ARUP

Progressive Commercial Construction

The Railyard Apartments

Flood Risk Assessment

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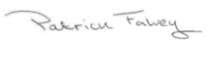
		Signature			
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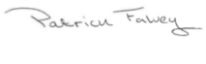
		Signature			
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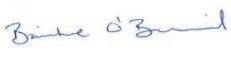
		Signature			

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Executive Summary

Arup was commissioned by Progressive Commercial Construction Ltd (the "Addressee") to prepare a site-specific Flood Risk Assessment (FRA) to support a planning application for a proposed residential development at Albert Quay East, Cork City.

The FRA has been undertaken in accordance with the 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' published in November 2009, jointly by the Office of Public Works (OPW) and the then Department of Environment, Heritage and Local Government (DoEHLG), herein referred to as 'the guidelines'.

Cork City has historically been prone to fluvial and/or tidal flooding with significant events occurring in recent years. The site is at risk of both fluvial and tidal flooding from the River Lee. The risk of pluvial and groundwater flooding to the site is considered low and moderate respectively.

The recommended flood defence level for the site is 3.80mOD which is derived as the sum of the 1 in 200-year design flood level (3.00mOD) plus an allowance for climate change (0.5m) and an additional allowance for freeboard (0.3m). The above level is in OSGM02 Malin Head datum.

It is proposed that the proposed buildings of the development shall have a minimum finished floor level of 3.80mOD (OSGM02 Malin Head datum).

Residents and staff of the proposed development will maintain awareness of flood and weather forecasts on an ongoing basis as well as receiving warnings from Cork City Council and Met Éireann as appropriate. Occupants of the buildings will have sufficient notice to either exit in advance of the flood or they may decide to remain within the buildings until the flood recedes. Where individual users wish to exit the buildings in advance of a flood, they shall be directed in a southerly, easterly or westerly direction as appropriate. Dry access and egress from the development will be via Albert Street (N27) and Albert Road.

The Lower Lee (Cork City) Drainage Scheme is currently being advanced and when constructed, will provide protection to properties in the study area from the 1 in 100-year fluvial and 1 in 200-year tidal flood events, plus an allowance for freeboard. As the site of the proposed development is within the defended area of the scheme, it will be offered a high standard of protection when it is completed. The site-specific measures proposed herein will provide protection to the Standard of Protection irrespective of the Drainage scheme.

The proposed development will not have a significant impact on flood risk off site as the primary flood risk to the site is tidal.

As the site is located within Flood Zone A, a Justification Test for the development has been undertaken. All the criteria of the Justification Test are deemed to be passed.

This FRA has demonstrated that the risks relating to flooding can be managed and mitigated to acceptable levels and therefore comply with DEHLG / OPW and Cork City Council planning guidance.

1. Introduction

1.1 Project Background

Arup was commissioned by Progressive Commercial Construction Ltd (the "Addressee") to prepare a site-specific Flood Risk Assessment (FRA) to support a planning application for a proposed development at Albert Quay East, Cork City.

The Addressee, their respective successors, and assigns, may use and reply upon this report. In addition, the Addressee is granted the right to share this report and its conclusions with its advisory clients, including direct investors in a fund.

The FRA has been undertaken in accordance with the 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' published in November 2009, jointly by the Office of Public Works (OPW) and the then Department of Environment, Heritage and Local Government (DEHLG), herein referred to as 'the guidelines'.

1.2 Scope

The scope of the FRA includes the following:

- Confirmation of the sources of flooding which may affect the site.
- A qualitative assessment of the risk of flooding to the site and to adjacent sites as a result of construction of the proposed development.
- Review of the availability and adequacy of existing information.
- Identification of possible measures which could mitigate the flood risk to acceptable levels.

1.3 Summary of Data Used

Data relating to flood risk relevant to the proposed development and surrounding area has been obtained from the following sources:

- Cork City Development Plan 2022 – 2028 including its Strategic Flood Risk Assessment.
- Lee CFRAM Hydrology and Hydraulics Reports and predictive flood mapping (https://www.floodinfo.ie/publications/).
- Lee CFRAM Catchment Flood Risk Management Plan (https://www.floodinfo.ie/publications/).
- OPW National Flood Hazard Mapping Website (Flood Maps - Floodinfo.ie).
- Preliminary Flood Risk Assessment (PFRA) mapping produced by the OPW (https://www.floodinfo.ie/publications/).
- Irish Coastal Wave and Water Level Modelling Study maps and reports (https://www.floodinfo.ie/publications/).
- Lower Lee (Cork City) Drainage Scheme Exhibition Drawings and Reports.
- Topographical survey of the site.
- Proposed development planning application drawings.

All Ordnance Datum (OD) levels referred to in this report are to Malin Head Ordnance Datum, unless otherwise noted.

1.4 Site Location

The proposed development is located at Albert Quay East, Cork City at approximate Irish Transverse Mercator (ITM) reference E:568168, N:571835. The location of the proposed development is shown in Figure 1.

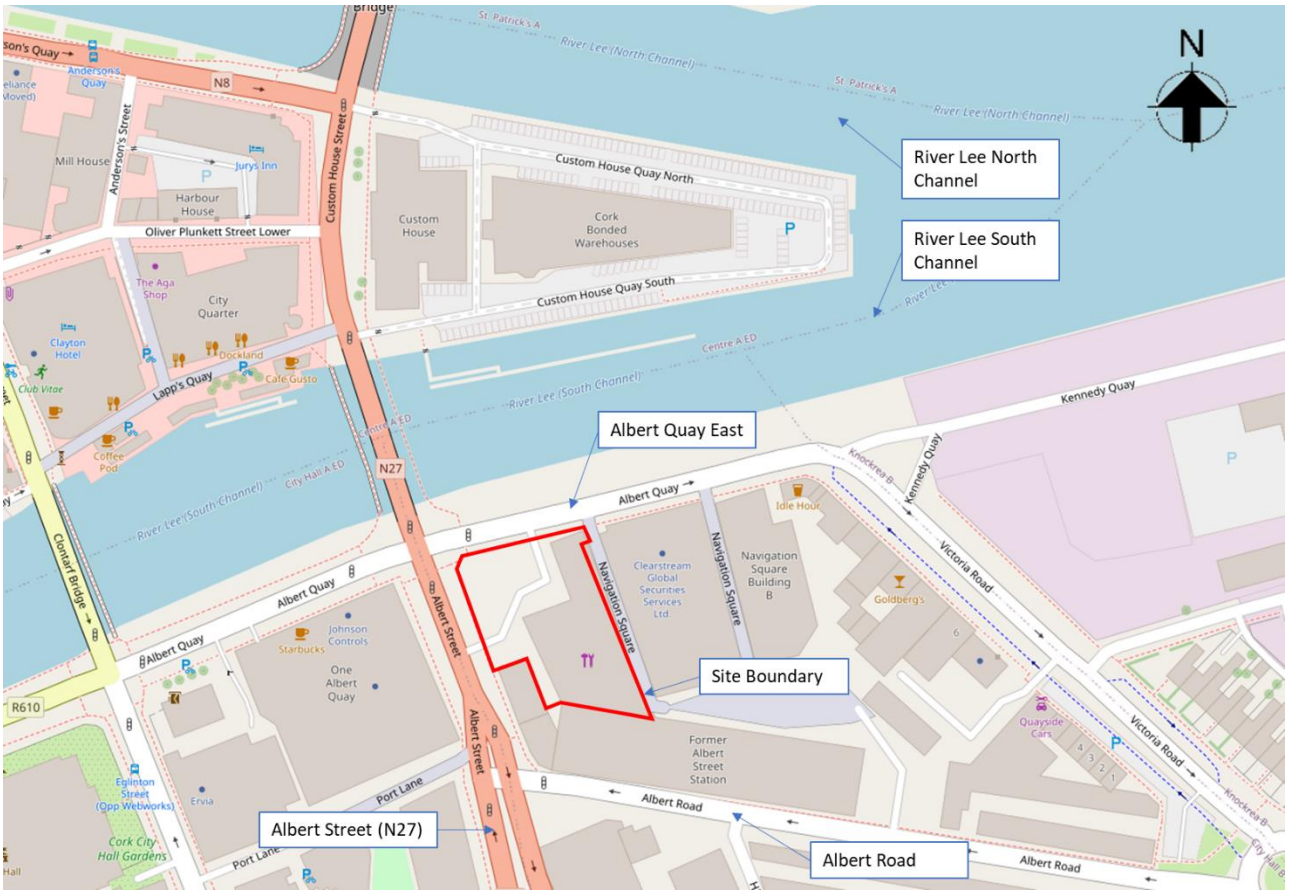


Figure 1: Site location (© Open Street Map (and) contributors)

The site is located on the south bank of the River Lee South Channel in Cork City. There are a number of existing derelict commercial buildings on the site at present with open car parking. The site is predominantly hardstanding, with the exception of a small number of trees. The site is bounded by Albert Quay East Road to the north and Albert Street (the N27) to the west.

The River Lee North and South Channels flow in an easterly direction approximately 150m and 30m respectively from the site boundary. The location of the River Lee North and South Channels are indicated in Figure 1.

Existing footpath levels adjacent to the site at Albert Quay East, Albert Road and Albert Street (N27) are approximately 2.60mOD, 3.10mOD and 2.90mOD respectively.

The site itself slopes from south to north, falling from Albert Road to Albert Quay East.

1.5 Proposed Development

Progressive Commercial Construction Limited intends to enter into a project agreement with Cork City Council, to deliver The Railyard Apartments scheme, pursuant to the requirements of Part 8 of the Planning & Development Regulations 2001.

The Railyard Apartments proposed development comprises of the construction of 217 no. apartments comprising 25 no. studio units; 92 no. 1-bed units; 88no. 2-bed units; and 12no. 3-bed units apartments in a building that ranges in height from 8 to 11 to 24 storeys over ground floor at the former Carey Tool Hire site, currently principally occupied by Park Facilities Management Ltd, Albert Quay, Cork City.

The development site, measuring approximately 0.2744 hectares, is bounded by Albert Quay East to the north, Albert Street to the west, the former Blackrock and Passage Railway Terminus – Ticket Office, a Protected Structure, Ref. No. PS 1138, and which is also a Recorded Monument, CO074-119002, the two-storey former Cork, Blackrock and Passage Railway Offices, Protected Structure, Ref. No. PS 1137, and the Albert Road Post Box, which is also a Protected Structure Ref. No. PS942 and Albert Road to the south, and Navigation Square to the east. The site is accessed by Albert Quay East and Albert Street.

The proposed works include:

a) The construction of 217no. apartments [25no. studio units; 92no. 1-bed units; 88no. 2-bed units; and 12no. 3-bed units] in a building that ranges in height from 8 to 11 to 24 storeys over ground floor.
b) The provision of external balconies on the east, west and south elevations to the 12th floor on the east and west elevation, and to the 9th floor on the southern elevation.
c) The provision of an external public realm area at ground level, an eastern laneway for servicing of the proposed development, in addition to its use as a pedestrian link.
d) The provision of internal communal space areas at ground floor, 1st floor, and 2nd floor, and 2no. external rooftop terraces on the 9th floor and the 12th floor.
e) The provision of a ground floor community/arts use, with external seating area and a ground floor creche with external covered play area.
f) The provision of ground level plant, ancillary uses, and bin store.
g) Bicycle spaces at lower ground floor and ground floor level; and additional visitor bicycle spaces, and a set down delivery area at ground floor level on Albert Street.
h) All site development, public realm and landscaping works.
i) The proposed development also involves the demolition of the existing two-storey Carey Tool Hire building, currently principally occupied by Park Facilities Management Ltd.

A site plan and typical sections of the proposed development are included in the planning application. Appendix A.5 contains architectural drawings of the proposed development.

1.6 Lower Lee (Cork City) Drainage Scheme

The OPW in partnership with Cork City Council (CCiC) and Cork County Council (CCC) are currently advancing the Lower Lee (Cork City) Drainage Scheme. The Scheme will be designed to provide protection to properties in the study area from the 1 in 100-year fluvial and 1 in 200-year tidal flood events plus an allowance for freeboard. The site of the proposed development on Albert Quay East is within the defended area of the Scheme and as such will be subject to the 1 in 100-year fluvial and 1 in 200-year tidal flood standard of protection when it is completed.

1.7 Datum and Geoid used in this Report

All flood levels and finished floor levels referenced in this report are with respect to Malin Head datum - Geoid OSGM02. Ordnance Survey Ireland (OSi) have worked with the equivalent British

and Northern Irish organisations to develop an improved Geoid – OSGM15. They have announced that from August 2016, the geoid model that all onshore mapping in Ireland shall be based on is OSGM15.

The difference in the two geoids ranges across the island. The difference in Cork city is approximately 123mm, with the OSGM02 being higher as shown in Table 1.This is at a location 5km southwest of the site. It is anticipated that the difference is smaller at the site location.

As many studies that this report refers to were done prior to 2016, the assessment of flood levels and recommended finished floor levels is reported in OSGM02. The accurate transformation of the levels to OSGM15 at the site location can be undertaken by the appointed surveyor at the next design stage.

Table 1: Height difference between the geoid models (OSGM15 - Geoid Changes for Ireland, Society of Chartered Surveyors Ireland)

	E	N	H(OSGM02)	H(OSGM15)	Diff (mm)
Dublin Airport	716482.764	743426.851	67.245	67.221	24
Cork	564152.173	569821.874	22.487	22.364	123

2. Planning Context

2.1 Introduction

The following planning policy documents are relevant to the flood risk assessment of the proposed development:

- The Planning System and Flood Risk Management Guidelines for Planning Authorities.
- Cork City Development Plan 2022 – 2028 including its Strategic Flood Risk Assessment.

2.2 The Planning System and Flood Risk Management

In November 2009, the Department of Environment, Heritage and Local Government and the Office of Public Works jointly published a Guidance Document for Planning Authorities entitled 'The Planning System and Flood Risk Management'.

The guidelines are issued under Section 28 of the Planning and Development Act 2000 and planning authorities and An Bord Pleanála are therefore required to implement these guidelines in carrying out their functions under the Planning Acts.

The aim of the guidelines is to ensure that flood risk is neither created nor increased by inappropriate development.

The guidelines require the planning system to avoid development in areas at risk of flooding, unless they can be justified on wider sustainability grounds, where the risk can be reduced or managed to an acceptable level.

They require the adoption of a Sequential Approach to Flood Risk Management of Avoidance, Reduction, Justification and Mitigation and they require the incorporation of a Flood Risk Assessment into the process of making decisions on planning applications and planning appeals. Fundamental to the guidelines is the introduction of flood risk zoning and the classification of different types of development having regard to their vulnerability. The management of flood risk is now a key element of any development proposal in an area of potential flood risk and should therefore be addressed as early as possible in the site masterplanning stage.

2.2.1 Definition of Flood Zones

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 as follows:

Table 2: Flood zone categories

Zone category	Description
Flood Zone A	Probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding).
Flood Zone B	Probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 year and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 year and 0.5% or 1 in 200 for coastal flooding).
Flood Zone C	Probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.

2.2.2 Definition of Vulnerability Classes

The following table summarises the vulnerability classes defined in the guidelines and provides a sample of the most common type of development applicable to each.

Table 3: Vulnerability class

Vulnerability class	Land uses and types of development which include;
Highly Vulnerable Development	Includes Garda, ambulance and fire stations, hospitals, schools, residential dwellings, residential institutions, essential infrastructure, such as primary transport and utilities distribution and SEVESO and IPPC sites, etc.
Less Vulnerable Development	Includes retail, leisure, warehousing, commercial, industrial and non-residential institutions, etc.
Water Compatible Development	Includes flood control infrastructure, docks, marinas, wharves, navigation facilities, water-based recreation facilities, amenity open spaces and outdoor sport and recreation facilities.

2.2.3 Sequential Approach and Justification Test

The guidelines outline the sequential approach that is to be applied to all levels of the planning process. This approach should also be used in the design and layout of a development and the broad philosophy is shown in Figure 2. In general, development in areas with a high risk of flooding should be avoided as per the sequential approach.

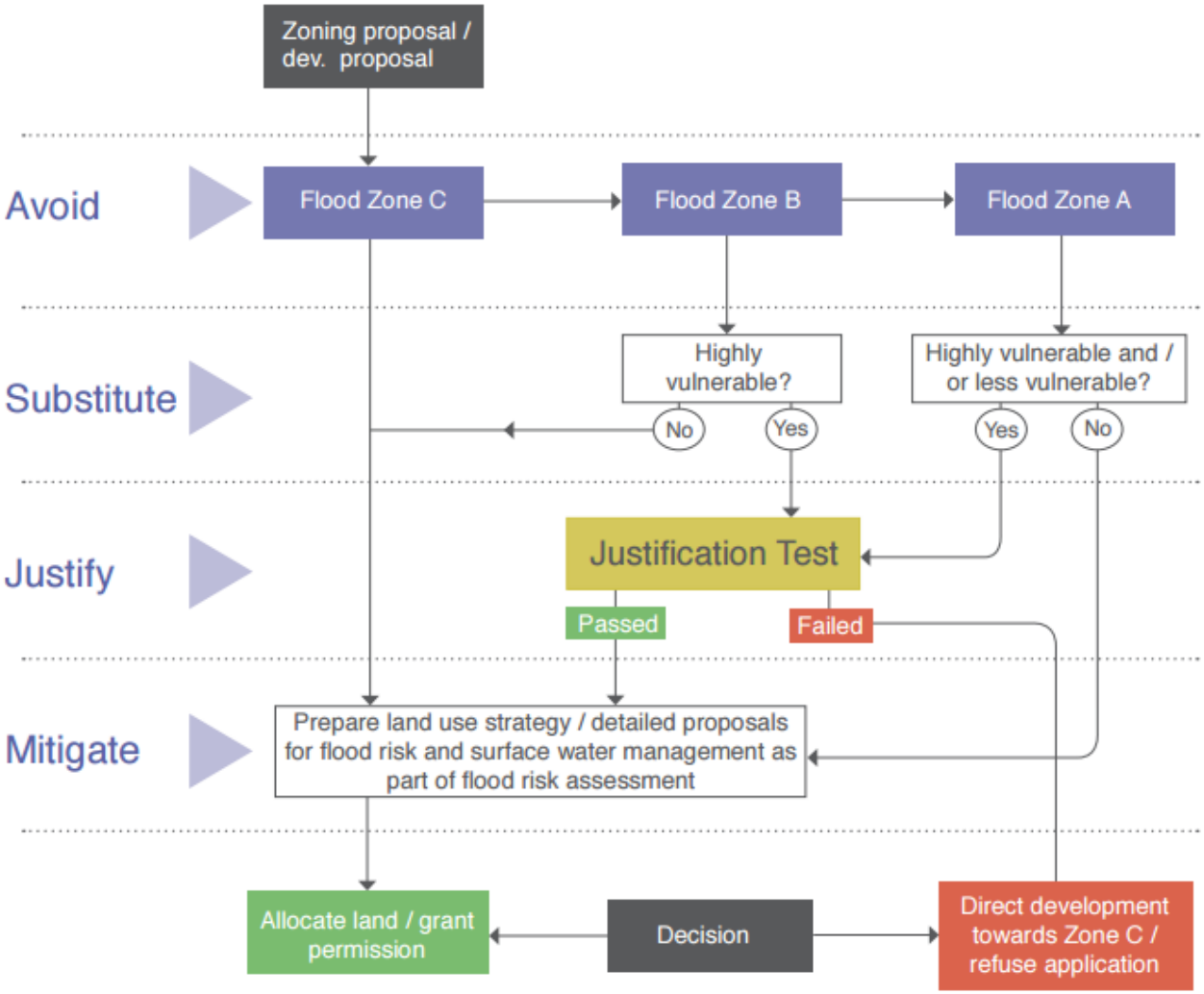


Figure 2: Sequential approach (reproduced from the guidelines)

The Justification Test has been designed to rigorously assess the appropriateness, or otherwise, of developments that are being considered in areas of moderate or high flood risk. The test comprises the following two processes.

- The first is the Plan-making Justification Test and is used at the plan preparation and adoption stage where it is intended to zone or otherwise designate land which is at moderate or high risk of flooding.
- The second is the Development Management Justification Test and is used at the planning application stage where it is intended to develop land at moderate or high risk of flooding for uses or development vulnerable to flooding that would generally be inappropriate for that land.

Table 4 illustrates the different types of vulnerability class appropriate to each zone and indicates where the Justification Test is required.

Table 4: Vulnerability classes

	Flood Zone A	**Flood Zone B**	**Flood Zone C**
Highly Vulnerable	Justification Test	Justification Test	Appropriate
Less Vulnerable	Justification Test	Appropriate	Appropriate
Water Compatible	Appropriate	Appropriate	Appropriate

The Guidelines recognise that there is a need to reconcile the desire to avoid development in areas at risk of flooding while also ensuring sequential and compact urban development as several large urban centres are already located in areas that are at risk of flooding. This section of the guidelines is particularly relevant to the proposed development at Albert Quay East:

"Notwithstanding the need for future development to avoid areas at risk of flooding, it is recognised that the existing urban structure of the country contains many well-established cities and urban centres, which will continue to be at risk of flooding. At the same time such centres may also have been targeted for growth in the National Spatial Strategy, regional planning guidelines and the various city and county development plans taking account of historical patterns of development and their national and strategic value. In addition, development plans have identified various strategically located urban centres and particularly city and town centre areas whose continued growth and development is being encouraged in order to bring about compact and sustainable urban development and more balanced regional development. Furthermore, development plan guidelines, issued by the Minister for the Environment, Heritage and Local Government under Section 28 of the Planning and Development Act 2000, have underlined the importance of compact and sequential development of urban areas with a focus on town and city centre locations for major retailing and higher residential densities."

2.3 Cork City Development Plan 2022 – 2028

The Cork City Development Plan 2022 – 2028 contains the policies and objectives to guide development and land use in Cork City. The subject site at Albert Quay East is identified as being within the City Centre Area in the plan. Figure 3 includes the zoning objectives for the City Centre and Docklands.

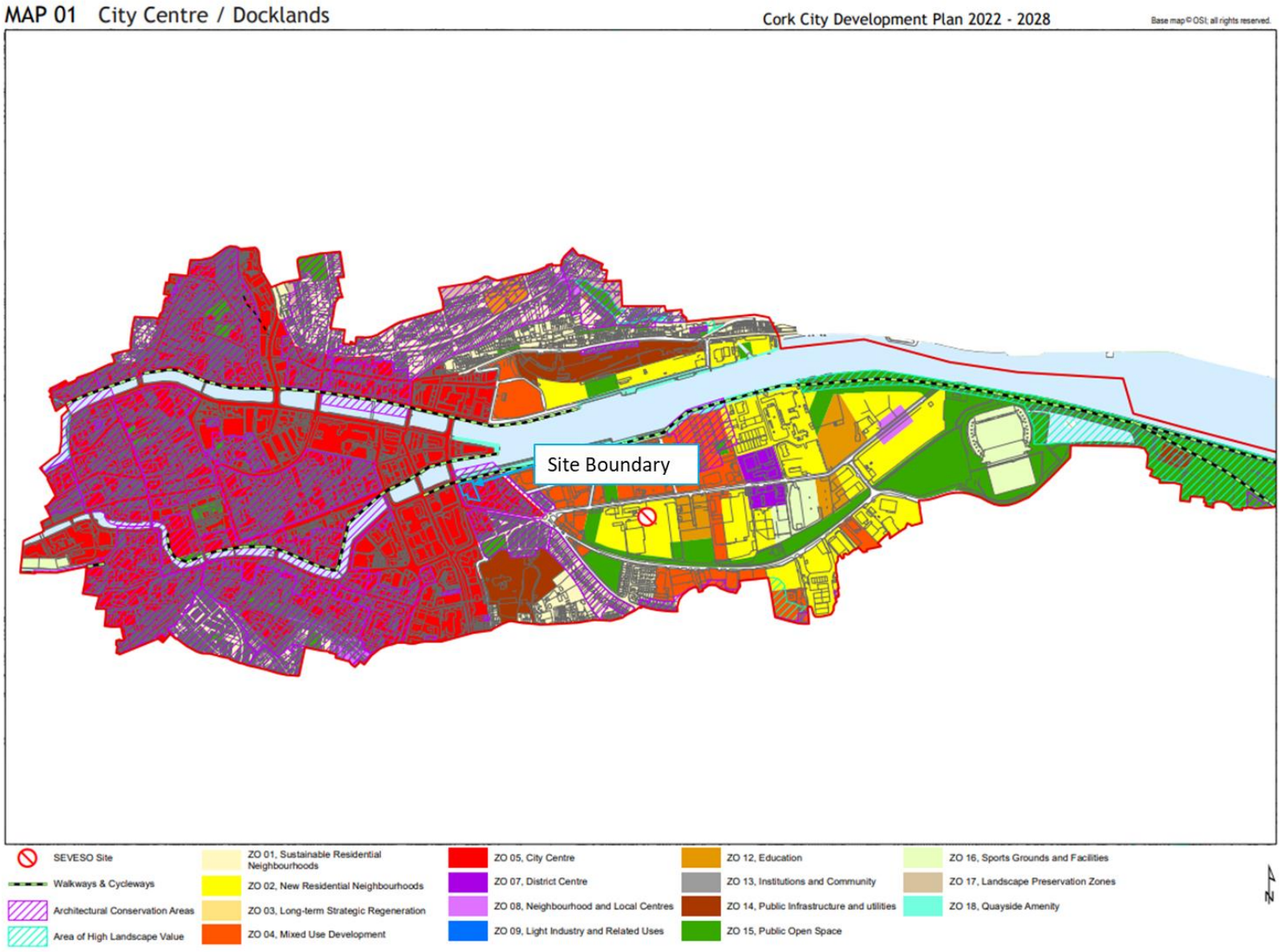


Figure 3: Cork City Development plan city centre and Docklands zoning objectives

The Development Plan states that the vision for Cork City will be achieved through a series of interconnected strategic objectives and related chapters. Strategic objective no.6 is relevant to flood risk and is reproduced in Table 5.

Table 5: Cork City development plan 2022 – 2028 Strategic objectives for growth

Strategic Objective	Details
SO 6 – Climate and Environment	Transition to a low-carbon, climate-resilient and environmentally sustainable future. Implement climate mitigation and adaptation measures that reduce our carbon footprint including sustainable energy consumption, sustainable transport, circular economy, green construction and flood risk mitigate and adaptation.

The following objectives relevant to flood risk are set out in Chapter 9 Environmental Infrastructure of the plan and is reproduced in Table 6.

Table 6: Cork City development plan 2022 – 2028 flood risk objectives

Objective	Details
Objective 9.4 Sustainable Urban Drainage Systems (SUDS)	a. To require that all planning applications for new development incorporate Sustainable Urban Drainage Systems (SUDS) in so far as possible. Such proposals shall be accompanied by a comprehensive SUDS assessment including run-off quantity, run off quality and impacts on habitat and water quality. b. To encourage the provision of green roofs and green walls as an integrated part of Sustainable Urban Drainage Systems (SUDS) and which provide benefits for biodiversity, wherever feasible. c. To investigate the feasibility of preparing Sustainable Urban Drainage Systems (SUDS) guidelines for Cork City during the lifetime of the plan. In the interim The Department of Housing, Local Government and Heritage document: Nature-based Solutions to the Management of Rainwater and Surface Water Runoff in Urban Areas Water Sensitive Urban Design - Best Practice Interim Guidance Document, will provide guidance in this regard.
Objective 9.6 Storm Water	To provide adequate storm water infrastructure in order to accommodate the planned levels of growth within the plan area and to ensure that appropriate flood management measures are implemented to protect property and infrastructure.
Objective 9.8 Flood Protection	To protect, enhance and manage the City's floodplains, wetlands and coastal habitat areas that are subject to flooding as vital 'green infrastructure' which provides space for storage and conveyance of floodwater, enabling flood risk to be more effectively managed and reduce the need to provide flood defence infrastructures. Cork City Council will also require that all proposed flood protection or alleviation works will be subject to Appropriate Assessment to ensure there are no likely significant effects on the integrity, defined by the structure and function, of any European Sites and that the requirements of Article 6 of the EU Habitats Directive are met.
Objective 9.9 Flood Protection Schemes	To work with the Office of Public Works (OPW) in the progression and completion of Flood Risk Management Plans and flood relief schemes including the Lower Lee Flood Relief Scheme (LLFRS), schemes in Blackpool, Glanmire/ Glashaboy, Douglas/ Togher and other schemes that may be developed during the period of the plan.
Objective 9.10 Development in Flood Risk Areas	a. To restrict development in identified flood risk areas, in particular flood plains. All new development proposals should comply with the requirements of the Planning System and Flood Risk Management – Guidelines for Planning Authorities (2009) and Department of Environment, Community and Local Government Circular PL2/2014, in particular through the application of the sequential approach and the Development Management Justification Test. b. All significant proposals for development identified as being vulnerable to flooding will be required to provide a site-specific Flood Risk Assessment to identify potential loss of floodplain storage and proposals for the storage or attenuation (e.g. SUDS) of run-off discharges (including foul drains) to ensure development does not increase the flood risk in the relevant catchment. c. Adopt a river catchment approach to rivers entering the City, practicing natural flood management wherever practical and appropriate.

2.3.1 Cork City Development Plan 2022 – 2028 Strategic Flood Risk Assessment

In preparation of the Cork City Development Plan 2022 – 2028, a Strategic Flood Risk Assessment (SFRA) was undertaken in accordance with The Guidelines. The SFRA includes a Justification Test for lands within Flood Zones A and B which are currently zoned for uses categorised as 'Highly Vulnerable' or 'Less Vulnerable' development. This includes the majority of Cork City centre, including Albert Quay East.

The Justification Test carried out in the SFRA for Cork City is reproduced in Figure 4.

Box 4.1: Justification Test for development plans

Where, as part of the preparation and adoption or variation and amendment of a development/local area plan[1], a planning authority is considering the future development of areas in an urban settlement that are at moderate or high risk of flooding, for uses or development vulnerable to flooding that would generally be inappropriate as set out in Table 3.2, all of the following criteria must be satisfied:

1 The urban settlement is targeted for growth under the National Spatial Strategy, regional planning guidelines, statutory plans as defined above or under the Planning Guidelines or Planning Directives provisions of the Planning and Development Act, 2000, as amended.

2 The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular:

- (i) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement[2];
- (ii) Comprises significant previously developed and/or under-utilised lands;
- (iii) Is within or adjoining the core[3] of an established or designated urban settlement;
- (iv) Will be essential in achieving compact and sustainable urban growth; and
- (v) There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement.

3 A flood risk assessment to an appropriate level of detail has been carried out as part of the Strategic Environmental Assessment as part of the development plan preparation process, which demonstrates that flood risk to the development can be adequately managed and the use or development of the lands will not cause unacceptable adverse impacts elsewhere.

N.B. The acceptability or otherwise of levels of any residual risk should be made with consideration for the proposed development and the local context and should be described in the relevant flood risk assessment.

Figure 4: Justification Test for development Plans (extract from The Guidelines)

3. Flood Mechanisms and Historical Flooding at the Site

3.1 Potential Flood Mechanisms at the Site

The following potential sources of flood risk have been assessed:

- Fluvial flooding (river, stream or mill race) – there is a risk of fluvial flooding during high flows in the River Lee.
- Tidal flooding – the main source of flood risk at the site is from tidal flooding. Flood levels at the location of the site are tidally dominated.
- Pluvial flooding/urban drainage – pluvial flooding may occur when the capacity of the local surface water drainage network is exceeded during periods of intense rainfall.
- Groundwater flooding – groundwater flooding can occur during lengthy periods of heavy rainfall, typically during late winter/early spring when the groundwater table is already high. If the groundwater level rises above ground level, it can pond at local low points and cause periods of flooding.

3.2 Past Flood Events

Records of historical fluvial and tidal floods were obtained from the OPW National Flood Information portal (Flood Maps) [Flood Maps - Floodinfo.ie] and reports produced as part of the Lee CFRAMS. There are no records for pluvial or groundwater flooding available from the above sources.

An extract from the OPW National Flood Information portal (Flood Maps) Past Flood Event Local Area Summary Report, indicating the locations of recorded flood events, is include in Figure 5. Refer to Appendix A.1 for the full report.

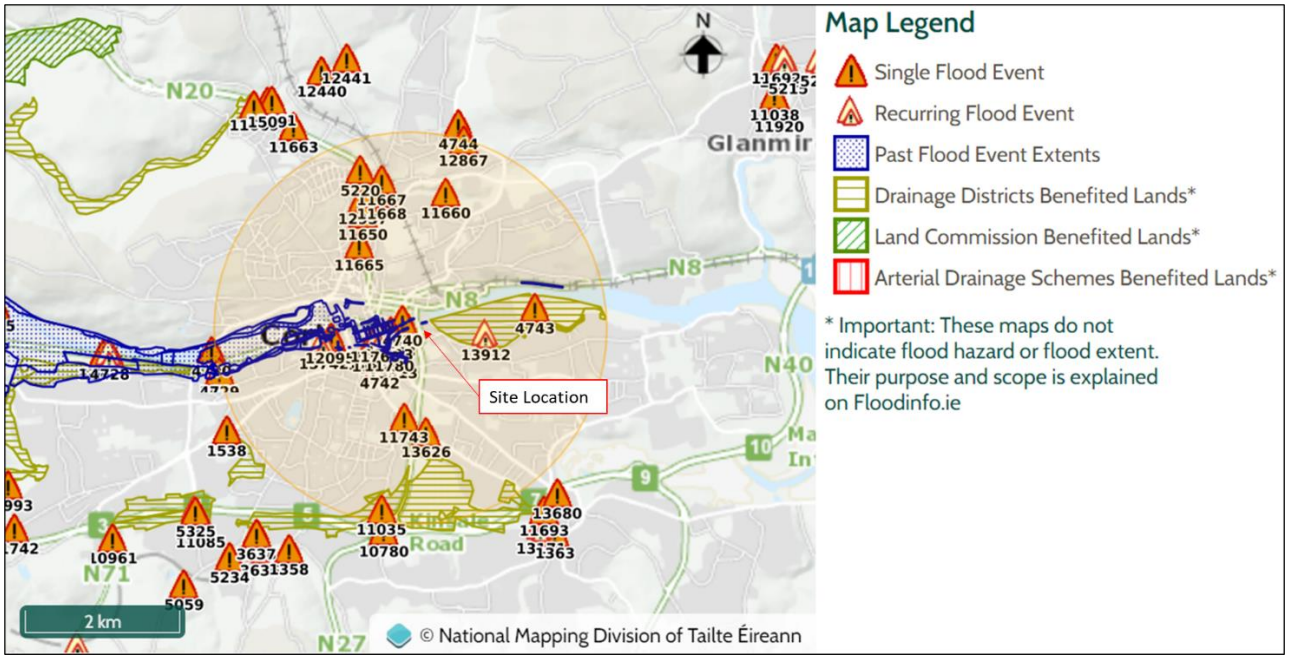


Figure 5: Extract from the OPW National Flood Information portal (Flood Maps) Past Flood Event Local Area Summary Report

3.3 Historical Fluvial/Tidal

Cork City has historically been prone to fluvial and/or tidal flooding with significant events occurring in recent years. A summary of the flood events that have occurred near the subject site is included in Table 7.

Table 7: Summary of recorded flood events near the subject site (Source: OPW National Flood Information portal (Flood Maps) Past Flood Event Local Area Summary Report).

Date of flood event	Flood mechanism
26 to 29 October 2015	Tidal
3 February 2014	Tidal
2 January 2014	Tidal
17 October 2012	Tidal
19 November 2009	Fluvial
27 October 2004	Tidal
6 January 1996	Fluvial / Tidal
16 December 1989	Tidal
5 August 1986	Fluvial
March 1962	Tidal

4. Existing Flood Risk

4.1 Fluvial Flood Risk

4.1.1 Lee CFRAM Study

An extract from the Lee CFRAMS fluvial flood extent map is presented in Figure 6. The predicted extents for three separate return period events are shown: the 1 in 10, 100 and 1000-year fluvial flood events. Refer to appendix A.2 for further details of the flood extent map.

It can be seen from the flood map that the northern part of the site is within Flood Zone B (1 in 1000-year fluvial flood extent) with the southern part of the site located within Flood Zone C.

Figure 6 also includes the modelled 1 in 10, 100 and 1000-year return period water levels for the displayed nodes (the nodes closest to the site on the south channel of the River Lee are 8SOU_0 and 8SOU_142). The 1 in 100-year fluvial water level at both nodes (8SOU_0 and 8SOU_142) is 2.75mOD (OSGM02).

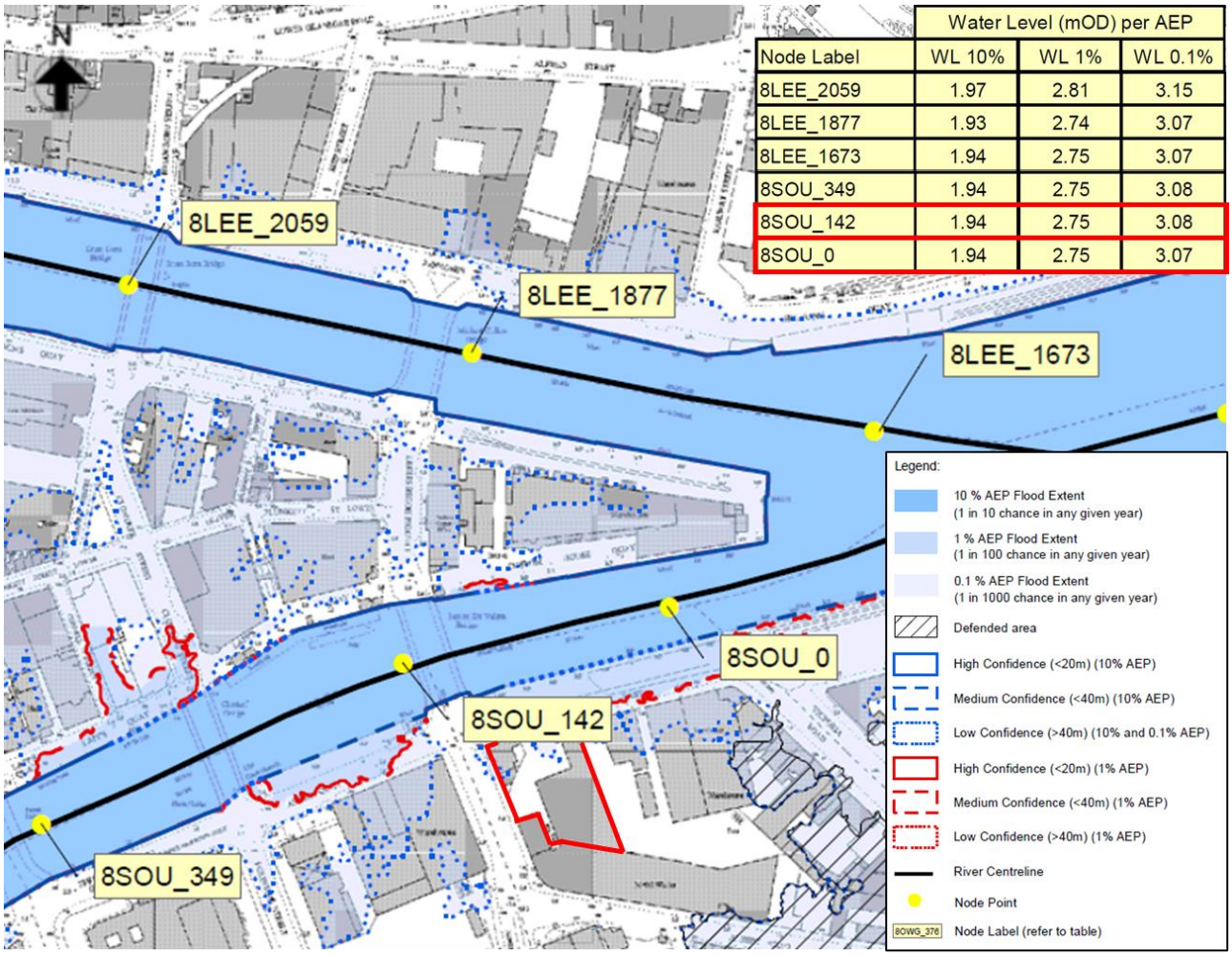


Figure 6: Extract from Lee CFRAMS fluvial flood extent maps, current scenario

4.2 Tidal Flood Risk

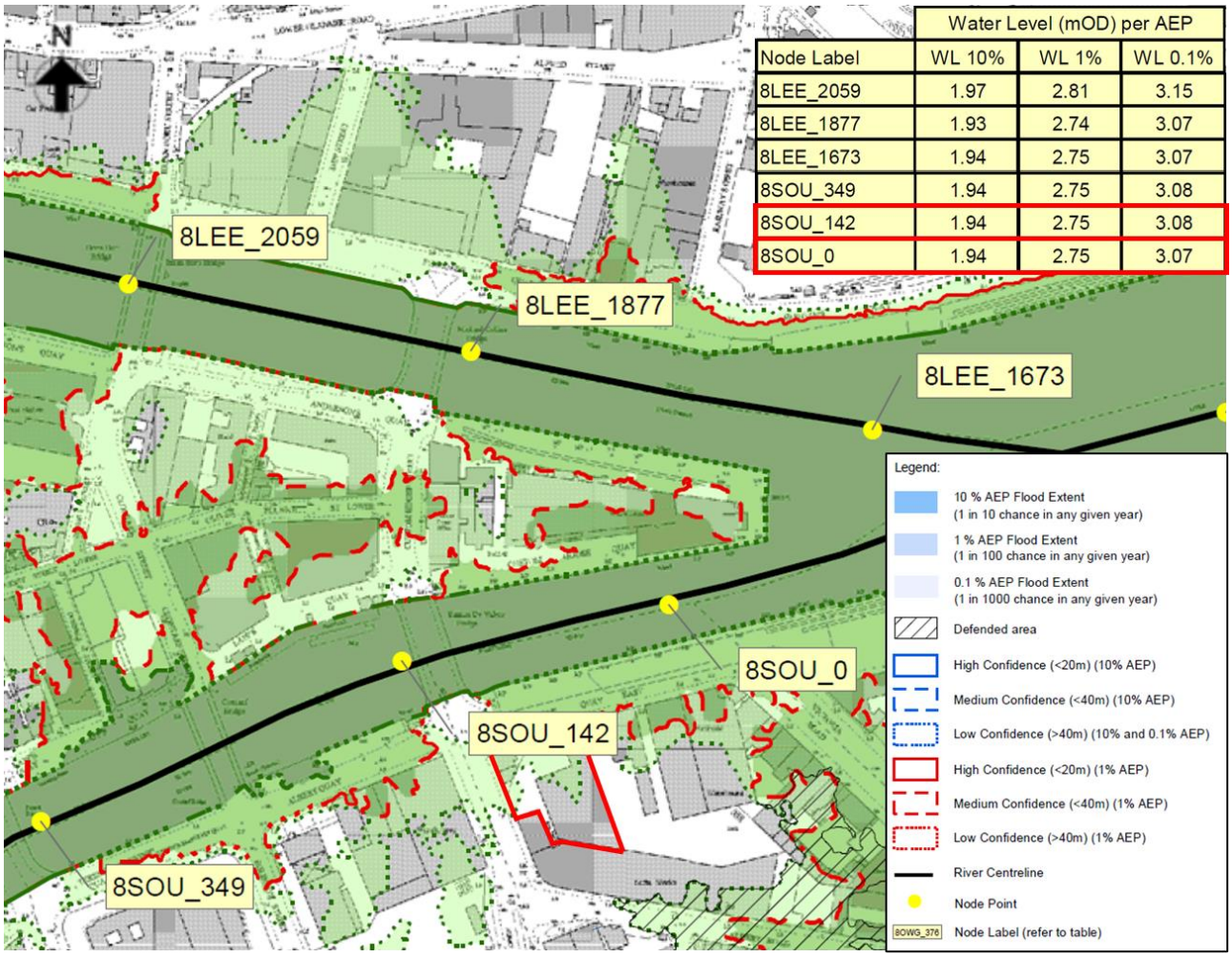
The Lee Catchment Flood Risk Assessment Management Study (Lee CFRAM) has been carried out in recent years and provides predicted tidal flood extents and water levels in Cork City for a range of return periods.

4.2.1 Lee CFRAM Study

An extract from the Lee CFRAMS tidal flood extent map is displayed in Figure 7. The predicted extents for three separate return period events are shown: the 1 in 10, 200 and 1000-year tidal flood events. Refer to Appendix A.2 for further details of the flood extent map.

The flood map indicates that the north of the site is located within Flood Zone A. The central area of the site is located within Flood Zone B with the remainder of the site within Flood Zone C.

Figure 7 includes the modelled water levels for the 1 in 10, 200 and 1000-year event for the nodes closest to the site (8SOU_0 and 8SOU_142). The 1 in 200-year tidal water level at both nodes (8SOU_0 and 8SOU_142) is 3.00m OD (OSGM02).



	Water Level (mOD) per AEP		
Node Label	WL 10%	WL 1%	WL 0.1%
8LEE_2059	1.97	2.81	3.15
8LEE_1877	1.93	2.74	3.07
8LEE_1673	1.94	2.75	3.07
8SOU_349	1.94	2.75	3.08
8SOU_142	1.94	2.75	3.08
8SOU_0	1.94	2.75	3.07

Figure 7: Extract from the CFRAM tidal flood extent map, current scenario

4.2.2 Irish Coastal Wave and Water Level Modelling Study (ICWWS) Phase 1 2018

This study was undertaken on behalf of OPW to provide an update to the Extreme Coastal Water Levels for the coast of Ireland, originally presented as output from the Irish Coastal Protection Strategy Study (ICPSS) undertaken between 2004-2013 for a range of Annual Exceedance Probability events around the coast.

The closest node to the site is 7km downstream within Cork Harbour at node C_3. The estimated flood levels at node C_3 are shown in Table 8 below.

Table 8: ICWWS 2018 extreme coastal water levels

Scenario	OSGM02	OSGM15
1 in 200-year	3.18 mOD	3.12 mOD
1 in 200-year MRFS (Mid-Range Future Scenario)	3.68 mOD	3.62 mOD

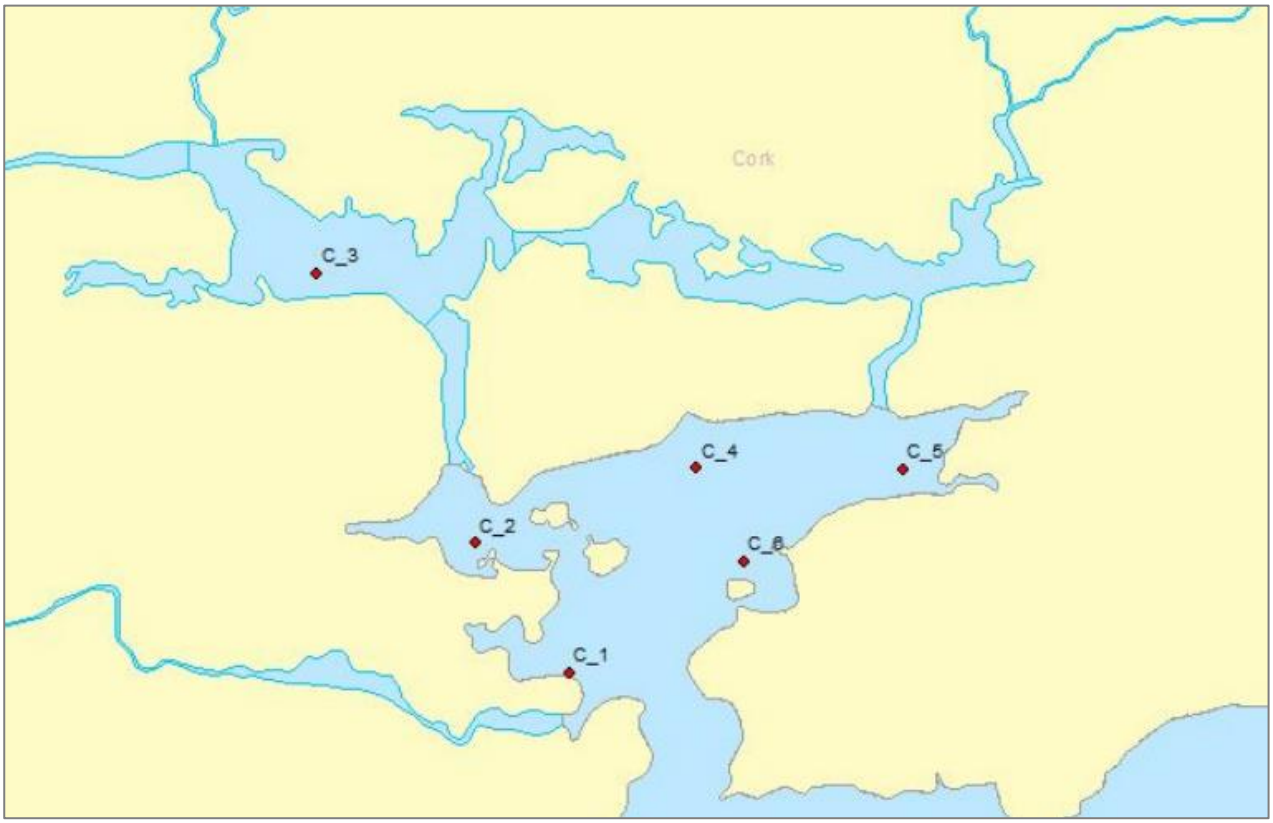


Figure 8: ICWWS 2018 node locations for Cork Harbour

4.2.3 Irish Combined Tidal and Fluvial Risk

The Exhibition Drawings for the Lower Lee (Cork City) Drainage Scheme, including the proposed flood defence levels and design water levels, were published by the OPW in December 2016. An extract from the Flood Extents and Benefitting Areas map is included in Figure 9. Refer to Appendix A.3 for details of the Flood Extents and Benefitting Areas map for Cork City Centre.

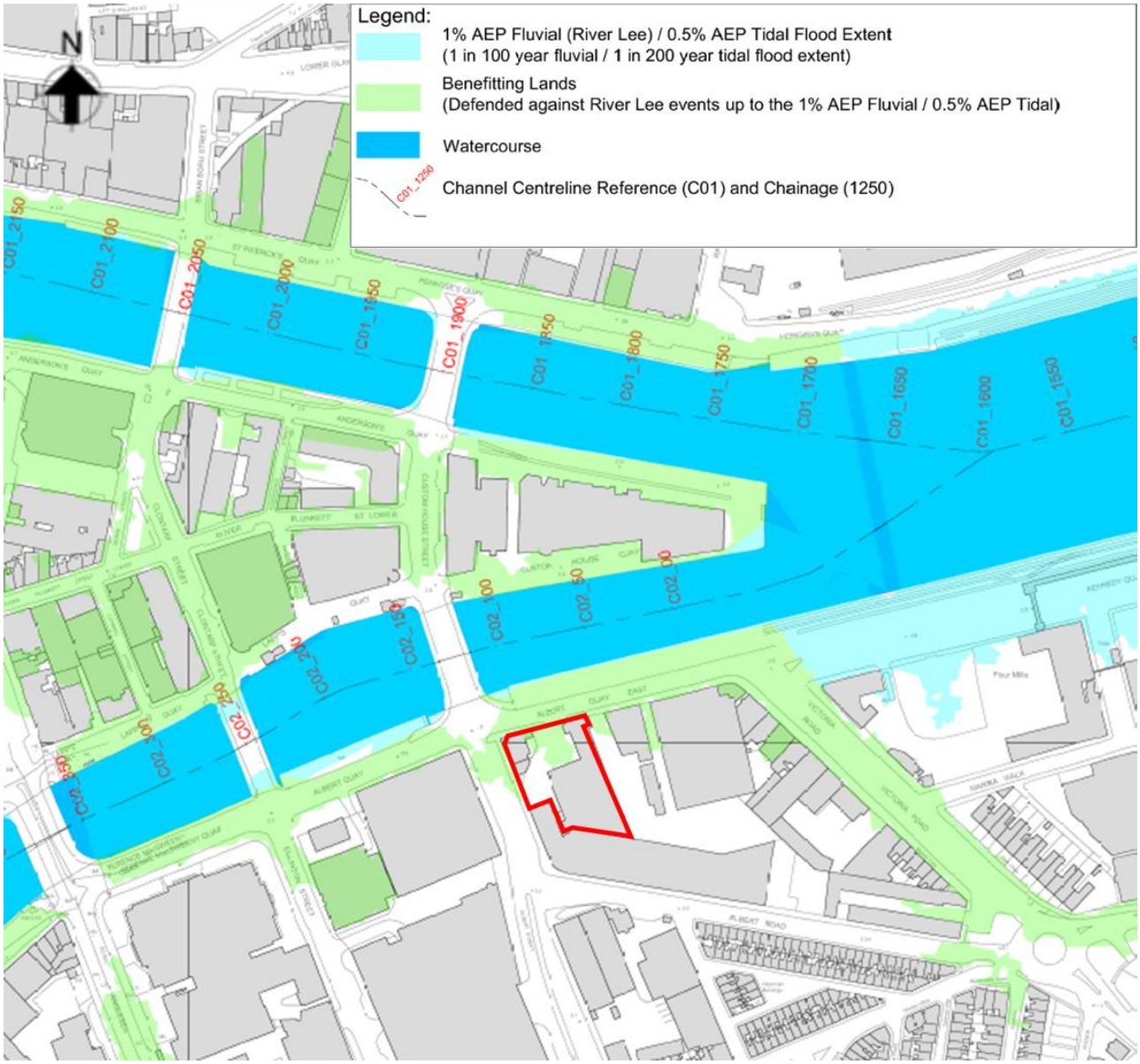


Figure 9: Extract from the Lower Lee (Cork City) Drainage Scheme Flood Extents and Benefitting Areas map

The green area on the above map represents lands that will be defended for the combined 1 in 100 year (1% AEP) fluvial/1 in 200 year (0.5% AEP) tidal event. These areas, including parts of the proposed development site, are identified as being at risk of fluvial or tidal flooding.

The Drainage Scheme drawings also provide cross sections of the proposed defences including the design water level and flood defence level. These defences are set at 3.40mOD.

The cross section nearest the site is SSC-2 on the River Lee South Channel, at Albert Quay East. This section is reproduced in Figure 10.

The design flood level indicated at this section is 3.01mOD.

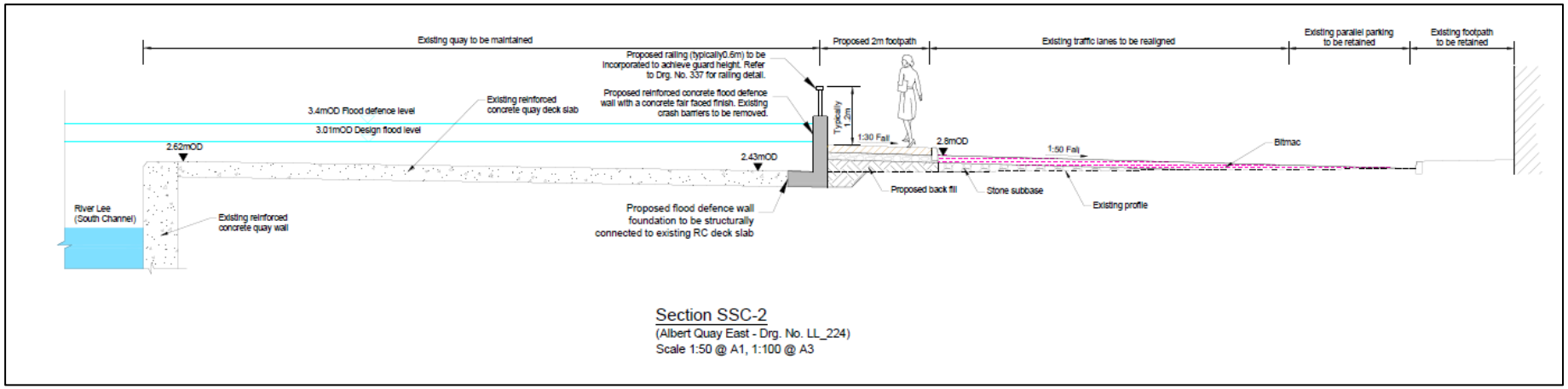


Figure 10: Lower Lee (Cork City) drainage scheme cross section SSC-2

4.3 Pluvial Flooding

Pluvial flooding occurs when extreme rainfall overwhelms drainage systems or soil infiltration capacity, causing excess rainwater to pond above ground at low points in the topography. In order to assess the risk of pluvial flooding to the development, the PFRA mapping undertaken by the OPW has been reviewed. The OPW PFRA map is included in Appendix A.4 an extract of which is presented in Figure 11.

PFRA map indicates the site and the majority of the roads in the vicinity of the site are not within areas at high risk of pluvial flooding. The map does indicate that the development is within the extreme extent case. Therefore, the risk of pluvial flooding at the site is considered overall to be low.

It should be noted that the PFRA maps are only indicative. Pluvial flooding to the site can be mitigated with appropriate landscaping and an upgraded drainage system and Sustainable Drainage Systems (SuDS).

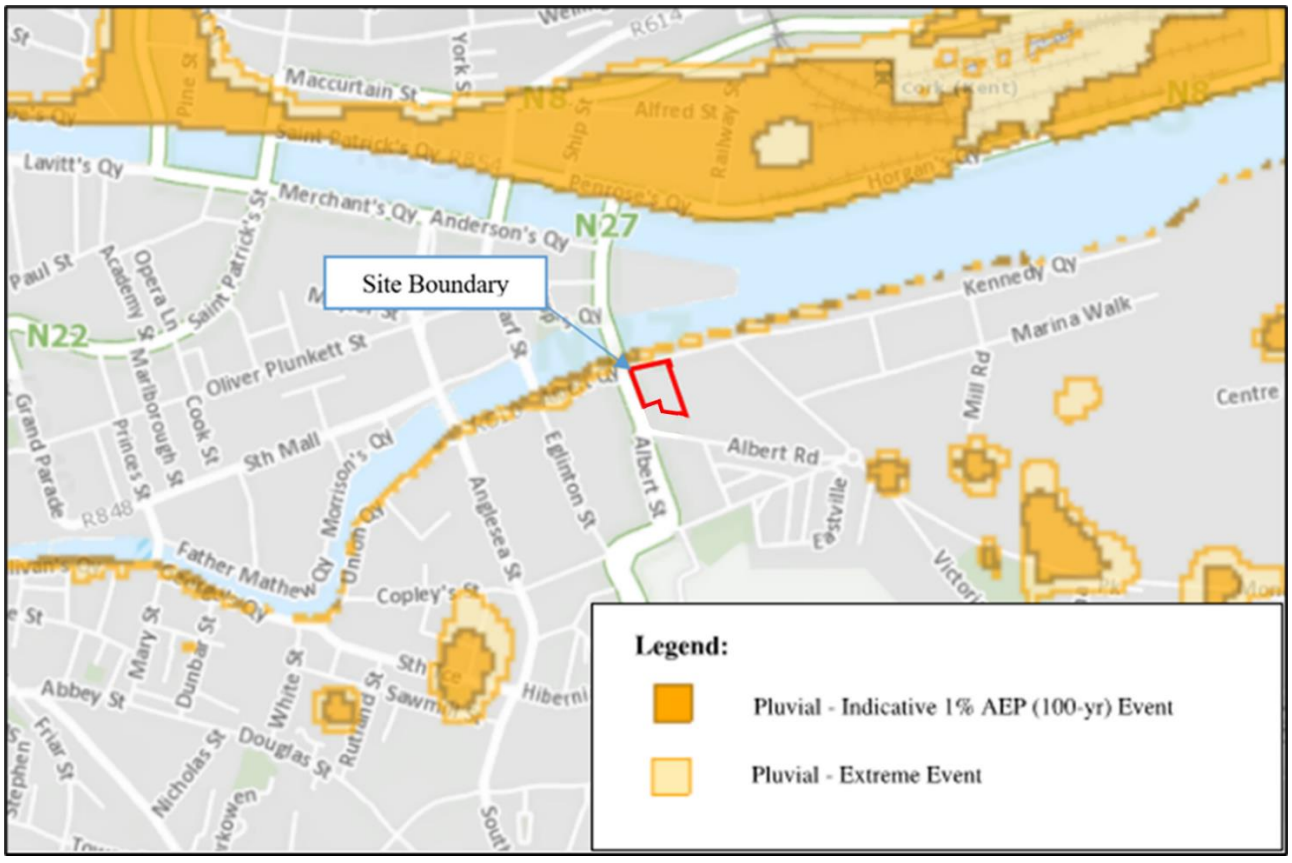


Figure 11: Extract from OPW PFRS pluvial flood map

4.4 Groundwater Flooding

Groundwater flooding can occur during lengthy periods of heavy rainfall, typically during late winter/early spring when the groundwater table is already high. If the groundwater level rises above ground level, it can pond at local low points and cause periods of flooding.

In order to assess the risk of groundwater flooding to the site, the PFRA mapping undertaken by the OPW has been reviewed.

The OPW PFRA map is included in Appendix A.4, an extract of which is presented in Figure 12. It should be noted that the PFRA maps are only indicative and not exhaustive.

The map suggests that the site or the areas in the vicinity of the site as not being at risk of groundwater flooding.

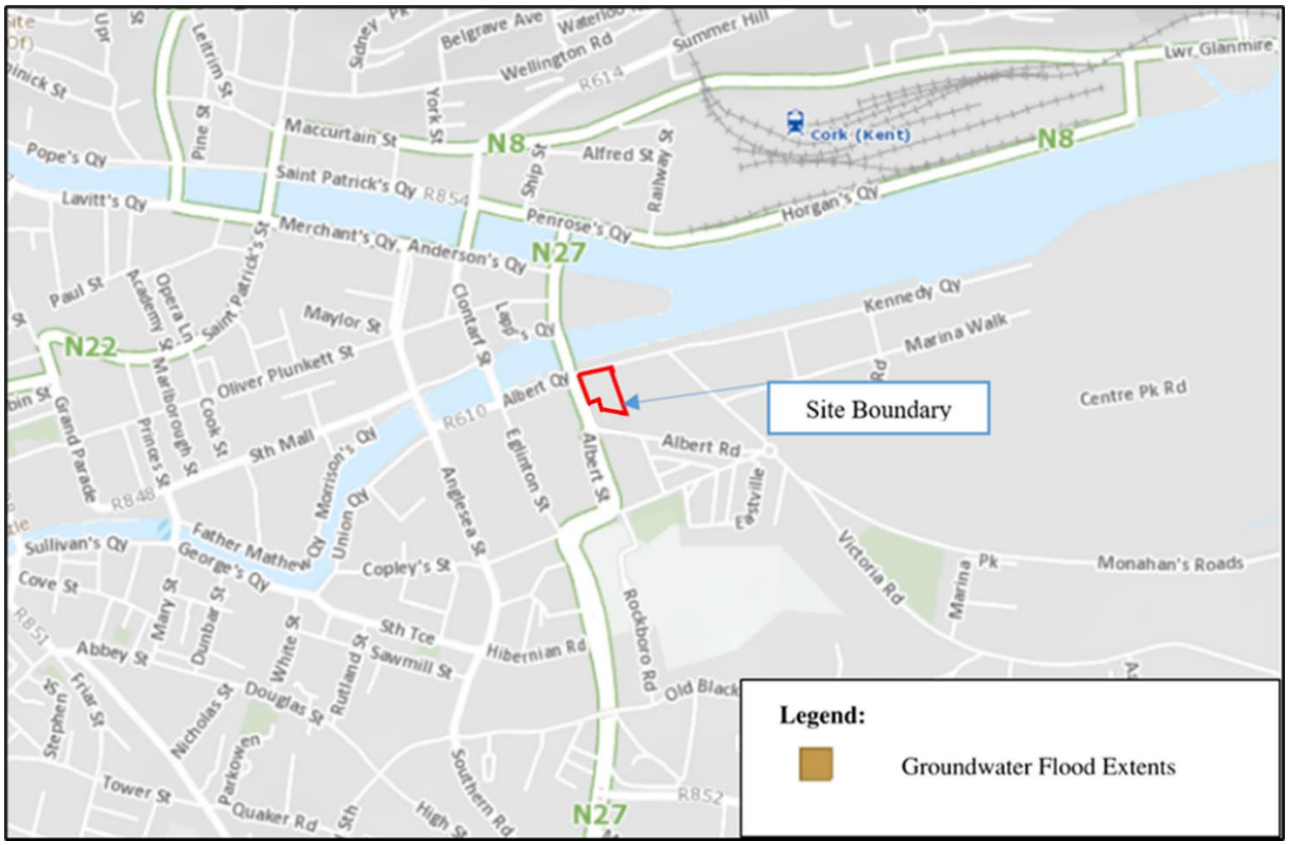


Figure 12: Extract from OPW PFRA groundwater flood map

Figure 13 presents information on the Geological Survey of Ireland (GSI) groundwater vulnerability for the proposed development. It can be seen from the figure that the groundwater vulnerability is indicated as moderate for the site. This suggests that either groundwater levels at the site may be relatively close to the surface and/or moderately permeable soils are present at the location.

It is likely that the vulnerability rating is indicative of a high-water table given the site's close proximity to the River Lee South Channel. Coupled with a potentially moderately permeable soil, this represents a risk of groundwater flooding.

Figure 13: Extract from GSI spatial Resources Groundwater Mapping

4.5 Summary of Existing Flood Risk

The risk of flooding to the existing site from fluvial, tidal, pluvial and groundwater sources has been assessed and is summarised as follows:

- The site is located within Flood Zone A, as it is located in the 200-year tidal flood extent.
- The site is at risk of both fluvial and tidal flooding from the River Lee. The respective water levels indicate that tidal flooding will be critical in the assessment of proposed finished floor levels.
- The risk of pluvial flooding to the site is considered low with the site not identified as being within the pluvial flood extents in the OPW PFRA mapping.
- The risk of groundwater flooding to the site is currently considered moderate.

5. Establishment of Site Design Flood Levels

5.1 Proposed Design Flood Level

As established above, the predicted 1 in 200-year tidal water levels in the vicinity of the site are higher than the corresponding fluvial levels. Therefore, tidal levels will be used as the basis for the design flood levels for the site.

The design water level indicated on the Lee CFRAM drawings is 3.00mOD. This study is the most comprehensive, publicly available and at close proximity to the site location. While the study was done before the ICWWS 2018 study was available, it is considered the most robust source of information for the purposes of a site-specific FRA. This level will therefore be used for the calculation of the design flood level.

5.2 Climate Change

Future climate change is predicted to result in several effects, including more extreme rainfall, more severe floods, and an increase in mean sea level.

In Ireland, current OPW draft guidance on climate change for flood risk management defines two possible future scenarios of varying severity:

- Mid-range future scenario (MRFS)
- High-end future scenario (HEFS)

OPW's recommended allowances for both of these scenarios is shown in Figure 14.

	MRFS	HEFS
Extreme Rainfall Depths	+ 20%	+ 30%
Flood Flows	+ 20%	+ 30%
Mean Sea Level Rise	+ 500 mm	+ 1000 mm
Land Movement	- 0.5 mm / year[1]	- 0.5 mm / year[1]
Urbanisation	*No General Allowance – Review on Case-by-Case Basis*	*No General Allowance – Review on Case-by-Case Basis*
Forestation	- 1/6 Tp[2]	- 1/3 Tp[2] + 10% SPR[3]

Note 1: Applicable to the southern part of the country only (Dublin – Galway and south of this)

Note 2: Reduce the time to peak (Tp) by a third: This allows for potential accelerated runoff that may arise as a result of drainage of afforested land

Note 3: Add 10% to the Standard Percentage Runoff (SPR) rate: This allows for increased runoff rates that may arise following felling of forestry.

Figure 14: OPW recommended allowances for future scenarios.

There are a number of conclusions that can be taken from the prediction made on climate change implications:

- Increases in sea levels may result in extreme tidal events, with tidal levels increasing by more than a metre in the next century.
- Increase in the frequency of extreme events, particularly hydrological extremes, storms and droughts may cause an increase in rainfall intensity, duration and amount, resulting in increased surface water runoff.

Considering the development uses are less vulnerable, it is recommended that the lower climate change allowance for the MRFS is incorporated to the proposed design level.

5.3 Freeboard

It is generally accepted that a minimum freeboard of 300mm above predicted flood levels is appropriate for establishing minimum floor levels. Therefore, a 300mm freeboard is proposed for this development.

5.4 Recommended Flood Defence Level

Based on the above, the following flood defence level for the site is recommended:

3.00mOD (1 in 200-year design flood level) + 0.5m (MRFS climate change allowance) + 0.3m (freeboard) = **3.80mOD**.

The above recommended flood defence level is in OSGM02 Malin Head datum.

The level is higher than the ICWWS predicted extreme water level for the MRFS of 3.68m OD (OSGM02).

6. Proposed Flood Defence Measures

6.1 Finished Flood Levels

It is proposed to set the minimum finished floor level of the proposed buildings at 3.80mOD in order to provide a high standard of flood protection to the building. This is 0.8m above the predicted 1 in 200-year tidal flood level and exceeds the proposed flood defence level of 3.40mOD at Albert Quay East as part of the Lower Lee (Cork City) Drainage Scheme.

6.2 Pluvial Flood Risk

The proposed elevated floor level will be sufficient to minimise the risk of pluvial flood risk to the proposed development.

6.3 Surface Water Drainage

The proposed drainage system for the development will incorporate non-return valves to minimise the risk of sewer flooding or of floodwaters backing up through sewers. All service ducts and utilities penetrating the defence line will be sealed.

Hardstanding areas will be designed to drain away from the proposed development to minimise the risk of overland flows resulting in flooding of the building. The development will also incorporate SuDS measures where appropriate.

6.4 Lower Lee (Cork City) Drainage Scheme

The Lower Lee (Cork City) Drainage Scheme is currently being advanced, and when constructed, will provide protection to properties in the study area from the 1 in 100-year fluvial and 1 in 200-year tidal flood events plus an allowance for freeboard.

As the site of the proposed development on Albert Quay East is within the defended area of the Scheme, it will be offered a high standard of protection when the scheme is completed. Site-specific flood protection measures have been put in place irrespective of the progression of the Drainage Scheme. Therefore, the flood protection of the proposed development does not rely on the Lower Lee Drainage Scheme.

7. Proposed Management of Residual Risks

7.1 Lower Flood Emergency Response Plan (Including Emergency Access and Egress)

An emergency response plan shall be prepared prior to occupation of the development and implemented in the event of a significant forecasted flood event.

Cork City Council currently operate a tidal flood forecasting and warning system which provides advance warnings of extreme tidal flooding. Currently, no fluvial flood forecasting system is in place for Cork. However, ESB issues warnings to Cork City Council in advance of releasing large volumes of water from Inniscarra dam. Cork City Council in turn distribute these warnings to the public. It is worth noting that a formal fluvial flood forecasting system is proposed to be developed as part of the ongoing Lower Lee (Cork City) Drainage Scheme.

As part of the flood emergency response plan, both residents and staff at the buildings of the proposed development will maintain awareness of flood and weather forecasts on an ongoing basis as well as receive warnings from Cork City Council and Met Éireann. Occupants of the buildings will have sufficient notice to either exit the building in advance of a flood or they may reside in the building until the flood recedes.

A Flood Awareness Plan will be developed, whereby users of the building will be made aware of the flood risks, mitigation measures and evacuation procedures. Similar to fire notices, flood information and evacuation notices will be posted throughout the building. Flood response drills will be conducted on a regular basis. The implications of flood events will need to be addressed in the Safety Plans of individual tenants.

In the event of forecasts of significant or severe flooding, the general response plan will be as follows:

- Warnings of the impending flood with details of timings and likely levels will be communicated to all users of the building.
- Where possible, users of the building will remain in the building until the flood recedes. This has been the normal practice in Cork City.

In advance of a flood event, occupants of the building may be evacuated as appropriate. Occupants may be directed in an easterly or westerly direction as appropriate in response to the nature of the flood event. Access and egress from the development will be via Albert Street to the west. The emergency egress routes are indicated in Figure 15.

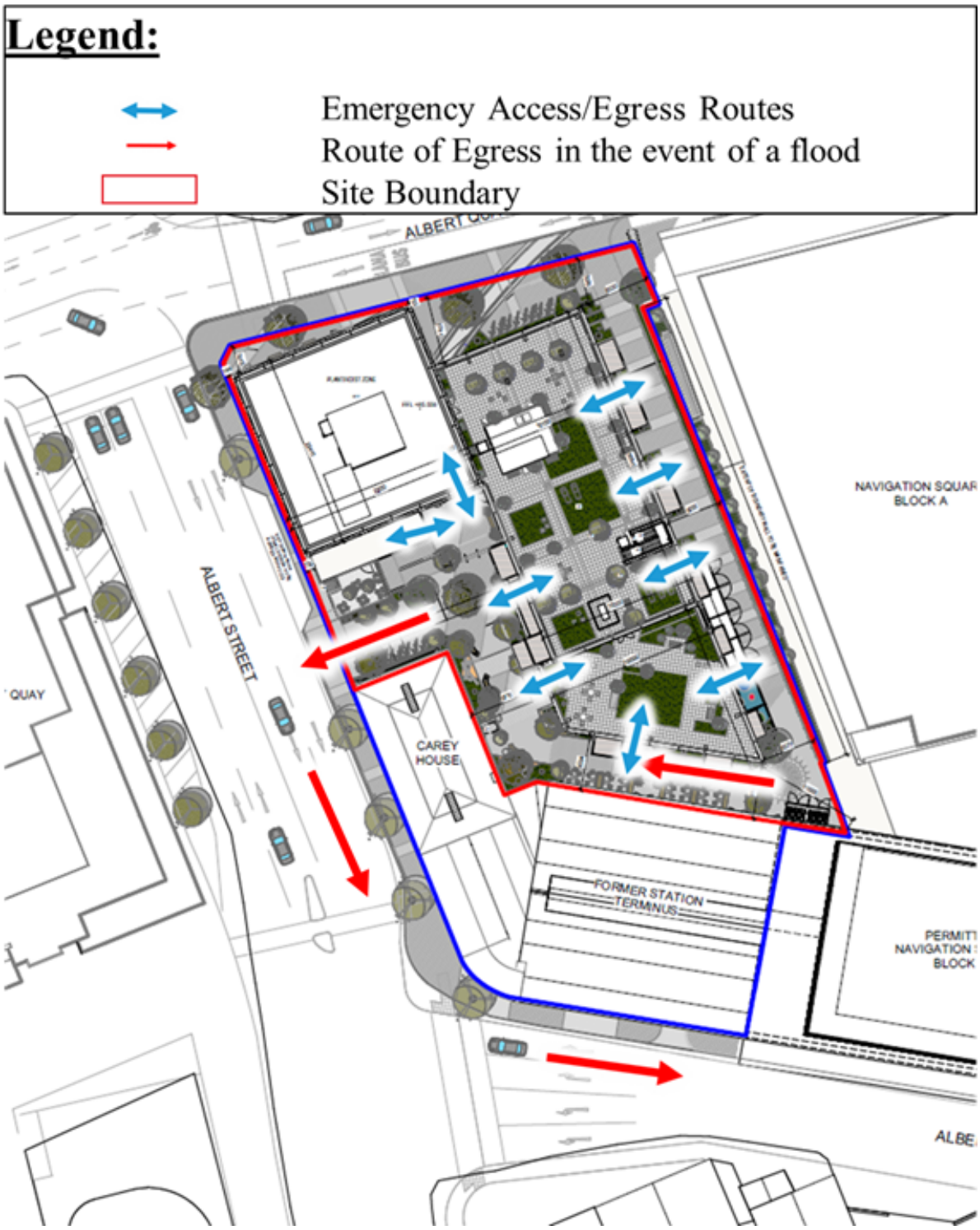


Figure 15: Emergency access/egress routes

- As with the general population of Cork City in this situation, people choosing to leave the building during a flood would be responsible for their own safety and would have to exercise appropriate care and caution. They would be advised of the best route to take to get to higher ground.
- Where an individual or individuals are required to leave the building due to medical emergency, depending on the severity of the flooding, they would be evacuated by emergency vehicle as required.
- The building will have its own first aid equipment (including defibrillators) and procedures, and the staff will be trained to respond as required.

- The building management will, as part of their Emergency Evacuation Plans, be connected to the medical services at appropriate hospitals and will have a plan to deal with the treatment and evacuation of a medical emergency during a flood.
- In the extremely unlikely event of a fire breaking out in the building during a flood and the building having to be evacuated, people will be advised of the optimum route to take on exiting the building to get to higher ground. Management staff will be trained to deal with such an emergency evacuation.
- To minimise the risk of an electrical fire being caused by a flood, all electrical systems will be designed to be flood proof and not to ignite in the event of a flood.
- In the event of an extreme flood being forecast, it is likely that advisories will be issued by Cork City Council and Emergency Authorities for the prior evacuation of all vulnerable parts of the city, and that such evacuation will be carried out in a safe and timely manner.
- The building management will develop a Flood Emergency Plan in accordance with the OPW Planning Guidelines which will be updated annually to take account of the latest knowledge on flooding, the latest situation on flood protection for Cork City and the latest Cork City Emergency Plan. The Flood Emergency Plan will be informed by the Emergency Response Plans of Cork City and Cork County Councils.

8. Application of the Planning Guidelines

8.1 Flood Zones

The northern area of the site of the proposed development is located within Flood Zone A and B. The southern area of the site however is located within Flood Zone C.

For the purposes of Flood Zone Classification, it is considered that the site is within Flood Zone A.

8.2 Off-site Impact

The proposed development will not have a significant impact on flood risk off site as the primary flood risk to the site is tidal.

8.3 Vulnerability Classification

The proposed development can be classified as a primarily residential building and is therefore classified as a 'Highly Vulnerable' development.

8.4 Sequential Approach of the Justification Test

As the site lies within Flood Zone A and is classified as 'Highly Vulnerable', a Justification Test is required in accordance with The Guidelines.

8.4.1 Application of the Justification Test

The applicable Justification Test is the 'Development Management' Justification Test described in Section 5 of The Guidelines.

The Justification Test is adopted by a planning authority when developments vulnerable to flooding are proposed in areas at moderate or high risk of flooding (Flood Zones A and B). Prior to granting permission for the development, the planning authority must be satisfied that the development meets the criteria set out in the Development Management Justification Test in the guidelines. These criteria are included in Figure 16.

Box 5.1 Justification Test for development management (to be submitted by the applicant)

When considering proposals for development, which may be vulnerable to flooding, and that would generally be inappropriate as set out in Table 3.2, the following criteria must be satisfied:

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:
   - (i) The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk;
   - (ii) The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably possible;
   - (iii) 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
   - (iv) 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 foreseen use of the development and the local development context.

Note: See section 5.27 in relation to major development on zoned lands where sequential approach has not been applied in the operative development plan.

Refer to section 5.28 in relation to minor and infill developments.

Figure 16: Justification Test for development management (extract from The Guidelines)

8.4.2 Justification Test – Part 1

The current Development Plan is the 2022 – 2028 Cork City Development Plan. This was informed by a Strategic Environmental Assessment (SEA) in accordance with The Guidelines.

The site is zoned for ‘City Centre’ Area in the Development Plan. A Justification Test was undertaken for Cork City Centre (including the proposed development location) and concluded that ‘the said lands and zoning objectives satisfies the Justification Test’.

The proposed development is primarily residential dwellings with commercial developments which is compatible with the zoning of ‘City Centre’ Area. Therefore, it is considered that the proposed development satisfies the criteria of Part 1 of the development management Justification Test.

8.4.3 Justification Test – Part 2(i)

In terms of assessing whether the development would increase flood risk elsewhere, the three key elements to consider are conveyance, storage and surface water runoff.

The majority of the proposed development sits within the footprint of existing buildings which currently act as a barrier to conveyance. The reduction in conveyance with the development in place will therefore be minimal. Also, the existing roads around the perimeter of the site will still act as natural conveyance routes for flood waters with the development in place.

It is considered that the loss of floodplain storage with the development in place will be minimal as the predominant risk of flooding to the site is tidal. Furthermore, on completion of the Lower Lee (Cork City) Drainage Scheme, the south bank of the South Channel will be protected to the 1 in 200-year tidal level including an allowance for freeboard. Therefore, flood storage for events up to this design standard will not be applicable.

In relation to surface water runoff, the design of the surface water drainage systems to serve the proposed development will incorporate applicable elements of SuDS and will limit post development run-off in accordance with Cork City Council requirements.

Therefore, it is considered that the proposed development satisfies the criteria of Part 2(i) of the development management Justification Test.

8.4.4 Justification Test – Part 2(ii)

The mitigation measures proposed to minimise flood risk to people, property, the economy and the environment are discussed in detail in sections 6 and 7 of this report.

It is therefore considered that the proposed development satisfies the criteria of Part 2(ii) of the development management Justification Test.

8.4.5 Justification Test – Part 2(iii)

The measures to ensure that residual risks to the area and/or development will 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 are addressed in Section 7 of this report.

It is considered that the proposed development satisfies the criteria of Part 2(iii) of the development management Justification Test.

8.4.6 Justification Test – Part 2(iv)

The proposed development is consistent with the objectives of the Cork City Development Plan 2022 – 2028 in terms of promoting high quality residential and commercial space, whilst also satisfying the requirements to maintain the landscape and visual character of the area by tying into the existing streetscape levels and being respectful to the historic architecture and heritage of the area.

It is considered that the proposed development satisfies the criteria of Part 2(iv) of the development management Justification Test.

9. Discussion and Conclusions

The site of the proposed development is at risk of both fluvial and tidal flooding. The risk from pluvial and groundwater flooding is considered to be low and moderate respectively.

The recommended flood defence level for the site of the proposed development is 3.80mOD which provides protection from the 1 in 200-year design tidal flood level (3.00mOD), with an allowance for climate change (0.5m) as well as an allowance for freeboard (0.3m). The above level is in OSGM02 Malin Head datum.

It is recommended to set the minimum finished floor level of the proposed development at 3.80mOD in order to provide a high standard of protection against flooding. This will provide the 1 in 200-year Standard of Protection to the proposed development.

Non-return valves on drains and sealed service ducts and utilities will also be incorporated into the proposed development. SuDS principles will be incorporated where appropriate.

Additionally, the Lower Lee (Cork City) Drainage Scheme is currently being advanced and when constructed will provide protection to properties in the study area from the 1 in 100-year fluvial and 1 in 200-year tidal flood events plus an allowance for freeboard. As the site of the proposed development on Albert Quay is within the defended area of the Scheme, it will be offered a high standard of protection by the scheme when it is completed. The protection of the proposed development from flooding to the 1 in 200-year tidal flood event does not rely on the Scheme and is achieved through the mitigation measures proposed herein.

A Justification Test has been carried out in Section 8 of this report. It has been demonstrated that the proposed development satisfies the criteria of the development management Justification Test.

This FRA has demonstrated that the risks relating to flooding to the proposed development can be managed and mitigated to acceptable levels and therefore comply with DEHLG/ OPW and Cork City Council planning guidance.

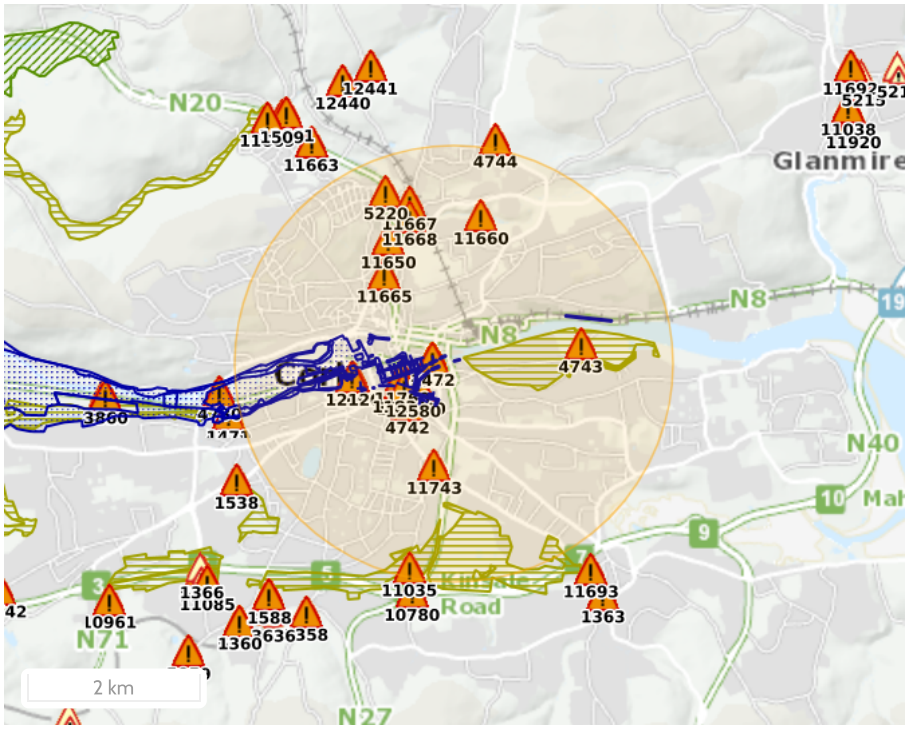
A.1 Past Flood Event Local Area Summary Report

Past Flood Event Local Area Summary Report

Report Produced: **7/4/2021 16:06**

This Past Flood Event Summary Report summarises all past flood events within 2.5 kilometres of the map centre.

This report has been downloaded from www.floodinfo.ie (the "**Website**"). The users should take account of the restrictions and limitations relating to the content and use of the Website that are explained in the Terms and Conditions. It is a condition of use of the Website that you agree to be bound by the disclaimer and other terms and conditions set out on the Website and to the privacy policy on the Website.



Map Legend

- Single Flood Event
- Recurring Flood Event
- Past Flood Event Extents
- Drainage Districts Benefited Lands*
- Land Commission Benefited Lands*
- Arterial Drainage Schemes Benefited Lands*

* Important: These maps do not indicate flood hazard or flood extent. Their purpose and scope is explained on Floodinfo.ie

29 Results

	Name (Flood_ID)	Start Date	Event Location
1.	Cork City from 26th. To 29th.October 2015 (ID-12580)	26/10/2015	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		
2.	Lee Cork City January 1789 (ID-1472)	16/01/1789	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		
3.	Lee Cork City November 1853 (ID-1473)	02/11/1853	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		
4.	Lee Cork City November 1916 (ID-1474)	16/11/1916	Approximate Point
	Additional Information: Reports (1) Press Archive (6)		
5.	Bride Blackpool Cork 2002 (ID-5220)	n/a	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		
6.	Cork City October 2004 (ID-4731)	27/10/2004	Area
	Additional Information: Reports (1) Press Archive (0)		

	Name (Flood_ID)	Start Date	Event Location
7.	Lee Cork City Jan 1996 (ID-455) **Additional Information:** Reports (10) Press Archive (1)	06/01/1996	Area
8.	Lee Cork City August 1986 (ID-6) **Additional Information:** Reports (2) Press Archive (3)	05/08/1986	Area
9.	Cork City centre Dec 1989 (ID-4735) **Additional Information:** Reports (1) Press Archive (0)	16/12/1989	Approximate Point
10.	Cork City centre March 1962 (ID-4737) **Additional Information:** Reports (1) Press Archive (0)	07/03/1962	Approximate Point
11.	Cork City centre Oct 1901 (ID-4738) **Additional Information:** Reports (1) Press Archive (0)	01/10/1901	Approximate Point
12.	Cork city centre 1955 (ID-4739) **Additional Information:** Reports (1) Press Archive (1)	n/a	Approximate Point
13.	Cork city centre 1945 (ID-4740) **Additional Information:** Reports (1) Press Archive (0)	n/a	Approximate Point
14.	Douglas St Cork Jan 1988 (ID-4742) **Additional Information:** Reports (1) Press Archive (0)	12/01/1988	Approximate Point
15.	Centre Park Road Cork Jan 1988 (ID-4743) **Additional Information:** Reports (1) Press Archive (0)	12/01/1988	Approximate Point
16.	Watercourse Road (South of O Connell Street) Cork. 28th.June 2012 (ID-11665) **Additional Information:** Reports (1) Press Archive (0)	28/06/2012	Approximate Point
17.	Cork City 17th.December 2012 (ID-11831) **Additional Information:** Reports (1) Press Archive (0)	17/12/2012	Approximate Point
18.	Turner's Cross, Cork 28th June 2012 (ID-11743) **Additional Information:** Reports (1) Press Archive (0)	28/06/2012	Approximate Point
19.	Cork City on 17th October 2012 (ID-11760) **Additional Information:** Reports (1) Press Archive (0)	17/10/2012	Approximate Point
20.	Cork City 14th.December 2012 (ID-11780) **Additional Information:** Reports (1) Press Archive (0)	14/12/2012	Approximate Point
21.	Flooding in Cork City Centre 2nd January 2014 (ID-12120) **Additional Information:** Reports (1) Press Archive (0)	02/01/2014	Approximate Point
22.	Cork City 16th and 17th October 2012 (ID-11825) **Additional Information:** Reports (2) Press Archive (0)	16/10/2012	Approximate Point
23.	Flooding in Cork City Centre, 3rd February 2014 (ID-12095) **Additional Information:** Reports (1) Press Archive (0)	03/02/2014	Approximate Point
24.	Cork City Flooding 19th.Nov. 2009 (ID-10820)	19/11/2009	Area

	Name (Flood_ID)	Start Date	Event Location
	Additional Information: Reports (4) Press Archive (0)		
25.	Tramore Stream Culvert,Kinsale Rd.Cork 30th.December 2009 (ID-11035)	30/12/2009	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		
26.	Blackpool and other locations 28th June 2012 (ID-11650)	28/06/2012	Approximate Point
	Additional Information: Reports (3) Press Archive (0)		
27.	Ballyvolane, Co.Cork. 28th June 2012 (ID-11660)	28/06/2012	Approximate Point
	Additional Information: Reports (2) Press Archive (0)		
28.	Dublin Street, Cork. 28th June 2012 (ID-11667)	28/06/2012	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		
29.	Spring Lane, Cork. 28th June 2012 (ID-11668)	28/06/2012	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		

A.2 Lee CFRAMS Flood Extent Maps

N

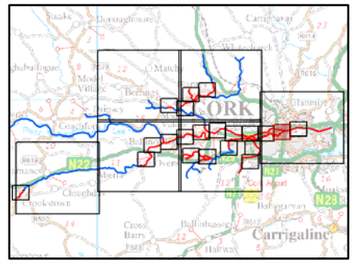
Node Label	Water Level (mOD) per AEP		
	WL 10%	WL 1%	WL 0.1%
8LEE_2705	2.11	3.10	3.49
8LEE_2504	2.05	2.96	3.33
8LEE_2276	1.95	2.80	3.13
8LEE_2059	1.97	2.81	3.15
8LEE_1877	1.93	2.74	3.07
8LEE_1673	1.94	2.75	3.07
8LEE_1476	1.94	2.75	3.07
8LEE_1281	1.94	2.75	3.07
8SOU_1101	2.05	2.87	3.22
8SOU_980	2.02	2.83	3.19
8SOU_825	1.96	2.77	3.10
8SOU_589	1.94	2.75	3.08
8SOU_349	1.94	2.75	3.08
8SOU_142	1.94	2.75	3.08
8SOU_0	1.94	2.75	3.07

8LEE_2705
8LEE_2504
8LEE_2276
8LEE_2059
8LEE_1877
8LEE_1673
8LEE_1476
8LEE_1281
8SOU_0
8SOU_142
8SOU_349
8SOU_589
8SOU_980
8SOU_1101
8SOU_825

Tidal flooding may also occur within the area shown on this map. Please refer to the tidal flood extent map. Figure No. M9/UA/EXT/CURS/004

0.1 0.05 0 0.1 0.2 0.3 0.4 Kilometres

Location Plan :



EXTENT MAP

Legend:

- 10 % AEP Flood Extent (1 in 10 chance in any given year)
- 1 % AEP Flood Extent (1 in 100 chance in any given year)
- 0.1 % AEP Flood Extent (1 in 1000 chance in any given year)
- Defended area
- High Confidence (<20m) (10% AEP)
- Medium Confidence (<40m) (10% AEP)
- Low Confidence (>40m) (10% and 0.1% AEP)
- High Confidence (<20m) (1% AEP)
- Medium Confidence (<40m) (1% AEP)
- Low Confidence (>40m) (1% AEP)
- River Centreline
- Node Point
- 8OWG_376 Node Label (refer to table)

USER NOTE :

USERS OF THESE MAPS SHOULD REFER TO THE DETAILED DESCRIPTION OF THEIR DERIVATION, LIMITATIONS IN ACCURACY AND GUIDANCE AND CONDITIONS OF USE PROVIDED AT THE FRONT OF THIS BOUND VOLUME. IF THIS MAP DOES NOT FORM PART OF A BOUND VOLUME, IT SHOULD NOT BE USED FOR ANY PURPOSE.

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OPW
Office of Public Works
17-19 Lower Hatch Street
Dublin 2
Ireland

Project :
LEE CATCHMENT FLOOD RISK ASSESSMENT AND MANAGEMENT STUDY

Map :
CORK CITY

Map Type :	FLOOD EXTENT		
Source :	FLUVIAL FLOODING		
Map area :	URBAN AREA		
Scenario :	CURRENT		
Figure By :	Valeria Medina	Date :	10 March 2014
Checked By :	Ricardo Santaella	Date :	10 March 2014
Approved By :	Clare Dewar	Date :	10 March 2014

Figure No. : M8/UA/EXT/CURS/011
Revision : 2

Drawing Scale : 1:5,000
Plot Scale : 1:1 @ A3

N

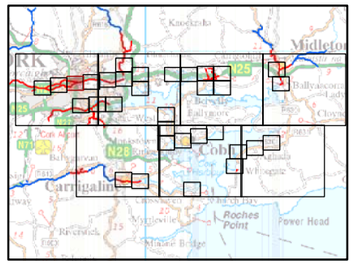
Fluvial flooding may also occur within the area shown on this map. Please refer to the fluvial flood extent map. Figure No. M8/UA/EXT/CURS/011

	Water Level (mOD) per AEP		
Node Label	WL 10%	WL 0.5%	WL 0.1%
8LEE_2504	2.70	3.13	3.35
8LEE_2276	2.67	3.03	3.24
8LEE_2059	2.67	3.04	3.25
8LEE_1877	2.66	2.99	3.20
8LEE_1673	2.66	3.00	3.21
8LEE_1476	2.66	3.00	3.21
8LEE_1281	2.66	3.00	3.21
8SOU_1101	2.70	3.05	3.28
8SOU_825	2.67	3.01	3.21
8SOU_589	2.67	3.00	3.21
8SOU_349	2.67	3.00	3.21
8SOU_142	2.66	3.00	3.21
8SOU_0	2.66	3.00	3.21

8LEE_2504
8LEE_2276
8LEE_2059
8LEE_1877
8LEE_1673
8LEE_1476
8LEE_1281
8SOU_0
8SOU_142
8SOU_349
8SOU_589
8SOU_825
8SOU_1101

0.1 0.05 0 0.1 0.2 0.3 0.4 Kilometres

Location Plan :



EXTENT MAP

Legend:

- 10 % AEP Flood Extent (1 in 10 chance in any given year)
- 0.5 % AEP Flood Extent (1 in 200 chance in any given year)
- 0.1 % AEP Flood Extent (1 in 1000 chance in any given year)
- Defended area
- High Confidence (<20m) (10% AEP)
- Medium Confidence (<40m) (10% AEP)
- Low Confidence (> 40m) (10% and 0.1% AEP)
- High Confidence (<20m) (0.5% AEP)
- Medium Confidence (<40m) (0.5% AEP)
- Low Confidence (>40m) (0.5% AEP)
- River Centreline
- Node Point
- 001 Node Label (refer to table)

USER NOTE :

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OPW
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Project :
LEE CATCHMENT FLOOD RISK ASSESSMENT AND MANAGEMENT STUDY

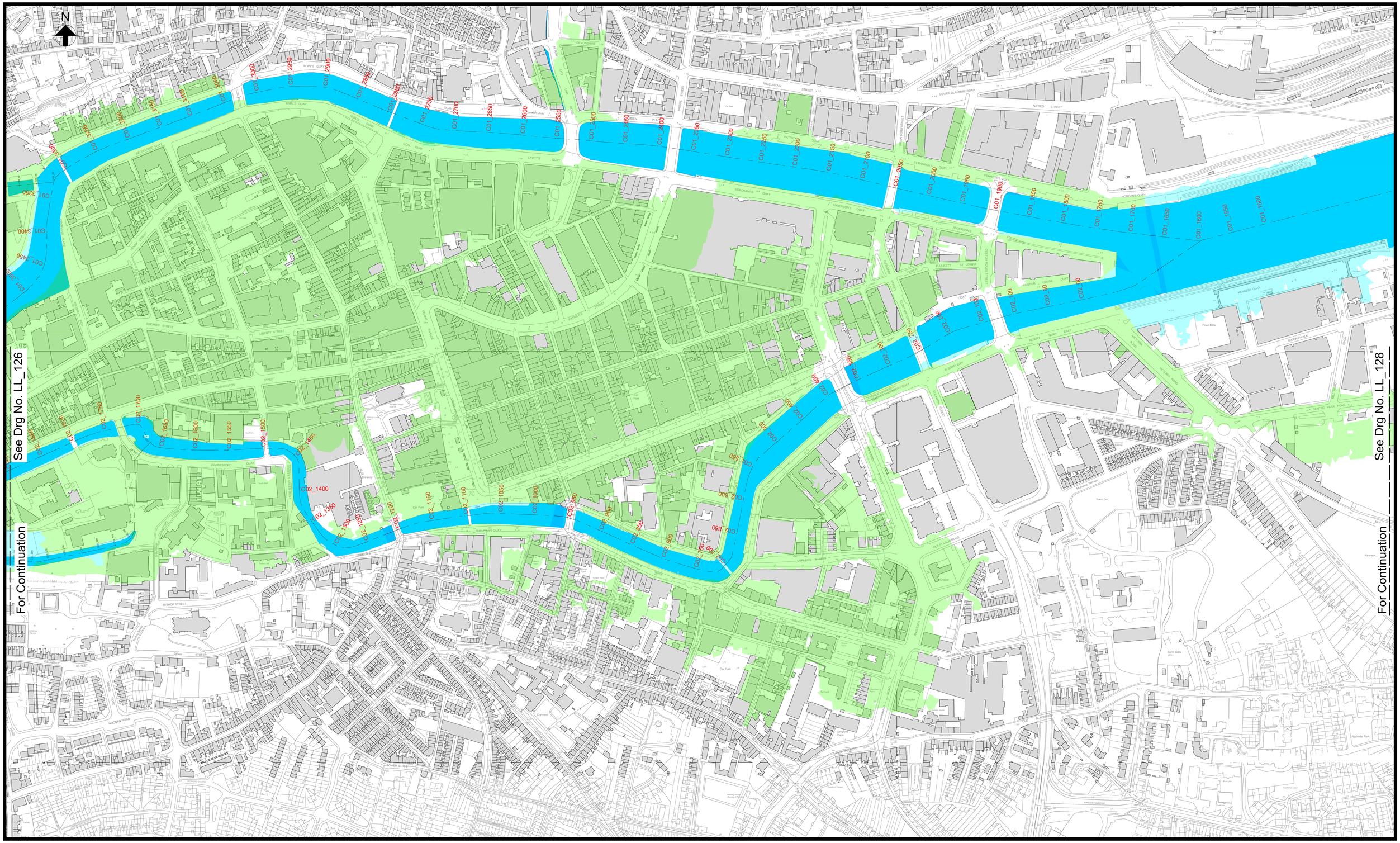
Map :
CORK CITY

Map Type :	FLOOD EXTENT
Source :	TIDAL FLOODING
Map area :	URBAN AREA
Scenario :	CURRENT
Figure By :	Valeria Medina Date : 10 March 2014
Checked By :	Ricardo Santaella Date : 10 March 2014
Approved By :	Clare Dewar Date : 10 March 2014
Figure No. :	M9/UA/EXT/CURS/004
Revision	2
Drawing Scale :	1:5,000
Plot Scale :	1:1 @ A3

A.3 Lower Lee (Cork City) Drainage Scheme Maps

Lower Lee (Cork City) Drainage Scheme

Issued for Exhibition December 2016



Location Plan

0 25 50 100 Metres

Legend:

🟦	1% AEP Fluvial (River Lee) / 0.5% AEP Tidal Flood Extent (1 in 100 year fluvial / 1 in 200 year tidal flood extent)
🟩	Benefitting Lands (Defended against River Lee events up to the 1% AEP Fluvial / 0.5% AEP Tidal)
🟦	Watercourse
C01_1250	Channel Centreline Reference (C01) and Chainage (1250)

Scale 1:2,500 at A1
Scale 1:5,000 at A3

Drg. No. LL_127 Flood Extents and Benefitting Areas (Sheet 8 of 9)

Notes:
1. Do not scale from drawing.
2. The channels on this drawing have been assigned colours for the purpose of assigning identification labels and interference references.
3. This drawing should be read in conjunction with all other Lower Lee (Cork City) Drainage Scheme Exhibition Drawings and Schedules.

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A.4 PFRA Mapping

© Government of Ireland
Osi permit number EN-002-1011

Location Plan :

Legend:

Flood Extents

🟦 Fluvial - Indicative 1% AEP (100-yr) Event

▫ Fluvial - Extreme Event

🟩 Coastal - Indicative 0.5% AEP (200-yr) Event

▫ Coastal - Extreme Event

🟧 Pluvial - Indicative 1% AEP (100-yr) Event

▫ Pluvial - Extreme Event

🟫 Groundwater Flood Extents

■ Lakes / Turloughs

PFRA Outcomes

✳ Probable Area for Further Assesment

✳ Possible Area for Further Assesment

Important User Note:

The flood extents shown on these maps are based on broad-scale simple analysis and may not be accurate for a specific location. Information on the purpose, development and limitations of these maps is available in the relevant reports (see www.cfram.ie). Users should seek professional advice if they intend to rely on the maps in any way.

If you believe that the maps are inaccurate in some way please forward full details by contacting the OPW (refer to PFRA Information leaflets or 'Have Your Say' on www.cfram.ie).

Office of Public Works
Jonathon Swift Street
Trim
Co Meath
Ireland

Project :
PRELIMINARY FLOOD RISK ASSESMENT (PFRA)

Map :
PFRA Indicative extents and outcomes
- Draft for Consultation

Figure By : PJW Date : July2011
Checked By : MA Date : July 2011

Figure No. : 2019 / MAP / 38 / A
Revision 0

Drawing Scale : 1:50,000 Plot Scale : 1:1 @ A3

A.5 Architect's Drawings

1 **L00 - SITE LAYOUT PLAN**
1 : 250

ALL DIMENSIONS TO BE CHECKED ON SITE
NO DIMENSIONS TO BE SCALED FROM THIS DRAWING
DRAWING IS TO BE READ IN CONJUNCTION WITH RELEVANT CONSULTANTS DRAWINGS
ALL MEASUREMENTS ARE METRIC. ALL LONGITUDINAL MEASUREMENTS AND SELECTED VERTICAL SEPERATION DISTANCES IN MM (ie 4020). ALL VERTICAL REFERENCE HEIGHTS IN METRES OD (ie +27.600). ALL FFL IN METRES OF (ie +3.800)

REV	DATE	DESCRIPTION	CKH	DRN
P3	31/07/2024	PLANNING APPLICATION	KMM	DOS
P2	25/07/2024	PLANNING APPLICATION	KMM	DOS
P1	14/06/2024	PLANNING APPLICATION	KMM	DOS

STATUS CODE DESCRIPTION
PLANNING

CLIENT
PROGRESSIVE COMMERCIAL CONSTRUCTION LIMITED

PROJECT
THE RAILYARD APARTMENTS

DRAWING
SITE
00 - SITE PLAN

PROJECT NUMBER
950491

DATE
23/02/2024

SCALE@ A1:
As indicated

DRAWN/CHECKED:
KMM/ DOS

STATUS CODE:
DRAWING NUMBER
AQ2-HJL-ZZ-00-DR-A-P1001
REVISION
P3

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infocork@henryjlyons.com
One Albert Quay
Cork, T12 X8N6

ALL DIMENSIONS TO BE CHECKED ON SITE
NO DIMENSIONS TO BE SCALED FROM THIS DRAWING
DRAWING IS TO BE READ IN CONJUNCTION WITH RELEVANT CONSULTANTS DRAWINGS
ALL MEASUREMENTS ARE METRIC. ALL LONGITUDINAL MEASUREMENTS AND SELECTED VERTICAL SEPERATION DISTANCES IN MM (ie 4020). ALL VERTICAL REFERENCE HEIGHTS IN METRES OD (ie +27.600). ALL FFL IN METRES OF (ie +3.800)

SITE BOUNDARY
LAND IN OWNERSHIP OF LANDOWNER

REV	DATE	DESCRIPTION	CKH	DRN
P3	31/07/2024	PLANNING APPLICATION	KMM	DOS
P2	25/07/2024	PLANNING APPLICATION	KMM	DOS
P1	14/06/2024	PLANNING APPLICATION	KMM	DOS

STATUS CODE DESCRIPTION
PLANNING

CLIENT
PROGRESSIVE COMMERCIAL CONSTRUCTION LIMITED

PROJECT
THE RAILYARD APARTMENTS

DRAWING
GENERAL ARRANGEMENT
LEVEL 0 - GROUND FLOOR PLAN

PROJECT NUMBER
950491

DATE
27/10/23

SCALE@ A1:
As indicated

DRAWN/CHECKED:
JI/ KMM

STATUS CODE: P1
DRAWING NUMBER: AQ2-HJL-ZZ-00-DR-A-P1010
REVISION: P3

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1 **L00 - GROUND FLOOR PLAN**
1 : 200