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# STRATEGIC FLOOD RISK ASSESSMENT SOUTH DUBLIN COUNTY DEVELOPMENT PLAN

## Strategic Flood Risk Assessment DRAFT

May 2021

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# South Dublin County Council
# South Dublin County Development Plan

# Strategic Flood Risk Assessment

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# 1. INTRODUCTION

## 1.1 Commission

Roughan & O'Donovan Consulting Engineers (ROD) was commissioned by South Dublin County Council (SDCC) to prepare a Strategic Flood Risk Assessment to supplement the preparation process and review of the South Dublin County Development Plan 2022 - 2028. The Development Plan will shape the future growth of the County over the 6-year period of the plan and beyond.

## 1.2 Scope

The scope of this report is as follows:

- Provide an assessment/identification of flood risk for the Development Plan area in accordance with "*The Planning System and Flood Risk Management – Guidelines for Planning Authorities"* (The Guidelines), 2009, published by the Department for the Environment, Heritage and Local Government and the Office of Public Works (OPW).
- Undertake a Flood Risk Assessment Report assessing the hydrology and hydraulics and determining mechanisms of flooding in the Development Plan area, taking into account anticipated future increases in rainfall, river flows and sea level rise as a result of climate change.
- Provide recommendations for future flood risk assessments for proposed developments and planning applications, in accordance with The Guidelines.
- Delineate Riparian Corridors at a strategic level and detail requirements for hydromorphological assessments to aid in meeting our obligations under the Water Framework Directive and Floods Directive. Riparian Corridors are identified to protect and enhance watercourses and their natural regimes including: ecological, biogeochemical, hydromorphological and flood resilience in the face of climate change.
- Liaison with Consultants completing the Strategic Environmental Assessment (SEA), Appropriate Assessment and South Dublin County Council as well as public consultation.

A Stage 1 Flood Risk Identification has been undertaken to identify any flooding or surface water management issues related within the County that may warrant further investigation. As part of this stage the most up to date available data at the time of preparation was acquired from the Office of Public Works (OPW) and South Dublin County Council. The Eastern and Dodder CFRAMS has generated flood zone mapping which has been deemed suitable as a Stage 2 Initial Flood Risk Assessment. This flood risk information has enabled SDCC to apply 'The Guidelines' sequential approach, and where necessary the Justification Test, to appraise sites for suitable land zonings and identify how flood risk can be managed as part of the development plan.

Although great care and modern widely-accepted methods have been used in the preparation and interpretation of flood risk areas, there is inevitably a range of inherent uncertainties and assumptions made during the estimation of design flows and the construction of flood models. The inherent uncertainty necessitates a precautionary approach when interpreting flood extent mapping.

## 1.3 Study Area

### 1.3.1 Overview

The subject area comprises lands in South Dublin County and is bounded by the River Liffey to the North, rural lands to the West and the Dublin Mountains to the South. It has an area of approximately 223 km$^2$ and consists of metropolitan consolidation towns and small towns/villages. The lands in South County Dublin are bounded by adjoining counties of Wicklow, Kildare, Dublin City, Fingal and Dun Laoghaire. Refer to Figure 1.1 below. The south of the study areas is characterised by the Dublin mountains and differs significantly from the urban and suburban landscape character of the majority of the county.

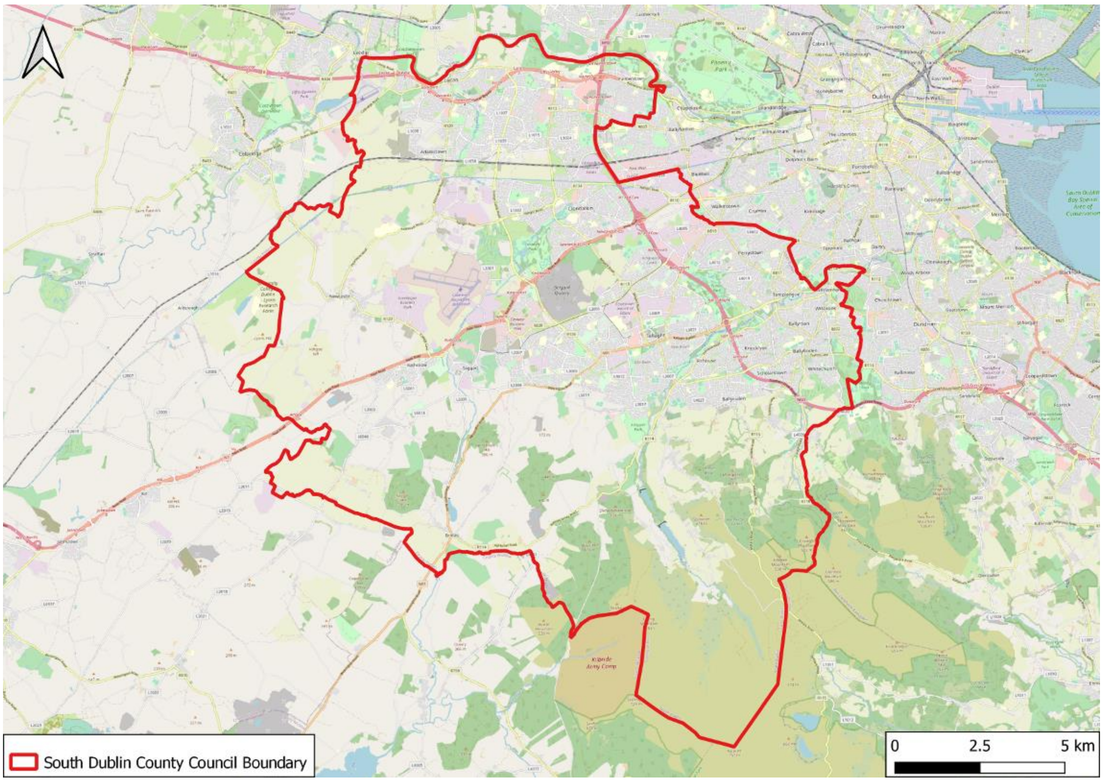



**Figure 1.1: South Dublin County Development Plan lands (©OpenStreetMap)**

### 1.3.2 Catchment Description

The Development Plan area lies within the Hydrometric Area 09 Liffey-Dublin Bay and contains catchments of the following key rivers: the Griffeen, the Dodder, the Poddle and the Camac river as well as the Owendoher and the Whitechurch Streams. The general topography of the county means all major watercourses within the county flow in a south west to north west direction watercourses and catchments are outlined in Figure 1.2.

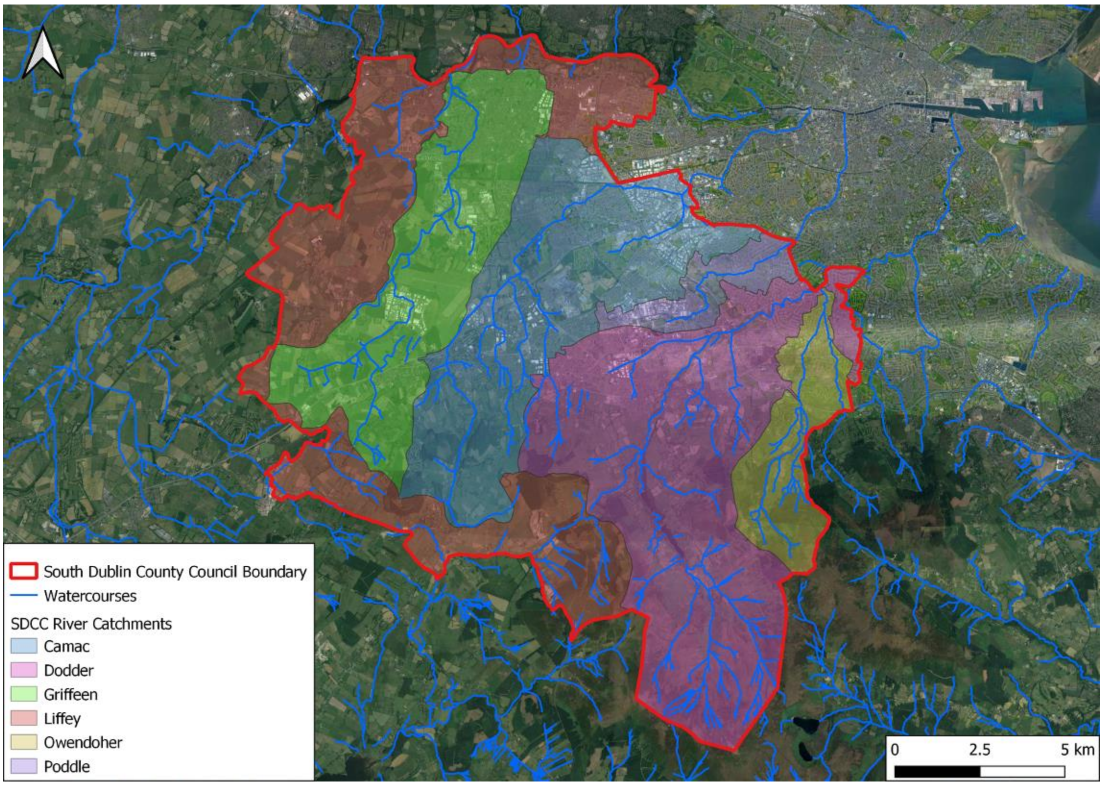



**Figure 1.2: Watercourses and catchments within South Dublin County (©Google Satellite)**

### 1.3.3 Environment

The following Natura 2000 sites are located within the study area:

- Glenasmole Valley (SAC), approximately 7km north of the border with the Wicklow/Dublin Mountains;
- Wicklow Mountain (SAC and SPA); at the southern boundary of South Dublin County.

Under Article 6(3) of the EU Habitats Directive, an "appropriate assessment" (AA) is required where any plan or project, either alone or 'in combination' with other plans or projects, could have an adverse effect on the integrity of a Natura 2000 site.

Natural Heritage Areas (NHAs) are sites of national importance for nature conservation and are afforded protection under planning policy and the Wildlife Acts, 1976-2012. Proposed NHAs (pNHAs) are published sites identified as of similar conservation interest but have not been statutorily proposed or designated. The NHA/pNHAs in the study area are:

- Liffey Valley (proposed NHA), along the northern border of South Dublin County;
- Grand Canal (proposed NHA), traversing the County from West to East;
- Dodder Valley (proposed NHA), South-East of Tallaght;
- Lugmore Glen (proposed NHA), South-West of Tallaght;
- Slade of Saggart and Crooksling Glen (proposed NHA), North of Brittas;
- Glenasmole Valley (proposed NHA), approximately 7km north of the border with the Wicklow/Dublin Mountains.

Therefore, the management of flood risk within the Development Plan study area must have regard to potential negative impacts to this environment.

## 1.4 Existing Land Use Zoning

The study area of South Dublin County currently comprises 16 different zoning objectives as per the Development Plan and are shown in Table 1.1 below.

**Table 1.1 SDCC Zoning Objectives from Development Plan 2016-2022**

| Zoning | Abbreviation | Objective |
|---|---|---|
| Existing Residential | RES | To protect and/or improve residential amenity |
| New Residential | RES-N | To provide for new residential communities in accordance with approved area plans |
| Strategic Development Zone | SDZ | To provide for strategic development in accordance with approved planning schemes |
| Regeneration | REGEN | To facilitate enterprise and/or residential led regeneration. |
| Town Centre | TC | To protect, improve and provide for the future development of Town Centres |
| District Centre | DC | To protect, improve and provide for the future development of District Centres |
| Village Centre | VC | To protect, improve and provide for the future development of Village Centres |
| Major Retail Centre | MRC | To protect, improve and provide for the future development of a Major Retail Centre |
| Local Centre | LC | To protect, improve and provide for the future development of Local Centres |
| Enterprise and Employment | EE | To provide for enterprise and employment related uses |
| Retail Warehousing | RW | To provide for and consolidate retail warehousing |
| High Amenity Dublin Mountains | HA-DM | To protect and enhance the outstanding natural character of the Dublin Mountains Area |
| High Amenity Liffey Valley | HA-LV | To protect and enhance the outstanding character and amenity of the Liffey Valley |
| High Amenity Dodder Valley | HA-DV | To protect and enhance the outstanding character and amenity of the Dodder Valley |
| Open Space | OS | To preserve and provide for open space and recreational amenities |
| Rural and Agriculture | RU | To protect and improve rural amenity and to provide for the development of agriculture |

Not taking the area from roads into account, the largest zonings by area pertain to rural agricultural and rural amenity land uses: High Amenity Dublin Mountains – HA-DM (~33%), followed by lands zoned as Rural and Agriculture - RU (~27%). The third largest land use is existing Residential - RES (~14%), refer to figure 1.3 below.

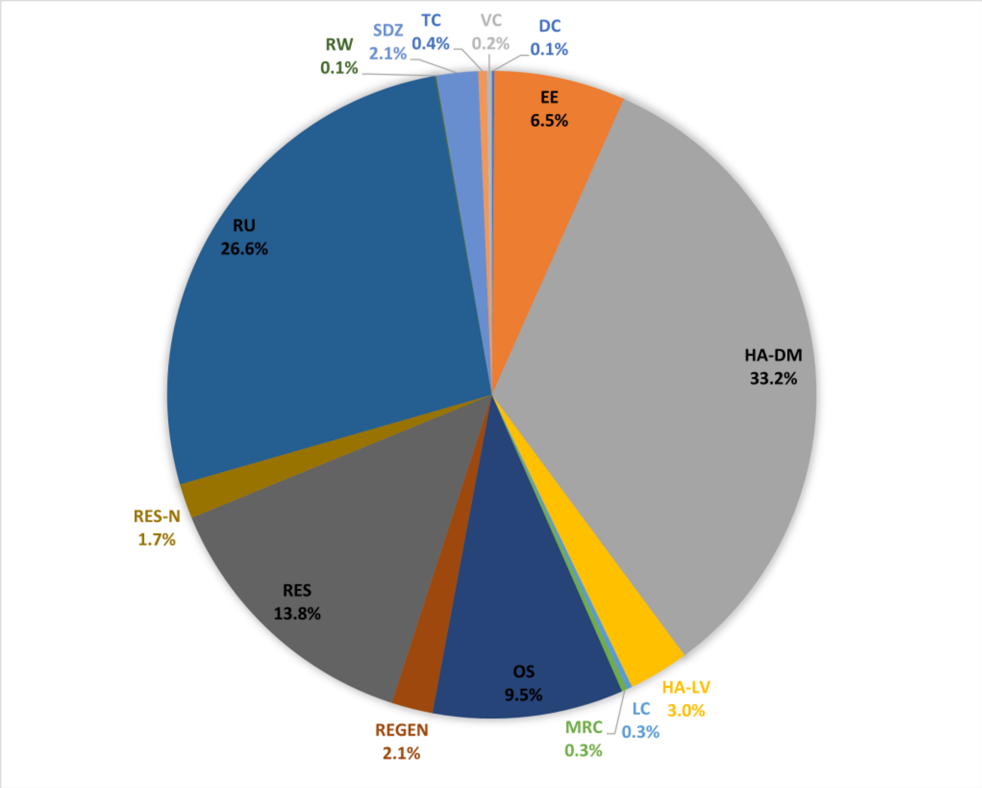



**Figure 1.3: Ratio of Zoning Objectives from South Dublin County Development Plan**

The zoning from the South Dublin County Development Plan is reproduced in Figure 1.4 below.

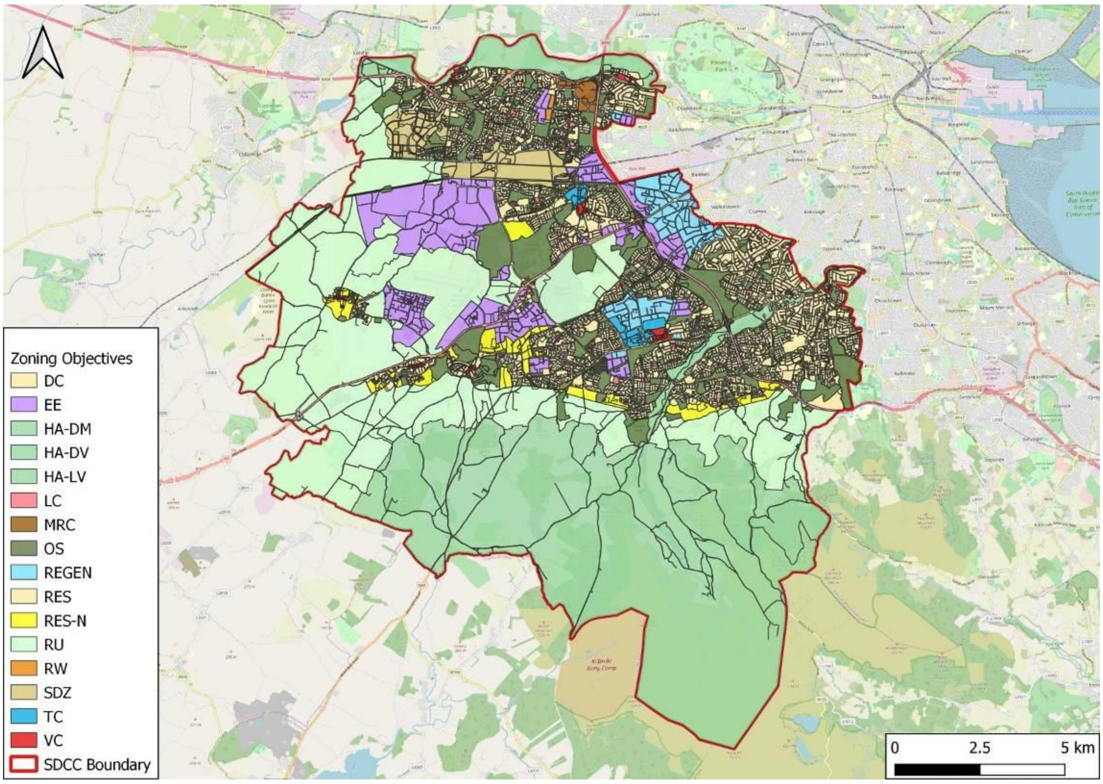



**Figure 1.4: South Dublin County Zoning Objectives (SDCC Development Plan ©OpenStreetMap)**

# 2. METHODOLOGY

## 2.1 Introduction

This report has been prepared in accordance with 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' herein referred to as 'The Guidelines' as published by the Office of Public Works (OPW) and Department of Environment, Heritage and Local Government (DoHLG) in 2009.

## 2.2 Definition of Flood Risk

Flood risk is a combination of the likelihood of a flood event occurring and the potential consequences arising from that flood event and is then normally expressed in terms of the following relationship:

Flood risk = Likelihood of flooding x Consequences of flooding.

To fully assess flood risk an understanding of where the water comes from (i.e. the source), how and where it flows (i.e. the pathways) and the people and assets affected by it (i.e. the receptors) is required. Figure 2.1 below shows a source-pathway-receptor model reproduced from 'The Guidelines'.

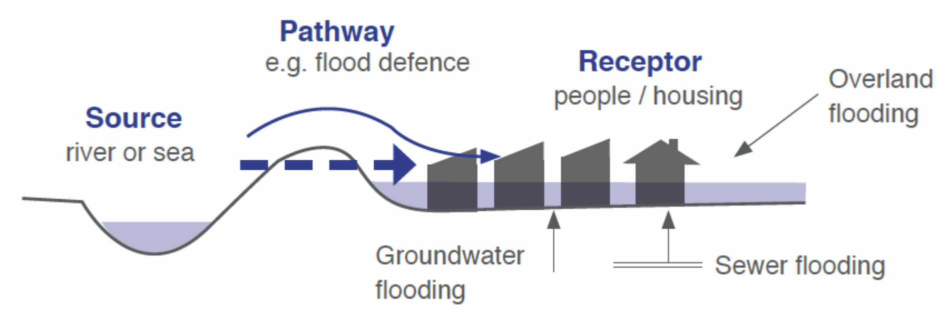



**Figure 2.1 Source-Pathway-Receptor Model**

The principal sources of flooding are rainfall or higher than normal sea levels. The principal pathways are rivers, drains, sewers, overland flow and river and coastal floodplains. The receptors can include people, their property and the environment. All three elements as well as the vulnerability and exposure of receptors must be examined to determine the potential consequences.

## 2.3 Likelihood of Flooding

The Guidelines define the likelihood of flooding as the percentage probability of a flood of a given magnitude or severity occurring or being exceeded in any given year. It is generally expressed as a return period or annual exceedance probability (AEP). A 1% AEP flood indicates a flood event that will be equalled or exceeded on average once every hundred years and has a return period of 1 in 100 years. Annual Exceedance Probability is the inverse of return period as shown in Table 2.1 below.

**Table 2.1 Correlation between return period and AEP**

| Return Period (years) | Annual Exceedance Probability (%) |
|---|---|
| 1 | 100 |
| 10 | 10 |
| 50 | 2 |

| Return Period (years) | Annual Exceedance Probability (%) |
|---|---|
| 100 | 1 |
| 200 | 0.5 |
| 1000 | 0.1 |

## 2.4 Definition of Flood Zones

Flood zones are geographical areas within which the likelihood of flooding is in a particular range and are split into three categories in The Guidelines:

**Flood Zone A**

Flood Zone A where the 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**

Flood Zone B where the probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 and 0.5% or 1 in 200 for coastal flooding);

**Flood Zone C**

Flood Zone C where the 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 plan areas which are not in zones A or B.

It is important to note that when determining flood zones the presence of flood protection structures should be ignored. This is because areas protected by flood defences still carry a residual risk from overtopping or breach of defences and the fact that there is no guarantee that the defences will be maintained in perpetuity.

## 2.5 Objectives and Principles of the Planning Guidelines

The principle actions when considering flood risk are set out in the planning guidelines and are summarised below:

- *"Flood hazard and potential risk should be determined at the earliest stage of the planning process..."*
- *"Development should preferentially be located in areas with little or no flood hazard thereby avoiding or minimising the risk...."*
- *"Development should only be permitted in areas at risk of flooding when there are no alternatives, reasonable sites available..."*
- *"Where development is necessary in areas at risk of flooding an appropriate land use should be selected"*
- *A precautionary approach should be applied, where necessary, to reflect uncertainties in flooding datasets and risk assessment techniques..."*
- *"Land required for current and future flood management... should be pro-actively identified..."*
- *"Flood risk to, and arising from, new development should be managed through location, layout and design incorporating Sustainable Drainage Systems (SuDS) and compensation for any loss of floodplain..."*

- *Strategic environmental assessment (SEA) of regional planning guidelines, development plans and Masterplans should include flood risk as one of the key environmental criteria..."*

## 2.6 The 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 2.2 below. In general, development in areas with a high risk of flooding should be avoided as per the sequential approach. However, this is not always possible as many town and city centres are within flood zones and are targeted for development.

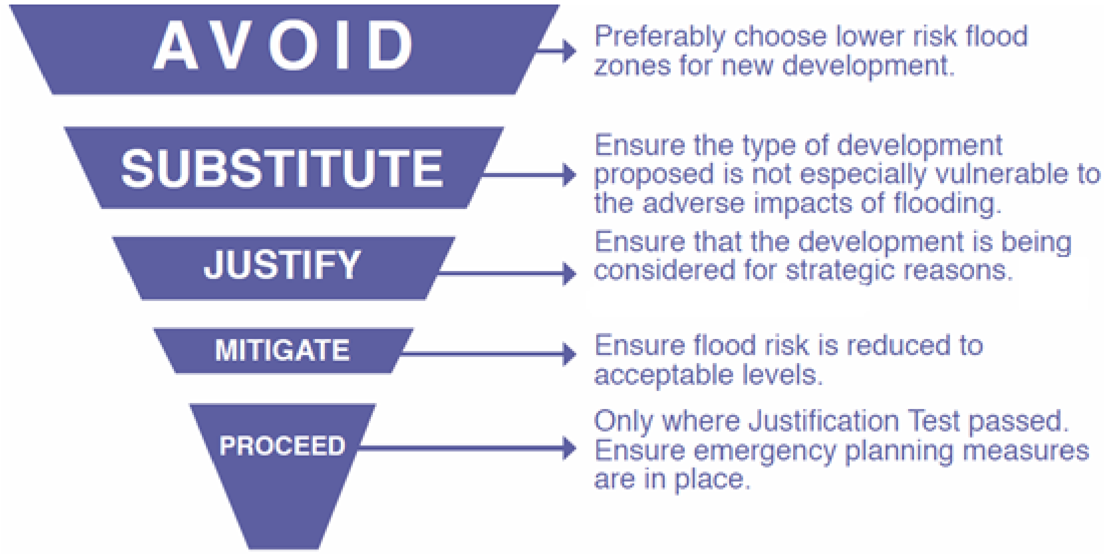



**Figure 2.2 Sequential Approach (The Guidelines)**

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 2.3 below illustrates the types of development that would be required to meet the Justification Test.

**Table 2.2 Matrix of Vulnerability Versus Flood Zone to Illustrate Appropriate Development and that Required to Meet the Justification Test (The Guidelines)**

| **Vulnerability Class (The Guidelines section 3.5)** | Flood Zone A | Flood Zone B | Flood Zone C |
|---|---|---|---|
| **Highly vulnerable development (including essential infrastructure)** | Justification Test | Justification Test | Appropriate |

| Vulnerability Class (The Guidelines section 3.5) | Flood Zone A | Flood Zone B | Flood Zone C |
|---|---|---|---|
| **Less vulnerable development** | Justification Test | Appropriate | Appropriate |
| **Water-compatible development** | Appropriate | Appropriate | Appropriate |

## 2.7 Climate Change

Climate change adaption and resilience will most likely become the fundamental consideration for strategic planning in the coming decades. Climate Change as a result of human activities is occurring and is going to continue for centuries to come. The likely result of climate change in the East of Ireland Include:

- Sea level rise,
- Increase in the duration of summer with more frequent droughts,
- More intense storms and rainfall events,
- Increased likelihood and magnitude of river and coastal flooding, and
- Adverse impacts on water quality,
- Changes in distribution of plant and animal species.

Nonetheless, properly managed the potential challenge may provide the catalysis for an integrated approach to environmental stewardship that archives long term suitability goals at diverse scales ranging from local community investiture to satisfying our international obligations. With the knowledge of what we as a society may face in the future, land use planning policies can be developed which are mindful of current management practices. As such, an appraisal of the potential impacts of climate change was carried out as part of the Strategic Flood Risk Assessment with regard to the OPW climate change parameters stated in the Flood Risk Management Climate Change Sectoral Adaptation Plan (2019), also international best practice within other European jurisdictions and the latest scientific studies. Climate change. OPW climate change allowances are stated in Table 2.3 below.

**Table 2.3 Allowances in Flood Parameters for Mid Range and High End Future Scenarios**

| Parameter | MRFS | HEFS |
|---|---|---|
| Extreme Rainfall Depths | + 20% | + 30% |
| Peak 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]<br>+ 10% SPR[3] |

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

Note 2: Reduction in the time to peak (Tp) to allow 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 temporary increased runoff rates that may arise following felling of forestry.

There is an increasing likelihood that Irelands climate will be similar to that depicted in the High End Future climate change scenario by the year 2100. Therefore, it is prudent to consider the HEFS parameters when planning for vulnerable infrastructure and developments. This approach will also assist in achieving our obligations under the Water Framework Directive (WFD). The OPW is currently transitioning to regional based climate models that reflect the likely varied impacts throughout the island of Ireland. This is likely to be implemented during the lifetime of the proposed county development plan.

## 2.8 Strategic Hydromorphological Assessment

A Strategic Hydromorphological Assessment has been undertaken of the main watercourses within South Dublin County. The assessment will aid in delineating floodplain boundaries using morphological features to identify functional riparian zones. The goal being to provide the basis for sustainable zoning policies that provides "room for the river" and in time allow river systems to return to a state of equilibrium with rich biodiversity, developed ecosystem service provision and resilience to future shocks such as climate change. This approach will aid in meeting our objectives under the Water Framework and Floods Directives.

### 2.8.1 Hydromorphical Assessment and Riparian Corridor Designation Methodology

Hydromorphological integrity is identified in the WFD as one of the three key criteria for determining Waterbody Status (the others being ecology and chemical). Currently in WFD Ecoregion 17 (The Island of Ireland) classification of Hydromorphology only contributes to the classification of water bodies at high ecological and chemical status. Nonetheless, high status Hydromorphology is an indicator of overall high-good waterbody status as well as resilience within the catchment. A strategic hydromorphological Assessment of major rivers within South Dublin County has been undertaken for the County Development Plan. The strategic hydromorphological Assessment considered a range of parameters including:

- Quaternary Alluvial Deposits
  Alluvial sediments are deposited during flood events and can indicate areas of historic flooding or natural routes of subsequently modified watercourses.

- Slope Analysis - Break in Slope and Terrace Definition
  High definition LiDAR was assessed to identify prominent changes in slope and terraces adjacent to watercourses. These terraces are formed due to long term erosional processes and their presence often corelate with recurring flood extents. In the uplands of the Dublin mountains breaks in slope defined the extents of steep valleys.

- Historical Mapping Review
  Mapping available from the early 19th century indicate land uses, areas liable to flood as well as modifications to watercourses and their floodplains.

- Review of Ariel photographs for Riparian Vegetation Extents.
  Riparian vegetation is crucial to the stability and resilience of riparian corridors and the biodiversity potential they promote. Riparian Corridors boundaries were identified to minimise fracturing of vegetated areas directly adjacent to watercourses.

The key finding of this assessment is the delineation of Riparian Corridors along the major rivers within the county. Riparian Corridors are shown on the drawings within Appendix A of this report.

# 3. STAGE 1 - FLOOD RISK IDENTIFICATION

## 3.1 General

This Flood Risk Identification phase includes a review of the existing information and the identification of any flooding or surface water management issues within South Dublin County that may warrant further investigation.

## 3.2 Sources of Flooding

### Flooding from Fluvial & Sea Level Rises / Coastal Flooding

Much of the Irish landscape is defined by the interface between land, rivers and coastlines. For the majority of the time this interface is largely static along historic riverbanks and coastal areas. However, the processes that create these zones primarily result from extreme events and as such flooding can be seen as a natural process that the landscapes we live in. Issues arise when development occurs within natural floodplains creating elevated risk. The primary pathway for fluvial and coastal flooding is simple bank overtopping or storm surges causing extreme tidal inundation. Flooding can be exacerbated when structures such as bridge crossings are inadequately sized or when development happens within the floodplain displacing flood waters.

### Surface Water Flooding

Surface water flooding occurs when the local drainage system cannot convey stormwater flows from extreme rainfall events. The rainwater does not drain away through the normal drainage pathways or infiltrate into the ground but instead ponds on or flows over the ground instead. Surface water flooding is unpredictable as it depends on several factors including ground levels, rainfall and the local drainage network.

### Groundwater Flooding

Ground water flooding is a result of upwelling in occurrences where the water table or confined aquifers rises above the ground surface. This tends to occur after long periods of sustained rainfall and/or very high tides. High volumes of rainfall and subsequent infiltration to ground will result in a rising of the water table. Groundwater flooding tends to occur in low-lying areas, where with additional groundwater flowing towards these areas, the water table can rise to the surface causing groundwater flooding.

### Pluvial Flood Risk

Pluvial flooding results from heavy rainfall that exceeds ground infiltration capacity or more commonly in Ireland where the ground is already saturated from previous rainfall events. This causes ponding and flooding at localised depressions. Pluvial flooding is commonly a result of changes to the natural flow regime such as the implementation of hard surfacing and improper drainage design.

## 3.3 Information Sources Consulted

The following information sources were consulted as part of the Flood Risk Identification:

### Table 3.1 Information Sources Consulted

| Source | Comments |
|---|---|
| OPW Preliminary Flood Risk Assessment (PFRA) maps | Fluvial, Pluvial, Coastal and Groundwater flooding examined; |
| Catchment Flood Risk Assessment and Management Study (CFRAM) | CFRAM mapping available at www.floodinfo.ie |
| OPW Benefitting Land Maps | Available at OPW Drainage District Viewer |
| OPW National Flood Hazard Mapping | www.floodmaps.ie |

### 3.3.1 Predictive Flood Maps and Flood Hazard Records

#### (i) OPW Preliminary Flood Risk Assessment (PFRA)

The PFRA is a national screening exercise to identify the areas where there may be a significant risk associated with flooding (referred to as Areas for Further Assessment or AFA's). As part of the PFRA study, maps of the country were produced showing the indicative fluvial, coastal, pluvial and groundwater flood extents.

In the past, PFRA maps have been used to largely identify flood zones and flood locations for the Development Plan area. They were used for a broad assessment to help identify areas where flood risk should be explored in greater detail. The PFRA mapping identifies flood areas in Ballycullen/Oldcourt, Brittas and Dublin/Wicklow Mountains. Fluvial flooding areas have been indicated along the Ballycullen Stream and the Orlagh in the area of Ballycullen, the Camac and the Brittas River in the area of Brittas, and the Dodder in the upland areas of Dublin/Wicklow Mountains.

It is important to note that these maps have limitations as any local errors in the digital terrain model (DTM) were not filtered out, local channel works were not included, flood defences were excluded and channel structures were not considered.

#### (i) Catchment Flood Risk Assessment and Management Study

The plan area is covered within the Eastern CFRAM and (pilot) Dodder CFRAMS) study areas. The CFRAM programme led by the OPW, provides a detailed assessment of flooding in areas identified as AFA's during the PFRA study. All of the main watercourses were considered as part of the CFRAMS programme. Catchment wide Flood Risk Management Plans were also developed as part of the programme.

The CFRAMS flood mapping highlights areas of historic flood risk as well as the impact of key hydraulic constraints along the subject watercourses. The CFRAMS flood extent mapping is seen as the most detailed appraisal of flood risk for majority of the watercourses within South Dublin and forms the basis for much of this assessment.

#### (ii) OPW Drainage Districts

Under the Arterial Drainage Act, 1945 the OPW undertook a number of arterial drainage schemes to improve land for agricultural production. The OPW has a statutory duty to maintain these schemes, which is delivered through their arterial drainage maintenance programme. The OPW does not have powers to undertake river or channel maintenance other than where these rivers form part of an arterial drainage scheme or flood relief schemes.

The OPW Drainage district maps show that lands at the north-western border of the county close to Celbridge are "benefiting lands", i.e. lands that have benefited from flood alleviation works previously completed under the Arterial Drainage Act, 1945. Lands in this area form part of the Shinkeen Stream (Hazelhatch) Flood Relief Scheme and contain an OPW Arterial Drainage (AD) Channel.

**(iii) OPW National Flood Hazard Mapping**

The OPW National Flood Hazard Mapping Web Site, www.floodmaps.ie, was examined to identify any recorded flood events within and in the Development Plan lands. Recurring events have been recorded throughout the plan lands.

### 3.3.2 Record of Flood Relief Schemes within South Dublin County

Flood Risk Management Schemes completed within the last 30 years are listed below:

- Camac River Phase I Improvement Scheme (1995)
- Shinkeen Stream (Hazelhatch) Drainage Scheme (2001)
- Camac River Phase II Improvement Scheme (2001)
- Griffeen River Flood Alleviation Scheme (2005)
- Tubermaclugg Improvement Scheme (2008)
- Robinhood Stream Improvement Scheme (2008)
- Whitehall Road Flood Alleviation Scheme (2009)
- Ballycullen Flood Alleviation Scheme (2018)

Any planning decisions should also be cognisant of future works in the catchment. Schemes currently being progressed include:

- Whitechurch Flood Allevaition Scheme
- River Poddle Flood Alleviation Scheme
- River Camac Flood Alleviation Scheme

**3.4**

## 3.4 Flood Risk Identification Summary

In accordance with The Guidelines the sources of flooding within South Dublin County have been identified. The findings of the stage 1 assessment indicate that the lands within the development plan area are at risk of flooding. Therefore, in accordance with The Guidelines (OPW 2009), a Stage 2 flood risk assessment should be carried out.

# 4. STAGE 2 – INITIAL FLOOD RISK ASSESSMENT

## 4.1 General

A Stage 2 SFRA (initial flood risk assessment) was undertaken to:

- Confirm the sources of flooding that may affect lands within South Dublin County;
- Appraise the adequacy of existing information as identified by the Stage 1 FRA.

## 4.2 Identification of Key Areas at Risk Of Flooding

The zoning objectives within the key areas at risk of flooding are identified in the section below. This review will look at the development land use zoning for the lands and comment on the flood risk.

1. Rathcoole - Saggart: Fluvial flooding deriving from the Camac is indicated west of the Saggart Waterworks at Slade Road, areas East of Rathcoole Park and Naas Road and College Lane. Fluvial flooding emanating from Corbally Stream is indicated north and east of the golf course (along Carraigmore Avenue) and in areas between Naas Road and Parklands Parade. Fluvial flooding from the Fortunestown river is indicated in areas west of CRH De Selby Quarry to and across Blessington Road up until Fortunestown Road. Indicated flooding affects areas currently zoned as "RU – To protect and improve rural amenity and to provide for the development of agriculture", "OS – To preserve and provide for open space and recreational amenities", "EE – To provide for enterprise and employment related uses", "RES – To protect and/or improve residential amenity " and "RES-N – To provide for new residential communities in accordance with approved area plans".

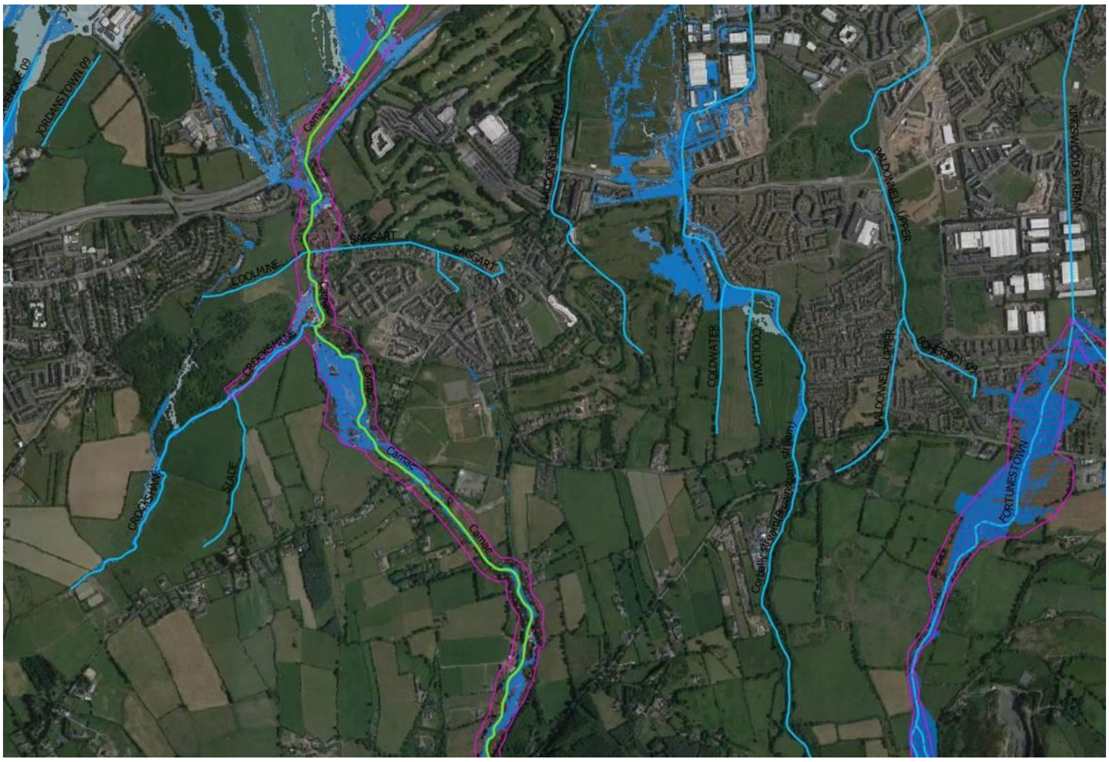


**Figure 4.1 Indicated flood risk areas and Riparian Corridors (in pink) for Rathcoole - Saggart**

1. Greenogue – Baldonnel: Indicated fluvial flooding from the Griffeen river and its tributaries affect areas from Naas Road to College Lane, across Greenogue Business Park / Aerodrome Park, and up until Baldonnel Road. Additional flooding from the Camac affects areas between Naas Road and Baldonnel Road (Casement Aerodrome Baldonnel) as well as areas in Corkagh Park and lands west of Grange Castle Road. Flooding is indicated to affect areas currently zoned as "RU – To protect and improve rural amenity and to provide for the development of agriculture", "OS – To preserve and provide for open space and recreational amenities", "EE – To provide for enterprise and employment related uses", "RES – To protect and/or

improve residential amenity " and "RES-N – To provide for new residential communities in accordance with approved area plans".

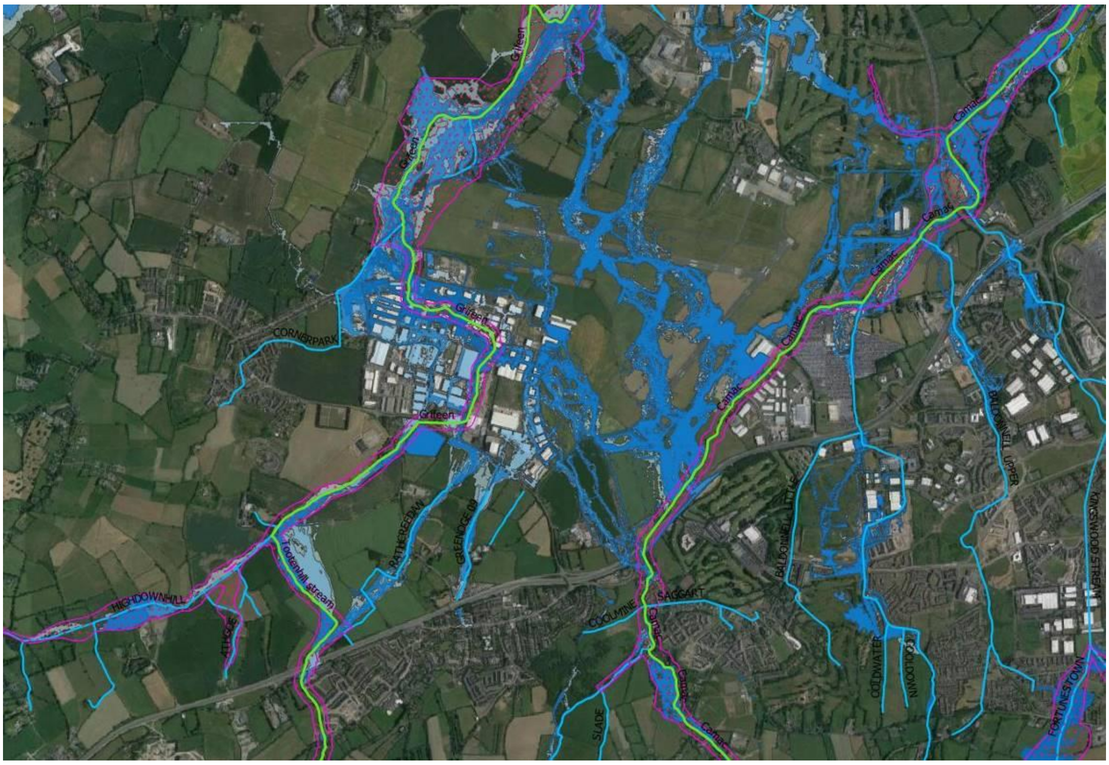



**Figure 4.2 Indicated flood risk areas and Riparian Corridors (in pink) for Greenogue - Baldonnel**

2. Jobstown – Killinarden: Fluvial flooding emanating from the Kingswood Stream and its tributaries is indicated in areas south of Blessington Road up until residential areas east and south of Mount Seskin Community College (Belfry Green). Fluvial flooding from the Jobstown Stream is indicated south of Tallaght Bypass and between Whitestown Way and Old Bawn Road. Indicated flooding affects areas currently zoned as "RU – To protect and improve rural amenity and to provide for the development of agriculture", "OS – To preserve and provide for open space and recreational amenities", "EE – To provide for enterprise and employment related uses", "RES – To protect and/or improve residential amenity", "HA-DM - To protect and enhance the outstanding natural character and amenity of the Liffey Valley, Dodder Valley and Dublin Mountains areas" and "RES-N – To provide for new residential communities in accordance with approved area plans".

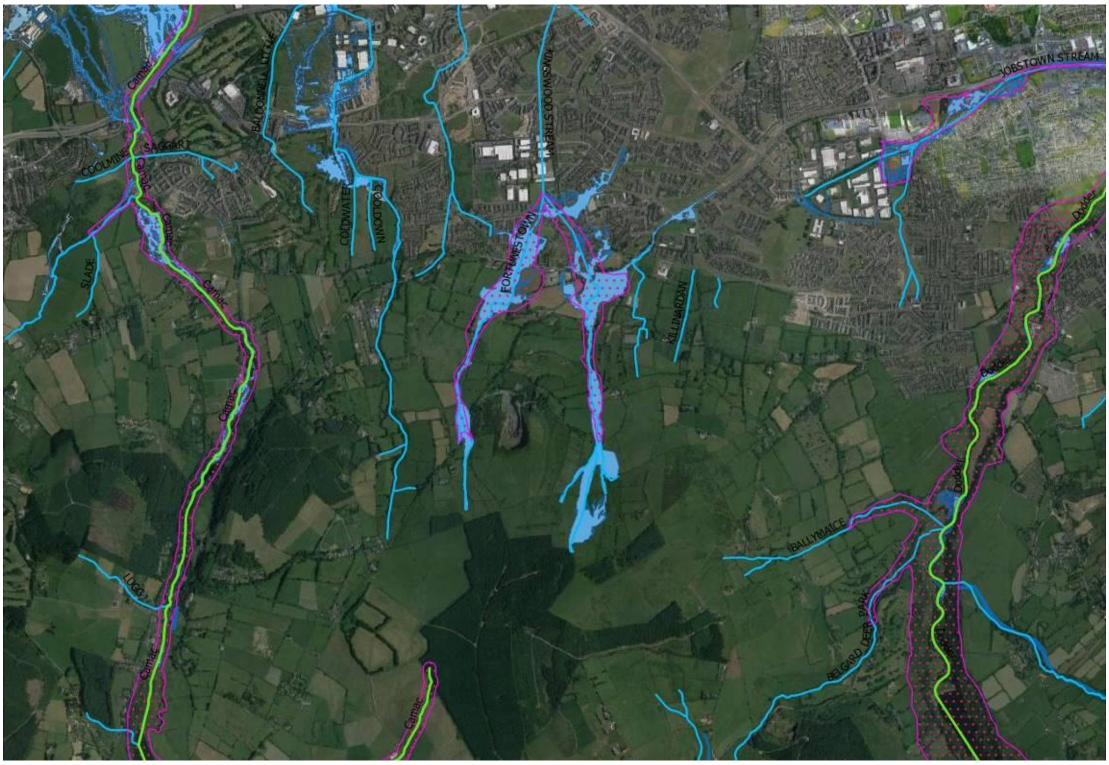



**Figure 4.3** **Indicated flood risk areas and Riparian Corridors (in pink) for Jobstown - Killinarden**

3. Clondalkin: Fluvial flooding deriving from the Camac river is indicated in areas between Fonthill Road South to and across Western Parkway Motorway up until areas west of John F Kennedey Industrial Estate (Nangor Road and south of the Grand Canal). Areas affected are currently zoned as "OS – To preserve and provide for open space and recreational amenities", "EE – To provide for enterprise and employment related uses", "RES – To protect and/or improve residential amenity ", "REGEN - To facilitate enterprise and/or residential-led regeneration", "VC - To protect, improve and provide for the future development of Village Centres" and "TC - To protect, improve and provide for the future development of Town Centres".

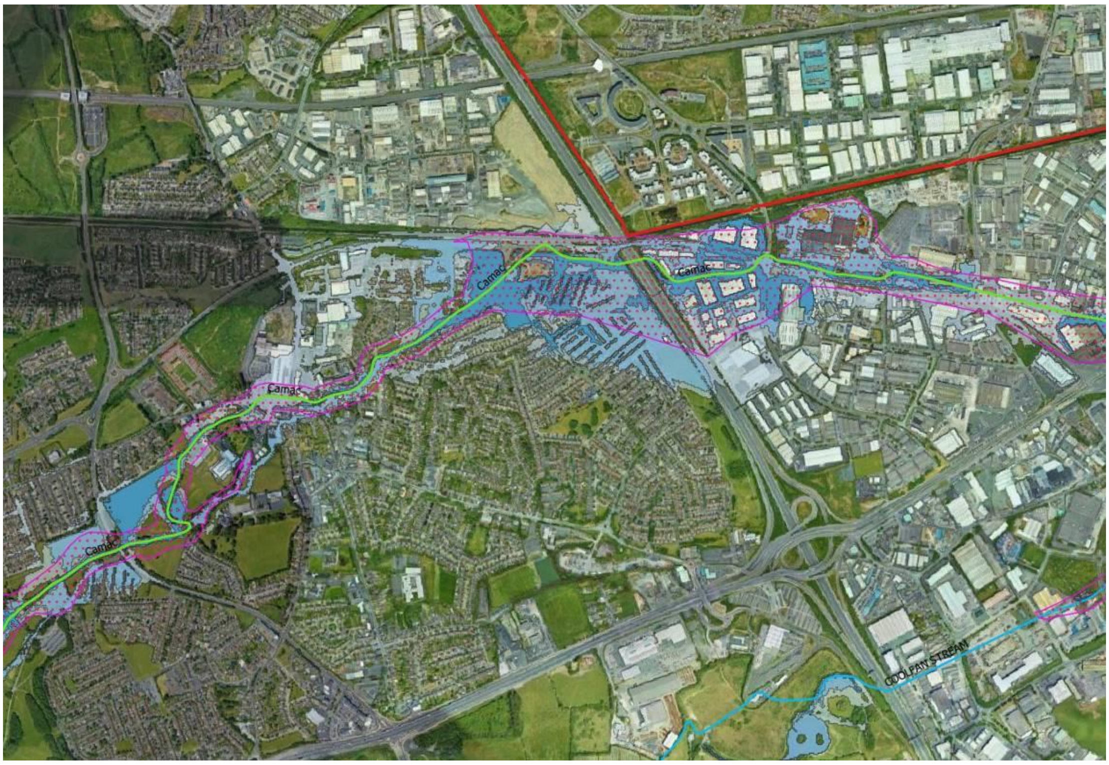



**Figure 4.4 Indicated flood risk areas and Riparian Corridors (in pink) for Clondalkin**

4. Naas Road – New Nangor Road: Indicated flooding from the Coolfan Stream (tributary of the Camac) affects areas in Ballymount Park, Robinhood Industrial Estate and Avonbeg Industrial Estate (between Long Mile Road and Naas Road). Flooding emanating from the Camac river is indicated west of Western Parkway Motorway and all along Nangor Road up until areas between the Grand Canal and Naas Road. Affected areas are currently zoned as "OS – To preserve and provide for open space and recreational amenities", "RES – To protect and/or improve residential amenity", and "REGEN - To facilitate enterprise and/or residential-led regeneration".

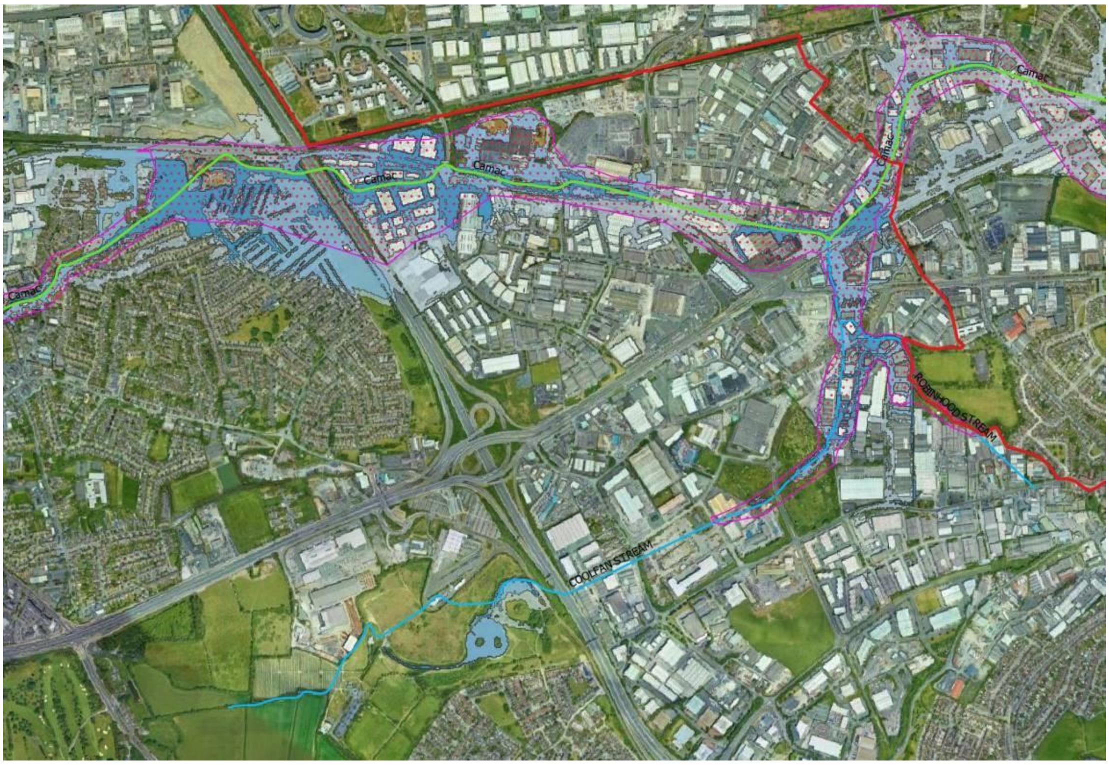



**Figure 4.5 Indicated flood risk areas and Riparian Corridors (in pink) for Naas Road – New Nangor Road**

5. Aungierstown and Ballybane: Indicated flooding emanating from the Griffeen and its tributaries affects areas between Peamount Road and Nangor Road/Grange Castle Road (Casement Aerodrome area) and areas north and west of Microsoft Ireland Data Centres (between railway line and Nangor Road). Indicated flooding emanating from the Camac affects areas north-west of Naas Road, in Corkagh Park and Fonthill Road South. Areas affected are currently zoned as "OS – To preserve and provide for open space and recreational amenities", "RES – To protect and/or improve residential amenity", "EE – To provide for enterprise and employment related uses", and "RU To protect and improve rural amenity and to provide for the development of agriculture".

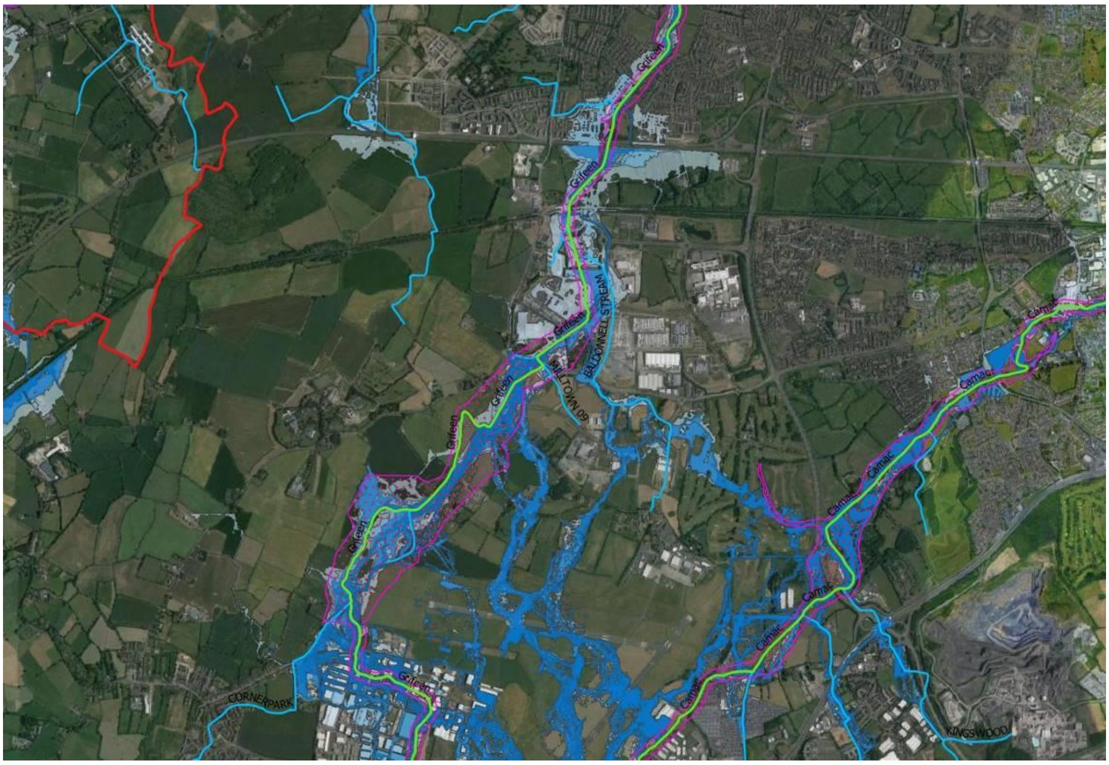



**Figure 4.6 Indicated flood risk areas and Riparian Corridors (in pink) for Aungierstown – Ballybane**

6. Adamstown: Flooding deriving from the Lucan Stream is indicated south and north of Adamstown Railway Station and south of Old Celbridge Road. Flooding from the Griffeen is indicated south of the rail line (between Adamstown Road and Grange Castle Road), north of the rail line (Griffeen Valley Park) and north of Lucan Bypass. Areas affected are currently zones as "OS – To preserve and provide for open space and recreational amenities", "SDZ - To provide for strategic development in accordance with approved planning schemes", "RES – To protect and/or improve residential amenity", and "EE - To provide for enterprise and employment related uses".

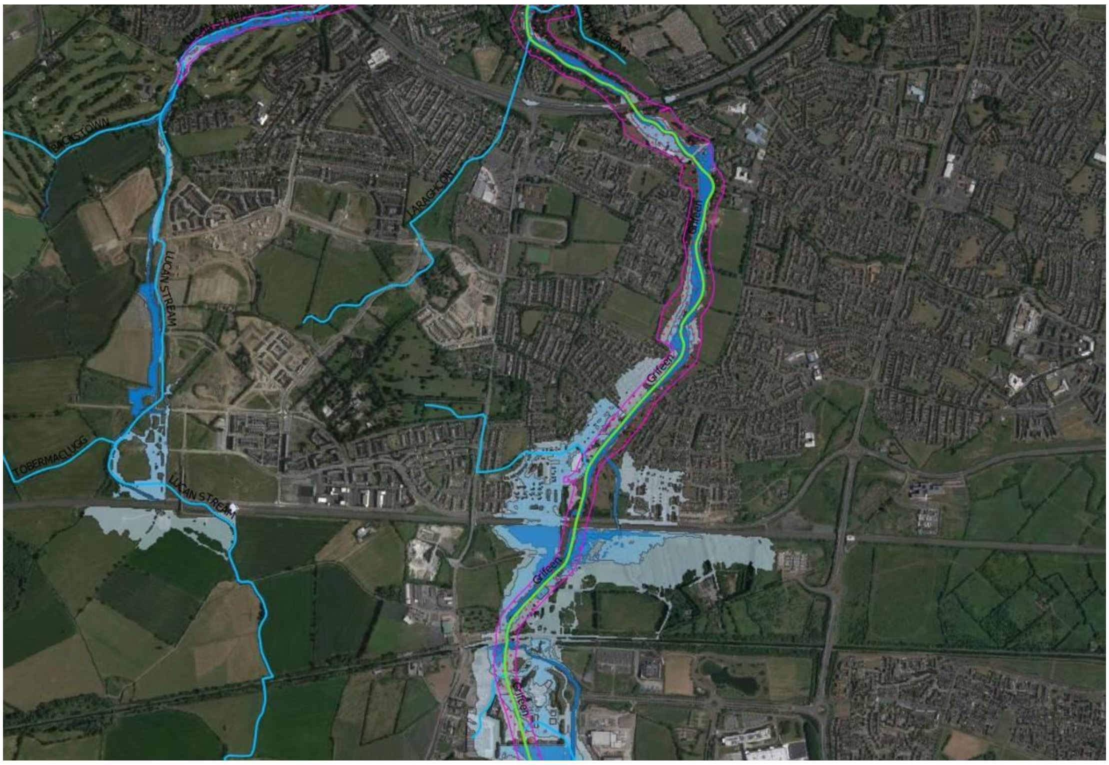


**Figure 4.7 Indicated flood risk areas and Riparian Corridors (in pink) for Adamstown**

7. Kimmage – Tempelogue: Indicated flooding deriing from the Poddle river affects areas west and east of Western Parkway Motorway (Tymon Park), across areas up to Templeville Road and across to Kimmage Road West. Flooding emanating from the Dodder is indicated between Templeogue Road and Firhouse Road/Butterfield Avenue. Affected areas are currently zones as "OS – To preserve and provide for open space and recreational amenities", "RES – To protect and/or improve residential amenity", and "LC - To protect, improve and provide for the future development of Local Centres".

**Figure 4.8 Indicated flood risk areas and Riparian Corridors (in pink) for Kimmage - Templeogue**

8. <u>Ballycullen – Oldcourt</u>: Indicated flooding from the Dodder and its tributaries (such as the Orlagh, Ballycullen Stream and Jobstown Stream) affects areas south of Tallaght Bypass, west of Balliharcorney Road/Firhouse Road, and areas south and north of Killiney Road (west of Southern Cross Route). Flooding from the Owenadoher and its tributaries is indicated in areas along Cruagh Road (south of Southern Cross Route) and around junction Edmondstown Road/BallybodenWay/Taylors Lane. Affected areas are currently zones as ""RES – To protect and/or improve residential amenity", "OS – To preserve and provide for open space and recreational amenities", "HA-DM - To protect and enhance the outstanding natural character and amenity of the Liffey Valley, Dodder Valley and Dublin Mountains areas", "RU – To protect and improve rural amenity and to provide for the development of agriculture" and "RES-N – To provide for new residential communities in accordance with approved area plans".


**Figure 4.9 Indicated flood risk areas and Riparian Corridors (in pink) for Ballycullen - Oldcourt**

9. <u>Rathfarnham (St. Endas and Tara Hill)</u>: Indicated flooding from the Dodder and its tributaries (such as Orlagh, Owenadoher, Kilmashogue, Little Dargle, and Slang river) occurs at areas west of Southern Cross Route, the Dodder Valley Park, along Dodder View/Park Road, north of Milltown Golf Club, along Ballyboden Road, along Whitechurch Road and Grange Road. There is further flooding indicated between Brethon Field Road and Southern Cross Route, north-west and west of Wyckham Point, from the junction Overend Way/Sandyford Road across Dundrum Town Centre along Dundrum Road up to Milltown Road. Flooding emanating from the Poddle indicates affected areas south of Limekiln Road and areas between Templeville Road and Kimmage Road West. Lands affected are currently zoned as "OS – To preserve and provide for open space and recreational amenities", "RES – To protect and/or improve residential amenity", "LC - To protect, improve and provide for the future development of Local Centres" and "RES-N – To provide for new residential communities in accordance with approved area plans".

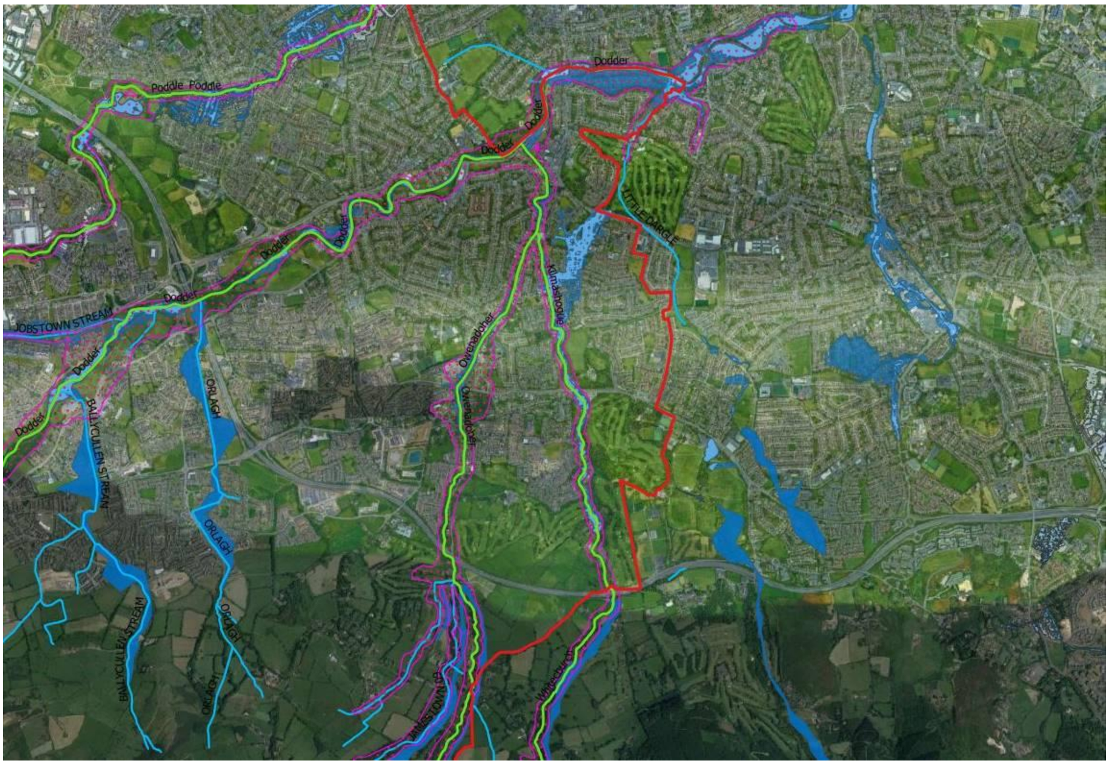



**Figure 4.10** **Indicated flood risk areas and Riparian Corridors (in pink) for Rathfarnham (St. Endas and Tara Hill)**

10. Brittas: Flooding is indicated to emanate from the Brittas river and its tributaries affecting areas between Blessington Road, Aghfarrell Road and Balyfolen Road as well as areas upstream of Brittas Lake. Lands affected are currently zoned as "HA-DM - To protect and enhance the outstanding natural character and amenity of the Liffey Valley, Dodder Valley and Dublin Mountains areas".

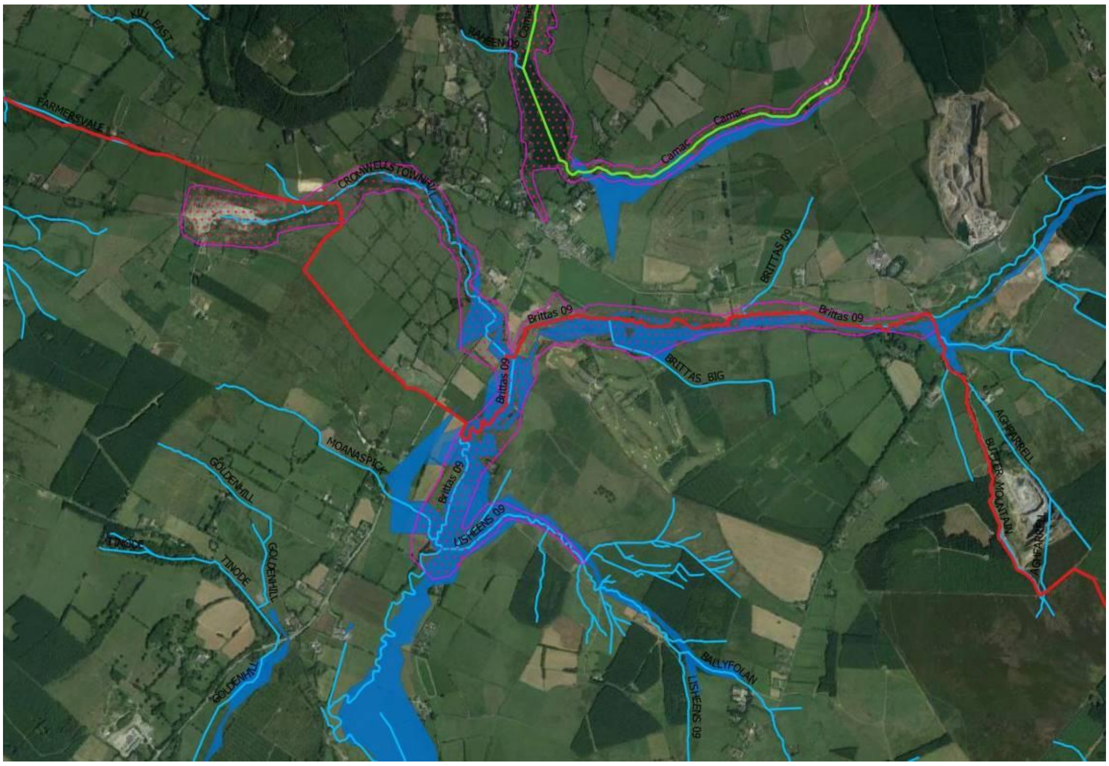



**Figure 4.11** **Indicated flood risk areas and Riparian Corridors (in pink) for Brittas**

11. Hazelhatch: Flooding deriving from the Grand Canal and the Castletown river is indicated south-east of the Grand Canal at Hazelhatch Road, between the rail line and the Grand Canal (east of Hazelhatch Road), and north-west of the rail line across Hazelhatch Road. Lands affected are currently zoned as "OS – To preserve and provide for open space and recreational amenities" and "RU – To protect and improve rural amenity and to provide for the development of agriculture".

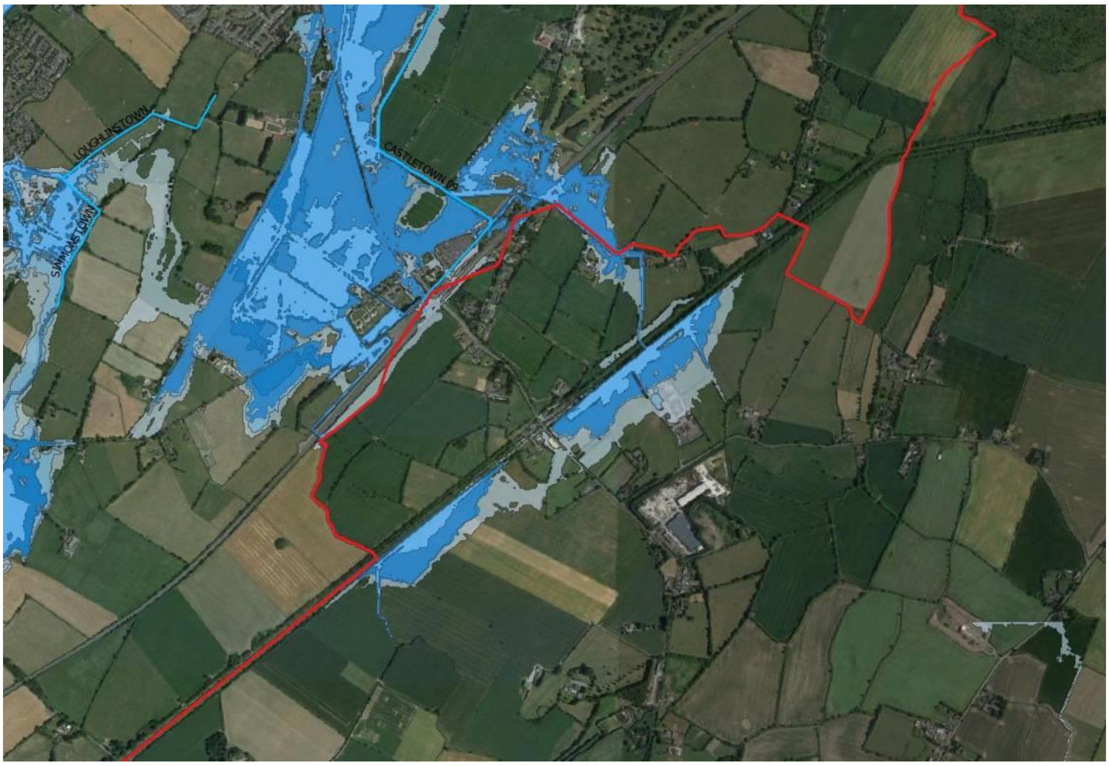



**Figure 4.12 Indicated flood risk areas and Riparian Corridors (in pink) for Hazelhatch**

## 4.3 Flood Risk Zoning Objectives

Flood Risk has been assessed throughout the county as part of the Strategic Flood risk Assessment. The following summarises the key finding with regard to sustainable flood risk management within the county. ROD proposes that the consideration of climate change is key to the flood zoning strategy. As discussed in Section 2 above, there is an increasing likelihood that Irelands climate will be similar to that depicted in the High End Future climate change scenario by the year 2100. Wherever zoning is discussed it should be assumed that this is to include a HEFS climate change allowance.

The flood zones mapping has been prepared in accordance The Guidelines identifying Flood Zones A, B and C. The flood zone maps are largely derived from the Eastern CFRAM and the Dodder CFRAM mapping. These maps are the most comprehensive flood maps produced for South Dublin since the introduction of the Guidelines and the Floods Directive. Flood extent mapping for areas that are not covered in the CFRAM Studies are supplemented by fluvial mapping from the earlier OPW Preliminary Flood Risk Assessment (PFRA) Report and assessments undertaken as part of existing Local Area Plans. Flood zone Mapping is presented in Appendix A.

**Flood Risk Objectives:**

1) To undertake site specific flood risk assessments for all new developments in accordance with The Planning System and Flood Risk Management – Guidelines for Planning Authorities (2009).
2) Ensure that future developments are designed and constructed in accordance with the "Precautionary Principle" detailed in The OPW Guidelines.

# 5. JUSTIFICATION TEST

***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.***

The National Spatial Strategy 2002-2022 identifies the consolidation of the Greater Dublin Area, as a primary policy of this Strategy. The NSS favours the physical consolidation of Dublin's Metropolitan Area as an essential requirement for competitive and sustainable growth. It seeks to sustain Dublin's role as the engine of the national economy and seeks to bring people, employment and services closer together to create a series of co-benefits including better quality of life, less congestion, reduced commuting distances, more regard to the quality of the environment and increased access to services like health, education and leisure.

***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;***

It is considered that the lands within the contiguous urban area of South Dublin are essential to allow for growth and expansion of South Dublin in order to meet the targets as set out in the RPGs.

***ii) Comprises significant previously developed and/or under-utilised lands;***

The majority of the contiguous urban area of South Dublin is developed with multiple instances of underutilised lands interspersed throughout.

***iii) Is within or adjoining the core of an established or designated urban settlement;***

The subject lands within south Dublin are located on the western periphery of Dublin City and forms an integral part of its urban form.

***iv) Will be essential in achieving compact and sustainable urban growth; and***

The future development of these lands will be in accordance with the approved County Development plan prepared in accordance with Ministerial guidance documents. A large portion of the county is within the Metropolitan Consolidation Area as outlined in the NSS.

***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.***

There are no alternative unzoned sites available for significant development with equivalent established infrastructure and services.

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.***

A SFRA has been carried out as part of the Strategic Environmental Assessment as part of the development plan preparation process. Existing sources of flood information including PRFA and CFRAMS flooding have been reviewed and flood zoning has been prepared for the county as per The Guidelines. Management of flood risk shall be undertaken in accordance with The Guidelines and the policies outlined in this document. A Site Specific Flood Risk Assessment of appropriate detail should accompany applications for development with South Dublin to demonstrate that they would not have adverse flood risk impacts. The FRA should consider the following:

- The sequential approach should be applied through site planning and should avoid encroachment onto, or loss of, the floodplain.
- FRAs should examine residual risk associated with culvert blockages, and climate change to set finished flood levels where appropriate. The FRAs should ensure development does not block flow paths and does increase flood risk elsewhere.
- FRAs should also address surface water management for development, demonstrating consideration of GDSDS policies and incorporation of SuDS e.g. Green Roofs, Rainwater Harvesting and Permeable Surfacing.
- Compensatory storage for development that results in a loss of floodplain must be provided on a level for level basis.

# 6. RIPARIAN CORRIDORS

## 6.1 The Need for Riparian Corridor Assessments

Riparian Corridors protect watercourses and their natural processes including: ecological, biogeochemical, hydromorphological and flood resilience in the face of climate change. These zones act as the interface between rivers and adjoining lands and are key to managing flood risk within catchments of all sizes. Maintaining and enhancing Riparian Corridors creates “room for the river” and the benefits that entails including reducing risk to persons and property from flooding. The sustainable management of riparian zones is crucial to meeting our objectives under the Water Framework and Floods Directives.

Recent decades have seen an increased awareness of the role of riparian zones in controlling the movement and processing of waterborne pollutants. This research was built upon growing interest in the interactions along aquatic-terrestrial fringes initially in relation to fisheries and more recently the effect of ecosystem diversity and resilience to climate change. The relationship between Riparian Corridors and nutrient processing is widely known, by acting as buffers between upland areas and open water, they help treat pollutants.

## 6.2 Riparian Vegetation

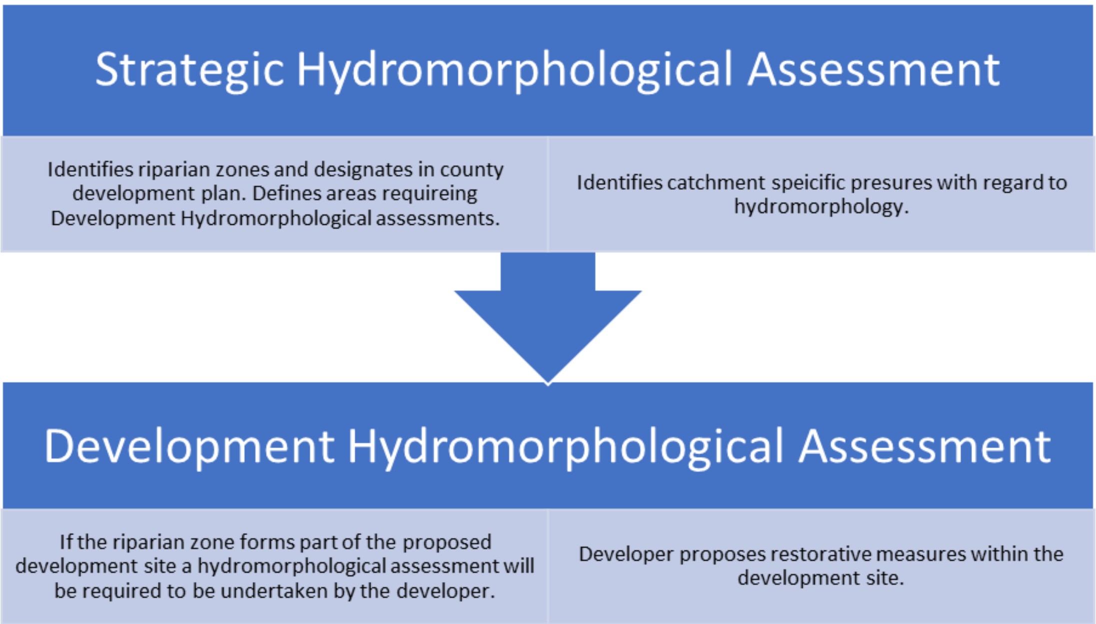
Riparian vegetation acts with flow, sediment and topography to influence channel form, instream habitat, nutrient dynamics, temperature and flow patterns. Therefore, removal of upland and riparian vegetation through agriculture and urbanisation disrupts land-water linkages leading to reductions in water quality, simplification of stream channels, less stable thermal and flow regimes, and ultimately, reduced ecosystem integrity. Riparian vegetation is a key source of beneficial in-stream nutrients and carbon, provides shade aiding thermally sensitive species (e.g. salmonids) and directly influences channel morphology (bank stabilisation, source of Large Woody Debris).

Designating and maintaining riparian corridors along the along major watercourses and their tributaries is key to maximising ecosystem services provided by the watercourses. Vegetative riparian buffers ecosystem services include:

- Interception and reduction of potential pollutants from both agricultural and urban sources,
- Attenuating flood waters,
- Bank stabilisation,
- Reducing runoff volumes
- Habitat provision and refuge,
- Ecological corridors
- Vegetal debris that falls into the watercourse is an important source of nutrients for instream biota.
- Thermal shading of watercourse,
- Amenity value.

## 6.3 Development Hydromorphical Assessment and Restorative Measures

The strategic assessment has informed the requirements for Development Hydromorphological assessments as outlined in the figure below.




Development Hydromorphical Assessments are to be undertaken where lands are partially or wholly within the Riparian Corridors identified as part of the Development

Plan. The Development Hydromorphological Assessment will include the following considerations:

- An assessment of the existing river reach, identify existing hydromorphological pressures, determine deviation from a "Natural" form and propose restorative measures to improve Hydromorphical integrity and resilience throughout the river reach.
- Key assessment parameters shall include: Flow, River Continuity, Planform, Sediment Regime, & Riparian Vegetation.
- Where proposed development lands are within the Riparian Corridor but are not directly adjacent to a watercourse, measures should focus on SuDS to manage the quality and quantity of surface water runoff and promote biodiversity.
- In general restorative measures should create "Room for the River" and in time allow river systems to return to a state of equilibrium with rich biodiversity, developed ecosystem service provision and resilience to future shocks such as climate change. Potential restorative measures are described below.

### 6.3.1 Flood Zoning

Lateral connectivity should be maintained where possible throughout catchments. Assessing and zoning floodplains throughout the catchment is key to defining appropriate land use practices and future sustainable development. Much of the historic floodplains within the catchment are defined as part of previous flood studies. Nonetheless, the impacts of climate change should be taken into account as the areas liable to flood in the near future may increase significantly over present-day extents and within the Riparian Corridors identified within this SFRA.

### 6.3.2 Riparian Buffer

The immediate riparian buffer should be "re-wilded" as much as possible. Any development within the riparian buffer strip, including pedestrian/cycle paths and highly managed parkland, should be minimised. Within these riparian buffer zones explicit care should be given to the variety of plant species. The vegetation within the riparian buffer should be native and appropriate to the location and soil water regime, preferably from a local source. Inclusion of riparian trees is important as currently the majority of catchments in the Dublin region have very little tree cover.

Providing buffer strips adjacent to the watercourses and limiting instream works maintains existing flow/flood regimes as well as important ecological corridors for aquatic and terrestrial flora and fauna.

### 6.3.3 Sustainable Agriculture Practices

The nature of land ownership in Ireland means that the majority of riparian land is privately owned. As such educating and involving riparian landowners is key to enhancing riverine environments. This includes:

- Educating farmers on the correct use of nitrates and agricultural fertilisers,
- Use of stock fencing as to minimize livestock access pressure have been seen to result in:
    - a decrease in sediment loads
    - woody vegetation cover increases,
    - increase resistance to erosion,

  - increase in vegetation increases roughness,
  - trapping sediment, which builds banks;
- Designated crossing / access points for livestock along the banks of a watercourse will aid in reducing bank erosion and sediment from entering the watercourse. At such points, the banks could be reinforced to aid in the prevention of bank erosion.
- The provision of riparian buffers and Integrated Constructed Wetlands (ICW) systems adjacent to rivers has been seen to greatly reduce pollutants in agricultural runoff (e.g. effluent, fertilisers & pesticides, etc.) from entering freshwater systems.
- The provision of ICW systems on agricultural lands within the LAP can provide storage to agricultural runoff, slow runoff, create aquatic and riparian habitat and absorb and/or retain CO2, however incentives would possibly need to be in place for the general public to adopt such systems.
- Educating the general public on the potential negative impacts of such activities can also help mitigate this pressure.

### 6.3.4 Instream Works and Channel Modifications

The methodologies outlined above have been chosen as to be minimally invasive. However, as with the majority of urban watercourses in Ireland, some of the primary pressures within the South Dublin catchments are the significant morphological alterations as a result of culverting, canalisation and construction of flow regulation structures such as weirs. Key ecosystem services and habitat types can not return to the urban catchments without some River Restoration measures being undertaken within the main river channel. Possible options include:

- De-culverting of Watercourses
- Introduction of Large Woody Debris,
- Establishment of in-stream vegetation,
- New meander in impounded river channel,
- Reconnecting a remnant meander,
- Current deflectors,
- Narrowing channel with aquatic ledges,
- Creating a sinuous low-flow channel in an over-widened channel,
- Creation of on-line bays,
- Fixing whole trees into the river bank for flow diversity,
- Gravel reworking to restore a low-flow channel,
- Weir removal
- Review of/reduction in maintenance.

The impact of these measures on the current channel morphology and maintenance practices varies significantly. Options such as introducing Large Woody Debris would likely have a minimal impact on flooding while providing substantial benefits in the form of flow heterogeneity and habitat creation.

## 6.4 Riparian Corridor Objectives:

1) To ensure that hydromorphological assessments are undertaken where proposed development is within lands which are partially or wholly within the Riparian Corridors identified as part of this Development Plan.
2) To require development proposals that are within riparian corridors to demonstrate how the integrity of the Riparian Corridor can be maintained and enhanced having regard to flood risk management, biodiversity, ecosystem service provision, water quality and hydromorphology.
3) To promote and protect native riparian vegetation along all watercourses and ensure that a minimum 10m vegetated riparian buffer from the top of the riverbank is maintained/reinstated along all watercourses within any development site.

# 7. STORMWATER MANAGEMENT STRATEGY AND SUDS RETROFIT

## 7.1 SUDS Overview

### 7.1.1 Introduction

The SuDS philosophy is to mimic the natural hydrological cycle by promoting; infiltration, evaporation, evapotranspiration, the harvesting of rainwater at source and the temporary storage of water (ponding), through the construction of a combination or series of components to form a 'management train'. Whilst there is no internationally agreed definition for SuDS – as the understanding of the SuDS philosophy correlates to the extent to which it is embedded in policy and practice over time, the three 'pillars' of sustainable stormwater management practice are generally accepted as;

(i) Reducing the rate and quantity of stormwater discharge,
(ii) Improve the quality of stormwater discharges and receiving water bodies and
(iii) Provide amenity and biodiversity value.

Consideration of the sensitivity of the surrounding environment and downstream water quality is fundamental to the successful implementation of SUDS systems, particularly as we face into the uncertainties of a changing climate.

### 7.1.2 Benefits of SuDS

Traditional surface water drainage design is relatively simple, using the Rational method to size pipes to ensure that surface water is removed as quickly as possible to ensure flooding does not take place on hardstanding areas. Unfortunately, this philosophy is flawed as, in more rapidly transferring the surface water downstream, it provides the potential for flooding of other areas. This accelerated run-off gives rise to higher flood levels and the corresponding loss of groundwater recharge results in reduced low flows in rivers thus increasing environmental vulnerability. In addition, the pollution in the run-off is conveyed into the natural environment.

SuDS offer multiple benefits over traditional drainage practices managing discharge rates, volumes and diffuse pollution as well as providing the flexibility for adaptation to future drainage needs through a modular implementation. Climate change predictions suggest that some types of extreme events will become more frequent, such as heat waves, flooding caused by extreme rainfall and drought. The SuDS approach is more robust and adaptable than the traditional approach of underground piped drainage systems. In shallow surface-based systems, such as swales, water levels rise gradually and visibly. When the capacity of the SuDS feature is exceeded, the excess water can be directed to safe storage zones. This allows the general public, and road owners and operators to prepare for flood events more effectively. Conversely, flooding from underground piped drainage systems can occur suddenly and rapidly when the design capacity is exceeded. Furthermore, shallow, visible surface-based systems can be designed to offer greater flexibility to adapt to Climate Change. SuDS systems can enhance more readily and cheaply, compared to underground drainage systems. Lower river flows; caused by drought, result in reduced dilution of pollutants following rainfall events. The treatment of surface water runoff, through SuDS, helps to protect and enhance the quality of receiving watercourses, which assists in the attainment of our objectives under the Water Framework Directive.

### 7.1.3 Factors Influencing the Design of SuDS

There is no unique solution and each situation must be evaluated on its own merits and suitable SuDS solutions applied, although the means to achieving these objectives are many and varied. Factors such as site suitability, available space, cost, maintenance regimes and community acceptance must be considered to ensure successful implementation. The various SuDS features can generally be categorised as 'hard' SuDS and 'soft' SuDS. Soft SuDS resemble natural features and include techniques such as swales, ponds and wetlands. Hard SuDS are more similar to traditional drainage methods but incorporate SUDS principles. Examples of these are permeable pavements and proprietary SUDS features such as filtration systems and vortex separators.

### 7.1.4 The Management Train

The SuDS philosophy, and effective stormwater management in general, requires a series of SuDS features, linked together, to form a stormwater management system to treat and attenuate surface water runoff as close to the source of runoff as possible, before being conveyed downstream for further treatment and storage.

## 7.2 Opportunities for SuDS Systems in a Changing Climate

The principal treatment processes in a SuDS system are Sedimentation and Biodegradation.

### 7.2.1 Sedimentation

Sedimentation is one of the primary removal mechanisms in SuDS. Most pollution in stormwater runoff is attached to sediment particles and therefore the removal of sediment will achieve a significant reduction in pollution loading to receiving water bodies. Sedimentation is achieved through the reduction in flow velocities to a level at which the sediment particles fall out of suspension.

### 7.2.2 Biodegradation

Biodegradation is a natural biological treatment process that is a feature of several SuDS systems - systems that are subject to both wet and dry conditions. In addition to the physical and chemical processes of SuDS systems, biological treatment may also occur. Microbial communities may be established in the ground using the oxygen within the free-draining materials and the nutrients supplied with the inflows, to degrade pollutants such as hydrocarbons and grease.

The level of bioremediation activity will be affected by environmental conditions such as temperature and the supply of oxygen and nutrients. It also depends on the physical conditions within the ground such as the suitability of the materials for colonisation.

### 7.2.3 'Wet and Dry' SuDS Systems Perform Best

The presence of vegetation adds a physical filtration aspect to SuDS systems in the case of filter strips leading to swale/basins, the majority of hydrocarbons are removed by the first stage. If vegetation has been affected by drought, this element of the treatment train will be absent (in a worst-case scenario or significantly diminished at best). Maintenance of filter strips, swales and detention basins typically involve grass cutting. It is worth noting that hydrocarbons are also broken down by UV light in a process called photolysis, but where increasing levels of contaminants are building up in the soil (in the swale, basin, pond or wetland) the affected soil is likely to require removal and will more than likely be classified as contaminated waste.

The most recent published literature suggests that ponds and wetlands do not seem to benefit from the enhanced biological treatment of hydrocarbons found in the oxygen-rich conditions of the swales and basins (which are not designed to hold a permanent volume of water). Nonetheless, ponds and wetlands have been utilised extensively as the default treatment system serving roads and motorways in Ireland and UK, with little supporting literature to justify such initiatives.

In the selection of the most resilient and enduring suds systems, this fact is important:

*Only SuDS features that experience <u>both wet and dry conditions</u> benefit from this added biological treatment - ponds and wetlands are proposed as polishing stage options as part of a treatment train.*

The temperature dependence of these aerobic microbes (responsible for this additional layer of treatment) means that the chemical and biological treatment mechanisms found in SuDS systems are enhanced with increasing temperature.

### 7.2.4 The Benefits of Vegetative Systems

The successful implementation of bioremediation systems requires the establishment of appropriate plants and /or microorganisms at the containment site. Factors to be considered include: (i) selection of appropriate plant species, (ii) the influence of contaminants on seed germination, (iii) the use of native versus non-native plants and (iv) the effectiveness of inoculating contaminated soils with microorganisms. Furthermore, the plant species must be well adapted to the soil and climate of the region, making soil characteristics, length of growing season, average temperature and annual rainfall important considerations in plant-assisted bioremediation / biodegradation planning. The rate of microbial degradation generally doubles for every 10-degree centigrade increase in temperature.

Indirect benefits include enhanced soil quality through improvements in soil structure, increased porosity and therefore water infiltration, providing nutrients, accelerating nutrient cycling and increasing soil organic carbon. The use of plants also stabilises the soil thus preventing erosion and direct human exposure.

## 7.3 SuDS Objectives

### 7.3.1 Quantity Control Processes

Several techniques can be implemented to control the quantity of runoff from a development. Each technique presents different opportunities for stormwater control, flood risk management, water conservation and groundwater recharge.

a) Infiltration

- Soaking of water into the ground
- Most desirable solution to runoff management as it restores the natural hydrologic process
- Impacted by groundwater vulnerability and infiltration ability of subsoil

b) Detention / Attenuation

- Slows down surface water flows before their transfer downstream
- Usually achieved through use of a storage volume and constrained outlet
- Should be above ground
- Reduces peak flow rate but total volume of runoff remains the same

c) Conveyance

- Transfer of surface runoff from one place to another
- Through grassed channels/trenches and pipes
- Transfer essential for managing flows and linking SuDS components
- Uncontrolled conveyance to a point of discharge in the environment not considered sustainable

d) Water Harvesting

- Direct capture and use of runoff on site for domestic or irrigation, overflowing/discharging to adjoining SuDS component(s)
- Contributes to Flood Risk Management

### 7.3.2 Quality Control Processes

A number of natural water quality treatment processes can be exploited within SuDS design. Different processes will predominate for each SuDS technique and will be present at different stages in the treatment train.

a) Sedimentation – reducing flow velocities to a level at which the sediment particles fall out of suspension;

b) Filtration & Biofiltration – trapping pollutants within the soil or aggregate matrix, on plants or on geotextile layers;

c) Adsorption – pollutants attach or bind to the surface of soil or aggregate particles;

d) Biodegradation – Microbial communities in the ground degrade organic pollutants such as oils and grease;

e) Volatilisation – transfer of a compound from solution in water to the soil atmosphere and then to the general atmosphere;

f) Precipitation – transform dissolved constituents to form a suspension of particles of insoluble precipitates;

g) Plant Uptake – removal of nutrients from water by plants in ponds and wetland;

h) Nitrification – Ammonia and ammonium ions can be oxidised by bacteria in the ground to form nitrate which can be readily used as a nutrient by plants;

i) Photolysis – The breakdown of organic pollutants by exposure to ultraviolet light.

### 7.3.3 Amenity & Biodiversity Processes

SuDS provides opportunities to create attractive landscaping features which offer a variety of amenity/biodiversity. The following are the main SuDS components offering aesthetic, amenity and ecological benefits.

Primary Processes:

a) Blue/Green Roofs

b) Grassed channels/Swales

c) Filter strips

d) Bioretention Areas

e) Vegetated swales and detention basins

f) Infiltration Basins

Benefits subject to design:

a) Ponds

b) Wetlands

### 7.3.4 Water Quality

The implementation of SuDS as part of future development within the SDCC CDP lands should ensure that the quality of discharge from future development to the surrounding watercourses, through the removal of sediments and contaminants, will not negatively impact the existing condition of the watercourses. The quantity of discharge from future developments to surrounding watercourses will also not negatively impact the existing condition of the watercourses, as discharge rates will be limited to an approximate greenfield rate. Moreover, the adoption of SuDS systems in all new developments and the protection of existing floodplains shall assist in the attainment of our objectives under the Water Framework Directive as downstream watercourse conditions will be improved as a result of a better quality and quantity of discharge from upstream developments.

### 7.3.5 Effects of Climate Change

The effects of climate change need to be considered when designing and preparing maintenance regimes for SuDS features. Sedimentation is one of the primary removal mechanisms in SuDS. As discussed above, this is achieved through the reduction in flow velocities to a level at which particles fall out of suspension. However, care must be taken through design and appropriate maintenance regimes to ensure the risk of re-suspension is minimised during extreme rainfall events.

The level of biodegradation activity that occurs within SuDS features will be affected by environmental conditions such as temperature and the supply of oxygen and nutrients. It is also depending on the physical conditions within the ground such as the suitability of the materials for colonisation.

## 7.4 SuDS Techniques

In addition to the objectives above, in order to replicate the natural drainage system, a 'Management Train' is required. The Management Train sets a hierarchy of SuDS techniques which should be implemented in series as follows:

- Prevention – prevent runoff and pollution
- Source Control – control runoff at or close to the source

- Site Control – management of surface water in the site/local area
- Regional Control – management of surface water from a number of sites together

Various SuDS components have different capabilities regarding the objectives outlined above and are more suited to certain stages of the Management Train. The principle of the Management Train is that wherever possible, surface water should be managed locally in small, sub-catchments rather than being conveyed to and managed in large systems further down the catchment. Table 8.1 below contains examples of SuDS techniques for Source, Site and Regional controls.

**Table 8.1 SuDS Techniques for Source, Site & Regional Control**

| Source Control | Site Control | Regional Control |
|---|---|---|
| Rainwater Harvesting | Permeable Paving | Detention Ponds/Basins |
| Green Roofs | Bioretention Strips | Retention Ponds/Basins |
| Permeable Paving | Infiltration Trenches | Wetlands |
| Bioretention Strips | Filter Drains | Infiltration Basins |
| Filter Drains | Filter Strips | Detention Basins |
| Infiltration Trenches | Swales | Petrol Interceptors* |
| Filter Strips | Sand Filters | |
| Soakaways | Infiltration Basins | |
| Blue Roofs | Detention Basins | |
| Swales | Petrol Interceptors* | |

*Use of Petrol Interceptors should be avoided except where the potential for hydrocarbons entering the surface water drainage network is particularly high. Treatment of surface water runoff should be provided through the use other SuDS techniques.

## 7.5 Modular SuDS Components

Management trains for new and existing developments should facilitate the construction of future SuDS components and/or provide for future enhancements to existing SuDS components – to mitigate the risk of flooding caused by more extreme rainfall events and risk of pollution due to lower baseflow in receiving waters.

Modular components can include:

- Additional physical SuDS features e.g. swales, basins and ponds and/or;
- Enhancements to existing SuDS features by upsizing and/or;
- Introducing vegetation and/or;
- Management actions e.g. changing the maintenance regime in response to findings of a monitoring regime.

## 7.6 SuDS Protocol for New Development

As part of any future development within the SDCC lands, the developing authority should adapt the following protocol. This protocol will provide guidance for assessing the resilience of SuDS to climate change during periods of drought, flash flooding, temperature extremes and periods of persistent rainfall and to propose appropriate resilient SuDS strategies to manage stormwater runoff arising from severe rainfall events now and into the future. An overview of this protocol is outlined in Figure 8.1 below.

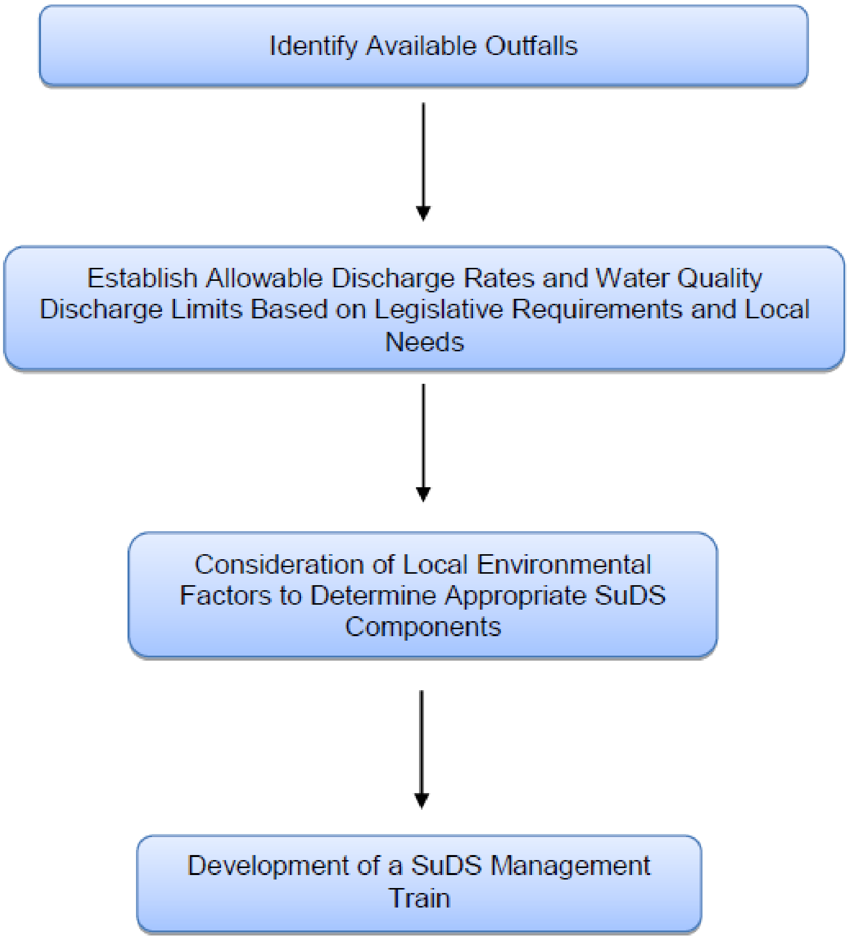



**Figure 8.1 Recommended SuDS Protocol to Be Adapted**

## 7.7 Management Train

A Management Train is usually required when developing a SuDS strategy. A Management Train sets a hierarchy of SuDS techniques which are subsequently linked together. Each technique employed contributes in different ways and degrees to the overall drainage network. The scale and number of components required will depend on the respective catchment characteristics and likely concentration of pollutants in the inflow. Considering the scale of proposed developments, a combination of carefully designed and appropriately maintained source controls, site controls and possibly regional controls are required as part of the surface water drainage system to ensure high water quality from runoff into these areas.

## 7.8 Quantity and Quality Performance

In selecting suitable SuDS components for a SuDS management train, the quantity of runoff and quality performance for various SuDS techniques should be assessed:

- Source Control techniques are most effective in reducing run off volume.
- Open Channels and Detention Basins provide the best hydraulic control for large flows (1% AEP), and water quality benefits.
- Permeable paving, Infiltration and Filtration techniques (filter strips, swales, grassed channels) are most effective for water quality treatment.

- Subsurface storage systems offer limited potential for water treatment.

## 7.9 Community, Environmental and Amenity Performance

Community and environmental factors for various SuDS techniques include Maintenance Regime, Community Acceptability, Construction and Maintenance Costs and Habitat Creation Potential.

Detention Basins and Swales (particularly Conveyance Swales) typically provide the most cost-effective SuDS solution while also incorporating the potential for habitat creation.

The implementation of wetlands will typically promote habitat creation and are generally accepted by communities as they provide valuable open space for visual and recreational enjoyment, however capital and maintenance costs can be relatively high.

There may be some public safety concerns associated with SuDS techniques involving open water, however good design and education can help minimise these concerns. This can be achieved through 'demonstration projects' and initiatives to educate local residents of the benefits of SuDS systems and natural floodplain management approaches as a means to tackle flood risk, particularly in response to climate change and the adverse environmental effects of uncontrolled contaminated stormwater runoff from urban developments. It is also recommended that developers make the proposals and advantages clear to future prospective buyers of the lands at the time of sale. The SuDS approach also offers benefits to the health and wellbeing of citizens.

## 7.10 SuDS Retrofitting

There are opportunities for SuDS retrofitting throughout the CDP lands, however, this would be difficult to implement on existing private development. This is due to a lack of knowledge on the societal benefits of SuDS (economic, ecological, health and wellbeing, amenity etc.) by the general public. SuDS measures that could be implemented on existing private development include permeable paving on driveways, installation of rainwater harvesting systems and the provision of vegetated systems such as swales and bioretention areas within private gardens.

## 7.11 Recommendations

1) New surface water drainage networks will be required as part of development within the plan lands. These networks should be designed in accordance with South Dublin County Council's *Sustainable Drainage Systems (SuDS) Explanatory, Design and Evaluation Guide* and current Health & Safety Legislation. Where the Local Authority is to take-in-charge SuDS features within developments, the Safety File will be required.
2) Protect existing floodplains and ensure no development occurs on flood-plains along the existing watercourses that flow through the lands. These flood-plains shall accommodate flood waters during extreme flooding events through the provision of Riparian Corridors.

3) A Management Train should be incorporated during the design stage whereby surface water should be managed locally in small sub-catchments rather than being conveyed to and managed in large systems further down the catchment.

4) Management trains for new developments should facilitate the construction of future SuDS components – to mitigate the risk of flooding caused by more extreme rainfall events and risk of pollution due to lower baseflow in receiving waters.

# 8. SUMMARY

This SFRA report for the South Dublin County has been carried out in accordance with the requirements of the OPW Flood Risk Assessment Guidelines for Planning Authorities (2009) and Circular PL02/2014 (August 2014). The SFRA has provided an assessment of flood risk within the County to assist SDCC to make informed strategic land-use planning decisions. The flood risk information has enabled SDCC to apply the sequential approach described in The Guidelines and a Justification Test.

## 8.1 Flood Zones And Flood Risk

South Dublin County is susceptible to several types of flood risk. The flood zone extent mapping have been prepared (presented in Appendix A) in accordance the Planning System and Flood Risk Assessment Guidelines identifying Flood Zones A, B and C. The flood zone maps are primarily derived from the Eastern CFRAM and the Dodder CFRAM mapping. These maps are the most comprehensive flood maps produced for South Dublin since the introduction of the Guidelines and the Floods Directive. Flood extents for areas that are outside of the scope of the CFRAM Studies and are supplemented by fluvial mapping from the earlier OPW Preliminary Flood Risk Assessment (PFRA) Report. Additionally, pluvial flood extent mapping has been prepared for the 1% and 0.1% AEP events as derived from the PFRA study. The Flood Zone mapping is based on the best currently available data and a more detailed, site specific FRA may generate localised flood extents.

## 8.2 Flood Management Objectives

The County Development Plan outlines flood risk management strategies and objectives that incorporate Flood Risk Management into the spatial planning of the County, to meet the requirements of the Floods Directive and the Water Framework Directive. Appropriate Flood Risk Management objectives are detailed in Section 5 Flood risk management will be carried out in accordance with the Flood Risk Management Guidelines for Planning Authorities, DOECLG (2009) and Circular PL2/2014.

The CFRAMS (www.floodinfo.ie) and South Dublin Strategic Flood Risk Assessment provide information in relation to known flood risk in South Dublin County. Development proposals on lands that may be at risk of flooding should be subject to a Site Specific Flood Risk Assessment, prepared by an appropriately qualified Chartered Engineer, in accordance with the Flood Risk Management Guidelines. Detailed flood risk assessments should be cognisant of possible pluvial / surface water flood risk and appropriate drainage proposals should be implemented to reduce the risk of pluvial flooding.

There is an increasing likelihood that Irelands climate will be similar to that depicted in the High End Future climate change scenario by the year 2100. Therefore, it is prudent to consider the HEFS parameters when planning for vulnerable infrastructure and developments. This approach will also assist in achieving our obligations under the Water Framework Directive (WFD).

## 8.3 Riparian Corridors

A Strategic Hydromorphological Assessment of Riparian Corridors has been completed and Riparian Corridors have been delineated for the major rivers within the County. Maintaining and enhancing Riparian Corridors creates "room for the river" and the benefits that entails including reducing risk to persons and property from flooding and resilience to future shocks such as climate change. The sustainable management of riparian zones is crucial to meeting our objectives under the Water Framework and Floods Directives. Objectives to maintain and enhance Riparian Corridors and the benefits they entail have been described in Section 7.

## 8.4 SFRA Review And Monitoring

The SDCC SFRA will be reviewed and updated every six years in line the County Development Plan review process. Additionally, outputs from future studies and datasets may trigger a review and update of the SFRA during the lifetime of the 2022-2028 Development Plan. With regard to Climate Change, the OPW is currently transitioning to regional based climate models that reflect the likely varied impacts throughout the island of Ireland. This is likely to be implemented during the lifetime of the proposed county development plan. Proposed developments should take account of the most up to date OPW guidance on climate change as part of Site Specific Flood Risk Assessments.

## 8.5 SFRA Objectives

- To undertake site specific flood risk assessments for all new developments in accordance with The Planning System and Flood Risk Management – Guidelines for Planning Authorities (2009).

- Ensure that future developments are designed and constructed in accordance with the "Precautionary Principle" detailed in The OPW Guidelines.

- To ensure that hydromorphological assessments are undertaken where proposed development is within lands which are partially or wholly within the Riparian Corridors identified as part of this Development Plan.

- To require development proposals that are within riparian corridors to demonstrate how the integrity of the Riparian Corridor can be maintained and enhanced having regard to flood risk management, biodiversity, ecosystem service provision, water quality and hydromorphology.

- To promote and protect native riparian vegetation along all watercourses and ensure that a minimum 10m vegetated riparian buffer from the top of the riverbank is maintained/reinstated along all watercourses within any development site.

# APPENDIX A
# FLOOD MAPPING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Project Stage: DRAFT

Project Title: SDCC County Devlopment Plan
Stategic Flood Risk Assessment

Drawing Title: SFRA Flood Zone Mapping
Overview Map

| Drawing Number | Project | Originator | Volume | Location | Type | Role | Number |
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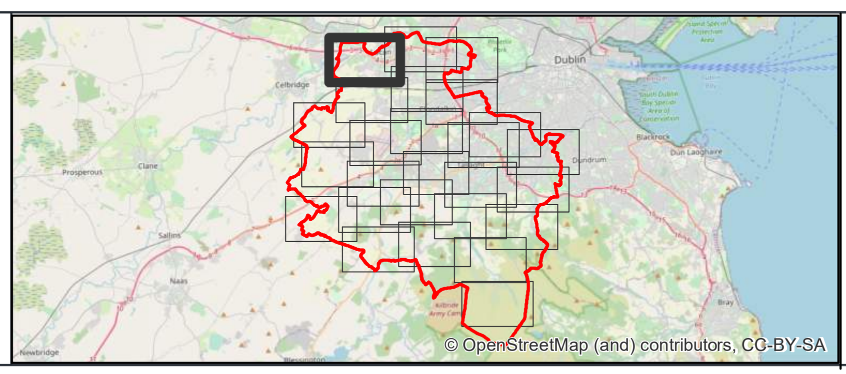


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Drawing Title: SFRA Flood Zone Mapping
Sheet 1 of 26

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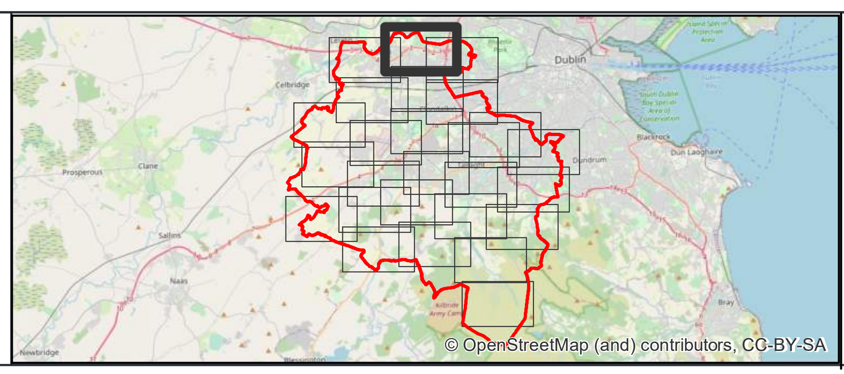


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| Drawing Title | SFRA Flood Zone Mapping<br>Sheet 2 of 26 |

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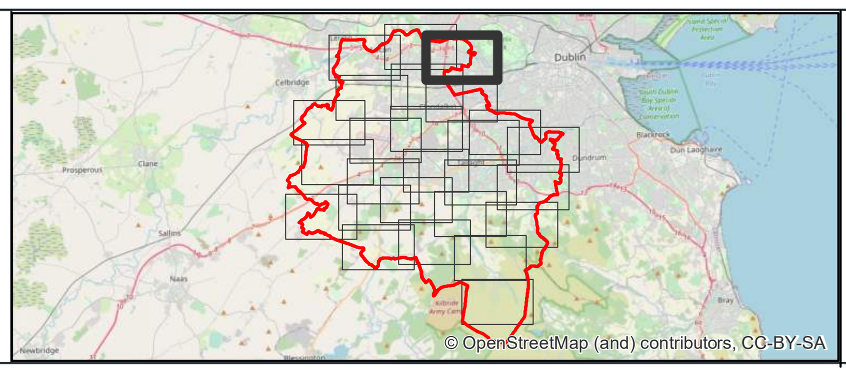


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Project Title: SDCC County Devlopment Plan Stategic Flood Risk Assessment

Drawing Title: SFRA Flood Zone Mapping Sheet 3 of 26

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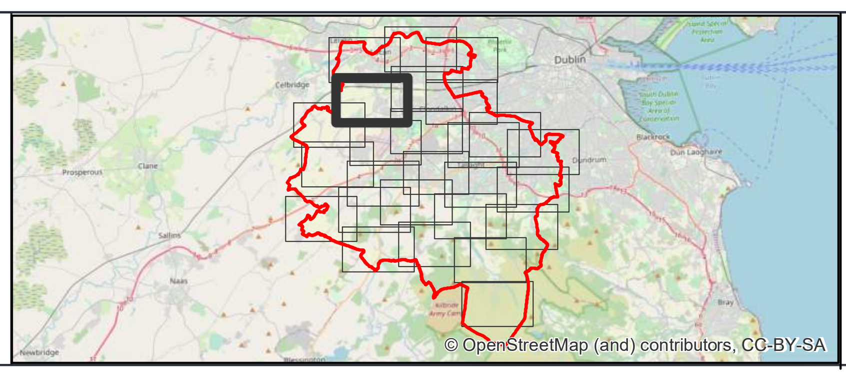


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Drawing Title: SFRA Flood Zone Mapping
Sheet 4 of 26

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## Legend

- Watercourses
- Flood Zone A – 1%AEP Flood Extent (1 in 100 Year Flood)
- Flood Zone B – 0.1%AEP Flood Extent (1 in 1000 Year Flood)
- Riparian Corridor
- County Boundary

0 100 200 400 600 800 1,000 m

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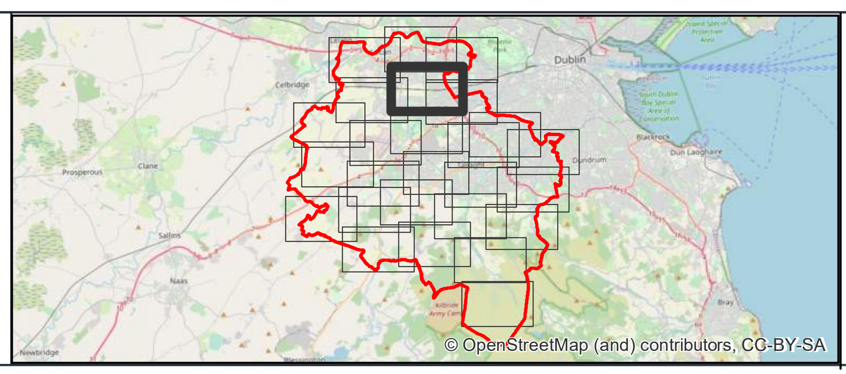


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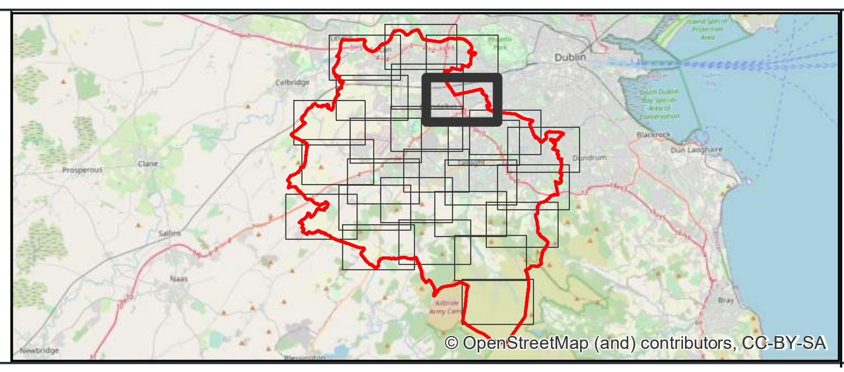


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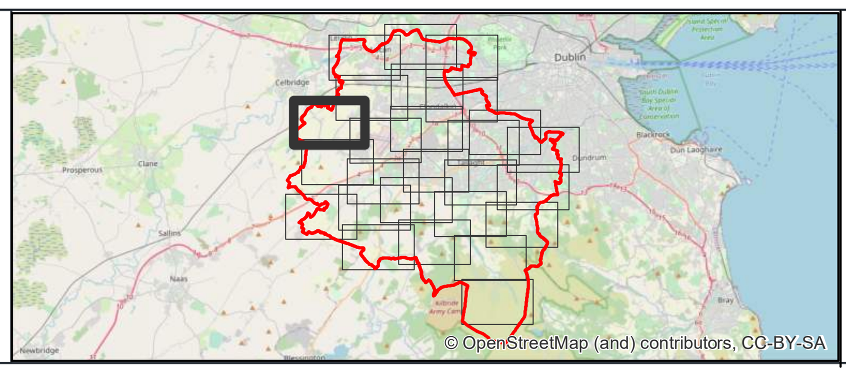


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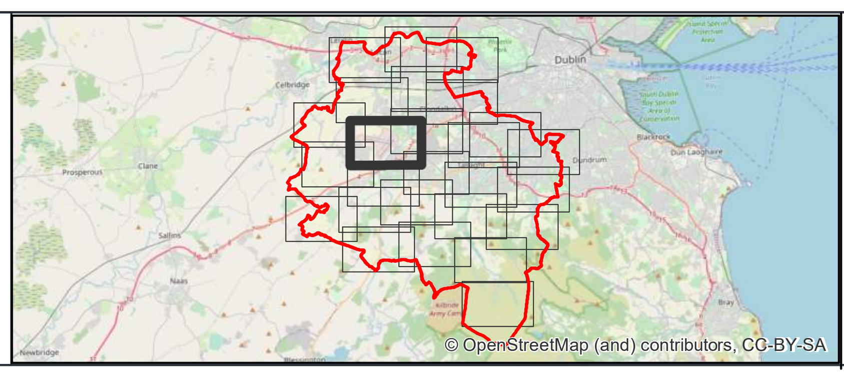


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Sheet 8 of 26

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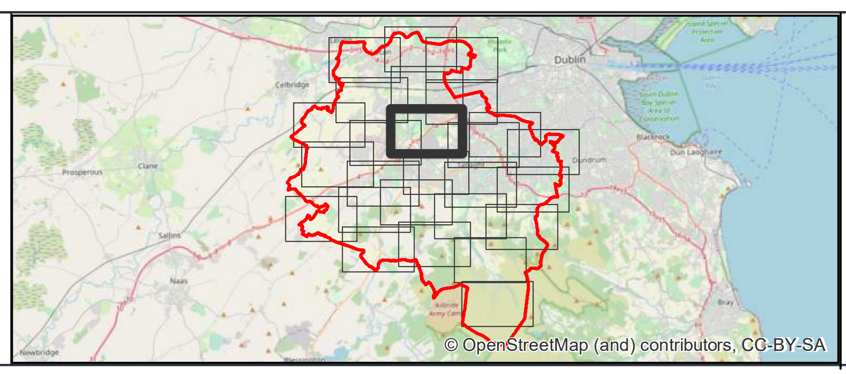


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Sheet 9 of 26

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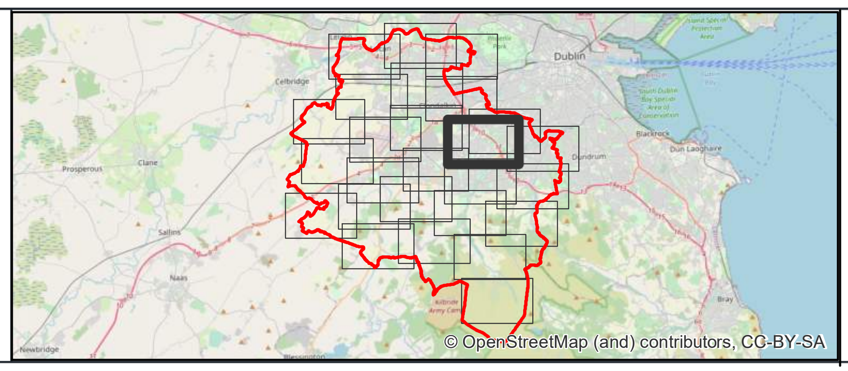


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Drawing Title: SFRA Flood Zone Mapping Sheet 10 of 26

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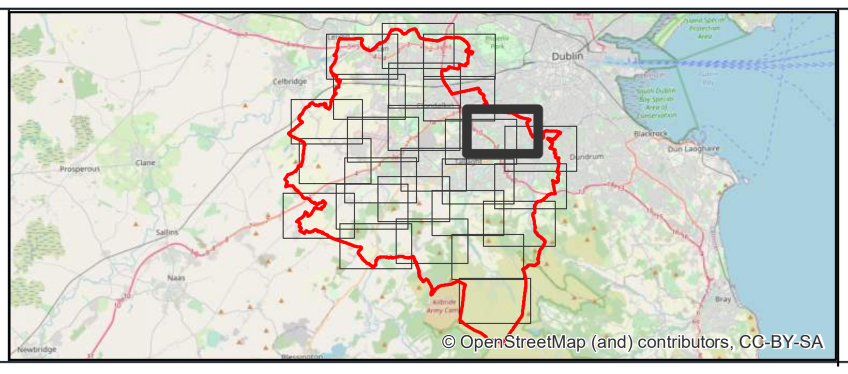


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| Project Stage | DRAFT |
| Project Title | SDCC County Devlopment Plan<br>Stategic Flood Risk Assessment |
| Drawing Title | SFRA Flood Zone Mapping<br>Sheet 11 of 26 |

| Drawing Number | Project | Originator | Volume | Location | Type | Role | Number |
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| | SDSFRA - | ROD - | EWE - | SW_AE - | DR - | ENV - | 40011 |

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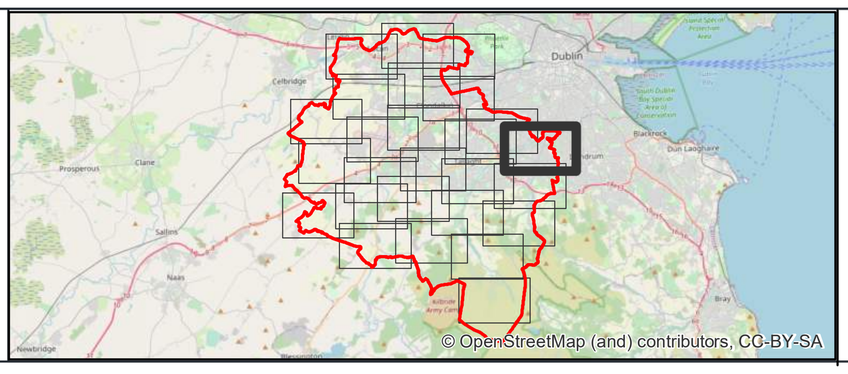


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Project Stage: DRAFT

Project Title: SDCC County Devlopment Plan
Stategic Flood Risk Assessment

Drawing Title: SFRA Flood Zone Mapping
Sheet 12 of 26

| Drawing Number | Project | Originator | Volume | Location | Type | Role | Number |
|---|---|---|---|---|---|---|---|
| | SDSFRA - | ROD - | EWE - | SW_AE - | DR - | ENV - | 40012 |

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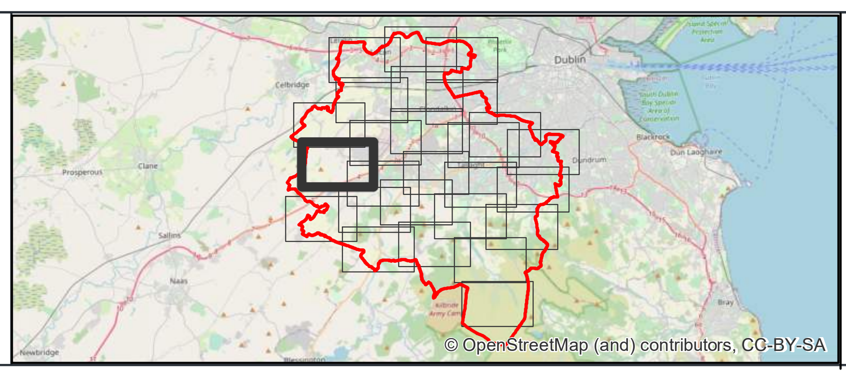


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Project Stage: DRAFT

Project Title: SDCC County Devlopment Plan
Stategic Flood Risk Assessment

Drawing Title: SFRA Flood Zone Mapping
Sheet 13 of 26

| Drawing Number | Project | Originator | Volume | Location | Type | Role | Number |
|---|---|---|---|---|---|---|---|
| | SDSFRA - | ROD - | EWE - | SW_AE - | DR - | ENV - | 40013 |

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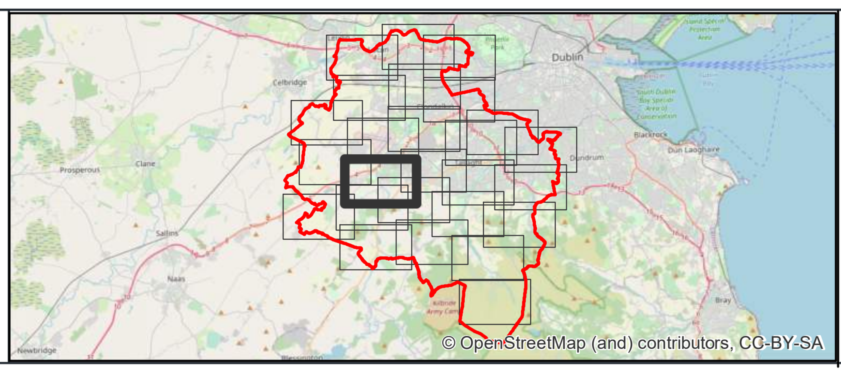


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| Project Stage | DRAFT |
| Project Title | SDCC County Devlopment Plan<br>Stategic Flood Risk Assessment |
| Drawing Title | SFRA Flood Zone Mapping<br>Sheet 14 of 26 |

| Drawing Number | Project | Originator | Volume | Location | Type | Role | Number |
|---|---|---|---|---|---|---|---|
| | SDSFRA - | ROD - | EWE - | SW_AE - | DR - | ENV - | 40014 |

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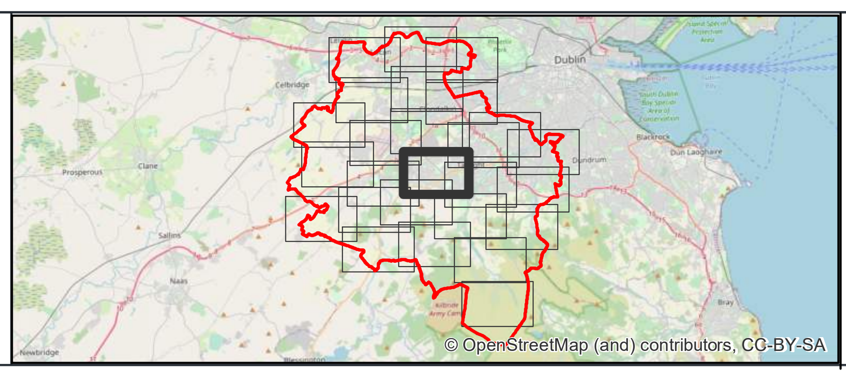


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Project Stage: DRAFT

Project Title: SDCC County Devlopment Plan
Stategic Flood Risk Assessment

Drawing Title: SFRA Flood Zone Mapping
Sheet 15 of 26

| Drawing Number | Project | Originator | Volume | Location | Type | Role | Number |
|---|---|---|---|---|---|---|---|
| | SDSFRA - | ROD - | EWE - | SW_AE - | DR - | ENV - | 40015 |

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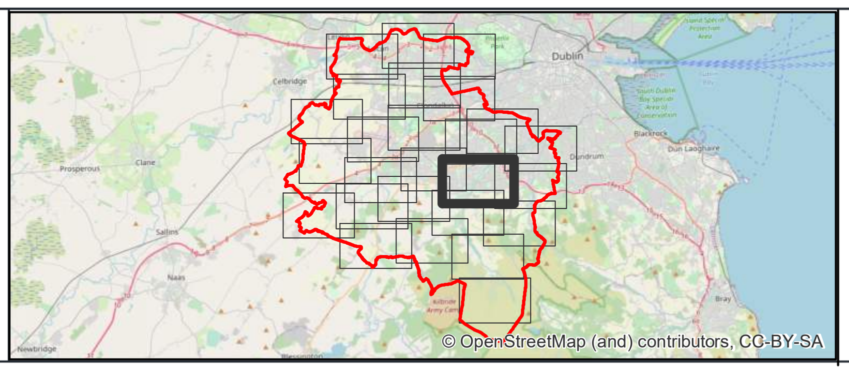


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| Project Stage | DRAFT |
| Project Title | SDCC County Devlopment Plan<br>Stategic Flood Risk Assessment |
| Drawing Title | SFRA Flood Zone Mapping<br>Sheet 16 of 26 |

| Drawing Number | Project | Originator | Volume | Location | Type | Role | Number |
|---|---|---|---|---|---|---|---|
| | SDSFRA - | ROD - | EWE - | SW_AE - | DR - | ENV - | 40016 |

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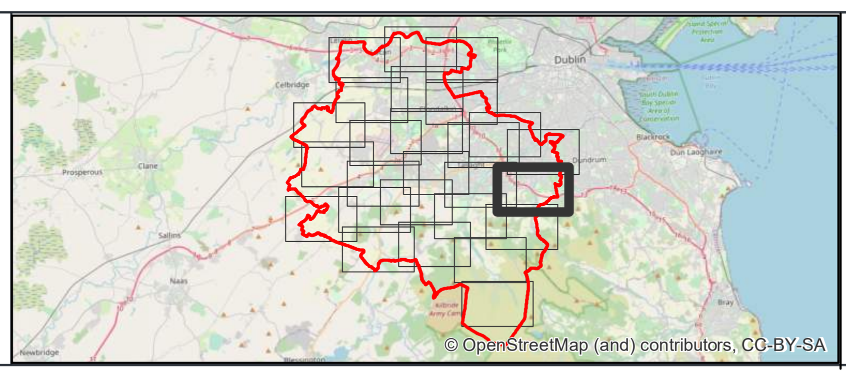


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Project Stage: DRAFT

Project Title: SDCC County Devlopment Plan Stategic Flood Risk Assessment

Drawing Title: SFRA Flood Zone Mapping Sheet 17 of 26

| Drawing Number | Project | Originator | Volume | Location | Type | Role | Number |
|---|---|---|---|---|---|---|---|
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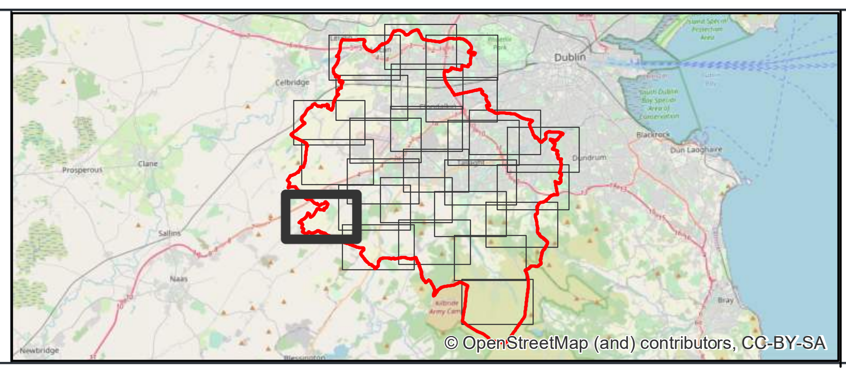


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| Project Stage | DRAFT |
| Project Title | SDCC County Devlopment Plan<br>Stategic Flood Risk Assessment |
| Drawing Title | SFRA Flood Zone Mapping<br>Sheet 18 of 26 |
| Drawing Number | Project: SDSFRA - Originator: ROD - Volume: EWE - Location: SW_AE - Type: DR - Role: ENV - Number: 40018 |
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| Job No: | 20.126 |
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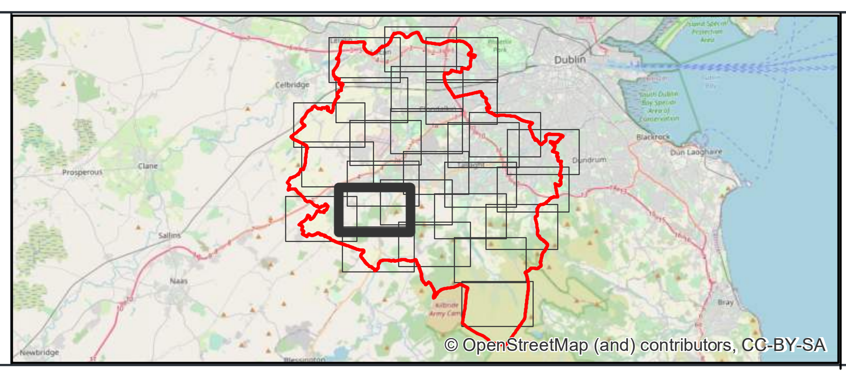


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Project Stage: DRAFT

Project Title: SDCC County Devlopment Plan
Stategic Flood Risk Assessment

Drawing Title: SFRA Flood Zone Mapping
Sheet 19 of 26

| Drawing Number | Project | Originator | Volume | Location | Type | Role | Number |
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| | SDSFRA - | ROD - | EWE - | SW_AE - | DR - | ENV - | 40019 |

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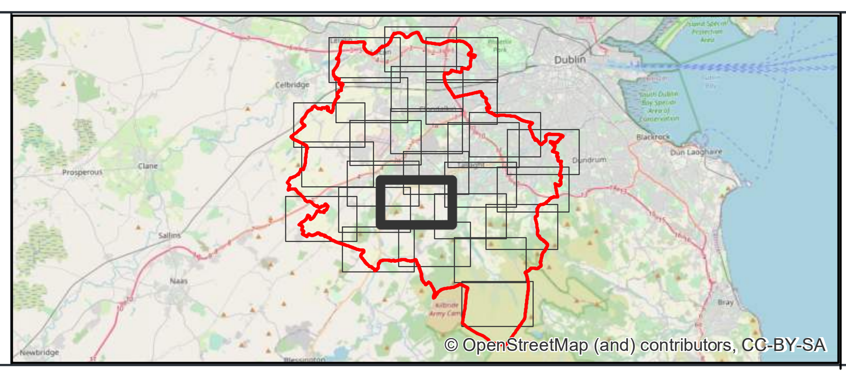


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| Project Stage | DRAFT |
| Project Title | SDCC County Devlopment Plan<br>Stategic Flood Risk Assessment |
| Drawing Title | SFRA Flood Zone Mapping<br>Sheet 20 of 26 |

| Drawing Number | Project | Originator | Volume | Location | Type | Role | Number |
|---|---|---|---|---|---|---|---|
| | SDSFRA - | ROD - | EWE - | SW_AE - | DR - | ENV - | 40020 |

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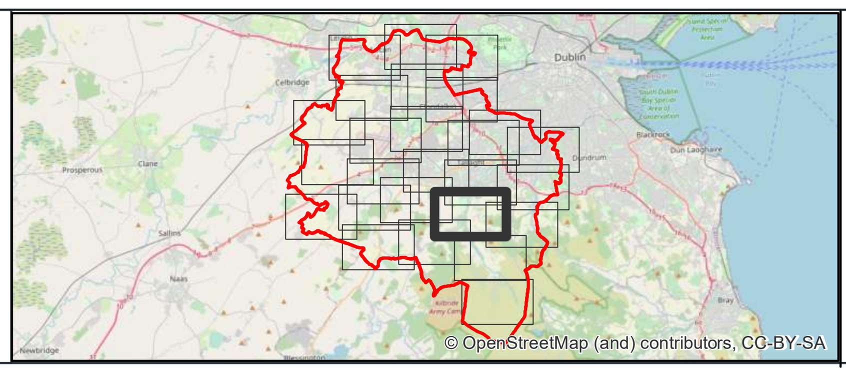


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Project Stage: DRAFT

Project Title: SDCC County Devlopment Plan
Stategic Flood Risk Assessment

Drawing Title: SFRA Flood Zone Mapping
Sheet 21 of 26

| Drawing Number | Project | Originator | Volume | Location | Type | Role | Number |
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| | SDSFRA - | ROD - | EWE - | SW_AE - | DR - | ENV - | 40021 |

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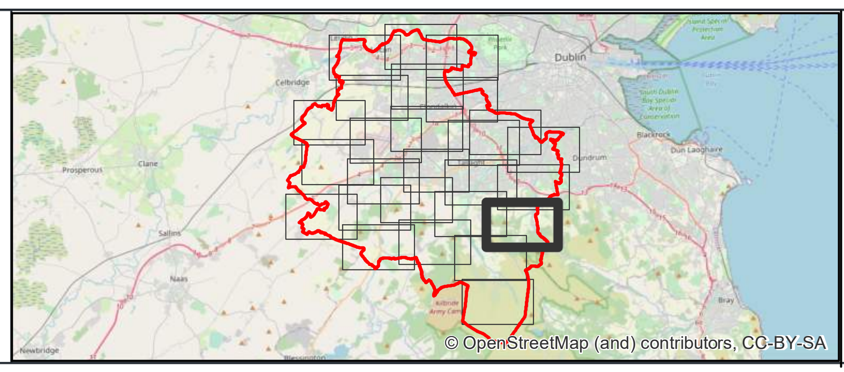


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| Project Stage | DRAFT |
| Project Title | SDCC County Devlopment Plan<br>Stategic Flood Risk Assessment |
| Drawing Title | SFRA Flood Zone Mapping<br>Sheet 22 of 26 |
| Drawing Number | Project: SDSFRA - Originator: ROD - Volume: EWE - Location: SW_AE - Type: DR - Role: ENV - Number: 40022 |
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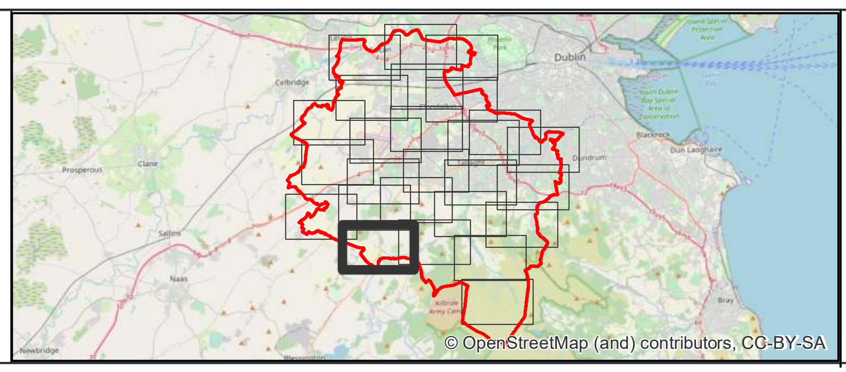


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Project Stage: DRAFT

Project Title: SDCC County Devlopment Plan
Stategic Flood Risk Assessment

Drawing Title: SFRA Flood Zone Mapping
Sheet 23 of 26

| Drawing Number | Project | Originator | Volume | Location | Type | Role | Number |
|---|---|---|---|---|---|---|---|
| | SDSFRA | ROD | EWE | SW_AE | DR | ENV | 40023 |

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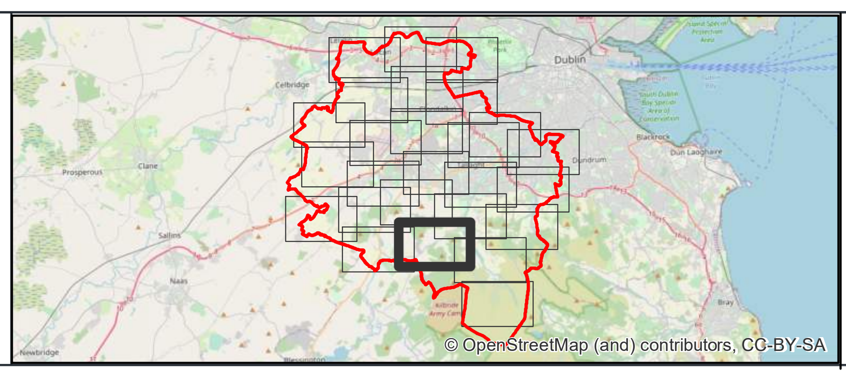


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| Project Stage | DRAFT |
| Project Title | SDCC County Devlopment Plan<br>Stategic Flood Risk Assessment |
| Drawing Title | SFRA Flood Zone Mapping<br>Sheet 24 of 26 |
| Drawing Number | Project: SDSFRA - Originator: ROD - Volume: EWE - Location: SW_AE - Type: DR - Role: ENV - Number: 40024 |
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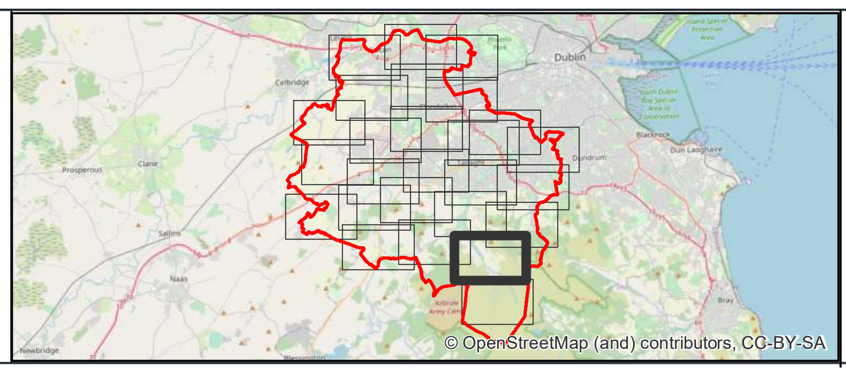


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| Project Stage | DRAFT |
| Project Title | SDCC County Devlopment Plan<br>Stategic Flood Risk Assessment |
| Drawing Title | SFRA Flood Zone Mapping<br>Sheet 25 of 26 |

| Drawing Number | Project | Originator | Volume | Location | Type | Role | Number |
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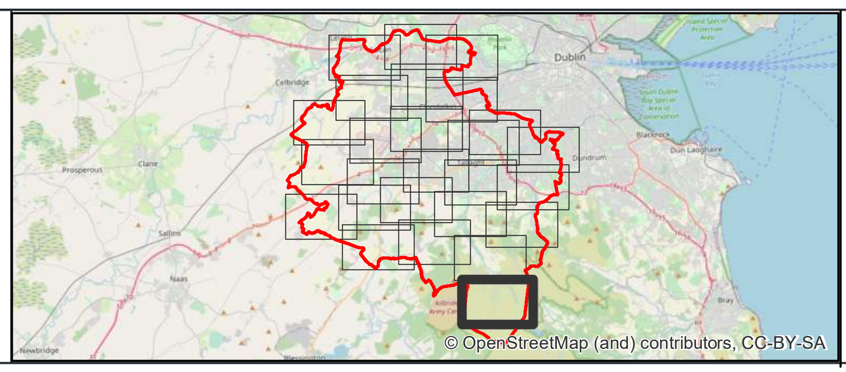


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| Project Stage | DRAFT |
| Project Title | SDCC County Devlopment Plan<br>Stategic Flood Risk Assessment |
| Drawing Title | SFRA Flood Zone Mapping<br>Sheet 26 of 26 |

| Drawing Number | Project | Originator | Volume | Location | Type | Role | Number |
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| Project Stage | DRAFT |
| Project Title | SDCC County Devlopment Plan<br>Stategic Flood Risk Assessment |
| Drawing Title | Indicative Pluvial Flood Mapping<br>Overview Map |

| Drawing Number | Project | Originator | Volume | Location | Type | Role | Number |
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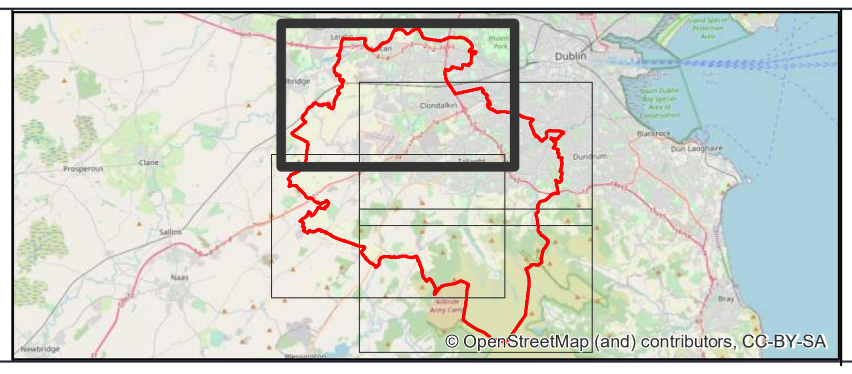


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| Project Stage | DRAFT |
| Project Title | SDCC County Devlopment Plan<br>Stategic Flood Risk Assessment |
| Drawing Title | Indicative Pluvial Flood Mapping<br>Sheet 1 of 4 |

| | Project | Originator | Volume | Location | Type | Role | Number |
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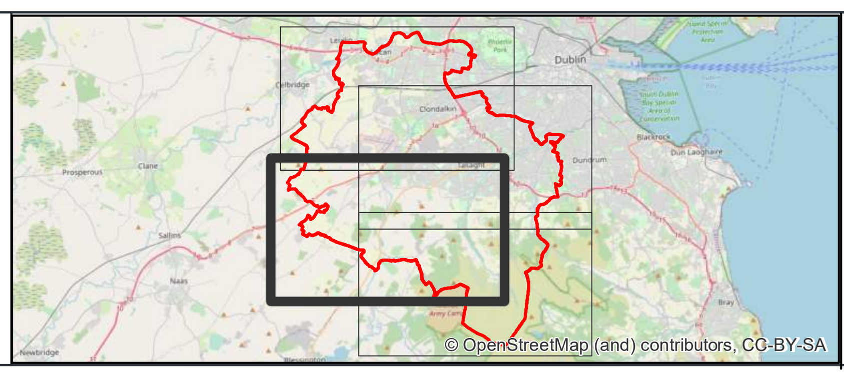


| No. | Revision | Date | By | Chk'd | App'd |
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| Drawn | Designed | Checked | Approved | Suitability Code - Description |
|---|---|---|---|---|
| LA | WV | WV | JPR | S2 - Information |

Project Stage: DRAFT

Project Title: SDCC County Devlopment Plan
Stategic Flood Risk Assessment

Drawing Title: Indicative Pluvial Flood Mapping
Sheet 2 of 4

| Drawing Number | Project | Originator | Volume | Location | Type | Role | Number |
|---|---|---|---|---|---|---|---|
| | SDSFRA | ROD | EWE | SW_AE | DR | ENV | 40102 |

Scale (A1): 1:20,000 Date: April 2021 Job No: 20.126 Rev:

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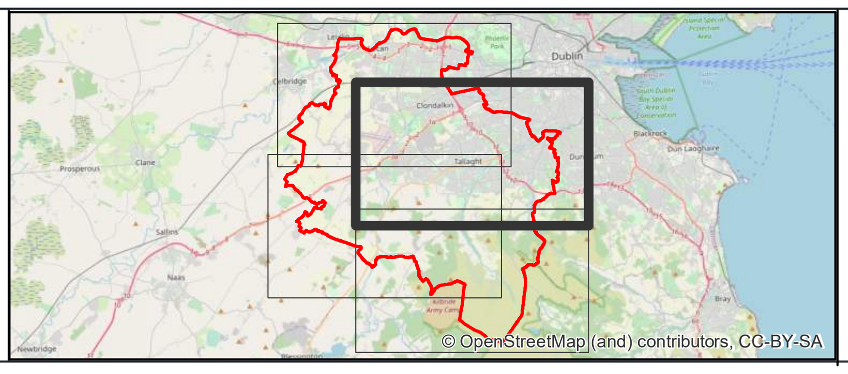


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| No. | Revision | Date | By | Chk'd | App'd |
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Project Stage: DRAFT

Project Title: SDCC County Devlopment Plan Stategic Flood Risk Assessment

Drawing Title: Indicative Pluvial Flood Mapping Sheet 3 of 4

| Drawing Number | Project | Originator | Volume | Location | Type | Role | Number |
| --- | --- | --- | --- | --- | --- | --- | --- |
| | SDSFRA - | ROD - | EWE - | SW_AE - | DR - | ENV - | 40103 |

Scale (A1): 1:20,000 | Date: April 2021 | Job No: 20.126 | Rev:

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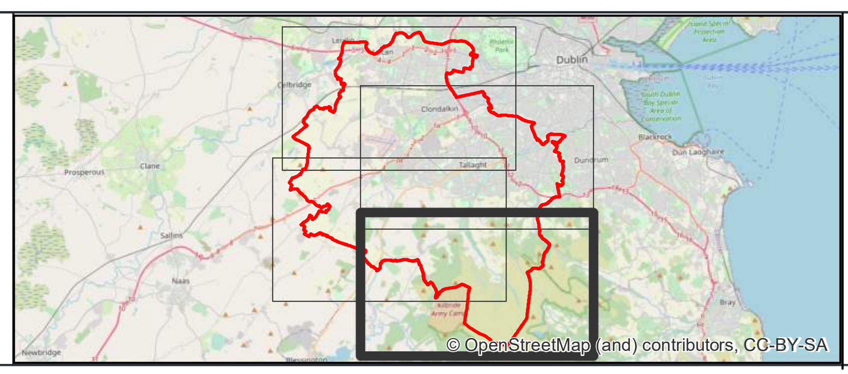


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| LA | WV | WV | JPR | S2 - Information |

Project Stage: DRAFT

Project Title: SDCC County Devlopment Plan
Stategic Flood Risk Assessment

Drawing Title: Indicative Pluvial Flood Mapping
Sheet 4 of 4

| Drawing Number | Project | Originator | Volume | Location | Type | Role | Number |
|---|---|---|---|---|---|---|---|
| | SDSFRA - | ROD - | EWE - | SW_AE - | DR - | ENV - | 40104 |

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