RIVER PODDLE FLOOD ALLEVIATION SCHEME

Response to Request for Further Information nos. 2 and 10

An Bord Pleanála Ref. 306725-20

B&V PROJECT NO. 122828

PREPARED FOR

South Dublin County Council and Dublin City Council

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BLACK & VEATCH

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1.0 Introduction

1.1 Background

A planning application has been submitted to An Bord Pleanála for the proposed River Poddle Flood Alleviation Scheme (ABP Ref. 306725-20). The Scheme is proposed to provide flood protection from the River Poddle and consists of upstream storage with raised defences in South Dublin and Dublin City Council areas.

Black & Veatch undertook the hydrological and hydraulic modelling including the production of reports which contributed to the environmental impact assessment and design of the Scheme.

An Bord Pleanála issued a request for further information (RFI) in respect of the planning application, dated 17 July 2020. Further information is sought in relation to Scheme Design and Environmental Impact Assessment and pertain to the Hydraulics Report prepared by Black & Veatch.

1.2 Purpose of this document

Black & Veatch were instructed by Nicholas O'Dwyer to prepare a response to items in the RFI as follows:

RFI no. 2. In responding to observations regarding natural flood management you are requested to:

- *include a brief description of the locations and volumes of water inputs to the Poddle*
- *comment on the option of increasing upstream storage at Tymon North or Tymon Park and at Ravensdale Park*
- *explain the design in terms of capacity to deal with blockage in culverts.*

RFI no. 10. (part) Requiring a brief review of the findings of the Hydraulics Report of February 2019.

A response to RFI no. 10 (part) is contained in the Further Information Response document, Section 11.

1.3 Statement of Authority

The modelling of the River Poddle was carried out by specialists at Black & Veatch including:

Ed Gower who is a Chartered Member of the Chartered Institute of Water and Environmental Management (CIWEM). He has over 20 years of experience in hydraulic modelling including undertaking river and network modelling for several UK and overseas clients.

Fabio Spaliviero who is a Project Director with over 20 years' experience in Flood Risk Management and is responsible for governance and delivery of a portfolio of projects in flood risk management ranging from project appraisal and optioneering to detailed design and construction supervision. Fabio has a strong background in hydrology and hydraulic modelling.

2.0 Description of the Locations and Volumes of Water Inputs

The River Poddle is an ungauged watercourse which rises in Cookstown, Tallaght and flows through Bancroft Park before going under the M50. On the downstream side of the motorway it flows through Tymon Park before flowing into the Templeogue / Kimmage area. Downstream of Templeville Road there is an overflow called Lakelands which allows flow to exit the river system to Terenure College Lakes over 1km away. From Kimmage, the river flows in parallel to Kimmage Road Lower before entering Ravensdale Park on the downstream side of Kimmage Road West. At the downstream end of this park there is a culvert which restricts flows. From Ravensdale Park the river flows through Mount Argus before flowing past Mount Jerome Cemetery towards Harold's Cross. Just downstream of Gandon Close the river enters a culverted system which flows through a syphon under the Grand Canal. Just upstream of the canal syphon there is another overflow which can discharge some of the flow into the Grand Canal sewer. The flow under the canal is restricted by the syphon. With the exception of a small open section of the river adjacent to White Swan Business Park, the downstream sections of the Poddle watercourse are culverted underground down to the discharge point into the River Liffey at Wellington Quay.

The main sources of inflow to the river are from the surface water system. There is no rural contribution to the River Poddle. In response to **RFI no. 2**, Table 2-1 gives the inflow location, peak flow and volume during a 1% Annual Exceedance Probability (AEP) event. A 1% AEP is often referred to as a 1 in 100 year event. Flow and input locations are shown as blue lines on Figure 2-1.

In total there are just over 60 inflows into the river. It should be noted that due to the relative timing of these inflows, the peak flow in the river is not a straight sum of these inflows. Some of the inflows as noted in the table below are shown to have a negative net inflow. This is because early in the rainfall event the flows into the river are positive (in that they contribute to additional flow in the river) but as the river levels rise water starts to back up into the surface water system resulting in a negative flow out of the river into the surface water drainage system. One of these negative flows is located close to Priory Road and includes the new surface water system which drains the area.

Location	Peak Flow (m^3/s)	Volume (m^3)
	Institute of Technology	
SO092800R1	1.69	27,155.53
SO09289101	1.50	13,879.5
SO10280001	0.50	5,235.61
SO10281006	0.06	919.13
SO10281003	0.01	179.18
SO10282201	0.75	7,017.15
SO10283303	0.17	2,064.04
SO10285302	0.05	569.73
SO10285201	0.03	274.83

Location	Peak Flow (m^3/s)	Volume (m^3)
SO10285202	0.26	2,724.24
SO10285203	0.17	1,790.21
SO10287301	0.44	5,528.14
SO10284901	0.58	6,443.13
SO10295002	0.62	5,232.54
SO10296101	0.15	2,589.76
	M50	
SO10294201	0.22	2,567.57
SO11290501D2	0.36	3,807.82
	Tymon Park	
SO11290503	0.17	1,405.64
SO11291201	0.23	3,612.85
SO11291401	0.08	1,007.12
SO11293505	0.02	228.4
SO11293507	0.10	1,548.74
SO11295502	-0.18	136.45
SO11295401	0.30	7,488.16
SO11296402	0.16	3,309.63
SO11296501	0.04	378.95
SO11299404	0.16	3,383.09
SO11299501	-0.04	52.88
SW22-6MH522	-0.05	-0.01
SO12291601	0.01	49.59
SO12291604	0.01	236.61
SO12291607	0.02	321.38
SO12291704	0.01	68.84
SO12292701	0.99	12,588.34
SO12292705	-0.14	-2,703.54
	Lakelands Overflow	
Unknown5	0.48	6,176.69
SO12296905	-0.75	-3,017.42
	Kimmage Manor	
SO12308103	0.18	3,612.33
SO13303405	0.06	574.95
SO13304609	0.09	2,097.46
	Ravensdale Park	
SO13304602	0.58	14,026.97
SO13305602	0.63	9,095.96
SO13305801	0.17	4,456.87

Location	Peak Flow (m³/s)	Volume (m³)
SO13316001	0.11	3,466.6
SO13306902	0.10	3,037.29
SO13318304	0.35	5,909.28
MH14	0.22	2,743.81
	Mount Argus	
SO14313403	0.27	6,954.01
	Gandon Close	
S1005_2011_2	0.04	249.56
SO14326308	0.04	257.49
SO14325407	0.05	313.34
	Grand Canal	
SO14333005	0.24	2,573.54
SO14339206	0.21	3,682.85
SO15331312	0.37	2,336.35
SO15331434	0.01	56.32
SO15331425	0.01	91.86
SO15330414	0.02	120.65
SO15331428	0.00	-0.23
SO15331509	0.14	1,019.69
SO15331609	0.06	361.2
SO15333802	0.25	1,815.99
SO15333703	0.07	444.99
	Confluence with the River Liffey	
TOTAL	**13.44**	**193,549.63**

Table 2-1 – Modelled Peak Flows and Volumes entering the River Poddle during a 1% AEP event

Design rainfall was calculated using the Flood Studies Update (FSU) web portal and was applied to the hydraulic model to estimate runoff into the surface water network which generates the flows and water levels within the River Poddle. As mentioned above, there are three controlled outflows from the River Poddle along its length: Lakelands overflow, the Grand Canal sewer overflow, and into the River Liffey.

The hydraulic model was constructed in a software package called InfoWorks ICM which can model the pipe system of the surface water drains, the open channel of the River Poddle, and overland flow routes of excess surface water. The catchment is broken down into subcatchments to represent discrete areas which drain to the surface water drainage system. These subcatchments generate the runoff based on the design rainfall and the area of impermeable and permeable surfaces in the subcatchment.

The model simulates flooding onto the ground surface when the pipe drainage capacity is exceeded or when the water level in the river is above bank level. The flow routes are calculated based on the ground levels derived from the LiDAR topographic data and ground surveys.

For the open channel sections of the river, all structures within the river which could obstruct or have a hydraulic influence on the flow were represented in the hydraulic model, including the various bridges which cross the river and any weirs, culverts or screens. The hydraulic model calculates the water level across the whole area for the whole simulation time period based on the input rainfall profile and hydraulic constraints as described above. The results can then be plotted within the software or exported into a Geographic Information System (GIS) platform to visualise water depths and extent of flooding (see EIAR volume 3)

Figure 2-1 shows the plan of the modelled catchment including key locations along the watercourse.

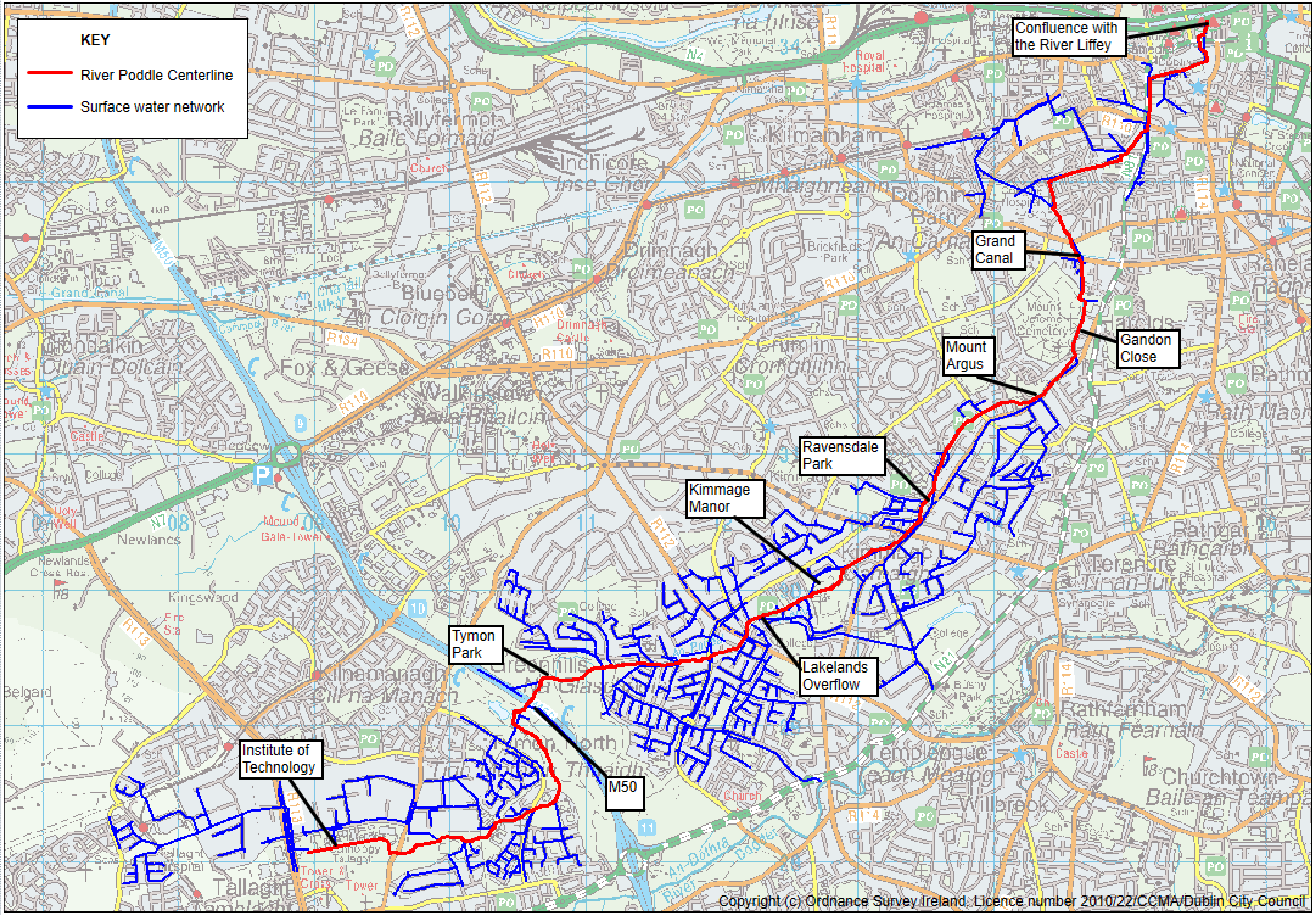

Figure 2-1 – Plan of the modelled catchment

3.0 Location of Flood Storage Area

In response to **RFI no. 2**, this section presents a discussion on the options for flood storage at various points along the Poddle River (i.e. Tymon North or Tymon Park, and at Ravensdale Park).

3.1 Flood storage at Tymon

The total catchment area of the River Poddle is 1,644.8 Ha. Upstream of Tymon Park the catchment area is approximately 323 Ha or 20% of the Catchment area. The determination of the most appropriate location for flood storage is dependent on a number of factors as outlined below. The location of flood storage at Tymon Park allows for a significant portion of the River catchment run-off to be controlled from the upper catchment. By storing flows in the upper catchment and limiting its contribution downstream, this affords more capacity in the channel downstream to manage the subsequent inflows.

A number of factors have to be considered when designing flood storage, including:

- Volume required to be stored
- Space available for the safe storage of waters, noting its impact on existing land uses
- Safe spill of volumes that exceed design storage volume

Table 3-1 Comparison of Flows entering and Leaving Tymon Park for a 1% AEP Event

Location	Existing Peak Flows in a 1% AEP (m^3/s)	Proposed Peak Flows in a 1% AEP (m^3/s)
Institute of Technology Tallaght	2.09	2.09
Entering Tymon Park	6.59	6.59
Leaving Tymon Park	5.79	0.75

Table 3-1 above shows a comparison of the peak flows volumes entering and leaving Tymon Park for a 1% AEP event for the existing scenario and for the proposed scenario with increased flood storage in Tymon Lakes. The storage proposal reduces downstream outflows from the lakes from 5.79 m^3/s to 0.75 m^3/s, i.e. 87% reduction in flow downstream. The restricted outflow volume of 0.75 m^3/s is equivalent to the 50% AEP flow or flow with a return period of 2 years. It was established in hydraulic modelling during CFRAM Poddle Options Report and verified in this study that significant flooding along Poddle starts somewhere between the 50%AEP and 20%AEP flood events. In order for flood storage to be effective the flow, therefore, needs to be reduced to the equivalent of the 50% AEP flood event. This is the magnitude of the flow that should be naturally contained within a riverbank and is considered to be the accepted standard as agreed with the OPW. This measure significantly reduces the flood risk downstream as well as within the vicinity of the storage area.

The existing lakes at Tymon Park were originally constructed in the 1990's to provide some flood attenuation. As described in EIAR Chapter 4, the Eastern CFRAM identified that raising the embankment on the eastern end of Tymon Lake and controlling the flow released over the outlet weir to a 50% AEP would provide the flood storage volumes needed to reduce the height and extent of flood defences further downstream where there is limited flood storage space available.

In the design of flood storage for the River Poddle Flood Alleviation Scheme, the modelling determined:

- Approximately 66,000m^3 of additional flood storage is needed for the upper catchment, including Tymon Park, for the design event of 1% AEP.

- This volume could be stored within the existing flood storage lakes and contoured lands to the north and south by raising the embankment along the eastern section of the main lake at Tymon Park with minimal impact on land uses and habitats in the surrounding parklands (e.g. sports field to the south and wildflower meadows to the north).

- The earth embankments are designed to safely spill (overtop) volumes in excess of 66,000m^3 downstream into the channel and parkland area for flood events that exceed the design without damaging the integrity of the embankment or increasing the extent of flooding downstream of Tymon Park.

Locating flood storage further upstream in Tymon North was considered but excluded for the following three primary reasons:

- It is not a safe area to store large volumes of water without significant additions of infrastructural works, associated increased impacts and remaining residual risks. Creating flood storage at Tymon north would have required a flow control structure upstream of the M50 to limit flow release and a dam or embankment structure along Tymon North or the motorway to retain the flood waters. This would have to be designed not to overtop as spilling over here would have a significant impact on the adjacent residential and commercial areas and the M50 motorway with considerable associated safety risks. Accordingly, an impoundment at Tymon North would have required a significantly more substantial spillway arrangement including channeled flows upstream of the M50 and a significant closed spillway channel (culvert) under the M50 to channel high flows to a downstream storage area in Tymon Park.

- The location of Tymon North is further upstream in the catchment than the proposed location for storage. Accordingly, storage at Tymon North would attenuate flows in a smaller portion of the catchment (c.246 ha). This in turn means that flood storage is less effective (less cumulative run-off can be stored). To maintain the design outflow of 0.75 m^3/s from Tymon Park, further storage would also be required downstream of Tymon North to control run-off between Tymon North and Tymon Park Lakes –i.e. in Tymon Park Lakes. Therefore, if storage was provided at Tymon North then further storage or some form of flood defences would still be required in Tymon Park Lakes.

- Even if the preceding reasons were not factors in identifying the preferred location Tymon North would still not be the preferred option as the topography at Tymon North does not provide a natural depression to readily facilitate the storing of large volumes of water. Accordingly, extensive earthworks and structural works, on a larger scale and over a larger area to those proposed at Tymon Lakes, would be required to create the impoundment and spillway. This in turn would have a more significant impact on the surrounding area and existing land use (i.e. sports fields, playgrounds etc.)

The option taken forward uses the footprint of existing lakes within Tymon Park, where they were created for flood storage in the first place, and where possible, utilises existing topography to form the embankment. It is the preferred option for flood storage because it:

- Stores flows from a greater portion of the catchment
- It presents the least safety risk
- It expands on an existing storage facility used for attenuation
- It has the least amount of civil engineering works and associated impacts

3.2 Flood storage downstream of Tymon Park

Downstream of Tymon Park there are 23 inflow points before Ravensdale Park, these can be seen in Table 2-1. Flood run-off generated in the catchment downstream of Tymon Park needs to be managed by a combination of defences and/or localised storage where available. As part of the study, peak flows were calculated at critical locations along the watercourse. These are shown in Table3-2. The table shows that the flows at the Institute of Technology Tallaght are the same in the existing and proposed flood defences scenario. Downstream of Tymon Park there is a reduction in the flow due to the flood storage proposed at Tymon Park from 5.79 m^3/s to 0.75 m^3/s. This reduces peak flow leaving Tymon Park by 87%. Progressing down the watercourse, peak flow gradually increases again due to contributions from the downstream drainage system, which are not attenuated, to the point that the flow capacity of the River Poddle is exceeded and further flood attenuation measures are required to mitigate against the flooding.

Location	Existing Peak Flows in a 1% AEP (m^3/s)	Proposed Peak Flows in a 1% AEP (m^3/s)
Institute of Technology Tallaght	2.09	2.09
Entering Tymon Park	6.59	6.59
Leaving Tymon Park	5.79	0.75
Lakelands Overflow	6.57	2.89
Mount Argus Park	5.00	2.44
Confluence with the River Liffey	2.05	3.44

Table 3-2 – Flows modelling at critical points along the River Poddle

The possibility for inclusion of further flood storage downstream of Tymon Park was limited due to the increasing urbanization of the catchment with the only notable green spaces for natural storage being Whitehall Park, Ravensdale Park, St Martin's and Mount Argus. The proposed re-alignment of the river channel through Whitehall Park has limited storage capacity as the Lakelands Overflow immediately downstream acts as a flow control structure and the area which could be used as flood storage is at a higher level than the river.

The area at Ravensdale Park is at a lower level than the river and therefore can be used as flood storage.

At St Martin's the surrounding ground levels are again significantly higher than the river. At Mount Argus there are existing small inline flood storage lakes constructed as part of the Mount Argus housing development with limited opportunity for increasing in capacity.

One of the largest inflows downstream of Tymon Park is from the Perrystown area. This includes a surface water system from Muckross Crescent running parallel to the River Poddle and then discharging into the Poddle just downstream of Ravensdale Park. It has a peak flow of 0.58 m^3/s in a 1% AEP event. Figure 3-1 shows the extent of this catchment.

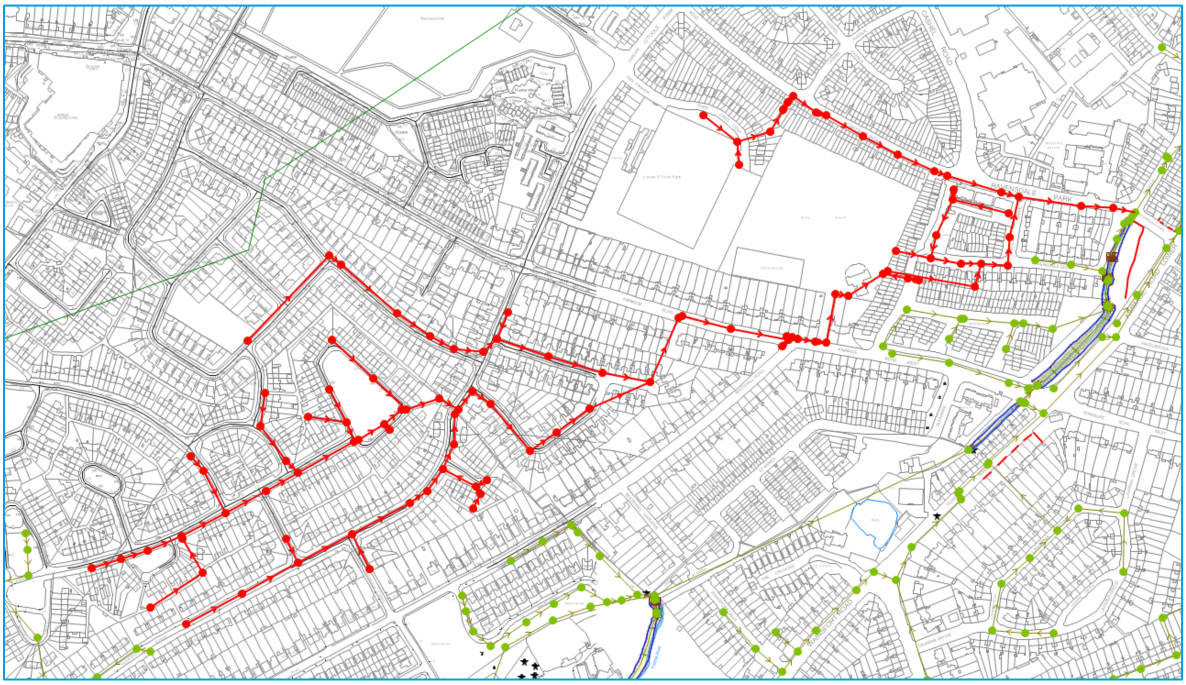

Figure 3-1 – Perrystown surface water network

Due to the location and volume of these inflows into the river system, there is a requirement to reduce peak flows in the river at this location. The area at Ravensdale Park is immediately upstream of this large inflow and at a lower level than the river. Therefore, it can effectively be used as a location for flood storage and limit peak flows in the channel immediately downstream. Without this additional flood storage, flood defences at Ravensdale and further downstream would need to be raised. For example, if the proposed flood containment area for Ravensdale Park (between 700m^3 and 800m^3) was not utilised then this volume would have to be contained within the narrow river channel within Ravensdale Park to prevent flooding of the surrounding properties. This would require walls along the length of the channel of a height in excess of 2.4m.

4.0 Design Capacity to Address Blockage at Key Structures

In response to **RFI no. 2**, we now describe how blockages are addressed in the design of the proposed River Poddle Flood Alleviation Scheme.

There is a risk of potential blockage of culverts and screens along the length of the River Poddle. During the design of the scheme, photographs were provided of some of the key structures showing blockage which had occurred during different flood events. During the October 2011 event there was significant blockage at Gandon Close which caused a wall to collapse and a large area downstream as far as the canal to be flooded. Blockages were also noted at the culverts at Lakelands, Kimmage Manor and Ravensdale Park.

Following the event in 2011, DCC & SDCC installed new trash screens, CCTV and level alarm monitors at Gandon Close, Kimmage Manor and Lakelands Overflow. The DCC Drainage maintenance team attend these critical site locations bi-weekly and when rain is forecast remove any material from the watercourse and culvert which may cause a blockage. They also respond to notifications from residents of illegal dumping in the channel.

In Dublin City, complaints are received through a number of routes – generally via phone (01-2222222) or customerservices@dublincity.ie but also via DCC Drainage Division (01-22221555) and cleansing department at waste.management@dublincity.ie. Drainage division removes trees and major blockages to the river and follow up on pollution incidents. Cleansing removes rubbish from the river, river banks and green areas and is supported by the Parks Department.

In South Dublin County Council in addition to the level monitors and CCTV on river screens where flooding previously occurred, they respond to notification of any substantial debris in channel or blocking screens within 24 hours. Illegal dumping is reported to Drainage Operation and is removed promptly, especially if it is likely to block screens or river. They note there has been relatively few incidents of illegal dumping in the Poddle river except for the occasional tree cuttings thrown into river from neighbouring properties.

In addition, each September, overgrown vegetation and any dumped material is removed from the river from the exit from the Tymon lakes downstream to the local authority boundary.

For both local authorities complaints regarding dumping are often reported to them from a local elected member.

Notwithstanding the above, during a storm event there is always a risk of fallen trees from storm winds and debris accumulating in the channel which will cause blockage. This risk is compounded by the fact that the stormwater peak run-off has a quick response to rainfall events (i.e. flow starts entering into the channel in a matter of minutes after a rainfall event begins). Run-off volumes peak in a couple of hours for major events. The risk of debris entering the watercourse and causing blockage during a large storm event is significant and could occur at any time during the storm event even at times of greatest flow.

During the modelling phase a significant number of sensitivity tests were undertaken to understand the effect of blockage at the 12 critical culverts along the watercourse. These were chosen based on the following criteria:

- Less than 1m wide;
- Screen in place; and,
- History of blockage.

The locations of the structures where the blockage analysis was undertaken are shown on Figure 4-1. The analysis was undertaken for a range of blockage scenarios ranging from 30% to 60% of the culvert opening being blocked for each individual structure both with and without the flood defence scheme in place. The model predicted flooding even without any blockage at those critical culverts. Therefore, flood defences would be required along the river. The amount of flooding increases with a blockage scenario. For the proposed Scheme the agreed standard of protection with the OPW was 1% AEP (i.e. 1% probability of flooding in any one year) with 60% blockage at the key structures due to the number of culverts and their previous involvement in flood events. The level of the proposed defences mean that if a 1% AEP event occurs, even for the medium or high climate change impact scenarios, the flood defences would not be overtopped.

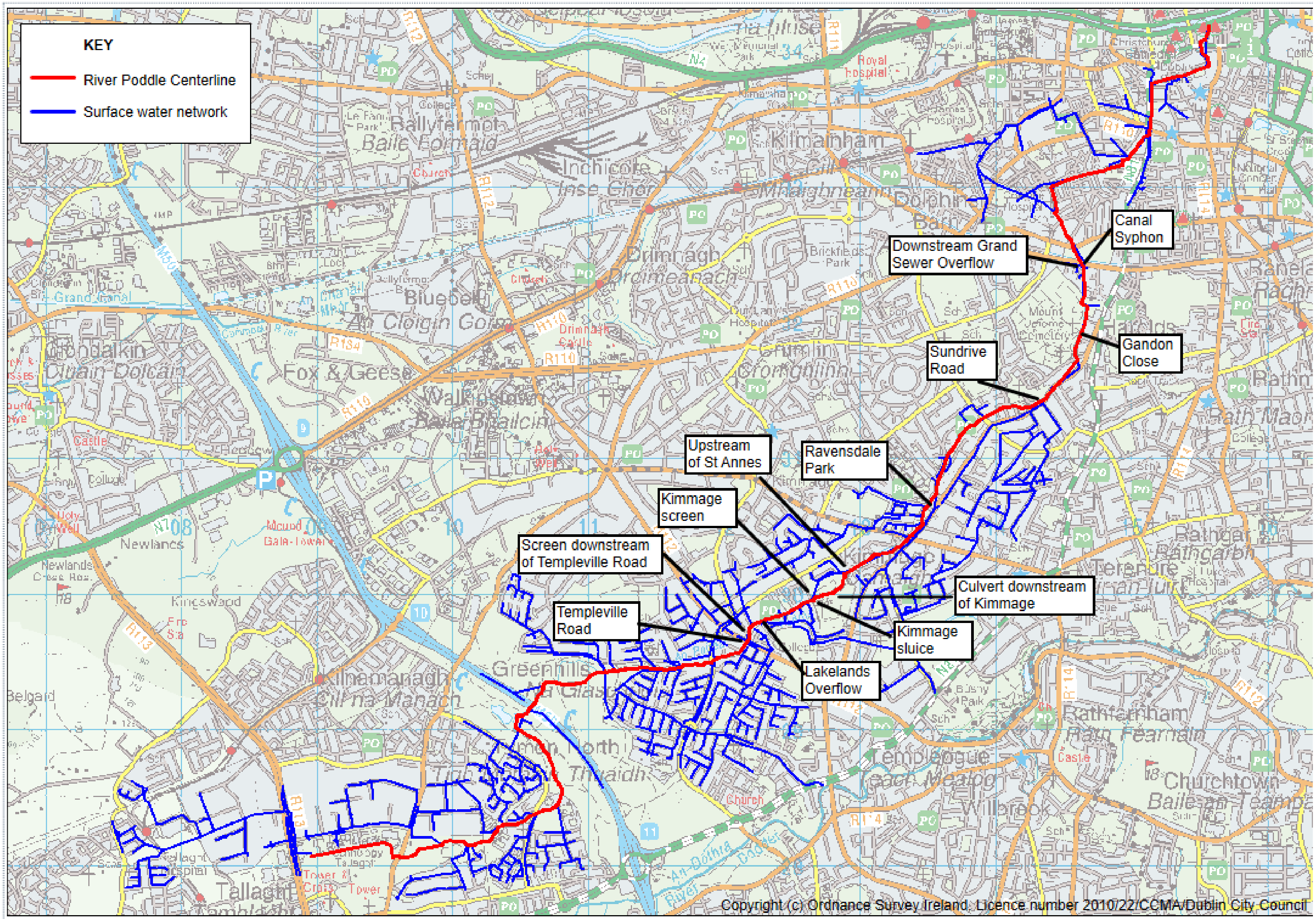

Figure 4-1 – Location of the structures where blockage analysis was undertaken