *Ulva lactuca*) which are widespread and form dense mats in the more sheltered areas. The intertidal angiosperm beaked tasselweed *Ruppia maritima* is also abundant in places beneath the algal mats (NPWS, 2013).

Both the north and south shores of the estuary support a variety of saltmarsh habitats and small patches of Annex I glasswort (*Salicornia*) beds were recorded on the southern shore of the estuary (Atkins, 2020). Annex I Atlantic salt meadows *Glauco-Puccinellietalia maritimae* made up most of the saltmarsh habitat within the study area (Atkins, 2020). This habitat is generally dominated by common saltmarsh-grass *Puccinellia maritima* and seapurslane *Atriplex portulacoides*, but also regularly supports sea aster *Aster tripolium*, sea plantain *Plantago maritima* and sea arrowgrass *Triglochin maritima* (Atkins, 2020). *Spartina* spp. sward saltmarsh habitat was also recorded extensively on the edge of the mudflats on the north shore of the estuary (Natural Environmental Consultants, 2016). However, these saltmarsh habitats on the north shore of the estuary were fragmented due to vehicle movements. Extensive swards of *Spartina* spp. were also present on the south of the outer estuary (ASU, 2022). These habitats and species are summarised in Table 12.5 and Table 12.6, and are shown in Figure 12.1.

Table 12.5: Intertidal species & habitats identified in the proximity of the Burrow from desktop data sources.

Common name/habitat type	Scientific name
Green algae	*Enteromorpha* spp. and *Ulva lactuca*
Tasselweed	*Ruppia maritima*
Glasswort (Annex I species)	*Salicornia*
Atlantic salt meadow (Annex I)	*Glauco-Puccinellietalia maritimae*
Common saltmarsh-grass	*Puccinellia maritima*
Seapurslane	*Atriplex portulacoides*
Blue mussel	*Mytilus edulis*
Lugworm	*Arenicola marina*

Subtidal areas within the Study Area are almost exclusively present outside the estuary in the Irish Sea and are dominated by circalittoral coarse sediment with circalittoral mud and, infralittoral coarse sediment also present. Patches of circalittoral rock and biogenic reef, infralittoral rock and biogenic reef and infralittoral sand are present 5km away, near Lambay Island (EMODnet, 2020). Subtidal areas are minimal within the estuary as only a small channel of water remains at low tide but are likely to comprise of soft sediments. The lugworm *Arenicola marina* is common in the outer estuary and large mussel beds *Mytilus edulis* occur at the outlet to the sea (NPWS, 2013).

12.3.1.2 Site specific surveys

A site-specific intertidal survey was carried out by ASU, across the Rogerstown Estuary in May 2022 (ASU, 2022). The survey comprised a Phase 1 intertidal walkover survey with Phase 2 sampling across the survey area. A total of 28 soft-sediment stations were sampled for benthic assessment and 30 stations were assessed as areas of biological or physical interest. Further data was collected from 30 intertidal reef locations during the survey. The intertidal soft sediment sampling involved collecting the upper 10cm of a 20 x 20cm quadrat and sieving contents through a 0.5mm mesh sieve. Retained macrofauna were then identified to species level (where possible) and quadrats were dug to 30cm to check for deeper taxa.

During the intertidal walkover survey, notes were taken in areas where sediment and/ or biogenic factor changes were noticeable; a position and photograph were taken in these locations. For the intertidal reef sampling, key habitats and species were recorded along transects; a position and photograph were taken for each habitat type.

Information from the survey data was used to assign habitat codes based on the European Nature Information System (EUNIS), (European Environment Agency (EEA), 2022). These are summarised in Table 12.6 and presented relative to the Proposed Development in Figure 12.1.

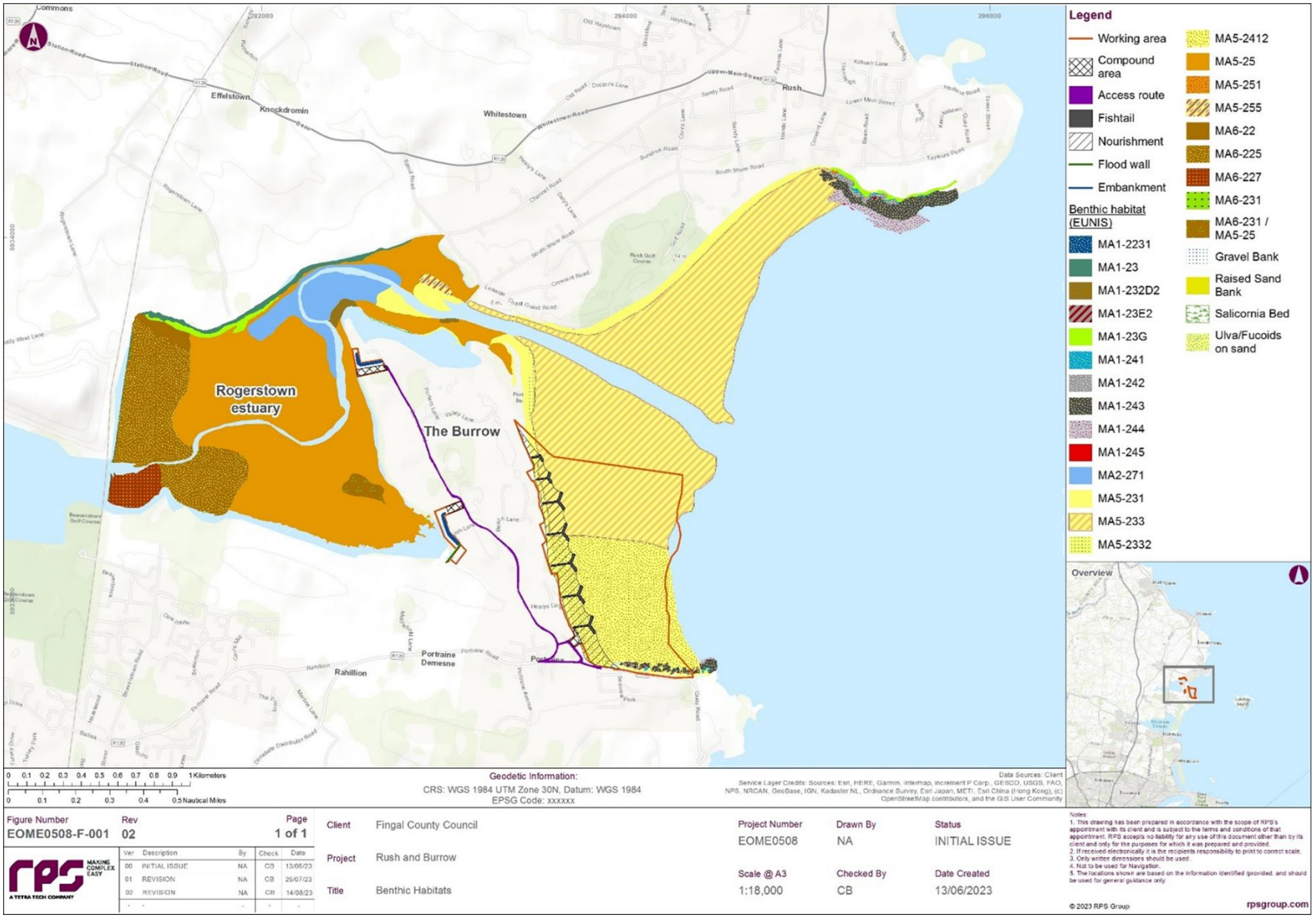


Figure 12.1: Habitat types present within the vicinity of the Proposed Development.

Table 12.6: Benthic habitat types present within the vicinity of the Proposed Development.

Habitat type	EUNIS code	Description
Littoral rock	MA1-2231	Common rock barnacle *Semibalanus balanoides* on exposed to moderately exposed or vertical sheltered eulittoral rock
	MA1-23	Seaweeds communities on full salinity Atlantic littoral rock
	MA1-232D2	*Corallina officinalis* on exposed to moderately exposed lower eulittoral rock
	MA1-23E2	Knotted wrack *Ascophyllum nodosum* on full salinity mid eulittoral mixed substrata
	MA1-23G	Gut weed *Enteromorpha* spp. on freshwater-influenced and/ or unstable upper eulittoral rock
	MA1-241	Channelled wrack *Pelvetia canaliculata* and barnacles on moderately exposed littoral fringe rock
	MA1-242	Spiralled wrack *Fucus spiralis* on full salinity exposed to moderately exposed upper eulittoral rock
	MA1-243	Bladder wrack *Fucus vesiculosus* and barnacle mosaics on moderately exposed mid eulittoral rock
	MA1-244	Serrated wrack *Fucus serratus* on moderately exposed lower eulittoral rock
	MA1-245	Sand binder *Rhodothamniella floridula* on sand-scoured lower eulittoral rock
Littoral biogenic habitat	MA2-271	Blue mussel *Mytilus edulis* beds on littoral sediments
Littoral sand	MA5-231	Barren Atlantic littoral coarse sand
	MA5-233	Amphipods and polychaete worm *Scolelepis* spp. In Atlantic littoral medium-fine sand
	MA5-2332	Speckled sea louse *Eurydice pulchra* in Atlantic littoral mobile sand
	MA5-2412	Polychaetes and tellin shell *Angulus tenuis* in Atlantic littoral fine sand
	MA5-25	Polychaete/ bivalve-dominated Atlantic littoral muddy sand
	MA5-251	Baltic tellin *Limecola balthica* and Arenicola marina in Atlantic littoral muddy sand
	MA5-255	Sand mason *Lanice conchilega* in Atlantic littoral sand
Littoral mud	MA6-22	Faunal communities of variable salinity Atlantic littoral mud
	MA6-225	Ragworm *Hediste diversicolor*, *Limecola balthica* and peppery furrow shell *Scrobiculariaplana* in Atlantic littoral sandy mud
	MA6-227	*Hediste diversicolor* in Atlantic littoral mud
Seagrass beds	MA6-231	Dwarf eelgrass *Zostera noltii* beds on Atlantic littoral mud
	MA6-231/MA5-25	*Zostera noltii* beds on Atlantic littoral mud, and Polychaete/bivalve-dominated Atlantic littoral muddy sand
Subtidal habitats	MB3	Infralittoral coarse sediments
	MC3	Circalittoral coarse sediments

12.3.2 Fish and shellfish

12.3.2.1 Desktop data sources

The desktop data sources set out in Table 12.7 were used to inform the baseline characterisation for the Proposed Development.

Table 12.7: Desktop sources which have informed fish and shellfish ecology within the vicinity of the Proposed Development.

Title	Source	Year	Author
An Offshore Wind Farm on the Kish and Bray Banks. Environmental Statement. January 2012 – Revision 1. Section 8: Marine Ecology.	Marine Environmental Impact Statement	2012	Dublin Array Offshore Wind Farm Limited (DAOWFL)
Ireland Red List No.11: Cartilaginous Fish	IUCN Red List	2016	Clarke *et al.*
Ireland Red List No.5: Amphibians, Reptiles and Freshwater Fish	IUCN Red List	2011	King *et al.*
Spawning and nursery grounds of selected fish species in UK Waters	Cefas	2012	Ellis *et al.*
An Inventory of Irish Herring Spawning Grounds	Marine Institute	2013	O'Sullivan *et al.*
Celtic Sea Trout Project (CSTP) – Technical Report	Celtic Sea trout project	2016	CSTP
Western Irish Sea *Nephrops* Grounds (FU15) 2019 UWTV Survey Report and Catch options for 2020	Celtic Sea trout project	2019	Lundy *et al.*
Fifty years of marine tag recoveries from Atlantic salmon. ICES Cooperative Research Report No. 343	Marine Institute	2018	Ó Maoiléidigh *et al.*
Sampling fish for the Water Framework Directive, Transitional Waters 2010 Rogerstown Estuary	Inland Fisheries Ireland	2010	Inland fisheries Ireland
Atlas of Commercial Fisheries for Shellfish around Ireland	Marine Institute	2017	Tully (Marine Institute)
Shellfish Stocks and Fisheries Review 2018: An assessment of selected stocks	Marine Institute	2019	Marine Institute and Bord Iascaigh Mhara
Irelands Marine Atlas: Biodiversity Maps	Marine Institute	2020(a)	N/A

12.3.2.2 Estuarine fish and shellfish communities

Fish and shellfish species identified as potentially occurring within the vicinity of the Proposed Development included:

- Demersal flatfish e.g. plaice *Pleuronectes platessa*, dab *Limanda limanda* and lemon sole *Microstomus kitt*.
- Demersal gadoids e.g. whiting *Merlangius merlangus*, sea trout *Salmo trutta*, haddock *Melanogrammus aeglefinus* and cod *Gadus morhua*.
- Other demersal species e.g., sand goby *Pomatoschistus minutus*, common goby *Pomatoschistus microps*, pipefish Syngnathinae spp., anglerfish *Lophius* spp., lesser weaver fish *Echiichthys vipera*,

sandeel *Ammodytidae* spp., common dragonet *Callionymus lyra*, pogge *Agonus cataphractus*, grey gurnard *Eutrigla gurnardus*, tub gurnard *Chelidonichthys lucerna* and butterfly blenny *Blennius ocellaris*.

- Pelagic species e.g. sprat *Sprattus sprattus*, herring *Clupea harengus.*
- Elasmobranchs e.g. thornback ray *Raja clavata*, letter spotted dogfish *Scyliorhinus canicula*, spotted ray *Raja montagui* and tope shark *Galeorhinus galaeus*.
- Migratory species e.g. Atlantic salmon *Salmo salar*, sea trout *Salmo trutta*, European eel *Anguilla anguilla*, sea lamprey *Petromyzon marinus,* river lamprey *Lampetra fluviatilis*, smelt *Osmerus eperlanus* and twaite shad *Alosa fallax*.
- Shellfish- crustaceans e.g. Norwegian lobster *Nephrops norvegicus*, velvet crab *Necora puber* and brown crab *Cancer pagurus*.
- Shellfish – molluscs e.g. blue mussels *Mytilus edulis*, Razor clams *Ensis* spp.

Cod are commonly found throughout the east Irish Sea, with spawning occurring between January and April and peaking in February and March. Spawning behaviour involves courtship in demersal environments typically consisting of sandy and boulder sediments (Grabowski *et al.*, 2012), followed by the release of buoyant eggs into the water column. Cod are of commercial importance.

Plaice spawn between January and March, with each female producing up to half a million eggs which drift passively in the plankton. Once the larvae reach a suitable size for settlement, they metamorphose into the asymmetric body shape. As juveniles, they inhabit mostly shallow water including tidal pools. In their second year, they move into deeper water and are mostly found in a depth range of 10m to 50m. Plaice are a target species in some mixed, demersal fisheries.

Whiting are common in the Irish Sea and spawning occurs between February and June. The Irish Sea provides ideal conditions for whiting spawning with sandy substrate and fast movement of water for release of eggs into the water column. After the eggs hatch, the larvae drift in surface waters for a year, and then move closer to the seabed as juveniles. Whiting are of commercial importance.

Haddock are widely distributed demersal species that occur throughout Irish and British waters at depths between 40 and 300m, occupying rock, sand, gravel or shell habitats (Barnes, 2008).

Herring are widely distributed throughout Irish and British waters and can be found in deep waters to depths of 200m; they swim through the open ocean in large schools. During spawning, they deposit eggs on a wide range of substrate types with a low proportion of fine sediment and well-oxygenated water, but preferred substrate type is gravel (Drapeau, 1973; Rogers and Stocks, 2001). These eggs adhere to the seabed and form extensive beds. Larvae have a planktonic phase and drift with the current until reaching inshore nursery grounds. After a year, herring migrate further offshore to join adults at feeding grounds. Herring are of commercial importance.

Lemon sole is a demersal species usually found on stony bottoms from depths of 20 to 200m. Spawning areas have not been fully identified, but spawning takes place in the spring. Lemon sole is a commercially targeted fish and stocks in the Irish and Celtic Seas have been declining since 2003 (Seafish, 2014).

Spotted rays have been found to inhabit inshore waters to depths of 8 to 283m. Juveniles tend to occur on sandy sediments, closer inshore, with adults occurring offshore in coarse gravel substrates. The population of

spotted ray is stable throughout its range, despite being commonly landed in fisheries, and is therefore listed on Ireland's Red List for cartilaginous fish as a species of Least Concern (Clarke *et al*., 2016).

Razor clams are commonly found throughout the Irish and British coasts and can be found in muddy sands from extreme low water to the shallow sublittoral, down to depths of around 60m. Razor clams occur along the east coast of Ireland in mud and muddy sand sediments from Dundalk to Dublin and from Cahore to Rosslare and in numerous areas along the west coast (Marine Institute and Bord Iascaigh Mhara, 2019). Blue mussels are also widely distributed throughout the northern hemisphere and all along Ireland's coastline. They are commonly found along the intertidal to the shallow sublittoral regions attached by byssus threads to hard substrate.

In 2010, a Water Framework Directive (WFD) surveillance monitoring programme was carried out in the Rogerstown Estuary. Fish and shellfish identified within the study area include plaice, cod, whiting, European eel *Anguilla anguilla*, sand goby, lesser sandeel *Ammodytes tobianus*, thick lipped grey mullet *Chelon labrosus*, flounder *Platichthys flesus*, five bearded rockling *Ciliata mustela*, sprat, sand smelt *Atherina presbyter*, corkwing wrasse *Crenilabrus melops*, fifteen-spined stickleback *Spinachia spinachia*, short-spined sea scorpion *Myoxocephalus scorpius*, gunnel *Pholis gunnellus*, pollack *Pollachius pollachius*, and brill *Scophthalmus rhombus.*

12.3.2.3 Migratory species

Atlantic salmon spend most of their lives at sea, growing rapidly and only returning to freshwater environments to spawn. Smolts then undertake a seaward migration through an estuary into marine waters. Atlantic salmon are found extensively around the coast of Ireland and in its estuaries however they have not been confirmed in the Rogerstown Estuary (IFI, 2018).

Atlantic salmon are widely distributed throughout Ireland and are recognised as an Annex II (EU Habitats Directive) species, an OSPAR species and declared as Vulnerable on the Ireland Red List (King *et al*., 2011).

Sea trout *Salmo trutta,* sea lamprey *Petromyzon marinus,* river lamprey *Lampetra fluviatilis,* European eel, twaite shad *Alosa fallax,* and Atlantic salmon *Salmo salar* are likely to transit the western Irish Sera from rivers located along the east coast of the Republic of Ireland.

Sea trout are widely distributed and remain within nearshore waters rather than undergoing extensive migration offshore (CSTP, 2016; DECC, 2009). Records from Biodiversity Maps indicate that sea trout are present in rivers all along the east coast of the Republic of Ireland and Northern Ireland. Sea trout are an OSPAR species and identified as Least Concern on the Ireland Red List.

European eels have a complex life history with two stages of metamorphosis. Once eels have reached the continental shelf from their spawning grounds in the Sargasso Sea, they metamorphose into 'glass eels'. Some will remain in the marine environment and others migrate up rivers and move between marine, estuarine and freshwater environments. They may remain there for up to 60 years before returning to their spawning grounds (Malcolm *et al*., 2010). Little is known about the migratory routes taken by eels but the timing of migration peaks in Irish waters is thought to be August to November (Sandlund *et al*., 2017).

The sea and river lamprey share similar ecologies and are both distributed throughout Irish waters. Spawning occurs between May and June in estuaries, with the eggs deposited in redds excavated in gravel. After five years in freshwater the lamprey travel to the open sea where they mature (Maitland, 2003; Igoe *et al*., 2004).

Sea lamprey has been designated as an EU Habitats Directive Annex II species and is listed as Near Threatened on the Ireland Red List (King *et a*l., 2011).

Twaite shad are in decline in many parts of Europe due to overfishing, pollution and migratory route obstructions. Twaite shad return from the sea to spawn in spring, usually between April and June. They are known to spawn at night in shallow areas near deeper pools. After hatching the fry develop and slowly drift downstream (Howson and Picton, 1997).

12.3.3 Nursery and spawning grounds

Nursery and spawning grounds exist within the fish and shellfish area for several fish and shellfish species; these grounds cover a large range along the coast of the Irish Sea. A low intensity nursery ground exists for tope *Galeorhinus galaeus*), thornback ray, spotted ray and plaice, and high intensity nursery ground exists for cod and whiting (Ellis *et al.,* 2012; Ireland's Marine Atlas, 2023). In addition, the Study Area includes low intensity spawning grounds for plaice and sole (Ellis *et al.,* 2012).

12.3.4 Marine mammals

12.3.4.1 Desktop data sources

The desktop data sources set out in Table 12.8 were used to inform the marine mammals baseline characterisation for the Proposed Development.

Table 12.8: Desktop sources which have informed marine mammal presence within the vicinity of the Proposed Development.

Title	Source	Year	Author
Marine mammal sightings and stranding records from dedicated surveys and from incidental observations	National Biodiversity Data Centre	2020	National Biodiversity Data Centre
Irish Cetacean Review (2000-2009)	Irish Whale and Dolphin Group	2010	Berrow *et al.*
The Status of EU Protected Habitats and Species in Ireland	NPWS	2019	NPWS
Lambay Island SAC. Site Code: 000204. Site Synopsis Report	NPWS	2014	NPWS
Aerial surveys of cetaceans and seabirds in Irish waters	Department of Communications, Climate Action & Environment, and NPWS	2018	Rogan *et al.*
Atlas of the distribution and relative abundance of marine mammals in Irish offshore waters 2005 – 2011	Irish Whale and Dolphin Group	2013	Wall *et al.*
UK Cetacean Status Review	Sea Watch Foundation	2003	Evans *et al.*
An aerial survey of harbour seals in Ireland	NPWS	2013	Duck & Morris

Potential marine mammal communities that could be impacted by the Proposed Development have been defined based on the Proposed Development's ZoI and are summarised in Table 12.9. The ZoI for Humpback whales *Megaptera novaeangliae*, bottlenose dolphin *Tursiops truncatus*, common dolphin *Delphinus delphis*, common porpoise *Phocoena phocoena* and minke whale *Balaenoptera acutorostrata* have all been recorded within the vicinity of the Proposed Development (National Biodiversity Data Centre, 2020).

Humpback whales occur occasionally in the Irish Sea, although they are more commonly seen in the south and southwest of Ireland (Berrow *et al.,* 2010). Therefore, numbers are likely to be low in the vicinity of the Proposed Development.

Bottlenose dolphin are found throughout the world's tropical and temperate marine waters and are regularly recorded in Irish coastal and offshore waters (NPWS, 2019). Sightings indicate a preference for deeper waters to those over the continental shelf (NPWS, 2019) and recent ObSERVE aerial surveys suggests that the west and southwest of Ireland are likely to be most important in terms of the distribution of this species (Rogan *et al*., 2018). Numbers are therefore likely to be low in the vicinity of the Proposed Development.

Common dolphin typically inhabits continental shelf waters and occurs along the shelf edge and in deep water and is the second most frequently reported cetacean within Irish waters (Berrow *et al*., 2010). However, the distribution of common dolphin around Irish waters is primarily to the west and south of Ireland, although there are some stranding records from the east coast of Ireland (Berrow *et al*., 2010). Therefore, numbers are likely to be low in the vicinity of the Proposed Development.

Common porpoise is one of the most frequently recorded cetacean species in Irish waters and is predominately distributed in coastal waters and waters of the continental shelf (e.g. Berrow *et al*., 2010; Wall *et al*., 2013). ObSERVE aerial surveys suggested that the Irish Sea is an important area for common porpoise, both during the summer and winter months, in the context of all Irish waters (Rogan *et al*., 2018).

The minke whale is the most frequently recorded baleen whale in British shelf waters (Evans *et al*., 2003), having been observed all around Ireland's coast and offshore in deep ocean basins as well as over the continental shelf (Berrow *et al*., 2010). The species has a largely offshore distribution and is most abundant off the southwest coast of Ireland and localised patches in the Irish Sea. Numbers are therefore likely to be low in the vicinity of the Proposed Development.

Common seal *Phoca vitulina* and grey seal *Halichoerus grypus* have been recorded within the vicinity of the Proposed Development (National Biodiversity Data Centre, 2020). Aerial surveys undertaken around the coast of Ireland in August/September 2003 and 2012 indicate that the Carlingford Lough haul-out (50km from the Proposed Development) and the Lambay Island haul-out (5km from the Proposed Development) are important sites for grey and common seals, in the context of the east coast of Ireland (Duck and Morris, 2013).

Common and grey seal are Qualifying Interests of Lambay Island SAC which contains regionally significant numbers of common seal (up to 47 individuals have been counted at the site) and supports the principal breeding colony of grey seal on the east coast of Ireland (NPWS, 2014). Grey seal and common seal occur year-round, and the island's intertidal shorelines, coves and caves are used by resting and moulting seals. It is likely that grey and harbour seal from this SAC may occur in the waters around the Proposed Development.

Table 12.9: Marine mammals potentially present within the vicinity of the Proposed Development.

Common name	Scientific name	Type
Bottlenose dolphin	*Tursiops truncates*	Cetacean
Common dolphin	*Delphinus delphis*	Cetacean
Common porpoise	*Phocoena phocoena*	Cetacean
Common seal	*Phoca vitulina*	Pinniped
Grey seal	*Halichoerus grypus*	Pinniped
Humpback whale	*Megaptera novaeangliae*	Cetacean
Minke whale	*Balaenoptera acutorostrata*	Cetacean

12.3.5 Designated sites

12.3.5.1 Rogerstown Estuary Special Area of Conservation

Rogerstown Estuary is designated as a Special Area of Conservation (SAC) and overlaps with the Proposed Development. Its Annex I qualifying interests of relevance to benthic habitats and their conservation objectives are:

- Estuaries (Maintain favourable condition);
- Mudflats not covered by seawater at low tide (Maintain favourable condition);
- *Salicornia* and other annuals colonise the mud and sand (Maintain favourable condition);
- Atlantic salt meadows (Restore favourable condition);
- Mediterranean salt meadows (Maintain favourable condition);
- Shifting dunes along the shoreline with *Ammophila arenaria* (Restore favourable conditions); and
- Fixed coastal dunes with herbaceous vegetation (Restore favourable conditions).

12.3.5.2 Rockabill to Dalkey Island Special Area of Conservation

Rockabill to Dalkey Island is designated as a SAC and extends to circa 2.5km east of the Proposed Development. Its Annex I qualifying interests of relevance to benthic habitats and their conservation objectives are:

- Reefs (Maintain favourable condition).

Its Annex II qualifying interests of relevance to marine mammals and their conservation objectives are:

- Common porpoise *Phocoena phocoena* [1351] (Maintain favourable condition).

12.3.5.3 Lambay Island Special Area of Conservation

Lambay Island is designated as a SAC and is 5km east of the Proposed Development. Its Annex I qualifying interests of relevance to benthic habitats and their conservation objectives are:

- Reefs (Maintain favourable conditions).

Its Annex II qualifying interests of relevance to marine mammals and their conservation objectives are:

- Grey seals *Halichoerus grypus* [1364] (Maintain favourable condition); and
- Common seals *Phoca vitulina* [1365] (Maintain favourable condition).

These designated sites are displayed in Figure 12.2.

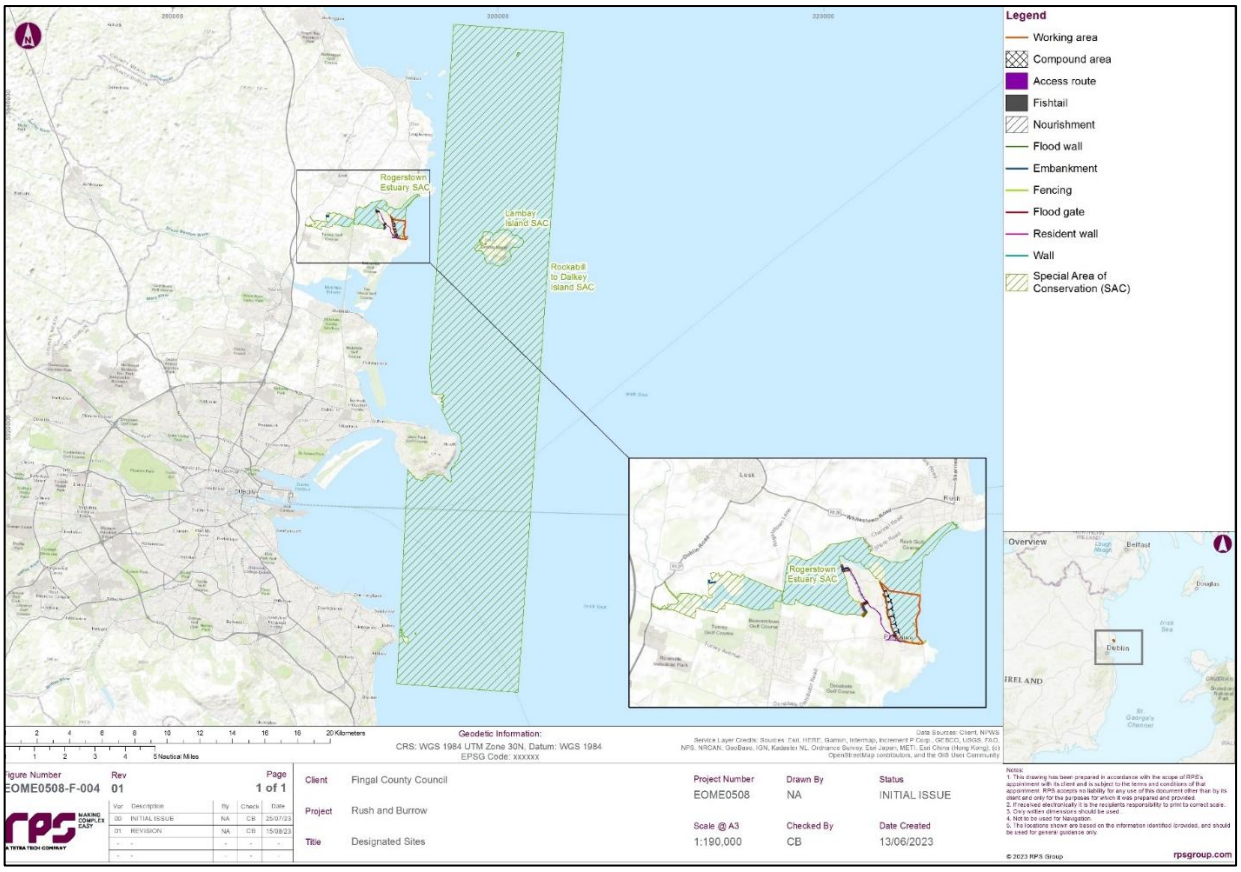


Figure 12.2: Designated sites within the vicinity of the Proposed Development.

12.3.6 Important Ecological Features (IEFs)

Important ecological features (IEFs) are habitats, species, ecosystems, and their functions/ processes that are considered to be important and potentially impacted by the Proposed Development. Guidance from the Chartered Institute of Ecology and Environmental Management (CIEEM) was used to inform the assessment of IEFs within the area (CIEEM, 2018).

IEFs can be attributed to individual species (such as plaice) or species groups (for example other flatfish species). Each IEF is assigned a value or importance rating based on commercial, ecological and conservation importance, including features of SACs. Table 12.10 details the criteria used for determining IEFs.

The benthic habitats which could be considered IEFs within the Proposed Development area are summarised in Table 12.11 whilst the fish, shellfish, and marine mammals which could be considered IEFs are summarised in Table 12.12.

Table 12.10: Defining criteria for Important Ecological Features (IEFs).

Value of IEF	Defining Criteria
International	• *Internationally designated sites (e.g., Special Areas of Conservation (SACs)).* • *Habitats and species protected under international law that are listed as a qualifying feature of an internationally designated site (e.g., Annex I habitats, Annex II species, or European Protected Species (EPS) within a SAC boundary).* • *Listed under Appendix I and II of the Bonn Convention on the Conservancy of Migratory Species of Wild Animals (hereafter: 'The Bonn Convention').* • *Listed under Annex II (strictly protected fauna) or Annex III (protected fauna) of the Bern Convention on the Conservation of European Wildlife and Natural Habitats (hereafter: 'The Bern Convention').* • *Listed under the Convention on the International Trade in Endangered Species of Flora and Fauna (CITES).*
National	• *Nationally designated sites (e.g., Natural Heritage Areas (NHAs)* • *Species or habitats protected under national law* • *OSPAR List of Threatened and/ or Declining Species and Habitats within OSPAR Region III (Celtic Seas).* • *Annex I habitats not within a SAC boundary.* • *Internationally protected species (including EPS) that are not qualifying interest features of a designated site but are regularly recorded within the various Marine Biodiversity study areas in relatively low densities. Therefore, this area is not considered to be important for these species at an international context.*
Regional	• *Habitats or species that provide important prey items for other species of conservation value.* • *Fish and shellfish species that have spawning and/ or nursery grounds within the regional fish and shellfish ecology study area that are important regionally (i.e. they may spawn in other parts of UK and Irish waters but this is a key spawning/nursery area).* • *Internationally protected species or habitats that are not qualifying interest features of any designated sites and are infrequently recorded within the local Marine Biodiversity study area in very low numbers compared to other parts of Irish waters.*
Local*	• *Habitats and species which are not protected under conservation legislation, and may be common in Irish waters, but form a key component of the marine biodiversity within the Marine Biodiversity study area.*

**The Local criteria are not applicable to marine mammals due to the high level of protection under international law for all marine mammal species*

Table 12.11: IEF benthic habitats within the vicinity of Proposed Development area.

IEF name	EUNIS code(s) – see (Table 12.6)	Importance	Justification and location relative to scheme
Littoral rock	MA1-2231, MA1-23, MA1-232D2, MA1-23E2, MA1-23G, MA1-241, MA1-242, MA1-243, MA1-244, MA1-245	National	Unlikely to be directly affected by the Proposed Development due to its proximity to groyne and renourishment works.
Littoral biogenic habitat	MA2-271	National	SAC target to conserve the high quality of the blue mussel dominated community, subject to natural processes. Unlikely to be directly affected by the Proposed Development due to its proximity to groyne and renourishment works.
Littoral sand	MA5-231, MA5-233, MA5-2332, MA5-2412, MA5-25, MA5-251, MA5-255	International	SAC qualifying interest – mudflats and sandflats not covered by seawater at low tide. Annex I feature. Coincides with the Proposed Development.
Littoral mud	MA6-22, MA6-225, MA6-227	International	SAC qualifying interest – mudflats (and sandflats) not covered by seawater at low tide. Annex I feature. Unlikely to be directly affected by the Proposed Development due to its proximity to groyne and renourishment works.
Seagrass beds	MA6-231, MA6-231/MA5-25	International	SAC qualifying interest – subfeature of the Annex I feature. Unlikely to be directly affected by the Proposed Development due to its proximity to groyne and renourishment works.
Subtidal soft sediment habitats	MB3, MC3	Regional	Unlikely to be directly affected by the Proposed Development due to its proximity to groyne and renourishment works.

Table 12.12: IEF fish, shellfish, and marine mammals within the vicinity of Proposed Development area.

IEF name	Importance	Justification
Diadromous fish	International to National	River lamprey, Atlantic salmon, sea lamprey and twaite shad are Annex II species. European eel, and sea trout are also diadromous species which may occur in the area, although are not Annex II species. These may utilise Rogerstown Estuary SAC and spend some time in the intertidal zone.
Elasmobranchs	Regional to International	Internationally important species includes basking shark. Regionally important species include thornback ray (commercially important), and tope (ecologically important). These species, along with spotted ray may spend some time near to the Proposed Development due to their nearby nursery grounds, though are unlikely to be directly affected by the Proposed Development due to their likely proximities to groyne and renourishment works.
Marine fish	Local to National	Juvenile fish, particularly those with nursery habitats close to the Proposed Development, have the potential to be impacted.
Shellfish	Regional	Brown crab, Norway lobster and razor clam are commercially important, though are unlikely to be affected by the Proposed Development as they are unlikely to inhabit areas in close proximity to groyne and renourishment works.
Marine mammals	International	Common dolphin, common porpoise, common seal, grey seal, humpback whale and minke whale are Annex II species. They are unlikely to be affected by the Proposed Development as they are unlikely to inhabit areas in close proximity to groyne and renourishment works but have been assessed further due to their importance.

12.4 Likelihood of Impacts

This section addresses the relevant receptors of the Proposed Development and the potential for impacts from the construction, operational, and maintenance activities within the intertidal area on these receptors.

The potentially significant effects relating to the identified receptors, which are subject to assessment are listed below and summarised in Table 12.13 and have been informed by the EIA Scoping Report (2021).

12.4.1 Construction phase

As set out in the EIA Scoping Report, the following impacts will be considered:

Temporary, direct habitat loss: There is limited potential for temporary, direct habitat loss and disturbance to benthic subtidal and intertidal habitats and fish and shellfish communities in the estuary because of installation of the seawalls and embankments. Habitat loss will be temporary as disturbance will result from the infrastructure installation techniques and will end after construction has finished.

There is potential for temporary, direct habitat loss and disturbance to benthic subtidal and intertidal habitats and indirect impacts to fish and shellfish communities due to beach replenishment and the works associated with installation of the groynes.

Increased suspended sediments: There is potential for increased suspended sediments and associated deposition to impact benthic subtidal and intertidal habitats, fish and shellfish communities and marine mammal communities from beach renourishment and installation of the groynes, seawalls, and embankments.

Resuspension of contaminated sediments: The EIA Scoping Report identified the potential for resuspension of contaminated sediments to impact benthic subtidal and intertidal habitats, fish and shellfish communities and marine mammal communities from beach renourishment and installation of the groynes, seawalls, and embankments. However, this has not been assessed further, as any sediments deposited during beach replenishment works will be clean and not contaminated, and there are no activities that would disturb sediments leading to resuspension of sediment bound contaminants. As such, no impacts on marine biodiversity receptors are likely to exist, and therefore, this impact has been scoped out.

Injury/ disturbance from underwater noise: There is potential for injury/ disturbance to fish and shellfish and marine mammal communities from underwater noise because of potential piling for embankment or seawall installation (noting all piling will be undertaken “in the dry”, i.e. when the tide is out).

Changes in prey availability: There is potential for changes in prey availability to impact marine mammal communities because of disturbance from construction activities.

Long-term habitat loss: Long term habitat loss will occur in the intertidal areas of the Proposed Development due to the creation of groynes (this will occur in the construction phase, but effects will extend into the operational and maintenance phase).

12.4.2 Operational and Maintenance phase

Temporary, direct habitat loss: There is potential for temporary, direct habitat loss and disturbance to benthic subtidal and intertidal habitats and indirect impacts to fish and shellfish communities due to beach renourishment during the operational and maintenance phase. This may include changes to coastal processes causing either accretion or erosion events that may cause changes to benthic habitats within the Study Area.

Long-term habitat loss: As noted above, long term habitat loss will occur in the intertidal areas of the Proposed Development (this will occur in the construction phase, but effects will extend into the operational and maintenance phase).

Table 12.13: Summary of assessed impacts.

Phase	Receptor groups	Temporary, direct habitat loss	Increased suspended sediments	Injury/disturbance from underwater noise (piling and vessels)	Changes in prey availability	Long-term habitat loss
Construction	Benthic ecology	✓	✓			✓
	Fish and shellfish	✓	✓	✓		
	Marine Mammals		✓	✓	✓	
Operational and Maintenance	Benthic ecology	✓				✓
	Fish and shellfish	✓				

12.5 Description of Likely Significant Impacts

12.5.1 Construction

12.5.1.1 Temporary, direct habitat loss

Magnitude

Upon completion of the groyne structures, temporary habitat loss may occur because of the beach renourishment works. The renourishment works (area covered *c.*0.084km^2) will involve transporting dredged material from a licensed renourishment extraction area (presently assumed to be Liverpool Bay) and pumped ashore via a sunken pipeline. For the beach renourishment works, it is envisaged that all *c.*425,000m^3 of material could be transported to Portrane Beach within approximately 6 weeks.

Whilst this will lead to a loss/ disturbance of benthic habitats and communities (e.g., through smothering of sediments and associated species under deposited material in the short term, over time the sediment will be re-worked through hydrodynamic processes which will allow communities to recover into the affected areas. In marine soft sediments, restoration from disturbance is possible through physical processes, like wave actions, and biological processes, like bioturbation (Dernie *et al.,* 2003). A recent study of the effect of beach nourishment on benthic habitats and communities found that overall species richness across different sites in California had fully recovered 15 months after nourishment (Kindeberg *et al.* 2023).

There may also be a limited amount of temporary habitat disturbance arising from the displacement/ compaction of the intertidal zone, particularly from heavy plant which will be used for construction of the groyne structures. Disturbance is likely to affect only the upper intertidal zone (primarily within the 1.36 hectare groyne footprint) along with a small area for vehicles to unload materials from vessels and recovery of sediments will occur quickly following completion of works.

The magnitude of this impact is predicted to be of local spatial extent and the works will be short term, temporary and reversible following completion of the construction works (replenishment is further considered under the operational and maintenance phase). As such, the magnitude of impact is considered to be low.

12.5.1.1.1 Benthic ecology

Sensitivity

According to guidance on evidence-based sensitivity assessment[21], the benthic habitat receptors in and around the Proposed Development are considered to have low biological sensitivities (Table 12.14). Related to pressures from vehicle movements, sensitivities to abrasion/ disturbance have been considered, and related to beach renourishment, sensitivities to heavy sedimentation have been considered.

[21] http://www.marlin.ac.uk/habitats/az)

Table 12.14: Sensitivity of benthic habitats to abrasion/ disturbance of the substrate, and to sedimentation.

Benthic habitat type (littoral sand)	Description	Sensitivity to abrasion/disturbance of the surface of the substratum or seabed	Sensitivity to heavy sedimentation
MA5-231	Barren Atlantic littoral coarse sand	Not sensitive	Not sensitive
MA5-233	Amphipods and polychaete worm *Scolelepis spp*. In Atlantic littoral medium-fine sand	Low	Low
MA5-2332	Speckled sea louse *Eurydice pulchra* in Atlantic littoral mobile sand	Low	Low
MA5-2412	Polychaetes and tellin shell *Angulus tenuis* in Atlantic littoral fine sand	Low	Low
MA5-25	Polychaete/bivalve-dominated Atlantic littoral muddy sand	Low	(not assessed)

Those habitat types listed in Table 12.14 exist only in small areas at the Proposed Development. Furthermore, recovery of these habitats would be expected occur quickly following completion of construction operations. Sensitivity of the benthic habitat receptors within the direct spatial footprint of the Proposed Development is therefore considered low.

Based on a low magnitude of impact and low sensitivity of receptors, the significance of the effect of temporary direct habitat loss on benthic intertidal habitats is predicted to be of negligible significance. No mitigation is considered necessary.

12.5.1.1.2 Fish and shellfish ecology

Sensitivity

The intertidal habitat in the Proposed Development area is primarily sandy shore and may therefore be a suitable nursery habitat at high tide (and low tide in the presence of tidal pools) for plaice. Nursery grounds also exist in the region for tope, thornback ray, spotted ray, cod and whiting, though it is unlikely that these species would occupy the intertidal zone.

The sensitivity of the receptor is therefore considered to be low as the scale of habitat loss is very small in comparison to the extent of the suitable habitat for diadromous, spawning, or nursery fish within the wider region.

Whilst there are several species of conservation concern in the wider area, including some diadromous fish species, the impacts are likely to be very localised and due to the mobility of most fish and shellfish receptor, any effects of disturbance during construction works are predicted to be negligible.

Based on a low magnitude of impact and negligible sensitivity of receptors, the significance of the effect of temporary direct habitat loss on fish and shellfish is predicted to be of negligible significance. No mitigation is considered necessary.

12.5.1.2 Increased suspension of sediments

Magnitude

There is a potential for localised increases in suspended sediment concentrations (SSCs) as a result of sediment disturbance associated with construction activities for the groynes, and beach renourishment works. The extent of smothering to subtidal habitats because of increased SSCs and associated sediment deposition, although difficult to quantify, is likely to be minimal, temporary, and of limited duration (over a period of approximately 6 weeks from initial material delivery to Portrane beach). Coastal processes modelling (see Chapter 6) has predicted that the Proposed Development will not result in a significant impact to the sediment transport regime along the Burrow, or the wider Rogerstown Estuary area other than to reduce coastal erosion along the coastline within the immediate vicinity of the scheme.

According to the coastal processes modelling, maximum SSCs occurring at any time during the simulation (and as such, covers all sediment plume excursions) can reach approximately 85,000mg/l within the immediate vicinity of the discharge pipeline during the beach renourishment works. Within approximately 500m of the discharge points, the sediment plume concentrations decrease to approximately 5,000mg/l, and to less than 5mg/l within around 700m of the discharge points. Further, the simulation did not predict background SSCs to increase by more than 2mg/l beyond the immediate vicinity of the foreshore area of the Burrow.

Regarding mean total SSC over the course of the proposed beach renourishment campaign, the average total SSC envelopes do not extend for more than approximately 600m beyond the discharge locations (they are typically less than 200mg/l). The highest average total SSCs of approximately 4,000mg/l are limited to within around 200m of the discharge locations and the simulation did not predict background SSCs to increase by more than 2mg/l beyond the immediate vicinity of the Burrow.

Bed level changes do not typically increase by more than 0.2m across the foreshore except within the immediate vicinity of the discharge locations; there, bed levels might increase by approximately 1.5m. The simulations indicated that no beach renourishment material settles onto the seabed beyond the Burrow's immediate foreshore. Therefore, an increased suspension of sediments is unlikely to impact reef or other sensitive habitats in the wider area and will be confined to the intertidal zone.

Furthermore, mitigation measures which will further reduce increased suspension of sediments have been proposed (see Chapter 6). These include:

- The works associated with the construction of the fishtail groynes should be undertaken at exposed low tides using land-based plant, therefore negating the need to work within the water column.
- The beach renourishment activities should only proceed after the construction of the fishtail groynes to reduce the rate of sediment losses to the marine environment.

As such, the magnitude of this impact is considered negligible.

12.5.1.2.1 Benthic ecology

Sensitivity

According to guidance on evidence-based sensitivity assessment (MarESA[22]), the benthic habitat receptors in and around the Proposed Development as described in Table 12.6 are considered to have negligible sensitivity to smothering and light siltation rate changes as summarised in Table 12.15.

Impacts are likely to be very localised to the small area of works to within the direct spatial footprint of the Proposed Development.

Based on a negligible magnitude of impact and negligible sensitivity of receptors, the significance of the effect of increased suspension of sediments on benthic intertidal habitats is predicted to be of negligible significance. No mitigation is considered necessary.

Table 12.15: Sensitivity of benthic habitats to physical change to another seabed type.

Benthic habitat type (littoral sand)	Description	Sensitivity to smothering and light siltation rate changes (from MarLIN: http://www.marlin.ac.uk/habitats/az)
MA5-231	Barren Atlantic littoral coarse sand	Not sensitive
MA5-233	Amphipods and polychaete worm *Scolelepis* spp. In Atlantic littoral medium-fine sand	Not sensitive
MA5-2332	Speckled sea louse *Eurydice pulchra* in Atlantic littoral mobile sand	Not sensitive
MA5-2412	Polychaetes and tellin shell *Angulus tenuis* in Atlantic littoral fine sand	Not sensitive
MA5-25	Polychaete/bivalve-dominated Atlantic littoral muddy sand	(not assessed)

12.5.1.2.2 Fish and shellfish ecology

Sensitivity

As suspended sediments are an integral part of estuarine systems (Ward & Montague, 1996), it is unlikely that the diadromous fish species (river lamprey, sea lamprey, twaite shad, Atlantic salmon or European eel) would be adversely affected by increases in suspended sediments on the intertidal region, given their occurrence in estuarine environments which typically comprise a higher sediment loading. Further, cod, herring, whiting and plaice are more likely to occur sub tidally, in deeper waters. Additionally, increases in suspended sediments from the scheme will be minimal and avoided through the mitigation measures described previously. The sensitivity of the receptor is therefore considered to be negligible.

[22] http://www.marlin.ac.uk/habitats/az

Based on a negligible magnitude of impact and negligible sensitivity of receptors, the significance of the effect of increased suspension of sediments on fish and shellfish is predicted to be of negligible significance. No mitigation is considered necessary.

12.5.1.2.3 Marine mammals

Sensitivity

The marine mammals presented in Table 12.9 which includes bottlenose dolphin, common dolphin, common porpoise, humpback whale, and minke whale do not usually frequent intertidal areas, except for seal species which can visit shallow areas and occasionally haul out onto land to moult. Grey seals usually moult between November to May and give birth in autumn or winter (Conserve Ireland, 2018) whilst common seal usually moult between July and August and give birth in June (NPWS, 2023).

Seal sightings at the Burrow have not been identified, implying their presence there may be uncommon. It is more likely that seals would utilise the less-disturbed islands such as Lambay SAC and the northern tip of Bull Island. The sensitivity of the receptor is therefore considered to be negligible. Note: refer to '*Changes in prey availability*' for marine mammals below, as increases in SSCs could impact upon prey availability.

Impacts are likely to be very localised and due to the likely proximity of marine mammals to the Proposed Development. Based on a negligible magnitude of impact and negligible sensitivity of receptors, the significance of the effect of increased suspension of sediments on marine mammals is predicted to be of negligible significance. No mitigation is considered necessary.

12.5.1.3 Injury/disturbance from underwater noise (piling)

Magnitude

Sound plays an important role to fish, invertebrates and marine mammals, allowing them to communicate with one another, detect predators and prey, navigate their environment, and avoid hazards. In addition, an increase in subsea noise can also cause behavioural disturbance to sensitive receptors (i.e. fish and marine mammals).

Piling will be undertaken as part of the Proposed Development through vibratory piling during construction of the seawall at Marsh Lane. Based on the preliminary design of the Proposed Development, piling operations are not expected to last more than *c.*6 weeks. All piling will be undertaken on land in dry conditions, which will mean noise emissions to the underwater environment will be limited to transfer of noise through the substrate from onshore piling. Wave speed in sediments is much slower (approximately 90%) than that of the speed of sound in water and it is likely that much of the sound will be attenuated by this interface (Buckingham, 2020). As piling will be limited to vibratory piling only, noise emissions will be low, with attenuation of noise through the substrate during transfer reducing noise levels further, likely to levels that are not detectable by sensitive receptors.

The works will be temporary, short-term, and localised with high reversibility as the soundscape is predicted to return to the baseline following completion. As such, the magnitude is considered to be low.

12.5.1.3.1 Fish and shellfish ecology

Sensitivity

Whilst fish are sensitive to noise at the various levels, depending on species (Robertis & Handegard, 2013), noise levels generated by the Proposed Development will be very low and likely undetectable by fish in the marine environment owing to the piling method employed and the high rate of attenuation as the noise transfers through the sediment. As such, sensitivity to vibratory piling is considered to be negligible.

Based on the low magnitude of impact and negligible sensitivity of receptors, the significance of the effect of injury/ disturbance from underwater noise on fish and shellfish through piling is predicted to be of negligible significance. No mitigation is considered necessary.

12.5.1.3.2 Marine mammals

Sensitivity

Subsea noise can affect marine mammals through 'masking', whereby vocal communication either between individuals of the same species or during hunting for prey may become ineffective. Animals that are sensitive to the noise emissions, will generally avoid the ensonified areas, thus reducing the potential for prolonged exposure. Avoidance behaviours, such as increased swimming speed, spatial avoidance, increased group cohesion and longer dive duration may be apparent (Miller *et al*., 2008).

As described for fish and shellfish, the transfer pathway for noise during construction of the embankments is limited by the attenuation of sound within the sediment strata; therefore, there are no anticipated noise disturbance effects on marine mammal receptors. As such, sensitivity is considered to be negligible.

Based on a low magnitude of impact and negligible sensitivity of receptors, the significance of the effect of injury/ disturbance from underwater noise on marine mammals through piling is predicted to be of negligible significance. No mitigation is considered necessary.

12.5.1.4 Direct disturbance from underwater noise (vessels and construction)

Magnitude

It is proposed that there will be relatively few vessel movements (likely only to be just one vessel for beach renourishment events) required for the Proposed Development, principally only for the transportation of beach renourishment materials. At sea, vessels will move at low speeds throughout the construction phase and over a relatively short period (6 weeks), and noise will be limited due to the nature of the proposed pumping methodology.

Most of the works will be carried out from land where the only potential transfer pathway for noise arising from construction activities (such as the profiling works by the dozers) would therefore be the transmission of sound through the seabed substrate to the water column of the marine environment. The works will be temporary, short-term, and localised with high reversibility as the soundscape is predicted to return to the baseline following completion, as such, the magnitude is considered to be negligible.

12.5.1.4.1 Fish and shellfish

Sensitivity

Though species-specific, fish have been documented to avoid approaching vessels, even when there is several hundred meters between the fish and the approaching vessel (Robertis & Handegard, 2013). For example, research looking at biases of vessel noise on the spatial distribution of fish showed that pelagic schooling fish respond by vertical or lateral avoidance of approaching vessels (Mitson and Knudsen, 2003). The existing soundscape includes some degree of vessel activity (small fishing vessels, motorboats, jet skis); therefore, a minor increase in traffic (likely only to be a single vessel) is unlikely to alter the soundscape.

Whilst low intensity nursery grounds exist for tope, thornback ray, spotted ray and plaice, and high intensity nursery grounds exist for cod and whiting, these are unlikely to be within the intertidal zone. As construction noise is largely on land, any noise attenuation would be through the sediment and unlikely to reach fish and shellfish species at levels which could cause disturbance. Sensitivity is considered to be negligible. Based on a negligible magnitude of impact and negligible sensitivity of receptors, the significance of the effect of direct disturbance from underwater noise on fish and shellfish is predicted to be of negligible significance. No mitigation is considered necessary.

12.5.1.4.2 Marine mammals

Sensitivity

Sensitivity to noise is related to the marine mammal activity at the time (Senior *et al*., 2008). For example, with respect to noise from vessels, Richardson *et al.* (1995) suggests that resting animals are likely to avoid vessels, foraging animals may ignore them, and socialising animals may approach vessels. Whilst the navigation route will be chosen by the captain, it is anticipated the vessel will not pass within 2.5km of Lambay Island whilst beach renourishment activities which will involve pumping material ashore will occur approximately 5km from Lambay Island.

As such, sensitivity is considered to be negligible. Based on a negligible magnitude of impact and negligible sensitivity of receptors, the significance of the effect of direct disturbance from underwater noise on marine mammals is predicted to be of negligible significance. No mitigation is considered necessary.

12.5.1.5 Changes in prey availability

Magnitude

There is potential for changes in prey abundance (e.g. fish and shellfish communities) resulting from construction activities to have a direct impact on the foraging success of marine mammals near to the Proposed Development. Further, prey availability could be impacted if prey are susceptible to increases in SSCs or temporary habitat loss. Both impacts have been considered and determined to be of negligible significance.

Whilst noise could affect fish and shellfish prey items of marine mammals, fish tend to avoid approaching vessels (Robertis & Handegard, 2013) and construction activities will include only one vessel in at least *c.*10m of water, fish and shellfish sensitivity was predicted to be of negligible significance. As such the magnitude of changes in prey availability is considered to be negligible.

12.5.1.5.1 Marine mammals

Sensitivity

The key prey species for marine mammals include gadoids (e.g., cod, haddock and whiting), forage fish (e.g., herring, sprat, sandeel, mackerel), cephalopods, and flatfish (e.g., dab, flounder, plaice). Some of these species (cod, herring, whiting, plaice) have been identified as IEFs of varying importance (Table 12.12) although the magnitude of habitat loss (and as such, potential migration of these species away from the vicinity of the Proposed Development) is considered negligible. This was also the case for an increase in suspended sediments. Sensitivity is therefore considered to be negligible.

Based on a negligible magnitude of impact and negligible sensitivity of receptors, the significance of the effect of changes in prey availability on marine mammals is predicted to be of negligible significance. No mitigation is considered necessary.

12.5.2 Operational and Maintenance

12.5.2.1 Temporary habitat loss

Magnitude

Temporary habitat loss may occur because of the beach renourishment works during the operational and maintenance phase of the Proposed Development. It is expected that the beach will require renourishment every 5-10 years, and that the magnitude of the renourishment will be subject to the rate of losses during the intervening period (expected to range between 50-75% of the initial renourishment volume). These future renourishment campaigns will be undertaken using the same methodology as the initial renourishment (via a vessel moored in approximately 10m water depth). While this will lead to a loss/ disturbance of benthic habitats and communities (e.g., through smothering of sediments and associated species under deposited material), over time, the sediment will be hydrodynamically reworked which will allow communities to recover into the affected areas.

There may also be a limited amount of temporary habitat disturbance arising from displacement/ compaction of the intertidal zone. Disturbance is likely to affect only the upper intertidal zone (primarily within the 1.36 hectare groyne footprint) along with a small area for vehicles to unload materials from vessels and recovery of sediments will occur quickly following completion of works.

Beach renourishment is likely to cause temporary habitat loss, and is anticipated to be short-term and temporary, intermittent (i.e. occurring every 5-10 years) and of medium reversibility through hydrodynamic reworking of sediments over time for the barren sand habitat (MA5-231), fine sand with speckled sea louse (MA5-2412), and fine sand containing amphipods and polychaete worms (MA5-233).

The magnitude is considered low due to the activities impacting a low proportion of the available spatial extent of these habitats, and the footprint for renourishment during the operational and maintenance phase is expected to be consistent with that of the construction phase.

12.5.2.1.1 Benthic ecology

Sensitivity

Those habitat types listed in Table 12.14 exist in large areas at the Burrow, albeit with only small proportions overlapping the Proposed Development. The recovery of these habitats would be expected to occur quickly following renourishment events, particularly given the frequency of renourishment campaigns (5-10 years) and smaller volume of renourishment materials (50-75% of the initial renourishment volume). One study which examined benthic community recovery from lower intensity and higher intensity disturbance noted recovery within 64 days following low intensity disturbance and 208 days after higher intensity disturbance (Dernie *et al.,* 2003). Sensitivity of the benthic habitat receptors within the direct spatial footprint of the Proposed Development is therefore considered low.

Based on a low magnitude of impact and low sensitivity of receptors, the significance of the effect of temporary direct habitat loss on benthic intertidal habitats is predicted to be of negligible significance. No mitigation is considered necessary.

12.5.2.1.2 Fish and shellfish ecology

Please refer to Section 12.5.1.1.2 for the sensitivity assessment and determination of significance of temporary habitat loss to fish and shellfish ecology during the construction phase, which is considered applicable to the operational and maintenance phase.

12.5.2.2 Long-term habitat loss (construction and operational and maintenance phases)

Magnitude

The proposed groyne construction and presence of structures during the operational and maintenance phase will cause long-term habitat loss of barren sand (MA5-231), fine sand with polychaetes and tellin shell (MA5-233), and fine sand with speckled sea louse (MA5-2412).

The core of the groynes will be constructed by re-using the existing Seabee units which are already on the beach, and a single layer of 0.3-1T rock armour will be placed over the Seabee units. The fishtail structures will be constructed of rock fill and rock armour and the filter layer of each fishtail structure will be placed onto and wrapped in a heavy-duty geotextile. This will represent a change from intertidal baseline sedimentary habitats to hard substrates.

Long term habitat loss will occur under the footprint of the groynes which will be up to 13,615m^2 in the intertidal zone. This equates to approximately 2.5% of the Rogerstown Estuary SAC. However, this likely overestimates the change in the baseline condition as some of the groyne structure will be constructed from the existing Seabee units which are already present within the SAC, which will reduce the overall effect of habitat loss on the SAC from those currently occurring. In contrast, from a terrestrial perspective, temporary and permanent losses to Rogerstown estuary Annex I habitats (during construction) are given in Table 13.4, and cumulative losses (temporary and permanent) to Annex I habitats within Rogerstown Estuary SAC are given in Table 13.8.

Given the extensive nature of the Annex I habitats within the SAC, the loss or change of a very small proportion of these habitats is not likely to change the overall character of the Annex I habitats within the Rogerstown Estuary SAC.

The impact will be long-term, permanent, and spatially limited within the Proposed Development footprint. The magnitude of the impact is therefore considered low as there is likely to be a minor loss of these habitats within the direct footprint of the Proposed Development.

12.5.2.2.1 Benthic ecology

Sensitivity

Hard substrates exist in the SAC (see the littoral rock habitat types given in Table 12.6). It is considered that some of these hard substrate communities will extend to, and colonise, the groynes. Particularly on soft sediment shores, structures such as groynes can provide new habitat for colonisation of species previously absent (Hall, 2017) and species richness can increase with the age of rock groynes (Pinn *et al.,* 2005). The sensitivity of benthic habitat receptors within the direct spatial footprint of the groyne construction is considered high.

Based on a low magnitude of impact and high sensitivity of receptors, the significance of the effect of long-term habitat loss on benthic intertidal habitats is predicted to be of moderate significance. No mitigation is considered necessary.

12.5.3 Summary of the assessment of effects

Table 12.16 presents a summary of the assessment of effects during the various phases of the Proposed Development.

Table 12.16: Summary of the assessment of effects.

Receptor	Potential Impact	Assessment of Effect
Benthic Ecology	(Construction) Temporary, direct habitat loss	Negligible
	(Construction) Increased suspended sediments	Negligible
	(Construction, operational and maintenance) Long-term habitat loss	Moderate
	(Operational and maintenance) Temporary habitat loss	Negligible
Fish and shellfish	(Construction) Temporary, direct habitat loss	Negligible
	(Construction) Increased suspended sediments	Negligible
	(Construction) Injury/ disturbance from underwater noise (piling)	Negligible
	(Construction) Direct disturbance from underwater noise (from vessels and construction)	Negligible
	(Operational and maintenance) Temporary habitat loss	Negligible
Marine mammals	(Construction) Increased suspended sediments	Negligible
	(Construction) Injury/ disturbance from underwater noise (piling)	Negligible
	(Construction) Direct disturbance from underwater noise (from vessels and construction)	Negligible
	(Construction) Changes in prey availability	Negligible

12.6 Mitigation Measures

No mitigation is required based on the evidence available to date. If any additional ecological receptors or potential impacts are identified during the statutory consultation process, appropriate mitigation measures will be proposed, in consultation with the appropriate statutory body, and outlined within the EIAR for consideration by the authority.

12.7 Residual Impacts

As no mitigation measures have been proposed for marine biodiversity, residual effects remain moderate.

12.8 Potential Cumulative Impacts

It is anticipated that the only other development which may cause cumulative impacts when considered alongside the Proposed Development is the FRS proposed at Rush South. The potential for cumulative impacts with this scheme on receptors has been summarised in Table 12.17 which justifies the scoping in or out of impacts for cumulative effects assessments (CEA).

The only impact scoped in for CEA is the temporary, direct habitat loss during the construction phases for benthic and fish and shellfish receptors as detailed in Section 12.8.1.

Table 12.17: Scoping justifications for CEA (where B = benthic, FSF = fish and shellfish, MM = marine mammals).

Impact	Impact – the Burrow	Impact – Rush South	Scoped into CEA/ justification
(Construction) Temporary, direct habitat loss	B – negligible FSF - negligible	B – negligible FSF - negligible	**In –** habitat loss of negligible effect, and lack of overlap in construction periods, though recoverability and timescales for recovery needs consideration.
(Construction) Increased suspended sediments	B – negligible FSF – negligible MM - negligible	B – negligible FSF – negligible MM - negligible	**Out –** Increased suspended sediments of negligible effect, and lack of overlap in construction periods between the two developments. No cumulative impact.
(Construction, operational and maintenance) Long-term habitat loss	B - minor	B – negligible FSF - negligible	**In –** long-term habitat loss to a lesser degree at Rush South than at the Burrow but may exist to a small degree on the upper intertidal zone.
(Construction) Injury/ disturbance from underwater noise (piling)	FSF – negligible	FSF – negligible	**Out –** injury/ disturbance of negligible effect, and lack of overlap in construction periods. No cumulative impact.

Impact	Impact – the Burrow	Impact – Rush South	Scoped into CEA/ justification
	MM - negligible	MM - negligible	
(Construction) Direct disturbance from underwater noise (from vessels and construction)	FSF – negligible MM - negligible	FSF – negligible MM - negligible	**Out –** underwater noise of negligible effect, and lack of overlap in construction periods. No cumulative impact.
(Construction) Changes in prey availability	MM - negligible	MM - negligible	**Out –** changes in prey availability of negligible effect, and lack of overlap in construction periods. No cumulative impact.
(Operational and maintenance) Temporary habitat loss	B – negligible FSF - negligible	N/A	**Out –** habitat loss of negligible effect, and lack of overlap in construction periods. Temporary habitat loss not assessed for Rush South during the operational and maintenance phases. No cumulative impact.

12.8.1 Construction

12.8.1.1 Temporary, direct habitat loss

Magnitude

Subject to detailed design and planning, it is intended that the construction phase of the Proposed Development will not overlap with the construction phase of the scheme at Rush South. This will ensure a low degree of cumulative temporary habitat loss between the two projects. The cumulative footprint of direct, temporary disturbance within the intertidal zone is 0.17km^2 (0.13km^2 from Burrow and 0.04km^2 from Rush).

The magnitude of this impact is predicted to be of local spatial extent (i.e. within the footprint of the two projects) and the works will be short term, temporary and reversible following completion of the construction works, although repeated beach renourishment at the Burrow is expected every 5 to 10 years.

Considering the above, the cumulative magnitude of impact is considered to be low.

Sensitivity

The sensitivity of benthic and fish and shellfish ecology receptors are the same as outlined in the project alone assessments for the construction phase in Section 12.5.1.1. The sensitivity for both receptor groups is considered low.

Based on a low magnitude and the low sensitivity of receptors, the cumulative significance of the effect of temporary, direct habitat loss on benthic and fish and shellfish ecology is predicted to be of negligible significance. No mitigation is considered necessary.

12.9 Conclusions

Benthic ecology receptors have the potential to be negligibly affected on a temporary timescale by habitat loss during the construction, operational and maintenance phases. During the construction phase, benthic ecology receptors also have the potential to be negligibly affected by an increase in suspended sediments. In context of long-term habitat loss, benthic ecology receptors have the potential to be affected at a minor adverse level.

Fish and shellfish receptors during the construction phase have the potential to be negligibly affected by temporary, direct habitat loss; increased suspended sediments; injury or disturbance from underwater noise; and direct disturbance from underwater noise. During operational and maintenance phases, fish and shellfish have the potential to be affected by temporary habitat loss at a negligible level.

Marine mammal receptors during the construction phase have the potential to be negligibly affected by increases in suspended sediments, injury/ disturbance from underwater noise, direct disturbance from underwater noise, and from changes in prey availability. During the operational and maintenance phases, marine mammal receptors have the potential to be negligibly affected by temporary habitat loss.

No mitigation measures for marine biodiversity receptors are proposed, and cumulative effects are negligible, with the only other planned development in the vicinity of the Burrow is the FRS proposed at Rush south (north of the Rogerstown Estuary).

The cumulative impact associated with the proposed FRS at Rush South which will be constructed after the Proposed Development at the Burrow is considered to be low and negligible in context of habitat loss and benthic and fish and shellfish ecology receptors respectively. No mitigation is considered necessary.

13 TERRESTRIAL & COASTAL BIODIVERSITY

13.1 Introduction

An Ecological Impact Assessment (EcIA) has been undertaken on terrestrial and coastal lands at the Burrow in respect of the Proposed Development described within Chapter 3 of this EIAR. The scope of this Ecological Impact Assessment (EcIA) was to identify ecological constraints within the study area, by means of:

- Identifying the ZoI of the Proposed Development on the natural environment.
- Establishing the baseline with regard to terrestrial and aquatic habitats, ecotopes, flora and fauna (volant and non-volant mammals, invertebrates, avifauna etc.) within the ZoI of the proposed works.
- Ascertaining the potential impacts upon all ecological receptors within the development footprint and ZoI to include, but not be limited to, species protected under the European and National Legislation, including the EU Habitats and Birds Directives and Irish Wildlife Acts (1976 to 2012, as amended).
- Presenting measures to avoid or minimise potential damage to any sensitive ecological receptors supported within the receiving environment.

13.2 Authority of author

The author, Samuel O'Hara, is an Associate Ecologist with RPS and holds a BSc (Hons) in Ecology and has over eight years of experience in the field of ecology. Samuel has experience of ecological field survey including; habitat, mammal and bird survey and is a protected species license holder. Samuel is a full member of the CIEEM.

The reviewer, James McCrory, is a Technical Director of Ecology within RPS and holds a BA (Hons) in Natural Sciences (Mod) Botany and a MSc in Habitat Creation and Management. James is a Chartered Environmentalist (CEnv), a Chartered Ecologist (CEcol) and a Chartered Biologist (CBiol). James is a former member of the CIEEM Irish Section Committee and CIEEM Policy Review Group in Ireland and a member of the CIEEM technical working group updating the Guidelines for Ecological Impact Assessment in the United Kingdom and Ireland. James currently sits on the CIEEM technical working group for EcIA accreditation across the Institutes practitioner network.

The professional judgement expressed herein is the true and bona fide opinion of our professional ecologist. The information prepared and provided is accurate at the time of issue of this report and has been prepared and provided in accordance with the CIEEM Code of Professional Conduct (CIEEM 2023).

This chapter is supported by Volume II Technical Appendices:

- **Appendix 13.A**: Data gathered from National Biodiversity Data Centre (NBDC);
- **Appendix 13.B**: Burrow and Rush Sand Dune and Saltmarsh Survey (BEC Consultants)
- **Appendix 13.C**: Ecological Survey for Birds.

13.3 Assessment Methodology

13.3.1 Ecological Impact Assessment

EcIA is the process of identifying, quantifying, and evaluating the potential effects of a Proposed Development on ecological features based on objective assessment of the best information available (CIEEM, 2018). An ecological feature is defined as a species, habitat or ecosystem that has the potential to be affected by a project.

The aim of the EcIA, detailed within this chapter of the EIAR, was to:

- Describe the existing ecological features; to identify the potential impacts associated with the Proposed Development during construction, operation and maintenance;
- Evaluate the likely significance of effects on the ecological features; to apply the mitigation hierarchy to avoid, mitigate and compensate for ecological impacts; and
- Highlight potential opportunities for ecological enhancement.

The EcIA has been written in accordance with the Chartered Institute of Ecology and Environmental Management (CIEEM) *Guidelines for Ecological Impact Assessment in the UK and Ireland* (CIEEM, 2018).

13.3.2 Relevant Guidance and Legislation

The EcIA has been undertaken in accordance with the British Standard (BS) 42020:2013; guidelines produced by the CIEEM (CIEEM, 2018); experience of 'best practice' in ecological assessment; and criteria set out within this sub-section.

13.3.2.1 International Directives

Council Directive on the Conservation of Natural Habitats of Wild Fauna and Flora (92/43/EEC) (The Habitats Directive)

The main aim of the Directive is to promote the maintenance of biodiversity through the conservation of natural habitats and wild species listed on the Annexes of the Directive. Member States are required to take measures to maintain or restore, at favourable conservation status, biodiversity whilst taking account of economic, social, cultural requirements and regional and local characteristics.

It gives effect to site and species protection measures through establishment of the Natura 2000 network and designation of European Sites including Special Areas of Conservation (SAC) and Special Protected Areas (SPA). It also establishes a list of species (other than birds) whose habitats must be protected to secure their survival. These priority species and habitats are subject to a higher level of protection.

The Directive also requires appropriate assessment of any plan or project not directly connected with or necessary to the management of a European Site, but likely to have significant effects upon a European site, either individually or in combination with other plans or projects.

Council Directive on the Conservation of Wild Birds (2009/147/EC) (The Birds Directive)

The Directive provides a framework for the conservation and management of, and human interactions with, wild birds in Europe. It makes provisions for the maintenance of the wild bird populations across their natural range; conserves the habitats for rare or vulnerable species listed in Annex I and of migratory species through the classification of SPAs and provides protection for all wild birds.

13.3.2.2 Irish Legislation

S.I. No. 355 of 2015 provides that the following shall be construed together as one:

- Wildlife Act 1976;
- Wildlife (Amendment) Acts of 2000, 2010 and 2012;
- European Communities (Birds and Natural Habitats) (Restrictions of the Use of Poison Bait) Regulations 2010;
- European Communities (Birds and Natural Habitats) Regulations 2011;
- European Communities (Birds and Natural Habitats) (Amendment) Regulations of 2013, 2015; and
- Wildlife Amendment Bill 2016.

European Communities (Birds and Natural Habitats) Regulations 2011 to 2015

The Regulations give effect to requirements relating to the designation of protected sites under the Birds Directive and Habitats Directive. The Regulations provide for the protection and management of European Sites and place obligations on all public authorities to have regard to the requirements of the Habitats Directive beyond the realms of planning related consents issued under the Planning and Development Act 2000, as amended (the PDA). The Regulations also provide for the protection of species of European importance.

Wildlife Acts 1976 to 2012

The Acts provide for *inter alia* the protection of wildlife. The Acts prohibit the intentional killing, taking or injuring of certain wild birds or wild animals; or the intentional destruction, uprooting or picking of certain wild plants.

13.3.2.3 Planning Policy

Fingal Development Plan 2023-2029

An overarching theme of the development plan in relation to Natural Heritage and Biodiversity is to ensure that there are no detrimental impacts to the biodiversity of the County and furthermore that development throughout the county maintains and enhances biodiversity for future generations.

Policies set out in respect of natural heritage and biodiversity, as set out within Chapter 9: Green Infrastructure and Natural Heritage, include a range of provisions to protect and conserve Natura 2000 sites, Natural Heritage Areas (NHAs) and proposed NHAs, species and habitats listed within the local Biodiversity Action Plan (BAP), ecological buffer zones, nature development areas, river corridors and the coastline.

13.3.3 Study Area

The study area, which encompasses the areas which are to be affected by the proposed coastal erosion and flood protection measures in addition to surrounding areas of coastal and terrestrial habitat, are generally characterised by the presence of a foreshore of variable width and adjacent areas which are largely comprised of unmanaged areas of former agricultural land at Portrane, in addition to housing and associated infrastructure and gardens, a number of caravan parks and hardstanding.

The areas proposed for works to facilitate the construction of the coastal erosion and flood defence measures are generally comprised of areas of beach and other foreshore habitat, in addition to unmanaged former agricultural lands, terrestrial grasslands and scrub adjacent to the foreshore and gardens.

On a precautionary basis the assessed ZoI extends to include European and Nationally designated sites within 15km of the study area and ecological receptors to be potentially affected by the biophysical changes caused by the Proposed Development. In addition, sites which are hydrologically linked to the proposals are also considered. The designated sites and ecological receptors within the ZoI of the Proposed Development are presented and discussed below.

13.3.4 Baseline

13.3.4.1 Desk Study

The National Biodiversity Data Centre (NBDC) is a national organisation that collates, manages, analyses and disseminates data on Ireland's biodiversity. It is funded by the Heritage Council and the Department of Arts, Heritage and the Gaeltacht. The NBDC provides access to all validated biodiversity data through Biodiversity Maps and the on-line biodiversity data portal.

Biodiversity records and full species accounts can be viewed and scrutinised through an interactive Biodiversity Maps portal (http://maps.biodiversityireland.ie/#/Home). This is a tool that can be used to help make a preliminary assessment of biodiversity issues when considering site-specific developments.

The chosen search area using the NBDC search tool was customised to capture all records within a minimum 1km distance of the Proposed Development and is illustrated at Appendix 13.A, which accompanies the returned records. The principal purpose of this task is to capture any records of protected species or species of natural heritage importance in close proximity to the Proposed Development. The ZoI of the Proposed Development for protected species, does not extend further than this given the relative size of the territories of the relevant terrestrial protected species and due to the nature of the proposals which will not give rise to any pathways of effect upon terrestrial species beyond this area.

NPWS GIS habitat data files were used to determine the presence of features of ecological significance.

13.3.4.2 Habitat Survey

Extended Phase 1 Habitat Survey was conducted of the site in August 2021 and June 2022 and covered the entirety of the Study Area. The survey was undertaken in line with the Heritage Council's *Best Practice Guidance for Habitat Survey and Mapping* (Heritage Council, 2011). Ecological value is based upon CIEEM and NRA guidelines (CIEEM, 2018; NRA, 2009).

The survey was extended to include further information on the potential of the habitats identified to support species protected by law or of natural heritage importance. In addition, the extended Phase 1 Habitat Survey also incorporated a detailed survey for protected and invasive non-native species of flora.

All habitats were mapped and categorised in accordance with the Heritage Council *Guide to Habitats in Ireland* (Fossitt, 2000). Aerial photographs were used as an aid to mapping habitats. The results of this survey are presented below.

It should be noted that whilst every effort has been made to provide a comprehensive description of the site of the Proposed Development, no survey can consist of a complete characterisation and prediction of the ecological environment.

13.3.4.3 Annex I Habitat Surveys

The study area lies within and adjacent to the Rogerstown Estuary SAC. The Qualifying Interests of this SAC include sand dune habitats and saltmarsh communities. In addition, the SAC is designated to protect marine habitats; (Estuaries [1130] and Mudflats and sandflats not covered by seawater at low tide [1310]), which are discussed within Chapter 12; Marine Biodiversity.

This EIAR chapter is supported by surveys undertaken of Annex I sand dune and saltmarsh habitats by BEC Consultants in September 2021 and detailed within the appended Burrow and Rush Sand Dune and Saltmarsh Survey report (Appendix 13.B). This report details the methodology utilised during the surveys and assessment of the extent and condition of Annex I sand dune and saltmarsh habitat within the study area.

13.3.4.4 Otter Survey

An otter survey was carried in August 2021 and June 2022 to establish the presence of otter dens and otter foraging areas. The site, and a buffer of at least 300m of coastline, woodlands and scrub, was surveyed for the presence of otter activity including:

- Holts
- Couches
- Spraints
- Otter paths
- Slides
- Paw prints

13.3.4.5 Preliminary Ecological Appraisal for Bats

A Preliminary Ecological Appraisal for Bats (PEAB) comprising of a desk study and site walkover has been completed for the Proposed Development.

The aim of the site walkover was to observe, assess and record the potential suitability of the site of the proposed project to support bat roosting habitat, commuting habitat and/or foraging habitat. Habitat features were

classified as negligible, low, moderate or high in accordance with Bat Conservation Trust (BCT) Good Practice Guidelines (Collins 2016).

13.3.4.6 Bird Surveys

The study area lies within, and adjacent to, Rogerstown Estuary SPA, which is designated to protect populations of Annex I waterbirds and waders, and their associated wetland habitats. To assess the potential for the Proposed Development to impact waders and waterbirds, comprising special conservation interests (SCIs) of the SPA and otherwise, a suite of bird surveys was undertaken in coastal and estuarine habitats within the study area, in addition to adjacent areas of terrestrial habitat, where relevant.

The methodology for the bird surveys undertaken of the site and surroundings utilised a wetland bird survey methodology based on the BTO's wetland bird survey (WeBS) Core Counts which use the so-called 'look-see' method (Bibby *et al*., 2000), whereby the observer, familiar with the species involved, surveys the whole of a predefined area, throughout the proposed project working area. The methodology included four survey visits per month with a range of tidal states captured across the survey visits.

Full details of the survey methodology utilised for bird surveys undertaken within the site of proposed project, the findings and interpretation of the findings are detailed within the accompanying Bird Survey Report (EIAR Appendix 13.C).

13.3.5 Assessment Criteria and Assignment of Significance

The information gathered from desk study and the suite of targeted ecological surveys was used to prepare an EcIA for the Proposed Development. The EcIA has been undertaken in accordance with the following guidelines which were used to derive valuation and assessment criteria as set out in Tables 13.1 and 13.2.

Section 3.7.3 of the Environmental Protection Agency's (EPA) *Guidelines on the Information to be contained in Environmental Impact Assessment Reports* (2022) note that "*where more specific definitions exist within a specialised factor or topic e.g. biodiversity, these should be used in preference to these generalised definitions*". The EcIA has been undertaken following the methodology set out in *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine* (CIEEM, 2018); and with reference to the National Roads Authority *'Guidelines for Assessment of Ecological Impacts of National Road Schemes*' (NRA, 2009); *EPA Guidelines on the Information to be contained in Environmental Impact Assessment Reports* (EPA 2022); and *BS 42020:2013 Biodiversity: Code of practice for planning and development* (BSI, 2013).

EcIA is based upon a source-pathway-receptor model, where the source is defined as the individual elements of the Proposed Development that have the potential to affect identified ecological features. The pathway is defined as the means or route by which a source can affect the ecological features. An ecological receptor is the feature of interest, being a species, habitat or ecologically functioning unit of natural heritage importance. Each element can exist independently however an effect is created where there is a linkage between the source, pathway and feature. A significant effect is defined in CIEEM (2018) as:

> "*an effect that either supports or undermines biodiversity conservation objectives for 'important ecological features' [...] or for biodiversity in general. Conservation objectives may be specific (e.g. for a designated*

site) or broad (e.g. national/local nature conservation policy) or more wide-ranging (enhancement of biodiversity). Effects can be considered significant at a wide range of scales from international to local".

and

"*an effect that is sufficiently important to require assessment and reporting so that the decision maker is adequately informed of the environmental consequences of permitting a project. A significant effect is a positive or negative ecological effect that should be given weight in judging whether to authorise a project: it can influence whether permission is given or refused and, if given, whether the effect is important enough to warrant conditions, restrictions or further requirements such as monitoring*".

BS 42020:2013 states that if an effect is sufficiently important to be given weight in the planning balance or to warrant the imposition of a planning condition, e.g. to provide or guarantee necessary mitigation measures, it is likely to be "significant" in that context at the level under consideration. The converse is also true: insignificant effects would not warrant a refusal of permission or the imposition of conditions.

Likely significant effects are predicted on the basis of the Proposed Development as described in Chapter 3 of the EIAR. Significant impacts are minor, moderate or major effects which require counterbalancing mitigation measures to offset their adverse effects. Beneficial effects do not require mitigation measures as their effects are welcomed.

Table 13.1 includes a geographic frame of reference and criteria for valuing ecological features. Table 13.2 sets out criteria for predicting magnitudes of effect. These tables have been prepared with due regard to CIEEM, EPA and NRA guidelines.

Significant impacts are minor, moderate or major effects which require counterbalancing mitigation measures to offset their adverse effects. Beneficial effects do not require mitigation measures as their effects are welcomed.

Table 13.1: Ecological Valuation Criteria for Ecological Features.

Value	Criteria
International	• 'European Sites' including Special Areas of Conservation (SAC) & Special Protection Areas (SPA) • Sites that satisfy the criteria for designation as a 'European Site' (see Annex III of the Habitats Directive) • Features essential to maintaining the coherence of the Natura 2000 Network • Sites containing 'best examples' of the habitat types listed in Annex I of the Habitats Directive • Resident or regularly occurring populations (assessed to be important at the international level) of the following: • Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; and/or • Species of animal and plants listed in Annex II and/or IV of the Habitats Directive • Ramsar Sites • World Heritage Sites

Value	Criteria
	• Sites hosting significant populations of species under the Bonn Convention • Sites hosting significant populations of species under the Berne Convention
National	• Wildlife Refuge for species protected under the Wildlife Acts • Resident or regularly occurring populations (assessed to be important at the national level) of the following: • Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; and/or • Species of animal and plants listed in Annex II and/or IV of the Habitats Directive • Natural Heritage Areas (NHA) or proposed NHA • National Nature Reserves (NNR) • Marine Nature Reserve (MNR)
County	• Sites listed as part of the Ecological Network in the County Development Plan (CDP) • Areas subject to a Tree Preservation Order in a CDP • Resident or regularly occurring populations (assessed to be important at the County level) of the following: • Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive • Species of animal and plants listed in Annex II and/or IV of the Habitats Directive • Species protected under the Wildlife Acts (1976-2018) and/or • Species listed on the relevant Red Data list • Sites containing areas of the habitat types listed in Annex I of the Habitats Directive that occur outside of designated International (SAC/SPA/Ramsar) or National (NHA/pNHA) sites • Regionally important populations of species or viable areas of semi-natural habitats or natural heritage features identified in a Biodiversity Action Plan (BAP) prepared for an administrative area, if this have been prepared • Sites containing natural habitat types with high biodiversity in a regional context and a high degree of naturalness, or populations of species that are uncommon within the County
Local	• Locally important populations of a priority or protected species; or habitats or features of natural heritage importance identified in a BAP, if this has been prepared • Sites containing semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness, or populations of species that are uncommon in the locality • Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological corridors between features of higher ecological value
Site	• Sites containing small areas of semi-natural habitat that are of limited local importance for wildlife

Table 13.2: Magnitudes of Effect upon Ecological Features.

Impact Significance	Magnitude of Effect	Criteria
Significant negative effect	Major adverse	• Loss of, permanent damage to or adverse impact on any part of a site of international or national importance; • Loss of a substantial part or key feature of a site of regional importance; • Loss of favourable conservation status (FCS) of a legally protected species; • Loss of or moderate damage to a population of nationally rare or scarce species.
	Moderate adverse	• Temporary disturbance to a site of international or national importance, but no permanent damage; • Loss of or permanent damage to any part of a site of regional importance; • Loss of a key feature of local importance; • A substantial reduction in the numbers of legally protected species such that there is no loss of FCS but the population is significantly more vulnerable; • Reduction in the amount of habitat available for a nationally rare or scarce species, or species that are notable at a regional or county level.
	Minor adverse	• Temporary disturbance to a site of regional value, but no permanent damage; • Loss of, or permanent damage to, a feature with some ecological value in a local context but that has no nature conservation designation; • A minor impact on legally protected species but no significant habitat loss or reduction in FCS; • A minor impact on populations of nationally rare or scarce species or species that are notable at a regional or county level.
No Significant Effect	Negligible	• No impacts on sites of international, national or county importance; • Temporary disturbance or damage to a small part of a feature of local importance; • Loss of or damage to land of negligible nature conservation value; • No reduction in the population of legally protected, nationally rare, nationally scarce or notable (regional level) species on the site or its immediate vicinity. • Beneficial and adverse impacts balance such that resulting impact has no overall affect upon feature.

Impact Significance	Magnitude of Effect	Criteria
Significant positive effect	Minor beneficial	• A small but clear and measurable gain in general wildlife interest, e.g. small-scale new habitats of wildlife value created where none existed before or where the new habitats exceeds in area that habitats lost.
	Moderate beneficial	• Larger new scale habitats (e.g. net gains over 1ha in area) created leading to significant measurable gains in relation to the objectives of biodiversity action plans.
	Major beneficial	• Major gains in new habitats (net gains of at least 10ha) of high significance for biodiversity being those habitats, or habitats supporting viable species populations, of national or international importance cited in Annexes I and II of the habitats Directive or Annex I of the Birds Directive.

13.3.6 Habitats Directive Appraisals

A Screening for Appropriate Assessment and a Natura Impact Statement (NIS) have been prepared by RPS on behalf of FCC to assist the competent authority in fulfilling its duties in accordance with Part XAB of the Planning and Development Acts 2000 to 2015 (the PDA) which transposes certain aspects of Article 6(3) and 6(4) of the Habitats Directive 92/43/EEC. These documents accompany the EIAR.

Impacts upon European Sites are also discussed below within this chapter of the EIAR.

13.4 Baseline Scenario

13.4.1 Designated Sites and Features of Natural Heritage Importance

The study area proposed for the construction of coastal defences is located within several designated sites. This includes two Natura 2000 Sites, the Rogerstown Estuary SAC and Rogerstown Estuary SPA, in addition to the Rogerstown Estuary proposed Natural Heritage Area (pNHA) and Portrane Shore pNHA. Further designated sites are also present within the wider area including the Rockabill to Dalkey Island SAC, Lambay Island SPA and Rockabill SPA. These sites are illustrated in Figure 13.1.

The Rogerstown Estuary designated sites, including the SAC, SPA and pNHA, will all be directly affected by the Proposed Development, which will involve works within the boundary of these designated sites. Hydrological impacts upon further sites which are linked, via marine waters, to the Proposed Development and lie in relative proximity to the proposals may also occur.

Table 13.3 provides descriptive details of designated sites and features of natural heritage importance located within the site of the project; within immediate proximity to the site of the proposed project; or outside the site of the proposed project but connected to it through an identifiable impact pathway.

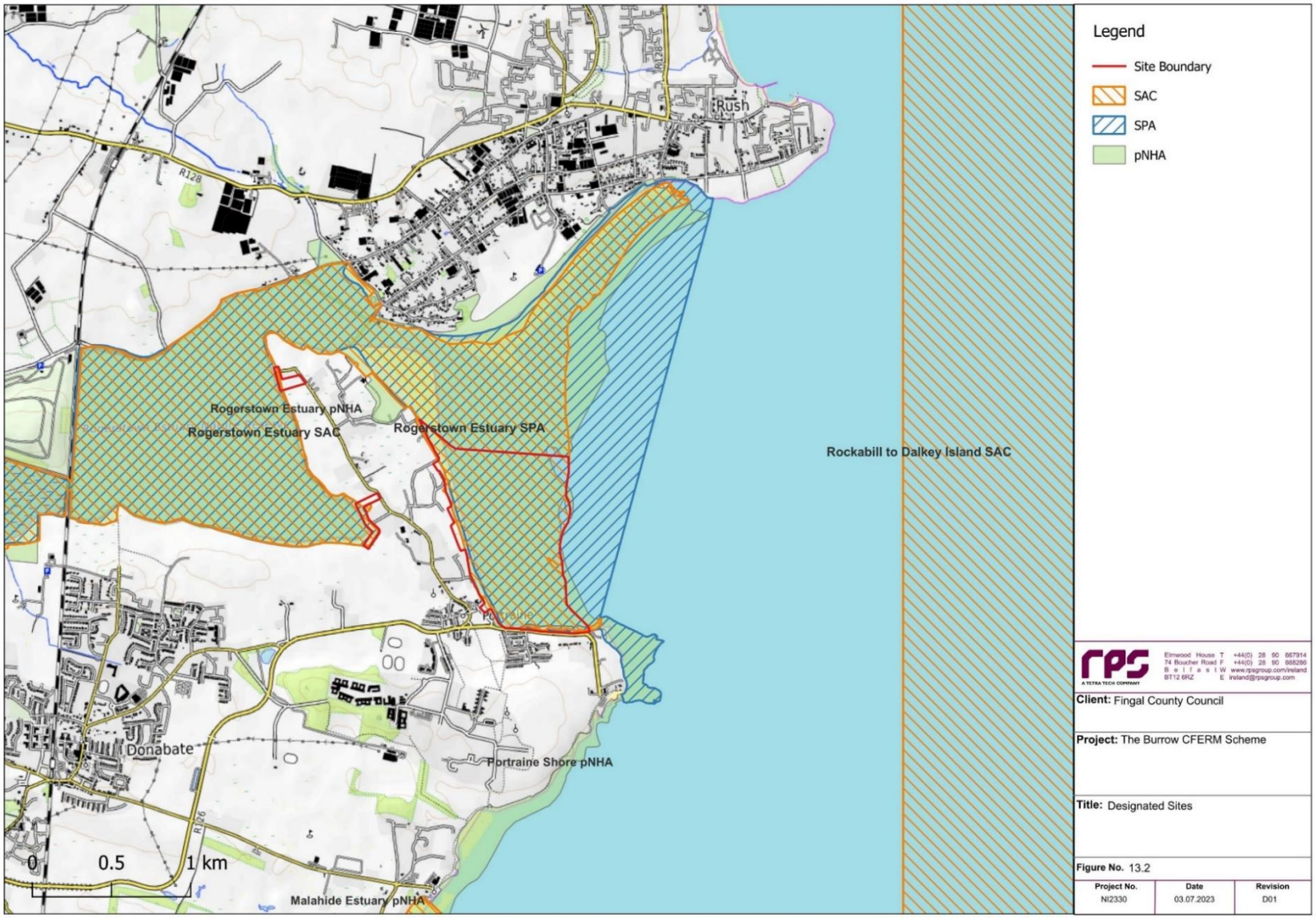


Figure 13.1: Designated Sites.

Table 13.3: Designated Sites & Features of Natural Heritage Importance.

Designated Site/Feature	Distance from Site (km)	Description
Rogerstown Estuary SAC [000208]	N/A	Estuaries [1130] Mudflats and sandflats not covered by seawater at low tide [1140] Salicornia and other annuals colonising mud and sand [1310] Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330] Mediterranean salt meadows (*Juncetalia maritimi*) [1410] Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2120] Fixed coastal dunes with herbaceous vegetation (grey dunes)* [2130]
Rogerstown Estuary SPA [004015]	N/A	A043 Greylag Goose *Anser anser* A046 Brent Goose *Branta bernicla hrota* A048 Shelduck *Tadorna tadorna* A056 Shoveler *Anas clypeata* A130 Oystercatcher *Haematopus ostralegus* A137 Ringed Plover *Charadrius hiaticula* A141 Grey Plover *Pluvialis squatarola* A143 Knot *Calidris canutus* A149 Dunlin *Calidris alpina alpina* A156 Black-tailed Godwit *Limosa limosa* A162 Redshank *Tringa totanus* A999 Wetlands
Rogerstown Estuary pNHA [000208]	N/A	As per SAC and SPA, above.
Portrane Shore pNHA [001215]	N/A	Rocky shores and associated flora and fauna.
Rockabill to Dalkey Island SAC [003000]	2.0	Reefs [1170] *Phocoena phocoena* (Harbour Porpoise) [1351]
Lambay Island SAC [000206]	4.2	Reefs [1170] Vegetated sea cliffs of the Atlantic and Baltic coasts [1230] *Halichoerus grypus* (Grey Seal) [1364] *Phoca vitulina* (Harbour Seal) [1365]
Lambay Island SPA [004069]	4.2	[A009] Fulmar *Fulmarus glacialis* [A017] Cormorant *Phalacrocorax carbo* [A018] Shag *Phalacrocorax aristotelis* [A043] Greylag Goose *Anser anser* [A183] Lesser Black-backed Gull *Larus fuscus* [A184] Herring Gull *Larus argentatus* [A188] Kittiwake *Rissa tridactyla* [A199] Guillemot *Uria aalge* [A200] Razorbill *Alca torda* [A204] Puffin *Fratercula arctica*
Rockabill SPA [004014]	7.5	[A148] Purple Sandpiper *Calidris maritima* [A192] Roseate Tern *Sterna dougallii* [A193] Common Tern *Sterna hirundo* [A194] Arctic Tern *Sterna paradisaea*

13.4.2 Desk Study

13.4.2.1 National Biodiversity Data Centre

A search of the existing records held by NBDC was undertaken. The search area was customised i.e. a 'user-defined' polygon was drawn capturing all records within *c.* 1km of each site. The output data (species list) was refined to include those afforded protection under national and international legislation. Also presented are species which have been assessed following International Union for the Conservation of Nature (IUCN) categories and criteria, and guidelines for their application. The customised search area in this instance was 15km². Given the nature of the Proposed Development which will not give rise to potential impacts upon protected species beyond this area, it is considered that this search area is sufficient to capture all relevant protected species records.

This user-defined polygon and refined output species list are presented in Appendix 13.A of the EIAR.

Records returned include:

- A range of seaweed species, almost entirely reported in the 1970s and 1980s;
- A large range of bird species including a variety of wader and waterfowl species, with records returned across a wide temporal range;
- A range of shoreline annelid species returned from the 1970s to 1990s;
- Several records of common frog, the most recent being from 2020;
- A range of marine crustacean species;
- A number of jellyfish species;
- A large range of flowering plant species including the vulnerable alder buckthorn *Frangula alnus* and endangered green-winged orchid *Orchis morio,* meadow barley *Hordeum secalinum*;
- A large range of insect species including a number of vulnerable, near-threatened and endangered species;
- Marine mammals including harbour porpoise *Phocoena phocoena,* common seal *Phoca vitulina,* grey seal *Halichoerus grypus* and minke whale *Balaenoptera acutorostrata*; and
- A range of terrestrial mammals including Irish hare *Lepus timidus sbsp. hibernicus,* hedgehog *Erinaceus europaeus* and a number of bat species.

13.4.3 Annex I Habitats

13.4.3.1 Annex I Saltmarsh

Annex I saltmarsh habitats have been subject to survey by BEC Consultants, as set out in the appended survey report, Appendix 13.B. This information is summarised below in respect of the areas potentially impacted by the Proposed Development in addition to the wider Rogerstown Estuary SAC.

Salicornia and other annuals colonising mud and sand [1310]

This habitat was recorded as present at the north-eastern extent of the Burrow, in a low-lying area between areas of Annex I sand dune habitat, which is regularly inundated by the tide, and in a narrow band along the foreshore at the northern part of the Burrow. In total the habitat was recorded to occupy an area of 1.06ha within the study area. This is an average annual increase of 2.4% when compared with the previously mapped extent of the habitat at the site, from 2006. The 2021 area assessment is therefore favourable.

Structure and function of the habitat was assessed through the use of two monitoring stops. A total of four structure and function criteria were utilised to assess condition. Overall, the condition of this Annex I habitat was deemed to be favourable with all four criteria passed.

Future prospects were considered to be favourable owing the lack of significant pressures or threats however potential negative effects were predicted as potentially arising through recreational use of the relevant areas by walkers and potential colonisation by cord-grass *Spartina* species.

The mapped extent of this habitat recorded in 2021 is illustrated in Figure 13.2. It is noted that no areas of this Annex I habitat will be directly affected by the Proposed Development as no coastal defences are proposed within these areas. However, indirect effects associated with the operational phase of the development may still occur, as discussed at Section 13.5.

Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330]

This habitat was recorded as present within several areas to the north and west of the Burrow including a relatively large area and several smaller areas at the north-east of the Burrow, and relatively narrow linear bands along the foreshore of the northern and western shorelines of the Burrow. In total, the area of habitat recorded across the study area was 7.43ha. This represents an average annual increase of 1.1% when compared to the 2006 survey data. The area assessment is therefore considered to be favourable.

Structure and function of the habitat was assessed through the use of eleven monitoring stops. A total of eight structure and function criteria were utilised to assess condition. Overall, the condition of this Annex I habitat was deemed to be unfavourable - inadequate with seven of the eight criteria passed.

Future prospects were considered to be unfavourable – inadequate due to the potential effects of informal sea defences in the absence of implementation of the proposed development and tractor movements along the foreshore. Identified pressures and threats include the presence of path, tracks, recreational use, modification of the coastline and colonisation by cord-grass *Spartina* species.

The mapped extent of this habitat recorded in 2021 is illustrated in Figure 13.2 to Figure 13.5. . The Proposed Development will involve the construction of coastal defences in close proximity to areas of this habitat along the south-western and north-western shoreline of the Burrow. The working area of the proposed construction lies within areas of this habitat. Direct and indirect impacts may occur, as discussed at Section 13.5.

A small area of Mediterranean salt meadow habitat was recorded within the wider study area, along the southern shoreline of the Rogerstown Estuary, to the west of the Burrow and in proximity to the train bridge. The total area of the habitat recorded was 0.31ha which represents an average annual increase of 16.3% when compared with the previously mapped extent from 2006. The 2021 area assessment is therefore favourable.

Structure and function of the habitat was assessed through the use of a single monitoring stop. A total of seven structure and function criteria were utilised to assess condition. Overall, the condition of this Annex I habitat was deemed to be unfavourable - inadequate with six of the seven criteria passed.

Future prospects were considered to be favourable owing the lack of significant pressures or threats however potential negative effects were predicted as potentially arising through recreational use of the relevant areas by walkers.

The mapped extent of this habitat recorded in 2021 is illustrated in Figure 13.5, which is inclusive of a small area of mixed Atlantic and Mediterranean saltmarsh. All other areas of this habitat lie distant from the proposed working areas. It is noted that this small area of mixed Annex I habitat will be directly affected by the proposals as it lies within the proposed working area. Additional indirect effects associated with the operational phase of the development may still occur, as discussed at Section 13.5.

Associated Habitats

Several areas of saltmarsh habitat are present in association with the Annex I habitats discussed above and include areas of Atlantic salt meadows with some level of colonisation by cord-grass *Spartina sp.,* areas of mud supporting cord-grass and areas dominated by cord-grass with other species. These areas may also be subject to direct and indirect effects associated with the Proposed Development.

13.4.3.2 Annex I Sand Dune

Annex I sand dune habitats have also been subject to survey by BEC Consultants, as set out in the appended survey report in Appendix 13.B. This information is summarised below in respect of the areas to be affected by the Proposed Development in addition to the wider Rogerstown Estuary SAC.

Annual vegetation of drift lines [1210]

A narrow band of this habitat is present along the vast majority of the eastern shoreline of the Burrow, widening somewhat in the north, where it interfaces with the wider dune system in this location at the north-east of the Burrow. The total area of this habitat recorded within the study area is 1.09ha. This represents an average annual increase of 25.5% from that previously mapped in most recent Rogerstown Estuary SAC surveys, in 2014. As such the 2021 area assessment for this habitat is favourable.

Structure and function of the habitat was assessed through the use of four monitoring stops. A total of six structure and function criteria were utilised to assess condition. Overall, the condition of this Annex I habitat was deemed to be unfavourable - inadequate with five of the six criteria passed.

Future prospects were considered to be unfavourable – inadequate due to the construction of informal sea defences in the absence of implementation of the proposed development.

The mapped extent of this habitat recorded in 2021 is illustrated in Figure 13.3 and Figure 13.4. The Proposed Development will involve the construction of coastal defences within and in close proximity to areas of this habitat along the eastern shoreline of the Burrow. Direct and indirect impacts may occur, as discussed at Section 13.5.

Perennial vegetation of stony banks [1220]

A narrow band of this habitat is present along several areas of the shoreline at Portrane, including a short section to the south-east of the Burrow, in addition to a long section on the north-west and western shores of the Burrow. The total area of this habitat recorded within the study area is 0.24ha. This habitat was not previously recorded during previous surveys of dune habitats within the study area, in 2014. The area assessment for this habitat was therefore considered to be favourable.

Structure and function of the habitat was assessed through the use of two monitoring stops. A total of seven structure and function criteria were utilised to assess condition. Overall, the condition of this Annex I habitat was deemed to be unfavourable - inadequate with six of the seven criteria passed.

Future prospects were considered to be unfavourable – inadequate due to the construction of informal sea defences in the absence of implementation of the proposed development.

The mapped extent of this habitat recorded in 2021 is illustrated in Figure 13.2 to Figure 13.5. The Proposed Development will involve the construction of coastal defences within and in close proximity to areas of this habitat along the eastern shoreline of the Burrow. Direct and indirect impacts may occur as discussed at Section 13.5.

Embryonic shifting dunes [2110]

This habitat was recorded exclusively in the north-eastern portion of the Burrow dune complex and interfaces with more established dune habitats in this location. The total area of this habitat recorded within the study area is 0.63ha. This represents an annual average decrease of 9.6% compared to mapped areas during surveys undertaken in 2014. The area assessment for this habitat was therefore considered to be unfavourable - bad.

Structure and function of the habitat was assessed through the use of four monitoring stops. A total of seven structure and function criteria were utilised to assess condition. Overall the condition of this Annex I habitat was deemed to be unfavourable - inadequate with six of the seven criteria passed.

Future prospects were considered to be unfavourable – inadequate due to the construction of informal sea defences in the absence of implementation of the proposed development.

No areas of this Annex I habitat will be directly affected by the proposals as no coastal defences are proposed within these areas. However, indirect effects associated with the operational phase of the development may still occur, as discussed at Section 13.5.

Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2120]

This habitat is recorded in a narrow band along the eastern shoreline of the Burrow and towards the north-eastern portion of the Burrow, where it exists in a mosaic with grey dunes and pioneer dune habitat. The total area of this habitat recorded within the study area is 0.46ha. This represents an average annual increase of 2.8% from that previously mapped in the most recent Rogerstown Estuary SAC surveys, in 2014. As such the 2021 area assessment for this habitat is favourable.

Structure and function of the habitat was assessed through the use of four monitoring stops. A total of seven structure and function criteria were utilised to assess condition. Overall, the condition of this Annex I habitat was deemed to be unfavourable - inadequate with five of the seven criteria passed.

Future prospects were considered to be unfavourable – bad due to the construction of informal sea defences in the absence of implementation of the proposed development, in addition to colonisation by invasive alien species.

The Proposed Development will involve the construction of coastal defences within and in close proximity to areas of this habitat along the eastern shoreline of the Burrow. Direct and indirect impacts may occur, as discussed within Section 13.5.

Fixed dunes with herbaceous vegetation (grey dunes) [2130]

This Annex I priority habitat is present in a band along the eastern shoreline of the Burrow, in addition to larger areas, which interface with white dunes and other dune habitats in the north-eastern portion of the Burrow. The total area of this habitat recorded within the study area is 5.98ha. This represents a decrease in the recorded area of this habitat at Portrane, with an average annual decrease of 1.4% following previous surveys in 2014. The area assessment for this habitat is therefore considered to be unfavourable – bad.

Structure and function of the habitat was assessed through the use of eight monitoring stops. A total of eleven structure and function criteria were utilised to assess condition. Overall, the condition of this Annex I habitat was deemed to be unfavourable - inadequate with eight of the eleven criteria passed.

Future prospects were considered to be unfavourable – bad due to the construction of informal sea defences in the absence of implementation of the proposed development, in addition to colonisation by invasive alien species.

The Proposed Development will involve the construction of coastal defences within and in close proximity to areas of this habitat along the eastern shoreline of the Burrow. Direct and indirect impacts may occur, as discussed at Section 13.5.



Figure 13.2: Annex I Habitat Survey – North-West.

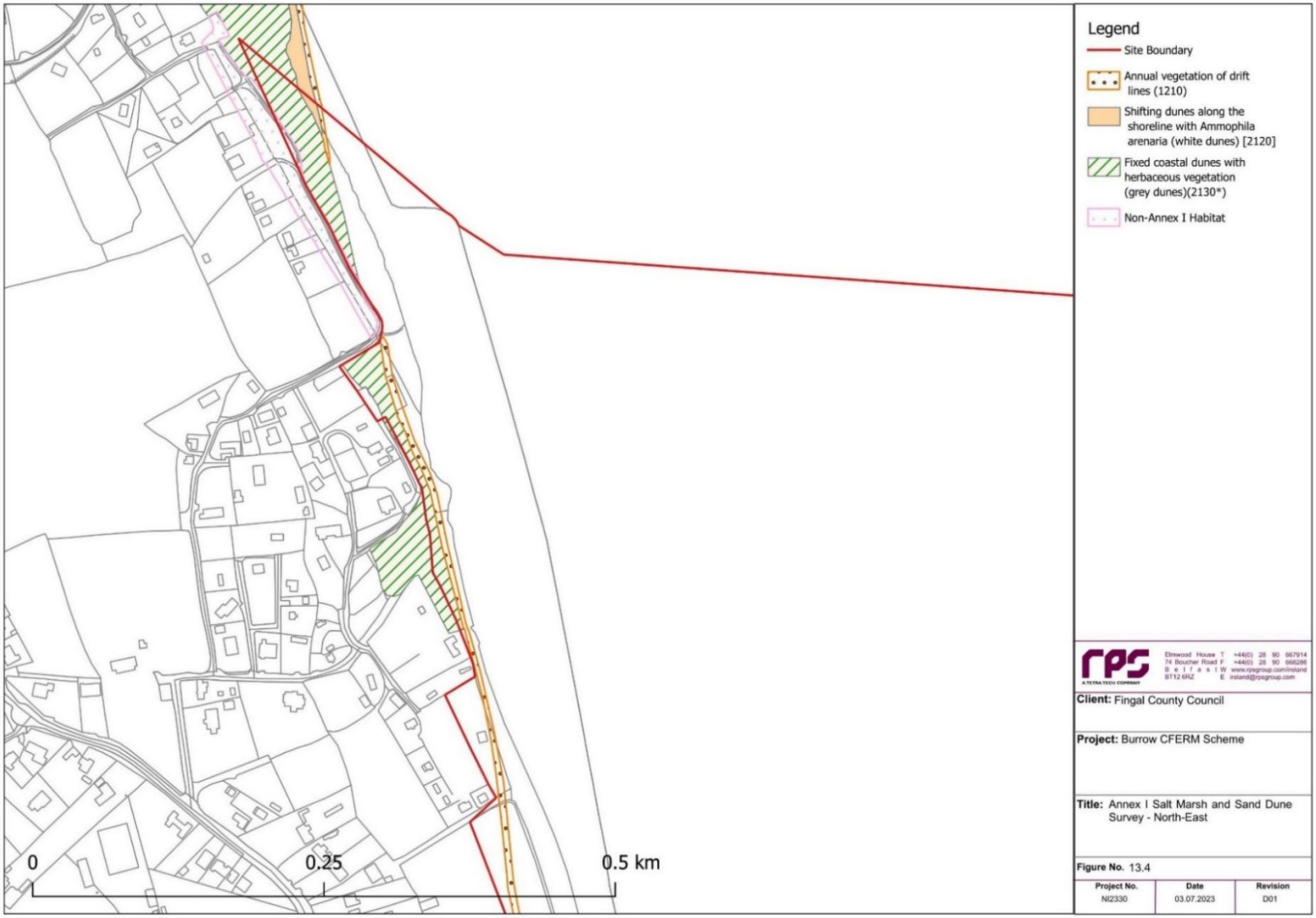


Figure 13.3: Annex I Habitat Survey – North-East.

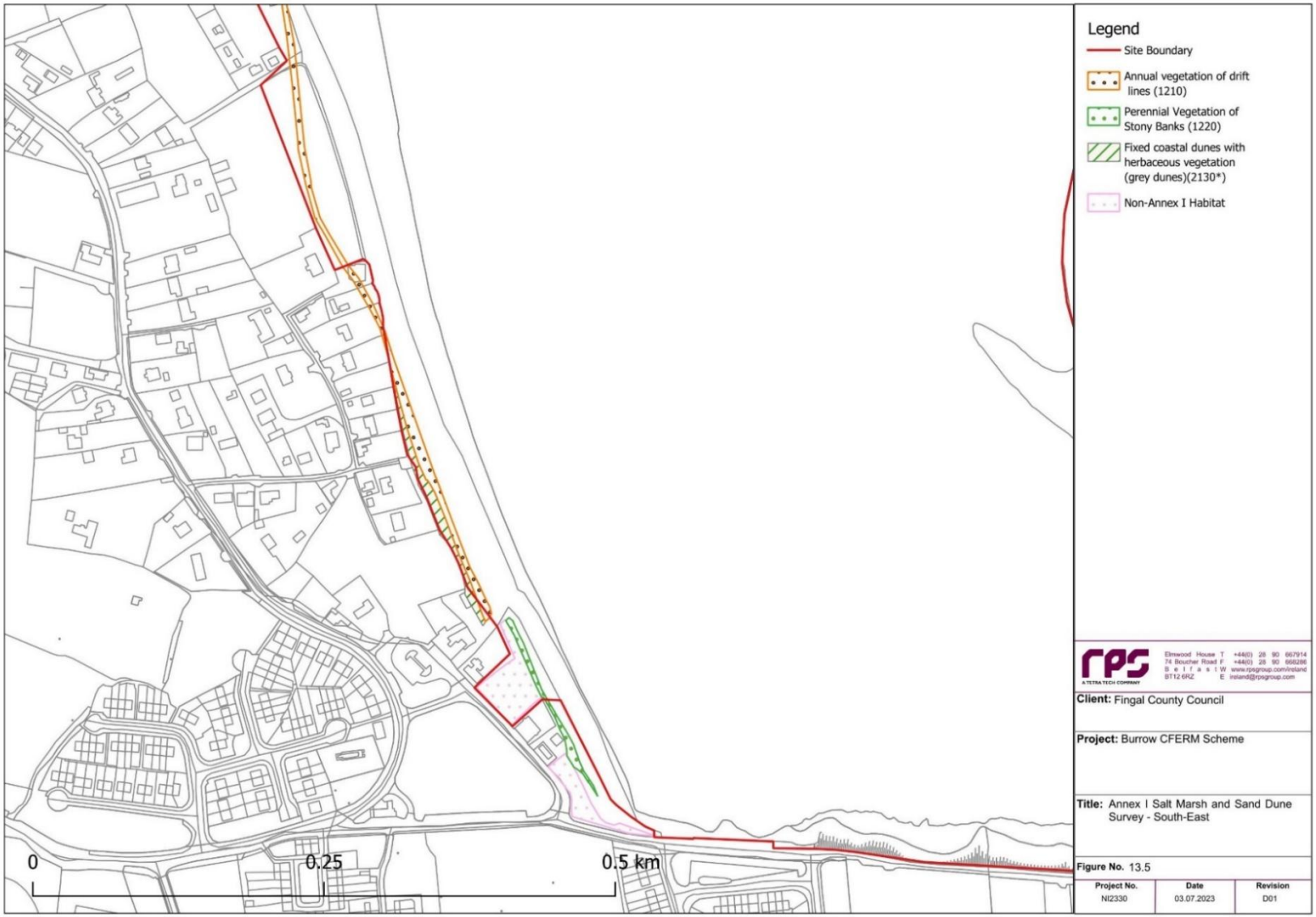


Figure 13.4: Annex I Habitat Survey – South-East.

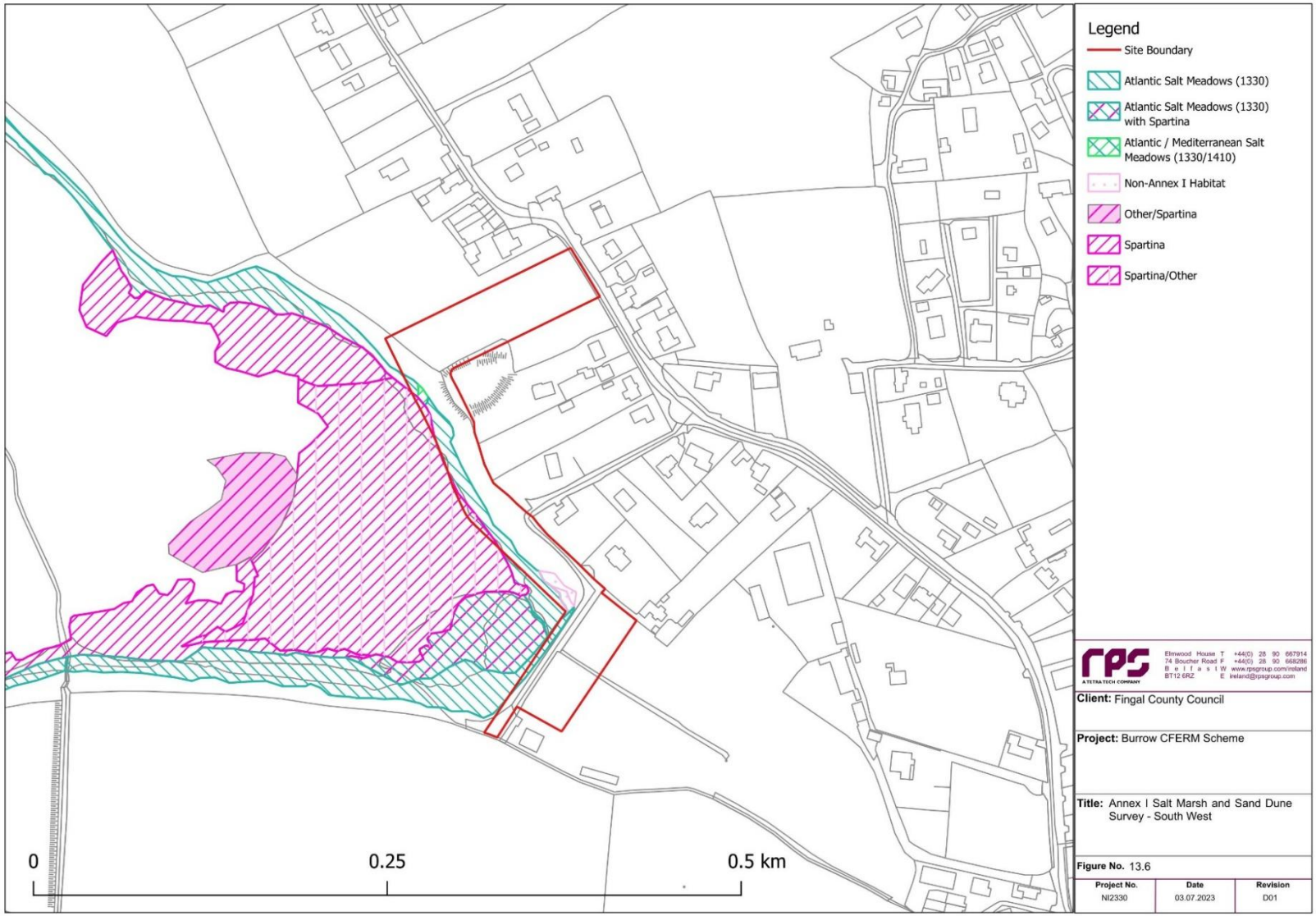


Figure 13.5: Annex I Habitat Survey – South-West.

13.4.4 Phase 1 Habitat Survey

In addition to specialist surveys of terrestrial and coastal Annex I habitats, as summarised above, an extended Phase 1 Habitat Survey was undertaken by RPS, of all areas of terrestrial habitat in close proximity to the areas proposed for coastal defence works including the working area and access route. These habitats are illustrated at Figure 13.6 to Figure 13.9 and described individually below.

13.4.4.1 Dry Meadows/ Grassy Verges

A large proportion of the proposed working area and its surrounds, inclusive of areas of former agricultural lands, unmanaged marginal habitat above the shoreline and unmanaged gardens. This habitat is variable and is generally present on fairly sandy soils. In places these grasslands are more species rich, with clear low soil nutrient levels while the majority are rank grasslands which are species poor. Some areas of this habitat have been subject to significant colonisation by scattered and dense scrub.

Species present within this habitat include false oat-grass *Arhennatherum elatius,* cock's-foot *Dactylis glomerata,* sweet vernal grass *Anthoxanthum odoratum,* common couch *Elymus repens,* perennial rye-grass *Lolium perenne,* Yorkshire fog *Holcus lanatus,* common bent *Agrostis capillaris,* creeping bent *Agrostis stolonifera,* velvet bent *Agrostis canina,* red fescue *Festuca rubra,* squirrel-tail fescue *Vulpia bromoides,* soft brome *Bromus hordaceus,* common quaking-grass *Briza media,* hard rush *Juncus inflexus,* compact rush *Juncus conglomeratus,* horseradish *Armoracia rusticana,* creeping thistle *Cirsium arvense,* spear thistle *Cirsium vulgare,* meadow buttercup *Ranunculus acris,* creeping buttercup *Ranunculus repens,* creeping cinquefoil *Potentilla reptans,* common knapweed *Centaurea nigra,* red clover *Trifolium pratense,* white clover *Trifolium repens,* bush vetch *Vicia sepium,* common vetch *Vicia sativa,* kidney vetch *Anthyllis vulnerarnia,* bird's-foot trefoil *Lotus corniculatus,* black medick *Medicago lupulina,* red bartsia *Odontites verna,* oxeye daisy *Leucanthemum vulgare,* cat's-ear *Hypochaeris radicata,* dandelion *Taraxacum officinale agg.,* ragwort *Senecio jacobaea,* hoary ragwort *Senecio erucifolius,* hedge mustard *Sisymbrium officinale,* prickly sow-thistle *Sonchus asper,* smooth sow-thistle *Sonchus oleraceus,* smooth hawksbeard *Crepis capillaris,* nipplewort *Lapsana communis,* rosebay willowherb *Chamerion angustifolium,* yellow rattle *Rhinanthus minor,* white campion *Silene latifolia,* doves-foot cranesbill *Geranium molle,* common mouse-ear *Cerastium fontanum,* broad-leaved dock *Rumex obtusifolium,* curled dock *Rumex crispus,* common sorel *Rumex acetosa,* ribwort plantain *Plantago lanceolata,* greater plantain *Plantago major,* meadowsweet *Filipendula ulmaria,* lady's bedstraw *Galium verum,* soapwort *Saponaria officinalis,* field bindweed *Convolvulus arvensis,* tree mallow *Lavatera maritima,* mugwort *Artemisia vulgaris,* common nettle *Urtica dioica,* hogweed *Heracleum sphondylium,* alexanders *Smyrnium olusatrum,* wild carrot *Daucus carota,* yarrow *Achillea millefolium,* common broomrape *Orobanche minor,* knotgrass *Polygonum aviculare,* bracken *Pteridium aquilinum,* field horsetail *Equisetum arvense* and Russian vine *Fallopia baldschuanica*.

Scrub species establishing within this habitat include grey willow *Salix cinerea,* osier *Salix viminalis,* purple willow *Salix purpurea,* hawthorn *Crategus monogyna,* buddleia *Buddleja davidii,* cherry *Prunus avium,* gorse *Ulex europaeus,* escaped cordyline *Cordyline australis,* blackthorn *Prunus spinosa,* elder *Sambucus nigra* and extensive bramble *Rubus fruticosus*.

Areas of this habitat lying in a narrow band adjacent to the shore were noted to support high dominance of sand couch *Thinopyrum junceum* associated with accumulations of sandier soils.

Given the wide range of species supported in addition to the sandy soils on which the habitat is predominately located this habitat is considered to be of ecological importance at the local (higher) level.

13.4.4.2 Dry Calcareous Grassland

A small field which lies in proximity to the north-west portion of the Proposed Development, but outside of the proposed working area, is characterised as supporting dry calcareous species-rich grassland which is subject to minimal management and some gorse scrub encroachment.

Species present within this habitat include meadow foxtail *Alopecurus pratensis,* false oat-grass, sweet vernal grass, crested dog's-tail *Cynosurus cristatus,* Yorkshire fog, perennial rye-grass, meadow oat-grass *Helictochloa pratensis,* common quaking grass, soft brome, red fescue, lady's bedstraw, rough poppy *Papaver hybridum,* meadow buttercup, cat's-ear, germander speedwell *Veronica chamaedrys,* field scabious *Knautia arvensis,* yarrow, common restharrow *Ononis repens,* bird's-foot trefoil, hop trefoil *Trifolium campestre,* wild mignonette *Reseda lutea,* weld *Reseda luteola,* ragwort, bracken, mugwort, yellow rattle, pyramidal orchid *Anacamptis pyramidalis,* wild carrot, red clover, red bartsia, hawkweed *Hieracium sp.,* autumn hawkbit *Scorzoneroides autumnalis,* scarlet pimpernel *Anagallis arvensis,* fat hen *Chenopodium album* and white campion.

This habitat is species rich with a high proportion of forbs within the sward and a high density of flowering plants of value for pollinators.

This habitat is considered to be of high ecological value and of importance at the county level.

13.4.4.3 Improved Grassland

Limited areas of agricultural improved grassland are present within and in proximity to the proposed working area in the south-west and south-east of the Proposed Development. These areas have been subject to re-seeding and significant agricultural improvement and are species poor.

Species present include the dominant perennial rye-grass, Italian rye-grass *Lolium multiflorum,* Yorkshire fog, false oat-grass, common couch, dandelion, broad-leaved dock, creeping thistle and common nettle.

These areas of habitat are of ecological value at the site level.

13.4.4.4 Mixed Broadleaved Woodland

Several small areas of mixed broadleaved woodland lie within proximity to the proposed working area. These comprise areas of largely native species woodland with occasional ornamental tree species, especially within gardens in the western parts of the site.

These habitats lie outside the proposed working areas and are considered to be of ecological value at the local level.

13.4.4.5 Scrub

Areas of dense and scattered scrub are present throughout the site and within the proposed working areas. These areas are unmanaged and characterised by the presence of young trees and shrub species including grey willow, osier, hawthorn, cherry, elder, alder *Alnus glutinosa,* gorse and extensive bramble. Areas of scattered scrub were exclusively located with areas of unmanaged dry meadow grassland.

This habitat is considered to be of ecological importance at the site level.

13.4.4.6 Coniferous Treeline

Several coniferous treelines are supported within proximity to the proposed working areas and are typically comprised of leylandii *Cupressus leylandii,* Lawson cypress *Chamaecyparis lawsoniana,* black pine *Pinus nigra* and Scot's pine *Pinus sylvestris*. These appear to have been largely planted as windbreaks.

These features are considered to be of site-level ecological value.

13.4.4.7 Amenity Grassland

A large proportion of terrestrial habitat within and in proximity to the proposed working area is comprised of managed amenity grassland which is subject to regular mowing, these include areas of managed gardens and municipal grasslands.

These areas are generally species poor and support a limited range of vegetation tolerant of regular cutting including a limited range of common grass species and forbs including dandelion, yarrow, cat's-ear, white clover, ribwort plantain, ragwort, curled dock, dove's-foot cranesbill, bird's-foot trefoil, lady's bedstraw and common vetch. Bracken and bramble are often present toward the unmanaged margins of these habitats.

This habitat is considered to be of low ecological value and of importance at the site level.

13.4.4.8 Amenity Planting

Areas of amenity planting, largely comprising non-native species and managed as gardens are present throughout the Study Area and in proximity to the proposed working areas.

These areas are inclusive of a range of managed ornamental planting including flower beds, shrubs and gardens generally and are of low ecological value and of importance at the site level.

13.4.4.9 Dense Bracken

Areas of dense bracken are present in several locations within and in proximity to the proposed working areas. these are characterised by dominant bracken with other flora being extremely limited.

This habitat is considered to be of ecological importance at the site level.

13.4.4.10 Buildings

Areas in proximity to the proposed working areas support a range of buildings, typically residential buildings with occasional agricultural, commercial and utility structures. No buildings lie within the proposed working areas.

This habitat is considered to be of ecological importance at the site level.

13.4.4.11 Hardstanding/ Bare Ground

A large proportion of terrestrial habitats in proximity to the proposed working areas is comprised of hardstanding including tarmac roads and concreted areas and bare ground which is regularly disturbed and as such supports no vegetation.

These areas are of negligible ecological value and are considered to be of importance at the site level.

13.4.4.12 Recolonising Bare Ground

Small areas of bare ground which have been subject to limited recolonisation by a range of plant species are supported within or in proximity to the proposed works areas. These areas are largely bare and subject to variable levels of disturbance.

Recolonising plant species include broad-leaved willowherb *Epilobium montanum,* mugwort, oxeye daisy, annual meadow grass *Poa annua,* buddleia, Yorkshire fog, prickly sow-thistle, spear thistle, rosebay willowherb and a limited range of further common and widespread species.

These areas are small, of limited diversity and considered to be of ecological value at the site level.

13.4.4.13 Shingle and Gravel Banks

Shingle and gravel banks are present along a short section of the proposed working area, in the south-east of the site, along stretches of the shore, where terrestrial habitats transition to areas of grassland. These areas are located within a very narrow band and are characterised by fairly large diameter substrates which are largely bare, with limited vegetation including curled dock and white campion.

These areas of habitat are considered to be representative of the Annex I habitat: 1220 Perennial vegetation of stony banks, as described above.

This habitat is therefore considered to be of importance at the international level.

13.4.4.14 Fixed Dunes

Several areas of fixed dunes are present in the north-eastern portion of the Proposed Development within and adjacent to the proposed works area in this location. These areas are characterised by the presence of bracken, false oat-grass, red fescue, lady's bedstraw and birds-foot trefoil.

Small areas of fixed dune habitat along the eastern side of the Burrow support dense stands of sea buckthorn *Hippophae rhamoides*.

These areas are representative of Annex I habitat: 2130 Fixed dunes with herbaceous vegetation (grey dunes), as described above.

This habitat forms a qualifying interest of the Rogerstown Estuary SAC and as such is considered to be of importance at the international level.

13.4.4.15 Marram Dunes

Limited areas of marram dunes are present in the north-east part of the site, with only a small area lying within the proposed working area in this location.

This habitat is characterised by a sand dune structure with very limited vegetation, with the exception of marram grass *Ammophila arenaria*.

This habitat is representative of the Annex I habitat: 2120 Shifting dunes along the shoreline with Ammophila arenaria (white dunes).

This habitat is a qualifying interest of the Rogerstown Estuary SAC and as such is considered to be of importance at the International level.

13.4.4.16 Lower Salt Marsh

Areas of lower salt marsh are present in the south-western part of the site and are characterised by fairly sparse vegetation on mud, largely limited in this location to dominant cord grass *Spartina anglica,* with common saltmarsh grass *Puccinellia maritima* and occasional sea plantain *Plantago maritima*.

These habitats were not assessed as comprising Annex I saltmarsh habitat however they are representative of the Annex I habitat: 1140 Mudflats and sandflats which are not covered by sea water at low tide.

This habitat is a qualifying interest of the Rogerstown Estuary SAC and as such is considered to be of importance at the International level.

13.4.4.17 Upper Salt Marsh

Areas of upper saltmarsh, characterised by the presence of a range of typical species, are present within the south-western and north-western parts of the site and lie within and in proximity to the proposed working areas in these locations.

Species present within these habitats include sea aster *Tripolium pannonicum,* sea plantain, sea lavender *Limonium vulgare,* thrift *Armeria maritima,* sea milkwort *Glaux maritima,* annual sea-blite *Suaeda maritima,* common scurvy-grass *Cochlearia officinalis,* sea purslane *Halimione portulacoides,* common saltmarsh grass, saltmarsh rush *Juncus gerardii*, sea rush *Juncus maritimus,* greater sea spurrey *Spergularia media,* sea arrowgrass *Triglochin maritima* and red fescue.

These areas are representative of both Annex I habitat: 1330 Atlantic Salt Meadows and 1410 Mediterranean salt meadows, both of which are qualifying interests of the Rogerstown Estuary SAC.

As such, this habitat is considered to be of International importance.

13.4.4.18 Shingle and Gravel Shores

Shingle and gravel shores are present along several stretches of the shoreline, where terrestrial habitats transition to areas of dune, saltmarsh and intertidal shoreline. These areas are located within a very narrow band and are characterised by fairly large diameter substrates which are largely bare, with limited vegetation including curled dock and white campion.

These areas of habitat are considered to be representative of the Annex I habitat: 1210 Annual vegetation of drift lines, as described above.

This habitat is therefore considered to be of importance at the international level.

13.4.4.19 Sand Shores

Sand shores are present in a narrow bank along the shore of the south-eastern portion of the proposed work area. These are characterised by a lack of vegetation due to regular tidal inundation and are comprised of sandy substrate interspersed with areas of sheltered rocky shoreline habitat.

This habitat is not representative of Annex I habitat and as such is considered to be of importance at the local level.

13.4.4.20 Mixed Sediment Shores

The vast majority of intertidal habitat along the shorelines within or in proximity to the proposed working area are mixed sediment shores comprised predominately of sand with significant proportions of mud and shingle. These habitats are devoid of vegetation and are subject to regular tidal erosion.

These habitats are representative of the Annex I habitat: 1140 Mudflats and sandflats not covered by sea water at low tide which is a qualifying feature of the Rogerstown Estuary SAC.

As such this habitat is considered to be of importance at the International level.

13.4.4.21 Estuarine and Intertidal Habitat

Estuarine habitat, in addition to further areas of intertidal mud and sand, are present outside the terrestrial areas of the Proposed Development and working areas. These areas are representative of both the Annex I habitats: 1130 Estuaries and 1140 Mudflats and sandflats not covered by sea water at low tide, both of which are qualifying features of the Rogerstown Estuary SAC.

As such this habitat is considered to be of importance at the International level.

13.4.4.22 Sea Walls/ Coastal Defences

Several coastal defences are present within the proposed working area, these include a section of loose rock armour located along the bay in the south-east portion of the site in addition to several lengths of Seabee coastal defence along much of the eastern shore of the Burrow. These areas do not support significant vegetation and are of negligible ecological value.

These features are considered to be of site level ecological importance.

13.4.4.23 Native Species Hedgerow

The areas within and in proximity to the proposed work areas support a number of native species hedgerows, typically dominated by hawthorn, which are subject to variable management.

These features are considered to be of local level ecological importance.

13.4.4.24 Non-Native Species Hedgerow

Hedgerows between gardens and other types of property throughout the Burrow are typically comprised a range of non-native species including New Zealand broadleaf *Griselinia littoralis,* leylandii, lawson cypress, privet *Ligustrum ovalifolium,* cotoneaster *Cotoneaster horizontalis,* laurel *Prunus laurocerasus,* red robin *Photinia x Fraseri* and a further range of ornamental species.

These features are considered to be of low ecological value and of importance at the site level.

13.4.4.25 Drainage Channel

A single flowing drainage channel was recorded within the site, that being an agricultural field drain in the south-west corner of the site, which empties into the Rogerstown Estuary through an areas of salt marsh.

This habitat is of limited ecological value and is considered to be of importance at the site level.

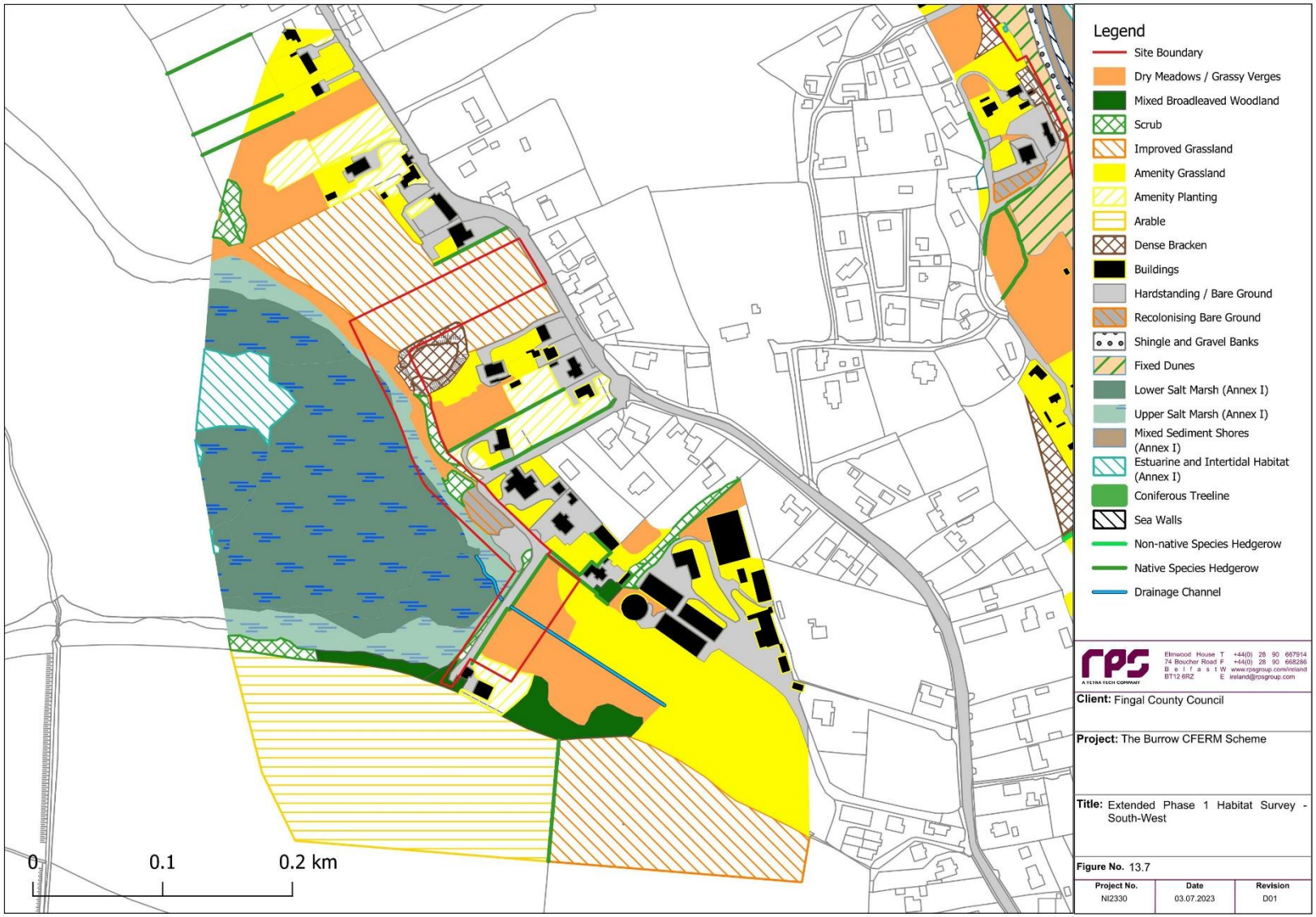


Figure 13.6: Extended Phase I Habitat Survey – South-West.

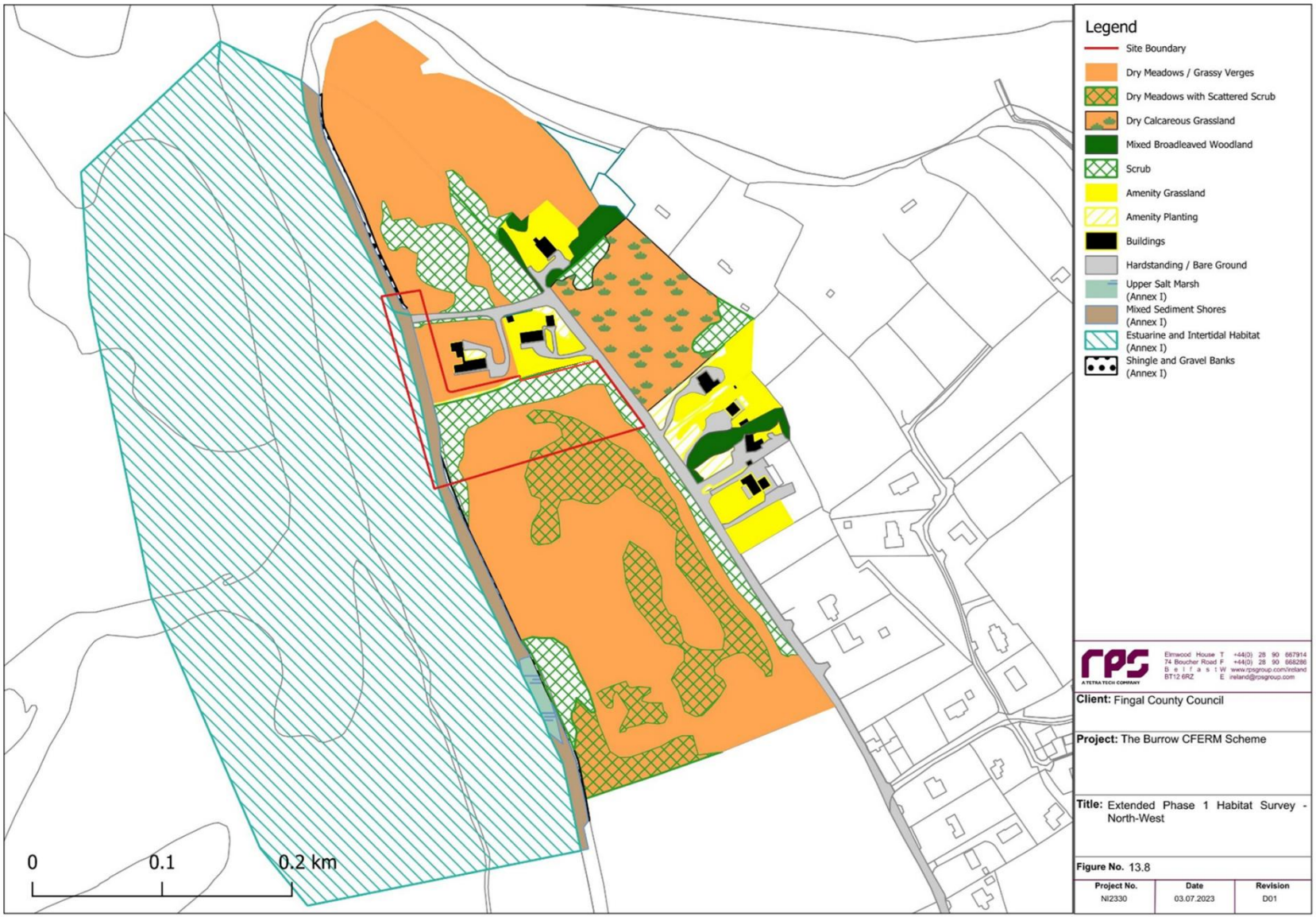


Figure 13.7: Extended Phase I Habitat Survey – North-West.

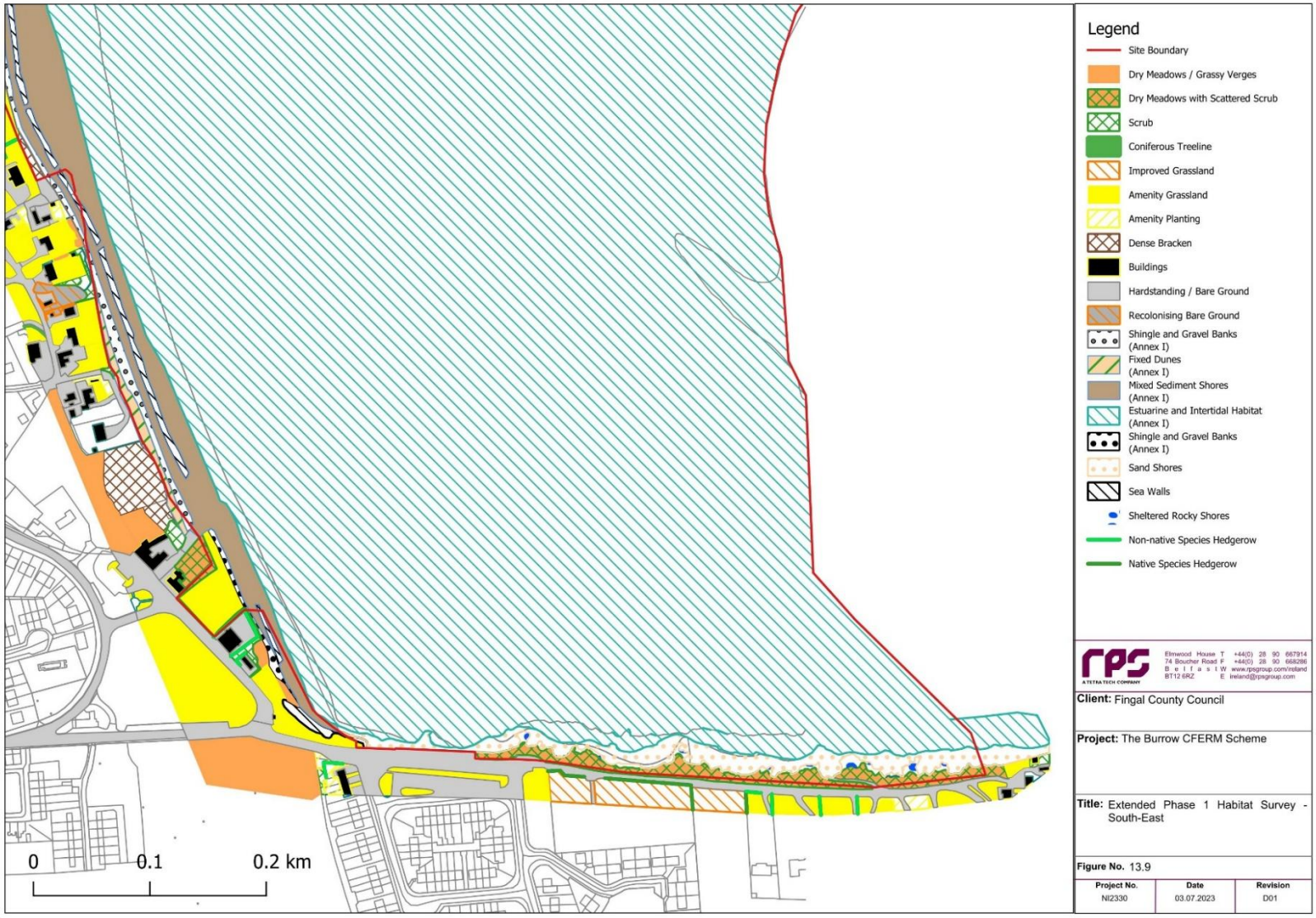


Figure 13.8: Extended Phase I Habitat Survey – South-East.

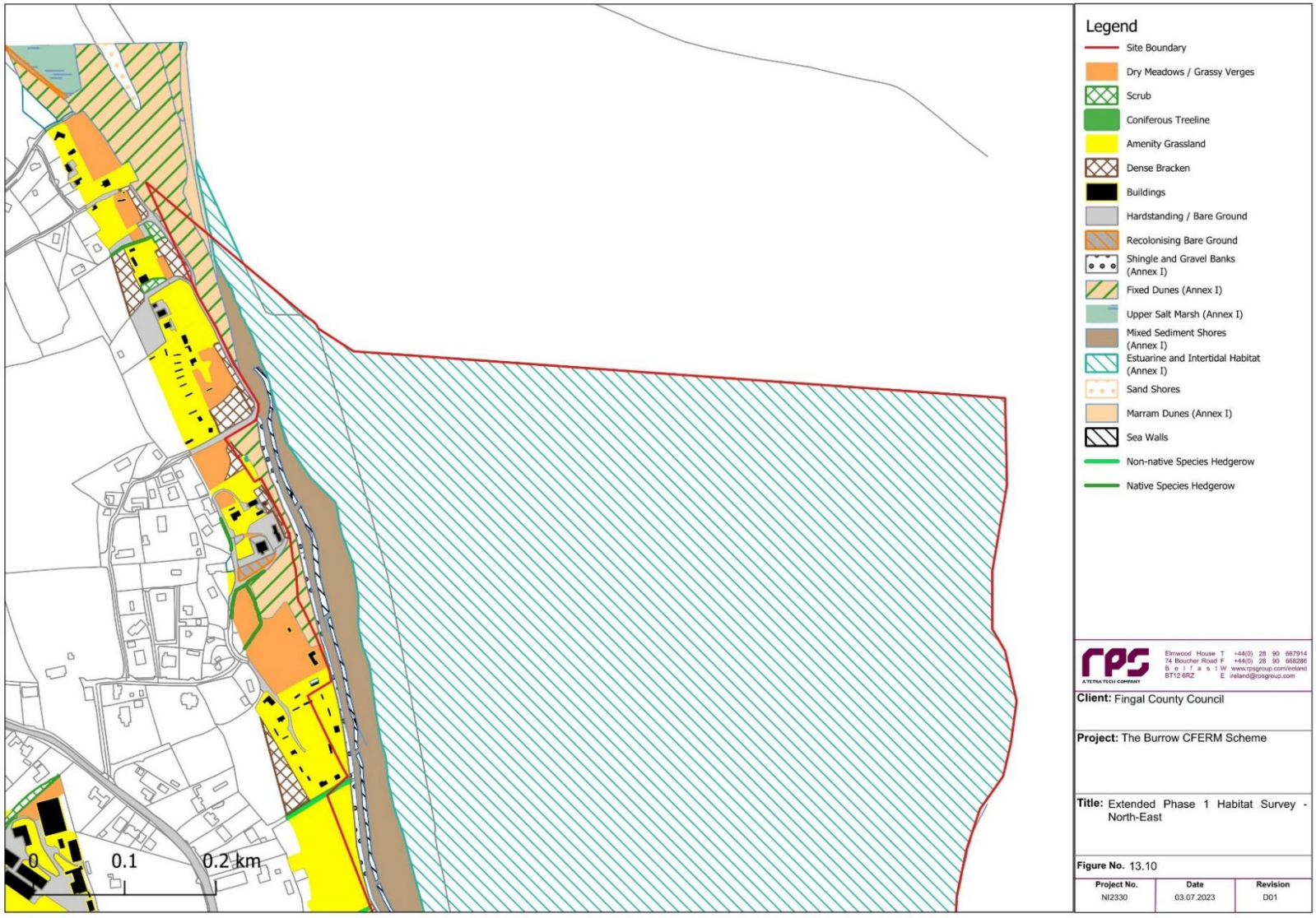


Figure 13.9: Extended Phase I Habitat Survey – North-East.

13.4.5 Protected Species

13.4.5.1 Otter

The site and its surrounds were searched for evidence indicating the presence of otter or their holts or dens.

No evidence indicating the presence of this species was recorded during the survey. It is considered that the site is likely to be of relatively limited value for the species given the lack of undisturbed semi-natural habitat and the frequency of recreational use of the shoreline which was recorded during the surveys. Furthermore, no records of otter were held by NBDC for the Burrow and its surrounding areas.

It is noted however, that the shores around the site are likely to support foraging and migrating otter on at least an occasional basis.

13.4.5.2 Bats

Areas of semi-natural habitat within the site, including agricultural lands, unmanaged grasslands, areas of woodland and scrub and lengths of hedgerow are considered to offer moderate potential for foraging and commuting bats and are considered likely to be utilised by relatively low numbers of common and widespread species within this group. Habitats with potential for foraging bats within the site are linked to the wider area via woodlands and agricultural hedgerows which extend from the site to the south-west. These areas are subject to variable degrees of light pollution associated with existing developments on the Burrow.

No buildings or mature trees are to be impacted by the Proposed Development as no such features lie within the proposed working areas. As such it is not considered that the Proposed Development has any potential to impact upon roosting bats.

13.4.5.3 Other Protected Species

No evidence indicating the presence of any other legally protected species was recorded within the site during the extended Phase 1 Habitat Surveys.

13.4.6 Birds

The detailed results of bird surveys undertaken of the site between 2021 and 2022 are set out within the accompanying Bird Survey Report (Appendix 13.C). These findings are summarised below.

13.4.6.1 Wintering Birds

Wetland bird surveys of the site and the wider Rogerstown Estuary SPA were undertaken across the wintering period in 2021/ 2022.

These surveys recorded that intertidal and coastal habitat within the proposed working areas, within and outside of the Rogerstown Estuary SPA boundary, were utilised by wintering populations of waders and waterfowl which represent a significant proportion of those SCI bird populations for which the SPA is designated. In particular, intertidal habitat to the west of the Burrow and in the bay adjacent to the end of Marsh Lane, was recorded to support large numbers of SCI species including light-bellied brent geese *Branta bernicla hrota*, black-tailed godwit *Limosa limosa*, dunlin *Calidris alpina*, knot *Calidris canutus*, grey plover *Pluvialis squatarola*,

oystercatcher *Haematopus ostralegus*, redshank *Tringa totanus*, ringed plover *Charadrius hiaticula* and shelduck *Tadorna tadorna* throughout the surveys and across tidal states with lower numbers and occurrence at high tide, typically for foraging. Oystercatcher, dunlin and ringed plover were also recorded within the proposed working area to the east of the Burrow but in lower numbers.

Populations of these species were also recorded to utilise other areas of the SPA, distant from the Proposed Development throughout the surveys and again across tidal states and it is therefore considered that the proposed working areas do not represent areas of the SPA which are solely relied upon by any SCI bird populations during any particular period of the winter or tidal state. Habitats within the proposed working area are rather considered to form a valuable component of a patchwork of suitable foraging and roosting habitat for the SCI bird populations throughout the SPA which is used variably according to tidal state, food availability and level of disturbance.

In addition to SCI species, areas of intertidal habitat within and in proximity to the proposed working area, particularly areas along the western shore of the Burrow, with lower numbers to the east, were recorded to support significant wintering populations of whimbrel *Numenius phaeopus,* turnstone *Arenaria interpres,* teal *Anas crecca,* sanderling *Calidris alba,* red-breasted merganser *Mergus serrator,* herring gull *Larus argentatus,* grey heron *Ardea cinerea,* greenshank *Tringa nebularia,* great black-backed gull *Larus marinus,* little egret *Egretta garzetta,* curlew *Numenius arquata,* common gull *Larus canus,* black-headed gull *Chroicocephalus ridibundus* and bar-tailed godwit *Limosa lapponica*.

13.4.6.2 Breeding Birds

Terrestrial areas of the project site support breeding bird habitat such as areas of woodland, scrub, hedgerows and scattered trees, which have potential to support a range of common and widespread species, and areas of dry grassland along the west of the Burrow, which have some potential to support ground nesting birds such as meadow pipit *Anthus pratensis*.

Surveys recorded the presence of breeding meadow pipit and skylark *Alauda arvensis* within grasslands along the west of the Burrow*,* and a limited range of common and widespread species including wren *Troglodytes troglodytes,* dunnock *Prunella modularis,* robin *Erithacus rubecula,* blackbird *Turdus merula,* great tit *Parus major,* chaffinch *Fringilla coelebs* among other typical species within hedgerows, scrub and agricultural land adjacent to the proposed working areas.

The proposed working area, along the eastern coastline of the Burrow, supports two sections of embankment, approximately 14m^2 and 4m^2 respectively, which support a small colony of sand martin *Riparia riparia*. A peak count of 12 adult individuals was recorded.

The north-east corner of the Burrow, which comprises a shingle beach with developing dune system, supports a colony of nesting little tern *Sternula albifrons,* with a peak count of 40 individuals (20 pairs) recorded in July. This site is subject to monitoring and protection from volunteers and is spread across a fenced area to reduce the risk of predation. This area also supports a colony of nesting ringed plover, a maximum of six nesting pairs recorded during the surveys. This area of the Burrow lies outside and to the north of the proposed working area.

The proposed working area and its surrounds, inclusive of areas of intertidal habitat to the east of the Burrow, during high, and high falling and high rising tidal states was recorded to support foraging populations of a range

of tern species including common tern *Sterna hirundo* (peak count of 150 birds), sandwich tern *Thalasseus sandvicensis* (peak count of 26 birds) and little tern (peak count 10 birds). Coastal waters which are largely covered by seawater at low tide, to the north of the proposed working area where flows from the Rogerstown Estuary discharge to the bay between Rush and Portrane, were recorded to be of importance for foraging tern species. These areas supported significant numbers of foraging common tern, arctic tern *Sterna paradisaea* and roseate tern *Sterna dougallii*. These populations are likely to be those breeding within the Rockabill SPA which is well within the known mean foraging ranges for each of these species (Woodward et al. 2019).

13.4.6.3 Non-Breeding and Passage Birds

Surveys recorded that areas of intertidal habitat within and in proximity to the proposed working area are utilised by a range of non-breeding waterbirds outside the wintering period.

Variable but typically small numbers of gulls including great black-backed gull, common gull, herring gull and black-headed gull were recorded to forage within these areas throughout the year.

Low numbers of grey heron were recorded to forage within these areas throughout the year.

Populations of non-breeding waders including black-tailed godwit, curlew, greenshank and other species persisted at various times throughout the year, in relatively lower numbers compared to those recorded during the wintering period. These populations also utilised a variety of locations within intertidal habitat throughout the Rogerstown Estuary SPA.

13.5 Description of Likely Significant Effects

13.5.1 Assessment of Construction Phase Effects

13.5.1.1 Designated Sites and Features of Natural Heritage Importance

Rogerstown Estuary SAC

The Proposed Development at the Burrow will involve the construction of a 190m long embankment at the end of Burrow Road and the construction of a 130m long sheet-piled flood wall and 200m embankment along Marsh Lane. These works will largely take place within the terrestrial environment. A large proportion of the proposed wall and embankment length lies within the boundary of the Rogerstown Estuary SAC. This includes areas of scrub, recolonising hardstanding, hardstanding, areas of dense bracken and largely dry meadows/ grassy verges habitat which lie along the western shore of the Burrow. In addition, areas of Annex I saltmarsh, perennial vegetation of stony banks and intertidal mud and sandflats and estuarine habitats of which Atlantic salt meadows [1330], mudflats and sandflats not covered by sea water at low tide [1140] and Estuaries [1130] are included as qualifying interests of the SAC will be affected by the proposed flood wall and embankments on the western shore of the Burrow.

The Proposed Development will also involve the construction of seven fishtail groynes along a 1.3km length of the eastern coastline of the Burrow and associated beach renourishment. The footprint of these structures will be within areas of both mixed sediment shores and further intertidal mudflats and estuarine habitat, with some limited areas of shingle and gravel banks which are representative of Annex I habitat: 1220 Perennial vegetation of stony banks also impacted. All areas of mixed sediment shores and intertidal estuarine habitat are considered

to be representative of mudflats and sandflats not covered by sea water at low tide [1140] and Estuaries [1130] which are included as qualifying interests of the SAC.

Areas of Annex I habitat within the footprint of the proposed flood walls, embankments and fishtail groynes will be permanently lost as a result of the construction. Further areas of the habitat are likely to be temporarily impacted as a result of construction activities within the proposed working area, which is considerably larger than the delivered footprint of the proposed infrastructure to facilitate the movement of the required plant for construction of proposed flood wall at Marsh Lane in addition to access to areas of adjacent intertidal and terrestrial habitat.

Table 13.4 sets out approximate areas of each Annex I habitat which represents a qualifying interest of the Rogerstown Estuary SAC which will be affected temporarily as a result of the construction phase of the Proposed Development. These areas are illustrated in Figure 13.10 to Figure 13.13.

Table 13.4: Construction Phase Impacts to Rogerstown Estuary Qualifying Annex I Habitats.

Annex I Habitat	Approximate Development Footprint: Permanent Loss (ha)	Approximate Working Area: Temporary Impacts (ha)	Total Area Within the SAC Conservation Objectives (2013) (ha)	% Area Permanently Affected [Temporarily Affected] (%)
Atlantic Salt Meadows (1330)	0.00016	0.18	37.2	0.00043 [0.48]
Mediterranean Salt Meadows (1410)	-	0.006	2.18	- [2.18]
Mudflats and sandflats not covered by seawater at low tide (1140)	1.36	13.01	370	0.37 [3.52]
Estuaries (1130)	-	-	268	-
Shifting dunes along the shoreline with Ammophila arenaria (white dunes) [2120]	-	0.02	2.56	- [0.78]
Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130]	-	0.79	8.37	- [9.44]
Annual vegetation of drift lines [1210] (Non-qualifying)	0.0006	0.34	-	-
Perennial vegetation of stony banks [1220] (Non-qualifying)	-	0.062	-	-
Embryonic shifting dunes [2110] (Non-qualifying)	-	-	-	-



Figure 13.10: Annex I Habitat and Impacts of the Proposed Development (North-West)

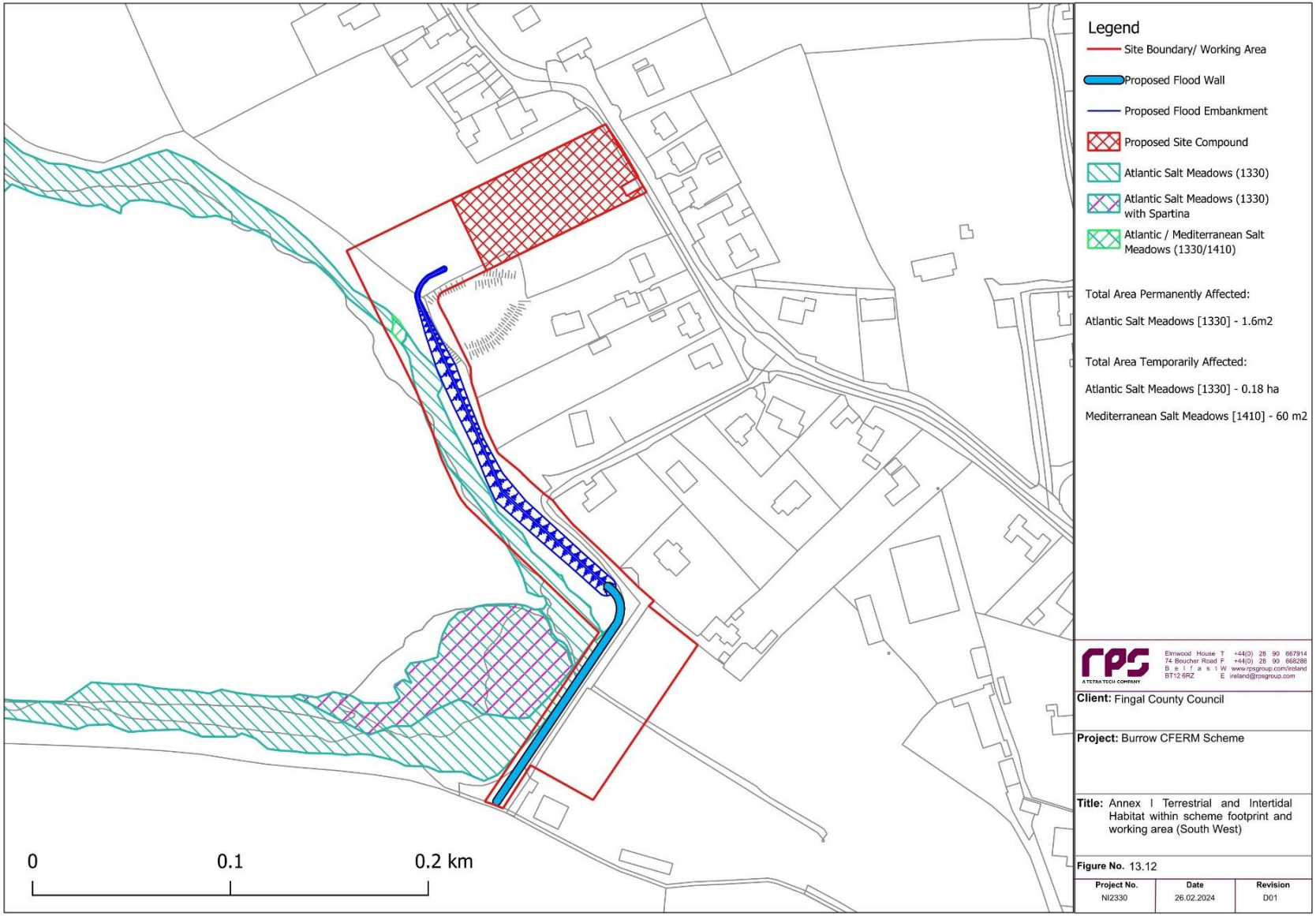


Figure 13.11: Annex I Habitat and Impacts of the Proposed Development (South-West)

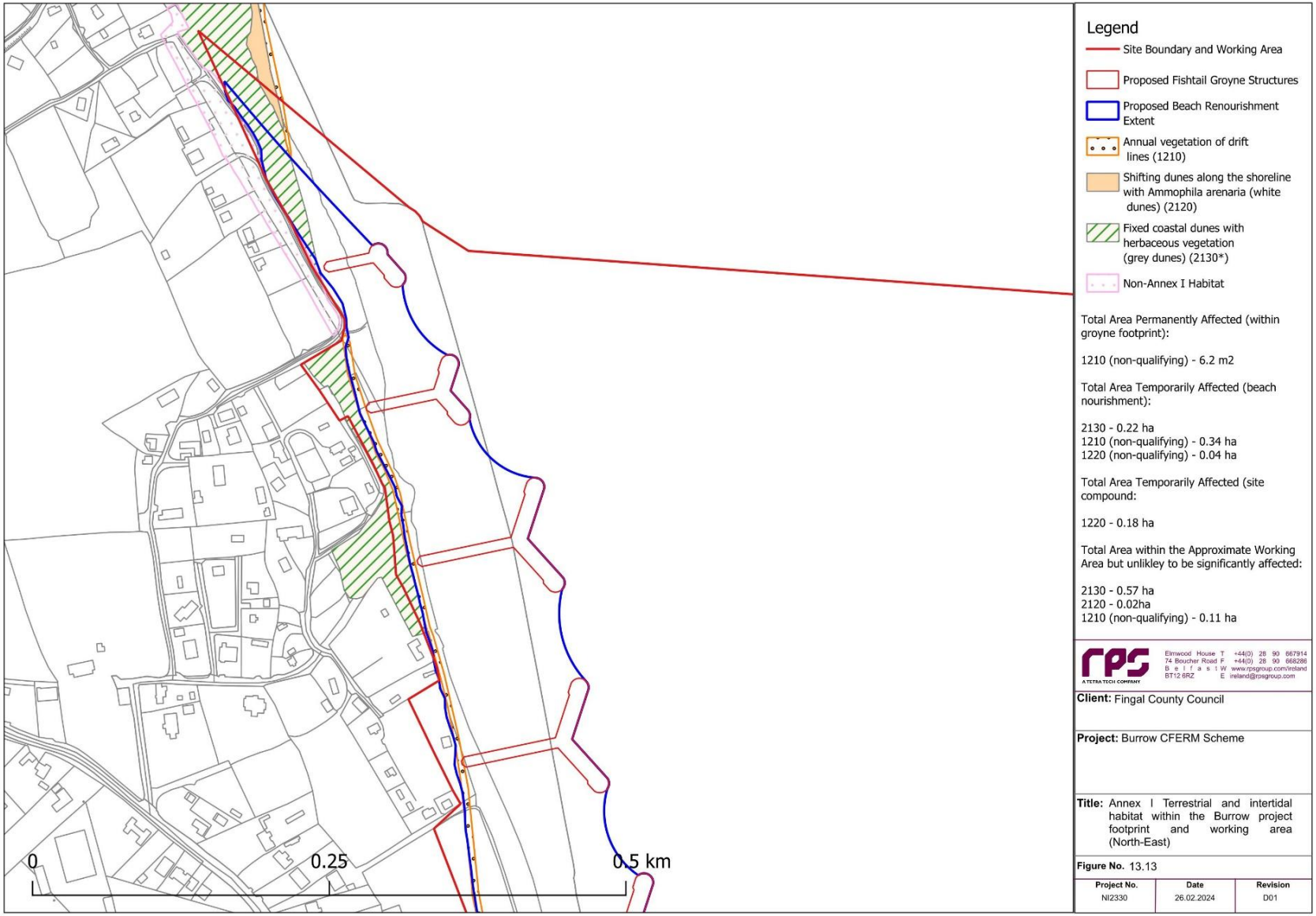


Figure 13.12: Annex I Habitat and Impacts of the Proposed Development (North-East)

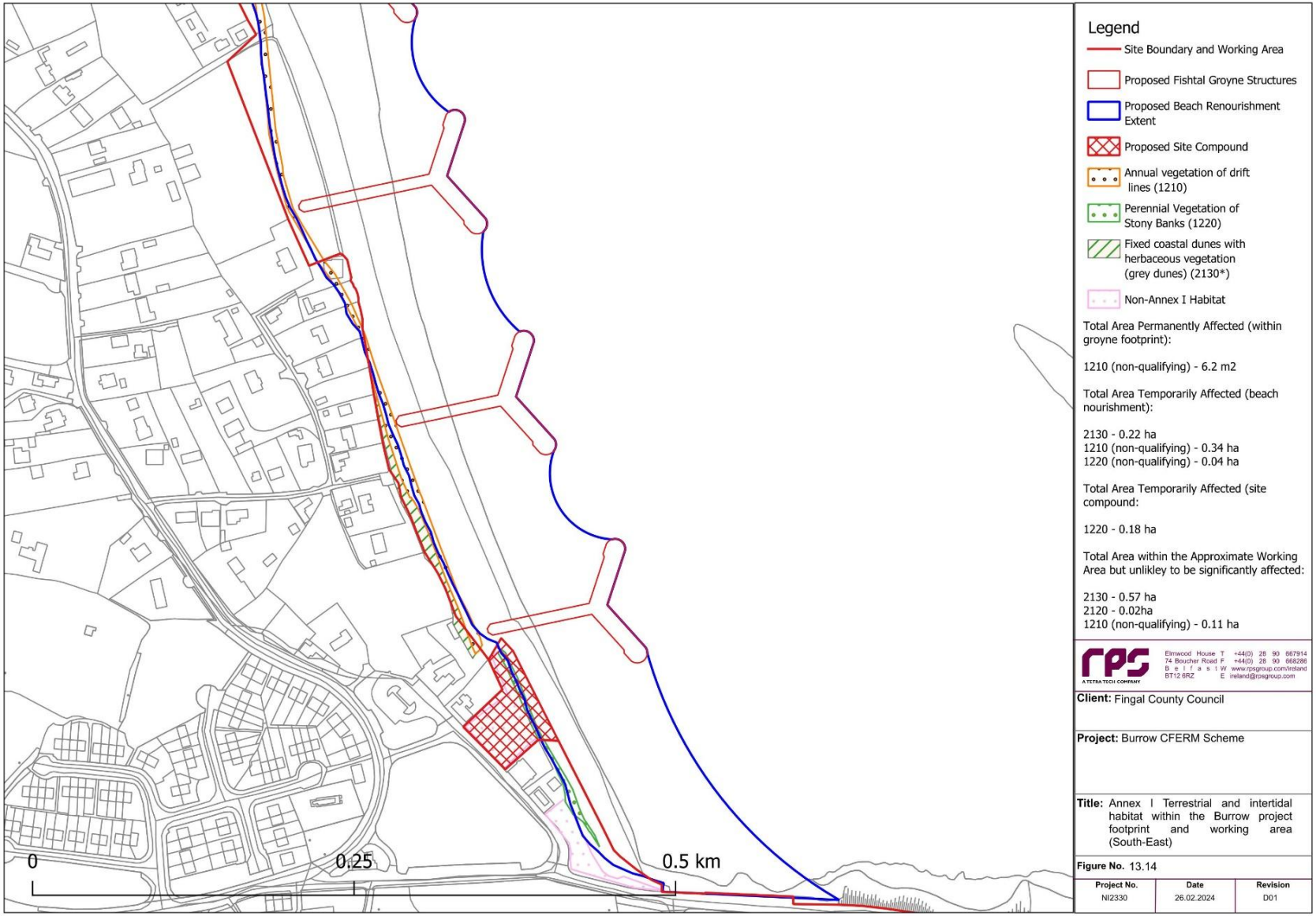


Figure 13.13: Annex I Habitat and Impacts of the Proposed Development (South-East)

On the basis of the information presented in Table 13.4, it is envisaged that the Proposed Development will give rise to permanent loss or temporary adverse impacts to significant areas of Annex I habitats which are qualifying interests of the SAC, this includes relatively large percentages of the supported Annex I mudflats and sandflats [1140] and grey dunes [2130] in addition to smaller percentage areas of Atlantic Salt Meadows [1330] and Mediterranean Salt Meadows [1410] and White dunes [2120]. Further areas of non-qualifying Annex I habitat will also be affected.

Permanent losses to habitat will be very limited and inclusive of:

- Loss of 1.6m^2 of Atlantic Salt Meadows [1330] to facilitate construction of proposed flood embankment at Marsh Lane.
- Loss of 1.36ha of Mudflats and sandflats not covered by seawater at low tide [1140] to facilitate proposed groyne structures.
- Loss of 6.2m^2 of Annual vegetation of drift lines [1210] (non-qualifying) to facilitate proposed groyne structures.

Temporary losses will occur over a relatively greater area and will differ in their respective severity and nature. These areas include:

- Temporary loss of approximately 70m^2 of Perennial vegetation of stony banks [1220] (non-qualifying) to facilitate proposed working area at Burrow Road.
- Temporary loss of approximately 0.18ha of Atlantic salt meadows [1330] and 60m^2 of Mediterranean salt meadows [1410] to facilitate the proposed working area at Marsh Lane.
- Temporary loss of approximately 12.01ha of Mudflats and sandflats not covered by seawater at low tide [1140], 0.22ha of grey dunes [2130], 0.34ha of Annual vegetation of drift lines [1210] (non-qualifying) and 0.04ha of Perennial vegetation of stony banks [1220] (non-qualifying) to facilitate proposed beach renourishment works.
- Temporary loss of approximately 0.18ha of Perennial vegetation of stony banks [1220] (non-qualifying) to facilitate the siting of the site compound along the east shore of the Burrow.

While it is acknowledged that permanent losses are by their nature irreversible, the extent to which temporary affects arising as a result of the Proposed Development will be of short to medium term in their extent is variable according to the nature of the impact pathway and the receptor.

Temporary impacts to salt marsh habitats are considered to be limited to those associated with the movement of excavators and similar construction machinery within the working area, where required.

McCorry and Ryle (2009) identified that the formation of tracks, including non-permanent tracks created by farm machinery and livestock, were generally resultant in a low negative impact upon both Atlantic salt meadows and Mediterranean salt meadows throughout Ireland. Such impacts were described as being distinct from the creation of permanent tracks within these habitats, which was described as resulting in irreparable damage.

Numerous studies have recorded that temporary disturbance associated with vehicular disturbance to salt marsh habitats and/or similar sources of disturbance such as digging gives rise to relatively long-term impacts to salt marsh habitats (Blionis and Woodin 1999, Kelleway 2006). Established vehicle tracks in saltmarsh have

been shown to support up to 90% lower vegetative coverage and 50% lower species diversity (Schofield 2016) with associated impacts to the seed bank attributed to soil compaction. De Leeuw et al. (1992) recorded that the type of disturbance was related to the extent of negative impacts and the associated regeneration time. Controlled application of herbicide and digging disturbance resulted in the dug plots taking significantly longer to recolonise with altered final species composition which was attributed to increased soil aeration.

Schofield (2016) identified that in places where saltmarsh habitats have been subject to soil compaction associated with vehicular movements, active restoration measures may be required to ensure that soil conditions are optimised for recolonisation by saltmarsh plants. Such measures may include the post construction levelling of soils and transplantation of vegetation. It is noted however that the studied areas, subject to compaction, had been impacted over the fairly long term. Hutchings and Russell (1989) recorded, in a study on saltmarsh seed viability, that areas which supported high densities of saltmarsh vegetation also supported well supplied seed banks. This study also recorded that the extent to which regeneration of vegetation would occur, and the speed of this change, was highly related to the presence of surrounding vegetation and influenced by the duration of disturbance, given that the seed bank is persistent and as such would only be significantly affected by disturbance lasting over several years.

On this basis it is considered that short-term impacts of vehicular movements over relatively small areas of qualifying salt meadow Annex I habitats are unlikely to persist beyond the short term however some changes to the habitat may occur and mitigation measures are recommended to facilitate the swift recovery of such habitats following completion of works.

Temporary losses of qualifying annex I habitat as a result of proposed beach renourishment works will be limited to areas of grey dune [2130] and intertidal mudflat [1140]. However, recent aerial imagery and anecdotal evidence from Fingal County Council would suggest that some of the grey dune habitat has already been lost to coastal erosion and replaced by intertidal sandflat.

Whilst proposed beach renourishment of areas of intertidal mud will lead to a loss/ disturbance of benthic habitats and communities (e.g., through smothering of sediments and associated species under deposited material in the short term), over time the sediment will be re-worked through hydrodynamic processes which will allow communities to recover into the affected areas. All intertidal habitats within the proposed working area are noted as being of low sensitivity to abrasion or disturbance to the surface of the seabed.

In marine soft sediments, restoration from disturbance is possible through physical processes, like wave action, and biological processes, like bioturbation (Dernie et al., 2003). Nelson (1989) recorded that various faunal groups associated with intertidal sandflats were relatively unaffected by beach nourishment works with various burrowing invertebrates recorded to have low mortality rates where nourishment had been undertaken and shown to simply burrow through such substrates to the new surface of the intertidal sands. This appears to be a natural adaptation of benthic invertebrates to natural processes giving rise to altered sediment depths in intertidal sand and mud and has also been observed in a number of further studies (Löffler and Coosen 1995; Miller et al. 2002). Where large quantities of material are to be deposited this resilience to sediment deposition may not be relevant (Jaramillo et al. 1996; Moffett et al. 1998) and large-scale invertebrate mortality may nonetheless occur, especially where the proposed depth of renourishment is deep and to be applied rapidly. Areas of shallower application towards the shore may be less severely affected (Schlacher et al. 2012).

Menn et al. (2003), in a study of the effects of beach nourishment upon habitats similar to those relevant to the project, recorded that beach nourishment led to a decreased abundance of macrofauna within sub-tidal zones up to nine months following the works. However, this study concluded that such changes are minimal when viewed in the context of natural changes from sediment transport along the shore and across time.

Where sediments are to be 'like for like' in grain structure (as is the case with the Proposed Development), it is anticipated that supported fauna is likely to begin to recolonise following the dispersive, larval, stage of the life cycle and associated juvenile settlement (Speybroeck et al. 2007), i.e. within a minimum of a single calendar year, within areas of MA5-233 Amphipods and polychaete worm Scolelepis spp. in Atlantic littoral medium-fine sand habitat. A study by Kindeberg et al. (2023) found beaches in San Diego, California, had full species richness recovered 15 months after nourishment, though stressed the importance of using similar grain sizes between the recipient beach and nourishment material. This finding concords with various studies which recorded recovery of infaunal species richness following nourishment of between one month (Nelson and Gorzelany 1983) and two years (Rakocinski et al. 1996).

The conservation objectives supporting document for coastal habitats within the Rogerstown Estuary SAC (NPWS 2013) list sea defences as a threat for dune habitats as they can interrupt longshore drift and associated increased erosion or starvation of dune systems. It is acknowledged within this document that erosion is part of the natural processes acting upon a dune system.

It is noted that surveys of Annex I coastal habitats undertaken by BEC Consultants in 2021 (Appendix 13B) recorded that Annex I grey dune habitat (2130) along the eastern shore of the Burrow has been subject to a significant decrease in area through erosion of the shore. In some places this has been recorded to include a 20m wide strip of grey dune habitat when compared to the most recent previous surveys undertaken in 2014. This recorded erosion of grey dunes is concurrent with the risk to properties arising from such erosion and flooding which has necessitated the Proposed Development

As a result of such erosion events, grey dunes along the eastern shore of the Burrow, within the areas proposed for works, exist in a narrow band of remnant dune present between a steep eroded cliff-edge and areas of non-annex habitat further inland including, in many cases, areas of existing development. Some embryonic dune structures were recorded at the base of this cliff indicating some recovery. However, under predicted models for storm events and associated erosion it is envisaged that further erosion events would further endanger the narrow band of remaining grey dune habitat in this area and destroy recovering embryonic dune communities at the base of the existing erosion cliffs.

Beach nourishment as a method for protecting coastlines from erosion, is used in many locations to assist in replenishing existing dune systems, principally to reinforce their function as sea defences whilst also achieving conservation of the dune habitats themselves (Hanson et al. 2002). This dune protection was especially relevant for dune systems which were close to shore (Costa et al. 2023). This is considered to be directly relevant to the dune structure along the eastern shore of the Burrow which as discussed, is subject to significant erosion.

Foreshore beach nourishment has been shown to result in the protection of supratidal areas of upper dune from erosion (Van der Wal 2004). In previous cases the formation of a native dune structure, progressing to Annex I white dunes habitat, through the associated use of planting of nourished material with Ammophila has been successful in generating large areas of dune habitat (Hanley et al. 2013). In previous examples of beach

nourishment schemes, the initial nourishment was followed by long-term dune accretion (Kaczkowski et al. 2017) which is considered likely to be favourable for the recovery of existing dune structures at the Burrow. This is evidenced by further studies which have recorded beach nourishment works to give rise to increased and significant establishment of embryonic dunes (Bezzi et al. 2009).

While it is envisaged that there will be short-term habitat loss effects upon grey dune habitats within the footprint of areas proposed for beach renourishment at the Burrow, associated with the deposition of dredge material, it is considered that the long-term result of proposed beach renourishment will give rise to increased protection of dune from erosion. In addition, it is envisaged that proposed beach renourishment will result in the formation of a healthier dune structure, resembling that which has been lost from the eastern shore of the Burrow as a result of large-scale coastal erosion. Long-term effects are therefore considered positive, and no long-term habitat loss is considered likely to occur.

While some discussion has been had on the extent to which the introduction of nourishment material may give rise to altered soil conditions for dune vegetation, and particularly an increase in the levels of supported phosphorous, a recent study has demonstrated that measured phosphorus levels were not discernibly different or resulting in an impact on dune vegetation after a period of four years (Pit et al. 2020). As such it is not considered that any habitat loss would arise through this mechanism as a result of beach nourishment works.

In addition to affects arising from beach renourishment there is also potential for short term adverse impacts upon areas of various Annex I qualifying habitats through the movement of plant and construction machinery within the proposed working area.

A limited amount of short-term temporary habitat disturbance arising from the displacement/ compaction of the intertidal zone is likely to arise, particularly from heavy plant which will be used for to construct the groyne structures and to move the sinker pipeline for beach renourishment. Impacts through alteration to sediments can occur where compaction occurs during the process, resulting in lower supported abundances of burrowing invertebrates (Lindquist and Manning 2001).

It is considered that changes to intertidal habitats arising through vehicular movements are likely to be minor in comparison to natural sediment transport processes which occur through storm events and in the context of their temporary and short-term nature. Natural sediment transport is likely to occur following completion of the works giving rise to levelling of the substrate and replenishing uncompacted surface layers and associated recovery of infaunal communities (Schoeman et al. 2000). It is estimated that such impacts would occur over an area of approximately 1ha of habitat, in addition to areas proposed for beach renourishment.

Similarly, impacts to areas within the proposed working area which support Annex I dune communities including grey dunes [2130] and white dunes [2120] will be extremely minor and limited to movement of vehicles and plant which will not give rise to medium to long-term effects.

While a large area of intertidal mudflat habitat [1140] is present across much of the working area to the east of the Burrow, the proposals will involve only the temporary presence of the dredge vessel and associated sinker pipeline for beach renourishment within these areas. As such it is not envisaged that such elements of the works will give rise to any particular effects upon the supported intertidal habitat.

In the absence of the implementation of a range of mitigation measures further adverse impacts as a result of the construction phase of the Proposed Development may also occur. These include water quality and habitat

deterioration effects associated with the accidental release of pollutants including silt, grit, fuels, oils or known soil contaminants into the marine waters of the SAC. Such effects could arise from the movement of plant and materials and the storage of materials taking place in proximity to watercourses which flow into the estuary including culverting works, in addition to such works within or within proximity to the estuary itself, which is subject to tidal inundation.

The proposed beach renourishment process will involve the pumping of large quantities of sand "slurry" mixture to within the established groyne structures. As set out within the Coastal Processes chapter of the EIAR (Chapter 6), these activities are predicted to give rise to sediment plumes within the adjacent marine and intertidal waters, arising largely from the initial pumping of this material while in suspension, prior to quick settlement on the shore or seabed. Due to the nature of the proposed pumping methodology sediment plumes will be largely limited excepting for 100 minutes every 16.5 hours of pumping over the 6-week beach renourishment works. During these periods suspended sediment concentrations (SSCs) of 85,000mg/l within the immediate vicinity of the discharge pipeline may occur. The concentration of the sediment plumes envelopes decreases to *c.*5,000mg/l within *c.*500m of the discharge points and to less than 5mg/l within *c.*700m of the discharge points.

Importantly, at no point during these operations are background SSCs expected to increase by more than 2mg/l beyond the immediate vicinity of the foreshore area of the Burrow, including at Rush beach or within Rogerstown Estuary. During the remainder of the beach renourishment works SSCs are predicted to be considerably lower, with the average total SSC envelopes not generally predicted to extend for more than *c.*600m beyond the discharge locations and typically comprising SSCs less than 200mg/l within this area. The greatest average total SSCs of *c.*4,000mg/l are typically limited to within *c.*200m of the discharge locations.

The marine environment within the Rogerstown Estuary SAC to be affected by the increased suspended sediment arising from the proposed works, is subject to significant natural sediment transport, including outputs from the Rogerstown Estuary in addition to suspension, transport and deposition of existing marine sediments. These existing sediment transport regimes, which regularly create naturally high concentrations of suspended sediment within marine waters within and in proximity to the SAC, form the natural processes of the estuary and intertidal mudflat and sandflat system within the SAC. As such it is considered that these habitats, the only marine habitats which represent qualifying interests of the SAC, are not likely to suffer adverse effects associated with any small-scale and temporary changes in the concentration of suspended sediments present within marine waters which would arise as a result of the proposed works. Effects associated with sediment plumes during beach renourishment works are therefore predicted to be negligible and not significant.

In addition, the proposed construction phase operations will involve works in close proximity to areas of the invasive species common cord-grass *Spartina anglica*. This species, present within tidal mud in the south-western areas of the site, is a non-native invasive species included within the third schedule of the European Communities (Birds and Natural Habitats) Regulations 2011. The Proposed Development, at construction stage, has potential to give rise to the limited spread of this species associated with construction works proposed within areas currently occupied by the plant.

Common cord-grass is included as a negative indicator species within the conservation objectives for the Annex I habitats Salicornia mud [1310], Atlantic saltmarsh [1330] and Mediterranean saltmarsh ([1410] within the SAC, which state that there should be no significant expansion of the species distribution beyond 1% annual growth

in locations where it is already known to occur. The further spread of this species within the SAC, including to areas of Annex I saltmarsh habitats would have potential to give rise to adverse impacts to these qualifying features through competition with existing floral communities and subsequent impacts to sediment deposition rates within areas of saltmarsh.

As set out above, saltmarsh habitats within the Rogerstown Estuary SAC are assessed as being universally unfavourable, as such any further impacts occurring to these habitats would be considered likely to give rise to further adverse effects upon their conservation status.

Adverse effects to the Rogerstown Estuary SAC will arise as a result of the Proposed Development. It is considered that these construction phase effects would be major adverse and significant in the absence of mitigation measures.

Whilst it is envisaged that the Proposed Development will afford enhanced protection to some habitats by reducing the rate of erosion of qualifying interest habitat types, it will result in the loss of qualifying Annex I habitats and introduce physical obstructions into the estuarine system of Rogerstown estuary and interrupt the natural circulation of sediment and organic matter. In our view, this outcome will prevent the achievement of the conservation objectives for the site and give rise to an adverse effect upon the integrity of Rogerstown Estuary SAC.

Rogerstown Estuary SPA

The boundary of the Rogerstown Estuary SPA is largely concurrent with that of the Rogerstown Estuary SAC and as such it is envisaged that impacts to habitats which underpin the value of the SPA site for birds will be broadly consistent with those predicted in respect of the SAC.

It is therefore considered that the Proposed Development will have potential to give rise to major adverse and significant effects upon the SPA through habitat loss, water quality and habitat deterioration effects and the spread of non-native invasive species.

Temporary and permanent losses to areas of intertidal mud and estuary habitat, as discussed above, would also result in an overall decrease to the available areas of foraging and roosting habitat for the SCI bird populations of the SPA. Deterioration of such habitats through diminution of water quality would result in potential decreases to prey abundance within the SPA foraging habitats and give rise to the potential for limited environmental toxicity for the SCI birds themselves. The spread of non-native invasive species, namely spartina, within areas of intertidal saltmarsh and mud would potentially give rise to altered habitat conditions leading to a decrease in the suitability of these habitats to support foraging SCI bird populations within the SPA.

As set out above, in respect of the Rogerstown Estuary SAC, the proposed beach renourishment works will result in minor sediment plumes with variable SSCs, throughout. Due to the nature of the proposed pumping methodology sediment plumes will be limited to 100 minutes every 16.5 hours of pumping over the 6-week beach renourishment works. During these periods suspended sediment concentrations (SSCs) of 85,000mg/l within the immediate vicinity of the discharge pipeline may occur. The concentration of the sediment plumes envelopes decreases to *c.*5,000mg/l within *c.*500m of the discharge points and to less than 5mg/l within *c.*700m of the discharge points. Importantly, at no point during the simulation are background SSCs increased by more than 2mg/l beyond the immediate vicinity of the foreshore area of the Burrow, including at Rush beach or within

Rogerstown Estuary. During the remainder of the beach renourishment works SSCs are predicted to be considerably lower, with the average total SSC envelopes not generally predicted to extend for more than *c.*600m beyond the discharge locations and typically comprising SSCs less than 200mg/l within this area. Again, as set out above, it is considered that these sedimentation impacts are unlikely to give rise to significant adverse effects upon estuary and intertidal mudflat and sandflat habitats, which are known to be of value for foraging bird populations associated with the SPA.

It is noted that these areas of habitat, encompassing the shoreline and intertidal habitat to the east of the Burrow, while recorded to support SCI bird populations in relatively small numbers and on an occasional basis during low and falling tides, were not considered to be of particular importance for these populations in the context of the wider SPA. A comparison of the recorded numbers of SCI bird species against the numbers supported within the SPA, including at designation and more recent census data, has been set out at Table 13.5.

Furthermore, the SCI bird species for which the SPA is designated are waders and waterfowl which typically utilise intertidal habitats for foraging when they are not inundated by tidal waters. As such, during periods in which sediment plumes within marine waters are generated by proposed beach renourishment works, waders and waterfowl SCI species are unlikely to be present within marine waters.

Given that sediments generated by the proposed beach renourishment works are predicted to be deposited quickly and not carried in suspension for distances beyond 700m from the site, it is considered that such sediment plumes would have no potential to give rise to adverse effects upon wintering populations of SCI bird species associated with the Rogerstown Estuary SPA. Effects are predicted to be negligible and not significant.

Table 13.5: Comparison of Bird Survey Results Within the Working Area, Study Area and Rogerstown Estuary SPA

SCI Bird Species	Mean no. recorded within the proposed working area (Winter 2021-2022)	Peak no. recorded within the proposed working area (Winter 2021-2022)	Mean no. recorded within the proposed study area (Winter 2021-2022)	Peak no. recorded within the proposed study area (Winter 2021-2022)	Baseline population reported across Rogerstown Estuary SPA within the original site selection documentation (NPWS 2013g)	Winter peak count reported across Rogerstown Estuary SPA within the last 5 years (I-Webs Birdwatch Ireland 2018-2023)	Winter peak count reported across Rogerstown Estuary SPA within the most recent Census data (I-Webs Birdwatch Ireland 2022-2023)
Greylag Goose *Anser anser* [A043]	0	0	0	0	160	2	0
Light-bellied brent goose *Branta bernicla hrota* [A046]	22.2	220	466.7	540	1069	6712	1950
Shelduck *Tadorna tadorna* [A048]	6.29	99	238.7	260	773	2286	735
Shoveler *Anas clypeata* [A056]	0	0	8.88	24	59	154	49
Oystercatcher *Haematopus ostralegus* [A130]	9.88	42	281.8	315	1345	2650	1832
Ringed plover *Charadrius hiaticula*	1	15	30.3	105	188	783	247

SCI Bird Species	Mean no. recorded within the proposed working area (Winter 2021-2022)	Peak no. recorded within the proposed working area (Winter 2021-2022)	Mean no. recorded within the proposed study area (Winter 2021-2022)	Peak no. recorded within the proposed study area (Winter 2021-2022)	Baseline population reported across Rogerstown Estuary SPA within the original site selection documentation (NPWS 2013g)	Winter peak count reported across Rogerstown Estuary SPA within the last 5 years (I-Webs Birdwatch Ireland 2018-2023)	Winter peak count reported across Rogerstown Estuary SPA within the most recent Census data (I-Webs Birdwatch Ireland 2022-2023)
[A137]							
Grey plover *Pluvialis squatarola* [A141]	0.08	2	34.3	101	229	653	399
Knot *Calidris canutus* [A143]	0	0	41.7	170	2454	4558	346
Dunlin *Calidris alpina* [A149]	8.6	205	537.5	1360	2745	9221	2815
Black-tailed godwit *Limosa limosa* [A156]	0.08	2	110.5	290	195	1813	663
Redshank *Tringa totanus* [A162]	4.71	26	220.2	248	490	3023	1147

The Proposed Development will involve works taking place within and in proximity to a range of intertidal and marine habitats which, in addition to comprising Annex I habitat features of the Rogerstown Estuary SAC, are known to be of importance for foraging and roosting populations of birds included as special conservation interests (SCIs) of the Rogerstown Estuary SPA.

Surveys undertaken to inform this application have shown that areas of the SPA within close proximity to the proposed working area are of importance to wintering SCI bird populations and in some locations include significant proportions of the SPA populations (see Table 13.5 and Appendix 13.C). However, these surveys also showed that these areas, in close proximity to the Proposed Development, did not represent the only available foraging or roosting areas for SCI bird populations during a given tidal state or part of the wintering bird season (See Figures 3.1 to 3.34 of the accompanying Bird Survey Report (Appendix 13.C)). As such it is considered that if localised disturbance effects to bird populations were to occur at construction phase, other areas of foraging and roosting habitat would be available within the SPA for temporarily displaced populations. Longer term disturbance within the proposed works area would however give rise to an effective temporary loss of the relevant areas for wintering bird populations, with potential for such effects to act in-combination with other sources of disturbance across the wider estuary.

The Proposed Development will therefore involve construction phase works with significant potential to give rise to adverse impacts upon the supported SCI bird populations through aerial noise and visual disturbance given their location within and in close proximity to the SPA. Such effects would arise through all aspects of the proposed works which will involve the movement of plant and personnel within and in proximity to the SPA and through noise generating activities of greater magnitude, such as during sheet piling of proposed flood walls. Such potential impacts, in line with those above which are envisaged to arise as a result of the Proposed Development through other pathways, are considered to be moderate adverse and significant.

While the Proposed Development may give rise to underwater noise and vibrational effects associated with the installation of sheet piled flood walls in proximity to the estuary, it is considered that intervening bedrock, mud and other overburden would give rise to significant attenuation of such effects. It is considered unlikely that appreciable levels of underwater noise or vibration would arise as a result of the proposals sufficient to create disturbance to SCI bird populations associated with the Rogerstown Estuary SPA.

All such SCI birds are not species which spend significant periods underwater and as such are considered to be fairly oblivious to the effects of activities generating underwater noise. There is a lack of scientific understanding of the use of underwater sound by diving birds and the extreme lack of scientific data on the underwater hearing capabilities of such birds, with evidence of responses to underwater auditory stimuli in birds being only recently discovered (Hansen et. al 2017). Given the lack of evidence indicating strong behavioural responses in birds to underwater auditory stimuli it is considered that this group are likely to be fairly resilient to such effects.

On the basis of the above it is considered that the Proposed Development would not give rise to likely significant underwater noise or vibrational disturbance effects upon the Rogerstown Estuary SPA.

No further impact pathways for effects upon the Rogerstown Estuary SPA are considered relevant at construction phase.

As discussed in the accompanying Natura Impact Statement, it is envisaged that the Proposed Development which will give rise to disturbance or displacement effects which will decrease in the range, timing or intensity of use of areas of the SPA by its SCI species, but that mitigation measures in the form of seasonal restrictions on works can prevent adverse effects on the integrity of the site from occurring.

Rogerstown Estuary pNHA

The Rogerstown Estuary SAC and SPA are underpinned by their designation as the Rogerstown Estuary pNHA. This site is designated on account of a range of receptors which are also reflected in its designation as an SAC and SPA.

It is considered that the impact pathways discussed above in respect of both the Rogerstown Estuary SAC and SPA are equally relevant to the predicted impacts on the Rogerstown Estuary pNHA.

No further effects, not discussed in respect of the SAC or SPA are considered likely to arise to the pNHA as a result of the Proposed Development.

Impacts on the Rogerstown Estuary pNHA are the same as those identified previously in respect of Rogerstown Estuary SAC and Rogerstown Estuary SPA and are considered to be major adverse and significant at construction stage.

Rockabill to Dalkey Island SAC

Rockabill to Dalkey Island SAC is designated on account of the supported areas of Annex I habitat: Reefs in addition to the supported populations of Annex II species: harbour porpoise.

Annex I reef habitats within the SAC are located a significant distance (>2.0km) from the Proposed Development and are separated from it by a significant area of marine waters. It is considered that the Proposed Development would have no potential, at construction phase, to give rise to any significant adverse effects upon the Annex I reef habitats of the Rockabill to Dalkey Island SAC due to the lack of supported impact pathways.

Populations of harbour porpoise for which the site is designated are known to occur throughout the SAC. Harbour Porpoise are also likely to be present within marine habitat in close proximity to the proposed works, including within the estuary and close to the shore of the Burrow on at least an occasional basis. Records of harbour porpoise held by NBDC include 13 records from within the bay between Rush and Portrane, the most recent of which being from 2020. No records are held by NBDC for the species from within the estuary itself.

The Proposed Development will involve works with potential to give rise to underwater noise and vibrational disturbance to estuarine waters which may occasionally support the species, principally through proposed sheet piling which will be used to construct the proposed sea wall at Marsh Lane, in addition to noise associated with the movement and use of a marine vessel required to facilitate beach renourishment works.

Harbour Porpoise use sound for foraging, navigation, social activities and predator detection. Changes in underwater noise therefore have the potential to interrupt these behaviours. The peak frequency of echolocation pulses produced by Harbour Porpoise is 120–130kHz, corresponding to their peak hearing sensitivity although hearing occurs throughout the range of ~1 and 180kHz (Southall et al 2007). A range of activities emit sound that falls within the hearing sensitivities of porpoise, including shipping, pile driving, Acoustic Deterrent Devices (ADDs) and military activities. The exact frequency, intensity and longevity of the sound will determine the

response. The impact on the porpoise is also mediated through individual behaviour, and perhaps quality of its immediate habitat, at the time of exposure.

To characterise the potential effects of construction noise, the magnitude of the effect and the sensitivity of the receptors determines the overall impact. Table 13.6 summarises the sensitivities of marine mammal species with regard to noise thresholds. A permanent threshold shift (PTS) occurs when a permanent auditory injury results in loss of hearing. PTS can result in very significant to profound negative impacts on marine species. A temporary threshold shift (TTS) describes a temporary but recoverable loss of hearing due to exposure to high energy sounds for a short duration or lower energy sounds for a longer duration. The impact of TTS is significant but recoverable. Determining the likelihood of noise sensitive species being exposed to such noise levels will help to categorise the significance of effects on each species. The international guidance on underwater noise threshold levels for marine mammals is published in Southall *et al* (2019) and provides (inter alia) the thresholds summarised in Table 13.6.

Table 13.6: TTS- and PTS-onset thresholds for marine mammals exposed to non-impulsive noise.

Marine mammal hearing group	TTS onset: SEL (weighted) dB re 1 µPa2s	PTS onset: SEL (weighted) dB re 1 µPa2s
Low Frequency Cetaceans (baleen whales)	179	199
High Frequency Cetaceans (most dolphin species)	178	198
Very High Frequency Cetaceans (Harbour Porpoise)	153	173
Phocid Carnivores (seal species)	181	201
Other Carnivores (otters)	199	219

The onset of auditory injury in marine mammals, defined as a Permanent Threshold Shift (PTS) occurs at different received noise levels, dependent on the hearing ability of the marine mammals. Furthermore, it is considered likely that localised increases to the levels of underwater noise are more likely to result in displacement of the individuals within proximity to the works prior to auditory injury. As such it is considered that several circumstances would have to occur concurrently for auditory injury effects to harbour porpoise to arise. Firstly, the proposed sheet piling operations would have to give rise to underwater noise levels sufficient to cause PTS (greater than 173dB), secondly this noise level would have to arise suddenly and without prior warning otherwise individuals are likely to vacate the area in which impacts would occur, thirdly harbour porpoise would need to be present within the area in which impacts would occur i.e. in close proximity to the works.

Detailed assessment of the noise levels arising as a result of the proposed sheet piling works is not possible given the variable nature of the substrates and intervening overburden and soils. In the absence of such an assessment it is assumed, on a precautionary basis, that the noise levels would be sufficient to result in auditory injury to harbour porpoise present within close proximity to the proposed works. It is noted however that

proposed piling operations will utilise a vibratory piling technique which will minimise such potential effects relative to percussive pile driving methods. In considering this, in addition to the attenuating effects of the intervening substrates as all works will occur within the terrestrial environment, it is considered fairly unlikely that generated noise levels would exceed the thresholds for PTS in harbour porpoise.

Likewise, the use of a marine vessel for the proposed beach renourishment works, the exact specification of which is not currently known, will give rise to underwater noise. Previous studies into the use of vessels during pumping operations, have recorded underwater noise levels of up to 143 to 144dB re. 1 μPa^2 at distances 250m from the source (Robinson et al. 2011). This study concluded that source levels below frequencies of 500Hz are generally in line with those expected for a cargo ship travelling at modest speed. A similar study (Theobald et al. 2010) recorded peak sound pressure levels of <144dB re. 1 μPa^2 at distances of 100m from the source location. A study of pumping operations beach nourishment material by a vessel similar in nature to that proposed in respect of the development (Reine et al. 2014) recorded peak sound pressure levels of <145dB re. 1 μPa^2 at distances of less than 50m from the vessel. These sound pressure levels were relatively consistent with those arising as a result of the movement of the studies vessel between the extraction and pumping out sites. In all such studies the peak noise levels were recorded to significantly decrease at distance from the studied vessel.

While it is noted that the above referenced studies were undertaken in conditions which may not exactly align with those within the proposed working area, it is considered highly unlikely that the use of such a vessel will generate noise levels that would exceed the thresholds for PTS in harbour porpoise.

Proposed vibrational piling has potential to start rapidly and as such give rise to sudden underwater noise and vibrational effects in the absence of mitigation measures.

Given the known distribution of harbour porpoise within the Rockabill to Dalkey Island SAC, in addition to records held for the species within proximity to the proposed works it is considered that the species may be present within areas to be affected on a very infrequent basis. It is also considered that given the highly tidal nature of the estuary, the use of these areas by the species is likely to coincide with high tide as access to the estuary is fairly limited during low tide events. The presence of harbour porpoise in proximity to the proposed works is therefore not ruled out on a precautionary basis.

Proposed piling is to take place within during dry conditions, outside of high tide events which would give rise to inundation of areas of estuary in close proximity to the proposed works location. As such, significant overburden including mud and sandflats will be present during the proposed works, between proposed piling works and the marine environment which will be significantly separated from the works. On this basis it is not anticipated that the proposed piling works will have potential to give rise to any significant risk of auditory injury or other underwater noise or disturbance effects upon harbour porpoise, which are also unlikely to be present within the estuary.

It is considered that the Proposed Development has no potential to give rise to likely significant adverse impacts to harbour porpoise populations of the Rockabill to Dalkey Island SAC through underwater noise and vibrational disturbance.

While it is acknowledged that individual harbour porpoise originating from or otherwise associated with the Rockabill to Dalkey Island SAC may be present within the marine environment in close proximity to the Proposed

Development, and thus may be affected by the proposed works, it is extremely unlikely that the habitats which may be potentially affected by the Proposed Development represent those which are essential to the favourable maintenance of the populations of these species as supported within the SAC boundary. This is evidenced by the general lack of recorded sightings of the species within the estuary in addition to the suboptimal nature of the estuary habitats for the species. Furthermore, any short-term disturbance effects are likely to lead to insignificant and temporary displacement during the construction phase as this species is known to forage for food across an extensive area.

It is noted that, given the intervening areas of marine waters, that the Proposed Development will not give rise to appreciable levels of noise disturbance or displacement effects within the SAC boundary, which is nonetheless already subject to regular sources of such disturbance including through the movement of shipping and other vessels.

On the basis of the above it is considered that the construction phase of the Proposed Development would not have potential to give rise to any significant displacement effects upon harbour porpoise populations originating within or otherwise associated with the Rockabill to Dalkey Island SAC.

Lambay Island SAC

Populations of grey seal supported within Lambay Island SAC have some limited potential to be disturbed as a result of underwater noise associated with vessel movements and associated pumping of beach renourishment material.

The conservation objectives for this SAC list human disturbance and its limitation as an attribute and target for grey and harbour seal. Discussion of this within the associated Conservation Objectives Supporting Document sets out that sources of such human disturbance include underwater and aerial noise.

Records held by NBDC include two records of grey seal (the most recent of which was from 2012 and a single record of harbour sea from 2019). Records were from within the bay between Rush and Portrane, with none being held by NBDC for the species within the estuary itself. Areas within proximity to the proposed works are not known to support haul out sites for breeding seals. Bird surveys undertaken to inform the assessment, as discussed above, did not record the presence of any seals.

Lambay Island SAC, which is partially designated on account of the supported breeding populations of grey and harbour seal, is situated 4.2km from the closest point of the proposed working area. While the exact specification of the vessel to be used for proposed beach renourishment works is yet to be finalised, it is anticipated that the vessel will produce noise levels which are in line with those arising through the use of a typical medium-sized vessels which occur throughout the Irish Sea, as discussed within the section above. It is not considered that the proposed works would have any potential to give rise to any measurable increase in noise levels within the SAC boundary given the intervening expanse of marine habitat over which any aerial or underwater noise effects will attenuate.

It is considered likely that grey seals which originate within or are otherwise associated with the SAC, may be present on an occasional basis in the area proposed for works given the known foraging ranges around known haul out sites for these species which are up to 100km for grey seal (Cronin et al. 2013) and 50km for harbour seal (Thompson et al. 1998).

Grey seals have been recorded as largely tolerant to underwater noise (J. Parsons in G.D. Green et al. 1985) with pinnipeds generally being resilient to the effects of regular high intensity underwater noise with localised avoidance recorded in association with underwater noise of up to and greater than 190dB (Harris et al. 2001). Both grey and harbour seals are known to frequent areas which are subject to relatively high levels of anthropogenic disturbance including busy ports (Brooks et al. 2016), marinas (Bankhead et al. 2023) and offshore wind farms (Russell et al. 2016).

As set out in Table 13.6, pinnipeds including grey and harbour seal are subject to much higher noise thresholds for auditory injury than any other marine mammals with the exception of otter.

On the basis of the above information and in the context of the apparent relatively low importance of the working area for both grey and harbour seals, the temporary nature of the proposals and the relatively limited nature of the proposed works to give rise to excessive underwater noise and vibrational effects, as discussed above, it is considered that the Proposed Development will not give rise to any significant adverse effects upon QI grey seal or harbour seal populations of the Lambay Island SAC. Such effects can therefore be excluded in the absence of mitigation measures.

Rockabill SPA

The construction phase of the Proposed Development will involve development within areas which have been shown to be utilised by foraging tern species or lie in close proximity to areas utilised by these species (see Appendix 13.C). These include populations of common, arctic and roseate tern which are likely to originate within or be otherwise associated with the Rockabill SPA.

Records of these species within the proposed working area during bird surveys undertaken to inform this EIAR were limited to a single record of a flock of 50 common tern. Further records of common, arctic and roseate tern were focused on areas to the north of the proposed working area, which were comparatively heavily used by these species and inclusive of the areas where the Rogerstown Estuary discharges to the wider bay. No terns were recorded to forage within the areas in which the permanent infrastructure is proposed however, it is acknowledged that this cannot be ruled out on an occasional basis as surveys undertaken are a representative sample of the use of the site by bird populations.

Table 13.7, below, sets out the numbers of SCI tern species likely associated with the Rockabill SPA, which were recorded during the bird surveys of the site within and in proximity to the Proposed Development. These are set against the populations of these birds which are present within the SPA and the recorded numbers as a percentage of these overall SPA populations.

Table 13.7: Recorded Numbers of SCI tern species associated with the Rockabill SPA.

Species	Peak Number Recorded Within or in Proximity to the Proposed Working Area	Population of the Rockabill SPA (As per latest conservation objectives (NPWS, 2013))	Recorded Numbers as a Percentage of SPA populations (%)
Roseate Tern [A192]	5	1207 Apparently Occupied Nests: Total Population assumed to be 2414 Birds.	0.207
Common Tern [A193]	150	2031 Apparently Occupied Nests: Total Population assumed to be 4062 Birds.	3.69
Arctic Tern [A194]	4	165 Apparently Occupied Nests: Total Population assumed to be 230 Birds.	1.74

Aspects of the Proposed Development which are to take place within the portions of the proposed working area which was shown to be of some value for limited numbers of foraging terns, as set out above, are limited to the movement of the renourishment vessel and associated sinker pipeline during proposed beach renourishment works envisaged to take place over a six-week period, in addition to associated small-scale sediment plumes.

These works are considered to have relatively limited potential to give rise to disturbance to foraging populations of terns, due to the nature of the works which will involve the moored vessel pumping beach renourishment material ashore via the sinker pipeline. These works are envisaged to be undertaken over 24 hours during suitable unloading conditions and will give rise to low levels of aerial or underwater noise and little movement of the vessel or associated aerial noise or visual disturbance. Furthermore, the relevant SCI tern species which have been recorded to utilise habitats within and in proximity to the proposed working area are known to be highly tolerant to disturbance associated with the movement of vessels within foraging areas. In a study examining behavioural responses of foraging seabirds to disturbance associated with shipping traffic (Fliessbach et al. 2019) both common tern and arctic tern, which also share similar ecology and behaviour to roseate tern, were assigned the lowest disturbance vulnerability indexes of all the seabirds subject to study and were recorded to show minimal behavioural responses to passing vessels.

On the basis of the above, in addition to consideration of the extent of the proposals and the relatively low numbers of terns which were recorded to utilise areas within and in proximity to the working area, as a proportion of the SPA populations, it is considered that the Proposed Development would not have potential to give rise to any significant aerial noise and visual disturbance effects upon SPA populations of the Rockabill SPA.

Furthermore, other potential indirect effects upon the local environment including water quality and habitat deterioration effects and construction effects are not considered to have potential to impact significantly on the

Rockabill SPA or any areas of supporting foraging habitat, due to the small proportion of these populations which utilise the site, in addition to the minimal and temporary nature of the potential arising effects and the dilution which it is predicted would occur within marine waters within the bay between Rush and Portrane.

The effects of the Proposed Development at construction phase upon the Rockabill SPA are considered to be negligible and not significant.

North-West Irish Sea SPA

The Proposed Development will involve works within the marine environment within *c.*250m of the North-West Irish Sea SPA with the site being separated from the closest point of the working area by *c.*0.25km of marine waters.

The proposed works are limited to the movement of marine vessel and associated sinker pipeline for beach renourishment works which will be temporary and will not give rise to any significant effects. It is further noted that any impacts to intertidal benthic communities through habitat loss or sedimentation, as discussed above in respect of the Rogerstown Estuary SPA, will not result in any adverse effects upon the SCI species of the North-west Irish Sea SPA. Such species, with the exception of the relevant gulls, are either pelagic or forage in open water only and primarily consume a diet of fish and as such are not directly vulnerable to effects arising to intertidal mud and sand.

As discussed above, proposed beach renourishment works will not result in any potential significant impacts associated with the arising sediment plumes within the wider area outside of the immediate location of material discharge. Given the spatial separation between the SPA and the proposed beach renourishment works it is not predicted that the Proposed Development would give rise to any significant sedimentation effects within the boundary of the SPA itself, as evidenced by the modelled dispersion rates. While some bird populations associated with the SPA may occur within the affected area, outside of the North-West Irish Sea SPA boundary, it is noted that bird surveys undertaken in support of this assessment did not record these areas as regularly supporting significant numbers of SCI bird species associated with the North-West Irish Sea SPA (see Appendix 13.C). As such it is considered that significant *ex-situ* effects upon SCI bird populations will not occur as a result of proposed beach renourishment works.

The proposals also have potential to give rise to adverse water quality and habitat deterioration effects in respect of the potential spillage of petrochemical fuels, lubricants and construction materials including soils and concrete.

It is noted that any such potential pollution events involving petrochemicals or lubricants would be of relatively small-scale associated with the volumes contained within a small number of construction vehicles, operating in proximity to the intertidal or marine environment and any associated refuelling stocks in addition to a single vessel which will undertake beach renourishment works.

The extent to which adverse effects associated with the release of concrete and soils into the marine environment would be limited by the nature of the proposed works involving the use such material in close proximity to the shore. The only area where it is predicted that the proposals will have potential to give rise to such effects is the proposed flood wall construction adjacent to Marsh Lane and embankment construction at the Burrow Road. Volumes of clay and other materials which are required in respect of these works are fairly

limited, with much of the work taking place at least 10m from the edge of the adjacent areas of intertidal habitat. Given that such works will take place on the estuary side of the Burrow and some distance from the North-West Irish Sea SPA boundary, it is considered that there will be no potential for significant adverse impacts upon SCI bird populations of the North-West Irish Sea SPA.

Spillage of hydrocarbons have potential to give rise surface water oiling effects to seabirds. Such effects which would potentially arise as a result of the proposed works are extremely minor, even in a worst-case scenario. Furthermore, any spillage of such low volumes of material, in the case of both construction materials and liquid pollutants, into the marine environment would be subject to significant dilution and dispersal within marine and estuarine waters which are subject to significant tidal mixing. As such it is highly likely that they would be reduced to background levels within close proximity to the location of the spillage and prior to their interaction with marine waters within the boundary of the North-West Irish Sea SPA (Lee et al. 2011).

On a precautionary basis it is assumed, despite the above information, that there may be a risk of adverse impacts upon SCI bird populations of the North-West Irish Sea SPA from spillages of pollutants or contaminants, in the absence of mitigation.

Significant adverse effects upon the North-west Irish Sea SPA as a result of water quality and habitat deterioration effects on its SCI birds cannot be excluded in the absence of pollution prevention mitigation measures. However as detailed in Chapter 9 with the adoption of standard construction phase mitigation measures the significance of environmental effect to the receiving water environment associated with spillages will be reduced to *Imperceptible.*

Other Designated Sites

Other designated sites of nature conservation interest within the local area are significantly spatially separated from the Proposed Development. In addition, there is a lack of hydrological connections to such sites and an associated lack of impact pathways. On this basis it is considered that there is no potential for the Proposed Development to give rise to significant effects upon any further designated sites at construction phase.

13.5.1.2 Habitats

Construction phase impacts to habitats within the site are considered to be largely limited to the direct loss of habitat required to facilitate the proposed works, whether temporary or permanent. Where other indirect effects to habitats occur, these are discussed below and generally limited to water quality and habitat deterioration effects upon freshwater, intertidal and estuarine habitats.

Dry Meadows/ Grassy Verges

Areas of this habitat within the site are considered to be of ecological importance at the local level.

The Proposed Development, at construction stage, will involve the loss of relatively small areas of this habitat, approximately 0.705ha, including areas of unmanaged grassland along the western coastline of the Burrow. While some small areas of this habitat are species-rich the vast majority are rank and species-poor.

The loss of small areas of this habitat are considered to be minor adverse and significant.

Dry Calcareous Grassland

The Proposed Development will retain all areas of calcareous grassland within the survey area. Effects are therefore predicted to be negligible and not significant.

Improved Grassland

The Proposed Development, at construction stage, will involve the loss of relatively small areas of this habitat, approximately 0.512ha. These areas are species-poor of site-level ecological importance and will be temporarily affected by the Proposed Development.

The loss of small areas of this habitat are considered to be negligible and not significant.

Mixed Broadleaved Woodland

The Proposed Development will retain all areas of woodland within the survey area. Effects are therefore predicted to be negligible and not significant.

Scrub

The Proposed Development, at construction stage, will involve the loss of relatively small areas of this habitat, approximately 0.484ha. These areas are of site-level ecological importance.

The loss of relatively small areas of this habitat are considered to be negligible and not significant.

Coniferous Treeline

The Proposed Development will retain all areas of coniferous treeline within the survey area. Effects are therefore predicted to be negligible and not significant.

Amenity Grassland

The Proposed Development will give rise to the loss of approximately 0.575ha of amenity grassland habitats which are assessed as being of site-level ecological importance. It is considered that ecological impacts associated with this loss will be negligible and not significant.

Amenity Planting

The Proposed Development will involve the loss of a single small area of amenity planting, 0.019ha, considered to be of site level ecological importance. It is considered that ecological impacts associated with this loss will be negligible and not significant.

Dense Bracken

The Proposed Development will involve the temporary loss of an area of approximately 0.099ha of dense bracken, located within the western portion of the Proposed Development. This habitat was considered to be of site level ecological value. The loss of such areas of habitat is considered to represent a negligible effect which is not significant.

Buildings

The Proposed Development at construction phase will not give rise to the loss of or any other impacts to this habitat considered to be of negligible ecological importance. Impacts are predicted to be negligible and not significant.

Hardstanding/ Bare Ground

The Proposed Development will give rise to the loss of approximately 0.18ha of hardstanding habitat which is assessed as being of negligible ecological importance. It is considered that ecological impacts associated with this loss will be negligible and not significant.

Recolonising Bare Ground

The Proposed Development will give rise to the loss of approximately 0.075ha of recolonising hardstanding considered to be of ecological importance at the site level. It is considered that ecological impacts associated with this loss will be negligible and not significant.

Shingle and Gravel Banks

The Proposed Development will give rise to the temporary loss (precautionary) of an area of this habitat of 0.062ha considered to be representative of Annex I Perennial vegetation of stony banks [1220] of international ecological importance.

This habitat is known to be vulnerable to temporary disturbance associated with trampling, given the nature of the plant communities which comprise the habitat. However, displacement through tidal erosion and deposition occurs naturally as part of the natural processes influencing the distribution of the early examples of the habitat (JNCC 2008), with these early communities more tolerant or erosion and partial burial. As such, temporary effects of the proposed works, which will be limited to the movement of vehicles within the working area, which is likely to be short-term, inconsistent and minimal, may not give rise to any significant loss of habitat beyond the short-term.

Minimal temporary losses to these areas of habitat which will arise as a result of the Proposed Development are considered to represent a moderate adverse and significant effect.

Lower Saltmarsh

The Proposed Development will give rise to the temporary loss of an area of lower saltmarsh approximately 0.296ha in size, inclusive of both permanent loss of areas in which the proposed sea wall is proposed in addition to temporary losses to areas of habitat within the proposed working area which may or may not be permanently lost as a result of the proposals. This habitat is considered to be representative of areas of the Annex I habitats: Atlantic salt meadows and mudflats and sandflats not covered by seawater at low tide. The loss of these areas of habitat required to facilitate the proposals is considered to represent a major adverse and significant ecological effect.

Upper Saltmarsh

The Proposed Development will give rise to the loss of a small area (0.375ha) of upper saltmarsh habitat considered to be representative of the Annex I habitat: Atlantic salt meadows and Mediterranean Salt Meadows. This is inclusive of narrow areas along the shore within the working area in proximity to Marsh Lane, in the south-west of the site. It is considered that this loss of habitat would represent a major adverse and significant effect.

Sand Shores

Sand shores are present in a narrow band along the southern shore of the bay between Rush and Portrane, to the east of Portrane and is characterised by a lack of vegetation due to regular tidal inundation and are comprised of sandy substrate.

This habitat is not representative of Annex I habitat and will be fully retained within the proposals, with only minor potential temporary effects occurring. Impacts are considered to be negligible and not significant.

Shingle and Gravel Shores

The Proposed Development will give rise to the permanent loss of an area of this habitat of 6m^2. In addition, a further area of approximately 0.34ha will be temporarily lost as a result of the proposed beach renourishment activity and the movement of machinery and plant within the working area. All such habitat is considered to be representative of Annex I Annual vegetation of drift lines [1210] and of international ecological importance.

The extent of temporary impacts arising to this habitat are likely to be minimal due to the short-term nature of such effects and in the context of the nature of the habitat itself which is subject to significantly spatial alteration as a result of the transport of larger sediments along the shore and erosion at high tides.

On a precautionary basis, losses to these areas of habitat which will arise as a result of the Proposed Development are considered to represent a **major adverse** and **significant** effect.

Mixed Sediment Shores

The vast majority of intertidal habitat along the shores within or in proximity to the proposed working area are mixed sediment shores comprised predominately of sand with significant proportions of mud and shingle representative of the Annex I habitat: 1140 Mudflats and sandflats not covered by sea water at low tide.

The working area of the Proposed Development overlies approximately 3.352ha of mixed sediment shore which was recorded throughout the areas of intertidal habitat within the working area. The vast majority of this area will not be subject to significant impacts, and simply comprises the area over which proposed beach renourishment operations are proposed, however some limited permanent losses will occur.

It is considered that the loss of this habitat represents a major adverse significant effect.

Indirect effects to this habitat arising as a result of the Proposed Development include habitat deterioration effects associated with the inappropriate storage of pollutants and sediments and the release of sediments associated with proposed beach renourishment during the construction phase, such effects would be moderate adverse and significant.

Estuarine and Intertidal Habitat

Estuarine habitat, in addition to further areas of intertidal mud and sand, are present outside the terrestrial areas of the Proposed Development and working areas and are representative of both the Annex I habitats: 1130 Estuaries and 1140 Mudflats and sandflats not covered by sea water at low tide.

The working area of the Proposed Development overlies approximately 69.77ha of intertidal mudflat habitat which was recorded throughout the areas of intertidal habitat within the working area. The vast majority of this area will not be subject to significant impacts, and simply comprises the area over which proposed beach renourishment operations are proposed. However, some limited permanent losses will occur, as discussed above in respect of the Rogerstown Estuary SAC.

It is considered that the loss of this habitat represents a major adverse significant effect.

Indirect effects to this habitat arising as a result of the Proposed Development include habitat deterioration effects associated with the inappropriate storage of pollutants and sediments and the release of sediments associated with proposed beach renourishment during the construction phase, such effects would be moderate adverse and significant.

Sea Walls/ Coastal Defence

The proposed working area encompasses areas of existing coastal defence including the areas occupied by seabees, to be reused within the proposed groyne construction, in addition to a short section of rock armour in the south-eastern portion of the site.

It is considered that the loss of these features would represent a negligible ecological effect which is not significant.

Native Species Hedgerow

The Proposed Development will retain all lengths of native species hedgerow within the survey area. Impacts are therefore considered to be negligible and not significant.

Non-Native Species Hedgerow

The Proposed Development will retain all lengths of non-native species hedgerow within the survey area. Impacts are therefore considered to be negligible and not significant.

Drainage Channel

Some modifications to the proposed discharge of a single drainage channel, in the south-west of the site will be implemented in line with the proposals. Impacts are considered to be negligible and not significant.

13.5.1.3 Protected Species

Otter

The Proposed Development will not involve any works within 200m of a known otter holt. Furthermore, the site was not recorded to support evidence indicating the regular or occasional use by otter, however, it is considered

likely that the species is present within the adjacent areas of coastal habitat on an occasional basis. Existing sources of human disturbance, principally associated with dog walkers along the shoreline are already supported on a regular basis within the site, as recorded during bird surveys undertaken of the estuary to support this assessment, as discussed above.

While the Proposed Development, at construction stage, would have potential to give rise to disturbance to otter which happen to be present within proximity to the proposed works it is considered that the likelihood of such effects would be limited due to the lack of evidence indicating the importance of these areas for the species. Potential disturbance would be temporary and short term in nature and likely to give rise to displacement of the species to other areas of suitable habitat in the wider area with no potential to result in any significant population level effects.

As habitats to be affected by the proposals are not known to be of particular importance for the species it is considered that the loss of relatively small areas of intertidal and coastal habitats which will occur as a result of the Proposed Development would be highly unlikely to give rise to significant effects upon otter.

Potential effects of the construction phase upon otter are therefore considered to be negligible and not significant.

13.5.1.4 Birds

As set out above, in respect of the Rogerstown Estuary SPA, the Proposed Development at construction phase, has potential to give rise to major adverse and significant effects upon wintering SCI bird populations as a result of habitat loss associated with the proposals and through aerial noise and visual disturbance effects which would give rise to displacement of the birds from areas of habitat which have been recorded to be of significance for wintering populations of these species across tidal states.

It is also noted that equivalent adverse impacts would also occur to populations of wintering species not included as SCIs of the Rogerstown Estuary SPA inclusive of a limited range of waterfowl in addition to populations of gulls and waders which are of importance at the national level. Such effects, including habitat loss and aerial noise and visual disturbance are predicted to be moderate adverse and significant.

Construction works taking place within the proposed working area outside the wintering period would also have potential to give rise to some comparatively minor disturbance and displacement effects upon non-breeding bird species populations that were recorded to utilise the site outside of the wintering period. This includes bar-tailed godwit, gulls and a range of other waterfowl, in relatively small numbers. Surveys of the site have demonstrated that these non-breeding populations utilise habitats in various locations throughout the SPA at a given tidal state or portion of the year. As such it is considered that any disturbance or displacement effects which would arise within this period would affect only a small proportion of available habitat and would therefore be minor adverse and significant.

The proposed construction phase works would also have potential to give rise to disturbance effects upon nesting and foraging populations of little tern, which nest on the shingle beach, to the north of the proposed working area, at the north-eastern portion of the Burrow. These birds were recorded on multiple locations to utilise areas to the north of the working area, where the estuary discharges to the wider bay, for foraging, with a single record of 10 individuals utilising habitat within the working area itself for foraging in July. These areas

would be subject only to minor disturbance effects associated with the movement and marine vessel and pumping of beach renourishment material via the sinker pipeline. As set out above in respect of the Rockabill SPA, tern species are known to be tolerant to disturbance associated with the movement of vessels, furthermore, given the nature of the proposed construction works which will not occur within close proximity to the little tern nest sites (at least 400m distant), it is not considered that the Proposed Development would have potential to give rise to significant construction phase disturbance effects upon these populations of breeding little tern.

As set out above in respect of the Rockabill SPA, areas of marine and intertidal habitat, in close proximity to the proposed working area, were recorded to be of some importance for small numbers of foraging tern populations, including common, arctic and roseate tern. These areas would be subject to only minor disturbance effects associated with the movement and use of the marine vessel and pumping of beach renourishment material via the sinker pipeline. As set out above in respect of the Rockabill SPA, tern species are known to be tolerant to disturbance associated with the movement of vessels. Given that the use of the working area by these species is sporadic and alternative foraging habitat is likely to be available for these species during this portion of the proposed works, in addition to the minor nature of any predicted disturbance, it is considered that the proposals would not give rise to any significant disturbance effects upon foraging tern populations.

The Proposed Development, at construction phase, would also involve the loss of small areas of habitat which have potential to support low numbers of common and widespread nesting bird species, including wren, dunnock, blackbird *Turdus merula* and other species not of conservation concern. This is in addition to small areas of habitat suitable for meadow pipit and skylark, red and amber listed species respectively and a length of sandy bank along the eastern shore of the Burrow which supports a small colony of sand martin, an amber listed species. It is not predicted that this proposed loss of habitat, inclusive of small areas of scrub and scattered trees or small areas of dry grassland would give rise to any adverse effects upon the conservation status of these species more widely. It is envisaged that the embankment which supports breeding sand martin will be retained within the proposals. Potential adverse effects would still arise however if the removal of such habitat was undertaken while birds were nesting. Such effects would be considered to be moderate adverse and significant.

13.5.2 Assessment of Operational Phase Effects

13.5.2.1 Designated Sites and Features of Natural Heritage Importance

The operational phase of the Proposed Development will involve the ongoing functioning of the Proposed Development for the purposes of mitigating coastal erosion and preventing flooding landward of these defences.

Rogerstown Estuary SAC

The operational phase of the Proposed Development will involve the ongoing functioning of coastal processes within the SAC in a manner which is broadly consistent with existing processes. Proposed sea walls or embankments will either be set back from the existing shoreline or will be positioned along the line of existing sea wall at Marsh Lane. As such it is considered that these sea walls are only likely to interact with tidal flows during periods of high water. Under typical circumstances, these proposed features will not cause any significant change to the tidal action of the estuary and associated sediment transport regimes.

The proposed groynes and associated beach renourishment have been subject to a detailed modelling assessment as set out within chapter of the EIAR. This exercise assessed the existing tidal flows, wave action and sediment transport regime at the site and drew a comparison with those which will occur in the operational phase of the proposals. The results of this assessment indicated that the operational phase of the Proposed Development will not give rise to any significant changes to tidal flows or wave climate except within the immediate proximity of the proposed groyne structures. Some minor changes to the sediment transport regime will occur during calm conditions. Most notably there will be an increase in sediment transport approximately 50m seaward of the proposed groyne structures associated with the shifting of the wave breaking point, an area which currently undergoes minimal sediment transport except during storm events. During calm events the assessment also predicts that there will be some limited reduction in levels of sediment transport arising to the northern tip of the Burrow. This is an area which lies adjacent to several Annex I habitats including areas of annual vegetation of drift lines [1210], embryonic shifting dunes [2110] and shifting dunes along the shoreline with *Ammophila arenaria* [2120], the latter representing a qualifying interest of the SAC. It is considered therefore that the Proposed Development will not give rise to any significant adverse effect upon these qualifying interests of the SAC and furthermore that the conditions for sand dune Annex I habitats may be subject to some enhancement through a decrease in their susceptibility to coastal erosion.

During storm conditions the modelling assessment predicted that the proposed groynes and associated beach renourishment would not give rise to any significant changes to sediment transport regimes except within the immediate vicinity of the Proposed Development. The estuarine environment within the Rogerstown Estuary SAC potentially affected by minor changes to sediment transport regimes arising from the proposed works, is subject to significant natural sediment transport, including outputs from the Rogerstown Estuary and the suspension, transport and deposition of existing marine sediments. The existing sediment transport regime, which regularly produces naturally high concentrations of suspended sediment within marine waters within and in proximity to the SAC, form the natural processes of the estuary and intertidal mudflat and sandflat system within the SAC. As such it is considered that these habitats, the only marine habitats which represent qualifying interests of the SAC, are not likely to suffer adverse effects associated with any small-scale and localised changes to sediment transport regimes which would arise as a result of the proposed works.

Consequently, it is considered that no further operational phase adverse effects upon qualifying habitats within the SAC as a result of altered coastal processes will occur. Effects are predicted to be negligible and not significant.

Following completion of the proposed construction phase and the associated reinstatement of areas of saltmarsh habitat which are to be subject to temporary effects associated with the proposed working area, it is envisaged that there will be a period of time in which normal tidal regimes and associated sediment transportation restore the distribution of mud, sand and other sediments within the affected areas of the estuary as are supported currently.

No further pathways for significant effects upon Rogerstown Estuary SAC are considered to arise as a result of the Proposed Development at operational stage.

Rogerstown Estuary SPA

Potential impacts associated with the operational phase of the Proposed Development upon the Rogerstown Estuary SPA are considered to be largely consistent with those identified in respect of the Rogerstown Estuary SAC and discussed above.

In line with the above, it is considered that the impacts to intertidal habitats associated with altered coastal processes at the site will not be significant. As such the proposals would have no potential to give rise to significant impacts to the area of available intertidal foraging habitat for SCI bird populations of the SPA, within the boundary of the designated site which will largely remain consistent with that currently supported, with minor changes to certain small areas which are to be subject to minor increases or decreases to sediment transport regimes which are predicted to retain their value for foraging wintering SCI bird populations of the SPA.

The operational phase of the Proposed Development will have no potential to give rise to any significant disturbance effects upon wintering bird populations associated with the SPA.

Impacts to this designated site at operational phase are considered to be negligible and not significant.

Rogerstown Estuary pNHA

Conclusions set out above in respect of the impacts predicted to the Rogerstown Estuary SAC at operational phase are considered equally relevant to the Rogerstown Estuary pNHA. No further impact pathways have been identified in respect of the pNHA which underpins both the Rogerstown Estuary SAC and SPA.

Rockabill to Dalkey Island SAC

The Proposed Development at operational phase will not give rise to any sources of potential disturbance to harbour porpoise populations associated with the Rockabill to Dalkey Island SAC.

As set out above, the coastal processes assessment undertaken of the Proposed Development has concluded that the proposed infrastructure will not give rise to a significant impact to sediment transport regimes within the wider Rogerstown Estuary and adjacent coastal intertidal or marine habitat. As such it is not envisaged that the operational phase of the Proposed Development would give rise to the loss or deterioration of marine habitats which may be used by harbour porpoise on an occasional basis or the Annex I reef habitats within the SAC boundary which are significantly spatially separated for the Proposed Development.

Potential for significant effects upon the Rockabill to Dalkey Island SAC at operational phase is therefore ruled out.

Lambay Island SAC

The Proposed Development at operational phase will not give rise to any sources of potential disturbance to seal populations associated with the Lambay Island SAC.

As set out above, the coastal processes assessment undertaken of the Proposed Development has concluded that the proposed infrastructure will not give rise to a significant impact to sediment transport regimes within the wider Rogerstown Estuary and adjacent coastal intertidal or marine habitat. As such it is not envisaged that the operational phase of the Proposed Development would give rise to the loss or deterioration of marine habitats

which may be used by grey or harbour seal on an occasional basis or the marine habitats within the SAC boundary which are significantly spatially separated for the Proposed Development.

Potential for significant effects upon the Lamaby Island SAC at operational phase is therefore ruled out.

Rockabill SPA

As set out above, it is not predicted that the Proposed Development would have significant potential to result in any significant operational phase changes to coastal process outside of the immediate proximity of the proposed infrastructure.

No operational phase effects upon areas of habitat which are known to be used by foraging terns likely to be associated with the Rockabill SPA are predicted. Effects are therefore considered to be negligible and not significant.

North-West Irish Sea SPA

As set out above, it is not predicted that the Proposed Development would have significant potential to result in any significant operational phase changes to coastal processes beyond the immediate proximity of the proposed infrastructure.

No operational phase effects upon areas of habitat which are known to be used by marine birds likely to be associated with the North-west Irish Sea SPA are predicted. Effects are therefore considered to be negligible and not significant.

13.5.2.2 Habitats

The Proposed Development at operational phase will have extremely limited potential to give rise to adverse effects upon habitats as it will involve the ongoing functioning of coastal defence structures, which as discussed above will not cause significant effects to sediment transport regimes within intertidal habitats. Proposed flood walls and embankments would only interact with tidal waters during extreme coastal events and as such would not interfere with typical coastal processes within the estuary. The proposed groynes and associated beach renourishment are predicted to give rise to no significant changes to coastal processes beyond the immediate vicinity of the proposed infrastructure. As such, no significant operational phase effects upon estuarine and intertidal habitats within the site are predicted to arise as a result of the Proposed Development.

No other operational phase pathways for effects upon habitats are predicted to arise as a result of the Proposed Development.

Operational phase effects are predicted to be negligible and not significant.

13.5.2.3 Protected Species

The Proposed Development will involve the ongoing functioning of proposed flood protection measures which will only interact with tidal waters during rare periods of coastal flooding.

Given the lack of potential pathways for significant effects to protected species, at operational phase, it is considered that there is no potential for the Proposed Development to give rise to operational phase effects upon protected species.

13.5.2.4 Birds

The Proposed Development, at operational phase, will give rise to no effects which are considered likely to result in an adverse impact upon wintering or non-breeding populations of waterbirds birds found within proximity to the proposed coastal defence infrastructure.

The proposed groynes and beach renourishment will give rise to some minor changes to sediment transport within the wider Estuary, limited to low levels of accretion at the north-eastern point of the Burrow. This area is known to support a colony of breeding little tern and ringed plover. It is envisaged that these species are vulnerable to effects associated with altered coastal processes in circumstances which result in an increase to the levels of coastal flooding and erosion. The Proposed Development will lead to increased accretion of sediments in the locations in which these species are known to breed and as such decrease the potential for general erosion of these breeding sites under calm condition. During storm conditions it is not predicted that any significant changes to sediment transport in these areas will occur as a result of the Proposed Development.

Given the lack of potential pathways for significant effects to birds, at operational phase, it is considered that there is no potential for the Proposed Development to give rise to operational phase effects upon birds.

13.5.3 Assessment of Cumulative Effects

The Proposed Development has been assessed in regard to the potential for cumulative biodiversity impacts to arise in-combination with other local planning applications.

The vast majority of the applications recently, submitted or approved within proximity to the Proposed Development are small-scale schemes such as dwelling extensions, amendments to previous permissions, proposed outbuildings and similar projects which are situated within the terrestrial environment and outside the boundary of the Rogerstown Estuary SAC and SPA. It is considered that these small-scale proposals have no potential to act in-combination with the Proposed Development.

The only scheme deemed to have potential to act cumulatively with the Proposed Development is the FRS proposed at Rush South. This project is considered below.

13.5.3.1 Rush: Flood Relief Scheme

This application has been submitted alongside another application being prepared for the FRS proposed at Rush South. This scheme will also involve works taking place within the boundary of the Rogerstown Estuary SAC, SPA and pNHA.

Predicted impacts arising as a result of the proposed FRS at Rush includes the loss of small areas of qualifying interest habitats of the SAC including intertidal estuarine and mudflat habitats and small areas of Atlantic and Mediterranean salt meadows, at construction phase. Significant operational phase impacts to SCI habitats are not predicted to occur.

It is considered therefore that the Proposed Development at Rush would have potential to act cumulatively with the Burrow project in respect of all adverse effects predicted to the Rogerstown Estuary SAC. The total areas of qualifying Annex I habitat to be lost are set out within Table 13.8.

As set out in Table 13.8, losses to QI Annex I sand dune habitat, including dunes with herbaceous vegetation (grey dunes) [2130] and shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2120] will occur as a result of the Proposed Development. The scheme will also give rise to the loss of non-qualifying Annex I habitat including areas of Annual vegetation of drift lines [1210] and Perennial vegetation of stony banks [1220]. However, such impacts will not have potential to act cumulatively with the Proposed Development as the Rush proposals will not give rise to any impacts to these qualifying and non-qualifying Annex I habitats.

Regarding the Rogerstown Estuary SPA, cumulative loss of habitats within the SPA boundary will give rise to synchronous loss of foraging habitat for wintering SCI bird populations. Associated cumulative effects are predicted to arise. It is noted however that any temporary loss of foraging habitat arising through the projects will not occur simultaneously as the projects will not be constructed concurrently.

Aerial noise and visual disturbance effects upon SCI bird populations of the Rogerstown Estuary SPA will occur as a result of both schemes, in the absence of mitigation. This disturbance and associated displacement would also have potential to act cumulatively if the schemes were constructed concurrently and consequently give rise to a relatively greater cumulative disturbance and displacement effect with a greater limitation on the available undisturbed area of habitat for wintering populations of SCI bird species. It is noted however that the schemes are proposed to be constructed separately and as such this potential for cumulative effects will not occur.

In addition to impacts to SCI bird populations of the SPA, the Proposed Development will give rise to adverse impacts upon non-qualifying populations of waders and waterfowl which are recorded to utilise the adjacent intertidal habitats for foraging during the wintering period. These include populations which are likely to be national importance. Disturbance to these populations of non-qualifying waterbirds and associated displacement is considered, in line with predicted impacts to SCI bird species, likely to act cumulatively with disturbance impacts arising as a result of the proposed Burrow scheme, in the absence of mitigation.

Potential construction phase disturbance effects to breeding tern species, including those associated with the Rockabill SPA, in addition to little tern populations of conservation concern which occur in close proximity to the proposed working area for the Burrow scheme, are not considered to have potential to act cumulatively with impacts associated with the FRS at Rush. The proposed FRS at Rush scheme will not give rise to any significant disturbance effects to areas of intertidal and marine habitat which were recorded to be of particular importance for the relevant tern species.

Other potential indirect impacts upon the Rogerstown Estuary SAC, SPA and pNHA including water quality and habitat deterioration effects also have potential to act cumulatively with the Proposed Development.

Given that impacts associated with the loss of non-Annex I habitats which will occur as a result of the Proposed Development are not predicted to be significant, it is not considered that the Rush and Burrow schemes have potential to act cumulatively in respect of likely impacts to habitats more generally.

No cumulative impacts to any further protected species are predicted to arise as a result of the two schemes.

Table 13.8: Cumulative Losses (temporary and permanent) to Annex I Habitat within Rogerstown Estuary SAC.

Annex I Habitat	Area permanently lost as a result of the proposed Burrow Scheme (ha) [% of the total within the SAC]	Area to be temporarily affected by the Proposed Burrow Scheme (Ha) [% of the total within the SAC]	Area lost as a result of the Proposed Development (Rush) (ha) [% of the total within the SAC]	Area to be temporarily affected by the Proposed Development (Rush) (Ha) [% of the total within the SAC]	Total Cumulative Area Permanently Lost [% of the total within the SAC]	Total Area Temporarily Affected (ha) [% of the total within the SAC]
Estuaries [1130]	-	-	0.0469 [0.0175]	2.203 [0.822]	0.0469 [0.0175]	2.203 [0.822]
Mudflats and sandflats not covered by seawater at low tide [1140]	1.36 [0.368]	13.01 [3.516]	0.0469 [0.013]	2.203 [0.595]	1.407 [0.380]	15.213 [4.112]
Salicornia and other annuals colonising mud and sand [1310]	-	-	-	-	-	-
Atlantic salt meadows (Glauco-Puccinellietalia maritimae) [1330]	0.00016 [0.00043]	0.18 [0.48]	-	0.0452 [0.12]	0.00016 [0.00043]	0.225 [0.6]
Mediterranean salt meadows (Juncetalia maritimi) [1410]	-	0.006 [2.18]	-	-	-	0.006 [2.18]
Shifting dunes along the shoreline with Ammophila arenaria (white dunes) [2120]	-	0.0184 [0.78]	-	-	-	0.0184 [0.78]

Annex I Habitat	Area permanently lost as a result of the proposed Burrow Scheme (ha) [% of the total within the SAC]	Area to be temporarily affected by the Proposed Burrow Scheme (Ha) [% of the total within the SAC]	Area lost as a result of the Proposed Development (Rush) (ha) [% of the total within the SAC]	Area to be temporarily affected by the Proposed Development (Rush) (Ha) [% of the total within the SAC]	Total Cumulative Area Permanently Lost [% of the total within the SAC]	Total Area Temporarily Affected (ha) [% of the total within the SAC]
Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130]	-	0.79 [9.44]	-	-	-	0.79 [9.44]
Annual vegetation of drift lines [1210] (Non-qualifying)	0.0006 [-]	0.34 [-]	-	-	0.0006 -	0.34 -
Perennial vegetation of stony banks [1220] (Non-qualifying)	-	0.062 [-]	-	-		0.062 -
Embryonic shifting dunes [2110] (Non-qualifying)	-	-	-	-	-	-

13.6 Mitigation Measures

13.6.1 Designated Sites and Features of Natural Heritage Importance

13.6.1.1 Rogerstown Estuary SAC

The Proposed Development necessarily involves the loss of areas of habitat which are QIs for the Rogerstown Estuary SAC at construction phase. No mitigation is proposed in respect of the loss of these areas of habitat. As such, predicted effects are considered to remain major adverse and significant.

The Proposed Development will result in the loss of qualifying Annex I habitats and introduce physical obstructions into the estuarine system of Rogerstown estuary and interrupt the natural circulation of sediment and organic matter. In our view, this outcome will prevent the achievement of the conservation objectives for the site and give rise to an adverse effect upon the integrity of Rogerstown Estuary SAC.

Indirect effects associated with the construction phase of the Proposed Development include those arising through water quality and habitat deterioration effects to intertidal and aquatic habitats through sedimentation and pollution associated with proposed construction activities.

To mitigate these potential effects upon intertidal and aquatic habitats a range of mitigation measures are to be implemented as set out within Chapter 10: Water Quality, of the EIAR and within the accompanying outline Construction and Environmental Management Plan (CEMP). Subject to the implementation of these construction phase mitigation measures, it is considered that any potential significant adverse effects upon intertidal and aquatic habitats within the Rogerstown Estuary SAC would be fully mitigated.

To address the potential spread of invasive species, namely common cord-grass (spartina), it is recommended that the construction phase of the Proposed Development is undertaken in line with an appropriate Invasive Species Management Plan (ISMP). This ISMP should include the following measures:

- Identification and demarcation of areas of spartina within or in proximity to the proposed working area in advance of the beginning of construction;
- Cutting of above-ground growths of the plant and removal of this material and appropriate disposal, as required;
- Appropriate storage of sediments, sands, soils and other material excavated from the intertidal environment;
- Use of barrier membrane (black plastic sheeting) between areas to be used for construction access and underlying sediments to provide a barrier between construction staff and equipment and the rhizomes and viable seed of the plant within underlying substrate, and to smother the plants;
- Screening of intertidal mud and other substrates prior to reinstatement of the areas used for construction access to ensure that plant material is not reintroduced to the site prior to reinstatement of such material following completion of the construction; and
- The careful removal of any temporary access arrangements and removal and washing of the barrier membrane.

Subject to the implementation of these mitigation measures it is considered that any risks associated with the inadvertent spread of invasive cord-grass resulting from construction stage works will be fully mitigated.

13.6.1.2 Rogerstown Estuary SPA

The Proposed Development necessarily involves the loss of areas of habitat which are used by SCI bird populations associated with the Rogerstown Estuary SPA, inclusive of 1.36ha of Annex I Mudflats and sandflats not covered by seawater at low tide [1140]. The use of these areas by SPA bird populations was recorded to be relatively low, and subject to existing disturbance associated with pedestrian dog walkers. No mitigation measures are proposed in respect of these losses and impacts are therefore considered to remain major adverse and significant.

As set out above, in respect of the Rogerstown Estuary SAC, the Proposed Development will incorporate a range of mitigation measures designed to address the potential for impacts associated with water quality and habitat deterioration and the spread of invasive species arising at construction phase. These measures are considered to be equally relevant to the Rogerstown Estuary SPA and will also mitigate against these predicted impacts in respect of this European site.

Additional pathways for significant impacts to the Rogerstown Estuary SPA were limited to those associated with construction phase disturbance effects upon SCI bird populations which are known to regularly utilise habitats within close proximity to the proposed works.

To mitigate potential aerial noise and visual disturbance effects it will be necessary to restrict the construction phase of Proposed Development to taking place outside of the wintering bird period (October to March). Subject to works being undertaken within April to September, it is considered that any potential construction phase aerial noise or visual disturbance effects to SCI bird populations will be fully mitigated.

13.6.1.3 Rogerstown Estuary pNHA

The Rogerstown Estuary SAC and SPA are underpinned by their designation as the Rogerstown Estuary pNHA. This site is designated on account of a range of receptors which are also reflected in its designation as an SAC and SPA.

It is considered that proposed mitigation measures, discussed above in respect of both the Rogerstown Estuary SAC and SPA are equally relevant to the predicted impacts to the Rogerstown Estuary pNHA.

No further effects, not discussed in respect of the SAC or SPA are considered likely to arise to the pNHA as a result of the Proposed Development.

13.6.1.4 Rockabill to Dalkey Island SAC

As set out above, it is considered that the Proposed Development has on a precautionary basis, some potential to give rise to auditory injury effects to harbour porpoise and seal populations originating from or otherwise associated with the Rockabill to Dalkey Island SAC. Such effects are only predicted to arise as a result of proposed piling operations and are considered to be highly unlikely given the sites location, the methodology proposed and the low likelihood that harbour porpoise would be present in proximity to the proposed work areas.

These aspects of the works are proposed to be undertaken using a vibrational piling technique which will give rise to considerably lower underwater noise and vibrational effects than other piling methods.

The following precautionary measures will be undertaken to minimise the risk of injury or disturbance to marine mammals in the area of operations in line with National Parks and Wildlife Service (NPWS) Guidelines (2014):

- A trained and experienced Marine Mammal Observer (MMO) will be put in place during piling, dredging, demolition and dumping operations. The MMO will scan the surrounding area to ensure no marine mammals are in a pre-determined exclusion zone in the 30-minute period prior to operations. The NPWS exclusion zone is 1,000m for piling activities.
- Noise-producing activities will only commence in daylight hours where effective visual monitoring, as performed and determined by the MMO, has been achieved. Where effective visual monitoring is not possible, the sound-producing activities will be postponed until effective visual monitoring is possible. Visual scanning for marine mammals (in particular harbour porpoise) will only be effective during daylight hours and if sea conditions are WMO Sea State 4 (≈Beaufort Force 4 conditions) or less.
- For piling activities, where the output peak sound pressure level (in water) exceeds 170dB re: 1µPa @ 1m, a ramp-up procedure will be employed following the pre-start monitoring. Underwater acoustic energy output will commence from a lower energy start-up and thereafter be allowed to gradually build up to the necessary maximum output over a period of 20-40 minutes.
- If there is a break in piling activity for a period greater than 30 minutes, then all pre-activity monitoring measures and ramp-up (where this is possible) will recommence as for start-up.
- Once normal operations commence (including appropriate ramp-up procedures), there is no requirement to halt or discontinue the activity at night-time, nor if weather or visibility conditions deteriorate, nor if marine mammals occur within a radial distance of the sound source that is 1,000m for piling activities.
- Any approach by marine mammals into the immediate (<50m) works area will be reported to the National Parks and Wildlife Service.
- The MMO will keep a record of the monitoring using a ‘MMO form location and effort (coastal works)’ available from the National Parks and Wildlife Service (NPWS) and submit to the NPWS on completion of the works.

Subject to the implementation of these measures it is considered that any potential underwater noise or vibrational disturbance effects arising as a result of the Proposed Development will be fully mitigated.

13.6.2 Habitats

The Proposed Development will not incorporate mitigation measures for the loss of areas of habitat which are either of low ecological value or are included as qualifying interests of the Rogerstown Estuary SAC, as discussed above.

Potential indirect effects upon habitats were limited to water quality and habitat deterioration effects arising at construction phase which, as discussed above, will be addressed through the implementation of a range of

mitigation measures proposed for the protection of water quality and also set out within Chapter 10: Water Quality, of the EIAR and within the accompanying CEMP. Subject to the implementation of these measures it is envisaged that any potential water quality and habitat deterioration effects upon aquatic and intertidal habitats will be fully mitigated.

13.6.3 Birds

As set out above in respect of the Rogerstown Estuary SPA, to minimise the potential for disturbance to SCI bird populations within the SPA, it will be necessary for all construction works proposed within the SPA boundary to take place outside of the wintering bird season (October to March).

Subject to the implementation of this measure it is considered that the proposals would have limited potential to give rise to any significant disturbance to wintering bird populations.

Some limited disturbance to non-wintering populations of waders and waterfowl, including SCI bird species, which were recorded to utilise the site would still occur however surveys have demonstrated that significant areas of the SPA remain suitable for these populations should any small-scale and temporary displacement occur. Such numbers have been recorded to be small in any event and areas within the working area to be of little importance for these species (See Appendix 13.C).

Where limited works are required within the terrestrial environment, to facilitate the proposals, which require the removal of vegetation including scrub, scattered trees and lengths of non-native hedgerows, it is recommended that this work take place outside of the nesting bird season (1st March to 31st August inclusive). Such works should be undertaken during the winter prior to the proposed start of works to ensure that conflicting constraints are appropriately managed.

As set out above, it is not considered that the Proposed Development will give rise to any potentially significant disturbance to breeding terns, the breeding sites of which are located approximately 400m from the closest aspect of the proposals.

Subject to the implementation of these mitigation measures it is envisaged that the Proposed Development will not give rise to any significant impacts upon birds, except those associated with the loss of foraging habitats arising as a result of the Proposed Development and discussed above in respect of the Rogerstown Estuary SPA.

13.7 Summary of Effects & Conclusion

The Proposed Development has potential to give rise to a range of significant impacts upon natural heritage and biodiversity receptors.

Significant adverse impacts are predicted to arise to three sites designated on account of their natural heritage or conservation interests, namely the Rogerstown Estuary SAC, Rogerstown Estuary SPA and Rogerstown Estuary pNHA. These impacts are anticipated to include:

- The permanent loss of approximately 1.36ha of mudflats and sandflats not covered by seawater at low tide [1140] to facilitate proposed groyne installation.
- The permanent loss of approximately 1.6m^2 of Atlantic salt meadows [1330] to facilitate proposed embankment construction at Marsh Lane.

Temporary impacts to approximately:

- 3.01ha of mudflats and sandflats not covered by seawater at low tide [1140].
- 0.18ha of Atlantic salt meadows [1330].
- 0.0006ha of Mediterranean salt meadows [1410].
- 0.018ha of white dunes [2120].
- 0.79ha of grey dunes [2130].
- Additional impacts upon non-qualifying Annex I habitats as a result of the proposed beach renourishment works and other temporary effects associated within lying within the proposed working area.

Such habitats, particularly areas of intertidal mud and salt meadows, provide foraging habitat for foraging SCI bird populations associated with the SPA. Synchronous impacts are predicted to the Rogerstown Estuary pNHA.

The Proposed Development will result in the loss of qualifying Annex I habitats and introduce physical obstructions into the estuarine system of Rogerstown estuary and interrupt the natural circulation of sediment and organic matter. In our view, this outcome will prevent the achievement of the conservation objectives for the site and give rise to an adverse effect upon the integrity of Rogerstown Estuary SAC.

Further impacts to designated sites may arise through water quality and habitat deterioration as a result of pollution or sedimentation of the aquatic environment, the spread of invasive cord-grass, and aerial noise and visual disturbance to wintering bird populations.

Predicted significant impacts upon habitats are limited to the loss of areas of habitat of international importance, as discussed above. Other habitats within the site are of low ecological value and impacts associated with the losses of these habitats are predicted to be negligible and not significant, with the exception of the loss of a small area of shingle and gravel banks habitat which is considered to be of regional level ecological importance. Loss of this habitat is considered to be **moderate adverse** and **significant**.

Potential indirect water quality and habitat deterioration effects through the accidental release of sediments or pollutants into the aquatic environment may arise at construction.

Potential impacts to protected species are limited to those associated with the disturbance of wintering and breeding and non-breeding bird populations at construction stage.

A summary of the predicted effects and proposed mitigation is set out below at Table 13.9.

Residual effects on natural heritage and biodiversity as a result of the Proposed Development are limited to major adverse and significant effects associated with the loss of QI Annex I habitats of the Rogerstown Estuary SAC and loss of areas of foraging habitat for SCI bird populations of the Rogerstown Estuary SPA.

Table 13.9: Summary Table of Likely Environmental Effects on Natural Heritage and Biodiversity Pre and Post Mitigation.

Receptor	Sensitivity of receptor (level)	Description of Effect	Duration	Magnitude	Magnitude of Effect	Significant Or not	Significant or Not Post Mitigation
Construction phase							
Designated Sites of Natural Heritage Importance: Rogerstown Estuary SAC, SPA, pNHA	International	Habitat loss: Annex I Estuaries, Mudflats and sandflats, Atlantic salt meadows, Mediterranean salt meadows, grey dunes.	Short term	Major	Major adverse	Significant	Significant
Designated Sites of Natural Heritage Importance: Rogerstown Estuary SAC, SPA, pNHA	International	Spread of invasive species: Spartina	Medium term	Major	Major adverse	Significant	Not significant
Designated Sites of Natural Heritage Importance: Rogerstown Estuary SAC, SPA, pNHA	International	Water quality and habitat deterioration: release of sediments or pollutants into the aquatic and intertidal environment.	Short term	Major	Major adverse	Significant	Not significant
Designated Sites of Natural Heritage Importance: Rogerstown Estuary SPA	International	Aerial noise and visual disturbance: Wintering birds.	Short term	Major	Major adverse	Significant	Not significant
Designated Sites of Natural Heritage Importance: Rockabill to Dalkey Island SAC	International	Underwater noise and vibrational disturbance: Harbour porpoise.	Short term	Major	Major adverse	Significant	Not significant
Habitats: Dry meadows/ Grassy verges	Local	Loss of habitat	Short term	Minor	Minor adverse	Significant	Significant
Habitats: Dry calcareous grassland	Site	Loss of habitat.	Short term	Negligible	Negligible	Not significant	Not significant
Habitats: Improved grassland	Site	Loss of habitat.	Short term	Negligible	Negligible	Not significant	Not significant
Habitats: Mixed broadleaved woodland	Site	Loss of habitat.	Short term	Negligible	Negligible	Not significant	Not significant

Receptor	Sensitivity of receptor (level)	Description of Effect	Duration	Magnitude	Magnitude of Effect	Significant Or not	Significant or Not Post Mitigation
Habitats: Scrub	Site	Loss of habitat.	Short term	Negligible	Negligible	Not significant	Not significant
Habitats: Coniferous treeline	Site	Loss of habitat.	Short term	Negligible	Negligible	Not significant	Not significant
Habitats: Amenity grassland	Site	Loss of habitat.	Short term	Negligible	Negligible	Not significant	Not significant
Habitats: Amenity planting	Site	Loss of habitat.	Short term	Negligible	Negligible	Not significant	Not significant
Habitats: Dense bracken	Site	Loss of habitat.	Short term	Negligible	Negligible	Not significant	Not significant
Habitats: Buildings	Negligible	Loss of habitat.	Short term	Negligible	Negligible	Not significant	Not significant
Habitats: Hardstanding/ Bare ground	Negligible	Loss of habitat.	Short term	Negligible	Negligible	Not significant	Not significant
Habitats: Recolonising bare ground	Site	Loss of habitat.	Short term	Negligible	Negligible	Not significant	Not significant
Habitats: Shingle and gravel banks	National	Loss of habitat.	Short term	Moderate	Moderate adverse	Significant	Significant
Habitats: Lower saltmarsh	International	Loss of habitat.	Short term	Major	Major adverse	Significant	Significant
Habitats: Upper saltmarsh	International	Loss of habitat.	Short term	Major	Major adverse	Significant	Significant
Habitats: Shingle and gravel shores	National	Loss of habitat.	Short term	Moderate	Moderate adverse	Significant	Significant
Habitats: Sand shores	Local	Loss of habitat.	Short term	Negligible	Negligible	Not significant	Not significant
Habitats: Mixed sediment shores	International	Loss of habitat.	Short term	Major	Major adverse	Significant	Significant
Habitats: Mixed sediment shores	International	Wate quality and habitat deterioration effects.	Short term	Major	Major adverse	Significant	Not significant
Habitats: Estuarine and intertidal habitat	International	Loss of habitat.	Short term	Major	Major adverse	Significant	Significant
Habitats: Estuarine and intertidal habitat	International	Wate quality and habitat deterioration effects.	Short term	Major	Major adverse	Significant	Not significant

Receptor	Sensitivity of receptor (level)	Description of Effect	Duration	Magnitude	Magnitude of Effect	Significant Or not	Significant or Not Post Mitigation
Habitats: Sea walls/ Coastal defences	Site	Loss of habitat.	Short term	Negligible	Negligible	Not significant	Not significant
Habitats: Native species hedgerow	Site	Loss of habitat.	Short term	Negligible	Negligible	Not significant	Not significant
Habitats: Non-native species hedgerow	Site	Loss of habitat.	Short term	Negligible	Negligible	Not significant	Not significant
Habitats: Drainage channel	Site	Loss of habitat.	Short term	Negligible	Negligible	Not significant	Not significant
Otter	National	Disturbance, habitat deterioration and water quality effects.	Short term	Negligible	Negligible	Not significant	Not significant
Birds: Wintering	International	Loss of foraging habitat: saltmarsh and intertidal habitat.	Short term	Major	Major adverse	Significant	Significant
Birds: Wintering	International	Water quality and habitat deterioration.	Short term	Major	Major adverse	Significant	Not significant
Birds: Wintering	International	Spread of invasive species.	Short term	Major	Major adverse	Significant	Not significant
Birds: Wintering	International	Aerial noise and visual disturbance	Short term	Major	Major adverse	Significant	Not significant
Birds: Breeding	International	Aerial noise and visual disturbance	Short term	Negligible	Negligible	Not significant	Not significant
Birds: Breeding	International	Water quality and habitat deterioration.	Short term	Negligible	Negligible	Not significant	Not significant
Birds: Breeding	National	Destruction of bird nests or disturbance to nesting birds.	Short term	Moderate	Moderate adverse	Significant	Not significant
Operational phase							
Designated Sites of Natural Heritage Importance: Rogerstown Estuary SAC and pNHA	International	Altered coastal processes	Long term	Negligible	Negligible	Not significant	Not significant

14 TRAFFIC & TRANSPORTATION

14.1 Introduction

This chapter of the EIAR compares the baseline transport conditions against the Proposed Development to establish the impacts and the extent of the area of influence in context of traffic and transportation.

14.2 Authority of author

The author of this chapter, Stephen Houlihan is an Associate Director with RPS and holds an MSc in Transport Planning and Engineering and has over 16 years of experience in the field of traffic and transport assessments and traffic impact assessment modelling. Stephen is a Chartered member of the Institute of Logistics and Transport (CILT) and a member of the Transport Planning Society (TPS).

14.3 Assessment Methodology

14.3.1 Planning Policy Context and Relevant Guidance

The assessment was undertaken in accordance with the following Policy and Guidance:

- Fingal County Development Plan (2023-2029) - Fingal County Council.
- Guidelines on the information to be contained in Environmental Impact Assessment Reports (2022) - Environmental Protection Agency.

The site is zoned under Fingal County Development Plan 2023-2029 as *"HA – High Amenity – Protect and enhance high amenity areas"*.

14.3.2 Study Area

The Study Area in relation to traffic and transport considers the road network along Burrow Road and R126, as this would comprise the primary construction traffic route to and from the site. The proposed construction traffic route and local road network are identified in Figure 14.1. No additional operational changes are proposed to the site, and therefore no additional operational assessment of the site has been undertaken as operational trip generation for the area would remain unchanged and insignificant. The construction and operational phase route/ traffic are discussed in detail in Section 14.5.

The site forms sections of the Portrane coastline and the Rogerstown Estuary, with an earth embankment proposed at the end of Burrow Road, a sheet-piled flood wall and embankment proposed at Marsh Lane and groynes structures and beach renourishment proposed along Portrane Beach.

14.4 Receiving Environment

The Proposed Development is located at the Burrow which separates the outer Rogerstown Estuary from the Irish Sea, as illustrated in Figure 14.1. The Burrow is fronted by a wide sandy beach and is bordered by rock headlands at Rush towards the north and Portrane to the south. Site compound locations and access routes are displayed in Figure 14.2. Details of the Proposed Development are described in Chapter 3.

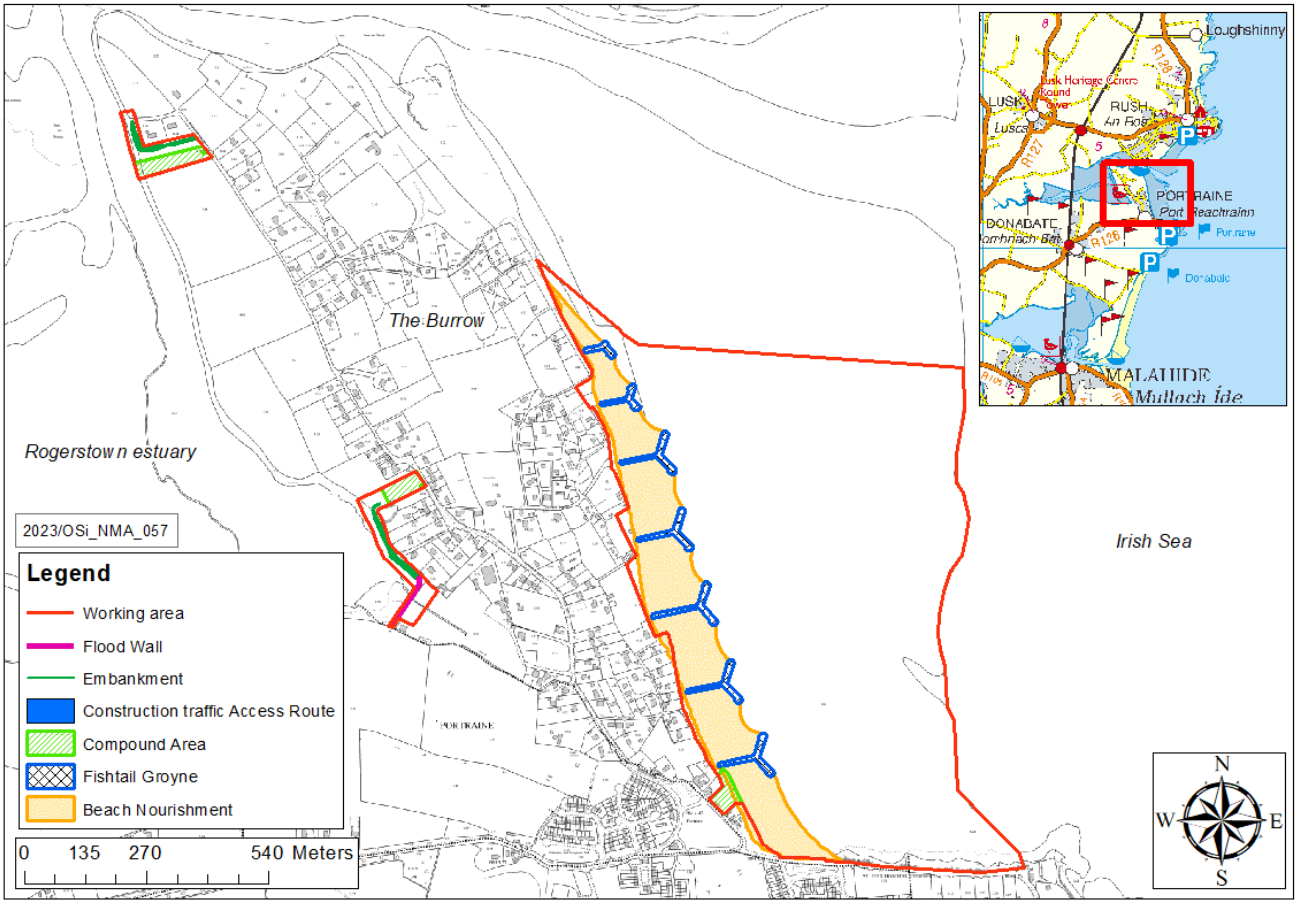


Figure 14.1: Site boundary at the Burrow with access routes and compound locations.



Figure 14.2: Site Location and ATC Survey Locations at Burrow, Fingal, County Dublin.

14.4.1 Baseline Transport Conditions

Automatic Traffic Count (ATC) surveys were commissioned by RPS and undertaken by Idaso Ltd. between 5th May and 11th May 2023 (inclusive) along the R126 Portrane Road and Burrow Road to assess the existing traffic conditions within the surrounding road network. These surveys included the collection of vehicle speeds to establish the 85th% speed of vehicles travelling along the carriageway, two-way daily vehicle flows and vehicle types across a 7-day period. The location of the ATC surveys is illustrated in Figure 14.2.

The weekday peak periods, existing Heavy Goods Vehicle (HGV)% and two-way traffic flows, informing Annual Average Daily Traffic (AADT), were identified from the ATC surveys along the construction route as shown in Figure 14.3. An AM Peak between 08:00 - 09:00 and a PM Peak of 17:00 - 18:00 was observed, with Table 14.1 also illustrating 18-hour and 24-hour traffic flow and HGV% summary.

The traffic count data provided in Table 14.1 is representative of the 5-day weekday average traffic, which was subsequently checked for major anomalies within the data. The data represented a consistent profile across the week and particularly during peak periods, and therefore an average of the 5-day period was adopted.

Table 14.1: ATC Traffic Count Data - Two-way Traffic Flows (5-day average).

Time	ATC1 R126			ATC2 Burrow Road			ATC1-2 Average Traffic Volumes		
	Total	HGV	HGV %	Total	HGV	HGV %	Total	HGV	HGV %
0800 - 0900	450	24	**5.3%**	126	7	**5.4%**	288	10	**3.5%**
1700 - 1800	416	13	**3.1%**	110	4	**3.3%**	263	8	**3.2%**
0600 - 0000	*5365*	*253*	***4.7%***	*1505*	*78*	**5.2%**	*3435*	*166*	**4.8%**
0000 - 0000	**5435**	**259**	**4.8%**	**1529**	**79**	**5.2%**	**3482**	**169**	**4.8%**

It can be seen from Table 14.1 that there are existing HGV flows on Burrow Road and the R126, with each having an average HGV% of around 5%.

14.4.2 Existing Road Network

14.4.2.1 Burrow Road

Burrow Road is a local access road that extends from the R126 to the top of the Burrow spit, connecting further local access roads (Marsh Lane and Valley Lane) and providing access to numerous residential properties and a caravan park at the junction towards the north. Burrow Road narrows significantly after the Marsh Lane junction heading north, with the carriageway narrowing to a width of only circa 2.2m in sections.

Burrow Road provides footpaths along approximately 1.2km of its length connecting to R126 Portrane Road to the south, and only 180m north of the junction with Marsh Lane. No pedestrian facilities or street lighting are available along Burrow Road further north of Marsh Lane.

14.4.2.2 Marsh Lane

Marsh Lane is a local access road which provides access to a few residential properties and a narrow footpath provided along the south side of the road. Marsh Lane is used for residents' local access, which would be maintained throughout the construction period.

Similarly, Marsh Lane exhibits carriageway narrowing, with minimum widths of 2m in sections. The Outline Buildability report for the Proposed Development notes that the installation of a temporary dry working area and a stoned haul route would be provided and subsequently reinstated to facilitate access requirements for the construction vehicles at this location. This would be specified at the detailed design stage of the project.

14.5 Impact Assessment

14.5.1 Construction Phase

The construction phase is proposed to occur over a period of 23 weeks, and it is assumed that delivery of materials to the site would occur uniformly over the project's construction period. A total of 208 delivery and haulage trips are expected over the project's lifecycle, which would be spread out across the full 23-week construction period. Deliveries are expected to occur daily and would be scheduled to prevent conflict between vehicle arrivals and departures, preventing queueing and delays within the road network.

The Proposed Development requires an estimated total of 39 staff across the three elements, the sheet piled flood wall, the embankment and the groyne structures. Considering a worst-case scenario for construction period, trip generation would see the site generate 39 construction staff arriving on site per day in their own cars, with an area of the site's storage to be used to park vehicles within.

It has been assumed that a worst-case scenario of *c.*90 two-way vehicle trips could be made over the course of a day. This includes staff trips, where 39 arrivals would occur in the morning and 39 departures would occur in the evening, and 6 HGV delivery of goods, which would be arriving and departing outside of the traffic network's peak periods. Whilst staff travel and site deliveries would be subject to a CEMP, it is expected that construction staff and delivery vehicles would be scheduled to arrive and depart outside of the traditional commuter peak periods of 08:00 - 09:00 and 17:00 - 18:00. It is envisaged that construction deliveries would be arriving/ depart during the working day (outside the AM/ PM commuter peaks).

It is proposed that the construction route will follow the strategic road to/from the south via the R126 and on to Burrow Road as shown in Figure 14.3.



Figure 14.3: Proposed Construction Route.

ATC Surveys were undertaken to determine the existing baseline traffic flows and traffic speeds recorded along the proposed construction traffic route. This data was used to inform how the site's expected daily trip arrivals and departures might impact the surrounding road network during the construction phase.

A worst case was assumed whereby staff arrive individually and park on-site within the site's identified *"Site Storage"* areas. Staff will be encouraged to arrive outside of the morning and evening peak hours, with construction delivery vehicles arriving/ departing throughout the day to prevent overspill of goods vehicles onto the public road network and therefore, no impact to peak hour traffic.

The expected total number of staff required on site is estimated at 39 persons across a construction period of 23 weeks. Table 14.2 demonstrates the proposed traffic flows (baseline + construction traffic) and anticipated increase in vehicle (and HGV) trips during the construction period.

Table 14.2: Proposed Traffic Flows During Construction - Two-way Traffic Flows (5-day average).

Time	ATC1 R126		ATC2 Burrow Road		Average Traffic Volumes	
	Total	HGV	Total	HGV	Total	HGV
0600 - 0000	*5455*	*265*	*1595*	*90*	*3525*	*178*
	1.7%	*4.7%*	*6.0%*	*15.4%*	*2.6%*	*7.2%*
0000 - 0000	**5525**	**271**	**1619**	**91**	**3572**	**181**
	1.7%	*4.6%*	*5.9%*	*15.2%*	*2.6%*	*7.1%*

It can be seen from Table 14.2 that the overall construction traffic (vehicle & HGV) equates to an increase of 1.7% on the R126, and 5.9% on Burrow Road. The increase in flows is considered a negligible increase in trips and will not result in any increase in peak-hour trips. As the site does not generate any additional peak-hour traffic, no further assessment of the traffic network is required.

14.5.2 Operational Phase

The Proposed Development of the site is not expected to create any additional operational trips; therefore, the greater impact of development is related traffic is likely to occur during the construction phase.

14.6 Mitigation Measures

It is expected that the Proposed Development may cause localised and temporary increase in traffic flows due to the construction. This increase would be mitigated and controlled using by means of a Construction Environmental Management Plan (CEMP) which would be developed by the contractor as part of the approval process.

A Construction Traffic Management Plan (CTMP) would also be developed for the Proposed Development at the project's detailed design stage to outline the requirements for safety risks for road users, the general public. The TTMP would also specify any construction access requirements for the scheme and traffic management schemes required across the construction phase of the scheme, including details for road closures.

At the preliminary stage, it is assumed that Marsh Lane and Burrow Road would require closures, with local access for residents only during the construction phase. The TTMP would be considered alongside the CEMP to mitigate any potential impacts the site construction phase may have upon the surrounding area, residents and road network.

Traffic generated during the operational phase of the Proposed Development will be negligible, consisting of routine maintenance vehicles only, and therefore would not require any mitigation.

14.7 Residual Effects

The nature of the Proposed Development does not generate any additional operational trips. The Proposed Development is to mitigate the risk of coastal erosion and flooding through the provision of sheet-piled flood walls, an embankment, groyne structures and the renourishment of Portrane beach. The nature of the Proposed

Development, with no additional amenities, is not expected to generate additional trips or result in a significant residual impact on the receiving environment. The only vehicular trips expected because of the Proposed Development would be infrequent maintenance trips undertaken approximately once per year to the site.

After considering the proposed mitigation for traffic management during the construction phase of the Proposed Development, temporary and localised impacts are likely to be experienced. These impacts would be experienced by local residents due to the TTMP required to access their properties, however as this is temporary and can be managed safely, the impacts are not deemed to be significant.

14.8 Potential Cumulative Impacts

A review of FCC Planning Portal was undertaken to determine if any approved developments exist along the local road network that should be considered as committed developments for the purpose of this assessment. Committed developments comprise any development that is expected to generate a significant number of trips or has an impact on the operational performance of the road network. Except for the proposed FRS at Rush which is anticipated to be constructed *after* the Proposed Development at the Burrow, no committed developments were identified within the receiving environment of the Proposed Development.

Therefore, there will be no cumulative impact from committed traffic to be considered within this assessment.

14.9 Conclusions

Staff access and delivery arrangements to the site would be presented within the CEMP and CTMP to minimise the impact during the construction phase.

As no trips are expected onto the road network during the network's peak period during the operational phase, the Proposed Development represents a temporary construction impact and would not be expected to generate any operational trips.

There are no traffic and transportation issues generated as a result of the Proposed Development.

15 AIR QUALITY & CLIMATE

15.1 Introduction

This chapter of the EIAR sets out the methodology for assessing of the impact of the Proposed Development on air quality and climate. It considers air quality and climate features within the Proposed Development and provides information on the key receptors that have the potential to be subject to likely significant effects.

This chapter considers two sub-topics:

- **Air Quality** - which relates to pollutants with the potential to affect human health and ecosystems at a local level (this includes a construction phase dust and emissions assessment).
- **Climate change** - which is related to emissions of greenhouse gases (GHGs). Climate change will continue to cause impacts on the environment. In this regard, it is appropriate to assess the impact of projects on climate (for example greenhouse gas emissions) and their vulnerability to climate change.

Impacts to air quality may arise during the construction and demolition phase, such as the generation of dust and emissions from traffic. The construction and demolition activities have been examined to identify those that have the potential for air emissions. Each of these potential sources has been identified and emissions have been evaluated using standard procedures as outlined in Section 15.3.

This chapter also considers the requirements of the EIA Directive in relation to climate change and provides:

- A description of the factors in relation to climate (for example greenhouse gas emissions and impacts relevant to climate adaptation) likely to be significantly affected by the project.
- A description of the likely significant effects of the project on the environment resulting from, inter alia, the impact of the project on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change.

Annex IV to the 2014 EIA Directive includes a direct reference to climate and climate change in two provisions. The emphasis is placed on two distinct aspects of the climate change issue:

- **Climate change mitigation:** this considers the impact the Proposed Development will have on climate change, through greenhouse gas emissions primarily.
- **Climate change adaptation:** this considers the vulnerability of the Proposed Development to future changes in the climate, and its capacity to adapt to the impacts of climate change, which may be uncertain.

This chapter has been prepared in accordance with the following guidance documents:

- Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment.
- The European Commission Environmental Impact Assessment of Projects Guidance on the preparation of the Environmental Impact Assessment Report (2017).

- The European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. No. 296 of 2018).
- The EPA Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR) (2022).
- The DHPLG published the revised Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (August 2018).

15.2 Authority of author

The author of this chapter, Stephen McAfee, is a chartered scientist (CSci) with over 18 years' experience in environmental assessment, environmental management plans, computer modelling and air quality, climate, dust and odour assessment. He has a BSc (Hons) in Geography from Queens University Belfast and a MSc in Environmental Engineering from the Queen's University Belfast. He is an environmental consultant, specialising in air quality and climate. This has involved work on EIAs and nationally significant infrastructure projects including power stations, wind farms and waste management facilities.

Stephen is a specialist in air quality, climate change, carbon footprint and sustainability assessments as part of the integrated suite of environmental impact assessment services offered by RPS.

15.3 Assessment Methodology

15.3.1 Baseline

15.3.1.1 Baseline Air Quality

The current state of the environment in terms of baseline air quality has been determined from the data from the EPA monitoring Zone D (Rural Ireland) network to determine compliance with relevant ambient air legislation, as detailed further in Section 15.4.1.

15.3.1.2 Baseline Climate

The climate is described as the average weather prevailing in an area over a period of time. The weather in Ireland is influenced by the Atlantic Ocean, resulting in mild, moist weather dominated by maritime air masses. The prevailing wind direction is from a quadrant centred on the west-southwest. These are relatively warm winds from the Atlantic and frequently bring rain.

To counteract the effects of climate change, climate adaptation has been identified as a vital strategy. The Intergovernmental Panel on Climate Change (IPCC) defined climate adaptation as *"the process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects."*

To address the forthcoming challenges associated with climate change, Ireland's first National Adaptation Framework (NAF) was published in January 2018[23]. The NAF sets out the national strategy to reduce the vulnerability of the country to the potential negative effects of climate change and to avail of positive impacts. Under the NAF, all local authorities were required to prepare and adopt a five-year Climate Adaptation Strategy.

While Ireland has experienced colder than normal periods since 1900 there is an upwards trend in national temperature with higher temperatures experienced in the middle of the 20th century and from the 1980's to the present day. While an increase in average annual rainfall has been observed, precise changes in spatial patterns of precipitation cannot be determined without further research. The mean annual sea surface temperature has increased by one degree compared to the long-term average over the end of the 20th century. An increase in annual mean rivers flows has also been observed including mean flow increases for both the summer and winter periods. Table 15.1 taken from the NAF highlights the main observations in Ireland's changing climate.

Flooding is a natural process, but is a significant risk to people, economy, environment and cultural heritage. It is likely that climate change will have a significant impact on flood risk in Ireland.

Accelerated sea level rise is being observed and is projected to continue to rise into the future, increasing risk to our coastal communities and assets. It is projected that the number of heavy rainfall days per year will increase, which would lead to an increase in both fluvial and pluvial (urban stormwater) flood risk.

[23] https://www.gov.ie/en/publication/fbe331-national-adaptation-framework/ (accessed 5th October 2022)

Table 15.1: Observed changes in Irelands Climate (from NAF).

Parameter	Observed
Temperature	Average temperatures have increased by 0.8ºC since 1900, an average of 0.07ºC per decade. The number of warm days (over 20ºC) has increased while the number of cold days (below 0ºC) has decreased.
Precipitation	Increase in average annual national rainfall of approximately 60mm or 5% in the period 1981-20210, compared to the *c.*30-year period from 1961-1990. The largest increases are observed over the west of the country.
Wind Speed and Storms	No long-term change in average wind speed or direction can be determined with confidence. The number and intensity of storms in the North Atlantic have increased by approx. three storms per decade since 1950.
Sea Level and Sea Surface Temperature	Historically, sea level has not been measured with the necessary accuracy to determine sea level changes around Ireland. However, measurements from Newlyn, in southwest England, show a sea level rise of 1.7cm per decade since 1916. These measurements are considered to be representative of the situation in the South of Ireland. Sea surface temperatures have increased by 0.85ºC since 1950, with 2007 the warmest year in Irish coastal records.

15.3.2 Legislation and Guidance

15.3.2.1 Air Quality Legislation and Guidance

To establish baseline conditions, the following key sources of information were referred to as part of the assessment on air quality:

- Air Quality Standards Regulations 2011 (S.I No. 180/2011).
- Clean Air for Europe (CAFE) Directive (2008/50/EC) (European Parliament, 2008).
- Traffic infrastructure Ireland (TII) Air Quality Assessment of Proposed National Roads – Standard, December 2022.
- World Health Organisation Air Quality Guidelines 2005 (WHO, 2005).
- Environmental Protection Agency - Air Quality in Ireland 2021 (EPA, 2022).

- Fingal Development Plan 2023-2029 (FCC 2023).

Air Quality Standards Regulations 2011 (S.I. 180 of 2011)

Assessment of the significance of emissions to air is made with reference to limit values established in the latest EU legislation, the Clean Air for Europe (CAFE) Directive (2008/50/EC) (European Parliament, 2008) which was transposed into Irish law in 2011 (S.I. No. 180 of 2011). The Air Quality Standards (AQS) set out in Air Quality Directive (2008/50/EC) and S.I. No. 180 of 2011 are shown in Table 15.2. The AQS are based on the effects of pollutants on human health, although other factors such as effects on vegetation and ecosystems are also considered.

Table 15.2: Limits specified in Air Quality Standards Regulations 2011 (S.I. 180 of 2011).

Pollutant	Criteria	Value
Nitrogen Dioxide	Hourly limit for protection of human health – not to be exceeded more than 18 times/year	200 µg/m^3
	Annual protection of human health	40 µg/m^3
	Annual limit for protection of vegetation	30 µg/m^3
Benzene	Annual limit for protection of human health	5 µg/m^3
Carbon Monoxide	Minimum daily 8-hour running system	10 µg/m^3
Lead	Annual limit for protection of human health	0.5 µg/m^3
Sulphur Dioxide	Hourly limit for protection of human health – not to be exceeded more than 24 times/year	350 µg/m^3
	Daily limit for protection – not to be exceeded more than 3 times/year	125 µg/m3
	Annual limit for protection of vegetation	20 µg/m^3
Particulate Matter PM_{10}	Hourly limit for protection of human health – not to be exceeded more than 35 times/year	50 µg/m^3
	Annual limit for protection of human health	40 µg/m^3
Particulate Matter $PM_{2.5}$	Annual target value for the protection of human health	20 µg/m^3

In addition to the statutory limits for the protection of human health listed in Air Quality Standards Regulations (S.I. 180 of 2011), the World Health Organisation (WHO) has published a set of air quality guidelines for the protection of human health.

The key publication is the "*WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulphur dioxide, Global update 2005 Summary of risk assessment*". The WHO guidelines are based on reducing the risk to human health and in some cases the levels differ from the EU statutory limits as these limits are based on balancing health risks with technological feasibility, economic considerations and various other political and social factors in the EU.

The 2005 WHO guidelines are presented in Table 15.3 and illustrate that while the NO_2 levels are analogous to those in S.I. 180 of 2011 (excluding the tolerance levels for the 1-hour averages), the annual average PM_{10} and $PM_{2.5}$ levels specified by the WHO are half those specified in the legislation. The WHO note that these are the lowest levels at which total, cardiopulmonary and lung cancer mortality have been shown to increase with more

than 95% confidence in response to long-term exposure to $PM_{2.5}$. The EPA has called for movement towards the adoption of these stricter WHO guidelines as the legal standards across Europe and in Ireland.

Table 15.3: WHO 2005 Air Quality Guidelines.

Pollutant	Criteria	Value
Nitrogen Dioxide (NO_2)	Hourly limit for protection of human health	200µg/m^3
	Annual protection of human health	40µg/m^3
Sulphur Dioxide (SO_2)	10-minute level for protection of human health	500µg/m^3
	Daily level for protection of human health	20µg/m^3
Particulate Matter (PM_{10})	24-hour level for protection of human health	50µg/m^3
	Annual level for protection of human health	20µg/m^3
Particulate Matter ($PM_{2.5}$)	24-hour level for protection of human health	25µg/m^3
	Annual level for protection of human health	10µg/m^3

Air Quality in Ireland 2021

Particulate Matter

Particulate matter levels continue to be a concern in villages, towns and cities. All solid fuels (e.g., coal, peat and wood) produce fine particulate matter emissions when burned in open fires or stoves. Fine particulate matter in our air greatly impacts respiratory and cardiovascular health. This is particularly problematic in or near villages, towns and cities because of the cumulative effects of multiple sources of the pollutant and the large numbers of people exposed.

Monitored levels of particulate matter were above WHO air quality guideline values at 65 of the 87 monitoring stations.

Nitrogen Dioxide

Air quality monitoring results in 2021 showed that nitrogen dioxide (NO_2) mainly from road transport, remains one of the main threats to good air quality. EPA monitoring shows that NO_2 levels are within the current EU legal limits, however this pollutant exceed the World Health Organisation (WHO) Air Quality guidelines (AQGs) for health. Emissions from traffic are the main source of nitrogen oxides in Ireland along with electricity generating stations and industry. Nitrogen dioxide can affect the throat and lung. The main effects are emphysema and cellular damage. It impacts visually as it has a brown colour and gives rise to a brown haze. Oxides of nitrogen contribute to the formation of acid rain and of ozone. Levels in Ireland are moderate but are increasing due to growth in traffic numbers.

Table 15.4 outlines the overall compliance for all pollutants[24]. Most of these were as a result of pollution from the burning of solid fuel for home heating.

Table 15.4: Pollutants Measured in 2020 and their Adherence to EU Legal Limit Values and WHO Air Quality Guideline Values.

Pollutant	Number of stations where parameter monitored 2021	EU legal limit values	WHO Air Quality Guideline (AQG) level or EEA reference level
PM_{10}	87	No Exceedances	Above annual WHO AQG values at 8 stations Above daily WHO AQG value at 21 stations
$PM_{2.5}$	81	No Exceedances	Above annual WHO AQG values at 65 stations Above daily WHO AQG value at 61 stations
NO_2	30	No Exceedances	Above WHO annual or 24-hour AQG level at 23 stations
Ozone	21	No Exceedances	Above WHO AQG level at 19 stations
Sulphur Dioxide (SO_2)	15	No Exceedances	Above WHO 24-hour AQG level at 1 station
PAHs	5	No Exceedances	Above EEA reference level at 3 stations
Heavy Metals	5	No Exceedances	N/A
CO	6	No Exceedances	N/A
Benzene	2	No Exceedances	N/A

Sources of Pollution

Domestic use of solid fuel, such as coal, peat and wood, is having a negative impact on air quality. The use of solid fuels, such as coal, peat and wood, for home heating has been identified by EPA-funded Irish research as the leading contributor to $PM_{2.5}$ concentrations in Irelands cities, towns and villages. This pollutant is the most problematic in Ireland from an air quality point of view and it has the most health-impacts. Especially problematic is the use of so-called smoky fuels such as smoky coal, wet wood and peat.

In terms of ambient air quality, the main source of NO_2 in towns and cities is road transport. Diesel engine vehicles produce more NO_2 than petrol vehicles. Other sources of NO_2 in Ireland include:

- Off-road machinery (for example, earth movers and lawnmowers).
- Industrial and construction activities.
- Electricity and heat production equipment such as central heating boilers and generators.

[24] Ireland met all of its EU CAFE legal requirements in 2021 but would not have met the new WHO air quality guidelines levels for health in 2021. The WHO AQGs are not legally binding, however, Ireland and Europe should move towards achieving these guidelines.

TII Air Quality Assessment of Proposed National Roads – Standard, December 2022

The purpose of this TII Guidance is for use on national road schemes[25] to assess the potential air quality impacts, as well as the following:

- To outline the application of Air Quality Assessment (AQA) during the planning of proposed national road schemes, motorway service areas, toll schemes, and any associated infrastructure.
- To apply AQA in a manner that is proportionate to the complexity, scale, and likely significance of air quality effects of a national road scheme, motorway service areas, toll scheme, and any associated infrastructure.
- Provide consistency to the consideration of AQA during the planning of a national road projects as set out in TII's Project Management Guidelines (PMG) (TII, 2020a), Project Manager's Manual for Major National Roads (PMM) (TII, 2019) and Project Appraisal Guidelines (PAG) (TII, 2022).

The pollutants of most concern in relation to emissions from road traffic are nitrogen dioxide (NO_2) and particulate matter in the fractions of equal to or less than 10µm (PM_{10}) and equal to or less than 2.5µm ($PM_{2.5}$). In addition, the effects of ammonia and nitrogen oxides (NO_x) shall be considered with respect to the potential effects on sensitive designated habitats. During the construction phase potential effects associated with dust will also need consideration.

15.3.2.2 Climate Legislation and Guidance

To establish baseline conditions, the following key sources of information were referred to as part of the assessment on climate:

- FCC's Climate Change Action Plan (2019-2024).
- Climate Action Plan (2023).
- Met Eireann National Meteorological Service Climate Data.
- Fingal Development Plan 2023-2029.
- Institute of Environmental Management and Assessment (IEMA) Environmental Impact Assessment Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance.
- Institute of Environmental Management and Assessment (IEMA) Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation.

Climate Action Plan 2023

The Climate Action Plan (CAP) 2023 sets out the Government of Ireland's ongoing, urgent response to the climate crisis. The impacts and risks of climate change are becoming more complex and harder to manage. These impacts will be felt by all, but they won't affect everyone equally. In Ireland, these impacts have been experienced, particularly through floods and storms, and the damage they have caused. The Government of

[25] Although this project is not a road scheme the TII guidance is still considered a useful guide in determining any notable changes in traffic volumes that would require assessment for Burrow FPS.

Ireland are making steady progress on their climate goals, but events like these, and their expected increase in frequency and intensity, highlight that they must work even harder to ensure the country can cope with the ongoing effects of climate change.

The CAP details the following six vital high impact sectors and their aims to reduce emissions:

- Powering renewables: 75% reduction in emissions by 2030.
- Building better: 45% reduction in commercial/ public and 40% reduction in residential emissions by 2030.
- Transforming how we travel: 50% reduction in emissions by 2030.
- Making family farms more sustainable: 25% reduction in emissions by 2030.
- Greening business and enterprise: 35% reduction in emissions by 2030.
- Changing our land use: exact reduction targets for this sector is yet to be determined.

Institute of Environmental Management and Assessment (IEMA) Environmental Impact Assessment Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance

IEMA published this guidance to assist practitioners with addressing greenhouse gas (GHG) emissions assessment and mitigation in statutory and non–statutory EIA. The guidance indicates that a 'good practice' approach is advocated where GHG emissions are always considered and reported but at varying degrees of detail depending on the project.

The guidance sets out several different assessment methods available for measuring and quantifying the GHG emissions associated with the built environment, ranging from general guidance to form standards for the use of an EIA. The guidance recognises that:

> *'qualitative assessments are acceptable, for example: where data is unavailable or where mitigation measures are agreed early on in the design phase with design and engineering teams.'*

The assessment in this chapter presents a qualitative assessments and discussion in terms of GHG emissions.

Institute of Environmental Management and Assessment (IEMA) Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation

The Guide to Climate Change Resilience and Adaptation (June 2020) provides an updated framework for the effective consideration of climate change resilience and adaption in the EIA process. This document is a revision of the 2015 IEMA guidance on Climate Change Resilience and Adaption in EIA and reflects on lessons learnt from emerging practice.

A step-by-step method presented within this guidance is set out below and has been given due cognizance within this chapter:

- Step 0 – Building climate resilience into the project by considering incorporating resilience during the design stage and by identifying appropriate mitigation measures.

- Step 1 – Scoping for the EIA; e.g., identify the climate change projections for use in the assessment and identify key climatic variables relevant to the project.
- Step 2 – Defining the future (climate) baseline; define future conditions using selected climate change projections (i.e. increase in rainfall, increase in mean summer temperature and wind strength).
- Step 3 – Identifying and determining sensitivity of receptors.
- Step 4 – Reviewing and determining magnitude of the effect; consider probability and consequence to determine the magnitude of the effect.
- Step 5 – Determination of significance.
- Step 6 – Developing additional adaptation/ EIA mitigation measures.
- Step 7 (Development permitted) – Monitoring and adaptive management by implementing mitigation measures.

EIA Reports produced in line with this guidance are to be proportionate in their approach and not include superfluous assessment that does not address likely material issues.

In lieu of a prescribed methodology, IEMA guidance on Climate Change Resilience and Adaptation (2020) has been prepared to assist practitioners with the effective consideration *"of both climate change resilience and adaptation in the EIA process"*.

The guidance stresses that climate change should be an integrated consideration within the EIA, by undertaking an assessment that is *"proportional to the evidence base available to support any assessment"* and focusses on impacts *"specific to project".*

15.3.3 Construction Stage Impacts

There are three potential impacts to atmosphere from the construction stage of the Proposed Development:

- Generation and dispersion of construction dusts during the proposed works (demolition and general construction).
- Emissions associated with construction traffic.
- Greenhouse gas emissions from the construction phase of the Proposed Development.

The methodologies employed for each of these impacts are summarised in the following sections of this chapter.

15.3.3.1 Dust Dispersion

Construction dust has the potential to cause local impacts through dust nuisance at the nearest sensitive receptors and also to sensitive ecosystems. The potential for dust generation from the construction activities associated with the Proposed Development was assessed on the basis of a review of the proposed methodologies and the proximity of these activities to sensitive receptors.

Construction activities such as stripping and storage of topsoil, import and storage of clay material, excavation and profiling may generate quantities of dust, particularly in dry weather conditions, all have potential to generate dust. The extent of any dust generation depends on the nature of the dust (soils, peat, sands, gravels, silts etc.)

and the nature of the construction activity. In addition, the potential for dust dispersion and deposition depends on local meteorological factors such as rainfall, wind speed and wind direction.

The potential for dust emissions from the construction phase of the project is addressed qualitatively in accordance with the TII Air Quality Assessment of Proposed National Roads – Standard, December 2022 (TII, 2022; referred to hereafter as the TII Guidelines). A dust and emissions management plan will be included in the outline CEMP that will set out management and mitigation measures for atmospheric emissions during the construction phase.

15.3.3.2 Construction Traffic

The proposed construction operations will involve the movement of materials for the construction of the coastal management scheme. A comprehensive assessment of the impact of the Proposed Development on Traffic and Transportation is presented in Chapter 14.

15.3.3.3 Greenhouse Gas Emissions

A construction phase climate assessment was carried out to identify sources and quantify total Greenhouse Gas (GHG) emissions generated from the construction activities associated with the Proposed Development. This assessment was carried out in accordance with IEMA Guidelines.

15.3.4 Operational Stage Impacts

Operational traffic movements are not anticipated to change traffic flows on the road network; therefore, air quality and climate are not deemed significant. Therefore, operational traffic air quality and climate was scoped out of the assessment.

15.3.5 Assessment Criteria and Assignment of Significance

The below definitions of the terms effect and impact are drawn from the glossary of the Highways Agency Design Manual for Roads and Bridges, which provides general guidance:

- **Impact:** Change that is caused by an action; for example, land clearing (action) during construction which results in habitat loss (impact);
- **Effect:** Term used to express the consequence of an impact (expressed as the 'significance of effect'), which is determined by correlating the magnitude of the impact to the importance, or sensitivity, of the receptor or resource in accordance with defined significance criteria. For example, land clearing during construction results in habitat loss (impact), the effect of which is the significance of the habitat loss on the ecological resource.

The term impact is used when discussing impact magnitude – the original impact on a receptor. The term effect is used when talking about significance (as this is the result of the impact and the sensitivity of the receptor). The following are set out:

- Magnitude of impact.
- Sensitivity of receptor.
- Significance of effect.

15.3.5.1 Air Quality

Table 15.5 describes the sensitivity of the receptor and may be used in an EIA to ensure a standardised approach. In this instance the construction phase assessment presented in this chapter employs standards and criteria set out in the IAQM guidance document (IAQM Guidance on the Assessment of Dust from Demolition and Construction, 2014). These standard definitions are presented in Table 15.5 and Table 15.6 for completeness.

Table 15.5: Definitions of Sensitivity or Value.

Sensitivity	Example Descriptor
Very High	Very high importance and rarity, international scale and very limited potential for substitution.
High	High importance and rarity, national scale, and limited potential for substitution.
Medium	High or medium importance and rarity, regional scale, limited potential for substitution.
Low	Low or medium importance and rarity, local scale.
Negligible	Very low importance and rarity, local scale.

Table 15.6: Definitions of Magnitude.

Sensitivity	Example Descriptor
High	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements (Adverse). Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality (Beneficial).
Medium	Loss of resource, but not adversely affecting the integrity; partial loss of/ damage to key characteristics, features or elements (Adverse). Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality (Beneficial).
Low	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements (Adverse). Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring (Beneficial).
Negligible	Very minor loss or detrimental alteration to one or more characteristics, features or elements (Adverse). Very minor benefit to or positive addition of one or more characteristics, features or elements (Beneficial).
No change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.

Both sensitivity/ value and magnitude are considered in determining the significance of effect. The points below define significance based on:

- Reference to IAQM Guidance on the Assessment of Dust from Demolition and Construction, 2014.

- Reference to TII Air Quality Assessment of Proposed National Roads – Standard, December 2022.
- Professional judgement based on extensive air quality assessment.

15.3.5.2 Assessment of GHG Emissions

The main emissions sources from the Proposed Development that have been considered are:

- Potential emissions to air during the construction phase, arising from construction activities, transport of materials and the use of plant and equipment.

15.3.6 Significance of Effects

15.3.6.1 Air Quality

To describe the air quality effects of the Proposed Development at sensitive receptors, the following was considered in the Air Quality Assessment as defined in the EPA's Guidelines on the information to be contained in Environmental Impact Assessment Reports' (EPA, 2022) including:

- Quality of Effects.
- Describing the Extent and Context of Effects.
- Describing the Probability of Effects.
- Describing the Duration and Frequency of Effects.
- Describing the significance of Effects.

According to TII Guidelines, factors to consider when determining the overall significance of the Proposed Development include:

- The number of people affected by increases and/ or decreases in concentrations and a judgement on the overall balance.
- The number of people exposed to levels above the standard.
- Whether or not the exceedance of a standard is predicted to arise in the study area where none existed before, or if the size of an exceedance area is substantially increased.
- Whether or not the study area exceeds a standard and this exceedance is removed, or the size of the exceedance area is reduced.
- Uncertainty, including the extent to which worse-case assumptions have been made.
- The extent to which a standard is exceeded e.g., an annual mean NO_2 of 41µg/m^3 shall attract less weight in the determination of significance than an annual mean of 51µg/m^3.

15.3.6.2 Climate Change

In the absence of any significance criteria or a defined threshold, it might be considered that all carbon emissions are significant and beneficial effects only arise if there is a net reduction in carbon and emissions. As per the IEMA Guidelines, when evaluating significance, all new GHG emissions contribute to a significant negative environmental effect.

The significance of a project's emissions should be based on its net impact, which may be positive or negative, EIA should ensure an assessment addresses the occurrence of GHGs by taking mitigating action. Whilst there is no single preferred method to evaluate significance of effects given this topic is emerging within EIA, the approach to determining the significance of effects has applied available guidance, standard industry practice and profession judgement.

There is currently no industry–wide agreed threshold of carbon emissions which, if exceeded, can be defined as significant or potentially significant. The 2017 IEMA Guidance acknowledges that all emissions could lead to cumulatively significant effects. The IEMA Guidance (2017) notes that the cumulative impact of carbon emissions arising from global human activity is considered major however, the contribution from individual developments, such as the Proposed Development considered in this EIAR, could be considered negligible/ low in the context of the Ireland's emissions since, in isolation, the quantity of carbon emissions from an individual development is likely to have limited potential to significantly increase atmospheric carbon emissions towards global environmental targets.

15.4 Receiving Environment

15.4.1 Air Quality

15.4.1.1 Primary Atmospheric Pollutants

Atmospheric pollution in the vicinity of the Proposed Development is largely dominated by road traffic exhaust fumes and commercial and residential emissions. Therefore, the primary contaminants of concern identified were Nitrogen Oxides (NO_X) and Particulate Matter (PM_{10} and $PM_{2.5}$). NO_X is primarily produced during combustion at high temperatures with contributions from traffic, residential heating, and industry. PM_{10} are particles in air with diameters of 10µm (microns) or less. These particles can consist of direct emission from combustion engines and burning solid fuels, while natural sources can be windblown salt, plant spores, and pollens. $PM_{2.5}$ or fine particulate matter is composed of varying components depending on its source but can include nitrates, sulphates, volatile organic compounds (VOCs), metals and soil or dust particles.

15.4.1.2 EPA Air Quality Zone

EU legislation on air quality requires that all Member States divide their territory into zones for the assessment and management of air quality. The current trends in air quality in Ireland are reported in the EPA publication Air Quality in Ireland – 2019 (EPA, 2020) which is the most up to date report on air quality in Ireland. For ambient air quality management and monitoring in Ireland, four zones, A, B, C and D are defined in the AQS Regulations (S.I. No. 180 of 2011) and are defined as follows:

- **Zone A**: Dublin Conurbation.
- **Zone B**: Cork Conurbation.
- **Zone C**: 24 cities and large towns. Includes Galway, Limerick, Waterford, Clonmel, Kilkenny, Sligo, Drogheda, Wexford, Athlone, Ennis, Bray, Naas, Carlow, Tralee, Dundalk, Navan, Newbridge, Mullingar, Letterkenny, Celbridge and Balbriggan, Portlaoise, Greystones and Leixlip.
- **Zone D**: Rural Ireland, i.e. the remainder of the State excluding Zones A, B & C.

According to the above classification, the Proposed Development is within **Zone D**.

15.4.1.3 EPA Air Quality Monitoring

There are two monitoring locations relevant to the Proposed Development site:

- National Air Monitoring Site – Station 55. Dublin Airport, Swords, Co. Dublin.
- National Air Monitoring Site – Station 61. Swords Council Depot, Co. Dublin.

The locations of these monitoring sites are highlighted in green in Figure 15.1 below. Monitoring results are shown in Figure 15.2 and Figure 15.3.

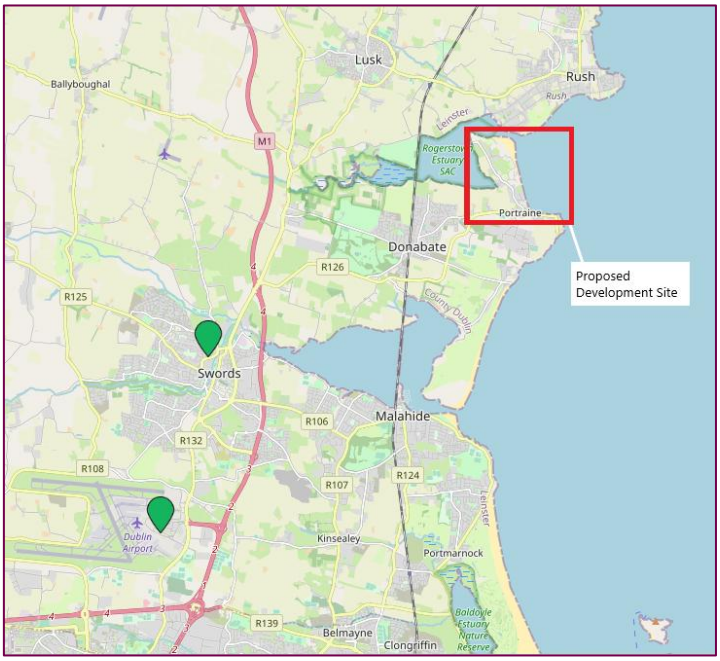


Figure 15.1: EPA Monitoring Sites (EPA, 2020).

The EPA reports real-time results of localised monitoring, providing the public with indicative data on current ambient air quality throughout the country.

15.4.1.3.1 Air Quality Levels at Station 55. Dublin Airport, Swords, Co. Dublin

Figure 15.2 illustrates the ambient NO_2, O_3, SO_2, PM_{10}, $PM_{2.5}$ concentrations recorded between 6th January 2023 and 6th July 2023 recorded at Station 55 in Dublin Airport, Swords, Co. Dublin.

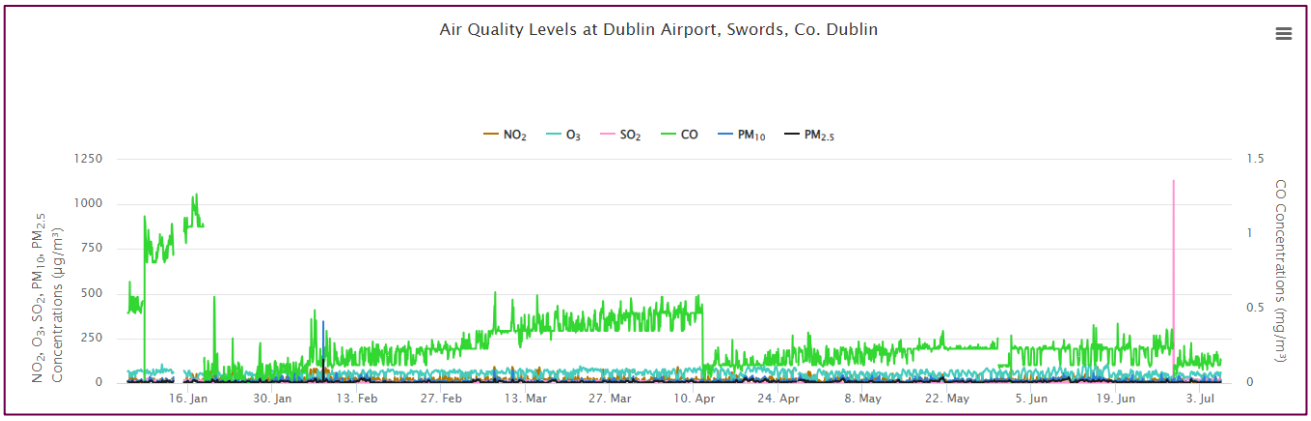


Figure 15.2: Air Quality Levels at Station 55. Dublin Airport, Swords, Co. Dublin.

Figure 15.3 below illustrates the ambient NO_2 and O_3 concentrations recorded between 6th January 2023 and 6th July 2023 recorded at Station 61 in Swords Council Depot, Co. Dublin.

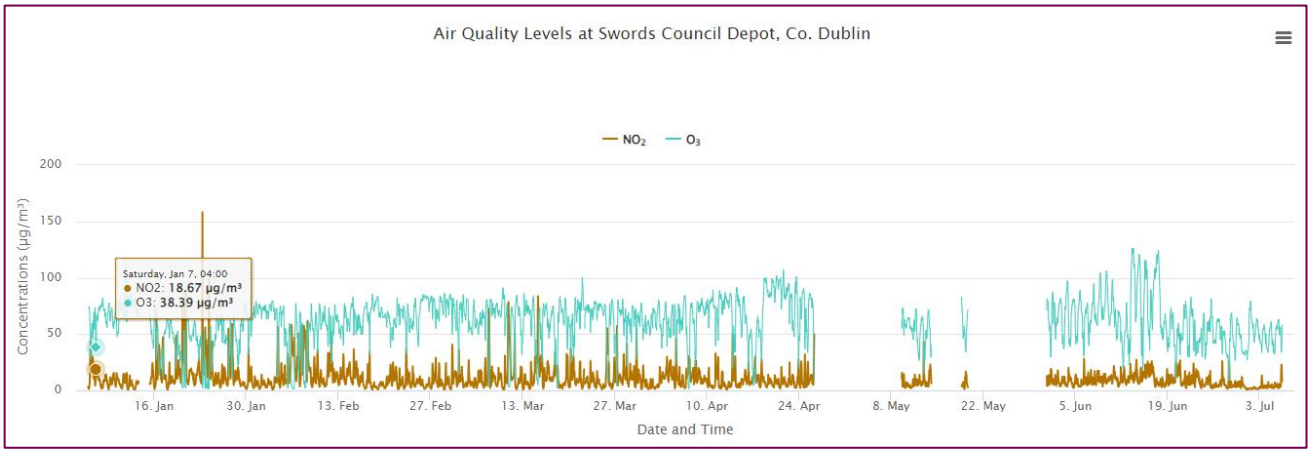


Figure 15.3: Air Quality Levels at Station 61 in Swords Council Depot, Co. Dublin.

15.4.1.4 Total Emissions in Fingal

This section examines the resulting total emissions from the different sectors in Fingal. The total emissions from the various sectors in Fingal amount to 1,976,230tonnes of CO_2 eq. The sectors that produced the most emissions were the transport, residential and commercial sectors, producing 44.6%, 26.0% and 24.5% respectively, of total emissions in Fingal. From this analysis, these three sectors should be the main targets of energy and emission reduction initiatives. Figure 15.4 below illustrates the share of total emissions in Fingal.

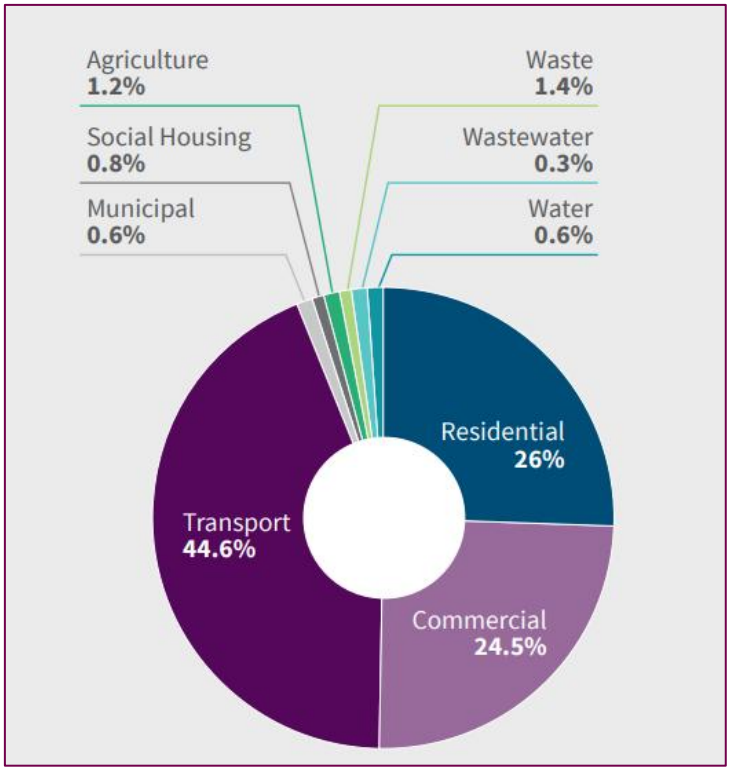


Figure 15.4: Share of Total Emissions in Fingal.

15.4.2 Climate

15.4.2.1 Fingal County Council's Climate Change Action Plan (2019-2024)

The Climate Change Action Plan[26] represents a proactive step by FCC in the process of adaptation planning to build resilience and respond effectively to the threats posed by climate change.

Fingal covers an area of 456km^2, and comprises of 88km of coastline, which stretches from Howth Head up to Balbriggan, encompassing villages, recreational areas and valuable protected natural habitats such as the Rogerstown Estuary.

According to the most recent Census (2016), Fingal currently has a population of 296,020, with 104,851 households, and these figures are expected to rise in the future. The 2016 Census highlights that by 2031, population in the Greater Dublin Area (GDA) will increase by just over 400,000, and this increase would account for approximately two thirds of the total projected population growth in Ireland. A rise in population will increase the impacts of climate change due to additional pressure on drainage systems that are already working at full capacity. Also, it is estimated that Ireland will need an additional 550,000 more homes by 2040, compared to 2017, and this will lead to a decrease in pervious or green surfaces, exacerbating flooding due to enhanced run-off.

Fingal's urban and rural geographic and demographic characteristics make it vulnerable to certain risks. As a rural environment, Fingal is home to agriculture, horticulture, equine industries, centres of food production and agri-food businesses. A changing climate can result in an increase in climatic events and will put Fingal's rural environment at risk. Whilst as an urban environment, the Dublin Region creates its own unique micro-climate and this can intensify current and future climate impacts. An example of this is the urban heat island effect, making it warmer than the surrounding semiurban and rural areas. This is mainly due to heat absorption from built-up areas in the urban environment, waste heat generated from urban activities and a lack of tree cover, which can reduce temperatures in the Fingal area through shading. Flood risks are also higher in urban areas due to the amount of impervious surfaces and lack of vegetation (pervious surfaces); this results in enhanced rainwater run-off, which may result in flooding.

The Fingal area has experienced an increase in extreme weather events, and this is evident from the Timeline of Major Climatic Events (illustrated below in Figure 15.5).

[26]https://www.fingal.ie/sites/default/files/2019-08/20190812_fcc_climate_change_action_plan_final_0.pdf

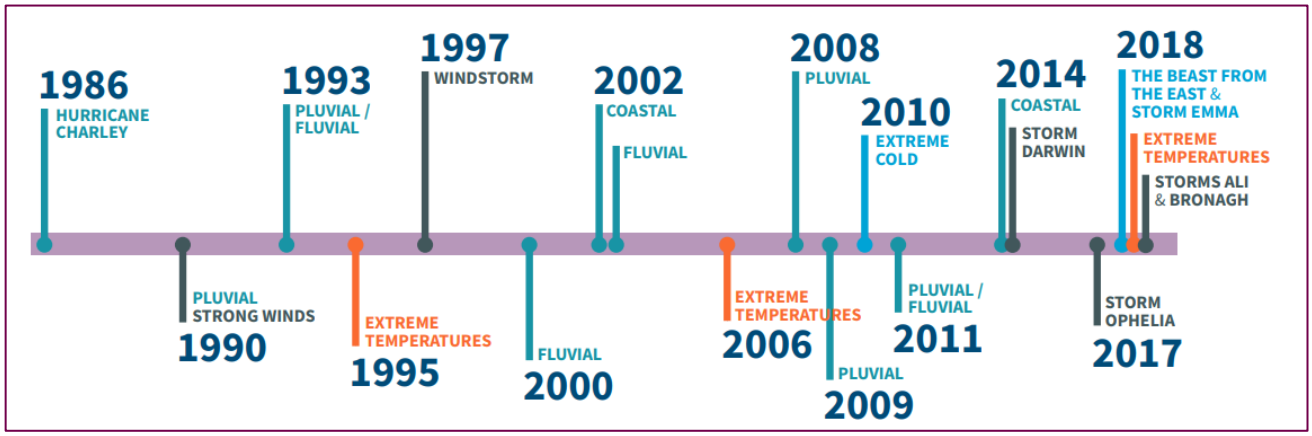


Figure 15.5: Timeline of Major Climatic Events in Fingal.

The rise in sea levels in Ireland is mainly due to climate change, and the seas and oceans surrounding the island are rising at approximately 35mm per decade. The main cause of sea level rise is an increase in temperatures; as these temperatures increase, oceans absorb more of this heat and expand. As the oceans become warmer, glaciers and polar ice caps start to melt and cause sea levels to rise. Coastal flooding is influenced by sea level rise, and since Fingal is a coastal County, rises in sea level and coastal tides would significantly impact the County and its infrastructure.

Continual rise of sea levels and the increase in the frequency, magnitude and intensity of coastal storms will further exacerbate existing complications of flooding, coastal erosion and deposition. Coastal and estuarine flooding are both very much affected by sea level rise. Changes in sea levels will cause the extent of estuaries to increase and thus result in the infiltration of tides further upstream in rivers. This would mean that areas along rivers that are already at risk of flooding will be at increased risk of sea level rise. Rising sea levels also provide a higher base for storm surges, which increase their intensity.

Mean Sea Level (MSL) is the average of all the high and low tides over the course of a year. Over the last 15 years, the Annual Average Sea Level (AASL) in the Dublin Region has been rising faster than initially projected (Figure 15.6). Data collected by Dublin City Council shows the AASL for the years 2014, 2015 and 2016 were 78, 138 and 114mm Observed Difference in Mean (ODM) respectively. This compares to values in the period between 2000 and 2004, which were much closer to 0mm ODM.

The highest tide ever recorded in Dublin City was on the 3rd of January 2014, reaching 3.014 metres at Malin Head. The second highest tide recorded was on the 1st of February 2002, at 2.950 metres at Malin Head. These were the highest tides recorded for the last 400 years, and possibly longer for Dublin Bay. To reduce vulnerability to sea level rise, a minimum safety of four metres above present sea level in the east coast of Ireland has been recommended by the Royal Irish Academy Irish Committee on Climate Change; this accounts for a rise in sea level of 0.5 metres, a storm surge of 2.95 metres, and a safety margin. Figure 15.6 below illustrates the Dublin Annual Average Sea Level 2000-2016 (Source: Dublin City Council).

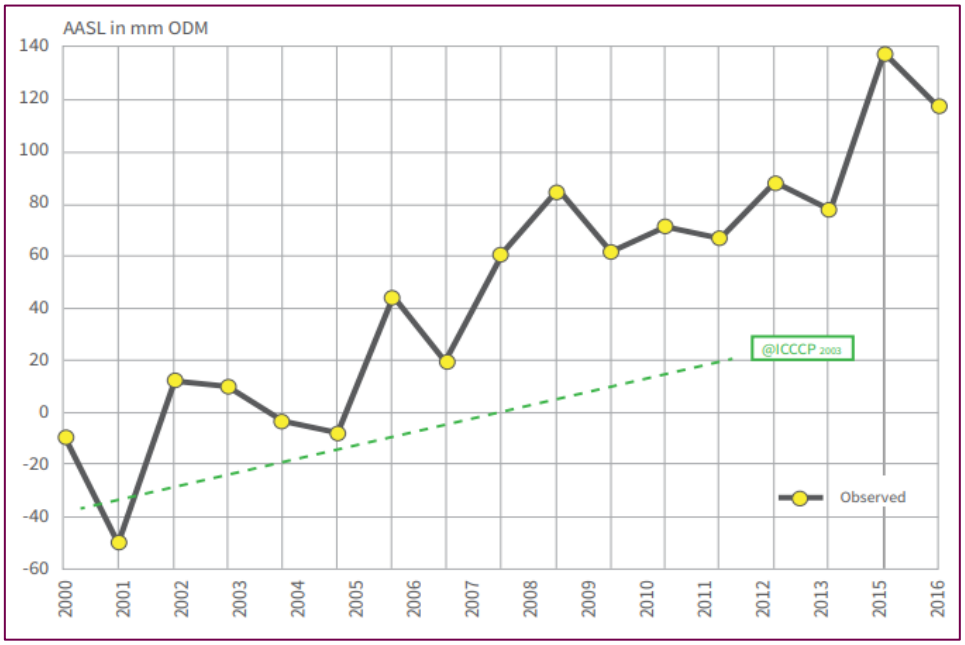


Figure 15.6: Dublin Annual Average Sea Level 2000-2016.

15.4.2.1.1 Observed Climate Change

Overview of 2018 Global Temperatures

Data released by the Copernicus Climate Change Service (C3S) show that 2018 was the fourth in a series of exceptionally warm years and together with the Copernicus Atmosphere Monitoring Service (CAMS), C3S reports that atmospheric CO_2 concentrations have continued to rise. The Copernicus C3S data found that 2018 surface temperatures were more than 0.4°C higher than the long-term average recorded over the period 1981-2010. The most pronounced warming compared to the long-term average occurred in the Arctic. Most land areas were warmer than average, especially Europe, the Middle East and the western USA. Apart from a relatively cold February and March 2018, Europe saw above average temperatures during all months of the year. Starting at the end of spring and continuing well into autumn and even winter, northern and central Europe experienced weather conditions that were persistently warmer and drier than average.

Observed Global Climate Change

Warming of the global climate system has been observed via global average air and ocean temperatures, the widespread melting of snow and ice, the rising sea level and the more frequent occurrence of extreme weather events, as summarised in Figure 15.7 below.

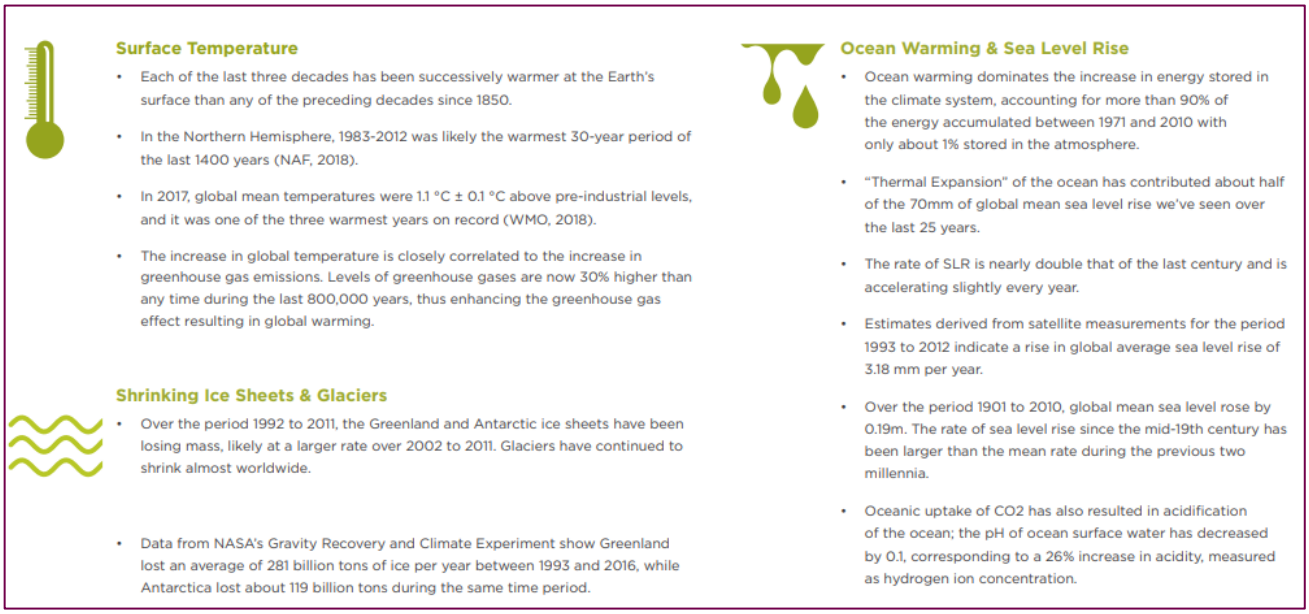


Figure 15.7: Summary of Observed Global Climate Change *(Source: IPCCAR5 Summary).*

Ireland's climate is changing in line with global patterns:

- Temperatures are rising across all seasons.
- The timing and spatial distributions of precipitation is changing.
- Sea levels are rising.
- The frequency and intensity of extreme weather events are changing.

These changes are expected to continue and intensify into the future with a wide range of economic, environmental and social impacts.

15.4.2.1.2 Climate Action Approach

Understanding how FCC has been impacted by climate hazards in the past is a crucial first step in the development of an Action Plan for the future. Past climate events and trends are detailed in Figure 15.8 below.

TYPE	DATE	DESCRIPTION
Hurricane Charley	August 1986	Pluvial – Worst flooding in Dublin in 100 years.
Pluvial & Strong Winds	February 1990	Heavy rain and consequently flooding, with long periods of strong winds. All weather stations reported gale gusts.
Pluvial/Fluvial	June 1993	100 mm of rain fell in Dublin and Kildare (more than three times the normal amount).
Extreme Temperatures	June - August 1995	Warmest summer on record, with mean air temperatures over two degrees above normal in most places. Temperatures rose to around 30°C on a number of days and night time minimum temperature remained above 15°C for many weeks.
Windstorm	December 1997	Conditions were severe in much of Leinster, especially the south and east. In the Dublin area, there were record gusts of 150 km/h, with maximum 10-minute winds of storm force.
Fluvial	November 2000	250 properties flooded in Dublin, 90.8 mm of rain fell. Significant disruption and damage, especially in the area of the Lower Tolka catchment.
Coastal	February 2002	Second highest tide ever recorded. This caused sea defences to be overtopped. 1,250 properties flooded in Dublin, €60M worth of damage.
Fluvial	November 2002	Similar to the 2000 flood, 80 mm of rain fell in Dublin. This led to high river levels in the River Tolka, which caused extensive flooding along the catchment.
Extreme Temperatures	Summer 2006	Warmest summer on record since 1995.
Pluvial	August - September 2008	76 mm of rain fell at Dublin Airport. Severe flooding in areas, many of which had no previous history of such flooding. Over 150 residential properties were inundated, as well as commercial premises, public buildings, major roadways, etc.
Pluvial	July 2009	This was a 1-in-50-year event. Several areas within the Dublin Region were severely affected.
Extreme Cold	December 2010	It was the coldest of any month at Dublin Airport in 50 years. Casement Aerodrome's temperature plummeted to -15.7°C on Christmas Day, the lowest temperature ever recorded in the Dublin Region.
Pluvial/Fluvial	October 2011	This was between a 1-in-50 and 1-in-100-year event across the majority of Dublin. Properties and roads were flooded, some electricity customers had no power supply in the County.
Coastal	January 2014	The highest tide ever recorded, at 3.014 metres ODM recorded at Alexandra Basin.
Storm Darwin	February 2014	1-in-20-year event, with gusts of 100-110 km/h in Dublin. Considerable damage to housing and other buildings. 8,000 ha of forests damaged. Status: Yellow.
Storm Ophelia	October 2017	First storm to come from a southerly direction, with damaging gusts of 120 to 150 km/h. 100 large trees blown over in the Dublin Region and significant damage to buildings throughout the country. Status: Red
The Beast from the East and Storm Emma	February – March 2018	Met Éireann issued its first Status Red warning for snow on record. Closure of all schools in the country, many businesses affected, water and power restrictions or outages. Status: Red
Extreme Temperatures	Summer 2018	Drier and warmer weather than normal throughout Ireland, with drought conditions in many areas, including Dublin. Temperatures reached 28°C with above average sunshine and heat wave conditions. Water restrictions were in place for the country for the majority of the summer. Status: Yellow
Storms Ali and Bronagh	September 2018	Storm Ali brought widespread, disruptive wind, which led to the delay or cancellation of most flights to and from Dublin Airport. Storm Bronagh passed over the east of Ireland bringing heavy rain. Mean wind speeds between 65-80 km/h and gusts between 110-130 km/h. Status: Orange

Figure 15.8: Past Climate Events and Trends.

15.4.2.1.3 Action Plan - Five Key Areas

FCC's Climate Action Plan will be achieved by a range of ongoing and planned actions in five key areas, which will be continuously monitored, evaluated, and updated to 2030 and beyond. FCC's Climate Action Plan has been organised under the five action areas below, reflecting FCC's range services.

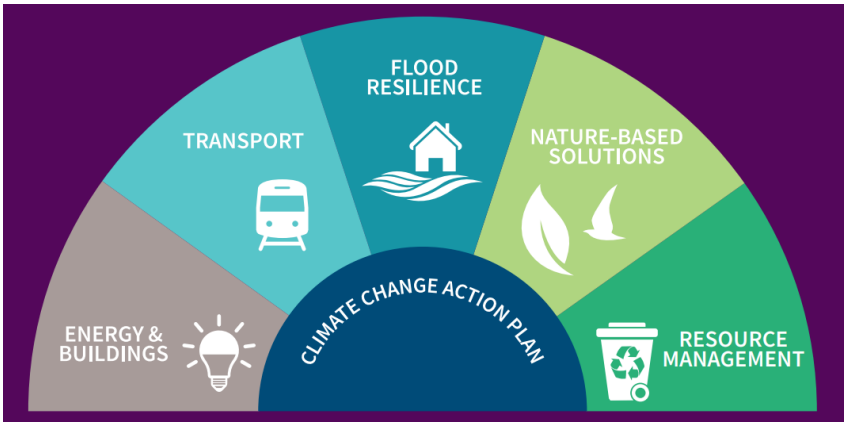


Figure 15.9: Fingal County Council's Five Climate Action Plan Areas.

As illustrated in Figure 15.9 above, the actions have been organised into the following areas - Energy and Buildings, Transport, Flood Resilience, Nature-Based Solutions, and Resource Management - reflecting FCC's remit and with the aim of fostering greater collaboration across departments within the Council. FCC understands that it has a role to play in reducing emissions and creating climate resilience outside its remit, both as a signatory to the Covenant of Mayors for Climate and Energy and contributing to national targets. It will take a role as a climate leader, pursuing new solutions or work practices that can be replicated by citizens, businesses or other public bodies. In order to increase awareness and acceptance of the climate change risks, FCC will inform citizens through actions with which the Council are raising awareness of climate issues and solutions or facilitating projects undertaken by citizens and businesses towards climate resilience. An integrated approach to decision making in relation to these climate change actions is recommended. Figure 15.10 below illustrates Final County Councils Action Plan targets going forward.

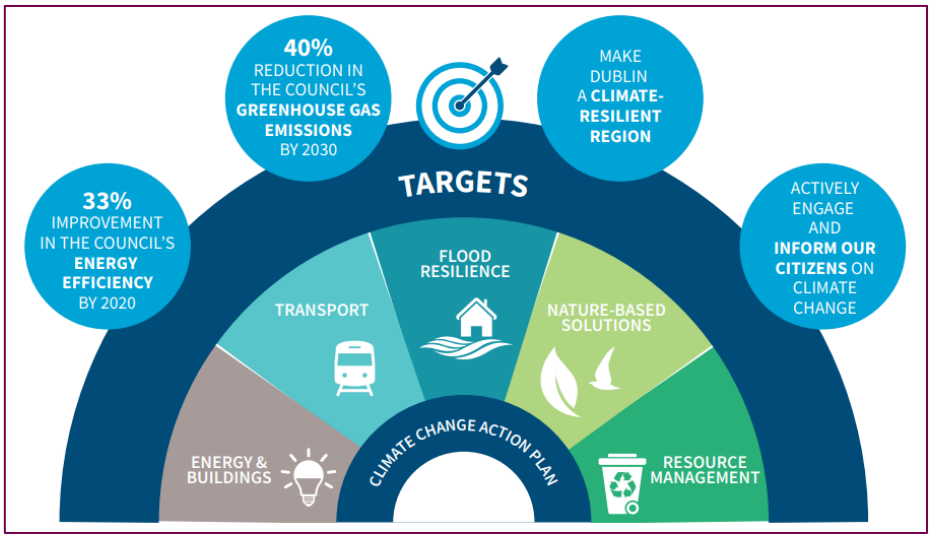


Figure 15.10: Action Plan Targets.

15.4.2.2 Rainfall and Temperature

Ireland has a wet temperate oceanic climate. Met Eireann provides annual temperature and rainfall data which can be accessed on their website[27]. The nearest weather station which records both annual temperatures and precipitation is located at Dublin Airport approximately 11.6km south-west of the Proposed Development. The annual temperatures and precipitation data (up to 05/07/2023) are set out in Table 15.7 and Table 15.8.

Table 15.7: Total Rainfall data in mm for Dublin Airport.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2023	41.2	16.2	119.0	77.6	35.9	49.4	13.2	-	-	-	-	-	352.5
2022	14.4	88.5	45.6	28.1	48.4	43.6	29.6	34.6	127.9	106.8	46.1	74.0	687.6
2021	115.1	55.0	32.1	10.8	83.5	12.6	72.9	65.3	42.0	79.8	11.7	85.8	666.6
2020	36.0	130.4	31.8	12.8	9.3	69.6	98.9	87.1	60.9	80.6	48.1	83.1	748.6
LTA	62.6	48.8	52.6	54.1	59.5	66.7	56.2	73.3	59.5	79.0	72.9	72.7	757.9

**** Long-Term-Average***

Table 15.8: Mean temperature in degrees Celsius for Dublin Airport.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2023	6.0	7.2	7.0	8.7	11.7	15.3	14.0	-	-	-	-	-	9.4
2022	5.4	6.7	6.6	7.6	11.9	13.6	16.3	15.9	13.0	12.0	8.8	4.4	10.2
2021	3.9	6.2	7.2	5.6	9.2	13.7	16.1	14.7	14.7	11.9	7.6	6.5	9.8
2020	6.3	5.8	5.8	8.5	10.9	13.4	14.4	14.7	12.8	9.5	8.2	4.9	9.6
LTA	5.3	5.3	6.7	8.1	10.7	13.4	15.4	15.1	13.1	10.3	7.3	5.6	9.7

**** Long-Term-Average***

[27] https://www.met.ie/climate/available-data/monthly-data accessed 6th July 2023

15.5 Impact Assessment

15.5.1 Construction Phase

The proposed construction phase is fully described in Chapter 3 of this EIAR and includes details of the main tasks. In summary, the activities with relevance to air quality and dust impact include:

- Construction of a *c.*190m long earth embankment at the end of Burrow Road.
- Construction of a *c.*130m long sheet piled flood wall and a *c.*200m embankment along Marsh Lane.
- Installation of back drainage behind the proposed defences with associated outfalls.
- Installation of non-return valves to existing outfalls to prevent backflow of water from the estuary.
- The construction of seven fishtail (or 'Y' shaped) groynes structures in combination with a beach renourishment scheme.

15.5.1.1 Construction Dust

In accordance with the TII Guidelines, where there are construction activities at a development site, there is a risk that dust may cause an impact on sensitive receptors in close proximity to the source of the dust generated. These distances are presented in Table 15.9, as outlined in TII Guidelines.

Table 15.9: TII Assessment Criteria for the Impact of Dust Emissions from Construction Activities (with standard mitigation in place).

Source		Potential Distance for Significant Effects (Distance from Source)		
Scale	**Description**	**Soiling**	**PM_{10}**	**Vegetation Effects**
Major	Large Construction sites, with high use of haul routes.	100m	25m	25m
Moderate	Moderate Construction sites, with moderate use of haul routes.	50m	15m	15m
Minor	Minor Construction sites, with minor use of haul routes.	25m	10m	10m

Source: Appendix 8: Assessment of Construction Impacts taken from "Guidelines for the treatment of Air Quality During the Planning & Construction of National Road Schemes" (TII, 2011)

The Proposed Development can be considered minor in scale and therefore there is the potential for significant dust soiling 25m from the source, as detailed in Table 15.9. There are several high-sensitivity residential receptors bordering the site boundary, some of which are within 25m as can be seen in Figure 15.11.

At Burrow Road, the two properties adjacent to the embankment would have a portion of their lands temporarily occupied to construct the embankments, with the property closest to the estuary permanently losing a small section of their garden.

Similarly, at Marsh Lane, the end property is likely to temporarily lose access to a portion of their yard as the proposed flood wall must extend beyond their property. Working room on the dry side of the proposed embankment may also encroach upon private rear gardens of properties on Marsh Lane.

The working areas at these interfaces will need to be fenced off using Heras panels or similar, which may need to be covered with netting/ tarpaulin for the duration of the works to minimise the impact of dust during dry periods.

In the absence of mitigation, there is the potential for significant, negative, short-term impacts to nearby sensitive receptors as a result of dust emissions arising from the construction of the Proposed Development.



Figure 15.11: Air Quality Sensitive Receptors.

15.5.1.2 Construction Traffic

All terrestrial plant and materials would be brought to Burrow Road via the R126 (Figure 15.12 below). This would require plant movements on public roads for the duration of the works and therefore consideration must be given to this in the Contractor's Traffic Management Plan. With appropriate controls and good contractor working practices, this can be achieved without significant risk to human health, but it must be thoroughly considered in terms of construction methodology, timeframes, and cost.

Within the confines of the working areas, plant movements would be linear in nature. Materials including clay, sheet piles, reinforcement steel, concrete, shuttering, pipework, and topsoil would require transportation up and down these areas from the construction access points, depending on the location of the defence. This may require stoning of the compound areas to provide adequate haul roads during all weather conditions.

There will be a degree of impact on properties in the Burrow as the narrow nature of roads would result in access constraints during the works due to unavoidable traffic management measures that would need to be implemented.

Due to the nature and scale of the works, as described above, the construction traffic is deemed to be minimal and does not meet the criteria detailed above. In this regard, employing the TII criteria the construction traffic volumes would not be significant and the resultant air quality impact from construction traffic is negligible**.**

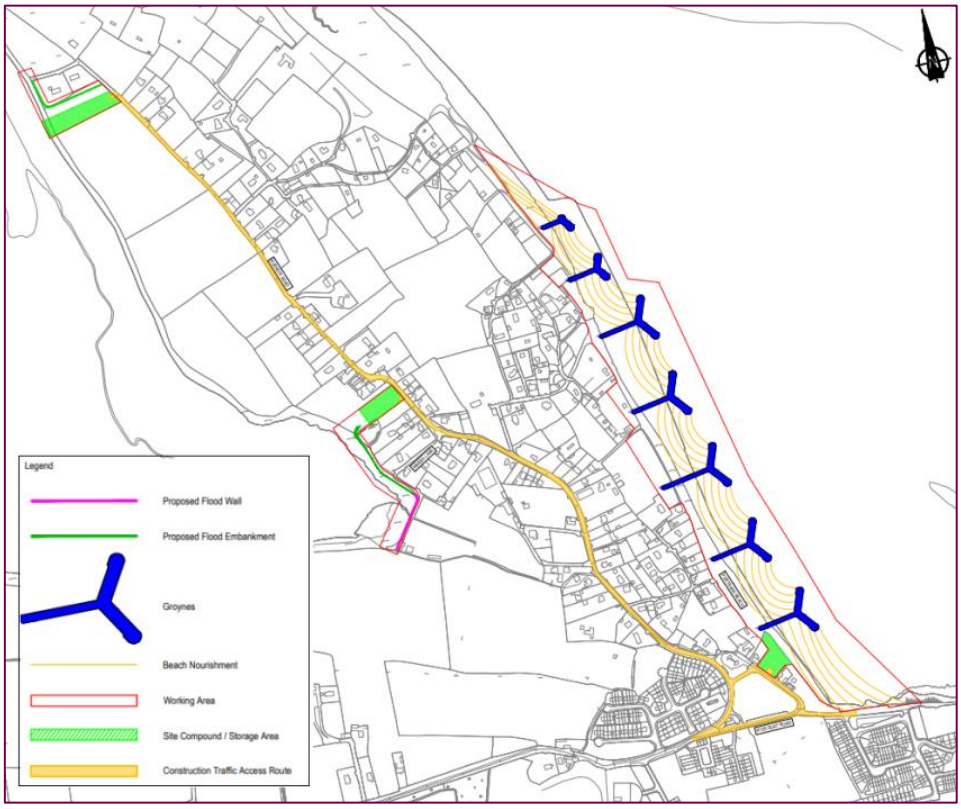


Figure 15.12: Burrow Construction Access Route and Working Area

15.5.1.3 Construction Greenhouse Gases

Emissions of construction generated Greenhouse Gases (GHG) will arise from embodied emissions in site materials, direct emissions from plant machinery/equipment as well as emissions vehicles delivering material and personnel to the construction site. The sensitivity of construction phase receptors is considered to be high. The magnitude of change is considered to be negligible. Therefore, there is likely to be a direct, temporary, short-term, adverse effect which is considered to be negligible.

15.5.1.4 Climate Change Resilience

During the construction process, receptors may be vulnerable to a range of climate risks. Potential impacts during the construction phase could include:

- Increased frequency of extreme weather - Damage, delay, health and safety impact, increased costs. The sensitivity of construction phase receptors is considered to be high. The magnitude of change is considered to be negligible. Therefore, there is likely to be a direct, temporary, short-term, adverse effect which is considered to be minor.

- Increased temperatures, prolonged periods of hot weather - Warm and dry conditions exacerbate dust generation and dispersions, health risks to construction workers. Appropriate dust control measures, which will be outlined in the outline CEMP, will be put in place during the construction phase of the Proposed Development to aid in protection from fugitive dust dispersion and potential health impact on construction workers.
- Increased precipitation, and intense periods of rainfall. 1) Flooding of works and soil erosion; 2) Increased risk of contamination of waterbodies; 3) Disruption to supply of materials and goods; 4) Landslides. Appropriate assessment has been undertaken in relation to future flooding. Please refer to Chapter 8 for full assessment details of future flood risk.
- Inaccessible construction site due to severe weather events (flooding, snow and ice, storms) restricting working hours and delaying construction.
- Health and safety risks to the workforce during severe weather events.
- Damage to construction materials, plant and equipment, including damage, material storage areas and worksites, for example from stormy weather.

With regard to climate change risks to the Proposed Development during the construction period, it is considered reasonable that construction contractors would be able to adapt working methods if necessary.

For example, warmer winter conditions may extend the time certain construction activities such as concrete pouring can be carried out, while a greater chance of summer heatwave conditions may require adaptations such as shading work areas or increased attention to construction dust control measures. Effects are considered to be negligible and not significant.

15.5.2 Operational Phase

Operational traffic movements are not anticipated to change traffic flows on the road network; therefore, air quality and climate are not deemed significant. Consequently, operational traffic air quality and climate have been scoped out of the assessment of the Proposed Development.

15.5.3 Inter-relationships

All environmental factors are inter-related to some extent. Interactions within the Study Area can be one-way interactions, two-way interactions and multiple-phase interactions may be influenced by the Proposed Development.

An assessment of the interaction between environmental factors are required under Article 3(1)(e) of the EIA Directive –1. The environmental impact assessment shall identify, describe and assess in an appropriate manner, in the light of each individual case, the direct and indirect significant effects of a project on the following factors:

- *Population and human health.*
- *Biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC.*
- *Land, soil, water, air and climate.*

- *Material assets, cultural heritage and the landscape.*
- *The interaction between the factors referred to in points (a) to (d).*

The interactions between impacts on different environmental factors will be considered, addressed and outlined as relevant throughout the EIAR.

Air quality is most likely to have an inter relationship with traffic and geology and soils, and climate is mostly likely to have an inter relationship with flooding. Air quality and climate emissions can be generated from the same sources which includes construction vehicle engines and road users during the construction phase. The impact of climate changes on hydrology increases the potential for future flood risk and drought periods.

15.6 Mitigation Measures

The Proposed Development has been designed, as far as practical, to minimise the impacts on air quality. Nevertheless, in order to avoid potential environmental impacts, the appointed contractor should be required to develop a CEMP as part of the approvals process. In context of air quality, dust mitigation measures would be based upon the industry guidelines in the Building Research Establishment (2003) document entitled '*Control of Dust from Construction and Demolition Activities*' (2003) and guidance documents published by the Institute of Air Quality Management such as the *Assessment of dust from demolition and construction* (2014).

The CEMP provides additional safeguards to the receiving environment and appraises the efficacy of the mitigation measures implemented to address any potential environmental effects on the receiving environment during the construction phase of the works. The monitoring programme would form part of the specification of the Contract Documents for the construction stage. The potential for dust to be emitted depends on the type of construction activity being carried out in conjunction with environmental factors including levels of rainfall, wind speeds and wind direction. The potential for impact from dust depends on the distance to potentially sensitive locations and whether the wind can carry the dust to these locations.

Measures to be included in the CEMP in context of air quality would include:

- Site roads shall be regularly cleaned and maintained as appropriate. Hard surface roads shall be swept to remove mud and aggregate materials from their surface while any un-surfaced roads shall be restricted to essential site traffic only.
- Any site roads with the potential to give rise to dust will be regularly watered, as appropriate, during dry and/ or windy conditions (also applies to vehicles delivering material with dust potential).
- Public roads outside the site shall be regularly inspected for cleanliness and cleaned as necessary.
- Material handling systems and site stockpiling of materials shall be designed and laid out to minimise exposure to wind.
- Water misting or sprays shall be used as required if particularly dusty activities are necessary during dry or windy periods.
- All vehicles which present a risk of spillage of materials, while either delivering or removing materials, will be loaded in such a way as to prevent spillage on to the public road.

- It will be required that all vehicles are suitably maintained to ensure that emissions of engine generated pollutants are kept to a minimum.

15.6.1 Greenhouse Gases

As with any construction site, there are associated vehicle movement, emissions and use of materials. With respect to vehicle emissions and materials, the following can reduce GHG emission to the atmosphere:

- Implementation of a Traffic Management Plan, as detailed in Chapter 14 of this EIAR, which will be prepared in advance of the construction works and which will form part of the specification for the construction works. This will outline measures to minimise congestion and queuing, reduce distances of deliveries and eliminate unnecessary loads.
- Visual monitoring of plant by operatives to ensure no black smoke is emitted other than during ignition (emissions to air controlled).
- Ensuring exhaust emissions are maintained to comply with the appropriate manufacturer's limits (emissions to air controlled).
- Reducing idle times by providing an efficient material handling plan that minimizes the waiting time for loads and unloads. Reducing idle times could save up to 10% of total emissions during the construction phase.
- Turning off vehicular engines when not in use for more than five minutes. This restriction will be enforced strictly unless the idle function is necessary for security or functionality reasons.
- Regular maintenance of plant and equipment. Technical inspection of vehicles to ensure they will perform the most efficiently.

15.6.2 Climate Change Resilience

With the design and mitigation measures proposed, the Proposed Development is considered to be resilient to projected climate change. The resilience of the Proposed Development to climate change impacts was qualitatively assessed, based on professional expertise and judgement.

15.6.3 Monitoring

Due to the nature and scale of the scheme, no future monitoring is required in relation to air quality and climate.

15.7 Residual Effects

15.7.1 Construction Phase

Notwithstanding the successful implementation of the construction and operation phase mitigation measures described in the previous section, the impact of construction dust from the Proposed Development on nearby receptors is considered negligible.

As the construction traffic volumes predicted with the Proposed Development are not considered significant, the resultant air quality impact from construction traffic is negligible.

The greenhouse gas emissions associated with the Proposed Development is considered to be negligible after considering mitigation during the construction phase such as efficient use of plant and vehicles and utilising low carbon and reusing materials where possible.

15.7.2 Operational Phase

Operational effects were scoped out of the assessment as operational traffic movements are not anticipated to change traffic flows on the road network. Therefore, operational effects on air quality and climate are considered to be **negligible.**

15.8 Potential Cumulative Impacts

The air quality impacts arising from other developments in the Study Area have been considered. The FRS proposed at Rush South has been considered in combination with the Proposed Development, and it is deemed with mitigation for preventing poor air quality during construction, no significant effects are expected.

The cumulative impact of carbon emissions arising from global human activity is *High*. This is true to the nature of climate change as a global, cumulative problem. As committed developments have been assessed throughout this EIAR the potential inter-scheme cumulative effects during the operational phase of the development have already been considered.

It is assumed that all committed developments will be required to meet relevant standards for emissions reduction and to comply with related planning policy. On this basis, it is considered appropriate to assume that any applications that are consented include 'reasonable' measures to avoid, reduce and/ or offset the generation of greenhouse gas emissions and therefore that no significant cumulative effects are anticipated.

15.9 Conclusions

This chapter considers the impacts on air quality and climate change from the Proposed Development. In undertaking this assessment, RPS experts have exercised professional skills and judgement to the best of their abilities and have given professional opinions that are objective, reliable and backed with scientific rigour.

In relation to air quality, for the construction phase, an important consideration is dust. In the absence of mitigation, there is the potential for significant, negative, short-term impacts to nearby sensitive receptors as a result of dust emissions. The mitigation measures provided within this assessment would ensure that the risk of adverse dust effects is negligible and therefore not significant. Impact associated with construction traffic would be negligible due to the small scale of the project and is deemed not significant.

In terms of climate change, the need for the Proposed Development arises from the increased risk of flooding associated with the Burrow area as a result of the changing climate. However, there is likely to be a direct, temporary, short-term, adverse effect on carbon emissions which is considered to be negligible and therefore not significant associated with the Proposed Development. Effects are considered to be negligible and not significant in terms of climate change resilience for construction.

In relation to both air quality and climate change for the operational phase, operational traffic movements were not anticipated to change traffic flows on the road network. Therefore, operational effects on air quality and

climate are considered to be negligible**.** The Proposed Development would also provide resilience for the local community into the future from the impacts so climate change such as sea level rise and storm events.

16 WASTE MANAGEMENT

16.1 Introduction

This chapter of the EIAR assesses the waste management aspect of the Proposed Development. It discusses the potential waste streams that will be generated during the construction and operation of the Proposed Development. The potential effects from the forecast waste generation are assessed in the context of the effects on waste management infrastructure and legislation, policy and strategy targets. Mitigation measures are proposed where potential for significant effects have been identified.

16.2 Authority of author

The author of this chapter, Ciara Devine, is a Senior Scientist with RPS and has over seven years of experience in the field of resource and waste management. Ciara holds a BSc (Hons) in Geography and a MSc (Distinction) in Environmental Engineering and is a Chartered Resource and Waste Manager (CRWM) of the Chartered Institution of Wastes Management (CIWM).

16.3 Assessment Methodology

A quantitative assessment of potential effects in relation to waste has been undertaken. The assessment comprised the following stages:

- A review of applicable legislation and guidance.
- A review of the Proposed Development design, undertaken in consultation with the project design team to estimate the waste generation during the various phases of construction.
- Determining waste arisings from the Proposed Development once operational.
- Consideration of potential interactions between proposals and the current site conditions.
- Identification of possible impacts.
- Assessment of impacts.
- Identification of measures and solutions to avoid, reduce or remedy potential impacts.
- Assessment of residual impacts, taking account of mitigation measures.

16.3.1 Assessment Criteria and Assignment of Significance

16.3.1.1 Assignment of Significance

The Institute of Environmental Management and Assessment (IEMA) published guidance in March 2020 which sets out criteria for determining the value (sensitivity) of material resources and waste (including waste infrastructure).

The determination of significance, in most cases, will be the product of professional judgement of the Waste Topic Lead and EIA Co-ordinator, with specific regard to:

- The sensitivity or importance (value) of receptors and the magnitude of impact on these receptors.

- The extent to which primary, secondary and tertiary measures are expected to minimise impacts and effects.

The importance or sensitivity of the resource or receptor will be based on the definitions outlined in Table 16.1.

Table 16.1: Importance or Sensitivity Matrix Definitions[28].

Importance/ Sensitivity of Resource or Receptor				
Across construction and or/operation phases, the baseline/future baseline (i.e. without development) or regional inert and non-hazardous landfill void capacity is expected to…				
Negligible	**Low**	**Medium**	**High**	**Very High**
Remain unchanged or is expected to increase through a committed change in capacity.	Reduce minimally: by <1% as a result of wastes forecast.	Reduce noticeable: by 1-5% as a result of wastes forecast.	Reduce considerably: by 6-10% as a result of wastes forecast.	Reduce very considerably (by >10%); end during construction or operations; is already known to be unavailable; or would require new capacity or infrastructure to be put in place to meet forecast demand.

16.3.1.2 Assignment of Magnitude

When assessing the construction phase, the magnitude of impact was considered from the point at which the site access is gained, through site remediation, enabling works, and construction, to development commissioning.

When assessing the operational phase, the magnitude of impact was assessed over the course of any one full and justifiably representative year within the first three years of commissioning.

The assessment of magnitude was based on the definitions outlined in Table 16.2.

[28] Assessing sensitivity of waste (Section 10.2.2) IEMA Guide to Materials and Waste Environmental Impact Assessment, March 2020.

Table 16.2: Magnitude of Impact Definitions.

Assessment of Magnitude				
Inert and Non-Hazardous Void Capacity				
No change	**Negligible**	**Minor**	**Moderate**	**Major**
Zero waste generation and disposal from the development	Waste generated by the development will reduce regional landfill void capacity baseline by <1%	Waste generated by development will reduce regional landfill void capacity baseline by 1-5%	Waste generated by the development will reduce regional landfill void capacity baseline by 6-10%.	Waste generated by the development will reduce landfill void capacity baseline by >10%.
Hazardous Void Capacity				
No change	**Negligible**	**Minor**	**Moderate**	**Major**
Zero waste generation and disposal from the development	Waste generated by the development will reduce national landfill void capacity baseline by <0.1%	Waste generated by development will reduce national landfill void capacity baseline by <0.1-0.5%	Waste generated by the development will reduce national landfill void capacity baseline by >0.5-1%	Waste generated by the development will reduce national landfill void capacity baseline by >1%.

16.3.1.3 Significance of Effects

The assessment of significance was based on the matrix outlined in Table 16.3 below.

Table 16.3: Assessment of Significance Matrix[29].

		Magnitude of Impact				
Sensitivity (or value) of receptor		**No Change**	**Negligible**	**Minor**	**Moderate**	**Major**
	Very high	Neutral	Slight	Moderate or large	Large or very large	Very large
	High	Neutral	Slight	Slight or moderate	Moderate or large	Large or very large
	Medium	Neutral	Neutral or slight	Slight	Moderate	Moderate or large
	Low	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or moderate
	Negligible	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight

[29] IEMA Guide to Materials and Waste Environmental Impact Assessment, March 2020.

16.3.1.4 Determining significance of effects

Once the effect threshold was determined, Table 16.4 describes how the significance of the environmental effects were determined.

Where a threshold is 'slight or moderate', i.e. transcends the significant – or not – effect boundary, professional judgement was used in combination with documented justification, to determine a final outcome. The cautious significant boundary applied responds to the need for developers and EIA practitioners to – in unison – continue to take an increasing responsibility for managing materials and wastes sustainably, with a view to incentivising sustainable resource management and (ultimately) a circular economy.

Table 16.4: Overall Significance of Effect[30].

Effect	Waste
Neutral	Not significant
Slight	
Moderate	Significant
Large	
Very Large	

16.3.2 Legislation and Guidance

An extensive document review was completed to assist in identifying current and future requirements for waste management which included applicable European Directives, National Regulations, National Policies and Strategies.

16.3.2.1 Definition of Waste

Waste is legally defined in EU and Irish law as "*any substance or object which the holder discards or intends or is required to discard*" under the Waste Framework Directive (European Directive 2006/12/EC as amended by Directive 2008/98/EC). Once a substance has become waste it will remain waste until it has been fully recovered and no longer poses a potential risk to the environment or human health.

From that moment onwards the material ceases to be waste, and it is no longer subject to the controls of the Waste Framework Directive. The principal objective of sustainable resource and waste management is to use material resources more efficiently, where the value of products, materials and resources are maintained in the economy for as long as possible and the generation of waste is minimised. To achieve resource efficiency there is a need to move from a traditional linear economy to a circular economy as illustrated in Figure 16.1.

[30] IEMA Guide to Materials and Waste Environmental Impact Assessment, March 2020.



Figure 16.1: Circular Economy Approach (Regional Waste Management Planning Offices, 2023).

Most of the waste generated from the Proposed Development works will be classified as construction and demolition waste (CDW). CDW is not clearly defined in Irish legislation, however a number of official documents provide a definition for CDW as follows:

The Department of the Environment, Community and Local Government in 2006 defined CDW as waste which arises from construction, renovation and demolition activities, together with all waste categories mentioned in Chapter 17 of the European Waste Catalogue (EWC). Also included within the definition are surplus and damaged products and materials arising in the course of construction work or used temporarily during the course of on-site activities.

The Environmental Protection Agency (EPA) adopted a broad definition of CDW (in line with the opening part of the definition of CDW as set out in Article 1(4) of Commission Decision 2011/753/EU12) as all waste that arises from construction and demolition activities (including excavated soil from contaminated sites). These wastes are listed in Chapter 17 of the European Waste Catalogue (EWC).

The definitions in Ireland for CDW do not provide any clear distinction between waste originating from construction or demolition.

16.3.2.2 Waste Management Policy

An extensive document review was completed to assist in identifying current and future requirements for waste management which included National and Regional Policies and Strategies such as:

- Draft National Waste Management Plan for a Circular Economy 2023.
- 2020 Programme for Government.

- The Climate Action Plan 2023.
- The Whole of Government Circular Economy Strategy 2022 – 2023.
- The Waste Action Plan for a Circular Economy – Ireland's National Waste Policy 2020 – 2025.
- The National Food Waste Prevention Roadmap 2023-2025.
- The National Policy Statement on the Bioeconomy 2018.
- National Hazardous Waste Management Plan 2021 – 2027, EPA, 2021.
- National Wastewater Sludge Management Plan, 2016-2021.
- By-Products (Article 27).
- End-of-Waste (Article 28).
- Waste Management Act 1996 (as amended).
- Circular Economy and Miscellaneous Provisions Act 2022.
- Changing Our Ways; A Policy Statement on Waste Management, Department of Environment, Heritage and Local Government, 1998.
- Preventing and Recycling Waste – Delivering Change, Department of Environment, Heritage and Local Government, 2002.
- Taking Stock and Moving Forward, Department of Environment, Heritage and Local Government, 2004.
- National Strategy on Biodegradable Waste, Department of Environment, Heritage and Local Government, 2006.
- A Resource Opportunity – Waste Management Policy in Ireland, Department of the Environment, Community and Local Government (DoECLG), 2012.
- Planning guidelines for future developments published by the DECLG.
- Eastern-Midlands Region Waste Management Plan 2015-2021.
- Green Public Procurement – Guidance for the Public Sector, EPA, 2021.
- Best Practice Guidelines for the preparation of resource & waste management plans for construction & demolition projects, EPA 2021.

16.3.2.3 Irish Legislation that impacts CDW Management

CDW is subject to a number of legislative requirements including the movement of waste, and management via authorised waste facilities.

Movement of Waste: Subject to minor exceptions, Section 34 of the Waste Management Act requires all bodies involved in the collection of waste to have this activity authorised by a waste collection permit. Besides the legal obligation to be in possession of a permit, the holder has to abide by its conditions. For example, these may limit collection activities to certain types of waste or require the permit holders to use specified tiers of the Waste Hierarchy. The details of the waste collection permit system are set down in the Waste Management (Collection

Permit) Regulations S.I. No. 820 of 2007 27, S.I. No. 87 of 2008 28 and S.I. No. 197 of 201529. Offaly County Council has been appointed as the National Waste Collection Permit Office (NWCPO).

Authorisation of Waste Facilities: The Waste Management Act contains a hierarchy of control systems, with the most stringent of these being licensed by the EPA. Local authorities are generally responsible for the regulation of non-disposal waste sites below specified thresholds (small scale and with a low degree of environmental significance). Because local authorities operate their own infrastructure, the EPA is mandated to oversee such activities. The following type of authorisations apply to waste management facilities in Ireland:

a. **Industrial Emissions Licences:** Directive 2010/75/EC of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control) was transposed in Ireland by the European Union (Industrial Emissions) Regulations 2013, S.I. 138 of 2013 and Environmental Protection Agency (Industrial Emissions) (Licensing) Regulations 2013, S.I. 137 of 2013. These regulations place a number of additional waste activities under the EPA licensing regime for the first time such as biological or thermal treatment facilities above a certain threshold. These regulations have limited impact on CDW treatment.

b. **Waste Licences:** The waste licensing system is operated by the EPA and is the main waste authorisation issued for major facilities in Ireland. This system provides for high environmental standards to apply for the development, operation, closure and aftercare of such sites. The Waste Management Act and the Waste Management (Licensing) Regulations 2004 govern the process under which the licences are applied for and maintained. CDW facilities that are managed by this regime include: landfills and materials reclamation facilities that handle more than 50,000 tonnes of non-hazardous waste.

c. **Waste facility permits and Certificates of Registration** are issued by local authorities under the under the Waste Management (Facility Permit and Registration) Regulations, S.I. No. 821 of 2007 (as amended) 3132. CDW facilities falling under the permit regime include places where concrete and brick crushers are being operated to recover up-to 50,000 tonnes per year of inert CDW and materials reclamation facilities (e.g. processing pre-treatment activity or backfilling activity) that handle less than 50,000 tonnes of non-hazardous waste. Certificates of registration are used for small scale CDW recovery activities processing less than 10,000 tonnes and generating less than 15% of residual waste. The revised facility permit and certificate of registration regulations introduced clear classes of activity, for the pre-treatment and backfilling of CDW, enabling operators to apply for an appropriate waste authorisation with more certainty. The previous regulations did not specify the type of and scale of recovery activities requiring a permit and were open to interpretation, particularly for CDW recovery activities. This uncertainty has been addressed with more CDW activities receiving a facility permit or certificate of registration, rather than a waste license. In this regard, Article 11 of S.I. No. 821 of 2007 introduced a process whereby the Environmental Protection Agency is designated as the responsible body for determining whether a particular activity requires a waste licence, a waste facility permit, a Certificate of Registration or none of these. Such determinations may be made by the Environmental Protection Agency (EPA) having regard to the following:

   - Following a request made by a prospective applicant for a waste authorisation for a decision on the type of waste authorisation that applies to the proposed facility/ activity.

- Following a request made by a local authority to whom an application for a waste facility permit or a Certificate of Registration has been made.
- On its own initiative in relation to an existing facility.

16.3.2.3.1 National Waste Policy in Ireland

The statutory basis for waste management policy in Ireland comes from the Waste Management Act 1996 (as amended). This Act provided the framework for the then Government's 1998 Policy Statement entitled "*Waste Management: Changing Our Ways*". This document outlined national targets and plans to modernise waste management practice over a 15-year period. A key concept of the Policy Statement was the Hierarchy of Waste Management, whereby waste prevention and re-use is preferable to non-sustainable practices such as disposal to landfill.

In Ireland, the Department of the Environment, Climate and Communications has divided the responsibility for waste regulation between the EPA and the local authorities. With respect to waste management planning, the EPA manages hazardous waste nationally while the responsibility for non-hazardous waste facilities lies with the local authorities.

Since the 1996 Waste Management Act, waste management planning of non-hazardous waste has been the responsibility of the local authorities. Section 22 of the Act allowed local authorities to amalgamate their waste management planning duties at their discretion. As a result, prior to 2013, there were 10 groupings of local authorities nationally. Following reform of local Government structures in 2014 this reduced the number of groupings further from ten to three, which were: the Eastern & Midlands, Southern and Connacht & Ulster.

The Waste Action Plan for a Circular Economy 2020 – 2025 called for the replacement of the existing three waste management plans with a single National Waste Management Plan containing targets for reuse, repair, resource consumption and a reduction in contamination. The Draft National Waste Management Plan for a Circular Economy was published in May 2023. This single Plan which replaces the existing regional plans sets out a framework for the prevention and management of waste in Ireland for the period 2023 to 2029. In accordance with this plan construction waste accounted for 60%, 8.8 million tonnes, of all waste generated within the state in 2019. In terms of waste management planning the Draft National Waste Management Plan For A Circular Economy sets out national target of 2% reduction in C&D waste per year. The plan also sets out 16 Focus Areas identified for the assignment of targeted policies and priority actions to support the achievement of the Plan ambition and targets. This includes Focus Area 8: Construction and Demolition Waste.

The Waste Action Plan for a Circular Economy 2020 – 2025 presents a roadmap to embrace the circular economy for the next decade. It promotes the focus on the following objectives: avoiding waste disposal; producer responsibility; sustainable economic models; a collaborative approach with other sectors & regulatory bodies and a strengthened role for Local Authorities (LA's).

The Circular Economy and Miscellaneous Provisions Act 2022 has become law and supports Ireland's move from a linear model to a to a circular economy that retains the value of resources in our economy for as long as possible.

The Landfilling Directive (1993/31/EC) amendment Directive (EU) 2018/850 requires Member States to reduce waste disposal by landfilling; waste suitable for recycling or other recovery will not be permitted for landfill

disposal. The Climate Action Plan 2023 has also set out targets to reduce the reliance on landfill disposal as follows:

- Limit diversion of biodegradable municipal waste to landfill to a maximum limit of 427,000 tonnes.
- Reduce the amount of municipal waste landfilled to 10% by 2035.

In addition, a number of measures have been introduced nationally to prevent materials from becoming waste from construction and demolition. In 2022, the EPA published consultation papers on National By- Product criteria for two construction waste streams as follows:

- Greenfield Soil & Stone used in developments; and
- Road Plannings as asphalt pavement material, in both milled and slab form, accepted at Reclaimed Asphalt Pavement plants.

Two end-of-waste operators (Integrated Materials Solution and Starrus Eco Holdings Limited, Panda) have been consented to recycle aggregates into product (Decision on Article 28 (Aggregate))[31].

16.3.2.4 Regional Level Policy

16.3.2.4.1 Eastern-Midlands Region Waste Management Plan 2015-2021

The Proposed Development is located in the Fingal County Council area who are responsible for setting and administering waste management activities in the area. Under Article 28 of the Waste Framework Directive, Member States are required to produce regional or local waste management plans. The Proposed Development is located within the Eastern-Midlands region and is therefore subject to the requirements of the Eastern-Midlands Region (EMR) Waste Management Plan 2015-2021. The plan set long term targets to:

- A 1% reduction per annum in the quantity of household waste generated per capita over the period of the plan.
- Achieve a recycling rate of 50% of managed municipal waste by 2020.
- Reduce to 0% the direct disposal of unprocessed residual municipal waste to landfill (from 2016 onwards) in favour of higher value pre-treatment processes and indigenous recovery practices.

The Eastern Midlands Regional Waste Management Plan 2015–2021 will be replaced by The National Waste Management Plan for a Circular Economy. A draft of this plan was published in May 2023 and is currently out for public consultation.

16.3.2.4.2 Fingal Development Plan 2023-2029

The Fingal Development Plan 2023-2029 sets out the Council's proposed policies and objectives for the development of the County over the Plan period.

[31] https://www.epa.ie/publications/licensing--permitting/waste/consultation-paper-regulation-277-national-by-product-criteria-for-road-planings-used-in-rap-plants.php.

One of its strategic aims is to support the implementation of national legislation and objectives on climate change, support the shift towards the circular economy approach as set out in the National Waste Policy for 2020-2025 (Policy CAP25), support the EMR Waste Management Plan 2015-2021 and its replacement National Waste Management Plan for a Circular Economy and have regard to the Best Practice Guidance on Waste Management Plans for Construction and Demolition Projects (Policy CAP26). Other objectives include supporting minimisation/prevention of waste and maximising material recycling, reuse and re-purposing.

16.4 Receiving Environmental

16.4.1 Current Operational Overview

The Proposed Development is located at the Burrow which is a sandy spit separating the outer Rogerstown Estuary from the Irish sea. The Proposed Development is located to the north of Portrane village and is split into three areas: the northern extent of the spit at the end of Burrow Road, Marsh Lane and along Portrane beach. The current operational overview of Portrane beach is a 1.8km long beach with concrete Seabee units providing partial protection to some areas, bounded by residential properties and several commercial properties to the west.

16.4.2 Characteristics of Current Wastes

Current waste arising at the site of the Proposed Development is a typical mix of recyclable and residual material generated from residential and commercial properties as well as mixed litter generated by footfall on Portrane beach. This waste is primarily collected through kerbside services operated by private companies or bring banks and the management/ disposal route is at the discretion of the private waste collector.

16.4.3 Current Method of Management/ Receiving Environment

16.4.3.1 Pre-treatment and Recovery Infrastructure

Pre-treatment infrastructure covers a wide variety of facilities in the region, but is mainly mechanical sorting, separation and processing plants which can vary in scale and sophistication.

Recovery infrastructure covers a wide range of activities which fall within the treatment tiers of preparing for reuse, recycling and other recovery. Pre-treatment and recovery facilities can be authorised either by the EPA, under a waste licence, or by the local authorities, under a waste facility permit (WFP) or certificate of registration (CoR).

In accordance with the Construction and Demolition Waste Soil and Stone Recovery/ Disposal Capacity – Update Report 2020, there were 106 authorised facilities in the Eastern-Midlands Region (EMR) for soil and stone acceptance at year end 2018, as follows:

- Four active licenced soil recovery facilities.
- Six licenced soil recovery facilities due to start providing capacity.
- Four active inert landfills.
- Forty-nine permitted facilities.

- Forty-three registered facilities with CoRs.

Table 16.5 to Table 16.8 summarises the soil recovery facility capacities in the EMR in 2018 as per the Construction and Demolition Waste Soil and Stone Recovery/ Disposal Capacity 2020 Report.

Table 16.5: Licenced Soil Recovery Facility Capacities in the EMR 2018[32].

County	No. of Facilities*	Annual Capacity (Application Stage) Tonnes	Annual Capacity (Licensed Un- commenced) Tonnes	Annual Capacity (Active and Available) Tonnes
Dublin (Fingal)	3	532,833	-	1,900,000
Meath	5	-	670,000	167,400
Kildare	5	740,000	570,000	344,000
Wicklow	2	-	300,000	-

**This includes closed facilities and facilities at application stage.*

Table 16.6: Inert Landfill Capacities in the EMR 2018[32].

Region	No. of Facilities	Permitted Capacity Tonnes (Lifetime)	Remaining Capacity Tonnes (Lifetime)
EMR	4	-	6,100,000

Table 16.7: Permitted Soil Recovery Facility Capacities in the EMR 2018[32].

Region	No. of Facilities	Permitted Capacity Tonnes (Lifetime)	Remaining Capacity Tonnes (Lifetime)
EMR	49	2,665,197	1,333,523

Table 16.8: Registered Soil Recovery Facility Capacities in the EMR 2018[32].

Region	No. of Facilities	Permitted Capacity Tonnes (Lifetime)	Remaining Capacity Tonnes (Lifetime)
EMR	43	394,934	188,288

The 2020 report found that licensed capacity is most prominent in the EMR which has a healthy supply of active capacity and substantial new capacity due to come on stream. The EMR contains 80% of the active national capacity.

Soil recovery facilities accept uncontaminated soil waste for recovery, primarily sourced from greenfield sites. The Draft National Waste Management Plan for a Circular Economy 2023 stated that there is significant capacity remaining at consented soil recovery facilities and the pending national Article 27 decision on greenfield soil and stone should reduce demand for this capacity. However, there is a capacity shortfall for facilities to treat non-inert non-hazardous wastes and dedicated facilities for this stream need to be supported and expanded to meet the projected shortfalls. This waste stream can no longer be allowed to compete with Municipal Solid

[32] Regional Waste Management Planning Offices (RWMPO), Construction & Demolition Waste Soil and Stone Recovery / Disposal Capacity – Update Report 2020.

Waste for void space in Municipal Solid Waste landfills. Table 16.9 summarises the current capacity in Ireland as per 2022 whilst Figure 16.2 shows the location of licenced soil recovery facilities across Ireland.

Table 16.9: Soil Recovery Facilities in Ireland 2021[33].

Type of Authorisatior	No. of Facilities	Available Treatment Capacity for Soil Waste	Soil Waste Accepted in 2020 (tonnes)	Remaining Available Treatment Capacity for Soil Waste from 2022 (tonnes)
Licensed	16	4,746,400 (annual)	2,773,687	25,272,206 (lifetime)
Permitted	230	9,939,156 (lifetime)	2,436,586	6,686,156 (lifetime)
Registered	228	3,598,291 (lifetime)	578,470	906,948 (lifetime)
Total	474		5,788,746	32,865,310

[33] Regional Waste Management Planning Offices (RWMPO), Draft National Waste Management Plan for a Circular Economy, 2023.

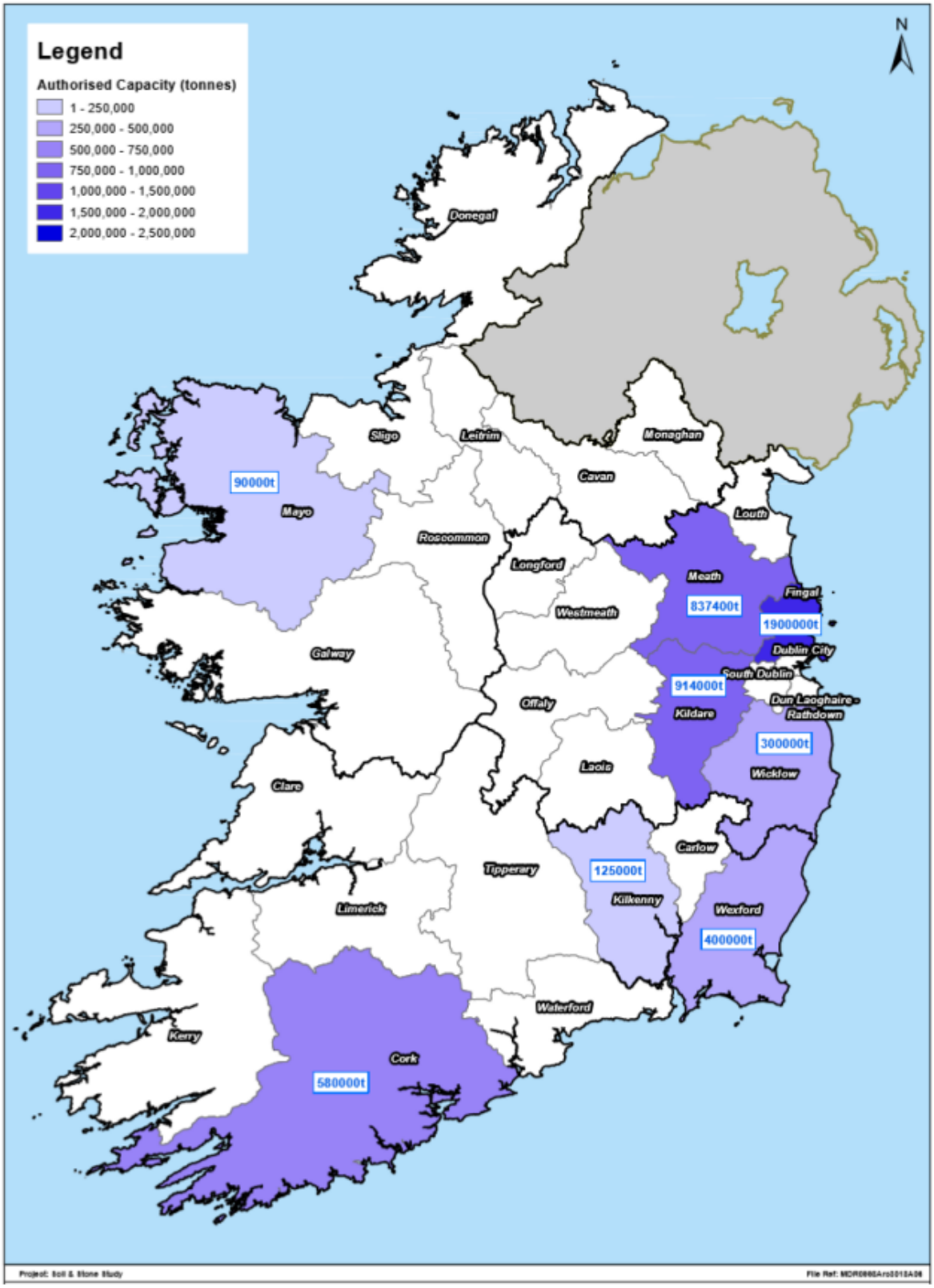


Figure 16.2: Location of Licenced Soil Recovery Facilities (including un-commenced)[34].

[34] Regional Waste Management Planning Offices (RWMPO), Construction & Demolition Waste Soil and Stone Recovery / Disposal Capacity – Update Report 2020.

16.4.3.2 Disposal Infrastructure

Inert landfill facilities accept wastes which comply with the waste acceptance criteria limits for inert landfills as described in the EU Landfill Directive. Table 16.10 outlines inert landfill facilities located within the EMR.

Table 16.10: Operational facilities accepting inert waste in Ireland[35].

Facility	Location	Annual Licensed Capacity (tonnes)	Accepted 2019 (tonnes)	Accepted 2020 (tonnes)	Accepted 2021 (tonnes)	Accepted 2022 (tonnes)	Remaining void space Inert Waste as per 2022[36]	Expected date to have used full capacity
Integrated Materials Solution (W0129-02)	Dublin	500,000	420,392	487,131	586,988	398,954	3,060,000	2035
Walshestown Restoration Ltd. (W0254-01)	Kildare	330,000	229,650	283,986	329,571	271,742	1,360,650	2033
Kyletalesha Landfill (W0026-03)	Laois	47,100	25,085	28,597	-	58,700 + 69,322	50,000	2023
Total		877,100	675,127	799,714	916,559	798,718		

The number of landfill sites accepting municipal waste in Ireland for disposal has continued to decrease from seven in 2016 to three facilities in 2022. Corranure Landfill in Cavan currently only accepts material to complete cell capping (including non-hazardous soil and stone material that does not meet the hazardous or inert waste acceptance criteria limits).

[35] Waste figures for 2021 and 2022 are from Annual Environmental Report (AER) returns for each site on https://leap.epa.ie/licence-profile

[36] Figures from EPA Environmental Performance Reporting (EPR) returns June 2023.

Table 16.11: Operational Municipal Waste Landfills in Ireland.

Facility	Location	Annual Licensed Capacity (tonnes)	Disposed 2019 (tonnes)	Remaining Capacity as per 2022[37]	Expected date to have used full capacity
Knockharley Landfill (W0146-02)125	Meath	175,000	65,992	3,797,802	2042
Ballynagran Residual Landfill (W0165-02)	Wicklow	150,000	202,994	503,165	2026
Drehid Waste Management Facility (W0201-03)	Kildare	120,000	111,454	475,694	2027
Corranure Landfill (W0077-04)	Cavan	45,000	0	N/A	
Total		445,000 (Excluding Corranure)	380,440		

16.4.3.3 Hazardous Soil and Stone

There is no dedicated hazardous waste to energy or landfill treatment capacity in Ireland. Such specialised indigenous facilities could treat and stabilise hazardous soil materials which can change the classification of soil wastes from hazardous to non-hazardous where the soil can then be managed at a non-hazardous facility. There is a reliance on overseas facilities for the final treatment of hazardous soils due to a lack of national capacity in Ireland.

[37] EPA 2023

16.5 Impact Assessment

Table 16.12 outlines the work elements during the construction and operational phase where waste is likely to arise.

Table 16.12 Phases where waste will likely arise.

Work Elements	Construction Phase	Operational Phase
Potential utility diversions	✓	
Site establishment and clearance	✓	
Construction of a *c.*190m long earth embankment at the end of Burrow Road	✓	✓
Construction of a *c.*130m long sheet piled flood wall and a *c.*200m embankment along Marsh Lane	✓	✓
Installation of back drainage behind the proposed defences with associated outfalls	✓	✓
Installation of non-return valves to existing outfalls to prevent backflow of water from the estuary	✓	✓
Construction of *c.* seven fishtail (or 'Y' shaped) groynes structures in combination with a beach renourishment scheme. These groynes structures will help control the longshore and cross-shore transport elements of the prevailing littoral drift along *c.*1.3km of the coastline of the Burrow. • Each groyne will extend seaward by approximately 70m at a spacing of *c.*175m to create seven sediment sub-cells along the Burrow. The total footprint of the proposed groynes will equate to *c.*1.36 hectares. • The beach renourishment will involve transporting dredged material from a licenced marine aggregate extraction site (presently assumed to be Liverpool Bay) to the Burrow and pumping the material ashore to fill each of the seven sediment sub-cells created by the fishtail groyne structures.	✓	✓

16.5.1 Construction Phase Impacts

16.5.1.1 Enabling Works Impacts

Waste materials will be generated as a result of the proposed demolition of the existing wall on Marsh Lane which is in poor condition. Waste arising from the proposed demolition is typically made up of several sub-waste streams, which are often mixed, depending on the amount of selective demolition and separate collection that has taken place.

The availability of space and private lands will dictate the width of clearance along the proposed defence. As the working areas are greenfield or estuarine in nature, topsoil or sand deposits will be stripped and stoned to provide a temporary haul road to facilitate the construction of flood defences and site traffic movement. Three site compounds will also be established. Stripped topsoil including removal of any soft spots will be stored onsite in the three designated storage areas for reuse as reinstatement on completion of the works. Any unsuitable material will need to be removed offsite for disposal. Waste will arise during site clearance works from the removal of tarmac surfaces, boundary fences and vegetation clearance.

Invasive species are commonly found in estuarine environments. If invasive species are present on the lands to be cleared and proper measures are not put in place, this has the potential to cause the spread of the invasive species plant. If invasive species are identified, an Invasive Species Management Plan should be prepared and implemented for the scheme. Under Section 52(7) and (8) of the Wildlife Act 1976 as inserted by amendment 56(d) of the Wildlife (Amendment) Act 2000, it is an offence to cause exotic species "*to grow in a wild state in any place in the State any species of flora, or the flowers, roots, seeds or spores of flora*". It is also an offence to plant or otherwise cause to grow in the wild any plant listed in Part 1 of the European Communities (Birds and Natural Habitats) Regulations 2011 (SI No. 477/2011). The National Parks and Wildlife Service (NPWS) is the department responsible for the enforcement of both the Wildlife Act and the European Communities legislation.

Construction waste can also include waste materials generated as a result of excavations, typically consisting of materials, for example, soil and made ground removed as a function of design to create trenches for flood wall construction, flood embankment construction, back drainage and land drains installation. Existing bunds and localised elevated ground features including the existing bluff at Burrow Road will be removed. Excavated material will be reused as backfill where possible.

An estimate of material arisings from excavation works is provided in Table 16.13 as well as the volume of material to be imported. The volume of excavated material that can be reused on site or will require removal offsite will be determined during the detailed design stage following further ground investigation to determine the suitability of material to prevent water seepage. There is the potential for excess volumes of materials to be managed off-site. Poor management of demolished or excavated waste could lead to the required disposal to landfill of waste deemed unsuitable for reuse or recycling.

Table 16.13: Volume of material required to be excavated and imported for the flood embankments at Burrow Road and Marsh Lane.

Metric	Marsh Lane Embankment	Burrow Road Embankment	Total
Volume of existing material to excavate [m^3]	776	856	1,632m^3
Volume of clay material to import [m^3]	198	190	388m^3
Volume of granular fill to import [m^3]	1,250	567	1,817m^3

A summary of the enabling works impacts is provided in Table 16.14 below.

Table 16.14: Enabling Works Impact Assessment Summary.

Impact Description	Potential significance of impact prior to mitigation
Demolition of existing wall on Marsh Lane which is likely to be inert/ non-hazardous waste arisings.	**Neutral or Slight** - Potential to require offsite reuse/ recovery/ disposal if reuse option onsite cannot be utilised
Excavation and removal of invasive species	**Neutral or Slight** - Potential to generate green materials and soils that require disposal to licenced deep fill landfill. Potential to spread invasive species if not correctly managed.
Excavated soils	**Neutral or Slight** - Potential to require offsite reuse/ recovery/ disposal if reuse option onsite cannot be utilised.

16.5.1.2 Construction Phase Impacts

CDW will arise from the construction phase. Typical waste materials arise from site management practices during the construction phase, for example: excess materials and packaging, over-ordering materials, off-cuts, damaged materials and poor storage during the construction phase as well as waste arisings from site compound offices, canteens and cabins.

For the fishtail groyne structures, approximately 42,000T (subject to detailed design) of rock armour material will be sourced from a nearby quarry and stored within the compound facility before being placed onto Portrane Beach. The core of the *c.*70m trunk of each groyne will be constructed by reusing the existing Seabee units currently on Portrane beach which is line with Circular Economy principles of reusing site assets and designing out waste. The sub-cells areas between the groyne structures will be filled with *c.*425,000m^3 of beach renourishment material imported from a licenced marine aggregate extraction site (presently assumed to be Liverpool Bay).

The proposed flood wall will be constructed using sheet piling therefore no spoil waste material is likely to arise.

Waste may arise from the removal of site compounds and temporary working areas if materials are not reused onsite. Site compounds and temporary working areas will be re-topsoiled or reinstated to the existing condition following completion of works. Agricultural fields and residential property gardens will be regraded and reinstated as appropriate on completion of works.

The main non-hazardous and hazardous resource streams that may possibly be generated during the construction phase are outlined in Table 16.15. These are based on a typical list of CDW resource streams in Appendix D of the 'Best Practice Guidelines for the preparation of resource and waste management plans for construction and demolition projects' (2021). The List of Waste (LoW) code (also referred to as the European Waste Code or EWC) for each waste stream is also shown.

Table 16.15: Applicable List of Waste (LoW) Summary[38].

Waste Material	LoW
Concrete	17 01 01
Bricks	17 01 02
Wood	17 02 01
Glass	17 02 02
Plastic	17 02 03
Bituminous Mixtures	17 03 02
Copper, Bronze, Brass	17 04 01
Aluminium	17 04 02
Lead	17 04 03
Zinc	17 04 04
Iron and Steel	17 04 05
Tin	17 04 06
Mixed Metals	17 04 07
Cables	17 04 11
Soil and Stone	17 05 04
Gypsum	17 08 02
Mixed C&D Waste	17 09 04
Mixtures of, or separate fractions of concrete, bricks, tiles and ceramics containing hazardous substances	17 01 06*
Glass, plastic and wood containing or contaminated with hazardous substances	17 02 04*
Bituminous mixtures containing coal tar	17 03 01*
Metal waste contaminated with hazardous substances	17 04 09*
Soil and stones containing hazardous substances	17 05 03*
Mixed packaging[39]	15 01 06
Waste hydraulic oils[39] *	13 01 01*
Wastes of liquid fuels[39] *	13 07 01*

Correct segregation, storage, handling and transport of all waste will be required to ensure there are no adverse effects on human health and that litter is not generated. The use of non-permitted waste contractors or unlicensed facilities could give rise to inappropriate management of waste and result in environmental impacts/

[38] Typical list of CDW resource streams in Appendix D of the 'Best Practice Guidelines for the preparation of resource and waste management plans for construction and demolition projects' (2021)

[39] Not included in the typical list of CDW resource streams in Appendix D of the 'Best Practice Guidelines for the preparation of resource and waste management plans for construction and demolition projects' (2021)

pollution. It is essential that all waste materials are dealt with in accordance with regional policies and national legislation and that time and resources are dedicated to ensuring efficient waste management practices.

Fuels and hydraulic oils/ lubricants that will be used during the construction phase are classed as hazardous. There will be fuels stored on site for machinery and construction vehicles along with oils and lubricants. Should any spillages, waste or surplus liquids be disposed of incorrectly it could cause serious harm to the surrounding environment. There is the potential for significant quantities of materials to be deposited in landfill sites unless proper management plans are implemented.

Further breakdown of potential waste streams that may arise during the construction phase of the development and the proposed management routes are set out in Table 16.16.

Table 16.16: Potential materials management during the Construction Phase.

Material Type	LoW	Management Option	Management Destination
Concrete	17 01 01	Recycled or reused off site	Off site to specialist contractor
Bricks	17 01 02	Recycled or reused off site	Off site to specialist contractor
Wood	17 02 01	Recycled or reused off site	Off site to specialist contractor
Glass	17 02 02	Recycled or reused off site	Off site to specialist contractor
Plastic	17 02 03	Recycled or reused off site	Off site to specialist contractor
Bituminous Mixtures	17 03 02	Recycled or reused off site	Off site to specialist contractor
Copper, Bronze, Brass	17 04 01	Recycled or reused off site	Off site to specialist contractor
Aluminium	17 04 02	Recycled or reused off site	Off site to specialist contractor
Lead	17 04 03	Recycled or reused off site	Off site to specialist contractor
Zinc	17 04 04	Recycled or reused off site	Off site to specialist contractor
Iron and Steel	17 04 05	Recycled or reused off site	Off site to specialist contractor
Tin	17 04 06	Recycled or reused off site	Off site to specialist contractor
Mixed Metals	17 04 07	Recycled or reused off site	Off site to specialist contractor
Cables	17 04 11	Recycled or reused off site	Off site to specialist contractor
Soil and Stone	17 05 04	Materials deemed unsuitable or not required for reuse on site and require management offsite	Off site to specialist contractor
Gypsum	17 08 02	Materials deemed unsuitable for reuse or recycling and require disposal to suitably licensed landfill	Disposal at licensed landfill
Mixed C&D Waste	17 09 04	Materials deemed unsuitable for reuse or recycling and require	Disposal at licensed landfill

Material Type	LoW	Management Option	Management Destination
		disposal to suitably licensed landfill	
Bituminous mixtures containing coal tar	17 03 01*	Materials deemed unsuitable for reuse or recycling and require disposal to suitably licensed landfill	Disposal at licensed landfill
Metal waste contaminated with hazardous substances	17 04 09*	Materials deemed unsuitable for reuse or recycling and require disposal to suitably licensed landfill	Disposal at licensed landfill
Soil and stones containing hazardous substances	17 05 03*	Materials deemed unsuitable for reuse or recycling and require disposal to suitably licensed landfill	Disposal at licensed landfill
Mixed packaging[40]	15 01 06	Recycled or reused off site	Offsite to specialist contractor
Waste hydraulic oils[39] *	13 01 01*	Recycled or disposed off site	Offsite to specialist contractor
Wastes of liquid fuels[39] *	13 07 01*	Recycled or disposed off site	Offsite to specialist contractor

A summary of the construction phase impacts is provided in Table 16.17.

Table 16.17: Construction Phase Impact Assessment Summary.

Impact	Potential significance of impact prior to mitigation
Construction related waste generated from the construction works - Surplus construction/ excavation materials including: concrete, bricks, metals, waste packaging, wrapping, waste cabling, pipework etc.	**Neutral or Slight** - Likely to require disposal to landfill if segregation and recycling initiatives not put in place o site during construction.

[40] Not included in the typical list of CDW resource streams in Appendix D of the 'Best Practice Guidelines for the preparation of resource and waste management plans for construction and demolition projects' (2021)

16.5.2 Operational Phase Impacts

There are no unusual or specialist maintenance or operational activities envisaged during the operational phase. Minimal maintenance will be required for the flood walls which include inspections and dealing with any vandalism in terms of graffiti or damage to coping stones. Embankments will require regular inspection and should be mowed at least twice annually to prevent growth of significant vegetation. Non-return valves on outfalls will need to be checked regularly as well as back drainage for blockages via manholes/ inspection chambers and rodded if necessary. Low quantities of general construction waste are anticipated to be generated during these maintenance activities.

The beach renourishment element of the Proposed Development is a "soft" nature-based solution and sediment material will be gradually lost from between the groyne structures overtime therefore periodic renourishment will be required. This is expected to be required every 5-10 years and the magnitude of renourishment required will be subject to the rate of losses but is expected to range between 50-75% of the initial renourishment volume. Low quantities of general construction waste are anticipated to be generated during future beach renourishment campaigns and the material will be sourced from a licensed marine aggregate extraction area (presently assumed to be Liverpool Bay).

A summary of the operational phase impact assessment on waste management is provided in Table 16.8.

Table 16.18: Operational Phase Impact Assessment Summary.

Impact	Potential significance of impact prior to mitigation
Minor repair and maintenance works - low quantities of waste are anticipated to be generated during maintenance works of flood walls, embankments, non-return valves and back drainage.	**Neutral or Slight** - Likely to require disposal to landfill if segregation and recycling initiatives not put in place on site during operational maintenance works.
Future beach renourishment – importing of *c*.318,750m^3 (50-75% of the initial renourishment volume) of material from a licenced marine aggregate extraction site.	**Neutral** – Negligible waste quantities are likely to be generated.

16.6 Mitigation Measures

16.6.1 Construction Phase Mitigation Measures

The clearance of the Proposed Development site will generate mostly CDW and excavated material, with a small number of green wastes, such as plants, trees and vegetation. These wastes will be segregated and stored appropriately in skips in a designated area onsite. In order to divert waste from landfill, possibilities for reuse of excavated material for fill or grading on site will be considered. Any clean excavated material that

cannot be reused onsite will be removed by licensed waste carriers and sent for reuse at another local development site, recycled into secondary aggregate or sent for disposal at appropriately licensed facilities.

The storage and reuse of excavation wastes on site may be subject to a number of waste licensing requirements. If these wastes are to be stored on site, prior to potential reuse or recovery during construction, this activity will be subject to a Waste Management Licence Exemption with a limited tonnage of material permitted to be stored on site. Storage will take place in a secure area on-site and the appointed contractor will monitor the amount of waste stored to ensure that the permitted limits of the Exemption are not exceeded. The appointed contractor (with oversight from FCC) will consult with the EPA prior to construction to ensure that the appropriate licences, permits and exemptions are in place prior to initiation.

Contractors working on site during the works will be responsible for the collection, control and disposal of all wastes generated by the works. The appointed contractor (with oversight from FCC) will ensure that all waste materials leaving the site are transported via a licensed carrier and disposed or recovered through licenced operators in accordance with National waste legislation. This duty implies, at the very least, checking to see that the required authorisation is in place, has not expired and is appropriate for the waste types that are to be handled. Monitoring and updating of records will be implemented.

Project design will incorporate adequate dedicated space to cater for the segregation and storage of all various waste streams during construction. Site compounds are located in or immediately adjacent to the relevant works phase. Adequate security measures should be put in place around the site and waste storage areas.

Construction waste materials shall be segregated on-site for recycling into the following categories:

- Timber
- Metal
- Cardboard & paper
- Glass
- Rubble
- General waste

A Construction Environmental Management Plan (CEMP) will be developed by the Contractor to be submitted as part of the approvals process. The CEMP will detail how to implement the mitigation measures including waste management measures to avoid, minimise, or mitigate adverse effects on the environment during the construction of the scheme. Contractors will be contractually obligated to comply with the requirements of the CEMP and should be adhered to by all parties with any involvement in construction, including main contractors, sub-contractors and visitors to the site.

A site-specific pre-construction RWMP will also be prepared by the client and design team which will be updated to reflect any planning conditions and included in tender documentation for the procurement of the Main Contractor. The Main Contractor will be required to update and implement the RWMP prior to construction. The RWMP will contain procedures for the effective management of resources and wastes during the construction phase and assist with providing a complete audit trail. This will be prepared in line with EPA '*Best Practice Guidelines for the preparation of resource & waste management plans for construction & demolition projects*'

published in 2021. The RWMP will consider circular economy principles set out in the Waste Action Plan for A Circular Economy – Ireland's National Waste Policy 2020-2025 and the waste management hierarchy, with waste prevention, reduction and reuse on site being of primary focus. The RWMP will be regularly revisited throughout the project's lifecycle to exploit opportunities to maximise waste reduction/ efficiencies and to ensure data is being collected on an ongoing basis. The appointed Contractor for site preparation, earthworks, piling and construction phases of the works will be contractually obliged to follow the RWMP and relevant legislation.

The following specific waste management requirements should be included in the CEMP:

- Building materials should be chosen with an aim to 'design out waste'.
- Control measures and attention to materials quantity requirements to avoid over-ordering and generation of waste materials.
- Agreements with materials suppliers to reduce the amount of packaging or to participate in a packaging take-back Scheme.
- Implement a 'just in time' materials delivery systems to avoid materials being stockpiled, which increases the risk of the damage and disposal as waste.
- Segregation of waste at source where practical. On-site segregation of non-hazardous waste materials into appropriate categories, where possible, including any excavated soils, concrete, bricks, metals and timber. On-site segregation of all hazardous waste materials into appropriate categories including contaminated soils, waste oil and fuels and paints, glues, adhesives and other known hazardous substances.
- All waste materials will be stored in skips or other suitable receptacles in designated areas of the site. The waste storage area(s) will be assigned, and all construction staff provided with training regarding the waste management procedures on commencement of the project.
- Measures to ensure appropriate staff training and levels of awareness in relation to waste management.
- Identify how the waste will be dealt with (i.e. disposal, recovery, recycle or re-use onsite or offsite etc.).
- Identify potential end markets e.g., reuse, recycling facilities, waste treatment facilities and disposal sites.
- Waste streams will be collected by an appropriately licensed and permitted private waste contractor, appointed by the contractor for recycling, recovery or disposal at suitably licensed facilities.
- All waste leaving site will be recycled, recovered or reused where possible, with the exception of those waste streams for which appropriate facilities are currently not available.
- Calculate the difference between expected waste quantities prior to commencement of the project and actual waste quantities after the project is complete.

The RWMP will be implemented from the outset of the project and throughout the duration of the project taking into consideration the waste management hierarchy to encourage sustainable development, circular economy, environmental protection and optimum use of resources.

Contractors will ensure all plant is inspected and serviced in accordance with its schedule.

The Waste Action Plan for Circular Economy: Ireland's National Waste Policy 2020-2025 underpins all waste related operations to be carried out on site. The appointed contractor (with oversight from FCC) will continue to review and implement any required changes in the waste management plan for the duration of the construction phase in order to avoid and minimise waste generation.

16.6.1.1 Construction Phase Monitoring

All waste types and amounts generated will be recorded and reviewed at regular intervals, to allow for continuous analysis and review of procedures that will be made to reduce waste to landfill, increase the percentage of recycling and reduce waste overall as much as possible.

Waste storage will take place in a secure area on-site and the appointed contractor will monitor the amount of waste stored to ensure that the permitted limits of any Exemption are not exceeded. The CEMP will set out measures and procedures to monitor waste flows on site and update records.

The appointed contractor will be required to appoint an Environmental Co-ordinator throughout the construction stage of the Proposed Development. The Environmental Co-ordinator will be trained in how to set up and maintain a record keeping system, how to perform, audit and how to establish targets for waste management on site. They will also be trained in the best method for segregation and storage of recyclable materials, have information on the materials that can be reused on-site and implement the RWMP.

Training of staff on site will be coordinated by the Environmental Co-ordinator and as such, a waste training programme will be organised. A basic awareness course will be held for all contractor site personnel to outline the RWMP and to detail the segregation of waste at source. This may be incorporated with other training needs (e.g., general site induction, safety training etc.). This basic course will describe the materials to be segregated, the storage methods and the location of waste storage areas. A subsection on hazardous wastes will be incorporated if required and the particular dangers of each hazardous waste will be explained.

A system will be put in place to record the waste arising on site during construction phases. The following should be recorded:

- Waste taken off-site for reuse.
- Waste taken off-site for recovery.
- Waste taken off-site for recycling.
- Waste taken off-site for disposal.

For each movement of waste off-site a signed waste collection docket will be obtained by the Environmental Co-ordinator from the licensed waste contractor. This will be carried out for each material type. This system will also be linked with the delivery records. A signed waste acceptance docket will be issued for each movement of waste on-site.

If waste movements are not accounted for, the reasons for this should be established in order to see if and why the record keeping system has not been maintained. Each material type will be examined in order to see where the largest percentage waste generation is occurring. The waste management methods for each material type will be reviewed in order to highlight how waste can be minimized.

The appointed Environmental Co-ordinator will be responsible for conducting a waste audit at the site during the construction phase of the development. A review of all records for waste generated and transported off-site, should be undertaken mid-way through the construction phase.

Upon completion of the construction phase, a final report will be prepared summarising the outcomes of waste management processes adopted and the total recycling/ reuse/ recovery figures for the Proposed Development.

16.6.2 Operational Phase Mitigation Measures

No preliminary waste management mitigation measures are currently proposed for the operational phase of the Proposed Development as negligible waste is anticipated to be produced from minor repair and maintenance works and beach renourishment works. Waste should be managed in accordance with the aims of The National Waste Management Plan for a Circular Economy to reduce waste, recycle and recover more materials. Waste should only be transported and disposed or recovered through licenced operators and in accordance with national waste legislation.

16.7 Residual Effects

Residual impacts of the Proposed Development considering the mitigation measures are presented in Table 16.19.

Table 16.19: Summary of Impacts

Phase	Receptor	Sensitivity of Receptor	Assessment of Magnitude	Predicted Effect	Adverse/ Beneficial	Permanent/ Temporary	Mitigation Measures	Residual Effect
Construction Phase	Inert and Non-Hazardous Landfill Void Capacity	Low	Negligible	Neutral or Slight	Adverse	Temporary	See Section 16.6.1	**Not Significant**
	Hazardous Landfill Void Capacity	Low	Negligible	Neutral or Slight	Adverse	Temporary	See Section 16.6.1	**Not Significant**
Operational Phase	Inert and Non-Hazardous Landfill Void Capacity	Low	Negligible	Neutral or Slight	Adverse	Permanent	See Section 16.6.2	**Not Significant**

16.8 Potential Cumulative Impacts

A review of projects in the immediate vicinity of the Proposed Development (including approved, proposed and future developments since 2020) was undertaken which may result in cumulative impacts when considered together with the Proposed Development. This was completed the using FCC Planning and Strategic Infrastructure Department planning application website (Table 16.20).

Table 16.20: Potential interactions between the Proposed Development and other proposed projects.

Planning Application	Location	Stage	Distance from Proposed Development	Spatial overlap?	Potential interaction(s) Construction Phase	Potential interaction(s) Operational Phase
F21A/0497 - Part change of use of existing off sales & bar to a new coffee/ ice cream shop & new restaurant & takeaway; the proposed works consist of the following: (1) A new 10.2 sq.m rear extension consisting of 2 no. new staff toilets, (2) Fit new retractable awning to the southwest (front) elevation, (3) 5 no. new illuminated associated signage to the southwest (front) elevation, (4) 5 no. new LED display lights to the southeast elevation with internal alterations & all associated site works.	The Brook Pub, Burrow Road, Portrane	Permitted 23/06/22	*c.*30m	No	No	No

Other future developments include a proposed flood scheme at Rush South which is located on the northern side of Rogerstown estuary.

There will be no interaction in relation to waste management between the aforementioned project, the project in Table 16.20 and the Proposed Development i.e. excess excavated materials will not be imported onto the Proposed Development from these sites and excavated soil from the Proposed Development will not be exported to these sites. The cumulative impact with these projects on the capacity of recovery/ disposal waste management facilities is considered to be **Neutral** or **Slight** as there will be relatively low volume of waste arising.

There is no potential for a cumulative resource and waste management effect during the operational phase of the Proposed Development resulting in effects on the capacity of recovery/ disposal waste management facilities. There are a high number of waste collectors and facilities registered/ licenced in the EMR Region.

16.9 Conclusions

A carefully planned approach to the demolition of the existing wall at Marsh Lane and adherence to a RWMP and CEMP during the Construction Phase will ensure that the waste effects on the environment and on landfill void space capacity will not be significant.

If invasive species are encountered, an Invasive Species Management Plan should be prepared. Materials not suitable for reuse onsite will go offsite for recycling, reuse or recovery as a priority over disposal to landfill. All waste materials leaving the site will be transported via a registered and licensed carrier and disposed or recovered at a licenced site in accordance with national waste legislation. Therefore, the effect of the Construction Phase in relation to waste management is predicted to be **Neutral or Slight** with the residual effect outcome being **Not Significant**.

Low quantities of general construction waste are anticipated to be generated from minimal maintenance works to the Proposed Development during the Operational Phase. Waste should be managed in accordance with the aims of The National Waste Management Plan for a Circular Economy and the circular economy strategic aims of Fingal Development Plan 2023-2029. Waste should be transported and disposed or recovered through licenced operators in accordance with national waste legislation. Therefore, the potential effect is **Neutral or Slight** and the residual effect on landfill void capacity being **Not Significant**.

The residual effects of the Proposed Development considering the mitigation measures presented in section 16.6 are **Not Significant**.

The cumulative impacts between the Proposed Development and other projects listed in Section 16.8 are considered to be **Neutral or Slight**.

17 MATERIAL ASSETS & LAND USE

17.1 Introduction

This chapter of the EIAR assesses the potential impact of the Proposed Development on existing land use and material assets.

The assessment of potential impacts on land use considers if there will be severance, loss of rights of way or amenities, conflicts, or other changes likely, which may alter the character and use of the surroundings. It has regard to the character and type of land use activities within the proposed site, and the location of any sensitive neighbouring occupied premises likely to be directly affected by the Proposed Development.

The assessment of potential impacts on material assets focuses on resources that are valued and are intrinsic to a place - these may be of either human or natural origin, and the value may arise for either economic or cultural reasons. In this context, this assessment focuses on buildings, built services and existing infrastructure within and directly adjoining the indicative study area.

The matters assessed within this section focus on the environmental effects on the following resources:

- Existing Land Use (e.g., education/ community/ recreation).
- Land with Development Potential and adjoining Land Use.
- Utilities and Infrastructure.

Material assets in the form of cultural heritage sites have been considered within Chapter 11. Consideration of potential impacts upon surrounding land use in terms of visual amenity and noise and vibration, is provided within Chapters 18 and 7 respectively.

17.2 Authority of author

The author of this chapter, Kieron McAuley, is a Town Planner with RPS and holds a BSc (Hons) in Planning, Environment and Development and a MSc (Merit) in Leadership for Sustainable Development from Queens University Belfast. Kieron has been working in planning for three and half years and is currently working towards becoming a chartered member of the Royal Town Planning Institute. Kieron's experience is primarily in the field of Planning, assisting on Environmental Impact Assessments, Environmental Statements and Planning Statements. Kieron has authored EIAR chapters, including accidents and major disasters, material assets and land use and assisting with landscape and visual assessments and associated chapter/ report. This has involved work on EIA and nationally significant projects including wind farms, solar farms, major infrastructure, wastewater treatment works, flood defences and commercial proposals.

The reviewer, Stephen McAfee, is a Senior Associate specialising in Air Quality and Climate within RPS and holds a BSc (Hons) in Geography from Queens University Belfast and a MSc in Environmental Engineering from Queens University Belfast. Stephen has over 18 years' experience and is a Chartered Scientist (CSci), a Full Member of the Institute of Environmental Management and Assessment (MIEMA), a Full Member of the Institute of Environmental Sciences (MIEnvSc) and a Full Member of the Institute of Air Quality Management (MIAQM).

17.3 Assessment Methodology

17.3.1 Baseline

The baseline environment is defined as the existing environment against which future changes can be measured. This section outlines the methodology used in assessing the baseline land use environment. The scope for the assessment has been informed by desktop analysis, consultation with statutory consultees, bodies with environmental responsibility and other interested parties at the scoping stage and during the pre-application community consultation.

With regards to existing land uses, consideration has been given to the existing character and type of land use, and the location of any sensitive neighbouring occupied premises likely to be directly affected by the Proposed Development. This includes educational, community, recreational, health care and those uses related to religious groups/ activities. The assessment focuses on direct land take which would occur through the implementation of the Proposed Development, including demolition of property. This was undertaken following a desktop study, review of aerial photography, and review of Ordnance Survey base mapping.

With respect to land with development potential, future planned changes to land use following the grant of planning permission are relevant to the assessment. A planning history search was therefore carried out to establish planning applications within and directly adjacent to the study area.

In relation to utilities and infrastructure, Ordnance Survey mapping and site survey work was used in conjunction with services data to identify the location of utilities and infrastructure that may be affected by the Proposed Development. Written consultation was undertaken with several government bodies and commercial organisations as part of the pre-application consultation. A review of the electricity network was also undertaken to identify if any existing apparatus/ infrastructure was located within and adjacent to the Proposed Development.

17.3.2 Relevant Guidance

The following guidance documents are relevant to this land use and material assets assessment:

- European Union (EU) (Planning and Development) (Environmental Impact Assessment) Regulations, 2018.
- EPA Advice notes on current practice in the preparation of Environmental Impact Statements (EPA, 2003);
- EPA Guidelines on the information to be contained in Environmental Impact Statements (EPA, 2002);

A desk-based study to identify baseline conditions has been undertaken to establish the existing provision of land use resources within the study area. This study utilised the following data sources:

- Fingal County Council: https://fingal.ie/.
- National Cycling Network and Irish Cycling Advocacy Network.
- The Heritage Council.
- Liaison with utility companies.

- Environmental Protection Agency (EPA).
- Geological Survey of Ireland (DECC).
- National Parks & Wildlife Service (NPWS).

17.3.3 Assessment Criteria and Assignment of Significance

A qualitative assessment of impacts on land use and material assets, based on professional judgement has been undertaken to indicate the significance of effects on identified receptors, based on the value or sensitivity of the receptor and the magnitude of the predicted impact.

The significance of an effect on these assets is a function of the value or sensitivity of the resource or receptor, and the magnitude of the impact (taking into account the timescale involved - permanent or temporary). The EPA (2022) EIAR Guidelines have been followed in order to clearly identify how the significance of impacts has been addressed. This common framework follows a 'matrix approach' to environmental assessment which is based on the characteristics of the impact (magnitude and nature) and the value (sensitivity) of the receptor. The criteria for assessing the significance of environmental effects on these assets are outlined in Table 17.1 and Table 17.2.

Table 17.1: Example Definitions of Sensitivity or Value.

Sensitivity	Example Descriptor
Very High	Very high importance and rarity, international scale and very limited potential for substitution.
High	High importance and rarity, national scale, and limited potential for substitution.
Medium	High or medium importance and rarity, regional scale, limited potential for substitution.
Low	Low or medium importance and rarity, local scale.
Negligible	Very low importance and rarity, local scale.

Table 17.2: Example Definitions of Magnitude.

Magnitude	Example Descriptor
High	Loss of resource and/ or quality and integrity of resource; severe damage to key characteristics, features or elements (Adverse). Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality (Beneficial).
Medium	Loss of resource, but not adversely affecting the integrity; partial loss of/ damage to key characteristics, features or elements (Adverse). Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality (Beneficial).
Low	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements. (Adverse).

Magnitude	Example Descriptor
	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring (Beneficial).
Negligible	Very minor loss or detrimental alteration to one or more characteristics, features or elements (Adverse). Very minor benefit to or positive addition of one or more characteristics, features or elements (Beneficial).
No change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.

17.3.4 Significance of Effects

The sensitivity of the receptor and the magnitude of impact were identified separately and contribute to the evaluation of the likely significance of the effect, which was assessed in accordance with the approach outlined in Table 17.3.

Table 17.3: Assessment of Significance for land use and material assets.

Sensitivity	Magnitude of Impact				
	No Change	**Negligible**	**Low**	**Medium**	**High**
Negligible	No change	Negligible	Negligible or Minor	Negligible or Minor	Minor
Low	No change	Negligible or Minor	Negligible or Minor	Minor	Minor or Moderate
Medium	No change	Negligible or Minor	Minor	Moderate	Moderate or Major
High	No change	Minor	Minor or Moderate	Moderate or Major	Major or Substantial
Very high	No change	Minor	Moderate or Major	Major or Substantial	Substantial

The levels of significance apply to both adverse and beneficial effects during the construction period and arising from the operation of the Proposed Development and take account of the guidance set out in the Table 17.4 below.

Table 17.4: Assessment of Significance Matrix.

Significance Category	Typical Descriptor of Effect
Very Large	Only adverse effects are normally assigned this level of significance. They represent key factors in the decision-making process. These effects are generally, but not exclusively, associated with sites or features of international, national or regional importance that are likely to suffer a most damaging impact and loss of resource integrity. A major change in a site or feature of local importance may also enter this category.

Significance Category	Typical Descriptor of Effect
Large	These beneficial or adverse effects are considered to be very important considerations and are likely to be material in the decision-making process.
Moderate	These beneficial or adverse effects may be important but are not likely to be key decision-making factors. The cumulative effects of such factors may influence decision-making if they lead to an increase in the overall adverse effect on a particular resource or receptor.
Slight	These beneficial or adverse effects may be raised as local factors. They are unlikely to be critical in the decision-making process, but are important in enhancing the subsequent design of the project
Neutral	No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

17.4 Receiving Environment

17.4.1 Overview

This section describes the baseline environment for land use and material assets, to establish those factors which may be directly affected by the Proposed Development. A brief sectoral analysis of the lands directly adjoining the Study Area is also included.

17.4.2 Existing Land Use

The Proposed Development is located on the seaward side of the Rogerstown Estuary, which occupies a coastal location just north of the Donabate-Portrane peninsula.

The Burrow is a sandy spit that separates the inner part of the Rogerstown Estuary from the Irish Sea. It stretches across the outer part of the estuary and as a result is subject to coastal erosion processes. Due to prolonged exposure this ecosystem has changed in response to tidal action and prevailing weather conditions.

The Burrow is positioned on the southern side of the Rogerstown Estuary. The coastline within the estuary is already heavily modified by means of a seawall and other landside developments such as the sailing club and two slip ways. The hinterland in this region is moderately populated. Portrane is situated to the south of the Proposed Development while Donabate is located approximately 2.8km southwest. As the Proposed Development is located on vacant or agricultural land subject to flooding, the baseline sensitivity of the existing land use is considered low. However, these lands are an important aspect of local land use and are worthy of protection, the footprint of the actual coastal defences proposed are not located on lands that are as important of the lands being protected.

17.4.3 Adjoining Land Use

Given the site's coastal location, the wider context is dominated by residential developments and agricultural land.

A planning history search immediately adjacent to the site boundary identified several applications related to small-scale new development, housing extensions, and refurbishments to existing buildings. It is unlikely that any of these will result in any significant cumulative effects on the environment. This is due to planning permissions being limited as FCC are currently implementing Objective GINHO76 of Development Plan– Development and Risk of Coastal Erosion which states "*Prohibit new development outside urban areas within the areas indicated on Green Infrastructure maps, which are within 100m of coastline at risk from coastal erosion, unless it can be objectively established based on the best scientific information available at the time of the application, that the likelihood of erosion at a specific location is minimal taking into account, inter alia, any impacts of the proposed development on erosion, or deposition.*"

As the Proposed Development is located outside of any Proposed Developments, the baseline sensitivity of the adjoining land use is considered low.

Further detail of the specific land uses in the area is outlined below.

17.4.3.1 Residential Land Use

There are a number of detached residential properties along Burrow Road with numerous streets off the main road which is directly to the west of the Proposed Development.

17.4.3.2 Industrial/ Commercial/ Retail

The town of Portrane is located adjacent to the Proposed Development and Donabate is located approximately 2.8km southwest of the Proposed Development. There, town centre uses, including retail, business and commercial are to be found. Furthermore, Beaverstown Golf Club is located approximately 2.3km to the west of the Proposed Development.

17.4.3.3 Community/ Recreational Facilities

There are no community or recreational facilities directly adjoining the site. However, the construction of a *c.*100m seawall at Marsh Lane to mitigate flood risk is in close proximity to Portrane Tour – Point 5. It is not considered that the construction of the Proposed Development will prevent the operation of this tour. There are also a number of caravan parks in the town of Portrane, but it is not envisaged that these will be impacted by the Proposed Development. There are extensive areas of green space and agricultural land surrounding the Proposed Development to the west. Rush Sailing Club is located approximately 1.35km to the north and Beaverstown Golf Club is located approximately 2.3km to the west of the Proposed Development.

There are no National Cycle Network routes within or directly adjoining the Proposed Development site.

17.4.3.4 Walking Routes

The Fingal Development Plan 2023-2029 map illustrated in Figure 17.1 indicates that there is a coastal walking route along the coastline of the Burrow. However, following a succession of storm events in 2013, this boardwalk

which is illustrated in Figure 17.1 below was lost to erosion. As such, there are presently no formally designated walking routes along the Burrow which could be impacted by the Proposed Development.



Figure 17.1: Boardwalk coastal walking route along the Burrow which was lost to coastal erosion in *c.* 2013.

17.4.3.5 Education/ Religious Facilities

There are no churches or schools/ universities adjacent to or within close proximity to the site.

17.4.4 Land with Development Potential

The Proposed Development site is located adjacent to an existing area of residential development and agricultural land. The proposal will not have an impact on any future development potential within these areas.

The adjoining lands of the Proposed Development have been zoned as 'High Amenity' (see Figure 17.2 below). The Proposed Development will provide important protection against coastal flooding and erosion and will not detract from any amenity areas.

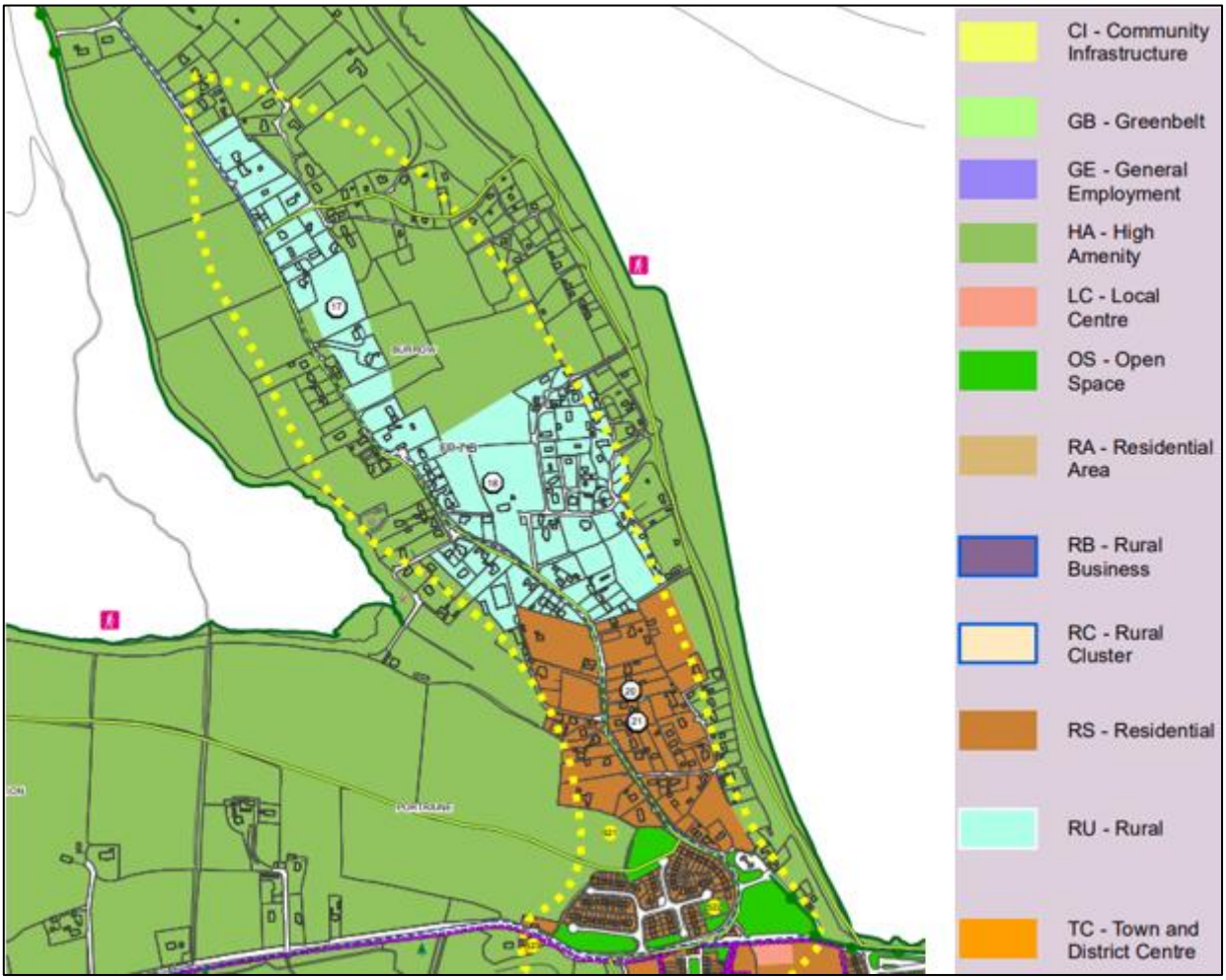


Figure 17.2: Fingal Development Plan 2023-2029 - Map 1: Sheet No.7 – Donabate/ Portrane.

17.4.5 Material Assets

Several main utility providers have provided indicative information to the applicant in relation to their existing services within or adjacent to the Proposed Development site. Please refer to Volume III Technical Drawings & Figures for details of utilities.

17.4.5.1 Watermains & Sewage Infrastructure

There is existing infrastructure which will be required to be diverted to facilitate this development and potential future developments. The existing infrastructure is as follows:

- Existing sewer main extending below the estuary from Rush to Burrow.
- An existing water main and combined sewer running parallel for a time and then crossing perpendicularly under the proposed embankment at the top of Burrow Road.

The exact location and depth of the water main and combined sewer will need to be confirmed by further investigation and consultation and agreement with Irish Water and the local authority will be required to confirm the final solution.

17.4.5.2 Utilities

A map illustrating the extent and location of existing utilities in relation to the Proposed Development is presented in Volume III Technical Drawings & Figures. To date, a number of the main utility providers have provided indicative information regarding existing services within or adjacent to the Proposed Development site. Continuous liaison with utility providers will be carried out during the detailed design and construction phases of this project.

17.4.5.3 ESB

The current ESB networks consist of both High Voltage (HV) and Medium Voltage (MV) overhead cables which clash with the line of the flood defences at both Burrow Road and Marsh Lane.

There may be two possible options for the diversion of the lines at the Proposed Development site. Firstly, it may be possible to work around the existing low voltage lines but raising/ moving the poles in advance of the proposed works may be necessary. Alternatively, it may be possible to de-energise the lines for short durations during the laying of the culvert. Early liaison with ESB will be needed to confirm arrangements.

17.4.5.4 Gas Infrastructure

There is no known gas network in the Proposed Development site area.

17.5 Impact Assessment

17.5.1 Construction Phase

This section sets out effects that could occur during the construction phase of the Proposed Development, with respect to land use and material assets.

17.5.1.1 Existing Land Use

It is estimated that the overall construction programme is 23 weeks. During the construction of the Proposed Development, the majority of the existing land use (within the direct footprint of the Proposed Development) will be removed through clearance/ resurfacing and therefore directly and permanently impacted.

The majority of the impacts during the construction will come from the construction traffic, as the access to the site is along Burrow Road.

Impacts to the adjoining residential developments to the west and northwest will be temporary and the predicted magnitude of impact is moderate during the construction period as some properties along Burrow Road will lose a portion of their gardens to the proposed embankment.

Overall, the pre-mitigation predicted magnitude of impact is low adverse.

17.5.1.2 Adjoining Land Uses

The existing land uses directly adjoining the Proposed Development site, or in close proximity will be affected by the construction of the Proposed Development. However, the residential properties to the west and northwest

will only be affected by short-term and temporary construction traffic. These uses are considered high sensitivity with minor impacts resulting from the Proposed Development during the construction process.

However as set out within Section 17.6, mitigation measures will be embedded into the construction phase such as good site management practices including the provision of high-quality heras fencing or similar/ signage and proactive communications with landowners, regarding phasing, timing, and duration of works

There will be changes to how the surrounding buildings may operate during the construction period, including additional health and safety procedures, changes to access, parking, and access to amenity space, however the use can remain operational. As such, the pre-mitigation predicted magnitude of impact will be low and the significance of the effect is considered adverse.

17.5.1.3 Land with Development Potential

The Proposed Development does not impact the implementation and delivery of the development potential of the site during the construction phase. Therefore, the magnitude of impact is predicted to be negligible.

17.5.1.4 Water & Sewage Infrastructure

There are several existing watermains which required diversion to facilitate this development and potential future developments. However, the magnitude of impact is predicted to be low, and the significance of effect is negligible.

17.5.1.5 Electrical Infrastructure

The current ESB networks consist of both High voltage (HV) and Medium Voltage (MV) overhead lines passing through the proposed site. There are two potential options for the diversion of the overhead lines. It could be possible to work around the existing low voltage lines, but it may be necessary to raise/ move the poles in advance of the proposed works. Or there is the option to de-energise the lines for short durations during the laying of the culvert. However, in each scenario, the predicted magnitude of impact will be low adverse prior to considering mitigation.

17.5.1.6 Gas Infrastructure

There is no gas network in the site area meaning that there will be no impact from the Proposed Development.

17.5.1.7 Telecommunications

There are existing telecommunication networks, and other broadband providers infrastructure located within proximity to the Proposed Development site, and as such there will be a need to co-ordinate construction activities to avoid impact on telecommunications supplies. The construction activities will be agreed in advance of construction and as such, no effect on the existing telecommunications infrastructure will occur as a result of the Proposed Development. The magnitude of impact is identified as negligible during construction.

17.5.2 Operational Phase

This section sets out effects that would occur during the operational phase of the Proposed Development, with respect to land use and material assets.

17.5.2.1 Existing Land Use

During the operation of the Proposed Development, the land use will be returned to its original use except where the new structures have been constructed and these will complement the surrounding land uses. This brings this area into active use, retaining the recreational value of the natural beach amenity. Furthermore, the Proposed Development would successfully meet the requirements of the Fingal Development Plan 2023-2029 as the objective of an area zoned as High Amenity is to *"Protect and enhance high amenity areas."*

While the Proposed Development will enhance the recreational value of the natural beach amenity, it will also enhance and protect some of the qualifying interests of the nearby environmentally designated sites which have been deteriorated by chronic and acute erosion over recent years. The proposal therefore will improve the quality of the resource directly and permanently, in terms of its functionality, attractiveness and integration with its surroundings. The magnitude of impact is expected to be high beneficial.

17.5.2.2 Adjacent Land Uses

The existing land uses directly adjoining the study area, or in close proximity will be positively affected by the operation of the Proposed Development. The Proposed Development would complement the existing residential developments and the surrounding agricultural lands. The magnitude of impact is expected to be low beneficial.

17.5.2.3 Land with Development Potential

The Proposed Development does not impact the implementation and delivery of the development potential of the site. It does not directly or indirectly affect the implementation of any recent/ extant planning approvals within the vicinity of the Proposed Development site. Therefore, the predicted magnitude of impact is predicted to be high beneficial by providing further opportunities in the future by protecting the area from flooding.

17.5.2.4 Water & Sewage Infrastructure

There are several existing watermains which will be required to be diverted to facilitate this development. However, the magnitude of impact is predicted to be negligible during the operation once diversions are completed during construction if required.

17.5.2.5 Electrical Infrastructure

There are no electricity connection upgrades required for the new development and while excavations will be required for this work, it will all be agreed with ESB to avoid impact on their existing electricity network in this part of Portrane. During the operational phase, the magnitude of impact is predicted to be negligible.

17.5.2.6 Gas Infrastructure

There is no known gas network in the site area meaning that there will be no impact from the Proposed Development.

17.5.2.7 Telecommunications

There is existing infrastructure belonging to ESB/ BT and other broadband providers located within close proximity to the Proposed Development site, and as such there will be a need to co-ordinate construction activities to avoid impact on telecommunication supplies. Any connections required to the new buildings will be agreed in advance of construction with ESB etc. As such no effect to the existing telecommunications infrastructure will occur as a result of the Proposed Development. The magnitude of impact is identified as negligible during the operational stage.

17.6 Mitigation Measures

17.6.1 Construction

During the construction phase for the Proposed Development, good site management practices and procedures will be carried out, including the provision of high-quality heras fencing or similar, signage and proactive communications landowners, regarding phasing, timing, and duration of works.

17.6.2 Adjoining Land Uses

Safe and appropriate access to the residential developments, adjacent buildings and the adjoining agricultural areas will be maintained throughout the construction process, and signage will be provided where necessary. This will ensure that no negative effects arise during the construction process.

17.6.3 Operation

No mitigation is required during the operational phase of the Proposed Development for material assets and land use.

17.7 Residual Effects

The residual effects during construction are considered minor adverse due to the temporary disturbance associated with construction activities. However, the residual effects associated with the long-term benefits of the scheme during the operational phase are considered highly beneficial due to mitigating the risk of coastal flooding and erosion in the area and providing development opportunities for the future. The residual effects are therefore deemed beneficial for both the construction and operation of the Proposed Development after considering the mitigation outlined above.

17.8 Potential Cumulative Impacts

The only other relevant marine project located within the vicinity of the Proposed Development is the FRS proposed at Rush south. This scheme primarily involves the replacement and improvement of existing seawalls located on the northern side of Rogerstown Estuary. Given the highly localised and negligible nature of the

Proposed Burrow Scheme impacts as identified above and the anticipated lesser impacts associated with the scheme at Rush, no cumulative material assets or land use impacts are anticipated during construction and operation of the Proposed Development.

17.9 Conclusions

The summary of effects from the Proposed Development during both the construction and operation phases of the Proposed Development are outlined in Table 17.5 below. The majority of impacts during construction are temporary and can be adequately mitigated through a range of procedures, good practices on site, and early consultation with statutory consultees and the adjacent landowners. The residual effects are therefore deemed minor adverse for the construction and high beneficial for the operation of the Proposed Development after considering the mitigation outlined above.

Table 17.5: Summary of Likely Environmental Effects on Land Use and Material Assets.

Receptor	Sensitivity of receptor	Description of Effect	Duration	Magnitude	Residual Effect	Significance
Construction phase						
Existing Land Use	Low	Clearance/ Disturbance	Long Term	Low Adverse	Minor (Adverse)	Not Significant
Adjoining Land Use	Low	Disturbance	Short Term	Low Adverse	Minor (Adverse)	Not Significant
Land with Development Potential	Low	Disturbance	Long Term	Negligible	Negligible	Not Significant
Water & Sewerage	Low	Removal/ Disturbance	Short Term	Low Adverse	Minor (Adverse)	Not Significant
Electrical Infrastructure	Medium	Removal/ Disturbance	Short Term	Low Adverse	Minor (Adverse)	Not Significant
Operational phase						
Existing Land Use	Low	Active Use	Long Term	High Beneficial	High (Beneficial)	Not Significant
Adjoining Land Use	Low	Active Use	Long Term	Low Beneficial	Minor (Beneficial)	Not Significant
Land with Development Potential	Low	Active Use	Long Term	Low Beneficial	Minor (Beneficial)	Not Significant
Water & Sewerage	Low	Active Use	Long Term	Negligible	Negligible	Not Significant
Electrical Infrastructure	High	Active Use	Long Term	Negligible	Negligible	Not Significant

18 LANDSCAPE & VISUAL

18.1 Introduction

This chapter of the EIAR considers the potential Landscape and Visual Impacts (LVIA) of the Proposed Development at the Burrow. The purpose of this LVIA is to identify and determine the effects on landscape character, landscape features, visual receptors and visual amenity as a result of the works described in Chapter 3.

18.2 Authority of author

The author of this chapter, Stuart Anderson, is a Senior Associate with RPS and has over fifteen years of experience in the field of landscape design, landscape and visual impact assessment an urban renewal. Stuart holds a BSc (Hons) in Landscape Design and Plant Science and a Postgraduate Diploma Landscape Management. He is a Chartered Member of the Landscape Institute (CMLI) and an Affiliate Member of the Institute of Environmental Management and Assessment (IEMA).

18.3 Assessment Methodology

18.3.1 General Approach

The following guidelines and documents have been used to determine the most appropriate methodology, terminology and approach to the assessment which has been adopted within this chapter:

- Guidelines for Landscape and Visual Impact Assessment, Third Edition (The Landscape Institute and Institute of Environmental Management & Assessment, 2013) (GLVIA3).
- Technical Guidance Note 06/19 Visual Representation of Development Proposals (The Landscape Institute, 2019).

The landscape has been appraised to allow it to be described and classified into landscape character areas that in turn enables the classification of landscape quality. The capacity of the landscape to accept change of the type proposed is assessed by determining the sensitivity of each landscape character area. Overall key landscape components are normally landform, vegetation and historical and cultural components.

Landform relates to topography, drainage characteristics and geology. Historical and cultural components include historic landscapes, listed buildings, conservation areas and historic designed landscapes. Vegetation plays an important role in how the landscape and visual resources of an area are viewed and is an integral component of a landscape character.

Assessment has been undertaken through analysis of:

- Up to date digital copies of Ordnance Survey Ireland maps.
- Aerial photography.
- Fingal County Development Plan 2023 – 2029.
- The National Inventory of Architectural Heritage (NIAH) of the Department of Arts.

- Detailed description and drawings of the Proposed Development.

Site visits were undertaken to assess the existing environment, to establish the existing visual resource and to identify sensitive receptors, i.e. residential properties, scenic viewpoints. Site visits were also used to establish the perceived extent of landscape and visual impacts that may be associated with the Proposed Development. These site visits concentrated on publicly accessible locations such as the surrounding road network and residential areas.

18.3.2 Identifying Effects

Assessing the significance of an effect is a key component of the LVIA and is an evidence-based process combining professional judgment on the nature of a landscape or visual receptor's sensitivity, their susceptibility or ability to accommodate change and the value attached to the receptor. It is important to note that judgments in this LVIA are impartial and based on professional experience and opinion informed by best practice guidance.

The effects of a Proposed Development are considered to be of variable duration and are assessed as being of either Temporary (less than 1 year), Short Term (1 to 7 years), Medium (7 to 15 years), Long Term (15 – 60 years) and Permanent (effects lasting over 60 years), and either permanent or reversible. Effects were considered to be long-term during the operational phase of the development, whilst operations and infrastructure works apparent during the construction and initial operating period were considered to be temporary, short-term duration.

The reversibility of an effect is also variable. The effects on the landscape and visual resource that occurs during the construction period such as the use of construction machinery are considered to be reversible.

Where effects arise during the construction period, these are most likely to be as a result of: movement of construction machinery within the landscape; construction of new structures and construction activities within the site boundary all of which are considered to be temporary, and short term in duration.

18.3.3 Study Area

The Study Area associated with the Proposed Development has been derived through analysis of the proposed built form (wall height, embankment height and groyne height) of the development, analysis of the receiving landscape resource and site visits. Field survey and assessment has established that a 2km Study Area is considered appropriate for this type of development as visibility of the Proposed Development and its associated elements is often screened or limited by intervening vegetation, topographical changes, attenuation by distance or built form associated with the Burrow.

18.3.4 Assessment Criteria

The objective of the assessment process is to identify and evaluate the predicted significant effects arising from a Proposed Development. Significance is a function of the:

- Sensitivity of the affected landscape or visual receptors, determined through consideration of the susceptibility of the receptor to the type of change arising from the specific proposals and the value attached to the receptor.

- Secondly its Scale or Magnitude, derived from a consideration of the size/ scale, geographical extent, duration and reversibility of the Proposed Development.

These definitions recognise that landscapes vary in their capacity to accommodate different forms of development according to the nature of the receiving landscape and the type of change being proposed.

As with any new development, it is acknowledged that, the introduction of a Proposed Development into the existing landscape or visual context could cause either a deterioration, improvement or neutral impact on the existing landscape or visual resource.

18.3.5 Landscape Impact Assessment

The LVIA firstly assessed how the Proposed Development would impact directly on any landscape features and resources. This category of effect relates to specific landscape elements and features (e.g., woods, trees, walls, hedgerows, watercourses) that are components of the landscape that may be physically affected by the Proposed Development, such as the removal or addition of trees and alteration to ground cover.

The LVIA then considered impacts on landscape character at two levels. Firstly, consideration was given to how the landscape character was affected by the removal or alteration of existing features and the introduction of new features. This is considered to be a direct impact on landscape character.

Secondly, the indirect impacts of the Proposed Development on the wider landscape were considered. The assessment of impacts on the wider landscape is discussed using the surrounding character areas identified in the relevant landscape character assessments. It is acknowledged there is an overlap between perception of change to landscape character and visual amenity, but it should be remembered that landscape character in its own right is generally derived from the combination and pattern of landscape elements within the view.

The significance of effects on landscape features and character was determined by considering both the sensitivity of the feature or landscape character and the magnitude of impact.

Consideration of the sensitivity of the landscape resource against the magnitude of impact caused by the Proposed Development is fundamental to landscape and visual assessment and these two criteria are defined in more detail below.

18.3.6 Landscape Sensitivity

The determination of the sensitivity of the landscape receptor is based upon an evaluation of the elements or characteristics of the landscape likely to be affected. The evaluation reflects such factors as its quality, value, contribution to landscape character and the degree to which the particular element or characteristic can be replaced or substituted.

GLVIA 3 at paragraph 5.39 states that '*landscape receptors need to be assessed firstly in terms of their sensitivity, combining judgments of their susceptibility to the type of change or development proposed and the value attached to the landscape*.'

Susceptibility is defined by GLVIA 3 at paragraph 5.40 as '*the ability of the landscape receptor (whether it be the overall character or quality/ condition of a particular landscape type or area, or an individual element and/ or feature, or a particular aesthetic and perceptual aspect) to accommodate the proposed development without*

due consequences for the maintenance of the baseline situation and/or the achievement of landscape planning policies and strategies.'

The value of a landscape receptor is determined with reference to the presence of relevant landscape designations, such as Areas of Outstanding Natural Beauty (AONB) and their level of importance. For the purpose of this assessment, landscape value was categorised as:

- **Very High:** Areas of landscape acknowledged through designation such as Areas of Outstanding Natural Beauty (AONB) or other landscape based sensitive areas. These are of landscape significance within the wider region or nationally.
- **High:** Areas that have a very strong positive character with valued and consistent distinctive features that gives the landscape unity, richness, and harmony. These are of landscape significance within the district.
- **Medium:** Areas that exhibit positive character, but which may have evidence of alteration/ degradation or erosion of features resulting in a less distinctive landscape. These may be of some local landscape significance with some positive recognisable structure.
- **Low:** Areas that are generally negative in character, degraded and in poor condition. No distinctive positive characteristics and with little or no structure. Scope for positive enhancement.

As previously discussed, landscape sensitivity is influenced by a number of factors including susceptibility to change, value and condition. To assist with bringing these factors together judgements regarding susceptibility and value have been used which define the landscape resource as being either, negligible, low, medium, high or very high. Table 18.1, defines the criteria that have guided the judgement as to the overall sensitivity of the landscape resource.

Assessments of susceptibility and value of a particular landscape resource may be different and professional judgement will always be used to conclude on the judgement of sensitivity. For example, value may be high, and susceptibility may be low, and a professional judgement will be made to determine whether sensitivity is high, low, or in between, supported by a narrative explanation.

Table 18.1 Landscape Sensitivity

Definition		Sensitivity
Landscape resource susceptibility	**Landscape resource value**	
Exceptional landscape quality, no or limited potential for substitution. Key elements/ features well known to the wider public. Little or no tolerance to change	Nationally/ internationally designated/ valued landscape, or key elements or features of national/ internationally designated landscapes. Little or no tolerance to change.	Very High
Strong/ distinctive landscape character; absence of landscape detractors. Low tolerance to change.	Regionally/ nationally designated/ valued countryside and landscape features. Low tolerance to change.	High
Some distinctive landscape characteristics; few landscape detractors. Medium tolerance to change.	Locally' regionally designated/ valued countryside and landscape features. Medium tolerance to change.	Medium
Absence of distinctive landscape characteristics; presence of landscape detractors. High tolerance to change	Undesignated countryside and landscape features. High tolerance to change	Low
Absence of positive landscape characteristics. Significant presence of landscape detractors. High tolerance to change	Undesignated countryside and landscape features. High tolerance to change	Negligible

18.3.7 Magnitude of Landscape Impacts

The effect on Landscape receptors and the overall judgement of the magnitude of Landscape effect is based on combining judgements on *'size or scale, the geographic extent of the area influenced, and its duration and reversibility*' (GLVIA3, paragraph 5.48).

Direct resource changes on the landscape character in the Study Area are brought about by the introduction of the Proposed Development and its impact on key landscape characteristics.

The categories and criteria used, and which reflect guidance in GLVIA3 are provided in Table 18.2.

Table 18.2 Magnitude of Landscape Impact

Definition	Magnitude
Total loss or addition or/ very substantial loss or addition of key elements/ features/ patterns of the baseline, i.e. pre-development landscape and/ or introduction of dominant, uncharacteristic elements with the attributes of the receiving landscape.	Large
Partial loss or addition of or moderate alteration to one or more key elements/ features/ patterns of the baseline, i.e. pre-development landscape and/ or introduction of elements that may be prominent but may not necessarily be substantially uncharacteristic with the attributes of the receiving landscape.	Medium
Minor loss or addition of or alteration to one or more key elements/ features/ patterns of the baseline, i.e. pre-development landscape and or introduction of elements that may not be uncharacteristic with the surrounding landscape.	Small
Very minor loss or addition of or alteration to one or more key elements/ features/ patterns of the baseline, i.e. pre-development landscape and/or introduction of elements that are not uncharacteristic with the surrounding landscape approximating to a 'no-change' situation.	Negligible
No loss, alteration or addition to the receiving landscape resource.	No change

18.3.8 Visual Impact Assessment

As outlined in GLVIA 3 (Paragraph 6.1) '*an assessment of visual effects deals with the effects of change and development on the views available to people and their visual amenity*'. The assessment of effects of the Proposed Development on views is an assessment of how the introduction of the Proposed Development will affect views within the Study Area. The assessment of visual effects therefore needs to consider:

- Direct impacts of the Proposed Development upon views of the landscape through intrusion or obstruction.
- The reaction of viewers who may be affected, e. g. residents, walkers, road users.
- The overall impact on visual amenity.

Viewpoints have been selected to meet the following criteria:

- A balance of viewpoints from where the main direction of view is focused towards the Proposed Development.
- A range of views of the Proposed Development covering the extent of the study area.
- A proportion representing areas known to be available to the community where people may frequently congregate.
- Locations of interest, e.g., settlements; amenity or recreation areas.

The selected viewpoint locations are presented in Appendix 18.A.

For visual receptors, judgements of susceptibility and value are closely interlinked. For example, the most valued views are likely to be those which people go and visit because of the available view. The value attributed to visual receptors also relates to the value of the view – for example a National Trail is nationally valued for its access, not necessarily for its views.

Paragraph 6.32 of the GLVIA refers to the susceptibility of different visual receptors to changes in views and states that susceptibility is mainly a function of "*the occupation or activity of different people experiencing the view at particular locations*" and "*the extent to which their attention or interest may therefore be focused on the views and the visual amenity they experience at particular locations.*"

Other factors affecting visual sensitivity include:

- The location and context of the viewpoint.
- The expectations and occupation or activity of the receptor.
- The importance of the view.

Judgements on the overall visual sensitivity/ susceptibility are provided in Table 18.3 below and overall sensitivity of the visual resource is based on combining judgements on the sensitivity of the human receptor (for example resident, commuter, tourist, walker, recreationist or worker, and the numbers of viewers affected) and judgements on the visual resource value (for example views experienced from residential properties, workplace, leisure venue, local beauty spot, scenic viewpoint, commuter route, tourist route or walkers' route).

Table 18.3: Visual Resource Sensitivity

Definition		Sensitivity
Visual resource Susceptibility	**Visual resource value**	
Views of remarkable scenic quality, of and within internationally designated Landscapes or key features or elements of nationally designated landscapes that are well known to the wider public. Little or no tolerance to change.	Observers, drawn to a particular view, including those who have travelled to experience the views. Little or no tolerance to change	Very High
Views from residential property. Public rights of way, National Trails, Long distance walking routes and nationally designated countryside/ landscape features with public access. Low tolerance to change.	Observers enjoying the countryside from their homes or pursuing quiet outdoor recreation are more sensitive to visual change. Little tolerance to change	High
Views from local roads and routes crossing designated countryside/	Observers enjoying the countryside from vehicles on quiet/ promoted	Medium

Definition		Sensitivity
Visual resource Susceptibility	**Visual resource value**	
landscape features and 'access land' as well as promoted paths. Medium Tolerance to change.	routes are moderately sensitive to visual change. Medium tolerance to change	
Views from workplaces, main roads and undesignated countryside/ landscape features. High tolerance to change.	Observers in vehicles or people involved in frequent or infrequent repeated activities are less sensitive to visual change. High tolerance to change	Low
Views from within and of undesignated landscapes with significant presence of landscape detractors. High tolerance to change.	Observers in vehicles or people involved in frequent or frequently repeated activities are less sensitive to visual change. High tolerance to change	Negligible

18.3.9 Photographs, Photomontages and Zone of Theoretical Visibility (ZTV)

All site photography and photomontages have been completed in accordance with the Landscape Institute's Technical Guidance Note 06/19 Visual Representation of Development Proposals

The photographer was equipped with a professional level Single-lens Reflex (SLR) camera. Specifically, to meet the requirements of best practice, this houses a full frame sensor and is fitted with a 50mm lens. A specialised panoramic head was fitted to the camera tripod for those viewpoints adjacent to the site. This enables the capture of multiple photographs in a linear sequence for the preparation of a panoramic image. Such imagery is required to include sufficient landscape context to depict the entire Proposed Development at close quarters. A mapping grade GPS (Trimble GeoXH) was used to record the precise position of the camera at each viewpoint. This offers corrected accuracy typically in the range of +/- 30cm in the xy plane. In addition, the photographer had all necessary information per viewpoint to capture the correct photographic detail – viewpoint map, photographic reference, Google Earth with a KMZ model of the Proposed Development. All photography used in the production of the photomontages was captured at a focal length of 50mm in RAW format for post-processing. The camera was consistently set up at 1.6m above ground level at each viewpoint location. The photography was captured in the clearest possible weather in the available time frame.

18.3.10 Magnitude of Visual Impacts

The magnitude of impact on the visual resource results from the scale of change in the view, with respect to the loss or addition of features in the view, and changes in the view composition. Important factors to be considered include proportion of the view occupied by the proposal, distance and duration of the view. Other vertical features in the landscape and the backdrop to the Proposed Development will all influence resource change.

The definition of the magnitude of visual impact in line with guidance provided in GLVIA3 is defined in Table 18.4.

Table 18.4 Magnitude of Visual Impact

Definition	Magnitude
Complete or very substantial change in view dominant involving complete or very substantial obstruction of existing view or complete change in character and composition of baseline, e.g., through removal of key elements.	Large
Moderate change in view: which may involve partial obstruction of existing view or partial change in character and composition of baseline, i.e. pre-development view through the introduction of new elements or removal of existing elements. Change may be prominent but would not substantially alter scale and character of the surroundings and the wider setting. Composition of the view would alter. View character may be partially changed through the introduction of features which, though uncharacteristic, may not necessarily be visually discordant.	Medium
Minor change in baseline, i.e. pre-development view - change would be distinguishable from the surroundings whilst composition and character would be similar to the pre change circumstances.	Small
Very slight change in baseline, i.e. pre-development view - change barely distinguishable from the surroundings. Composition and character of view substantially unaltered.	Negligible
No alteration to the existing view.	No change

18.3.11 Significance of Effects

The purpose of this LVIA is to determine, in a transparent way, the likely significant landscape and visual effects of the proposal. It is accepted that, due to the nature and scale of the Proposed Development, the proposal could potentially give rise to some notable visual and landscape effects.

GLVIA3 identifies that '*The Regulations require that a final judgment is made about whether or not each effect is likely to be significant. There are no hard and fast rules about what effects should be deemed 'significant' but LVIAs should always distinguish clearly between what are considered to be significant and non-significant effects'*.

Significance can only be defined in relation to each particular development and its specific location. The relationship between receptors and effects is not typically a linear one. It is for each LVIA to determine how judgements about receptors and effects should be combined to derive significance and to explain how this conclusion has been arrived at.

As a general guide it is considered that the following are likely to be considered effects of the greatest significance:

- Major loss or irreversible negative effects, over an extensive area, on elements and/ or aesthetic and perceptual aspects that are key to the character of nationally valued landscapes; or

- Irreversible negative effects on people who are particularly sensitive to changes in view, on recognised and important viewpoints or scenic routes, large-scale change which introduces non-characteristic, discordant or intrusive elements into the view.

The identification of significant effects would not necessarily mean that the effect is unacceptable in planning terms. What is important is that the likely effects on the landscape and visibility are transparently assessed and understood in order that the determining authority can bring a balanced, well-informed judgement to bear when making the planning decision.

The significance of effects on landscape, views and visual amenity are evaluated according to a six-point scale: Substantial, Major, Moderate, Minor, Negligible or None as presented in Table 18.5 below, which contains a description of the significance of effect criteria.

Table 18.5: Significance of Effect Criteria

Significance of Effect	Landscape Resource	Visual Resource
None	Where the project would not alter the Landscape character of the area.	Where the project would retain existing views.
Negligible	Where proposed changes would have an indiscernible effect on the character of an area.	Where proposed changes would have a barely noticeable effect on views/ visual amenity.
Minor	Where proposed changes would be at slight variance with the character of an area.	Where proposed changes to views, although discernible, would only be at slight variance with the existing view.
Moderate	Where proposed changes would be noticeably out of scale or at odds with the character of an area.	Where proposed changes to views would be noticeably out of scale or at odds with the existing view.
Major	Where proposed changes would be uncharacteristic and/ or would significantly alter a valued aspect of (or a high quality) Landscape.	Where proposed changes would be uncharacteristic and/ or would significantly alter a valued view or a view of high scenic quality.
Substantial	Where proposed changes would be uncharacteristic and/ or would significantly alter a Landscape of exceptional Landscape quality (e.g., internationally designated Landscapes), or key elements known to the wider public of nationally designated landscapes (where there is no or limited potential for substitution nationally).	Where proposed changes would be uncharacteristic and/ or would significantly alter a view of remarkable scenic quality, within internationally designated landscapes or key features or elements of nationally designated landscapes that are well known to the wider public.

For those effects indicated as being Moderate to Major the assessor will exercise professional judgement in determining if the effect is considered significant.

For the purposes of this assessment those effects indicated as being of Substantial or Major to Substantial were considered significant as highlighted in Table 18.6 in line with guidance provided in GLVIA3 (para 6.43). Effects of ‘Moderate’ and lesser significance have been identified in the assessment but are not considered significant

upon the character and quality of the landscape and on views although they remain worthy of consideration throughout the decision-making process.

Table 18.6: Significance of Effects Matrix

Magnitude of Impact	Sensitivity				
	Negligible	***Low***	***Medium***	***High***	***Very High***
No Change	None	None	None	None	None
Negligible	Negligible	Negligible to Minor	Negligible to Minor	Minor	Minor
Small	Negligible to Minor	Negligible to Minor	Minor	Minor to Moderate	Moderate to Major
Medium	Negligible to Minor	Minor	Moderate	Moderate to Major	Major to Substantial
Large	Minor	Minor to Moderate	Moderate to Major	Major to Substantial	Substantial

Change can be adverse or beneficial. A conclusion that an effect is 'significant' should not be taken to imply that the proposal is unacceptable. Significance of effect needs to be considered with regard to the scale over which it is experienced.

18.3.12 Cumulative Landscape & Visual Effects

The methodology for assessment of cumulative impacts has been derived from Guidelines for Landscape and Visual Impact Assessment, Third Edition (The Landscape Institute and Institute of Environmental Management & Assessment, 2013) (GLVIA3).

The purpose of the Cumulative Landscape and Visual Impact Assessment (CLVIA) is to consider the landscape and visual impacts of the Proposed Development when viewed in context with other similar development.

Cumulative effects consist of direct effects on the physical character of the site containing the development, and indirect, perceived effects on the character of areas from which the developments would be visible. GLVIA3 identifies effects as follows:

- Cumulative effects as 'the additional changes caused by a proposed development in conjunction with other similar developments or as the combined effect of a set of developments, taken together' (NatureScot, 2012:4).
- Cumulative landscape effects as effects that 'can impact on either the physical fabric or character of the landscape, or any special value attached to it' (NatureScot, 2012:10).
- Cumulative visual effects as effects that can be caused by combined visibility, which 'occurs when the observer is able to see two or more developments from one viewpoint' and/or sequential effects which 'occur when the observer has to move to another viewpoint to see different developments' (NatureScot, 2012:11).

The significance of any identified cumulative landscape and visual effect has been assessed as per the main LVIA methodology. These categories have been based on the same combination of receptor sensitivity and predicted magnitude of impact in order to identify the residual significance of effects.

18.4 Receiving Environment

18.4.1 General Overview

The Proposed Development and associated Study Area is located at the Burrow, a sandy spit that separates the outer Rogerstown Estuary from the Irish Sea. The Burrow is fronted by a wide sandy beach and is bordered by rock headlands at Rush towards the north and Portrane to the south.

The nature of the spit and beach is strongly influenced by the tidal action of the estuary and waves approaching the shoreline from the Irish Sea. Lambay Island, which lies around 5km east of the beach, also influences both the wave and tidal conditions. The beach at the Burrow is around 1.8km long, with a bathing area at its southern end that has been awarded Blue Flag status. It is a popular recreational location that offers many amenities to the public and tourists throughout the year.

The Burrow is moderately populated with residential housing which becomes more populated further south and southwest towards Portrane Demesne and Donabate, respectively. There are also several areas of farmland in the surrounding area. Dublin City is located approximately 19km west of the Proposed Development site.

18.4.2 Landscape Character Assessment Fingal County Development Plan 2023 – 2029

The Proposed Development site and associated study area are located within the Fingal County Council area, covered by the Fingal County Development Plan 2023 – 2029 (CDP). As part of the CDP, Fingal Council has carried out a Landscape Character Assessment, which identifies six Landscape Character Types (LCT).

A review of the Landscape Character Assessment accompanying the CDP has identified that the Proposed Development is located within the Estuary LCT and the Coastal LCT.

18.4.2.1 Estuary LCT

The CDP describes the Estuary Character Type as being '*categorised as having an exceptional value, recognised by the EU designations (candidate Special Areas of Conservation and Special Protection Areas) that apply to each in addition to national designations such as proposed Natural Heritage Areas and Ramsar. Estuary Character consists of the three large sand spits which have created protected estuarine and saltmarsh habitats of great ornithological and ecological interest at Rogerstown, Swords/ Malahide and Baldoyle. The flat horizontal nature of estuaries means that views are generally contained within the low hills and dunes that enclose these areas. There are some groups of trees to the edges of the estuary zones especially to the north side of the Swords/Malahide estuary. The character of these zones can alter depending on the tidal condition. The aesthetic quality of the estuaries is also outstanding*.'

The CPD also defines the Estuary LCT as having an Exceptional Landscape Value and a High Landscape sensitivity.

18.4.2.2 Coastal LCT

The CPD describes the Coastal Character Type as being '*categorised as having an exceptional landscape value. The type forms the eastern boundary of the County and contains a number of important beaches, islands and headlands that together create a landscape of high amenity and landscape value. A number of important settlements are located within this area, including Balbriggan, Skerries, Rush, Malahide, Portmarnock and Howth. The land is generally low lying, with the exception of some prominent headlands and hills in the northern part of the area, Howth and the offshore islands. Most of the Howth peninsula is covered by the 1999 Special Amenity Area Order (SAAO). There are a number of important demesne or estate landscapes containing important woodlands in or adjoining this area at Ardgillan, Hampton, Milverton and Portrane. Horticulture (around Rush), golf courses and individual dwellings are prevalent land uses in the area also. Views along the coast are generally contained within headlands, ridgelines and harbours, creating a number of visual compartments. The Coastal Character Type is categorised as having an exceptional landscape value. This value is arrived at due to the combination of visual, ecological, recreational and historical attributes. The area has magnificent views out to sea, to the islands and to the Mourne and Wicklow mountains and contains numerous beaches and harbours. The area's importance is highlighted by the High Amenity zoning covering substantial parts of the area. The area is rich in archaeological, architectural and natural heritage and is of high ecological value*.'

The CPD also defines the Coastal LCT as having an Exceptional Landscape Value and a High Landscape sensitivity.

18.4.3 Landscape Policies Fingal County Development Plan 2023 – 2029

Policies of relevance to landscape and visual amenity are documented in Chapter 9 of the CDP. General policies of relevance to this LVIA are set out below:

- **Policy GINHP2:** Ensure that areas and networks of Green Infrastructure are identified, protected, enhanced, managed and created to provide a wide range of environmental, social and economic benefits to communities.
- **Policy GINHP4:** Ensure the Green Infrastructure strategy for Fingal protects existing Green Infrastructure resources and plans for future Green Infrastructure provision which addresses the five main themes identified in this Plan, namely: Biodiversity, Parks, Open Space and Recreation, Sustainable Water Management, Archaeological and Heritage landscapes, Landscape.
- **Policy GINHP9:** Ensure Green Infrastructure provision responds to and reflects landscape character including historic landscape character, conserving, enhancing and augmenting the existing landscapes and townscapes of Fingal which contribute to a distinctive sense of place.
- **Policy GINHP12:** Protect areas designated or proposed to be designated as Natura 2000 sites (i.e. Special Areas of Conservation (SACs) and Special Protection Areas (SPAs), proposed Natural Heritage Areas (pNHAs), Natural Heritage Areas (NHAs), Statutory Nature Reserves, and Refuges for Fauna.

- **Policy GINHP21:** Protect existing woodlands, trees and hedgerows which are of amenity or biodiversity value and/or contribute to landscape character and ensure that proper provision is made for their protection and management.
- **Policy GINHP22:** Provide for appropriate protection of trees and hedgerows, recognising their value to our natural heritage, biodiversity and climate action and encourage tree planting in appropriate locations.
- **Policy GINHP24:** Support the aims and objectives of the European Landscape Convention by implementing the relevant objectives and actions of the National Landscape Strategy 2015-2025.
- **Policy GINHP25:** Ensure the preservation of the uniqueness of a landscape character type by having regard to the character, value and sensitivity of a landscape when determining a planning application.
- **Policy GINHP26:** Preserve Views and Prospects and the amenities of places and features of natural beauty or interest including those located within and outside the County.
- **Policy GINHP28:** Protect High Amenity areas from inappropriate development and reinforce their character, distinctiveness and sense of place.

18.4.4 Landscape Designations Fingal County Development Plan 2023 – 2029

As mentioned previously the Proposed Development site lies within the Fingal County Council area, covered by the CDP. A review has taken place of the CDP and other relevant statutory documents to establish if there are any relevant landscape related designations that may influence the assessment within the Study Area.

18.4.4.1 Areas of High Amenity

A review of the CDP has identified that all elements of the Proposed Development are located on lands that have been classified as being of High Amenity, which are applied to areas of the County of high landscape value (refer Sheet 14: Green Infrastructure Map 1 of the CDP).

18.4.4.2 Protected Views

A review of the CDP has identified that lands associated with the Proposed Development do not fall within areas that have been classified as 'Preserve Views' (refer Sheet 14: Green Infrastructure Map 1 of the CDP).

18.5 Proposed Development

The Proposed Development for the Burrow is split into three areas, the northern extent of the spit at the end of Burrow Road, at Marsh Lane, and along Portrane beach. The Proposed Development consists of the following main elements:

- Construction of a *c.*190m long earth embankment at the end of Burrow Road.
- Construction of a *c.*130m long sheet piled flood wall and a *c.*200m embankment along Marsh Lane.
- Installation of back drainage behind the proposed defences with associated outfalls.
- Installation of non-return valves to existing outfalls to prevent backflow of water from the estuary.

- The construction of c. seven fishtail (or 'Y' shaped) groynes structures in combination with a beach renourishment scheme. These groyne structures will help control the longshore and cross-shore transport elements of the prevailing littoral drift along *c.*1.3km of the coastline of the Burrow.
    - Each groyne will extend seaward by approximately 70m at a spacing of *c.*175m to create seven sediment sub-cells along the Burrow.
    - The beach renourishment will involve transporting dredged material from a licenced marine aggregate extraction site (presently assumed to be Liverpool Bay) to the Burrow and pumping the material ashore to fill each of the seven sediment sub-cells created by the fishtail groyne structures.

The location and extent of the Proposed Development are illustrated in Chapter 3, Figure 3.4. Typical cross-sections and further information regarding the flood embankments, flood walls and beach elements are presented in Chapter 3, Figure 3.5 to Figure 3.7 respectively.

Where there is potential for minor deviations in respect of project components, for example heights of walls above the ground, in all instances the maximum/most onerous design parameter has been applied to ensure a robust "worst case scenario" assessment.

18.6 Landscape Impacts

18.6.1 Landscape Character Type Impacts

The assessment of landscape effects follows the methodology previously described in Section 18.2 and considers those effects which are predicted to occur during the construction and operational phases of the Proposed Development.

The assessment of construction phase effects relates to the following identified activities:

- Construction works associated with the formation of the new walls and embankments proposed as part of the Proposed Development.
- Construction works and activities associated with the formation of the 7Nr. coastal groynes.
- Transportation of dredged materials for beach renourishment and associated offshore pumping equipment.
- Delivery of materials to working areas.
- Localised site clearance and reinstatement.

The construction phase associated with the Proposed Development will result in additional built elements, such as new walls, embankments and groynes being introduced into the landscape. The operational phase will result in new built form being visible within the surrounding landscape.

An assessment of the significance of impact arising during the construction and operational phases on the landscape character types described in Section 18.3 previously are presented in Table 18.7 and Table 18.8.

Table 18.7: Estuary Landscape Character Type; Predicted Impacts

Estuary Landscape Character Type	
Sensitivity	Proposed earth embankments on Burrow Road and sheet piled walls and embankments on Marsh Lane, associated with the Proposed Development are located within this LCT. The LCT is considered, by the CDP, to have a High Landscape Sensitivity and an Exceptional Landscape Value. Key characteristics of the LCT in the vicinity of the Proposed Development which, together with field work, have informed an understanding of the susceptibility of this landscape to the development proposed are described as: • A general lack of elevation, with hedgerows, garden boundary vegetation and trees forming enclosure; • Localised panoramic views available, particularly from western shoreline and coastal areas with more elevated, distant lands forming enclosure; • Large/ medium scale field pattern, generally arable in nature, with fields defined by post and wire fencing and instances of hedgerows; • Timber poles carrying overhead lines add verticality at a local level, with overhead lines perceived at varying distances; and • Built form associated with Burrow influences the character of the LCT at a local level. Overall, the character of the LCT within proximity to the Proposed Development is influenced by roadside vegetation, garden boundary vegetation which form a strong sense of enclosure. The existing road infrastructure, residential development and vertical elements such as timber poles carrying overhead lines, do impact on the character of the LCT, however in the vicinity of the Proposed Development the LCT does retain a primarily rural character. Taking account of the above characteristics and the influence of existing man-made features, the susceptibility of the LCT to the type of development proposed is judged to be high. Lands within the LCT, associated with the Proposed Development have been designated as High Amenity Lands. Given the influences of existing vegetation cover, garden boundary vegetation and centralised residential development the overall value of the LCT within the study area is judged to be high. Based on the susceptibility and value attached to this LCT, the overall sensitivity of this LCT is judged to be high.
Magnitude of Change	Direct impacts on this LCT will arise from the physical construction of new earth embankments and sheet piled walls, as well as re-instatement works associated with work compound areas located within adjacent agricultural fields. Such works will result in the localised temporary loss of rough grass/ grazing lands, along with replacement of existing walls along shoreline areas of Marsh Lane. The construction of new walling and the formation of new earth embankments on Marsh Lane and Burrow Road will require construction equipment and activities that will be locally visible during the construction phase. It is considered that construction activities will have a localised effect only, as construction phase activities are readily absorbed into the surrounding landscape and will become screened by existing vegetation, including roadside hedgerows and garden boundary vegetation which includes coniferous species. Localised portions of the LCT adjacent to, but beyond the works boundary of the Proposed Development are predicted to experience indirect effects as a consequence of

Estuary Landscape Character Type	
	the formation of the new elements, though the predicted impacts are negated by surrounding vegetation which provide visual containment. The predicted magnitude of change associated with the construction phase of the new walls are considered to be localised, short term and small during the construction phase, restricted to land contained within the site boundary. During the operational phase, new walls and embankments will be perceived as a very minor addition locally, as the introduction of walls is not uncharacteristic within the surrounding landscape and will not be obvious within the wider context. The predicted magnitude of change in the landscape resource is considered to be localised and negligible during the operational phase.
Significance of Landscape Effect during Construction Phase	Minor to moderate, temporary, short term, effects assessed as not significant are predicted to be experienced during the construction phase of the Proposed Development. Remaining portions of the LCT are predicted to experience no significant effects.
Significance of Landscape Effect during Operational Phase.	Minor localised, long-term effects, assessed as not significant are predicted to be experienced during the operational phase. Effects are limited in extent by surrounding vegetation cover and built form with elements perceived as a minor localised addition to the overall LCT. Remaining portions of the LCT are predicted to experience no significant effects during the operational phase.

Table 18.8: Coastal Landscape Character Type; Predicted Impacts

Coastal Landscape Character Type	
Sensitivity	Construction activities and works associated with the formation of the groynes and beach renourishment works associated with the Proposed Development are located within this LCT. The LCT is considered, by the CDP, to have a High Landscape Sensitivity and an Exceptional Landscape Value. Key characteristics which, together with field work, have informed an understanding of the susceptibility of this landscape to the development proposed are described as: • Residential development towards the south of the LCT adds variety and interest within the LCT; • Sand dune systems along the eastern edge of Burrow locally views; • More open, sand dune system present to the north of the LCT, with more recreational activities present; • Built form of Burrow, increases the sense of enclosure within more inland areas, • Garden boundary vegetation, adds local sense of enclosure, with coniferous species present; • Existing coastal erosion defences, including rock armour and concrete block systems are locally prominent though not dominant due to low level form; • Whilst there is a general lack of elevation within the LCT, coastal views are limited from within more inland areas, though do become more prominent from southern and northern areas of Burrow; • Open panoramic views available from eastern coastal/ shoreline areas; • Where visible, the road networks add movement locally within the landscape, • Timber poles carrying overhead lines add verticality at a local level, with overhead lines perceived at varying distances; and • Built form associated with burrow locally influences the character of the LCT. Overall, the character of the LCT within proximity to the Proposed Development is influenced by the existing coastal development, which is primarily residential in nature, vegetation which includes garden boundary vegetation of varying types and forms, which form a sense of enclosure locally. The existing road infrastructure, residential development and vertical elements such as timber poles carrying overhead lines, do impact on the character of the LCT, however in the vicinity of the Proposed Development the LCT does retain a coastal character. Taking account of the above characteristics and the influence of existing man-made features, the susceptibility of the LCT to the type of development proposed is judged to be high. Lands within the LCT, associated with the Proposed Development have been designated as High Amenity Lands. Given the influences of woodland, existing road corridors and development the overall value of the LCT within the study area is judged to be high. Based on the susceptibility and value attached to this LCT, the overall sensitivity of this LCT is judged to be high.
Magnitude of Change	Direct impacts on southern portions of the LCT will arise from the physical construction of the new beach groynes and works associated with the beach renourishment. Works associated with the re-instatement of the compound area located on open land, within the existing development of Burrow will be locally prominent and may require the removal of existing council equipment (fitness trail) adjacent to Burrow Road. Works associated with

Coastal Landscape Character Type	
	the re-instatement of the compound area will result in the localised temporary loss of grassed open space, along with replacement of existing fitness trail equipment, whilst works associated with the formation of the groynes will see the replacement of existing coastal defences (concrete blocks) with new protection measures. New groynes will require construction equipment and activities that will be visible during the construction phase. It is considered that construction activities will have a localised effect only, as construction phase activities are readily absorbed into the surrounding landscape. Localised portions of the LCT adjacent to, but beyond the works boundary of the Proposed Development are predicted to experience indirect effects as a consequence of the works, though the predicted impacts are negated by vegetation and development which provide visual containment from within more central portions of the LCT. The predicted magnitude of change associated with the construction phase is considered to be localised, short term and medium during the construction phase, restricted to land contained within the site boundary. During the operational phase, new beach groynes will be perceived as a minor addition locally, as the introduction of such features, whilst new and uncharacteristic will be readily absorbed within the surrounding landscape and will not be obvious within the wider context. The predicted magnitude of change in the landscape resource is considered to be localised and negligible during the operational phase.
Significance of Landscape Effect during Construction Phase	Moderate to major, localised, temporary, short term, effects assessed as significant are predicted to be experienced during the construction phase of the Proposed Development. Remaining portions of the LCT are predicted to experience no significant effects.
Significance of Landscape Effect during Operational Phase.	Minor localised, long-term effects assessed as not significant are predicted to be experienced during the operational phase. Effects are limited in extent and the low built form associated with the Proposed Development are considered not to substantially alter the LCT at a local level, with existing elements of the LCT remaining the key character. Remaining portions of the LCT are predicted to experience no significant effects during the operational phase.

18.6.2 Landscape Designation Impacts

An assessment of the significance of impact arising during the construction and operational phases on the landscape designations identified and described in Section 18.3 previously are provided in Table 18.9.

Table 18.9: Areas of High Amenity; Predicted Impacts

Areas of High Amenity	
Sensitivity	All elements of the Proposed Development are located on land identified as an Area of High Amenity. This designation covers lands along eastern, northern and western portions of Burrow, and is generally comprised of scattered large to medium scale fields shorelines associated with Rogerstown Estuary and the Irish Sea and residential development, which is largely located on more inland areas. Taking account of the characteristics and the influence of existing manmade features within the Study Area the susceptibility of the designation to the type of development proposed is judged to be high. The overall value of the designation is considered to be high as it is a regional level designation. Based on the susceptibility and value attached to this designation, the overall sensitivity is judged to be high.
Magnitude of Change	Construction traffic and construction activities associated with the formation of the Proposed Development, including new wall sections, earth embankments and the beach groynes are considered to have a localised, short-term impact on the designation during the construction phase of the Proposed Development. The predicted magnitude of change associated with the construction phase is considered to be small, as the wider character of the designation will remain unaltered. The predicted magnitude of change in the landscape resource is considered negligible during the operational phase as new elements are readily absorbed into the surrounding landscape.
Significance of Landscape Effect during Construction Phase	Minor to moderate, localised, short-term effects assessed as not significant are predicted to be experienced during the operational phase.
Significance of Landscape Effect during Operational Phase.	Minor localised, long-term effects assessed as not significant are predicted to be experienced during the operational phase.

Table 18.10 below summarises the predicted significance of landscape effect for each of the previously assessed landscape character types and designations.

Table 18.10: Landscape Impacts; Predicted Impacts

Landscape Character/ Landscape Designation	Predicted Construction Phase Landscape Effects	Predicted Operational Phase Landscape Effects
Estuary LCT	Minor to moderate, temporary, short term, effects assessed as not significant	Minor localised, long-term effects assessed as not significant.
Coastal LCT	Moderate to major, localised, temporary, short term, effects assessed as significant	Minor localised, long-term effects assessed as not significant
Areas of High Amenity	Minor to moderate, localised, short-term effects assessed as not significant	Minor localised, long-term effects assessed as not significant

18.7 Visual Impacts

Viewpoints used in the following visual impact assessment have been selected to meet the following criteria:

- A balance of viewpoints from where the main direction of view is towards the Proposed Development.
- A range of views towards the Proposed Development from within the Study Area.
- Locations of interest e.g., recreational areas, local roads, settlements, footpaths.

To avoid repetition, an assessment of construction phase impacts and predicted operational phase impacts is included within the following viewpoint assessment tables.

Table 18.11: Viewpoint 1 – Burrow Road

Viewpoint 1 – Burrow Road			
Grid Ref	724721, 752382	**Existing View Figure Number**	Appendix 18.1; VP01 Burrow Road
Direction of View	North-west	**Approx. Distance from Development**	1m
Description of existing view and potential receptors	This viewpoint is located on the western edge of Burrow Road in the vicinity to residential dwellings, approximately 140m south-west of the embankment proposed as part of the Proposed Development works on Burrow Road. Views north-west from this location, as represented in Appendix 18.1: VP01 – Burrow Road; Existing View, are partially enclosed by existing roadside vegetation though become more open and panoramic in nature beyond. The immediate foreground is comprised of existing roadside hedgerow, with mid-distance lands characterised by rough grasslands and mixed scrub vegetation. Rooflines associated with residential properties are visible at distance within the central portion of the view, though the dwellings are partially screened by intervening garden boundary vegetation. distant horizons are partly formed by more elevated lands associated with Rogerstown Park, which forms a distinct horizon line whilst remaining horizons are formed by existing tree canopies on lower elevated lands adjacent. The railway bridge crossing is visible to the		

Viewpoint 1 – Burrow Road	
	left of the view, whilst an operational wind turbine is also perceived above existing tree canopies. Timber poles carrying overhead lines, are visible throughout the view at varying distances, adding verticality to the view. The view is considered to be representative of views experienced primarily by road users traveling north on the Burrow Road, though is also experienced by residential receptors in the immediate vicinity and recreational receptors on the Burrow Road.
Sensitivity	Residential and recreational receptors are judged to be of a high susceptibility to change in their views, whilst transient receptors on the Burrow Road are judged to be of a low susceptibility to change as their main focus is on the direction of travel and roadside vegetation focuses the view along the direction of travel. The viewpoint does not represent a recognised stopping place and does not form part of a recognised tourist route. However, the views experienced are available to residential receptors in the vicinity, and the overall value of the view available is judged to be medium. Overall, considering the receptor susceptibility and the value of the view the sensitivity is judged to be medium.
Magnitude of Change – Construction Phase	During the construction phase, operations and machinery movements associated with the Proposed Development will be partially visible at mid-distance within a small cental portion of the available view, with works and activities seen below and against an exisitng backdrop which includes existing vegetation and residential development. Construction phase activities and vehicular movements will be viewed as a minor change to the overall view. Overall, the magnitude of change during the construction phase of the Proposed Development is judged to be localised and medium as the wider view available remains unaltered.
Magnitude of Change – Operational phase	During the operational phase, the earthworks embankment associated with the Proposed Development will be not easily discernible as a new element, due to screening provided by existing roadside vegetation and the proposed grassed finish to the earthworks slopes. It is considered that where discernible, visible portions of the Proposed Development will not look out of place in the view and will not form a prominent or dominant feature. Overall, the magnitude of visual impact during the operational phase is judged to be negligible.
Significance of Visual Effect during Construction Phase	Localised Moderate, temporary, assessed as not significant, effects predicted to be experienced during the construction phase of the Proposed Development.
Significance of Visual Effect during Operational Phase	Localised negligible to minor, long term, reversible effects assessed as not significant, predicted to be experienced during the operational phase of the Proposed Development.

Table 18.12: Viewpoint 2 – R126 (Quay Road)

Viewpoint 2 – R126 (Quay Road)			
Grid Ref	725580, 750902	**Existing View Figure Number**	Appendix 18.1; VP02 R126 (Quay Road)
Direction of View	North-west	**Approx. Distance from Development**	275m
Description of existing view and potential receptors	This viewpoint is located on the grassed very adjacent to the R126 (Quay Road) in proximity to its junction with Seaview Park, in the vicinity to residential dwellings, approximately 275m south-east of the proposed groynes, associated with the coastal defence and beach renourishment elements of the Proposed Development. Views north-west from this location, as represented in Appendix 18.1: VP02 – R126 (Quay Road); Existing View, are open, expansive and panoramic in nature. Existing road network and associated footpath networks form the immediate foreground which are physically separated from the tidal portions by existing stone and concrete walling. Development associated with the south-eastern areas of Burrow are visible across the mid-distance, whilst mixed development associated with Rush forms a minor element below distant horizons, with both being read as a single element within the view. mid-distance horizons are formed by rooflines associated with Burrow, which are often elevated by localised instances of upper tree canopies, often coniferous. Existing coastal defence system of concrete blocks forms a minor element of the view, visible in proximity to the built form of Burrow. Street lighting columns adjacent to the road network adds verticality to the view, though these become less prominent with distance. The tower associated with St Catherine's Church, is visible to the left of the view, forming a localised point of interest. The view is considered to be representative of peripheral views experienced by road users traveling east – west along the R126 (Quay Road) though are also experienced by receptors on the footpath network and the residential dwellings to the rear of the viewpoint location. This view however is also experienced by residential receptors in the immediate vicinity and recreational receptors on the R126 (Quay Road).		
Sensitivity	Residential and receptors on the local footpath network are judged to be of a high susceptibility to change in their views, whilst transient receptors on the R126 (Quay Road) are judged to be of a low susceptibility to change as their main focus is on the direction of travel. The viewpoint does not represent a recognised stopping place and does not form part of a recognised tourist route. However, the views experienced are available to residential receptors in the vicinity, and the overall value of the view available is judged to be high. Overall, considering the receptor susceptibility and the value of the view the sensitivity is judged to be high.		
Magnitude of Change – Construction Phase	During the construction phase, operations and machinery movements associated with the Proposed Development will be visible at mid-distance within the cental portion of the available view, with works and activities seen below existing horizons formed by vegetation and built form associated with Burrow. Construction phase activities will be viewed more extensively during low water periods as groynes are extended seawards. Construction phase activities and vehicular movements associated with the formation of the groynes will be viewed as a moderate change to the overall view. Constrution phase operations associated with the beach renourishment phase of the Proposed Development will be viewed as a minor change within the overall view, as operaions and		

Viewpoint 2 – R126 (Quay Road)	
	activites will be distinguishable but do not significantly alter the character or composition of the view available from this location. Overall, the magnitude of change during the construction phase of the Proposed Development is judged to be localised and medium as the wider view available remains unaltered.
Magnitude of Change – Operational phase	During the operational phase, the groynes associated with the Proposed Development will be discernible as a new element within the view, though are considered not to substantially alter the scale or character of the view. Visible portions of the Proposed Development will be viewed adjacent to and well below the existing horizons formed by the built form of Burrow, with features of the view such as the tower at St Catherine's Church, distant horizons containing built form of Rush and localised instances of mixed vegetation retaining visual prominence. Overall, the magnitude of visual impact during the operational phase is judged to be small.
Significance of Visual Effect during Construction Phase	Localised Moderate to major, temporary, assessed as significant, effects predicted to be experienced during the construction phase of the Proposed Development.
Significance of Visual Effect during Operational Phase	Localised Minor to moderate, long term, reversible effects assessed as not significant, predicted to be experienced during the operational phase of the Proposed Development.

Table 18.13: Viewpoint 3 – Rush Beach

Viewpoint 3 – Rush Beach			
Grid Ref	725793, 753140	**Existing View Figure Number**	Appendix 18.1; VP03 Rush Beach
Direction of View	South	**Approx. Distance from Development**	800m
Description of existing view and potential receptors	This viewpoint is located on an informal pathway on an elevated section of the grassed dunes system to the immediate north of Rush Beach, adjacent to Rush Golf Course, approximately 800m north-east of the proposed groynes, associated with the coastal defence and beach renourishment elements of the Proposed Development. Views south from this location, are represented in Appendix 18.1: VP03 – Rush Beach; Existing View. The available view from this location is open, expansive and panoramic in nature. The immediate foreground of the view from this location is comprised of grassed sections of the dune system, which form a distinct element of the view, and which act as a natural boundary with the adjacent beach. Mid-distance is predominantly open water associated with the Irish Sea, and the channel to Rogerstown Estuary which extends across the whole of the view. Distant portions of the view contain visibility of the mixed built form associated with Burrow, which is viewed amongst existing vegetation cover. Vertical elements such as the Martello Tower at Portrane, Portrane Round Tower, water tower and the tower associated with St Ita's Hospital are visible above the intermediate horizon and add distinct focal draws to the view. Existing coastal defences associated with Burrow are difficult to perceive at this distance, though where visible form a very minor element of the view. More distance horizons are formed by more elevated land at Howth, to the left of the view and elevated lands to the south of Dublin.		

Viewpoint 3 – Rush Beach	
	The view is considered to be representative of views experienced by recreational receptors and southern views from residential properties within the vicinity of the viewpoint location.
Sensitivity	Recreational and residential receptors are judged to be of a high susceptibility to change in their views. The viewpoint does not represent a recognised stopping place and does not form part of a recognised tourist route. However, the views experienced are available to recreational and residential receptors and the overall value of the view available is judged to be high. Overall, considering the receptor susceptibility and the value of the view the sensitivity is judged to be high.
Magnitude of Change – Construction Phase	During the construction phase, operations and machinery movements associated with the Proposed Development will be visible at distance within a small cental portion of the available view, with works and activities seen below existing horizons formed by vegetation and built form associated with Burrow. Construction phase activities and vehicular movements associated with the formation of the groynes will be viewed as a minor change to the overall view. Constrution phase operations associated with the beach renourishment phase of the Proposed Development will be viewed as a negligible change within the overall view, as operaions and activites will be distinguishable but do not significantly alter the character or composition of the view available from this location. Overall, the magnitude of change during the construction phase of the Proposed Development is judged to be localised and small as the wider view available remains unaltered.
Magnitude of Change – Operational phase	During the operational phase, the groynes associated with the Proposed Development will not be easily discernible within the view, as they will be read well below existing horizons and against a strongly vegetated backdrop, which aids integration. Existing features and visual draws of the view such as Martello Tower at Portrane, Portrane Round Tower, water tower and the tower associated with St Ita's Hospital, will remain as localised points of interest within the view, with distant horizons containing built form associated with Burrow and Portrane and localised instances of mixed vegetation retaining visual prominence. Overall, the magnitude of visual impact during the operational phase is judged to be negligible.
Significance of Visual Effect during Construction Phase	Localised minor to moderate, temporary, assessed as not significant, effects predicted to be experienced during the construction phase of the Proposed Development.
Significance of Visual Effect during Operational Phase	Localised Minor, long term, reversible effects assessed as not significant, predicted to be experienced during the operational phase of the Proposed Development.

Table 18.14: Viewpoint 4 – Burrow Road

Viewpoint 4 – Burrow Road			
Grid Ref	724736, 751770	**Existing View Figure Number**	Appendix 18.1; VP04 Burrow Road
Direction of View	South-west	**Approx. Distance from Development**	200m
Description of existing view and potential receptors	This viewpoint is located on the footpath on the western side of Burrow Road at a point where roadside vegetation permits open views, approximately 200m north-east of the proposed earth embankment associated with Marsh Lane section of the Proposed Development. Views south-west from this location, are represented in Appendix 18.1: VP04 – Burrow Road; Existing View. The immediate foreground of the available view from this location is grassed pastureland, which is partially defined by roadside vegetation (not visible in the representative view) and becomes restricted in nature by existing residential development, garden boundary treatments, which include high vertical timber board fencing and existing vegetation. Central portions of the available view as represented, become more open in nature, agricultural lands visible amongst a well vegetated landscape. Whilst there is a relative lack of elevation, existing horizons are formed by upper canopies of coniferous woodland, scattered trees and hedgerow. Rooflines of residential dwellings are perceived beyond and below existing vegetation cover, whilst an operational turbine is visible above Carr's Mill tower to the right of the view. The view is considered to be representative of views experienced by receptors on the footpath (recreational), residential properties within the vicinity of the viewpoint location and peripheral views available for a short duration from transient receptors traveling north-south on Burrow Road.		
Sensitivity	Recreational and residential receptors are judged to be of a high susceptibility to change in their views, whilst transient receptors on Burrow Road are considered to be of a medium sensitivity to change. The viewpoint does not represent a recognised stopping place and does not form part of a recognised tourist route. However, the views experienced are available to recreational and residential receptors and the overall value of the view available is judged to be high. Overall, considering the receptor susceptibility and the value of the view the sensitivity is judged to be medium.		
Magnitude of Change – Construction Phase	During the construction phase, operations and machinery movements associated with the formation of the new earth embankment will be fully visible at mid-distance within a small portion of the available view, with works and activities seen well below existing horizons and viewed against a well vegetated backdrop which will aid integration. Construction phase activities and vehicular movements associated with the formation of the new earth embankment will be viewed as a minor change to the overall view. Overall, the magnitude of change during the construction phase of the Proposed Development is judged to be localised and medium as the wider view available remains unaltered.		
Magnitude of Change – Operational phase	During the operational phase, the new section of earth embankment will be read as a new feature for a short duration, whilst grass seeding establishes and softens the feature. New sections of embankment will be read in combination with the existing residential property, though viewed well below existing horizons and viewed against a well vegetated backdrop which aids its integration into the wider view. Existing elements of		

Viewpoint 4 – Burrow Road	
	the view will retain their visual prominence, and the character of the view will not be substantially altered by the Proposed Development. Overall, the magnitude of visual impact during the operational phase is judged to be negligible.
Significance of Visual Effect during Construction Phase	Localised moderate, temporary, assessed as not significant, effects predicted to be experienced during the construction phase of the Proposed Development.
Significance of Visual Effect during Operational Phase	Localised Negligible to minor, long term, reversible effects assessed as not significant, predicted to be experienced during the operational phase of the Proposed Development.

Table 18.15: Viewpoint 5 – Marsh Lane

Viewpoint 5 – Marsh Lane			
Grid Ref	724754, 751757	**Existing View Figure Number**	Appendix 18.1; VP05 Marsh Lane
Direction of View	South-west	**Approx. Distance from Development**	50m.
Description of existing view and potential receptors	This viewpoint is located on Marsh Lane approximately 50m north-east of the proposed earth embankment proposed adjacent to Marsh Lane. Views south-west from this location, as represented in Appendix 18.1: VP05 – Marsh Lane; Existing View, are restricted and focused in nature by existing vegetation to the right of the view, and concrete block walling associated with the adjacent residential property to the right of the view. The immediate foreground of the view is comprised of Marsh Lane, whilst an agricultural field utilised for grazing purposes is visible beyond the timber fence. Boundaries of the agricultural field are well defined by existing mature vegetation, which includes scattered trees of varying species. More elevated land, forming partially screened horizons are associated with agricultural lands at Rahillion, though the horizon line is often punctuated and elevated by intervening vegetation cover. Timber poles carrying overhead lines are visible at a variety of distances within the view, adding verticality. The view is considered to be representative of views experienced by transient receptors on Marsh Lane and views from residential properties within the vicinity of the viewpoint location.		
Sensitivity	Residential receptors are judged to be of a high susceptibility to change in their views, whilst transient receptors on Marsh Lane are considered to be of a medium susceptibility to change as their main focus will be on traversing the route. The viewpoint does not represent a recognised stopping place and does not form part of a recognised tourist route. However, the views experienced are available to recreational and residential receptors and the overall value of the view available is judged to be high. Overall, considering the receptor susceptibility and the value of the view the sensitivity is judged to be medium.		
Magnitude of Change – Construction Phase	During the construction phase, operations and machinery movements associated with the Proposed Development will be visible at mid distance across the central portion of		

Viewpoint 5 – Marsh Lane	
	the view, though perceived below and against existing field boundary hedgerows on more elevated land. Construction phase activities and vehicular movements will be viewed as a moderate change to the overall view. Overall, the magnitude of change during the construction phase of the Proposed Development is judged to be localised and medium.
Magnitude of Change – Operational phase	During the operational phase, the new section of earth embankment will be read as a new feature for a short duration, whilst grass seeding establishes and softens the feature. New sections of embankment will be viewed beyond existing field boundaries, though viewed well below existing horizons and viewed against a well vegetated backdrop which aids its integration into the wider view. Existing elements of the view will retain their visual prominence, and the character of the view will not be substantially altered by the Proposed Development. Overall, the magnitude of visual impact during the operational phase is judged to be negligible.
Significance of Visual Effect during Construction Phase	Localised moderate, temporary, assessed as not significant, effects predicted to be experienced during the construction phase of the Proposed Development.
Significance of Visual Effect during Operational Phase	Localised Negligible to minor, long term, reversible effects assessed as not significant, predicted to be experienced during the operational phase of the Proposed Development.

18.7.1 Protected Views

An assessment of the Protected Views (identified as Preserve Views in the CPD) has been undertaken in combination with the individual viewpoint assessments. Overall, it is considered that the Proposed Development will not have any significant effect on views available as elements of the Proposed Development are not contained within any identified 'Preserved View' locations.

18.7.2 Visual Impacts on Residential Properties

As part of the visual effects assessment associated with the Proposed Development, assessment of the predicted visual impacts on residential receptors that occur within close proximity to each section of the development has been undertaken. A review of the properties within the vicinity of each section of the Proposed Development has identified that the following properties are predicted to experience views during the construction and operational phases:

- 2 properties at northern end of Burrow Road, located immediately north of the Proposed Development (embankment) and in close proximity to the site works compound for this section of the works.
- 5 properties on the eastern side of Burrow Road in proximity to the Proposed Development (embankment) and site compound for this section of the works.
- 2 properties on Marsh Lane with direct views of the Proposed Development (embankment and sheet piled wall).

- 9 properties in close proximity to the site works compound associated with Marsh Lane section of the Proposed Development.
- 12 properties on Seaview Park, with northern views along the coastline where the Proposed Development (groynes and beach renourishment) will be visible in views.
- Approximately 20 properties with direct views of the Proposed Development (groynes and beach renourishment) lying along eastern portions of the Burrow peninsula.

Potential views from properties beyond those identified above are considered to be screened by intervening built form, garden boundary vegetation and roadside vegetation. In many instances garden boundary vegetation, mounding, fences, roadside vegetation, field boundary vegetation and sand dune systems along the eastern coastline restrict visibility of the Proposed Development and associated works compounds, particularly from lower, single storey dwellings.

For the purposes of this assessment residential receptors have been considered as being of high sensitivity to the type of development proposed.

For all residential properties identified above, it is considered that construction phase operations will be locally visible, though partially screened by various garden treatments. Construction stage operations will be visible for short duration and are judged to be locally medium, giving rise to localised moderate to major, temporary short duration visual effects.

Operational phase visual impacts are generally considered to be localised and negligible to small depending on the location of the residential receptor and view available from garden areas as following completion of the construction phase operations earth embankments will, upon establishment of seeding, be easily absorbed into views. Groyne's proposed as part of the Proposed Development, will over time, become a minor element of the expansive views available from coastal properties, often viewed well below distant horizons which aids their integration. It is therefore judged that operational phase impacts will give rise to minor, long term visual effects which have been assessed as not significant.

18.7.3 Significance of Landscape & Visual Effects

The potential effects on landscape character have been assessed in Section 18.6.1. The significance of these potential effects is summarised in Table 18.16.

Table 18.16 Significance of Landscape Character Effects

Landscape Character Area	Predicted Significance of Effect (Without Mitigation)
Estuary Landscape	Minor localised, long-term effects, assessed as not significant as effects are limited in extent by surrounding vegetation cover and built form with elements perceived as a minor localised addition to the overall LCT.
Coastal Landscape	Minor localised, long-term effects assessed as not significant are limited in extent and the low built form associated with the Proposed Development are considered not to substantially alter the LCT at a local level, with existing elements of the LCT remaining the key character.

The potential landscape and visual effects on landscape designations have been assessed in Section 18.6.2. The significance of these potential effects is summarised in Table 18.6.

Table 18.17 Significance of Landscape & Visual Effects on Planning Policy Designations

Planning Policy or Designation	Predicted Significance of Effect (Without Mitigation)
Fingal Development Plan 2023 - 2029	
Areas of High Amenity	Minor localised, long-term effects assessed as not significant.
Preserve Views	No Change

The potential visual impact from a series of viewpoints has been assessed in Section 18.7. The significance of these potential effects is summarised in Table 18.18.

Table 18.18 Summary of Viewpoint Assessment

Viewpoint No.	Viewpoint Name	Predicted Significance of Effect (*Without Mitigation*)
1	Burrow Road	Localised negligible to minor, long term, reversible effects assessed as not significant
2	R126 (Quay Road)	Localised Minor to moderate, long term, reversible effects assessed as not significant
3	Rush Beach	Localised Minor, long term, reversible effects assessed as not significant,
4	Burrow Road	Localised Negligible to minor, long term, reversible effects assessed as not significant
5	Marsh Lane	Localised Negligible to minor, long term, reversible effects assessed as not significant

The potential visual impact on residential properties has been assessed in Section 18.7.2. The significance of these potential effects is summarised in Table 18.19.

Table 18.19 Significance of Visual Effects on Residential Properties

Property Locations	Predicted Significance of Effect (*Without Mitigation*)
Properties on Burrow Road (northern end) with a view	Minor adverse and not significant
Properties on Marsh Lane with a view	Minor adverse and not significant
Properties on Seaview Park with a view	Minor adverse and not significant
Properties on eastern coastal areas of Burrow with a view	Minor adverse and not significant

18.8 Remedial & Mitigation Measures

Landscape mitigation measures are those taken to help remedy, reduce or compensate for significant landscape and visual impacts created by the development. As set out in the text above it has been judged that the Proposed Development will not result in any significant landscape or visual impacts. It is therefore considered that there are no specific landscape mitigation measures required.

The design evolution of the Proposed Development has been undertaken to enable incorporation of the following built-in design measures:

- Appropriate colour/ form of new walling to reflect the existing coastal and estuary character.
- Grass seeding of proposed embankments to ensure softening of outline and blending with surrounding character.
- Re-use of existing concrete coastal elements to ensure integration with coastal areas on eastern side of Burrow peninsula.

18.9 Residual Effects

This section of the chapter assesses the impact of the Proposed Development on the landscape character and visual receptors (previously identified in Section 18.6 and Section 18.7 above).

Within the wider landscape, the Proposed Development will generally blend with existing features and elements of the landscape, with no significant residual landscape character impacts predicted. With regards to visual impact on sensitive receptors, predicted impacts on existing views are largely offset by the existing visual context of the varied coastal landscape with new elements blending well with the existing coastal area and generally perceived as a minor alteration or addition to the overall expansive views available.

19 POPULATION AND HUMAN HEALTH

19.1 Introduction

This chapter of the EIAR applies a broad socio-economic model of health that encompasses conventional health impacts such as disease, accidents and risk, along with wider socio-economic health determinants vital to achieving good health and wellbeing. As such, the chapter combines a public health assessment (which focuses on environmental determinants of health), and a socio-economic assessment; providing additional commentary on how changes to some socio-economic factors could potentially influence health and wellbeing.

This chapter draws from and builds upon detailed project information and the wider technical disciplines within the EIAR (namely, Chapter 7: Noise and Vibration; Chapter 8: Flood Risk; Chapter 9: Water Quality; Chapter 14: Traffic and Transportation; Chapter 15: Air Quality and Climate; and Chapter 18: Landscape and Visual) to communicate the potential influence upon population and health. For the sake of brevity, this chapter does not seek to repeat text or replicate data from the wider EIAR chapters. This chapter is supported by Appendix 19A: Population and Human Health Baseline.

19.2 Authority of author

This chapter has been written by Tara Barratt (Associate Director, Health and Social Impact at Savills). Tara has a Master of Science in Environmental Technology with a focus in environmental epidemiology. Tara has seven years' experience coordinating and delivering health impact assessments and population and human health ES chapters for a range of major infrastructure projects across the UK, Ireland, and Australia.

In addition to being a technical adviser to the World Health Organisation, Tara sits on the IEMA Health in EIA Working Group, and is an acknowledged co-author of IEMAs recently published guidance on 'effective scoping for human health in EIA' and 'determining significance for human health in EIA'. In addition, Tara has had opinion articles discussing the benefits of quantifying health impacts featured by IEMA in their Quality Mark Resource Article series and Impact Assessment Outlook Journal series (Volume 8).

19.3 Assessment Methodology

19.3.1 Relevant policy and guidance

19.3.1.1 Guidelines on the information to be contained in EIAR

The Environmental Protection Agency's Guidelines on the Information to be contained in EIAR (Environmental Protection Agency, 2022), highlights the amendments to Article 3(1) of the amended European Union (EU) Environmental Impact Assessment (EIA) Directive which states that:

"*The environmental impact assessment shall identify, describe and assess in an appropriate manner, in light of each individual case, the direct and indirect significant effects of a project on the following factors: a) population and human health*"

Moreover, Annex IV, paragraph 5(d) requires an EIAR to contain:

"*A description of the likely significant effects of the project on the environment resulting from, inter alia, 'the risks to human health'*".

19.3.1.2 European Commission's guidance on the preparation of the EIAR

When outlining the scope of environmental factors covered by the EIA Directive within the European Commission's guidance on the preparation of the EIAR (European Commission, 2017), "population and human health" is defined as follows:

"Human health is a very broad factor that would be highly Project dependent. The notion of human health should be considered in the context of the other factors in Article 3(1) of the EIA Directive and thus environmentally related health issues (such as health effects caused by the release of toxic substances to the environment, health risks arising from major hazards associated with the Project, effects caused by changes in disease vectors caused by the Project, changes in living conditions, effects on vulnerable groups, exposure to traffic noise or air pollutants) are obvious aspects to study. In addition, these would concern the commissioning, operation, and decommissioning of a Project in relation to workers on the Project and surrounding population."

Additionally, when describing the likely significant effects of a project, the European Commission's guidance poses the following questions to consider:

"Have the primary and secondary effects on human health and welfare described and, where appropriate, been quantified? (e.g. health effects caused by the release of toxic substances to the environment, health risks arising from major hazards associated with the Project, effects caused by changes in disease vectors caused by the Project, changes in living conditions, effects on vulnerable groups)."

19.3.1.3 Institute of Public Health Impact Assessment Technical Guidance

The Institute of Public Health (IPH) launched the fourth edition of HIA Guidance for Ireland and Northern Ireland, incorporating the most recent developments and best practice in the field (Institute of Public Health, 2021). The guidance is split into the following key themes:

- **Screening** – to determine whether an impact assessment is required.
- **Scoping** – identifying the determinants of health and the populations to be assessed, as well as the methods by which they will be assessed; health effects that are considered to be 'likely' and 'potentially significant' require further analysis and are scoped in.
- **Analysis** – evidence of potential health effects is gathered and considered when conclusions are drawn on the significance of effects.
- **Reporting** – to document the judgements made on health, with reference to the evidence that informed those judgements;
- **Implementation** – whereby to be effective, assessment findings must be followed through when implementing the proposal.
- **Monitoring** – involves data collection and analysis after the assessment report has been issued, however, is resource-intensive so it should be used in a proportionate and time-limited manner.
- **Evaluation** – of process, impact or outcome.

The approach adopted in the original HIA complies with all HIA guidance that has been published since.

19.3.1.4 National Planning Framework

The National Planning Framework (NPF) (Government of Ireland, 2018) is the strategic plan for Ireland's growth and development until 2040. The NPF comprises 10 National Strategic Outcomes (NSOs) and 75 National Policy Objectives (NPOs) which guide sustainable economic, social and environmental development at the national to local levels. The NSOs include:

1. Compact Growth
2. Enhanced Regional Accessibility
3. Strengthened Rural Economies and Communities
4. Sustainable Mobility
5. A Strong Economy supported by Enterprise, Innovation and Skills
6. High-Quality International Connectivity
7. Enhanced Amenity and Heritage
8. Transition to a Low Carbon and Climate Resilient Society
9. Sustainable Management of Water, Waste and other Environmental Resources
10. Access to Quality Childcare, Education and Health Services

19.3.1.5 National Development Plan 2021-2030

The National Development Plan (NDP) (Government of Ireland, 2021) provides the accompanying investment strategy which aligns with the NPOs outlined in the NPF. The NDP sets out the Government's over-arching investment strategy and budget for the period 2021–2030 with a spending of €165 billion budget with a focus on solutions to strengthen housing, climate ambitions, transport, healthcare, and job growth for the 10 years.

The NDP with the NFP combine to form Project Ireland 2040 which is the long-term strategy to build a resilient and sustainable future for Ireland.

19.3.1.6 Fingal County Council: Final Development Plan 2023-2029 (April 2023)

The Fingal Development Plan is relevant to the Proposed Development. It sets out the framework for creating vibrant and resilient communities along with a focus on the places people live, work, and visit and how we interact and move between these places while protecting the environment (Fingal County Council, 2023).

Additionally, FCC have several policies associated with Coastal Management (i.e. Policy CAP31 – Coastal Monitoring; Policy CAP32 – Coastal Protection; Policy CAP33 – Coastal Zone Management; Policy CAP34 – Engagement with Key Stakeholders) within the Fingal Development Plan (Fingal County Council, 2023).

19.3.2 Approach

19.3.2.1 Scoping exercise

As detailed in the IPH HIA guidance, health effects that are considered to be 'likely' and 'potentially significant' require further analysis and they are scoped in. A health effect is considered 'likely' when, based on the scientific

literature, there is a plausible theoretical link between source-pathway-receptor. A health effect is considered 'potentially significant' when they are important (a positive or negative effect), highly desirable (a positive effect) or unacceptable (a negative effect) for population health.

As such, the assessment methodology follows a source-pathway-receptor model to identify and assess population and health effects that are plausible and directly attributable to the Proposed Development. As shown in Table 19.1, a hazard source itself does not constitute a health risk. It is only when there is a hazard source, a receptor and a pathway of exposure that there is any potential risk to human health. The same is true for potential health benefits where a positive influence must be present alongside a pathway of exposure and a receptor for there to be a potential health improvement.

Where a source-pathway-receptor linkage exists, it is then the nature of the specific hazard source or positive influence; the magnitude of impact via the pathway of exposure; and the sensitivity of the receptor that will determine what level of health risk or benefit is predicted, if any.

Table 19.1: Source-pathway-receptor model

Source	Pathway	Receptor	Plausible health impact	Explanation
X	✓	✓	No	There is not a clear source from where a potential health impact could originate.
✓	X	✓	No	The source of a potential health impact lacks a means of transmission to a population.
✓	✓	X	No	Receptors that would be sensitive or vulnerable to the health outcome are not present.
✓	✓	✓	Yes	Identifying a source, pathway and receptor does not mean a health outcome is a likely significant effect; health impacts should be assessed (describing what effect will occur and its likelihood) and likely health effects are then evaluated for significance.

In this instance, scoping relating to the population and human health chapter has been informed by multiple reviews of the project description, technical chapters and any pertinent consultee responses. The results of the scoping exercise are provided in Table 19.2, and present the relevant population and health determinants that have been assessed within this chapter.

Table 19.2: Scoping exercise results

Population and health determinant	Potential direction of impact	Distribution	Duration
Construction (including demolition and excavation)			
Air quality (including impacts on amenity)	Adverse	Local	Temporary
Noise and vibration (including impacts on amenity)	Adverse	Local	Temporary
Transport	Adverse	Local/regional	Temporary

Population and health determinant	Potential direction of impact	Distribution	Duration
Water quality	Adverse	Local	Temporary
Flood risk	Adverse	Local	Temporary
Access to recreational facilities	Adverse	Local	Temporary
Operation			
Flood risk and coastal erosion	Beneficial	Local	Long-term
Access to recreational facilities	Beneficial	Local	Long-term

19.3.2.2 Baseline

Different communities have varying susceptibility to population and human health effects (both adverse and beneficial) as a result of social and demographic structure, behaviour and relative economic circumstance.

As detailed in the IPH HIA guidance, building a population profile helps in developing a better understanding of those affected by the proposal, identifying potentially vulnerable groups and establishing a baseline against which possible future health effects can be assessed.

The approach to defining the baseline involves the collation and interpretation of published demographic, socio-economic and existing public health data. From this, potential changes due to the Proposed Development can be investigated and their significance of effect assessed.

19.3.2.3 Appraisal

The appraisal in Section 19.5 of this chapter uses the baseline information provided in Section 19.4 and key outputs from inter-related technical disciplines to establish receptor sensitivity, magnitude of impact and resultant significance of effect (whether adverse or beneficial) that would be directly attributed to the Proposed Development during construction and operational phases, and further considers any cumulative impact.

19.3.3 Study Area

The site falls within the boundaries of Donabate coastal towns, with residential receptors in proximity to the Proposed Development including permanent and mobile housing within the communities of Portrane and individual properties in the hinterlands parallel to the proposed sea walls and embankments. For data collection, the relevant electoral division (ED) is Donabate.

Environmental health determinants (such as changes to air quality and noise exposure) are likely to have a local impact where the potential change in hazard exposure is limited by physical dispersion characteristics. As a result, the local Study Area for health-specific baseline statistics relating to human health effects focuses on Donabate, with the Local Administrative Unit (Nomenclature of Territorial Units for Statistics (NUTS) NUTS4) (i.e. Fingal), the regional data (NUTS3) (i.e. Dublin) and Ireland averages used as relevant comparators. Where data for EDs are not available, statistics relating to Fingal and Dublin County are collected using the Ireland average as a comparator.

Wider socio-economic health determinants (such as employment and related income generation) have a wider geographic scope of influence than environmental health determinants, due to the willingness to commute significant distances to work. On this basis, the study area for socio-economic baseline statistics has a wider focus (Fingal and/ or Dublin County), using the Ireland average as a relevant comparator (although Donabate-level statistics are provided for context).

The Study Area defining the relevant sensitive receptors identified for assessment purposes remains consistent with the inter-related technical disciplines assessed within the EIAR, which the population and human health topic relies upon.

19.3.4 Assessment criteria and assignment of significance

19.3.4.1 Sensitivity

As detailed in the IPH HIA guidance, sensitivity is the sensitivity of the receptor to change. It includes consideration of that receptor's capacity to accommodate changes brought about by the proposal. There are several components of sensitivity, which include:

- **Life stage** – typically, children and older people are particularly sensitive to change, including due to being dependants; in addition, particular age groups are likely to experience effects more strongly, e.g. pregnant women and their unborn children; the very young; the very old; or working-age people (benefiting from jobs).
- **Deprivation** – deprivation reflects an increased sensitivity due to lack of ownership of or access to assets, including those that support good health; the potential for localised high deprivation within wider areas showing average or low deprivation should always be considered.
- **Health status** – areas with a poor health status are typically of higher sensitivity.
- **Daily activities** – people's ability to perform day-to-day activities is relevant, particularly where there are changes in access to services or community amenities.
- **Inequalities** – descriptive measures of difference in exposure to health risk factors, and to differences in health status between groups of people; where inequalities between areas or populations are wide (or at risk of widening), this indicates greater sensitivity.
- **Capacity to adapt (resilience)** – the ability of the population or service to absorb the change or voluntarily (consciously or unconsciously) make small changes to their behaviour that lessen the effects of the proposal.
- **Resource sharing with the proposal** – Where a proposal affects a resource (service, power supply, water supply, highway capacity, school places etc.), the effects may extend a great distance from the development boundary; where there is high resource sharing and a lack of easily accessible alternatives, the population that is sharing the resource may be more sensitive.

The criteria for defining sensitivity in this chapter are outlined in Table 19.3.

Table 19.3: Sensitivity descriptors

Sensitivity	Description
High	High levels of deprivation (including pockets of deprivation); reliance on resources shared (between the population and the project); existing wide inequalities between the most and least healthy; a community whose outlook is predominantly anxiety or concern; people who are prevented from undertaking daily activities; dependants; people with very poor health status; and/or people with a very low capacity to adapt.
Medium	Moderate levels of deprivation; few alternatives to shared resources; existing widening inequalities between the most and least healthy; a community whose outlook is predominantly uncertainty with some concern; people who are highly limited from undertaking daily activities; people providing or requiring a lot of care; people with poor health status; and/ or people with a limited capacity to adapt.
Low	Low levels of deprivation; many alternatives to shared resources; existing narrowing inequalities between the most and least healthy; a community whose outlook is predominantly ambivalence with some concern; people who are slightly limited from undertaking daily activities; people providing or requiring some care; people with fair health status; and/ or people with a high capacity to adapt.
Very low	Very low levels of deprivation; no shared resources; existing narrow inequalities between the most and least healthy; a community whose outlook is predominantly support with some concern; people who are not limited from undertaking daily activities; people who are independent (not a carer or dependant); people with good health status; and/or people with a very high capacity to adapt.

An extensive amount of baseline data has been collected to interpret local health circumstance and consequent population sensitivity. This information is detailed in Appendix 19A and summarised in Section 19.4. Overall, it is concluded that local health circumstance in the study area is generally good.

As such, when looking at the population in general, the existing burden of poor health is low. However, this does not exclude the probability that there will be individuals within a defined population who are particularly sensitive and could experience disproportionate/ differential effects.

To supplement this exercise, small area analysis was done using the HP Deprivation Index (2016) to identify any pockets of deprivation within the Study Area, the results of which is are shown in Figure 19.1. Results show that the sensitive receptors identified in Chapter 7: Noise and Vibration and Chapter 15: Air Quality and Climate, which are consistent with receptors that are considered sensitive to human health effects) are located in areas which are categorised to be in the 'marginally above average' or ‘marginally below average’ and are therefore not considered to be particularly vulnerable. As such, no specific sub-populations have been analysed separately as part of the overarching assessment of population health.

On this basis, the sensitivity of the population within the study area is considered to be “low”.

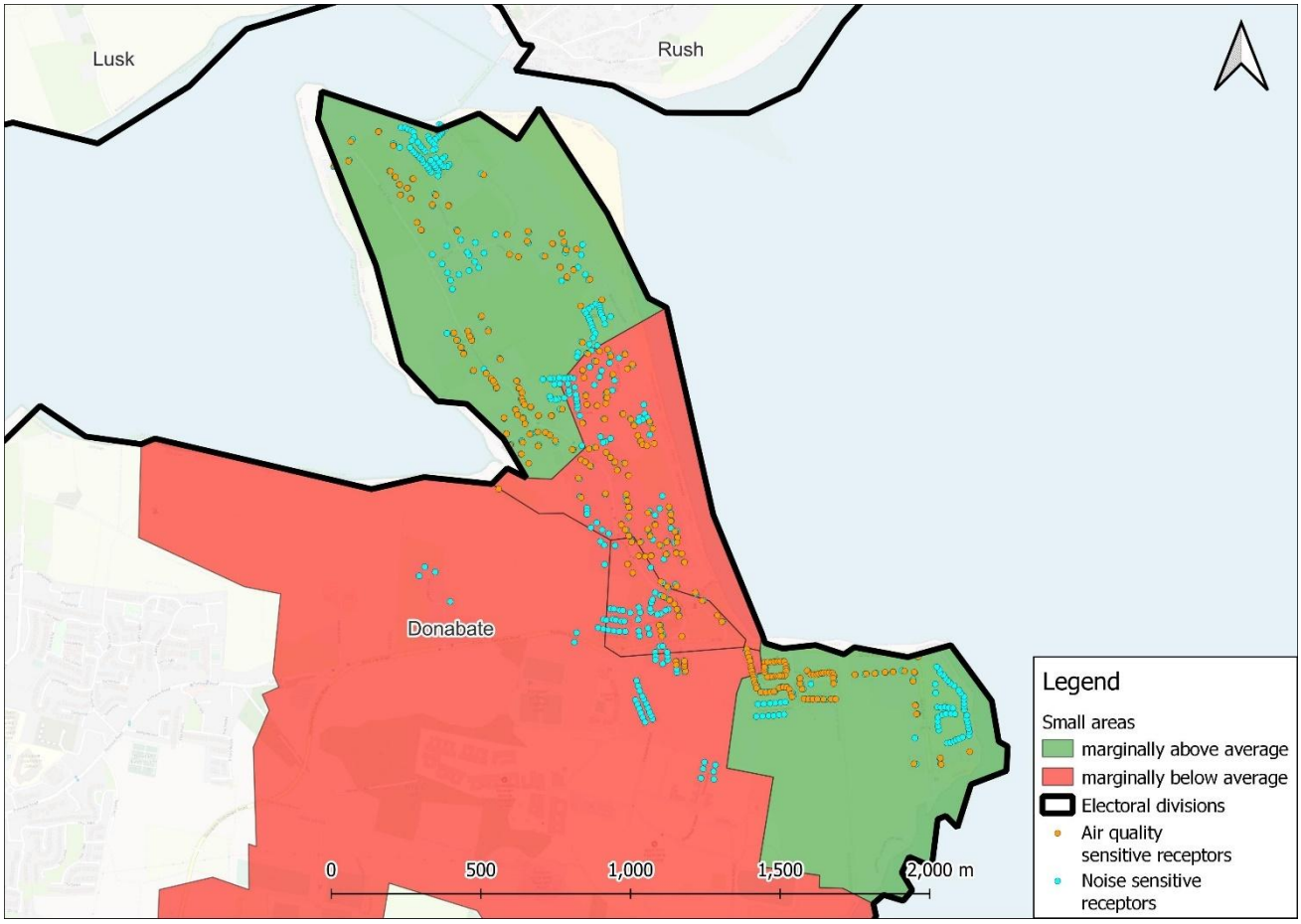


Figure 19.1 Deprivation analysis

19.3.4.2 Magnitude of impact

As detailed in the IPH HIA guidance, magnitude considers the characteristics of the change which would affect the receptor as a result of the proposal. There are several components of magnitude, which include:

- **Exposure** – exposure tends to vary with proximity of the population to the source, but also has an important time dimension relevant to health, e.g. low concentrations over a long period, or high concentrations over a short period.
- **Scale** – the scale of change is a useful characterisation, particularly when exposure is not a relevant descriptive for the type of effect. For example, the scale of change in open space that is available for physical activity.
- **Duration** – effects that continue for a long duration are of greater magnitude (including inter-generational effects). Where effects are best characterised as short term, other factors such as scale or exposure may still indicate that the change is of high magnitude.
- **Frequency** – effects that are frequent or continuous are likely to indicate greater magnitude; however, even where the effect would be occasional, other factors such as scale or exposure may still indicate that the change is of high magnitude.
- **Severity** – health severity relates to the type of health outcome affected, such as changes predominantly related to mortality, disease, nuisance or wellbeing. It may also relate to the type of

change relative to the baseline conditions (for example, onset of new conditions, a change affecting existing conditions or change to day-to-day functioning). While changes in mortality indicate a higher magnitude than changes in wellbeing or quality of life (less severe), this should not preclude a large change in quality of life from being a high-magnitude effect.

- **Population extent** – the proportion of the population (defined by the assessment) that is affected informs the decision on magnitude. Where most of the Study Area's population is affected, this would indicate a higher magnitude. This is not to downplay cases where only a few people are affected to a high degree; however, where this is the case, this may indicate greater potential for targeted mitigation. Furthermore, a population health effect would not occur.
- **Outcome reversibility** – some changes in health outcomes rapidly reverse once the source is removed, for example, the cessation of nuisance will lead to reduction in anxiety. In other cases, health effects may reverse at a slower rate, for example, gradual returns to physical activity levels once access is resorted to amenities. Where health effects are considered permanent, this indicates a higher magnitude.
- **Service quality implication** – there may be an associated or independent change in the quality of services that support or facilitate good health (including health services, schools, social care, etc.). For example, where direct population health reductions (or population influx) increase demand on services that consequently reduce in quality, the magnitude of the effect on health is amplified.

The criteria for defining magnitude of impact in this chapter are outlined in Table 19.4.

Table 19.4: Magnitude descriptors

Magnitude of impact	Description
High	High exposure or scale; long-term duration; continuous frequency; severity predominantly related to mortality or changes in morbidity (physical or mental health) for very severe illness/ injury outcomes; majority of population affected; permanent change; substantial service quality implications.
Medium	Low exposure or medium scale; medium-term duration; frequent events; severity predominantly related to moderate changes in morbidity or major change in quality-of-life; large minority of population affected; gradual reversal; small service quality implications.
Low	Very low exposure or small scale; short-term duration; occasional events; severity predominantly related to minor change in morbidity or moderate change in quality-of-life; small minority of population affected; rapid reversal; slight service quality implications.
Negligible	Negligible exposure or scale; very short-term duration; one-off frequency; severity predominantly relates to a minor change in quality-of-life; very few people affected; immediate reversal once activity complete; no service quality implication.

19.3.4.3 Significance of effect

As detailed in the IPH HIA guidance, significance relies on informed, expert judgement about what is important, desirable or acceptable with regards to changes triggered by the proposal in question. In addition to the components on sensitivity and magnitude contributing to significance conclusions, the following components should also contribute to the significance conclusion and provide context relating to the importance/ acceptability/ desirability of a change to population health:

- **Scientific literature** – the literature can indicate if there is evidence to support an association between the proposal-related change, a relevant determinant of health and a relevant health outcome.
- **Health priorities** – these can identify if relevant determinants of health or health outcomes have been identified as particularly important locally, regionally or nationally.
- **Baseline conditions** – these can establish if relevant sensitivities or inequalities identified in the scientific literature are present. It may be relevant to note whether conditions differ from local, regional, national or international comparators, or if geographic or population features may amplify effects.
- **Health policy context** – this can identify published local or national government position statements that raise particular expectations for the relevant proposal change, determinant of health or health outcome. The health policy context may include adopted local area development plans or references (implicit or explicit) to health in published planning or other sectoral policies. Wider international health policies or treaties may also be relevant.
- **Regulatory standards** – such standards (if applicable) can identify where there would be formal monitoring by regulators. Discussion may include modelling results on the extent to which regulatory or statutory limit values would be met. It may also be relevant to discuss advisory guidelines. Limit values for occupational exposure tend to differ from non-occupational exposure. Where thresholds have been set, these do not mean that there would be no health effect below these levels. For example, in the case of fine particulate matter and nitrogen dioxide, there are non-threshold health effects (i.e. no known limit below which health effects may not occur).

For simplicity, a significance matrix (which takes into consideration sensitivity and magnitude) is provided in Table 19.5. As outlined above, a range of other components contribute to the determination of significance. For the purpose of this assessment, any effects with a significance level of minor or less are not considered to be significant in terms of the EIA Regulations.

Table 19.5: Significance of effect matrix

Sensitivity	Magnitude of Impact				
	No Change	**Negligible**	**Low**	**Medium**	**High**
Negligible	No change	Negligible	Negligible or Minor	Negligible or Minor	Minor
Low	No change	Negligible or Minor	Negligible or Minor	Minor	Minor or Moderate
Medium	No change	Negligible or Minor	Minor	Moderate	Moderate or Major
High	No change	Minor	Minor or Moderate	Moderate or Major	Major or Substantial
Very high	No change	Minor	Moderate or Major	Major or Substantial	Substantial

19.3.5 Limitations to the assessment

Where the population and health assessment draws from and builds upon the technical outputs from inter-related technical disciplines, the same limitations and assumptions therein apply.

19.4 Receiving Environment

19.4.1 Existing baseline conditions

Individuals and communities vary in their susceptibility to adverse and/ or beneficial population and health impacts associated with changes in environmental and socio-economic conditions as a result of demographic structure (i.e. age); existing burden of poor health; behaviours (i.e. lifestyle choices that constitute risk factors); and socioeconomic circumstance.

The following information, which summarises the full population and human health baseline provided in Appendix 19A, is intended to contextualise the local health circumstance of the communities within the boundaries of Donabate coastal towns using publicly available statistics. When feasible, data were collected for the Electoral Division (ED) (i.e. Donabate) and were compared to the national average. Data for Local Administrative Unit (Nomenclature of Territorial Units for Statistics (NUTS) NUTS4) (i.e. Fingal) or Regional data (NUTS3) (i.e. Dublin) were utilised in instances where ED data were not available. In terms of socio-economic indicators, income and work prospects are likely to have a broader impact and are therefore more relevant for Fingal County and Dublin region than for Donabate.

Overall, the population living within the Donabate have higher levels of employment and education when compared to the national average. Donabate is classified as ‘Marginally above average’ as per the Pobal HP Deprivation Index. Donabate comprises a higher proportion of people aged 0-19 and 40-54 in comparison to the national average for both sexes, and its population has increased by 7.6% between 2011 and 2016.

Regarding physical health, all-cause mortality in the Dublin region is lower than the national average. Mortality relating to certain specific causes (cardiovascular diseases, respiratory diseases and cancer) is generally lower in Fingal compared to the regional and national averages. Regarding mental health, levels of depression in Dublin are comparable to the national average and the suicide rate is consistently lower than the national average.

In terms of lifestyle and behavioural risk factors, Dublin has greater levels of alcohol consumption and comparable smoking prevalence. The proportion of the population living within Dublin who are overweight/ obese is similar to the national average.

19.4.2 Future baseline conditions

Trends and the most recent publicly available data are analysed as part of the current baseline to provide insight into likely future local community circumstances. In broad strokes, the existing health burden is lower than the national average.

As it is challenging to predict health-specific data with high confidence, it is considered appropriate that the present-day statistics are used for the purpose of this assessment, implementing a precautionary approach.

19.5 Description of Likely Significant Effects

19.5.1 Construction phase

19.5.1.1 Air quality (including impacts on amenity)

As stated in Chapter 15: Air Quality and Climate, construction of the coastal flood and erosion protection elements and associated construction traffic have the potential to alter local air quality (including nuisance dust, which may impact local amenity).

Appropriate mitigation measures have been identified in Chapter 15: Air Quality and Climate to mitigate the impact of dust from demolition, excavation and construction activities at the nearest sensitive receptors. For example, working areas may need to be fenced off using Heras panels or similar, and covered with netting/ tarpaulin for the duration of the works. Following the implementation of appropriate mitigation measures, dust impacts are considered to be negligible in air quality terms.

As stated in Chapter 15: Air Quality and Climate, all terrestrial plant and materials would be brought to Burrow Road via the R126 and would be subject to a Contractor's Traffic Management Plan (CTMP) which details appropriate controls and good contractor working practices. Within the confines of the working areas, plant movements would be linear in nature. Overall, due to the scale and nature of the works, construction traffic is deemed to be minimal and the impact on traffic-related pollutants would be negligible in air quality terms.

On the basis that both dust and changes from air quality associated with construction plant and traffic movements would be negligible in air quality terms, the magnitude of impact on population and human health would be negligible. In an area of low sensitivity, this would result in a negligible significance of effect, which is not significant.

19.5.1.2 Noise and vibration (including impacts on amenity)

As detailed in Chapter 7: Noise and Vibration, the total time to complete construction works at Burrow will be *c*.23 weeks.

Construction works associated with bulk earthworks, installations of new seawalls and vegetated embankments are not proposed to occur during night-time or on Sundays, unless for emergency works. As a result, there is

limited potential for sleep disturbance from construction of these elements, and the potential population and human health impacts are limited to annoyance during the daytime only.

Beach renourishment material will be pumped ashore from the dredger. It is possible that evening and night-time noise will occur during beach renourishment, whereby there is potential for both annoyance and sleep disturbance. While this is the case, any noise impacts would occur over a short period of time (*c.*6 weeks) and would be transient in nature due to the targeting of different sections of the beach. This short-term and transient nature of the activity would limit the potential for any population and human health impacts.

As detailed in Chapter 7: Noise and Vibration, construction noise has been predicted on a worst-case scenario, (i.e., all the sources are operating all the time close to the receptors). The attenuated construction noise levels reported in Appendix 7.B (Construction Noise Assessment) includes mitigation associated with temporary construction noise barriers.

Results for the attenuated construction noise levels in terms of exceedances of relevant noise limits are summarised in Table 19.6.

Table 19.6: Summary of construction noise levels

Construction activity	Number of day exceedances (>65dB)	Number of evening/weekend exceedances (>55dB)	Night exceedances (>45dB)
Bulk earthworks	68 (24%)	n/a	n/a
Flood wall	2 (13%)	n/a	n/a
Flood embankment	5 (11%)	n/a	n/a
Groynes phase 1	3 (8%)	n/a	n/a
Groynes phase 2	4 (11%)	n/a	n/a
Groynes phase 3	1 (2%)	n/a	n/a
Groynes phase 4	1 (3%)	n/a	n/a
Dredger	0 (0%)	0 (0%)	7 (100%)
Beach renourishment phase 1	2 (0.5%)	29 (7%)	222 (55%)
Beach renourishment phase 2	5 (1%)	30 (8%)	224 (56%)
Beach renourishment phase 3	7 (2%)	21 (6%)	112 (31%)
Beach renourishment phase 4	0 (0%)	23 (7%)	95 (29%)

Note: brackets denote the percentage of relevant receptors experiencing exceedances of the relevant noise limit.

As can be seen, some exceedances would occur during the day, evening/ weekend and night-time periods. However, it should be noted that these results are worst-case and assume that all noise sources are operating simultaneously and at the closest point to receptors. In reality, the sources will be distributed throughout the

construction working areas and in operation on a cyclical basis, depending on specific tasks; on this basis, the actual noise impact is likely to be lower. Furthermore, whether or not construction works would take place during the evening/ weekend or night time periods (for dredging and beach renourishment) are dependent on the awarded contractor.

A CEMP, including specific Noise Management Plan, will be prepared by the final appointed contractor of the Proposed Development and will set out the specific mitigation measures that will be employed to reduce the noise and vibration impacts of the development during the construction phase (e.g. careful scheduling of the works, timing of activities and using best practicable means).

Following the implementation of these mitigation measures, noise levels would be reduced to as low as possible and no significant noise effects would arise. Furthermore, residents will be informed of the timing and duration of activities that may produce high noise or vibration, whereby any elevated levels would be temporary in nature and are more likely to be tolerated if prior notification and explanation is given. Monitoring of noise levels throughout the duration of the construction phase is also proposed.

Overall, construction phase noise impacts will be short-term, localised, and mitigation measures would be applied to reduce noise levels to as low as possible so that significant nose effects would not arise. On this basis, the magnitude of impact on population and human health would be negligible. In an area of low sensitivity, this would result in a negligible significance of effect, which is not significant.

19.5.1.3 Transport

As stated in Chapter 14: Traffic and Transportation, it has been assumed that a worst-case scenario of *c.*90 two-way vehicle trips could be made over the course of a day. This includes staff trips, where 39 arrivals would occur in the morning and 39 departures would occur in the evening, and 6 HGV delivery of goods.

Construction staff and delivery vehicles would be scheduled to arrive and depart outside of the traditional commuter peak periods of 08:00 - 09:00 and 17:00 - 18:00. Furthermore, it is envisaged that construction deliveries would be arriving/ depart during the working day (outside the AM/ PM commuter peaks).

Overall construction traffic (vehicle & HGV) equates to an increase of 1.7% on the R126, and 5.9% on Burrow Road. This is considered a negligible increase in traffic terms and will not result in any increase in peak-hour trips. No further traffic assessment has been undertaken as such increase outside of the AM/ PM peak would not result in likely significant traffic effects.

On the basis that the increase in construction traffic would be negligible in traffic terms, the magnitude of impact on population and human health would be negligible. In an area of low sensitivity, this would result in a negligible significance of effect, which is not significant.

19.5.1.4 Water quality

As detailed in Chapter 9: Water Quality, the risk of water quality impacts associated with works machinery, infrastructure and on-land operations (for example leakages/ spillages of fuels, oils, other chemicals and wastewater) will be controlled through good site management and the adherence to codes and practices which limit the risk to within acceptable levels.

Following the implementation of appropriate mitigation measures during the construction phase, the impact of the Proposed Development on the water quality in the area will be imperceptible.

On the basis that the any change in water quality would be imperceptible, the magnitude of impact on population and human health would be negligible. In an area of low sensitivity, this would result in a negligible significance of effect, which is not significant.

19.5.1.5 Flood risk

As detailed in Chapter 8: Flood Risk, during construction, there will be a risk of flooding from extreme tidal events that will need to be managed. Of relevance to population and human health, impacts include risk to construction workers.

Temporary works may be required to prevent coastal waters interacting with works activities throughout the duration of the construction period. Following the implementation of such mitigation measures there would be a low probability of damage to construction works and any impact on the working area would likely be temporary and managed through monitoring of the weather forecast (i.e. through Met Éireann, which provides a weather warnings alert service).

On the basis that any risk to construction workers from coastal flooding would be carefully managed, the magnitude of impact on population and human health would be negligible. In an area of low sensitivity, this would result in a negligible significance of effect, which is not significant.

19.5.1.6 Access to recreational facilities

As detailed in Chapter 3, to facilitate the storage of materials, accommodate welfare facilities and site offices it will be necessary to provide sufficient site compounds and working areas within the proximity of the proposed construction works. These would preferably be located adjacent to the main work areas and must be secured adequately. Temporary works will also be required in some areas to prevent the tide from infiltrating the works zone each day during construction.

At Burrow Road (embankment location), the area of land directly south of the proposed embankment location is proposed for a site compound. At the Marsh Lane site (embankment and sea wall location), the proposed compound area is to the north of the defence with access directly off Burrow Road. This land comprises empty fields and is not anticipated to materially impact access to recreational space.

For the construction of the coastal elements (i.e. groyne structures and beach renourishment), the proposed compound area is within a recreational green space (which includes outdoor exercise equipment) located directly adjacent to Pipers Takeaway. As a result, there would be a temporary direct impact on access to this recreational space. While this is the case, many alternative recreational/open spaces exist within the local area (refer to Figure 17.2 which shows areas of high amenity and open space). For example, directly opposite is Portrane Green which is classified as open space in Figure 17.2; however, the majority of the local area is considered an area of high amenity.

At all construction compound locations, stripping of topsoil or sand deposits and stoning the working areas would be required to provide a temporary haul road to facilitate plant movement. Upon completion of the works,

site compounds and temporary working areas will be re-topsoiled and/ or reinstated to the existing condition ensuring no permanent impacts.

On the basis that the loss of recreational space would be temporary, and many alternative spaces exist locally, the magnitude of impact on population and human health would be negligible. In an area of low sensitivity, this would result in a negligible significance of effect, which is not significant.

19.5.2 Operation phase

19.5.2.1 Flood risk and coastal erosion

As stated in Chapter 8: Flood Risk, one of the primary objectives of the Proposed Development is to provide effective coastal flood protection. A reduction in flood risk would have associated population and human health benefits through protection of residential properties and community assets.

Similarly, the Proposed Development will protect against excessive erosion which would be particularly problematic in the Burrow due to the urban nature of the surrounding land use. As detailed in Section 2.1.2.2 without the Proposed Development the coastline along the Burrow could retreat, on average, by between *c.*48m and 88m (±30m) by 2100 which could result in between 19 and 46 buildings being lost due to erosion. The groynes and beach renourishment proposed would mitigate this impact, providing population and human health benefits through protection of residential properties and community assets.

On the above basis, the magnitude of impact on population and human health would be high (beneficial). In an area of low sensitivity, this would result in a moderate beneficial significance of effect, which is significant.

19.5.2.2 Access to recreational facilities

Recreational resources within the Study Area include the beach and various green space/ areas of high amenity. As stated above, one of the primary objectives of the Proposed Development is to provide effective coastal flood and erosion protection.

Presently, the beach is underwater for the majority of each tidal cycle owing to the very low beach level, rendering the beach unusable for significant periods of time. As a result, the presence of groynes and proposed beach renourishment works would restore and maintain beach levels which would increase the overall useability, amenity and value of the beach. All other coastal flood and erosion protection infrastructure proposed would not adversely impact access to the beach. Furthermore, the associated reduction in flood and erosion risk from the proposed coastal protection infrastructure would directly safeguard other green space within Burrow.

Indirectly, the coastal protection works would be visible to people using the beach and green space, with the potential to impact local amenity. Landscape and visual impacts from the beach and amenity areas during operation have been considered in Chapter 18: Landscape and Visual and are summarised below.

The groynes have the potential to impact the coastal landscape character type (LCT). However, as stated in Chapter 18: Landscape and Visual, new beach groynes will be perceived as a minor addition locally, as the introduction of such features will be readily absorbed within the surrounding landscape and will not be obvious within the wider context. Similarly, all other coastal protection infrastructure has the potential to visually impact

areas of high amenity; however, similarly, these new elements will readily be absorbed into the surrounding landscape.

On the basis that the presence of the permanent coastal protection infrastructure would be readily absorbed into the surrounding landscape, would improve useability of the beach, and would safeguard other green space within Burrow, the magnitude of impact on population and human health would be high. In an area of low sensitivity, this would result in a moderate significance of effect, which is significant.

19.6 Mitigation Measures

Public health is by definition preventative in nature. Therefore, mitigation measures adopted as part of the construction and operation of the project are embedded in nature and focus on precursors to population and human health outcomes, thereby providing an opportunity for intervention to prevent any adverse impacts.

Construction would be undertaken in accordance with a CEMP which sets out the key mitigation measures that contractors would be required to adopt and implement in order to control the generation or release of environmental pollutants with the potential to cause adverse population and health outcomes. Similarly, a CTMP would be prepared which details any required traffic calming measures.

Once operational, one of the primary objectives of the Proposed Development is to provide effective coastal flood and erosion protection, with associated significant population and human health benefits.

On the basis that no significant adverse population and human health effects are identified, no additional population and human health mitigation measures are necessary.

19.7 Residual Effects

On the basis that no additional mitigation measures are proposed, the residual effects remain the same as those reported in Section 19.5.

19.8 Potential Cumulative Impacts

Potential cumulative impacts from the Rush South flood relief scheme and other nearby developments associated with all health determinants assessed have been considered in the relevant chapters. No cumulative effects during construction or operation have been identified. As a result, there would be no cumulative population and human health effects.

19.9 Conclusions

Overall, operation of the Proposed Development reduces coastal flood and erosion risk, with associated population and human health benefits due to the protection of residential and community assets. Furthermore, the coastal protection infrastructure would enhance access to the beach and the associated reduction in flood and erosion risk would directly safeguard green space within Burrow. The presence of the coastal protection infrastructure would be readily absorbed within the surrounding landscape and would not have a significant effect on local amenity. Operationally, there would be significant benefits to population and human health for the community in Burrow.

The only adverse impacts are associated with the construction phase, whereby there would be temporary changes in local air quality, noise exposure, and transport nature and flow rate; however, these impacts would not be significant. Changes in water quality and flood risk (including the potential safety implications of this for construction workers) are also able to be effectively mitigated to a level which is not significant.

The presence of construction compounds would temporarily impact access to recreational facilities such as the outdoor gym equipment directly adjacent to Pipers Takeaway. However, many alternative recreational/ open spaces exist within the local area, the majority of which is considered an area of high amenity. As a result, there would be no significant effects associated with this.

Table 19.7 Summary of effects

Health determinant	Magnitude of impact	Receptor sensitivity	Significance of residual effect
Construction phase			
Air quality	Negligible	Low	Negligible (not significant)
Noise and vibration	Negligible	Low	Negligible (not significant)
Transport	Negligible	Low	Negligible (not significant)
Water quality	Negligible	Low	Negligible (not significant)
Flood risk	Negligible	Low	Negligible (not significant)
Access to recreational facilities	Negligible	Low	Negligible (not significant)
Operation phase			
Flood risk and coastal erosion	High (beneficial)	Low	Moderate beneficial (significant)
Access to recreational facilities	High (beneficial)	Low	Moderate beneficial (significant)

20 MAJOR ACCIDENTS & DISASTERS

20.1 Introduction

This chapter of the EIAR describes the assessment of the potential risk of major accidents and disasters presented by the Proposed Development. It sets out the methodology for the assessment of Major Accidents & Disasters and the potential risks and likelihood of such events occurring during both the construction and operational phases. In addition, potential mitigation measures to reduce the risk of major accidents and disasters have also been explored, while the cumulative effects between the Proposed Development and other projects in the area, and residual effects that may still be experienced after mitigation measures have been applied have been identified.

It should be noted that this chapter was initially scoped out at the EIA scoping stage, however, it was brought back in for full assessment as part of the EIAR upon request by An Bord Pleanála who stated:

> *"The EIAR should also provide an assessment of the expected effects arising from the vulnerability of the project to major accidents and disasters that are relevant to the project. These risks should be considered in the context of the factors of the environment."*

20.2 Authority of Author

The author of this chapter, AmyJo Regan, is a Project Scientist with RPS who has over two years of experience in water and environment. Much of this experience has been in EIA development and coordination. AmyJo holds a BSc (First Class Hons) in Geography and an MSc (Distinction) in Environmental Engineering from Queen's University, Belfast. She is currently a Non-Chartered Member of the Chartered Institution of Water and Environmental Management (CIWEM) and is working towards chartership.

20.3 Assessment Methodology

This chapter identifies how risks of major accidents and/or disasters relevant to the Proposed Development have been identified and subsequently managed.

This chapter considers:

- Major accidents and/ or disasters that the Proposed Development may be vulnerable to;
- Major accidents and/ or disasters that the Proposed Development may potentially cause;
- Whether likely significant effects could result from a major accident and/ or disaster to which the Proposed Development may be vulnerable, or which the Proposed Development may cause, and if so, the identification of these effects; and
- Any existing and/ or proposed mitigation measures to prevent or mitigate the likely significant adverse effects of any potential major accidents and/or disasters on the environment.

20.3.1 Key Definitions

The EIA Directive does not provide a clear definition of the term 'major accident and/or disaster', at the time of writing. Definitions contained in the Institute of Environmental Management and Assessment (IEMA) Major

Accidents and Disasters in EIA: A Primer (IEMA, 2020) have been adopted, for the purpose of this assessment. These are outlined in Table 20.1.

Table 20.1 Key definitions adopted for the purpose of this assessment (IEMA, 2020)

Key Term	Definition
Accident	Something that happens by chance or without expectation.
As low as reasonably practicable (ALARP)	Involves weighing a risk against the trouble, time and money needed to control it. Thus, ALARP describes the level to which we expect to see risks controlled.
Disaster	May be a natural hazard (e.g. earthquake) or a man-made/ external hazard (e.g. act of terrorism) with the potential to cause an event or situation that meets the definition of a major accident.
Hazard	Something with the potential to cause harm.
Likelihood	Chance of something happening.
Major Accident	Events that threaten immediate or delayed serious environmental effects to human health, welfare and/or the environment and require the use of resources beyond those of the client or its appointed representatives to manage. Whilst malicious intent is not accidental, the outcome (e.g. train derailment) may be the same and therefore many mitigation measures will apply to both deliberate and accidental events.
Reasonable Worst Case Scenario	A challenging manifestation of the scenario after highly implausible scenarios are excluded.
Risk	The likelihood of an impact occurring, combined with the effect or consequence(s) of the impact on a receptor if it does occur.
Risk Event	An identified, unplanned event, which is considered relevant to the development and has the potential to result in a major accident and/ or disaster, subject to assessment of its potential to result in a significant adverse effect on an environmental receptor.
Significant environmental effect (in relation to a major accident and/ or disaster assessment)	Could include the loss of life, permanent injury and temporary or permanent destruction of an environmental receptor which cannot be restored through minor clean-up and restoration.
Vulnerability	Describes the potential for harm as a result of an event, for example due to sensitivity or value of receptors. In the context of the EIA Directive, the term refers to the 'exposure and resilience' of the development to the risk of a major accident and/ or disaster. Vulnerability is influenced by sensitivity, adaptive capacity and magnitude of impact.

20.3.2 Guidance and Legislation

The assessment of major accidents and/or disasters has been carried out with regard to the following guidance and legislation:

- EIA Directive 2014/52/EU (amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment);
- Institute of Environmental Management and Assessment (IEMA) Major Accidents and Disasters in EIA: A Primer (IEMA, 2020);
- Environmental Protection Agency (EPA) Guidelines on the information to be contained in Environmental Impact Assessment Reports (EPA, 2022);

- Environmental Protection Agency (EPA) Guidance on Assessing and Costing Environmental Liabilities (EPA, 2014);
- The Department of Environment, Heritage and Local Government (DEHLG) A Framework for Major Emergency Management. A Guide to Risk Assessment in Major Emergency Management t (DEHLG, 2010);
- Environmental Impact Assessment of Projects: Guidance on the preparation of the Environmental Impact Assessment Report (European Commission, 2017);
- S.I. No. 291 of 2013 - Safety, Health and Welfare at Work (Construction) Regulations 2013 (hereafter referred to as the Safety, Health and Welfare (Construction) Regulations);
- Number 10 of 2005 - Safety, Health and Welfare at Work Act 2005 (hereafter referred to as the Safety, Health and Welfare at Work Act); and
- S.I. No. 299/2007 - Safety, Health and Welfare at Work (General Application) Regulations 2007 (hereafter referred to as the Safety, Health and Welfare at Work (General Application) Regulations).

20.3.3 Study Area

The Study Area for the assessment of Major Accidents & Disasters is illustrated in Figure 20-1. This covers the area in which the works will be undertaken (Working Area), including the main area at the Burrow which extends *c.*1.4km north from the village of Portrane and *c.*0.55km east into the Irish Sea, and two smaller areas located at the southern and northern extents of the L6169 road, respectively. The Study Area also includes the Rogerstown Estuary, the village of Portrane and the road network from where the R126 road begins, at the roundabout off the M1, to the Working Area. A section of the Irish Sea comprising a 10km buffer from the Working Area is also included within Study Area to give consideration to the environmental designations within the surrounding area.

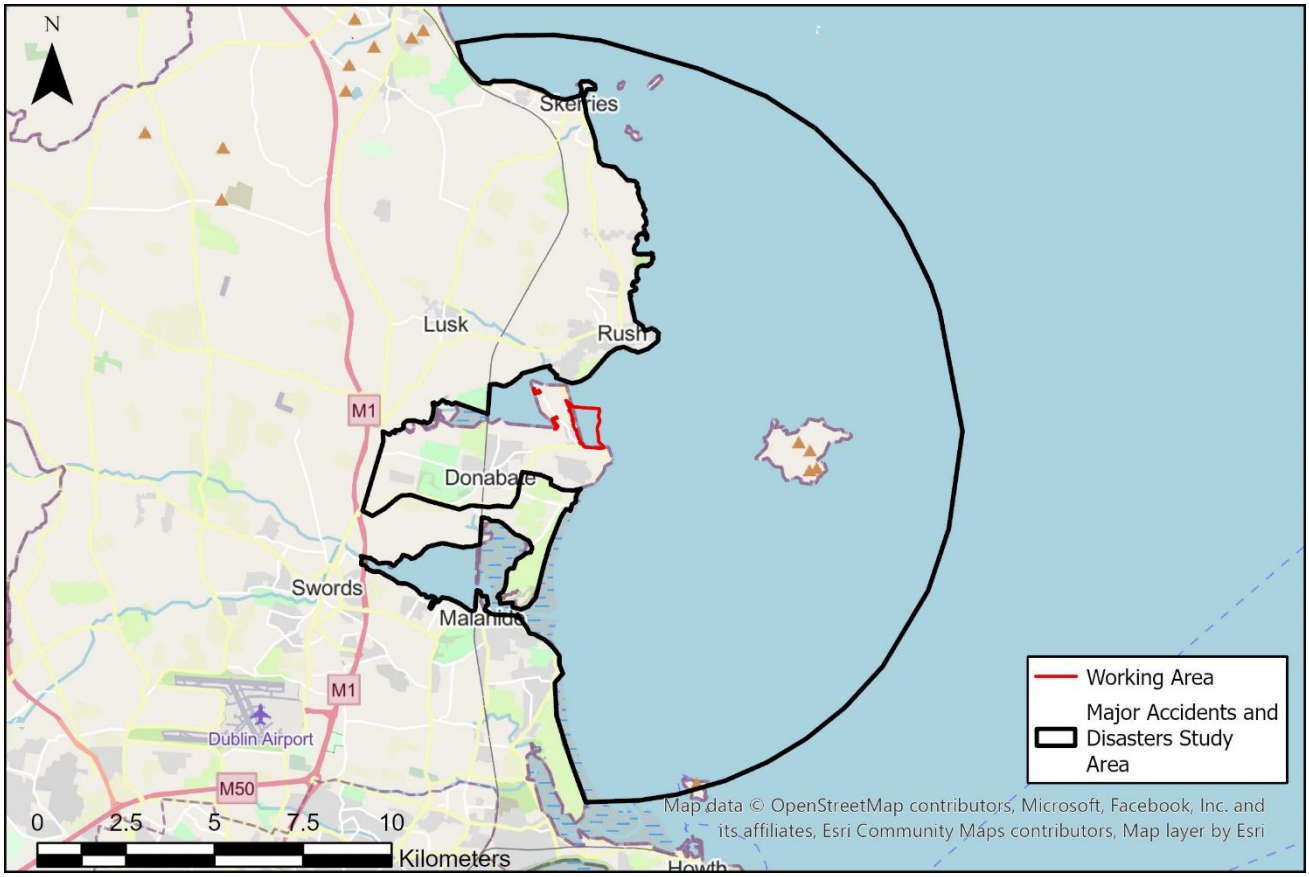


Figure 20-1: Major Accidents and Disasters Study Area

20.3.4 Receptor Identification

All environmental factors defined in Article 3 of the 2014 EIA Directive (as amended), should be considered in the assessment of significant adverse effects. For the purpose of this assessment, an environmental receptor is therefore considered to be any of the relevant receptors identified within the following EIAR topics:

- Coastal Processes (Chapter 6);
- Noise and Vibration (Chapter 7);
- Flood Risk (Chapter 8);
- Water Quality (Chapter 9);
- Soils, Geology and Contamination (Chapter 10);
- Archaeology and Cultural Heritage (Chapter 11);
- Biodiversity (Marine, Terrestrial and Coastal) (Chapters 12, 13);
- Traffic and Transportation (Chapter 14);
- Air Quality and Climate (Chapter 15);
- Waste (Chapter 16);

- Material Assets and Land Use (Chapter 17);
- Landscape and Visual (Chapter 18); and
- Population and Human Health (Chapter 19).

Key receptors were scrutinised through the examination of information presented in the EIAR, a review of mapping and aerial photography, and identification of designated sites/ areas.

20.3.5 Risk Assessment Methodology

For the purposes of this assessment, the definition of significant environmental effect outlined in Table 20.1 has been adopted. The site-specific risk assessment identifies and quantifies risks focusing on unplanned, but possible and plausible events occurring during the construction and operation of the Proposed Development. The approach to identifying and quantifying risks associated with the Proposed Development by means of a site-specific risk assessment is derived from the EPA (2022) Guidance. The criteria for categorising impact is derived from the DEHLG (2010) guidance.

The risk assessment is set out in three stages:

1 Risk Identification;

2 Risk Classification (Likelihood and Consequence); and

3 Risk Evaluation.

20.3.5.1 Risk Identification

In accordance with the European Commission Guidance on the preparation of the Environmental Impact Assessment Report (2017), the identification of potential risks is undertaken in respect of the Proposed Development's:

- Potential vulnerability to major accidents and/ or disasters; and
- Potential to cause accidents and/or disasters.

A Hazard Identification Register was completed and can be found in Appendix 20.A.

20.3.5.2 Risk Classification

Following the initial identification process, an assessment of the likelihood of occurrence of each risk event has been undertaken. Safety procedures and proposed environmental mitigation relevant to the Proposed Development were considered when estimating the likelihood of identified potential risk events occurring. The rating criteria of DEHLG (2010) Guidance is adopted for the assessment. This is presented in Table 20.2.

A 'risk likelihood' has been assumed in the adopted approach, where one or more aspects of the likelihood description are met. This assessment excludes any risk event associated with the Proposed Development with a likelihood of occurrence less than 'extremely unlikely'.

Table 20.2 Risk Classification Table - Likelihood (DEHLG, 2010)

Rating	Classification	Impact Description
1	**Extremely Unlikely**	May occur only in exceptional circumstances; once every 500 or more years.
2	**Very Unlikely**	Is not expected to occur; and/ or no recorded incidents or anecdotal evidence; and/ or very few incidents in associated organisations, facilities, or communities; and/ or little opportunity, reason or means to occur; may occur once every 100-500 years.
3	**Unlikely**	May occur at some time; and/ or few, infrequent, random recorded incidents, or little anecdotal evidence; some incidents in associated or comparable organisation's worldwide; some opportunity, reason or means to occur; may occur once per 10-100 years.
4	**Likely**	Likely to or may occur; regular recorded incidents and strong anecdotal evidence and will probably occur once per 1-10 years.
5	**Very Likely**	Very likely to occur; high level of recorded incidents and/or strong anecdotal evidence. Will probably occur more than once a year.

20.3.5.3 Classification of Consequence

The EPA (2022) guidance states that the risk assessment must be based on a 'worst-case' scenario. As such, the consequence rating assigned to each potential risk event has assumed that mitigation measures and/ or safety procedures have failed to prevent an effect on the environment. The rating criteria of DEHLG (2010) Guidance is adopted for the assessment. This is presented in Table 20.3.

The consequence of a risk to the Proposed Development has been determined where one or more aspects of the consequence description are met. This assessment excludes any risk event associated with the Proposed Development with a consequence score of less than 'Minor'.

Table 20.3 Risk Classification Table - consequence (DEHLG, 2010)

Rating	Consequence	Impact	Description
1	**Minor**	Life, Health, Welfare; Environment; Infrastructure; and Social	• Small number of people affected; no fatalities and small number of minor injuries with first aid treatment • No contamination, localised effects • <0.5 million euro • Minor localised disruption to community services or infrastructure (<6 hours)
2	**Limited**	Life, Health, Welfare; Environment; Infrastructure; and Social	• Single fatality; limited number of people affected; a few serious injuries with hospitalisation and medical treatment required. Localised displacement of a small number of people for 6-24 hours. Personal support satisfied through local arrangements. • Simple contamination, localised effects of short duration • 0.5 million to 3 million euro • Normal community functioning with some inconvenience

Rating	Consequence	Impact	Description
3	**Serious**	Life, Health, Welfare; Environment; Infrastructure; and Social	• Significant number of people in affected area impacted with multiple fatalities (<5), multiple serious or extensive injuries (20), significant hospitalisation. Large number of people displaced for 6-24 hours or possibly beyond; up to 500 evacuated. External resources required for personal support. • Simple contamination, widespread effects or extended duration • 3 million to 10 million euro • Community only partially functioning, some services available
4	**Very Serious**	Life, Health, Welfare; Environment; Infrastructure; and Social	• 5 to 50 fatalities, up to 100 serious injuries, up to 2,000 evacuated • Heavy contamination, localised effects or extended duration • 10 million to 25 million euro • Community functioning poorly, minimal services available.
5	**Catastrophic**	Life, Health, Welfare; Environment; Infrastructure; and Social	• Large numbers of people impacted with a significant number of fatalities (>50), injuries in the hundreds, more than 2,000 evacuated. • Very heavy contamination, widespread effects of extended duration. • >25 million euro • Serious damage to infrastructure causing significant disruption to, or loss of, key services for prolonged period. Community unable to function without significant support

20.3.5.4 Risk Evaluation

In accordance with DEHLG (2010) Guidance, the evaluated major accidents and/ or disasters risk events were compared to a risk matrix to determine the level of significance of each risk event. These have been grouped according to three categories:

- High Risk – events that have an evaluation score of 15 to 25, as indicated by the Red Zones in Table 20.4.
- Medium Risk – events that have an evaluation score of 8 to 12, as indicated by the Amber Zone in Table 20.4.; and
- Low Risk – events that have an evaluation score of 1 to 6, as indicated by the Green Zone in Table 20.4

Table 20.4 Risk Matrix (DEHLG, 2010)

Likelihood						
	5 – Very Likely					
	4 – Likely					
	3 – Unlikely					
	2 – Very Unlikely					
	1 – Extremely Unlikely					
		1 - Minor	2 - Limited	3 - Serious	4 – Very Serious	5 - Catastrophic
	Consequence of Impact					

20.4 Receiving Environment

The baseline environmental conditions in the absence of the Proposed Development, as presented in each of the EIAR topic chapters identified in Section 20.3.4, were examined individually to identify the key hazards that may exist in the study area.

20.5 COMAH Establishments

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

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

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

There are 17 upper tier Establishments and 15 lower tier establishments located within County Dublin[41]. The SK Biotek lower tier COMAH establishment, which produces pharmaceuticals, is the closest to the Proposed Development, situated *c.*7.7km to the southwest of the Working Area in Swords, County Dublin. All remaining COMAH establishments are located over 10km from the Working Area of the Proposed Development. Given the distance of the Proposed Development from these COMAH establishments, this does not need to be considered further within this assessment.

[41] The HSA publishes details of upper tier and lower tier establishments on its website, https://www.hsa.ie/eng/Your_Industry/Chemicals/Legislation_Enforcement/COMAH/List_of_Establishments/.

20.6 Natural Events

20.6.1 Introduction

Natural events (such as earthquakes, lightning strikes, extreme weather events, etc.) may cause or exacerbate a major accident at the location of the works, which may in turn impact on the Proposed Development. These events are outlined in the following subsections.

20.6.2 Earthquakes

The School of Cosmic Physics (part of the Dublin Institute for Advanced Studies – DIAS) operates the Irish National Seismic Network (INSN), which comprises a series of monitoring stations around the country. Figure 20.2 shows the location and magnitude of historic and recorded seismic events in Ireland since 1980. This shows that while there have been several recorded seismic events, they are all of low or very low magnitude (typically less than magnitude 1.9).

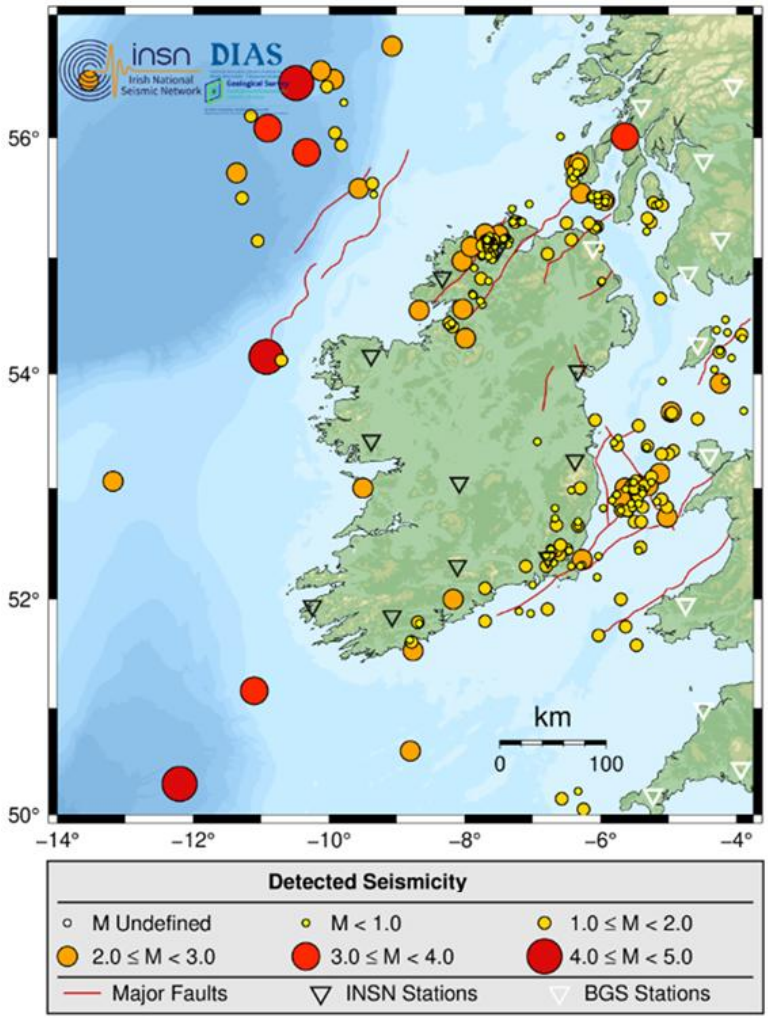


Figure 20.2 Historical & Recorded Seismic Events since 1980[42]

[42] https://www.insn.ie/

The Seismic Hazard Harmonization in Europe (SHARE) project, comprising eighteen European partner institutions, has compiled two European Earthquake Catalogues, one for the period 1000 to 1899, and one for the period 1900 to 2006, which show the locations of seismic events across Europe. The map for the period 1900 to 2006 is shown in Figure 20.3. It indicates that there is relatively little seismic activity in Ireland.

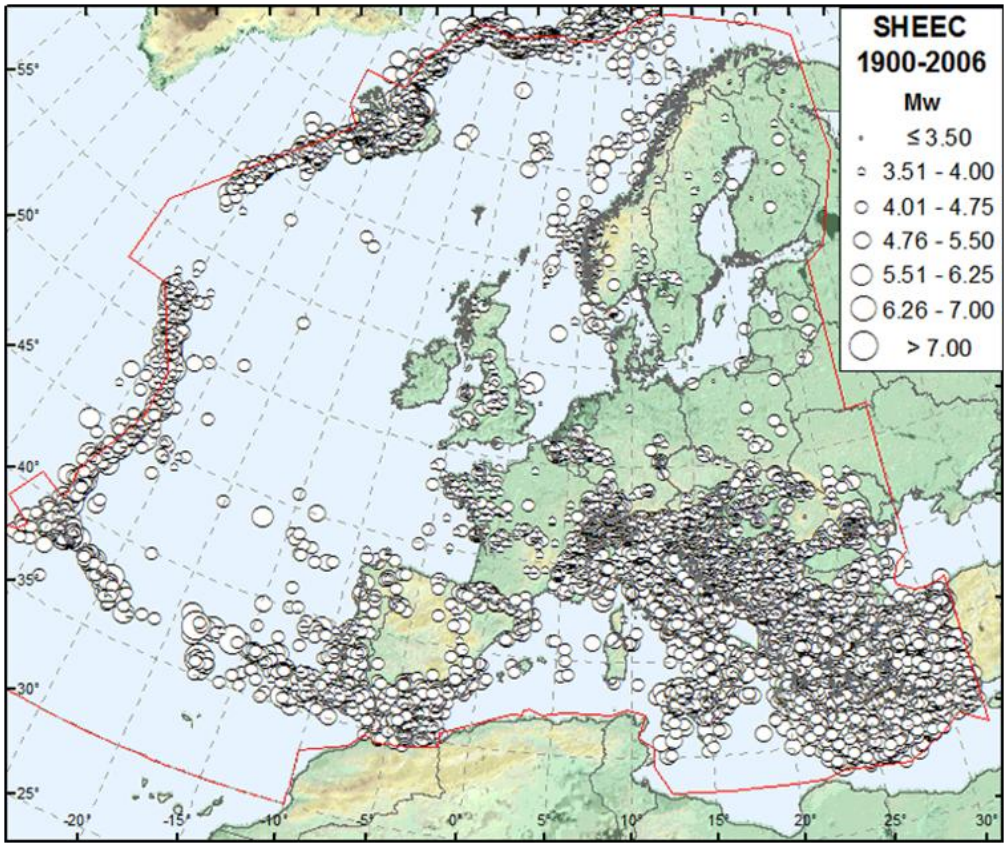


Figure 20.3 SHARE European Earthquake Catalogue (1900 to 2006)[43]

The SHARE project has also developed a European Seismic Hazard Map, shown in Figure 20.4. This shows the peak horizontal ground acceleration (measured in gravitational acceleration (g)) predicted to be reached or exceeded with a 10% probability in 50 years. This corresponds to the average recurrence of such ground motions every 475 years, as prescribed by the national building codes in Europe for standard buildings. Low hazard areas (PGA≤0.1 g) are coloured in blue-green, moderate hazard areas in yellow-orange and high hazard areas (PGA>0.25 g) in red. As can be seen from Figure 20.4, Ireland is a low hazard area.

[43] http://hazard.efehr.org/en/Documentation/specific-hazard-models/europe/overview/earthquake-catalogue/

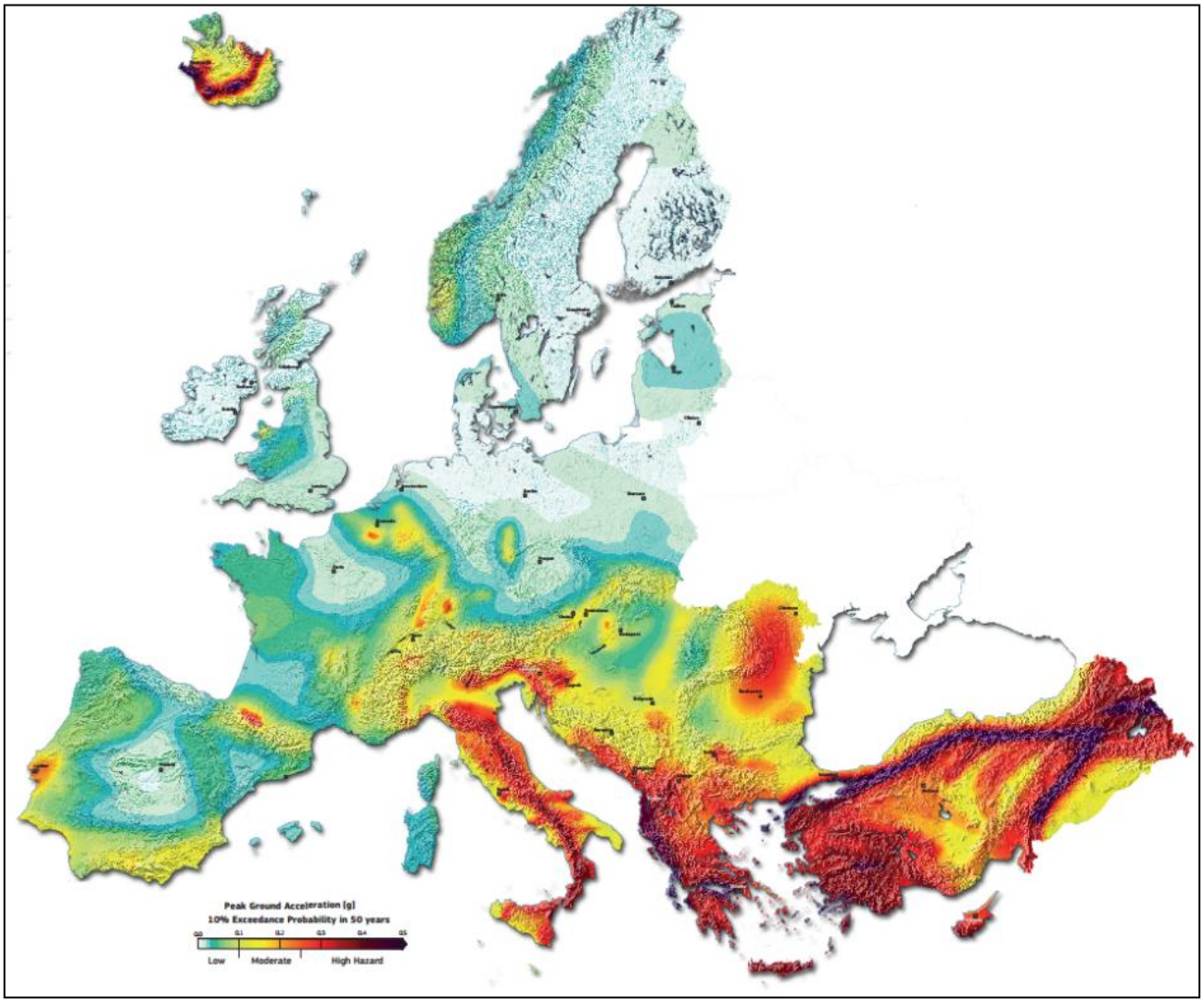


Figure 20.4 European Seismic Hazard Map[44]

20.6.3 Lightning Strikes

The UK Met Office has operated a lightning strike location network since 1987 (in its current form known as ATDnet), which allows for the detection of lightning activity across Europe and in turn the development of maps showing the density of lightning strikes. A 2020 research paper[45] analysed the data from the network and produced the lightning flash density map shown in Figure 20.5. This shows that, in general, Ireland is an area of relatively low lightning activity, with the paper noting that:

Over the UK, Ireland and Scandinavia the densities are generally lower than the rest of Europe. Some of the lowest densities are observed over the Atlantic, North Sea and Baltic Sea.

[44] http://www.share-eu.org/

[45] Sven-Erik Enno, Jacqueline Sugier, Regina Alber, Mark Seltzer, Lightning flash density in Europe based on 10 years of ATDnet data.

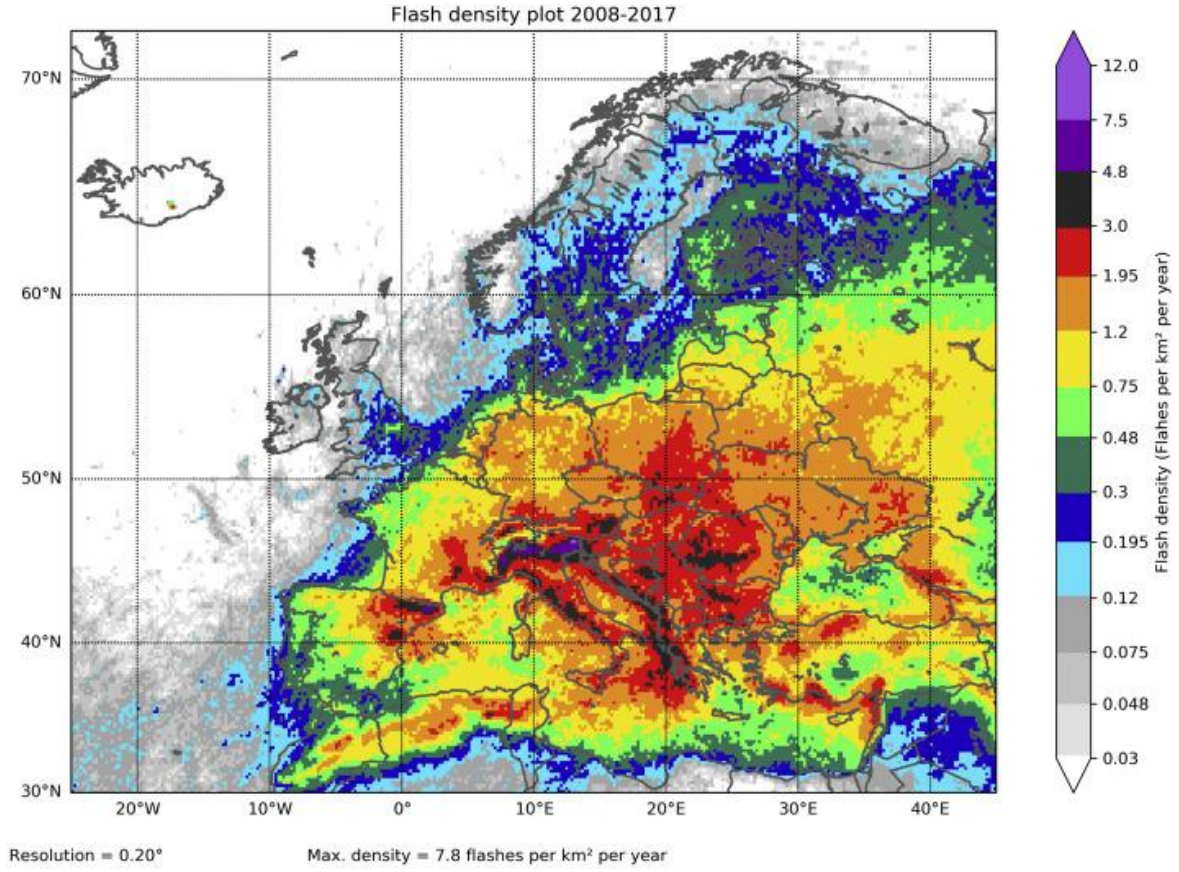


Figure 20.5 Annual Detected Lightning Flash Density (2008 – 2017)[45]

20.6.4 Flooding

The Office of Public Works (OPW) National Flood Hazard Mapping system provides details of historic flooding incidents throughout the country, however, there are currently no flood maps available on the OPW website for this area as they are 'Under review'. A Flood Risk Assessment for the Proposed Development based on the Rogerstown CFERM report prepared by RPS (2020) is presented in Chapter 8 of this report.

Currently, there is a notable coastal flood risk in the Burrow which could potentially flood up to 23 properties during the 0.5% AEP event. Flood risk is sensitive to future sea level rises caused by climate change, thus increasing the flood risk at the Burrow. During the 0.5% AEP mid-range future scenario up to 148 properties are at risk. In addition, the Burrow has experienced two flooding events in the past.

For further information on the baseline scenario for Flood Risk please see Chapter 8.

20.6.5 Extreme Weather Events

Dublin Airport weather station[46] is the closest station to the Proposed Development which records data for rainfall, temperature and wind, as such this was used to outline the baseline climatic conditions. There is a closer weather station at Malahide but records are only available for rainfall.

[46] https://www.met.ie/climate/available-data/historical-data

20.6.5.1 Temperature

The maximum daily air temperature at the Dublin Airport weather station over the period 2014 to 2023 (the latest 10-year period) was 29.1°C (occurring on 18th July 2022), with a minimum daily air temperature of -7.9°C (on 3rd February 2015). The largest daily temperature range over the period was 19.5°C, varying from a low of 5.5°C to a high of 25°C (on 2nd June 2020).

Met Éireann defines a heatwave as five consecutive days or more with a maximum temperature over 25°C. No heatwaves have been recorded at Dublin Airport in the last 30-years, although there have been several periods during which the maximum daily temperatures have been above 20°C for more than five days. There is no equivalent definition for a prolonged cold period ('cold spell'); over the period 2014 to 2023 there have been multiple periods of low minimum temperatures (less than 0°C) on consecutive days, the longest of which was over 9 days. This occurred on two occasions:

- 28th January to 5th February 2019; and
- 8th December to 16th December 2022.

20.6.5.2 Wind

Wind data (speed and direction) from the Dublin Airport weather station is summarised in Table 20.5 and shown in Figure 20.6 for the period 2014 to 2023. The prevailing wind direction is from the west and southwest. The mean wind speed over the period was 5.2m/s; the mean wind speed over the period 1981 to 2010 was 5.3m/s.

Table 20.5 Wind Speed Data for Dublin Airport (2014 to 2023)

Direction (from)	All wind speeds	0 – 2m/s (0 – 7.2km/h)	2 – 5m/s (7.2 – 18km/h)	5 – 10m/s (18 – 36km/h)	> 10m/s (> 36km/h)
North	0.8%	2.7%	1.3%	0.0%	4.8%
North east	0.3%	2.7%	1.9%	0.1%	4.9%
East	1.0%	5.7%	3.0%	0.2%	10.0%
South east	1.1%	6.7%	4.4%	0.5%	12.6%
South	1.0%	4.3%	4.3%	0.5%	10.1%
South west	0.8%	9.2%	10.9%	1.3%	22.2%
West	1.0%	11.1%	13.5%	2.0%	27.7%
North west	0.7%	3.7%	3.1%	0.2%	7.6%
Total	6.8%	46.1%	42.4%	4.8%	100.0%

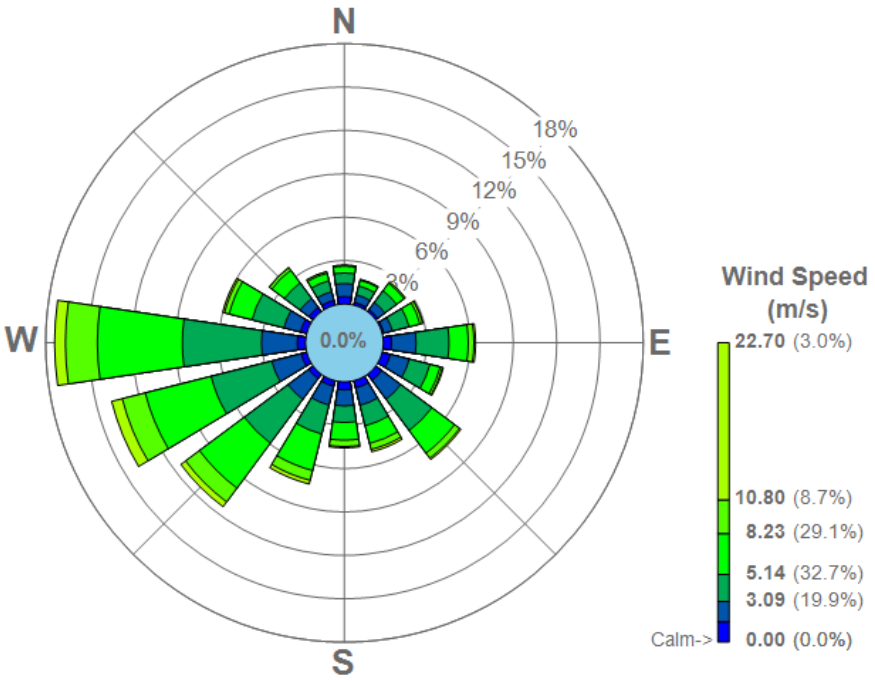


Figure 20.6 Wind Rose for Dublin Airport (2014 – 2023)

Data from Met Éireann shows that the typical maximum gust speeds for a 50-year return period are up to 50m/s (180km/h) depending on the location of the site in Ireland. The historic meteorological data from the Dublin Airport weather station shows that the highest 10-minute mean wind speed over the period 2014 to 2023 was 25m/s (approximately 90km/h), with a maximum gust of 34m/s (approximately 120km/h).

20.6.5.3 Rainfall

The average annual rainfall at Dublin Airport over the last ten years (2014 to 2023) ranged from 661mm (in 2017) to 1,001mm (in 2023), with a 30-year annual average (1981 to 2010) of 758mm. The highest total daily rainfall over the last ten years was 84mm, recorded on 2nd August 2014, and the longest prolonged period of wet weather (days on which precipitation was recorded) was 23 days, which occurred between 24th November and 16th December 2018, during which 91mm of rainfall was recorded. The longest period during which no rainfall occurred was over a period of 24 days between 21st June and 14th July 2018.

20.6.6 Summary

Ireland is an area of relatively low seismic activity and low lightning activity, and in general is not subject to extreme weather events other than flooding. In light of this and the potential major accident scenarios, it is considered that these natural events will not significantly increase the likelihood of a major accident arising at and on the area of the Proposed Development.

20.7 Potential Effects

20.7.1 Do-Nothing Scenario

If the Proposed Development does not proceed, there will be no change to the likelihood of occurrence or consequences of a major accident and/or disaster.

20.7.2 Construction Phase

Potential risk events during the construction phase have been identified and are outlined in the construction phase risk register in Table 20.6.

Table 20.6 Risk Register – Construction Phase

Risk ID	Potential Risk Event	Possible Cause
C1	Major Construction Vessel Collision or Allision during construction works	- Operator or system error - Navigational error - Severe weather - Engine failure
C2	Major traffic collision/ allision	- Contractor error - Operator error - Severe weather event - Unforeseen structural weakness
C3	Flooding of construction areas and/ or site storage areas/ compounds/ welfare facilities	- Severe weather event - In adequate temporary flood protection
C4	Major pollution or sedimentation event affecting nearby designated sites	- Remobilisation of contaminated material into water column - Spill or leaks of oils or hydrocarbons from machinery or vessels - Vessel collision - Extreme weather (rain, wind) - Employee negligence
C5	Accident to construction workers due to machinery or heavy lift failure	- Machinery failure - Severe weather event
C6	Accident involving the general public in the vicinity of construction works	- Vessel collision - Severe weather event - Inadequate security or safety fencing
C7	Man overboard during beach renourishment	- Vessel collision - Severe weather event - Slip, trips or falls
C8	Severe weather conditions leading to storm surges, high tides and large waves affecting construction areas	- Severe weather event
C9	Piling activities causing damage to the soil structure leading to an accident involving land slippage or sinking.	- Contractor error - Operator error - Slip, trips or falls - Severe weather event - Unforeseen structural weakness
C10	Fire/ explosion	- Vessel collision - Engine failure

20.7.3 Operation Phase

Potential risk events during the operation phase have been identified and are outlined in the operation phase risk register in Table 20.7.

Table 20.7 Risk Register – Operation Phase

Risk ID	Potential Risk Event	Possible Cause
O1	Major Vessel Collision/ Allision during periodic beach renourishment	- Operator or system error - Navigational error - Severe weather - Engine failure
O2	Major pollution or sedimentation event affecting nearby designated sites during periodic beach renourishment	- Remobilisation of contaminated material into water column - Spill or leaks of oils or hydrocarbons from machinery or vessels - Vessel collision - Extreme weather (rain, wind) - Employee negligence
O3	Severe weather conditions leading to storm surges, high tides and large waves affecting beach renourishment	- Severe weather event
O4	Man overboard during periodic beach renourishment	- Vessel collision - Severe weather event - Slip, trips or falls
O5	Major traffic collision when travelling to undertake inspections	- Contractor error - Operator error - Severe weather event - Unforeseen structural weakness
O6	Severe Flood Event	- Severe weather event - Flood Defence Failure
O7	Fire/ explosion	- Vessel collision - Engine failure

20.7.4 Risk Assessment

The potential risk events identified in Sections 20.7.2 and 20.7.3 have been assessed and the resulting risk analysis is presented in Table 20.8. All basis of consequence assessments are based on the DEHLG guidance presented in Table 20.2 and Table 20.3.

The risk register is based upon likely significant risks associated with the Proposed Development. The consequence rating assigned to each potential risk assumes that the proposed mitigation measures and safety procedures have failed to prevent the effect on the environment.

Table 20.8 Risk Assessment

Risk ID	Potential Risk Event	Environmental Effect	Likelihood Rating (1-5)	Consequence Rating (1-5)	Risk Score (Likelihood x Consequence)	Comments
C1	Major construction vessel collision or allision during construction works	- Injury/loss of life - Damage to marine environment from leaked oil /fluids - Damage to infrastructure	2	2	4	Collisions may occur during the construction phase due to increased construction vessel activity. During construction a TSHD will sail to Portrane Beach from a licensed renourishment extraction area (presently assumed to be Liverpool Bay) to pump the beach nourishment material to shore. This will require multiple journeys over an approximate 6-week period. The potential route required to/ from Liverpool Bay could interact a number of known ferry routes including the Dublin - Liverpool, Dublin - Heysham, Isle of Man – Dublin, Isle of Man – Liverpool and Belfast – Liverpool routes, interaction is also possible with commercial fishing vessels within the Irish Sea given that this is an important area for the commercial fishing industry, while interaction with recreational sailing areas outside Liverpool Bay and areas of relatively low sailing activity on the approach to Rogerstown Estuary and Lambay Island cannot be ruled out. There is also potential for the route to interact with the routes of cargo and tanker vessels passing between/from ports in Great Britain, Northern Ireland and Republic of Ireland. Collisions could occur between construction vessels (if more than one TSHD is utilised), between construction vessels and small craft, recreational or commercial vessels, as well as the construction vessels and the mooring/ sinker pipeline. Allisions could occur between construction vessels and the shoreline (i.e., running aground) as well as contact with existing man-made infrastructure along the shoreline. Given that only one TSHD is anticipated to be involved in the construction phase and the relatively low vessel activity within the vicinity of the Proposed Development, it is considered very unlikely for a collision to occur. Especially when considering recommended mitigation measures within Chapter 6 such as using a land-based plant at exposed low tides for the construction of fishtail groynes to negate working with the water column and the development of a robust plan to monitor and respond to tides and storm events. Additionally, a mooring point to allow for the safe mooring of the dredger over all states of the tide may reduce the likelihood of allision. Furthermore, community liaison will be undertaken to inform locals about the works. Works will be undertaken in accordance with industry good practice measures, and health and safety regulations, and

Risk ID	Potential Risk Event	Environmental Effect	Likelihood Rating (1-5)	Consequence Rating (1-5)	Risk Score (Likelihood x Consequence)	Comments
						carried out by suitably qualified personnel. A CEMP will also be developed. The consequence of an accidental collision or allision will be dependent on the nature of the collision. A collision could result in a 'limited' number of people affected, a few serious injuries or loss of life to operators on any vessel involved in the collision. Should a collision occur, there is the potential for a pollution event to occur which would have a localised short-term effect on sensitive marine receptors.
C2	Major traffic collision/ allision	- Injury/ loss of life - Potential for damage to transport infrastructure and disruption to transport - Potential to discharge deleterious material (e.g. fuel) to watercourses - Fire/ Explosion	2	2	4	Collisions may occur during the construction phase due to increased construction vehicle activity, primarily related to the transportation of construction materials for the flood embankments, flood wall and fishtail groynes, and supporting equipment required for beach renourishment elements. All terrestrial plant and materials will be brought to Burrow Road via the R126, which will require plant movements on public roads for the duration of the works. Collisions could occur between construction vehicles and/or between construction vehicles and vehicles operated by the general public. Allisions could occur between construction vehicles and natural or manmade features. This is particularly important given the narrow nature of the roads providing access to the site and the potential for large vehicles (e.g. HGVs) navigating them. Given that the Traffic and Transport assessment concluded that the increase in flows is considered a negligible increase in trips, it is considered very unlikely for a vehicle collision to occur. Especially when considering the mitigation measures recommended in Chapter 14 such as the development of a CEMP, CTMP, as well as road closures where necessary at the preliminary stage. Furthermore, landowner and community liaison regarding the construction works will be undertaken including the requirement of roads for access. Pre-approved routes will be used to transport equipment and infrastructure to the site, while alternative access routes for residents and appropriate signage will be erected around the site. Works will be undertaken in accordance with industry good practice measures, and health and safety regulations, and carried out by suitably qualified personnel. The consequence of an accidental collision will be dependent on the nature of the collision. A collision could result in a 'limited' number of

Risk ID	Potential Risk Event	Environmental Effect	Likelihood Rating (1-5)	Consequence Rating (1-5)	Risk Score (Likelihood x Consequence)	Comments
						people affected, a few serious injuries or loss of life to operators in any vehicle involved. Should a collision occur, there is the potential for a pollution event to occur which would have a localised short-term effect on sensitive receptors. There is also potential for damage or disruption to existing transport infrastructure.
C3	Flooding of construction areas and/or site storage areas/ compounds/ welfare facilities	- Injury/loss of life - Disruption/ damage to construction activities	2	2	4	The Proposed Development Working Areas are currently at risk of coastal flooding (Flood Zone A), as such there will be a temporary risk of flooding to the construction works from extreme tidal events. Given the designed in measures outlined in Section 3.3 and the mitigation measures proposed in Chapter 8 –– i.e. temporary works to prevent coastal waters interacting with work activities and use of the Met Éireann weather warning alert service – it is very unlikely that this will occur. Furthermore, Chapter 6 recommends the development of robust plan to monitor and respond to tides and storm events. Works will be undertaken in accordance with industry good practice measures, and health and safety regulations, and carried out by suitably qualified personnel. If flooding of the construction areas were to occur the potential of injury or death to construction workers on site, as well as damage/ disruption to the construction activities which may have economic implications.
C4	Major pollution or sedimentation event affecting nearby designated site	- Damage to marine environment	3	2	6	Many designated sites are located within the vicinity of the Proposed Development. A major pollution or sedimentation event is possible due to the requirement for use of cements, fuels oils and other chemicals, and the pumping of sand “slurry” mixture. These events my impact the water quality as well as directly or indirectly impacting the species and habitats for which the sites are designated. The following mitigation measures are discussed in Section 3.4.9 or Chapter 9: - CEMP - Emergency Response Plan (ERP) should be included within the CEMP - A site-specific pre-construction Site Waste Management Plan (SWMP)

Risk ID	Potential Risk Event	Environmental Effect	Likelihood Rating (1-5)	Consequence Rating (1-5)	Risk Score (Likelihood x Consequence)	Comments
						- Concrete use and production shall adhere to control measures outlined in Guidance for Pollution Prevention (GPP5): Works and maintenance in or near water. - Follow requirements of best practice and relevant guidelines listed in the Netregs Guidelines for Pollution Prevention (GPP) - Where preferential surface flow paths occur, silt fencing or other suitable barriers will be used to ensure silt laden or contaminated surface runoff from the site does not discharge directly to a water body or surface water drain. - In the event that dewatering of foundations or drainage trenches is required during construction and/or discharge of surface water from sumps, a treatment system prior to the discharge will be used; silt traps, settlement skips etc. This measure will allow additional settlement of any suspended solids within storm water arising from the construction areas. - Where possible, storage of materials shall be outside of the Rogerstown Estuary designation boundaries to reduce the risk of contamination from potential pollution events. - Beach renourishment should only occur following the construction of the fishtail groynes to reduce the potential dispersion of sediments to the wider marine environment. - Type and sources of construction materials – using clean local material should help reduce the risk of pollution during construction phase and reduce transport distances. - The safe operation of refuelling activities shall be in accordance with PPG 7 “Safe Storage – The safe operation of refuelling facilities”. - Fuel, oil and chemical storage will be sited on an impervious base within a bund and secured. The base and bund walls must be impermeable to the material stored and of adequate capacity. The control measures in GPP2: Above Ground Oil Storage Tanks and PPG 26 “Safe storage – drums and intermediate bulk containers” will be implemented to ensure safe storage of oils and chemical.

Risk ID	Potential Risk Event	Environmental Effect	Likelihood Rating (1-5)	Consequence Rating (1-5)	Risk Score (Likelihood x Consequence)	Comments
						- A project specific Pollution Incident Response Plan will be prepared by the contractor consistent and will be in accordance with PPG 21 Pollution Incident Response Planning. - Construction Phase Monitoring – records will be kept for each waste material which leaves the site, whether for reuse on another site, recovery, recycling or disposal. A system will be put in place to record the waste arising on site during the construction phase. Given these mitigation measures, and that these works will be undertaken in accordance with industry good practice measures, and health and safety regulations, and carried out by suitably qualified personnel, it is unlikely a major pollution event will impact a designated site. As the works are relatively small-scale, there are likely to be small volumes of material used, apart from sand, therefore, any accidental spillages are likely to be relatively small-scale and of limited impact. It is anticipated these may only impact the intertidal area within the Rogerstown Estuary SAC, SPA, Ramsar, pNHA and Nature Reserve. Given the spatial separation of the works to other designations in the wider Study Area, it is extremely unlikely for suspended sediment to have an impact on these. If a major sedimentation or pollution event were to occur it is expected to be localised with a short duration of limited impacts.
C5	Accident to construction workers due to machinery or heavy-lift failure	Injury/ loss of life	2	2	4	Machinery and heavy-lift equipment are required during the construction phase and unforeseen issues can occur. Although accidents due to machinery failure can occur, given the scale of the work to be completed during the Proposed Development, this is considered to be very unlikely. Especially when a CEMP will be developed for these works and that they will be undertaken in accordance with industry good practice measures, and health and safety regulations, as well as being carried out by suitably qualified personnel who are aware of the risks and how to reduce them effectively. Should an accident occur, this is expected to be limited in impacts, but with the potential for a fatality, depending on the nature of the accident.
C6	Accident involving the general public in the	Injury/ loss of life	1	2	2	There is potential for accidents involving the general public, although safety fencing and pedestrian management measures are proposed to be in place on the beach to manage interaction with the public. Furthermore,

Risk ID	Potential Risk Event	Environmental Effect	Likelihood Rating (1-5)	Consequence Rating (1-5)	Risk Score (Likelihood x Consequence)	Comments
	vicinity of construction works					community liaison regarding the works will be undertaken. A CEMP will also be developed including a CTMP. As such, it is considered extremely unlikely for an accident to occur. If an accident did occur, this is expected to be limited in impact, but with the potential for a fatality, depending on the nature of the accident.
C7	Man overboard during beach renourishment	Injury/ loss of life	2	2	4	Vessels are utilised during beach renourishment and as such there is a risk of a construction worker falling overboard. This is considered to be very unlikely as a CEMP will be developed for these works and they will be undertaken in accordance with industry good practice measures, and health and safety regulations, and carried out by suitably qualified personnel who are aware of the risks and how to reduce them effectively. Furthermore, a robust plan to monitor and respond to tides and storm events has been recommended in Chapter 6, avoiding harsh conditions may reduce the likelihood of this risk. A mooring point to allow for the safe mooring of the dredger over all states of the tide will also be developed. In the very unlikely event that a person falls overboard during the construction phase, there is potential for injury or a fatality.
C8	Severe weather conditions leading to storm surges, high tides and large waves affecting construction areas	- Injury/ loss of life - Damage to infrastructure	2	2	4	As noted in Chapter 6 the area within which the Proposed Development is being constructed has been affected by severe weather conditions in the past. As such this may pose a risk to construction workers undertaking beach nourishment, or within the onshore Working Area. Given the recommended mitigation measures within Chapter 6 such as the development of a robust plan to monitor and respond to tides and storm events, the designed in measures outlined in Section 3.3 and the mitigation measures proposed in Chapter 8 - temporary works to prevent coastal waters interacting with work activities and use of the Met Éireann weather warning alert service – it is very unlikely that this will occur. A mooring point to allow for the safe mooring of the dredger over all states of the tide will also be developed. In the very unlikely event (may occur once every 100-500 years) that severe weather conditions lead to storm surges and high tides, the Working Areas, and wider Burrow area could need to be evacuated and a significant number of people impacted. However, this is little different to the present situation.
C9	Piling activities causing damage to the soil	- Injury/ loss of life	2	2	4	During construction, there is the potential for piling activities to lead to land slippage or sinking in construction areas. A stable working platform will be

Risk ID	Potential Risk Event	Environmental Effect	Likelihood Rating (1-5)	Consequence Rating (1-5)	Risk Score (Likelihood x Consequence)	Comments
	structure leading to an accident involving land slippage or sinking.	- Damage to the marine environment				established for the rig to operate from. Furthermore, a CEMP will be developed for these works, and they will be undertaken in accordance with industry good practice measures, and health and safety regulations, and carried out by suitably qualified personnel who are aware of the risks and how to reduce them effectively. As such it is considered very unlikely that this will occur. Should a land slippage or sinking related accident occur, this is expected to be limited in impacts, but with the potential for death and/or injury depending on the scale of the accident. There is potential this would damage/disruption to the construction activities which may have economic implications. Additionally, there is potential for the release of sediment or pollutants into the marine environment which would be expected to be localised and temporary in nature.
C10	Fire/ explosion	- Injury/ loss of life - Damage to marine environment - Damage to infrastructure	1	3	3	The quantities of flammable materials on site will be negligible during the construction phase and therefore it is considered extremely unlikely for a fire/ explosion to occur. Fuel, oil and chemical storage will be sited on an impervious base within a bund and secured. The base and bund walls must be impermeable to the material stored and of adequate capacity. The control measures in GPP2: Above Ground Oil Storage Tanks and PPG 26 “Safe storage – drums and intermediate bulk containers” will be implemented to ensure safe storage of oils and chemical. Furthermore, a CEMP will be developed for these works, and they will be undertaken in accordance with industry good practice measures, and health and safety regulations, and carried out by suitably qualified personnel who are aware of the risks and how to reduce them effectively. Should a fire/ explosion occur, the consequence could be serious resulting in a significant number of people being impacted with the potential for multiple fatalities.
O1	Major Vessel Collision/ Allision during periodic beach renourishment	- Injury/ loss of life - Damage to marine environment from leaked oil/ fluids - Damage to infrastructure	2	2	4	Sediment material will be gradually lost from between the groyne structures over time and particularly during storm conditions. Consequently, beach levels within these cells will gradually reduce over time and require periodic renourishment. The frequency of renourishment is expected approximately every 5-10 years. The magnitude of renourishment will be subject to the rate of losses

Risk ID	Potential Risk Event	Environmental Effect	Likelihood Rating (1-5)	Consequence Rating (1-5)	Risk Score (Likelihood x Consequence)	Comments
						during the intervening period but is expected to range between 50 – 75% of the initial renourishment volume. As future beach renourishment campaigns will be undertaken as per the methodology and mitigation used during the construction period, the same level of risk likelihood of 'unlikely' and consequence of 'limited' are applicable during the operation phase.
O2	Major pollution or sedimentation event affecting nearby designated sites during periodic beach renourishment	Damage to the marine environment	2	2	4	As previously mentioned, periodic beach renourishment will be required during the operation phase. These campaigns will be undertaken as per the methodology and relevant mitigation used during the construction period. The impact level of 'limited' remains the same as the construction phase, while the level of risk likelihood is reduced to 'very unlikely' due to the absence of all other works undertaken in the construction phase.
O3	Severe weather conditions leading to storm surges, high tides and large waves	- Injury/ loss of life - Damage to infrastructure	2	2	4	As noted in Chapter 6, the area within which the Proposed Development is being constructed has been affected by severe weather conditions in the past. The Proposed Development should not be adversely affected during extreme tidal events as it has been designed for these events and should provide protection to the Burrow area. In regards to the beach renourishment, which will follow the same methods and relevant mitigation as the construction phase, as well as some of the recommended mitigation measures within Chapter 6 such as the development of a robust relevant plan to monitor and respond to tides and storm events, the designed in measures outlined in Section 3.3 and the mitigation measures proposed in Chapter 8 - use of the Met Éireann weather warning alert service – it is very unlikely workers undertaking periodic beach nourishment will encounter such severe conditions. In the very unlikely event (may occur once every 100-500 years) that severe weather conditions lead to storm surges and high tides the wider Burrow area could need to be evacuated and a significant number of people impacted. However, this is similar to the current situation.
O4	Man overboard during periodic beach renourishment	Injury/ loss of life	2	2	4	Vessels will be utilised during the periodic beach renourishment and as such there is a risk of a construction worker falling overboard. As within the construction period, this is considered to be very unlikely as this these works will be undertaken in accordance with industry good practice measures, and health and safety regulations, and carried out by suitably qualified personnel who are aware of the risks and how to reduce them effectively. A mooring point to allow for the safe mooring of the dredger over all states of the tide.

Risk ID	Potential Risk Event	Environmental Effect	Likelihood Rating (1-5)	Consequence Rating (1-5)	Risk Score (Likelihood x Consequence)	Comments
						In the very unlikely event that a person falls overboard during the periodic beach renourishment, there is potential for injury or a fatality.
O5	Major traffic collision	- Injury/ loss of life - Potential for damage to transport infrastructure and disruption to transport - Potential to discharge deleterious material (e.g. fuel) to watercourses	1	2	2	Collisions may occur during the operation phase due to vehicle activity, primarily related to undertaking inspections of the flood scheme infrastructure and transport of beach renourishment supporting infrastructure to the site. The number of trips potentially required during the operation phase will be lower, and less frequent, than during the construction phase. As such the risk of collision is considered to be extremely unlikely. However, the consequence of an accidental collision will be dependent on the nature of the collision. A collision could result in a 'limited' number of people affected, a few serious injuries or loss of life to operators in any vehicle involved, especially as inspections and transport of supporting equipment for beach renourishment will be undertaken in accordance with industry good practice measures, and health and safety regulations, by suitably qualified professionals. Should a collision occur, there is the potential for a pollution event to occur which would have a localised short-term effect on sensitive receptors. There is also potential for damage or disruption to existing transport infrastructure.
O6	Severe flood event	- Injury/ loss of life - Damage to marine environment - Damage to Infrastructure - Displacement of community receptors	1	2	2	The Proposed Development will not be adversely impacted by flooding as one of the primary objectives of the Proposed Development is to provide effective coastal flood protection. The proposed new groynes, beach renourishment and flood defences will provide enhanced protection but not increase the risk from coastal flooding elsewhere. The Proposed Development should not be adversely affected during extreme tidal events as it has been designed for these events. During operation there will be no new receptors introduced into the flood hazard area, any maintenance activities will be infrequent and can be planned to avoid periods of extreme weather. Additionally, the overall flood risk which might contribute to a major accident and/ or disaster will be reduced by the presence of the flood defences in place. The failure of flood defences would be considered as extremely unlikely given that these works will be undertaken in accordance with industry

Risk ID	Potential Risk Event	Environmental Effect	Likelihood Rating (1-5)	Consequence Rating (1-5)	Risk Score (Likelihood x Consequence)	Comments
						good practice measures and by suitably qualified personnel. Furthermore, this new infrastructure will be monitored and maintained. Nonetheless, should this occur, the consequences would be limited with the potential for multiple fatalities or injuries, damage to infrastructure and minor displacement.
O7	Fire/ explosion	- Injury/ loss of life - Damage to marine environment - Damage to infrastructure	1	3	3	The quantities of flammable materials on site during many maintenance activities are expected to be negligible and they should be present infrequently. Therefore, it is considered extremely unlikely for a fire/ explosion to occur. Fuel, oil and chemical storage will be sited on an impervious base within a bund and secured. The base and bund walls must be impermeable to the material stored and of adequate capacity. The control measures in GPP2: Above Ground Oil Storage Tanks and PPG 26 “Safe storage – drums and intermediate bulk containers” will be implemented to ensure safe storage of oils and chemicals. Furthermore, these works will be undertaken in accordance with industry good practice measures, and health and safety regulations, and carried out by suitably qualified personnel who are aware of the risks and how to reduce them effectively. Should a fire/explosion occur, the consequence could be serious resulting in a significant number of people being impacted with the potential for multiple fatalities.

20.8 Mitigation Measures

Mitigation measures may be implemented in order to manage the risk of major accidents and/ or disasters to a manageable level.

Mitigation measures have been defined throughout the topic chapters of this report (Chapters 6 – 19) and are summarised in Chapter 22. These mitigation measures were considered within the assessment undertaken in this chapter to assign a risk likelihood to each risk event, as outlined in Table 20.8.

As all risk events are within the low-risk category with existing recommended mitigation and safety procedures, no further mitigation measures have been recommended in this chapter.

20.9 Residual Effects

From examining the plausible risks presented in Table 20.8, all risk events are in the Green Zone in Table 20.4, indicating that these are low risk events, and they are below the threshold of significance set for the purposes of this assessment. Through the implementation of mitigation measures as defined within the environmental topic chapters of this Report, there are no identified incidents or examples of major accidents and/ or natural disasters that present a sufficient combination of risk and consequence that would lead to significant negative residual impacts or environmental effects.

20.10 Potential Cumulative Impacts

Upon review of available information, it was determined that the only other relevant marine project located within the vicinity of the Proposed Development is the Flood Relief Scheme (FRS) proposed at Rush South, which comprises the replacement and improvement of existing seawalls located on the northern side of Rogerstown Estuary.

The potential for significant cumulative effects in terms of major accidents or disasters occurring on the Rush FRS would require the coincident occurrence of one of the hazards identified in the assessment for this Proposed Development at the Burrow. This is considered unlikely as there is a negligible probability of two such unlikely events occurring and resulting in significant cumulative effects.

Furthermore, the construction of the Rush scheme is proposed to occur after the Proposed Development at the Burrow, as such there is no potential for cumulative impacts during the construction phase. The impacts of the Proposed Development identified during the operational phase, are relatively localised and considered to be non-significant in EIA terms. Given the distance to the proposed FRS at Rush, it is unlikely cumulative effects will arise during the operation phase of the Proposed Development.

Therefore, it can be concluded that there are no significant cumulative adverse effects on the environment from major accidents and disasters from the Proposed Development alongside the proposed FRS at Rush.

20.11 Conclusions

The assessment of major accidents and disasters for the Proposed Development has found that there are a number of potential Risks during construction and operation including vessel collisions, man overboard, machinery failure, pollution/ sedimentation events, traffic collision/allision, flooding, severe weather conditions,

land slippage or sinking, and risks to the general public. These Risks could have potential for negative impacts on a number of receptors including biodiversity, water quality, coastal processes, and population and human health.

A wide variety of mitigation measures have been identified throughout the topic chapters of this report, which, when implemented will significantly reduce the potential for major accidents and disasters relating to the Proposed Development. Despite mitigation measures, a (low level) risk of a major accident or disaster occurring will remain. However, it is determined that this risk is not likely to be significant in EIA terms.

21 CUMULATIVE EFFECTS

21.1 Introduction

This chapter of the EIAR presents a summary of the assessment of cumulative effects which may arise from adjacent or nearby developments together with those predicted for the Proposed Development as well as the environmental interactions which have been examined within the individual technical assessment chapters (Chapters 6 –20).

21.1.1 Cumulative Effects

Cumulative effects address long-term changes that may result from the construction and operation of the Proposed Development in combination with other developments in the area. Cumulative assessment is undertaken to ensure that the combined effects of the Proposed Development and other influences are assessed together, and not as individual aspects of the environmental assessment.

Cumulative effects are defined as changes to the environment that are caused by an action in combination with other actions, arising from:

- The interaction between all of the different (existing and/ or approved) Projects in the same area; as required by Annex IV, point 5 (e) of the EIA Directive.
- The interaction between the various impacts within a single Project.

The EU Guidance on the preparation of the Environmental Impact Assessment Report guidance states that it is important to consider effects, not in isolation, but cumulatively, as this may show that individually analysed impacts can become significant when they are added together, or with, other effects.

The coexistence of impacts may increase or decrease their combined impact. Impacts that are considered to be not significant, when assessed individually, may become significant when combined with other impacts.

Cumulative effects can occur at different temporal and spatial scales. The spatial scale can be local, regional or global, while the frequency or temporal scale includes past, present and future impacts on a specific environment or region.

The methodology for selecting the relevant Projects to be considered in-combination with the Proposed Development is presented in Section 21.2.

The experts leading each of the technical assessments (as presented in Chapters 6 – 20), have defined significance thresholds and criteria for the cumulative effects assessment, using professional judgement and consideration of the relevant standards and guidelines via a collaborative approach, involving all the interested parties in the process of data collection and analysis, to determine whether in-combination effects give rise to additional levels of significance.

21.2 Assessment Methodology

The following guidelines and publications were considered when determining the other projects to be considered for their potential to generate cumulative effects with the Proposed Development.

- European Commission (EC) Guidelines for the Assessment of Indirect and Cumulative Impacts (1999).
- European Commission (EC) Guidance on the preparation of the Environmental Impact Assessment Report (2017).
- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (Environmental Protection Agency, May 2022).
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment, 2018.

The first step in determining cumulative effects comprised the identification of a list of other projects which may have the potential to overlap with the proposed redevelopment based on available information. Other projects and plans that have been considered as part of this cumulative assessment have been identified through a desk study involving general internet searches and in particular, scrutiny of consenting authority websites. To this end, RPS referred to:

- The Fingal County Council planning application website.
- The Foreshore License applications website as hosted by the Department of Housing, Local Government and Heritage.

The different developments that were considered as part of this cumulative assessment were those in close proximity to the Proposed Development and with the potential to interact with it. Other projects whose impacts could foreseeably overlap with the construction or operation of the proposed redevelopment or where construction impacts may be consecutive but cumulative, were also considered.

Upon review of available information, RPS determined that the vast majority of the applications recently, submitted or approved within proximity to the Proposed Development are small-scale schemes such as dwelling extensions, amendments to previous permissions, proposed outbuildings and similar projects. The assessment found no source-pathway-receptor linkage between these small-scale proposals and the Proposed Development, and therefore no potential for these proposals to act in-combination with the Proposed Development.

21.3 Proposed Flood Relief Scheme at Rush

Whilst no formal planning application has yet been submitted, as the lead design and environmental consultants, RPS are aware that it is the aspiration of FCC to submit a separate proposal for the FRS proposed at Rush South.

The FRS at Rush south consists of the following main elements:

- The construction of a *c.*1,055m long flood wall between the western extent of Channel Road and along South Shore Road.
- A *c.*30m long blockwork wall to consolidate the flood protection between the western extent of Channel Road and the last residential property in this area.
- An alteration of existing ground levels at the western extent of Channel Road to consolidate flood protection and to facilitate the potential future development of a cycle path between Rush and Balleally.
- Provision for flood gates/ vehicular/ pedestrian access at *c.*8 locations.
- Potential utility diversions.

The location and extent of the proposed flood relief scheme, which is located *c.*0.5km to the north of Burrow and across the Rogerstown Estuary is illustrated in Figure 21.1.

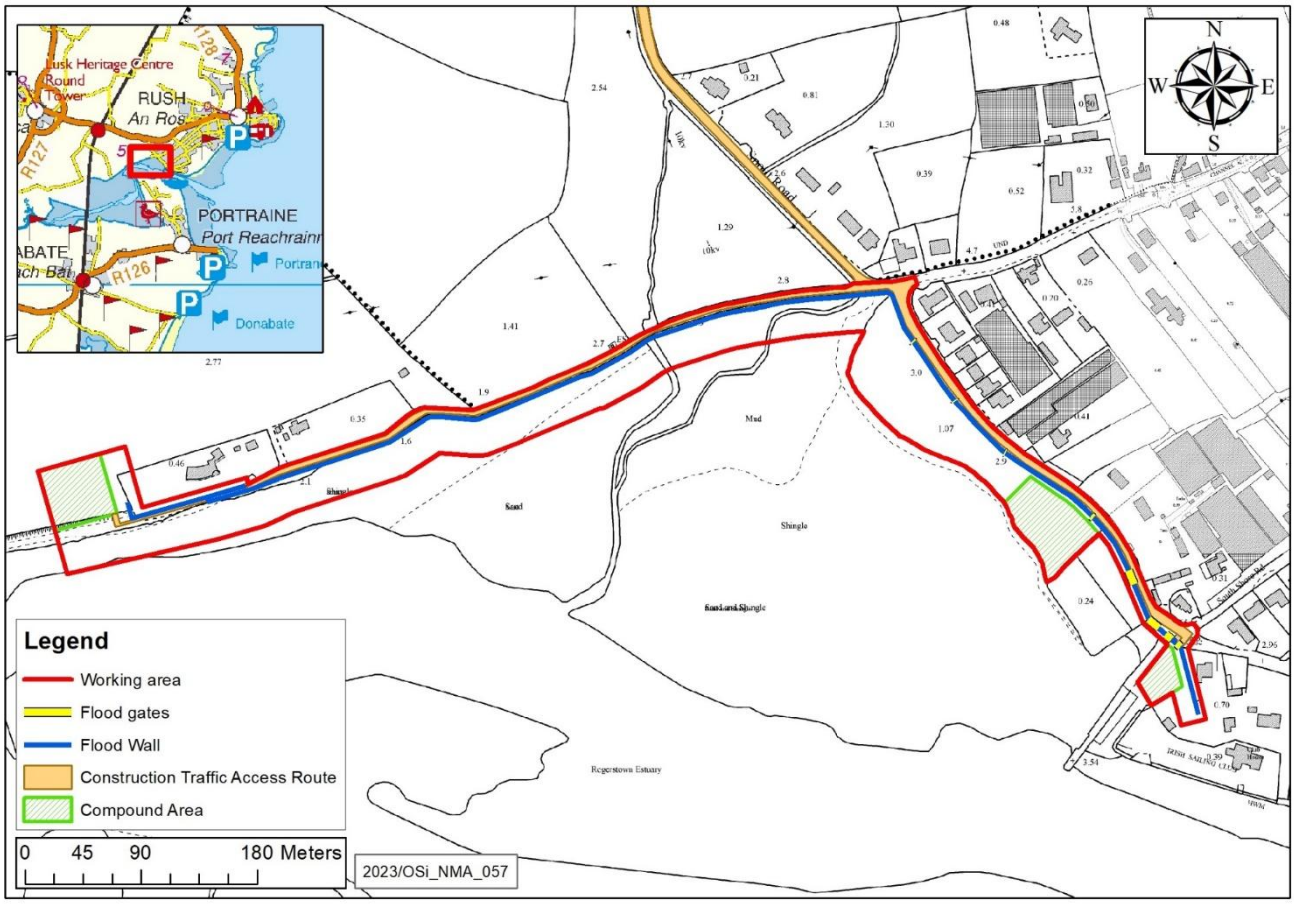


Figure 21.1 Location of the Proposed Development in relation to the Rush FRS Project.

Subject to detailed design, it is anticipated the duration of the construction phase of this project will be *c.*23 weeks. FCC plan to phase the construction of this scheme ***after*** that of the Proposed Development. As such, there will be no temporal or spatial overlap between the two developments.

However, there remains the potential for both schemes to result in an in-combination effect during the operational phase of both developments. These potential operational in-combination effects are discussed further in the following sections of this chapter.

21.4 Assessment of Likely Significant Effects

21.4.1 Environmental Interactions between the Proposed Development and other Projects

When determining the significance of the cumulative effects of the Proposed Development and other existing and/ or approved projects, consideration was given to the following factors:

- The Spatial and Temporal interactions between the Project and other projects.
- Identification of potential of cumulative effects by environmental topics and establish if a potential linkage exists using the source-pathway-receptor model.
- The type and duration of the impact - will it be temporary or permanent.
- The value and resilience of the receptor affected.
- Mitigation measures that will be employed and the likelihood of their success.

Table 21.1 provides a description of potential interactions between the Proposed Development and other relevant projects in the area which are deemed likely to have cumulative effects. It should be noted that owing to the lack of a source-pathway-receptor linkage between the other small-scale proposals and the Proposed Development, this assessment was generally limited to the FRS at Rush South.

21.4.2 Environmental Interactions within the Proposed Development

This section of the EIAR determines the potential for environmental interactions within the Proposed Development, between specialist topic chapters.

Environmental factors are inter-related to some degree, and these interactions can exist on many levels. Table 21.2 identifies primary interactions between the environmental topics and provides a reference to relevant chapters and sections whereby these interactions are considered.

Table 21.1 Potential interactions between the Proposed Development and other projects.

Potential Cumulative Effects on Environmental Factors	Overall Cumulative Impact
Coastal Processes: The cumulative effects of the Proposed Development along with other developments were considered quantitively in a numerical model. In circumstances where the mitigation measures are fully implemented during the construction and operational phases, the impact of the Proposed Development on the coastal processes along the Burrow and other locations around the Rogerstown Estuary consist of small-scale, low magnitude changes in the tidal regime, wave climate, littoral currents, and sedimentology. The Proposed Development is therefore not expected to have a significant effect on coastal processes or make a significant change to the existing morphology.	Non-significant
Noise & Vibration: As there is no overlap in construction phases of the Proposed Development and the scheme proposed at Rush South, therefore there is no source-pathway-receptor linkage between the schemes. Other local planned developments are small-scale schemes such as dwelling extensions, amendments to previous permissions, proposed outbuildings and similar projects. Due to the distance of these other developments, it is unlikely that cumulative construction noise impacts will arise. With construction noise mitigation measures in place, the cumulative construction impacts are predicted to be temporary minor. There are no operational phase impacts predicted with the Proposed Development, therefore cumulative operation noise impacts are not likely.	Minor
Flood Risk: Both the Proposed Development and the flood relief scheme at Rush South have been designed to reduce the local flood risk and have been demonstrated by numerical modelling to have no adverse cumulative impact. Furthermore, to gain planning permission all new developments must show that they do not increase flood risk elsewhere in compliance with '*The Planning System and Flood Risk Management Guidelines*'. There will be no cumulative impacts on flood risk because of neighbouring developments.	Non-significant

Potential Cumulative Effects on Environmental Factors	Overall Cumulative Impact
Water Quality: The only relevant marine project located within the vicinity of the Proposed Development is the flood relief scheme at Rush South. This scheme primarily involves the replacement and improvement of existing seawalls located on the northern side of Rogerstown Estuary. Given the highly localised and negligible nature impacts associated with the Proposed Development at the Burrow and the anticipated lesser impacts associated with the scheme at Rush, no cumulative water quality effects are anticipated during construction or operation of the Proposed Development.	Non-significant
Soils and Geology: There are no developments within the surrounding area which may interact with the Proposed Development in terms of geology and soils. It is envisaged that impacts as a result of interactions between Proposed Development and flood relief scheme proposed at Rush South will be limited and there should be no adverse impacts on soils and geology.	Non-significant
Marine Archaeology: It is not anticipated that archaeological material will come to light as a result of potential cumulative impacts because the archaeological risk will be resolved during the archaeological monitoring that will be carried out during the construction phase. However, in the event that new archaeological material is exposed as a result of residual effects, such finds must be reported to FCC and the NMS.	Non-significant
Marine Biodiversity: The only other development which may cause cumulative impacts when considered alongside the Proposed Development, is the proposed flood relief scheme at Rush South. Subject to detailed design and planning, it is intended that the construction phase of the Proposed Development will not overlap with the construction phase of the scheme at Rush South. This will ensure a low degree of cumulative temporary habitat loss between the two projects. The magnitude of this impact is predicted to be of local spatial extent (i.e. within the footprint of the two projects) and the works will be short term, temporary and reversible following completion of the construction	Negligible significance

Potential Cumulative Effects on Environmental Factors	Overall Cumulative Impact
works. Considering the above, the cumulative magnitude of impact is considered to be low. Based on a low magnitude and the low sensitivity of receptors, the cumulative significance of the effect of temporary, direct habitat loss on benthic and fish and shellfish ecology is predicted to be of negligible significance. No mitigation is considered necessary.	
Terrestrial Biodiversity: The vast majority of the applications recently submitted or approved within proximity to the Proposed Development are small-scale schemes such as dwelling extensions, amendments to previous permissions, proposed outbuildings and similar projects which are situated within the terrestrial environment and outside the boundary of the Rogerstown Estuary SAC and SPA. It is considered that these small-scale proposals have no potential to act in-combination with the Proposed Development. The only scheme deemed to have potential to act cumulatively with the Proposed Development is flood relief scheme at Rush. The Proposed Development at the Burrow will give rise to the loss of non-qualifying Annex I habitat. However, such impacts will not have potential to act cumulatively with the Proposed Development and the flood relief scheme at Rush South. Aerial noise and visual disturbance effects upon SCI bird populations of the Rogerstown Estuary SPA will occur as a result of both schemes, in the absence of mitigation. This disturbance and associated displacement would also have potential to act cumulatively if the schemes were constructed concurrently. Given that impacts associated with the loss of non-Annex I habitats which will occur as a result of the Proposed Development at the Burrow are not predicted to be significant, it is not considered that the Rush and Burrow schemes have potential to act cumulatively in respect of likely impacts to habitats more generally. The flood relief scheme at Rush South will not give rise to any significant disturbance effects to areas of intertidal and marine habitat which were recorded to be of particular importance for the relevant tern species.	Non-Significant
Traffic and Transport: A review of FCC Planning Portal did not identify any committed developments within the receiving environment of the Proposed Development. Furthermore, given there is no spatial overlap or connection between the Proposed Development and the flood	Non-Significant

Potential Cumulative Effects on Environmental Factors	Overall Cumulative Impact
relief scheme at Rush South, there will be no cumulative impact from committed traffic.	
Air Quality and Climate Change: It is assumed that all committed developments will be required to meet relevant standards for emissions reduction and to comply with related planning policy. On this basis, it is considered appropriate to assume that any applications that are consented include 'reasonable' measures to avoid, reduce and/ or offset the generation of greenhouse gas emissions and therefore that no significant cumulative effects are anticipated.	Non-significant
Waste: Consideration has been given to a number of other cumulative developments. These have been considered in detail in respect of a cumulative assessment. No significant cumulative effects on land use resources or material assets are anticipated and are therefore considered negligible. Furthermore, there will be no interaction in relation to waste management between the Proposed Development and the flood relief scheme at Rush South. The cumulative impact between these projects on the capacity of recovery/ disposal waste management facilities is considered to be Neutral or Slight as there will be relatively low volume of waste arising. There is no potential for a cumulative resource and waste management effect during the operational phases of the schemes that could impact the capacity of recovery/ disposal waste management facilities. There are a high number of waste collectors and facilities registered/ licenced in the EMR Region.	Neutral or Slight
Material Assets and Land Use: The only other relevant marine project located within the vicinity of the Proposed Development is the flood relief scheme at Rush South. Given the highly localised and negligible nature of impacts associated with the Proposed Development at the Burrow and the anticipated lesser impacts associated with the scheme at Rush, no cumulative material asset or land use impacts are anticipated.	Non-significant
Landscape & Visual: The Proposed Development will generally blend with existing features and elements of the landscape, with no significant residual landscape character impacts predicted.	Non-significant

Potential Cumulative Effects on Environmental Factors	Overall Cumulative Impact
No specific cumulative landscape and visual or land use impacts are therefore anticipated between the Proposed Development and any other scheme.	
Population and Human Health: No cumulative effects during construction or operation have been identified between this the Proposed Development and any other scheme.	Non-significant
Major Accidents & Disasters: The potential for significant cumulative effects in terms of major accidents or disasters occurring on the Rush FRS would require the coincident occurrence of one of the hazards identified in the assessment for this Proposed Development at the Burrow. This is considered unlikely as the probability of two such unlikely events occurring and resulting in significant cumulative effects is negligible . Furthermore, the construction of the Rush scheme is proposed to occur after the Proposed Development at the Burrow, as such there is no potential for cumulative impacts during the construction phase. The impacts of the Proposed Development identified during the operational phase, are relatively localised and considered to be non-significant in EIA terms. Given the distance to the proposed FRS at Rush, it is unlikely cumulative effects will arise during the operation phase of the Proposed Development. It can be concluded that there are no significant cumulative adverse effects on the environment from major accidents and disasters from the Proposed Development alongside the proposed FRS at Rush.	Non-significant

Table 21.2 Proposed Development environmental interactions.

	Coastal Processes	Noise & Vibration	Flood Risk	Water Quality	Soils and Geology	Marine Archaeology	Marine Biodiversity	Terrestrial Biodiversity	Traffic and Transport	Air Quality and Climate	Waste	Material Assets and Land Use	Landscape and Visual	Population and Human Health	Major Accidents and Disasters
Coastal Processes			✓ Chp. 8.5	✓ Chp. 9.6			✓ Chp. 12.5								✓ Chp. 20.7.4
Noise & Vibration							✓ Chp. 7.6 Chp. 12.5	✓ Chp. 7.6 Chp. 13.5	✓ Chp. 14.5					✓ Chp. 7.6	
Flood Risk															✓ Chp. 20.7.4
Water Quality					✓ Chp. 9.6 Chp. 10.5		✓ Chp. 12.5 Chp. 9.6	✓ Chp. 13.5 Chp. 9.6			✓ Chp. 16.5				✓ Chp. 20.7.4
Soils and Geology							✓ Chp. 10.5	✓ Chp. 10.5	✓ Chp.10.5 Chp. 14.5		✓ Chp. 10.5 Chp. 16.5				✓ Chp. 20.7.4
Marine Archaeology													✓ Chp. 11.5		
Marine Biodiversity								✓ Chp. 12.5 Chp. 13.5							✓ Chp. 20.7.4
Terrestrial Biodiversity															✓ Chp. 20.7.4
Traffic and Transport										✓ Chp. 15.5					✓ Chp. 20.7.4
Air Quality and Climate															
Waste												✓ Chp. 16.5		✓ Chp. 16.5	✓

	Coastal Processes	Noise & Vibration	Flood Risk	Water Quality	Soils and Geology	Marine Archaeology	Marine Biodiversity	Terrestrial Biodiversity	Traffic and Transport	Air Quality and Climate	Waste	Material Assets and Land Use	Landscape and Visual	Population and Human Health	Major Accidents and Disasters
															Chp. 20.7.4
Material Assets and Land Use															✓ Chp. 20.7.4
Landscape and Visual															
Population and Human Health															✓ Chp. 20.7.4
Major Accidents and Disasters															

22 SUMMARY OF MITIGATION MEASURES

FCC seeks to achieve the highest possible standards of environmental management during both the construction and operational phases of the Proposed Development. A summary of all mitigation measures proposed within the Environmental Impact Assessment Report (EIAR) is contained in this chapter.

Table 22.1 overleaf summarises all recommended mitigation measures which could avoid, prevent, reduce and, where possible, offset likely significant adverse effects upon the environment.

Table 22.1: Summary of proposed mitigation and monitoring measures per individual topic chapter.

Potential effects	Summary of Proposed Mitigation
Chapter 6: Coastal Processes	
Health and safety issues working near water	• Works associated with the construction of the fishtail groynes should be undertaken at exposed low tides using land-based plant, therefore negating the need to work within the water column. • The successful contractor should develop a robust plan to monitor tides and storm events during the construction of the Proposed Scheme. This should also include an action plan for responding to storm events and/ or extreme tide events.
Potential for increased suspended sediments within water column during beach renourishment phase of works	• Beach renourishment should only occur following the construction of the fishtail groynes. This will reduce the potential dispersion of sediments to the wider marine environment. • Future maintenance beach renourishment campaigns should be undertaken subject to the same mitigation measure as above.
Chapter 7: Noise and vibration	
Increased noise from construction activities	• Standard practice measures outlined in BS5228:2009+A1:2014 will be applied by the contractor where appropriate during the construction phase of the Proposed Development. This should include the following specific measures: • Ensuring that mechanical plant and equipment used for the purpose of the works are fitted with effective exhaust silencers and are maintained in good working order. • Careful selection of quiet plant and machinery to undertake the required work where available. • Machines in intermittent use will be shut down in the intervening periods between work. • Ancillary plant such as generators, compressors and pumps will be placed behind existing physical barriers, and the direction of noise emissions from plant including exhausts or engines will be placed away from sensitive locations, in order to cause minimum noise disturbance. Where possible, in potentially sensitive areas, temporary construction barriers or enclosures will be utilised around noisy plant and equipment. • Handling of all materials will take place in a manner which minimises noise emissions.

Potential effects	Summary of Proposed Mitigation
	• Audible warning systems will be switched to the minimum setting required by the Health & Safety Authority. • The successful contractor should develop a Noise Management Plan. • The contractor will agree standard construction working hours with FCC and local residents' group. • Construction noise monitoring will be undertaken as part of noise control planning at nearby sensitive receptors. • Pre-construction structural surveys and vibration monitoring at the closest properties will be carried out during the construction phase.
Chapter 8: Flood Risk	
Potential for coastal waters to interact with construction phase works	• The appointed contractor will be responsible for the design of temporary works to ensure temporary flood protection are stable and avoids seepage. • Met Éireann provide a weather warnings alert service which is available on the Met Éireann app or through its website. These warnings should be used by the contractor during construction to manage the risk of flooding to the works from extreme events.
Chapter 9: Water Quality	
Potential for operational phase to impact water quality	• The operational phase impacts associated with the Proposed Development have been assessed as imperceptible and therefore mitigation is not required.
There is the potential for cement and concrete pollution during construction works	• Concrete use and production shall adhere to control measures outlined in Guidance for Pollution Prevention (GPP5): Works and maintenance in or near water.

There is the potential for increased suspended sediment during the construction works, particularly during the beach renourishment works.	• In addition to the requirements of best practice and relevant guidelines listed in the Netregs Guidelines for Pollution Prevention (GPP), the appointed contractor will implement the following sediment control measures where necessary:
	  ○ Where preferential surface flow paths occur, silt fencing or other suitable barriers will be used to ensure silt laden or contaminated surface runoff from the site does not discharge directly to a water body or surface water drain.
	  ○ In the event that dewatering of foundations or drainage trenches is required during construction and/ or discharge of surface water from sumps, a treatment system prior to the discharge will be used; silt traps, settlement skips etc. This measure will allow additional settlement of any suspended solids within storm water arising from the construction areas.

Potential effects	Summary of Proposed Mitigation
Chapter 10: Soils, Geology and Contamination	
• No mitigation measures have been proposed based on the significance of the anticipated effects on receptors. Best practice would be included in the CEMP as a precaution (as outlined in the oCEMP) regarding the discovery of unknown waste (i.e. potential contamination).	
Chapter 11: Cultural Heritage and Marine Archaeology	
Construction works have the potential to adversely impact sites of cultural heritage interest	Prior to construction works commencing, an archaeological photographic record survey of the concrete retaining wall on Marsh Lane should be completed, to provide a permanent record of the wall before it is demolished. During construction, a contractor will implement the following mitigation measures: • Fencing will be erected at DU008-028 and DU008-029 prior to construction proceeding to ensure that no impacts, direct or indirect, occur at the protected sites. The fencing should be located at least 5m away from the known perimeter of both sites. • Archaeological monitoring will be carried out by suitably qualified and experienced maritime archaeological personnel licensed by DHLGH. Archaeological monitoring is conducted during all terrestrial, inter-tidal/foreshore and seabed disturbances associated with the development. • The monitoring will be undertaken in a safe working environment that will facilitate archaeological observation and the retrieval of objects that may be observed and that require consideration during the course of the works. • The monitoring will include a finds retrieval strategy that complies with the requirements of the National Museum of Ireland. • The time scale for the construction phase will be made available to the archaeologist, with information on where and when ground disturbances will take place. • In the event of archaeologically significant features or material being uncovered during the construction phase, machine work will cease in the immediate area to allow the archaeologist/s to inspect any such material. • Once the presence of archaeologically significant material is established, full archaeological recording of such material will be recommended. If it is not possible for the construction works to avoid the material, full excavation will be recommended. The extent and duration of excavation will be a matter for discussion between the client and the licensing authorities. • It is recommended that the core of a suitable archaeological team be on standby to deal with any such rescue excavation. This would be complemented in the event of a full excavation.

Potential effects	Summary of Proposed Mitigation

	• Impacts on associated features of cultural heritage interest should be avoided. These include:
	  ○ DU008-028, chapel
	  ○ DU008-029, Holy Well
	  ○ ADCO 2, sea wall
	• Should impacts on the above be unavoidable, a full archaeological survey should be conducted prior to impacts and subject to the approval of the NMS at DHLGH, and FCC

Chapter 12: Marine Biodiversity	
No mitigation measures have been proposed based on the insignificance of the anticipated effects on marine biodiversity receptors	
Chapter 13: Terrestrial & Coastal Biodiversity	
Indirect effects associated with construction phase of the Proposed Development include those arising through water quality and habitat deterioration effects to intertidal and aquatic habitats through sedimentation and pollution associated with proposed construction activities.	• A range of mitigation measures are to be implemented within the Proposed Development and are set out within Chapter 9: Water Quality, of the EIAR
There is potential to spread of invasive species, namely common cord-grass (spartina) during the construction phase of the Proposed Development	• Construction works should be undertaken in line with a s undertaken in line with an appropriate Invasive Species Management Plan (ISMP)
Potential aerial noise and visual disturbance to bird populations within Rogerstown Estuary SPA	• The construction phase of the Proposed Development will be restricted to taking place outside of the wintering bird period (October to March). • works that require the removal of vegetation including scrub, scattered trees and lengths of non-native hedgerow will take place outside of the nesting bird season (1st March to 31st August inclusive).
Vibrational piling of flood walls may give rise to injury or disturbance to marine mammals	• Works will be undertaken in line with “Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters Noise-producing activities” (NPWS, 2014).
Chapter 14: Traffic and Transportation	
Construction works may result in temporary increase in traffic flows	• The appointed contractor will develop a CEMP to mitigate potential impacts to traffic and transportation.

Potential effects	Summary of Proposed Mitigation
	• A Temporary Traffic Management Plan (TTMP) will be developed by the appointed contractor at the detailed design phase to outline the requirements for safety risks for road users, the general public. The TTMP would also specify any construction access requirements for the scheme and traffic management schemes required across the construction phase of the scheme, including details for road closures. • At the preliminary stage, it is assumed that Marsh Lane and Burrow Road would require closures, with local access for residents only during the construction phase. The TTMP would be considered alongside the CEMP to mitigate any potential impacts the site construction phase may have upon the surrounding area, residents and road network.
Chapter 15: Air Quality and Climate	
Vehicle emissions and use of materials has the potential to increase GHG emissions	• As per mitigations described in Chapter 15, a Temporary Traffic Management Plan (TTMP) will be prepared and outline measures to minimise congestion and queuing, reduce distances of deliveries and eliminate unnecessary loads. • Operatives will visually monitor plant to ensure no black smoke is emitted other than during ignition (emissions to air controlled). • The appointed contractor will ensure exhaust emissions are maintained to comply with the appropriate manufacturer's limits (emissions to air controlled). • Idle times will be reduced by providing an efficient material handling plan that minimizes the waiting time for loads and unloads. • Vehicular engines will be turned off when not in use for more than five minutes. This restriction will be enforced strictly unless the idle function is necessary for security or functionality reasons. • All plant and equipment will undergo regular inspection and maintenance.
Chapter 16: Waste Management	
The Proposed Development has the potential to produce construction and demolition waste (CDW)	• The appointed contractor will develop a CEMP which will include the following specific waste management measures: o Building materials should be chosen with an aim to 'design out waste'. o Control measures and attention to materials quantity requirements to avoid over-ordering and generation of waste materials.

Potential effects	Summary of Proposed Mitigation
	○ Agreements with materials suppliers to reduce the amount of packaging or to participate in a packaging take-back Scheme. ○ Implement a 'just in time' materials delivery systems to avoid materials being stockpiled, which increases the risk of the damage and disposal as waste. ○ Segregation of waste at source where practical. On-site segregation of non-hazardous waste materials into appropriate categories, where possible, including any excavated soils, concrete, bricks, metals and timber. On-site segregation of all hazardous waste materials into appropriate categories including contaminated soils, waste oil and fuels and paints, glues, adhesives and other known hazardous substances. ○ All waste materials will be stored in skips or other suitable receptacles in designated areas of the site. The waste storage area(s) will be assigned and all construction staff provided with training regarding the waste management procedures on commencement of the project. ○ Measures to ensure appropriate staff training and levels of awareness in relation to waste management. ○ Identify how the waste will be dealt with (i.e. disposal, recovery, recycle or re-use onsite or offsite etc.). ○ Identify potential end markets e.g., reuse, recycling facilities, waste treatment facilities and disposal sites. ○ Waste streams will be collected by an appropriately licensed and permitted private waste contractor, appointed by the contractor for recycling, recovery or disposal at suitably licensed facilities. ○ All waste leaving site will be recycled, recovered or reused where possible, with the exception of those waste streams for which appropriate facilities are currently not available. ○ Calculate the difference between expected waste quantities prior to commencement of the project and actual waste quantities after the project is complete. • A site specific pre-construction Resource Waste Management Plan (RWMP) will be prepared by the client and design team in with EPA '*Best Practice Guidelines for the preparation of resource & waste management plans for construction & demolition projects*'. ○ The RWMP will be implemented from the outset of the project and throughout the duration of the project taking into consideration the waste management hierarchy to encourage sustainable development, circular economy, environmental protection and optimum use of resources. • The appointed contractor will consult with the EPA prior to construction to ensure that the appropriate licences, permits and exemptions are in place prior to initiation.
Chapter 17: Material Assets & Land use	

Potential effects	Summary of Proposed Mitigation
There is a potential for the Proposed Development to impact existing and adjoining land uses	• Good site management practices and procedures will be carried out, including the provision of high-quality heras fencing or similar/ signage and proactive communications landowners, regarding phasing, timing, and duration of works.
Chapter 18: Landscape & Visual	
It has been judged that the Proposed Development will not result in any significant landscape or visual impacts. It is therefore considered that there are no specific landscape mitigation measures required.	
Chapter 19: Population & Human Health	
On the basis that no significant adverse population and human health effects are identified, no additional population and human health mitigation measures are necessary.	
Chapter 20: Major Accidents & Disasters	
Mitigation measures defined throughout the topic chapters of this report (Chapters 6– 19), and summarised above, were considered within the Risk of Major Accident and Disasters assessment to assign a risk likelihood to each risk event identified. As all risk events are within the low-risk category with existing recommended mitigation and safety procedures, no further mitigation measures have been recommended in this chapter. Given that all risk events are within the low-risk category with existing recommended mitigation and safety procedures, no further mitigation measures have been recommended in this chapter.	

23 CONCLUSIONS

The assessment presented within this EIAR has identified and documented impacts arising from the Proposed Development. These impacts have been assessed as to whether or not they are likely to result in significant effects. Where significant effects have been predicted, measures to avoid or mitigate these effects have been included so that, where possible, they are no longer significant.

23.1 Need for the Proposed Development

The Proposed Development is urgently required to implement a sustainable and technically effective coastal management solution for the Burrow, which at present is affected by chronic coastal erosion. Following Storm Emma and several other arduous storm events in the winter period of 2017/ 2018 the position of the shoreline retreated by more than 20m in some areas. This resulted in the abandonment and demolition of one private residential property in 2019 and left many other nearby properties at immediate risk of coastal erosion.

In response to this immediate risk, FCC implemented an interim coastal protection solution to mitigate the effect of coastal erosion where properties were considered at greatest risk until a long-term coastal management plan could be developed. Whilst these interim measures have *slowed* erosion, undefended regions of the coastline continue to retreat at a rate of *c.*2-4 metres per year. Upon removal these interim protection works, the rate of coastal erosion along the Burrow is expected return to what it was before they were implemented. This would significantly exacerbate the existing coastal erosion risk posed to many private residential properties which are already considered at immediate risk.

Over the long term, it is estimated that the coastline along the Burrow could retreat, on average, by between *c.*2m and 4m per year. This could result in between 17 and 234 buildings being lost to erosion over the next 50 years. The actual extent of coastal erosion will be subject to rate of future climate change and sea level rise.

Owing to the low-lying nature of the Burrow, the area is at very high risk of coastal flooding. Based on present day climate conditions, it is estimated that 9 buildings would be at risk of coastal flooding during a 1 in 200-year return period storm event. Subject to future climate change and sea level rise, the number of buildings at risk during the same event is expected to increase to between 82 and 29[47] over the next 50 years.

An initial economic appraisal of damages associated with the coastal flood and erosion risks identified the net present value of damages for the Burrow to range between €25.3 mil and €77.7 mil depending on the assumed erosion rate and threshold for flooding. This appraisal concluded that based on a 50-year life the proposed scheme would yield a Benefit Cost Ratio of greater than unity for 96% of the 24 scenarios considered.

The Proposed Development is in-line with objectives set out in national, regional and local planning policies and guidance documents, including Project Ireland 2040: National Planning Framework, the Fingal Development Plan 2023 – 2029 and National Adaptation Framework, Planning for a Climate Resilient Ireland. Specifically, the Proposed Development provides a sustainable coastal management plan to a very vulnerable area whilst retaining the physical and environmental quality of an internationally important site.

[47] The number of properties affected by flooding under the 4m/yr erosion scenario drops as many properties are lost to erosion.

23.2 Summary of Environmental Impacts

With adherence to a CEMP and with implementation of the mitigation laid out in the EIAR, most negative effects from the Proposed Development will generally not be significant. However, some significant negative effects will remain and result in potential adverse impacts to a number of internationally important receptors.

23.2.1 Coastal Processes

Once operational, the Proposed Development would have a permanent beneficial significant effect in reducing the existing coastal flooding and erosion risk along the Burrow. This would protect existing communities and facilitate potential investment and regeneration in the area.

Crucially, the Proposed Development was found not to result in any significant impacts to the existing tidal regime, wave climate or sediment transport beyond the immediate vicinity of the scheme, including along Rush beach or within the Rogerstown estuary.

23.2.2 Noise & Vibration

Through the implementation of construction mitigation measures as described in this document, the noise impacts of construction activities are predicted to be temporary minor. No operational noise or vibration impacts are anticipated from the operation of the Proposed Development.

23.2.3 Flood Risk

The long-term operation of the Proposed Development would have a very significant beneficial effect upon the study area in terms of flood risk, and the residents whom the flood defences would serve.

23.2.4 Water Quality

With the appropriate mitigations measures fully implemented during the construction phase, the impact of the Proposed Development on the water quality will be imperceptible. The Proposed Development at the Burrow is not expected to have a significant effect on the water quality of the receiving waters.

As such, the Proposed Development works are compliant with the requirements and environmental objectives of the EU Water Framework Directive and the other relevant water quality objectives for these water bodies.

23.2.5 Soils & Geology

Neither the construction or operational phases of the Proposed Development are anticipated to result significant adverse effects upon soils and geology.

23.2.6 Cultural Heritage and Marine Archaeology

The impact assessment presented in this chapter concluded that the demolition of the existing concrete flood wall at Marsh Lane will result a direct, negative and permanent impact. It is recommended that the existing wall is recorded by photography and further written record prior to its demolition. This magnitude of this impact is not considered significant.

The construction of the groynes represents direct and permanent impacts on the foreshore. However, as there is no known shipwreck material or associated archaeological features in this area, there will be no impacts on known archaeological assets at this location, and an archaeological monitoring programme will be carried out during construction to ensure that any previously unknown archaeological material that may come to light as a result of the works activities is recorded and resolved.

In circumstances where the mitigations measures are fully implemented during the construction phase, the impact of the Proposed Development on cultural heritage and marine archaeology in the area will be imperceptible. The Proposed Development at The Burrow is therefore not expected to have a significant effect on cultural heritage and marine archaeology.

23.2.7 Marine Biodiversity

Benthic ecology, fish and shellfish and also marine mammal receptors have the potential to be impacted by the Proposed Development. However, these impacts which relate primarily to increase in suspended sediments, habitats loss and underwater noise were considered to be negligible during the construction, operation and maintenance phases of the Proposed Development.

23.2.8 Terrestrial and Coastal Biodiversity

The Proposed Development has potential to give rise to a range of significant impacts upon natural heritage and biodiversity receptors.

Significant adverse impacts are predicted to arise to three sites designated on account of their natural heritage or conservation interests, namely the Rogerstown Estuary SAC, Rogerstown Estuary SPA and Rogerstown Estuary pNHA. These impacts are associated with losses to small areas of Annex I saltmarsh, mudflat and estuary habitats which will occur at construction phase which form qualifying interests of the SAC and provide foraging habitat for foraging SCI bird populations associated with the SPA. Synchronous impacts are predicted to the Rogerstown Estuary pNHA.

23.2.9 Traffic and Transportation

Through the implementation of construction mitigation measures as described in this document, the impacts of construction activities to traffic and transport are not considered significant. During the operational phase, the Proposed Development is not expected to create any additional operational trips and are therefore considered negligible.

23.2.10 Air Quality and Climate

In relation to both air quality and climate change for the operational phase, operational traffic movements were not anticipated to change traffic flows on the road network. Therefore, operational effects on air quality and climate are considered to be negligible.

23.2.11 Waste Management

Through the implementation of construction mitigation measures as described in this document, the residual effects of the construction and operational phases of the Proposed Development on waste management are not considered significant.

23.2.12 Material Assets

Through the implementation of construction mitigation measures as described in this document, the residual effects of the construction and operational phases of the Proposed Development on material assets are not considered significant.

23.2.13 Landscape & Visual

Within the wider landscape, the Proposed Development will generally blend with existing features and elements of the landscape, with no significant residual landscape character impacts predicted. With regards to visual impact on sensitive receptors, predicted impacts on existing views are largely offset by the existing visual context of the varied coastal landscape with new elements blending well with the existing coastal area and generally perceived as a minor alteration or addition to the overall expansive views available.

23.2.14 Population & Human Health

The Proposed Development reduces coastal flood and erosion risk, with associated population and human health benefits due to the protection of residential and community assets.

During the construction phase, there would be temporary adverse changes in local air quality, noise exposure, and transport nature and flow rate; however, these impacts would not be significant. Changes in water quality and flood risk (including the potential safety implications of this for construction workers) are also able to be effectively mitigated to a level which is not significant.

The presence of construction compounds would temporarily impact access to recreational facilities such as the outdoor gym equipment directly adjacent to Pipers Takeaway. However, many alternative recreational/open spaces exist within the local area, the majority of which is considered an area of high amenity. As a result, there would be no significant effects associated with this.

Operation of the Proposed Development reduces flood and erosion risk, with associated population and human health benefits due to the protection of residential and community assets. This reduction in coastal flood and erosion risk represents a significant beneficial effect to the community at the Burrow.

23.2.15 Major Accidents & Disasters

The Risk of Major Accidents and Disasters assessment identified ten potential risk events during the construction phase (vessel collision/ allision, road traffic collision, flooding of construction areas, major pollution or sedimentation event, accident due to heavy lift or machinery failure, accident involving general public, man overboard, severe weather conditions, land slippage or sinking and fire/ explosion) and seven during the operational phase (vessel collision/ allision, major pollution or sedimentation event, severe weather conditions, man overboard, road traffic collision, severe flood event and fire/ explosion).

All potential risk events during the construction and operational phases, identified in the assessment, are considered to be low risk events if mitigation measures are implemented as recommended. It is determined that this residual, low-level risk of a major accident or disaster occurring is not likely to be significant in EIA terms.

24 BIBLIOGRAPHY & REFERENCES

Chapter 1 – Introduction

- Environmental Protection Agency (2022) Air Quality in Ireland 2021.
- EU Directive 85/337/EEC as amended by Directives 2011/92/EU and DIRECTIVE 2014/52/EU.

Chapter 2 – Need for the Project

- Department of Communications, Climate Action and Environment (2018) National Adaptation Framework Planning for a Climate Resilient Ireland.
- Department of Environment, Heritage and Local Government (2002) The National Spatial Strategy, 2002–2020.
- Department of Public Expenditure and Reform (2018) The National Development Plan, 2018 – 2027.
- Fingal County Council (2023) Fingal Development Plan 2023-2029.
- Government of Ireland (2018) *Technical specifications and guidance notes*. Available at: https://www.gov.ie/en/publication/b15dd0-technical-specifications-and-guidance-notes/# (Accessed: 26 September 2023).
- John Chatterton Associates (2024) The Burrow, Economic Appraisal.
- Office of Public Works (2019) Flood Risk Management, Climate Change Sectoral Adaptation Plan.
- RPS (2020) Rogerstown Coastal Flood Erosion Risk Management (CFERM) Study. RPS on behalf of Fingal County Council.
- The Regional Planning Guidelines Office (2010) Regional Planning Guidelines for the Greater Dublin Area 2010-2022.

Chapter 3 – Project Description

- RPS (2020) Rogerstown Coastal Flood Erosion Risk Management (CFERM). Study, RPS on behalf of Fingal County Council.

Chapter 4 – Consideration of Alternatives

- Department of Housing, Local Government and Heritage (2018) Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment.
- Environmental Protection Agency (2022) Air Quality in Ireland 2021.
- European Commission (2017) Guidance on the preparation of the Environmental Impact Assessment Report (Directive 2011/92/EU as amended by 2014/52/EU).
- Fingal County Council (2023) Fingal Development Plan 2023-2029.
- Office of Public Works (2018) Option Appraisal and Multi-Criteria Analysis (MCA) Framework.

- Pontee, N. (2013). Defining coastal squeeze: a discussion. Ocean and Coastal management. 84. 204-207pp.

Chapter 5 – Project Scoping & Consultation

- Department of Public Expenditure and Reform (2018) The National Development Plan, 2018 – 2027.
- European Commission (2017) Guidance on the preparation of the Environmental Impact Assessment Report (Directive 2011/92/EU as amended by 2014/52/EU).
- The Regional Planning Guidelines Office (2010) Regional Planning Guidelines for the Greater Dublin Area 2010-2022.

Chapter 6 – Coastal Processes

- Aggregate Production Licence Application, Area 457 Liverpool Bay: Environmental Statement (ERM,2003 (b))
- Aggregate Production Licence Application, Area 457 Liverpool Bay: Vol 1 - Summary of Consultation and Supplementary ES (Appendix A), (ERM, 2003 (b))
- Area 457 (Liverpool Bay) Application Volume 1 Summary of Consultation and Supplementary ES (Appendix A) December 2003, (ERM, 2003 (c))
- Area 457 (Liverpool Bay) Application Volume 2 Supplementary ES (Appendices B, C and D) (ERM, 2003 (d))
- Bruun P. (1962) Sea-level rise as a cause of shoreline erosion. Journal of the Waterways and Harbours Division. Vol. 88.
- EurOtop (2018) Manual on wave overtopping of sea defences and related structures.
- Office of Public Works (2020) Irish Wave and Water level Study.
- RPS (2014) Coastal Erosion Risk Management Study.
- RPS (2018) Coastal Processes at the Burrow, Portrane: Interim Coastal Protection Works Report.
- RPS (2018) Tide and Storm Surge Forecast (TSSF) for the Coast of Ireland.
- U.S Geological Survey (2018) Digital Shoreline Analysis System (DSAS).

Chapter 7 – Noise & Vibration

- BS 5228-1:2009+A1:2014 Code of practice for noise control on construction and open sites. Part 1: Noise
- BS 5228-2:2009+A1:2014 Code of practice for noise control on construction and open sites. Part 2: Vibration
- Environment and Forestry Directorate (2011) Assessment of Noise: Technical Advice Note.
- Environmental Protection Agency (2017) Guidelines on the Information to be contained in Environmental Impact Assessment Reports.

- Institute of Environmental Management and Assessment (2014) Guidelines for Environmental Noise Impact Assessment Institute of Environmental Management and Assessment.
- Standards for Highways (2019) The Design Manual for Roads and Bridges: LA111 Noise and Vibration Guidance.
- Transport Infrastructure Ireland (2014) Good Practice Guidance for the Treatment of Noise during the Planning of National Road Developments, National Roads Authority.

Chapter 8 – Flood Risk

- Office of Public Works (2023) Flood Maps. Available at, https://www.floodinfo.ie/map/floodmaps/
- Office of Public Works (2009) The Planning System and Flood Risk Management: Guidelines for Planning Authorities.
- Met Eireann (2023) The Irish Meteorological Service. Available at https://www.met.ie/
- RPS (2009) Rogerstown CFERM Study: Stage 1 Optioneering [Report].
- RPS (2020) Rogerstown Coastal Flood Erosion Risk Management (CFERM). Study, RPS on behalf of Fingal County Council.

Chapter 9 – Water Quality

- Construction Industry Research and Information Association (2001) Control of water pollution from construction sites: guidance for consultants and contractors. CIRIA, London.
- Construction Industry Research and Information Association (2006) Control of water pollution from linear construction projects: Technical Guidance, CIRIA, London
- Department of Environment, Community and Local Government (2016) Marine Strategy Framework Programme of Measures Summary Report.
- Department of Housing, Local Government and Heritage (2022) Marine Strategy Framework Directive 2008/56/EC, Article 17 update to Ireland's Marine Strategy Part 3: Programme of Measures (Article 13).
- Department of Housing, Planning and Local Government (2018) River Basin Management Plan for Ireland 2018 – 2021. Available at: https://www.gov.ie/pdf/?file=https://assets.gov.ie/131981/dea37730-1ef0-4106-875b-5c433e823ad6.pdf#page=null
- Environment Agency (2012). Working at construction and demolition sites: PPG6 Pollution Prevention Guidelines. Available at: http://www.environment-agency.gov.uk/static/documents/Business/EA-PPG6_-_03_2012_Final.pdf
- Environmental Protection Agency (2021) Water Quality in 2020 – An Indicators Report.
- Environmental Protection Agency (2022) Urban Waste Water Treatment Report in 2021. Available at https://www.epa.ie/publications/monitoring--assessment/waste-water/Urban-Waste-Water-Treatment-in-2021-report.pdf

- Environmental Protection Agency (2022) Water Quality in Ireland 2016 – 2021. Available at https://www.epa.ie/publications/monitoring--assessment/freshwater--marine/EPA_WaterQualityReport2016_2021.pdf
- Environmental Protection Agency (2023) Bathing Water Quality in Ireland A report for the year 2022. Available at: https://www.epa.ie/publications/monitoring--assessment/freshwater--marine/Bathing-Water-Quality-in-Ireland-2022.pdf
- Environmental Protection Agency (2023) Water Quality in 2022. An Indicators Report. Available at: https://www.epa.ie/publications/monitoring--assessment/freshwater--marine/Water-Quality-2022-Indicator-Report-Web.pdf
- European Commission (2000) EU Water Framework Directive 2000/60/EC, Official Journal of the European Communities. Available at https://eur-lex.europa.eu/resource.html?uri=cellar:5c835afb-2ec6-4577-bdf8-756d3d694eeb.0004.02/DOC_1&format=PDF
- European Commission (2017) Guidance on the preparation of the Environmental Impact Assessment Report (Directive 2011/92/EU as amended by 2014/52/EU).
- Government of Ireland (2009) The Planning System and Flood Risk Management Guidelines for Planning Authorities.
- National Roads Authority (2008) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.

Chapter 10 – Soils, Geology and Contamination

- Contaminated Land: Applications in Real Environments (2010) Soil Generic Assessment Criteria for Human Health Risk Assessment.
- Department of Agriculture, Environment and Rural Affairs (2019) Redeveloping Land Affected by Contamination – A developers Guide to Planning Considerations and Environmental Responsibilities.
- Department of Housing, Planning and Local Government (2018) Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment.
- Environment Agency (2009) Science Report 2: Human Health Toxicological Assessment of Contaminants in Soil.
- Environment Agency (2009) Science Report 3: Updated Technical Background to the CLEA Model.
- Environment Agency (2020) Land contamination risk management (LCRM) - How to assess and manage the risks from land contamination.
- Environmental Protection Agency (2017) 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports.
- European Communities (Environmental Liability) Regulation 2008 (SI 547 of 2009).
- European Environment Agency (2002) Water Framework Directive (WFD) 2000/60/EC.

- Institute of Geologists of Ireland (2002) Geology in Environmental Impact Statements.
- Institute of Geologists of Ireland (2013) Guidance for the preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements.
- National Roads Authority (2008) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.

Chapter 11 – Archaeology

- Brady, K (2008) Shipwreck Inventory of Ireland: Louth, Meath, Dublin and Wicklow.
- Department of Housing, Local Government & Heritage (2023) Database of Irish Excavation Reports. Available at: https://excavations.ie
- Department of Housing, Local Government & Heritage (2023) Historic Environment Viewer. Available at: https://maps.archaeology.ie/HistoricEnvironment
- Department of Housing, Local Government & Heritage (2023) National Inventory of Architectural Heritage.
- Department of Housing, Local Government & Heritage (2023) National Monuments Service Wreck Viewer. Available at: https://dahg.maps.arcgis.com/apps/webappviewer/index.html?id=89e50518e5f4437abfa6284ff39fd640.
- INFOMAR (2023) Integrated Mapping for the sustainable development of Ireland's marine resource - Data Portal. Available at: www.infomar.ie.
- Trinity College – The University of Dublin (2013) The Down Survey of Ireland.

Chapter 12 – Marine Biodiversity

- Aquatic Service Unit (2022) A Phase I Intertidal survey of Rogerstown Estuary.
- Atkins (2020) Fingal Country Council, Rogerstown, Estuary – Coastal Walking and Cycling Routes, Constraints Study, March 2020.
- Berrow, S.D., Whooley, P., O'Connell, M. and Wall, D. (2010) Irish Cetacean Review (2000-2009). Irish Whale and Dolphin Group, 60pp.
- Buckingham, M. J. (2020) Wave speed and attenuation profiles in a stratified marine sediment: Geo-acoustic modeling of seabed layering using the viscous grain shearing theory. The Journal of the Acoustical Society of America, 148: 962–974. Available at: https://doi.org/10.1121/10.0001778
- Chartered Institute of Ecology and Environmental Management (2019) Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial, Freshwater, Coastal and Marine, September 2018, Version 1.1 – Updated September 2019.
- Clarke, M., Farrell, E.D., Roche, W., Murray, T.E., Foster, S. and Marnell, F. (2016) Ireland Red List No. 11: Cartilaginous fish [sharks, skates, rays and chimaeras]. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs. Dublin, Ireland.

- Cutts, N., Phelps, A. & Burdon, D. (2009) Construction and Waterfowl: Defining Sensitivity, Response, Impacts and Guidance. Report to Humber INCA. Institute of Estuarine & Coastal Studies, University of Hull.
- Department of Energy and Climate Change (2009) UK Offshore Energy SEA 2 Environmental Report.
- Dublin Array Offshore Wind Farm Limited (2012) An Offshore Wind Farm on the Kish and Bray Banks. Environmental Statement. January 2012 – Revision 1. Section 8: Marine Ecology.
- Duck, C. and Morris, C. (2013) An aerial survey of harbour seals in Ireland: Part 2: Galway Bay to Carlingford Lough. August-September 2012. A report to the National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin.
- Ellis et al. (2012) Spawning and nursery grounds of selected fish species in UK Waters.
- EMODnet (2020) Broad-scale seabed habitat map for Europe.
- Environmental Protection Agency (2017) Draft Revised Guidelines on the Information to be Contained in Environmental Impact Assessment Reports.
- European Environment Agency (2022) EUNIS web application. Available at: http://eunis.eea.europa.eu/habitats.jsp
- Evans, P. G. H., Anderwald, P., and M. E. Baines. (2003) UK Cetacean Status Review. Report to English Nature and Countryside Council for Wales, Oxford.
- Fingal County Council (2004) Ecological Study of the Coastal Habitats in County Fingal Phase I&II. Habitats & Flora.
- Hansen, K.A., Maxwell, A., Siebert, U. et al. Sci Nat (2017) Great cormorants (Phalacrocorax carbo) can detect auditory cues while diving. Available at: https://doi.org/10.1007/s00114-017-1467-3
- Heinänen, S and Skov, H. (2015) The identification of discrete and persistent areas of relatively high harbour porpoise density in the wider UK marine area, JNCC Report No. 544, JNCC, Peterborough.
- Howson, C.M. and Picton, B.E. (1997) The species directory of the marine fauna and flora of the British Isles and surrounding seas. Belfast: Ulster Museum.
- Igoe F., Quigley D.T.G., Marnell F., Meskell E., O'Connor W. and Byrne, C. (2004) The Sea Lamprey Petromyzon marinus (L.), River Lamprey Lampetra fluviatilis (L.) and Brook Lamprey Lampetra planeri (Bloch) In Ireland: General Biology, Ecology, Distribution and Status with Recommendations for Conservation. Biology and Environment: Proceedings Of The Royal Irish Academy, Vol.104b, No.3, 43/56
- Inland fisheries Ireland (2010) Sampling fish for the water framework directive, Transitional wasters 2010 Rogerstown Estuary. Available at: http://www.wfdfish.ie/wp-content/uploads/2011/11/Rogerstown_estuary_report_2010.pdf
- Inland Fisheries Ireland (2016). Guidelines on Protection of Fisheries During Constructions Works in and Adjacent to Waters. Available at: https://www.fisheriesireland.ie/media/guidelines-on-protection-of-fisheries-during-construction-works-in-and-adjacent-to-waters

- Inland Fisheries Ireland (2018) Consolidated Fish Counter Summary Report 2017. Available at: https://www.fisheriesireland.ie/extranet/fisheries-management-1/salmon/1493-ifi-consolidated-fish-counter-summary-report-2017.html. Inland Fisheries Ireland/
- Inland Fisheries Ireland (2018) Consolidated Fish Counter Summary Report 2017. Available at: https://www.fisheriesireland.ie/extranet/fisheries-management-1/salmon/1493-ifi-consolidated-fish-counter-summary-report-2017.html. Inland Fisheries Ireland/
- King et al. (2011) Ireland Red List No.5: Amphibians, Reptiles and Freshwater Fish.
- Lundy et al. (2019) Western Irish Sea Nephrops Grounds (FU15) 2019 UWTV Survey Report and Catch options for 2020.
- Maitland PS. (2003) Ecology of the River, Brook and Sea Lamprey. Conserving Natura 2000 Rivers Ecology Series No. 5. English Nature, Peterborough
- Malcolm, I., Godfrey, J. and Youngson, A. (2010) Review of migratory routes and behaviour of Atlantic salmon, Sea trout and European eel in Scotland's coastal environment: implications for the development of marine renewables. Scottish Marine and Freshwater Science Volume 1 No 14, Marine Scotland Science.
- Marine Institute (2017) Atlas of Commercial Fisheries for Shellfish around Ireland.
- Marine Institute (2020) Irelands Marine Atlas: Designated sites.
- Marine Institute (2023) Ireland's Marine Atlas. Available at: http://atlas.marine.ie/#?c=53.9108:-15.9082:6.
- Marine Institute and Bord Iascaigh Mhara (2019) Shellfish Stocks and Fisheries Review 2018: An assessment of selected stocks. Marine Institute.
- Miller, L.J., Solangi, M, and Kuczaj II, S.A. (2008) Immediate response of Atlantic bottlenose dolphins to high-speed personal watercraft in the Mississippi Sound, Journal of the Marine Biological Association of the UK, 88: 1139-1143.
- Milner, N., McGinnity, P. and Roche, W. (2016) Celtic Sea Trout Project – Technical Report to Ireland Wales Territorial Co-operation Programme 2007-2013 (INTERREG 4A). Available at: http://celticseatrout.com/downloads/technical-report/
- Milner, N., McGinnity, P. and Roche, W. Eds (2016) Celtic Sea Trout Project – Technical Report to Ireland Wales Territorial Co-operation Programme 2007-2013 (INTERREG 4A). [Online] Dublin, Inland Fisheries Ireland. Available at: http://celticseatrout.com/downloads/technical-report/
- Mitson, R.B, and Knudsen, H.P. (2003) Causes and effects of underwater noise on fish abundance estimation, Aquatic Living Resources, 16: 255-263.
- National Biodiversity Data Centre (2020) Marine mammal sightings and stranding records from dedicated surveys and from incidental observations.
- National Parks and Wildlife Service (2013) Site Name: Rogerstown Estuary SAC. Site code: 000208 Site Synopsis Report. (Version date: 12.08.2013) Available at: https://www.npws.ie/sites/default/files/protected-sites/synopsis/SY000208.pdf

- National Parks and Wildlife Service (2014) Site Name: Lambay Island SAC. Site Code: 000204. Site Synopsis Report (Version date: 31.01.2014). Available at: https://www.npws.ie/sites/default/files/protected-sites/synopsis/SY000204.pdf
- National Parks and Wildlife Service (2019) The Status of EU Protected Habitats and Species in Ireland. Volume 3: Species Assessments. Unpublished NPWS report. Edited by: Deirdre Lynn and Fionnuala O'Neill.
- National Parks and Wildlife Service (2020) Designated sites.
- Natural Environmental Consultants (2016) Fingal Country Council Saltmarsh Restoration Study, Rogerstown Estuary North Shore, Final Report, June 2016.
- Ó Maoiléidigh et al. (2018) Fifty years of marine tag recoveries from Atlantic salmon. ICES Cooperative Research Report No. 343, Marine Institute.
- O'Sullivan et al. (2013) An Inventory of Irish Herring Spawning Grounds, Marine Institute.
- Robertis, A.D. & Handegard, N.O. (2013) Fish avoidance of research vessels and the efficacy of noise-reduced vessels: a review, ICES Journal of Marine Science, 70: 34-45. Available at: https://doi.org/10.1093/icesjms/fss155
- Rogan, E., Breen, P., Mackey, M., Cañadas, A., Scheidat, M., Geelhoed, S. and Jessopp, M. (2018) Aerial surveys of cetaceans and seabirds in Irish waters: Occurrence, distribution and abundance in 2015-2017. Department of Communications, Climate Action & Environment and National Parks and Wildlife Service (NPWS), Department of Culture, Heritage and the Gaeltacht, Dublin, Ireland. 297pp.
- Sandlund, O. T., Diserud, O. H., Poole, R., Bergesen, K., Dillane, M., Rogan, G., and Vøllestad, L. A. (2017) Timing and pattern of annual silver eel migration in two European watersheds are determined by similar cues. Ecology and evolution, 7(15), 5956-5966.
- Seafish (2014) Lemon sole species guide, January 2014, version 4.
- Southall B L, Finneran J J, Reichmuth C, Nachtigall P E, Ketten D R, Bowles A E, Ellison W T, Nowacek D P, Tyack P L (2019). Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects. Aquatic Mammals 2019, 45(2), 125-232, DOI 10.1578/AM.45.2.2019.125
- Southall, B. Southall, A. E., Bowles, W., Ellison, T., Finneran, J.J., Gentry, R. L., Greene Jr. C. R., Kastak, D., Ketten, D.R., Miller, J. H., Nachtigall, P. E., Richardson, W. J., Thomas, J. A. and Tyack, P. L. 2007. Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. Aquatic Mammals, 33, (4)
- Wall, D., Murray, C., O'Brien, J., Kavanagh, L., Wilson, C., Ryan, C., Glanville, B., Williams, D., Enlander, I., O'Connor, I., McGrath, D., Whooley, P., Berrow, S. (2013) Atlas of the distribution and relative abundance of marine mammals in Irish offshore waters 2005 – 2011. Irish Whale and Dolphin Group, Kilrush, Co. Clare, 63pp.
- Ward, G., and Montague, C. (1996) Estuaries. New York, NY: McGraw-Hill Book Company.

Chapter 13 – Terrestrial and Coastal Biodiversity

- CIEEM (20171) Guidelines for Preliminary Ecological Appraisal, 2nd Edition, Chartered Institute of Ecology and Environmental Management, Winchester.
- CIEEM (20172) Guidelines for Ecological Report Writing, Chartered Institute of Ecology and Environmental Management, Winchester.
- Cutts, N., Phelps, A. & Burdon, D. (2009) Construction and Waterfowl: Defining Sensitivity, Response, Impacts and Guidance. Report to Humber INCA. Institute of Estuarine & Coastal Studies, University of Hull.
- EPA (2022) Guidelines on the information to be contained in Environmental Impact Assessment Reports, Environment Protection Agency, Wexford.
- Hansen, K.A., Maxwell, A., Siebert, U. et al. Sci Nat (2017) 104: 45. https://doi.org/10.1007/s00114-017-1467-3
- Heinänen, S and Skov, H. (2015) The identification of discrete and persistent areas of relatively high harbour porpoise density in the wider UK marine area, JNCC Report No. 544, JNCC, Peterborough.
- Southall B L, Finneran J J, Reichmuth C, Nachtigall P E, Ketten D R, Bowles A E, Ellison W T, Nowacek D P, Tyack P L (2019) Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects. Aquatic Mammals 2019, 45(2), 125-232, DOI 10.1578/AM.45.2.2019.125
- Southall, B. Southall, A. E., Bowles, W., Ellison, T., Finneran, J.J., Gentry, R. L., Greene Jr. C. R., Kastak, D., Ketten, D.R., Miller, J. H., Nachtigall, P. E., Richardson, W. J., Thomas, J. A. and Tyack, P. L. (2007) Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. Aquatic Mammals, 33, (4).

Chapter 14 – Traffic and Transportation

- EPA (2022) Guidelines on the information to be contained in Environmental Impact Assessment Reports, Environment Protection Agency, Wexford.
- Fingal County Council (2019) Climate Change Action Plan (2019-2024).

Chapter 15 – Air Quality & Climate

- Environment Protection Agency (2011) Air Quality Standards Regulations 2011 (S.I No. 180/2011).
- Environmental Protection Agency (2022) Air Quality in Ireland 2021.
- European Parliament (2008) Clean Air for Europe (CAFE) Directive (2008/50/EC).
- Fingal County Council (2019) Climate Change Action Plan (2019-2024).
- Government of Ireland (2022) Climate Action Plan 2023.
- Institute of Environmental Management and Assessment (2017) Environmental Impact Assessment Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance.
- Institute of Environmental Management and Assessment (2020) Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation.

- Met Eireann (2023) National Meteorological Service Climate Data.
- Traffic Infrastructure Ireland (2022) Air Quality Assessment of Proposed National Roads – Standard.
- World Health Organisation (2005) Air Quality Guidelines.

Chapter 16 – Waste Management

- Eastern Midlands Region, Connacht Ulster Region, Southern Region Waste Management Plans 2015-2021 (2020) Construction & Demolition Waste Soil and Stone Recovery/ Disposal Capacity - Update Report 2020.
- Environmental Protection Agency (2021) Best Practice Guidelines for the preparation of resource and waste management plans for construction and demolition projects.
- Environmental Protection Agency (2022). Urban Waste Water Treatment Report in 2021. Available at https://www.epa.ie/publications/monitoring--assessment/waste-water/Urban-Waste-Water-Treatment-in-2021-report.pdf
- Institute of Environmental Management and Assessment (2020) IEMA guide to: Materials and Waste in Environmental Impact Assessment Guidance for a proportionate approach.
- Regional Waste Management Planning Offices (2020) Construction & Demolition Waste Soil and Stone Recovery/ Disposal Capacity – Update Report 2020.
- Regional Waste Management Planning Offices (2023) Draft National Waste Management Plan for a Circular Economy.

Chapter 17 – Material Assets and Land Use

- Environmental Protection Agency (2002) Guidelines on the Information to be Contained in Environmental Impact Statements.
- Environmental Protection Agency (2003) Advice Notes on Current Practice in Preparation of Environmental Impact Statements.
- European Union (2018) Planning and Development – Environmental Impact Assessment Regulations.

Chapter 18 – Landscape and Visual

- Landscape Institute (2013) Guidelines for Landscape and Visual Impact Assessment (GLVIA3).
- Landscape Institute (2017) Advice Note 02/17 Visual Representation of Development Proposals.
- Landscape Institute (2011) Advice Note 01/11 Photography and Photomontage in Landscape and Visual Impact Assessment.

Chapter 19 – Population & Human Health

- Environmental Protection Agency (2022) Guidelines on the information to be contained in Environmental Impact Assessment Reports.

- European Commission (2017) Environmental Impact Assessment of Projects: Guidance on the preparation of the Environmental Impact Assessment Report. European Commission.
- Fingal County Council (2023) Fingal Development Plan 2023-2029.
- Government of Ireland (2021) National Development Plan 2021-2030." October.
- (2018) Project Ireland 2040 National Planning Framework.
- Institute of Public Health (2021) Health Impact Assessment Guidance: A Manual." Institute of Public Health

Chapter 20 – Major Accidents & Disasters

- Dublin Institute for Advanced Studies (DIAS) and Irish National Seismic Network (INSN) (2023) Detected Seismicity 1980 to Present. Available at: https://www.insn.ie/.
- EIA Directive 2014/52/EU (amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment).
- Enno, S-E. Sugier, J., Alber,R. and Seltzer, M. (2020) Lightning flash density in Europe based on 10 years of ATDnet data.
- Environmental Protection Agency (EPA) (2014) Guidance on Assessing and Costing Environmental Liabilities.
- Environmental Protection Agency (EPA) (2022) Guidelines on the information to be contained in Environmental Impact Assessment Reports.
- European Commission (2017) Environmental Impact Assessment of Projects: Guidance on the preparation of the Environmental Impact Assessment Report.
- Giardini, D., Woessner, J. and Danciu, L. (2014) Mapping Europe's Seismic Hazard. EOS, 95(29): 261-262.
- Grünthal, G., Wahlström, R. and Stromeyer, D. (2013) The SHARE European Earthquake Catalogue (SHEEC) for the time period 1900-2006 and its comparison to EMEC. Journal of Seismology, 17, 4, 1339-1344, doi: 10.1007/s10950-013-9379-y.
- Health and Safety Authority (HSA) (2023) Notified Seveso Establishments. Available at: https://www.hsa.ie/eng/Your_Industry/Chemicals/Legislation_Enforcement/COMAH/List_of_Establishments/.
- Institute of Environmental Management and Assessment (IEMA) (2020) Major Accidents and Disasters in EIA: A Primer.
- Met Éireann (2023) Historical Data – Dublin Airport. Available at: https://www.met.ie/climate/available-data/historical-data
- RPS (2020) Rogerstown Coastal Flood Erosion Risk Management (CFERM) Study, on behalf of Fingal County Council.

- Safety, Health and Welfare at Work (Construction) Regulations 2013 (S.I. No. 291).
- Safety, Health and Welfare at Work (General Application) Regulations 2007 (S.I. No. 299/2007).
- Safety, Health and Welfare at Work Act 2005 (Number 10).
- The Control of Major Accident Hazards (COMAH) Regulations (2015).
- The Department of Environment, Heritage and Local Government (DEHLG) (2010) A Framework for Major Emergency Management. A Guide to Risk Assessment in Major Emergency Management.