

# DRAFT KILCULLEN SETTLEMENT PLAN

## Surface Water Management Strategy

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# 1 INTRODUCTION

## 1.1 Background

RPS was commissioned by Kildare County Council (KCC) to complete a Surface Water Management Strategy (SWMS) for the town of Kilcullen and the area covered by the Settlement Plan area including lands zoned by Kildare County Council in Kilcullen.

The overall objective of the study is:

*“To prepare a Kilcullen Surface Water Drainage Strategy for both existing and new development areas within the town to provide for a municipal-level, multi-site nature-based solution(s) to surface water management in the town over the life of the Settlement Plan and beyond.”*

The existing surface water drainage system in Kilcullen is as follows:

1. Kilcullen town area is currently served by Upper Liffey Valley Regional Sewerage Scheme. Kilcullen is connected to the Osberstown Wastewater Treatment Plant (WWTP). This WWTP treats wastewater from a combined sewer network for the towns of Naas, Newbridge, Sallins, Clane, Kill, Johnstown, Prosperous, Caragh, Brownstown, the Curragh Military Camp, Suncroft and Kilcullen. The treated effluent is discharged into the River Liffey (River Code 09L01). Combined runoff from the Kilcullen town area is pumped to the Osberstown WWTP via Kilcullen Pumping Station. Excess storm water overflows from a storm water retention tank at Kilcullen Pumping Station to the River Liffey.
2. There is also separate surface water drainage network present within Kilcullen Settlement Plan area which discharges into the adjacent surface watercourses, mainly to the River Liffey and Pinkeen Stream.

## 1.2 Objectives of the Surface Water Study

The scope of the Kilcullen SWMS will aim to identify a sustainable surface water management strategy with the following key aims:

- To designate areas where surface water can be managed.
- For KCC to be in control of the situation.
- To identify opportunities to build-in extra capacity.
- To prioritise nature-based solutions.
- To consider the amenity potential for any solution of scale (i.e., open space/parkland/linear & riparian access).
- To ensure that development along urban watercourses must comply with the Inland Fisheries Ireland Guidance ‘*Planning for Watercourses in the Urban Environment*’ (2020), including the maintenance of a minimum riparian setback zones.

## 1.3 Key Constraints and Opportunities

Some key constraints and opportunities that shall be considered during the SWMS are as following:

- Outdated Surface Water Drainage Network Records
- Engagement with Irish Water and Surface Water Separation strategy

## 1.4 Scope of this Report

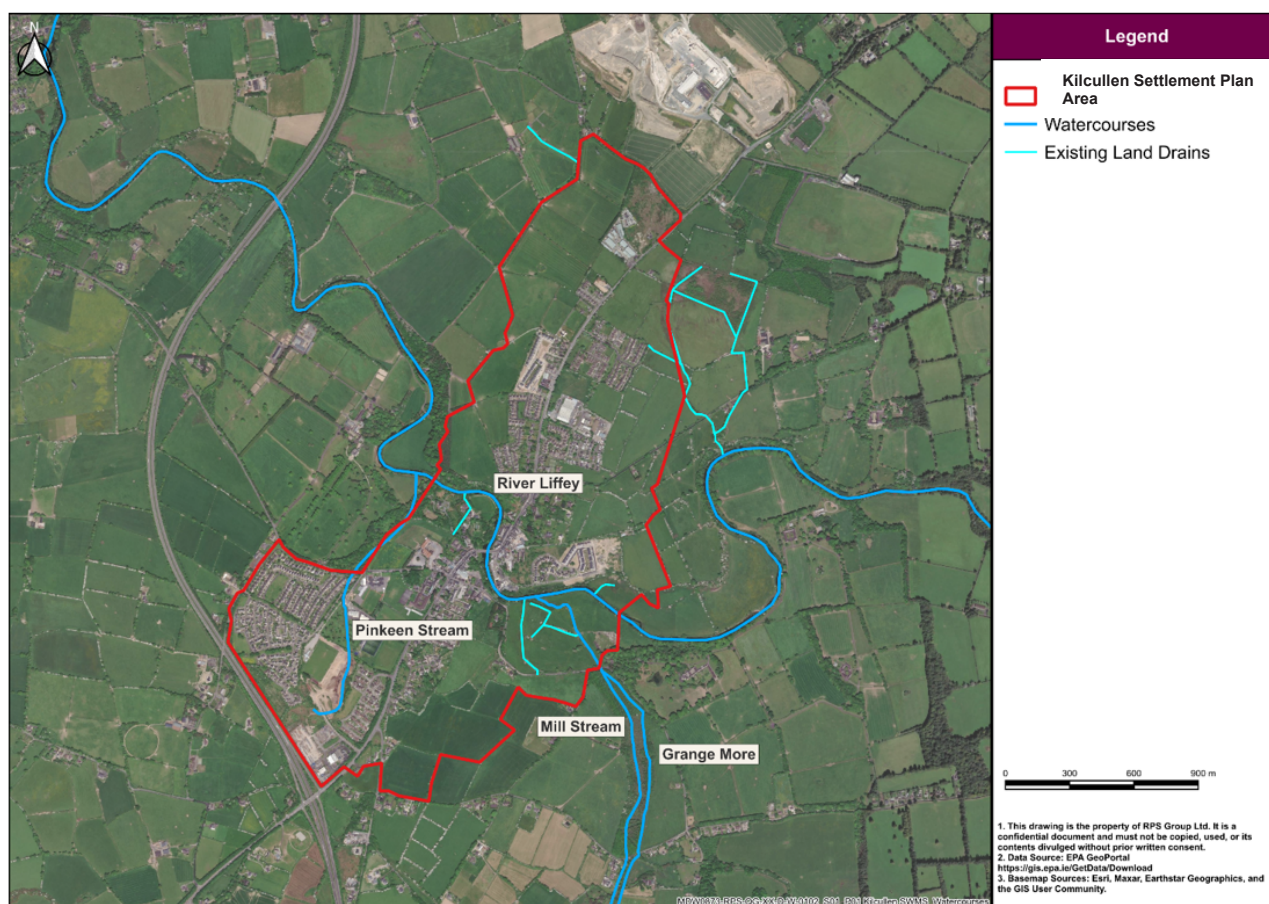
The scope of this report includes:

1. Identification of surface water assets / GIS layers / combined systems – mapping of existing infrastructure.
2. Identification of permitted developments and their surface water arrangements.
3. Assessment of the capacity of permitted developments and undeveloped zoned land within the town.
4. To inform the preparation of the new Draft Settlement Plan.
5. Identification of areas and modes / types of surface water management.

## 1.5 Study Area

The study area includes Kilcullen Town (Co. Kildare) as shown in **Figure 1-1**. Kilcullen is located on the River Liffey, 38km from Dublin, 10km from Naas and 6km from Newbridge. The town is primarily a service and retail centre for south Kildare and increasingly a residential centre within the Greater Dublin Area. The River Liffey is a designated salmonid river.

The River Liffey flows through the Kilcullen Settlement Plan area and divides the Plan area into two parts (north and south). Three other tributary streams, namely, the Pinkeen, Grange More and Mill streams also flow through the southern part of the Plan area and discharge into the River Liffey (see **Figure 1-1**).



**Figure 1-1 Kilcullen SWMS study area overview**

The Kilcullen Settlement Plan area covers an approximate land area 316 ha. The southwestern edge of the Plan area is bounded by M9 Motorway and all other edges are surrounded by greenfield/agricultural lands. The R448 road traverses through the centre of the Plan area in the southwest to northeast direction.

## 2 METHODOLOGY

Current surface water drainage records and available datasets exist for approximately 35% of Kilcullen Settlement Plan area. As such, the foundation of the Surface Water Management Strategy was to consolidate existing drainage data sources and produce an updated dataset of surface water infrastructure.

### 2.1 Data Collection

Data and information were gathered to assist in defining the surface water drainage catchments. **Table 2-1** below shows the primary datasets and reports used in the study.

**Table 2-1 Datasets and Reports used to help define the surface water drainage catchments.**

Dataset	Ownership	Source
Watercourse Network	Environmental Protection Agency (EPA)	EPA Geoportal <a href="https://gis.epa.ie/GetData/Download">https://gis.epa.ie/GetData/Download</a>
Historic Flood Data	OPW	Flood Maps Portal <a href="https://floodmapsportal.ie/">Flood Maps - Floodinfo.ie</a>
Permitted Developments and surface water arrangements	KCC	KCC Planning and Strategic Development Department <a href="http://webgeo.kildarecoco.ie/planningenquiry">http://webgeo.kildarecoco.ie/planningenquiry</a>
Permitted Developments and surface water arrangements	ABP	An Bord Pleanála <a href="https://www.abp.ie/MapSearch/">Map Search   An Bord Pleanála (pleanala.ie)</a>
Surface Water Drainage Network Shapefile	KCC, Irish water	Kildare County Council, <a href="https://www.kildarecoco.ie/MyMap/">My Map (arcgis.com)</a>
Irish Water DAP Model, Stage 2 and Stage 3 Reports	Uisce Éireann	Uisce Éireann
Groundwater and Surface Water Flood Data	GSI	GSI Geoportal <a href="https://www.gsi.ie/GeologicalSurveyIrelandSpatialResources/">Geological Survey Ireland Spatial Resources (arcgis.com)</a>
Soil Hydrology Map	EPA	EPA Geoportal <a href="https://gis.epa.ie/GetData/Download">https://gis.epa.ie/GetData/Download</a>

### 2.2 Data Gap Analysis

The SW Drainage Network Shapefile received from Irish water covered about 70% of existing developed areas of Kilcullen.

Where possible, surface water drainage drawings extracted from various planning applications were compiled together with the existing drainage datasets to produce a more complete surface water drainage network record for Kilcullen. **Figure 2-1** and **Figure 2-2** illustrate the spatial coverage of each available dataset.

Despite best efforts, considerable uncertainty remains in some areas where conflicting information existed between datasets or where additional information could not be found and data gaps remain.

No LiDAR data for the Settlement Plan area was available, therefore the surface water drainage subcatchments (surface water management units) could not be delineated accurately. However, an effort was made to delineate the subcatchments using the EPA 10 m contours for Ireland and also using the existing Irish Water storm and foul sewers network layouts.





Figure 2-1 Consolidated surface water drainage network dataset for Kilcullen Town(North of River Liffey)



Figure 2-2: Consolidated surface water drainage network dataset for Kilcullen Town(South of River Liffey)

## 2.3 Conceptual Approach

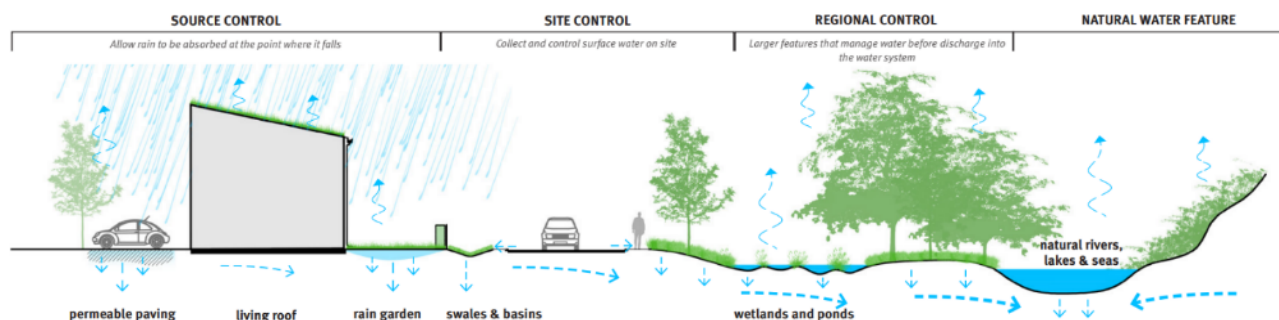
Surface water management in Kilcullen should be in accordance with modern sustainable design practice, incorporating SuDS and water-sensitive urban design (WSUD) principles. The use of SuDS and nature-based solutions is required by the County Development Plan.

The following guidance applies:

- Greater Dublin Strategic Drainage Study (DDC, 2005)
- The SuDS Manual C753 (CIRIA, 2015)
- Nature-based Solutions to the Management of Rainwater and Surface Water Runoff in Urban Areas – Best Practice Interim Guidance Document (DoHLGH, 2022)
- Sustainable Drainage Systems Guidance Document (KCC, 2024)

In order to promote a holistic, catchment-wide approach to surface water management between neighbouring development sites, the concept of a SuDS ‘management train’ is used. This means surface water controls are implemented in a hierarchical fashion from the point at which rain lands (source control) up to the extent of a development site (site control) and eventually up to the wider sub catchment level (regional control).

A level of disposal is designed in at each stage of the management train and the surplus is conveyed to the next stage at an attenuated quantity and improved quality. This allows for connectivity of drainage systems between sites and the creation of green corridors providing habitat and amenity value. The concept is illustrated below in **Figure 2-3**.



Source: [Sustainable Rainwater Management Guidance, CEC 2021](#)

**Figure 2-3: SuDS Management Train**

Planning for specific areas dedicated to managing surface water at the sub catchment level is a practical and efficient approach. Kilcullen has several watercourses running through it which serves as the final discharge points for the surface water.

Surface water from agricultural land should be managed by channelling it through open ditches, directing its flow towards designated watercourses. Similarly, in developed areas of Kilcullen like town centre and resident estates, it is essential to employ strategies such as rainwater harvesting to capture surface water at its source. The surface water collected by the surface water drainage network should undergo attenuation processes before being discharged into watercourses. This not only helps in managing water quantity but also contributes to enhancing the quality of surface water intended for release into the river. This approach enhances the preservation of water quality in rivers.



### 3 FLOODING

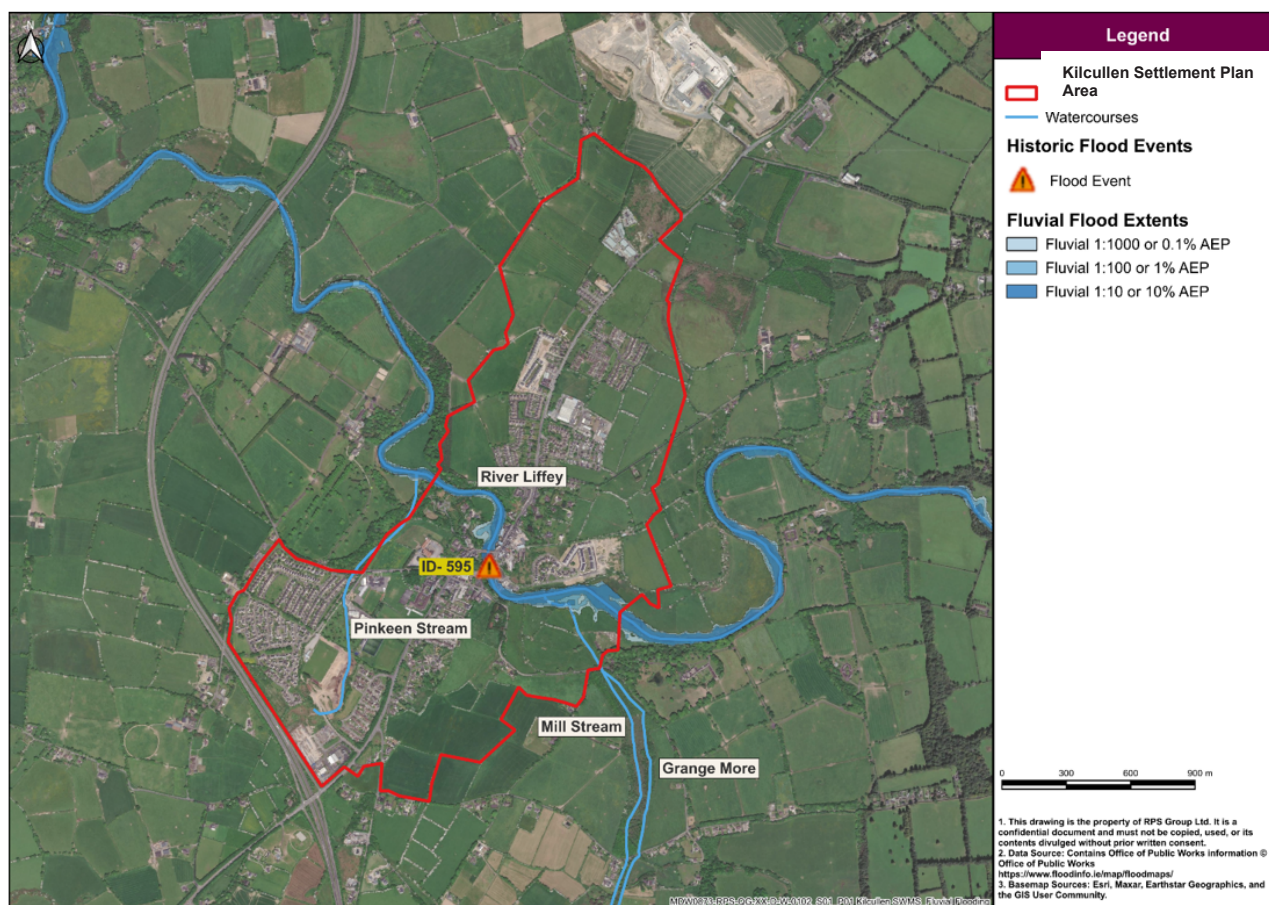
A desktop study was conducted to review existing sources of flooding including fluvial, pluvial and groundwater mechanisms.

#### 3.1 Fluvial Flooding

The main source of flooding in Kilcullen is fluvial. Fluvial flooding at Kilcullen occurs primarily from the River Liffey. **Figure 3-1** presents the Eastern CFRAM study prepared 1% AEP and 0.1% AEP fluvial flood extents maps along with the locations of various historic flood events occurred in the vicinity of Kilcullen town. A notable flood occurred at Kilcullen on 9<sup>th</sup> June 1993. Flooding caused by heavy rainfall. The River Liffey burst its banks and some properties and lands located in the low-lying floodplains of River Liffey in Kilcullen town were flooded.

**Table 3-1** presents the description of additional previous known flood events.

In the context of the CFRAM study predictive flood maps, the River Liffey's banks are susceptible to flooding (see **Figure 3-1**), while the OPW National Indicative Fluvial Mapping (NIFM) study prepared flood map (see indicates flooding along the banks of Mill Stream and Grange More Stream **Figure 3-2**).



**Figure 3-1** Fluvial flood events in Kilcullen

**Table 3-1** Historical Flooding in Kilcullen

Flood ID	Flood Event	Description
ID-595	Liffey Kilcullen June 1993	Major flooding caused by heavy rainfall. Liffey river burst its banks and caused flooring to some properties in Kilcullen town.

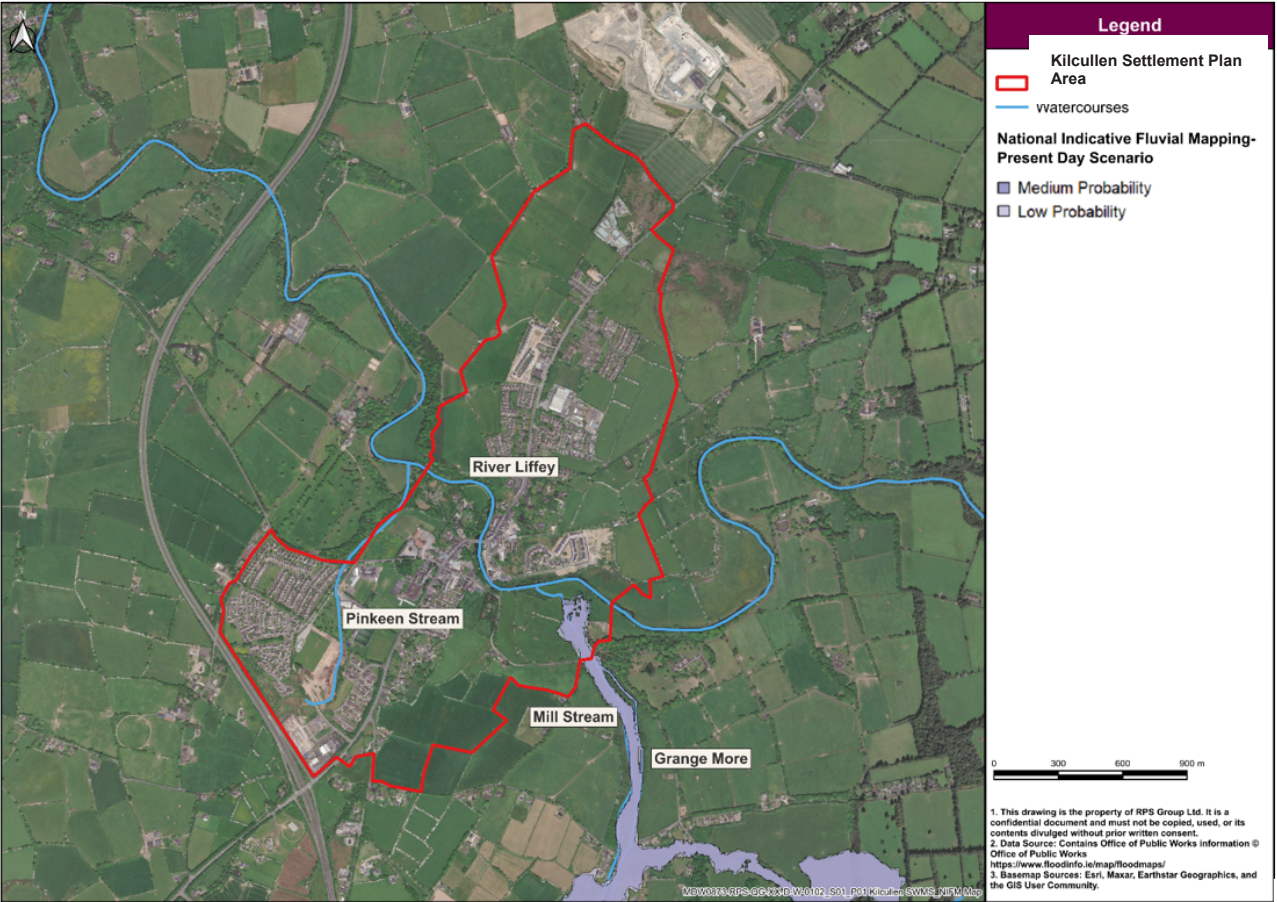


Figure 3-2 NIFM flood map for Kilcullen

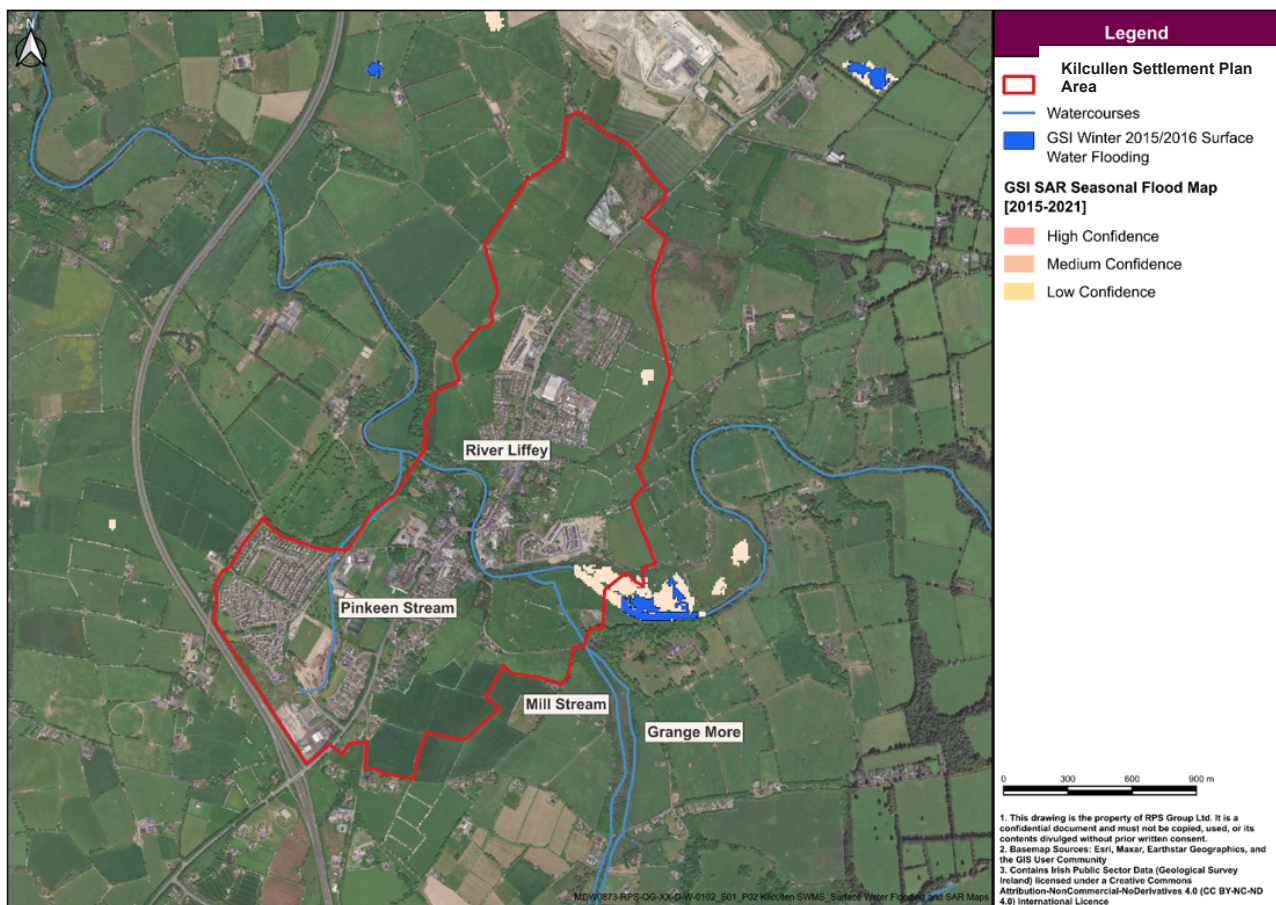


## 3.2 Groundwater Flooding

Groundwater flooding is not identified at Kilcullen<sup>1</sup>.

## 3.3 Pluvial Flooding

The GSI winter 2015/2016 surface water flooding data confirms that there have been historic events of surface water flooding in and around the Kilcullen Settlement Plan area as shown in the **Figure 3-3**. Further, GSI Synthetic Aperture Radar (SAR) collected Seasonal Flood Maps show mapping of surface water extents for Kilcullen between Autumn 2015 and Summer 2021. Most areas affected are located in the agricultural fields to the east of existing developed areas, and along the adjacent floodplain of River Liffey.



**Figure 3-3 GSI Winter 2015/2016 Surface Water Flooding and SAR Seasonal Flood Maps for Kilcullen**

<sup>1</sup> [Flood Maps - Floodinfo.ie](https://www.floodinfo.ie)



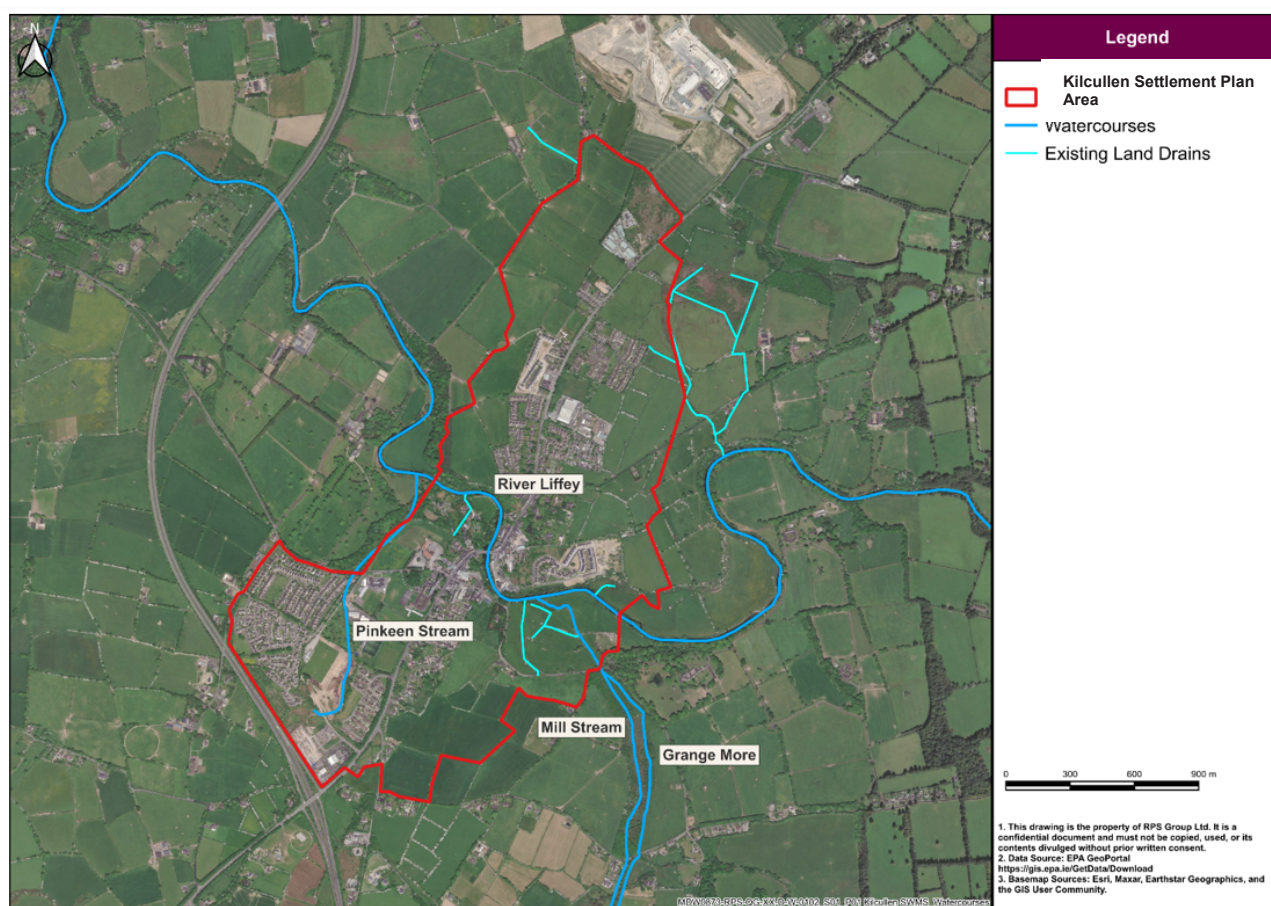
## 4 NATURAL DRAINAGE

### 4.1 Overview

Natural drainage refers to the process by which surface water moves in an area depending on topography and geological features of the area. This section aims to provide information about soils hydrology, topography and receiving water bodies for the study area.

### 4.2 Receiving Surface Water Bodies

The River Liffey is the main hydrologic pathway through Kilcullen, flowing from west to east across the middle area on the Kilcullen Settlement Plan area (see Figure 4-1). The Mill stream joins the Liffey River on the upstream of the town, coming from the direction of New Abbey. At the western edge of the town is the Pinkeen Stream, a minor tributary of River Liffey, which forms one boundary of Castlemartin Estate.



**Figure 4-1 Watercourses present in the Study Area**

The River Liffey rises on the western slopes of Tonduff in the Wicklow Mountains, from where it flows west, before being joined by the Brittas River from the north and then flowing into the northern end of Pollaphuca Reservoir, which was created by the ESB in the 1930s. The Kings River, which flows into the southern end of the reservoir, together with the Liffey, drains much of the north-western side of the Dublin and Wicklow Mountain area. The Liffey flows out of the reservoir through the Pollaphuca generating station and into the lower reservoir and generating station at Golden Falls, upstream of Ballymore Eustace. The Liffey then flows

west through Kilcullen before flowing through Newbridge, then past Sallins and Clane, after which it is joined by the Morell from the south. The Liffey continues through Celbridge to Leixlip, before which it flows into Leixlip reservoir and generating station and is then joined by the Rye Water. The Liffey then enters a steep-sided valley, through which it flows past Islandbridge, where the river becomes tidal, and through the centre of Dublin City where it is now considerably constrained by quay walls. The Liffey is then joined by the outflow from the Royal and Grand Canals, the River Dodder from the south and the River Tolka to the north. The Liffey flows past Dublin Port and through the north and south Bull Walls flowing out to sea in Dublin Bay.

It should be mentioned here that some drainage improvement works were carried out within the River Liffey Catchment area as part of the OPW Drainage Districts (DD) Schemes. These works were carried out between 1842 to 1930 to improve lands for agriculture and to mitigate flooding. Channels and lakes were deepened and widened, weirs removed, embankments constructed, bridges replaced and/or modified. Examples of few of the DD schemes located within the Liffey River catchment area are the Connell DD, Baltracey DD and Kilcock DD. Further details of these schemes can be found in [https://www.floodinfo.ie/map/drainage\\_map/](https://www.floodinfo.ie/map/drainage_map/).

The River Liffey has an approximate catchment area of 444 km<sup>2</sup> upstream of Kilcullen. **Table 4-1** below presents some Physical Catchment Descriptors (PCDs) details of River Liffey, upstream of Kilcullen Town.

**Table 4-1 River Liffey- Physical Catchment Descriptors (PCDs)**

Location	PCDs											
	AREA (km <sup>2</sup> )	DRAIN (km/km <sup>2</sup> )	S1085 (m/km)	ARTDRAIN2	FARL	SAAR (mm)	URBEXT	BFISOIL	MSL (km)	FOREST	PEAT	PASTURE
Kilcullen Bridge (FSU Node 09_1277_2)	444.26	1.274	3.359	0.00	0.798	1233	0.005	0.541	52.983	0.179	0.327	0.459

## 4.3 Topography

As mentioned earlier in Section 2.2, no LiDAR data for the Kilcullen Settlement Plan area was available. However, some approximate topographical information for the subject area has been sourced from the "ALOS Global Digital Surface Model " ([https://www.eorc.jaxa.jp/ALOS/en/dataset/aw3d30/aw3d30\\_e.htm](https://www.eorc.jaxa.jp/ALOS/en/dataset/aw3d30/aw3d30_e.htm)).

**Figure 4-2** presents a DEM for the Kilcullen Settlement Plan area, prepared from this approximate topographical data. The land elevations within the Kilcullen Settlement Plan area range between 90 mOD and 150 mOD. The majority of the Plan area slopes towards the River Liffey.

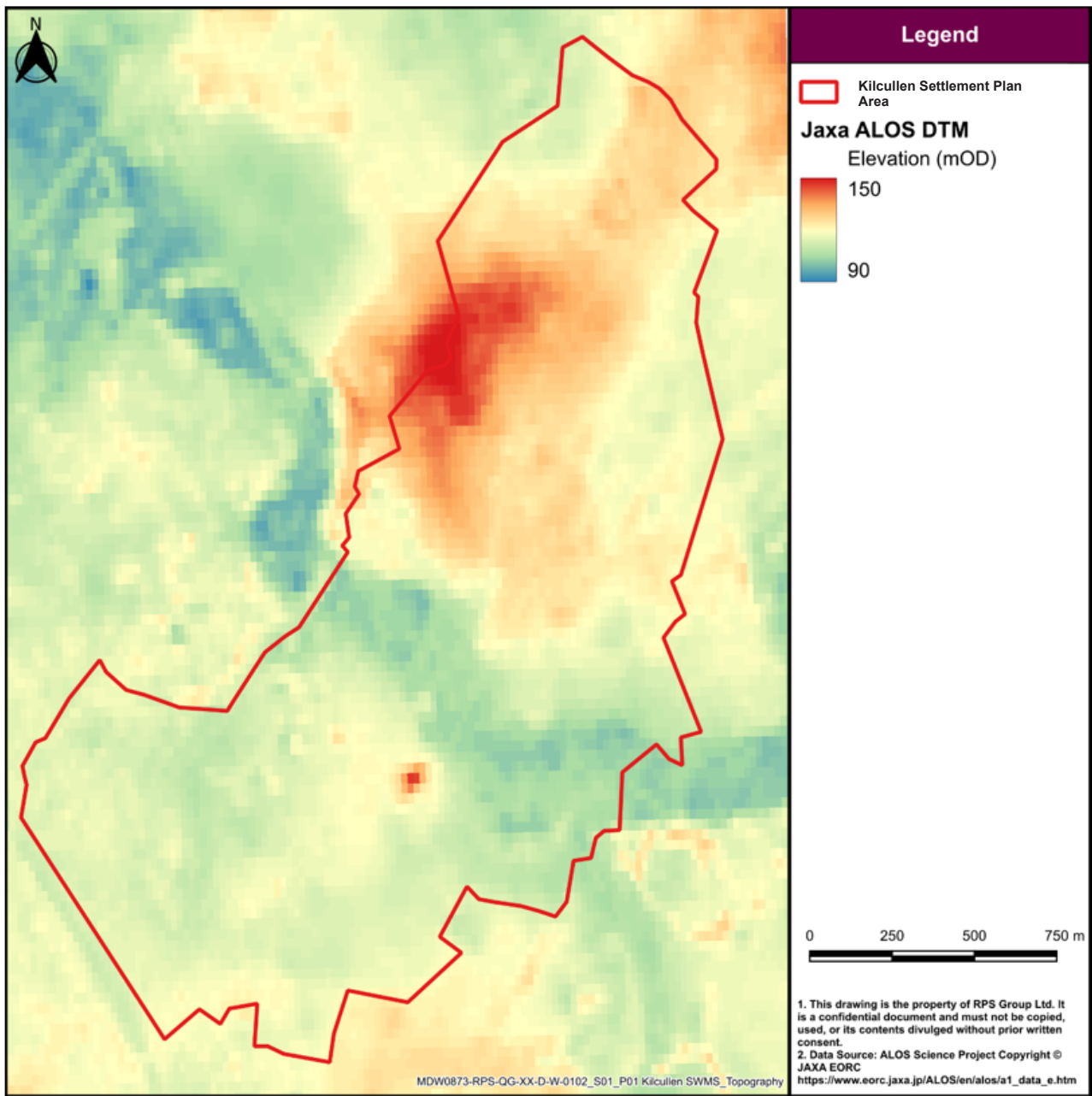


Figure 4-2 Study Area Topography<sup>2</sup>

<sup>2</sup> [Dataset | ALOS@EORC \(jaxa.jp\)](#)

## 4.4 Soil Hydrology

The central area of the Kilcullen Settlement Plan area is largely underlain by made ground material. Outside of the existing developed area are typically well draining with some poorly draining soils in the south as shown in **Figure 4-3** Soils Hydrology in the Study Area . The River Liffey is underlain by AlluvMIN.

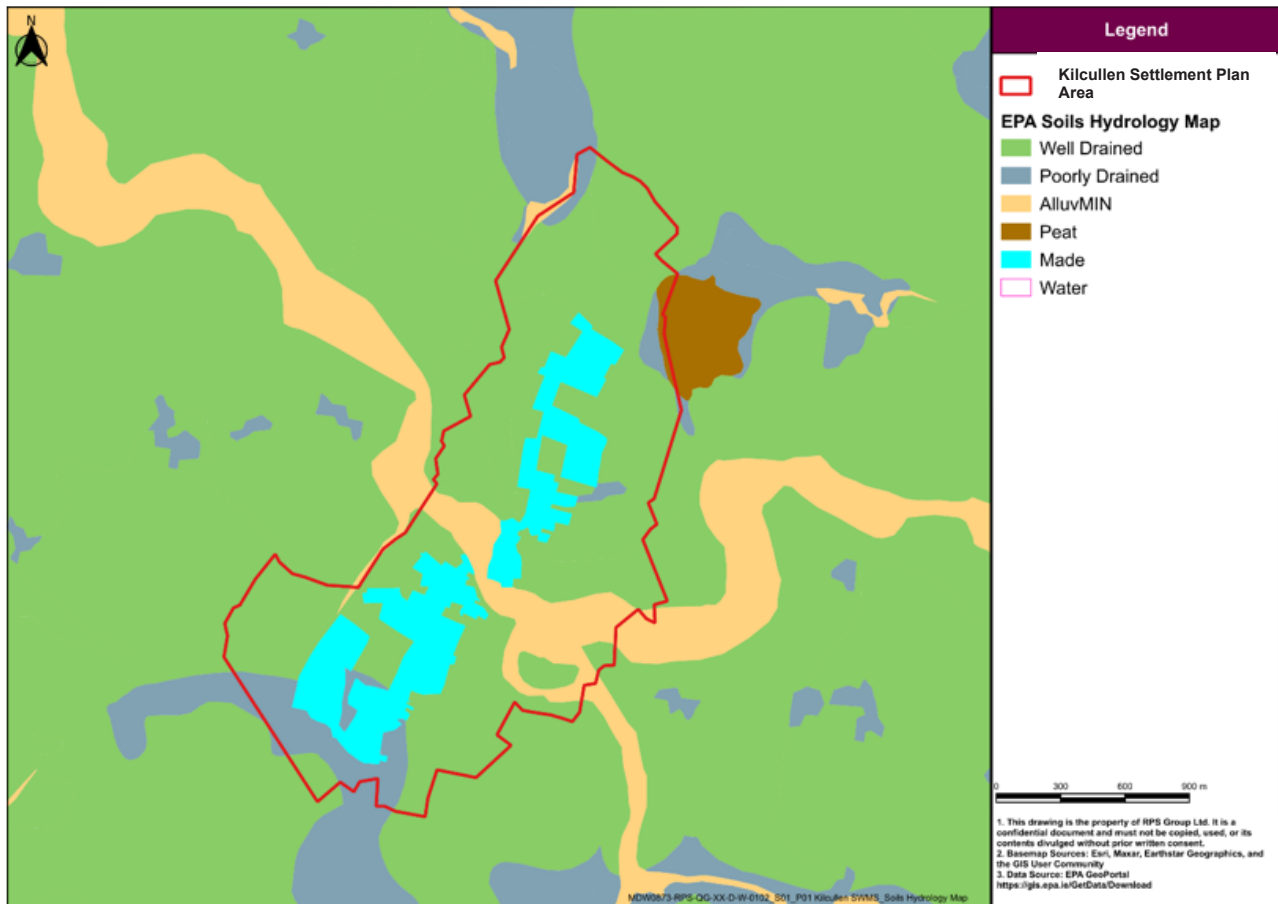


Figure 4-3 Soils Hydrology in the Study Area



## 5 EXISTING DRAINAGE NETWORK

### 5.1 Surface Water Network

The existing surface water drainage systems within the Kilcullen town comprises of both the combined and separate storm water drainage network. Storm runoff collected through the combined network is pumped to the Osberstown WWTP via the Kilcullen Pumping Station for treatment. Excess storm water overflows from a storm water retention tank at Kilcullen Pumping Station to River Liffey. Surface runoff collected through the separate system is attenuated first prior to discharging into the adjacent surface watercourses including the River Liffey and Pinkeen Stream. The surface water drainage network prevailing in Kilcullen is represented in **Figure 5-1** and **Figure 5-2** below.

Discussion with KCC operations and maintenance staff responsible for drainage in Kilcullen communicated concern that higher intensity rainfall associated with climate change combined with future developments place the existing network under stress. It was noted that any recorded issues of flooding from the existing network was attributed to blockage rather than design capacity constraints. **Figure 5-2** shows a flood prone area which floods every year during an intense rainfall event as reported by KCC maintenance staff during a site visit carried out on 17<sup>th</sup> May 2024. The cause of flooding is due to inadequate capacity and/or blockage in the storm sewer



Figure 5-1 Kilcullen Surface Water Drainage Network (North of River Liffey)



Figure 5-2 Kilcullen Surface Water Drainage Network (South of River Liffey)

## 5.2 Foul Drainage Network

The town of Kilcullen has both the separate and combined foul water drainage network. The main foul sewer network runs throughout the town and passes through the R448, and R413. The Kilcullen town area is currently served by Upper Liffey Valley Regional Sewerage Scheme. Kilcullen is connected to the Osberstown Wastewater Treatment Plant (WWTP). This WWTP treats wastewater from a combined sewer network for the towns of Naas, Newbridge, Sallins, Clane, Kill, Johnstown, Prosperous, Caragh, Brownstown, the Curragh Military Camp, Suncroft and Kilcullen. The treated effluent is discharged into the River Liffey (River Code 09L01). Combined runoff from the Kilcullen town area is pumped to the Osberstown WWTP via Kilcullen Pumping Station. Excess storm water overflows from a storm water retention tank at Kilcullen Pumping Station to River Liffey. Further to this, foul sewage also overflows at two other locations in the vicinity of the Kilcullen Town Bridge. These locations are shown in **Figure 5-5** (red circled area).

**Figure 5-3** and **Figure 5-4** illustrate the locations of the existing foul sewer network within the Kilcullen Settlement Plan area.

It should also be mentioned here, RPS was informed by the Kildare County Council Drainage Maintenance Team that most of the areas in Kilcullen Town have separate drainage systems. However, as part of this study, a number of locations were identified where some interactions between the foul and storm sewers were found in Kilcullen (see Figure 5-5). It is recommended that a surface water separation project be implemented in Kilcullen for removing these interactions, mainly to improve the foul sewer capacity & resilience for future growth and also to reduce the surface water pollution risks to the receive waters.



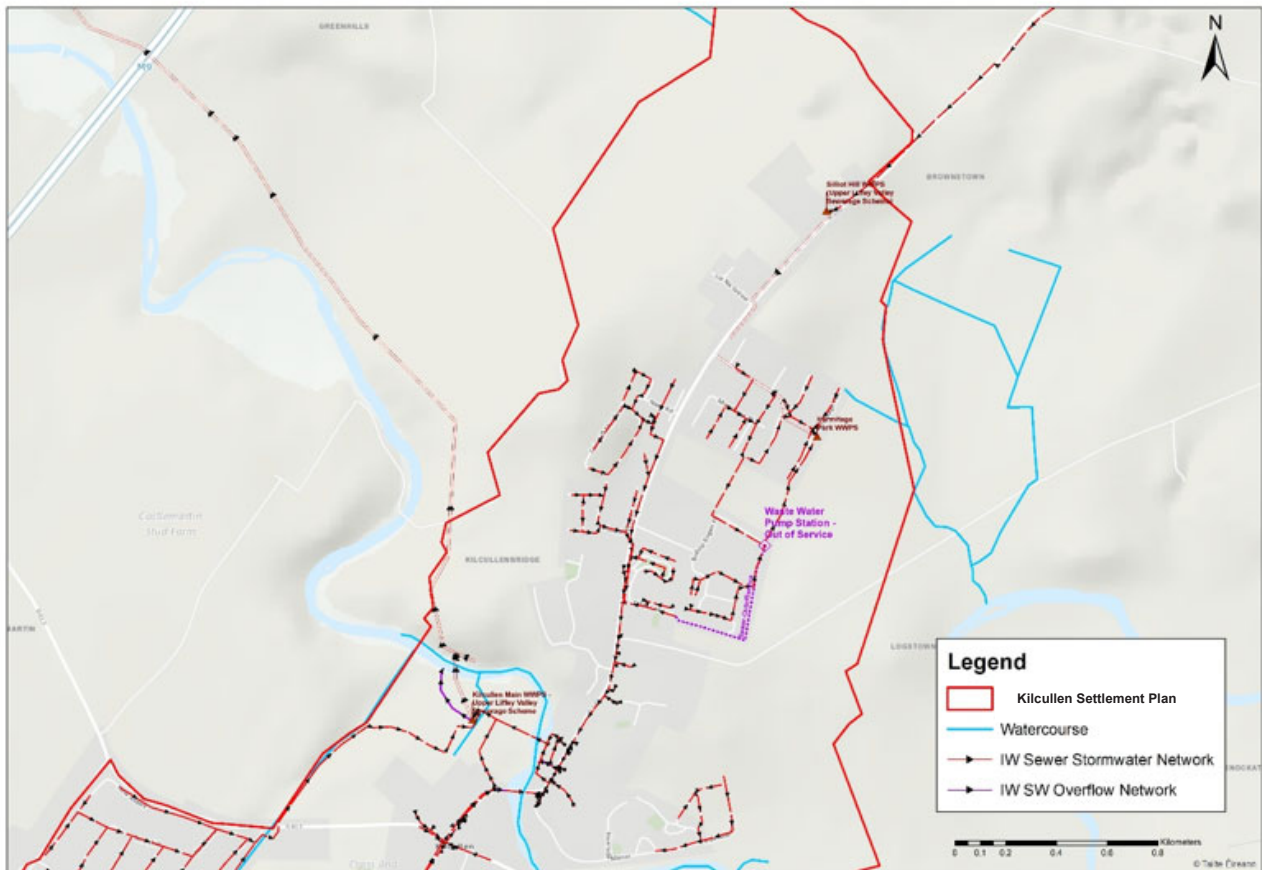


Figure 5-3 Foul Sewer Network (North of River Liffey)

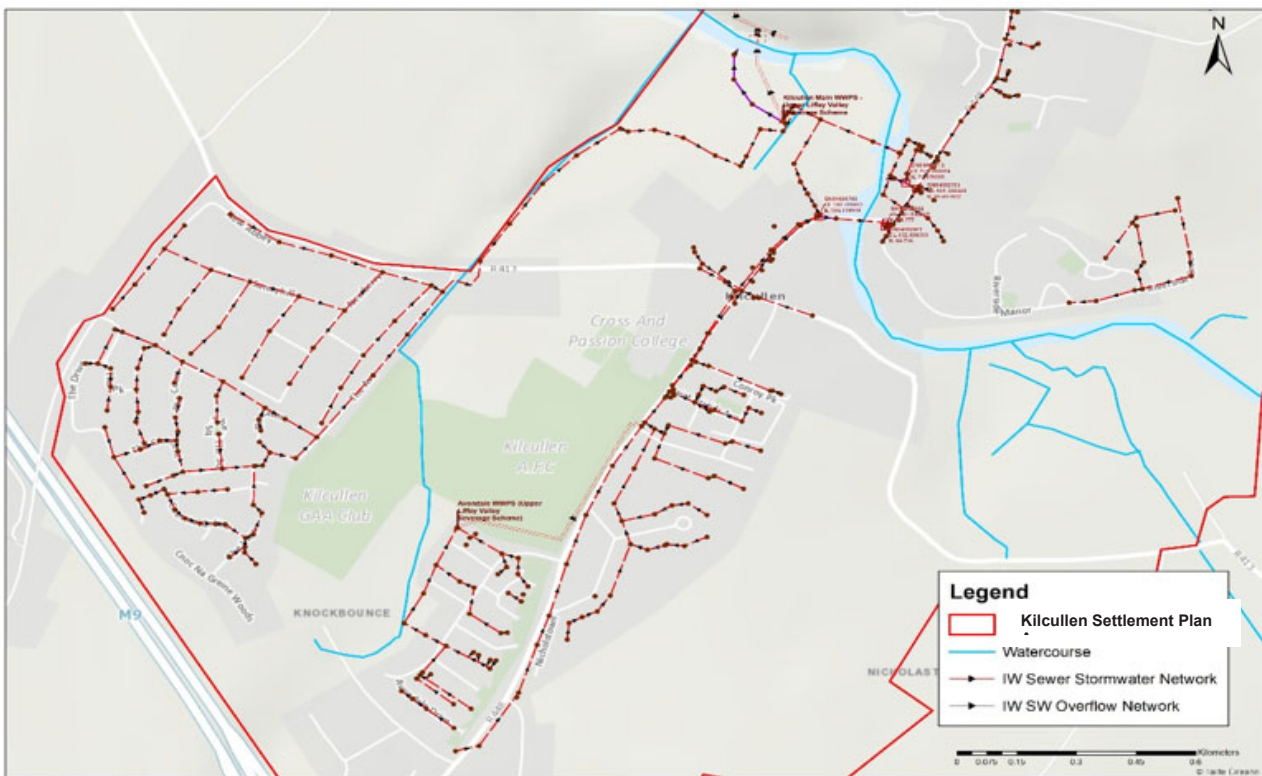


Figure 5-4 Foul Sewer Network (South of River Liffey)



Figure 5-5 Foul Sewerage overflow to River Liffey (Circled in red) and surface & foul sewers interactions.

## 5.3 Drainage Summary

The existing surface water drainage systems within the Kilcullen town comprises of both the combined and separate storm water drainage network. Storm runoff collected through the combined network is pumped to the Osberstown WWTP via the Kilcullen Pumping Station for treatment. Excess storm water overflows from a storm water retention tank at Kilcullen Pumping Station to River Liffey. Surface runoff collected through the separate system is attenuated first prior to discharging into the adjacent surface watercourses including the River Liffey and Pinkeen Stream.

The town of Kilcullen has both the separate and combined foul water drainage network. Foul network is largely separate in Kilcullen. The Kilcullen town area is currently served by Upper Liffey Valley Regional Sewerage Scheme. Foul water from the Kilcullen town area is pumped to the Osberstown WWTP via Kilcullen Pumping Station. The treated effluent is discharged into the River Liffey (River Code 09L01).

The foul drainage network is largely separate from stormwater, however, as part of this study, a number of locations were identified where some interactions between the foul and storm sewers were found in Kilcullen (see Figure 5-5). It is recommended that a surface water separation project be implemented in Kilcullen for removing these interactions, mainly to improve the foul sewer capacity & resilience for future growth and also to reduce the surface water pollution risks to the receive waters.

It is important to note the River Liffey is a designated salmonid river. This receiving waterbody for all surface water discharge and foul water overflow, is a key risk receptor and potentially sensitive to water quality and fisheries requirements.



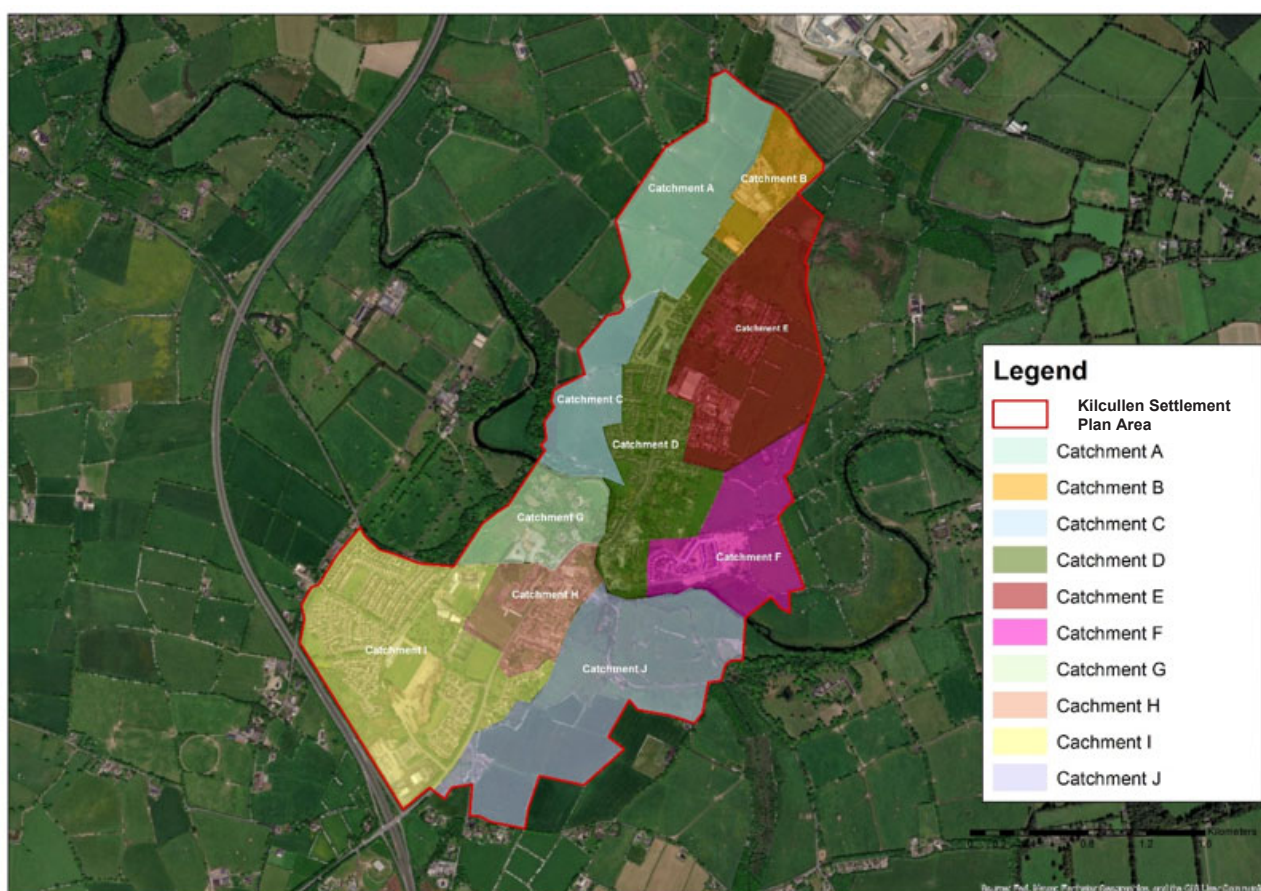
## 6 SURFACE WATER MANAGEMENT PROPOSALS

### 6.1 Catchment Delineation Review

The steps outlined below were followed to review and update the surface water drainage catchments:

1. The Ireland 10m contour of the Study Area was procured.
2. The catchment delineation was performed in the GIS software package ArcGIS manually using the Ireland 10m contour, existing natural surface watercourses and Irish Water Surface Water Network.
3. Following the review, corrections were made to the developed catchment.

Based on the above information the Kilcullen Settlement Plan area has been sub-divided into 10 subcatchments for the surface water management purposes. **Figure 6-1** illustrates the extents of these Surface Water Management subcatchments.



**Figure 6-1 Overview of delineated Catchments for Kilcullen SWMS**

**Table 6-1** presents the further details of the subcatchment areas including the area covered by each subcatchment and the existing & proposed land use zoning details within each subcatchment. **Figure 6-2** also shows the land use zoning details in each subcatchment within the Kilcullen Settlement Plan area. The following 11 no. land use zones have been identified/proposed within the Kilcullen Settlement Plan area:

- A - Town Centre
- B - Existing Residential / Infill
- C - New Residential
- E - Community and Education
- F - Open Space and Amenity

- H - Industry and Warehousing
- I - Agriculture
- N - Neighbourhood Centre
- SS - Service Sites
- T - General Development
- U - Utilities and Services

**Table 6-1 Surface Water Management- Subcatchment Areas and Land Use Zoning**

Sub-catchments	AREA (km <sup>2</sup> )	Land Use Zoning
Catchment A	30.15	<ul style="list-style-type: none"> <li>• I - agriculture</li> </ul>
Catchment B	11.30	<ul style="list-style-type: none"> <li>• Q – Enterprise and Environment</li> <li>• I – Agriculture</li> <li>• F - Open space and Amenity</li> </ul>
Catchment C	16.78	<ul style="list-style-type: none"> <li>• F - Open space and Amenity</li> <li>• I - Agriculture</li> </ul>
Catchment D	36.36	<ul style="list-style-type: none"> <li>• A - Town centre</li> <li>• B - Existing Residential and Infill</li> <li>• C – New Residential</li> <li>• E – Community and Education</li> <li>• F - Open space and Amenity</li> <li>• N – Neighbourhood Centre</li> <li>• T – General development</li> </ul>
Catchment E	44.52	<ul style="list-style-type: none"> <li>• B - Existing Residential and Infill</li> <li>• C – New Residential</li> <li>• F - Open space and Amenity</li> <li>• H – Industry and Warehousing</li> <li>• I - Agriculture</li> </ul>
Catchment F	26.21	<ul style="list-style-type: none"> <li>• B - Existing Residential and Infill</li> <li>• C – New Residential</li> <li>• F - Open space and Amenity</li> <li>• I - Agriculture</li> </ul>
Catchment G	16.41	<ul style="list-style-type: none"> <li>• A - Town centre</li> <li>• I - Agriculture</li> <li>• F - Open space and Amenity</li> </ul>
Catchment H	9.75	<ul style="list-style-type: none"> <li>• A - Town centre</li> <li>• E - Community and Educational</li> </ul>
Catchment I	69.17	<ul style="list-style-type: none"> <li>• A - Town centre</li> <li>• B - Existing Residential and Infill</li> <li>• E - Community and Educational</li> <li>• F - Open space and Amenity</li> <li>• H - Industry and Warehousing</li> </ul>
Catchment J	55.19	<ul style="list-style-type: none"> <li>• A - Town centre</li> <li>• B - Existing Residential and Infill</li> <li>• F - Open space and Amenity</li> <li>• SS – Service sites</li> <li>• I – Agriculture</li> <li>• H - Industry and Warehousing</li> </ul>

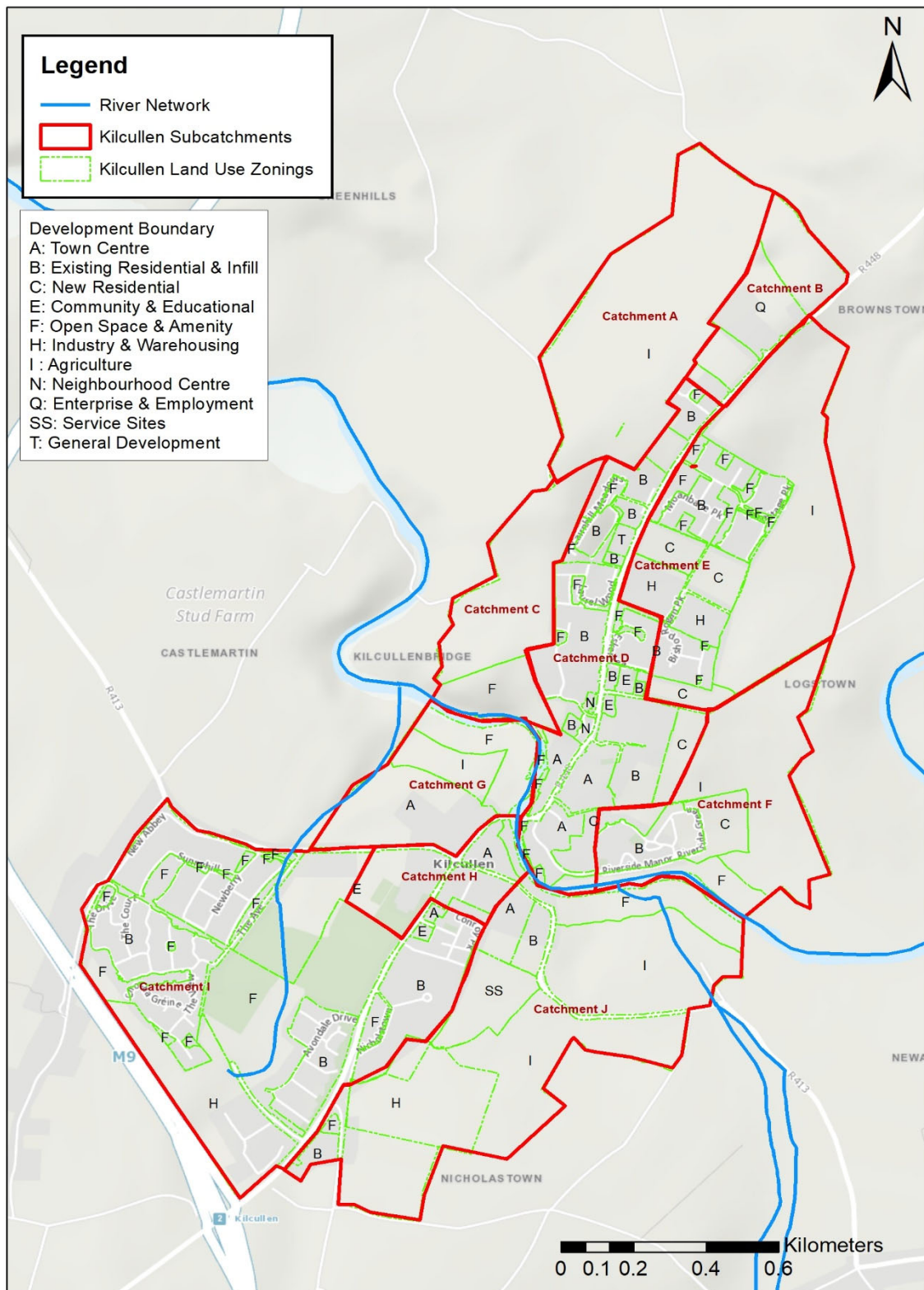


Figure 6-2 SWM Subcatchments and Land Use Zoning details within the Kilcullen Settlement Plan Area

Further details of land use zoning in each subcatchment including the existing surface water drainage systems and proposed strategy for the surface water management are provided in the following sections of the report.

The proposed surface water drainage strategy within each subcatchment has been identified in line with the following guidelines:

- Sustainable Drainage Systems, Guidance Document, Kildare County Council
- Kilcullen Town Land Use Zoning, Kildare County Development Plan 2023 – 2030
- Nature-based Solutions to the Management of Rainwater and Surface Water Runoff in Urban Areas, Department of Housing, Local Government and Heritage.
- The SuDs Manual (C753), London 2015.
- The Planning System and Flood Risk Management – Guidelines for Planning Authority, Department of Environment, Heritage and Local Government (DEHLG), 2009.

The development of surface water management strategies for Settlement Plans should follow the Sustainable Urban Drainage Systems (SuDs) concept design process. A comprehensive review of potential SuDs components relative to Plan Area characteristics should be undertaken to identify appropriate SuDs techniques at an early stage to be taken through the design process. Refer to the SuDs Manual (2015) and the KCC Guidance on Sustainable Drainage Systems (2024) for the details on this concept design process.

The hierarchy of techniques that should be considered in developing the Surface Water Management Strategy include:

1. **Prevention** – the use of good site design and site housekeeping measures to prevent runoff and pollution (eg sweeping to remove surface dust and detritus from car parks), and rainwater reuse/harvesting. Prevention policies should generally be included within the site management plan.
2. **Source control** – control of runoff at or very near its source (eg soakaways, other infiltration methods, green roofs, pervious pavements, bioretention).
3. **Site control** – management of water in a local area or site (eg routing water from building roofs and car parks to a large soakaway, infiltration or detention basin).
4. **Regional control** – management of runoff from a site or several sites, typically in a balancing pond or wetland.

The natural hydrology and existing site characteristics should be assessed through flow route analysis to determine how the Plan Area behaves naturally before development. The SuDs design will have to consider how flows along these flow paths will be managed.

Providing storage throughout the site (distributed storage components), means that every opportunity for storage across the site is exploited, greatly reducing the overall volume and size of site controls. Source controls remove most silts, heavy metals and heavy oils from runoff.

A typical example of the Rainwater Management Plan (RMP) for the Plan Area is shown in **Figure 6-3**.



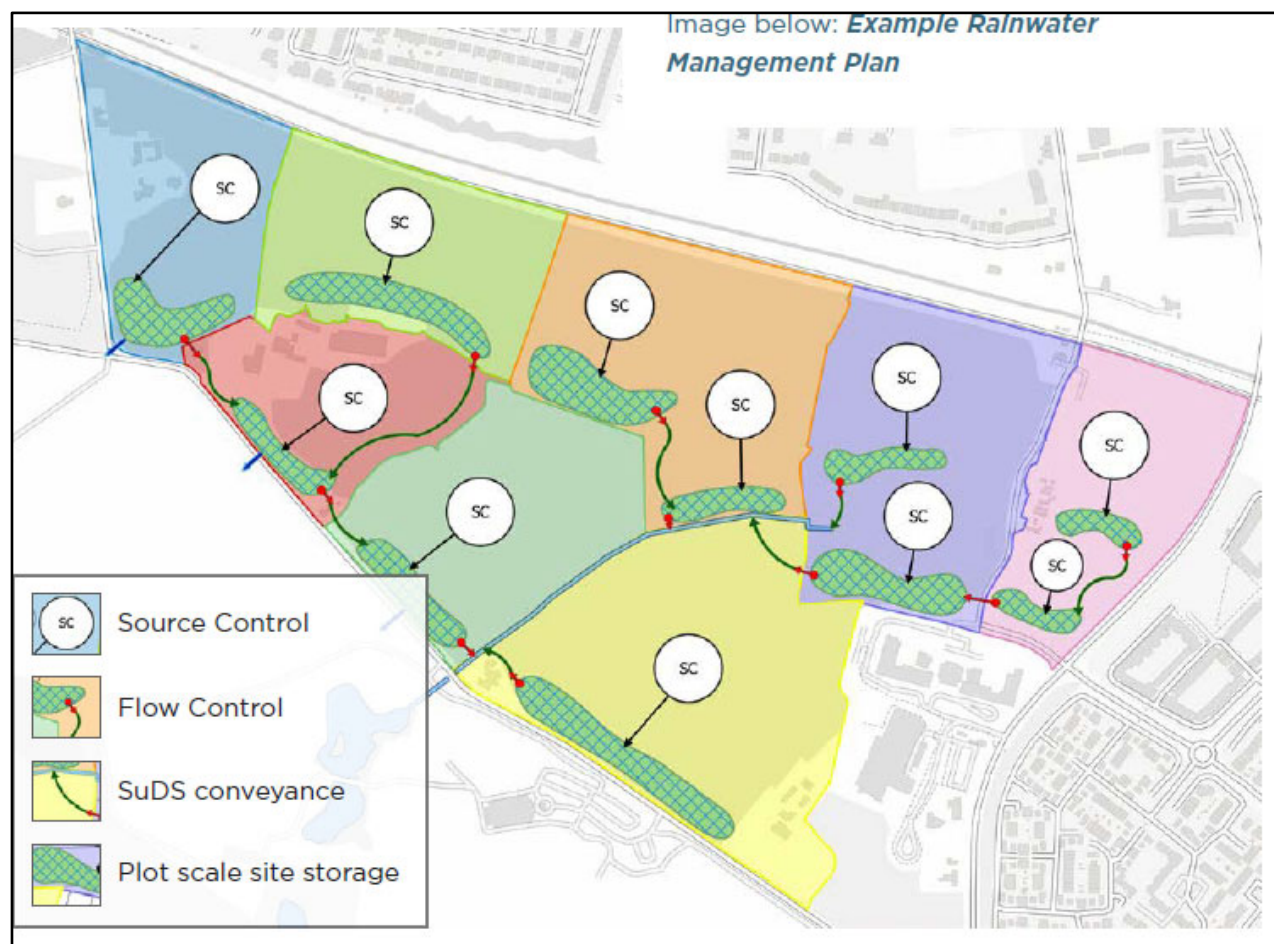


Figure 6-3 Example of a Rainwater Management Plan (source, SuDs Guidance document, KCC, 2024)

## 6.2 Catchment A

### 6.2.1 Development Zoning

Catchment A is located in the northern part of the Kilcullen Settlement Plan area. The northern boundary of this catchment is bounded by a local road, while the west and northwestern boundaries are bounded by a number of greenfield sites / agricultural lands. The eastern and southern boundaries of this catchment area are bounded by a number of existing commercial and residential developments (e.g. *Link Kilcullen Business Park and residential developments at Lui Na Greine and Cairnhill Meadows*). The existing grounds within this catchment area slopes towards its northwestern boundary. The soil type of the entire catchment area comprises of "Well Drained" soil (see **Figure 4-3**). Most of the Catchment A is currently agricultural fields. Under the proposed plan, the entire Catchment A is zoned for agriculture land use (see **Figure 6-2**).

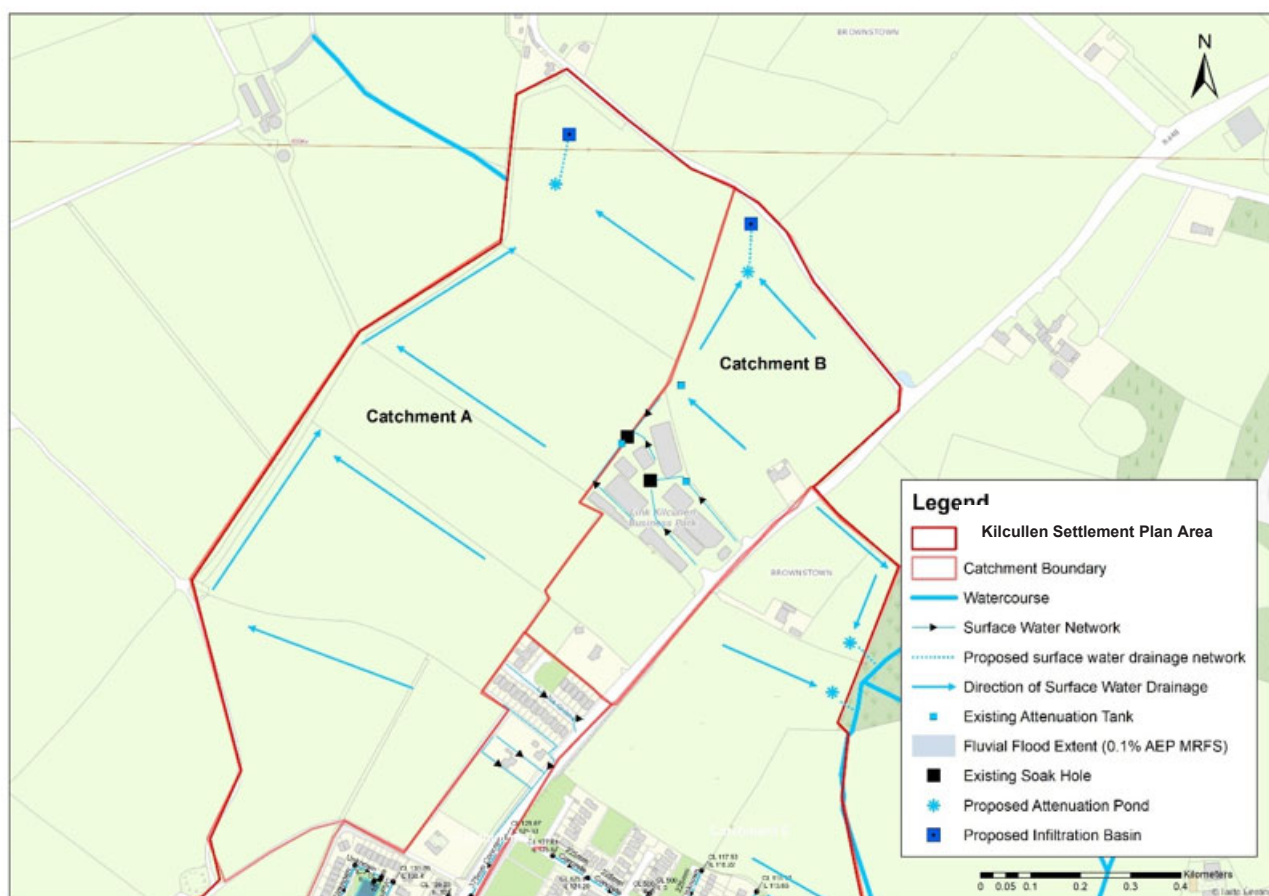


Figure 6-4 Catchment A and B Assessment

## 6.2.2 Proposed Drainage Strategy

- No surface watercourses are located within the Catchment A and its nearest vicinity. The existing soils are well drained in this catchment. Much of the rainwater currently infiltrates to the grounds. Any excess surface runoff flows as overland flow towards the low-lying northwestern edge of the catchment area.
- It is recommended that an infiltration basin /pond be constructed at the low-lying northwestern boundary of this catchment area. Surface runoff will be conveyed to this basin as overland flow and/or via a grassed interceptor ditch/swales running along its western boundary. Accumulated surface runoff will be infiltrated slowly to the ground at the infiltration basin.

Figure 6-4 illustrates a high-level outline plan of the proposed Storm Water Management Strategy for Catchment A.

## 6.3 Catchment B

### 6.3.1 Development Zoning

Catchment B is located in the northeastern part of the Kilcullen Settlement Plan area. Catchment A bounds the western boundary of this Catchment. The northern boundary is bounded by a local road, while the R448 road traverses along the eastern edge of this Catchment. The existing grounds within this catchment area slopes towards its northeastern boundaries. Similar to Catchment A, the soils of this catchment area mainly comprise of “Well Drained” type soil (see **Figure 4-3**). A number of commercial and residential developments are currently located within this catchment area. Under the Kilcullen Settlement Plan, Catchment B has been zoned for “H- Industry and Warehousing” and “B – Existing Residential” types developments (see **Figure 6-2**).

## 6.3.2 Proposed Drainage Strategy

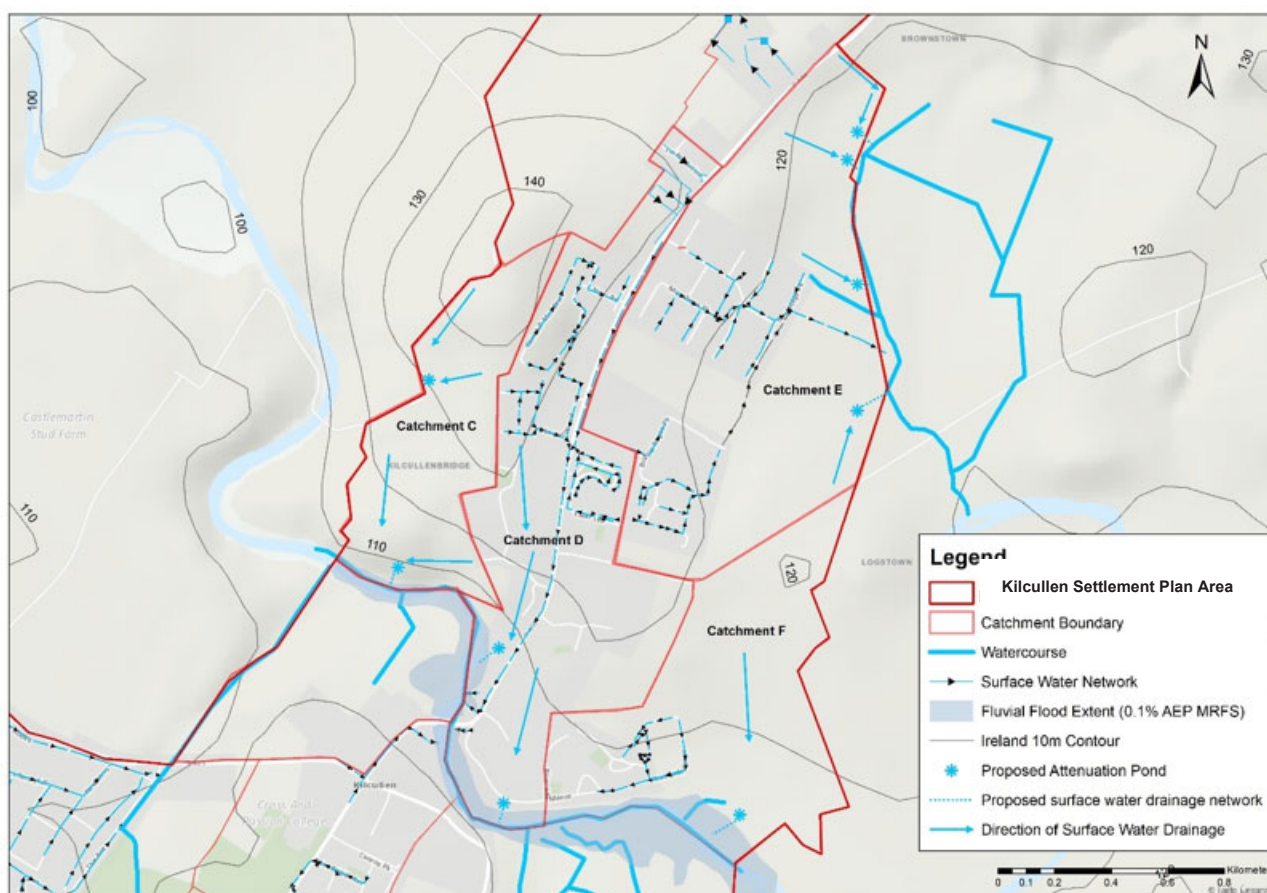
- Given it's well drained type soil, the existing developments within Catchment B is currently serviced by onsite attenuation and infiltrations systems
- It is recommended that an infiltration basin /pond will be constructed at the low-lying northwestern boundary of the catchment area. Surface runoff within each of the individual developments will be managed using various SuDs elements (green roof, bioretention, attenuation ponds, etc). Any excess runoff will be conveyed to the infiltration basin either via open ditches or separate pipelines. Accumulated surface runoff will be infiltrated slowly to the ground at this infiltration basin.

**Figure 6-4** illustrates a high-level outline plan of the proposed Storm Water Management Strategy for Catchment B.

## 6.4 Catchment C

### 6.4.1 Development Zoning

Catchment C is located in the northeastern part of Kilcullen Settlement Plan area. Catchment D bounds the eastern edge of this catchment while the western boundary is bounded by a number of agricultural fields. The River Liffey flows by the southern boundary of Catchment C. The existing grounds within this catchment area slopes southwards towards the River Liffey. Similar to Catchment B, the soils of this catchment area mainly comprise of "Well Drained" with some "AlluMIN" type soil along the River Liffey (see **Figure 4-3**). Under the Kilcullen Settlement Plan, Catchment C has been zoned for "F - Open space and Amenity" and "I - Agriculture" type developments (see **Figure 6-2**).



**Figure 6-5** Catchment C, D, E, and F Assessment

### 6.4.2 Proposed Drainage Strategy

The soils in this catchment are well drained and hence infiltration is likely to be a viable option. Much of the rainwater will be infiltrates to the grounds.

It is recommended that excess surface runoff be attenuated first prior to discharging into the River Liffey. Attenuation can be provided through a number of attenuation ponds located along southern edge of the catchment area.

**Figure 6-5** illustrates a high-level outline plan of the proposed Storm Water Management Strategy for Catchment C.

## 6.5 Catchment D

### 6.5.1 Development Zoning

Catchment D covers most of the existing developments located along both sides of the R448 road, north of River Liffey. The existing developments within this catchment area mainly comprises of residential and commercial type developments. The River Liffey flows by the southern boundary of this catchment. The existing grounds within this catchment area slopes towards the River Liffey. The soils in this catchment area mainly comprise of “Made Ground” type soil with some “AlluMIN” type soil along the River Liffey (see **Figure 4-3**).

Under the Kilcullen Settlement Plan, Catchment D has been zoned as:

- A - Town centre
- B - Existing Residential and Infill
- C – New Residential
- E – Community and Education
- F - Open space and Amenity
- N – Neighbourhood Centre

Locations of the above land use zones within Catchment D are shown in **Figure 6-2**.

### 6.5.2 Proposed Drainage Strategy

- The existing surface water drainage systems within Catchment D comprises of both the combined and separate storm water drainage network. Storm runoff collected through the combined network is pumped to the Osberstown WWTP via the Kilcullen Pumping Station for treatment. Excess storm water overflows from a storm water retention tank at Kilcullen Pumping Station to River Liffey. Surface runoff collected through the separate system is attenuated first prior to discharging into the River Liffey.
- It is recommended that surface runoff from any new development within Catchment D be managed using various SuDs elements (green roof, bioretention, attenuation ponds, etc). Attenuated surface runoff will be conveyed via the existing main storm sewer running along the R448 road and discharged into the River Liffey.

**Figure 6-5** illustrates a high-level outline plan of the proposed Storm Water Management Strategy for Catchment D.



## 6.6 Catchment E

### 6.6.1 Development Zoning

Catchment E is located in the northeastern part of the Settlement Plan area. The western boundary of this catchment is bounded by the R448 road, while the eastern and southeastern edges of this catchment is bounded by a number of agricultural fields. A number of industrial and residential developments are located at the southwestern boundary of this catchment area. The existing developments in Catchment E comprise of both residential and industrial (Kilcullen Industrial Park) types.

Under the Kilcullen Settlement Plan, Catchment E has been zoned as:

- B - Existing Residential and Infill
- F - Open space and Amenity
- H – Industry and Warehousing
- I – Agriculture

The existing grounds within this catchment area slopes towards the eastern boundary of the catchment area. A number of land drains / surface watercourses are located along this eastern boundary which discharges into the River Liffey located in southeastern vicinity of this catchment area. The soils in this catchment area mainly comprise of “Well Drained” type soil (see **Figure 4-3**).

### 6.6.2 Proposed Drainage Strategy

- The existing surface water drainage systems within Catchment E comprises of separate storm water drainage network. Surface runoff collected through this separate system is attenuated first prior to discharging into the adjacent watercourses.
- The soil in the catchment is well drained and hence infiltration is likely to be a viable option. Much of the rainwater will be infiltrates to the grounds.
- It is recommended that surface runoff from any new development within Catchment E will be managed using various SuDs elements (green roof, bioretention, attenuation ponds, etc). Attenuated surface runoff will be conveyed via a new storm sewer and discharged into the adjacent surface water courses.

**Figure 6-5** illustrates a high-level outline plan of the proposed Storm Water Management Strategy for Catchment E.

## 6.7 Catchment F

### 6.7.1 Development Zoning

Catchment F is located at the eastern part of the Kilcullen Settlement Plan area. The River Liffey flows by the southern boundary of this catchment. The northern and eastern boundaries are bounded by a number of agricultural fields. A number of residential developments are located at the western boundary of this catchment. The existing land uses within this catchment are mainly residential and agricultural (See **Figure 6-4** Catchment A and B Assessment).

Under the Kilcullen Settlement Plan, Catchment F has been zoned as:

- B - Existing Residential and Infill
- C – New Residential
- F - Open space and Amenity
- I – Agriculture

The existing grounds within this catchment area slopes towards the River Liffey which flows along the southern boundary. The soils in this catchment area mainly comprise of “Well Drained” type soil with some “AlluMIN” type soil along the River Liffey (see **Figure 4-3**).

### 6.7.2 Proposed Drainage Strategy

The soils in the catchment area are well drained hence infiltration is potentially to be a viable option.

A Surface-based attenuation NBS should be included in development plans prior to discharge of any future surface drainage network into the River Liffey.

**Figure 6-5** illustrates a high-level outline plan of the proposed Storm Water Management Strategy for Catchment F.

## 6.8 Catchment G

### 6.8.1 Development Zoning

Catchment G is located on the north side of the River Liffey. The northern and eastern boundaries of this catchment is bounded by the River Liffey. The southern side is bounded by the R413 and R448 road. The Pinkeen Stream flows along the western boundary of this catchment.

A number of commercial and residential developments are located in the southern part of this catchment area. The remaining areas are mainly agricultural type lands.

Under the Kilcullen Settlement Plan, Catchment G has been zoned as:

- A - Town centre
- I - Agriculture
- F - Open space and Amenity

The existing grounds within this catchment area slopes towards the River Liffey. The soils in this catchment area comprise of “Well Drained”, and “Made Ground” type soils with some “AlluMIN” type soil along the River Liffey (see **Figure 4-3**).

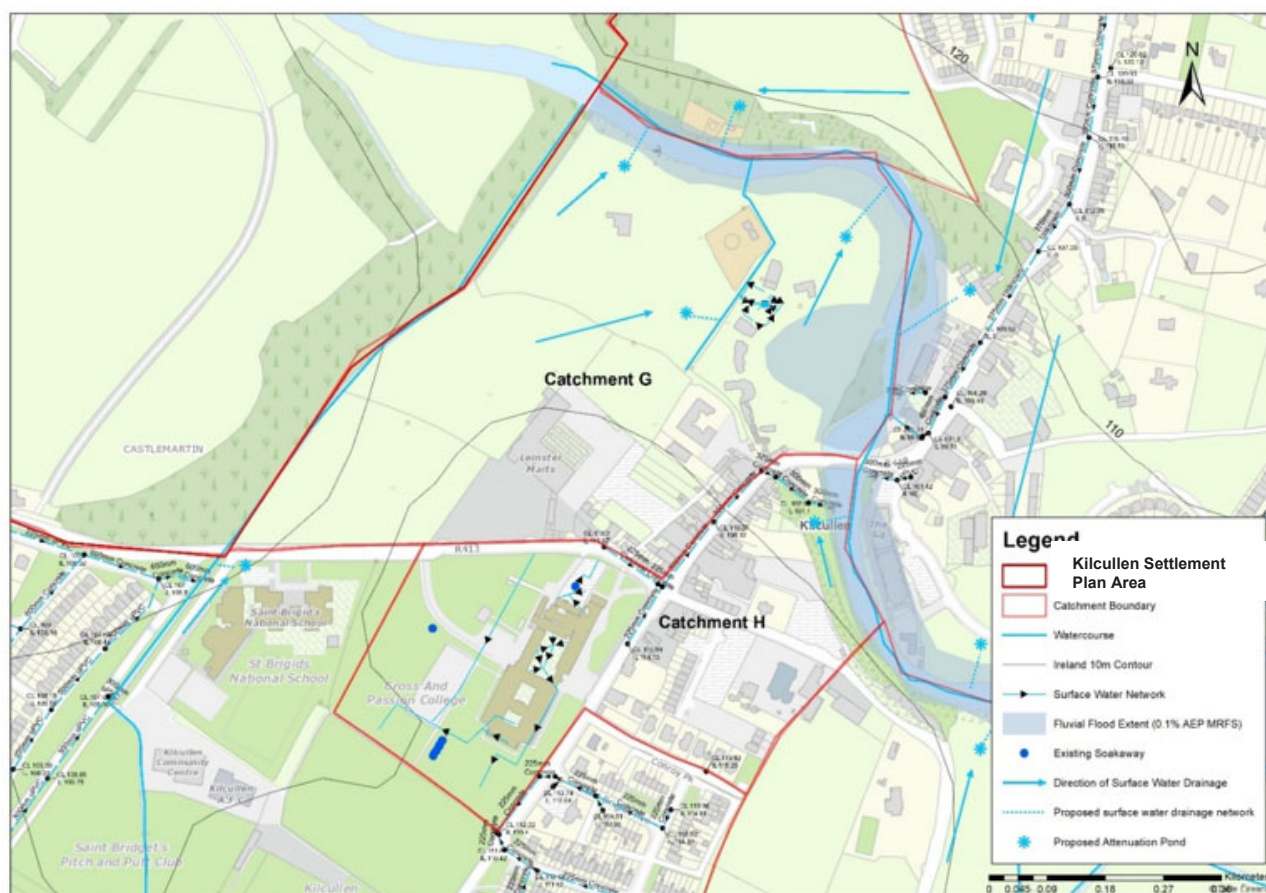


Figure 6-6 Catchment G and H Assessment

## 6.8.2 Proposed Drainage Strategy

- The existing surface water drainage systems within Catchment G comprises of both the combined and separate storm water drainage network. Storm runoff collected through the combined network is pumped to the Osberstown WWTP via the Kilcullen Pumping Station for treatment. Excess storm water overflows from a storm water retention tank at Kilcullen Pumping Station to River Liffey. Surface runoff collected through the separate system is attenuated first prior to discharging into the River Liffey and Pinkeen Stream.
- It is recommended that surface runoff from any new development within Catchment G be managed using various SuDs elements (green roof, bioretention, attenuation ponds, etc). Attenuated surface runoff will be conveyed via a separate storm sewer network and discharged into the River Liffey.

Figure 6-6 illustrates a high-level outline plan of the proposed Storm Water Management Strategy for Catchment G.

## 6.9 Catchment H

### 6.9.1 Development Zoning

Currently Catchment H consists of mixed land use zones with residential, commercial and educational type developments. The River Liffey flows along its northeastern boundary. The northern and some western boundaries of this catchment area are bounded by the R413 and R448 road. The southern and eastern boundaries are surrounded by a number of greenfield sites and residential developments.

Under the Kilcullen Settlement Plan, Catchment H has been zoned as:

- A - Town centre
- E - Community and Educational

The existing grounds within this catchment area slopes towards the River Liffey. The soil in this catchment area is mainly the “Made Ground” type soil (see **Figure 4-3**).

### 6.9.2 Proposed Drainage Strategy

- Similar to Catchment G, the existing surface water drainage systems within Catchment H comprises of both the combined and separate storm water drainage network. Storm runoff collected through the combined network is pumped to the Osberstown WWTP via the Kilcullen Pumping Station for treatment. Excess storm water overflows from a storm water retention tank at Kilcullen Pumping Station to River Liffey. Surface runoff collected through the separate system is attenuated first prior to discharging into the River Liffey.
- Any future development within Catchment H should ensure inclusion of SuDS measures in accordance with the requirements for new development proposals as outlined in the Kildare County Development Plan. Attenuated surface runoff will be conveyed via a separate storm sewer network and discharged into the River Liffey.

**Figure 6-6** illustrates a high-level outline plan of the proposed Storm Water Management Strategy for Catchment H.

## 6.10 Catchment I

### 6.10.1 Development Zoning

Catchment I is located on the south side of the River Liffey. Currently Catchment I consists of mixed type land use zones with residential, commercial and educational type developments. The Pinkeen stream flows through this catchment area. The existing grounds slope towards this stream

Under the Kilcullen Settlement Plan, Catchment I has been zoned as:

- A - Town centre
- B - Existing Residential and Infill
- E - Community and Educational
- F - Open space and Amenity

Refer to **Figure 6-2** for the locations of these land use zones.

The soils in this catchment area comprise of “Well Drained”, and “Made Ground” type soils with some “Poorly Drained” type soil along the southwestern part (see **Figure 4-3**).

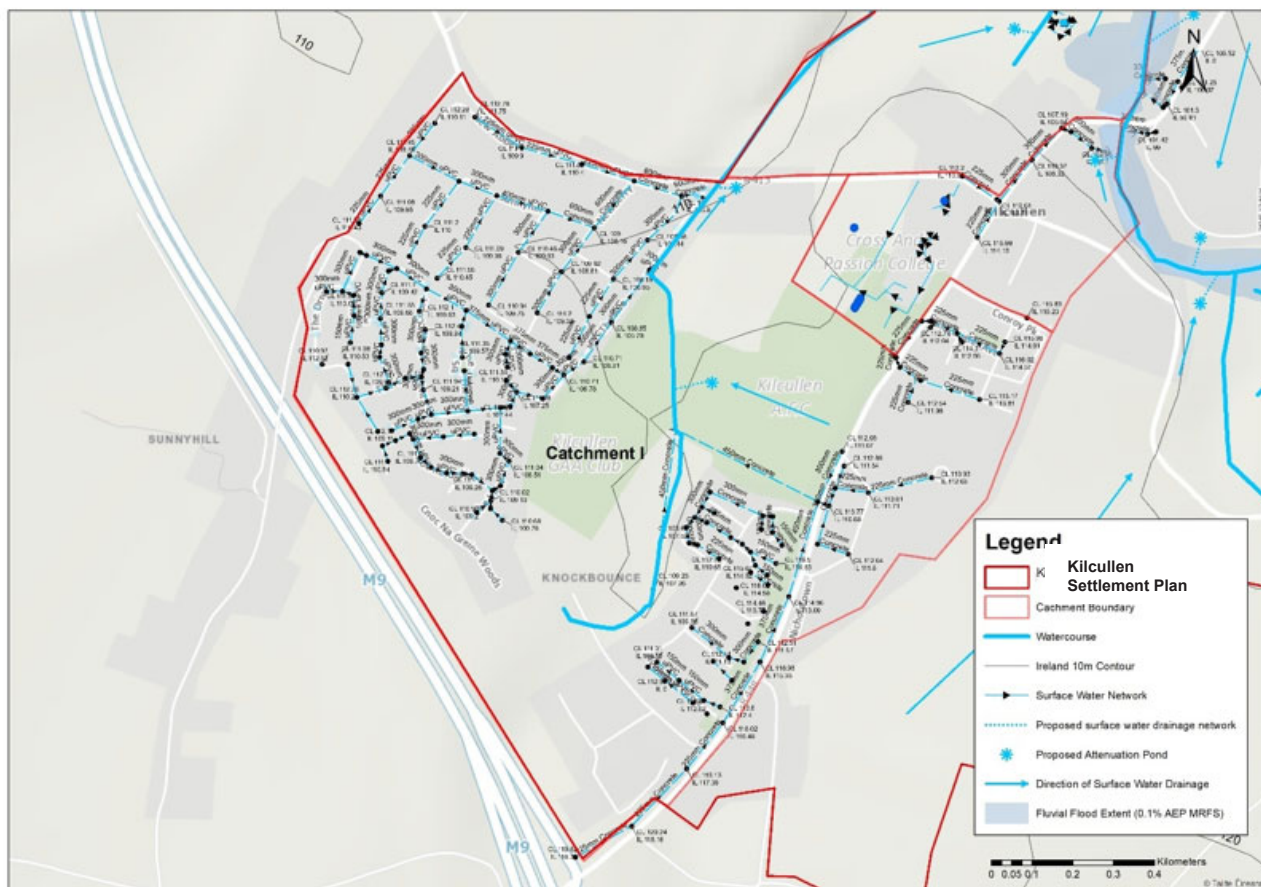


Figure 6-7 Catchment I Assessment

## 6.10.2 Proposed Drainage Strategy

- In Catchment I, the recently developed housing estates incorporate a well-structured surface water drainage network discharging into the Pinkeen Stream. Residential properties in this catchment are outfitted with attenuation storage.
- Any future development within Catchment I should ensure inclusion of SuDS measures in accordance with the requirements of the Plan area. Attenuated surface runoff will be conveyed via the existing and/or separate storm sewer network and discharged into the Pinkeen Stream.

Figure 6-7 illustrates a high-level outline plan of the proposed Storm Water Management Strategy for Catchment I.

## 6.11 Catchment J

### 6.11.1 Development Zoning

Catchment J is situated at the southeastern part of the Kilcullen Settlement Plan area. The River Liffey flows along its northern boundary, while the eastern and southern boundaries are surrounded by a number of agricultural fields. The existing land use within the catchment area is mainly agricultural.

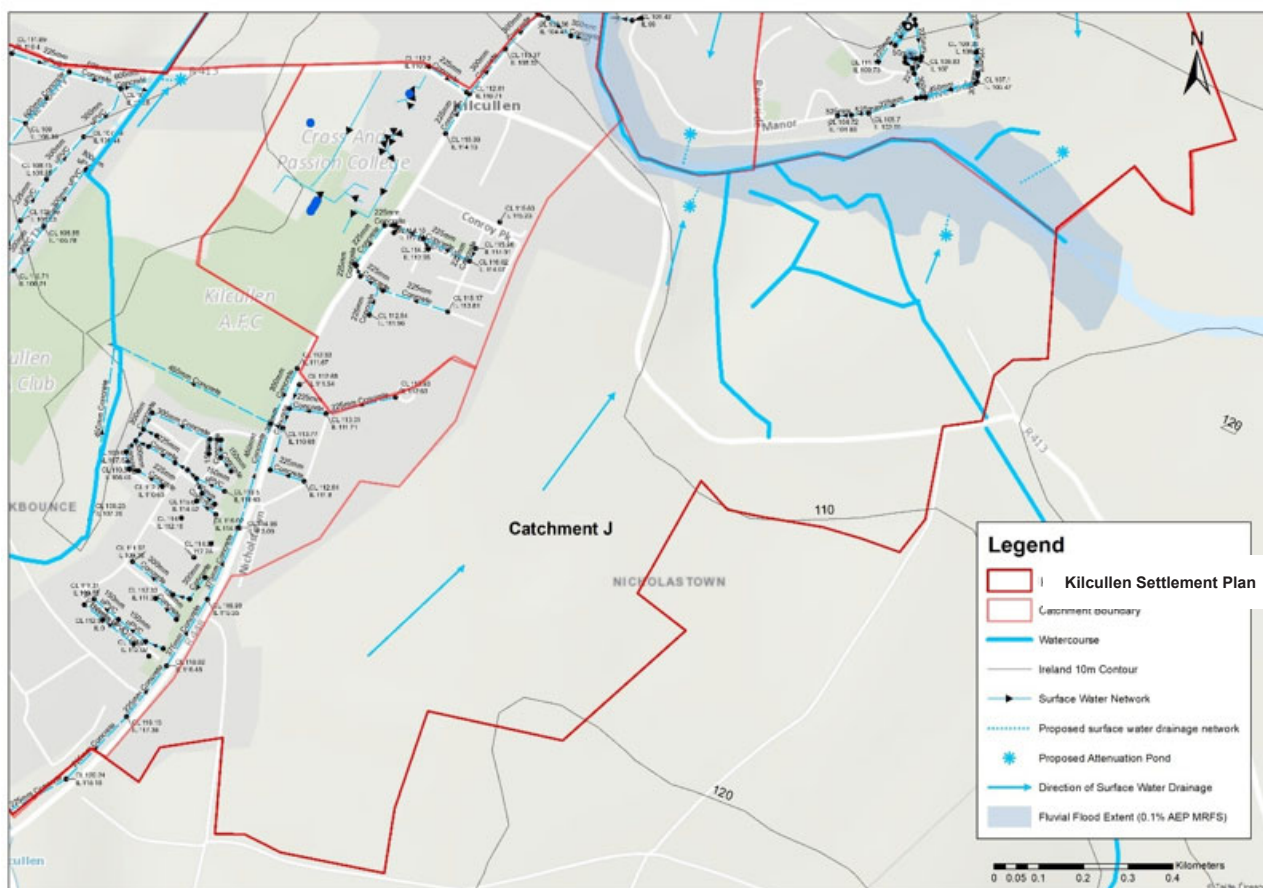
Under the Kilcullen Settlement Plan, Catchment J has been zoned as:

- A - Town centre



- B - Existing Residential and Infill
- F - Open space and Amenity
- SS – Service sites
- I – Agriculture

Refer to **Figure 6-2** for the locations of these land use zones.



**Figure 6-8 Catchment J Assessment**

Kilcullen stream flows through the northern section of this catchment and discharges into the River Liffey. The existing grounds within this catchment area slopes towards the Kilcullen Stream and River Liffey. The soils in this catchment area mainly comprise of “Well Drained” type soil with some “AlluMIN” type soil along the River Liffey (see **Figure 4-3**).

### 6.11.2 Proposed Drainage Strategy

- Catchment J is mostly consisting of agricultural land. Much of the rainwater currently infiltrates to the grounds. Any excess surface runoff flows as overland flow towards the Kilcullen Stream and River Liffey.
- The soil in Catchment J is well drained hence infiltration is potentially to be a viable option. It is suggested that proposed NBS type drainage systems can potentially drain attenuated water through infiltration by developing them as bioretention area or infiltration basin or similar. It is recommended that the new development in the should have proposed NBS plan based on landscape design.
- Surface runoff can conveyed to the infiltration basin as overland flow and/or via a grassed interceptor ditch/swales (to be constructed) along the eastern boundary. Accumulated surface runoff will be infiltrated slowly to the ground at the infiltration basin. In addition to this infiltration attenuated surface runoff can be discharged into the River Liffey and Kilcullen Stream.

**Figure 6-8** illustrates a high-level outline plan of the proposed Storm Water Management Strategy for Catchment J.

## 7 CONCLUSIONS

### 7.1 Conclusions

- Data was collected by desktop assessment, Irish water and provide by KCC. Information was collected on surface water management for various permitted developments which are now either completed or under construction.
- The data gathered includes information on the surface water drainage infrastructure within the study area. Some data gaps remain due to unavailable records at the time of writing.
- The existing surface water drainage systems within the Kilcullen town comprises of both the combined and separate storm water drainage network. Storm runoff collected through the combined network is pumped to the Osberstown WWTP via the Kilcullen Pumping Station for treatment. Excess storm water overflows from a storm water retention tank at Kilcullen Pumping Station to River Liffey. Surface runoff collected through the separate system is attenuated first prior to discharging into the River Liffey.
- The natural catchment drainage paths have been altered by urbanisation.
- Fluvial flooding has been a concern within the study area from Liffey River and Mill Stream.
- It was also reported that pluvial flooding occurs at a number of locations in Kilcullen due to inadequate capacity and/or blockage in the existing storm sewer pipe.
- This report explores options for sustainably managing surface water in future developments within the Study Area. A hierarchical approach to managing surface water in discrete sub-catchments is proposed with areas reserved for the implementation of nature-based solutions.
- The development of NBS in delineated catchment is encouraged, with surface-based conveyances such as swales, rain gardens and open low flow channels utilised to mimic natural drainage processes as closely as possible. The exact locations and discharge routes of proposed NBS are flexible and will be subject to the design and landscaping proposals for each development. Similarly, the routes of the proposed extensions to the surface water network is flexible and will depend on local design considerations.

### 7.2 Recommendations

- Identify opportunities to integrate surface water management objectives with other KCC-led development projects in the area.
- Require developers to provide an audited SuDS Strategy with their planning applications which takes account of any future surface water masterplan for the town and any recommendations from this report adopted into the Kilcullen Settlement Plan area.
- Make provision for maintenance of nature-based surface water management solutions by KCC operations staff.
- Complete a capacity assessment if increasing discharges to existing surface water infrastructure.
- Conduct an integrated surface water modelling study to represent all potential surface water flooding and connections with the surface water and foul water drainage networks to support the aims of this strategy through quantification of pipe network capacities and to demonstrate practical implementation of the strategy.
- It is recommended that a Surface Water Separation programme be implemented in Kilcullen town. The aim of this programme will be separating storm water discharges from the foul network in the identified subcatchments of Kilcullen. Inter-agency collaboration with Uisce Eireann is recommended to incorporate the aims and objectives of the Surface Water Separation Project.



## 8 REFERENCES

1. Greater Dublin Strategic Drainage Study (DDC, 2005)
2. Kilcullen Town Land Use Zoning, Kildare County Development Plan 2023 – 2029
3. Nature-based Solutions to the Management of Rainwater and Surface Water Runoff in Urban Areas, Department of Housing, Local Government and Heritage (2022).
4. Sustainable Drainage Systems, Guidance Document, Kildare County Council, 2024
5. The Planning System and Flood Risk Management – Guidelines for Planning Authority, Department of Environment, Heritage and Local Government (DEHLG), 2009.
6. The SuDS Manual C753 (CIRIA, 2015)

