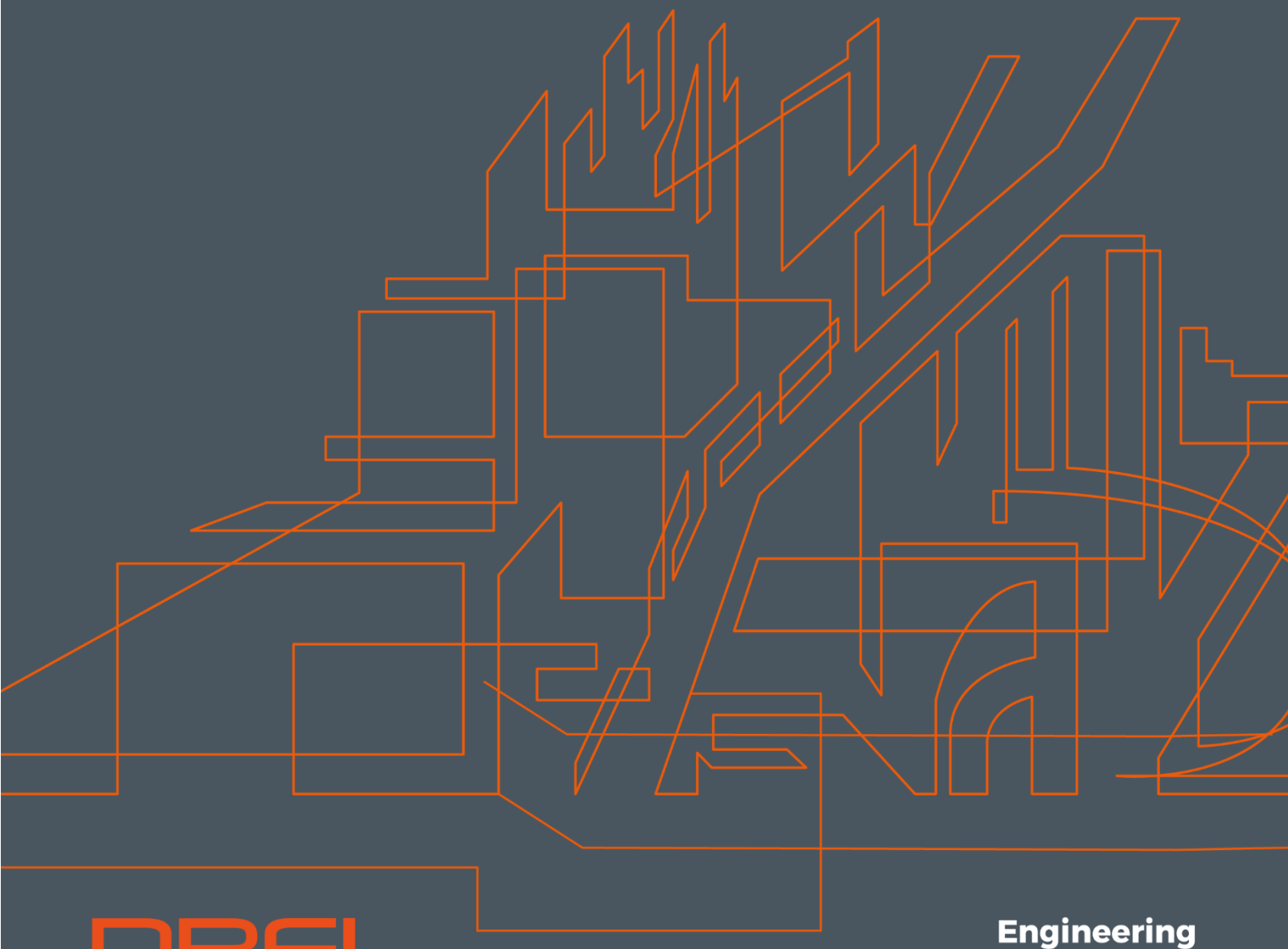
Cabinteely Greenway

Site Specific Flood Risk Assessment

230119-DBFL-X-X-XXX-RP-DBFL-CE-0005

September 2025



DBFL CONSULTING ENGINEERS

Engineering Sustainable Futures

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P1	0	19/09/2024	Draft Planning	Aislinn Murtagh	Dieter Bester	Dieter Bester
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P3	2	26/08/2025	Planning	Aislinn Murtagh	Dieter Bester	Dieter Bester

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1 INTRODUCTION

1.1 Background

DBFL Consulting Engineers (DBFL) have been commissioned by Dún Laoghaire Rathdown County Council (DLRCC) to undertake a "Site Specific Flood Risk Assessment" (SSFRA), for a proposed planning application for the Cabinteely Greenway scheme, Cabinteely, Dublin 18.

1.2 Proposed Development

Dún Laoghaire Rathdown County Council have announced plans for a new greenway linking Cornelscourt to Cherrywood. The overall purpose of the project is to enhance connectivity between Bray Road, Cornelscourt to the Cherrywood Greenway for people walking, wheeling and cycling by providing approximately 2.3 km of safe, high-quality greenway infrastructure.

The proposal aligns with Government Policy at both national and local government level in its commitment to ensure that active travel is appropriately provided for as part of an interconnected network of cycle and pedestrian routes. This route forms an important part in the DLR (Dún Laoghaire-Rathdown) Cycle Network and is a strategic north-west / south-east link.

The objective of this report is to inform the detail design of the scheme regarding flood risk. The report assesses the proposed pedestrian and cycle route in accordance with the requirements of "The Planning System and Flood Risk Management Guidelines for Planning Authorities" determining the flood zone category along the route and presents information in the context of flood risk and level of vulnerability.

Several route options were duly investigated along existing roads and paths that would improve safety and connectivity for pedestrians and cyclists but also maintain appropriate capacity and connectivity for private vehicle users. As a result of this investigation an appropriate design was created and as a result overall scheme incorporates four distinct sections.

- **Section A**- Cornelscourt Village to Glen Lawn Drive via Cornelscourt Hill Road and Park Drive before linking onto Glen Lawn drive.
- **Section B**- Glen Lawn Drive to Cabinteely Park
- **Section C**- Cabinteely Park via the existing footpath, with some alterations to the path route in the Southeast corner of the park.
- **Section D**- Brennanstown Road to Cherrywood (Druids Glen/ Orchard Square) via Brennanstown road before linking into the proposed Cherrywood Greenway and Cherrywood Green Routes.

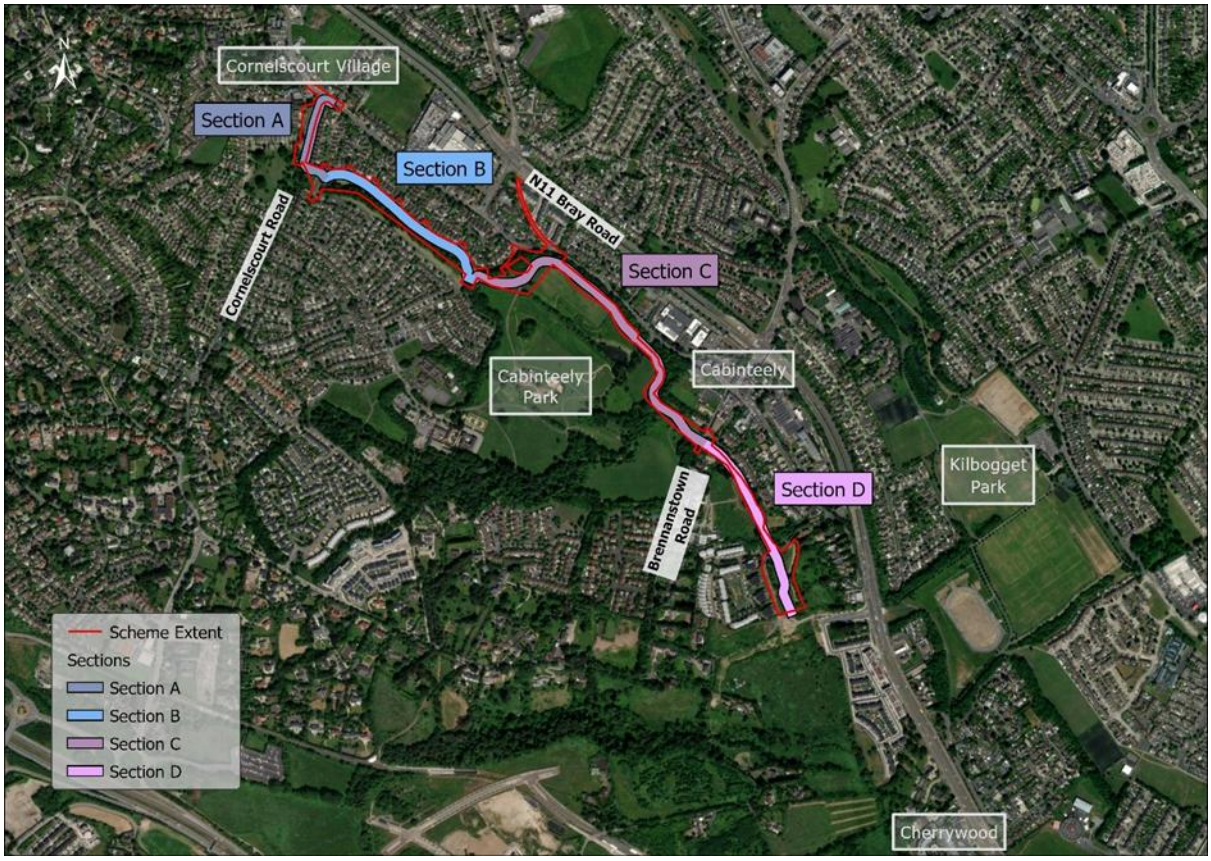


Figure 1-1 Proposed Indicative Route of Cabinteely Greenway (Source; www.dlrcoco.ie)

The proposed route will be made up of two fundamental construction forms depending on location:

1. Construction directly alongside, or within very close proximity of, an existing road within an area of roadside verge or redistribution of the road cross section.
2. Construction directly alongside, or in close proximity of an existing road which will include new surfacing and markings on the road to denote a mixed street for cyclist and motorists.
3. Construction away from the roadside, along an existing path through Cabinteely Park whilst also coming into close proximity to Cabinteely Stream running through Cabinteely Park.
4. Construction of a new off-road path adjacent to Cabinteely Stream, linking Brennanstown Road to Cherrywood Green Routes.
5. Construction of a new bridge to facilitate users where the greenway crosses over Cabinteely Stream.

1.3 Local Hydrology

Cabinteely is located within the Carrickmines/ Shanganagh catchment which outfalls into the Irish sea, approximately 9km Southeast of Dublin Bay. There are several waterbodies which flow through the site and wider area. These include Cabinteely Stream, Carrickmines River, Loughlinstown River, Shanganagh River and Kill of the Grange Stream.

The water bodies referenced below in Figure 1-2 Watercourses in vicinity of the siteflow in a west to east direction and are found within the Carrickmines/ Shanganagh catchments. The Shanganagh River discharges into the sea near Ballybrack. The Carrickmines River and Cabinteely Stream, discharges into the Loughlinstown river which flows parallel to the N11 national road. The Carrickmines river flows through the M50 motorway in a west to east motion. The Loughlinstown river flows in a northwest to southeast direction before discharging into the Shanganagh River. The Shanganagh/ Loughlinstown Confluence flows under the N11.

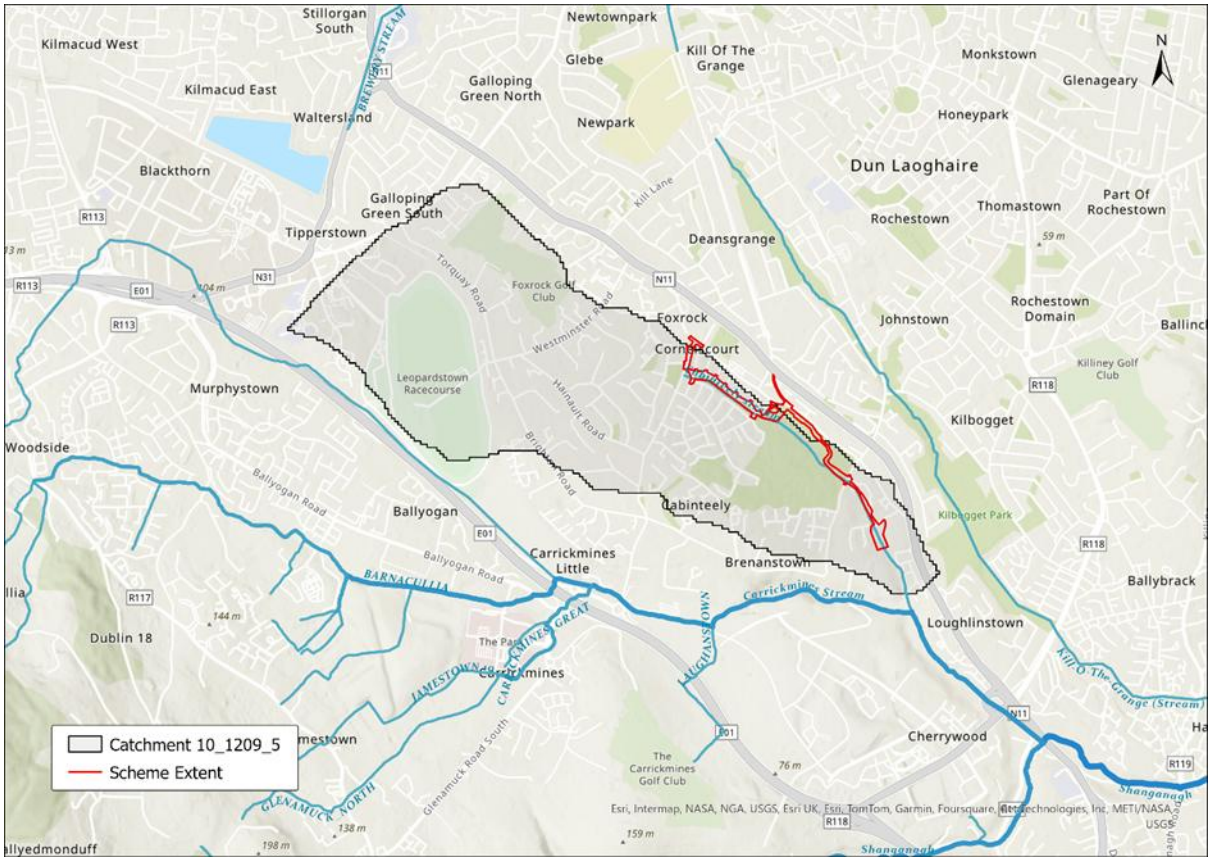


Figure 1-2 Watercourses in vicinity of the site

1.4 Topography

The topography is an important factor in terms of assessing and understanding the flood risk associated with the site. Online sources can provide a baseline of information which can assist the flood risk identification process.

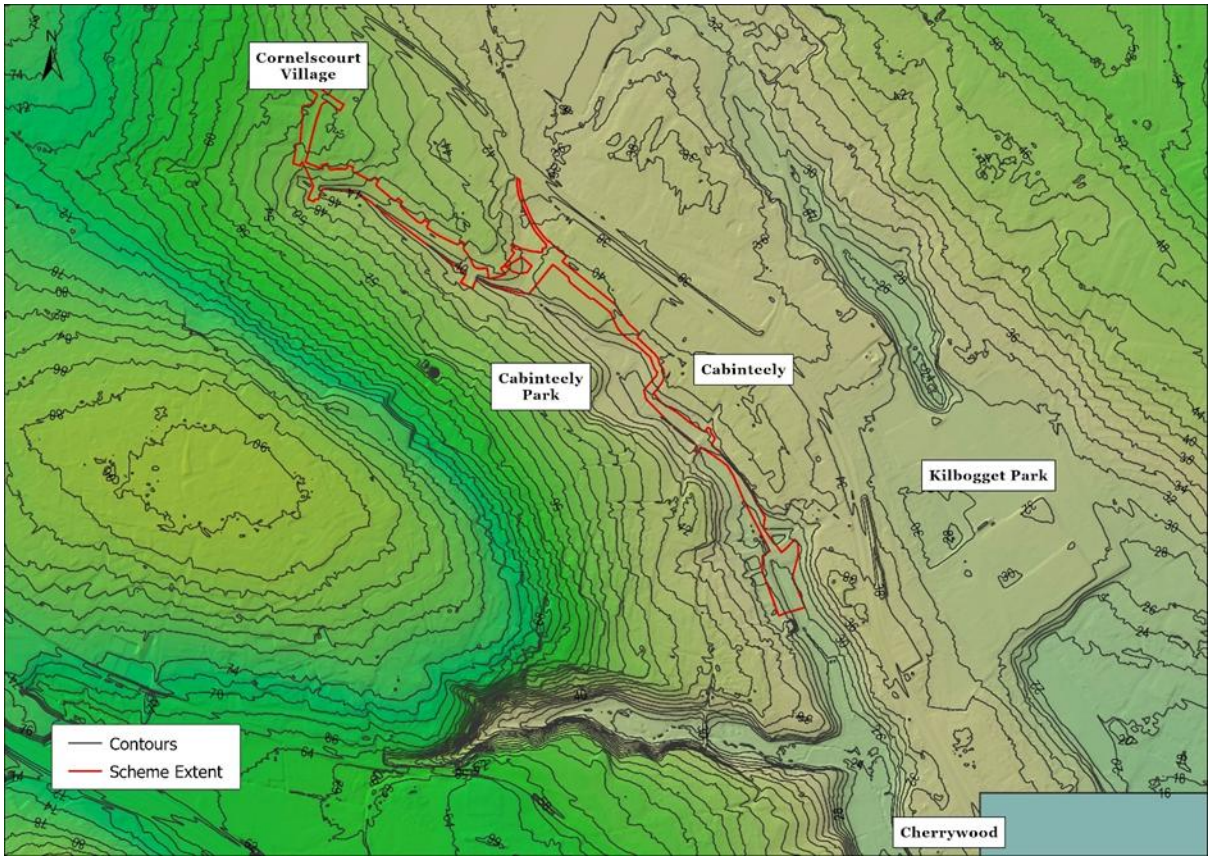


Figure 1-3 Site Topography

Figure 1-3 Site Topographysuggests a gradual increase in elevation from the southwest to northwest across the site. The elevation appears to vary between approximately 31m to 53m AOD.

1.5 Pedestrian and Cycle Route Construction Alongside Road

Figure 1-1 Proposed Indicative Route of Cabinteely Greenway (Source; www.dlrcoco.ie)shows a significant proportion (Section A and B) of the proposed route, approx. 1km, is to be constructed adjacent to or on an existing road/ path surface. Given the location, access and low maintenance requirements, robust construction forms are preferred. Therefore, Bituminous construction in accordance with the recommendations from the Design Manual for Urban Roads and Streets (DMURS) and for pavement construction standards, Table 5.1 of the Cycle Design Manual is considered the most appropriate.

As there is to be no positive drainage on this scheme, the run off method will be used. This will be achieved by the use of hard surfacing, all stormwater will infiltrate into the surrounding landscaped areas from hard surfaced areas. This will result in no additional stormwater entering into the existing network.

Some similar cycle/ pedestrian route examples are provided below for illustration. In key locations such as Glen Lawn Drive, considered options that provide a safer more pedestrianised feel will be provided to ensure safety amongst residents and reducing vehicular traffic. Figure 1-4 Glen Lawn Drive Section below illustrates a typical section displaying how the pedestrian path will coexist alongside traffic.

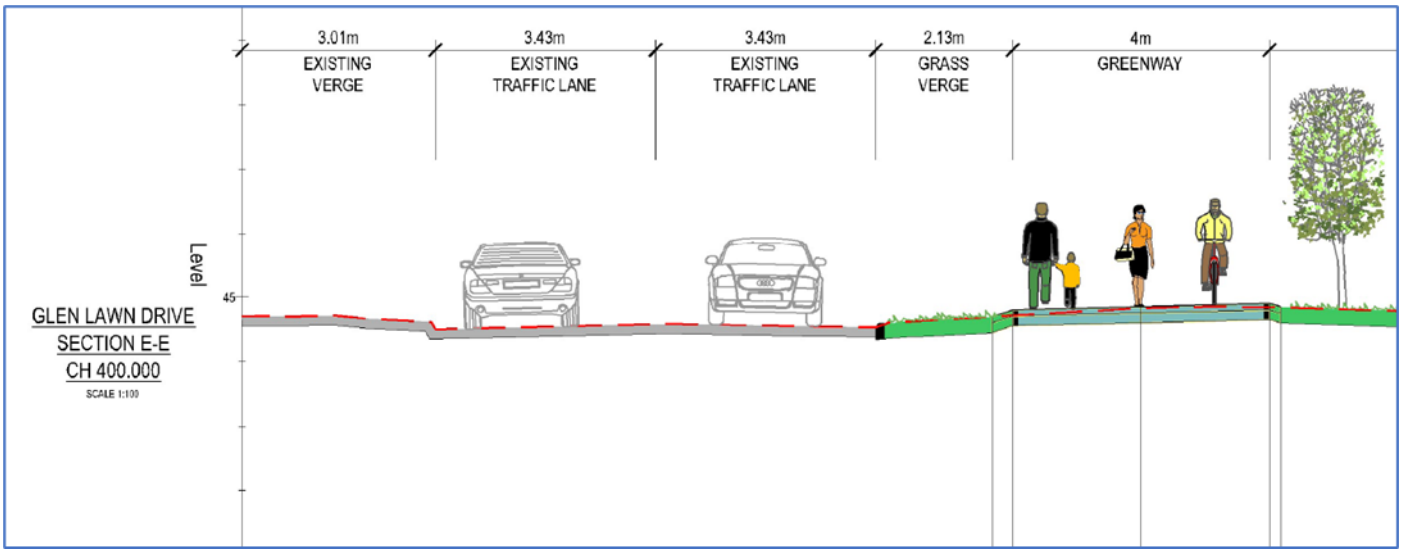


Figure 1-4 Glen Lawn Drive Section

1.6 Pedestrian and Cycle Route Construction Along an Existing Path

There is approximately 0.9km of the route that will be constructed both directly on and alongside an existing path through Cabinteely Park. This section is proposed to be a 5m wide shared use path of bituminous construction in accordance with the recommendations of the Design Manual for Urban Roads and Streets (DMURS) to allow a robust and long-lasting solution that will require limited maintenance.

Figure 1-5 Cabinteely Park Section below shows a typical section of shared path along the greenway.

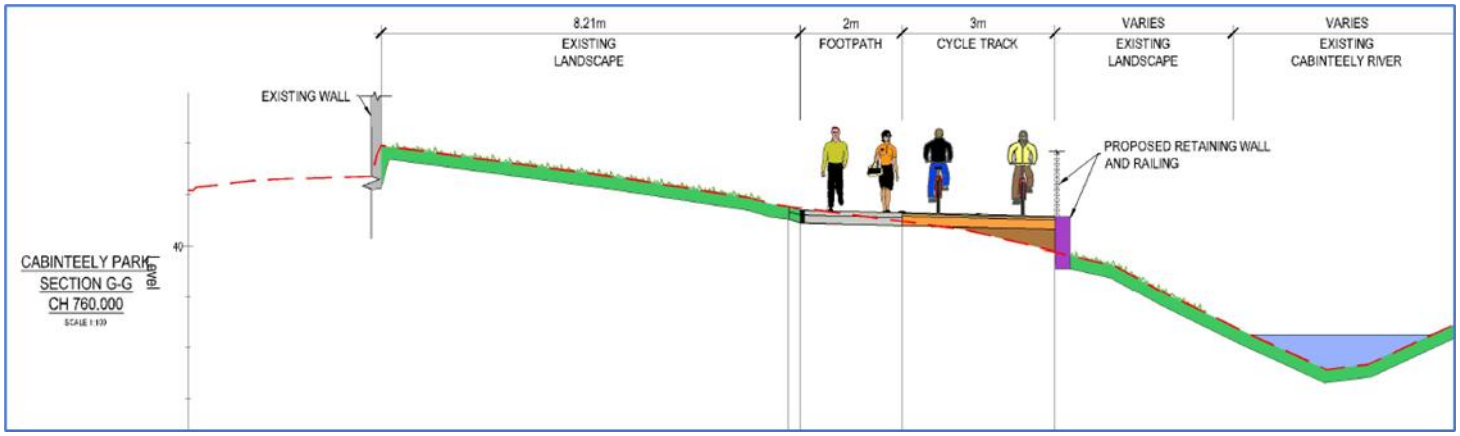


Figure 1-5 Cabinteely Park Section

2 Planning System Flood Management Guidelines

2.1 General

"The Planning System and Flood Risk Management Guidelines for Planning Authorities" (Government of Ireland, Nov 2009) and its technical appendices outline the requirements for a Flood Risk Assessment.

The assessment of flood risk requires an understanding of where water comes from (the source), how and where it flows (the pathway) and the people and assets affected by it (the receptors).

The principal sources are rainfall or higher than normal sea levels, pluvial and fluvial flooding. The principal pathways are rivers, drains, sewers, overland flow and river and costal floodplains and their defence assets. The receptors can include people, their property and the environment. All three elements are examined as part of the flood risk assessment including the vulnerability and exposure of receptors to determine potential consequences.

Risks to people, property and the environment should be assessed over the full range of probabilities, including extreme events. Flood risk assessment should cover all sources of flooding, including effects of run-off from development locally and beyond.

2.2 Sequential Approach

This FRA applies the sequential approach to flood risk assessment as outlined in guidelines. The process begins by establishing the flood zone category of the site. The next stage is to determine the vulnerability classification for the proposed development. Using these determinations, the development is either considered appropriate or will require that a justification test to be carried out. Below Figure 2-1 Sequential approach in the planning process (Source: OPW Guidelines for planning authorities)illustrated the sequential approach.

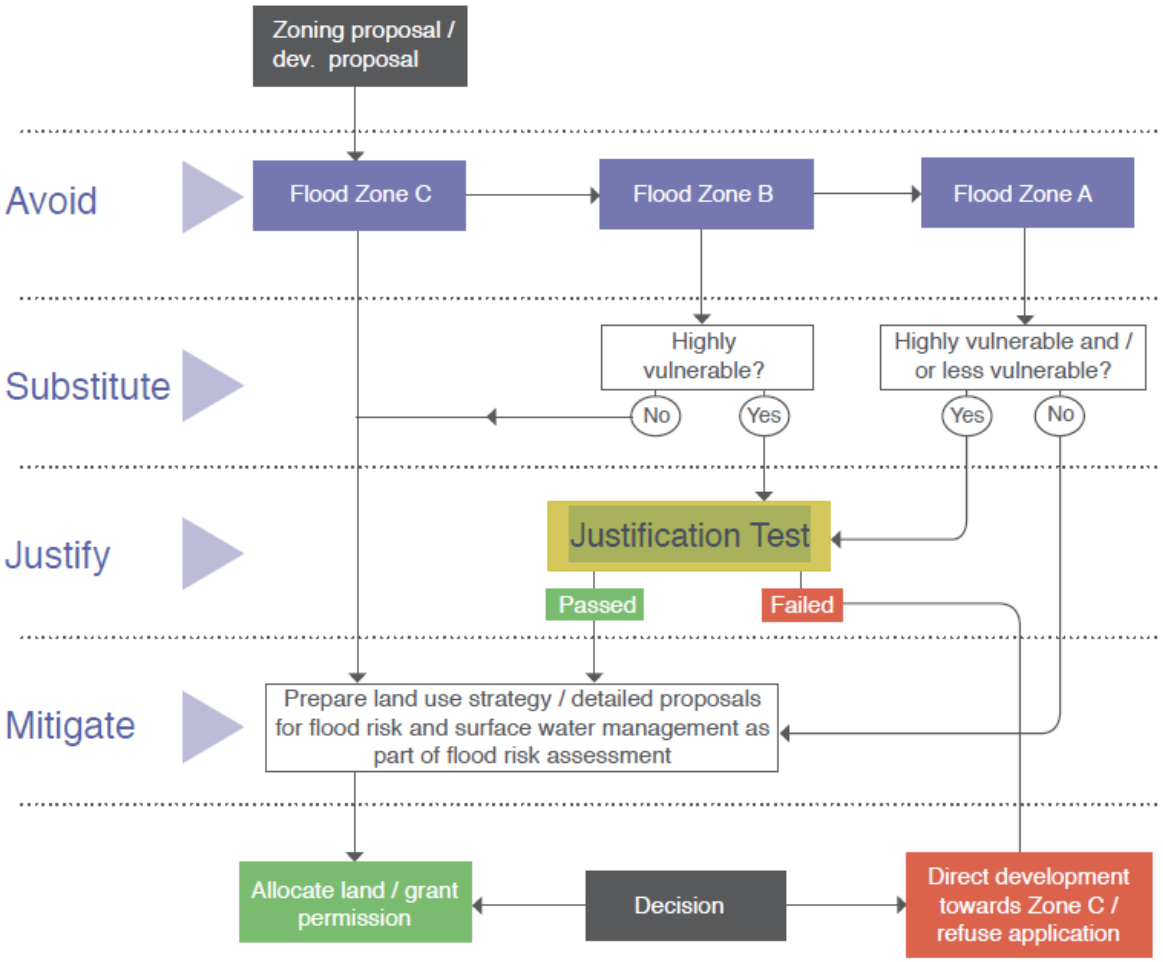


Figure 2-1 Sequential approach in the planning process (Source: OPW Guidelines for planning authorities)

2.3 Flood Zones

The FRM Guidelines uses flood zones to determine the likelihood of flooding and or flood risk management as part of the planning process. The three flood zones are identified below.

Zone A- where the probability of flooding from rivers and the sea is highest (i.e., greater than 1% AEP for river flooding and 0.5% for coastal flooding).

Zone B- where the probability of flooding from rivers and the sea is moderate (i.e., between 0.1% and 1% for river flooding and between 0.1% and 0.5% for coastal flooding).

Zone C- where the probability of flooding from rivers and the sea is low (i.e., less than 0.1% or for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.

2.4 Vulnerability

The FRM Guidelines also categorised types of development as either;

- **Highly Vulnerable**- e.g., dwellings, hospitals, fire stations, essential infrastructure.
- **Vulnerable**- e.g., retail, commercial or industrial buildings, local transport infrastructure.
- **Water Compatible**- e.g., flood infrastructure, docks, amenity open space.

2.5 Flood Zone vs. Vulnerability

The aim of the FRM Guidelines, using the sequential approach, is to ensure that development is best positioned on land that is at the lowest risk of flooding appropriate to the level of vulnerability assigned. Where the form of development is not considered appropriate, a justification test can be undertaken.

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (including essential infrastructure)	Justification Test	Justification Test	Appropriate
Less vulnerable development	Justification Test	Appropriate	Appropriate
Water-compatible development	Appropriate	Appropriate	Appropriate

Figure 2-2 Matrix of flood zone vs vulnerability (source; OPW Guidelines for planning authorities)

2.6 Flood Risk Assessment Stages

The FRM Guidelines also outlines that a staged approach should be adopted when carrying out a flood risk appraisal or assessment. The stages of appraisal are:

Stage 1 Flood Risk Identification- to identify whether there may be any flooding or surface water management issues related to either the area of regional planning guidelines, development plans and LAP's or a proposed development site that may warrant further investigation at the appropriate lower-level plan or planning application levels.

Stage 2 Initial Flood Risk Assessment- to confirm sources of flooding that may affect a plan area or proposed development site, to appraise the adequacy of existing information and to scope the extent of the risk of flooding which may involve preparing indicative flood zone maps. Where hydraulic models exist the potential impact of a development on flooding elsewhere and of the scope of possible mitigation measures can be assessed. In addition, the requirements of the detailed assessment should be scoped.

Stage 3 Detailed Flood Risk Assessment- to assess flood risk issues in sufficient detail and to provide a quantitative appraisal of potential flood risk to a proposed or existing development or

land to be zoned, of its potential impact on flood risk elsewhere and of the effectiveness of any proposed mitigation measures.

This FRA comprises Stages 1,2 and 3 involving both identification, initial assessment, and a more detailed assessment of flood risk.

3 Stage 1- Flood Risk Identification

3.1 General

The initial flood risk identification stage uses existing information to identify and confirm whether there may be flooding or surface water management issues for the subject site which may warrant further investigation. According to DLR County Development Plan 2022-2028, the proposed site is categorised in zone F; "to preserve and provide for open space with ancillary active recreational amenities." This is seen below in Figure 3-1 Land Zoning Map Dún Laoghaire Rathdown County Development Plan 2022-2028. Zone F is indicative of a Water Compatible vulnerability scale, seen below in Figure 3-2 Land Zoning Objective Vulnerability Table Dún Laoghaire Rathdown County Development Plan 2022-2028.

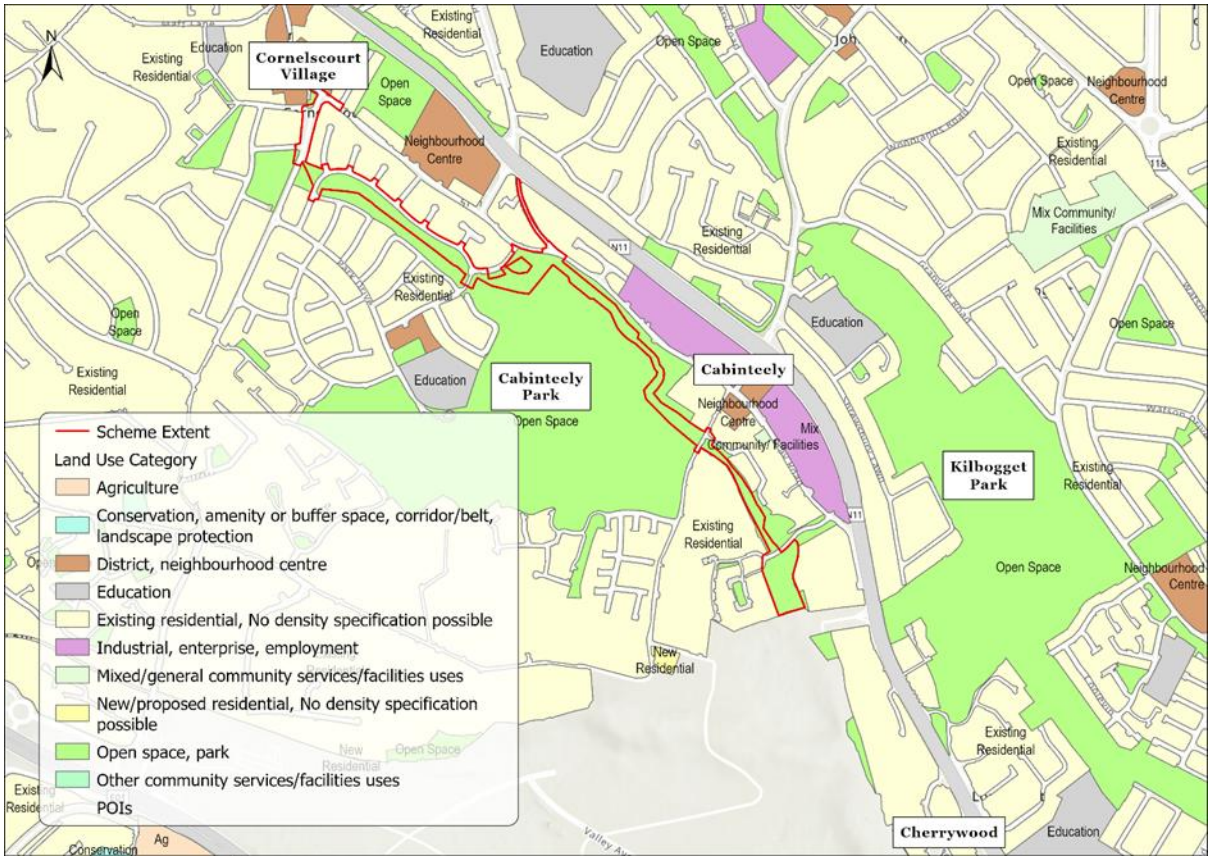


Figure 3-1 Land Zoning Map Dún Laoghaire Rathdown County Development Plan 2022-2028

Zoning Objective		Indicative Primary Vulnerability	Flood Risk Commentary in relation to the Justification Test for Plan Making
B	To protect and improve rural amenity and to provide for the development of agriculture.	Water compatible / less / highly vulnerable	Rural amenity will include water compatible uses, but individual and groups of residential and other developments may arise. Justification Test to be passed for highly vulnerable development in Flood Zone A and B and less vulnerable development in Flood Zone A.
DC	To protect, provide for and-or improve mixed-use district centre facilities.	Less / highly vulnerable	Justification Test to be passed for highly vulnerable development in Flood Zone A and B and less vulnerable development in Flood Zone A.
E	To provide for economic development and employment.	Less vulnerable	Justification Test to be passed for less vulnerable development in Flood Zone A.
F	To preserve and provide for open space with ancillary active recreational amenities.	Water compatible	Appropriate for all Flood Zones. Ancillary developments to be assessed in accordance with the sequential approach.

Figure 3-2 Land Zoning Objective Vulnerability Table Dún Laoghaire Rathdown County Development Plan 2022-2028

3.2 Information Sources

The following sources are considered relevant to the Cabinteely Greenway pedestrian and cycle route and have been researched in order to identify flood risks.

Information Source	Comments
Predictive and Historic flood maps/ OPW CFRAM Maps, and benefiting lands maps such as those at www.floods.ie	Whilst the map for this area is available, no flooding information is shown on the OPW Maps.
Dun Laoghaire Rathdown County development plan 2022-2028 Flood Maps.	Flood maps on DLRCC development plans displays a stream running through Cabinteely Park.
Groundwater Vulnerability Ireland	Geological Survey Ireland Groundwater Vulnerability maps display the site extents in to areas, Vulnerability

	Category E & H, extreme and high respectively.
Strategic Flood Risk Assessment DLRCC	Information provided on DLRCC Development plan Appendix 25 regarding flood risk extents surrounding Cabinteely and Shanganagh river.

Table 1- Flooding Information Sources

3.3 Initial Findings

3.3.1 OPW CFRAM Flood Maps

The National Catchment-based Flood Risk Assessment and Management (CFRAM) Programme set out to study and assess flood risk in Ireland and focused on communities at risk of significant flooding. After Reviewing the OPW National Irish CFRAM Programme 2004, the various areas that were studied and investigated, flood plans were published displaying their findings in relation to flooding.

Figure 3-3 below shows the extent of the map showing Cabinteely and the flood risk to surrounding areas. It is clear to see that flooding is observed to the northeast of Cabinteely Park in Kill of the Grange. However, it does not show any significant flooding or mention of watercourse flowing through Cabinteely and the extents of the proposed scheme.

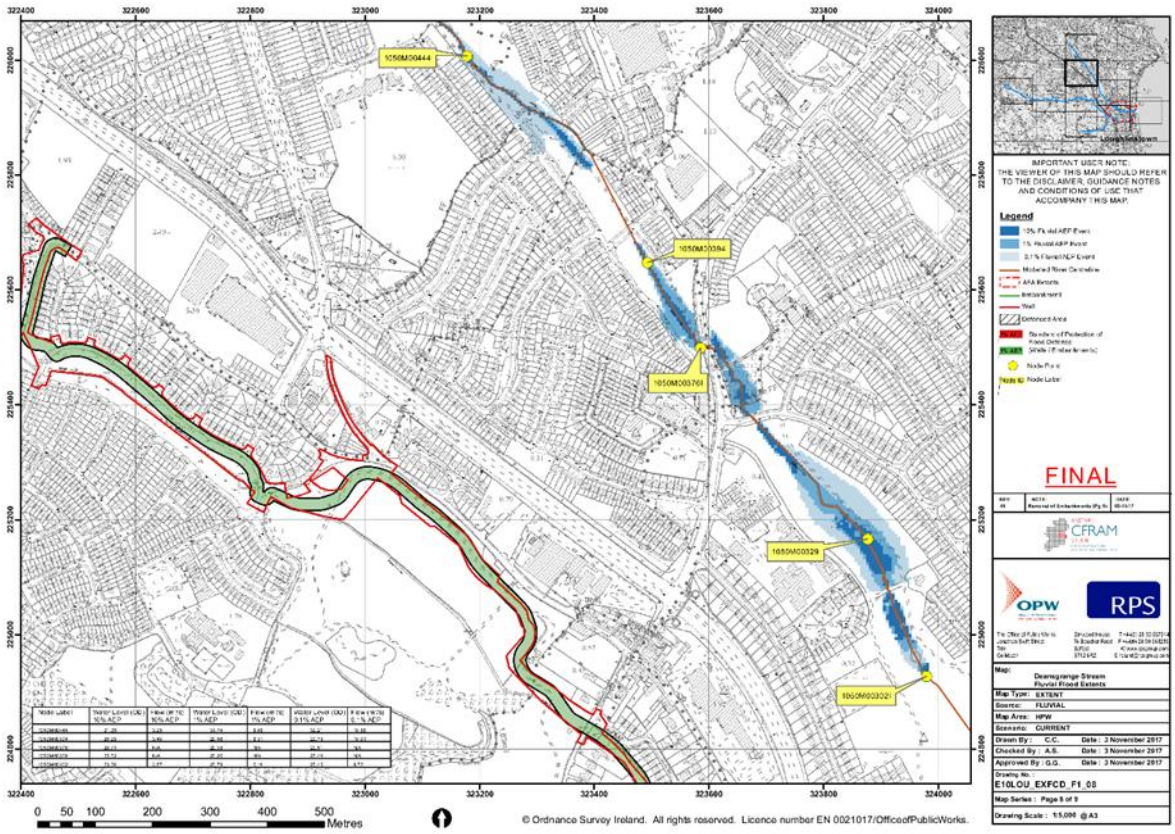


Figure 3-3 CFRAM Flood Map Displaying Indicative Cabinteely Greenway Route

3.3.2 Dún Laoghaire Rathdown Development Plan 2022-2028 Flood Maps

No flood data was discovered for the proposed development through Glen Lawn drive, Cabinteely Park, Clonkeen Road and Brennanstown Road in the CFRAM.

However, within the more recent maps within the Dun Laoghaire Rathdown County Council Development plan 2022-2028, it is noted that the stream running south of Glen Lawn drive and Cabinteely Park, known as 'St Brides Stream' but also referred to as Cabinteely Stream, is a proposed flood risk to the site.

This flood map can be seen below in Figure 3-4 showing the red line boundary of the proposed greenway, indicating the stream running through the site extents.

This map indicates that the stream is within flood Zone A and B and the blue triangle near Brennanstown Road indicates a risk of Fluvial- Surface water flooding.

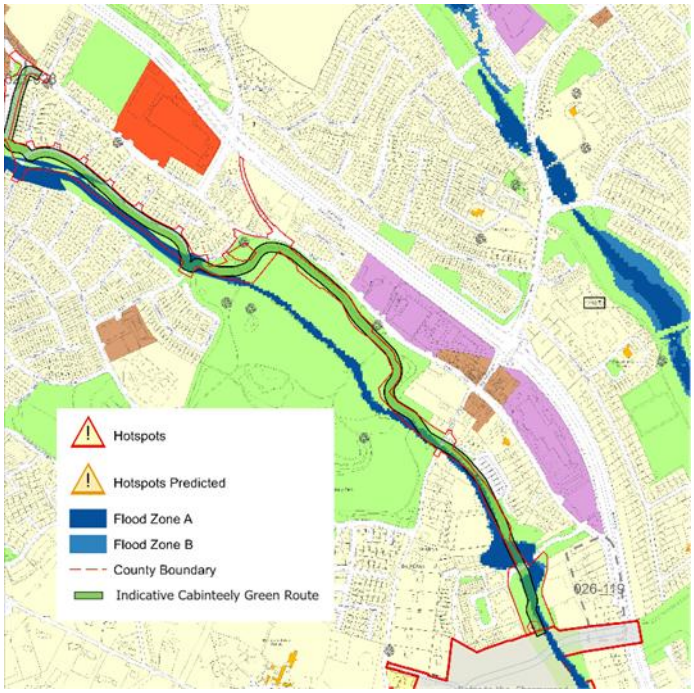


Figure 3-4 Dún Laoghaire Rathdown County Development Plan 2022-2028 Flood Map 7

3.3.3 National Groundwater Vulnerability Ireland

After reviewing Geological Surveys from Department of Environment, Climate and Communications, it is seen from National Groundwater Vulnerability Maps, the proposed site falls in two main categories which are Category H described as high and category E described as extreme. While water level may rise slowly, ground water flooding can last for extended periods of time. The use of resin-bound surfacing on this scheme will help to alleviate flooding risks on the proposed greenway. Below Figure 3-5 shows groundwater vulnerability map in the area.

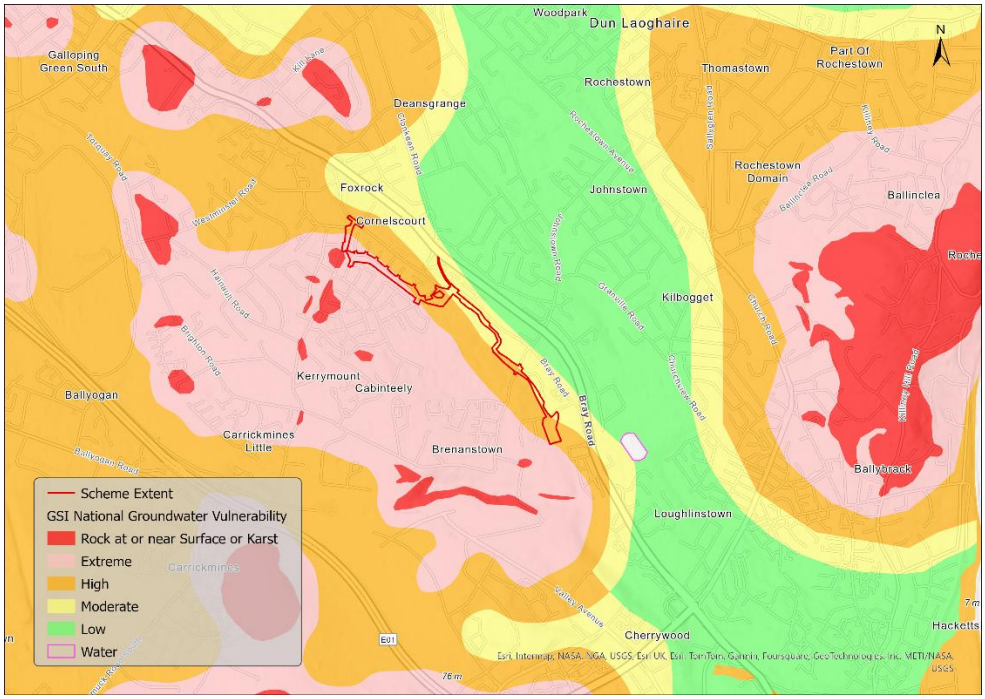


Figure 3-5 Groundwater Vulnerability Category Map

3.3.4 OPW Flood Hazard Map

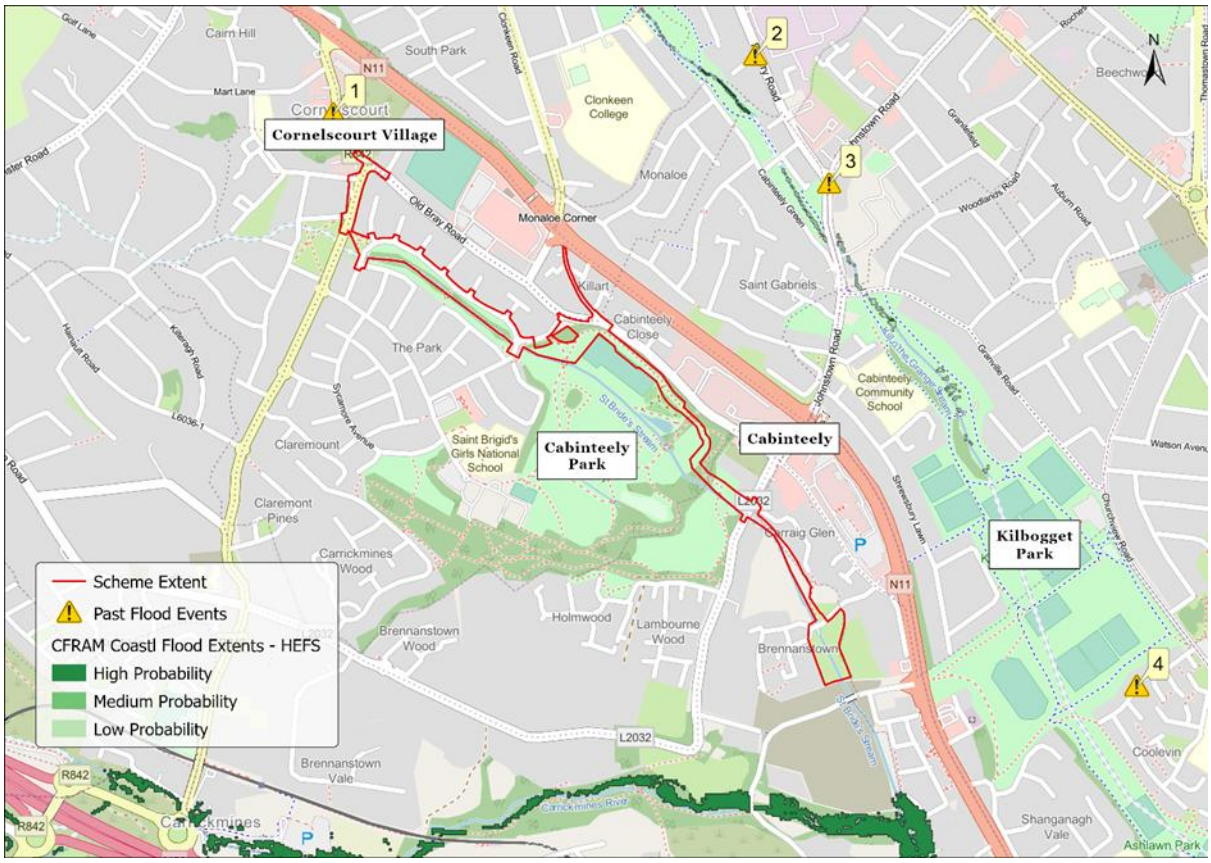


Figure 3-6 OPW Flood Hazard Map Flood Maps - Floodinfo.ie

The OPW Flood Hazard Maps website was consulted in relation to available historical or anecdotal information on any flooding incidents or occurrence in the vicinity of the greenway. Figure 3-6 above indicates all flood events in the area nearby the proposed site. All flood events are detailed in Table 2 below.

Location	Date	Summary of Events	Source
1- Cornells Court Shopping Centre.	21/8/2021	No Reports Available	N/A
2- Little Meadow, Pottery Road, Cabinteely Dublin 18.	24/10/2011	Flows in the stream exceeded the available capacity of a length of culverted stream and overflowed following a path overland that closely followed the historical or pre-culverted stream route. 3 NO. Residential properties were affected by this flood in Little Meadow and Pottery Road.	Deansgrange Stream
3- Deansgrange Johnstown Pottery Road	5/11/1982	A large quantity of debris in the stream blocked culverts and obstructed flows in the stream causing flooding. Arrangements are being made for this stream to be cleared out as it is one of the worst streams in South County Dublin affected by fly tipping. A number of houses were affected by this flood.	Deansgrange Stream
4- Coolevin Ballybrack	9/2/1980	Complaints received from residents that 6 gardens had been flooded to a depth of 7 inches. This was a result of the drainage system in a park area (most likely Kilbogget Park).	Kill O' The Grange Stream

Table 2- Flood Events in Surrounding Area

Furthermore, Figure 3-7 detailing the flood map in relation to the proposed development layout.

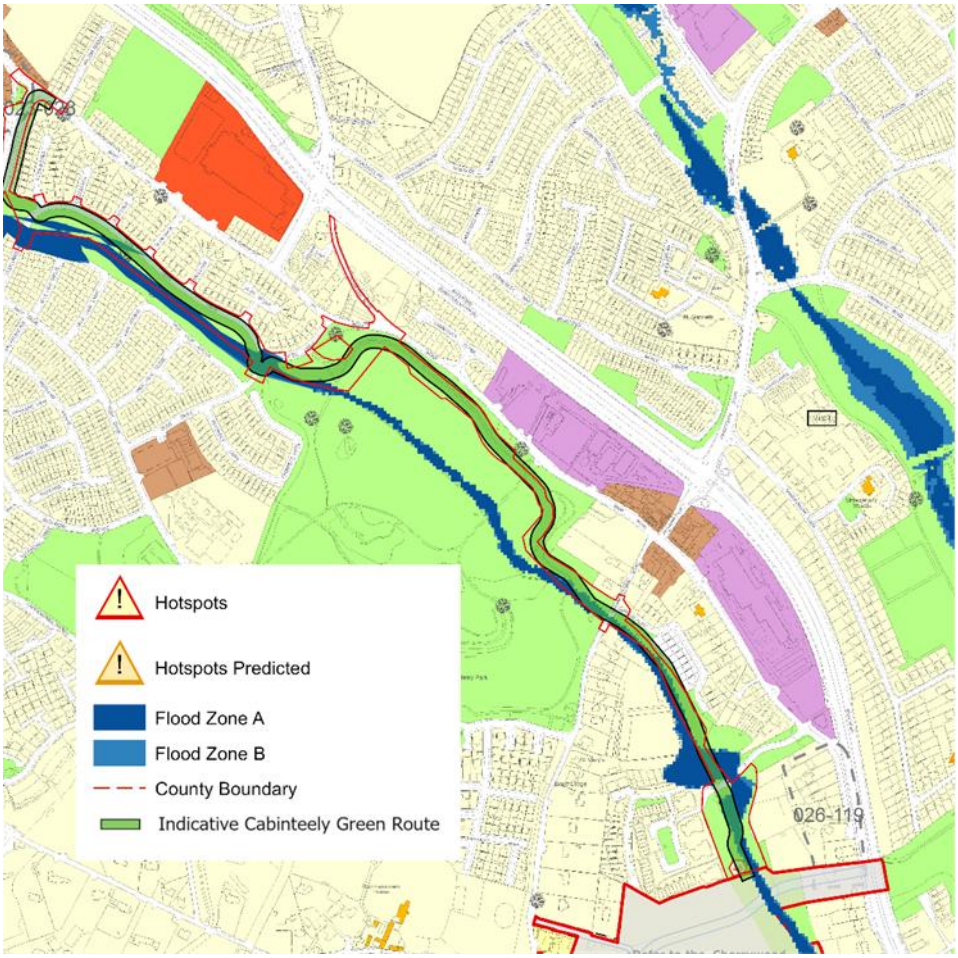


Figure 3-7 Flood map in relation to Proposed Site Layout

The initial flood risks identified above are summarised below.

- Significant risk of fluvial flooding in certain areas from the Cabinteely Stream running through Cabinteely Park.
- High/ Extreme risk of groundwater flooding.

3.4 Vulnerability Classification

The assignment of a vulnerability class for the proposed pedestrian and cycle route is a key decision in the level of flood risk that is appropriate. The route will predominantly be used as a leisure route helping to provide people with a safe, convenient active travel route which will encourage a greater uptake in travel by sustainable modes and reduce the number of short local trips made my car. Below Figure 3-8 displays the classification of vulnerability, the proposed cycle

and pedestrian route can be classified as amenity open space and outdoor sports and recreation and therefore is a water compatible development.

Less vulnerable development	Buildings used for: retail, leisure, warehousing, commercial, industrial and non-residential institutions; Land and buildings used for holiday or short-let caravans and camping, subject to specific warning and evacuation plans; Land and buildings used for agriculture and forestry; Waste treatment (except landfill and hazardous waste); Mineral working and processing; and Local transport infrastructure.
Water-compatible development	Flood control infrastructure; Docks, marinas and wharves; Navigation facilities; Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location; Water-based recreation and tourism (excluding sleeping accommodation); Lifeguard and coastguard stations; Amenity open space, outdoor sports and recreation and essential facilities such as changing rooms; and Essential ancillary sleeping or residential accommodation for staff required by uses in this category (subject to a specific warning and evacuation plan).

Figure 3-8 Vulnerability Classification (Source; OPW Guidelines for planning authorities)

4 Stage 2- Initial Flood Risk Assessment

4.1 Flood Sources

The possible flooding mechanisms in consideration of the proposed Green, (Greenway, Cycle and Pedestrian), Routes Network are summarised in Table 3 below.

The purpose of this screening assessment was to identify whether a potential risk of flooding exists and to what extent for the proposed works. The assessment was based on the collation and assessment of existing current information, historical information and data which may indicate the level or extent of any flood risk.

A source-pathway-receptor model has been produced to summarise the possible sources of floodwater, the pathways by which flood water could reach receptors and the receptors that could be affected by potential flooding. See Table 3 below.

It outlines effects of various potential sources, the performance and response of pathways and the consequences to the receptors in the context of the proposed development.

Additionally, Table 4 showing the risk matrix, explains the impact and likelihood of a flood event on the proposed development.

These sources, pathways and receptors will be assessed further by the initial flood risk assessment stage.

Source	Pathway	Receptor	Likelihood	Consequence	Risk
Fluvial	Cabinteely Stream runs through Cabinteely Park.	People/ cycle/ vehicular route	Probable	High	Significant
Surface water (Pluvial)	Blockage and / or surcharging of the existing road surface water drainage network.	People/ cycle/ vehicular route	Possible	Low	Moderate
Groundwater	Rising groundwater levels within the site	People/ cycle/ vehicular route	Probable	High	Significant

Table 3- Source Pathway Receptor Analysis

		Impact				
		Very Low	Low	Medium	High	Very High
		2	3	4	5	6
Likelihood	Highly Probable	Moderate	Significant	Significant	Severe	Severe
	Probable	Moderate	Moderate	Significant	Significant	Severe
	Possible	Minor	Moderate	Moderate	Significant	Significant
	Unlikely	Minor	Minor	Moderate	Moderate	Significant
	Rare	Moinor	Minor	Minor	Moderate	Moderate

Table 4- Qualitative Risk Matrix

4.2 Determination of Flood Zones

After reviewing the flood zone determination guidelines in section 2 it is clear from table 5 that due to the location and severity of flood zone in relation to the site the development can be assigned a vulnerability classification of Water compatible Development. Table 5 below indicates the land uses and types of development allowed within this vulnerability class.

Vulnerability Class	Land uses and types of development
Water- compatible development	Flood Control infrastructure; Docks, marinas and wharves; Navigation facilities; Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location; Water-based recreation and tourism (excluding sleeping accommodation); Lifeguard and coastguard stations; Amenity open space, outdoor sports and recreation and essential facilities such as changing rooms; and Essential ancillary sleeping or residential accommodation for staff required by uses in this category (subject to a specific warning and evacuation plan).

Table 5- Classification of Vulnerability, Source: the planning system and flood risk management- guidelines for planning authorities

In accordance with 'The Planning System and Flood Risk Management- Guidelines for planning authorities (DOEHLG 2009)' there are three flood zones designated in the construction of flood risk to a particular site. The three flood zones are described in Table 6 below.

Flood Zone	Description
Flood Zone A	High probability of flooding. Most types of development would be considered inappropriate in this zone. Development in this zone should be avoided and/or only considered in exceptional circumstances, such as in city and town centres, or in the case of essential infrastructure that cannot be located elsewhere, and where the Justification Test has been applied. Only water-compatible development, such as docks and marinas, dockside activities that require a waterside location, amenity open space, outdoor sports and recreation, would be considered appropriate in this zone.
Flood Zone B	Moderate probability of flooding. Highly vulnerable development, such as hospitals, residential care homes, Garda, fire and ambulance stations, welling houses and primary strategic transport and utilities infrastructure, would generally be considered inappropriate in this zone, unless the requirements of the Justification Test can be met. Less vulnerable development, such as retail, commercial and industrial uses, sites used for short let for caravans and camping and secondary strategic transport and utilities infrastructure, and water-compatible development might be considered appropriate in this zone. In general, however, less vulnerable development should only be considered in this zone if adequate lands or sites are not available in Zone C and subject to an FRA to the appropriate level of detail to demonstrate that flood risk to and from the development can or will adequately be managed.
Flood Zone C	Low probability of flooding. Development in this zone is appropriate from a flood risk perspective (subject to assessment of flood hazard from sources other than rivers and the coast) but would need to meet the normal range of other proper planning and sustainable development considerations.

Table 6- Planning implications relating to each flood zone Source: the planning system and flood risk management- guidelines for planning authorities.

In consideration to the above guidelines, the 1% AEP and 0.1% AEP fluvial event is to be taken into account in order to assess whether the site is located within flood zones A or B.

4.2.1 Coastal Flooding

The site is not at risk of coastal flooding as the waterbodies within the site and surrounding the site are not tidally influenced, thus no further assessment will be carried out. Below in Figure 4-1 the coastal flood map shows that the site is within Flood Zone 'C' from a coastal flood risk perspective.

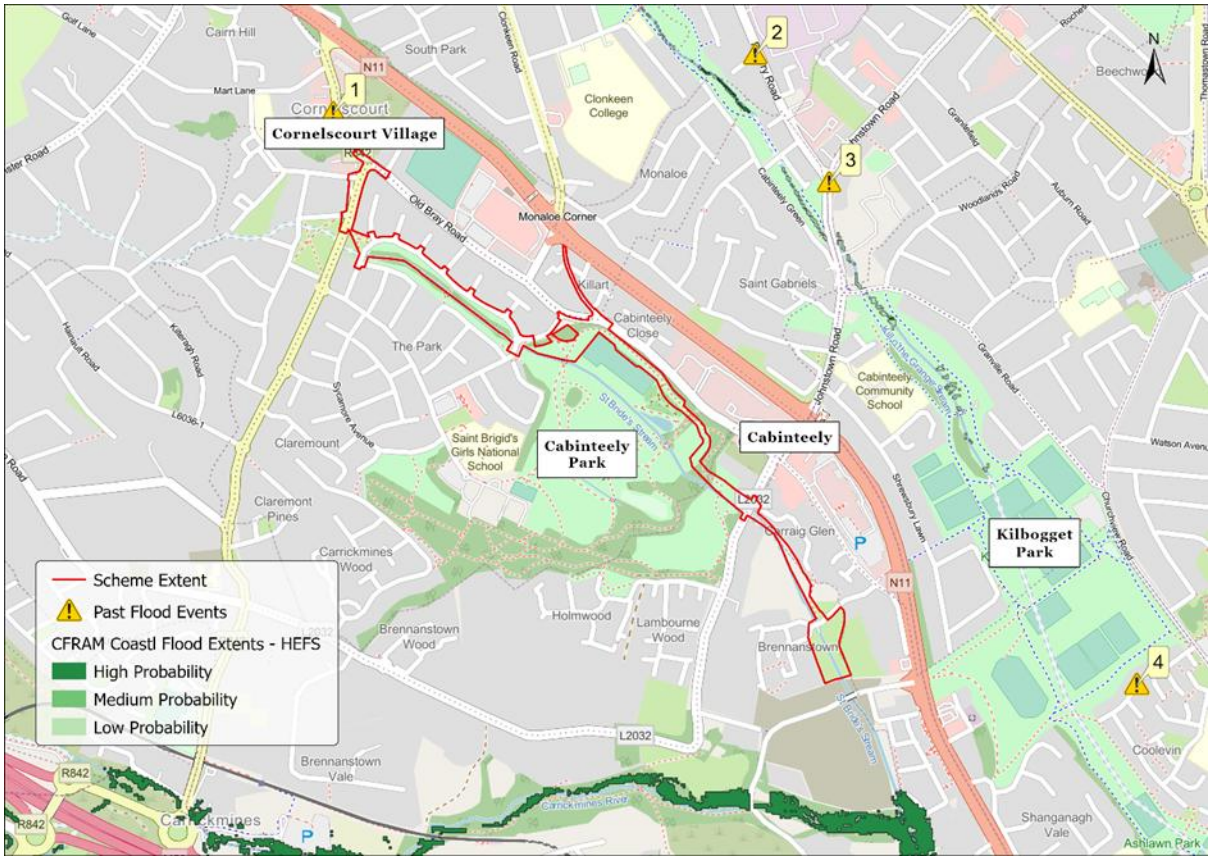


Figure 4-1 Coastal Flood Map

4.2.2 Fluvial Flooding

The CFRAM Flood Maps confirms out of bank flooding along the Carrickmines River, Loughlinstown River, and Shanganagh River. Upstream of the crossing point between the Shanganagh River and the N11, and at the confluence of the Shanganagh and Loughlinstown Rivers, lands within Flood Zone A and B are mainly zoned for water compatible uses, which should be retained. There are some areas of existing residential development including parts of Glen Lawn Drive and Carraig glen that are in Flood Zone A and B. In these areas of existing development, flood risks are generally moderate and risks to Minor Development and can be managed through site specific risk assessments in accordance with the specification guidance in this SFRA. Figure 4-2 illustrates the local watercourses in the area in relation to the proposed greenway.

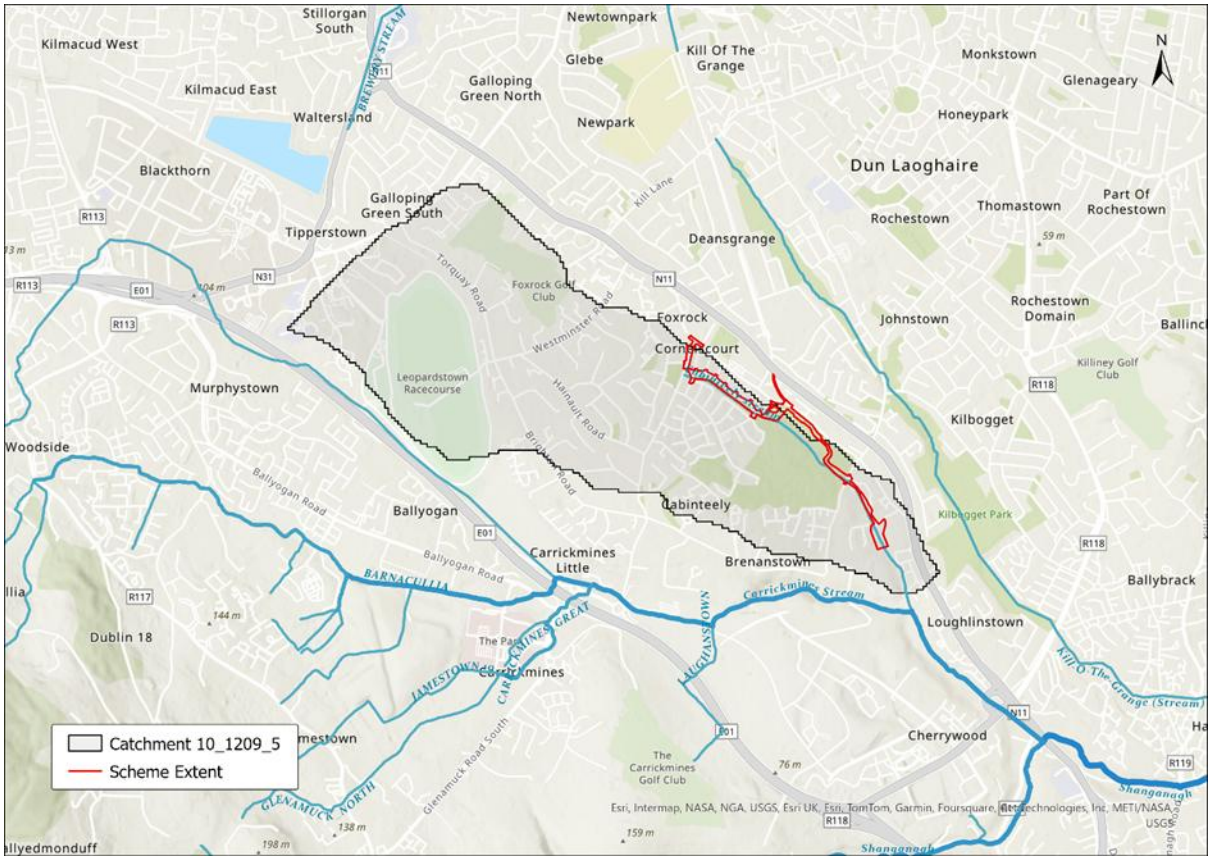


Figure 4-2 Map of surrounding water courses

4.2.3 Pluvial Flooding (Urban Drainage)

The current surface water management practices are fit for purpose. The existing road areas already have their own drainage network. The park areas will be drained into the stream, and as previously mentioned, positive drainage will not be used in this scheme. Instead, surfacing materials will promote runoff and drainage and prevent flooding. Due to nature of the proposed development no further action is required to determine the impact associated with the development. See below Figure 4-3.

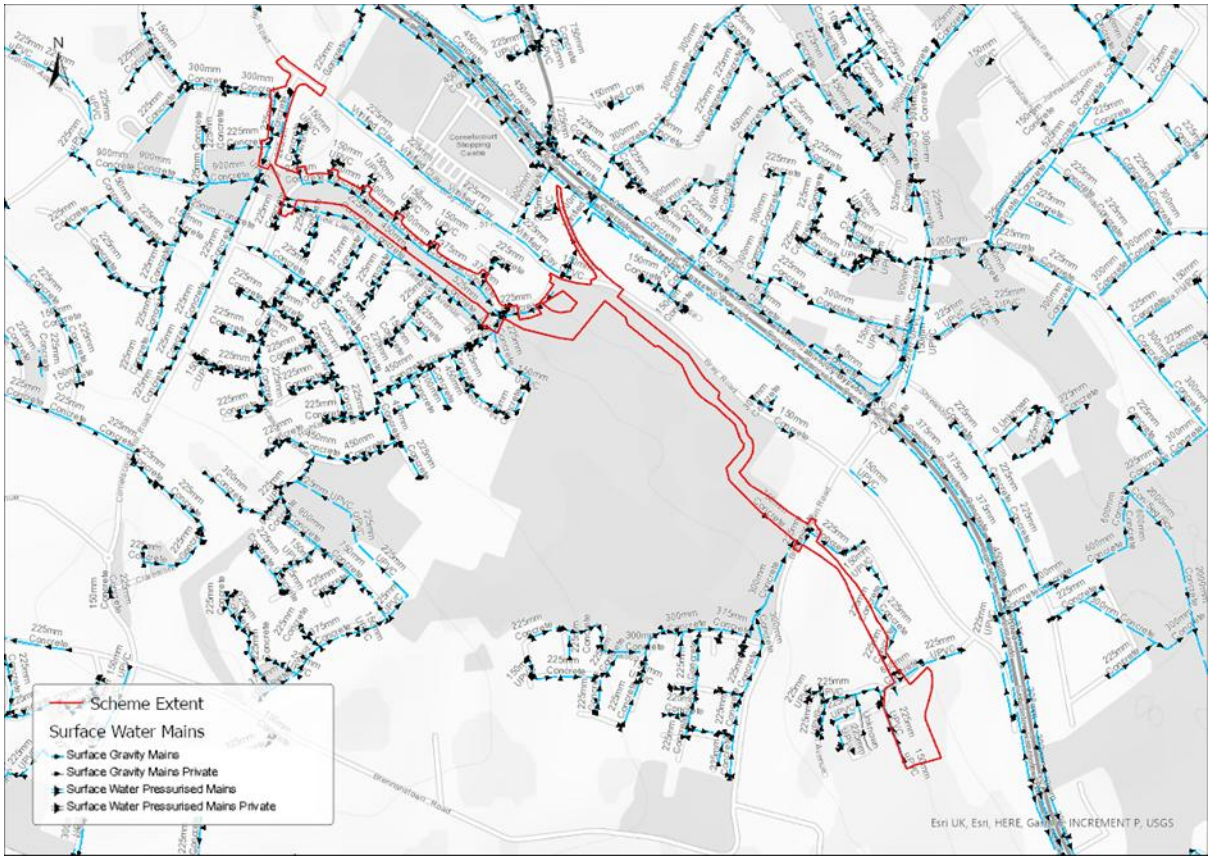


Figure 4-3 Existing Drainage Network Surrounding site

4.3 Justification Test Requirement

The requirement for a justification test was reviewed for this study to determine whether the proposed works would be considered acceptable in terms of flood risk. The conclusion of 'Stage 1- Flood Risk Identification' noted that there is a risk of fluvial flooding thin the new development from Cabinteely Stream.

After using the Risk Matrix in Table 4, it was deemed that the likelihood of flooding was Probable due to the stream being in flood Zone A and B. The impact of flooding was seen as high resulting in an overall classification of 'Significant'. The requirement for a justification Test is based on the type of development and flood zone designation as indicated in Table 7 below.

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

Table 7- Justification Test Matrix Source: the planning system and flood risk management- guidelines

Given the determination of the flood zone as Flood Zone A for the Cabinteely Greenway route and determination of the development as Water Compatible Development a justification test is not required to be passed as the development is appropriate.

4.4 Stage 2 Flood Assessment Conclusion

In order to fulfil the justification test there is a requirement to quantify the flood risk at the proposed site and where necessary mitigate the flood risk.

Initial Findings from Stage 2 Assessment are the different flood sources for the area, these being Fluvial and groundwater which are both ranked '*Significant*' based on the Risk matrix in Table 4. Similarly, another flooding source is Surface water (Pluvial), this has also been ranked using the Risk Matrix in Table 4 and this was classified as '*Moderate*' based on that same matrix.

After Assessing these sources, the determination of flood zones and vulnerability classification it was clear that the site was a Water Compatible Development within Flood Zone A. This is seen above in Table 7.

Additional findings in relation to coastal, fluvial and pluvial flooding found that coastal flooding posed no risk to the proposed site. Fluvial flooding showed a potential risk of flooding, and pluvial flooding doesn't pose a risk as currently the road areas are draining into the existing system.

After reviewing all relevant maps and data, it is clear that the main threat and primary cause of flooding within the proposed site will be fluvial flooding.

However, whilst the main risk will be Fluvial Flooding it must be noted that the extents of the flooding on the proposed site is limited due to the nature of the development and the location of flood plains. Access and egress must remain of high importance during flood events to ensure health and safety remains at the forefront in the event of any flooding. Therefore, in order to reduce the impact of flooding on the new development mitigating measures must be used when

appropriate to reduce risk such as alternative surfacing materials in footpaths and roads in order to control water runoff.

While the proposed development can be classed as water compatible, and its construction has been deemed under 'Flood Zone A' it is appropriate without any justification. The flood risk to the site overall is Low, though a detail flood risk assessment will be conducted for the proposed pedestrian bridge over Cabinteely Stream to determine bridge levels.

5 Stage 3- Detailed Flood Risk Assessment

Section 5 of this report has concluded that while a detailed flood risk assessment is not required for the greenway the flood levels and potential impact need to be determined at the proposed new crossing location of the Cabinteely Stream just south of Brennanstown Avenue where the greenway passes over the stream to the south side of it. This has been achieved through the development of a linked 1D-2D flood model. The following section will outline the process undertaken to calculate the Q values (seen in Appendix A), along with the development of the hydraulic model.

5.1 Model Geometry, Build and Parameters

In order to determine the base level of the bridge deck the Civil 3D modelling tool *'Hydraflow Express'* was used. In order to use this tool, existing site survey levels were required in order to determine invert levels of the stream and ground levels either side of the stream.

The existing site topo survey revealed an invert level of 26.49m at the bed of the stream and on either side of the stream on the embankment the ground level was 27.67m and 27.59m. Based on these levels the following baseline data was obtained and used in the model.

- Bottom Width: 1m
- Side Slope: 2.5: 2.7
- Total Depth: 1.2m
- Invert Level: 26.49m
- Slope: 0.25

Additionally Manning N is taken from Chow 1959, Mannings N for Channels, where it states that for Natural streams, that are: clean, winding, some pools, shores, stones, weeds, Mannings N is approx. 0.045.

The slope of the steam based on the topo survey is approx. 0.25%.

5.2 Model Scenarios

Q values vary for different storm events. Q bar= 1.32, Q100= 1.37 and Q1000=1.82. The Q value is calculated using peak flow formula.

The model illustrates three different scenarios. It was to be tested using the following QBar, Q100 and Q1000 peak flow rates in order to determine maximum water depths.

Using the FSR Regional Statistical Method (FSR 6 Variable) the QBar is 0.701m³/s.

5.3 Baseline Model Results

Using the Values detailed above, the following section will detail the results from these values after modelling.

Q100

The Q100 value was calculated by multiplying the Qbar value by the growth factor for Q100 taken from FSR which is 1.96. This resulted in a Q100 value of 1.37. Using this Q100 and the values detailed above in Section 5.1 the results of this model resulted in an overall max depth of 0.7468m, a top of water level of 27.23m, an area of 2.197sqm and Velocity of 0.6237m/s. these results can be seen below in Figure 5-1.

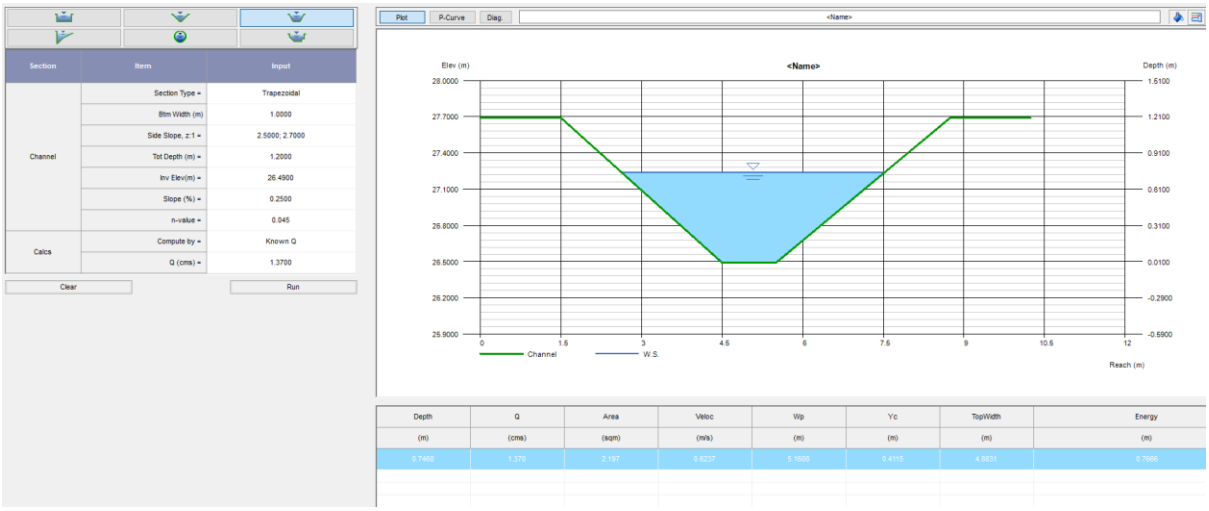


Figure 5-1 Q100 Hydraflow Model and Results

Q1000

The Q100 value was calculated by multiplying the QBar value by the growth factor for Q1000 taken from FSR which is 2.6. This resulted in a Q1000 value of 1.82. Using this Q1000 and the values listed in Section 5.1 the results of this model resulted in an overall max depth of 0.8473m, a top of water level of 27.34m, an area of 2.714sqm and velocity of 0.6706m/s. These results can be seen below in Figure 5-2.

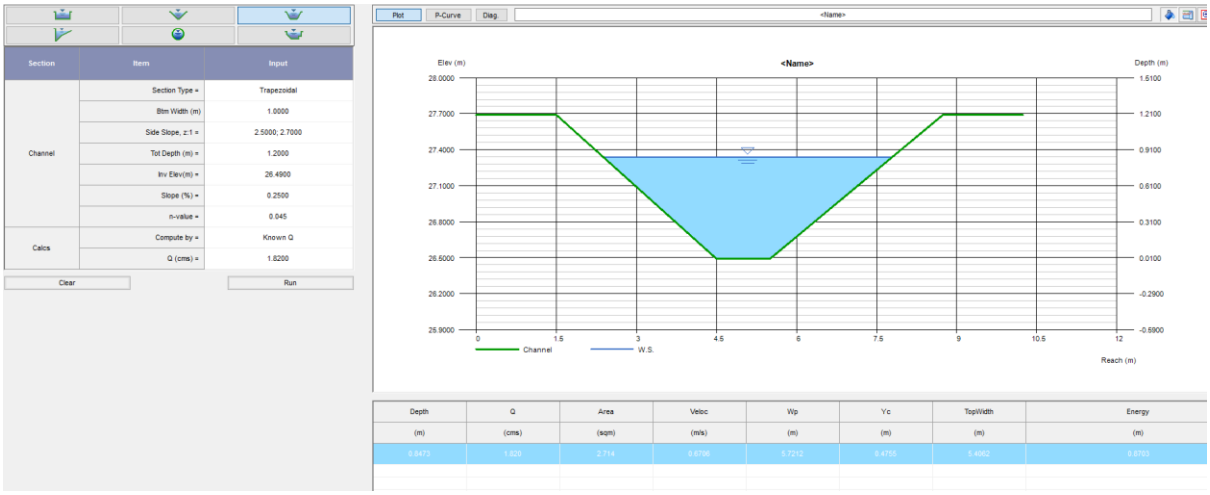


Figure 5-2 Q1000 Hydraflow Model and Results

Q Value

The Q value was calculated by dividing the Q1000 value by the Q100. This resulted in a Q value of 1.33 and the above values detailed above the maximum depth of water was 0.7346m. Resulting in a top of water level of approx. 27.22m. Additionally the area of the water was 2.137m² and velocity of 0.6222m/s. these values can be seen below in Figure 5-3.

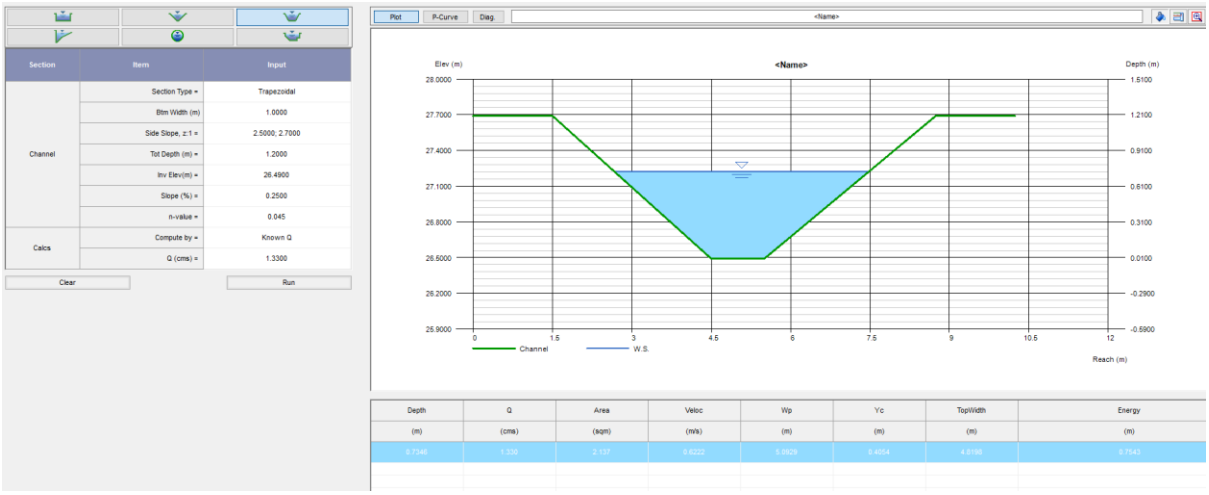


Figure 5-3 QBar Hydraflow Model and Results

5.4 Detailed Flood Risk Assessment Conclusion

After modelling the three results, the top of water level at the maximum storm event Q1000, is 27.34m. This level of **27.34m** will be taken as the top of water value, and the bridge deck design will be based on this value. The bridge deck has a proposed level of **28.85m** and the underside of the bridge deck has a proposed level of **28.4m** This results in **1m** freeboard between top of water and underside of bridge deck. Meaning even in worst case storm there is still adequate space

between water level and bridge deck, meaning the likelihood of this stream flooding the proposed bridge deck is unlikely.

6 Conclusion

DBFL Consulting Engineers have been commissioned by Dun Laoghaire Rathdown County Council to undertake a Flood Risk Assessment as part of the Part 8 Planning process for the proposed development of Cabinteely Greenway.

The Stage 1- Flood Risk Identification identified that the site is likely to be impacted by fluvial flooding with flooding identified in the DLRCC SFRA and County Development Plan, and using the 'The Planning System and Flood Risk Management' a vulnerability classification was assigned as 'Water Compatible'.

The Stage 2- Initial Flood Assessment determined that the proposed project would be categorised as Flood Zone A, this was selected after successfully classifying the development in Stage 1 and it proved that there was no need for further justification.

The Stage 3- Detailed Flood Risk Assessment explored the risk of flooding regarding the proposed bridge. This assessment proved that as long as the underside of the bridge deck (**28.4m**), is a minimum of **1m** above the top of water level (**27.34m**), the probability of the bridge deck being submerged in water is unlikely even in the largest storm event.

Appendix A : Hydrological Flow Estimation Calculations

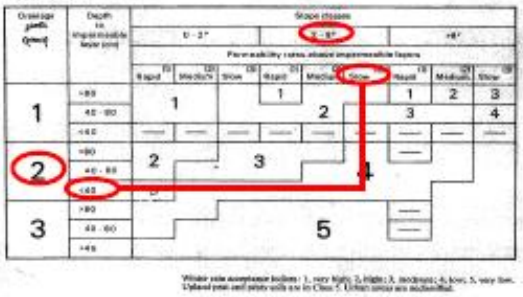
TITLE	Job Reference		
Cabinteely Greenway	230119		
SUBJECT	Calc. Sheet No.		
Hydrological Flow Estimation - HEP 01	-		
DRAWING NUMBER	Calculations by	Checked by	Date
-	DOB	JPC	14/10/2024

Catchment Map

Catchment Characteristics

Area	3.893	km²
BFISOIL	0.554	
SAAR	729	mm
FARL	1	
DRAIND	0.514	km/km²
S1085	12.221	m/km
ARTDRAIN2	0	
URBEXT	0.695	
LAKE	0%	
rsmd	26.96	
no of stream junctions	2	
STRMFRQ	1.000	

Soil Characteristics



Soil Type	4
SOIL Index	0.30

Institute of Hydology (IoH) 124

$$QBAR_{Rural} = 0.00108\,AREA^{0.89}\,SAAR^{1.17}\,SOIL^{2.17}$$

QBARrural	0.594	m³/s

Q100	1.16
Q1000	1.54

Growth Factor to Q100	1.96	<- From FSR
Growth Factor to Q1000	2.6	<- From FSR

FSR Regional Statistical Method (FSR 6 Variable)

$$Q_{bar} = 0.0172 \times AREA^{0.94} \times STMFRQ^{0.27} \times SOIL^{1.23} \times RSMD^{1.03} \times S1085^{0.16} \times (1 - LAKE)^{-0.85}$$

QBAR	0.701	m³/s

Q100	1.37
Q1000	1.82

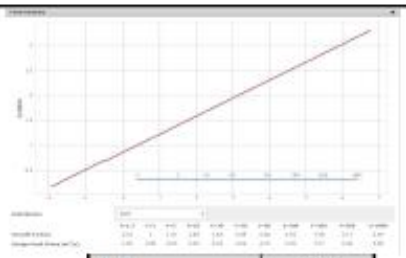
Growth Factor to Q100	1.96	<- From FSR
Growth Factor to Q1000	2.6	<- From FSR

Flood Studies Update (FSU) 7 Variable

$$Qmed_{Rural} = 1.237 \times 10^{-5} AREA^{0.937} BFIsoils^{-0.922} SAAR^{1.276} FARL^{2.217}$$
$$DRAIND^{0.341}\ S1085^{0.185}(1 + ARTDRAIN2)^{0.409}$$
$$QMED_{urban} = QMED(1 + URBEXT)^{1.48}$$

QMED Rural	0.529	m³/s
QMED Urban	1.156	m³/s

Growth Factor to Q100	2.53	<- From Pooling Group Analysis
Growth Factor to Q1000	3.36	<- From Pooling Group Analysis



Q100	2.92
Q1000	3.88

Appendix B : Dún Laoghaire Rathdown County Development Plan 2022-2028 Flood Maps

DBFL
CONSULTING ENGINEERS

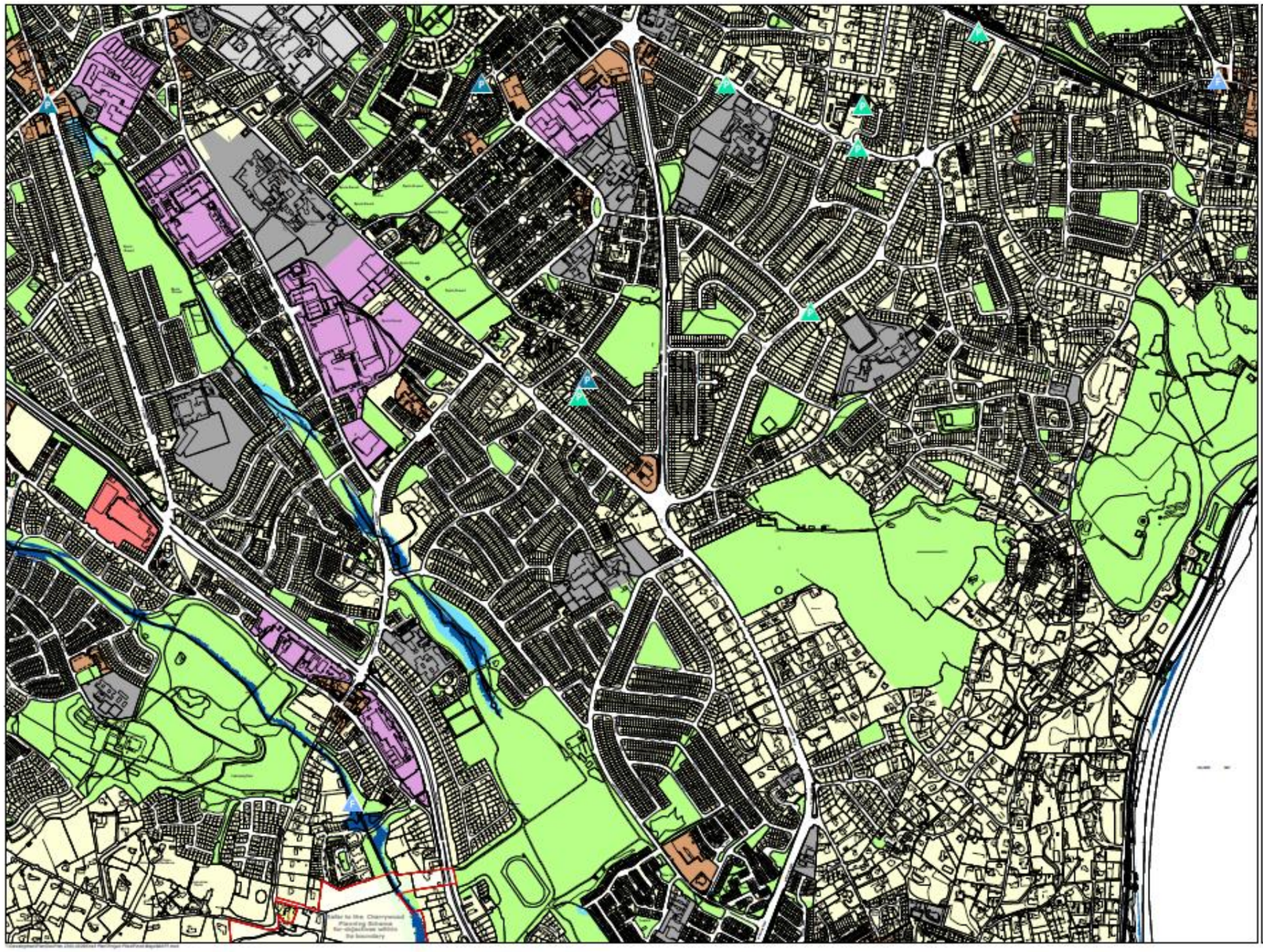
Flood Zone Map

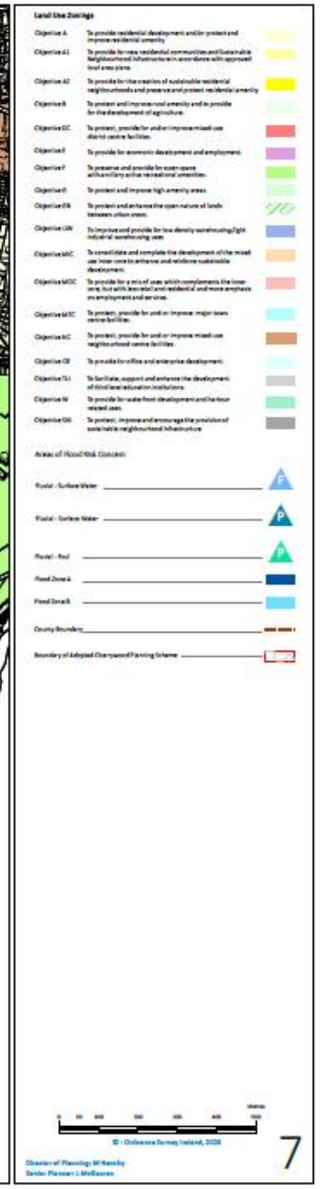
COMHAIRLE CHONTAE DHÚN LAOGHAIRE-RÁTH AN DÚIN

DÚN LAOGHAIRE-RATHDOWN COUNTY COUNCIL

COUNTY DEVELOPMENT PLAN 2022-2028

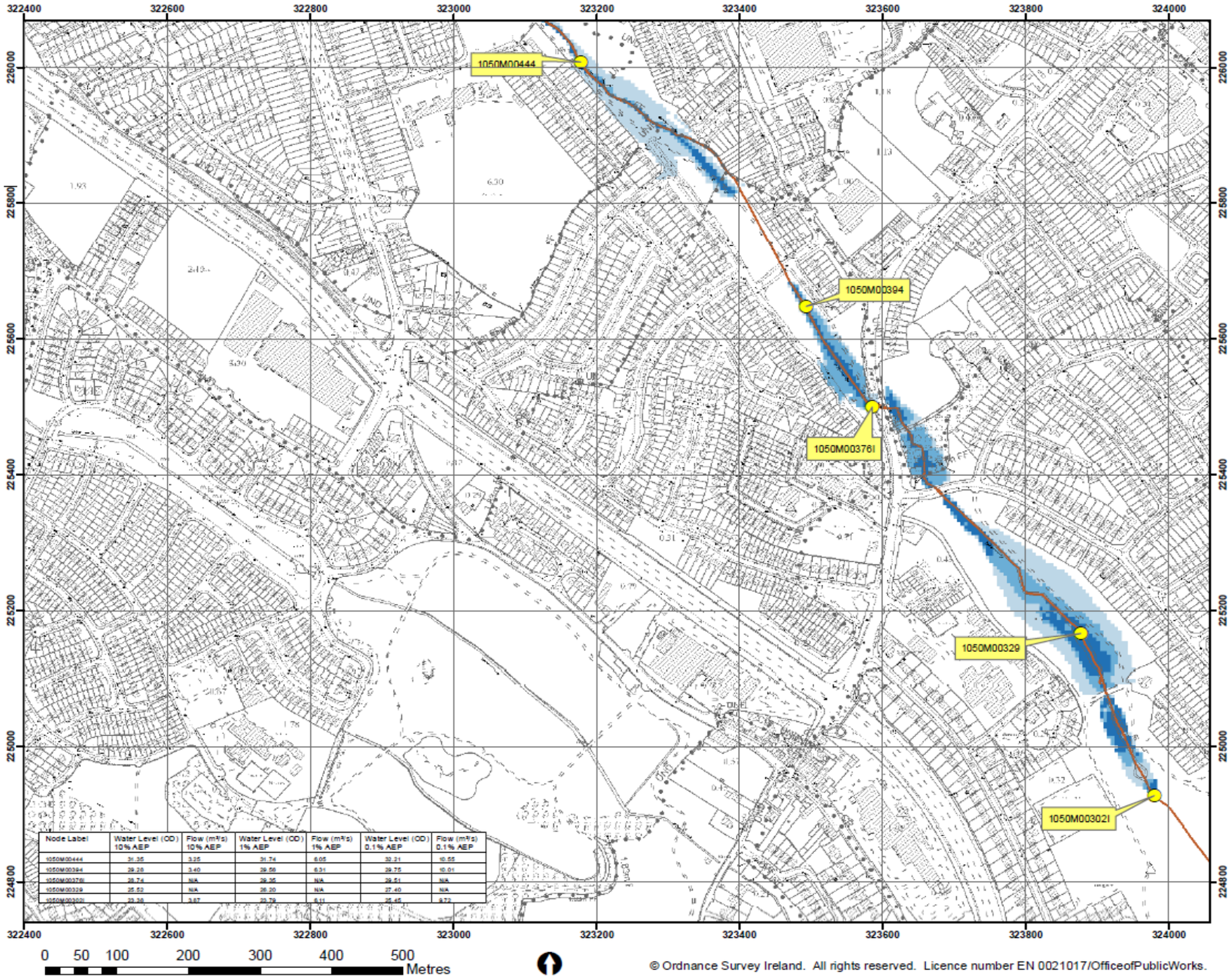
Draft County Development Plan January 2021



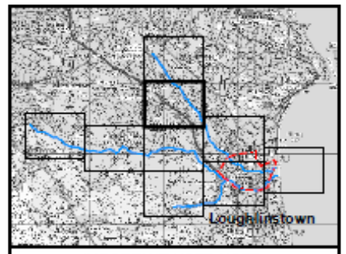


Appendix C : OPW Fluvial Flood Extents

DBFL
CONSULTING ENGINEERS



Node Label	Water Level (OD) 10% AEP	Flow (m³/s) 10% AEP	Water Level (OD) 1% AEP	Flow (m³/s) 1% AEP	Water Level (OD) 0.1% AEP	Flow (m³/s) 0.1% AEP
1050M00444	31.35	3.25	31.74	6.05	32.21	10.55
1050M00394	29.28	3.40	29.56	6.31	29.75	10.01
1050M00376I	28.74	N/A	29.35	N/A	29.51	N/A
1050M00329	25.52	N/A	26.20	N/A	27.40	N/A
1050M00302I	23.38	3.67	23.79	6.11	25.45	9.72



IMPORTANT USER NOTE:
THE VIEWER OF THIS MAP SHOULD REFER TO THE DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE THAT ACCOMPANY THIS MAP.

Legend

- 10% Fluvial AEP Event
- 1% Fluvial AEP Event
- 0.1% Fluvial AEP Event
- Modelled River Centreline
- AFA Extents
- Embankment
- Wall
- Defended Area
- 1% AEP Standard of Protection of Flood Defence (Walls / Embankments)
- Node Point
- Node ID Node Label

FINAL

REV:	NOTE:	DATE:
01	Removal of Embankments (Pg 6)	03/11/17

EASTERN CFRAM STUDY

OPW

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Map:	Deanegrange Stream Fluvial Flood Extents
Map Type:	EXTENT
Source:	FLUVIAL
Map Area:	HPW
Scenario:	CURRENT
Drawn By : C.C.	Date : 3 November 2017
Checked By : A.S.	Date : 3 November 2017
Approved By : G.G.	Date : 3 November 2017
Drawing No. :	E10LOU_EXFCD_F1_08
Map Series :	Page 8 of 9
Drawing Scale :	1:5,000 @ A3

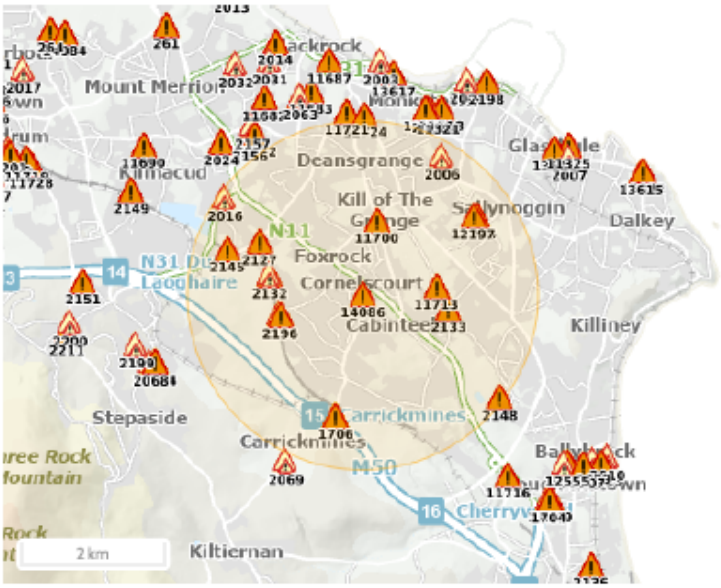
Appendix D : Past Flood Event Local Area Summary Report

OPW

Past Flood Event Local Area Summary Report

Report Produced: 23/10/2024 10:40

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



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

20 Results

	Name (Flood_ID)	Start Date	Event Location
1.	Brighton Cottages Foxrock Recurring (ID-2196)	n/a	Exact Point
	Additional Information: Reports (7) Press Archive (0)		
2.	Shanganagh Carrickmines Nov 1982 (ID-1706)	06/11/1982	Approximate Point
	Additional Information: Reports (3) Press Archive (0)		
3.	Shanganagh Carrickmines May 1993 (ID-1707)	25/05/1993	Approximate Point
	Additional Information: Reports (7) Press Archive (0)		
4.	Shanganagh Carrickmines Dec 1997 (ID-1708)	18/12/1997	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		
5.	Ramore Leopardstown Road May and June 1993 (ID-2127)	30/04/1993	Approximate Point
	Additional Information: Reports (2) Press Archive (0)		
6.	Torquay Road Foxrock Nov 1982 (ID-2132)	05/11/1982	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		

	Name (Flood_ID)	Start Date	Event Location
7.	Deansgrange Johnstown Pottery Road Nov 1982 (ID-2133) Additional Information: Reports (1) Press Archive (0)	05/11/1982	Exact Point
8.	Leopardstown Road Dec 1979 (ID-2145) Additional Information: Reports (1) Press Archive (0)	14/12/1979	Exact Point
9.	Coolevin Ballybrack Feb 1980 (ID-2148) Additional Information: Reports (1) Press Archive (0)	09/02/1980	Approximate Point
10.	Brighton Terrace Jan 1980 (ID-2152) Additional Information: Reports (1) Press Archive (0)	01/01/1980	Approximate Point
11.	Brighton Cottages Dec 1978 (ID-2154) Additional Information: Reports (2) Press Archive (0)	26/12/1978	Exact Point
12.	O Rourke Park Sallynoggin Oct 2002 (ID-2197) Additional Information: Reports (1) Press Archive (0)	20/10/2002	Exact Point
13.	Brewery Road Recurring (ID-2016) Additional Information: Reports (3) Press Archive (0)	n/a	Exact Point
14.	Dunedin Monkstown Recurring (ID-2006) Additional Information: Reports (4) Press Archive (0)	n/a	Exact Point
15.	Torquay Road Recurring (ID-2195) Additional Information: Reports (4) Press Archive (0)	n/a	Exact Point
16.	Flooding at Cornelscourt Shopping Centre on 21/08/2021 (ID-14086) Additional Information: Reports (0) Press Archive (0)	21/08/2021	Approximate Point
17.	Shanganagh Carrickmines Nov 2002 (ID-1703) Additional Information: Reports (1) Press Archive (0)	26/11/2002	Approximate Point
18.	Flooding at O'Rourke Park, Sallynoggin, Co. Dublin. on 24th Oct 2011 (ID-11715) Additional Information: Reports (1) Press Archive (0)	23/10/2011	Exact Point
19.	Flooding at Deansgrange Village, Deansgrange, Co. Dublin on 24th Oct 2011 (ID-11700) Additional Information: Reports (1) Press Archive (0)	23/10/2011	Exact Point
20.	Flooding at Little Meadow, Pottery Road, Cabinteely, Dublin 18 on 24th Oct 2011 (ID-11713) Additional Information: Reports (1) Press Archive (0)	23/10/2011	Exact Point

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HEALTH & SAFETY ISO 45001:2018 NSAI Certified

QUALITY I.S. EN ISO 9001:2015 NSAI Certified

Engineering Sustainable Futures

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