MALONE O'REGAN
CONSULTING ENGINEERS

SOCIAL HOUSING BUNDLE 4 & 5, DEVELOPMENT AT BALLYMUN

ENGINEERING REPORT

DUBLIN CITY COUNCIL

October 2024

Job: 23006

Contents Amendment Record

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Title: **Social Housing Bundle 4 & 5, Development at Ballymun Engineering Report / Dublin City Council**

Job Number: **23006**

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Revision Record

Issue No.	Date	Description	Remark	Prepared	Checked	Approved
0	22/12/2023	Information	P1	PB	ND	ND
1	18/07/2024	Pre-Planning	P1	KA	DW	DW
2	17/09/2024	Update	P1	MG	DW	DW
0	22/10/2024	Planning	P3	MG	DW	DW

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1 INTRODUCTION

1.1 Introduction

This report is prepared on behalf of the National Development Finance (NDFA) in consultation with Dublin City Council for the construction of 288 apartment/duplex and housing units at a site of c. 2.6 ha (c. 2.2 ha net) bound by Balbutcher Lane to the north, Balcurris Park to the west, the Ballymun Road to the east, and Balcurris Gardens to the south-west, Ballymun, Dublin 11. The proposed development will consist of the following:

- Construction of 288 no. apartment/duplex and housing units across 5 sites (Sites 5, 15, 16, 17 and 18) ranging from 2 to 6 storeys containing 138 no one-bed, 87 no. 2-bed units, 61 no. 3-bed and 2 no. 4-bed dwellings.
  - ➢ Site 5 consists of 132 no. apartment units (66 no. 1 bed, 44 no. 2 bed units and 22 no. 3 bed units) and ranges from 4 to 5 storeys including a new urban edge along Ballymun Road;
  - ➢ Site 15 consists of 8 no. dwellings comprising 6 no. 1 bed own-door apartments and 2 no. 3 bed houses adjoining Balcurris Gardens
  - ➢ Site 16 consists of 5 no. dwellings comprising 2 no. 1 bed own-door apartments, 1 no. 3 bed house and 2 no. 4 bed houses adjoining Balcurris Gardens
  - ➢ Site 17 consists of 34 no. apartment units (17 no. 1 bed units, 9 no. 2 bed units and 8 no. 3 bed units) and ranges from 3 to 6 storeys forming an urban block with incomplete urban cell at the Linnbhla and Charter apartments;
  - ➢ Site 18 consists of 109 no. apartments (47 no. 1 bed units, 34 no. 2 bed units and 28 no. 3 bed units) and ranges from 4 to 5 storeys with edges to Balcurris Road, Balcurris Park and a new edge to Balbutcher Lane;
- 70 no. car parking spaces, 4 no. loading bays and 4 no. motorbike parking spaces
- 551 no. long stay and 180 no. short stay bicycle parking spaces to serve the housing units.
- Provision of 1611 m² Retail/Commercial floor space at ground level facing Ballymun Road/St. Pappins Square (sites 5 and 17)
- Provision of a 324 m² childcare facility at ground floor in Site 5.
- Provision of 1,058 m² of community, cultural and arts space located at ground floor level in sites 5 and 17.
- Provision of 91 no bicycle spaces to serve the non-residential uses distributed across the site.
- The provision of a public open space in a new plaza at St Pappin's Square (1,953 m²) and additional areas of 979m², 496m² and 839 m² with 2,969 m² of communal open space
- Realignment of Balcurris Road, provision of two new vehicular accesses (one off the Balbutcher Lane and one off the Ballymun Road) and a dedicated pedestrian and cycle lane off the Balbutcher Lane
- Boundary treatments, public lighting, site drainage works, internal road surfacing and footpaths, ESB meter rooms, ESB substations, stores, bin and cycle storage, plant rooms, landscaping; and
- All ancillary site services and development works above and below ground.

Figure 1-1 – Proposed Site Layout

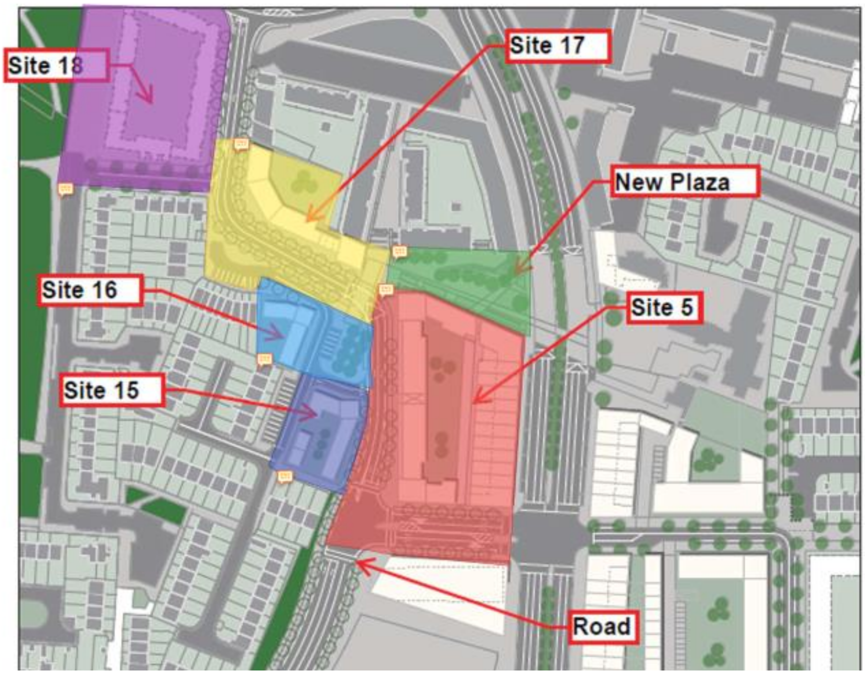


Figure 1-2 - Site Plan outlining Sites 5, 15&16, 17, 18

The purpose of this document is to describe the engineering proposals associated with the new development. These proposals are indicated on the drawings prepared by Malone O'Regan which accompany the planning submission. Where reference is made to drawings and drawing numbers within this report these should be taken as meaning those drawings produced by Malone O'Regan unless specifically stated otherwise.

1.2 Site Description

The proposed site is located within the suburb of Ballymun, Co. Dublin. It is located approximately 5.9km north of Dublin city centre. The site is subdivided into five sites; refer to Figure 1-2. The location of the proposed development is illustrated in Figure 1-3.

The proposed site 5 is bordered to the north by a new plaza called St. Pappins Square and further north by a residential development known as the Turnpike Apartments, to the east by the main Ballymun Road, to the west by new residential development sites 15 and 16 and to the south by a Lidl retail unit.

The proposed sites 15 and 16 are bordered to the north by new residential development site 17, to the east by Balcurris Road and development site 5, to the west and south by existing residential 2-3 storey housing units.

The proposed site 17 is bordered to the north by a residential development known as Linnbhla, to the east by the new plaza and development site 5, to the west and part south by existing residential 2-3 storey housing units. The remaining southern border links onto Balcurris Road and the development site 16.

The proposed site 18 is bordered to the north by Balbutcher Lane, to the east by Balcurris Road and the existing residential development Linnbhla, to the west by the existing Balcurris Park and to the south by existing residential 2-3 storey housing units.

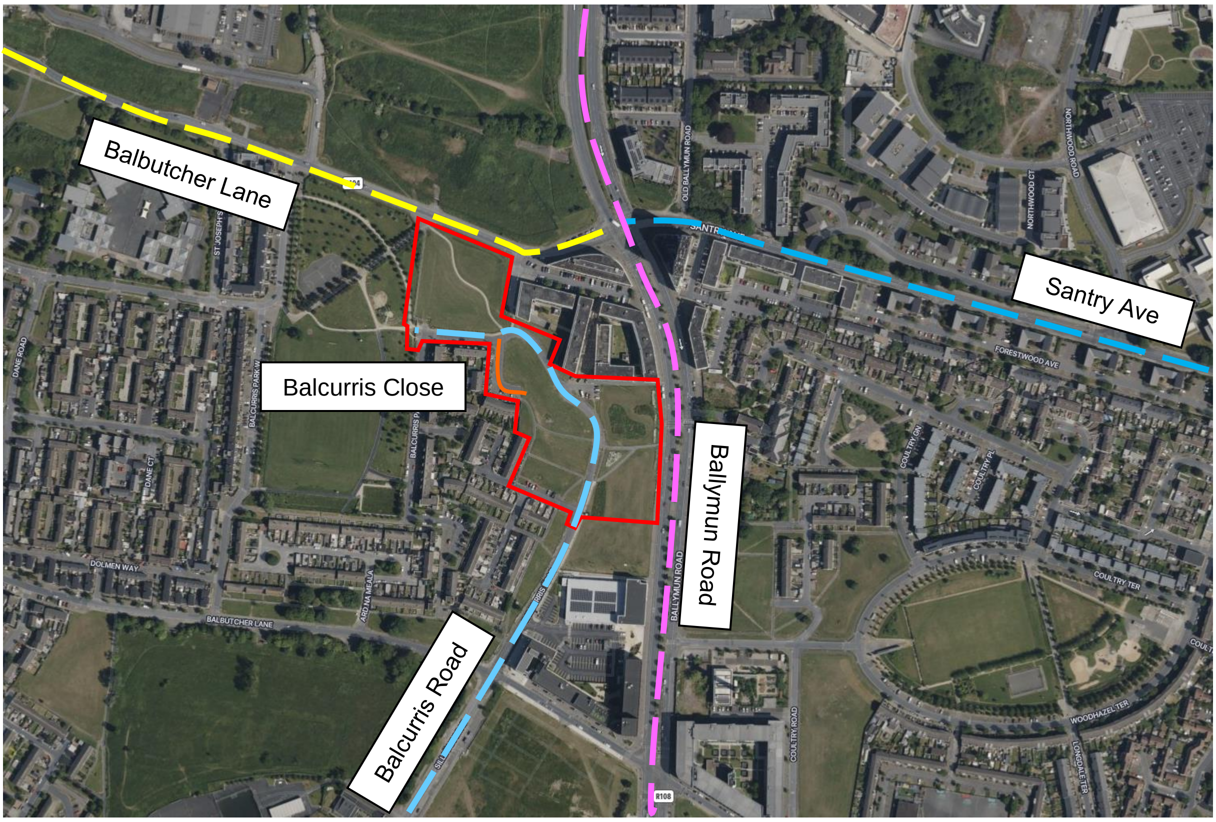


Figure 1-3 - Site Location

2 SURFACE WATER DRAINAGE DESIGN

2.1 Introduction

This chapter follows 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 surrounding watercourse systems, existing surface water networks and groundwater systems. This SuDS strategy will achieve these aims by using a variety of SuDS measures within the site. These measures include water interception, treatment, infiltration and attenuation. The SuDS strategy will be developed with the following steps:

1. The existing greenfield run-off of the development site will be calculated and used as the minimum benchmark for the SuDS design. This run-off calculation is based on the drained area of the new development. The post development run-off will not exceed the greenfield run-off.
2. A set of SuDS measures will be chosen based on their applicability and usage for the site.
3. A "FLOW" model will be created to analyse the rainfall on the site and the effectiveness of the proposed SuDS measures.
4. If effective, these SuDS measures will be incorporated into the proposed design.

Table 2-1 outlines the parameters adopted in the design of the surface water drainage infrastructure.

Table 2-1 - Surface Water Design Parameters

Parameter Description	Assigned Value
Surface Water Drainage Pipework Design Return Period	2 years (Ref IS EN 752 Table 2 for 'City centres / industrial / commercial areas')
Attenuation Pond Design Return Period	100 years
Allowance for climate change	20% (Ref. OPW Flood Risk Management Climate Change Sectoral Adaptation Plan, High-End Future Scenario)
M5-60	18.3mm (Met Eireann data)
M5-2D	67.9mm (Met Eireann data)
Ratio, r	0.27
Time of Entry	4 min
Pipe roughness, Ks	0.6mm (Ref. GDSDS Volume 2, Table 6.4)
Minimum velocity	1.0 m/s (Ref. GDSDS Volume 2, Table 6.4)

2.2 Existing Services

Existing surface water sewers run around the perimeter of the sites on a variety of sides. Along the southern boundary of the site there is an existing 300mm diameter concrete sewer increasing to 400mm diameter concrete sewer along Balcurris Road. Towards the north of the site there is an existing 300mm diameter concrete sewer along Balcurris Close.

- For site 5 there is 300mm diameter concrete sewer on Balcurris Road.
- For sites 15 and 16 there is a 225mm concrete sewer on Balcurris Close and on Balcurris Park East. There is a 225mm increasing to a 400mm concrete sewer running just off Balcurris Road.
- For site 17 there is a 225mm increasing to a 400mm concrete sewer running just off Balcurris Road heading south.
- For site 18 there is a 225mm concrete sewer on Balcurris Close and a 375mm concrete sewer running along Balbutcher Lane.

These underground sewers carry surface water runoff from other catchments adjacent to the site. Due to the relative levels of the existing drainage and the proposed site levels, it is possible to achieve a gravity connection to the surface water drainage pipework installed.

2.3 Proposed Services

The proposed surface water drainage system is designed to comply with the 'Greater Dublin Strategic Drainage Study (GDSDS) Regional Drainage Policies Technical Document – Volume 2, New Developments, 2005' and the 'Greater Dublin Regional Code of Practice for Drainage Works, V6.0 2005'. CIRIA Design Manuals C753, C697 and C609 have also been used to design the surface water drainage system within the site.

Surface drainage collected from Sites 5, 15&16 and 17 are connecting to the existing 300mm diameter concrete sewer along Balcurris Road. Surface drainage collected from Site 5 is connecting to the existing 300mm diameter concrete sewer along Balcurris Close.

The proposed surface water drainage layout for the development is indicated on Malone O'Regan drawings SHB4-BMD-DR-MOR-CS-P3-130 and 150. Surface water runoff from new internal road surfaces, footpaths, other areas of hardstanding and the roofs of the buildings will be collected within a gravity drainage network and directed towards a detention basin.

Surface water runoff from Site 18 is directed towards an attenuation tank. Surface water runoff from Site 15&16, 17 and 5 are directed towards detention basin, located within their own grouping sites. The attenuation storage calculated for each site is sized to cater for a 1:100-year storm event.

The outfall from the attenuation tank and detention basins will be restricted to the applicable 'greenfield' runoff rate using a Hydrobrake flow control device. A number of sustainable drainage systems (SuDS) are proposed in order to minimise the volume and rate of runoff from the site. Further details on these SuDS measures are provided in Section 2.5. All surface water drainage will be designed and installed in accordance with the Greater Dublin Regional Code of Practice for Drainage Works. The runoff coefficients used in the calculations are as outlined in the Table 2-2.

Table 2-2 - Runoff Coefficients

Type of Areas	CV
Landscaping (Grass / Soft)	0.20
Intensive/Extensive Green Roof	0.60
Blue Roof	0.60
Permeable Paving	0.50
Impermeable Surface (Incl. tree pits)	0.90
Standard Roof (Impermeable)	0.95

Calculations for the Surface Water Pipe Network are provided in Appendix C.

2.4 Permissible Runoff

The regression equation recommended for use by the Greater Dublin Strategic Drainage Study 2005 calculates a value, $QBAR_{rural}$, which is sourced from the Institute of Hydrology Report 124. This value is the mean annual flood flow from a rural catchment in m^3/s and is given by the equation,

$$QBAR_{rural} = 0.00108[(Areax0.01)^\wedge 0.89] \times [SAAR^\wedge 1.17] \times [Soil^\wedge 2.17]$$

Where:

$QBAR_{rural}$	Mean annual flood flow from a rural catchment in m^3/s
Area	Area of the catchment in hectare
SAAR	Standard Average Annual Rainfall in mm.
Soil	Soil index

For catchments smaller than 50 hectares, $QBAR_{rural}$ is first calculated assuming an area of 50ha and then $QBAR_{rural}$ for the site area is calculated on a pro rata basis.

Standard Average Annual Rainfall for the site in Ballymun was taken from the Flood Studies Report as 946mm.

An appropriate Soil Index value was determined following a review of published data and site-specific ground investigation works.

The 1975 Flood Studies Report included a Soil Index map, a digitised various of which is available at www.uksuds.com. This map indicates that the site lies within an area of Soil Type 4 (SPR Index 0.47). Soil Type 4 corresponds with clay or loamy soils with a high runoff potential.

Site Investigation works were completed by Ground Investigations Ireland in March 2024. The investigation showed that ground consisted of:

- Made Ground: Made ground deposits were encountered at depths between 0.60m and 4.10m bgl. These deposits consisted of brown slightly sandy gravelly clay.
- Cohesive Deposits: Cohesive deposits were described as brown slightly sandy slightly gravelly clay with occasional cobbles and boulders overlying a dark grey slightly sandy gravelly clay with occasional cobbles and boulders. The strength of the cohesive deposits was firm to stiff below 2m bgl.

5no. soakaway tests were conducted on site. At the location of the 5 soakaways the water level dropped too slowly to allow calculation of ‘f’ the soil infiltration. The report prepared by Ground Investigation Ireland concludes that the low-permeability clay soils are considered to be poor infiltration media and would be deemed unsuitable for the implementation of infiltration drainage systems.

The ground investigation reveal that the subsoil corresponds with Soil Type 4 (SPR Index 0.47). For the purpose of surface water attenuation design, the site is dealt with as four catchments as shown in Figure 2-1.

Catchment 1 area – This catchment area (highlighted in red) serves site 18 and has an overall area of 4794.80m². This proposed SuDS measures for this area include permeable paving, green landscaped areas and blue green roofs.

Catchment area 2 – This catchment area (highlighted in orange) serves site 17 and has an overall area of 1974.30m². This proposed SuDS measures for this area include permeable paving, blue roofs and green landscaped areas; all draining to a detention basin.

Catchment area 3 – This catchment area (highlighted in green) serves sites 5 and has an overall area of 5606.50m². This proposed SuDS measures for this area include permeable paving, blue roofs, and green landscaped areas; all draining to a detention basin.

Catchment area 4 – This catchment area (highlighted in yellow) serves site 16 and has an overall area of 790.10m². This proposed SuDS measures for this area include permeable paving, landscaped areas and bioretention (rain gardens); all draining to a detention basin.

Catchment area 5 – This catchment area (highlighted in purple) serves the green area in between site 15 and 16 and has an overall area of 813.60m². This proposed SuDS measures for this area include permeable paving and the green landscaped areas.

Catchment area 6 – This catchment area (highlighted in blue) serves site 15 and has an overall area of 922.10m². This proposed SuDS measures for this area include permeable paving, landscaped areas, bioretention (rain gardens); all draining to a detention basin.

Non designated areas – the areas which are not highlighted and given to a designated catchment area, are areas that will be taken in charge by the local authority and therefore will drainage into the existing public sewers directly.

Figure 2-1 - Surface Water Drainage Catchment Area

Figure 2-2 – Attenuation Systems

When the regression equation is applied to the proposed development, the following value for $QBAR_{rural}$ is obtained.

For 50ha area $QBAR_{rural}$ $= 0.00108\ [0.5]^{0.89} \times [946]^{1.17} \times [0.47]^{2.17}$

$= 0.343\ m^3/s$

$QBAR_{rural}$ = 6.867 l/s/ha > 2l/s/ha

$QBAR_{rural}$ area 1 = 6.867 l/s/ha x 0.48 ha = 3.293 l/s

$QBAR_{rural}$ area 2 = 6.867 l/s/ha x 0.20 ha = 1.356 l/s

$QBAR_{rural}$ area 3 = 6.867 l/s/ha x 0.56 ha = 3.850 l/s

$QBAR_{rural}$ area 5 = 6.867 l/s/ha x 0.08 ha = 0.559 l/s

According to the GDSDS Chapter 6.3.14 if the separate long-term storage cannot be provided and temporary flood storage forms part of the single attenuation system, all the runoff from the site should be discharged at a rate of 2 l/s/ha or the average annual peak flow rate QBAR, whichever is greater. In this case QBAR is the higher value and has been adopted as the limiting discharge rate.

While it is possible to design and manufacture a Hydrobrake which will restrict flow rates to very low values, when the flow rate is less than 2 litres / second the Hydrobrake units are highly susceptible to blockage and are not necessarily suitable in the drainage network. The SuDS Manual (CIRIA Document C753) specifies a minimum orifice diameter of 75mm which cannot be achieved while simultaneously limiting the flow to 1.356 l/s and 0.559 l/s for areas 2 and 5 respectively. Therefore, it is proposed to provide a Hydrobrake which will limit the outflow from the attenuation tank to 2 litres / second.

A breakdown of the impermeable areas contributing to the surface water drainage network in each catchment with applied runoff coefficients is provided in Table 2-3 to Table 2-11.

Table 2-3 - Breakdown of Impermeable Area 1

Total Area sq.m	Type of Surface		Area sq.m	Run-off Coefficient	Equivalent Impermeable	Urban Creep Allowance (10%)	Climate Change (20%)	Overall Impermeable
4,794.80	Roof	Standard roof (25%)	695.17	0.95	660.41	726.45	871.74	1577.92
		Green Roof (75%)	0.00	0.60	0.00	0.00	0.00	
	Permeable Paving inc. areas from hardstanding		440.52	0.50	220.26	242.29	290.74	
ha	Landscaped Areas inc. areas from hardstanding		1573.61	0.20	314.72	346.19	415.43	ha
0.48	Hardstanding		0.00	0.90	0.00	0.00	0.00	0.16

Table 2-4 – Breakdown of Impermeable Area 1 – Green Blue Roof

Total Area sq.m	Type of Surface		Area sq.m	Run-off Coefficient	Equivalent Impermeable	Urban Creep Allowance (10%)	Climate Change (20%)	Overall Impermeable
4,798.03	Roof	Standard roof (25%)	0.00	0.95	0.00	0.00	0.00	1651.72
		Green Roof (75%)	2085.50	0.60	1251.30	1376.43	1651.72	
	Permeable Paving inc. areas from hardstanding		0.00	0.50	0.00	0.00	0.00	
ha	Landscaped Areas inc. areas from hardstanding		0.00	0.20	0.00	0.00	0.00	ha
0.48	Hardstanding		0.00	0.90	0.00	0.00	0.00	0.17

Table 2-5 – Breakdown of Impermeable Area 2

Total Area sq.m	Type of Surface		Area sq.m	Run-off Coefficient	Equivalent Impermeable	Urban Creep Allowance (10%)	Climate Change (20%)	Overall Impermeable
1,974.30	Roof	Standard roof (25%)	274.73	0.95	261.00	287.10	344.51	702.28
		Green Roof (75%)	0.00	0.60	0.00	0.00	0.00	
	Permeable Paving inc. areas from hardstanding		319.86	0.50	159.93	175.92	211.11	
ha	Landscaped Areas inc. areas from hardstanding		555.51	0.20	111.10	122.21	146.65	ha
0.20	Hardstanding		0.00	0.90	0.00	0.00	0.00	0.07

Table 2-6 – Breakdown of Impermeable Area 2 – Green Blue Roof

Total Area sq.m	Type of Surface		Area sq.m	Run-off Coefficient	Equivalent Impermeable	Urban Creep Allowance (10%)	Climate Change (20%)	Overall Impermeable
1,974.30	Roof	Standard roof (25%)	0.00	0.95	0.00	0.00	0.00	652.76
		Green Roof (75%)	824.20	0.60	494.52	543.97	652.76	
	Permeable Paving inc. areas from hardstanding		0.00	0.50	0.00	0.00	0.00	
ha	Landscaped Areas inc. areas from hardstanding		0.00	0.20	0.00	0.00	0.00	ha
0.20	Hardstanding		0.00	0.90	0.00	0.00	0.00	0.07

Table 2-7 – Breakdown of Impermeable Site Area 3

Total Area sq.m	Type of Surface		Area sq.m	Run-off Coefficient	Equivalent Impermeable	Urban Creep Allowance (10%)	Climate Change (20%)	Overall Impermeable
5,606.50	Roof	Standard roof (25%)	854.80	0.95	812.06	893.26	1071.92	2215.43
		Green Roof (75%)	0.00	0.60	0.00	0.00	0.00	
	Permeable Paving inc. areas from hardstanding		1429.45	0.50	714.73	786.20	943.44	
ha	Landscaped Areas inc. areas from hardstanding		757.86	0.20	151.57	166.73	200.08	**ha**
0.56								0.22
	Hardstanding		0.00	0.90	0.00	0.00	0.00	

Table 2-8 – Breakdown of Impermeable Area 3 – Green Blue Roof

Total Area sq.m	Type of Surface		Area sq.m	Run-off Coefficient	Equivalent Impermeable	Urban Creep Allowance (10%)	Climate Change (20%)	Overall Impermeable
5,606.50	Roof	Standard roof (25%)	0.00	0.95	0.00	0.00	0.00	2031.00
		Green Roof (75%)	2564.39	0.60	1538.64	1692.50	2031.00	
	Permeable Paving inc. areas from hardstanding		0.00	0.50	0.00	0.00	0.00	
ha	Landscaped Areas inc. areas from hardstanding		0.00	0.20	0.00	0.00	0.00	**ha**
0.56								0.20
	Hardstanding		0.00	0.90	0.00	0.00	0.00	

Table 2-9 – Breakdown of Impermeable Area 4

Total Area sq.m	Type of Surface	Area sq.m	Run-off Coefficient	Equivalent Impermeable	Urban Creep Allowance (10%)	Climate Change (20%)	Overall Impermeable
790.10	Standard Roof	258.77	0.95	245.83	270.41	324.50	491.15
	Permeable Paving inc. areas from hardstanding	66.62	0.50	33.31	36.64	43.97	
ha	Landscaped Areas inc. areas from hardstanding	464.71	0.20	92.94	102.24	122.68	**ha**
0.08							0.05
	Hardstanding	0.00	0.90	0.00	0.00	0.00	

Table 2-10 – Breakdown of Impermeable Area 5

Total Area sq.m	Type of Surface	Area sq.m	Run-off Coefficient	Equivalent Impermeable	Urban Creep Allowance (10%)	Climate Change (20%)	Overall Impermeable
813.60	Standard Roof	0.00	0.95	0.00	0.00	0.00	311.34
	Permeable Paving inc. areas from hardstanding	243.81	0.50	121.91	134.10	160.91	
ha	Landscaped Areas inc. areas from hardstanding	569.79	0.20	113.96	125.35	150.42	**ha**
0.08							0.03
	Hardstanding	0.00	0.90	0.00	0.00	0.00	

Table 2-11 – Breakdown of Impermeable Area 6

Total Area sq.m	Type of Surface	Area sq.m	Run-off Coefficient	Equivalent Impermeable	Urban Creep Allowance (10%)	Climate Change (20%)	Overall Impermeable
922.10	Standard Roof	348.87	0.95	331.43	364.57	437.48	621.74
	Permeable Paving inc. areas from hardstanding	83.15	0.50	41.58	45.73	54.88	
ha	Landscaped Areas inc. areas from hardstanding	490.08	0.20	98.02	107.82	129.38	**ha**
0.09							0.06
	Hardstanding	0.00	0.90	0.00	0.00	0.00	

2.5 Sustainable Drainage Systems (SuDS)

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)

2.5.1 Compliance with the principles of the CIRIA C753 SuDS Manual

The C753 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 in present and 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)

Table 2-12 includes a list of all current SuDS measures which would typically be considered when designing a new residential development such as that which is now proposed. This table also outlines the rationale behind the selection of SuDS measures and why other measures would not be appropriate. The runoff generated from the catchment will be attenuated in storage structures within and below ground and in the blue roof attenuation systems. The proposed attenuation systems are explained in section 2.5. A wide range of SuDS measures are proposed across the site to maximise interception and treatment.

Table 2-12 - Proposed SuDS Features

SUDS Measure	Measure Adopted	Rationale for Selecting / Not Selecting Measure
Bioretention Swales *Shallow landscaped depressions that serve to reduce runoff rates / volumes as well as providing interception storage, treatment of runoff and encouraging biodiversity*	Yes	Bioretention swales are proposed in areas beside roads and green spaces within the site.
Tree pits *Attenuate surface water runoff by utilising voids within the root zone*	Yes	Tree pits have been specified in suitable areas beside the development roads and car parking.
Green Roofs *Vegetated roofs used to reduce the rate and volume of runoff as well as encouraging biodiversity*	Yes	It is proposed to provide green roofs for the apartment blocks at Site 18, 17 and 5.
Blue Roofs *Provide attenuation storage, reducing requirement for storage elsewhere on site*	Yes	It is proposed to provide blue roofs for the apartment blocks at Site 18, 17 and 5.
Green Living Walls *Planted walls which improve air quality and encourage biodiversity*	No	Green walls are not considered appropriate given the proposed residential building use.
Rain Gardens *Localised depressions in the ground that collect runoff from hard surfaces and allow infiltration and absorption*	Yes	Rain gardens are proposed in areas beside roads and green open spaces within the site.
Rainwater harvesting *Runoff captured from roofs is reused for non-potable purposes, thereby reducing overall runoff volume.*	No	In the case of the proposed residential development, it is not considered viable to gather the water for grey water use.
Permeable paving *Allows runoff to percolate into the subsoil, reducing overall runoff volume*	Yes	Permeable paving is proposed within the development in homezones, driveways and car parking spaces.
Porous asphalt *Allows runoff to percolate into the subsoil, reducing overall runoff volume*	No	Porous asphalt is not considered suitable for use in roads within the development as it does not comply with the Local Authority roads standards.
Integrated Constructed Wetlands (ICWs) *System of shallow ponds, planted to treat water, removing nutrients and harmful impurities*	No	ICWs are not considered appropriate due to the limited space available.
Dry Ponds *Depressed area of site for water infiltration, planted to treat water, removing harmful impurities and provide attenuation*	Yes	Detention Basins are considered appropriate in the communal open space available.

Further details of the principal SuDS features proposed for this development are provided in the following sections.

2.5.2 Intensive Green/ Blue Roofs

As part of the proposed development, it is intended to provide intensive green/ blue roofs to apartments at Sites 18, 17 and 5. Green roofs provide ecological, aesthetic and amenity benefits and intercept and retain rainfall, at source, reducing the volume of runoff and attenuating peak flows. Details from the suppliers of green systems indicate that they will typically provide interception storage of 38 litres per square metre of roof covering.

Green roofs absorb most of the rainfall that they receive during normal rainfall events and treat surface water through removal of atmospherically deposited urban pollutants. They also reduce building heating requirements (by evaporating cooling). Intensive green roofs typically have a growing medium of 200mm allowing for a wider array of planting possibilities than extensive (sedum) green roof coverings.

The green roofs will be underlaid by a storage medium so that they also perform as blue roofs, capable of attenuating rainwater. The proposed green/ blue roofs will provide initial storage of rainwater, while also reducing the rate at which rainwater from heavier rainfall events discharges to the attenuation systems.

Flow restrictor outlets will be provided to control the rate of runoff from the roofs. The overflow from the green/blue roof is limited by a Hydrobrake flow control device which will control the rate of runoff from the roofs to **3.295 l/s** for area 1, **1.356 l/s** for area 2 and **3.850 l/s** for area 3. Refer to Appendix B for the breakdown of the $QBAR_{rural}$ for the blue green roofs.

Since the green/blue roofs provide their own attenuation with flow restrictor outlet on the roof, these areas will not drain towards the main attenuation tank on site. Runoff from the green/ blue roofs will connect to the surface water drainage pipework downstream from the main attenuation tank and associated Hydrobrake.

It is proposed to provide intensive green/ blue roofs over at least 75% of the total roof area, which exceeds the minimum coverage requirement of 50% as outlined in the Dublin City Council Green & Blue Roof Guidelines 2021.

Roof structures will be designed to cater for the additional loads associated with the blue roof storage layer and the overlying green roof build-up. Details of the proposed green/ blue roof build-up are provided on Malone O'Regan drawing no. SHB4-BMD-DR-MOR-CS-P3-151, an extract from which is provided in Figure 2-3.

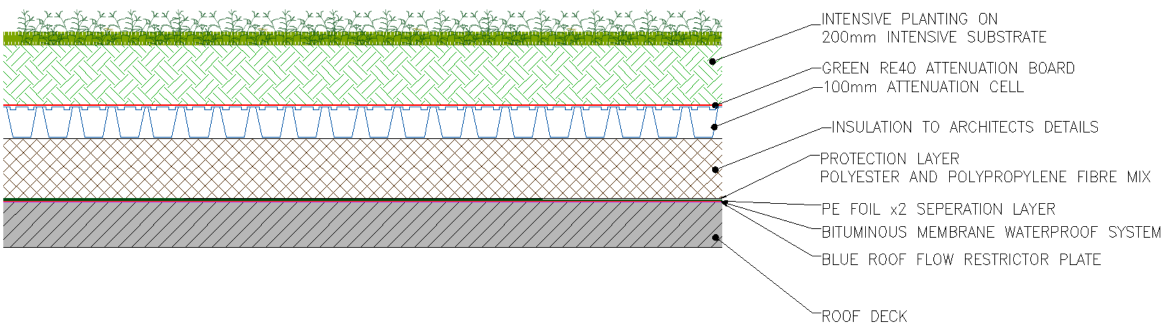


Figure 2-3 – Typical Intensive Green/ Blue Roof Section

2.5.3 Permeable Paving

It is proposed to use permeable paving to surface the private curtilage areas, parking spaces and footpaths in the development. It is anticipated that most of the rainwater will be able to percolate through the permeable paving and infiltrate into the underlying soils. However, it is proposed to provide a number of overflow outlets within the permeable paving build-up which will ensure the permeable area is not flooded during severe rainfall events. The outlet from the permeable paving areas will be raised 100-150mm above formation level to provide interception storage within the stone sub-base; this gives 30mm interception storage @ 30% voids in the gravel.

These permeable surfaces, together with their associated substructures, are an efficient means of managing surface water runoff close to source – intercepting runoff, reducing the volume and frequency of runoff, and providing treatment medium. Refer to the Malone O'Regan SuDS detail drawing no. SHB4-BMD-DR-MOR-CS-P3-151 for typical permeable paving details.

Permeable paving will be provided with a perforated underdrain pipe. The pipe shall be raised above the base of the stone sub-base so that minor accumulations of runoff water can percolate through the stone sub-base. During significant rainfall events, excess water will disperse through the perforated underdrain preventing flooding at surface level. The underdrain will connect to inspection manholes which will facilitate maintenance of the drainage pipework.

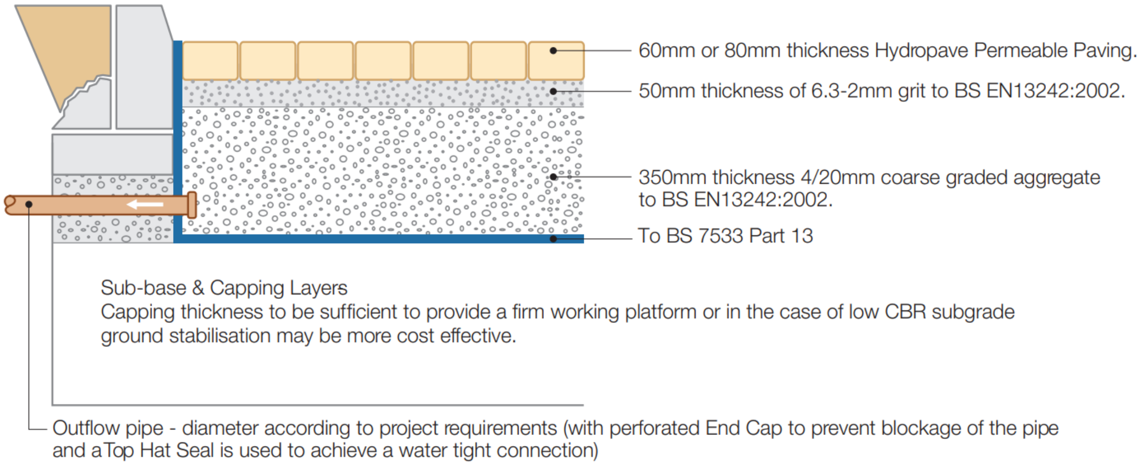


Figure 2-4 – Typical Section through Permeable Paving

2.5.4 Rain Garden / Bioretention Area

It is proposed to provide a number of bioretention rain gardens in the green open spaces of the development. A bioretention rain garden employs an engineered topsoil and is used to manage polluted urban rainfall runoff from hard surfaces areas. Refer to the Malone O'Regan SuDS detail drawing no. SHB5-LDR-DR-MOR-CS-P3-151 for typical rain garden detail.

The report prepared by Causeway Geotech imply that the subsoil may be considered suitable media for infiltration. It is anticipated that runoff from minor rainfall events will be able to percolate directly into the soil. Key design aspects for bioretention raingardens include:

1. Silt collection in forebays to allow for easy removal of silt.
2. Space above the soil profile for water collection and stilling before infiltration through the engineered soil.
3. A surface mulch of organic matter, grit or gravel protects the infiltration capacity of the soil.
4. A free draining soil, typically 450 – 600mm deep, with 20 – 30% organic matter cleans, stores and conveys runoff to a drainage layer.
5. A transition layer of grit and/ or sand protects the under-drained drainage layer.

6. A surface overflow for heavy rain or in the event of blockage.
7. Perforated underdrain pipe.

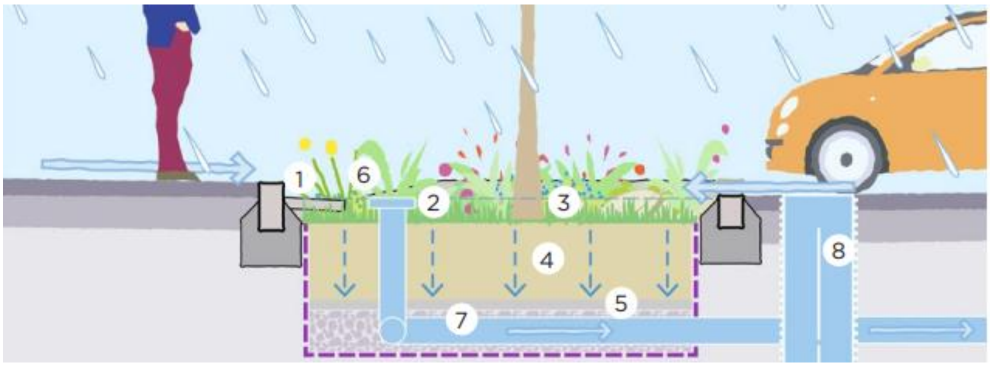


Figure 2-5 - Typical Section through Bioretention Rain Garden (Extract from South Dublin County Council – Sustainable Drainage Explanatory Design & Evaluation Guide 2022)

2.5.5 Tree Pit

It is proposed to provide a number of tree pits adjacent to car parking and footpaths where feasible within the development. Runoff from the roads and footpaths will be directed towards these tree pits. Refer to landscape architects detailed drawings for Tree Pit details.

These features will provide a level of storage to attenuate the runoff flows. It is anticipated that runoff from minor rainfall events will be able to percolate directly into the soil. An overflow from the tree pits will be provided. During larger storm events, the water in the bioretention areas will be able to overflow and drain towards the attenuation system.

The bioretention areas will be planted in order to promote biodiversity. Runoff will also be treated through the adsorption of particles by vegetation or by soil, and by biological activity. Tree pits can reduce the runoff rates and volumes of surface water although the area contributing is small. They are effective in delivering interception and treatment storage.

2.6 Interception Storage

To prevent pollutants or sediments discharging into watercourses the GDSDS requires "interception storage" to be incorporated into the drainage design for the development. The volume of interception required is based on 5-10mm of rainfall depth from 80% of the runoff from impermeable areas as defined in GDSDS. The interception volume attributable to each SuDS feature consists of the volume of water that can infiltrate to the ground, the quantity that evaporates into the atmosphere and the volume lost through transpiration in plants and vegetation. Additionally, there will be some loses of water due to absorption and wetting of stone and soil media.

The required interception storage and provided interception storage is provided in Appendix B of the report.

2.7 Attenuation Design

Attenuation storage is provided on the site using water storage within the stone of permeable paved areas and a detention basin. For the purposes of surface water attenuation design, the site is broken down into the six catchments split between four storage systems as shown in Figure 2-1 and Figure 2-2. The volume of surface water storage required within the site has been calculated in accordance with the SuDS Manual Ciria C697, taking account of design invert levels, ground levels, attenuation storage or detention basin depth and allowable discharge rate. Calculations for the attenuation systems are provided in Appendix B.

Surface water runoff from area 1 is directed towards an attenuation tank. Surface water runoff from area 2 and 3 is directed towards detention basin located within their respective areas, surface water runoff from areas 4, 5 and 6 is directed towards a detention basin in area 5. The attenuation storage calculated for each site is sized to cater for a 1:100-year storm event.

The attenuation volumes have been calculated accommodating a 20% increase in future rainfall intensities as a result of climate change allowing for 10% urban creep. The attenuation storage has been assessed using the average annual peak flow rate QBAR. Based on those calculations, the volume runoff water that will be generated during the 1 in 100-year storm event for the site and the value at which the flow control device will restrict the flow is shown in Table 2-13.

Table 2-13 – Attenuation Volumes

	Calculated Storage Capacity (m^3)	**1:100-year flood event Calculated (m^3)**	**QBARrural (l/s)**
Area 1 (site 18) Attenuation Tank	55.10	38.753	3.293
Area 2 (site 17) Detention Basin	76.524	18.037	1.356
Area 3 (site 5) Detention Basin	118.462	59.975	3.850
Site 4,5&6 (sites 15 & 16) Detention Basin	43.304	37.301	0.543

2.8 GDSDS Criterion Compliance

2.8.1 Criterion 1 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.

2.8.2 Criterion 2 River Regine Protection

Attenuation storage is provided to limit the discharge rate from the site into the public network. As per the GDSGS, the required attenuation volume has been calculated for the 1-year, 30-year and 100-year return periods, identifying the critical storm for each – refer to the calculations included in Appendix B.

Standard Average Annual Rainfall for the site in Ballymun was taken from the Flood Studies Report as 946mm. An appropriate Soil Index value was determined following a review of published data and site-specific ground investigation works.

The 1975 Flood Studies Report included a Soil Index map, a digitised various of which is available at www.uksuds.com. This map indicates that the site lies within an area of Soil Type 4 (SPR Index 0.47). Soil Type 4 corresponds with clay or loamy soils with a high runoff potential.

Site Investigation works were completed by Ground Investigations Ireland in March 2024. The investigation showed that ground consisted of:

- Made Ground: Made ground deposits were encountered at depths between 0.60m and 4.10m bgl. These deposits consisted of brown slightly sandy gravelly clay.
- Cohesive Deposits: Cohesive deposits were described as brown slightly sandy slightly gravelly clay with occasional cobbles and boulders overlying a dark grey slightly sandy gravelly clay with occasional cobbles and boulders. The strength of the cohesive deposits was firm to stiff below 2m bgl.

5no. soakaway tests were conducted on site. At the location of the 5 soakaways the water level dropped too slowly to allow calculation of 'f' the soil infiltration. The report prepared by Ground Investigation Ireland concludes that the low-permeability clay soils are considered to be poor infiltration media and would be deemed unsuitable for the implementation of infiltration drainage systems.

The ground investigation reveal that the subsoil corresponds with Soil Type 4 (SPR Index 0.47). Based on those calculations, the volume runoff water that will be generated during the 1 in 100-year storm event for the site and the value at which the flow control device will restrict the flow is shown in Table 2-13.

2.8.3 Criterion 3 Level of Service

There are four criteria for levels of service. These are:

- Criterion 3.1: No external flooding except where specifically planned (30-year high intensity rainfall event).
- Criterion 3.2: No internal flooding (100-year high intensity rainfall event).
- Criterion 3.3: No internal flooding (100-year river event and critical duration for site storage).
- Criterion 3.4: No flood routing off site except where specifically planned (100-year high intensity rainfall event).

Both internal and external flooding have been assessed in the Flood Risk Assessment report which accompanies this Engineering Assessment report. The Flood Risk Assessment has been carried out in accordance with the DEHLG/OPW Guidelines on the Planning Process and Flood Risk Management published in November 2009.

The assessment identifies the risk of both internal and external flooding at the site from various sources and sets out mitigation measures against the potential risks of flooding. The sources of possible flooding assessed in the report include coastal, fluvial, pluvial (direct heavy rain), groundwater.

As a result of the flood risk management and mitigation measures proposed, the residual risk of internal or external flooding for the 30-year and 100-year flood events is low, and accordingly all four of the above criteria have been met. Please refer to the accompanying Flood Risk Assessment report for the full analysis of the flood risk at the subject site.

2.8.4 Criterion 4 River Flood Protection

The long-term storage volume is a comparison of pre- and post- development runoff volumes. The objective is to limit the runoff discharged after development to the same as that which occurred prior to the development.

Of the three methods described in the GDSDS for establishing River Flood Protection by comparison of the pre- and post- development runoff volumes, (Criteria 4.1, 4.2 and 4.3 respectively), Criteria 4.3 is selected for use as the most practical criteria at this stage in the design.

The Criteria 4.3 approach is for all runoff to be limited to either QBAR or to 2l/s/ha, whichever is greater. As noted in Section 2.4, in this instance, the QBAR is greater than 2l/s/ha and has been adopted as the limiting discharge rate.

The proposed drainage system includes a flow control device to ensure that the discharge rate is limited to the greenfield equivalent and ample attenuation is provided for the 1 in 100-year flood event, accounting for 20% increase due to climate change.

2.9 Enhanced Biodiversity

Bioretention areas will be included as part of the proposed development. Biodiversity has been carefully considered when determining both the location and the detailed design of these elements. The proposed bioretention area offers the opportunity to create a planted vegetation zone for plants and animals which will encourage biodiversity on the site.

2.10 SuDS CIRIA Pillars of Design

2.10.1 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 (i.e., the peak runoff rate) and
- How much runoff is discharged from the site (i.e., the runoff volume)

2.10.2 Water Quality

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

2.10.3 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.

MOR 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 are green/blue roofs and bio-retention areas.

2.10.4 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 should also aim to replicate the existing habitats from the pre- development stage.

By incorporating large, landscaped areas, green/blue roofs throughout the site and the bio-retention areas, biodiversity on site is promoted.

2.10.5 SuDS Conclusion

This section of the report has comprehensively discussed the various SuDS measures which can be applied to the site and then selected the applicable systems, based on the site layout. A wide range of measures have been employed.

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 extensive coverage of the developed area of the site. These measures will be effective in treating rainfall on the site to meet GDSDS and CIRIA.

2.11 Maintenance and Management Plan

Refer to appendix E for details of maintenance requirements for individual SuDS drainage measures on the site.

2.12 Potential Future Expansion

No future expansion has been considered for the proposed drainage networks for the development.

3 FOUL WATER DRAINAGE DESIGN

3.1 General

The foul water drainage infrastructure has been designed in accordance with Irish Water Technical Standard for Wastewater Gravity Sewers (Document Number: IW-TEC-800-01) and the Irish Water Code of Practice for Wastewater Infrastructure (Document Number: IW-CDS-5030-03).

On 11th of April 2024 a Pre-Connection Enquiry Form was submitted to Irish Water in respect of this development. Irish Water provided a Confirmation of Feasibility letter which confirms that, subject to a valid connection agreement being put in place, the proposed connection to the public sewer network can be facilitated. The letter further notes that Irish Water have reviewed the wastewater characteristics and hydraulic discharge load and determined that the proposed wastewater connection was feasible without infrastructure upgrade. A Copy of the Irish Water Confirmation of Feasibility Letter is provided in Appendix A.

Table 3-1 outlines the parameters adopted in the design of the foul and process water drainage infrastructure.

Table 3-1 - Foul Water Design Parameters

Parameter Description	Assigned Value
Hydraulic Loading (Foul associated with domestic)	150 litres / person / day
Pipe Friction	1.5 mm
Minimum Velocity	0.7 m/s
Maximum Velocity	3.0 m/s
Peaking Factor (for domestic foul flows only)	6.0

Calculations for the foul and process water pipe networks are provided in Appendix D. An extract from Irish Water Maps showing the foul water serving the site is provided in Appendix F.

3.2 Existing Services

Existing foul water sewers run around the perimeter of the sites on a variety of sides. For site 5 there are 2no. 225mm concrete sewers on Ballymun Road. There is a 300mm concrete sewer mid-way through the site running in east west direction and then heading southwards. For sites 15 and 16 there is a 225mm concrete sewer on Balcurris Close and on Balcurris Park East. The latter increases to a 600mm concrete sewer running just off Balcurris Road. For site 17 there is a 300mm concrete sewer running through the site heading south. For site 18 there is a 300mm concrete sewer running from Balbutcher Lane diagonally across the site heading southeast direction. These underground sewers carry foul water from other areas adjacent to the site. Due to the relative levels of the existing drainage and the proposed site levels, it is possible to achieve a gravity connection to the foul water drainage pipework installed.

3.3 Proposed Services

The proposed foul water drainage system is designed to comply with the 'Greater Dublin Strategic Drainage Study (GDSDS) Regional Drainage Policies Technical Document – Volume 2, New Developments, 2005' and the 'Greater Dublin Regional Code of Practice for Drainage Works, V6.0 2005'.

The proposed foul water drainage layout for the development is indicated on Malone O'Regan drawings SHB4-BMD-DR-MOR-CS-P3-130. Foul water from new housing units will be collected within a gravity drainage network and directed towards the main sewer.

3.4 Foul Water Demand Calculations

3.4.1 Residential Foul Water Demand

In accordance with the Irish Water Code of Practice for Wastewater Infrastructure works which carry domestic wastewater shall be designed to carry a wastewater volume of between 6 times the dry weather flow.

Dry weather flow (DWF) should be taken as 446 litres per dwelling.

DWF = 277 units x 446 l/dwelling = 123,542 l/day = **1.430 l/sec**

Peak discharge = 6 x DWF = **8.579 l/sec**

3.4.2 Creche Foul Water Demand

Consideration was given to the planned development of 1 no. crèche facility of 241sqm at ground floor in Site 5. The average and peak water demand rates were calculated in accordance with the Irish Water Code of Practice for Water Infrastructure guidelines which assumes a loading rate of 90 litres per person per day for non-residential school with canteen cooking on site.

It was assumed that there will be 40 children (Assumed 1 child per 6m^2) attending the creche with 10 staff members (Assumed 1 staff member per 4 children) working in the creche.

Total persons = 50 people

Average water demand = 90litres/person/day

Total daily discharge = 50 people x 90litres/person/day = 45000 litres/day

Average Hour Demand = 4500 litres/day / (24hr x 60min x 60sec)
= **0.052 l/s**

In accordance with Table 2.7 Commercial Peaking Factors, the peaking factor applied to commercial wastewater flow for an area of 0 – 5.5ha is 4.5 x DWF.

Peak discharge = 4.5 x DWF = **0.234 l/s**

3.4.3 Community Centre/ Retail Commercial Foul Water Demand

There is provision of 1205m^2 Retail/ Commercial floor space at ground level facing Ballymun Road/ St. Pappins Square in Sites 5 and 17. There is also provision of 704m^2 of community, cultural and arts spaces located at ground floor level in Sites 5 and 17.

The average and peak water demand rates were calculated in accordance with the Irish Water Code of Practice for Water Infrastructure guidelines which assumes a loading rater of 40 l/person/day for a Local Community Sports Club.

Total persons = 955 people
(Assumed 1 person per 2m^2 of floor area = 1205m^2 + 704m^2 = 1909m^2/ 2 = 955 people)

Average water demand = 40litres/person/day

Total daily discharge = 955 people x 40litres/person/day = 38,200 litres/day

Average Hour Demand = 38,200 litres/day / (24hr x 60min x 60sec)
= **0.442 l/s**

In accordance with Table 2.7 Commercial Peaking Factors, the peaking factor applied to commercial wastewater flow for an area of 0 – 5.5ha is 4.5 x DWF.

Peak discharge = 4.5 x DWF = **1.989 l/s**

Average and peak discharge rates for all existing and proposed developments are summarised in Table 3-2.

Table 3-2 – Average and Peak Foul Discharge Rates for All Developments

Development Description	Average Demand (l/s)	Peak Demand (l/s)
Proposed development of residential units	1.430	8.579
Creche	0.052	0.234
Community Centre/ Retail Commercial	0.442	1.989
Total	**1.924**	**10.802**

3.5 Potential Future Expansion

No future expansion has been considered for the proposed drainage networks for the development.

4 WATER SUPPLY

4.1 General

The Proposed Development will use mains water. The proposed water supply infrastructure has been designed in accordance with the Irish Water Code of Practice for Water Infrastructure (Document Number: IW-CDS-5020-03).

On 11th of April 2024 a Pre-Connection Enquiry Form was submitted to Irish Water in respect of this development. Irish Water provided a Confirmation of Feasibility (CoF) letter which confirms that, subject to a valid connection agreement being put in place, the proposed connection to the public water supply was feasible subject to upgrades. A Copy of the Irish Water Confirmation of Feasibility Letter is provided in Appendix A. An extract from Irish Water Maps showing the watermains serving the site is provided in Appendix F.

4.2 Existing & Proposed Services

It is proposed to provide a potable water supply to the development off the existing mains in the vicinity of the site. Existing watermains run around the perimeter of the site on a variety of sides.

For site 5 there is a 200mm increasing to a 300mm watermain on Ballymun Road. There is a 100mm watermain mid-way through the site running in east west direction. For sites 15 and 16 there is a 100mm watermain on Balcurris Close and on Balcurris Park East. For site 17 there is a 100mm watermain on Balcurris Close. For site 18 there is a 100mm watermain on Balcurris Close and there is a 450mm watermain running along Balbutcher Lane. The proposed watermain layout is indicated on drawing SHB5-BMD-DR-MOR-CS-P3-140 which accompanies this planning application.

4.3 Water Demand Calculations

4.3.1 Residential Water Demand

The average and peak water demand rates were calculated in accordance with the Irish Water Code of Practice for Water Infrastructure guidelines which assumes a loading rate of 150 litres per person per day and an occupancy rate of 2.7 persons per dwelling. The average day/ peak week demand is taken as 1.25 times the average daily domestic demand. The peak demand is taken to be 5 times the average day/ peak week demand.

Total Daily Water Demand = 288 units x 2.7 persons x 150 litres per day per person
= 116,640 litres/day

Average Hour Demand = 116,640 litres/day / (24hr x 60min x 60sec)
= 1.350 litres/sec

Average Day / Peak Week Demand = 1.350 litres/sec x 1.25
= **1.688 litres/sec**

Peak Demand = 5 x 1.688 litres/sec = **8.440 litres/sec**

4.3.2 Creche Water Demand

Consideration was given to the planned development of 1 no. crèche facility of 324sqm at ground floor in Site 5. The average and peak water demand rates were calculated in accordance with the Irish Water Code of Practice for Water Infrastructure guidelines which assumes a loading rate of 90 litres per person per day for non-residential school with canteen cooking on site.

It was assumed that there will be 53 children attending the creche and 11 staff members working in the creche.

Total persons = 64 people

Average water demand = 90litres/person/day

Total daily discharge = 64 people x 90litres/person/day = 5760 litres/day = 0.067 litres/sec

Average Day Peak Week Demand = 0.067 x 1.25 = **0.084 litres/sec**

Peak Demand = 5 x 0.084 = **0.420 litres/sec**

4.3.3 Community Centre/ Retail Commercial Foul Water Demand

There is provision of 1611.1m^2 Retail/ Commercial floor space at ground level facing Ballymun Road/ St. Pappins Square in Sites 5 and 17. There is also provision of 680m^2 of community, cultural and arts spaces located at ground floor level in Sites 5 and 17.

The average and peak water demand rates were calculated in accordance with the Irish Water Code of Practice for Water Infrastructure guidelines which assumes a loading rater of 40 l/person/day for a Local Community Sports Club.

Total persons = 1146 people
(Assumed 1 person per 2m^2 of floor area = 1611.1m^2 + 680m^2 = 2291.1m^2/ 2 = 1146 people)

Average water demand = 40litres/person/day

Total daily discharge = 1146 people x 40litres/person/day = 45,840 litres/day = 0.531 litres/sec

Average Day Peak Week Demand = 1.25 x 0.531 = **0.664 litres/sec**

Peak Demand = 5 x 0.664 = **3.319 litres/sec**

Average and peak discharge rates for the proposed development is summarised in Table 4-1.

Table 4-1 - Average and Peak Discharge Rates for All Developments

Development Description	Average Demand (l/s)	Peak Demand (l/s)
Proposed development of residential units	1.688	8.440
Creche	0.084	0.420
Community Centre/ Retail Commercial	0.664	3.319
Total	**2.436**	**12.179**

Since the Pre-Connection Enquiry Form was submitted, there was minor changes in the number of proposed residential units, creche and community centre/retail GFA. Therefore, resulting in a 4% increase in the demand for the residential units, 29% increase in the creche and 20% for the community centre/retail demand when compared to the values submitted to Irish water in November 2023.

APPENDIX A – IRISH WATER CONFIRMATION OF FEASIBILITY

CONFIRMATION OF FEASIBILITY

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

Uisce Éireann
PO Box 448
South City
Delivery Office
Cork City

www.water.ie

Ray O'Connor

Malone O'Regan
2B Richview Office Park
Clonskeagh
Dublin 14
D14 XT57

11 April 2024

Our Ref: CDS23009380 Pre-Connection Enquiry
Apartments at Ballymun, Balcurris Road, Ballymun, Dublin

Dear Applicant/Agent,

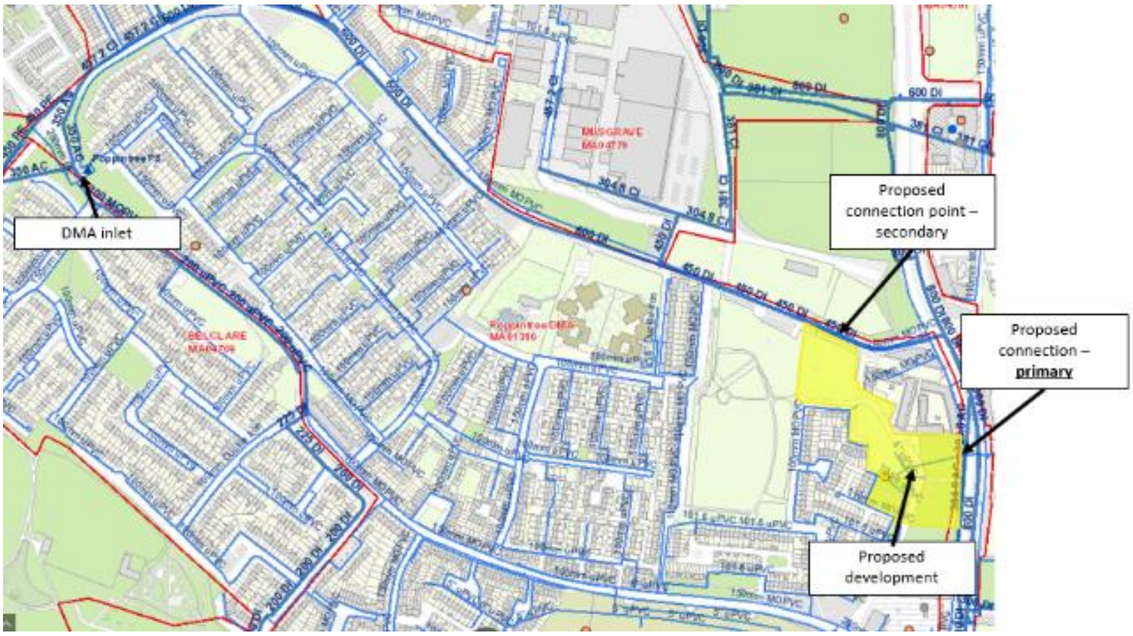
We have completed the review of the Pre-Connection Enquiry.

Uisce Éireann has reviewed the pre-connection enquiry in relation to a Water & Wastewater connection for a Housing Development of 280 unit(s) at Apartments at Ballymun, Balcurris Road, Ballymun, Dublin, (the **Development)**.

Based upon the details provided we can advise the following regarding connecting to the networks;

- **Water Connection** - Feasible Subject to upgrades

- To accommodate the proposed Development, following are required:
  • The Development to be connected to the existing 200mm MOPVC main.
  • Secondary connection to be from the existing 150mm MOPVC on Balbutcher Ln. and should remain shut during normal operation.
  • Both connection pipes and spine main to be 150mm ID pipe.
  • Poppintree DMA has to be rezoned and will include approx. 25m of 150mm ID pipe cross connection in St. Joseph's Way and new valves.
  • Proposed diversions have to be approved by Uisce Éireann Diversion Team. For design submissions and queries related to diversion/build near or over, please contact UÉ Diversion Team via email address diversions@water.ie

- 

- The above will be funded by the Applicant. The fee will be calculated at a connection application stage.

- **Wastewater Connection** - Feasible without infrastructure upgrade by Uisce Éireann

- Proposed diversions have to be approved by Uisce Éireann Diversion Team. For design submissions and queries related to diversion/build near or over, please contact UÉ Diversion Team via email address diversions@water.ie

This letter does not constitute an offer, in whole or in part, to provide a connection to any Uisce Éireann infrastructure. Before the Development can be connected to our network(s) you must submit a connection application and be granted and sign a connection agreement with Uisce Éireann.

As the network capacity changes constantly, this review is only valid at the time of its completion. As soon as planning permission has been granted for the Development, a completed connection application should be submitted. The connection application is available at www.water.ie/connections/get-connected/

Where can you find more information?

- **Section A -** What is important to know?
- **Section B -** Details of Uisce Éireann's Network(s)

This letter is issued to provide information about the current feasibility of the proposed connection(s) to Uisce Éireann's network(s). This is not a connection offer and capacity in Uisce Éireann's network(s) may only be secured by entering into a connection agreement with Uisce Éireann.

For any further information, visit **www.water.ie/connections**, **email newconnections@water.ie** or contact 1800 278 278**.**

Yours sincerely,

Dermot Phelan
Connections Delivery Manager

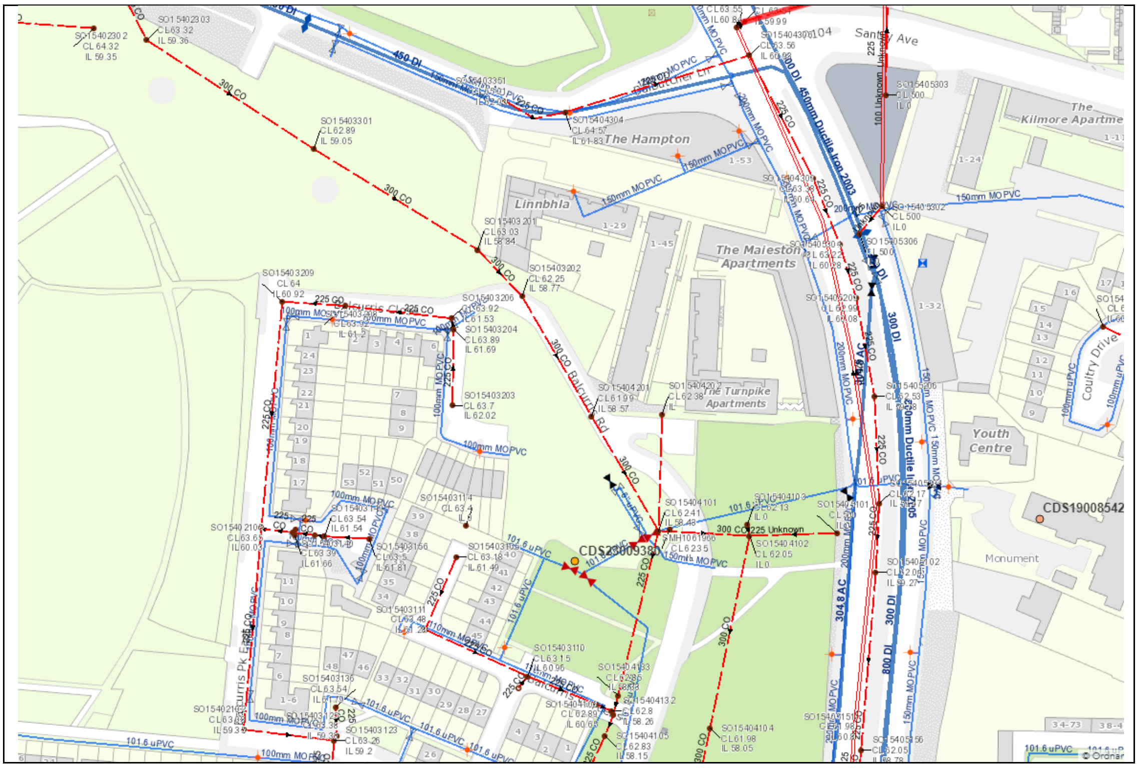
Section A - What is important to know?

What is important to know?	Why is this important?
Do you need a contract to connect?	• Yes, a contract is required to connect. This letter does not constitute a contract or an offer in whole or in part to provide a connection to Uisce Éireann's network(s). • Before the Development can connect to Uisce Éireann's network(s), you must submit a connection application and be granted and sign a connection agreement with Uisce Éireann.
When should I submit a Connection Application?	• A connection application should only be submitted after planning permission has been granted.
Where can I find information on connection charges?	• Uisce Éireann connection charges can be found at: https://www.water.ie/connections/information/charges/
Who will carry out the connection work?	• All works to Uisce Éireann's network(s), including works in the public space, must be carried out by Uisce Éireann*. *Where a Developer has been granted specific permission and has been issued a connection offer for Self-Lay in the Public Road/Area, they may complete the relevant connection works
Fire flow Requirements	• The Confirmation of Feasibility does not extend to fire flow requirements for the Development. Fire flow requirements are a matter for the Developer to determine. • **What to do?** - Contact the relevant Local Fire Authority
Plan for disposal of storm water	• The Confirmation of Feasibility does not extend to the management or disposal of storm water or ground waters. • **What to do?** - Contact the relevant Local Authority to discuss the management or disposal of proposed storm water or ground water discharges.
Where do I find details of Uisce Éireann's network(s)?	• Requests for maps showing Uisce Éireann's network(s) can be submitted to: datarequests@water.ie

What are the design requirements for the connection(s)?	• The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this Development shall comply with ***the Uisce Éireann Connections and Developer Services Standard Details and Codes of Practice,*** available at www.water.ie/connections
Trade Effluent Licensing	• Any person discharging trade effluent** to a sewer, must have a Trade Effluent Licence issued pursuant to section 16 of the Local Government (Water Pollution) Act, 1977 (as amended). • More information and an application form for a Trade Effluent License can be found at the following link: https://www.water.ie/business/trade-effluent/about/ **trade effluent is defined in the Local Government (Water Pollution) Act, 1977 (as amended)

Section B – Details of Uisce Éireann's Network(s)

The map included below outlines the current Uisce Éireann infrastructure adjacent the Development: To access Uisce Éireann Maps email datarequests@water.ie



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Note: The information provided on the included maps as to the position of Uisce Éireann's underground network(s) is provided as a general guide only. The information is based on the best available information provided by each Local Authority in Ireland to Uisce Éireann.

Whilst every care has been taken in respect of the information on Uisce Éireann's network(s), Uisce Éireann assumes no responsibility for and gives no guarantees, undertakings or warranties concerning the accuracy, completeness or up to date nature of the information provided, nor does it accept any liability whatsoever arising from or out of any errors or omissions. This information should not be solely relied upon in the event of excavations or any other works being carried out in the vicinity of Uisce Éireann's underground network(s). The onus is on the parties carrying out excavations or any other works to ensure the exact location of Uisce Éireann's underground network(s) is identified prior to excavations or any other works being carried out. Service connection pipes are not generally shown but their presence should be anticipated.

APPENDIX B – ATTENUATION VOLUME CALCULATIONS

Job Title	Ballymun: Area 1	Job no.	23006
By:	MG	Checked by:	DW
Date	16/10/2024	Rev number	1

Part 1 **Permissible Runoff**

The regression equation recommended for use by the Greater Dublin Strategic Drainage Study 2005 calculates a value, QBARural, which is sourced from the Institute of Hydrology Report 124. This value is the mean annual flood flow from a rural catchment in m^3/s and is given by the equation:

QBARrural = 0.00108[Area^0.89] x [SAAR^1.17] x [Soil^2.17]

Rainfall Data		
M5-60 (1 hour - 5 years) mm		16.1
M5-2D (2 days - 5 years) mm		58.6
Ratio "r" (M5-60/ M5-2D)		0.27
SAAR mm		946
Soil/ SPR mm		0.47

Soil Type 4 - Based on SI findings - clay or loamy soils; high runoff potential

For 50 Ha Area ~ QBARrural =		0.343	m^3/s
QBARrural =		6.867	l/s/ha
For 0.48 Ha Area ~ QBARrural =		3.293	l/s

Discharge should be limited to QBAR or 2 l/s/ha whichever is greater.

Part 2 **Impermeable Area**

Breakdown of the impermeable areas contributing to the surface water drainage network in each catchment with applied runoff coeifficients is provided in the table below

Total Area sq.m	Type of Surface		Area sq.m	Run-off Coefficient	Equivalent Impermeable	Urban Creep Allowance (10%)	Climate Change (20%)	Overall Impermeable
4,794.80	Roof	Standard roof (25%)	695.17	0.95	660.41	726.45	871.74	1577.92
		Green Roof (75%)	0.00	0.60	0.00	0.00	0.00	
	Permeable Paving inc. areas from hardstanding		440.52	0.50	220.26	242.29	290.74	
ha	Landscaped Areas inc. areas from hardstanding		1573.61	0.20	314.72	346.19	415.43	ha
0.48								0.16
	Hardstanding		0.00	0.90	0.00	0.00	0.00	

These calculations are based on "Engineering Hydrology" by E.M.Wilson (4th Edition)
Ratio R (%) - Refer to Table 2.9 of "Engineering Hydrology
M10/M100 - Refer to Table 2.7 of "Engineering Hydrology

Part 3 **Attenuation Volume Required**

1 in 10 Years								
Rainfall Duration (D)	Ratio r (%)	M5 (mm)	M10 (mm)	Area	MT	Inflow "I"	Outflow "O"	Capacity Required
	Table 2.9	(M5-2D*Ratio)/100	Table 2.7		M5*M10	MT* Impermeable Area	(QBARrural/1000)*60	"I"-"O" ="S"
1 min	3	1.8	1.15	1	2.022	3.190	0.197562168	2.993
2min	5	2.9	1.15	1	3.370	5.317	0.395124336	4.922
5 min	9	5.3	1.16	1	6.118	9.653	0.98781084	8.666
10 min	12.9	7.6	1.17	1	8.844	13.956	1.97562168	11.980
15 min	15.5	9.1	1.18	1	10.718	16.912	2.96343252	13.949
30 min	20.7	12.1	1.18	1	14.314	22.586	5.92686504	16.659
60 min	27	15.8	1.18	1	18.670	29.460	11.85373008	17.606
2 hour	35	20.5	1.18	1	24.202	38.188	23.70746016	14.481
4 hour	44	25.8	1.17	1	30.167	47.601	47.41492032	0.187
6 hour	51	29.9	1.17	1	34.967	55.174	71.12238048	-15.948
12 hour	65	38.1	1.16	1	44.184	69.719	142.244761	-72.525
24 hour	83	48.6	1.15	1	55.934	88.259	284.4895219	-196.231
48 hour	106	62.1	1.14	1	70.812	111.736	568.9790438	-457.243
Size of Attenuation for 1 in 10 year flood event m³								**17.606**

1 in 30 Years								
Rainfall Duration (D)	Ratio r (%)	M5 (mm)	M30 (mm)	Area	MT	Inflow "I"	Outflow "O"	Capacity Required
	Table 2.7	(M5-2D*Ratio)/100	Table 2.9		M5*M30	MT* Impermeable Area	(QBARrural/1000)*60	"I"-"O" ="S"
1 min	3	1.8	1.43	1	2.514	3.967	0.197562168	3.769
2min	5	2.9	1.43	1	4.190	6.611	0.395124336	6.216
5 min	9	5.3	1.48	1	7.806	12.316	0.98781084	11.329
10 min	12.9	7.6	1.51	1	11.415	18.011	1.97562168	16.036
15 min	15.5	9.1	1.54	1	13.988	22.072	2.96343252	19.108
30 min	20.7	12.1	1.54	1	18.681	29.476	5.92686504	23.549
60 min	27	15.8	1.54	1	24.366	38.447	11.85373008	26.594
2 hour	35	20.5	1.51	1	30.970	48.868	23.70746016	25.161
4 hour	44	25.8	1.5	1	38.676	61.027	47.41492032	13.613
6 hour	51	29.9	1.48	1	44.231	69.793	71.12238048	-1.329
12 hour	65	38.1	1.45	1	55.231	87.149	142.244761	-55.096
24 hour	83	48.6	1.41	1	68.580	108.213	284.4895219	-176.277
48 hour	106	62.1	1.39	1	86.341	136.239	568.9790438	-432.740
Size of Attenuation for 1 in 30 year flood event m³								**26.594**

1 in 100 Years								
Rainfall Duration (D)	Ratio r (%)	M5 (mm)	M100 (mm)	Area	MT	Inflow "I"	Outflow "O"	Capacity Required
	Table 2.7	(M5-2D*Ratio)/100	Table 2.9		M5*M100	MT* Impermeable Area	(QBARrural/1000)*60	"I"-"O" ="S"
1 min	3	1.8	1.75	1	3.077	4.854	0.197562168	4.657
2min	5	2.9	1.77	1	5.186	8.183	0.395124336	7.788
5 min	9	5.3	1.86	1	9.810	15.479	0.98781084	14.491
10 min	12.9	7.6	1.9	1	14.363	22.663	1.97562168	20.688
15 min	15.5	9.1	1.96	1	17.803	28.091	2.96343252	25.128
30 min	20.7	12.1	1.97	1	23.896	37.707	5.92686504	31.780
60 min	27	15.8	1.98	1	31.328	49.432	11.85373008	37.579
2 hour	35	20.5	1.93	1	39.584	62.461	23.70746016	38.753
4 hour	44	25.8	1.89	1	48.732	76.895	47.41492032	29.480
6 hour	51	29.9	1.85	1	55.289	87.242	71.12238048	16.119
12 hour	65	38.1	1.77	1	67.419	106.382	142.244761	-35.863
24 hour	83	48.6	1.72	1	83.657	132.004	284.4895219	-152.485
48 hour	106	62.1	1.69	1	104.976	165.643	568.9790438	-403.336
Size of Attenuation for 1 in 100 year flood event m³								**38.753**

Part 4 **Interception Storage**

To prevent pollitant or sediments discharging into water courses the GDSDS required "interception storage" to be incorporated into the drainage design for the development. The volume of interception required is based on the 5-10mm of rainfall depth from 80% of the runoff from impermeable areas. The interception volume attributable to each of the SuDS features consists of the volyme of water that can infiltrate to the ground, the quanity that evaporates into the atmosphere and the volyme lost through transpiration in plants and vegitation. Additionally, there will be some loses of water due to absorption and westting of stone and soil media.

Required Interception Storage

Overall Impermeable area is 1577.9 m² including 10% for urban creep

Therefore, the total interception storage required is 'overall impermeable area x 80% x 0.005 x 1.2 for climate change' 7.57 m³

Interception Storage Provided *Only fill in SuDS on your site

Permeable Paving	Area	440.5	m²
	Stone Layer 100mm deep	0.1	m
	Void Ratio	30%	
	Storage Volume	13.2156	m³

*Storage depth will depend on your site

Swale	Area	0.0	m²
	*75mm	0	m
	Storage Volume	0	m³

Bio-Retention Area/ Raingarden	Area	0.0	m²
	Depth of subgrade	0	m
	Storage Volume	0	m³

Total interception volume provided for the overall site 13.22 m³

which exceeds the required volume calculated of 7.57 m³

Job Title	Ballymun: Area 1 Blue Green Roof	Job no.	23006
By:	MG	Checked by:	DW
Date	16/10/2024	Rev number	1

Part 1 **Permissible Runoff**

The regression equation recommended for use by the Greater Dublin Strategic Drainage Study 2005 calculates a value, QBARural, which is sourced from the Institute of Hydrology Report 124. This value is the mean annual flood flow from a rural catchment in m^3/s and is given by the equation:

QBARrural = 0.00108[Area^0.89] x [SAAR^1.17] x [Soil^2.17]

Rainfall Data		
M5-60 (1 hour - 5 years) mm		16.1
M5-2D (2 days - 5 years) mm		58.6
Ratio "r" (M5-60/ M5-2D)		0.27
SAAR mm		946
Soil/ SPR mm		0.47

Soil Type 4 - Based on SI findings - clay or loamy soils; high runoff potential

For 50 Ha Area ~ QBARrural =	0.343	m^3/s
QBARrural =	6.867	l/s/ha
For 0.48 Ha Area ~ QBARrural =	3.295	l/s

Discharge should be limited to QBAR or 2 l/s/ha whichever is greater.

Part 2 **Impermeable Area**

Breakdown of the impermeable areas contributing to the surface water drainage network in each catchment with applied runoff coeifficients is provided in the table below

Total Area sq.m	Type of Surface		Area sq.m	Run-off Coefficient	Equivalent Impermeable	Urban Creep Allowance (10%)	Climate Change (20%)	Overall Impermeable
4,798.03	Roof	Standard roof (25%)	0.00	0.95	0.00	0.00	0.00	1651.72
		Green Roof (75%)	2085.50	0.60	1251.30	1376.43	1651.72	
	Permeable Paving inc. areas from hardstanding		0.00	0.50	0.00	0.00	0.00	
ha	Landscaped Areas inc. areas from hardstanding		0.00	0.20	0.00	0.00	0.00	ha
0.48								0.17
	Hardstanding		0.00	0.90	0.00	0.00	0.00	

These calculations are based on "Engineering Hydrology" by E.M.Wilson (4th Edition)
Ratio R (%) - Refer to Table 2.9 of "Engineering Hydrology
M10/M100 - Refer to Table 2.7 of "Engineering Hydrology

Part 3 **Attenuation Volume Required**

1 in 10 Years								
Rainfall Duration (D)	Ratio r (%)	M5 (mm)	M10 (mm)	Area	MT	Inflow "I"	Outflow "O"	Capacity Required
	Table 2.9	(M5-2D*Ratio)/100	Table 2.7		M5*M10	MT* Impermeable Area	(QBARrural/1000)*60	"I"-"O" ="S"
1 min	3	1.8	1.15	1	2.022	3.339	0.197695337	3.142
2min	5	2.9	1.15	1	3.370	5.565	0.395390675	5.170
5 min	9	5.3	1.16	1	6.118	10.105	0.988476687	9.116
10 min	12.9	7.6	1.17	1	8.844	14.609	1.976953375	12.632
15 min	15.5	9.1	1.18	1	10.718	17.703	2.965430062	14.738
30 min	20.7	12.1	1.18	1	14.314	23.642	5.930860124	17.711
60 min	27	15.8	1.18	1	18.670	30.838	11.86172025	18.976
2 hour	35	20.5	1.18	1	24.202	39.975	23.7234405	16.251
4 hour	44	25.8	1.17	1	30.167	49.828	47.44688099	2.381
6 hour	51	29.9	1.17	1	34.967	57.755	71.17032149	-13.415
12 hour	65	38.1	1.16	1	44.184	72.980	142.340643	-69.360
24 hour	83	48.6	1.15	1	55.934	92.387	284.6812859	-192.295
48 hour	106	62.1	1.14	1	70.812	116.962	569.3625719	-452.401
Size of Attenuation for 1 in 10 year flood event m³								**18.976**

1 in 30 Years								
Rainfall Duration (D)	Ratio r (%)	M5 (mm)	M30 (mm)	Area	MT	Inflow "I"	Outflow "O"	Capacity Required
	Table 2.7	(M5-2D*Ratio)/100	Table 2.9		M5*M30	MT* Impermeable Area	(QBARrural/1000)*60	"I"-"O" ="S"
1 min	3	1.8	1.43	1	2.514	4.152	0.197695337	3.955
2min	5	2.9	1.43	1	4.190	6.921	0.395390675	6.525
5 min	9	5.3	1.48	1	7.806	12.893	0.988476687	11.904
10 min	12.9	7.6	1.51	1	11.415	18.854	1.976953375	16.877
15 min	15.5	9.1	1.54	1	13.988	23.104	2.965430062	20.139
30 min	20.7	12.1	1.54	1	18.681	30.855	5.930860124	24.924
60 min	27	15.8	1.54	1	24.366	40.246	11.86172025	28.384
2 hour	35	20.5	1.51	1	30.970	51.154	23.7234405	27.430
4 hour	44	25.8	1.5	1	38.676	63.882	47.44688099	16.435
6 hour	51	29.9	1.48	1	44.231	73.058	71.17032149	1.887
12 hour	65	38.1	1.45	1	55.231	91.225	142.340643	-51.115
24 hour	83	48.6	1.41	1	68.580	113.274	284.6812859	-171.407
48 hour	106	62.1	1.39	1	86.341	142.611	569.3625719	-426.751
Size of Attenuation for 1 in 30 year flood event m³								**28.384**

1 in 100 Years								
Rainfall Duration (D)	Ratio r (%)	M5 (mm)	M100 (mm)	Area	MT	Inflow "I"	Outflow "O"	Capacity Required
	Table 2.7	(M5-2D*Ratio)/100	Table 2.9		M5*M100	MT* Impermeable Area	(QBARrural/1000)*60	"I"-"O" ="S"
1 min	3	1.8	1.75	1	3.077	5.082	0.197695337	4.884
2min	5	2.9	1.77	1	5.186	8.566	0.395390675	8.171
5 min	9	5.3	1.86	1	9.810	16.203	0.988476687	15.214
10 min	12.9	7.6	1.9	1	14.363	23.723	1.976953375	21.746
15 min	15.5	9.1	1.96	1	17.803	29.405	2.965430062	26.440
30 min	20.7	12.1	1.97	1	23.896	39.470	5.930860124	33.539
60 min	27	15.8	1.98	1	31.328	51.744	11.86172025	39.883
2 hour	35	20.5	1.93	1	39.584	65.382	23.7234405	41.659
4 hour	44	25.8	1.89	1	48.732	80.491	47.44688099	33.044
6 hour	51	29.9	1.85	1	55.289	91.322	71.17032149	20.152
12 hour	65	38.1	1.77	1	67.419	111.358	142.340643	-30.983
24 hour	83	48.6	1.72	1	83.657	138.178	284.6812859	-146.503
48 hour	106	62.1	1.69	1	104.976	173.391	569.3625719	-395.972
Size of Attenuation for 1 in 100 year flood event m³								**41.659**

Part 4 **Interception Storage**

To prevent pollitant or sediments discharging into water courses the GDSDS required "interception storage" to be incorporated into the drainage design for the development. The volume of interception required is based on the 5-10mm of rainfall depth from 80% of the runoff from impermeable areas. The interception volume attributable to each of the SuDS features consists of the volyme of water that can infiltrate to the ground, the quanity that evaporates into the atmosphere and the volyme lost through transpiration in plants and vegitation. Additionally, there will be some loses of water due to absorption and westting of stone and soil media.

<u>Required Interception Storage</u>

Overall Impermeable area is 1651.7 m² including 10% for urban creep

Therefore, the total interception storage required is 'overall impermeable area x 80% x 0.005 x 1.2 for climate change' 7.93 m³

<u>Interception Storage Provided</u> *Only fill in SuDS on your site

Green Roof A 'Bauder Sedume' or equivalent design to retain 30 l/m² of rainwater will be used on roof level	Area	2085.50	m²
	Interception Store 30 l/m²	0.03	l/m²
	Storage Volume	62.57	m³

Total interception volume provided for the overall site 62.57 m³
which exceeds the required volume calculated of 7.93 m³

Job Title	Ballymun: Area 2	Job no.	23006
By:	MG	Checked by:	DW
Date	16/10/2024	Rev number	1

Part 1 **Permissible Runoff**

The regression equation recommended for use by the Greater Dublin Strategic Drainage Study 2005 calculates a value, QBARural, which is sourced from the Institute of Hydrology Report 124. This value is the mean annual flood flow from a rural catchment in m^3/s and is given by the equation:

QBARrural = 0.00108[Area^0.89] x [SAAR^1.17] x [Soil^2.17]

Rainfall Data		
M5-60 (1 hour - 5 years) mm		16.1
M5-2D (2 days - 5 years) mm		58.6
Ratio "r" (M5-60/ M5-2D)		0.27
SAAR mm		946
Soil/ SPR mm		0.47

Soil Type 4 - Based on SI findings - clay or loamy soils; high runoff potential

For 50 Ha Area ~ QBARrural =		0.343	m^3/s
QBARrural =		6.867	l/s/ha
For 0.20 Ha Area ~ QBARrural =		1.356	l/s

Discharge should be limited to QBAR or 2 l/s/ha whichever is greater.

Part 2 **Impermeable Area**

Breakdown of the impermeable areas contributing to the surface water drainage network in each catchment with applied runoff coeifficients is provided in the table below

Total Area sq.m	Type of Surface		Area sq.m	Run-off Coefficient	Equivalent Impermeable	Urban Creep Allowance (10%)	Climate Change (20%)	Overall Impermeable
1,974.30	Roof	Standard roof (25%)	274.73	0.95	261.00	287.10	344.51	702.28
		Green Roof (75%)	0.00	0.60	0.00	0.00	0.00	
	Permeable Paving inc. areas from hardstanding		319.86	0.50	159.93	175.92	211.11	
ha	Landscaped Areas inc. areas from hardstanding		555.51	0.20	111.10	122.21	146.65	ha
0.20								0.07
	Hardstanding		0.00	0.90	0.00	0.00	0.00	

These calculations are based on "Engineering Hydrology" by E.M.Wilson (4th Edition)
Ratio R (%) - Refer to Table 2.9 of "Engineering Hydrology
M10/M100 - Refer to Table 2.7 of "Engineering Hydrology

Part 3 **Attenuation Volume Required**

1 in 10 Years								
Rainfall Duration (D)	**Ratio r (%)**	**M5 (mm)**	**M10 (mm)**	**Area**	**MT**	**Inflow "I"**	**Outflow "O"**	**Capacity Required**
	Table 2.9	**(M5-2D*Ratio)/100**	**Table 2.7**		**M5*M10**	MT* Impermeable Area	(QBARrural/1000)*60	**"I"-"O" ="S"**
1 min	3	1.8	1.15	1	2.022	1.420	0.081347916	1.338
2min	5	2.9	1.15	1	3.370	2.366	0.162695832	2.204
5 min	9	5.3	1.16	1	6.118	4.296	0.406739581	3.890
10 min	12.9	7.6	1.17	1	8.844	6.211	0.813479161	5.398
15 min	15.5	9.1	1.18	1	10.718	7.527	1.220218742	6.307
30 min	20.7	12.1	1.18	1	14.314	10.052	2.440437484	7.612
60 min	27	15.8	1.18	1	18.670	13.111	4.880874968	8.231
2 hour	35	20.5	1.18	1	24.202	16.996	9.761749936	7.235
4 hour	44	25.8	1.17	1	30.167	21.186	19.52349987	1.662
6 hour	51	29.9	1.17	1	34.967	24.556	29.28524981	-4.729
12 hour	65	38.1	1.16	1	44.184	31.030	58.57049962	-27.541
24 hour	83	48.6	1.15	1	55.934	39.281	117.1409992	-77.860
48 hour	106	62.1	1.14	1	70.812	49.730	234.2819985	-184.552
Size of Attenuation for 1 in 10 year flood event m³								**8.231**

1 in 30 Years								
Rainfall Duration (D)	**Ratio r (%)**	**M5 (mm)**	**M30 (mm)**	**Area**	**MT**	**Inflow "I"**	**Outflow "O"**	**Capacity Required**
	Table 2.7	**(M5-2D*Ratio)/100**	**Table 2.9**		**M5*M30**	MT* Impermeable Area	(QBARrural/1000)*60	**"I"-"O" ="S"**
1 min	3	1.8	1.43	1	2.514	1.765	0.081347916	1.684
2min	5	2.9	1.43	1	4.190	2.942	0.162695832	2.780
5 min	9	5.3	1.48	1	7.806	5.482	0.406739581	5.075
10 min	12.9	7.6	1.51	1	11.415	8.016	0.813479161	7.203
15 min	15.5	9.1	1.54	1	13.988	9.823	1.220218742	8.603
30 min	20.7	12.1	1.54	1	18.681	13.119	2.440437484	10.678
60 min	27	15.8	1.54	1	24.366	17.112	4.880874968	12.231
2 hour	35	20.5	1.51	1	30.970	21.750	9.761749936	11.988
4 hour	44	25.8	1.5	1	38.676	27.161	19.52349987	7.638
6 hour	51	29.9	1.48	1	44.231	31.063	29.28524981	1.777
12 hour	65	38.1	1.45	1	55.231	38.787	58.57049962	-19.783
24 hour	83	48.6	1.41	1	68.580	48.162	117.1409992	-68.979
48 hour	106	62.1	1.39	1	86.341	60.635	234.2819985	-173.647
Size of Attenuation for 1 in 30 year flood event m³								**12.231**

1 in 100 Years								
Rainfall Duration (D)	**Ratio r (%)**	**M5 (mm)**	**M100 (mm)**	**Area**	**MT**	**Inflow "I"**	**Outflow "O"**	**Capacity Required**
	Table 2.7	**(M5-2D*Ratio)/100**	**Table 2.9**		**M5*M100**	MT* Impermeable Area	(QBARrural/1000)*60	**"I"-"O" ="S"**
1 min	3	1.8	1.75	1	3.077	2.161	0.081347916	2.079
2min	5	2.9	1.77	1	5.186	3.642	0.162695832	3.479
5 min	9	5.3	1.86	1	9.810	6.889	0.406739581	6.482
10 min	12.9	7.6	1.9	1	14.363	10.087	0.813479161	9.273
15 min	15.5	9.1	1.96	1	17.803	12.502	1.220218742	11.282
30 min	20.7	12.1	1.97	1	23.896	16.782	2.440437484	14.342
60 min	27	15.8	1.98	1	31.328	22.001	4.880874968	17.120
2 hour	35	20.5	1.93	1	39.584	27.799	9.761749936	18.037
4 hour	44	25.8	1.89	1	48.732	34.223	19.52349987	14.700
6 hour	51	29.9	1.85	1	55.289	38.828	29.28524981	9.543
12 hour	65	38.1	1.77	1	67.419	47.347	58.57049962	-11.223
24 hour	83	48.6	1.72	1	83.657	58.751	117.1409992	-58.390
48 hour	106	62.1	1.69	1	104.976	73.722	234.2819985	-160.560
Size of Attenuation for 1 in 100 year flood event m³								**18.037**

Part 4 **Interception Storage**

To prevent pollitant or sediments discharging into water courses the GDSDS required "interception storage" to be incorporated into the drainage design for the development. The volume of interception required is based on the 5-10mm of rainfall depth from 80% of the runoff from impermeable areas. The interception volume attributable to each of the SuDS features consists of the volyme of water that can infiltrate to the ground, the quanity that evaporates into the atmosphere and the volyme lost through transpiration in plants and vegitation. Additionally, there will be some loses of water due to absorption and westting of stone and soil media.

Required Interception Storage

Overall Impermeable area is 702.3 m² including 10% for urban creep

Therefore, the total interception storage required is 'overall impermeable area x 80% x 0.005 x 1.2 for climate change' 3.37 m³

Interception Storage Provided *Only fill in SuDS on your site

Permeable Paving	Area	319.9	m²
	Stone Layer 100mm deep	0.1	m
	Void Ratio	30%	
	Storage Volume	9.5958	m³

*Storage depth will depend on your site

Swale	Area	0.0	m²
	*75mm	0	m
	Storage Volume	0	m³

Bio-Retention Area/ Raingarden	Area	0.0	m²
	Depth of subgrade	0	m
	Storage Volume	0	m³

Total interception volume provided for the overall site 9.60 m³

which exceeds the required volume calculated of 3.37 m³

Job Title	Ballymun: Area 2 Blue Green Roof	Job no.	23006
By:	MG	Checked by:	DW
Date	16/10/2024	Rev number	1

Part 1 **Permissible Runoff**

The regression equation recommended for use by the Greater Dublin Strategic Drainage Study 2005 calculates a value, QBARural, which is sourced from the Institute of Hydrology Report 124. This value is the mean annual flood flow from a rural catchment in m^3/s and is given by the equation:

QBARrural = 0.00108[Area^0.89] x [SAAR^1.17] x [Soil^2.17]

Rainfall Data	
M5-60 (1 hour - 5 years) mm	16.1
M5-2D (2 days - 5 years) mm	58.6
Ratio "r" (M5-60/ M5-2D)	0.27
SAAR mm	946
Soil/ SPR mm	0.47

Soil Type 4 - Based on SI findings - clay or loamy soils; high runoff potential

For 50 Ha Area ~ QBARrural =	0.343	m^3/s
QBARrural =	6.867	l/s/ha
For 0.20 Ha Area ~ QBARrural =	1.356	l/s

Discharge should be limited to QBAR or 2 l/s/ha whichever is greater.

Part 2 **Impermeable Area**

Breakdown of the impermeable areas contributing to the surface water drainage network in each catchment with applied runoff coeifficients is provided in the table below

Total Area sq.m	Type of Surface		Area sq.m	Run-off Coefficient	Equivalent Impermeable	Urban Creep Allowance (10%)	Climate Change (20%)	Overall Impermeable
1,974.30	Roof	Standard roof (25%)	0.00	0.95	0.00	0.00	0.00	652.76
		Green Roof (75%)	824.20	0.60	494.52	543.97	652.76	
	Permeable Paving inc. areas from hardstanding		0.00	0.50	0.00	0.00	0.00	
ha	Landscaped Areas inc. areas from hardstanding		0.00	0.20	0.00	0.00	0.00	**ha**
0.20								0.07
	Hardstanding		0.00	0.90	0.00	0.00	0.00	

These calculations are based on "Engineering Hydrology" by E.M.Wilson (4th Edition)
Ratio R (%) - Refer to Table 2.9 of "Engineering Hydrology
M10/M100 - Refer to Table 2.7 of "Engineering Hydrology

Part 3 **Attenuation Volume Required**

1 in 10 Years								
Rainfall Duration (D)	Ratio r (%)	M5 (mm)	M10 (mm)	Area	MT	Inflow "I"	Outflow "O"	Capacity Required
	Table 2.9	(M5-2D*Ratio)/100	Table 2.7		M5*M10	MT* Impermeable Area	(QBARrural/1000)*60	"I"-"O" ="S"
1 min	3	1.8	1.15	1	2.022	1.320	0.081347916	1.238
2min	5	2.9	1.15	1	3.370	2.199	0.162695832	2.037
5 min	9	5.3	1.16	1	6.118	3.994	0.406739581	3.587
10 min	12.9	7.6	1.17	1	8.844	5.773	0.813479161	4.960
15 min	15.5	9.1	1.18	1	10.718	6.996	1.220218742	5.776
30 min	20.7	12.1	1.18	1	14.314	9.343	2.440437484	6.903
60 min	27	15.8	1.18	1	18.670	12.187	4.880874968	7.306
2 hour	35	20.5	1.18	1	24.202	15.798	9.761749936	6.036
4 hour	44	25.8	1.17	1	30.167	19.692	19.52349987	0.169
6 hour	51	29.9	1.17	1	34.967	22.825	29.28524981	-6.460
12 hour	65	38.1	1.16	1	44.184	28.842	58.57049962	-29.728
24 hour	83	48.6	1.15	1	55.934	36.512	117.1409992	-80.629
48 hour	106	62.1	1.14	1	70.812	46.224	234.2819985	-188.058
Size of Attenuation for 1 in 10 year flood event m³								**7.306**

1 in 30 Years								
Rainfall Duration (D)	Ratio r (%)	M5 (mm)	M30 (mm)	Area	MT	Inflow "I"	Outflow "O"	Capacity Required
	Table 2.7	(M5-2D*Ratio)/100	Table 2.9		M5*M30	MT* Impermeable Area	(QBARrural/1000)*60	"I"-"O" ="S"
1 min	3	1.8	1.43	1	2.514	1.641	0.081347916	1.560
2min	5	2.9	1.43	1	4.190	2.735	0.162695832	2.572
5 min	9	5.3	1.48	1	7.806	5.095	0.406739581	4.688
10 min	12.9	7.6	1.51	1	11.415	7.451	0.813479161	6.638
15 min	15.5	9.1	1.54	1	13.988	9.131	1.220218742	7.911
30 min	20.7	12.1	1.54	1	18.681	12.194	2.440437484	9.754
60 min	27	15.8	1.54	1	24.366	15.905	4.880874968	11.024
2 hour	35	20.5	1.51	1	30.970	20.216	9.761749936	10.454
4 hour	44	25.8	1.5	1	38.676	25.246	19.52349987	5.723
6 hour	51	29.9	1.48	1	44.231	28.873	29.28524981	-0.413
12 hour	65	38.1	1.45	1	55.231	36.053	58.57049962	-22.518
24 hour	83	48.6	1.41	1	68.580	44.766	117.1409992	-72.375
48 hour	106	62.1	1.39	1	86.341	56.360	234.2819985	-177.922
Size of Attenuation for 1 in 30 year flood event m³								**11.024**

1 in 100 Years								
Rainfall Duration (D)	Ratio r (%)	M5 (mm)	M100 (mm)	Area	MT	Inflow "I"	Outflow "O"	Capacity Required
	Table 2.7	(M5-2D*Ratio)/100	Table 2.9		M5*M100	MT* Impermeable Area	(QBARrural/1000)*60	"I"-"O" ="S"
1 min	3	1.8	1.75	1	3.077	2.008	0.081347916	1.927
2min	5	2.9	1.77	1	5.186	3.385	0.162695832	3.223
5 min	9	5.3	1.86	1	9.810	6.403	0.406739581	5.997
10 min	12.9	7.6	1.9	1	14.363	9.376	0.813479161	8.562
15 min	15.5	9.1	1.96	1	17.803	11.621	1.220218742	10.401
30 min	20.7	12.1	1.97	1	23.896	15.599	2.440437484	13.158
60 min	27	15.8	1.98	1	31.328	20.450	4.880874968	15.569
2 hour	35	20.5	1.93	1	39.584	25.839	9.761749936	16.077
4 hour	44	25.8	1.89	1	48.732	31.810	19.52349987	12.287
6 hour	51	29.9	1.85	1	55.289	36.091	29.28524981	6.806
12 hour	65	38.1	1.77	1	67.419	44.009	58.57049962	-14.562
24 hour	83	48.6	1.72	1	83.657	54.609	117.1409992	-62.532
48 hour	106	62.1	1.69	1	104.976	68.525	234.2819985	-165.757
Size of Attenuation for 1 in 100 year flood event m³								**16.077**

Part 4 **Interception Storage**

To prevent pollitant or sediments discharging into water courses the GDSDS required "interception storage" to be incorporated into the drainage design for the development. The volume of interception required is based on the 5-10mm of rainfall depth from 80% of the runoff from impermeable areas. The interception volume attributable to each of the SuDS features consists of the volyme of water that can infiltrate to the ground, the quanity that evaporates into the atmosphere and the volyme lost through transpiration in plants and vegitation. Additionally, there will be some loses of water due to absorption and westting of stone and soil media.

Required Interception Storage

Overall Impermeable area is 652.8 m² including 10% for urban creep

Therefore, the total interception storage required is 'overall impermeable area x 80% x 0.005 x 1.2 for climate change' 3.13 m³

Interception Storage Provided *Only fill in SuDS on your site

Green Roof A 'Bauder Sedume' or equivalent design to retain 30 l/m² of rainwater will be used on roof level	Area	824.20	m²
	Interception Store 30 l/m²	0.03	l/m²
	Storage Volume	24.73	m³

Total interception volume provided for the overall site 24.73 m³

which exceeds the required volume calculated of 3.13 m³

Job Title	Ballymun: Area 3	Job no.	23006
By:	MG	Checked by:	DW
Date	16/10/2024	Rev number	1

Part 1 **Permissible Runoff**

The regression equation recommended for use by the Greater Dublin Strategic Drainage Study 2005 calculates a value, QBARural, which is sourced from the Institute of Hydrology Report 124. This value is the mean annual flood flow from a rural catchment in m^3/s and is given by the equation:

QBARrural = 0.00108[Area^0.89] x [SAAR^1.17] x [Soil^2.17]

Rainfall Data		
M5-60 (1 hour - 5 years) mm		16.1
M5-2D (2 days - 5 years) mm		58.6
Ratio "r" (M5-60/ M5-2D)		0.27
SAAR mm		946
Soil/ SPR mm		0.47

Soil Type 4 - Based on SI findings - clay or loamy soils; high runoff potential

For 50 Ha Area ~ QBARrural =	0.343	m^3/s
QBARrural =	6.867	l/s/ha
For 0.56 Ha Area ~ QBARrural =	3.850	l/s

Discharge should be limited to QBAR or 2 l/s/ha whichever is greater.

Part 2 **Impermeable Area**

Breakdown of the impermeable areas contributing to the surface water drainage network in each catchment with applied runoff coeifficients is provided in the table below

Total Area sq.m	Type of Surface		Area sq.m	Run-off Coefficient	Equivalent Impermeable	Urban Creep Allowance (10%)	Climate Change (20%)	Overall Impermeable
5,606.50	Roof	Standard roof (25%)	854.80	0.95	812.06	893.26	1071.92	2215.43
		Green Roof (75%)	0.00	0.60	0.00	0.00	0.00	
	Permeable Paving inc. areas from hardstanding		1429.45	0.50	714.73	786.20	943.44	
ha	Landscaped Areas inc. areas from hardstanding		757.86	0.20	151.57	166.73	200.08	ha
0.56								0.22
	Hardstanding		0.00	0.90	0.00	0.00	0.00	

These calculations are based on "Engineering Hydrology" by E.M.Wilson (4th Edition)
Ratio R (%) - Refer to Table 2.9 of "Engineering Hydrology
M10/M100 - Refer to Table 2.7 of "Engineering Hydrology

Part 3 **Attenuation Volume Required**

1 in 10 Years								
Rainfall Duration (D)	Ratio r (%)	M5 (mm)	M10 (mm)	Area	MT	Inflow "I"	Outflow "O"	Capacity Required
	Table 2.9	(M5-2D*Ratio)/100	Table 2.7		M5*M10	MT* Impermeable Area	(QBARrural/1000)*60	"I"-"O" ="S"
1 min	3	1.8	1.15	1	2.022	4.479	0.231006986	4.248
2min	5	2.9	1.15	1	3.370	7.465	0.462013971	7.003
5 min	9	5.3	1.16	1	6.118	13.554	1.155034928	12.399
10 min	12.9	7.6	1.17	1	8.844	19.594	2.310069857	17.284
15 min	15.5	9.1	1.18	1	10.718	23.745	3.465104785	20.280
30 min	20.7	12.1	1.18	1	14.314	31.711	6.93020957	24.781
60 min	27	15.8	1.18	1	18.670	41.362	13.86041914	27.502
2 hour	35	20.5	1.18	1	24.202	53.617	27.72083828	25.897
4 hour	44	25.8	1.17	1	30.167	66.833	55.44167656	11.392
6 hour	51	29.9	1.17	1	34.967	77.466	83.16251484	-5.696
12 hour	65	38.1	1.16	1	44.184	97.887	166.3250297	-68.438
24 hour	83	48.6	1.15	1	55.934	123.917	332.6500594	-208.733
48 hour	106	62.1	1.14	1	70.812	156.879	665.3001187	-508.421
Size of Attenuation for 1 in 10 year flood event m³								**27.502**

1 in 30 Years								
Rainfall Duration (D)	Ratio r (%)	M5 (mm)	M30 (mm)	Area	MT	Inflow "I"	Outflow "O"	Capacity Required
	Table 2.7	(M5-2D*Ratio)/100	Table 2.9		M5*M30	MT* Impermeable Area	(QBARrural/1000)*60	"I"-"O" ="S"
1 min	3	1.8	1.43	1	2.514	5.569	0.231006986	5.338
2min	5	2.9	1.43	1	4.190	9.282	0.462013971	8.820
5 min	9	5.3	1.48	1	7.806	17.293	1.155034928	16.138
10 min	12.9	7.6	1.51	1	11.415	25.288	2.310069857	22.978
15 min	15.5	9.1	1.54	1	13.988	30.989	3.465104785	27.524
30 min	20.7	12.1	1.54	1	18.681	41.385	6.93020957	34.455
60 min	27	15.8	1.54	1	24.366	53.981	13.86041914	40.120
2 hour	35	20.5	1.51	1	30.970	68.612	27.72083828	40.891
4 hour	44	25.8	1.5	1	38.676	85.684	55.44167656	30.242
6 hour	51	29.9	1.48	1	44.231	97.991	83.16251484	14.829
12 hour	65	38.1	1.45	1	55.231	122.359	166.3250297	-43.966
24 hour	83	48.6	1.41	1	68.580	151.933	332.6500594	-180.717
48 hour	106	62.1	1.39	1	86.341	191.283	665.3001187	-474.017
Size of Attenuation for 1 in 30 year flood event m³								**40.891**

1 in 100 Years								
Rainfall Duration (D)	Ratio r (%)	M5 (mm)	M100 (mm)	Area	MT	Inflow "I"	Outflow "O"	Capacity Required
	Table 2.7	(M5-2D*Ratio)/100	Table 2.9		M5*M100	MT* Impermeable Area	(QBARrural/1000)*60	"I"-"O" ="S"
1 min	3	1.8	1.75	1	3.077	6.816	0.231006986	6.585
2min	5	2.9	1.77	1	5.186	11.489	0.462013971	11.027
5 min	9	5.3	1.86	1	9.810	21.733	1.155034928	20.578
10 min	12.9	7.6	1.9	1	14.363	31.820	2.310069857	29.510
15 min	15.5	9.1	1.96	1	17.803	39.441	3.465104785	35.975
30 min	20.7	12.1	1.97	1	23.896	52.941	6.93020957	46.011
60 min	27	15.8	1.98	1	31.328	69.404	13.86041914	55.544
2 hour	35	20.5	1.93	1	39.584	87.696	27.72083828	59.975
4 hour	44	25.8	1.89	1	48.732	107.962	55.44167656	52.520
6 hour	51	29.9	1.85	1	55.289	122.489	83.16251484	39.327
12 hour	65	38.1	1.77	1	67.419	149.363	166.3250297	-16.962
24 hour	83	48.6	1.72	1	83.657	185.337	332.6500594	-147.313
48 hour	106	62.1	1.69	1	104.976	232.567	665.3001187	-432.733
Size of Attenuation for 1 in 100 year flood event m³								**59.975**

Part 4 **Interception Storage**

To prevent pollitant or sediments discharging into water courses the GDSDS required "interception storage" to be incorporated into the drainage design for the development. The volume of interception required is based on the 5-10mm of rainfall depth from 80% of the runoff from impermeable areas. The interception volume attributable to each of the SuDS features consists of the volyme of water that can infiltrate to the ground, the quanity that evaporates into the atmosphere and the volyme lost through transpiration in plants and vegitation. Additionally, there will be some loses of water due to absorption and westting of stone and soil media.

<u>Required Interception Storage</u>

Overall Impermeable area is 2215.4 m² including 10% for urban creep

Therefore, the total interception storage required is 'overall impermeable area x 80% x 0.005 x 1.2 for climate change' 10.63 m³

<u>Interception Storage Provided</u> *Only fill in SuDS on your site

Permeable Paving	Area	1429.5	m²
	Stone Layer 100mm deep	0.1	m
	Void Ratio	30%	
	Storage Volume	42.8835	m³

*Storage depth will depend on your site

Swale	Area	0.0	m²
	*75mm	0	m
	Storage Volume	0	m³

Bio-Retention Area/ Raingarden	Area	0.0	m²
	Depth of subgrade	0	m
	Storage Volume	0	m³

Total interception volume provided for the overall site 42.88 m³
which exceeds the required volume calculated of 10.63 m³

Job Title	Ballymun: Area 3 Blue Green Roof	Job no.	23006
By:	MG	Checked by:	DW
Date	16/10/2024	Rev number	1

Part 1 **Permissible Runoff**

The regression equation recommended for use by the Greater Dublin Strategic Drainage Study 2005 calculates a value, QBARural, which is sourced from the Institute of Hydrology Report 124. This value is the mean annual flood flow from a rural catchment in m^3/s and is given by the equation:

QBARrural = 0.00108[Area^0.89] x [SAAR^1.17] x [Soil^2.17]

Rainfall Data		
M5-60 (1 hour - 5 years) mm		16.1
M5-2D (2 days - 5 years) mm		58.6
Ratio "r" (M5-60/ M5-2D)		0.27
SAAR mm		946
Soil/ SPR mm		0.47

Soil Type 4 - Based on SI findings - clay or loamy soils; high runoff potential

For 50 Ha Area ~ QBARrural =		0.343	m^3/s
QBARrural =		6.867	l/s/ha
For 0.56 Ha Area ~ QBARrural =		3.850	l/s

Discharge should be limited to QBAR or 2 l/s/ha whichever is greater.

Part 2 **Impermeable Area**

Breakdown of the impermeable areas contributing to the surface water drainage network in each catchment with applied runoff coeifficients is provided in the table below

Total Area sq.m	Type of Surface		Area sq.m	Run-off Coefficient	Equivalent Impermeable	Urban Creep Allowance (10%)	Climate Change (20%)	Overall Impermeable
5,606.50	Roof	Standard roof (25%)	0.00	0.95	0.00	0.00	0.00	2031.00
		Green Roof (75%)	2564.39	0.60	1538.64	1692.50	2031.00	
	Permeable Paving inc. areas from hardstanding		0.00	0.50	0.00	0.00	0.00	
ha	Landscaped Areas inc. areas from hardstanding		0.00	0.20	0.00	0.00	0.00	ha
0.56								0.20
	Hardstanding		0.00	0.90	0.00	0.00	0.00	

These calculations are based on "Engineering Hydrology" by E.M.Wilson (4th Edition)
Ratio R (%) - Refer to Table 2.9 of "Engineering Hydrology
M10/M100 - Refer to Table 2.7 of "Engineering Hydrology

Part 3 **Attenuation Volume Required**

1 in 10 Years								
Rainfall Duration (D)	Ratio r (%)	M5 (mm)	M10 (mm)	Area	MT	Inflow "I"	Outflow "O"	Capacity Required
	Table 2.9	(M5-2D*Ratio)/100	Table 2.7		M5*M10	MT* Impermeable Area	(QBARrural/1000)*60	"I"-"O" ="S"
1 min	3	1.8	1.15	1	2.022	4.106	0.231006986	3.875
2min	5	2.9	1.15	1	3.370	6.843	0.462013971	6.381
5 min	9	5.3	1.16	1	6.118	12.425	1.155034928	11.270
10 min	12.9	7.6	1.17	1	8.844	17.963	2.310069857	15.653
15 min	15.5	9.1	1.18	1	10.718	21.768	3.465104785	18.303
30 min	20.7	12.1	1.18	1	14.314	29.071	6.93020957	22.141
60 min	27	15.8	1.18	1	18.670	37.919	13.86041914	24.058
2 hour	35	20.5	1.18	1	24.202	49.154	27.72083828	21.433
4 hour	44	25.8	1.17	1	30.167	61.270	55.44167656	5.828
6 hour	51	29.9	1.17	1	34.967	71.017	83.16251484	-12.145
12 hour	65	38.1	1.16	1	44.184	89.739	166.3250297	-76.586
24 hour	83	48.6	1.15	1	55.934	113.601	332.6500594	-219.049
48 hour	106	62.1	1.14	1	70.812	143.820	665.3001187	-521.480
Size of Attenuation for 1 in 10 year flood event m³								**24.058**

1 in 30 Years								
Rainfall Duration (D)	Ratio r (%)	M5 (mm)	M30 (mm)	Area	MT	Inflow "I"	Outflow "O"	Capacity Required
	Table 2.7	(M5-2D*Ratio)/100	Table 2.9		M5*M30	MT* Impermeable Area	(QBARrural/1000)*60	"I"-"O" ="S"
1 min	3	1.8	1.43	1	2.514	5.106	0.231006986	4.875
2min	5	2.9	1.43	1	4.190	8.510	0.462013971	8.048
5 min	9	5.3	1.48	1	7.806	15.853	1.155034928	14.698
10 min	12.9	7.6	1.51	1	11.415	23.183	2.310069857	20.873
15 min	15.5	9.1	1.54	1	13.988	28.409	3.465104785	24.944
30 min	20.7	12.1	1.54	1	18.681	37.940	6.93020957	31.010
60 min	27	15.8	1.54	1	24.366	49.487	13.86041914	35.627
2 hour	35	20.5	1.51	1	30.970	62.900	27.72083828	35.179
4 hour	44	25.8	1.5	1	38.676	78.551	55.44167656	23.109
6 hour	51	29.9	1.48	1	44.231	89.834	83.16251484	6.671
12 hour	65	38.1	1.45	1	55.231	112.173	166.3250297	-54.152
24 hour	83	48.6	1.41	1	68.580	139.285	332.6500594	-193.365
48 hour	106	62.1	1.39	1	86.341	175.359	665.3001187	-489.941
Size of Attenuation for 1 in 30 year flood event m³								**35.627**

1 in 100 Years								
Rainfall Duration (D)	Ratio r (%)	M5 (mm)	M100 (mm)	Area	MT	Inflow "I"	Outflow "O"	Capacity Required
	Table 2.7	(M5-2D*Ratio)/100	Table 2.9		M5*M100	MT* Impermeable Area	(QBARrural/1000)*60	"I"-"O" ="S"
1 min	3	1.8	1.75	1	3.077	6.248	0.231006986	6.017
2min	5	2.9	1.77	1	5.186	10.533	0.462013971	10.071
5 min	9	5.3	1.86	1	9.810	19.923	1.155034928	18.768
10 min	12.9	7.6	1.9	1	14.363	29.171	2.310069857	26.861
15 min	15.5	9.1	1.96	1	17.803	36.157	3.465104785	32.692
30 min	20.7	12.1	1.97	1	23.896	48.534	6.93020957	41.604
60 min	27	15.8	1.98	1	31.328	63.626	13.86041914	49.766
2 hour	35	20.5	1.93	1	39.584	80.396	27.72083828	52.675
4 hour	44	25.8	1.89	1	48.732	98.974	55.44167656	43.533
6 hour	51	29.9	1.85	1	55.289	112.292	83.16251484	29.130
12 hour	65	38.1	1.77	1	67.419	136.929	166.3250297	-29.396
24 hour	83	48.6	1.72	1	83.657	169.908	332.6500594	-162.742
48 hour	106	62.1	1.69	1	104.976	213.206	665.3001187	-452.094
Size of Attenuation for 1 in 100 year flood event m³								**52.675**

Part 4 **Interception Storage**

To prevent pollitant or sediments discharging into water courses the GDSDS required "interception storage" to be incorporated into the drainage design for the development. The volume of interception required is based on the 5-10mm of rainfall depth from 80% of the runoff from impermeable areas. The interception volume attributable to each of the SuDS features consists of the volyme of water that can infiltrate to the ground, the quanity that evaporates into the atmosphere and the volyme lost through transpiration in plants and vegitation. Additionally, there will be some loses of water due to absorption and westting of stone and soil media.

Required Interception Storage

Overall Impermeable area is 2031.0 m² including 10% for urban creep

Therefore, the total interception storage required is 'overall impermeable area x 80% x 0.005 x 1.2 for climate change' 9.75 m³

Interception Storage Provided *Only fill in SuDS on your site

Green Roof A 'Bauder Sedume' or equivalent design to retain 30 l/m² of rainwater will be used on roof level	Area	2564.39	m²
	Interception Store 30 l/m²	0.03	l/m²
	Storage Volume	76.93	m³

Total interception volume provided for the overall site 76.93 m³

which exceeds the required volume calculated of 9.75 m³

Job Title	Ballymun: Area 4	Job no.	23006
By:	MG	Checked by:	DW
Date	16/10/2024	Rev number	1

Part 1 **Permissible Runoff**

The regression equation recommended for use by the Greater Dublin Strategic Drainage Study 2005 calculates a value, QBARrural, which is sourced from the Institute of Hydrology Report 124. This value is the mean annual flood flow from a rural catchment in m³/s and is given by the equation:

QBARrural = 0.00108[Area^0.89] x [SAAR^1.17] x [Soil^2.17]

Rainfall Data		
M5-60 (1 hour - 5 years) mm		16.1
M5-2D (2 days - 5 years) mm		58.6
Ratio "r" (M5-60/ M5-2D)		0.27
SAAR mm		946
Soil/ SPR mm		0.47

Soil Type 4 - Based on SI findings - clay or loamy soils; high runoff potential

For 50 Ha Area ~ QBARrural =		0.343	m³/s
QBARrural =		6.867	l/s/ha
For 0.08 Ha Area ~ QBARrural =		0.543	l/s

Discharge should be limited to QBAR or 2 l/s/ha whichever is greater.

Part 2 **Impermeable Area**

Breakdown of the impermeable areas contributing to the surface water drainage network in each catchment with applied runoff coeifficients is provided in the table below

Total Area sq.m	Type of Surface	Area sq.m	Run-off Coefficient	Equivalent Impermeable	Urban Creep Allowance (10%)	Climate Change (20%)	Overall Impermeable
790.10	Standard Roof	258.77	0.95	245.83	270.41	324.50	491.15
	Permeable Paving inc. areas from hardstanding	66.62	0.50	33.31	36.64	43.97	
ha	Landscaped Areas inc. areas from hardstanding	464.71	0.20	92.94	102.24	122.68	**ha**
0.08							0.05
	Hardstanding	0.00	0.90	0.00	0.00	0.00	

These calculations are based on "Engineering Hydrology" by E.M.Wilson (4th Edition)
Ratio R (%) - Refer to Table 2.9 of "Engineering Hydrology
M10/M100 - Refer to Table 2.7 of "Engineering Hydrology

Part 3 **Attenuation Volume Required**

1 in 10 Years								
Rainfall Duration (D)	Ratio r (%)	M5 (mm)	M10 (mm)	Area	MT	Inflow "I"	Outflow "O"	Capacity Required
	Table 2.9	(M5-2D*Ratio)/100	Table 2.7		M5*M10	MT* Impermeable Area	(QBARrural/1000)*60	"I"-"O" ="S"
1 min	3	1.8	1.15	1	2.022	0.993	0.032554824	0.960
2min	5	2.9	1.15	1	3.370	1.655	0.065109648	1.590
5 min	9	5.3	1.16	1	6.118	3.005	0.162774119	2.842
10 min	12.9	7.6	1.17	1	8.844	4.344	0.325548238	4.018
15 min	15.5	9.1	1.18	1	10.718	5.264	0.488322356	4.776
30 min	20.7	12.1	1.18	1	14.314	7.030	0.976644713	6.054
60 min	27	15.8	1.18	1	18.670	9.170	1.953289425	7.216
2 hour	35	20.5	1.18	1	24.202	11.887	3.906578851	7.980
4 hour	44	25.8	1.17	1	30.167	14.817	7.813157701	7.004
6 hour	51	29.9	1.17	1	34.967	17.174	11.71973655	5.454
12 hour	65	38.1	1.16	1	44.184	21.701	23.4394731	-1.738
24 hour	83	48.6	1.15	1	55.934	27.472	46.87894621	-19.407
48 hour	106	62.1	1.14	1	70.812	34.779	93.75789241	-58.978
Size of Attenuation for 1 in 10 year flood event m³								**7.980**

1 in 30 Years								
Rainfall Duration (D)	Ratio r (%)	M5 (mm)	M30 (mm)	Area	MT	Inflow "I"	Outflow "O"	Capacity Required
	Table 2.7	(M5-2D*Ratio)/100	Table 2.9		M5*M30	MT* Impermeable Area	(QBARrural/1000)*60	"I"-"O" ="S"
1 min	3	1.8	1.43	1	2.514	1.235	0.032554824	1.202
2min	5	2.9	1.43	1	4.190	2.058	0.065109648	1.993
5 min	9	5.3	1.48	1	7.806	3.834	0.162774119	3.671
10 min	12.9	7.6	1.51	1	11.415	5.606	0.325548238	5.281
15 min	15.5	9.1	1.54	1	13.988	6.870	0.488322356	6.382
30 min	20.7	12.1	1.54	1	18.681	9.175	0.976644713	8.198
60 min	27	15.8	1.54	1	24.366	11.967	1.953289425	10.014
2 hour	35	20.5	1.51	1	30.970	15.211	3.906578851	11.304
4 hour	44	25.8	1.5	1	38.676	18.996	7.813157701	11.183
6 hour	51	29.9	1.48	1	44.231	21.724	11.71973655	10.004
12 hour	65	38.1	1.45	1	55.231	27.126	23.4394731	3.687
24 hour	83	48.6	1.41	1	68.580	33.683	46.87894621	-13.196
48 hour	106	62.1	1.39	1	86.341	42.407	93.75789241	-51.351
Size of Attenuation for 1 in 30 year flood event m³								**11.304**

1 in 100 Years								
Rainfall Duration (D)	Ratio r (%)	M5 (mm)	M100 (mm)	Area	MT	Inflow "I"	Outflow "O"	Capacity Required
	Table 2.7	(M5-2D*Ratio)/100	Table 2.9		M5*M100	MT* Impermeable Area	(QBARrural/1000)*60	"I"-"O" ="S"
1 min	3	1.8	1.75	1	3.077	1.511	0.032554824	1.478
2min	5	2.9	1.77	1	5.186	2.547	0.065109648	2.482
5 min	9	5.3	1.86	1	9.810	4.818	0.162774119	4.655
10 min	12.9	7.6	1.9	1	14.363	7.054	0.325548238	6.729
15 min	15.5	9.1	1.96	1	17.803	8.744	0.488322356	8.255
30 min	20.7	12.1	1.97	1	23.896	11.737	0.976644713	10.760
60 min	27	15.8	1.98	1	31.328	15.387	1.953289425	13.433
2 hour	35	20.5	1.93	1	39.584	19.442	3.906578851	15.535
4 hour	44	25.8	1.89	1	48.732	23.935	7.813157701	16.121
6 hour	51	29.9	1.85	1	55.289	27.155	11.71973655	15.436
12 hour	65	38.1	1.77	1	67.419	33.113	23.4394731	9.674
24 hour	83	48.6	1.72	1	83.657	41.088	46.87894621	-5.791
48 hour	106	62.1	1.69	1	104.976	51.559	93.75789241	-42.199
Size of Attenuation for 1 in 100 year flood event m³								**16.121**

Part 4 **Interception Storage**

To prevent pollitant or sediments discharging into water courses the GDSDS required "interception storage" to be incorporated into the drainage design for the development. The volume of interception required is based on the 5-10mm of rainfall depth from 80% of the runoff from impermeable areas. The interception volume attributable to each of the SuDS features consists of the volyme of water that can infiltrate to the ground, the quanity that evaporates into the atmosphere and the volyme lost through transpiration in plants and vegitation. Additionally, there will be some loses of water due to absorption and westting of stone and soil media.

Required Interception Storage

Overall Impermeable area is 491.2 m² including 10% for urban creep

Therefore, the total interception storage required is 'overall impermeable area x 80% x 0.005 x 1.2 for climate change' 2.36 m³

Interception Storage Provided *Only fill in SuDS on your site

Permeable Paving	Area	66.6	m²
	Stone Layer 100mm deep	0.1	m
	Void Ratio	30%	
	Storage Volume	1.9986	m³

*Storage depth will depend on your site

Swale	Area	0.0	m²
	*75mm	0	m
	Storage Volume	0	m³

Bio-Retention Area/ Raingarden	Area	118.2	m²
	Depth of subgrade	0.1	m
	Storage Volume	11.818	m³

Total interception volume provided for the overall site 13.82 m³

which exceeds the required volume calculated of 2.36 m³

Job Title	Ballymun: Area 5	Job no.	23006
By:	MG	Checked by:	DW
Date	16/10/2024	Rev number	1

Part 1 **Permissible Runoff**

The regression equation recommended for use by the Greater Dublin Strategic Drainage Study 2005 calculates a value, QBARrural, which is sourced from the Institute of Hydrology Report 124. This value is the mean annual flood flow from a rural catchment in m^3/s and is given by the equation:

QBARrural = 0.00108[Area^0.89] x [SAAR^1.17] x [Soil^2.17]

Rainfall Data		
M5-60 (1 hour - 5 years) mm		16.1
M5-2D (2 days - 5 years) mm		58.6
Ratio "r" (M5-60/ M5-2D)		0.27
SAAR mm		946
Soil/ SPR mm		0.47

Soil Type 4 - Based on SI findings - clay or loamy soils; high runoff potential

For 50 Ha Area ~ QBARrural =		0.343	m^3/s
QBARrural =		6.867	l/s/ha
For 0.08 Ha Area ~ QBARrural =		0.559	l/s

Discharge should be limited to QBAR or 2 l/s/ha whichever is greater.

Part 2 **Impermeable Area**

Breakdown of the impermeable areas contributing to the surface water drainage network in each catchment with applied runoff coeifficients is provided in the table below

Total Area sq.m	Type of Surface	Area sq.m	Run-off Coefficient	Equivalent Impermeable	Urban Creep Allowance (10%)	Climate Change (20%)	Overall Impermeable
813.60	Standard Roof	0.00	0.95	0.00	0.00	0.00	311.34
	Permeable Paving inc. areas from hardstanding	243.81	0.50	121.91	134.10	160.91	
ha	Landscaped Areas inc. areas from hardstanding	569.79	0.20	113.96	125.35	150.42	**ha**
0.08							0.03
	Hardstanding	0.00	0.90	0.00	0.00	0.00	

These calculations are based on "Engineering Hydrology" by E.M.Wilson (4th Edition)
Ratio R (%) - Refer to Table 2.9 of "Engineering Hydrology
M10/M100 - Refer to Table 2.7 of "Engineering Hydrology

Part 3 **Attenuation Volume Required**

1 in 10 Years								
Rainfall Duration (D)	**Ratio r (%)**	**M5 (mm)**	**M10 (mm)**	**Area**	**MT**	**Inflow "I"**	**Outflow "O"**	**Capacity Required**
	Table 2.9	**(M5-2D*Ratio)/100**	**Table 2.7**		**M5*M10**	MT* Impermeable Area	(QBARrural/1000)*60	**"I"-"O" ="S"**
1 min	3	1.8	1.15	1	2.022	0.629	0.033523104	0.596
2min	5	2.9	1.15	1	3.370	1.049	0.067046208	0.982
5 min	9	5.3	1.16	1	6.118	1.905	0.167615521	1.737
10 min	12.9	7.6	1.17	1	8.844	2.754	0.335231042	2.418
15 min	15.5	9.1	1.18	1	10.718	3.337	0.502846563	2.834
30 min	20.7	12.1	1.18	1	14.314	4.456	1.005693125	3.451
60 min	27	15.8	1.18	1	18.670	5.813	2.01138625	3.801
2 hour	35	20.5	1.18	1	24.202	7.535	4.022772501	3.512
4 hour	44	25.8	1.17	1	30.167	9.392	8.045545001	1.347
6 hour	51	29.9	1.17	1	34.967	10.886	12.0683175	-1.182
12 hour	65	38.1	1.16	1	44.184	13.756	24.136635	-10.380
24 hour	83	48.6	1.15	1	55.934	17.414	48.27327001	-30.859
48 hour	106	62.1	1.14	1	70.812	22.047	96.54654002	-74.500
Size of Attenuation for 1 in 10 year flood event m³								**3.801**

1 in 30 Years								
Rainfall Duration (D)	**Ratio r (%)**	**M5 (mm)**	**M30 (mm)**	**Area**	**MT**	**Inflow "I"**	**Outflow "O"**	**Capacity Required**
	Table 2.7	**(M5-2D*Ratio)/100**	**Table 2.9**		**M5*M30**	MT* Impermeable Area	(QBARrural/1000)*60	**"I"-"O" ="S"**
1 min	3	1.8	1.43	1	2.514	0.783	0.033523104	0.749
2min	5	2.9	1.43	1	4.190	1.304	0.067046208	1.237
5 min	9	5.3	1.48	1	7.806	2.430	0.167615521	2.263
10 min	12.9	7.6	1.51	1	11.415	3.554	0.335231042	3.219
15 min	15.5	9.1	1.54	1	13.988	4.355	0.502846563	3.852
30 min	20.7	12.1	1.54	1	18.681	5.816	1.005693125	4.810
60 min	27	15.8	1.54	1	24.366	7.586	2.01138625	5.575
2 hour	35	20.5	1.51	1	30.970	9.642	4.022772501	5.619
4 hour	44	25.8	1.5	1	38.676	12.041	8.045545001	3.996
6 hour	51	29.9	1.48	1	44.231	13.771	12.0683175	1.703
12 hour	65	38.1	1.45	1	55.231	17.195	24.136635	-6.941
24 hour	83	48.6	1.41	1	68.580	21.352	48.27327001	-26.922
48 hour	106	62.1	1.39	1	86.341	26.881	96.54654002	-69.665
Size of Attenuation for 1 in 30 year flood event m³								**5.619**

1 in 100 Years								
Rainfall Duration (D)	**Ratio r (%)**	**M5 (mm)**	**M100 (mm)**	**Area**	**MT**	**Inflow "I"**	**Outflow "O"**	**Capacity Required**
	Table 2.7	**(M5-2D*Ratio)/100**	**Table 2.9**		**M5*M100**	MT* Impermeable Area	(QBARrural/1000)*60	**"I"-"O" ="S"**
1 min	3	1.8	1.75	1	3.077	0.958	0.033523104	0.924
2min	5	2.9	1.77	1	5.186	1.615	0.067046208	1.548
5 min	9	5.3	1.86	1	9.810	3.054	0.167615521	2.887
10 min	12.9	7.6	1.9	1	14.363	4.472	0.335231042	4.136
15 min	15.5	9.1	1.96	1	17.803	5.543	0.502846563	5.040
30 min	20.7	12.1	1.97	1	23.896	7.440	1.005693125	6.434
60 min	27	15.8	1.98	1	31.328	9.753	2.01138625	7.742
2 hour	35	20.5	1.93	1	39.584	12.324	4.022772501	8.301
4 hour	44	25.8	1.89	1	48.732	15.172	8.045545001	7.127
6 hour	51	29.9	1.85	1	55.289	17.214	12.0683175	5.145
12 hour	65	38.1	1.77	1	67.419	20.990	24.136635	-3.146
24 hour	83	48.6	1.72	1	83.657	26.046	48.27327001	-22.227
48 hour	106	62.1	1.69	1	104.976	32.683	96.54654002	-63.863
Size of Attenuation for 1 in 100 year flood event m³								**8.301**

Part 4 **Interception Storage**

To prevent pollitant or sediments discharging into water courses the GDSDS required "interception storage" to be incorporated into the drainage design for the development. The volume of interception required is based on the 5-10mm of rainfall depth from 80% of the runoff from impermeable areas. The interception volume attributable to each of the SuDS features consists of the volyme of water that can infiltrate to the ground, the quanity that evaporates into the atmosphere and the volyme lost through transpiration in plants and vegitation. Additionally, there will be some loses of water due to absorption and westting of stone and soil media.

Required Interception Storage

Overall Impermeable area is 311.3 m^2 including 10% for urban creep

Therefore, the total interception storage required is 'overall impermeable area x 80% x 0.005 x 1.2 for climate change' 1.49 m^3

Interception Storage Provided *Only fill in SuDS on your site

Permeable Paving	Area	243.8	m^2
	Stone Layer 100mm deep	0.1	m
	Void Ratio	30%	
	Storage Volume	7.3143	m^3

*Storage depth will depend on your site

Swale	Area	0.0	m^2
	*75mm	0	m
	Storage Volume	0	m^3

Bio-Retention Area/ Raingarden	Area	0.0	m^2
	Depth of subgrade	0.1	m
	Storage Volume	0	m^3

Total interception volume provided for the overall site 7.31 m^3

which exceeds the required volume calculated of 1.49 m^3

Job Title	Ballymun: Area 6	Job no.	23006
By:	MG	Checked by:	DW
Date	16/10/2024	Rev number	1

Part 1 **Permissible Runoff**

The regression equation recommended for use by the Greater Dublin Strategic Drainage Study 2005 calculates a value, QBARural, which is sourced from the Institute of Hydrology Report 124. This value is the mean annual flood flow from a rural catchment in m^3/s and is given by the equation:

QBARrural = 0.00108[Area^0.89] x [SAAR^1.17] x [Soil^2.17]

Rainfall Data		
M5-60 (1 hour - 5 years) mm		16.1
M5-2D (2 days - 5 years) mm		58.6
Ratio "r" (M5-60/ M5-2D)		0.27
SAAR mm		946
Soil/ SPR mm		0.47

Soil Type 4 - Based on SI findings - clay or loamy soils; high runoff potential

For 50 Ha Area ~ QBARrural =		0.343	m^3/s
QBARrural =		6.867	l/s/ha
For 0.09 Ha Area ~ QBARrural =		0.633	l/s

Discharge should be limited to QBAR or 2 l/s/ha whichever is greater.

Part 2 **Impermeable Area**

Breakdown of the impermeable areas contributing to the surface water drainage network in each catchment with applied runoff coeifficients is provided in the table below

Total Area sq.m	Type of Surface	Area sq.m	Run-off Coefficient	Equivalent Impermeable	Urban Creep Allowance (10%)	Climate Change (20%)	Overall Impermeable
922.10	Standard Roof	348.87	0.95	331.43	364.57	437.48	621.74
	Permeable Paving inc. areas from hardstanding	83.15	0.50	41.58	45.73	54.88	
ha	Landscaped Areas inc. areas from hardstanding	490.08	0.20	98.02	107.82	129.38	ha
0.09							0.06
	Hardstanding	0.00	0.90	0.00	0.00	0.00	

These calculations are based on "Engineering Hydrology" by E.M.Wilson (4th Edition)
Ratio R (%) - Refer to Table 2.9 of "Engineering Hydrology
M10/M100 - Refer to Table 2.7 of "Engineering Hydrology

Part 3 **Attenuation Volume Required**

1 in 10 Years								
Rainfall Duration (D)	Ratio r (%)	M5 (mm)	M10 (mm)	Area	MT	Inflow "I"	Outflow "O"	Capacity Required
	Table 2.9	(M5-2D*Ratio)/100	Table 2.7		M5*M10	MT* Impermeable Area	(QBARrural/1000)*60	"I"-"O" ="S"
1 min	3	1.8	1.15	1	2.022	1.257	0.037993675	1.219
2min	5	2.9	1.15	1	3.370	2.095	0.075987351	2.019
5 min	9	5.3	1.16	1	6.118	3.804	0.189968377	3.614
10 min	12.9	7.6	1.17	1	8.844	5.499	0.379936755	5.119
15 min	15.5	9.1	1.18	1	10.718	6.664	0.569905132	6.094
30 min	20.7	12.1	1.18	1	14.314	8.899	1.139810264	7.760
60 min	27	15.8	1.18	1	18.670	11.608	2.279620528	9.328
2 hour	35	20.5	1.18	1	24.202	15.047	4.559241056	10.488
4 hour	44	25.8	1.17	1	30.167	18.756	9.118482111	9.638
6 hour	51	29.9	1.17	1	34.967	21.740	13.67772317	8.063
12 hour	65	38.1	1.16	1	44.184	27.471	27.35544633	0.116
24 hour	83	48.6	1.15	1	55.934	34.776	54.71089267	-19.935
48 hour	106	62.1	1.14	1	70.812	44.027	109.4217853	-65.395
Size of Attenuation for 1 in 10 year flood event m³								**10.488**

1 in 30 Years								
Rainfall Duration (D)	Ratio r (%)	M5 (mm)	M30 (mm)	Area	MT	Inflow "I"	Outflow "O"	Capacity Required
	Table 2.7	(M5-2D*Ratio)/100	Table 2.9		M5*M30	MT* Impermeable Area	(QBARrural/1000)*60	"I"-"O" ="S"
1 min	3	1.8	1.43	1	2.514	1.563	0.037993675	1.525
2min	5	2.9	1.43	1	4.190	2.605	0.075987351	2.529
5 min	9	5.3	1.48	1	7.806	4.853	0.189968377	4.663
10 min	12.9	7.6	1.51	1	11.415	7.097	0.379936755	6.717
15 min	15.5	9.1	1.54	1	13.988	8.697	0.569905132	8.127
30 min	20.7	12.1	1.54	1	18.681	11.614	1.139810264	10.475
60 min	27	15.8	1.54	1	24.366	15.149	2.279620528	12.870
2 hour	35	20.5	1.51	1	30.970	19.255	4.559241056	14.696
4 hour	44	25.8	1.5	1	38.676	24.047	9.118482111	14.928
6 hour	51	29.9	1.48	1	44.231	27.500	13.67772317	13.823
12 hour	65	38.1	1.45	1	55.231	34.339	27.35544633	6.984
24 hour	83	48.6	1.41	1	68.580	42.639	54.71089267	-12.072
48 hour	106	62.1	1.39	1	86.341	53.682	109.4217853	-55.740
Size of Attenuation for 1 in 30 year flood event m³								**14.928**

1 in 100 Years								
Rainfall Duration (D)	Ratio r (%)	M5 (mm)	M100 (mm)	Area	MT	Inflow "I"	Outflow "O"	Capacity Required
	Table 2.7	(M5-2D*Ratio)/100	Table 2.9		M5*M100	MT* Impermeable Area	(QBARrural/1000)*60	"I"-"O" ="S"
1 min	3	1.8	1.75	1	3.077	1.913	0.037993675	1.875
2min	5	2.9	1.77	1	5.186	3.224	0.075987351	3.148
5 min	9	5.3	1.86	1	9.810	6.099	0.189968377	5.909
10 min	12.9	7.6	1.9	1	14.363	8.930	0.379936755	8.550
15 min	15.5	9.1	1.96	1	17.803	11.069	0.569905132	10.499
30 min	20.7	12.1	1.97	1	23.896	14.857	1.139810264	13.718
60 min	27	15.8	1.98	1	31.328	19.478	2.279620528	17.198
2 hour	35	20.5	1.93	1	39.584	24.611	4.559241056	20.052
4 hour	44	25.8	1.89	1	48.732	30.299	9.118482111	21.180
6 hour	51	29.9	1.85	1	55.289	34.376	13.67772317	20.698
12 hour	65	38.1	1.77	1	67.419	41.917	27.35544633	14.562
24 hour	83	48.6	1.72	1	83.657	52.013	54.71089267	-2.698
48 hour	106	62.1	1.69	1	104.976	65.268	109.4217853	-44.154
Size of Attenuation for 1 in 100 year flood event m³								**21.180**

Part 4 Interception Storage

To prevent pollitant or sediments discharging into water courses the GDSDS required "interception storage" to be incorporated into the drainage design for the development. The volume of interception required is based on the 5-10mm of rainfall depth from 80% of the runoff from impermeable areas. The interception volume attributable to each of the SuDS features consists of the volyme of water that can infiltrate to the ground, the quanity that evaporates into the atmosphere and the volyme lost through transpiration in plants and vegitation. Additionally, there will be some loses of water due to absorption and westting of stone and soil media.

Required Interception Storage

Overall Impermeable area is 621.7 m² including 10% for urban creep

Therefore, the total interception storage required is 'overall impermeable area x 80% x 0.005 x 1.2 for climate change' 2.98 m³

Interception Storage Provided *Only fill in SuDS on your site

Permeable Paving	Area	83.2	m²
	Stone Layer 100mm deep	0.1	m
	Void Ratio	30%	
	Storage Volume	2.4945	m³

*Storage depth will depend on your site

Swale	Area	0.0	m²
	*75mm	0	m
	Storage Volume	0	m³

Bio-Retention Area/ Raingarden	Area	224.4	m²
	Depth of subgrade	0.1	m
	Storage Volume	22.441	m³

Total interception volume provided for the overall site 24.94 m³

which exceeds the required volume calculated of 2.98 m³

APPENDIX C – SURFACE WATER PIPE NETWORK CALCULATIONS

Design Settings

Rainfall Methodology	FSR
Return Period (years)	2
Additional Flow (%)	0
FSR Region	Scotland and Ireland
M5-60 (mm)	16.100
Ratio-R	0.270
CV	0.750
Time of Entry (mins)	4.00
Maximum Time of Concentration (mins)	30.00
Maximum Rainfall (mm/hr)	50.0
Minimum Velocity (m/s)	1.00
Connection Type	Level Inverts
Minimum Backdrop Height (m)	0.500
Preferred Cover Depth (m)	1.000
Include Intermediate Ground	✓
Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
SWMH 01	0.020	4.00	64.850	1200	1.225
SWMH 02	0.020	4.00	64.850	1200	1.298
SWMH 03	0.020	4.00	65.350	1200	1.225
SWMH 04	0.020	4.00	64.850	1200	1.375
SWMH 05	0.020	4.00	64.100	1200	0.725
SWMH 06	0.020	4.00	64.350	1200	1.047
SWMH 07	0.020	4.00	64.850	1200	1.594
SWMH 08	0.020	4.00	64.850	1200	1.606
SWMH 09-HB			64.350	1200	1.163
SWMH 10			64.350	1200	1.296
EXSW MH			64.560	1200	1.580

Links

Name	US Node	DS Node	Length (m)	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	Rain (mm/hr)
1.000	SWMH 01	SWMH 02	12.236	63.625	63.552	0.073	167.6	225	50.0
1.001	SWMH 02	SWMH 04	13.018	63.552	63.475	0.077	169.1	225	50.0
2.000	SWMH 03	SWMH 04	13.349	64.125	63.475	0.650	20.5	225	50.0
1.002	SWMH 04	SWMH 07	11.370	63.475	63.256	0.219	51.9	225	49.7
3.000	SWMH 05	SWMH 06	14.383	63.375	63.303	0.072	200.0	225	50.0
3.001	SWMH 06	SWMH 07	9.372	63.303	63.256	0.047	199.4	225	50.0
1.003	SWMH 07	SWMH 08	2.303	63.256	63.244	0.012	200.0	225	49.5
1.004	SWMH 08	SWMH 09-HB	11.473	63.244	63.187	0.057	200.0	225	48.8
1.005	SWMH 09-HB	SWMH 10	26.586	63.187	63.054	0.133	199.9	225	47.1
1.006	SWMH 10	EXSW MH	14.767	63.054	62.980	0.074	200.0	225	46.2

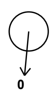
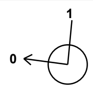
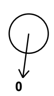
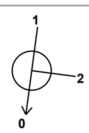
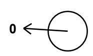
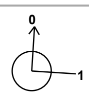
Name	Vel (m/s)	Flow (l/s)	US Depth (m)	DS Depth (m)
1.000	1.007	2.7	1.000	1.073
1.001	1.002	5.4	1.073	1.150
2.000	2.900	2.7	1.000	1.150
1.002	1.819	10.8	1.150	1.369
3.000	0.921	2.7	0.500	0.822
3.001	0.922	5.4	0.822	1.369
1.003	0.921	18.8	1.369	1.381
1.004	0.921	21.1	1.381	0.938
1.005	0.921	20.4	0.938	1.071
1.006	0.921	20.0	1.071	1.355

Pipeline Schedule

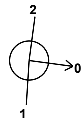
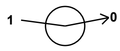
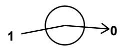
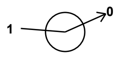
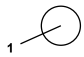
Link	Length (m)	Slope (1:X)	Dia (mm)	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	12.236	167.6	225	64.850	63.625	1.000	64.850	63.552	1.073
1.001	13.018	169.1	225	64.850	63.552	1.073	64.850	63.475	1.150
2.000	13.349	20.5	225	65.350	64.125	1.000	64.850	63.475	1.150
1.002	11.370	51.9	225	64.850	63.475	1.150	64.850	63.256	1.369
3.000	14.383	200.0	225	64.100	63.375	0.500	64.350	63.303	0.822
3.001	9.372	199.4	225	64.350	63.303	0.822	64.850	63.256	1.369
1.003	2.303	200.0	225	64.850	63.256	1.369	64.850	63.244	1.381
1.004	11.473	200.0	225	64.850	63.244	1.381	64.350	63.187	0.938
1.005	26.586	199.9	225	64.350	63.187	0.938	64.350	63.054	1.071
1.006	14.767	200.0	225	64.350	63.054	1.071	64.560	62.980	1.355

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	SWMH 01	1200	Manhole	Adoptable	SWMH 02	1200	Manhole	Adoptable
1.001	SWMH 02	1200	Manhole	Adoptable	SWMH 04	1200	Manhole	Adoptable
2.000	SWMH 03	1200	Manhole	Adoptable	SWMH 04	1200	Manhole	Adoptable
1.002	SWMH 04	1200	Manhole	Adoptable	SWMH 07	1200	Manhole	Adoptable
3.000	SWMH 05	1200	Manhole	Adoptable	SWMH 06	1200	Manhole	Adoptable
3.001	SWMH 06	1200	Manhole	Adoptable	SWMH 07	1200	Manhole	Adoptable
1.003	SWMH 07	1200	Manhole	Adoptable	SWMH 08	1200	Manhole	Adoptable
1.004	SWMH 08	1200	Manhole	Adoptable	SWMH 09-HB	1200	Manhole	Adoptable
1.005	SWMH 09-HB	1200	Manhole	Adoptable	SWMH 10	1200	Manhole	Adoptable
1.006	SWMH 10	1200	Manhole	Adoptable	EXSW MH	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
SWMH 01	715269.845	740367.057	64.850	1.225	1200		0	1.000	63.625	225
SWMH 02	715268.691	740354.876	64.850	1.298	1200		1	1.000	63.552	225
							0	1.001	63.552	225
SWMH 03	715257.552	740369.813	65.350	1.225	1200		0	2.000	64.125	225
SWMH 04	715255.785	740356.581	64.850	1.375	1200		1	2.000	63.475	225
							2	1.001	63.475	225
							0	1.002	63.475	225
SWMH 05	715268.039	740335.044	64.100	0.725	1200		0	3.000	63.375	225
SWMH 06	715253.685	740335.958	64.350	1.047	1200		1	3.000	63.303	225
							0	3.001	63.303	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
SWMH 07	715254.281	740345.311	64.850	1.594	1200		1	3.001	63.256	225
							2	1.002	63.256	225
							0	1.003	63.256	225
SWMH 08	715256.564	740345.006	64.850	1.606	1200		1	1.003	63.244	225
							0	1.004	63.244	225
SWMH 09-HB	715267.828	740347.185	64.350	1.163	1200		1	1.004	63.187	225
							0	1.005	63.187	225
SWMH 10	715294.329	740345.061	64.350	1.296	1200		1	1.005	63.054	225
							0	1.006	63.054	225
EXSW MH	715307.803	740351.103	64.560	1.580	1200		1	1.006	62.980	225

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
Rainfall Events	Singular	Skip Steady State	x
FSR Region	Scotland and Ireland	Drain Down Time (mins)	240
M5-60 (mm)	16.100	Additional Storage (m³/ha)	20.0
Ratio-R	0.270	Starting Level (m)	
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	20	0	0
30	20	0	0
100	20	0	0

Node SWMH 09-HB Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	63.187	Product Number	CTL-SHE-0087-3300-0940-3300
Design Depth (m)	0.940	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	3.3	Min Node Diameter (mm)	1200

Node SWMH 08 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	63.244
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	56

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	89.0	0.0	0.760	89.0	0.0	0.761	0.0	0.0

Results for 2 year +20% CC Critical Storm Duration. Lowest mass balance: 99.93%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SWMH 01	10	63.669	0.044	3.4	0.0642	0.0000	OK
15 minute winter	SWMH 02	10	63.617	0.065	6.8	0.0940	0.0000	OK
15 minute winter	SWMH 03	10	64.152	0.027	3.4	0.0387	0.0000	OK
15 minute winter	SWMH 04	10	63.541	0.066	13.6	0.0935	0.0000	OK
15 minute winter	SWMH 05	10	63.421	0.046	3.4	0.0773	0.0000	OK
120 minute winter	SWMH 06	88	63.394	0.091	2.4	0.1379	0.0000	OK
120 minute winter	SWMH 07	88	63.394	0.138	8.3	0.1910	0.0000	OK
120 minute winter	SWMH 08	88	63.394	0.150	9.3	13.5511	0.0000	OK
120 minute winter	SWMH 09-HB	88	63.394	0.206	3.3	0.2335	0.0000	OK
120 minute winter	SWMH 10	88	63.100	0.046	3.3	0.0523	0.0000	OK
120 minute winter	EXSW MH	88	63.025	0.045	3.3	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SWMH 01	1.000	SWMH 02	3.4	0.457	0.085	0.0918	
15 minute winter	SWMH 02	1.001	SWMH 04	6.8	0.706	0.170	0.1250	
15 minute winter	SWMH 03	2.000	SWMH 04	3.4	0.597	0.029	0.0818	
15 minute winter	SWMH 04	1.002	SWMH 07	13.6	0.834	0.187	0.1862	
15 minute winter	SWMH 05	3.000	SWMH 06	3.4	0.360	0.093	0.1390	
120 minute winter	SWMH 06	3.001	SWMH 07	2.3	0.282	0.063	0.1904	
120 minute winter	SWMH 07	1.003	SWMH 08	8.1	0.831	0.222	0.0618	
120 minute winter	SWMH 08	1.004	SWMH 09-HB	3.3	0.284	0.091	0.3802	
120 minute winter	SWMH 09-HB	Hydro-Brake®	SWMH 10	3.3				
120 minute winter	SWMH 10	1.006	EXSW MH	3.3	0.566	0.089	0.0848	27.5

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 99.93%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SWMH 01	10	63.684	0.059	6.2	0.0866	0.0000	OK
15 minute summer	SWMH 02	10	63.644	0.092	12.4	0.1320	0.0000	OK
15 minute winter	SWMH 03	10	64.160	0.035	6.2	0.0516	0.0000	OK
15 minute winter	SWMH 04	10	63.569	0.094	24.8	0.1340	0.0000	OK
120 minute winter	SWMH 05	100	63.566	0.191	2.2	0.3213	0.0000	OK
120 minute winter	SWMH 06	100	63.566	0.263	4.2	0.3976	0.0000	SURCHARGED
120 minute winter	SWMH 07	98	63.566	0.310	14.6	0.4280	0.0000	SURCHARGED
120 minute winter	SWMH 08	98	63.566	0.322	16.4	29.0607	0.0000	SURCHARGED
120 minute winter	SWMH 09-HB	98	63.565	0.378	3.5	0.4274	0.0000	SURCHARGED
480 minute summer	SWMH 10	328	63.101	0.047	3.3	0.0527	0.0000	OK
480 minute summer	EXSW MH	328	63.025	0.045	3.3	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SWMH 01	1.000	SWMH 02	6.2	0.530	0.155	0.1441	
15 minute summer	SWMH 02	1.001	SWMH 04	12.4	0.801	0.311	0.2014	
15 minute winter	SWMH 03	2.000	SWMH 04	6.2	0.672	0.054	0.1317	
15 minute winter	SWMH 04	1.002	SWMH 07	24.6	0.991	0.341	0.2788	
120 minute winter	SWMH 05	3.000	SWMH 06	2.1	0.337	0.057	0.5444	
120 minute winter	SWMH 06	3.001	SWMH 07	3.7	0.294	0.102	0.3727	
120 minute winter	SWMH 07	1.003	SWMH 08	14.2	0.998	0.387	0.0916	
120 minute winter	SWMH 08	1.004	SWMH 09-HB	3.5	0.279	0.096	0.4563	
120 minute winter	SWMH 09-HB	Hydro-Brake®	SWMH 10	3.3				
480 minute summer	SWMH 10	1.006	EXSW MH	3.3	0.569	0.090	0.0857	68.5

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.93%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	SWMH 01	168	63.707	0.082	2.2	0.1188	0.0000	OK
180 minute winter	SWMH 02	168	63.707	0.155	4.4	0.2223	0.0000	OK
15 minute summer	SWMH 03	10	64.165	0.040	8.1	0.0588	0.0000	OK
180 minute winter	SWMH 04	168	63.706	0.231	8.8	0.3292	0.0000	SURCHARGED
180 minute winter	SWMH 05	168	63.706	0.331	2.2	0.5578	0.0000	SURCHARGED
180 minute winter	SWMH 06	168	63.706	0.403	3.9	0.6103	0.0000	SURCHARGED
180 minute winter	SWMH 07	164	63.706	0.450	14.4	0.6219	0.0000	SURCHARGED
180 minute winter	SWMH 08	168	63.706	0.462	16.3	41.7681	0.0000	SURCHARGED
180 minute winter	SWMH 09-HB	168	63.706	0.519	3.5	0.5865	0.0000	SURCHARGED
60 minute winter	SWMH 10	162	63.101	0.047	3.3	0.0527	0.0000	OK
180 minute winter	EXSW MH	308	63.025	0.045	3.3	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
180 minute winter	SWMH 01	1.000	SWMH 02	2.2	0.407	0.055	0.2571	
180 minute winter	SWMH 02	1.001	SWMH 04	4.4	0.628	0.110	0.4480	
15 minute summer	SWMH 03	2.000	SWMH 04	8.1	0.711	0.070	0.1652	
180 minute winter	SWMH 04	1.002	SWMH 07	8.7	0.508	0.121	0.4522	
180 minute winter	SWMH 05	3.000	SWMH 06	1.8	0.320	0.050	0.5720	
180 minute winter	SWMH 06	3.001	SWMH 07	3.7	0.252	0.101	0.3727	
180 minute winter	SWMH 07	1.003	SWMH 08	14.1	0.970	0.385	0.0916	
180 minute winter	SWMH 08	1.004	SWMH 09-HB	3.5	0.273	0.095	0.4563	
180 minute winter	SWMH 09-HB	Hydro-Brake®	SWMH 10	3.3				
60 minute winter	SWMH 10	1.006	EXSW MH	3.3	0.569	0.090	0.0857	49.5

Design Settings

Rainfall Methodology	FSR
Return Period (years)	2
Additional Flow (%)	0
FSR Region	Scotland and Ireland
M5-60 (mm)	16.100
Ratio-R	0.270
CV	0.750
Time of Entry (mins)	4.00
Maximum Time of Concentration (mins)	30.00
Maximum Rainfall (mm/hr)	50.0
Minimum Velocity (m/s)	1.00
Connection Type	Level Inverts
Minimum Backdrop Height (m)	0.500
Preferred Cover Depth (m)	1.500
Include Intermediate Ground	✓
Enforce best practice design rules	✓

Nodes

Name	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
SWMH 11	4.00	64.880	1200	2.225
SWMH 12		63.830	1200	1.469
EXSW MH		63.850	1200	1.599

Links

Name	US Node	DS Node	Length (m)	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	Rain (mm/hr)
1.000	SWMH 11	SWMH 12	58.704	62.655	62.361	0.294	200.0	225	47.7
1.001	SWMH 12	EXSW MH	11.042	62.361	62.251	0.110	100.4	225	47.2

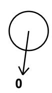
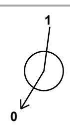
Name	Vel (m/s)	Flow (l/s)	US Depth (m)	DS Depth (m)
1.000	0.921	0.0	2.000	1.244
1.001	1.305	0.0	1.244	1.374

Pipeline Schedule

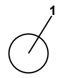
Link	Length (m)	Slope (1:X)	Dia (mm)	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	58.704	200.0	225	64.880	62.655	2.000	63.830	62.361	1.244
1.001	11.042	100.4	225	63.830	62.361	1.244	63.850	62.251	1.374

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	SWMH 11	1200	Manhole	Adoptable	SWMH 12	1200	Manhole	Adoptable
1.001	SWMH 12	1200	Manhole	Adoptable	EXSW MH	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
SWMH 11	715305.022	740365.685	64.880	2.225	1200		0	1.000	62.655	225
SWMH 12	715297.144	740307.512	63.830	1.469	1200		1	1.000	62.361	225
							0	1.001	62.361	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
EXSW MH	715291.360	740298.106	63.850	1.599	1200		1	1.001	62.251	225

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
Rainfall Events	Singular	Skip Steady State	x
FSR Region	Scotland and Ireland	Drain Down Time (mins)	240
M5-60 (mm)	16.100	Additional Storage (m³/ha)	20.0
Ratio-R	0.270	Starting Level (m)	
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	20	0	0
30	20	0	0
100	20	0	0

Results for 2 year +20% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SWMH 11	1	62.655	0.000	0.0	0.0000	0.0000	OK
15 minute summer	SWMH 12	1	62.361	0.000	0.0	0.0000	0.0000	OK
15 minute summer	EXSW MH	1	62.251	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SWMH 11	1.000	SWMH 12	0.0	0.000	0.000	0.0000	
15 minute summer	SWMH 12	1.001	EXSW MH	0.0	0.000	0.000	0.0000	0.0

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SWMH 11	1	62.655	0.000	0.0	0.0000	0.0000	OK
15 minute summer	SWMH 12	1	62.361	0.000	0.0	0.0000	0.0000	OK
15 minute summer	EXSW MH	1	62.251	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SWMH 11	1.000	SWMH 12	0.0	0.000	0.000	0.0000	
15 minute summer	SWMH 12	1.001	EXSW MH	0.0	0.000	0.000	0.0000	0.0

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SWMH 11	1	62.655	0.000	0.0	0.0000	0.0000	OK
15 minute summer	SWMH 12	1	62.361	0.000	0.0	0.0000	0.0000	OK
15 minute summer	EXSW MH	1	62.251	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SWMH 11	1.000	SWMH 12	0.0	0.000	0.000	0.0000	
15 minute summer	SWMH 12	1.001	EXSW MH	0.0	0.000	0.000	0.0000	0.0

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	Scotland and Ireland	Connection Type	Level Inverts
M5-60 (mm)	16.100	Minimum Backdrop Height (m)	0.500
Ratio-R	0.270	Preferred Cover Depth (m)	0.600
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
SWMH 13	0.010	4.00	63.554	1200	1.025
SWMH 14	0.010	4.00	63.605	1200	1.138
SWMH 15	0.010	4.00	63.475	1200	0.925
SWMH 16	0.010	4.00	63.475	1200	1.042
SWMH 17	0.010	4.00	63.575	1200	1.234
SWMH 18	0.010	4.00	63.404	1200	1.080
SWMH 19	0.010	4.00	62.954	1200	0.825
SWMH 20			62.954	1200	0.848
SWMH 21		4.00	62.954	1200	0.848
SWMH 22-HB			63.400	1200	1.407
SWMH 23			63.475	1200	1.718
EXSW MH	0.000		61.810	1200	0.825

Links

Name	US Node	DS Node	Length (m)	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	Rain (mm/hr)
2.000	SWMH 13	SWMH 14	10.430	62.529	62.467	0.062	168.2	225	50.0
2.001	SWMH 14	SWMH 17	21.343	62.467	62.341	0.126	169.4	225	49.7
3.000	SWMH 15	SWMH 16	19.850	62.550	62.433	0.117	169.7	225	50.0
3.001	SWMH 16	SWMH 17	7.858	62.433	62.341	0.092	85.4	225	50.0
2.002	SWMH 17	SWMH 18	2.802	62.341	62.324	0.017	164.8	225	49.5
2.003	SWMH 18	SWMH 19	7.624	62.324	62.129	0.195	39.1	225	49.3
2.004	SWMH 19	SWMH 20	3.832	62.129	62.106	0.023	166.6	225	49.0
1.000	SWMH 21	SWMH 22-HB	6.804	62.106	61.993	0.113	60.0	225	50.0
1.001	SWMH 22-HB	SWMH 23	14.136	61.993	61.757	0.236	60.0	225	50.0
1.002	SWMH 23	EXSW MH	30.355	61.757	60.985	0.772	39.3	225	50.0

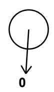
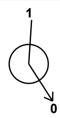
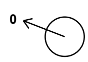
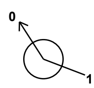
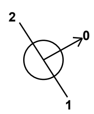
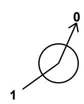
Name	Vel (m/s)	Flow (l/s)	US Depth (m)	DS Depth (m)
2.000	1.005	1.4	0.800	0.913
2.001	1.001	2.7	0.913	1.009
3.000	1.001	1.4	0.700	0.817
3.001	1.415	2.7	0.817	1.009
2.002	1.015	6.7	1.009	0.855
2.003	2.098	8.0	0.855	0.600
2.004	1.010	9.3	0.600	0.623
1.000	1.691	0.0	0.623	1.182
1.001	1.691	0.0	1.182	1.493
1.002	2.092	0.0	1.493	0.600

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
2.000	10.430	168.2	225	63.554	62.529	0.800	63.605	62.467	0.913
2.001	21.343	169.4	225	63.605	62.467	0.913	63.575	62.341	1.009
3.000	19.850	169.7	225	63.475	62.550	0.700	63.475	62.433	0.817
3.001	7.858	85.4	225	63.475	62.433	0.817	63.575	62.341	1.009
2.002	2.802	164.8	225	63.575	62.341	1.009	63.404	62.324	0.855
2.003	7.624	39.1	225	63.404	62.324	0.855	62.954	62.129	0.600
2.004	3.832	166.6	225	62.954	62.129	0.600	62.954	62.106	0.623
1.000	6.804	60.0	225	62.954	62.106	0.623	63.400	61.993	1.182
1.001	14.136	60.0	225	63.400	61.993	1.182	63.475	61.757	1.493
1.002	30.355	39.3	225	63.475	61.757	1.493	61.810	60.985	0.600

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
2.000	SWMH 13	1200	Manhole	Adoptable	SWMH 14	1200	Manhole	Adoptable
2.001	SWMH 14	1200	Manhole	Adoptable	SWMH 17	1200	Manhole	Adoptable
3.000	SWMH 15	1200	Manhole	Adoptable	SWMH 16	1200	Manhole	Adoptable
3.001	SWMH 16	1200	Manhole	Adoptable	SWMH 17	1200	Manhole	Adoptable
2.002	SWMH 17	1200	Manhole	Adoptable	SWMH 18	1200	Manhole	Adoptable
2.003	SWMH 18	1200	Manhole	Adoptable	SWMH 19	1200	Manhole	Adoptable
2.004	SWMH 19	1200	Manhole	Adoptable	SWMH 20	1200	Manhole	Adoptable
1.000	SWMH 21	1200	Manhole	Adoptable	SWMH 22-HB	1200	Manhole	Adoptable
1.001	SWMH 22-HB	1200	Manhole	Adoptable	SWMH 23	1200	Manhole	Adoptable
1.002	SWMH 23	1200	Manhole	Adoptable	EXSW MH	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
SWMH 13	715325.888	740306.992	63.554	1.025	1200		0	2.000	62.529	225
SWMH 14	715325.206	740296.584	63.605	1.138	1200		1	2.000	62.467	225
							0	2.001	62.467	225
SWMH 15	715359.492	740264.884	63.475	0.925	1200		0	3.000	62.550	225
SWMH 16	715340.961	740271.998	63.475	1.042	1200		1	3.000	62.433	225
							0	3.001	62.433	225
SWMH 17	715336.722	740278.614	63.575	1.234	1200		1	3.001	62.341	225
							2	2.001	62.341	225
							0	2.002	62.341	225
SWMH 18	715339.080	740280.125	63.404	1.080	1200		1	2.002	62.324	225
							0	2.003	62.324	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SWMH 19	715341.809	740287.243	62.954	0.825	1200	1	2.003	62.129	225
						0	2.004	62.129	225
SWMH 20	715338.312	740288.809	62.954	0.848	1200	1	2.004	62.106	225
SWMH 21	715339.121	740290.656	62.954	0.848	1200				
						0	1.000	62.106	225
SWMH 22-HB	715345.389	740288.009	63.400	1.407	1200	1	1.000	61.993	225
						0	1.001	61.993	225
SWMH 23	715340.349	740274.802	63.475	1.718	1200	1	1.001	61.757	225
						0	1.002	61.757	225
EXSW MH	715368.456	740263.339	61.810	0.825	1200	1	1.002	60.985	225

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
Rainfall Events	Singular	Skip Steady State	x
FSR Region	Scotland and Ireland	Drain Down Time (mins)	240
M5-60 (mm)	16.100	Additional Storage (m^3/ha)	20.0
Ratio-R	0.270	Starting Level (m)	
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	20	0	0
30	20	0	0
100	20	0	0

Node SWMH 22-HB Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	61.993	Product Number	CTL-SHE-0065-2000-1182-2000
Design Depth (m)	1.182	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node SWMH 21 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Main Channel Length (m)	15.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	62.106	Main Channel Slope (1:X)	999999.0
Safety Factor	2.0	Time to half empty (mins)	0	Main Channel n	0.025

Inlets
SWMH 20

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	36.9	0.0	0.744	161.1	0.0	0.745	0.0	0.0

Results for 2 year +20% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SWMH 13	10	62.560	0.031	1.7	0.0417	0.0000	OK
15 minute winter	SWMH 14	10	62.511	0.044	3.4	0.0572	0.0000	OK
15 minute winter	SWMH 15	10	62.581	0.031	1.7	0.0423	0.0000	OK
15 minute winter	SWMH 16	10	62.470	0.037	3.4	0.0491	0.0000	OK
15 minute winter	SWMH 17	10	62.413	0.072	8.4	0.0929	0.0000	OK
15 minute winter	SWMH 18	10	62.377	0.053	9.9	0.0699	0.0000	OK
15 minute winter	SWMH 19	10	62.213	0.084	11.6	0.1151	0.0000	OK
60 minute winter	SWMH 20	47	62.207	0.101	6.3	0.1146	0.0000	OK
60 minute winter	SWMH 21	46	62.208	0.102	12.1	0.1154	0.0000	OK
60 minute winter	SWMH 22-HB	45	62.226	0.233	7.7	0.2632	0.0000	SURCHARGED
60 minute winter	SWMH 23	49	61.780	0.023	1.8	0.0258	0.0000	OK
60 minute winter	EXSW MH	44	61.008	0.023	1.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SWMH 13	2.000	SWMH 14	1.7	0.390	0.042	0.0457	
15 minute winter	SWMH 14	2.001	SWMH 17	3.3	0.415	0.084	0.1742	
15 minute winter	SWMH 15	3.000	SWMH 16	1.7	0.444	0.042	0.0756	
15 minute winter	SWMH 16	3.001	SWMH 17	3.4	0.454	0.060	0.0596	
15 minute winter	SWMH 17	2.002	SWMH 18	8.2	0.919	0.204	0.0253	
15 minute winter	SWMH 18	2.003	SWMH 19	9.9	0.968	0.118	0.0786	
15 minute winter	SWMH 19	2.004	SWMH 20	11.5	1.265	0.286	0.0396	
60 minute winter	SWMH 20	Flow through pond	SWMH 21	7.9	0.045	0.108	4.6145	
60 minute winter	SWMH 21	1.000	SWMH 22-HB	7.7	0.426	0.114	0.1928	
60 minute winter	SWMH 22-HB	Hydro-Brake®	SWMH 23	1.8				
60 minute winter	SWMH 23	1.002	EXSW MH	1.8	0.845	0.021	0.0633	9.5

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SWMH 13	10	62.571	0.042	3.1	0.0558	0.0000	OK
15 minute winter	SWMH 14	10	62.526	0.059	6.2	0.0776	0.0000	OK
15 minute winter	SWMH 15	10	62.592	0.042	3.1	0.0568	0.0000	OK
15 minute winter	SWMH 16	10	62.483	0.050	6.2	0.0662	0.0000	OK
15 minute winter	SWMH 17	10	62.442	0.101	15.4	0.1305	0.0000	OK
15 minute winter	SWMH 18	10	62.401	0.077	18.4	0.1013	0.0000	OK
120 minute winter	SWMH 19	94	62.310	0.181	7.7	0.2481	0.0000	OK
120 minute winter	SWMH 20	94	62.310	0.204	7.6	0.2304	0.0000	OK
120 minute winter	SWMH 21	94	62.310	0.204	11.7	0.2304	0.0000	OK
120 minute winter	SWMH 22-HB	94	62.310	0.317	7.6	0.3580	0.0000	SURCHARGED
30 minute winter	SWMH 23	35	61.780	0.023	1.8	0.0260	0.0000	OK
30 minute winter	EXSW MH	35	61.008	0.023	1.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SWMH 13	2.000	SWMH 14	3.1	0.466	0.078	0.0703	
15 minute winter	SWMH 14	2.001	SWMH 17	6.2	0.486	0.155	0.2731	
15 minute winter	SWMH 15	3.000	SWMH 16	3.1	0.530	0.078	0.1161	
15 minute winter	SWMH 16	3.001	SWMH 17	6.2	0.529	0.110	0.0935	
15 minute winter	SWMH 17	2.002	SWMH 18	15.3	1.051	0.379	0.0409	
15 minute winter	SWMH 18	2.003	SWMH 19	18.4	1.119	0.220	0.1255	
120 minute winter	SWMH 19	2.004	SWMH 20	7.6	0.732	0.190	0.1380	
120 minute winter	SWMH 20	Flow through pond	SWMH 21	7.5	0.046	0.102	10.9802	
120 minute winter	SWMH 21	1.000	SWMH 22-HB	7.6	0.389	0.113	0.2640	
120 minute winter	SWMH 22-HB	Hydro-Brake®	SWMH 23	1.8				
30 minute winter	SWMH 23	1.002	EXSW MH	1.8	0.848	0.021	0.0638	13.0

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SWMH 13	10	62.577	0.048	4.0	0.0633	0.0000	OK
15 minute winter	SWMH 14	10	62.535	0.068	8.0	0.0885	0.0000	OK
15 minute summer	SWMH 15	10	62.598	0.048	4.0	0.0646	0.0000	OK
15 minute winter	SWMH 16	10	62.490	0.057	8.0	0.0754	0.0000	OK
15 minute winter	SWMH 17	10	62.458	0.117	19.9	0.1517	0.0000	OK
15 minute winter	SWMH 18	10	62.415	0.091	23.8	0.1197	0.0000	OK
120 minute winter	SWMH 19	106	62.375	0.246	9.8	0.3380	0.0000	SURCHARGED
120 minute winter	SWMH 20	106	62.375	0.269	9.6	0.3044	0.0000	OK
120 minute winter	SWMH 21	106	62.375	0.269	8.6	0.3044	0.0000	SURCHARGED
120 minute winter	SWMH 22-HB	106	62.375	0.382	8.3	0.4320	0.0000	SURCHARGED
30 minute summer	SWMH 23	57	61.780	0.023	1.8	0.0260	0.0000	OK
30 minute summer	EXSW MH	57	61.008	0.023	1.9	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SWMH 13	2.000	SWMH 14	4.0	0.500	0.100	0.0843	
15 minute winter	SWMH 14	2.001	SWMH 17	8.0	0.518	0.200	0.3304	
15 minute summer	SWMH 15	3.000	SWMH 16	4.0	0.571	0.101	0.1395	
15 minute winter	SWMH 16	3.001	SWMH 17	8.0	0.563	0.142	0.1132	
15 minute winter	SWMH 17	2.002	SWMH 18	19.8	1.102	0.490	0.0504	
15 minute winter	SWMH 18	2.003	SWMH 19	23.7	1.168	0.284	0.1551	
120 minute winter	SWMH 19	2.004	SWMH 20	9.6	0.772	0.240	0.1524	
120 minute winter	SWMH 20	Flow through pond	SWMH 21	7.0	0.040	0.095	16.0098	
120 minute winter	SWMH 21	1.000	SWMH 22-HB	8.3	0.432	0.123	0.2706	
120 minute winter	SWMH 22-HB	Hydro-Brake®	SWMH 23	1.8				
30 minute summer	SWMH 23	1.002	EXSW MH	1.8	0.848	0.021	0.0638	15.2

Design Settings

Rainfall Methodology	FSR
Return Period (years)	2
Additional Flow (%)	0
FSR Region	Scotland and Ireland
M5-60 (mm)	16.100
Ratio-R	0.270
CV	0.750
Time of Entry (mins)	4.00
Maximum Time of Concentration (mins)	30.00
Maximum Rainfall (mm/hr)	50.0
Minimum Velocity (m/s)	1.00
Connection Type	Level Inverts
Minimum Backdrop Height (m)	0.500
Preferred Cover Depth (m)	0.800
Include Intermediate Ground	✓
Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
SWMH 33	0.030	4.00	62.500	1200	0.825
SWMH 34	0.030	4.00	62.500	1200	1.025
SWMH 35	0.030	4.00	62.500	1200	1.083
SWMH 36	0.030	4.00	62.500	1200	1.025
SWMH 37	0.030	4.00	62.500	1200	1.126
SWMH 38	0.030	4.00	62.500	1200	1.178
SWMH 39	0.030	4.00	62.500	1200	1.211
SWMH 40			62.500	1200	1.236
SWMH 41		4.00	62.500	1200	1.236
SWMH 42-HB			62.500	1200	1.278
SWMH 43			62.500	1200	1.438
EXSW MH			62.390	1200	1.403

Links

Name	US Node	DS Node	Length (m)	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	Rain (mm/hr)
1.000	SWMH 33	SWMH 34	26.344	61.675	61.475	0.200	131.7	225	50.0
1.001	SWMH 34	SWMH 35	9.766	61.475	61.417	0.058	168.4	225	49.6
1.002	SWMH 35	SWMH 39	9.678	61.417	61.289	0.128	75.6	225	49.2
2.000	SWMH 36	SWMH 37	17.146	61.475	61.374	0.101	169.8	225	50.0
2.001	SWMH 37	SWMH 38	10.356	61.374	61.322	0.052	200.0	300	50.0
2.002	SWMH 38	SWMH 39	6.555	61.322	61.289	0.033	200.0	300	49.6
1.003	SWMH 39	SWMH 40	4.927	61.289	61.264	0.025	200.0	300	48.9
3.000	SWMH 41	SWMH 42-HB	7.034	61.264	61.222	0.042	167.5	225	50.0
3.001	SWMH 42-HB	SWMH 43	27.157	61.222	61.062	0.160	169.7	225	49.5
3.002	SWMH 43	EXSW MH	12.597	61.062	60.987	0.075	168.0	225	48.7

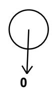
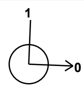
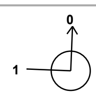
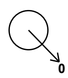
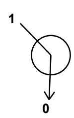
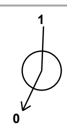
Name	Vel (m/s)	Flow (l/s)	US Depth (m)	DS Depth (m)
1.000	1.137	4.1	0.600	0.800
1.001	1.005	8.1	0.800	0.858
1.002	1.505	12.0	0.858	0.986
2.000	1.000	4.1	0.800	0.901
2.001	1.108	8.1	0.826	0.878
2.002	1.108	12.1	0.878	0.911
1.003	1.108	27.8	0.911	0.936
3.000	1.007	0.0	1.011	1.053
3.001	1.000	0.0	1.053	1.213
3.002	1.006	0.0	1.213	1.178

Pipeline Schedule

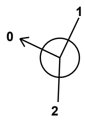
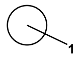
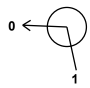
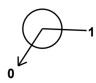
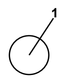
Link	Length (m)	Slope (1:X)	Dia (mm)	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	26.344	131.7	225	62.500	61.675	0.600	62.500	61.475	0.800
1.001	9.766	168.4	225	62.500	61.475	0.800	62.500	61.417	0.858
1.002	9.678	75.6	225	62.500	61.417	0.858	62.500	61.289	0.986
2.000	17.146	169.8	225	62.500	61.475	0.800	62.500	61.374	0.901
2.001	10.356	200.0	300	62.500	61.374	0.826	62.500	61.322	0.878
2.002	6.555	200.0	300	62.500	61.322	0.878	62.500	61.289	0.911
1.003	4.927	200.0	300	62.500	61.289	0.911	62.500	61.264	0.936
3.000	7.034	167.5	225	62.500	61.264	1.011	62.500	61.222	1.053
3.001	27.157	169.7	225	62.500	61.222	1.053	62.500	61.062	1.213
3.002	12.597	168.0	225	62.500	61.062	1.213	62.390	60.987	1.178

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	SWMH 33	1200	Manhole	Adoptable	SWMH 34	1200	Manhole	Adoptable
1.001	SWMH 34	1200	Manhole	Adoptable	SWMH 35	1200	Manhole	Adoptable
1.002	SWMH 35	1200	Manhole	Adoptable	SWMH 39	1200	Manhole	Adoptable
2.000	SWMH 36	1200	Manhole	Adoptable	SWMH 37	1200	Manhole	Adoptable
2.001	SWMH 37	1200	Manhole	Adoptable	SWMH 38	1200	Manhole	Adoptable
2.002	SWMH 38	1200	Manhole	Adoptable	SWMH 39	1200	Manhole	Adoptable
1.003	SWMH 39	1200	Manhole	Adoptable	SWMH 40	1200	Manhole	Adoptable
3.000	SWMH 41	1200	Manhole	Adoptable	SWMH 42-HB	1200	Manhole	Adoptable
3.001	SWMH 42-HB	1200	Manhole	Adoptable	SWMH 43	1200	Manhole	Adoptable
3.002	SWMH 43	1200	Manhole	Adoptable	EXSW MH	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
SWMH 33	715400.119	740211.509	62.500	0.825	1200		0	1.000	61.675	225
SWMH 34	715399.048	740185.187	62.500	1.025	1200		1	1.000	61.475	225
							0	1.001	61.475	225
SWMH 35	715408.806	740184.790	62.500	1.083	1200		1	1.001	61.417	225
							0	1.002	61.417	225
SWMH 36	715400.466	740222.991	62.500	1.025	1200		0	2.000	61.475	225
SWMH 37	715412.444	740210.723	62.500	1.126	1200		1	2.000	61.374	225
							0	2.001	61.374	300
SWMH 38	715412.023	740200.376	62.500	1.178	1200		1	2.001	61.322	300
							0	2.002	61.322	300

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
SWMH 39	715409.200	740194.460	62.500	1.211	1200		1	2.002	61.289	300
							2	1.002	61.289	225
							0	1.003	61.289	300
SWMH 40	715404.753	740196.582	62.500	1.236	1200		1	1.003	61.264	300
SWMH 41	715406.867	740207.767	62.500	1.236	1200		0	3.000	61.264	225
SWMH 42-HB	715405.374	740214.641	62.500	1.278	1200		1	3.000	61.222	225
							0	3.001	61.222	225
SWMH 43	715378.239	740215.745	62.500	1.438	1200		1	3.001	61.062	225
							0	3.002	61.062	225
EXSW MH	715371.378	740205.180	62.390	1.403	1200		1	3.002	60.987	225

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
Rainfall Events	Singular	Skip Steady State	x
FSR Region	Scotland and Ireland	Drain Down Time (mins)	240
M5-60 (mm)	16.100	Additional Storage (m³/ha)	20.0
Ratio-R	0.270	Starting Level (m)	
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	20	0	0
30	20	0	0
100	20	0	0

Node SWMH 42-HB Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	61.222	Product Number	CTL-SHE-0094-3900-1000-3900
Design Depth (m)	1.000	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	3.9	Min Node Diameter (mm)	1200

Node SWMH 41 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Main Channel Length (m)	10.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	61.264	Main Channel Slope (1:X)	999999.0
Safety Factor	2.0	Time to half empty (mins)	44	Main Channel n	0.025

Inlets
SWMH 40

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	6.4	0.0	1.100	136.6	0.0	1.110	0.0	0.0

Results for 2 year +20% CC Critical Storm Duration. Lowest mass balance: 99.82%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SWMH 33	10	61.726	0.051	5.1	0.0940	0.0000	OK
120 minute winter	SWMH 34	90	61.632	0.157	3.6	0.2693	0.0000	OK
120 minute winter	SWMH 35	88	61.632	0.215	5.4	0.3621	0.0000	OK
120 minute winter	SWMH 36	90	61.632	0.157	1.8	0.2687	0.0000	OK
120 minute winter	SWMH 37	88	61.632	0.258	3.6	0.4288	0.0000	OK
120 minute winter	SWMH 38	88	61.632	0.310	4.8	0.5085	0.0000	OK
120 minute winter	SWMH 39	90	61.632	0.343	10.6	0.5578	0.0000	OK
120 minute winter	SWMH 40	90	61.632	0.368	10.0	0.4158	0.0000	OK
120 minute winter	SWMH 41	90	61.632	0.368	7.0	0.4158	0.0000	SURCHARGED
120 minute winter	SWMH 42-HB	90	61.631	0.409	4.1	0.4626	0.0000	SURCHARGED
15 minute summer	SWMH 43	12	61.111	0.049	3.9	0.0552	0.0000	OK
120 minute summer	EXSW MH	64	61.034	0.047	3.9	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SWMH 33	1.000	SWMH 34	5.1	0.522	0.112	0.2595	
120 minute winter	SWMH 34	1.001	SWMH 35	3.6	0.598	0.090	0.3351	
120 minute winter	SWMH 35	1.002	SWMH 39	5.2	0.407	0.087	0.3817	
120 minute winter	SWMH 36	2.000	SWMH 37	1.8	0.369	0.045	0.5938	
120 minute winter	SWMH 37	2.001	SWMH 38	3.0	0.397	0.039	0.6982	
120 minute winter	SWMH 38	2.002	SWMH 39	4.2	0.323	0.054	0.4616	
120 minute winter	SWMH 39	1.003	SWMH 40	10.0	0.503	0.128	0.3470	
120 minute winter	SWMH 40	Flow through pond	SWMH 41	7.0	0.074	0.051	10.3990	
120 minute winter	SWMH 41	3.000	SWMH 42-HB	4.1	0.421	0.102	0.2797	
120 minute winter	SWMH 42-HB	Hydro-Brake®	SWMH 43	3.9				
15 minute summer	SWMH 43	3.002	EXSW MH	3.9	0.632	0.098	0.0778	13.8

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 99.82%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	SWMH 33	114	61.934	0.259	3.3	0.4809	0.0000	SURCHARGED
120 minute winter	SWMH 34	114	61.934	0.459	6.6	0.7877	0.0000	SURCHARGED
120 minute winter	SWMH 35	114	61.934	0.517	8.9	0.8710	0.0000	SURCHARGED
120 minute winter	SWMH 36	120	61.934	0.459	3.3	0.7881	0.0000	SURCHARGED
120 minute winter	SWMH 37	114	61.934	0.560	6.2	0.9318	0.0000	SURCHARGED
120 minute winter	SWMH 38	114	61.934	0.612	9.0	1.0037	0.0000	SURCHARGED
120 minute winter	SWMH 39	112	61.934	0.645	20.1	1.0494	0.0000	SURCHARGED
120 minute winter	SWMH 40	114	61.934	0.670	19.7	0.7575	0.0000	OK
120 minute winter	SWMH 41	114	61.934	0.670	11.9	0.7574	0.0000	SURCHARGED
120 minute winter	SWMH 42-HB	114	61.933	0.711	4.1	0.8045	0.0000	SURCHARGED
60 minute winter	SWMH 43	26	61.111	0.049	3.9	0.0552	0.0000	OK
60 minute winter	EXSW MH	26	61.034	0.047	3.9	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	SWMH 33	1.000	SWMH 34	3.3	0.444	0.072	1.0477	
120 minute winter	SWMH 34	1.001	SWMH 35	5.6	0.598	0.140	0.3884	
120 minute winter	SWMH 35	1.002	SWMH 39	8.4	0.394	0.141	0.3849	
120 minute winter	SWMH 36	2.000	SWMH 37	3.0	0.368	0.074	0.6819	
120 minute winter	SWMH 37	2.001	SWMH 38	5.8	0.356	0.074	0.7293	
120 minute winter	SWMH 38	2.002	SWMH 39	8.4	0.312	0.107	0.4616	
120 minute winter	SWMH 39	1.003	SWMH 40	19.7	0.572	0.252	0.3470	
120 minute winter	SWMH 40	Flow through pond	SWMH 41	11.9	0.090	0.086	30.8950	
120 minute winter	SWMH 41	3.000	SWMH 42-HB	4.1	0.386	0.103	0.2797	
120 minute winter	SWMH 42-HB	Hydro-Brake®	SWMH 43	3.9				
60 minute winter	SWMH 43	3.002	EXSW MH	3.9	0.632	0.098	0.0778	51.7

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.82%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	SWMH 33	168	62.096	0.421	3.2	0.7818	0.0000	SURCHARGED
180 minute winter	SWMH 34	168	62.096	0.621	6.0	1.0656	0.0000	SURCHARGED
180 minute winter	SWMH 35	168	62.096	0.679	8.3	1.1434	0.0000	SURCHARGED
180 minute winter	SWMH 36	168	62.096	0.621	3.2	1.0654	0.0000	SURCHARGED
180 minute winter	SWMH 37	172	62.096	0.722	6.0	1.2007	0.0000	SURCHARGED
180 minute winter	SWMH 38	168	62.096	0.774	8.9	1.2696	0.0000	SURCHARGED
180 minute winter	SWMH 39	172	62.095	0.806	19.3	1.3113	0.0000	SURCHARGED
180 minute winter	SWMH 40	168	62.095	0.831	19.2	0.9404	0.0000	OK
180 minute winter	SWMH 41	168	62.095	0.831	11.5	0.9404	0.0000	SURCHARGED
180 minute winter	SWMH 42-HB	172	62.095	0.873	4.1	0.9871	0.0000	SURCHARGED
180 minute winter	SWMH 43	68	61.111	0.049	3.9	0.0552	0.0000	OK
15 minute summer	EXSW MH	107	61.034	0.047	3.9	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
180 minute winter	SWMH 33	1.000	SWMH 34	3.0	0.415	0.066	1.0477	
180 minute winter	SWMH 34	1.001	SWMH 35	5.3	0.564	0.133	0.3884	
180 minute winter	SWMH 35	1.002	SWMH 39	8.0	0.386	0.134	0.3849	
180 minute winter	SWMH 36	2.000	SWMH 37	2.8	0.339	0.071	0.6819	
180 minute winter	SWMH 37	2.001	SWMH 38	5.7	0.356	0.072	0.7293	
180 minute winter	SWMH 38	2.002	SWMH 39	8.4	0.306	0.107	0.4616	
180 minute winter	SWMH 39	1.003	SWMH 40	19.2	0.566	0.245	0.3470	
180 minute winter	SWMH 40	Flow through pond	SWMH 41	11.5	0.080	0.083	46.2861	
180 minute winter	SWMH 41	3.000	SWMH 42-HB	4.1	0.353	0.102	0.2797	
180 minute winter	SWMH 42-HB	Hydro-Brake®	SWMH 43	3.9				
180 minute winter	SWMH 43	3.002	EXSW MH	3.9	0.632	0.098	0.0778	86.7

APPENDIX D – FOUL WATER PIPE NETWORK CALCULATIONS

Design Settings

Frequency of use (kDU)	0.50	Minimum Velocity (m/s)	0.75
Flow per dwelling per day (l/day)	446	Connection Type	Level Inverts
Domestic Flow (l/s/ha)	0.0	Minimum Backdrop Height (m)	0.500
Industrial Flow (l/s/ha)	0.0	Preferred Cover Depth (m)	1.200
Additional Flow (%)	10	Include Intermediate Ground	✓

Nodes

Name	Units	Cover Level (m)	Diameter (mm)	Depth (m)
FWMH 01		64.900	1200	4.900
FWMH 02		64.740	1200	4.781
FWMH 03		64.210	1200	4.471
FWMH 04		64.060	1200	4.411
FWMH 05		63.790	1200	4.282
FWMH 06		63.700	1200	4.385
FWMH 07		63.490	1200	4.335
FWMH 08		63.500	1200	4.394
FWMH 09		63.540	1200	4.513
FWMH 10	9.0	63.720	1200	1.425
FWMH 11	9.0	63.660	1200	1.841
FWMH 12	9.0	63.230	1200	2.121
FWMH 13		63.500	1200	1.425
FWMH 14		63.500	1200	1.837
FWMH 15		63.500	1200	1.984
FWMH 16		63.000	1200	4.184
FWMH 17		62.800	1200	4.042
FWMH 18	15.0	61.200	1200	1.425
FWMH 19	15.0	61.200	1200	1.643
FWMH 20	15.0	62.500	1200	3.478
FWMH 21	15.0	62.500	1200	1.425
FWMH 22	15.0	62.500	1200	1.710
FWMH 23	15.0	62.500	1200	1.876
FWMH 24	15.0	62.500	1200	2.076
FWMH 25	15.0	62.500	1200	3.551
FWMH 26	15.0	62.500	1200	3.648
FWMH 27		62.320	1200	3.502
FWMH 28	0.6	62.600	1200	3.939
FWMH 29	0.6	62.200	1200	3.758
FWMH 30	0.6	62.200	1200	3.780
FWMH 31	0.6	62.700	1200	4.397
EXFW MH		62.800	1200	4.570

Links

Name	US Node	DS Node	Length (m)	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
1.000	FWMH 01	FWMH 02	8.197	60.000	59.959	0.041	200.0	225
1.001	FWMH 02	FWMH 03	43.951	59.959	59.739	0.220	200.0	225
1.002	FWMH 03	FWMH 04	18.010	59.739	59.649	0.090	200.0	225
1.003	FWMH 04	FWMH 05	28.189	59.649	59.508	0.141	200.0	225
1.004	FWMH 05	FWMH 06	38.535	59.508	59.315	0.193	200.0	225
1.005	FWMH 06	FWMH 07	31.942	59.315	59.155	0.160	200.0	225
1.006	FWMH 07	FWMH 08	9.706	59.155	59.106	0.049	200.0	225
1.007	FWMH 08	FWMH 09	15.831	59.106	59.027	0.079	200.0	225
1.008	FWMH 09	FWMH 16	42.109	59.027	58.816	0.211	200.0	225
2.000	FWMH 10	FWMH 11	28.533	62.295	61.819	0.476	60.0	225
2.001	FWMH 11	FWMH 12	42.588	61.819	61.109	0.710	60.0	225
2.002	FWMH 12	FWMH 16	10.601	61.109	60.932	0.177	60.0	225
3.000	FWMH 13	FWMH 14	24.746	62.075	61.663	0.412	60.0	225
3.001	FWMH 14	FWMH 15	8.838	61.663	61.516	0.147	60.0	225
3.002	FWMH 15	FWMH 16	7.910	61.516	61.384	0.132	60.0	225
1.009	FWMH 16	FWMH 17	11.660	58.816	58.758	0.058	200.0	225
1.010	FWMH 17	FWMH 28	19.425	58.758	58.661	0.097	200.0	225
4.000	FWMH 18	FWMH 19	13.087	59.775	59.557	0.218	60.0	225
4.001	FWMH 19	FWMH 20	32.112	59.557	59.022	0.535	60.0	225
4.002	FWMH 20	FWMH 25	4.381	59.022	58.949	0.073	60.0	225
5.000	FWMH 21	FWMH 22	17.120	61.075	60.790	0.285	60.0	225
5.001	FWMH 22	FWMH 23	9.943	60.790	60.624	0.166	60.0	225
5.002	FWMH 23	FWMH 24	11.996	60.624	60.424	0.200	60.0	225
5.003	FWMH 24	FWMH 25	4.762	60.424	60.345	0.079	60.0	225

Name	Vel (m/s)	Flow (l/s)	US Depth (m)	DS Depth (m)
1.000	0.810	0.0	4.675	4.556
1.001	0.810	0.0	4.556	4.246
1.002	0.810	0.0	4.246	4.186
1.003	0.810	0.0	4.186	4.057
1.004	0.810	0.0	4.057	4.160
1.005	0.810	0.0	4.160	4.110
1.006	0.810	0.0	4.110	4.169
1.007	0.810	0.0	4.169	4.288
1.008	0.810	0.0	4.288	3.959
2.000	1.483	1.7	1.200	1.616
2.001	1.483	2.3	1.616	1.896
2.002	1.483	2.9	1.896	1.843
3.000	1.483	0.0	1.200	1.612
3.001	1.483	0.0	1.612	1.759
3.002	1.483	0.0	1.759	1.391
1.009	0.810	2.9	3.959	3.817
1.010	0.810	2.9	3.817	3.714
4.000	1.483	2.1	1.200	1.418
4.001	1.483	3.0	1.418	3.253
4.002	1.483	3.7	3.253	3.326
5.000	1.483	2.1	1.200	1.485
5.001	1.483	3.0	1.485	1.651
5.002	1.483	3.7	1.651	1.851
5.003	1.483	4.3	1.851	1.930

Links

Name	US Node	DS Node	Length (m)	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
4.003	FWMH 25	FWMH 26	14.621	58.949	58.852	0.097	150.0	225
4.004	FWMH 26	FWMH 27	5.114	58.852	58.818	0.034	150.0	225
4.005	FWMH 27	FWMH 28	8.590	58.818	58.661	0.157	54.7	225
1.011	FWMH 28	FWMH 29	43.740	58.661	58.442	0.219	200.0	225
1.012	FWMH 29	FWMH 30	4.468	58.442	58.420	0.022	200.0	225
1.013	FWMH 30	FWMH 31	23.446	58.420	58.303	0.117	200.0	225
1.014	FWMH 31	EXFW MH	14.683	58.303	58.230	0.073	200.0	225

Name	Vel (m/s)	Flow (l/s)	US Depth (m)	DS Depth (m)
4.003	0.936	6.0	3.326	3.423
4.004	0.936	6.4	3.423	3.277
4.005	1.553	6.4	3.277	3.714
1.011	0.810	7.0	3.714	3.533
1.012	0.810	7.0	3.533	3.555
1.013	0.810	7.0	3.555	4.172
1.014	0.810	7.1	4.172	4.345

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	8.197	200.0	225	64.900	60.000	4.675	64.740	59.959	4.556
1.001	43.951	200.0	225	64.740	59.959	4.556	64.210	59.739	4.246
1.002	18.010	200.0	225	64.210	59.739	4.246	64.060	59.649	4.186
1.003	28.189	200.0	225	64.060	59.649	4.186	63.790	59.508	4.057
1.004	38.535	200.0	225	63.790	59.508	4.057	63.700	59.315	4.160
1.005	31.942	200.0	225	63.700	59.315	4.160	63.490	59.155	4.110
1.006	9.706	200.0	225	63.490	59.155	4.110	63.500	59.106	4.169
1.007	15.831	200.0	225	63.500	59.106	4.169	63.540	59.027	4.288
1.008	42.109	200.0	225	63.540	59.027	4.288	63.000	58.816	3.959
2.000	28.533	60.0	225	63.720	62.295	1.200	63.660	61.819	1.616
2.001	42.588	60.0	225	63.660	61.819	1.616	63.230	61.109	1.896
2.002	10.601	60.0	225	63.230	61.109	1.896	63.000	60.932	1.843
3.000	24.746	60.0	225	63.500	62.075	1.200	63.500	61.663	1.612

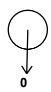
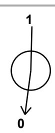
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	FWMH 01	1200	Manhole	Adoptable	FWMH 02	1200	Manhole	Adoptable
1.001	FWMH 02	1200	Manhole	Adoptable	FWMH 03	1200	Manhole	Adoptable
1.002	FWMH 03	1200	Manhole	Adoptable	FWMH 04	1200	Manhole	Adoptable
1.003	FWMH 04	1200	Manhole	Adoptable	FWMH 05	1200	Manhole	Adoptable
1.004	FWMH 05	1200	Manhole	Adoptable	FWMH 06	1200	Manhole	Adoptable
1.005	FWMH 06	1200	Manhole	Adoptable	FWMH 07	1200	Manhole	Adoptable
1.006	FWMH 07	1200	Manhole	Adoptable	FWMH 08	1200	Manhole	Adoptable
1.007	FWMH 08	1200	Manhole	Adoptable	FWMH 09	1200	Manhole	Adoptable
1.008	FWMH 09	1200	Manhole	Adoptable	FWMH 16	1200	Manhole	Adoptable
2.000	FWMH 10	1200	Manhole	Adoptable	FWMH 11	1200	Manhole	Adoptable
2.001	FWMH 11	1200	Manhole	Adoptable	FWMH 12	1200	Manhole	Adoptable
2.002	FWMH 12	1200	Manhole	Adoptable	FWMH 16	1200	Manhole	Adoptable
3.000	FWMH 13	1200	Manhole	Adoptable	FWMH 14	1200	Manhole	Adoptable

Pipeline Schedule

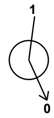
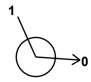
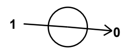
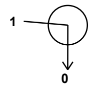
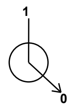
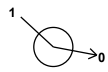
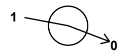
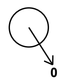
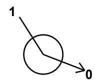
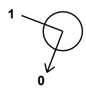
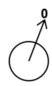
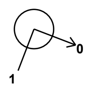
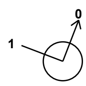
Link	Length (m)	Slope (1:X)	Dia (mm)	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
3.001	8.838	60.0	225	63.500	61.663	1.612	63.500	61.516	1.759
3.002	7.910	60.0	225	63.500	61.516	1.759	63.000	61.384	1.391
1.009	11.660	200.0	225	63.000	58.816	3.959	62.800	58.758	3.817
1.010	19.425	200.0	225	62.800	58.758	3.817	62.600	58.661	3.714
4.000	13.087	60.0	225	61.200	59.775	1.200	61.200	59.557	1.418
4.001	32.112	60.0	225	61.200	59.557	1.418	62.500	59.022	3.253
4.002	4.381	60.0	225	62.500	59.022	3.253	62.500	58.949	3.326
5.000	17.120	60.0	225	62.500	61.075	1.200	62.500	60.790	1.485
5.001	9.943	60.0	225	62.500	60.790	1.485	62.500	60.624	1.651
5.002	11.996	60.0	225	62.500	60.624	1.651	62.500	60.424	1.851
5.003	4.762	60.0	225	62.500	60.424	1.851	62.500	60.345	1.930
4.003	14.621	150.0	225	62.500	58.949	3.326	62.500	58.852	3.423
4.004	5.114	150.0	225	62.500	58.852	3.423	62.320	58.818	3.277
4.005	8.590	54.7	225	62.320	58.818	3.277	62.600	58.661	3.714
1.011	43.740	200.0	225	62.600	58.661	3.714	62.200	58.442	3.533
1.012	4.468	200.0	225	62.200	58.442	3.533	62.200	58.420	3.555
1.013	23.446	200.0	225	62.200	58.420	3.555	62.700	58.303	4.172
1.014	14.683	200.0	225	62.700	58.303	4.172	62.800	58.230	4.345

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
3.001	FWMH 14	1200	Manhole	Adoptable	FWMH 15	1200	Manhole	Adoptable
3.002	FWMH 15	1200	Manhole	Adoptable	FWMH 16	1200	Manhole	Adoptable
1.009	FWMH 16	1200	Manhole	Adoptable	FWMH 17	1200	Manhole	Adoptable
1.010	FWMH 17	1200	Manhole	Adoptable	FWMH 28	1200	Manhole	Adoptable
4.000	FWMH 18	1200	Manhole	Adoptable	FWMH 19	1200	Manhole	Adoptable
4.001	FWMH 19	1200	Manhole	Adoptable	FWMH 20	1200	Manhole	Adoptable
4.002	FWMH 20	1200	Manhole	Adoptable	FWMH 25	1200	Manhole	Adoptable
5.000	FWMH 21	1200	Manhole	Adoptable	FWMH 22	1200	Manhole	Adoptable
5.001	FWMH 22	1200	Manhole	Adoptable	FWMH 23	1200	Manhole	Adoptable
5.002	FWMH 23	1200	Manhole	Adoptable	FWMH 24	1200	Manhole	Adoptable
5.003	FWMH 24	1200	Manhole	Adoptable	FWMH 25	1200	Manhole	Adoptable
4.003	FWMH 25	1200	Manhole	Adoptable	FWMH 26	1200	Manhole	Adoptable
4.004	FWMH 26	1200	Manhole	Adoptable	FWMH 27	1200	Manhole	Adoptable
4.005	FWMH 27	1200	Manhole	Adoptable	FWMH 28	1200	Manhole	Adoptable
1.011	FWMH 28	1200	Manhole	Adoptable	FWMH 29	1200	Manhole	Adoptable
1.012	FWMH 29	1200	Manhole	Adoptable	FWMH 30	1200	Manhole	Adoptable
1.013	FWMH 30	1200	Manhole	Adoptable	FWMH 31	1200	Manhole	Adoptable
1.014	FWMH 31	1200	Manhole	Adoptable	EXFW MH	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
FWMH 01	715226.284	740369.800	64.900	4.900	1200		0	1.000	60.000	225
FWMH 02	715226.082	740361.605	64.740	4.781	1200		1	1.000	59.959	225
							0	1.001	59.959	225

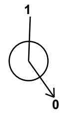
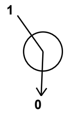
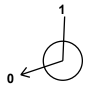
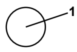
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
FWMH 03	715220.303	740318.036	64.210	4.471	1200		1	1.001	59.739	225
							0	1.002	59.739	225
FWMH 04	715227.671	740301.602	64.060	4.411	1200		1	1.002	59.649	225
							0	1.003	59.649	225
FWMH 05	715255.791	740299.636	63.790	4.282	1200		1	1.003	59.508	225
							0	1.004	59.508	225
FWMH 06	715294.186	740296.351	63.700	4.385	1200		1	1.004	59.315	225
							0	1.005	59.315	225
FWMH 07	715294.102	740264.409	63.490	4.335	1200		1	1.005	59.155	225
							0	1.006	59.155	225
FWMH 08	715301.237	740257.829	63.500	4.394	1200		1	1.006	59.106	225
							0	1.007	59.106	225
FWMH 09	715316.795	740254.901	63.540	4.513	1200		1	1.007	59.027	225
							0	1.008	59.027	225
FWMH 10	715304.755	740288.997	63.720	1.425	1200		0	2.000	62.295	225
FWMH 11	715320.145	740264.970	63.660	1.841	1200		1	2.000	61.819	225
							0	2.001	61.819	225
FWMH 12	715359.907	740249.716	63.230	2.121	1200		1	2.001	61.109	225
							0	2.002	61.109	225
FWMH 13	715336.161	740212.494	63.500	1.425	1200		0	3.000	62.075	225
FWMH 14	715345.025	740235.598	63.500	1.837	1200		1	3.000	61.663	225
							0	3.001	61.663	225
FWMH 15	715353.277	740232.433	63.500	1.984	1200		1	3.001	61.516	225
							0	3.002	61.516	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
FWMH 16	715356.110	740239.818	63.000	4.184	1200	1	3.002	61.384	225
						2	2.002	60.932	225
						3	1.008	58.816	225
						0	1.009	58.816	225
FWMH 17	715366.997	740235.644	62.800	4.042	1200	1	1.009	58.758	225
						0	1.010	58.758	225
FWMH 18	715410.590	740183.050	61.200	1.425	1200	0	4.000	59.775	225
FWMH 19	715397.514	740183.582	61.200	1.643	1200	1	4.000	59.557	225
						0	4.001	59.557	225
FWMH 20	715398.789	740215.669	62.500	3.478	1200	1	4.001	59.022	225
						0	4.002	59.022	225
FWMH 21	715412.842	740195.896	62.500	1.425	1200	0	5.000	61.075	225
FWMH 22	715413.538	740213.002	62.500	1.710	1200	1	5.000	60.790	225
						0	5.001	60.790	225
FWMH 23	715406.592	740220.117	62.500	1.876	1200	1	5.001	60.624	225
						0	5.002	60.624	225
FWMH 24	715394.606	740220.605	62.500	2.076	1200	1	5.002	60.424	225
						0	5.003	60.424	225
FWMH 25	715394.412	740215.847	62.500	3.551	1200	1	5.003	60.345	225
						2	4.002	58.949	225
						0	4.003	58.949	225
FWMH 26	715379.803	740216.442	62.500	3.648	1200	1	4.003	58.852	225
						0	4.004	58.852	225
FWMH 27	715374.786	740217.431	62.320	3.502	1200	1	4.004	58.818	225
						0	4.005	58.818	225
FWMH 28	715366.280	740216.232	62.600	3.939	1200	1	4.005	58.661	225
						2	1.010	58.661	225
						0	1.011	58.661	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
FWMH 29	715364.633	740172.523	62.200	3.758	1200		1	1.011	58.442	225
							0	1.012	58.442	225
FWMH 30	715367.232	740168.889	62.200	3.780	1200		1	1.012	58.420	225
							0	1.013	58.420	225
FWMH 31	715366.266	740145.463	62.700	4.397	1200		1	1.013	58.303	225
							0	1.014	58.303	225
EXFW MH	715352.341	740140.807	62.800	4.570	1200		1	1.014	58.230	225

Design Settings

Frequency of use (kDU)	0.50	Minimum Velocity (m/s)	0.75
Flow per dwelling per day (l/day)	446	Connection Type	Level Inverts
Domestic Flow (l/s/ha)	0.0	Minimum Backdrop Height (m)	0.500
Industrial Flow (l/s/ha)	0.0	Preferred Cover Depth (m)	1.200
Additional Flow (%)	0	Include Intermediate Ground	✓

Nodes

Name	Units	Cover Level (m)	Diameter (mm)	Depth (m)
FWMH 32	13.0	65.440	1200	1.525
FWMH 33	13.0	64.840	1200	1.454
FWMH 34	13.0	64.200	1200	1.549
FWMH 35	13.0	64.000	1200	1.656
EXFW MH		63.940	1200	1.692

Links

Name	US Node	DS Node	Length (m)	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
1.000	FWMH 32	FWMH 33	31.712	63.915	63.386	0.529	60.0	225
1.001	FWMH 33	FWMH 34	44.081	63.386	62.651	0.735	60.0	225
1.002	FWMH 34	FWMH 35	18.429	62.651	62.344	0.307	60.0	225
1.003	FWMH 35	EXFW MH	5.745	62.344	62.248	0.096	60.0	225

Name	Vel (m/s)	Flow (l/s)	US Depth (m)	DS Depth (m)
1.000	1.483	1.8	1.300	1.229
1.001	1.483	2.5	1.229	1.324
1.002	1.483	3.1	1.324	1.431
1.003	1.483	3.6	1.431	1.467

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	31.712	60.0	225	65.440	63.915	1.300	64.840	63.386	1.229
1.001	44.081	60.0	225	64.840	63.386	1.229	64.200	62.651	1.324
1.002	18.429	60.0	225	64.200	62.651	1.324	64.000	62.344	1.431
1.003	5.745	60.0	225	64.000	62.344	1.431	63.940	62.248	1.467

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	FWMH 32	1200	Manhole	Adoptable	FWMH 33	1200	Manhole	Adoptable
1.001	FWMH 33	1200	Manhole	Adoptable	FWMH 34	1200	Manhole	Adoptable
1.002	FWMH 34	1200	Manhole	Adoptable	FWMH 35	1200	Manhole	Adoptable
1.003	FWMH 35	1200	Manhole	Adoptable	EXFW MH	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
FWMH 32	715230.678	740393.949	65.440	1.525	1200	0	1.000	63.915	225
FWMH 33	715229.833	740362.248	64.840	1.454	1200	1	1.000	63.386	225
						0	1.001	63.386	225
FWMH 34	715223.836	740318.577	64.200	1.549	1200	1	1.001	62.651	225
						0	1.002	62.651	225
FWMH 35	715222.643	740300.187	64.000	1.656	1200	1	1.002	62.344	225
						0	1.003	62.344	225
EXFW MH	715228.375	740299.794	63.940	1.692	1200	1	1.003	62.248	225

Design Settings

Frequency of use (kDU)	0.50	Minimum Velocity (m/s)	0.75
Flow per dwelling per day (l/day)	446	Connection Type	Level Inverts
Domestic Flow (l/s/ha)	0.0	Minimum Backdrop Height (m)	0.500
Industrial Flow (l/s/ha)	0.0	Preferred Cover Depth (m)	1.200
Additional Flow (%)	10	Include Intermediate Ground	✓

Nodes

Name	Units	Cover Level (m)	Diameter (mm)	Depth (m)
FWMH 36	10.0	65.760	1200	2.425
FWMH 37	10.0	65.000	1200	2.232
FWMH 38	10.0	64.020	1200	1.225
FWMH 39	10.0	63.720	1200	1.900
FWMH 40	10.0	63.830	1200	2.069
EXFW MH		63.850	1200	2.170

Links

Name	US Node	DS Node	Length (m)	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
1.000	FWMH 36	FWMH 37	34.034	63.335	62.768	0.567	60.0	225
1.001	FWMH 37	FWMH 40	66.245	62.768	61.761	1.007	65.8	225
2.000	FWMH 38	FWMH 39	58.496	62.795	61.820	0.975	60.0	225
2.001	FWMH 39	FWMH 40	8.837	61.820	61.761	0.059	150.0	225
1.002	FWMH 40	EXFW MH	12.143	61.761	61.680	0.081	150.0	225

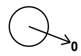
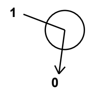
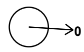
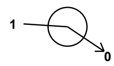
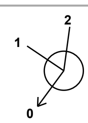
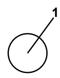
Name	Vel (m/s)	Flow (l/s)	US Depth (m)	DS Depth (m)
1.000	1.483	1.7	2.200	2.007
1.001	1.416	2.5	2.007	1.844
2.000	1.483	1.7	1.000	1.675
2.001	0.936	2.5	1.675	1.844
1.002	0.936	3.9	1.844	1.945

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	34.034	60.0	225	65.760	63.335	2.200	65.000	62.768	2.007
1.001	66.245	65.8	225	65.000	62.768	2.007	63.830	61.761	1.844
2.000	58.496	60.0	225	64.020	62.795	1.000	63.720	61.820	1.675
2.001	8.837	150.0	225	63.720	61.820	1.675	63.830	61.761	1.844
1.002	12.143	150.0	225	63.830	61.761	1.844	63.850	61.680	1.945

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	FWMH 36	1200	Manhole	Adoptable	FWMH 37	1200	Manhole	Adoptable
1.001	FWMH 37	1200	Manhole	Adoptable	FWMH 40	1200	Manhole	Adoptable
2.000	FWMH 38	1200	Manhole	Adoptable	FWMH 39	1200	Manhole	Adoptable
2.001	FWMH 39	1200	Manhole	Adoptable	FWMH 40	1200	Manhole	Adoptable
1.002	FWMH 40	1200	Manhole	Adoptable	EXFW MH	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
FWMH 36	715275.105	740383.127	65.760	2.425	1200		0	1.000	63.335	225
FWMH 37	715306.913	740371.021	65.000	2.232	1200		1	1.000	62.768	225
							0	1.001	62.768	225
FWMH 38	715232.362	740314.115	64.020	1.225	1200		0	2.000	62.795	225
FWMH 39	715290.733	740310.299	63.720	1.900	1200		1	2.000	61.820	225
							0	2.001	61.820	225
FWMH 40	715298.067	740305.369	63.830	2.069	1200		1	2.001	61.761	225
							2	1.001	61.761	225
							0	1.002	61.761	225
EXFW MH	715290.870	740295.589	63.850	2.170	1200		1	1.002	61.680	225

Design Settings

Frequency of use (kDU)	0.50	Minimum Velocity (m/s)	0.75
Flow per dwelling per day (l/day)	446	Connection Type	Level Inverts
Domestic Flow (l/s/ha)	0.0	Minimum Backdrop Height (m)	0.500
Industrial Flow (l/s/ha)	0.0	Preferred Cover Depth (m)	1.200
Additional Flow (%)	10	Include Intermediate Ground	✓

Nodes

Name	Units	Cover Level (m)	Diameter (mm)	Depth (m)
FWMH 41	2.5	63.240	1200	1.425
FWMH 42	2.5	63.060	1200	1.752
EXFW MH		63.130	1200	1.894

Links

Name	US Node	DS Node	Length (m)	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
1.000	FWMH 41	FWMH 42	30.416	61.815	61.308	0.507	60.0	225
1.001	FWMH 42	EXFW MH	4.336	61.308	61.236	0.072	60.0	225

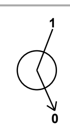
Name	Vel (m/s)	Flow (l/s)	US Depth (m)	DS Depth (m)
1.000	1.483	0.9	1.200	1.527
1.001	1.483	1.2	1.527	1.669

Pipeline Schedule

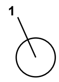
Link	Length (m)	Slope (1:X)	Dia (mm)	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	30.416	60.0	225	63.240	61.815	1.200	63.060	61.308	1.527
1.001	4.336	60.0	225	63.060	61.308	1.527	63.130	61.236	1.669

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	FWMH 41	1200	Manhole	Adoptable	FWMH 42	1200	Manhole	Adoptable
1.001	FWMH 42	1200	Manhole	Adoptable	EXFW MH	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
FWMH 41	715332.362	740195.338	63.240	1.425	1200		0	1.000	61.815	225
FWMH 42	715321.467	740166.940	63.060	1.752	1200		1	1.000	61.308	225
							0	1.001	61.308	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
EXFW MH	715323.228	740162.978	63.130	1.894	1200	 1	1.001	61.236	225

APPENDIX E – MAINTENANCE AND MANAGEMENT PLAN

SuDS Component	Maintenance Responsibility	Maintenance Schedule	Required Action	Typical Frequency
Permeable Paving	PPP management company for 25 years then Dublin City Council for public realm areas	Regular Maintenance	Brushing (Standard cosmetic sweep over whole surface)	Once a year or reduced frequency as required
		Occasional Maintenance	Removal of weeds or management using glyphosate or other suitable weed killer.	As required – once a year on less frequently used pavements
		Remedial Action	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing materials.	As required
			Remediate any landscaping which has been raised within the level of the paving.	As required
			Rehabilitation of surface and upper sub-structure by remedial sweeping.	Every 10 to 15 years or as required (if performance is reduced due to significant flooding)
		Monitoring	Initial Inspection	Monthly for three months after installation
			Inspect for evidence of poor operation and/ or weed growth – if required, take remedial action,	Every 3 months, 48 hours after large storms in first six months
			Inspect slit accumulation rates and establish appropriate brushing frequencies.	Annually
			Monitor inspection chambers	Annually

Maintenance and Management Plan			
Project	NDFA Social Housing Bundles 4 & 5	Analysed by	Kezia Adanza
Job no.	23006	Date	September 2023

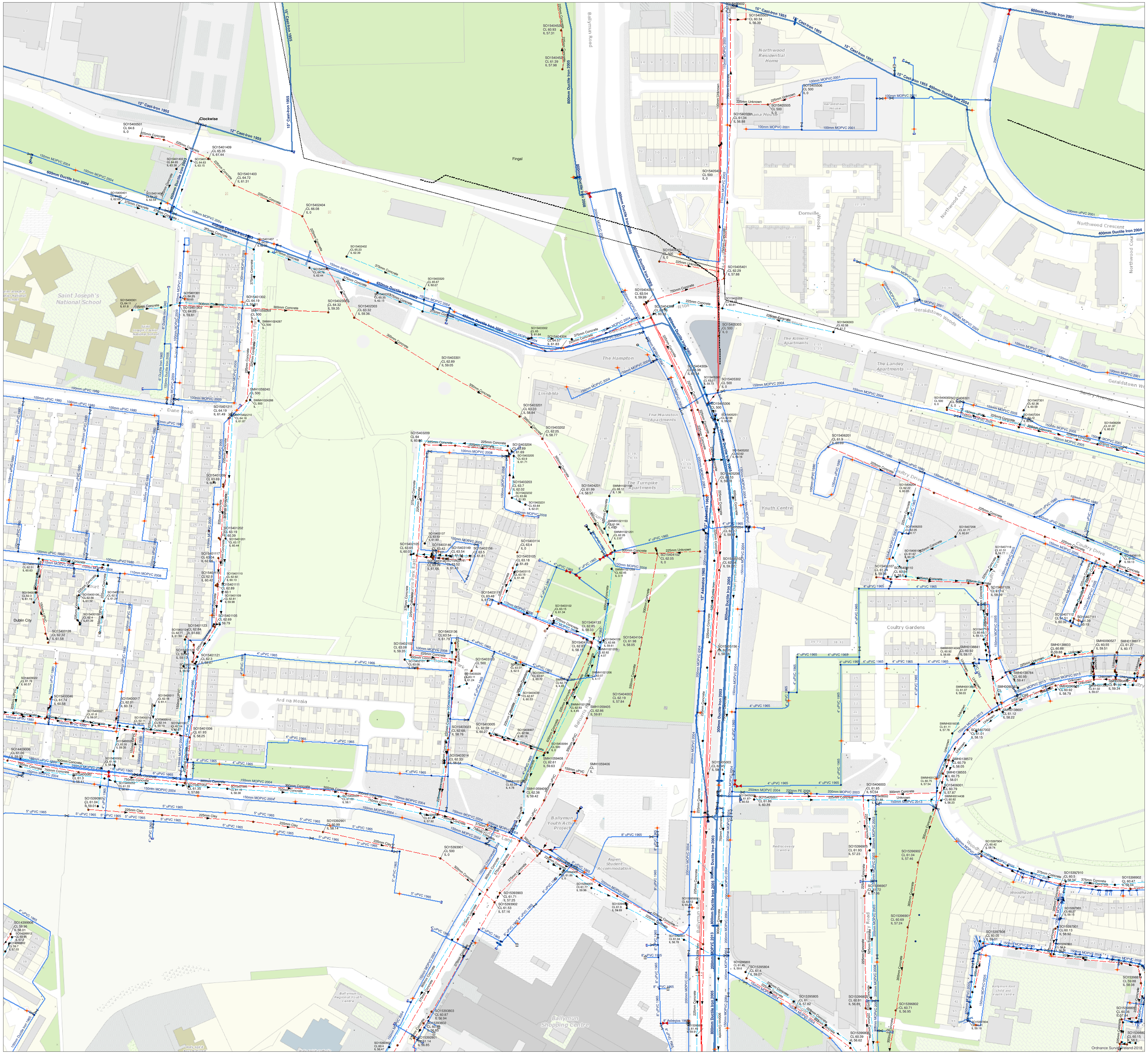
SuDS Component	Maintenance Responsibility	Maintenance Schedule	Required Action	Typical Frequency
Bioretention Areas - Swales / tree pits / Rain Gardens	PPP management company for 25 years then Dublin City Council	Regular Inspections	Inspect infiltration surfaces for silting and ponding, record de-watering time of the facility and assess standing water levels in underdrain to determine if maintenance is necessary.	Quarterly
			Check operation of underdrains by inspection of flows after rain.	Annually
			Assess plants for disease infection, poor growth, invasive species etc. and replace as necessary.	Quarterly
			Inspect inlets and outlets for blockage.	Quarterly
		Regular Maintenance	Remove litter, surface debris and weeds.	Quarterly (or more frequently for tidiness or aesthetic reasons)
			Replace any plants to maintain plant density.	Quarterly to bi-annually
			Remove sediment, litter and debris build-up from around inlets.	As required
		Occasional Maintenance	Infill any holes or scour in the filter medium, improve erosion protection if required.	As required
			Repair minor accumulations of silt by raking away surface mulch, scarifying surface of medium and replacing mulch.	As required
		Remedial Actions	Remove and replace filter medium and vegetation.	As required but likely to be > 20 years

Maintenance and Management Plan

Project	NDFA Social Housing Bundles 4 & 5	Analysed by	Kezia Adanza
Job no.	23006	Date	September 2023

SuDS Component	Maintenance Responsibility	Maintenance Schedule	Required Action	Typical Frequency
Attenuation Storage	PPP management company for 25 years then Dublin City Council	Regular Inspections	Inspect infiltration surfaces for silting, record de-watering time of the facility and assess standing water levels in underdrain to determine if maintenance is necessary.	Quarterly
			Check operation of underdrains by inspection of flows after rain.	Annually
			Inspect inlets and outlets for blockage.	Quarterly
		Regular Maintenance	Remove sediment, litter and debris build-up from around inlets.	As required

APPENDIX F – EXTRACT FROM IRISH WATERMAP – WATERMAIN AND FOUL



Water Distribution Network

- Water Treatment Plant
- Water Pump Station
- Storage Cell/Tower
- Dosing Point
- Meter Station
- Abstraction Point
- Telemetry Kiosk

Reservoir

- Potable
- Raw Water

Water Distribution Mains

- Irish Water
- Private

Trunk Water Mains

- Irish Water
- Private

Water Lateral Lines

- Irish Water
- Non IW
- Water Casings
- Water Abandoned Lines
- Boundary Meter
- Bulk/Check Meter
- Group Scheme
- Source Meter
- Waste Meter
- Unknown Meter ; Other Meter
- Non-Return
- PRV
- PSV
- Sluice Line Valve Open/Closed
- Butterfly Line Valve Open/Closed
- Sluice Boundary Valve Open/Closed
- Butterfly Boundary Valve Open/Closed
- Scour Valves
- Single Air Control Valve
- Double Air Control Valve
- Water Stop Valves
- Water Service Connections
- Water Distribution Chambers
- Water Network Junctions
- Pressure Monitoring Point
- FH Hydrant (FH, WO)

Water Fittings

- Cap
- Other Fitting

Sewer Foul Combined Network

- Waste Water Treatment Plant
- Waste Water Pump station

Sewer Mains Irish Water

- Gravity - Combined
- Gravity - Foul
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Overflow

Sewer Mains Private

- Gravity - Combined
- Gravity - Foul
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Overflow
- Sewer Lateral Lines
- Sewer Casings

Sewer Manholes

- Standard
- Backdrop
- Cascade
- Catchpit
- Bifurcation
- Hatchbox
- Lamphole
- Hydrobrake
- Other; Unknown

Discharge Type

- Outfall
- Overflow
- Soakaway
- Standard Outlet
- Other; Unknown

Cleanout Type

- Rodding Eye
- Flushing Structure
- Other; Unknown

Sewer Inlets

- Catchpit
- Gully
- Standard
- Other; Unknown

Sewer Fittings

- Vent/Col
- Other; Unknown

Storm Water Network

Surface Water Mains

- Surface Gravity Mains
- Surface Gravity Mains Private
- Surface Water Pressurised Mains
- Surface Water Pressurised Mains Private

Inlet Type

- Gully
- Standard
- Other; Unknown

Storm Manholes

- Standard
- Backdrop
- Cascade
- Catchpit
- Bifurcation
- Hatchbox
- Lamphole
- Hydrobrake
- Other; Unknown
- Storm Culverts
- Storm Clean Outs
- Stormwater Chambers

Discharge Type

- Outfall
- Overflow
- Soakaway
- Other; Unknown

Gas Networks Ireland

- Transmission High Pressure Gasline
- Distribution Medium Pressure Gasline
- Distribution Low Pressure Gasline

ESB Networks

ESB HV Lines

- HV Underground
- HV Overhead
- HV Abandoned

ESB MVLV Lines

- MV Overhead Three Phase
- MV Overhead Single Phase
- LV Overhead Three Phase
- LV Overhead Single Phase
- MVLV Underground
- Abandoned

Non Service Categories

- Proposed
- Under Construction
- Out of Service
- Decommissioned

Water Non Service Assets

- Water Point Feature
- Water Pipe
- Water Structure

Waste Non Service Assets

- Waste Point Feature
- Sewer
- Waste Structure

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