BARRETT **MAHONY**
CONSULTING ENGINEERS
CIVIL & STRUCTURAL












CIVIL ENGINEERING INFRASTRUCTURE REPORT

PROPOSED MIXED-USE DEVELOPMENT AT THE FORMER GALLAHER'S SITE, AIRTON ROAD, TALLAGHT, DUBLIN 24

PROJECT: **PROPOSED MIXED-USE DEVELOPMENT AT THE FORMER GALLAHER'S SITE, AIRTON ROAD, TALLAGHT, DUBLIN 24**

PROJECT NO. **19.136**

DOCUMENT TITLE: **CIVIL ENGINEERING INFRASTRUCTURE REPORT FOR PLANNING**

DOCUMENT NO: **19.136 – IR – 02**

Issue	Date	Description	Orig.	PE	PD	Issue Check
1	26/08/2019	ISSUED FOR DRAFT SHD SUBMISSION	RM	RM	JC	
2	12/02/2020	PLANNING SUBMISSION	RM	RM	JC	

barrett mahony

CIVIL ENGINEERING INFRASTRUCTURE REPORT FOR PLANNING FOR

PROPOSED MIXED-USE DEVELOPMENT,
THE FORMER GALLAHER'S SITE,
AIRTON ROAD,
TALLAGHT,
DUBLIN 24

TABLE OF CONTENTS

APPENDICES

1.0 INTRODUCTION

1.1 General Description

Barrett Mahony Consulting Engineers (BMCE) have been commissioned to prepare Civil Engineering Infrastructure Report (IR) by Greenleaf Homes Limited for the proposed mixed-use development at the former Gallaher's Site, Airton Road. The 2.79-hectare site is currently occupied by the disused factory/warehouse & associated hardstanding.

The proposed development will consist of 502no. residential apartment units in 6no. multi-storey blocks (A-F). Ground level car parking will be provided as an undercroft to blocks A-C and basement car parking will be provided below blocks E and F. The total number of car parking spaces provided is 202. 3no. retail units are with a combined total area of 482m² will be provided (187m², 161m² and 134m²). A 329m² crèche will be provided under the south eastern of Block C, within the site adjacent to the open space. The site will also include communal facilities, (gym, offices) of 704m². This is not a 'Build-to-Rent' (BTR) scheme.

- Apartments 502 no.
- Creche 329m²
- Communal Facilities 704m²
- Retail Area 482m²
- Car Parking Spaces 202
- Bicycle Parking Spaces 584

Apartment breakdown as follows;

- 1 Bedroom 197
- 2 Bedroom 257
- 3 Bedroom 48

The subject site is currently occupied by an abandoned industrial unit, the Former Gallaher's Cigarette production factory. The breakdown of the site is as follows:

- Industrial Unit footprint 0.7 ha
- Offices footprint 0.1 ha
- Roads/Hardstanding 0.85 ha
- Landscaping 0.85 ha

The site is bounded to the north by Airton Road and to the east by Greenhills road. The north west of the site is bounded by an entrance road to an industrial unit, the south west is bounded by the car park used for the industrial unit. The Poddle/Tymon stream runs along the south of the site and Tallaght University sports grounds are on the other side of the river. There will be two permanent road access points to the site, one along Airton road and another on Greenhills road. The development will have no through route, and each of these entrances will serve their respective apartment blocks, (blocks A-C on Airton and blocks D-F on Greenhills).

Figure 1.1 - SITE LOCATION

1.2 Scope of this Report

This report describes the proposed civil engineering infrastructure for the development and how it connects to the public infrastructure serving the area.

Foul and surface water drainage, water supply, flood risk and traffic engineering aspects are addressed. This report should be read in conjunction with the following drawings submitted with the planning application.

- ARD-BMD-00-XX-DR-C-1000 – Foul Drainage Layout - Basement
- ARD-BMD-00-XX-DR-C-1001 – Foul Drainage Layout – Ground Level
- ARD-BMD-00-XX-DR-C-1002 – Foul Drainage Layout – North
- ARD-BMD-00-XX-DR-C-1003 – Foul Drainage Layout – South
- ARD-BMD-00-XX-DR-C-1005 – Watermain Drainage Layout
- ARD-BMD-00-XX-DR-C-1006 – Watermain Drainage Layout – North
- ARD-BMD-00-XX-DR-C-1007 – Watermain Drainage Layout – South
- ARD-BMD-00-XX-DR-C-1009 – Combined Drainage Layout
- ARD-BMD-00-XX-DR-C-1010 – Surface Water Drainage Layout
- ARD-BMD-00-XX-DR-C-1015 – Surface Water SuDS Strategy
- ARD-BMD-00-XX-DR-C-1020 – Roads Layout
- ARD-BMD-00-XX-DR-C-1025 – Entrance Details
- ARD-BMD-00-XX-DR-C-1030 – Junction Sightlines
- ARD-BMD-00-XX-DR-C-1040 – Autotrack – Fire Tender Access
- ARD-BMD-00-XX-DR-C-1041 – Autotrack – ESB & Refuse Collection
- ARD-BMD-00-XX-DR-C-1050 – Drainage Longitudinal Sections – Foul Water
- ARD-BMD-00-XX-DR-C-1051 – Drainage Longitudinal Sections – Foul Water
- ARD-BMD-00-XX-DR-C-1052 – Drainage Longitudinal Sections – Surface Water
- ARD-BMD-00-XX-DR-C-1053 – Drainage Longitudinal Sections – Surface Water
- ARD-BMD-00-XX-DR-C-1200 – Standard Drainage Details
- ARD-BMD-00-XX-DR-C-1205 – SuDS Standard Details
- ARD-BMD-00-XX-DR-C-1210 – Standard Road & Hardstanding Details
- ARD-BMD-00-XX-DR-C-1220 – Standard Watermain Details

1.3 Pre-planning Discussion

An S247 meeting took place with South Dublin City Council on the 30th of May 2019. During this meeting members of the SDCC review committee reviewed the proposed surface water drainage strategy and the proposed roads layout.

SDCC requested that sustainable and renewable methods of surface water drainage should be used throughout the site and attenuation tanks size reduced. At this meeting the various inputs and factors used for the design were agreed upon. Full details of the design are provided in this report and appendices.

1.4 Irish Water

A Pre-Connection Enquiry (PCE) was submitted to Irish Water on the 18th April 2019 to determine the feasibility of connecting to the public water and drainage infrastructure. A response to the PCE was received on the 25th of November 2019 and Irish Water confirmed a connection is feasible. This is included in Appendix II.

The project is subject to the Strategic Housing Development (SHD) planning process and therefore a Statement of Design Acceptance for the project drainage is required from Irish Water. BMCE submitted our drawing package on the 16th of December 2019 and received comments from Irish Water on the 20th of December. These comments have been addressed and the drawing package was resubmitted on the 13th of January 2020.

To ensure that the development adheres to the Irish Water Codes of Practice, BMCE discussed elements of the design with Irish Water. After taking on board further comments, BMCE submitted outstanding items on the 07th of February. BMCE received the Irish Water Statement of Design Acceptance on 12th of February, which is included in Appendix II.

2.0 SITE TOPOGRAPHY

A detailed topographical survey of the existing site has been prepared by Geodata Surveying Ltd. The site was levelled out in the past to accommodate the factory buildings & hardstanding areas. The site level varies typically from +91.00 approx. near the north west corner of the main building to +88.00 at the south east car park. These levels are summarised in the plan below.

Figure 2.1 - Site Levels

3.0 SURFACE WATER DRAINAGE SYSTEM

3.1 Introduction

This chapter will follow the guidelines set out in Greater Dublin Strategic Drainage Study (GDSDS) and the CIRIA 2015 SuDS Manual.

The aim of any SuDS strategy is to ensure that a new development does not negatively affect the surrounding watercourse system, existing surface water network and groundwater system. This SuDS strategy will aim to achieve this by using a variety of SuDS measures within the site. These measures include water interception, water treatment and water attenuation.

The SuDS strategy will be developed with the following steps:

- The existing greenfield run-off of the development area will be calculated and used as the minimum benchmark for the SuDS design.
- A set of SuDS measures will be chosen based on their applicability and usage for the site.
- A "MICRODRAINAGE" model will be created to analyse the rainfall on the site and the effectiveness of the proposed SuDS measures.
- If effective, these SuDS measures will be implemented on the site.

3.2 Existing Surface Water Infrastructure

The existing site layout is comprised of existing buildings, hardstanding and landscaping with unattenuated outflow to the public drainage network and river system. There is an existing surface water network within the site. This surface water network is divided into two different catchments. The northern network catchment discharges rainwater from the industrial unit roof, office roof and hardstanding (1.30 ha). This catchment discharges to a surface water manhole in the north east of the site and then to the surface water sewer along Airton Road. The southern network discharges the remaining hardstanding and roof area (0.35 ha) in a southerly direction on the site. There is no surface water system in this area, so it assumed that this network discharges to the Poddle/Tymon river which runs along the southern boundary of the site.

3.3 Compliance with the Principles of SuDS

3.3.1 Compliance with the principles of the GDSDS

The proposed development will be designed in accordance with the principles of Sustainable Drainage Systems (SuDS) as embodied in the recommendations of the Greater Dublin Strategic Drainage Study (GDSDS) and will significantly reduce run-off rates and improve storm water quality discharging to the public storm water system. The GDSDS addresses the issue of sustainability by requiring designs to comply with a set of drainage criteria which aim to minimize the impact of urbanization by replicating the run-off characteristics of the greenfield site. The criteria provide a consistent approach to addressing the increase in both rate and volume of run-off, as well as ensuring the environment is protected from any pollution from roads and buildings. These drainage design criteria are as follows:

- Criterion 1 – River Water Quality Protection
- Criterion 2 – River Regime Protection
- Criterion 3 – Flood Risk Assessment
- Criterion 4 – River Flood Protection

The requirements of SuDS are typically addressed by provision of the following:

- Interception storage
- Treatment storage (commonly addressed in interception storage)
- Attenuation storage
- Long term storage (not applicable if growth factors are not applied to Qbar when designing attenuation storage)

3.3.2 Compliance with the principles of the CIRIA C573 SuDS Manual

The C573 SuDS Manual explains that the primary function of SuDS measures is to protect watercourses from any impact due to the new development. However, SuDS can also improve the quality of life in a new development and urban spaces by making them more vibrant, visually attractive, sustainable and more resilient to change. This document explains the wider social context of SuDS and how SuDS can deliver high quality drainage while supporting urban areas to cope better with sever rainfall both now and in the future.

There are four main categories of benefits that can be achieved by SuDS:

1. Water Quantity (mitigate flood risk & protect natural water cycle)
2. Water Quality (manage the quality of the runoff to prevent pollution)
3. Amenity (create and sustain better places for people)
4. Biodiversity (create and sustain better places for nature)

3.4 SuDS Measure Selection

The site will be a high-density urban environment and therefore the available applicable SuDS measures are limited within the site. Below are the applicable SuDS measures which have been chosen for the site. The proposed site has been divided into two sub-catchment areas. Catchment 1 comprises of blocks A-C and is in the north west of the site. Catchment 2 comprises of Blocks D, E & F as well as the central public amenity area.

Within catchment 2 of the site, between blocks C-D there is a large green public open space, which is the only area within the site classified as “High” available space. As per the suggestion from SDCC during the S247 meeting (30/06/2019) a large portion of this will be used as a dry detention basin. There is a small bio-retention tree pit at the entrance to the site serving this catchment.

To ensure both catchments adhere to the SuDS requirements, another dry detention basin will be implemented at the south-western corner of block A, within catchment 1. This will be smaller than the other dry detention basin, however a significantly larger bio-retention tree pit will be implemented along the western boundary of block A, on the western boundary of the site.

As per the SuDS Manual, bio-retention tree pits are not applicable for usage with site drainage areas greater than 2 ha, therefore these bio-retention tree pits will be used as additional treatment areas.

3.4.1.1 Green Roofs – General

Green roofs are areas of living vegetation, installed on the top of buildings. They provide water quality, water quantity, amenity and provide biodiversity benefits. Green roofs also intercept rainfall at source reducing the reliance on attenuation storage structures.

3.4.1.2 Green Roof – Extensive:

Extensive roofs have low substrate depths and therefore low loadings on the building structure, they are lightweight and have a low cost to maintain. These systems cover the entire roof area with hardy, slow growing, drought resistance, low maintenance plants and vegetation, such as sedums. The planting usually matures slowly, with the long-term biodiverse benefits being the sought-after results. These roofs are typically only accessed for maintenance and are usually comprised of between 20mm – 150mm overall total depth.

It is proposed to cover the apartment block roofs with extensive green roofs. The apartment block roofs take up a considerable portion of the site area and therefore by utilising these for green roofs, there will be interception and treatment storage provided at source. The proposed system is the Bauder XF301 Sedum system.

3.4.1.3 Green Roof – Intensive

Intensive green roofs are designed to sustain more complex landscaped environments that can provide high amenity and biodiverse benefits. They are planted with a range of plants, including grasses, shrubs, trees and may also include water features, as well as hard landscape paved areas. They are designed to be accessible and normally require regular maintenance.

The podiums over the undercroft car parking will be covered with an intensive green roof build-up and hard landscaping. The podiums will be heavily trafficked by the residents within the development and therefore extensive green roofs are not applicable here. The use of intensive of green roofs will also allow the planting of large shrubs, small trees and small water features within the podium area. These features will provide amenities for the residents, promote the growth of biodiversity and also provide interception and treatment storage at source. The podium build-up will include an interception tray to capture the first 10mm of rainfall falling on each podium.

3.4.1.4 Permeable Paving

Permeable paving provides a surface suitable for pedestrian and/or vehicular traffic, while also allowing rainwater to infiltrate through the surface and into the underlying structural layers. The water is temporarily stored beneath the overlying surface before controlled discharge. Permeable paving systems are an effective way of managing surface water runoff close to its source.

Due to the proximity of the paving to the building/building foundations, system C is considered (no infiltration) appropriate. The pathways throughout the site will be made up of permeable paving. These will be linked with the overall management train used in each respective catchment.

3.4.1.5 Porous Pavements

Porous pavements have the same benefits as permeable paving, however unlike permeable paving (which is in itself impervious to water), porous pavements allow water to infiltrate across their entire surface material.

Porous pavements will be utilised in 2no. locations within the site. The external area provided for the creche will be made up of a porous rubber, resin bound material. This material will also be utilized for the outdoor play and congregation areas for the general public.

3.4.1.6 Detention Basin / Rain Gardens

Detention basins are landscaped depressions that are normally dry except during and immediately following storm events. Detention basins can form part of the management train for surface water run-off. The outlet from this local depression can be restricted and therefore the depression will fill and provide storage of runoff and flow attenuation.

The proposed detention basin for the site is located within the centre of the site, between block C and D. It will provide storage for Catchment 2. The detention basin will be an online detention basin, receiving water from the bio-retention tree pits and excessive rainwater run-off from the Block D roof. Both areas have treatment storage incorporated and therefore the detention basin can be soft landscaped with grass and small vegetation. Due to site constraints, it is not proposed to incorporate a permanent pool within the basin, and thus will effectively act as a rain garden.

3.4.1.7 Bioretention Systems & Tree Pits

Bioretention systems are shallow landscaped depressions that can reduce the runoff rates and volumes of surface water. They treat pollution using engineered soils and vegetation. They are very effective in delivering interception and treatment storage. By including tree pits, the effectiveness of the overall system in meeting the requirements of water quality, water quantity, amenity and biodiversity is significantly improved. Trees provide benefits to the SuDS measures by:

- Transpiration – Water evaporates through the stomata on the leaf as a result of photosynthesis.
- Interception – Leaves, branches and trunk surfaces intercept and absorb rainfall reducing the amount of water that reaches the ground.
- Infiltration – Root growth increases the soil infiltration capacity and rate, ultimately reducing run-off volumes.
- Phytoremediation – When drawing up water, trees also take up trace amounts of harmful chemicals. These chemicals can be transformed into less harmful substances within the tree.

Bioretention tree-pits will be used within the site, near the main pedestrian entrance within catchment 2.

3.4.1.8 Swales

Swales are shallow, flat bottomed, vegetated open channels designed to convey, treat and often attenuate surface water run-off. Swales can have a variety of profiles and can incorporate a range of different planting strategies. There are 3no. types of swales:

- Conveyance & Attenuation Swale: A shallow swale, particularly effective at collecting and conveying run-off from the drained area to another stage of the SuDS management train. These can incorporate treatment and attenuation, depending on the flow constraint and ponding depths.

- Dry Swale: The dry swale is a vegetated conveyance channel with a filter bed of prepared soil that overlays an underdrain system. This underdrain provides additional treatment and conveyance.

- Wet Swale: This system is equivalent to the conveyance swale but is designed specifically to deliver wet and/or marshy conditions in the base.

Along the western boundary a conveyance & attenuation swale has been proposed. The primary purpose of this swale is for treatment storage and pollutant removal. Conveyance and attenuation swales provide treatment storage by removing medium sediments and pollutants through surface vegetation, by biological uptake of dissolved pollutants and the removal of organic contaminants by photolysis and volatilisation.

3.4.1.9 Attenuation Tanks

Attenuation tanks are used to create below-ground void space for the temporary storage of surface water before infiltration, controlled release or use. Attenuation tanks can be constructed up using geocellular crates, which offer flexibility in size, shape and constructability of the tank meaning that they can be tailored to suit specific site characteristics.

It is proposed to provide 2no. attenuation tanks within the site, i.e. 1no. tank per catchment. These will be designed for the 1 in 100 year storm + 20% climate change. They will form the last part of the SuDS management train. A Hydrobrake will be fitted downstream of each tank in order to restrict the flow to Qbar for each sub-catchment.

Please refer to BMCE drawing ARD-BMD-00-XX-DR-C-1010 & C-1015 for a full list of SuDS measures.

3.5 SuDS Management Train

The SuDS measures proposed are linked in series, and this is commonly known as a SuDS Management Train, (SMT). The SMT ensures that rainwater falling on a site is captured, conveyed, stored, intercepted and removed of pollutant correctly and efficiently before it is discharged back into the surrounding water course of network.

A robust SMT will ensure that the most effective measures are utilised in the correct sequence throughout the site. Table 26.7 (Figure 3.1 below) in *(CIRIA, SuDS Manual 2015)* illustrates the effectiveness of each SuDS measure along the SMT.

TABLE 26.7 Indicative suitability of SuDS components within the Management Train

SuDS component	Interception[1]	Close to source/ primary treatment	Secondary treatment	Tertiary treatment
Rainwater harvesting	Y			
Filter strip	Y	Y		
Swale	Y	Y	Y	
Filter drain	Y		Y	
Permeable pavement	Y	Y		
Bioretention	Y	Y	Y	
Green roof	Y	Y		
Detention basin	Y	Y	Y	
Pond	[3]	Y[2]	Y	Y
Wetland	[3]	Y[2]	Y	Y
Infiltration system (soakaways/ trenches/ blankets/basins)	Y	Y	Y	Y
Attenuation storage tanks	Y[4]			
Catchpits and gullies		Y		
Proprietary treatment systems		Y[5]	Y[5]	Y[5]

Figure 3.1 - C573 SuDS Manual Table 26.7

Figure 2.2 - SuDS Layout

3.6 SuDS Pollutant Analysis

To ensure that the SuDS measures proposed are sufficient in removing pollutants from the generated run-off, a SuDS pollutant analysis has been carried out. This is performed in conjunction with the guidelines and steps set out in Section 26.7 of CIRIA SuDS Manual (2015).

The main form of pollutant is from surface water run-off from the entrances to the undercroft car park and basement car park. Table 26.2 highlights the pollution hazards for different land uses (extract below Figure 3.2). The pollution hazards on site are generally 'very low'. The 2no. entrances to the car parking areas are classed as 'Low'. (**Note**: The undercroft car park and basement car park will discharge to the foul network).

TABLE 26.2 Pollution hazard indices for different land use classifications

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4

Figure 3.2 – C573 SuDS Manual Table 26.2 Extract

Giving the very low to low pollution index the 'Simple Index Approach,' is applied and can be summarised below;

Total SuDS Mitigation Index ≥ Pollution Hazard Index

By inspection the extensive use of SuDS measures throughout the site insures that criterion is met, for example, considering the entrances to the undercroft car parking referred to above. Using Table 26.2 and Table 26.3, from the SuDS manual we can compare the mitigation index for permeable paving with the hazard index for the residential car park entrances:

Table 3-1 - Pollution Hazard Assessment

	Total SuDS Mitigation Index		Pollution Hazard Index	Status
Total Suspended Solids	0.7	>	0.5	O.K.
Metals	0.6	>	0.4	O.K.
Hydrocarbons	0.7	>	0.4	O.K.

From Table 3-1 above it is clear that the SuDS strategy for the site is effective in removing pollutants from the surface water and therefore protecting the watercourse.

3.7 Attenuation Storage

The GDSDS requires that flood waters be managed within the site for a 1 in 100 year flood. As described in previous sections, the site has been divided into 2no. sub-catchments. The overall Qbar of each of these sub-catchments will be less than the total site Qbar (5.00 l/s).

The surface water from each sub-catchment will flow into an attenuation storage tank which has been designed for that catchment.

The surface water system within each catchment has been hydraulically modelled in MICRODRAINAGE. Each sub-catchment system has been designed to ensure that their combined discharge rate does not exceed the previous discharge rate from the site.

The attenuation tanks have been provisionally designed as geocellular units with 95% void ratio. The tanks will be placed outside of the building envelope.

Please see Appendix III for full breakdown of MICRODRAINAGE calculations.

3.7.1 Attenuation Storage

Catchment 1 within the development consists of blocks A-C and limited walkways and landscaping. The attenuation tank will be placed to the south of block C. Below is the breakdown of the attenuation storage for catchment 1.

Table 3-2 – Catchment 1 Attenuation Storage

	Area (m^2)	Attenuation Storage Provided (m^3)	Discharge rate (l/s)
Catchment 1	11,655	190	2.5
Catchment 2	13,345	152	2.5
Total	25000	342	5

3.8 Interception Storage

The GDSDs requires that Interception storage, where provided, should ensure that at a minimum the first 5mm and preferably the first 10mm of rainfall is intercepted on site and does not directly pass to the receiving watercourse.

Interception storage can be attained using SuDS features which allow the rainwater to infiltrate into the ground, evaporate into the atmosphere or transpire through vegetation.

3.8.1 Interception Storage - Catchment 1

Table 3-3 – Interception Storage Catchment 1

	Area (m^2)	Interception Storage Required (m^3)		Interception Storage Provided (m^3)
Catchment 1	11,655	116		
Extensive Green Roof	2289.85	/		103.04
Intensive Green Roof (podium)	1338.32	/		120.45
Permeable Paving	1248.7	/		9.4
Swale	450	/		67.5
Detention Basin	336.07	/		2.48
Porous paving	140.8	/		1.1
Total		116	<	304

3.8.2 Interception Storage - Catchment 2

Table 3-5 – Interception Storage Catchment 2

	Area (m^2)	Interception Storage Required (m^3)	Interception Storage Provided (m^3)
Catchment 1	13,345	133	
Extensive Green Roof	1130.41	/	50.87
Intensive Green Roof (podium)	889.78	/	80.08

Permeable Paving	4591.1	/		34.4
Swale	0	/		0
Detention Basin	541	/		3.4
Porous paving	496.6	/		3.7
Total		133	<	172.4

3.9 Treatment Storage

The GDSDS requires that a “treatment volume” (Vt) be provided in order to prevent any pollutants or sediments discharging into river systems. The treatment volume is based on treatment 15mm of rainfall depth from 80% of the runoff from impermeable areas as defined in the GDSDS (Appendix E section E2.1.2).

The impermeable areas within the site will consist of 30% of the roof area, podium area, permeable paving and porous paving as well as the total hardstanding within the site.

All run-off areas will pass through the required number of treatment stages prior to discharging to the downstream outfall. Treatment methods include swales, permeable paving, ‘Stormtech’ attenuation system and existing petrol interceptor.

3.9.1 Treatment Storage - Catchment 1

Table 3-6 – Treatment Storage Catchment 1

	Area (m^2)	Treatment Storage Required (m^3)		Treatment Storage Provided (m^3)
Extensive Green Roof (30%)	687.0	8.2		9.2
Intensive Green Roof (podium) (30%)	401.5	4.8		5.4
Permeable Paving (30%)	374.6	4.5		0.0
Swale	135.0	0.0		74.6
Detention Basin / Rain Garden	336.1	0.0		18.6
Porous paving (30%)	42.2	0.5		0.0
Hardstanding	481.4	5.8		0.0
Total		23.8	<	107.8

3.9.2 Treatment Storage - Catchment 2

Table 3-7 – Treatment Storage Catchment 2

	Area (m^2)	Treatment Storage Required (m^3)		Treatment Storage Provided (m^3)
Extensive Green Roof (30%)	339.1	1.5		4.5
Intensive Green Roof (podium) (30%)	266.9	1.2		3.6
Permeable Paving (30%)	1377.3	6.2		0.0
Swale	0.0	0.0		0.0
Detention Basin / Rain Garden	541	2.0		25.2
Porous paving (30%)	149.0	0.7		0.0
Hardstanding	888.8	4.0		0.0
Total		15.6	<	33.3

3.10 GSDS Criterion Compliance

3.10.1 Criterion 1 GDSDS – River Water Quality Protection

Run-off from natural greenfield areas contributes very little pollution and sediment to rivers and for most rainfall events direct run-off from greenfield sites to rivers does not take place as rainfall percolates into the ground. By contrast, urban run-off, when drained by pipe systems, results in run-off from virtually every rainfall event with high levels of pollution, particularly in the first phase of run-off, with little rainfall percolating to the ground. To prevent this happening, Criterion 1 requires that interception storage and/or treatment storage is provided, thereby replicating the run-off characteristics of the pre-development greenfield site.

As discussed in section 3.8, interception storage is provided for the site by a variety of measures.

3.10.2 Criterion 3 GDSDS – Site Flooding

The GDSDS requires that no flooding should occur on site for storms up to and including the 1 in 30-year event. The pipe network and the attenuation storage volumes should, therefore, be checked for such storms to ensure that no site flooding occurs although partial surcharging of the system is allowed if it does not threaten to flood.

For the 1 in 100-year event, the pipe network can fully surcharge and cause site flooding, and the flood waters should be contained within the site. In addition, the top water level in any attenuation device during the 100-year storm must be at least 500mm below any vulnerable internal floor levels.

Microdrainage analysis shows the following;

- The system does not surcharge for the 1-year event
- The system surcharges but does not flood for the 30-year event.
- The system surcharges but flooding occurs in the North-East corner for the 100-year event. This will be controlled by an emergency overflow from this area to the onsite detention basin to control flood water on site and prevent any risk to vulnerable internal floors. Total flood volume is calculated as $70m^3$ – the detention basin volume is $76.4m^3$ which exceeds this.

The surcharging of the system is based on the system being allowed to fill as the attenuation tank fills, because the invert of the incoming pipes is below the top of the attenuation tank. This is not a function of the pipe size.

The under-croft car parks are covered by podium slabs and do not receive direct rainfall. There will be limited outflow from these areas. Rainfall coming off cars & rainwater coming in through car park vents. They are drained by a separate system that outfalls to a petrol interceptor buried below the ground floor slab. From there, the car park drainage is pumped to the nearest foul manhole and is not at risk of any backflow from the surface water system during storm conditions. GDSDS Criterion 3 is therefore complied with.

3.10.3 Criterion 2 & Criterion 4 GDSDS – River Regime and Flood Protection

Regardless of the rainfall event, unchecked run-off from the developed site through traditional pipe networks will discharge into receiving waters at rates that are an order of magnitude greater than that prior to development. This can cause flash flow in the outfall river / stream that can cause scour, erosion & downstream flooding. Attenuation storage is provided to prevent this occurring by limiting the rate of run-off to that which took place from the pre-development greenfield site. In practice, the rate of run-off needs to be appropriately low for most rainfall events, and attenuation storage volumes should be provided for the 1 and 100-year storm event + 20% for climate change. The rate of outflow from such storage should be controlled so that it does not exceed the greenfield run-off rate of QBAR, which can be factored upwards by factors appropriate to the various return periods (given in the Flood Studies Report) if long term storage is provided. Notwithstanding that significant long-term storage will be provided in the form of interception storage, this does not equate to full long-term storage volume provision and so growth factors will not be applied to QBAR when calculating the attenuation storage volume required.

Qbar for the site has been calculated in accordance with the IH124 method as 5.00 l/s. A hydro brake downstream of each of the 2no. attenuation tanks will be limited to 2.5l/s, combining to a 5l/s discharge at the outfall, the max site discharge of Qbar for the site. As the surface runoff flow rate generated on site does not exceed Qbar, there is no requirement for long-term storage to limit the impact on the receiving watercourse.

Criterion 4 is intended to prevent flooding of the receiving system / watercourse by either;

a) limiting the volume of run-off to the pre-development greenfield volume using 'long-term storage' (Option 1) or by

b) limiting the rate of run-off for the 1 in 100-year storm to QBAR without applying growth factors using 'extended attenuation storage' (Option 2).

Option (B) is therefore been used to comply with Criterion 4 and an attenuation volume will be provided in the proposed attenuation tank to limit the rate of discharge in the 1 in 100-year storm +20% event to QBAR without growth factors applied.

3.11 SuDS CIRIA Pillars of Design

3.11.1 Water Quantity

The "Water Quantity" design objective is to ensure that the surface water runoff from a developed site does not have a detrimental impact on people, property or the environment, it is important to control:

- How fast the runoff is discharged from the site (ie the peak runoff rate) and
- How much runoff is discharged from the site (ie the runoff volume)

Per section 3.7, the attenuation tank has been designed to ensure that the new peak flow does not exceed the existing peak runoff rate. The various other SuDS measures have been implemented to limit the amount of runoff volume in accordance with the guidelines within the site boundary, by the use of interception storage.

3.11.2 Water Quality

The "Water Quality" design object seeks to ensure the surface water runoff from the site does not compromise the groundwater or surrounding water courses relating to the site.

A pollutant analysis was performed in 3.6 of this report. In that section, the only applicable area within the site capable of providing surface water runoff is the entrances to the car park. This was resolved with permeable pavement treating the potential pollutants prior to them entering the attenuation tank and ultimately the surrounding watercourse.

3.11.3 Amenity

The “Amenity” design objective aims to deliver attractive, pleasant, useful and above all liveable urban environments. SuDS measures should be designed to replicate the existing natural environment and blend in with the urban development.

BMCE have worked closely with the landscaping architect throughout the SuDS strategy design process to ensure that the measures which have been suggested and incorporated have a high sense of public use. Throughout the site, there is podium green roofs, bioretention pits and detention basins.

3.11.4 Biodiversity

The encouragement of biodiverse environments within urban environments is incredibly important. The SuDS measures must not only replicate the pre-development surface water runoff systems and treatment for rainfall, but they must only replicate the existing habitats pre-development.

By incorporating a swale along the western boundary and a tree pit in the north of the site we can promote bio-diversity on site.

3.12 SuDS Conclusion

This section of the report has comprehensively discussed the various SuDS measures which can be applied to the site and then selected them based on the site layout. A pollutant analysis and a series of SuDS management trains have then been developed based upon these SuDS measures.

Finally, the chosen SuDS measures have been analysed for various rainfall scenarios to ensure that all the SuDS design criteria are met an extensive range of SuDS measures are proposed with almost total coverage of the developed area of the site.

In conclusion, the chosen SuDS measures are the most effective measures which can be applied to the site and these measures are effective in treating rainfall on the site to GDSDS and CIRIA criterion.

4.0 FOUL DRAINAGE SYSTEM

4.1 Existing Foul Sewer Infrastructure

There is an existing foul sewer network on the site. This network discharges to a public foul sewer at the junction of Airton & Greenhills Road manhole.

The foul discharge from the site is principally from staff toilets associated with the factory building. The site is currently vacant with no discharge rate into the foul network.

4.2 Proposed Foul Drainage System

A new system will serve the development. It is proposed to provide 2no. Connections from the site drainage system into the sewer network.

A new 225mm diameter foul drainage will connect into Airton Road, to the existing 225mm diameter sewer. This connection will serve Catchment 1 (Block A, B & C). This consists of 275 apartments, a 329m² crèche, 465m² of communal space and 187m² of retail.

A new 225mm diameter foul drainage will connect into a new proposed manhole connection on the existing sewer network on Greenhills Road. This connection will serve Catchment 2 (block D, E & F), a total of 227 apartments, 239m² of communal space and 295m² of retail.

For a full breakdown of the calculations see Appendix VI.

The flow table below are calculated using Irish Water flow rates of 150 l/hd/person per day for residential use and the I.W. recommended occupancy rate of 2.7 per unit.

Table 4-1 – Foul Network Summary

		Units / m²	Daily Flow (l/day)	Average Flow (l/s)	Peak Flow (l/s)
Catchment 1	Residential	275 units	122,513	1.418	8.508
	Crèche	329 m²	3,300	0.038	0.229
	Communal	465 m²	6,380	0.074	0.148
	Retail	187 m²	1,624	0.190	0.038
Catchment 2	Residential	227 units	101,129	1.170	7.023
	Retail	295 m²	2,553	0.030	0.059
	Communal	239 m²	3,259	0.038	0.075
Overall Site	Residential	502 units	223,642	2.588	15.531
	Retail	482 m²	4,177	0.220	0.097
	Communal	704 m²	9,639	0.112	0.223
	Crèche	329 m²	3,300	0.038	0.229

5.0 WATER SUPPLY

5.1 Existing Water Supply Infrastructure

There was a water supply to the site to serve the existing factory & staff facilities. The site is currently vacant with no abstraction from the public watermain network.

5.2 Proposed Foul Drainage System

A new 150mm diameter HDPE water main pipe will be installed on site. It is proposed to provide 2no. connections from the site water system into the water main system nearby.

A new 225mm diameter foul drainage will connect into Airton Road, to the existing 225mm diameter sewer. This connection will serve Catchment 1 (Block A, B & C). This consists of 275 apartments, a 329m² crèche, 464m² of communal space and 187m² of retail.

A new 225mm diameter foul drainage will connect into the existing sewer network on Greenhills Road, to the existing 225mm diameter sewer. This connection will serve Catchment 2 (block D, E & F), a total of 227 apartments, 237m² of communal space and 294m² of retail.

Table 5-1 – Watermain Summary

		Units / m²	Daily Flow (l/day)	Average Flow (l/s)	Peak Flow (l/s)
Catchment 1	Residential	275 units	111,375	1.611	8.057
	Crèche	329 m²	3,000	0.043	0.217
	Communal	465 m²	5,800	0.084	0.420
	Retail	187 m²	1,476	0.021	0.107
Catchment 2	Residential	227 units	91,935	1.330	6.650
	Retail	295 m²	2,321	0.034	0.168
	Communal	239 m²	2,963	0.043	0.214

Overall Site	Residential	502 units	203,310	2.941	14.707
	Retail	482 m²	3,797	0.055	0.275
	Communal	704 m²	8,763	0.127	0.634
	Crèche	329 m²	3,000	0.043	0.217

For a full breakdown of the calculations see Appendix VII.

6.0 SITE FLOOD RISK ASSESSMENT

6.1 Introduction

The flood risk assessment outlined below is carried out in accordance with the OPW publication "The Planning System and Flood Risk Assessment Guidelines for Planning Authorities".

The stages involved in the assessment of flood risk are listed in these publications as follows:

- Stage 1: Flood Risk Identification
- Stage 2: Initial Flood Risk Assessment
- Stage 3: Detailed Flood Risk Assessment

The OPW publication also outlines a Sequential Approach for determining whether a development is appropriate for a specified location in terms of flood risk. The categorization of the subject site in terms of the OPW's sequential approach is further outlined in section 2.2 below.

6.2 Stage 1: Flood Risk Identification

Stage 1 identifies whether there are any flooding or surface water management issues related to the site, i.e. it identifies whether a flood risk assessment is required. The coastline is approximately 10.5 kilometres to the East of the site and does not pose a risk.

The Poddle/Tymon river, which later downstream becomes the River Poddle, runs adjacent to the southern boundary of the side. The OPW Map (National Flood Hazard Mapping Service) presented in Appendix IV shows that no flood incidents have been recorded on the site or the adjacent area to the site.

All rain falling on the site will be dealt with using our SuDS strategy. The SuDS strategy will be designed for the 1 in 100-year flood with outfall less than the greenfield runoff (Qbar). Therefore, the risk of pluvial flooding within the site is small. In the event of a system blockage, there is considerable rainwater storage available given the extensive coverage of the site with SuDS measures. Any overland flow will be southwards along paved or green areas between buildings towards the Poddle/Tymon river watercourse.

6.2.1 Flood Zones

The sequential approach defines the flood zones as detailed below:

- *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* – 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 year and 0.5% or 1 in 200 for coastal flooding); and
- *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 areas of the plan which are not in zones A or B.

The site is located in 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 areas of the plan which are not in zones A or B. (See Appendix IV for further information of flood zone).

6.2.2 Vulnerability Class

The sequential approach describes the vulnerability classes as follows:

- Highly vulnerable development – hospitals, schools, houses, student halls of residence etc.;
- Less vulnerable development – retail, commercial, industrial, agriculture etc.;
- and
- Water compatible development – docks, marinas, amenity open space etc.

The development is a residential development which is classed as 'highly vulnerable'.

6.2.3 Development Classification

The matrix of vulnerability as per "The Planning System and Flood Risk Management – Guidelines for Planning Authorities" is reproduced in Table 6-1 below.

Table 6-1 – Matrix of Vulnerability

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development	Justification Test	Justification Test	Appropriate
Less vulnerable development	Justification Test	Appropriate	Appropriate
Water compatible development	Appropriate	Appropriate	Appropriate

This development is therefore deemed appropriate.

6.3 Stage 2: Initial Flood Risk Assessment

The initial flood risk assessment should ensure that all relevant flood risk issues are assessed in relation to the decisions to be made and potential conflicts between flood risk and development are addressed. It should assess the adequacy of existing information and any flood defences.

6.3.1 Examination of potential flooding sources that can affect the site

The possible sources of flood water are assessed in the table below using the
"Source – Pathway – Receptor Model"

Table 6-2 – The Possible Sources of Flood Water

Source	Pathway	Receptor	Likelihood	Consequence	Risk	Notes
Tidal Note	Overtop Breach	People Property	Extremely Unlikely	High	Negligible	
Fluvial Note	Overtop Breach	People Property	Possible	High	Low	
Pluvial Surface Water	Overflow / Blockage	People Property	Possible	High	Low	
Groundwater	Rising Groundwater Levels	People Property	Unlikely (1)	Medium	Negligible	

6.3.2 Appraisal of the availability and adequacy of existing information and flood zone maps

6.3.2.1 Tidal/Fluvial: Current

Good data is available on possible flooding of the surrounding area to the site in the Eastern CFRAM Study by the OPW. The study is a requirement of the EU 'Floods' Directive (2007/60/EC). The PFRA map is also available and considers flood risk arising from any major source of flooding, including natural sources such as river, sea, groundwater and rainfall as well as infrastructural sources such as urban drainage systems, reservoirs, water supply systems ESB and Waterways Ireland Infrastructure.

The relevant maps are contained in Appendix IV and show that the site is located outside of the Flood Risk Areas.

6.3.3 Determination of what technical studies are appropriate

Given the comprehensive nature of the existing information available regarding flooding, it is not considered necessary to carry out any further analysis of fluvial or tidal flooding or of the sewer network serving the area.

6.3.4 Description of what residual risks will be assessed and how they might be mitigated and potential impacts of development on flooding elsewhere

Partial blockages of the surface water drainage system are considered further below as is maximum flooding of the Poddle/Tymon river.

6.4 Stage 3: Detailed Flood Risk Assessment

A detailed flood risk assessment involves the estimation of the level of flooding on the site and the performance of the development under these conditions so that a "fit for purpose" development can be delivered. Once the likely maximum flood level has been estimated, the design should develop so that the ground floor level is above this level. Residual flood risk may remain in other areas that for operational reasons have to be below the maximum flood level (street access, bin stores, etc.) and these areas will have to incorporate flood resilient design features and flood risk management procedures so that the risk is mitigated in so far as possible.

6.4.1 Blockage of the surface water drainage system on site & consequently overland flows.

In the unlikely event of a full blockage of the surface water system before or during a storm event then water will build up in the pipe system and discharge back into the ground level SuDS devices – permeable paved & porous surfaced areas, bio-retention areas, the detention basement & soft landscaping. Given the building levels & ground levels on site, overland flow will occur in the site towards the Poddle/Tymon river. The ground floor levels of the buildings are 150mm min above surrounding external ground level preventing any flooding on Airton Road.

6.4.2 Overland flows from adjacent areas.

The site is bounded by Airton Road, on the north side, Greenhills Road on the east side, an adjacent industrial premise on the south and west side and the Poddle/Tymon river on the south side. The ground levels in the development at the two road access points are higher than the adjacent public roads preventing any water from these roads entering the development. The industrial premises hard standing areas are at or below the proposed levels on the subject site.

There will be a new wall along the boundary separating these premises from the new development preventing any overland flow travelling between sites.

6.4.3 The Poddle/Tymon River

The flood maps indicate that flooding of the Poddle/Tymon river only slightly encroaches the site at its lowest point at the south east corner. The lands south & south west including the Tallaght University playing fields are at a lower level than the subject site (0.5 to circa 1.0m). Any flooding of the stream will enter these lands as predicted on the CFRAMS flood maps. Therefore, there is no significant risk of flooding on site.

6.5 CONCLUSION

The flood risk assessment has been carried out in accordance with the OPW publication "The Planning System and Flood Risk Assessment Guidelines for Planning Authorities".

There is no risk of flooding affecting the site from fluvial sources, so it is possible to develop the site within Flood Zone C. Any flood events do not cause flooding of the proposed development, and the development does not affect the flood storage volume or increase flood risk elsewhere.

7.0 ROAD & TRAFFIC ENGINEERING

7.1 Roads

7.1.1 Existing Access

Existing access to the site is provided along Airton Road. This entrance served the entire factory site (now dis-used) and would have been used by cars and HGV's. Airton road is a two-way carriageway with no cycle lanes along the road. The road is in approximately 10.7m wide, with each lane being 4m wide and a turning island of 2.7m in the middle of the road outside of the site. There is a pedestrian footpath adjacent to our site approximately 1.8m wide, which is separated from the road by a grass verge, which is approximately 3.2m deep and sparsely lined with trees.

There is no existing site access along Greenhills road. Greenhills road is a two-way carriageway. The road is approximately 9m wide here with a ghost island 3.2m wide locally present. There is a shared surface for pedestrians and cyclists adjacent to our site, 2.8m wide. The cycle path joins the vehicular traffic and becomes a dedicated cycle path as it approaches the junction with Airton Road.

7.1.2 Proposed Access

2no. new site entrances are proposed to serve the development, 1no. on Airton Road and 1no. on Greenhills Road. These accesses have been developed on foot of comments from the SDCC review team.

Please see Appendix V for DMURS statement of consistency.

7.1.3 Access to Blocks A, B & C

7.1.3.1 Site Entrance 1

The site entrance on Airton road is in-line with the opposing junction into the Harvey Norman retail park. This removes the potential clash of road-users wishing to enter the industrial and retail unit and those entering our site, as the queueing zones are now on opposite sides of the junction. It also increases the availability length we can now use for queueing lengths when turning into our site. The design is in line with SDCC requirements.

The site entrance will serve the undercroft parking in Blocks A, B & C and has been designed following the DMURS guidelines.

Sightlines for the new junction have been assessed for a 50kph design speed on Airton Road in accordance with the recommendations of DMURS.

7.1.3.2 Emergency Access / Fire Tender Access

The site entrance on Airton Road serves the Block A, B & C undercroft car park and does not afford any access to the open-air areas within the site. To allow emergency access and/or fire tender access throughout the site, a drop kerb with padlocked bollards has been provided for along the site boundary on Airton Road between Block C & D. This drop kerb will permit emergency service vehicles access throughout the site.

A fire tender access Autotrack has been carried and confirms that emergency service vehicles can gain access to the site and progress around the site. The full extent of fire tender access requirements is to be determined by the fire consultant.

Please see drawing ARD-BMD-00-XX-DR-C-1040 - 1041 for further Autotrack details.

7.1.3.3 Lay-By

A lay-by has been proposed along the Airton Road site boundary. This lay-by will serve the refuse collection services for the proposed development. This development will have a full management system in place who will oversee the coordination of the refuse collection and waste management.

The lay-by will also serve deliveries to the residential units (furniture etc.) within the site and taxi drop-offs.

The lay-by has been designed per DMURS guidelines when designing an inlet for buses. The sightlines from the existing sight entrance are unaffected by this lay-by.

7.1.4 Access to Blocks E & F

7.1.4.1 Site Entrance 2

The site entrance on Greenhills road will serve the basement parking below Blocks E & F. This site entrance has been designed following the DMURS guidelines. The new kerb radii for the site entrance are 4.5m and the entrance road is a total width of 6.5m.

SDCC informed BMCE that there is congestion problem at the Airton Road junction north of the site entrance and there is regular traffic back-up. To ensure that residents could still egress from the site, a yellow box has been designed and implemented at the site entrance.

Sightlines for the new junction have been assessed for a 50kph design speed on Greenhills Road in accordance with the recommendations of DMURS.

7.1.4.2 Emergency Access / Fire Tender Access

The site entrance on Greenhills Road serves the Block E & F basement car park and does not afford any access to the open-air areas within the site. To allow emergency access and/or fire tender access throughout the site, a drop kerb with padlocked bollards has been provided along the site boundary on Airton Road between Block D & E. This drop kerb will permit emergency service vehicles where access throughout the site.

7.1.4.3 Bus Connects Corridor

Bus Connects is a major investment programme to improve public transport by overhauling the current Dublin Bus infrastructure and replacing it with more efficient routes. Part of the plan involves Compulsory Purchase Orders (CPO's) of privately-owned lands. A strip of land in the site has been included in the future CPO zone.

There is no official information on the scope of the CPO and the exact extent of this CPO has not been disclosed by Bus Connects. Therefore, the date of implementation and the extent of CPO (total width in m) is unknown. The design team have taken the fullest extent of the possible CPO which is 12.5m and includes the footpath, cycle track, bus lane and a traffic lane.

The site has been fully designed for the CPO. I.e. no development in the CPO zone.

7.2 Traffic

Refer to the Traffic & Transport Assessment (19.136 – TTA – 01) which has been submitted as part of this submission.

BARRETT MAHONY
CONSULTING ENGINEERS
CIVIL & STRUCTURAL

APPENDIX 1

SITE LOCATION

Proposed Ground Level Site Plan
1 : 500

Application Site

Extent of property owned by Applicant

Existing trees

Proposed trees

NOTES:

* Please refer to Arborist report and drawings for information on trees to be removed.

** Please refer to Landscape Design drawings for landscaping and boundary treatment details.

GENERAL NOTES:

ALL DIMENSIONS ARE TO BE CONFIRMED ON SITE

DIMENSIONS ARE NOT TO BE SCALED FROM THIS DRAWING

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH CONSULTANTS DRAWINGS

ALL WORK TO BE CARRIED OUT IN ACCORDANCE WITH CURRENT BUILDING REGULATIONS

rev	date	by	Description
A	11.02.2020	CB	For Planning

FOR PLANNING

PROJECT TITLE:	Residential Development at the Former Gallaher site, Airton Road, Tallaght, Dublin 24 for Greenleaf Homes Limited
DRAWING TITLE:	Proposed Ground Level Site Plan
PROJECT NO: 1904	DATE: 27/01/20
SCALE: 1 : 500 @ A1	DRAWN BY: CB/PS
MODEL NAME: 1904-FA-ZZ-00-M3-A-Site	CHECKED BY: CB
DRAWING NO: 1904 - SITE - 0502	REVISION: A

FERREIRA ARCHITECTS

ROSEMOUNT HALL, ROSEMOUNT ESTATE DUNDRUM ROAD, DUNDRUM, D14 FP59
tel: ++ 353-1-2063523
web: www.ferreira.ie
email : admin@ferreira.ie

BARRETT MAHONY
CONSULTING ENGINEERS
CIVIL & STRUCTURAL

APPENDIX 2

IRISH WATER DETAILS

UISCE ÉIREANN : IRISH WATER

Uisce Éireann
Bosca OP 448
Oifig Sheachadta na Cathrach Theas
Cathair Chorcaí

Irish Water
PO Box 448,
South City
Delivery Office,
Cork City.

www.water.ie

Mark Elliott
c/o Ryan Mulvaney
Barrett Mahony Consulting Engineers,
Sandwith House,
52-54 LWR Sandwith St. D2
D02 WR26

12 February 2020

Re: Design Submission for Airton Road, Greenhills Road, Co. Dublin (the "Development") (the "Design Submission") / Connection Reference No: CDS19003263

Dear Mark Elliott,

Many thanks for your recent Design Submission.

We have reviewed your proposal for the connection(s) at the Development. Based on the information provided, which included the documents outlined in Appendix A to this letter, Irish Water has no objection to your proposals.

This letter does not constitute an offer, in whole or in part, to provide a connection to any Irish Water infrastructure. Before you can connect to our network you must sign a connection agreement with Irish Water. This can be applied for by completing the connection application form at www.water.ie/connections. Irish Water's current charges for water and wastewater connections are set out in the Water Charges Plan as approved by the Commission for Regulation of Utilities (CRU)(https://www.cru.ie/document_group/irish-waters-water-charges-plan-2018/).

You the Customer (including any designers/contractors or other related parties appointed by you) is entirely responsible for the design and construction of all water and/or wastewater infrastructure within the Development which is necessary to facilitate connection(s) from the boundary of the Development to Irish Water's network(s) (the "**Self-Lay Works**"), as reflected in your Design Submission. Acceptance of the Design Submission by Irish Water does not, in any way, render Irish Water liable for any elements of the design and/or construction of the Self-Lay Works.

If you have any further questions, please contact your Irish Water representative:

Name: Marina Zivanovic Byrne
Phone: (01) 8925991
Email: mzbyrne@water.ie

Yours sincerely,

M O'Dwyer

Maria O'Dwyer
Connections and Developer Services

Appendix A

Document Title & Revision

- [ARD-BMD-00-XX-DR-C-1001 Rev. PL2 Foul Drainage Layout]
- [ARD-BMD-00-XX-DR-C-1005 Rev. PL2 Watermain Layout]
- [ARD-BMD-00-XX-DR-C-1009 Rev. PL2 Combined Surface Water, Foul Drainage & Watermain Layout]
- [ARD-BMD-00-XX-DR-C-1050 Rev. P1 Foul Drainage Longitudinal Sections]
- [ARD-BMD-00-XX-DR-C-1051 Rev. P1 Foul Drainage Longitudinal Sections]
- [ARD-BMD-00-XX-DR-C-1200 Rev. PL1 Standard Drainage Details]
- [ARD-BMD-00-XX-DR-C-1220 Rev. PL1 Standard Watermain Details]

Standard Details/Code of Practice Exemption:

<N/A>

For further information, visit ***www.water.ie/connections***

Notwithstanding any matters listed above, the Customer (including any appointed designers/contractors, etc.) is entirely responsible for the design and construction of the Self-Lay Works. Acceptance of the Design Submission by Irish Water will not, in any way, render Irish Water liable for any elements of the design and/or construction of the Self-Lay Works.

UISCE ÉIREANN : IRISH WATER

Ryan Mulvaney
Barrett Mahony Consulting Engineers,
Sandwith House,
52-54 LWR Sandwith St. D2
D02WR26

Uisce Éireann
Bosca OP 448
Oifig Sheachadta na Cathrach Theas
Cathair Chorcaí

Irish Water
PO Box 448,
South City
Delivery Office,
Cork City.

www.water.ie

25 November 2019

Dear Ryan Mulvaney,

Re: Connection Reference No CDS19003263 pre-connection enquiry - Subject to contract | Contract denied

Connection for Mixed Use Development of 603 units at Airton Road, Greenhills Road, Co. Dublin.

Irish Water has reviewed your pre-connection enquiry in relation to a Water & Wastewater connection at Airton Road, Greenhills Road, Co. Dublin.

Based upon the details that you have provided with your pre-connection enquiry and on the capacity currently available in the network(s), as assessed by Irish Water, we wish to advise you that, subject to a valid connection agreement being put in place, your proposed connection to the Irish Water network(s) can be facilitated.

Irish Water notes that the scale of this development dictates that it is subject to the Strategic Housing Development planning process. Therefore:

- In advance of submitting your full application to An Bord Pleanala for assessment, you must have reviewed this development with Irish Water and received a Statement of Design Acceptance in relation to the layout of water and wastewater services.
- All infrastructure should be designed and installed in accordance with the Irish Water Codes of Practice and Standard Details.
- You are advised that this correspondence does not constitute an offer in whole or in part to provide a connection to any Irish Water infrastructure and is provided subject to a connection agreement being signed and appropriate connection fee paid at a later date.

.

A connection agreement can be applied for by completing the connection application form available at **www.water.ie/connections**. Irish Water's current charges for water and wastewater connections are set out in the Water Charges Plan as approved by the Commission for Regulation of Utilities.

If you have any further questions, please contact Marina Zivanovic Byrne from the design team on 01 89 25991 or email mzbyrne@water.ie. For further information, visit **www.water.ie/connections.**
Yours sincerely,

M. O'Dwyer

Maria O'Dwyer

Connections and Developer Services

Pre-connection enquiry form

Large industrial and commercial developments, mixed use developments, housing developments, business developments.

This form is to be filled out by applicants enquiring about the feasibility of a water and/or wastewater connection to Irish Water infrastructure. If completing this form by hand, please use BLOCK CAPITALS and black ink.

Please refer to the **Guide to completing the pre-connection enquiry form** on page 12 of this document when completing the form.

Section A | Applicant details

1 WPRN number (where available):

2 Applicant details:

Registered company name (if applicable): AIRTON ROAD PROPERTIES LTD.

Trading name (if applicable):

Company registration number (if applicable):

If you are not a registered company/business, please provide the applicant's name:

Contact name: MARK ELLIOT

Postal address: 89 Harcourt Street, St. Kevin's, Dublin 2

Eircode: D02WY88

Telephone: 014100400

Mobile: 0862552289

Email: M.ELLIOTT@GREENLEAFGROUP.I.E.

3 Agent details (if applicable):

Contact name: RYAN MULVANEY

Company name (if applicable): BARRETT MAHONY

Postal address: BARRETT MAHONY CONSULTING ENGINEERS, SANDWITH HOUSE, 52-54 LWR SANDWITH ST. D2

Eircode: D02WR26

Telephone: 016773200

Email: RMULVANEY@BMCE.IE

4 **Please indicate whether it is the applicant or agent who should receive future correspondence in relation to the enquiry:**

Applicant ☐ Agent ☑

Section B | Site details

5 **Site address:** AIRTON RD/GREENHILLS RD
TALLAGHT, DUBLIN 24

6 **Irish Grid co-ordinates of site:** E(X) 309563 N(Y) 228236

Eg. co-ordinates of GPO, O'Connell St., Dublin: E(X) 315,878 N(Y) 234,619

7 **Local Authority:**

Local Authority that granted planning permission (if applicable):

SOUTH DUBLIN COUNTY COUNCIL

8 **Has full planning permission been granted?** Yes ☐ No ☑

If 'Yes', please provide the current or previous planning reference number:

9 **Previous use of this site (if applicable):** INDUSTRIAL

10 **Date that previous development was last occupied (if applicable):** 0 / 0 / 0

11 **Are there poor ground conditions on site?** Yes ☐ No ☑

If 'Yes', please include site investigation report and a detailed site-specific report on the approach being taken to deal with ground conditions specifically with regard to pipe support and trenching.

12 **Are there potential contaminated land issues?** Yes ☐ No ☑

If 'Yes', please include a detailed site-specific report on the approach being taken to deal with contaminated land and the measures being taken to mitigate the impact on infrastructure.

13 **Is the development compliant with the local area development plan?** Yes ☑ No ☐

Section C | Water connection and demand details

14 **Is there an existing connection to public water mains at the site?** Yes ☑ No ☐

15 **Is this enquiry for an additional connection to the one already installed?** Yes ☑ No ☐

16 **Is this enquiry to increase the size of an existing water connection?** Yes ☐ No ☑

17 **Is this enquiry for a new water connection?** Yes ☑ No ☐

18 **Approximate date water connection is required:** 1 / 1 / 2021

19 **Please indicate pre-development water demand (if applicable):**

Pre-development peak hour water demand	0.3348	**l/s**
Pre-development average hour water demand	0.067	**l/s**

Pre-development refers to brownfield sites only. Please include calculations on the attached sheet provided.

20 **Please indicate the domestic water demand (housing developments only):**

Post-development peak hour water demand	17.578	**l/s**
Post-development average hour water demand	3.516	**l/s**

Please include calculations on the attached sheet provided.

21 **Please indicate the business water demand (shops, offices, schools, hotels, restaurants, etc.):**

Post-development peak hour water demand	0.370	**l/s**
Post-development average hour water demand	0.074	**l/s**

Please include calculations on the attached sheet provided. Where there will be a daily/weekly/seasonal variation in the water demand profile, please provide all such details.

22 **Please indicate the industrial water demand (industry-specific water requirements):**

Post-development peak hour water demand	0	**l/s**
Post-development average hour water demand	0	**l/s**

Please include calculations on the attached sheet provided. Where there will be a daily/weekly/seasonal variation in the water demand profile, please provide all such details.

23 **What is the existing ground level at the property boundary at connection point (if known) above Malin Head Ordnance Datum?**

88 m

24 **What is the highest finished floor level of the proposed development above Malin Head Ordnance Datum?**

107 m

25 **Is on-site water storage being provided?** Yes ☑ No ☐

Please include calculations on the attached sheet provided.

26 **Are there fire flow requirements?** Yes ☐ No ☑

Additional fire flow requirements over and above those identified in Q20, Q21 and Q22 above	-	**l/s**

Please include calculations on the attached sheet provided, and include confirmation of requirements from the Fire Authority.

27 **Do you propose to supplement your potable water supply from other sources?** Yes ☐ No ☑

If 'Yes', please indicate how you propose to supplement your potable water supply from other sources (see **Guide to completing the application form** on page 12 of this document for further details):

Section D | Wastewater connection and discharge details

28 **Is there an existing connection to a public sewer at the site?** Yes ☐ No ☑

29 **Is this enquiry for an additional connection to one already installed?** Yes ☐ No ☑

30 **Is this enquiry to increase the size of an existing connection?** Yes ☐ No ☑

31 **Is this enquiry for a new wastewater connection?** Yes ☑ No ☐

32 **Approximate date that wastewater connection is required:** 1 / 3 / 2021

33 **Please indicate pre-development wastewater discharge (if applicable):**

Pre-development peak discharge	0.354	**l/s**
Pre-development average discharge	0.0589	**l/s**

Pre-development refers to brownfield sites only. Please include calculations on the attached sheet provided.

34 **Please indicate the domestic wastewater hydraulic load (housing developments only):**

Post-development peak discharge	9.281	**l/s**
Post-development average discharge	3.094	**l/s**

Please include calculations on the attached sheet provided.

35 **Please indicate the commercial wastewater hydraulic load (shops, offices, schools, hotels, restaurants, etc.):**

Post-development peak discharge	0.332	**l/s**
Post-development average discharge	0.060	**l/s**

Please include calculations on the attached sheet provided.

36 **Please indicate the industrial wastewater hydraulic load (industry-specific discharge requirements):**

Post-development peak discharge	0	**l/s**
Post-development average discharge	0	**l/s**

Please include calculations on the attached sheet provided.

37 **Wastewater organic load:**

Characteristic	**Max concentration (mg/l)**	**Average concentration (mg/l)**	**Maximum daily load (kg/day)**
Biochemical oxygen demand (BOD)		150 - 500	
Chemical oxygen demand (COD)		300 - 1000	
Suspended solids (SS)		200 - 700	
Total nitrogen (N)			
Total phosphorus (P)			
Other		AMMONIA 22-80 COLIFORMS 10^6 - 10^9	

Temperature range	–
pH range	–

38 **Storm water run-off will only be accepted from brownfield sites that already have a storm/surface water connection to a combined sewer. In the case of such brownfield sites, please indicate if the development intends discharging surface water to the combined wastewater collection system:**

Yes ☐ No ☑

If 'Yes', please give reason for discharge and comment on adequacy of SUDS/attenuation measures proposed.

39 **Do you propose to pump the wastewater?** Yes ☐ No ☑

If 'Yes', please include justification for your pumped solution with this application.

40 **What is the existing ground level at the property boundary at connection point (if known) above Malin Head Ordnance Datum?**

8 8 m

41 **What is the lowest finished floor level on site above Malin Head Ordnance Datum?** 8 8 m

Section E | Development details

42 Please outline the domestic and/or industry/business use proposed:

Property type	Total number of units for this application
Domestic	600
Office	850m²
Residential care home	-
Hotel	-
Factory	-
School	-
Institution	-
Retail unit	515m²
Industrial unit	-
Other (please specify)	Creche - 350m²

43 Approximate start date of proposed development: 1 / 6 / 2019

44 Is the development multi-phased? Yes ☐ No ☑

If 'Yes', application must include a master-plan identifying the development phases and the current phase number.

If 'Yes', please provide details of variations in water demand volumes and wastewater discharge loads due to phasing requirements.

Section F | Supporting documentation

Please provide the following additional information:

- Site location map: A site location map to a scale of 1:1000, which clearly identifies the land or structure to which the enquiry relates. The map shall include the following details:
  - a) The scale shall be clearly indicated on the map.
  - b) The boundaries shall be delineated in red.
  - c) The site co-ordinates shall be marked on the site location map.
- Details of planning and development exemptions (if applicable).
- Calculations (calculation sheets provided below).
- Site layout map to a scale of 1:500 showing layout of proposed development, water network and wastewater network layouts, additional water/wastewater infrastructure if proposed, connection points to Irish Water infrastructure (if known).
- Any other information that might help Irish Water assess this pre-connection enquiry.

Section G | Declaration

I/We hereby make this application to Irish Water for a water and/or wastewater connection as detailed on this form.

I/We understand that any alterations made to this application must be declared to Irish Water.

The details that I/we have given with this application are accurate.

I/We have enclosed all the necessary supporting documentation.

Signature: Ryan Mulvaney   Date: 18/04/2019

Your full name (in BLOCK CAPITALS):

RYAN MULVANEY

Irish Water will carry out a formal assessment based on the information provided on this form.
Any future connection offer made by Irish Water will be based on the information that has been provided here.

Please submit the completed form to **newconnections@water.ie** or alternatively, post to:

Irish Water
PO Box 860
South City Delivery Office
Cork City

For office use only:

Input customer number:

Calculations

Water demand

PLEASE SEE APPENDIX B ATTACHED.

On-site storage

- No on-site Wastewater storage.
- On-site 24-hour water supply storage is to be provided to cater to the daily demand.

Fire flow requirements

ON SITE STORAGE TANKS WITH WET RISERS WILL BE PROVIDED FOR FIRE FIGHTING PRUPOSES. THERE WILL BE NO INSTANTANEOUS FIRE FLOW REQUIREMENTS.

STANDARD HYDRANTS WILL BE PROVIDED THROUGHOUT THE DEVELOPMENT.

Foul wastewater discharge

PLEASE SEE ATTACHED APPENDIX A.

Guide to completing the pre-connection enquiry form

This form should be completed by applicants enquiring about the feasibility of a water and/or wastewater connection to Irish Water infrastructure.

The Irish Water Codes of Practice are available at **www.water.ie** for reference.

Section A | Applicant Details

Question 1: 'Water Point Reference Number (WPRN)' is a unique number assigned to every single water services connection in the country. The WPRN is prominently displayed on correspondence received from Irish Water, and can be found on water bills, previous connection offers, or previous enquiries in relation to the site. Existing customers and brownfield sites should have a WPRN. New customers are not required to answer this question.

Question 2: This question requires the applicant or company enquiring about the feasibility of a connection to identify themselves, their postal address, and to provide their contact details.

Question 3: If the applicant has employed a consulting engineer or an agent to manage the enquiry on their behalf, the agent's address and contact details should be recorded here.

Question 4: Please indicate whether it is the applicant or the agent who should receive future correspondence in relation to the enquiry.

Section B | Site details

Question 5: This is the address of the site requiring the water/wastewater service connection and for which this enquiry is being made.

Question 6: Please provide the Irish Grid co-ordinates of the proposed site. Irish grid positions on maps are expressed in two dimensions as Eastings (E or X) and Northings (N or Y) relative to an origin. You will find these coordinates on your Ordnance Survey map which is required to be submitted with an application.

Question 7: Please identify the Local Authority that is or will be dealing with your planning application, for example Cork City Council.

Question 8: Please indicate if planning permission has been granted for this application, and if so, please provide the planning permission reference number.

Question 9: Please specify the previous use of the site that is proposed to be developed, for example if greenfield, please state 'Agricultural'.

Question 10: Please specify the date that the development site was last occupied. Your answer will help us to determine the previous water usage/wastewater load of the development. If the site was previously greenfield, then this question does not need to be completed.

Question 11: Please provide details in relation to the ground conditions on the site if they are known to be poor, for example soil with a low bearing capacity, high water table, presence of peat, silt, etc. If a site investigation report is available, please include it with your enquiry.

Question 12: Please provide details in relation to contaminated land on your site (if any); this will determine what pipe material will be appropriate in the vicinity of the contaminated ground.

Question 13: Please indicate if the development is compliant with the local area development plan. You should contact your Local Authority in this regard and confirm same by ticking the appropriate box.

Section C | Water connection and demand details

Question 14: Please indicate if a water connection already exists for this site.

Question 15: Please indicate if this enquiry concerns an additional connection to one already installed on the site.

Question 16: Please indicate if you are proposing to upgrade the water connection to facilitate an increase in water demand. Irish Water will determine what impact this will have on our infrastructure.

Question 17: Please indicate if this enquiry concerns a new water connection for this site.

Question 18: Please indicate the approximate date that the proposed connection to the water infrastructure will be required.

Question 19: If the site was previously in use, please provide details of the pre-development peak hour and average hour water demand.

Question 20: Please provide calculations for domestic water demand and include your calculations on the calculation sheet provided. Demand rates (peak and average) are site specific. Average demand is the total daily volume divided by a 24-hour time period and expressed in litres per second (l/s). For design purposes, please refer to the Irish Water Codes of Practice for Water Infrastructure.

Question 21: If this connection enquiry concerns a business premises, please provide calculations for the water demand and include your calculations on the calculation sheet provided. Business premises include shops, offices, hotels, schools, etc. Demand rates (peak and average) are site specific. Average demand is the total daily volume divided by a 24-hour time period and expressed in litres per second (l/s). For design purposes, please refer to the Irish Water Codes of Practice for Water Infrastructure.

Question 22: If this connection enquiry is for an industrial premises, please calculate the water demand and include your calculations on the calculation sheet provided. Demand rates (peak and average) are site specific. Average demand is the total daily volume divided by a 24-hour time period and expressed in litres per second (l/s). The peak demand for sizing of the pipe network will be as per the specific business production requirements. For design purposes, please refer to the Irish Water Codes of Practice for Water Infrastructure.

Question 23: Please specify the ground level at the location where connection to the public water mains will be made. This is required in order to determine if there is sufficient pressure in the existing water infrastructure to serve your proposed development. Levels should be quoted in metres relative to Malin Head Ordnance Datum.

Question 24: Please specify the highest finished floor level on site. This is required in order to determine if there is sufficient pressure in the existing water infrastructure to serve your proposed development. Levels should be quoted in metres relative to Malin Head Ordnance Datum.

Question 25: If storage is required, water storage capacity of 24-hour water demand must usually be provided at the proposed site. In some cases, 24-hour storage capacity may not be required, for example 24-hour storage for a domestic house would be provided in an attic storage tank. Please calculate the 24-hour water storage requirements and include your calculations on the attached sheet provided. Please also confirm that on-site storage is being provided by ticking the appropriate box.

Question 26: The water supply system shall be designed and constructed to reliably convey the water flows that are required of the development including fire flow requirements by the Fire Authority. The Fire Authority will provide the requirement for fire flow rates that the water supply system will have to carry. Please note that while flows in excess of your required demand may be achieved in the Irish Water network and could be utilised in the event of a fire, Irish Water cannot guarantee a flow rate to meet your fire flow requirement. To guarantee a flow to meet the Fire Authority requirements, you should provide adequate fire storage capacity within your development. Please include your calculations on the attached sheet provided, and further provide confirmation of the Fire Authority requirements.

Question 27: Please identify proposed additional water supply sources, that is, do you intend to connect to the public water mains or the public mains and supplement from other sources? If supplementing public water supply with a supply from another source, please provide details as to how the potable water supply is to be protected from cross contamination at the premises.

Section D | Wastewater connection and discharge details

Question 28: Please indicate if a wastewater connection to a public sewer already exists for this site.

Question 29: Please indicate if this enquiry relates to an additional wastewater connection to one already installed.

Question 30: Please indicate if you are proposing to upgrade the wastewater connection to facilitate an increased discharge. Irish Water will determine what impact this will have on our infrastructure.

Question 31: Please indicate if this enquiry relates to a new wastewater connection for this site.

Question 32: Please specify the approximate date that the proposed connection to the wastewater infrastructure will be required.

Question 33: If the site was previously in use, please provide details of the pre-development peak and average wastewater discharge.

Question 34: Please provide calculations for domestic wastewater discharge and include your calculations on the attached sheet provided. Discharge rates (peak and average) are site specific. Average discharge is the total daily volume divided by a 24-hour time period and expressed in litres per second (l/s). For design purposes, please refer to the Irish Water Codes of Practice for Wastewater Infrastructure.

Question 35: If this enquiry relates to a business premises, please provide calculations for the wastewater discharge and include your calculations on the attached sheet provided. Business premises include shops, offices, hotels, schools, etc. Discharge rates (peak and average) are site specific. Average discharge is the total daily volume divided by a 24-hour time period and expressed in litres per second (l/s). For design purposes, please refer to the Irish Water Codes of Practice for Wastewater Infrastructure.

Question 36: If this enquiry relates to an industrial premises, please provide calculations for the wastewater discharge and include your calculations on the calculation sheet provided. Discharge rates (peak and average) are site specific. Average discharge is the total daily volume divided by a 24-hour time period and expressed in litres per second (l/s). The peak discharge for sizing of the pipe network will be as per the specific business production requirements. For design purposes, please refer to the Irish Water Codes of Practice for Wastewater Infrastructure.

Question 37: Please specify the maximum and average concentrations and the maximum daily load of each of the wastewater characteristics listed in the wastewater organic load table (if not domestic effluent), and also specify if any other significant concentrations are expected in the effluent. Please complete the table and provide additional supporting documentation if relevant. Note that the concentration shall be in mg/l and the load shall be in kg/day. Note that for business premises (shops, offices, schools, hotels, etc.) for which only domestic effluent will be discharged (excluding discharge from canteens/restaurants which would require a Trade Effluent Discharge licence), there is no need to complete this question.

Question 38: In exceptional circumstances, such as brownfield sites, where the only practical outlet for storm/surface water is to a combined sewer, Irish Water will consider permitting a restricted attenuated flow to the combined sewer. Storm/surface water will only be accepted from brownfield sites that already have a storm/surface water connection to a combined sewer and the applicant must demonstrate how the storm/surface water flow from the proposed site is minimised using sustainable urban drainage system (SUDS). This type of connection will only be considered on a case by case basis. Please advise if the proposed development intends discharging surface water to the combined wastewater collection system.

Question 39: Please specify if the development needs to pump its wastewater discharge to gain access to Irish Water infrastructure.

Question 40: Please specify the ground level at the location where connection to the public sewer will be made. This is required to determine if the development can be connected to the public sewer via gravity discharge. Levels should be quoted in metres relative to Malin Head Ordnance Datum.

Question 41: Please specify the lowest floor level of the proposed development. This is required in order to determine if the development can be connected to the public sewer via gravity discharge. Levels should be quoted in metres relative to Malin Head Ordnance Datum.

Section E | Development details

Question 42: Please specify the number of different property/premises types by filling in the table provided.

Question 43: Please indicate the approximate commencement date of works on the development.

Question 44: Please indicate if a phased building approach is to be adopted when developing the site. If so, please provide details of the phase master-plan and the proposed variation in water demand/wastewater discharge as a result of the phasing of the development.

Section F | Supporting documentation

Please provide additional information as listed.

Section G | Declaration

Please review the declaration, sign, and return the completed application form to Irish Water by email or by post using the contact details provided in Section G.

Notes

Notes

Irish Water Web Map

July 11, 2019

1:5,000

0	0.125	0.25	0.5 mi
0	0.175	0.35	0.7 km

Legend

Sewer Discharge Points
- Outfall
- Overflow
- Soakaway
- Standard Outlet
- Other; Unknown

Sewer Clean Outs
- Rodding Eye
- Flushing Structure
- Other; Unknown
- Sewer Flow Control Valves
- Treatment plant
- Pump station

Sewer Inlets
- Catchpit
- Gully
- Standard
- Other; Unknown

Sewer Manholes
- Cascade
- Catchpit
- Hatchbox
- Lamphole
- Standard
- Other; Unknown

Sewer Fittings
- Vent/Col
- Other; Unknown

Sewer Gravity Mains (Irish Water owned)
- Combined
- Foul
- Overflow
- Unknown

Sewer Gravity Mains (Non-Irish Water owned)
- Combined
- Foul
- Overflow
- Unknown

Sewer Pressurized Mains
- Combined
- Foul
- Overflow
- Unknown

Irish Water gives this information as to the position of its underground network as a general guide only on the strict understanding that it is based on the best available information provided by each Local Authority in Ireland. It should not be relied upon in the event of excavations or other works being carried out in the vicinity of the network. The onus is on the parties carrying out the works to ensure the exact location of the network is identified prior to mechanical works being carried out. Service pipes are not generally shown but their presence should be anticipated.

Irish Water

UISCE ÉIREANN : IRISH WATER

BARRETT MAHONY
CONSULTING ENGINEERS
CIVIL & STRUCTURAL

APPENDIX 3

MICRODRAINAGE CALCULATIONS

Barrett Mahony Consulting Eng		Page 1
12 Mill Street London SE1 2AY		Micro Drainage
Date 24/01/2020 12:17 File Surface.mdx	Designed by Tmachale Checked by	
XP Solutions	Network 2018.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	14.000	Add Flow / Climate Change (%)	0
Ratio R	0.300	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.036	4-8	0.575	8-12	0.081

Total Area Contributing (ha) = 0.692

Total Pipe Volume (m³) = 19.879

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	26.312	0.132	200.0	0.133	4.00	0.0	0.600	o	225	Pipe/Conduit	🔓
S1.001	36.476	0.182	200.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	🔓
S1.002	42.438	0.386	110.0	0.097	0.00	0.0	0.600	o	225	Pipe/Conduit	🔓
S2.000	51.705	0.259	200.0	0.120	4.00	0.0	0.600	o	225	Pipe/Conduit	🔓

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	4.48	89.320	0.133	0.0	0.0	0.0	0.92	36.6	18.0
S1.001	50.00	5.14	89.188	0.133	0.0	0.0	0.0	0.92	36.6	18.0
S1.002	50.00	5.70	89.006	0.230	0.0	0.0	0.0	1.25	49.5	31.1
S2.000	50.00	4.94	89.000	0.120	0.0	0.0	0.0	0.92	36.6	16.2

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S2.001	29.327	0.147	200.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	5.523	0.028	200.0	0.030	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.004	14.000	0.070	200.0	0.030	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.000	90.000	0.450	200.0	0.099	4.00	0.0	0.600	o	225	Pipe/Conduit	
S4.000	27.113	0.195	139.0	0.123	4.00	0.0	0.600	o	225	Pipe/Conduit	
S3.001	10.660	0.053	201.1	0.060	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.005	56.000	0.280	200.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.006	6.824	0.034	200.7	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.007	80.753	0.404	199.9	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.008	22.822	0.114	200.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S2.001	50.00	5.47	88.741	0.120	0.0	0.0	0.0	0.92	36.6	16.2
S1.003	50.00	5.80	88.595	0.380	0.0	0.0	0.0	0.92	36.6«	51.5
S1.004	50.00	6.06	88.567	0.410	0.0	0.0	0.0	0.92	36.6«	55.5
S3.000	50.00	5.63	89.255	0.099	0.0	0.0	0.0	0.92	36.6	13.4
S4.000	50.00	4.41	89.000	0.123	0.0	0.0	0.0	1.11	44.0	16.7
S3.001	50.00	5.82	88.805	0.282	0.0	0.0	0.0	0.92	36.5«	38.2
S1.005	50.00	7.07	87.497	0.692	0.0	0.0	0.0	0.92	36.6«	93.7
S1.006	50.00	7.19	87.217	0.692	0.0	0.0	0.0	0.92	36.5«	93.7
S1.007	50.00	8.66	87.183	0.692	0.0	0.0	0.0	0.92	36.6«	93.7
S1.008	50.00	9.07	86.779	0.692	0.0	0.0	0.0	0.92	36.6«	93.7

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
SS1.0	91.000	1.680	Open Manhole	1200	S1.000	89.320	225				
SS1.1	90.100	0.912	Open Manhole	1200	S1.001	89.188	225	S1.000	89.188	225	
SS1.2	89.800	0.794	Open Manhole	1200	S1.002	89.006	225	S1.001	89.006	225	
SS2.0	90.125	1.125	Open Manhole	1200	S2.000	89.000	225				
SS2.1	90.000	1.259	Open Manhole	1200	S2.001	88.741	225	S2.000	88.741	225	
SS1.3	90.000	1.405	Open Manhole	1200	S1.003	88.595	225	S1.002	88.620	225	25
								S2.001	88.595	225	
SS1.4	90.000	1.433	Open Manhole	1200	S1.004	88.567	225	S1.003	88.567	225	
SS4.0	91.000	1.745	Open Manhole	1200	S3.000	89.255	225				
SS3.0	90.125	1.125	Open Manhole	1200	S4.000	89.000	225				
SS4.1	90.100	1.295	Open Manhole	1200	S3.001	88.805	225	S3.000	88.805	225	
								S4.000	88.805	225	
SS5.0	89.700	2.203	Open Manhole	1200	S1.005	87.497	225	S1.004	88.497	225	1000
								S3.001	88.752	225	1255
SS5.1	88.850	1.633	Open Manhole	1200	S1.006	87.217	225	S1.005	87.217	225	
SS5.2	88.750	1.567	Open Manhole	1200	S1.007	87.183	225	S1.006	87.183	225	
SS5.3	88.500	1.721	Open Manhole	1200	S1.008	86.779	225	S1.007	86.779	225	
S	88.500	1.835	Open Manhole	0		OUTFALL		S1.008	86.665	225	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	225	SS1.0	91.000	89.320	1.455	Open Manhole	1200
S1.001	o	225	SS1.1	90.100	89.188	0.687	Open Manhole	1200
S1.002	o	225	SS1.2	89.800	89.006	0.569	Open Manhole	1200
S2.000	o	225	SS2.0	90.125	89.000	0.900	Open Manhole	1200
S2.001	o	225	SS2.1	90.000	88.741	1.034	Open Manhole	1200
S1.003	o	225	SS1.3	90.000	88.595	1.180	Open Manhole	1200
S1.004	o	225	SS1.4	90.000	88.567	1.208	Open Manhole	1200
S3.000	o	225	SS4.0	91.000	89.255	1.520	Open Manhole	1200
S4.000	o	225	SS3.0	90.125	89.000	0.900	Open Manhole	1200
S3.001	o	225	SS4.1	90.100	88.805	1.070	Open Manhole	1200
S1.005	o	225	SS5.0	89.700	87.497	1.978	Open Manhole	1200
S1.006	o	225	SS5.1	88.850	87.217	1.408	Open Manhole	1200
S1.007	o	225	SS5.2	88.750	87.183	1.342	Open Manhole	1200
S1.008	o	225	SS5.3	88.500	86.779	1.496	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	26.312	200.0	SS1.1	90.100	89.188	0.687	Open Manhole	1200
S1.001	36.476	200.0	SS1.2	89.800	89.006	0.569	Open Manhole	1200
S1.002	42.438	110.0	SS1.3	90.000	88.620	1.155	Open Manhole	1200
S2.000	51.705	200.0	SS2.1	90.000	88.741	1.034	Open Manhole	1200
S2.001	29.327	200.0	SS1.3	90.000	88.595	1.180	Open Manhole	1200
S1.003	5.523	200.0	SS1.4	90.000	88.567	1.208	Open Manhole	1200
S1.004	14.000	200.0	SS5.0	89.700	88.497	0.978	Open Manhole	1200
S3.000	90.000	200.0	SS4.1	90.100	88.805	1.070	Open Manhole	1200
S4.000	27.113	139.0	SS4.1	90.100	88.805	1.070	Open Manhole	1200
S3.001	10.660	201.1	SS5.0	89.700	88.752	0.723	Open Manhole	1200
S1.005	56.000	200.0	SS5.1	88.850	87.217	1.408	Open Manhole	1200
S1.006	6.824	200.7	SS5.2	88.750	87.183	1.342	Open Manhole	1200
S1.007	80.753	199.9	SS5.3	88.500	86.779	1.496	Open Manhole	1200
S1.008	22.822	200.2	S	88.500	86.665	1.610	Open Manhole	0

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.133	0.133	0.133
1.001	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.097	0.097	0.097
2.000	-	-	100	0.120	0.120	0.120
2.001	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.030	0.030	0.030
1.004	-	-	100	0.030	0.030	0.030
3.000	-	-	100	0.099	0.099	0.099
4.000	-	-	100	0.123	0.123	0.123
3.001	-	-	100	0.060	0.060	0.060
1.005	-	-	100	0.000	0.000	0.000
1.006	-	-	100	0.000	0.000	0.000
1.007	-	-	100	0.000	0.000	0.000
1.008	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.692	0.692	0.692

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.008	S	88.500	86.665	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	8
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	14.000	Storm Duration (mins)	30
Ratio R	0.300		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: SS5.0, DS/PN: S1.005, Volume (m³): 3.4

HYDROBRAKE DESIGN PARAMETERS

Unit Reference	MD-SHE-0072-2500-1200-2500
Design Head (m)	1.200
Design Flow (l/s)	2.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	72
Invert Level (m)	87.497
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	**Head (m)**	**Flow (l/s)**
Design Point (Calculated)	1.200	2.5
Flush-Flo™	0.318	2.3
Kick-Flo®	0.644	1.9
Mean Flow over Head Range	-	2.1

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**
0.100	1.9	1.200	2.5	3.000	3.8	7.000	5.7
0.200	2.2	1.400	2.7	3.500	4.1	7.500	5.9
0.300	2.3	1.600	2.8	4.000	4.4	8.000	6.0
0.400	2.3	1.800	3.0	4.500	4.6	8.500	6.2
0.500	2.2	2.000	3.2	5.000	4.8	9.000	6.4
0.600	2.0	2.200	3.3	5.500	5.1	9.500	6.5
0.800	2.1	2.400	3.4	6.000	5.3		
1.000	2.3	2.600	3.6	6.500	5.5		

Storage Structures for Storm

Cellular Storage Manhole: SS5.0, DS/PN: S1.005

Invert Level (m) 87.497 Safety Factor 1.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m^2)	Inf. Area (m^2)	Depth (m)	Area (m^2)	Inf. Area (m^2)
0.000	260.0	0.0	1.001	0.0	0.0
1.000	260.0	0.0			

AQUACELL ATTENUATION TANK -
1m dp X 260m^2

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 1 Number of Time/Area Diagrams 8
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.300
Region Scotland and Ireland Cv (Summer) 0.750
M5-60 (mm) 14.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 100.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 20, 20, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	SS1.0	240 Winter	1	+20%				
S1.001	SS1.1	240 Winter	1	+20%				
S1.002	SS1.2	240 Winter	1	+20%	100/1440 Winter			
S2.000	SS2.0	240 Winter	1	+20%	100/1440 Winter			
S2.001	SS2.1	240 Winter	1	+20%	100/720 Winter			
S1.003	SS1.3	240 Winter	1	+20%	100/30 Winter			
S1.004	SS1.4	240 Winter	1	+20%	100/60 Winter			
S3.000	SS4.0	240 Winter	1	+20%				
S4.000	SS3.0	240 Winter	1	+20%	100/1440 Winter			
S3.001	SS4.1	240 Winter	1	+20%	100/960 Winter			
S1.005	SS5.0	1440 Winter	1	+20%	30/60 Winter	100/960 Winter		
S1.006	SS5.1	1440 Winter	1	+20%				
S1.007	SS5.2	1440 Winter	1	+20%				
S1.008	SS5.3	1440 Winter	1	+20%				

RESULTS FOR 1-in-1 YEAR STORM
+20% CLIMATE CHANGE ALLOWANCE

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	SS1.0	89.362	-0.183	0.000	0.08		2.6	OK	
S1.001	SS1.1	89.228	-0.185	0.000	0.07		2.4	OK	
S1.002	SS1.2	89.052	-0.179	0.000	0.09		4.3	OK	
S2.000	SS2.0	89.038	-0.187	0.000	0.06		2.3	OK	
S2.001	SS2.1	88.779	-0.187	0.000	0.07		2.2	OK	
S1.003	SS1.3	88.674	-0.146	0.000	0.26		7.1	OK	
S1.004	SS1.4	88.642	-0.150	0.000	0.24		7.6	OK	
S3.000	SS4.0	89.286	-0.194	0.000	0.04		1.4	OK	
S4.000	SS3.0	89.036	-0.189	0.000	0.06		2.4	OK	
S3.001	SS4.1	88.865	-0.165	0.000	0.16		4.8	OK	
S1.005	SS5.0	87.699	-0.023	0.000	0.06		2.2	OK	2
S1.006	SS5.1	87.259	-0.183	0.000	0.08		2.2	OK	
S1.007	SS5.2	87.219	-0.189	0.000	0.06		2.2	OK	
S1.008	SS5.3	86.817	-0.187	0.000	0.07		2.2	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 1 Number of Time/Area Diagrams 8
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.300
Region Scotland and Ireland Cv (Summer) 0.750
M5-60 (mm) 14.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 100.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 20, 20, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow
S1.000	SS1.0	60 Winter	30	+20%			
S1.001	SS1.1	60 Winter	30	+20%			
S1.002	SS1.2	60 Winter	30	+20%	100/1440 Winter		
S2.000	SS2.0	60 Winter	30	+20%	100/1440 Winter		
S2.001	SS2.1	60 Winter	30	+20%	100/720 Winter		
S1.003	SS1.3	120 Winter	30	+20%	100/30 Winter		
S1.004	SS1.4	120 Winter	30	+20%	100/60 Winter		
S3.000	SS4.0	60 Winter	30	+20%			
S4.000	SS3.0	60 Winter	30	+20%	100/1440 Winter		
S3.001	SS4.1	120 Winter	30	+20%	100/960 Winter		
S1.005	SS5.0	1440 Winter	30	+20%	30/60 Winter	100/960 Winter	
S1.006	SS5.1	2880 Winter	30	+20%			
S1.007	SS5.2	10080 Summer	30	+20%			
S1.008	SS5.3	10080 Summer	30	+20%			

RESULTS FOR 1-in-30 YEAR STORM
+20% CLIMATE CHANGE ALLOWANCE

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	SS1.0		89.402	-0.143	0.000	0.27		9.3	OK	
S1.001	SS1.1		89.269	-0.145	0.000	0.26		9.1	OK	
S1.002	SS1.2		89.096	-0.135	0.000	0.33		15.5	OK	
S2.000	SS2.0		89.076	-0.149	0.000	0.24		8.4	OK	
S2.001	SS2.1		88.817	-0.150	0.000	0.24		8.2	OK	
S1.003	SS1.3		88.767	-0.053	0.000	0.94		25.7	OK	
S1.004	SS1.4		88.729	-0.063	0.000	0.86		27.6	OK	
S3.000	SS4.0		89.315	-0.165	0.000	0.14		5.1	OK	
S4.000	SS3.0		89.071	-0.154	0.000	0.21		8.6	OK	
S3.001	SS4.1		88.927	-0.103	0.000	0.57		17.6	OK	
S1.005	SS5.0		88.283	0.561	0.000	0.07		2.3	SURCHARGED	2
S1.006	SS5.1		87.260	-0.182	0.000	0.08		2.3	OK	
S1.007	SS5.2		87.220	-0.188	0.000	0.06		2.3	OK	
S1.008	SS5.3		86.817	-0.187	0.000	0.07		2.3	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	8
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.300
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	14.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	100.0	DVD Status	ON
Analysis Timestep	Fine	Inertia Status	ON
DTS Status	OFF		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	20, 20, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	SS1.0	60 Winter	100	+20%				
S1.001	SS1.1	1440 Winter	100	+20%				
S1.002	SS1.2	1440 Winter	100	+20%	100/1440 Winter			
S2.000	SS2.0	1440 Winter	100	+20%	100/1440 Winter			
S2.001	SS2.1	2160 Winter	100	+20%	100/720 Winter			
S1.003	SS1.3	2160 Winter	100	+20%	100/30 Winter			
S1.004	SS1.4	2160 Winter	100	+20%	100/60 Winter			
S3.000	SS4.0	1440 Winter	100	+20%				
S4.000	SS3.0	1440 Winter	100	+20%	100/1440 Winter			
S3.001	SS4.1	2160 Winter	100	+20%	100/960 Winter			
S1.005	SS5.0	2160 Winter	100	+20%	30/60 Winter	100/960 Winter		
S1.006	SS5.1	1440 Winter	100	+20%				
S1.007	SS5.2	1440 Winter	100	+20%				
S1.008	SS5.3	1440 Winter	100	+20%				

RESULTS FOR 1-in-100 YEAR STORM
+20% CLIMATE CHANGE ALLOWANCE

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	SS1.0	89.421	-0.124	0.000	0.41		13.8	OK	
S1.001	SS1.1	89.376	-0.037	0.000	0.08		2.7	OK	
S1.002	SS1.2	89.348	0.117	0.000	0.10		4.7	SURCHARGED	
S2.000	SS2.0	89.323	0.098	0.000	0.07		2.4	SURCHARGED	
S2.001	SS2.1	89.583	0.617	0.000	0.05		1.8	SURCHARGED	
S1.003	SS1.3	89.707	0.887	0.000	0.21		5.7	SURCHARGED	
S1.004	SS1.4	89.697	0.905	0.000	0.19		6.2	SURCHARGED	
S3.000	SS4.0	89.364	-0.116	0.000	0.04		1.6	OK	
S4.000	SS3.0	89.368	0.143	0.000	0.06		2.5	SURCHARGED	
S3.001	SS4.1	89.511	0.481	0.000	0.13		4.0	SURCHARGED	
S1.005	SS5.0	89.700	1.978	1.639	0.09		3.0	FLOOD	2
S1.006	SS5.1	87.266	-0.176	0.000	0.11		3.1	OK	
S1.007	SS5.2	87.227	-0.181	0.000	0.09		3.1	OK	
S1.008	SS5.3	86.825	-0.179	0.000	0.09		3.1	OK	

HYDROBRAKE MANHOLE IS LISTED AS FLOODING IN STORMS OF DURATION GREATER THAN 960min - HOWEVER FLOOD DEPTH = 0.00mm -AS SUCH UNLIKELY TO OCCUR IN PRACTICE. ANY OVERFLOW WHICH MAY OCCUR WILL BE CAPTURED ON SITE IN RETENTION BASIN

NORTH EAST CATHCMENT SIMULATION

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	14.000	Add Flow / Climate Change (%)	0
Ratio R	0.300	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.416	4-8	0.421

Total Area Contributing (ha) = 0.837

Total Pipe Volume (m³) = 12.624

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	15.871	0.063	250.0	0.070	4.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	25.105	0.185	135.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	19.747	0.079	250.0	0.106	4.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	4.32	87.775	0.070	0.0	0.0	0.0	0.82	32.7	9.5
S1.001	50.00	4.69	87.712	0.070	0.0	0.0	0.0	1.12	44.6	9.5
S2.000	50.00	4.40	87.625	0.106	0.0	0.0	0.0	0.82	32.7	14.4

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.002	25.568	0.102	250.0	0.044	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	24.233	0.097	250.0	0.058	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.000	34.941	0.175	200.0	0.159	4.00	0.0	0.600	o	225	Pipe/Conduit	
S3.001	29.067	0.145	200.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.002	30.147	0.134	225.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.000	22.744	0.114	199.5	0.202	4.00	0.0	0.600	o	225	Pipe/Conduit	
S1.004	18.125	0.073	250.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.005	13.959	0.056	250.0	0.100	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.006	7.633	0.031	246.2	0.065	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.007	15.533	0.062	250.5	0.033	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.008	12.535	0.050	250.7	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.002	50.00	5.21	87.526	0.220	0.0	0.0	0.0	0.82	32.7	29.8
S1.003	50.00	5.70	87.424	0.278	0.0	0.0	0.0	0.82	32.7«	37.6
S3.000	50.00	4.63	87.775	0.159	0.0	0.0	0.0	0.92	36.6	21.5
S3.001	50.00	5.16	87.600	0.159	0.0	0.0	0.0	0.92	36.6	21.5
S3.002	50.00	5.74	87.455	0.159	0.0	0.0	0.0	0.87	34.5	21.5
S4.000	50.00	4.41	87.875	0.202	0.0	0.0	0.0	0.92	36.7	27.4
S1.004	50.00	6.10	87.327	0.639	0.0	0.0	0.0	0.82	32.7«	86.5
S1.005	50.00	6.39	87.255	0.739	0.0	0.0	0.0	0.82	32.7«	100.1
S1.006	50.00	6.54	87.199	0.804	0.0	0.0	0.0	0.83	33.0«	108.9
S1.007	50.00	6.86	86.768	0.837	0.0	0.0	0.0	0.82	32.7«	113.3
S1.008	50.00	7.04	86.706	0.837	0.0	0.0	0.0	1.14	125.9	113.3

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
SS6.0	88.500	0.725	Open Manhole	1200	S1.000	87.775	225				
SS6.1	89.000	1.288	Open Manhole	1200	S1.001	87.712	225	S1.000	87.712	225	
SS7.0	88.750	1.125	Open Manhole	1200	S2.000	87.625	225				
SS6.2	88.600	1.074	Open Manhole	1200	S1.002	87.526	225	S1.001	87.526	225	
								S2.000	87.546	225	20
SS6.3	88.750	1.326	Open Manhole	1200	S1.003	87.424	225	S1.002	87.424	225	
SS8.0	88.500	0.725	Open Manhole	1200	S3.000	87.775	225				
SS8.1	88.800	1.200	Open Manhole	1200	S3.001	87.600	225	S3.000	87.600	225	
SS8.2	89.000	1.545	Open Manhole	1200	S3.002	87.455	225	S3.001	87.455	225	
SS9.0	89.000	1.125	Open Manhole	1200	S4.000	87.875	225				
SS6.4	88.750	1.429	Open Manhole	1200	S1.004	87.327	225	S1.003	87.327	225	
								S3.002	87.321	225	
								S4.000	87.761	225	434
SS6.5	88.750	1.496	Open Manhole	1200	S1.005	87.255	225	S1.004	87.255	225	
SS6.6	88.750	1.551	Open Manhole	1200	S1.006	87.199	225	S1.005	87.199	225	
SS6.7	88.750	1.982	Open Manhole	1200	S1.007	86.768	225	S1.006	87.168	225	400
SS5.4	88.750	2.044	Open Manhole	1350	S1.008	86.706	375	S1.007	86.706	225	
S	88.000	1.344	Open Manhole	0		OUTFALL		S1.008	86.656	375	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	225	SS6.0	88.500	87.775	0.500	Open Manhole	1200
S1.001	o	225	SS6.1	89.000	87.712	1.063	Open Manhole	1200
S2.000	o	225	SS7.0	88.750	87.625	0.900	Open Manhole	1200
S1.002	o	225	SS6.2	88.600	87.526	0.849	Open Manhole	1200
S1.003	o	225	SS6.3	88.750	87.424	1.101	Open Manhole	1200
S3.000	o	225	SS8.0	88.500	87.775	0.500	Open Manhole	1200
S3.001	o	225	SS8.1	88.800	87.600	0.975	Open Manhole	1200
S3.002	o	225	SS8.2	89.000	87.455	1.320	Open Manhole	1200
S4.000	o	225	SS9.0	89.000	87.875	0.900	Open Manhole	1200
S1.004	o	225	SS6.4	88.750	87.327	1.198	Open Manhole	1200
S1.005	o	225	SS6.5	88.750	87.255	1.270	Open Manhole	1200
S1.006	o	225	SS6.6	88.750	87.199	1.326	Open Manhole	1200
S1.007	o	225	SS6.7	88.750	86.768	1.757	Open Manhole	1200
S1.008	o	375	SS5.4	88.750	86.706	1.669	Open Manhole	1350

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	15.871	250.0	SS6.1	89.000	87.712	1.063	Open Manhole	1200
S1.001	25.105	135.5	SS6.2	88.600	87.526	0.849	Open Manhole	1200
S2.000	19.747	250.0	SS6.2	88.600	87.546	0.829	Open Manhole	1200
S1.002	25.568	250.0	SS6.3	88.750	87.424	1.101	Open Manhole	1200
S1.003	24.233	250.0	SS6.4	88.750	87.327	1.198	Open Manhole	1200
S3.000	34.941	200.0	SS8.1	88.800	87.600	0.975	Open Manhole	1200
S3.001	29.067	200.0	SS8.2	89.000	87.455	1.320	Open Manhole	1200
S3.002	30.147	225.0	SS6.4	88.750	87.321	1.204	Open Manhole	1200
S4.000	22.744	199.5	SS6.4	88.750	87.761	0.764	Open Manhole	1200
S1.004	18.125	250.0	SS6.5	88.750	87.255	1.271	Open Manhole	1200
S1.005	13.959	250.0	SS6.6	88.750	87.199	1.326	Open Manhole	1200
S1.006	7.633	246.2	SS6.7	88.750	87.168	1.357	Open Manhole	1200
S1.007	15.533	250.5	SS5.4	88.750	86.706	1.819	Open Manhole	1350
S1.008	12.535	250.7	S	88.000	86.656	0.969	Open Manhole	0

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.070	0.070	0.070
1.001	-	-	100	0.000	0.000	0.000
2.000	-	-	100	0.106	0.106	0.106
1.002	-	-	100	0.044	0.044	0.044
1.003	-	-	100	0.058	0.058	0.058
3.000	-	-	100	0.159	0.159	0.159
3.001	-	-	100	0.000	0.000	0.000
3.002	-	-	100	0.000	0.000	0.000
4.000	-	-	100	0.202	0.202	0.202
1.004	-	-	100	0.000	0.000	0.000
1.005	-	-	100	0.100	0.100	0.100
1.006	-	-	100	0.065	0.065	0.065
1.007	-	-	100	0.033	0.033	0.033
1.008	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.837	0.837	0.837

Network Classifications for Storm

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
S1.000	SS6.0	225	0.500	1.063	Unclassified	1200	0	0.500	Unclassified
S1.001	SS6.1	225	0.849	1.063	Unclassified	1200	0	1.063	Unclassified
S2.000	SS7.0	225	0.829	0.900	Unclassified	1200	0	0.900	Unclassified
S1.002	SS6.2	225	0.849	1.101	Unclassified	1200	0	0.849	Unclassified
S1.003	SS6.3	225	1.101	1.198	Unclassified	1200	0	1.101	Unclassified
S3.000	SS8.0	225	0.500	0.975	Unclassified	1200	0	0.500	Unclassified
S3.001	SS8.1	225	0.975	1.320	Unclassified	1200	0	0.975	Unclassified
S3.002	SS8.2	225	1.204	1.320	Unclassified	1200	0	1.320	Unclassified
S4.000	SS9.0	225	0.764	0.900	Unclassified	1200	0	0.900	Unclassified
S1.004	SS6.4	225	1.198	1.271	Unclassified	1200	0	1.198	Unclassified
S1.005	SS6.5	225	1.270	1.326	Unclassified	1200	0	1.270	Unclassified
S1.006	SS6.6	225	1.326	1.357	Unclassified	1200	0	1.326	Unclassified
S1.007	SS6.7	225	1.757	1.819	Unclassified	1200	0	1.757	Unclassified
S1.008	SS5.4	375	0.969	1.669	Unclassified	1350	0	1.669	Unclassified

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.008	S	88.000	86.656	86.700	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	7
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	14.000	Storm Duration (mins)	30
Ratio R	0.300		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: SS6.7, DS/PN: S1.007, Volume (m³): 2.5

HYDROBRAKE OUTFLOW LIMITED TO 2.5L/S

Unit Reference	MD-SHE-0075-2500-1000-2500
Design Head (m)	1.000
Design Flow (l/s)	2.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	75
Invert Level (m)	86.768
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	**Head (m)**	**Flow (l/s)**
Design Point (Calculated)	1.000	2.5
Flush-Flo™	0.307	2.5
Kick-Flo®	0.627	2.0
Mean Flow over Head Range	-	2.2

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**
0.100	2.1	1.200	2.7	3.000	4.1	7.000	6.2
0.200	2.4	1.400	2.9	3.500	4.5	7.500	6.4
0.300	2.5	1.600	3.1	4.000	4.7	8.000	6.6
0.400	2.5	1.800	3.3	4.500	5.0	8.500	6.8
0.500	2.4	2.000	3.4	5.000	5.3	9.000	7.0
0.600	2.1	2.200	3.6	5.500	5.5	9.500	7.1
0.800	2.3	2.400	3.7	6.000	5.7		
1.000	2.5	2.600	3.9	6.500	6.0		

Storage Structures for Storm

Tank or Pond Manhole: SS6.7, DS/PN: S1.007

Invert Level (m) 86.768

AQUACELL TANK
0.4m X 400m²

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	400.0	0.400	400.0	0.401	0.0

Time Area Diagram for Green Roof at Pipe Number S1.000 (Storm)

Area (m³) 390 Evaporation (mm/day) 3
Depression Storage (mm) 10 Decay Coefficient 0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.007087	32	36	0.001431	64	68	0.000289	96	100	0.000058
4	8	0.005802	36	40	0.001171	68	72	0.000237	100	104	0.000048
8	12	0.004751	40	44	0.000959	72	76	0.000194	104	108	0.000039
12	16	0.003889	44	48	0.000785	76	80	0.000159	108	112	0.000032
16	20	0.003184	48	52	0.000643	80	84	0.000130	112	116	0.000026
20	24	0.002607	52	56	0.000526	84	88	0.000106	116	120	0.000021
24	28	0.002135	56	60	0.000431	88	92	0.000087			
28	32	0.001748	60	64	0.000353	92	96	0.000071			

Time Area Diagram for Green Roof at Pipe Number S2.000 (Storm)

Area (m³) 1060 Evaporation (mm/day) 3
Depression Storage (mm) 10 Decay Coefficient 0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.019262	32	36	0.003889	64	68	0.000785	96	100	0.000159
4	8	0.015771	36	40	0.003184	68	72	0.000643	100	104	0.000130
8	12	0.012912	40	44	0.002607	72	76	0.000526	104	108	0.000106
12	16	0.010571	44	48	0.002134	76	80	0.000431	108	112	0.000087
16	20	0.008655	48	52	0.001747	80	84	0.000353	112	116	0.000071
20	24	0.007086	52	56	0.001431	84	88	0.000289	116	120	0.000058
24	28	0.005802	56	60	0.001171	88	92	0.000236			
28	32	0.004750	60	64	0.000959	92	96	0.000194			

Time Area Diagram for Green Roof at Pipe Number S3.000 (Storm)

Area (m³) 542 Evaporation (mm/day) 3
Depression Storage (mm) 10 Decay Coefficient 0.050

Time Area Diagram for Green Roof at Pipe Number S3.000 (Storm)

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.009849	32	36	0.001989	64	68	0.000401	96	100	0.000081
4	8	0.008064	36	40	0.001628	68	72	0.000329	100	104	0.000066
8	12	0.006602	40	44	0.001333	72	76	0.000269	104	108	0.000054
12	16	0.005405	44	48	0.001091	76	80	0.000220	108	112	0.000044
16	20	0.004426	48	52	0.000893	80	84	0.000180	112	116	0.000036
20	24	0.003623	52	56	0.000732	84	88	0.000148	116	120	0.000030
24	28	0.002967	56	60	0.000599	88	92	0.000121			
28	32	0.002429	60	64	0.000490	92	96	0.000099			

Time Area Diagram for Green Roof at Pipe Number S4.000 (Storm)

Area (m³) 2017 Evaporation (mm/day) 3
Depression Storage (mm) 10 Decay Coefficient 0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.036653	32	36	0.007400	64	68	0.001494	96	100	0.000302
4	8	0.030009	36	40	0.006059	68	72	0.001223	100	104	0.000247
8	12	0.024569	40	44	0.004960	72	76	0.001001	104	108	0.000202
12	16	0.020116	44	48	0.004061	76	80	0.000820	108	112	0.000166
16	20	0.016469	48	52	0.003325	80	84	0.000671	112	116	0.000136
20	24	0.013484	52	56	0.002722	84	88	0.000550	116	120	0.000111
24	28	0.011040	56	60	0.002229	88	92	0.000450			
28	32	0.009038	60	64	0.001825	92	96	0.000368			

Time Area Diagram for Green Roof at Pipe Number S1.005 (Storm)

Area (m³) 1000 Evaporation (mm/day) 3
Depression Storage (mm) 10 Decay Coefficient 0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.018172	32	36	0.003669	64	68	0.000741	96	100	0.000150
4	8	0.014878	36	40	0.003004	68	72	0.000606	100	104	0.000122
8	12	0.012181	40	44	0.002459	72	76	0.000497	104	108	0.000100
12	16	0.009973	44	48	0.002014	76	80	0.000407	108	112	0.000082
16	20	0.008165	48	52	0.001649	80	84	0.000333	112	116	0.000067
20	24	0.006685	52	56	0.001350	84	88	0.000272	116	120	0.000055
24	28	0.005473	56	60	0.001105	88	92	0.000223			
28	32	0.004481	60	64	0.000905	92	96	0.000183			

Time Area Diagram for Green Roof at Pipe Number S1.006 (Storm)

Area (m³) 570 Evaporation (mm/day) 3
Depression Storage (mm) 10 Decay Coefficient 0.050

Time Area Diagram for Green Roof at Pipe Number S1.006 (Storm)

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.010358	32	36	0.002091	64	68	0.000422	96	100	0.000085
4	8	0.008480	36	40	0.001712	68	72	0.000346	100	104	0.000070
8	12	0.006943	40	44	0.001402	72	76	0.000283	104	108	0.000057
12	16	0.005685	44	48	0.001148	76	80	0.000232	108	112	0.000047
16	20	0.004654	48	52	0.000940	80	84	0.000190	112	116	0.000038
20	24	0.003811	52	56	0.000769	84	88	0.000155	116	120	0.000031
24	28	0.003120	56	60	0.000630	88	92	0.000127			
28	32	0.002554	60	64	0.000516	92	96	0.000104			

Time Area Diagram for Green Roof at Pipe Number S1.007 (Storm)

Area (m^3) 330 Evaporation (mm/day) 3
Depression Storage (mm) 10 Decay Coefficient 0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.005997	32	36	0.001211	64	68	0.000244	96	100	0.000049
4	8	0.004910	36	40	0.000991	68	72	0.000200	100	104	0.000040
8	12	0.004020	40	44	0.000812	72	76	0.000164	104	108	0.000033
12	16	0.003291	44	48	0.000664	76	80	0.000134	108	112	0.000027
16	20	0.002695	48	52	0.000544	80	84	0.000110	112	116	0.000022
20	24	0.002206	52	56	0.000445	84	88	0.000090	116	120	0.000018
24	28	0.001806	56	60	0.000365	88	92	0.000074			
28	32	0.001479	60	64	0.000299	92	96	0.000060			

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	7
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.300
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	14.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	100.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	20, 20, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	SS6.0	240 Winter	1	+20%	30/600 Winter	100/240 Winter		
S1.001	SS6.1	240 Winter	1	+20%	30/600 Winter			
S2.000	SS7.0	240 Winter	1	+20%	30/480 Winter			
S1.002	SS6.2	15 Winter	1	+20%	30/480 Winter			
S1.003	SS6.3	15 Winter	1	+20%	30/120 Winter			
S3.000	SS8.0	240 Winter	1	+20%	30/600 Winter	100/240 Winter		
S3.001	SS8.1	240 Winter	1	+20%	30/480 Winter			
S3.002	SS8.2	240 Winter	1	+20%	30/480 Winter			
S4.000	SS9.0	240 Winter	1	+20%	30/720 Winter			
S1.004	SS6.4	15 Winter	1	+20%	30/60 Winter			
S1.005	SS6.5	240 Winter	1	+20%	30/60 Summer			
S1.006	SS6.6	240 Winter	1	+20%	30/60 Winter			
S1.007	SS6.7	1440 Winter	1	+20%	30/120 Summer			
S1.008	SS5.4	1440 Winter	1	+20%				

RESULTS FOR 1-in-1 YEAR STORM
+20% CLIMATE CHANGE ALLOWANCE

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	SS6.0	87.799	-0.201	0.000	0.03		0.8	OK	18
S1.001	SS6.1	87.730	-0.206	0.000	0.02		0.7	OK	
S2.000	SS7.0	87.664	-0.186	0.000	0.07		2.0	OK	
S1.002	SS6.2	87.583	-0.168	0.000	0.14		4.3	OK	
S1.003	SS6.3	87.513	-0.136	0.000	0.32		9.8	OK	
S3.000	SS8.0	87.801	-0.199	0.000	0.03		1.0	OK	18
S3.001	SS8.1	87.626	-0.199	0.000	0.03		1.0	OK	
S3.002	SS8.2	87.481	-0.199	0.000	0.03		1.0	OK	
S4.000	SS9.0	87.926	-0.174	0.000	0.12		3.9	OK	
S1.004	SS6.4	87.416	-0.136	0.000	0.33		9.7	OK	
S1.005	SS6.5	87.350	-0.130	0.000	0.37		10.6	OK	
S1.006	SS6.6	87.304	-0.120	0.000	0.44		11.6	OK	
S1.007	SS6.7	86.922	-0.071	0.000	0.08		2.3	OK	
S1.008	SS5.4	86.745	-0.336	0.000	0.02		2.3	OK	

NETWORK DOES NOT FLOOD OR SURCHARGE

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 1 Number of Time/Area Diagrams 7
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.300
Region Scotland and Ireland Cv (Summer) 0.750
M5-60 (mm) 14.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 100.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 20, 20, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	SS6.0	1440 Winter	30	+20%	30/600 Winter	100/240 Winter		
S1.001	SS6.1	1440 Winter	30	+20%	30/600 Winter			
S2.000	SS7.0	1440 Winter	30	+20%	30/480 Winter			
S1.002	SS6.2	1440 Winter	30	+20%	30/480 Winter			
S1.003	SS6.3	1440 Winter	30	+20%	30/120 Winter			
S3.000	SS8.0	1440 Winter	30	+20%	30/600 Winter	100/240 Winter		
S3.001	SS8.1	1440 Winter	30	+20%	30/480 Winter			
S3.002	SS8.2	1440 Winter	30	+20%	30/480 Winter			
S4.000	SS9.0	1440 Winter	30	+20%	30/720 Winter			
S1.004	SS6.4	1440 Winter	30	+20%	30/60 Winter			
S1.005	SS6.5	1440 Winter	30	+20%	30/60 Summer			
S1.006	SS6.6	1440 Winter	30	+20%	30/60 Winter			
S1.007	SS6.7	1440 Winter	30	+20%	30/120 Summer			
S1.008	SS5.4	1440 Winter	30	+20%				

RESULTS FOR 1-in-30 YEAR STORM
+20% CLIMATE CHANGE ALLOWANCE

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	SS6.0	88.423	0.423	0.000	0.02		0.6	FLOOD RISK	18
S1.001	SS6.1	88.422	0.486	0.000	0.02		0.6	SURCHARGED	
S2.000	SS7.0	88.423	0.573	0.000	0.06		1.7	SURCHARGED	
S1.002	SS6.2	88.422	0.671	0.000	0.10		3.1	SURCHARGED	
S1.003	SS6.3	88.420	0.771	0.000	0.13		4.0	SURCHARGED	
S3.000	SS8.0	88.419	0.419	0.000	0.03		0.9	FLOOD RISK	18
S3.001	SS8.1	88.419	0.594	0.000	0.03		0.9	SURCHARGED	
S3.002	SS8.2	88.418	0.738	0.000	0.03		0.9	SURCHARGED	
S4.000	SS9.0	88.420	0.320	0.000	0.10		3.3	SURCHARGED	
S1.004	SS6.4	88.418	0.866	0.000	0.28		8.2	SURCHARGED	
S1.005	SS6.5	88.413	0.933	0.000	0.34		9.8	SURCHARGED	
S1.006	SS6.6	88.409	0.985	0.000	0.41		10.7	SURCHARGED	
S1.007	SS6.7	88.405	1.412	0.000	0.11		3.1	SURCHARGED	
S1.008	SS5.4	86.750	-0.331	0.000	0.03		3.1	OK	

NETWORK DOES NOT FLOOD, SURCHARGING IS PERMISSIBLE IN THIS STORM SIMULATION

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 1 Number of Time/Area Diagrams 7
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.300
Region Scotland and Ireland Cv (Summer) 0.750
M5-60 (mm) 14.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 100.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 20, 20, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	SS6.0	1440 Winter	100	+20%	30/600 Winter	100/240 Winter		
S1.001	SS6.1	1440 Winter	100	+20%	30/600 Winter			
S2.000	SS7.0	600 Winter	100	+20%	30/480 Winter			
S1.002	SS6.2	600 Winter	100	+20%	30/480 Winter			
S1.003	SS6.3	600 Winter	100	+20%	30/120 Winter			
S3.000	SS8.0	1440 Winter	100	+20%	30/600 Winter	100/240 Winter		
S3.001	SS8.1	1440 Winter	100	+20%	30/480 Winter			
S3.002	SS8.2	480 Winter	100	+20%	30/480 Winter			
S4.000	SS9.0	480 Winter	100	+20%	30/720 Winter			
S1.004	SS6.4	480 Winter	100	+20%	30/60 Winter			
S1.005	SS6.5	480 Winter	100	+20%	30/60 Summer			
S1.006	SS6.6	480 Winter	100	+20%	30/60 Winter			
S1.007	SS6.7	480 Winter	100	+20%	30/120 Summer			
S1.008	SS5.4	480 Winter	100	+20%				

RESULTS FOR 1-in-100 YEAR STORM
+20% CLIMATE CHANGE ALLOWANCE

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

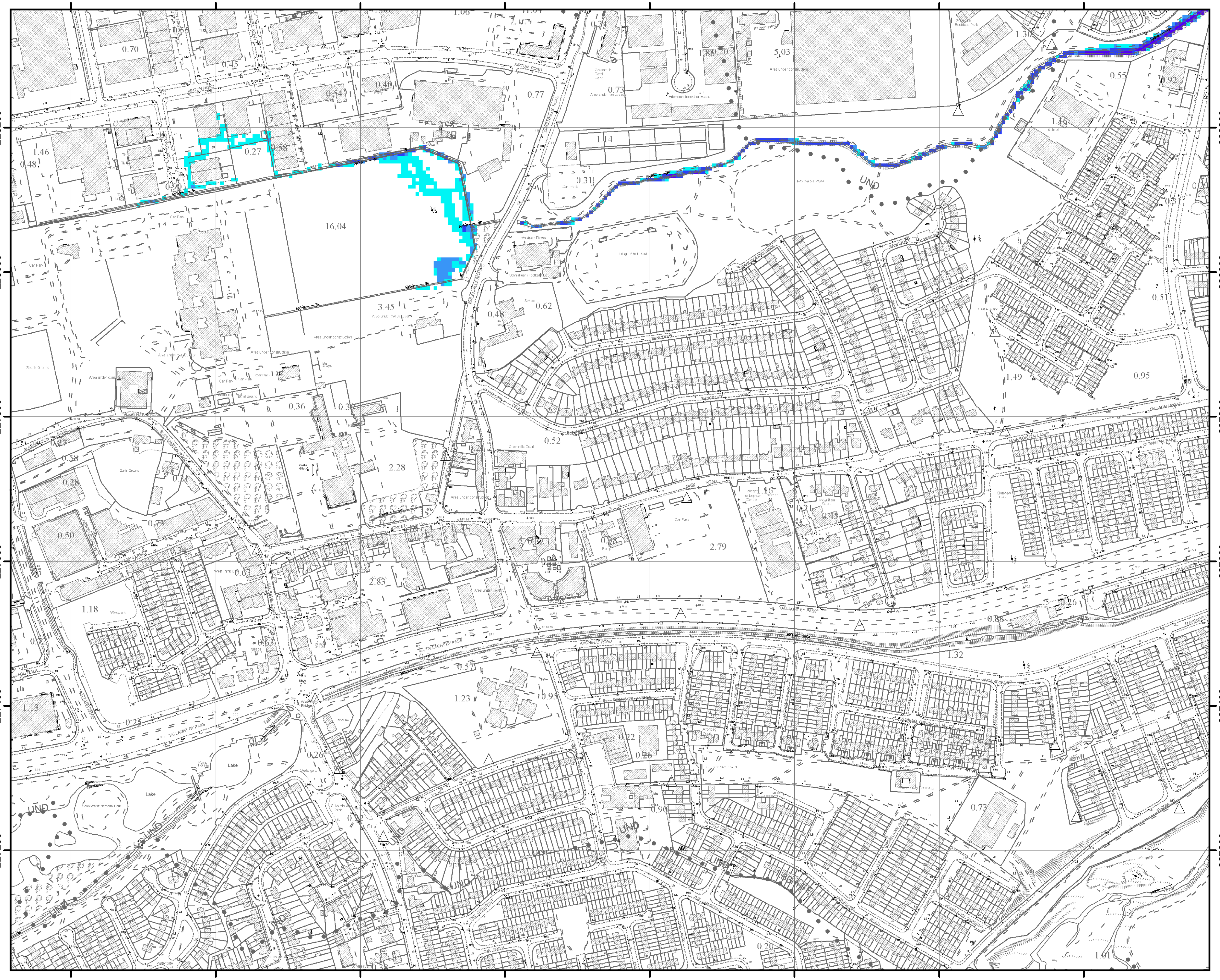
PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	SS6.0	88.537	0.537	37.266	0.10		2.9	FLOOD	18
S1.001	SS6.1	88.538	0.601	0.000	0.07		2.9	SURCHARGED	
S2.000	SS7.0	88.559	0.709	0.000	0.13		4.0	SURCHARGED	
S1.002	SS6.2	88.553	0.802	0.000	0.24		7.1	FLOOD RISK	
S1.003	SS6.3	88.566	0.917	0.000	0.31		9.4	SURCHARGED	
S3.000	SS8.0	88.532	0.532	32.340	0.05		1.6	FLOOD	18
S3.001	SS8.1	88.533	0.707	0.000	0.05		1.6	SURCHARGED	
S3.002	SS8.2	88.549	0.870	0.000	0.07		2.4	SURCHARGED	
S4.000	SS9.0	88.586	0.486	0.000	0.26		8.8	SURCHARGED	
S1.004	SS6.4	88.574	1.022	0.000	0.75		21.9	SURCHARGED	
S1.005	SS6.5	88.581	1.101	0.000	0.92		26.2	SURCHARGED	
S1.006	SS6.6	88.579	1.155	0.000	1.09		28.7	SURCHARGED	
S1.007	SS6.7	88.577	1.584	0.000	0.11		3.3	SURCHARGED	
S1.008	SS5.4	86.750	-0.331	0.000	0.03		3.3	OK	

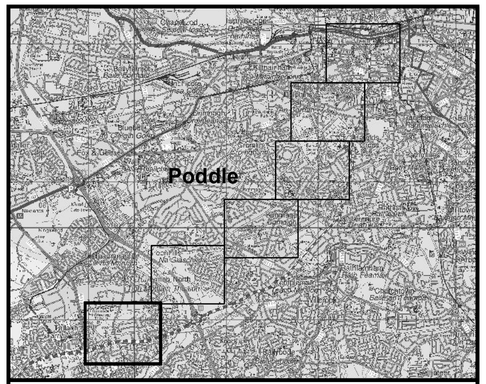
FLOODING OCCURS AT LOWEST POINT OF NETWORK
IN STORMS OF DURATION GREATER THAN 240min.
OVERFLOW VOLUME TO BE CAPTURED ON SITE IN
RETENTION BASIN.
OUTFLOW REMAINS BELOW QBAR VALUE OF 5L/S

BARRETT MAHONY
CONSULTING ENGINEERS
CIVIL & STRUCTURAL

APPENDIX 4

FLOOD MAPS





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

Legend

1% Fluvial AEP Flood Depth

- 0 - 0.25m
- 0.25 - 0.5m
- 0.5 - 1m
- 1.0 - 1.5m
- 1.5 - 2m
- >2m
- Modelled River Centreline
- AFA Extents

FINAL

REV:	NOTE:	DATE:

EASTERN CFRAM STUDY
CATCHMENT FLOOD RISK ASSESSMENT AND MANAGEMENT

OPW
Oifig na nOibreacha Poiblí
The Office of Public Works

RPS

The Office of Public Works
Jonathan Swift Street
Trim
Co Meath

Elmwood House
74 Boucher Road
Belfast
BT12 6RZ

T +44(0) 28 90 667914
F +44(0) 28 90 668286
W www.rpsgroup.com
E ireland@rpsgroup.com

Map:
Poddle River Fluvial Flood Depths

Map Type: DEPTH
Source: FLUVIAL
Map Area: HPW
Scenario: CURRENT

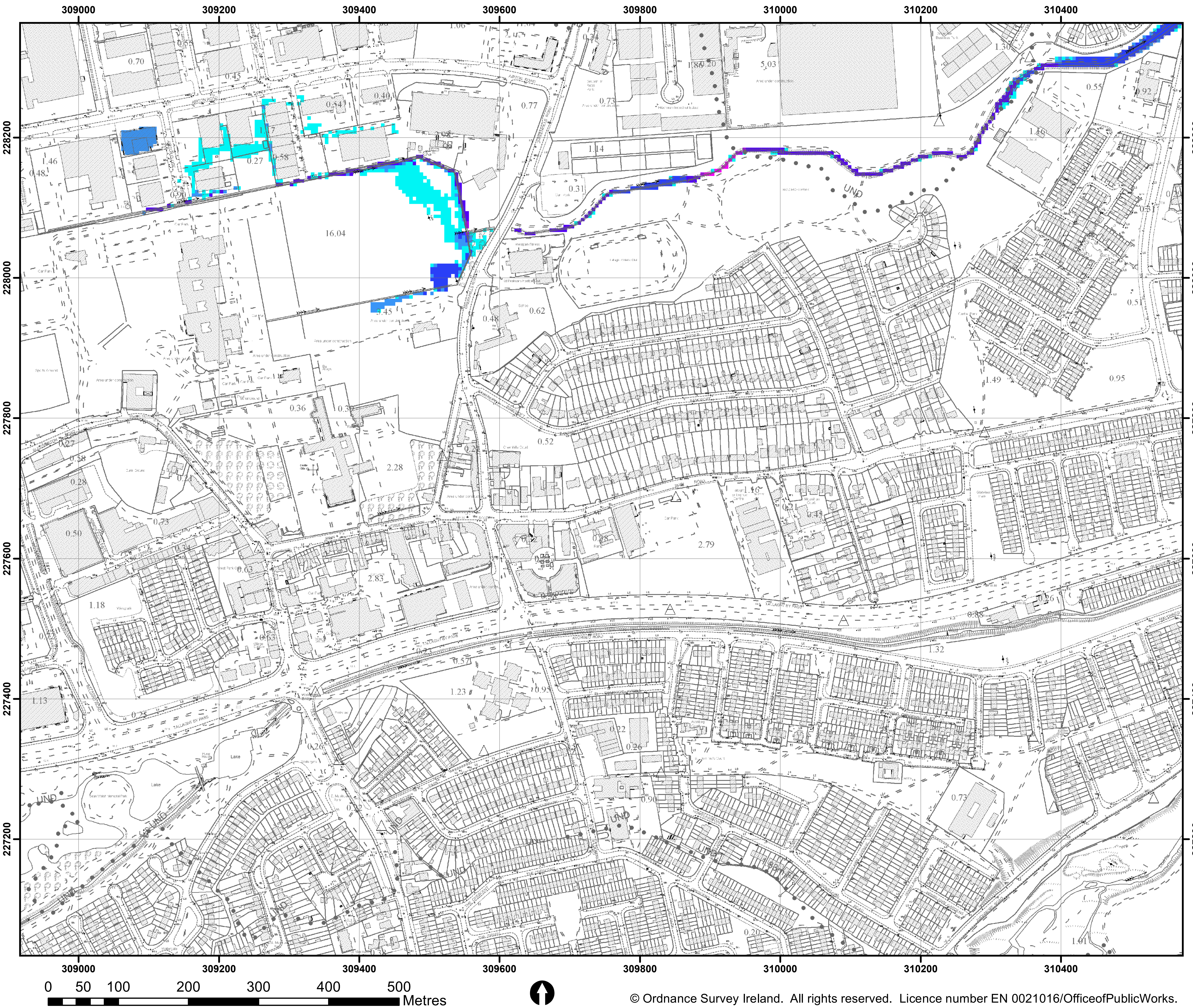
Drawn By : F.M.C.	Date : 20 October 2016
Checked By : A.S.	Date : 20 October 2016
Approved By : S.P.	Date : 20 October 2016

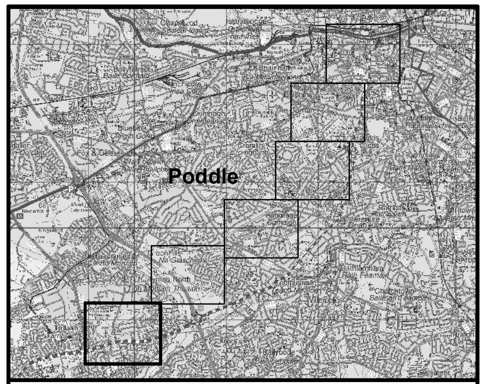
Drawing No. :
E09POD_DPFCD010_F0_01

Map Series : Page 1 of 6

Drawing Scale : 1:5,000 @ A3

0 50 100 200 300 400 500 Metres





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

Legend

0.1% Fluvial AEP Flood Depth

- 0 - 0.25m
- 0.25 - 0.5m
- 0.5 - 1m
- 1.0 - 1.5m
- 1.5 - 2m
- >2m
- Modelled River Centreline
- AFA Extents

FINAL

REV:	NOTE:	DATE:

EASTERN CFRAM STUDY
CATCHMENT FLOOD RISK ASSESSMENT AND MANAGEMENT

OPW
Oifig na nOibreacha Poiblí
The Office of Public Works

RPS

The Office of Public Works
Jonathan Swift Street
Trim
Co Meath

Elmwood House
74 Boucher Road
Belfast
BT12 6RZ

T +44(0) 28 90 667914
F +44(0) 28 90 668286
W www.rpsgroup.com
E ireland@rpsgroup.com

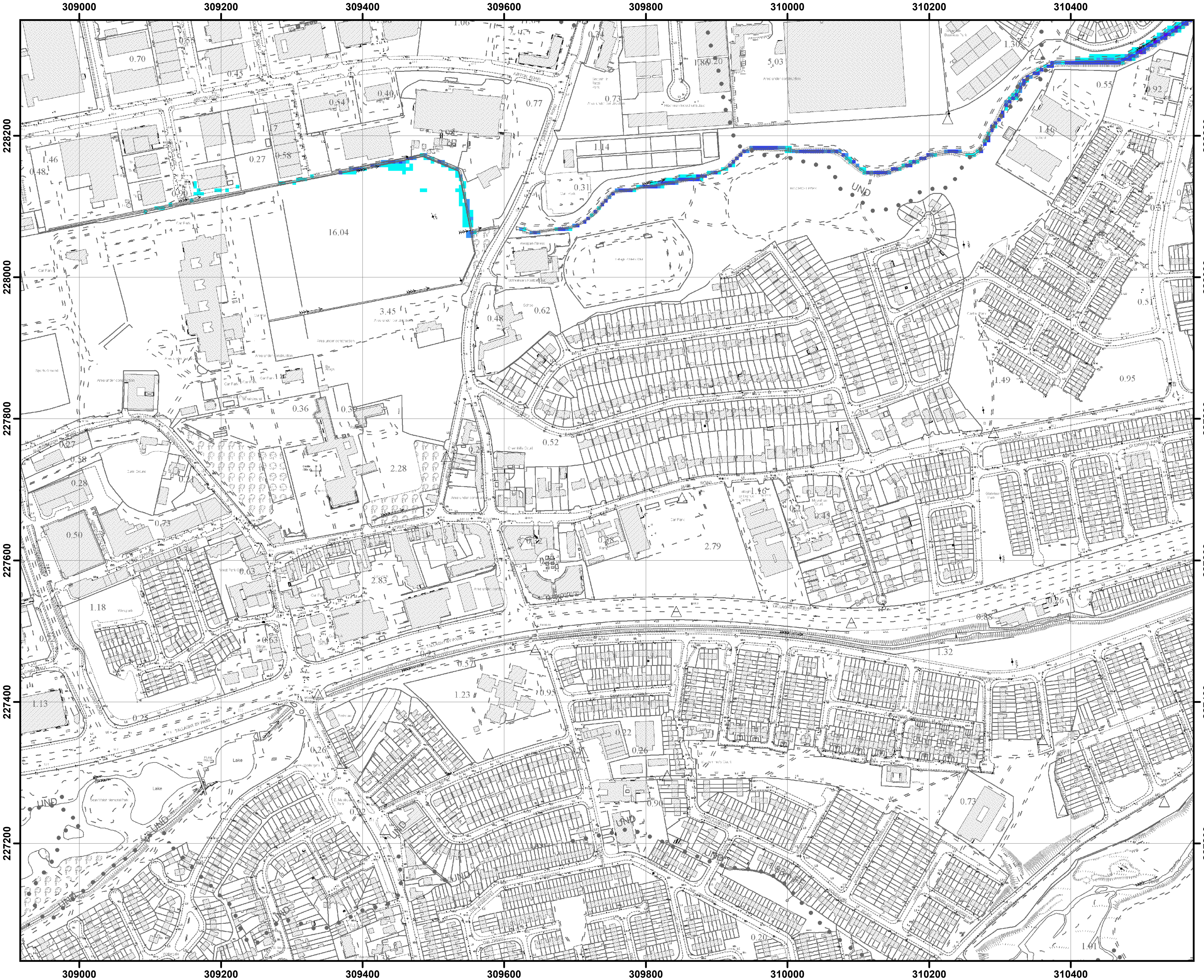
Map:
Poddle River Fluvial Flood Depths

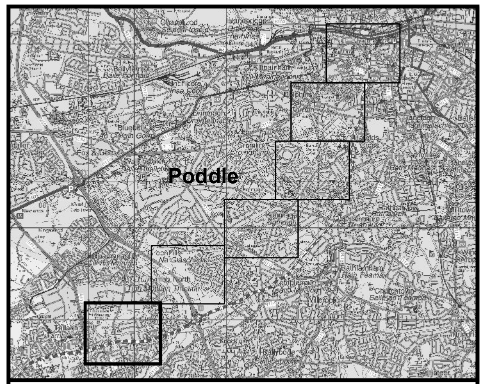
Map Type: DEPTH
Source: FLUVIAL
Map Area: HPW
Scenario: CURRENT
Drawn By : F.M.C. Date : 20 October 2016
Checked By : A.S. Date : 20 October 2016
Approved By : S.P. Date : 20 October 2016

Drawing No. :
E09POD_DPFCD001_F0_01

Map Series : Page 1 of 6

Drawing Scale : 1:5,000 @ A3





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

Legend

10% Fluvial AEP Flood Depth

- 0 - 0.25m
- 0.25 - 0.5m
- 0.5 - 1m
- 1.0 - 1.5m
- 1.5 - 2m
- >2m
- Modelled River Centreline
- AFA Extents

FINAL

REV:	NOTE:	DATE:

EASTERN CFRAM STUDY
CATCHMENT FLOOD RISK ASSESSMENT AND MANAGEMENT

OPW
Oifig na nOibreacha Poiblí
The Office of Public Works

RPS

The Office of Public Works
Jonathan Swift Street
Trim
Co Meath

Elmwood House
74 Boucher Road
Belfast
BT12 6RZ

T +44(0) 28 90 667914
F +44(0) 28 90 668286
W www.rpsgroup.com
E ireland@rpsgroup.com

Map:
Poddle River Fluvial Flood Depths

Map Type:	DEPTH
Source:	FLUVIAL
Map Area:	HPW
Scenario:	CURRENT
Drawn By : F.M.C.	Date : 20 October 2016
Checked By : A.S.	Date : 20 October 2016
Approved By : S.P.	Date : 20 October 2016

Drawing No. :
E09POD_DPFCD100_F0_01

Map Series : Page 1 of 6

Drawing Scale : 1:5,000 @ A3

0 50 100 200 300 400 500 Metres

BARRETT MAHONY
CONSULTING ENGINEERS
CIVIL & STRUCTURAL

APPENDIX 5

DMURS STATEMENT

Design Manual for Urban Roads and Streets (DMURS)

Design Principles	*Provisions*	*Statement of Consistency*
Integrated Street Networks	• Does the development create connected centres that prioritise pedestrian movement and access to public transport?	Presently, there are well-established footpaths surrounding the site. ✓ Pedestrians making the journey to the site will generally be comfortable doing so provided the journey time does not exceed 30 minutes (approximate distance 3 km). Walking becomes highly desirable if the journey time does not exceed 15 minutes (approximate distance 1.5km). ✓ Residents can walk into The Square Tallaght in less than a 15 minute walk. ✓ Local amenities are available within c 10-15 minute walk-time of the subject site. ✓ Public transport links. Buses are available within 10 minutes' walk or less and a LUAS stop is located within 20 minutes' walk of the candidate site.
Movement and Place	• Does the development create a legible street hierarchy that is appropriate to its context? • Are the proposed streets connected, maximising the number of walkways & cycle routes between streets as well as specific destination (i.e. community centre, shops, creche, schools etc.)?	✓ The design incorporates a permeable and legible street network that offers route choice and flexibility for managing movement within it. ✓ There is a fully integrated pedestrian network with all the main landscape spaces connected to a universally accessible route. ✓ In line with best practice the design incorporates an orthogonal street layout thus promoting legibility as well as connectivity. ✓ The proposed network is structured and will draw future occupants toward focal points including the communal open space and riparian strip.
Permeability and Legibility	• Has the street layout been well considered to maximise permeability for pedestrians and cyclists? • Are the streets legible with maximum connection opportunities?	A podium is provided at 1st floor level, between the blocks. This hides the parking facilities at ground floor. ✓ A high degree of pedestrian permeability throughout the site is created by providing footways that connect the spaces between each block.

	• Are blocks of a reasonable size and permeability, with consideration to the site constraints?	
Management	✓ Is the layout designed to self-regulate vehicle speeds and traffic congestion? ✓ Does the proposed layout minimise noise / air pollution wherever possible?	✓ The parking for the development is provided using an undercroft car park. Access to the units is through the main entrances. ✓ The location of the site will promote the use of public transport thus contributing to reduced air emissions.
Movement, Place and Speed	✓ Does the proposed development balance speed management with the values of place and reasonable expectations of appropriate speed? ✓ Does the design promote a reasonable balance of both physical and psychological measures to regulate speed?	See previous section. ✓ High levels of pedestrian movement are catered for which supports vibrant and sustainable places. The exclusion of vehicular traffic within the development also supports the sense of place. ✓ Both car parks are directly off Airton road and Greenhills road respectively. Drivers are instantly diverted into the car park. At no point is there a long stretch that may encourage speeding. ✓ Numerous pedestrian crossing will be provided along with relative signage. ✓ Speed reducing measures to be provided in the form of bumps and signage on entering both car parks.
Streetscape	• Does the scheme create an appropriate sense of enclosure in addition to a strong urban / suburban structure? • Have street trees and areas of planting been provided where appropriate? • Have active street edges been provided where appropriate? • Is a palette of high quality surface materials and finishes provided?	✓ The scheme is developed to hide the lower ground carpark with ground floor landscaped podiums. The podiums will span the breath of the car parks. ✓ The Tymon Stream currently runs along the south end of the site. A 10m riparian strip is to be created. ✓ Street trees are proposed to provide a visual structure to Airton and Greenhills Road. ✓ Throughout the rest of the scheme a comprehensive planting scheme including trees, shrubs and groundcover is proposed to create a comfortable and attractive urban environment. ✓ It is proposed that the shared surfaces and the general circulation paths will be permeable paving.

Pedestrian and Cyclist Environment	• Are footways of appropriate width provided so as to ensure pedestrian safety? • Are verges provided adjacent to larger roadways so as to provide a buffer between vehicular routes and pedestrian paths? • Have pedestrian crossings, whether controlled or uncontrolled, been provided at appropriate locations? • Are shared surfaces located appropriately in areas where an extension of the pedestrian domain is required? • Have cycle facilities been factored into the design?	✓ Excluding carparking areas, footpaths in the remainder of the development will be a minimum 1.8m as per Section 4.3.1 of DMURS. ✓ Pedestrian access to the development will be separate to vehicular traffic. The pedestrians will access the development via footways through the landscaped gardens. In the car park, pedestrian access will be via designated walkways. ✓ The podium level is a car free zone. ✓ Secure covered resident cycle parking is provided in the undercroft car park.
Carriageway Conditions	✓ Are vehicular carriageways sized appropriately for their function / location? ✓ Are surface materials appropriate to their application in order to inform drivers of the expected driving conditions? ✓ Are junctions designed to balance traffic concerns with the needs of pedestrians / cyclists? ✓ Have adequate parking / loading areas been provided?	✓ The total aisle width is 6 meters. This is in compliance with Section 4.4.9 of DMURS. ✓ On entering the development the carriage way is 6.4m. ✓ The road carriageway will be surfaced in Stone Mastic Asphalt demonstrating a clear and obvious vehicular route into the development which will contrast visually with the finishes on pedestrian footways. ✓ Junctions have been designed to minimise corner radii in line with Section 4.3.3 of DMURS. A corner radius of 4.5m has been selected as appropriate for the junctions off Aitron Road and Greenhills road, while internal junction corner radii will be minimised further while still achieving the required dimensions to facilitate the swept path of vehicles. A total of 230 No. parking spaces are proposed. The parking is provided in two separate undercroft car parks. ✓ A staging area for refuse collection will be provided in a lay-by on Airton road. Waste bins will be collected from designated areas within the site serving each respective apartment block. They will be

		brought to a staging area adjacent to the lay-by at the waste collection time.

APPENDIX 6

FOUL WATER CALULATIONS

BM
BARRETT MAHONY
CONSULTING ENGINEERS
CIVIL & STRUCTURAL

Dublin | London | Sofia
Sandwith House,
52-54 Lower Sandwith Street,
Dublin 2, D02 WR26, Ireland
Phone +353 1 6773200
Email bmce@bmce.ie
www.bmce.ie

PROJECT TITLE: MIXED USE DEVELOPMENT, AIRTON ROAD BY: R.M.
CALCULATION: FOUL WATER DEMAND PAGE: 1
CATCHMENT: A DATE: 17/01/2020

SUMMARY:		Total Peak Flow	Total Average Flow
A:	Residential (294 units)	8.508 l/s	1.418 l/s
B:	Crèche (355 m²)	0.229 l/s	0.038 l/s
C:	Retail (196 m²)	0.038 l/s	0.019 l/s
D:	Communal (466 m²)	0.148 l/s	0.074 l/s
TOTAL		**8.775 l/s**	**1.475 l/s**

A: RESIDENTIAL

The foul effluent from the proposed dwellings is calculated as per the Irish Water Code of Practice for Wastewater Infrastructure (Dec. 2017) assuming dry weather flow of 150 l/head/day plus a 10% infiltration rate and using the Irish Water assumed average occupancy of 2.7 persons/unit.

No. of Units = 275
No. of Occupants = 275 x 2.7 = 742.5

Daily Flow = No. of Occupants x Dry Weather Flow
Daily Flow = 742.5 x 150 x 1.1 = 122,513 l/day

$$\text{Average Flow} = \frac{\text{Daily Flow}}{\text{Flow Duration}} = \frac{122{,}513 \text{ l/day}}{24 \times 60 \times 60} = \mathbf{1.418\ l/s}$$

Peak Flow = Average Flow x 6
Peak Flow = 1.418 l/s x 6 = **8.508 l/s**

B: CRÈCHE

Assume conservatively 50no. children catered for. Assume staff:child ratio of 1:5 on average (based on Schedule 6 Part 1 of Child Care Act 1991 (Early Years Services) Regulations 2016.). Thus assume total of 10no. staff + 50no. children = 60no. persons. As per Irish Water CoP for WW Infrastructure Appendix D, assume flow rate for "Schools - non-residential without a canteen" = 50litres/person/day.

No. of Children = 50
Staff:Child Ratio = 1:5
Total Population = 50 + 10 = 60

Daily Flow = Population x Dry Weather Flow
Daily Flow = 60 x 50 x 1.1 = 3,300 l/day

$$\text{Average Flow} = \frac{\text{Daily Flow}}{\text{Flow Duration}} = \frac{3{,}300 \text{ l/day}}{24 \times 60 \times 60} = \mathbf{0.038\ l/s}$$

Peak Flow = Average Flow x 6
Peak Flow = 0.038 l/s x 6 = **0.229 l/s**

Dublin | London | Sofia
Sandwith House,
52-54 Lower Sandwith Street,
Dublin 2, D02 WR26, Ireland

Phone +353 1 6773200
Email bmce@bmce.ie
www.bmce.ie

C: **RETAIL**

Workers calculated: area in m² / area per FTE; as per Employment Densities Guide from OFFPAT. Type Retail A1 – High street with 19 FTE per m².

Retail m² = 187 m²
FTE per m² = 19
No. of FTE = 187 m² / 19 = 9.842105

Daily Flow = No. of Occupants x Dry Weather Flow
Daily Flow = 9.8 x 150 x 1.1 = 1,624 l/day

$$\text{Average Flow} = \frac{\text{Daily Flow}}{\text{Flow Duration}} = \frac{1{,}624 \text{ l/day}}{24 \times 60 \times 60} = \mathbf{0.019 \text{ l/s}}$$

Peak Flow = Average Flow x 2
Peak Flow = 0.019 l/s x 2 = **0.038 l/s**

D: **Communal**

Workers calculated: area in m² / area per FTE; as per Employment Densities Guide from OFFPAT. Type General Office:B1 – High street with 12 FTE per m².

Area m² = 464 m²
FTE per m² = 12
No. of FTE = 464 m² / 12 = 38.67

Daily Flow = No. of Occupants x Dry Weather Flow
Daily Flow = 38.7 x 150 x 1.1 = 6,380 l/day

$$\text{Average Flow} = \frac{\text{Daily Flow}}{\text{Flow Duration}} = \frac{6{,}380 \text{ l/day}}{24 \times 60 \times 60} = \mathbf{0.074 \text{ l/s}}$$

Peak Flow = Average Flow x 2
Peak Flow = 0.074 l/s x 2 = **0.148 l/s**

BM
BARRETT MAHONY
CONSULTING ENGINEERS
CIVIL & STRUCTURAL

Dublin | London | Sofia
Sandwith House,
52-54 Lower Sandwith Street,
Dublin 2, D02 WR26, Ireland
Phone +353 1 6773200
Email bmce@bmce.ie
www.bmce.ie

PROJECT TITLE: MIXED USE DEVELOPMENT, AIRTON ROAD — BY: R.M.

CALCULATION: FOUL WATER DEMAND — PAGE: 1

CATCHMENT: 2 — DATE: 17/01/2020

SUMMARY:

		Total Peak Flow	Total Average Flow
A:	Residential (294 units)	7.023 l/s	1.170 l/s
B:	Retail (337 m²)	0.059 l/s	0.030 l/s
C:	Communal (230 m²)	0.075 l/s	0.038 l/s
	TOTAL	**7.157 l/s**	**1.238 l/s**

A: RESIDENTIAL

The foul effluent from the proposed dwellings is calculated as per the Irish Water Code of Practice for Wastewater Infrastructure (Dec. 2017) assuming dry weather flow of 150 l/head/day plus a 10% infiltration rate and using the Irish Water assumed average occupancy of 2.7 persons/unit.

No. of Units = 227

No. of Occupants = 227 x 2.7 = 612.9

Daily Flow = No. of Occupants x Dry Weather Flow

Daily Flow = 612.9 x 150 x 1.1 = 101,129 l/day

$$\text{Average Flow} = \frac{\text{Daily Flow}}{\text{Flow Duration}} = \frac{101{,}129\ \text{l/day}}{24 \times 60 \times 60} = \mathbf{1.170\ l/s}$$

Peak Flow = Average Flow x 6

Peak Flow = 1.170 l/s x 6 = **7.023 l/s**

B: RETAIL

Workers calculated: area in m² / area per FTE; as per Employment Densities Guide from OFFPAT. Type Retail A1 – High street with 19 FTE per m².

Retail m² = 294 m²

FTE per m² = 19

No. of FTE = 294 m² / 19 = 15.47368

Daily Flow = No. of Occupants x Dry Weather Flow

Daily Flow = 15.5 x 150 x 1.1 = 2,553 l/day

$$\text{Average Flow} = \frac{\text{Daily Flow}}{\text{Flow Duration}} = \frac{2{,}553\ \text{l/day}}{24 \times 60 \times 60} = \mathbf{0.030\ l/s}$$

Peak Flow = Average Flow x 2

Peak Flow = 0.030 l/s x 2 = **0.059 l/s**

Dublin | London | Sofia
Sandwith House,
52-54 Lower Sandwith Street,
Dublin 2, D02 WR26, Ireland

Phone +353 1 6773200
Email bmce@bmce.ie
www.bmce.ie

C: **Communal**

Workers calculated: area in m² / area per FTE; as per Employment Densities Guide from OFFPAT. Type General Office:B1 – High street with 12 FTE per m².

Area m²	=	237 m²				
FTE per m²	=	12				
No. of FTE	=	237 m²	/	12	=	19.75

Daily Flow = No. of Occupants x Dry Weather Flow

Daily Flow = 19.8 x 150 x 1.1 = 3,259 l/day

$$\text{Average Flow} = \frac{\text{Daily Flow}}{\text{Flow Duration}} = \frac{3{,}259\ \text{l/day}}{24 \times 60 \times 60} = \mathbf{0.038\ l/s}$$

Peak Flow = Average Flow x 2

Peak Flow = 0.038 l/s x 2 = **0.075 l/s**

BARRETT **MAHONY**
CONSULTING ENGINEERS
CIVIL & STRUCTURAL

APPENDIX 7
WATER SUPPLY CALCULATIONS

Dublin | London | Sofia
Sandwith House,
52-54 Lower Sandwith Street,
Dublin 2, D02 WR26, Ireland

Phone +353 1 6773200
Email bmce@bmce.ie
www.bmce.ie

PROJECT TITLE:	MIXED USE DEVELOPMENT, AIRTON ROAD	BY: R.M.
CALCULATION:	WATER DEMAND	PAGE: 1
CATCHMENT:	A	DATE: 18/01/2020

SUMMARY:		**Total Peak Demand**	**Total Average Day / Peak Week Demand**
A:	Residential (250 units)	8.057 l/s	1.611 l/s
B:	Crèche (355 m²)	0.217 l/s	0.043 l/s
C:	Retail (196 m²)	0.107 l/s	0.021 l/s
D:	Communal (466 m²)	0.420 l/s	0.084 l/s
TOTAL		**8.380 l/s**	**1.676 l/s**

A: RESIDENTIAL

The water demand for the proposed development has been calculated using the guidelines given in the Irish Water Code of Practice for Water Infrastructure (Dec. 17) Section 3.7.2 assuming a per-capita consumption of 150 l/head/day and using the Irish Water assumed average occupancy of 2.7 persons/unit. The average day/peak week demand is taken as 1.25 times the average daily domestic demand. The peak demand factor is taken as 5 times the average day/peak week demand.

No. of Units = 275
No. of Occupants = 275 x 2.7 = 742.5

Avg. Daily Demand = No. of Occupants x Allowance per head
Avg. Daily Demand = 742.5 x 150 = 111,375 l/day

$$\text{Avg. Day / Peak Week Demand} = \frac{\text{Daily Flow}}{\text{Flow Duration}} \times 1.25 = \frac{111{,}375 \text{ l/day}}{24 \times 60 \times 60} \times 1.25 = \mathbf{1.611 \text{ l/s}}$$

Peak Demand = Average Flow x 5
Peak Demand = 1.611 l/s x 5 = **8.057 l/s**

B: CRÈCHE:

Assume conservatively 50no. children catered for. Assume staff:child ratio of 1:5 on average (based on Schedule 6 Part 1 of Child Care Act 1991 (Early Years Services) Regulations 2016.). Thus assume total of 10no. staff + 50no. children = 60no. persons. As per Irish Water CoP for WW Infrastructure Appendix D, assume flow rate for "Schools - non-residential without a canteen" = 50litres/person/day. The average day/peak week demand is taken as 1.25 times the average daily domestic demand. The peak demand factor is taken as 5 times the average day/peak week demand.

No. of Children = 50
Staff:Child Ratio = 1:5
Total Population = 50 + 10 = 60

Avg. Daily Demand = No. of Workers x Dry Weather Flow
Avg. Daily Demand = 60 x 50 = 3,000 l/day

$$\text{Avg. Day / Peak Week Demand} = \frac{\text{Daily Flow}}{\text{Flow Duration}} \times 1.25 = \frac{3{,}000 \text{ l/day}}{24 \times 60 \times 60} \times 1.25 = \mathbf{0.043 \text{ l/s}}$$

Peak Demand = Average Flow x 5
Peak Demand = 0.043 l/s x 5 = **0.217 l/s**

BM
BARRETT MAHONY
CONSULTING ENGINEERS
CIVIL & STRUCTURAL

Dublin | London | Sofia
Sandwith House,
52-54 Lower Sandwith Street,
Dublin 2, D02 WR26, Ireland

Phone +353 1 6773200
Email bmce@bmce.ie
www.bmce.ie

C: RETAIL

Workers calculated: area in m² / area per FTE; as per Employment Densities Guide from OFFPAT. Type Retail A1 – High street with 19 FTE per m².

Area = 187
FTE = 19
No. of Occupants = 187 / 19 = 9.842105

Avg. Daily Demand = No. of Occupants x Allowance per head
Avg. Daily Demand = 9.842105 x 150 = 1,476 l/day

$$\text{Avg. Day / Peak Week Demand} = \frac{\text{Daily Flow}}{\text{Flow Duration}} \times 1.25 = \frac{1{,}476 \text{ l/day}}{24 \times 60 \times 60} \times 1.25 = \mathbf{0.021 \text{ l/s}}$$

Peak Demand = Average Flow x 5
Peak Demand = 0.021 l/s x 5 = **0.107 l/s**

D: Communal

Workers calculated: area in m² / area per FTE; as per Employment Densities Guide from OFFPAT. Type General Office:B1 – High street with 12 FTE per m².

Area = 464
FTE = 12
No. of Occupants = 464 / 12 = 38.66667

Avg. Daily Demand = No. of Occupants x Allowance per head
Avg. Daily Demand = 38.66667 x 150 = 5,800 l/day

$$\text{Avg. Day / Peak Week Demand} = \frac{\text{Daily Flow}}{\text{Flow Duration}} \times 1.25 = \frac{5{,}800 \text{ l/day}}{24 \times 60 \times 60} \times 1.25 = \mathbf{0.084 \text{ l/s}}$$

Peak Demand = Average Flow x 5
Peak Demand = 0.084 l/s x 5 = **0.420 l/s**

BM
BARRETT MAHONY
CONSULTING ENGINEERS
CIVIL & STRUCTURAL

Dublin | London | Sofia
Sandwith House,
52-54 Lower Sandwith Street,
Dublin 2, D02 WR26, Ireland

Phone +353 1 6773200
Email bmce@bmce.ie
www.bmce.ie

PROJECT TITLE:	MIXED USE DEVELOPMENT, AIRTON ROAD		BY: R.M.
CALCULATION:	WATER DEMAND		PAGE: 1
CATCHMENT:	2		DATE: 17/01/2020

SUMMARY:		**Total Peak Demand**	**Total Average Day / Peak Week Demand**
A:	Residential (250 units)	6.650 l/s	1.330 l/s
B:	Retail (337 m²)	0.168 l/s	0.034 l/s
C:	Communal (230 m²)	0.214 l/s	0.043 l/s
	TOTAL	**6.818 l/s**	**1.364 l/s**

A: RESIDENTIAL

The water demand for the proposed development has been calculated using the guidelines given in the Irish Water Code of Practice for Water Infrastructure (Dec. 17) Section 3.7.2 assuming a per-capita consumption of 150 l/head/day and using the Irish Water assumed average occupancy of 2.7 persons/unit. The average day/peak week demand is taken as 1.25 times the average daily domestic demand. The peak demand factor is taken as 5 times the average day/peak week demand.

No. of Units = 227
No. of Occupants = 227 x 2.7 = 612.9

Avg. Daily Demand = No. of Occupants x Allowance per head
Avg. Daily Demand = 612.9 x 150 = 91,935 l/day

$$\text{Avg. Day / Peak Week Demand} = \frac{\text{Daily Flow}}{\text{Flow Duration}} \times 1.25 = \frac{91{,}935 \text{ l/day}}{24 \times 60 \times 60} \times 1.25 = \mathbf{1.330 \text{ l/s}}$$

Peak Demand = Average Flow x 5
Peak Demand = 1.330 l/s x 5 = **6.650 l/s**

B: RETAIL

Workers calculated: area in m² / area per FTE; as per Employment Densities Guide from OFFPAT. Type Retail A1 – High street with 19 FTE per m².

Area = 294
FTE = 19
No. of Occupants = 294 / 19 = 15.47368

Avg. Daily Demand = No. of Occupants x Allowance per head
Avg. Daily Demand = 15.47368 x 150 = 2,321 l/day

$$\text{Avg. Day / Peak Week Demand} = \frac{\text{Daily Flow}}{\text{Flow Duration}} \times 1.25 = \frac{2{,}321 \text{ l/day}}{24 \times 60 \times 60} \times 1.25 = \mathbf{0.034 \text{ l/s}}$$

Peak Demand = Average Flow x 5
Peak Demand = 0.034 l/s x 5 = **0.168 l/s**

Dublin | London | Sofia
Sandwith House,
52-54 Lower Sandwith Street,
Dublin 2, D02 WR26, Ireland

Phone +353 1 6773200
Email bmce@bmce.ie
www.bmce.ie

C: **Communal**

Workers calculated: area in m² / area per FTE; as per Employment Densities Guide from OFFPAT. Type General Office:B1 – High street with 12 FTE per m².

Area	=	237				
FTE	=	12				
No. of Occupants	=	237	/	12	=	19.75

Avg. Daily Demand = No. of Occupants x Allowance per head

Avg. Daily Demand = 19.75 x 150 = 2,963 l/day

$$\text{Avg. Day / Peak Week Demand} = \frac{\text{Daily Flow}}{\text{Flow Duration}} \times 1.25 = \frac{2{,}963\ \text{l/day}}{24 \times 60 \times 60} \times 1.25 = \mathbf{0.043\ l/s}$$

Peak Demand = Average Flow x 5

Peak Demand = 0.043 l/s x 5 = **0.214 l/s**

Barrett Mahony Consulting Engineers

Dublin:
Sandwith House,
52-54 Lower Sandwith Street,
Dublin 2,
D02 WR26, Ireland.
Tel: +353 1 677 3200

London:
12 Mill Street,
London, SE1 2AY,
United Kingdom
Tel: +44 203 750 3530.

Sofia:
19 Yakubitsa Street,
Lozenets,
Sofia 1164,
Bulgaria
Tel: +359 2 494 9772

WWW.BMCE.IE