

M28 Cork to Ringaskiddy Project

Ringaskiddy Urban Realm and Active Travel

Flood Risk Assessment

M28CRP-RING-HDG-ACTR-ZZZ-RP-JAC-CE-000001

0

2024-05-31





M28 Cork to Ringaskiddy Project

Project No: 32110902
Document Title: Ringaskiddy Urban Realm and Active Travel Flood Risk Assessment
Document No.: M28CRP-RING-HDG-ACTR-ZZZ-RP-JAC-CE-000001
Revision: 0
Document Purpose: P2 - Coordination
Document Acceptance: S - Issued
Date: 2024-05-31

Client Name: Cork County Council
Client No: 5657
Project Manager: Paddy.DeFeu@jacobs.com
Author: Vasiliki Poulimenakou
File Name: M28CRP-RING-HDG-ACTR-ZZZ-RP-JAC-CE-000001

Jacobs Engineering Ireland
Mahon Industrial Estate, Bessboro Road,
Blackrock, Cork,
T12 HY54
Ireland
T +353 21 451 5777
F +353 0 21 435 8977
www.jacobs.com

© Copyright 2024 Jacobs. The concepts and information contained in this document are the property of Jacobs. Use or copying of this document in whole or in part without the written permission of Jacobs constitutes an infringement of copyright.

Limitation: This document has been prepared on behalf of, and for the exclusive use of Jacobs' client, and is subject to, and issued in accordance with, the provisions of the contract between Jacobs and the client. Jacobs accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this document by any third party.

Document history and status

Revision	Date	Description	Author	Checked	Reviewed	Approved
0	2024-05-31	For Approval	VP	AK	AK	SP



Contents

Acronyms and abbreviations	iv
1. Introduction.....	1
1.1 Project Background.....	1
1.2 Construction Phase	2
1.3 Report Structure.....	3
2. Planning Guidelines	1
2.1 The Planning System and Flood Risk Management Guidelines for Planning Authorities.....	1
2.2 Cork County Development Plan 2022 – Volume Four South Cork.....	1
2.3 Cork County Development Plan – Strategic Flood Risk Assessment 2022	2
3. Flood Risk Assessment Methodology	4
3.1 Flood Zones	4
3.2 Vulnerability of the Scheme.....	4
4. Stage 1 Flood Risk Identification	5
4.1 Historic Flood Events.....	5
4.2 Fluvial Flood Risk	6
4.3 Pluvial Flood Risk.....	6
4.4 Groundwater Flood Risk	7
4.5 Coastal Flood Risk	8
4.5.1 OPW CFRAM Study	8
4.5.2 Irish Coastal Protection Strategy Study (ICPSS).....	8
4.5.3 National Coastal Flood Hazard Mapping.....	9
4.6 Strategic Flood Risk Assessment (SFRA)	10
4.7 Stage 1 Flood Risk Assessment Conclusions.....	11
5. Stage 2 Initial Flood Risk Assessment.....	13
5.1 Potential Sources of Flooding.....	13
5.2 Pluvial Flood Risk	13
5.3 Groundwater Flood Risk.....	14
5.4 Coastal Flood Risk.....	14
5.5 Artificial Drainage Systems.....	14
5.6 Flood Risk due to Climate Change	15
5.7 Summary of Flood Risk	17
6. Stage 2 Potential Flood Risk Impacts from Development	19
6.1 Impacts on Fluvial Flooding	19
6.2 Impacts on Pluvial Flooding	19
6.3 Impacts on Groundwater Flooding	19
6.4 Impacts on Coastal Flooding.....	19
6.5 Impacts on Estuarine Flooding.....	19
6.6 Impacts on Flooding from Artificial Drainage Systems	19



6.6.1	Drainage Strategy	20
6.6.1.1	Existing Network Findings.....	20
6.6.1.2	Drainage Design Proposals.....	20
6.6.1.3	SuDS 21	
6.7	Summary of Potential Flood Risk Impacts from Proposed Development.....	22
7.	Conclusions and Recommendations.....	23

Tables

Document history and status	i
Table 2.1: Objectives and recommendations of the Cork County Development Plan	1
Table 2.2: Objectives and recommendations of the Cork County Development Plan SFRA for Ringaskiddy	3
Figure 4.1: Past flood events in close proximity to Ringaskiddy Urban Realm and Active Travel Scheme...5	
Table 4.1: Historic flood events identified on or adjacent to the proposed scheme.....	6
Table 4.2 Recent flooding in close proximity to Ringaskiddy Urban Realm and Active Travel Scheme.....	6
Table 4.3: Stage 1 FRA Summary	11
Table 5.1: 0.5% Pluvial Flood Risk along the proposed scheme.....	13
Table 5.2: Climate Change Forecast.....	15
Table 5.3: MRFS Coastal Flood Levels near proposed scheme	16
Table 5.4: Climate Change Impact	17
Table 5.5: Summary of Flood Risk.....	17
Table 6.1: SuDS Management Train, produced by Jacobs from CIRIA SuDS Manual 2015.....	20
Table 6.2: Summary of potential flood risk impacts on surrounding areas as a result of the scheme development.....	22

Figures

Figure 4.2: Extract of PFRA 0.5% AEP pluvial flooding (the most unfavourable rainfall event) for the proposed scheme.....	7
Figure 4.3: Extract of CFRAM coastal flood mapping for the proposed scheme.....	8
Figure 4.4: Extract of ICPSS coastal flood mapping for the proposed scheme	9
Figure 4.5: Extract of National Coastal Flood Hazard mapping for the proposed scheme	10
Figure 4.6: Extract from Cork CDP 2022 - Volume Four South Cork, Cork Land Use & Flood Zones.....	11
Figure 5.1: Extract of ICPSS coastal flood mapping for the mid-range future scenario along the proposed scheme	16



Acronyms and abbreviations

CCC – Cork County Council

CDK – Combined Drainage Kerbs

CFRAM – Catchment Flood Risk Assessment and Management

DMURS – Design Manual for Urban Roads and Streets

FRM – Flood Risk Management

FRMP – Flood Risk Management Plans

GIS – Geographical Information Systems

ICPSS – Irish Coastal Protection Strategy Study

OPW – Office of Public Works

SFRA – Strategic Flood Risk Assessment



1. Introduction

1.1 Project Background

The Proposed Development will provide an active travel route along the existing N28 road, through the village of Ringaskiddy and on to the L2545 between the signalised junction with the R613 and the car park at Gobby Beach. A new shared use pedestrian/cycle facility will be provided on the north side of the N28. Public Realm improvements to the village centre will also be undertaken, and will include new paving, landscaping and junction improvements. Speed reduction measures in the form of Gateway features and raised pedestrian crossings are also included.

The scheme extents cover approximately 1.7km of the N28 through Ringaskiddy village from the R613 junction to the east of Gobby Beach car park including the side road and private accesses. The scheme covers engineering works within the existing road corridor only. Gateway and landscaping features are provided to provide a transition zone into the village and enhance the urban realm. The scheme is split to the west of the Yarra fertiliser plant by the new Ringaskiddy Roundabout which forms part of a separate sub-scheme of the M28 Cork to Ringaskiddy project known as the Protected Road.

The proposed development is designed to DMURS and where applicable relevant TII standards. The scheme includes the following:

- Implementation of a 50kph speed limit throughout.
- New shared use two-way cycle facility with pedestrians north of the N28 throughout the scheme extents.
- Improvement of the existing footway to the south of the N28.
- Formalisation of parking laybys with landscaped build outs.
- Re-configured Port of Cork junction opposite the Oratory to reduce entry/exit cross section.
- Public realm improvements to the village centre, including paving and landscaping.
- Narrowing of the road cross section to 6m (two 3m lanes) to promote slower speeds.
- Gateway transition zones into the village at the eastern and western extents.
- Signalised puffin crossing in village centre.
- Five new raised pedestrian crossings on the N28.
- Raised shared use/pedestrian facility across private accesses.
- New public lighting.
 - Replace old sodium lights with LEDs
 - Increase coverage at pedestrian crossing points.
- Re-positioned online bus stops.
- Provision of new bus shelters for westbound traffic.
- Installation of some new drainage underground pipes in the extents of the scheme to supplement the existing pipe network.
 - Discharges to existing outfall.
 - Negligible increase in permeable area to capture as runoff.
 - No works to the foul network.

- Underground ducting of ESB overhead network in village centre.
- Installation of road signage and line marking.
- Rain Gardens in the gateway medians.

The location of the proposed Ringaskiddy Urban Realm and Active Travel scheme is shown in Figure 1.1 below.

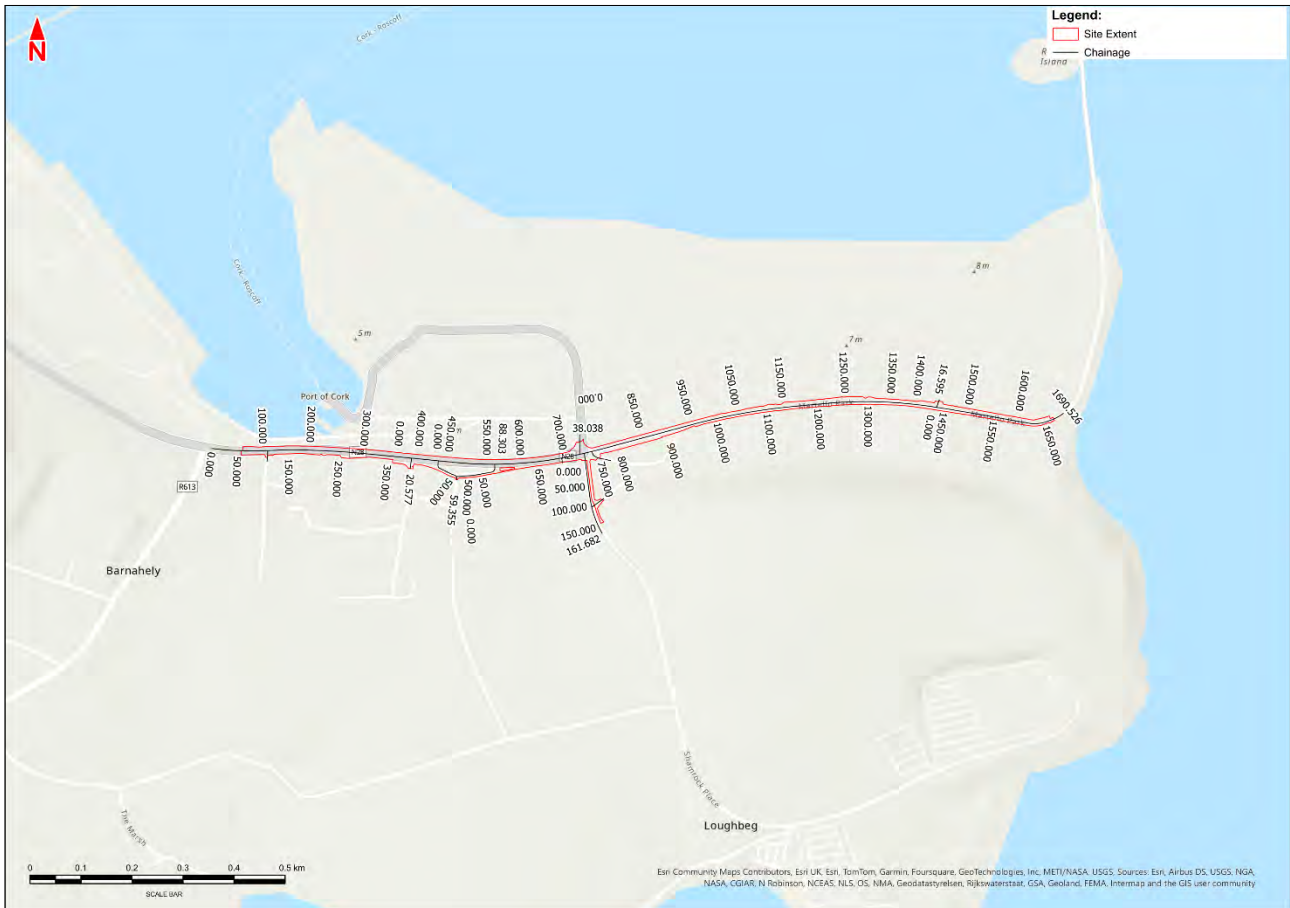


Figure 1.1: Ringaskiddy Urban Realm and Active Travel Scheme Location Map

1.2 Construction Phase

The construction phase will be approximately 10 months and will include the following:

- Small amounts of vegetation clearance which includes topsoil strip, hedge trimming and the removal of trees.
- No new permanent fencing.
- Break out and repositioning of kerbs and gullies.
- Construction of bituminous cycle tracks and footpaths.
 - Shared use path is widening of existing footway into the road.
- Construction of widening the existing concrete footway.
- Landscaping – topsoiling, seeding, tree planting, architectural features.
- Plane and inlay of pavement.



- Plane off existing pavement asphalt layers using a milling machine and replacing with new asphalt.
- Japanese knotweed root protection barrier installation and removal of a small area for disposal in a designated burial cell located off site.
- Excavation of trenches for the installation of new drainage pipes.
- Breakout of small section of existing Old Quay Wall to increase size of gap for village amenity space.
 - Wall has been surveyed and found to be of local significance only.
- Topsoil stripping and small amounts of excavation will be removed off site and disposed of to licensed landfill.
- Contractor will have a designated site compound adjacent to the site for storage of material, refuelling machinery, and operative welfare.

1.3 Report Structure

The flood risk assessment is structured as follows:

- Chapter 2 sets out the Planning Guidelines considered.
- Chapter 3 sets out the Flood Risk Assessment Methodology.
- Chapter 4 outlines the findings of the Stage 1 Flood Risk Assessment.
- Chapter 5 outlines the findings of the Stage 2 flood risk impacts to the proposed scheme.
- Chapter 6 outlines the findings of the Stage 2 flood risk impacts from the proposed scheme.
- Chapter 7 presents the conclusions.

2. Planning Guidelines

2.1 The Planning System and Flood Risk Management Guidelines for Planning Authorities

The Planning System and Flood Risk Management Guidelines for Planning Authorities ‘introduce comprehensive mechanisms for the incorporation of flood risk identification, assessment and management into the planning process.’

The FRM Guidelines set out methodology to be used for the flood risk assessment of proposed developments which require the planning system at national, regional, and local levels to:

- Avoid development in areas at risk from flooding, particularly floodplains, unless there are proven wider sustainability grounds that justify development. Where this is the case development must be appropriate and flood risks must be effectively managed to reduce the level of risk.
- Adopt a Sequential Approach to flood risk management when assessing the locations for new development based on avoidance, reduction, and mitigation of flood risk.
- Incorporate flood risk assessment into planning application decisions and appeals.

2.2 Cork County Development Plan 2022 – Volume Four South Cork

Volume Four of the Cork County Development Plan 2022 – South Cork – Carrigaline, Cobh, East Cork and Macroom Municipal Districts includes the plan for Ringaskiddy. Sections 1.7.61 and 1.7.62 analyse the flooding in Ringaskiddy as follows:

- There have been a number of flooding events in Ringaskiddy. A flood event occurred in 2014 and was caused by surface water due to extremely heavy rainfall. This resulted in the low lying areas close to Ringaskiddy village and the NMCI being impassable. Minor flood events have also been recorded at Coolmore Crossroads and Raffan Bridge.
- Parts of Ringaskiddy have been identified as being at risk of flooding. The areas at risk are mainly the areas affected by tidal flooding along the coastline. Government Guidelines require, and it is an objective of this plan, that future development is avoided in areas indicated as being at risk of flooding. The approach to Flood Risk Management is set out in Chapter 11 Water Management in Volume One of this Plan and in the updated Strategic Flood Risk Assessment (SFRA). The SFRA should be consulted for any settlement specific comments and recommendations, including site specific recommendations made as part of any Justification Tests carried out, prior to any application for development.

The key policies and objectives Chapter 11 Water Management in Volume One relevant to the proposed scheme are shown in Table 2.1 below.

Table 2.1: Objectives and recommendations of the Cork County Development Plan

Objective No.	Objective
WM 11-15: Flood Risk Assessments	<p>To require flood risk assessments to be undertaken for all new developments within the County in accordance with The Planning System and Flood Risk Management – Guidelines for Planning Authorities (2009) and the requirements of DECLG Circular P12/2014 and the EU Floods Directive.</p> <ul style="list-style-type: none"> - For sites within Flood Zone A or B, a site specific Flood Risk Assessment will be required. - For sites within Flood Zone C, an examination of all potential sources of flooding, and consideration of climate change (flood risk screening assessment), will be required. In limited circumstances where the ‘Flood Risk Screening assessment’ identifies potential sources of flood risk, a site specific flood risk assessment may also be required. - All proposed development must consider the impact of surface water flood risks on drainage design through a Drainage Impact Assessment. The drainage design should ensure no increase in flood risk to the site, or the downstream catchment.

Objective No.	Objective
<p>WM 11-16: Flood Risks – Overall Approach</p>	<p>Take the following approach in order to reduce the risk of new development being affected by possible future flooding:</p> <ul style="list-style-type: none"> • Avoid development in areas at risk of flooding; and • Apply the sequential approach to flood risk management based on avoidance, substitution, justification and mitigation of risk. • Where development in floodplains cannot be avoided, applications for development must meet the definition of Minor Development or have passed the Justification Test for Development Plans in the updated SFRA and can pass the Justification Test for Development Management to the satisfaction of the planning authority. • Consider the impacts of climate change on the development. <p>In areas where the Justification Test for Development Plans has not been applied, or has been failed, the sequential approach should be applied as follows:</p> <ul style="list-style-type: none"> • In areas where there is a high probability of flooding - 'Flood Zone A' - avoid highly and less vulnerable development as described in Section 3 of 'The Planning System and Flood Risk Management – Guidelines for Planning Authorities' issued in November 2009 by DoEHLG. • In areas where there is a moderate probability of flooding - 'Flood Zone B' - avoid 'highly vulnerable development' described in section 3 of 'The Planning System and Flood Risk Management – Guidelines for Planning Authorities' issued in November 2009 by DoEHLG. • In areas where there is low probability of flooding – 'Flood Zone C' all uses may be considered subject to a full consideration of all flood risks.
<p>WM 11-17: Development in Flood Risk Areas</p>	<p>When considering proposals for development, which may be vulnerable to flooding, and that would generally be inappropriate as set out in Table 3.2 of the Guidelines, the following criteria must be satisfied:</p> <ol style="list-style-type: none"> 1. The subject lands have been zoned or otherwise designated for the particular use or form of development in an operative development plan, which has been adopted or varied taking account of these Guidelines. 2. The proposal has been subject to an appropriate flood risk assessment that demonstrates: a. The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk; b. The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably possible; c. The development proposed includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design, implementation and funding of any future flood risk management measures and provisions for emergency services access; and d. The development proposed addresses the above in a manner that is also compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes. The acceptability or otherwise of levels of residual risk should be made with consideration of the type and predicted future use of the development and the local development context. The development is assessed not to have the potential to give rise to negative or adverse impacts on the integrity of Natura 2000 sites or Natural Heritage Areas or proposed Natural Heritage Areas.

2.3 Cork County Development Plan – Strategic Flood Risk Assessment 2022

Section 4.4 of the SFRA analyses flood risk in the Carrigaline Municipal District. Tables 15, 16 and 17 set out the requirements by settlement for flood risk in the district. With regards to Ringaskiddy, specific recommendations are given for certain land use zonings. The key policies and objectives relevant to the proposed scheme are shown in Table 2.1 2.2 below.



Table 2.2: Objectives and recommendations of the Cork County Development Plan SFRA for Ringaskiddy

Cork County Development Plan SFRA Objective	Proposed Scheme Approach to Compliance
<p>Sequential approach to be applied and development to be avoided in Flood Zones A and B.</p>	<p>Reference to the information contained Cork County Council Development Plan 2022 – Volume Four South Cork shows that parts of the proposed scheme would be located within the Flood Zones A and B. The application of the sequential approach will be followed, and the Justification Test will be applied if required.</p> <p>The Proposed Scheme therefore meets this objective.</p>
<p>Proposals for development within Flood Zone A or B should follow the Planning System and Flood Risk Management Guidelines, and the approach detailed in this SFRA with regard to the consideration of all sources of flood risk. The Plan Making Justification Test has not been applied, so should fluvial flood risk be identified (such as from unmapped watercourses), the avoidance approach must be followed.</p>	<p>The proposed development follows the Planning System and Flood Risk Management Guidelines. Fluvial flood risk is not identified along the scheme.</p> <p>The Proposed Scheme therefore meets this objective.</p>

3. Flood Risk Assessment Methodology

The document *Planning System and Flood Risk Management: Guidelines for Planning Authorities* published by the OPW (referred to hereafter as the FRM Guidelines) outlines the key principles that should be used for assessing flood risk to proposed development sites. It recommends that a staged approach should be adopted. The stages of appraisal and assessment are as follows:

- **Stage 1: Flood risk identification** – This stage identifies any issues (flooding or surface water management) related to the proposed Ringaskiddy Urban Realm and Active Travel Scheme development.
- **Stage 2: Initial flood risk assessment** – This stage will seek confirmation on the sources of flooding identified in Stage 1 that may affect the proposed development. All existing information, and the accuracy of this, will be reviewed in detail and extent of the flood risk associated with the Ringaskiddy Urban Realm and Active Travel Scheme development will be established. This stage will determine the nature of any further work required as part of the Flood Risk Assessment
- **Stage 3: Detailed flood risk assessment** – Where required, this stage will assess flood risk issues in sufficient detail and to provide a quantitative appraisal of potential flood risk to a proposed or existing development, of its potential impacts on flood risk elsewhere and of the effectiveness of any proposed mitigation measures. This will typically involve use of an existing or construction of a hydraulic model across a wide enough area to appreciate the catchment wide impacts and hydrological process involved. It is not expected this will be required.

3.1 Flood Zones

The FRM Guidelines define the following three flood zones:

- **Flood Zone A** – ‘Where the probability of flooding from rivers and the sea is highest (greater than 1% annually or 1 in 100 years for river flooding or 0.5% annually or 1 in 200 years for coastal flooding)’.
- **Flood Zone B** – ‘Where the probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 years and 1% annually or 1 in 100 for river flooding and between 0.1% annually or 1 in 1000 years and 0.5% annually or 1 in 200 for coastal flooding)’.
- **Flood Zone C** – ‘Where the probability of flooding from rivers and the sea is low (less than 0.1% annually or 1 in 100 years for both river and coastal flooding (Flood Zone C covers all areas of the plan that are not in zones A or B))’.

These flood zones are used to assess the suitability of the location for a proposed development with respect to its vulnerability to flooding.

3.2 Vulnerability of the Scheme

With reference to Table 3.1 of the Planning System and Flood Risk Management Guidelines for Planning Authorities, the proposed works are assessed as “essential infrastructure such as primary transport” and therefore classed as a “highly vulnerable development”. The FRM Guidelines require that a Justification Test should be completed for any highly vulnerable developments that are located within Flood Zone A or Flood Zone B.

Document reference PL 2/2014 issued by the Department of Housing, Local Government and Heritage (9th March 2021), sought to provide clarification on the use of Flood Mapping in planning applications and application of flood zones within older developed areas of towns and cities. Document PL 2/2014 noted that where developments concern the extension to existing assets, the sequential approach cannot be used to locate them in lower areas of flood risk. The Justification Test will therefore not apply, however a commensurate assessment of the risk of flooding from the development is required to ensure no adverse impacts.

4. Stage 1 Flood Risk Identification

The Stage 1 Flood Risk Assessment assesses the existing flood risk to the Proposed Scheme. This is carried out as a desktop study using existing information from a number of sources. The objective is to identify whether there are potential flooding or surface water management issues for the scheme that require further investigation.

4.1 Historic Flood Events

The OPW National Flood Hazard Mapping website (www.floodinfo.ie) was used to identify historical flooding along the proposed scheme, refer to Figure 4.1 below.

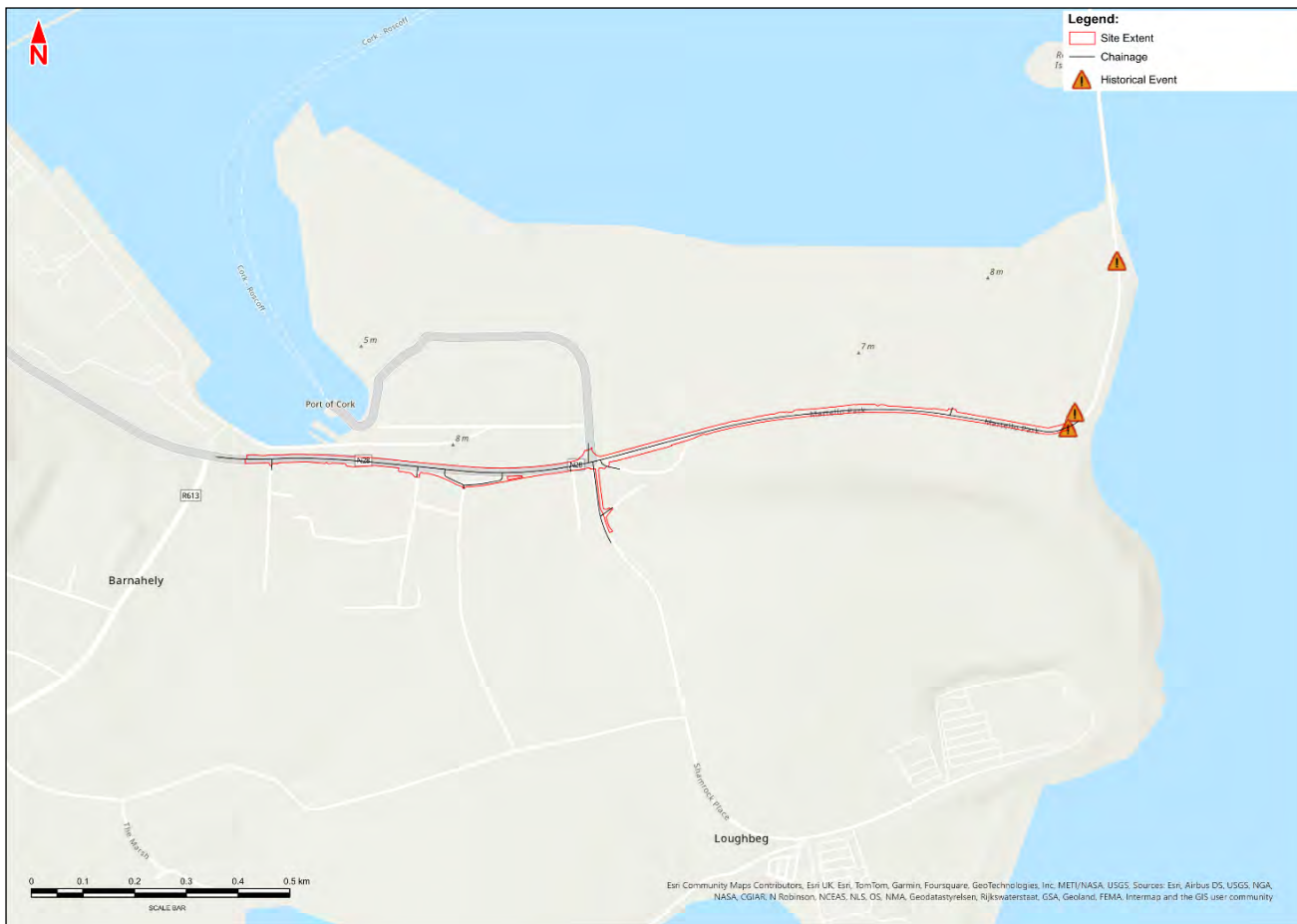


Figure 4.1: Past flood events in close proximity to Ringaskiddy Urban Realm and Active Travel Scheme

Further details of the past flood events on or adjacent to the proposed scheme are provided in Table 4.1 below.

Table 4.1: Historic flood events identified on or adjacent to the proposed scheme

ID	Location	Type	Start Date	Description
1 (ID-12085)	Ringaskiddy, Co. Cork (Approximate Irish Grid Co-ordinates – 179210, 064300)	Tidal	03/02/2014 (Single Flood Event)	High Tides and Strong Winds. The flooding was in the Lee Catchment. Flooding caused by a combination of south-easterly winds and high tides. From Monday morning 03rd February to Tuesday evening 04th February 2014. Flood water extended approximately 60m from car park at end of local road (L2545) and was approximately 13 - 15 inches deep.
2 (ID-13082)	Ringaskiddy	Coastal/ Estuarine waters	03/02/2014 (Single Flood Event)	No reports, photos or press articles associated with this flooding event were available on floodinfo.ie.
3 (ID-1364)	Paddys Block, Ringaskiddy	Tidal/ Low lying land	26/10/2004 (Single Flood Event)	Road flooding from a combination of heavy rainfall and extreme tidal conditions.

There has been also recent flooding in the Ringaskiddy Urban Realm and Active Travel Scheme area on the 18th of October 2023. Please refer to Table 4.2 below for further details.

Table 4.2 Recent flooding in close proximity to Ringaskiddy Urban Realm and Active Travel Scheme

Location	Event Date
Gobby Beach (Approximate Irish Grid Co-ordinates – 179212, 064299)	18/10/2023 (Single Flood Event)
Along Internal Port Access Road (Approximate Irish Grid Co-ordinates – 178054, 064304)	18/10/2023 (Single Flood Event)
Along Main St. & L2545 (Approximate Irish Grid Co-ordinates – 179122, 064322)	18/10/2023 (Single Flood Event)

4.2 Fluvial Flood Risk

Fluvial flood risk along the proposed scheme was assessed as part of the OPW Catchment Flood Risk Assessment and Management (CFRAM) Study. The CFRAM maps show that the Ringaskiddy Urban Realm and Active Travel Scheme is not at risk of fluvial flooding.

4.3 Pluvial Flood Risk

Pluvial flooding occurs during periods of heavy rainfall, when the rainfall rate is greater than the infiltration capacity. It is usually associated with high intensity rainfall events (typically > 30mm/h) resulting in overland flow and ponding in depressions in the topography. In urban situations underground sewerage/drainage systems and surface watercourses may be completely overwhelmed.

Pluvial flood extents are not available for the areas of County Cork from the CFRAM study. The rainfall flood extents at the area of interest were reviewed based on data from an extract of the PFRA 0.5% AEP pluvial flooding (the most unfavourable rainfall event), refer to Figure 4.2 below.

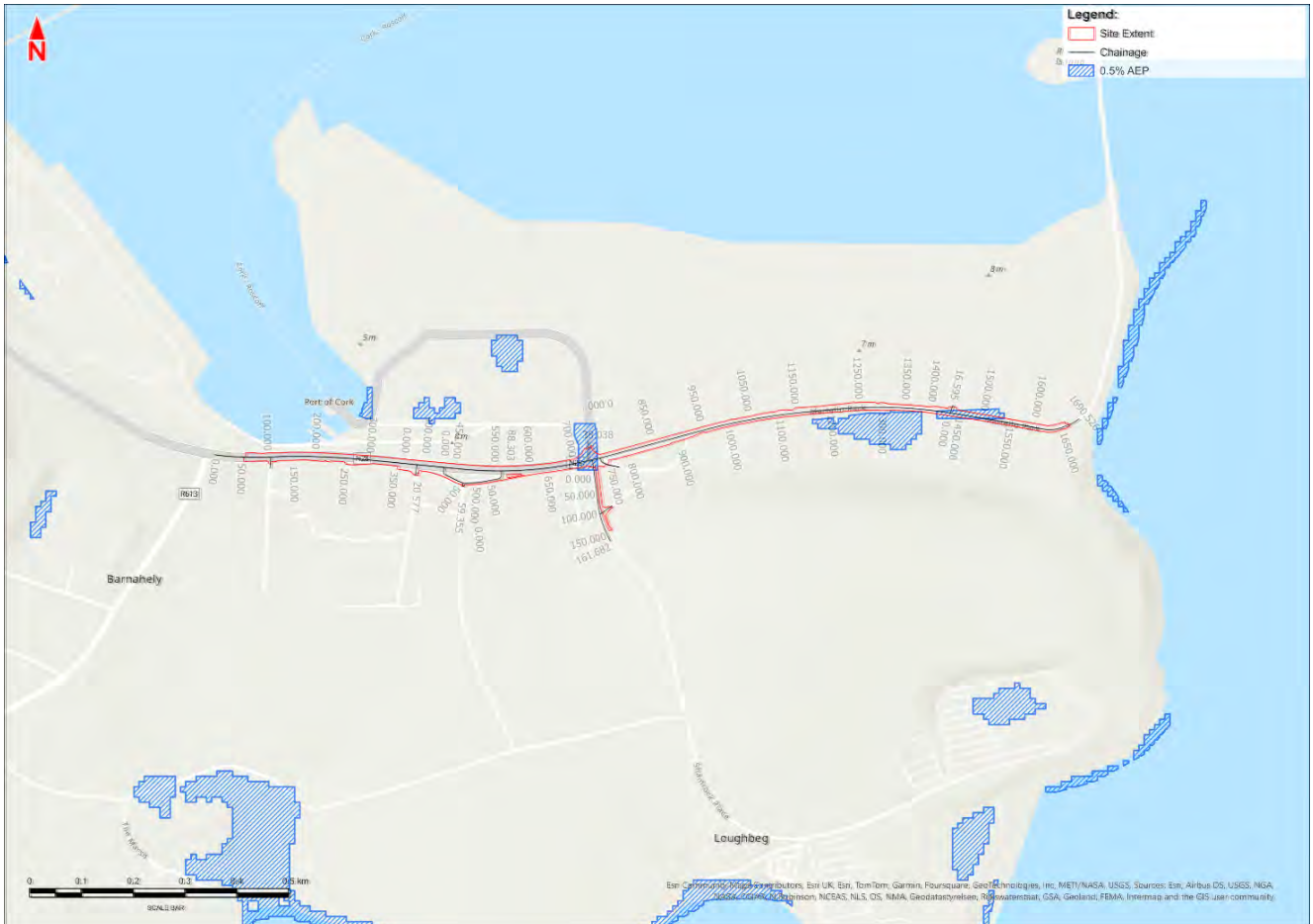


Figure 4.2: Extract of PFRA 0.5% AEP pluvial flooding (the most unfavourable rainfall event) for the proposed scheme

As shown in Figure 4.2, there is pluvial flood risk along the mainline between Ch. 700 – Ch. 750 and Ch. 1400 – Ch. 1550.

4.4 Groundwater Flood Risk

The Geological Survey Ireland (GSI) Groundwater Flooding Probability Maps show that there is no observed groundwater risk to the proposed scheme.

It should be noted, however, that seawater infiltration is likely to occur along the proposed scheme either through defective drainage pipes or merely seepage through the ground resulting in saturated ground. There is evidence of a manhole within the scheme showing signs of seawater infiltration.

The groundwater flood risk to the proposed development can be therefore considered low.

4.5 Coastal Flood Risk

4.5.1 OPW CFRAM Study

Coastal flood risk along the proposed scheme was assessed as part of the OPW Lee Catchment Flood Risk Assessment and Management (CFRAM) Study. The applicable coastal flood extent is presented in Figure 4.3 below.

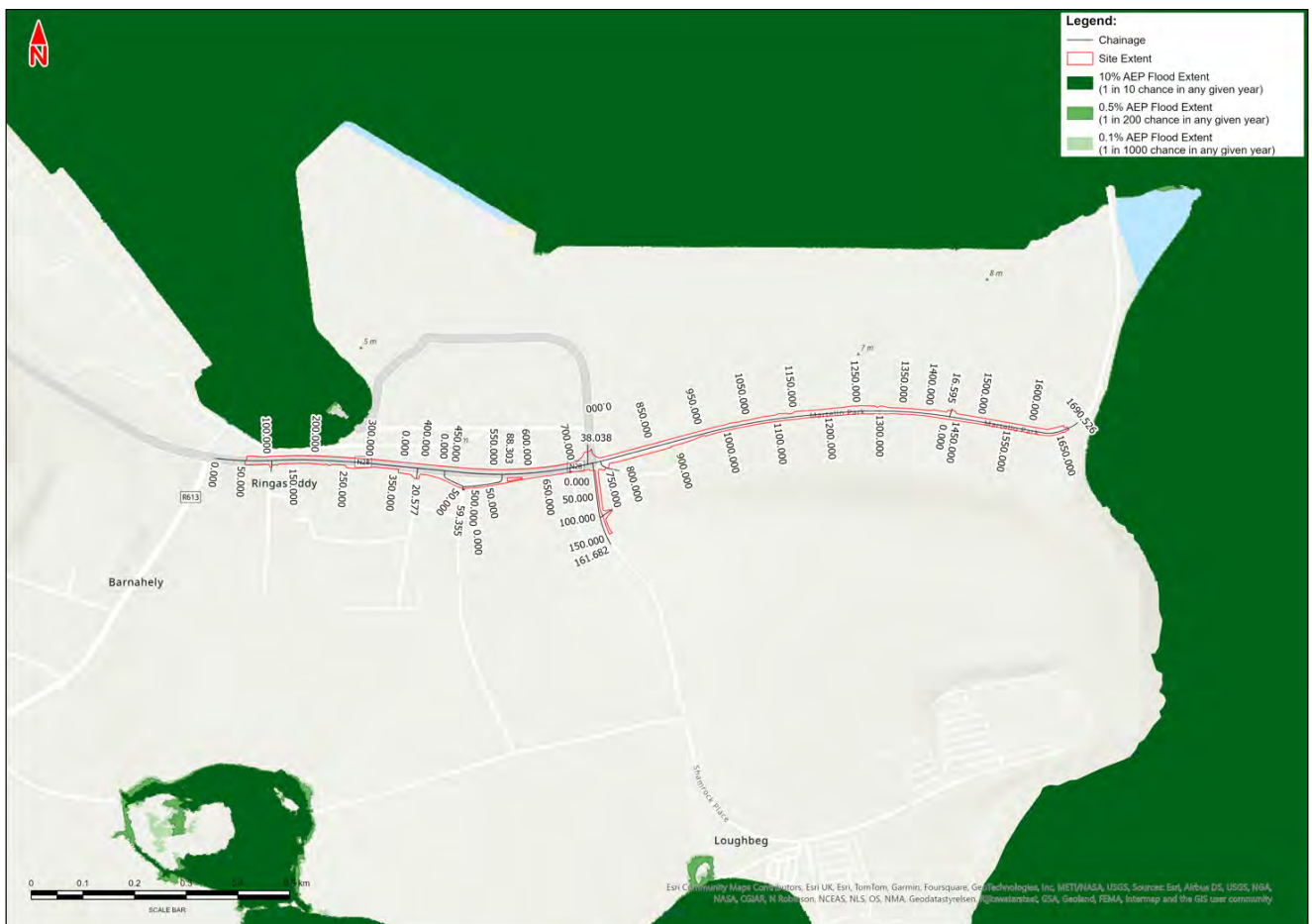


Figure 4.3: Extract of CFRAM coastal flood mapping for the proposed scheme

As shown in Figure 4.3, according to the CFRAM coastal flood mapping the proposed scheme is at low risk of coastal flooding with observed coastal risk identified immediately adjacent.

4.5.2 Irish Coastal Protection Strategy Study (ICPSS)

The Irish Coastal Protection Strategy Study (ICPSS) produced for the OPW provides an overview of coastal flood hazard and risk in Ireland. Flood maps were produced for the 0.5% and 0.1% AEP flood events. A volume of maps which represent projected future scenarios and include allowances for projected future changes in climate is also available.

ICPSS coastal flood extent maps for the current scenario have not been produced for the area of interest hence an extract from the ICPSS flood extent mapping for the mid-range future scenario has been utilised to characterise coastal flood risk, refer to Figure 4.4 below.

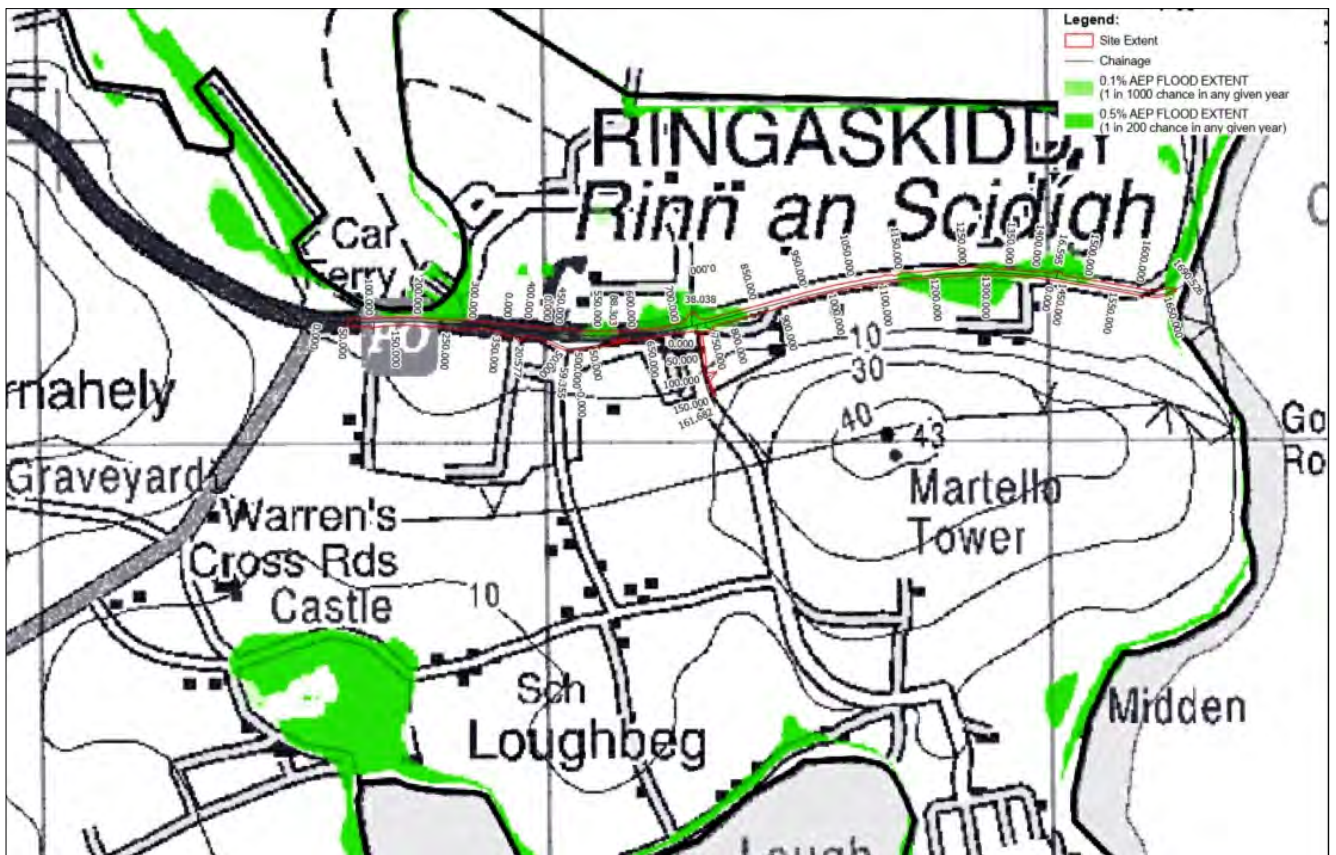


Figure 4.4: Extract of ICPSS coastal flood mapping for the proposed scheme

As shown in Figure 4.4, based on a review of available ICPSS coastal flood mapping, there is coastal flood risk along the proposed scheme between Ch. 250 – Ch. 270, Ch. 500 – Ch. 570, Ch. 620 – Ch. 850 and Ch. 1150 – Ch. 1500. and Ch. 1650 – Ch. 1690.

4.5.3 National Coastal Flood Hazard Mapping

The above findings are confirmed by the National Coastal Flood Hazard Mapping 2021; refer to Figure 4.5 below.

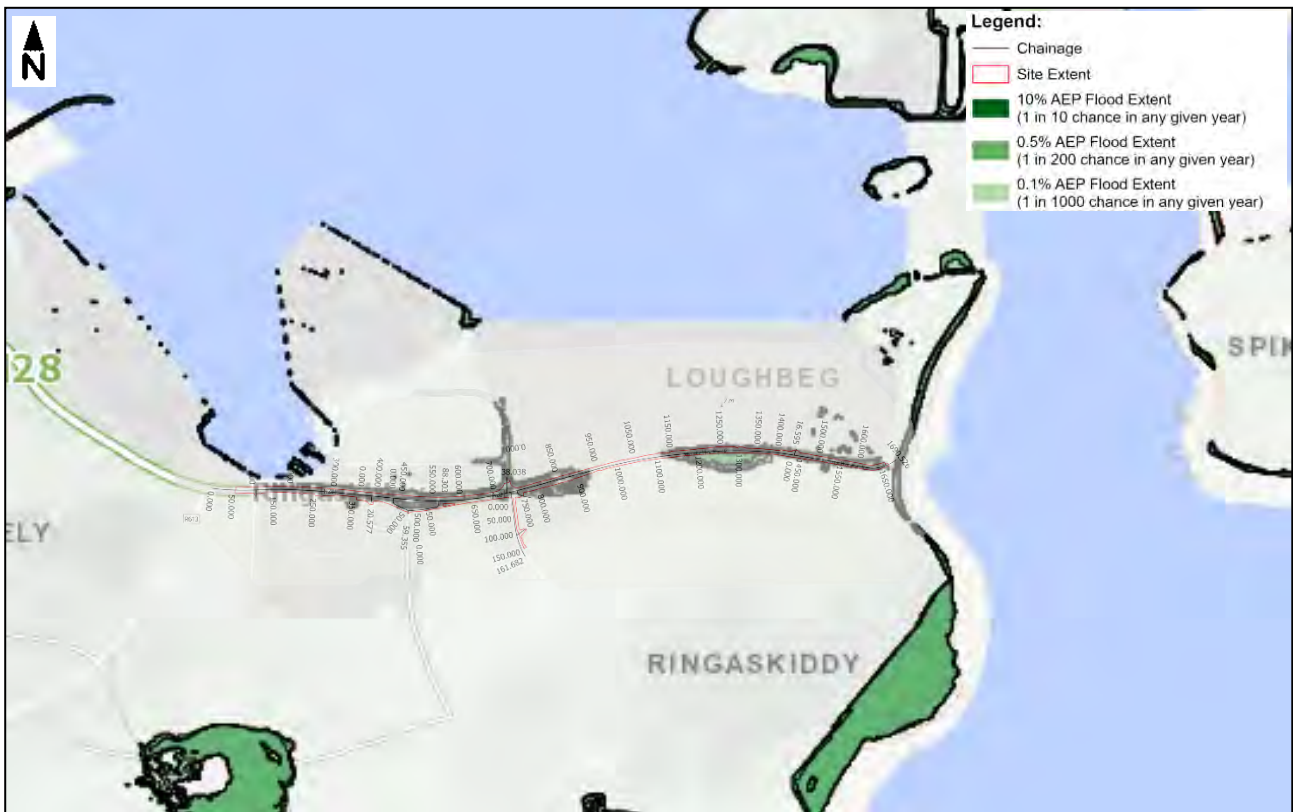


Figure 4.5: Extract of National Coastal Flood Hazard mapping for the proposed scheme

As shown, according to the National Coastal Flood Hazard mapping, there is coastal flood risk along the mainline between Ch. 150 – Ch. 950 and Ch. 1100 – Ch. 1670.

Taking into consideration the coastal flood risk analysis in Sections 4.5.1, 4.5.2 and 4.5.3, it can be concluded that there is a medium risk of coastal flooding to the proposed scheme. The proposed scheme is not expected to increase the coastal flood risk. There is no change of use proposed as part of it hence the existing level of coastal flood risk is considered to be acceptable. Nevertheless, a Stage 2 Flood Risk Assessment is undertaken to confirm the extent of the flood risk associated with the proposed scheme established.

4.6 Strategic Flood Risk Assessment (SFRA)

A Strategic Flood Risk Assessment Plan was prepared as part of the Cork City Development Plan 2022 - Volume Four South Cork. Reference to the information contained in this document shows that parts of the proposed scheme would be located within the Flood Zones A and B, refer to Figure 4.6 below.

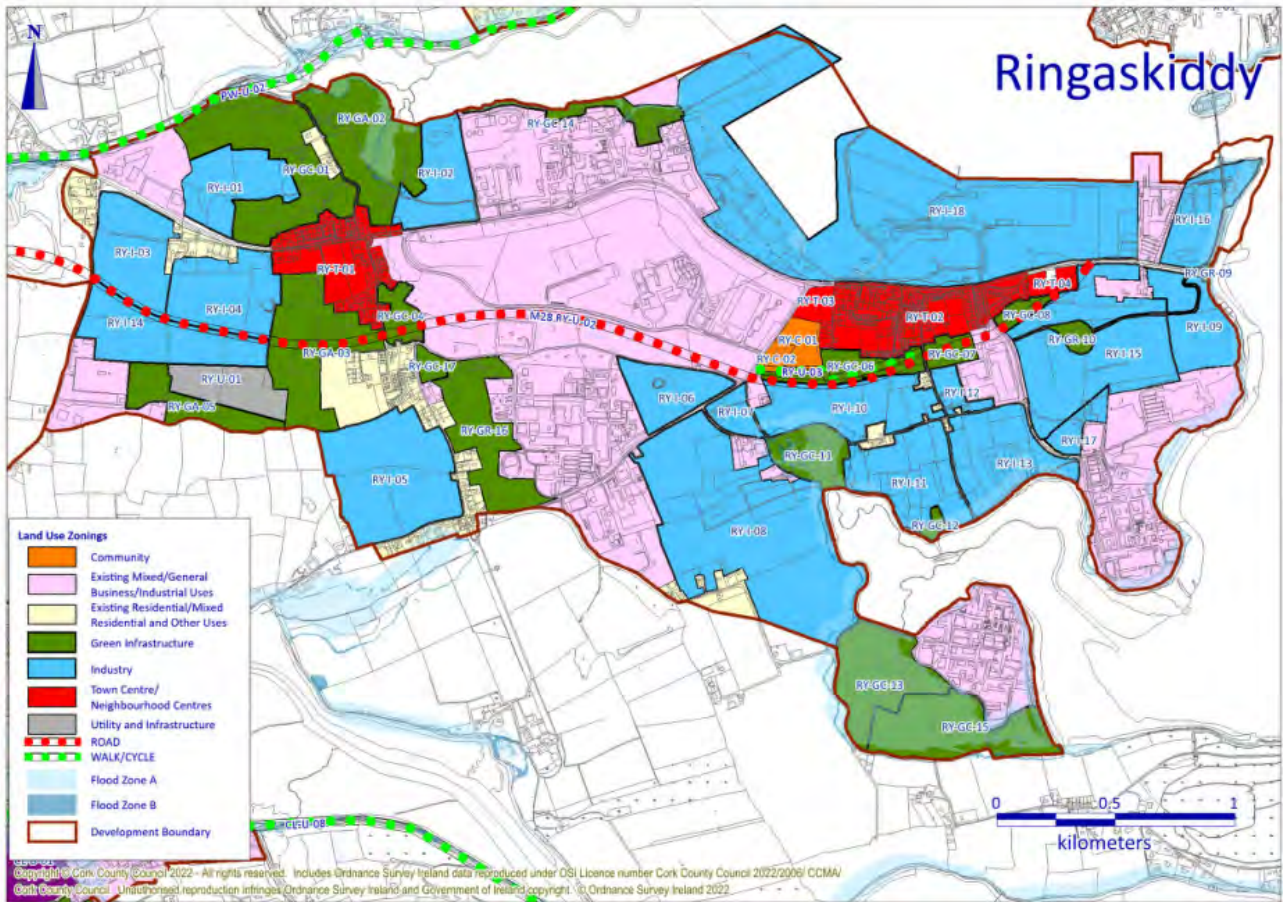


Figure 4.6: Extract from Cork CDP 2022 - Volume Four South Cork, Cork Land Use & Flood Zones

4.7 Stage 1 Flood Risk Assessment Conclusions

The Stage 1 Flood Risk Assessment included desktop investigations into the potential flood risks from incoming sources such as fluvial, pluvial, groundwater and coastal. The sources of flood risk identified along the proposed Ringaskiddy Urban Realm and Active Travel Scheme are summarised in Table 4.3 below.

Table 4.3: Stage 1 FRA Summary

Flood Risk	Preliminary Flood Risk Identification	Notes
Fluvial	N/A	There is no observed fluvial flood risk to the proposed scheme.
Pluvial	Low	PFRA pluvial flood mapping indicates that the risk of pluvial flooding along the proposed scheme is low.
Groundwater	Low	There is a low groundwater flood risk to the proposed scheme.
Coastal	Medium	Following an analysis of available data from OPW CFRAM coastal flood mapping, ICPSS mapping and National Coastal Flood Hazard Mapping 2021, a medium coastal flood risk is identified along the proposed scheme; refer to Section 4.5 above. The proposed scheme is not expected to increase the coastal flood risk.



The flooding events along the proposed scheme are attributed to heavy rainfall and high tide in conjunction with saturated ground due to seawater infiltration.

5. Stage 2 Initial Flood Risk Assessment

This section assesses the risk of flooding to the proposed development site once the works are complete from a range of different sources, which is then used to develop a broader understanding of the risk characteristics to the proposed development.

5.1 Potential Sources of Flooding

Further to the Stage 1 Flood Risk Assessment, there is no identified risk of fluvial, groundwater or estuarine flooding to the proposed development.

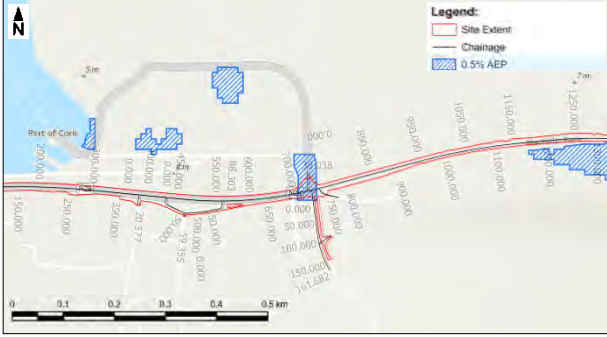
The potential sources of flooding are listed below:

- **Pluvial** – The PFRA maps show pluvial flood risk along the mainline between Ch. 700 – Ch. 750 and Ch. 1400 – Ch. 1550.
- **Groundwater** – While available mapping suggests that there is no observed groundwater risk to the proposed scheme, there is evidence of groundwater infiltration, refer to Section 6.6.
- **Coastal** – The CFRAM coastal flood maps show that the proposed scheme is at low risk of coastal flooding with observed coastal risk identified immediately adjacent. Available data from ICPSS and National Coastal Flood Hazard mapping suggests that there is medium coastal flood risk along the proposed highway.
- **Artificial Drainage Systems** – The proposed scheme will result in a marginal increase in impermeable surfaces. The drainage strategy proposals, refer to Section 6.6, will provide an improvement over the current situation as the percentage of catchment area experiencing a level of SuDS is expected to be significantly increased. In addition, collapsed and damaged pipes within Ringaskiddy village will be repaired as an advanced works package, refer to Section 6.6.

5.2 Pluvial Flood Risk

Table 5.1 below shows the sections of the proposed highway mainline which are located within the 0.5% pluvial flood risk.

Table 5.1: 0.5% Pluvial Flood Risk along the proposed scheme

Location	Comments
	<p>Mainline between Ch. 700 – Ch. 750</p>

Location	Comments
	<p>Mainline between Ch. 1400 – Ch. 1550</p>

The drainage strategy proposals, refer to Section 6.6, will provide an improvement over the current situation as the percentage of catchment area experiencing a level of SuDS is expected to be significantly increased. In addition, collapsed and damaged pipes within Ringaskiddy village will be repaired as an advanced works package.

The risk of pluvial flooding to the proposed scheme is therefore considered low.

5.3 Groundwater Flood Risk

This type of flooding occurs when the level of water within the soil makes up the land surface (known as the water table) and rises due to periods of abnormally high rainfall.

While available mapping suggests there is no observed groundwater flood risk to the proposed scheme, there is evidence of groundwater infiltration (video provided by CCC site team in one manhole showing significant infiltration), as detailed in Section 6.6.

The risk of groundwater flooding to the proposed scheme is therefore considered low.

5.4 Coastal Flood Risk

Coastal flooding is caused by higher sea levels than usual, resulting in the sea overflowing onto the land. Coastal flooding is influenced by three main factors, which often work in combination. These are:

- **High tide levels** – caused by normal, and predictable, astronomical factors.
- **Storm surges** – where sea levels are artificially raised by areas of low barometric pressure such as depression weather systems.
- **Wave action** – this is dependent on wind speed and direction, as well as local topography and exposure.

The Stage 1 assessment indicated that the proposed scheme is at risk from coastal flooding along the mainline. CFRAM maps are not available at this location. In line with the recommendations of the Cork SFRA Table 2, the available ICPSS maps have been utilised to characterise coastal flood risk. While ICPSS coastal flood extent maps for the current scenario have not been produced, there is available ICPSS flood mapping for the mid-range and high-end future scenarios for the area of interest, refer to Section 5.5. As mentioned above, the implementation of the proposed scheme is not expected to increase the coastal flood risk. There is no change of use proposed as part of it hence the existing level of coastal flood risk is considered to be acceptable.

5.5 Artificial Drainage Systems

Flooding occurs from artificial drainage systems during periods of heavy rainfall, when the local drainage system reaches capacity and surcharges from manholes and/or gullies.



The scheme proposals aim to provide significant SuDS provision within the design by maximising infiltration. As mentioned before, the proposals will provide an improvement over the current situation as the percentage of catchment area experiencing a level of SuDS is expected to be significantly increased. In addition, collapsed and damaged pipes within Ringaskiddy village will be repaired as an advanced works package.

It can therefore be concluded that the risk from flooding to the scheme from artificial drainage systems is low.

5.6 Flood Risk due to Climate Change

Future climate change is predicted to give rise to an increased risk of flooding through rising sea levels and an increase in river flows and the frequency and intensity of extreme rainfall. The OPW has identified two potential scenarios for the impacts of climate change which are known as the Mid-Range Future Scenario (MRFS) and High-End Future Scenario (HEFS). Table 5.2 below summarises the predicted impacts of both scenarios on predicted sea levels, river flows and rainfall depths over the next 100 years.

Table 5.2: Climate Change Forecast

Parameter	Mid-range Future Scenario MRFS	High-End Future Scenario HEFS
Mean Sea Level Rise	+500mm	+1000mm
River Flows	+20%	+30%
Extreme Rainfall Depths	+20%	+30%

The Mid-Range Future Scenario (MRFS) scenario is intended to represent the 'likely' future scenario based on a range of forecasts. The High-End Future Scenario (HEFS) represents a more extreme forecast that is at the upper end of accepted projections. For the purposes of this flood risk assessment, the potential impact of climate change on flood risk to the proposed development has been made relative to the MRFS scenario as suggested in The Planning System and Flood Risk Management Guidelines for Planning Authorities (OPW, 2009).

Future climate change has the potential to increase the risk from coastal flooding to the proposed scheme. An extract from the ICPSS flood extent mapping for the mid-range future scenario has been utilised to characterise coastal flood risk. The predicted flood extent for the mid-range future scenario is shown in Figure 5.1 below.

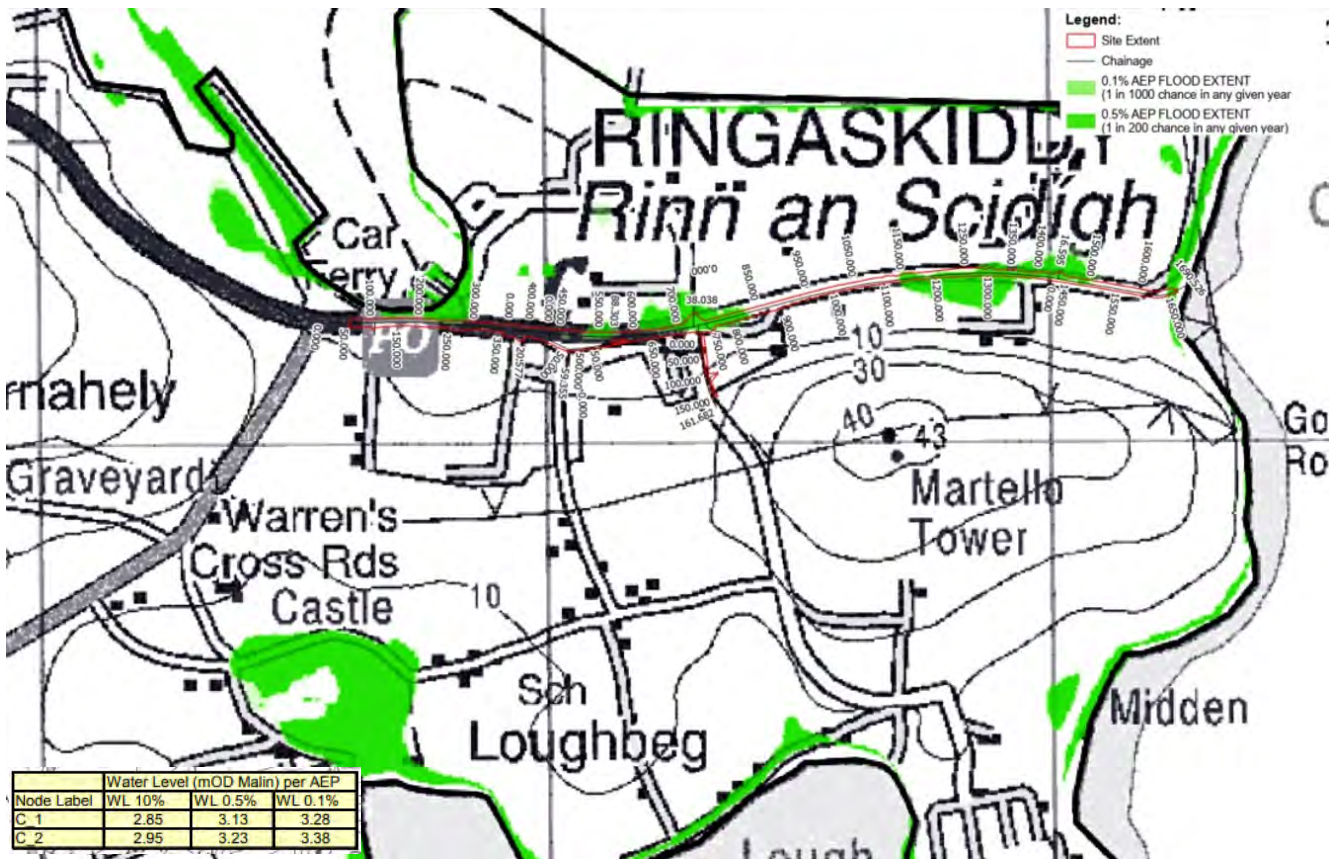


Figure 5.1: Extract of ICPSS coastal flood mapping for the mid-range future scenario along the proposed scheme

The predicted flood levels have been obtained from the ICPSS study for the 10%, 0.5% and 0.1% AEP flood events. According to the ICPSS mapping there is coastal flood risk between Ch. 250 – Ch. 270, Ch. 500 – Ch. 570, Ch. 620 – Ch. 850 and Ch. 1150 – Ch. 1500. and Ch. 1650 – Ch. 1690 of the mainline. Therefore, the water level results have been compared against the minimum ground level of the proposed highway between the above chainages.

Table 5.3 below compares the MRFS scenario forecast increase in coastal flood levels against the proposed scheme.

Table 5.3: MRFS Coastal Flood Levels near proposed scheme

AEP Event	Flood Level (mOD)	Minimum Ground Levels (mOD)	Difference/Freeboard Allowance (m)
10% (1 in 10)	2.95	2.360	- 0.59
1% (1 in 100)	3.23		- 0.87
0.1% (1 in 1000)	3.38		-1.02

Values obtained from node C_2

As shown, the proposed scheme is at risk of flooding in the 10%, 1% and 0.1% AEP MRFS coastal floods. The model node 'C_2' is the node that has been considered for the Stage 2 Flood Risk Assessment as the nearest node to the location of interest. However, it should be noted that the water levels reported at this model node are overestimating the potential flood depths at this location given that flows would incur significant hydraulic losses before spilling onto the proposed scheme.

The development of the proposed scheme is not expected to increase the existing coastal flood risk and will likely have a negligible impact on the existing coastal flood regime. Taking into consideration the above and given the minimal change in ground level, it can be concluded that the existing level of coastal flood risk is considered to be

acceptable. A wider flood relief scheme would be required to reduce the overall level of risk. Such a scheme is outside of the remit of this project. A Stage 3 flood risk assessment is not required at this location.

The potential effects of climate change on the flood risk to the proposed corridor are summarised in Table 5.4 below.

Table 5.4: Climate Change Impact

Source of Flooding	Likely Impacts of Climate Change	Comments
Fluvial	N/A	There is no existing risk of fluvial flooding to the proposed highway. Future climate change will not result in potential flooding from fluvial sources.
Pluvial	No Change (Proposed systems)	<p>While future climate change will result in increased rainfall depths over the proposed development, the following should be noted:</p> <ul style="list-style-type: none"> For existing drainage systems, the proposals will provide an improvement over the current situation as the percentage of catchment area experiencing a level of SuDS is expected to be significantly increased. The proposed measures also include repairs of the existing system in place, refer to Section 6.6 below. For new drainage systems constructed as part of the development, this will not result in an increase in the risk of pluvial flooding. These will be designed to allow for the effects of future climate change.
Groundwater	Increase	There is evidence of groundwater infiltration.
Coastal	Increase	There is a risk of coastal flooding to the proposed development. Future climate change will result in an increased risk of potential flooding from coastal sources, refer to Table 5.3 above. However, the development of the proposed scheme is not expected to increase the coastal flood risk and will likely have a negligible impact on the existing coastal flood regime.
Estuarine	N/A	There are no fluvial sources of flood risk affecting the proposed scheme. There is no existing risk of estuarine flooding to the proposed highway. Future climate change will not result in potential estuarine flooding.
Artificial Drainage Systems	No Change (Proposed systems)	The proposals will provide an improvement over the current situation as the percentage of catchment area experiencing a level of SuDS is expected to be significantly increased. The proposed measures also include repairs of the existing system in place, refer to Section 6.6 below.

5.7 Summary of Flood Risk

The flood risk to the proposed scheme is summarised in Table 5.5 below.

Table 5.5: Summary of Flood Risk

Flood Risk	Summary of Impact	Comments
Fluvial	N/A	There is no existing risk of fluvial flooding to the proposed highway.
Pluvial	Low	There is pluvial flood risk along the mainline between Ch. 700 – Ch. 750 and Ch. 1400 – Ch. 1550. All new drainage infrastructure will be designed in line with the recommendations from the Cork County Strategic Flood Risk Assessment and CIRIA 753. The proposals will provide an improvement over



Flood Risk	Summary of Impact	Comments
		the current situation as the percentage of catchment area experiencing a level of SuDS is expected to be significantly increased. In addition, collapsed and damaged pipes within Ringaskiddy village will be repaired as an advanced works package.
Groundwater	Low	The risk of groundwater flooding is low.
Coastal	Acceptable	A medium coastal flood risk is identified along the proposed scheme. The development of the proposed scheme is not expected to increase the existing coastal flood risk which is considered acceptable. A wider flood relief scheme would be required to reduce the overall level of risk. Such a scheme is outside of the remit of this project. A Stage 3 flood risk assessment is not required at this location.
Estuarine	N/A	There is no existing risk of estuarine flooding to the proposed highway.
Artificial Drainage Systems	Low	All new drainage infrastructure will be designed in line with the recommendations from the Cork County Strategic Flood Risk Assessment and CIRIA 753. The proposals will provide an improvement over the current situation as the percentage of catchment area experiencing a level of SuDS is expected to be significantly increased. In addition, collapsed and damaged pipes within Ringaskiddy village will be repaired as an advanced works package.

6. Stage 2 Potential Flood Risk Impacts from Development

Section 6 considered the flood risk to the proposed development. This section considers the potential change in flood risk to the surrounding areas from the proposed works for each source.

6.1 Impacts on Fluvial Flooding

There are no fluvial sources of flood risk in close proximity to the proposed scheme. The proposed scheme has therefore no impact on fluvial flood risk.

6.2 Impacts on Pluvial Flooding

To assess the increase in pluvial flood risk the following points need to be considered:

- Will the proposed development increase the rainfall runoff rate?
- Will the proposed development alter existing flow- or drainage paths?

The proposed scheme will result in a marginal increase in the area of impermeable surfaces along the route. To ensure no associated increase in flood risk, the scheme will utilise the implementation of drainage features developed through detailed design in line with the CIRIA SuDS manual C753 (2015) and the Cork County Development Plan. The proposals will provide an improvement over the current situation as the percentage of catchment area experiencing a level of SuDS is expected to be significantly increased. In addition, collapsed and damaged pipes within Ringaskiddy village will be repaired as an advanced works package, refer to Section 6.6 below.

6.3 Impacts on Groundwater Flooding

The proposed scheme is currently at low risk of groundwater flooding. Groundwater will be intercepted during excavation of the existing drainage network, as detailed in Section 6.6. It will not be intercepted by the new drainage network. Below-ground elements of the works will be localised and will not impact ground water movements.

6.4 Impacts on Coastal Flooding

The scheme is not expected to increase the existing level of costal risk. The detailed design of the works will include Sustainable Drainage Systems (SuDS) to store any additional runoff generated by the proposed works. Mitigation measures to ensure no increase in site runoff and volume are described in Section 6.6 below.

6.5 Impacts on Estuarine Flooding

There are no fluvial sources of flood risk in close proximity to the proposed scheme. The proposed scheme has therefore no impact on estuarine flooding.

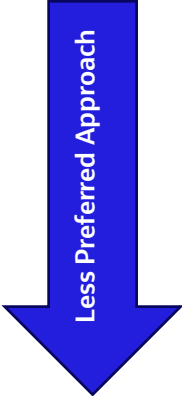
6.6 Impacts on Flooding from Artificial Drainage Systems

Flooding occurs from artificial drainage systems during periods of heavy rainfall, when the local drainage system reaches capacity and surcharges from manholes and/or gullies.

The proposed scheme will result in a marginal increase in the area of impermeable surfaces along the route. To ensure no associated increase in flood risk, the scheme will utilise the implementation of drainage features developed through detailed design in line with the CIRIA SuDS manual C753 (2015) and the Cork County Development Plan.

SuDS measures are selected following a hierarchy which favoured source type solutions close to the new impermeable areas e.g. tree pits as opposed to tanks and other regional type solutions at the downstream end of the network. A conceptual model is presented in Table 6.1 below.

Table 6.1: SuDS Management Train, produced by Jacobs from CIRIA SuDS Manual 2015

Scale		SuDS Management Train
	Source	Rainwater Harvesting – capture and reuse within the local environment.
		Pervious Surfacing Systems – structural surfaces that allow water to penetrate the ground reducing discharge to a drainage system e.g., pervious pavements, tree pits.
	Site	Infiltration Systems – structures which encourage infiltration into the ground e.g., Bioretention Basins.
		Conveyance Systems – components that convey and control the discharge of flows to downstream storage components e.g., swales.
Regional	Storage Systems – components that control the flows before discharge e.g., attenuation ponds, tanks, oversized pipes, or basins.	

The proposed drainage strategy for the proposed scheme is summarised below.

6.6.1 Drainage Strategy

6.6.1.1 Existing Network Findings

Review of a CCTV survey, procured by Cork County Council to ascertain the nature and extent of the existing surface water drainage infrastructure in the vicinity of the Active Travel Scheme within Ringaskiddy village, shows the existing network to be in varying states of repair throughout. There are a number of gullies that connect to soakaways and the existing foul sewer network. There is a complete collapse of the 525mm diameter pipe north of the N28 approximately 40m west of Perry Street Café.

Two additional areas west of the Port of Cork access with severe longitudinal fractures are at risk of collapse. This pipe run varies in diameter between 450mm and 525mm along its length and has had a section opposite the centre of the village green repaired previously by sleeving a PVC pipe over the top half of the concrete pipe.

Many of the smaller pipes that connect into the main pipe run north of the N28 are in poor condition with displaced joints and evidence of groundwater infiltration (video provided by CCC site team in one manhole showing significant infiltration). There is no evidence of the foul sewer overflow experiencing flows into the surface water drainage system.

6.6.1.2 Drainage Design Proposals

The drainage design proposals aim to provide a robust collection system together with the upsizing and remediation of the existing system to provide a degree of betterment.

The collection method from the western end of the scheme to the Protected Road interface consists of a mix of gullies and combined drainage kerbs (CDKs) predominantly tying into the existing surface water drainage network and will be designed in accordance with the TII DMRB for a 1 in 5 year return period. Gullies are preferred over CDKs as the existing carriageway is extremely flat both longitudinally and in crossfall (1:500 to 1:1000



longitudinally and less than 1% crossfall typically) which precludes the use of gullies in some areas, due to the close frequency of the required gully spacing making them impractical.

East of the Protected Road interface the collection method consists of a grassed surface water channel along the south side of the L2545 connecting into the existing 450mm diameter pipe within the southern verge and outfalls at Gobby Beach. The outfall at Gobby Beach is slightly damaged and will be repaired in advance as part of the protected road scheme.

The design will not introduce any additional connections or catchment area into the existing combined foul sewer network. Collapsed and damaged pipes within Ringaskiddy village will be repaired as an advanced works package. The overall catchment area discharging to the foul network will be reduced as additional gullies connecting to the surface water network and soakaways are proposed in areas currently draining to the foul network.

A non-return valve is proposed within a new chamber constructed on the line of the existing 525mm pipe prior to the Port of Cork entrance to prevent the surface water drainage network upstream being surcharged by the tide and making the 525mm pipe through the park available for storage during mid to high tide.

6.6.1.3 SuDS

The scheme proposals aim to provide significant SuDS provision within the design by maximising infiltration through soakaways and infiltration trenches. New soakaways are proposed within additional buildouts in the scheme along with infiltration trenches along the L2545 from the eastern end of Martello Park to the Protected Road interface. Drainage to the east of the Protected Road interface experiences a level of SuDS through the provision of a grassed surface water channel along the south side of the L2545. Drainage along the north side of the N28 through the village is also proposed to connect to the existing pipe network through infiltration connections where space permits. Rain gardens with soakaways will be provided at the gateway medians. The proposals will provide an improvement over the current situation as the percentage of catchment area experiencing a level of SuDS is expected to be significantly increased. The % of the existing surface water drainage network receiving a level of SuDS through infiltration is currently ~20%, while the % of the proposed surface water drainage network receiving a level of SuDS through infiltration will be ~40%. As there is no information on permeability of existing ground conditions or groundwater levels to assess the efficiency of soakaways and infiltration trenches, infiltration testing will be undertaken at construction stage and checks will be undertaken to assess the impact of failure of soakaways to ensure any surface water build up will encounter positive drainage connections to the surface water network before any risk of flooding to properties.

6.7 Summary of Potential Flood Risk Impacts from Proposed Development

The flood risk impacts from the proposed scheme development are summarised in Table 6.2 below.

Table 6.2: Summary of potential flood risk impacts on surrounding areas as a result of the scheme development

Flood Risk	Potential Scheme Impact	Comments and Mitigation (where required)	Residual Scheme Impact (With mitigation)
Fluvial	No Impact	The proposed scheme has no impact on fluvial flood risk.	No Impact
Pluvial	To be determined following infiltration testing undertaken at construction stage.	The proposals will provide an improvement over the current situation as the percentage of catchment area experiencing a level of SuDS is expected to be significantly increased. In addition, collapsed and damaged pipes within Ringaskiddy village will be repaired as an advanced works package.	To be determined following infiltration testing undertaken at construction stage.
Groundwater	No Impact	The proposed scheme is currently at low risk of groundwater flooding. Groundwater will be intercepted during excavation of the existing drainage network, as detailed in Section 6.6. It will not be intercepted by the new drainage network. Below-ground elements of the works will be localised and will not impact ground water movements.	To be determined following infiltration testing undertaken at construction stage.
Coastal	To be determined following infiltration testing undertaken at construction stage.	The development of the proposed scheme is not expected to increase the existing coastal flood risk. To ensure no associated increase in flood risk, the scheme will utilise the implementation of drainage features developed through detailed design in line with the CIRIA SuDS manual C753 (2015) and the Cork County Development Plan.	No Impact
Estuarine	No Impact	The proposed scheme has no impact on estuarine flood risk.	No Impact
Artificial Drainage Systems	To be determined following infiltration testing undertaken at construction stage.	To ensure no associated increase in flood risk, the scheme will utilise the implementation of drainage features developed through detailed design in line with the CIRIA SuDS manual C753 (2015) and the Cork County Development Plan. The proposals will provide an improvement over the current situation as the percentage of catchment area experiencing a level of SuDS is expected to be significantly increased. In addition, collapsed and damaged pipes within Ringaskiddy village will be repaired as an advanced works package.	To be determined following infiltration testing undertaken at construction stage.



7. Conclusions and Recommendations

The following sources of flood risk are identified along the proposed scheme:

- A risk of pluvial flooding;
- A risk of coastal flooding.

The flooding events along the proposed scheme are attributed to heavy rainfall and high tide in conjunction with saturated ground due to seawater infiltration.

Pluvial Flooding

A low risk of pluvial flooding has been identified along the proposed scheme. The proposals will provide an improvement over the current situation as the percentage of catchment area experiencing a level of SuDS is expected to be significantly increased. In addition, collapsed and damaged pipes within Ringaskiddy village will be repaired as an advanced works package.

Groundwater Flooding

The proposed scheme is currently at low risk of groundwater flooding. Groundwater will be intercepted during excavation of the existing drainage network, as detailed in Section 6.6. It will not be intercepted by the new drainage network. Below-ground elements of the works will be localised and will not impact ground water movements.

Coastal Flooding

A medium coastal flood risk has been identified along the proposed scheme. The development of the proposed scheme is not expected to increase the existing coastal flood risk. A wider flood relief scheme would be required to reduce the overall level of risk. Such a scheme is outside of the remit of this project.

Artificial Drainage Systems

The proposals will provide an improvement over the current situation as the percentage of catchment area experiencing a level of SuDS is expected to be significantly increased. Since there is no information on permeability of existing ground conditions or groundwater levels to assess the efficiency of soakaways and infiltration trenches, infiltration testing and checks will be undertaken at construction stage to assess the impact of failure of soakaways to ensure any surface water build up will encounter positive drainage connections to the surface water network before any risk of flooding.