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ENGINEERING SERVICES REPORT

SANDYFORD CENTRAL RESIDENTIAL DEVELOPMENT,
SANDYFORD, DUBLIN 18

Sandyford GP Limited

Project No. R478

18th November 2019

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P01	S3	J. Burke	P. Raggett	M. McGrath	17.06.2019

Contents

1.0 INTRODUCTION

1.1 APPOINTMENT

O'Connor Sutton Cronin (OCSC) has been instructed to prepare an Engineering Services Report for the proposed development at Sandyford Central, at the former Aldi site, Carmanhall Road, Sandyford Business District, Dublin 18.

1.2 DEVELOPMENT DESCRIPTION

The development, which will have a Gross Floor Area of 49,342 sq m, will principally consist of:

The demolition of the existing structures on site and the provision of a Build-to-Rent residential development comprising 564 No. apartments (46 No. studio apartments, 205 No. one bed apartments, 295 No. two bed apartments and 18 No. three bed apartments) in 6 No. blocks as follows: Block A (144 No. apartments) is part 10 to part 11 No. storeys over basement; Block B (68 No. apartments) is 8 No. storeys over basement; Block C (33 No. apartments) is 5 No. storeys over lower ground; Block D (103 No. apartments) is part 16 to part 17 No. storeys over lower ground; Block E (48 No. apartments) is 10 No. storeys over semi-basement; and Block F (168 No. apartments) is 14 No. storeys over semi basement.

The development provides resident amenity spaces (1,095 sq m) in Blocks A, C and D including concierge, gymnasium, lounges, games room and a panoramic function room at Roof Level of Block D; a creche (354 sq m); café (141 sq m); a pedestrian thoroughfare from Carmanhall Road to Blackthorn Drive also connecting into the boulevard at Rockbrook to the west; principal vehicular access off Carmanhall Road with servicing and bicycle access also provided off Blackthorn Drive; 285 No. car parking spaces (254 No. at basement level and 31 No. at ground level); 21 No. motorcycle spaces; set-down areas; bicycle parking; bin storage; boundary treatments; hard and soft landscaping; lighting; plant; ESB substations and switchrooms; sedum roofs; and all other associated site works above and below ground.

1.3 ADMINISTRATIVE JURISDICTION

The site is located within the administrative jurisdiction of Dún Laoghaire-Rathdown Council, whose offices are located at Dún Laoghaire-Rathdown County Council (DLRCC), County Hall, Marine Road, Dún Laoghaire, Co. Dublin.

1.4 SITE LOCATION

The site is situated within the Sandyford Industrial Estate, which is in jurisdiction of Dún Laoghaire Rathdown County Council (DLRCC). The site's locality is typically a relatively flat coastal area, with a rise of 160mAOD at the Sandyford Industrial Estate approximately 5.0km from the Sea. The administrate area is a highly urbanised area. The exact site location is highlighted in **Figure 1** following.

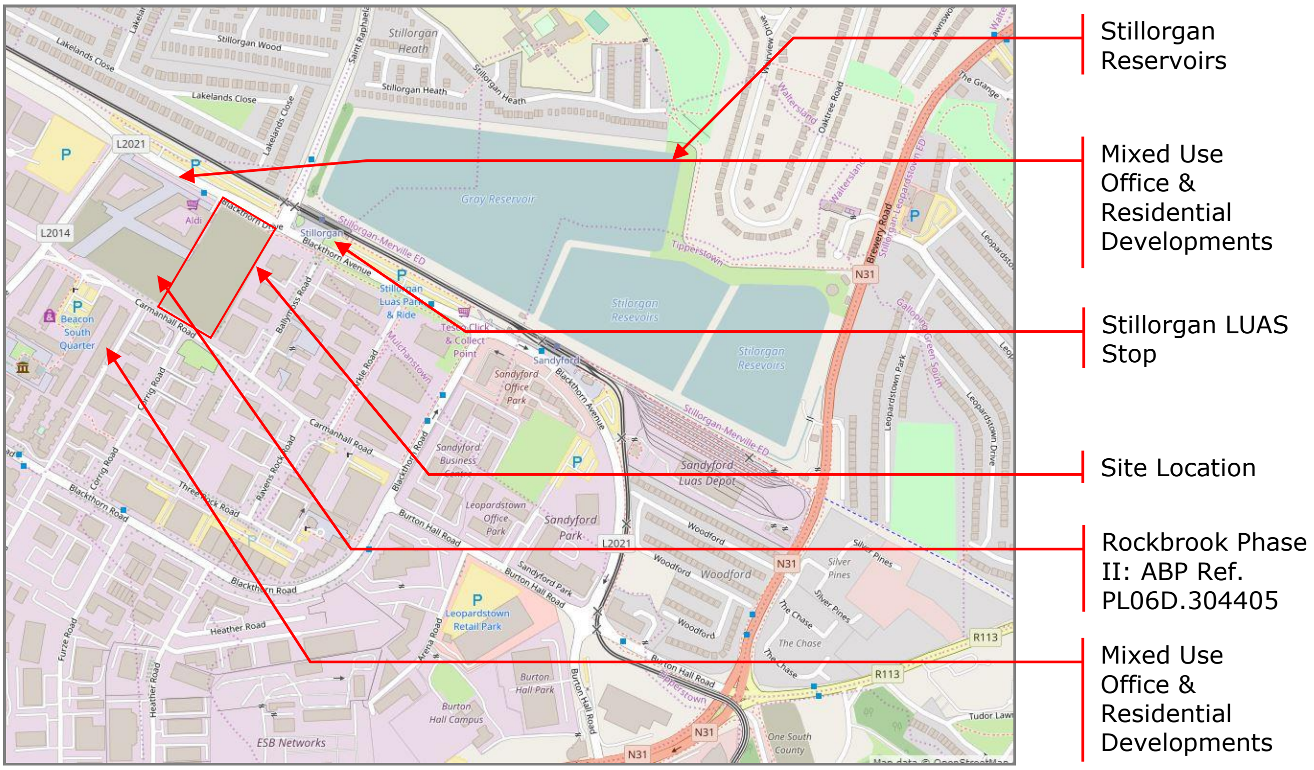

Figure 1 - Site Location Map (Source: Bing Maps)

As shown on Figure 1, the site's immediate surrounding area is mixed use in nature. The site is located south of the junction of Saint Raphaela's Road and Blackthorn Drive in Sandyford, Dublin 18.

1.5 SITE OVERVIEW

The existing site is a brownfield site, with almost 100% hardstanding. The total site is approximately 1.54 hectares (3.80 acres) and is currently an open yard in the northern and central section, with an industrial / commercial building located in the southern section.

The site topography sees the existing ground levels rise from north to south resulting in a shallow fall in levels from Carmanhall Road to Blackthorn Drive of approximately 4.0m. A detailed topographical survey has been carried out for the site and has informed the design. The site topography is generally level with an existing concrete slab from a previous warehouse building at a level of approx. 81.3m.

The site is bounded to the west by an existing apartment block (Rockbrook, Phase 1) and remaining vacant parcel of land, which has recently been granted planning permission, for Rockbrook Phase II (ABP Ref. PL06D.304405) for a residential development with ancillary retail, crèche and residential amenity elements. It is bound to the north by Blackthorn Drive, with the Luas Green Line, Stillorgan Reservoir and residential properties beyond. It is bound to the east by commercial developments zoned for "mixed use inner core" and to the southwest by Carmanhall Road.

2.0 SCOPE OF SERVICES REPORT

This report was prepared by reviewing available data from Local Authority records and national bodies, i.e. Dún Laoghaire-Rathdown County Council (DLRCC) and the wider Design Team.

The report addresses;

- Storm Water Drainage;
- Foul Water Drainage;
- Potable Water Supply;
- Road Network / Layout;

All design and calculations will be in accordance with;

- Local Authority Requirements;
- DLRCoCo Development Plan 2016 – 2022;
- BS EN 752 – Drainage Outside Buildings;
- The Building Regulations – Technical Guidance Document Part 'H';
- The Building Regulations – Technical Guidance Document Part 'M';
- Recommendations for Site Development works for housing Areas, Dept. of Environment, 1998;
- Design Manual for Urban Roads and Streets (DMURS);
- Traffic Signs Manual;
- DETR Guidance on the use of Tactile Paving Surfaces;
- Greater Dublin Strategic Drainage Study (GDSDS);
- BS EN 12056-2:2000 Gravity drainage systems inside buildings;
- The SuDS Manual (CIRIA C753);
- Irish Water Code of Practice for Water Infrastructure;
- Irish Water Code of Practice for Wastewater Infrastructure;

Other aspects of the site development strategy relating to architectural design, landscaping, ecology, conservation, visual quality and planning compliance are covered by other members of the design team.

3.0 STORM WATER DRAINAGE

3.1 PROPOSED STORM WATER DRAINAGE OVERVIEW

Any planning permission sought on the subject lands will be required to adhere to the Local Authority requirements and the Greater Dublin Strategic Drainage Study (Dublin City Council, 2005). The proposed development is to have a hardstanding area of 0.74 ha, which is to be drained to the proposed new surface water system, serving the proposed development prior to discharging an attenuated flow to Blackthorn Drive as per OCSC Drawing No. SFC-OCSC-00-00-DR-C-0500.

All proposed developments must ensure that a comprehensive sustainable urban drainage system (SUDS) is incorporated into the development. SuDS requires that post development run-off rates be maintained at the equivalent to, or lower than, the pre-development run-off levels. Thus, the development must be able to retain, within its boundaries, storm water volumes from extreme storm events up to and including a design for a 1 in 100 year storm event, more commonly expressed as a 1.0% AEP (Annual Exceedance Probability), while also allowing for climate change factors (+CC).

Any new development must have physical capacity to retain storm water volumes as directed under the Greater Dublin Strategic Drainage Study and, if necessary, release this attenuated surface water runoff before it enters a natural watercourse or into a public sewer, which ultimately discharges to a water body. This is to ensure the highest possible standard of storm water quality.

The overall approach to storm drainage design taken by OCSC is as outlined in further detail throughout this chapter. OCSC have used the recognised MicroDrainage (by Innovyze) design software to produce a detailed design model of the development's catchments and network, from the ground / roof areas, to the outfall from the site; with the design rainfall events simulated, to determine the required storage volumes. The GDSDS recommends use of a detailed hydraulic model to demonstrate that the performance criteria (as established in GDSDS) are achieved, as set out in Section 6.6 (Attenuation Storage Design) of the GDSDS. The methodology used for finding the storm water attenuation volume, in order to reduce development runoff to the greenfield equivalent is as follows:

- Find the greenfield peak runoff rate for the site;
- Apply this restricted flow rate as a throttle to the development's model's outfall and analyse it for a range of rainfall duration events for design

return periods outlined within the GDSDS design criteria. As standard procedure, OCSC request the current rainfall data from Met Eireann for each specific site. Met Eireann provide a Rainfall Return Period table (Refer Appendix B), which is used to derive the M5-60 and Ratio R for each specific site and this is input into MicroDrainage Design software.

It is also noted that Flood Studies Report (FSR) and Flood Studies Update (FSU) have the same rainfall Hyetographs for Ireland.

OCSC confirm that the most current available rainfall data is sourced and applied in the simulation of design storm events and in the hydraulic modelling process of our storm water network design.

3.2 SITE CATCHMENTS

The proposed development has an overall site area of approximately 1.54ha, with the sub-catchment types outlined in Table 1, below.

Ref.	Sub Catchment Type	Area (ha)
A	Green Roofs	0.363
B	Other Roof	0.130
B	Podium	0.635
C	Eastern Boundary (Raingarden / shallow depression storage & swales)	0.227
D	North Boundary	0.080
E	South Boundary	0.105
	Total	**1.540**

Table 1 – *Summary of Proposed Surface Water Catchments*

The development's surface water drainage network contains a number of sub-catchments, as categorised in Table 1. These catchment areas are illustrated on drawing SFC-OCSC-00-00-DR-C-0508, whereby along with drawing SFC-OCSC-00-00-DR-C-0500, it can be seen how each catchment is integrated as part of the overall surface water network.

All hardstanding contributing areas (i.e. paved podium and flat roof) are applied directly to the surface water network at the appropriate time of concentration. The remaining areas (i.e. green roofs and soft landscaping) are applied using a Time Area Diagram, to best represent the natural behaviour of the rainfall runoff behaviour for these catchment types.

3.3 SITE LIMITED DISCHARGE

The development's surface water network has been designed in order to restrict the development's discharge rate to the greenfield equivalent i.e. Q_{BAR}. The allowable discharge rate calculation, Q_{BAR}, is included in ***Appendix B***, as derived using the online HR Wallingford design tool at www.uksuds.com.

Q_{BAR} has been calculated at a flow rate of ***8.1 l/s*** for the proposed development, when using the design tools default values, which is less than the ***9.3 l/s*** that is calculated when using the site-specific information. However, the more conservative value of 8.1 l/s was used for the proposed design's maximum site discharge rate. A summary of the applied design criteria for the calculation of Q_{BAR} is shown in Table 2.

Design Criteria	Input Value
Imp. Area (ha)	1.54
SOIL Type	4
SPR	0.47
SAAR (mm)	868
Growth Factor: 1 Yr	0.85
Growth Factor: 10 Yr	1.70
Growth Factor: 30 Yr	2.10
Growth Factor: 100 Yr	2.60

Table 2 - *Extract of input figures from HRWallingford UKSuds Tool*.

Q_{BAR} has been calculated based on the site area of 1.54ha to be positively drained, standard annual average rainfall (SAAR) value of 868mm and a SOIL Type 4. The proposed SAAR value is as per Met Eireann SAAR Mapping Values for the site coordinates.

While, the overall site discharge is restricted to the greenfield runoff at the outfall, there are a number of sub-catchments within the development, including the green roofs, bio retention / raingardens and cellular / OGCR storage that form part of an integrated drainage network. Each of these sub-catchments provide interim flow controls and attenuation, which results in less end of line attenuation to be provided i.e. no underground tank. The integrated surface water drainage network, complete with flow controls and storage has been simulated for all design rainfall events, up to and including the 1% AEP event + 10% allowance for climate change, using the MicroDrainage Network design software by Innovyze Inc.

All flow controls within the upstream sub-catchments have been designed with overflow features, above the storage structure design level for 1% AEP Storm Event. Sub-catchment flow controls comprise a relatively small orifice, in order to throttle the flow sufficiently and fully utilise the available depth of storage in the associated SuDS component.

Sustainable Drainage Systems, such as pervious pavements are considered sealed systems due to the very limited risk of large solids passing through, and can be designed with orifice sizes smaller than 75mm as per GDSDS guidance (pg. 82 Section 6.8.2.3 Throttle Sizes and Discharge Rate).

A maintenance regime for all SuDS will be included for all flow control devices for inclusion in the Safety File / End user file on completion of construction. A preliminary Maintenance Regime procedure is provided in **Appendix B**. Access arrangements for roof maintenance is shown on the architect's design drawings, referenced Drg. No. SFC-HJL-BA-ZZ-M3-A-0001-Block A.

It is noted that a number of preventative measures against potential blockage of the smaller orifices proposed for have been incorporated into the design including;

- Leaf grates on all roof outlets;
- Downpipe discharge chambers with leaf filters;
- Distribution boxes wrapped in geotextiles for all inlet & outlets of OGCR sub-base;
- Protected orifices on all flow controls;
- Overflows to all flow controls (Hydrobrake site control will not have an overflow);
- Manhole sumps downstream of raingarden / shallow depression storage areas;
- Sealed Permeable Paving system;
- Regular Maintenance Regime.

3.4 ATTENUATION STORAGE PROVISION

Overall site storage requirements have been estimated using the Wallingford IH124 Method attached in ***Appendix B***. The UKSuds Surface Water Storage Volume estimation tool was initially used as a baseline for preliminary storage estimates. The Greenfield Run-off Rate has been calculated to IH124 in accordance with GDSDS, using the Source Control tool within MicroDrainage, and the discharge rate is then input into the UKSuDs Storage Estimation Tool.

An integrated drainage network model was developed to verify storage requirements for the site using MicroDrainage provided by Innovyze. The aforementioned estimation tool was used to gauge the initial storage size for the model and adjustments are made to meet the requirements of the GDSDS. The HR Wallingford UKSuds Storage Report in ***Appendix B*** has been produced using the surface water storage volume estimation tool provided by www.uksuds.com. Please see below a summary of the required and proposed volumes.

Storage	**Required** (m^3)	**Provided** (m^3)
Interception (Green Roofs & Bio-retention / planters, permeable paving)	62	78
Attenuation (Cellular storage - permavoid 150, OGCR Sub base & filter drains)	752	1,299
Treatment (Green Roofs, Bio-Retention, OGCR Sub Base & Filter Drains)	185	443.5
Total (**Excluding** Interception & Treatment)	752	1,299

Table 3 – *Summary of Storage requirements from HRWallingford UKSuds Storage Report and of provided storage volumes.*

The location of the various sub-catchments, and the elements of interception, storage, conveyance and flow control for each are shown on OCSC Drawings No. SFC-OCSC-XX-XX-DR-C-0500 & SFC-OCSC-XX-XX-DR-C-0508, along with details of the proposed design network.

3.5 INTERCEPTION

Interception storage is provided through the provision of green roofs, permeable paving, raingardens / shallow landscaped depression storages and filter drains.
The estimated 5mm interception storage for each SuDs component catchment has been provided in table 4 and has been calculated in accordance with GDSDS and CIRIA C673. The losses for raingarden / shallow landscaped depression storages, permeable paving, filter drains which discharge to ground and have been calculated using the following example formula;

Total estimated site losses:

Vol. = **RD x A x 10 x (0.8 x PIMP/100 – SPR)**

= 102.65 x 0.132ha x 10 x (0.8 x 80/100 – 0.47)

= $23m^3$

Where:

RD - Critical Storm 16 hour rainfall depth for 1% AEP = 102.65mm (Interpolated from Met Eireann Site Weather Data in ***Appendix B***)

A – Sub Catchment area in hectares = 0.132ha

PIMP - Percentage Impermeable = 80% Average across site surfaces

SPR - Soil percentage runoff = Type 4 (0.47)

Evapotranspiration Losses (without any infiltration capacity) for Green Roofs, raingarden / shallow depression storages are assumed to be 1mm/day (Average Winter Rate derived from the potential Evapotranspiration Data from Met Éireann) i.e. most conservative value.

It is noted that only the treatment storage volumes are included in the Micro Drainage Model simulation i.e. Infiltration and evapotranspiration is not included, as these have been assumed as zero, for the purpose of a conservative design. The interception losses noted are as estimated using CIRIA guidelines.

SuDS Structure	Area (m^2)	Treatment Vol. (m^3)	Evap-trans. Losses (m^3)	Infiltration Losses (m^3)	Total Losses (m^3)
200mmDp Green Roof	3,629	211.2	3.52	0.0	3.52
150mmDp Bio Retention / Planters on podium	2,780	125.1	2.78	0.0	2.78
300mmDp Permeable Paving off podium (OGCR) @ 30%	510	46.0	0.0	8.90	8.90
50mmDp Raingarden/shallow depression storages & Swale	710	35.5	0.71	12.39	13.10
Filter Drains (600x600mmDp)	102	18.0	0.0	1.78	1.78
Total	**7,731**	**435.8**	**7.01**	**23.07**	**30.08**

Table 4 – *Summary of Treatment / Attenuation storage provided) and estimated Interception storage by calculation.*

3.6 SITE SOIL CHARACTERISTICS

The SOIL type has been classified as Soil Type 4 by a Geotechnical Engineer for Ground Investigations Ireland Ltd. based on site investigation data together with

Table 4.5 (The classification of soils from Winter Rainfall Acceptance Rate) of the Flood Studies Report (FSR) as shown in the extract in ***Figure 2***.

Table 4.5 The classification of soils by winter rain acceptance rate from soil survey data

Drainage Class	Depth to impermeable layer (cm)	Slope Classes 0 - 2°			2 - 8°			> 8°		
		Permeability rates above impermeable layers								
		Rapid (1)	Medium (2)	Slow (3)	Rapid (1)	Medium (2)	Slow (3)	Rapid (1)	Medium (2)	Slow (3)
	> 80	1			1			1	2	3
	40 - 80					2		3		4
1	< 40	—	—	—	—	—	—	—	—	—
	> 80	2						—		
	40 - 80			3			4			
2	< 40	3								
	> 80							—		
	40 - 80				5			—		
3	< 40									

winter rain acceptance indices:

1 - Very high
2 - High
3 - Moderate
4 - Low
Upland peat and peaty soils are in Class 5,
Urban areas are unclassified

Figure 2 –*Extract of Table 4.5 (The classification of soils from Winter Rainfall Acceptance Rate) of the Flood Studies Report (FSR)*

A copy of the Site Investigation report, as carried out by Ground Investigations Ireland Ltd, is provided in ***Appendix A*** of this report, with confirmation of the Soil Type outlined on pg. 12 of the Site Investigation Report (10th April 2019). The classification of the soils by winter rain acceptance rate from soil survey data is also included in ***Appendix B***. Please see an extract of the SOIL type confirmation from Section 5.4 of the Site Investigation Report below in ***Figure 3***. As the site is brownfield the underlying soil is 100% covered with made ground, concrete and tarmac, and there are no existing drain paths to recharge the ground water on site.

The recommended SOIL type is S4 or 4 for the proposed site based on Table 4.5 from the Flood Studies Report. The drainage group is 2, depth to impermeable layer is <40cm, the slope is 0-2 degrees and the permeability above the impermeable layer is medium. This is also confirmed by the approach advocated by the TII Publication DN-DNG-03064 Table 5/1 (adapted from the Agricultural Development and Advisory Service, ADAS).

Figure 3. - *Extract of the Soil Classification from the Site Investigation Report*

3.7 SITE HYDROLOGY CHARACTERISTICS

The hydrological input values for the M5-60 Rainfall Depth has been derived as 18.0mm from the site specific weather data obtained from Met Eireann contained

in ***Appendix B***. Due to the assumptions used in the online Surface water storage volume estimation tool, M5-60 values have been classified into three zones:
Zone 1 - 20mm for areas where M5-60 values are greater than 18.5mm;
Zone 2 - 17mm for M5-60 values ranging from 15.5mm to 18.5mm;
Zone 3 - 14mm for M5-60 values below 15.5mm.

Zone 2 has been selected as the appropriate value for the Surface water storage volume estimation.

The proposed SAAR value of 868mm is as per Met Eireann SAAR Mapping. Please see an extract of the SAAR Mapping specific to the site location in ***Appendix B***.

QBAR can be factored using the Flood Studies Report regional growth curve for Ireland to produce peak flood flows for a number of return periods. Growth Curve factors have been applied for hydrological region in accordance with the Greater Dublin Strategic Drainage Study (GDSDS). An extract of the growth factors Dublin from Table 6.6 of the GDSDS is included below.

Return period (Years)	Growth curve factor
1	0.85
10	1.70
30	2.10
100	2.60

Table 5 - *Extract of the Growth Factors From GDSDS*

3.8 ATTENUATION

Open storage attenuation will be provided by tiered raingardens and shallow landscaped depression storages in the lower north east landscaped corner of the site. The maximum design storage depth will be set at 150mm depth, with a freeboard of 150mm for a 1% AEP + 10% Climate Change (CC). Each raingarden / shallow depression storage will have a flow control to maximise attenuation in these areas, with an overflow at high level into downstream storage areas, so that storm events in excess of the 1% AEP + 10% Climate Change (CC) does not breach (and overtop) the surrounding ground levels of raingarden / shallow depression storage. All flows are restricted from discharging the site outfall at the specified greenfield run-off rate.

The final site discharge, at the outfall chamber, has been designed to be controlled by a hydro brake; limited to the greenfield runoff rate, as noted previously.

Significant attenuation is also provided underneath the permeable paving, which is provided throughout the development area at podium level. This comprises a layer of permavoid cellular units (or similar approved) with a sub-base of open graded crushed rock, where required. Further cellular storage is provided upstream of the development's outfall chamber, to temporarily store rainfall in excess of the maximum 8.1 l/s flow rate.

3.9 GREEN ROOFS

The proposed development has an overall approximate roof area of 4,924m^2. The proposed green roof area to be provided is approximately 3,629m^2, as illustrated on Drg. no. *SFC-OCSC-XX-XX-DR-C-0500.*

The proposed development has been designed to provide approximately 73% Extensive Green Roof (Sedum) in accordance with DLRCC current Development Plan. The green roof coverage is provided in tabular form in ***Table 6*** below. Please see attached maintenance regime in the appendices of this report. Access locations are indicated on the Architect design drawings.

Location	Total Roof Area (m^2)	Total Green Roof Area (m^2)	Green Roof Percentage Coverage (%)
Block A (GR1.0+2.0)	1,270	1,166	92
Block B (GR3.0)	670	615	92
Block C (GR4.0)	1,465	560	38
Block E (GR6.0)	550	383	70
Block F (GR5.0)	969	905	93
Total	4,924	3,629	73

Table 6 – *Summary of Green Roofs Area Coverage*

Please refer to Proposed Drainage Layout shown on Drg. no. SFC-OCSC-XX-XX-DR-C-0500 for the locations of green roofs. Typical design details of the proposed green roof have been provided in ***Appendix B*** and proposed SuDS Details Drg.

No. *SFC-OCSC-XX-XX-DR-C-0510*. The proposed Green Roof system is to be Bauder SDF-Mat, or similar approved.

3.10 OPEN GRADED CRUSHED ROCK

The catchment area, which comprises permeable paving / open graded crushed rock (OGCR) sub base, has an approximate area of 3,110m^2 and is partly made up of paver blocks sections, linear inlets and soft landscaping. The depth of the Open Graded Crushed Rock (OGCR) storage layer below the paving is 300mm, and the depth of the OGCR storage below the landscaping is 150mm. Refer OCSC Drawing No. SFC-OCSC-00-00-DR-C-0510 for further detail. The OGCR storage below the permeable paving is just outside / off podium is included in the storage volume calculations.

3.11 SURCHARGE ANALYSIS

A review of the designed surface water drainage network was carried out to assess if surcharging is experienced within the network, along with any potential impacts that may arise due to blockages, or other nuisance flooding scenarios.

It is noted that surcharging of the network will be typically experienced as a result of the flow controls that have been strategically designed, along with the associated SuDS. In principle:

- The storm water network has been hydraulically designed and simulated with no flooding for all design rainfall events, up to and including the 1% AEP with climate change, as per GDSDS requirements;
- A freeboard has been provided, through design, to all SuDS components with a minimum of 150mm from the design TWL to the proposed finish level;
- Surcharging of the network is typically experienced as a result of the flow controls that have been strategically designed, along with the associated SuDS;
- Details of the online flow controls for these pipes can be found on pg. 120-123 of SFC-OCSC-MD-C-P05-SW. located in **Appendix B**;
- No flooding from the network is experienced during the design 1% AEP rainfall event, as per GDSDS requirements;
- There is no flood risk to the proposed habitable space of the development, as a result of the proposed design;

- The storm water network has been hydraulically designed and simulated to result in no flooding as a result of all design rainfall events, up to and including the 1% AEP with climate change;
- The surcharge analysis that was carried out, to assess impact of potential blockages within the network, indicate that flooding will likely be experienced in such a situation that all flow controls are simultaneously partially blocked;
- The network has been designed with overflows to all flow controls, however, there is no such overflow from the development's outfall;
- All potential flood risk, as a result of blockage to the system has been designed to stay within landscaped features, for rainfall events up to, and exceeding, the 1% design rainfall event;
- Protective measures have been designed into the integrated drainage network, as outlined in Section 3.3, to minimise risk of blockage;
- A preliminary maintenance procedure outline has been included in Appendix B, to help Building Management develop a comprehensive and appropriate Maintenance Plan, to further reduce potential risk of blockage within the surface water network.
-

3.12 FLOOD RISKS

An integrated Micro Drainage simulation will be developed to confirm that there is no flooding for storm event up to 1% AEP including climate change as shown in the MicroDrainage output R478-OCSC-MD-C-P07-SW included in **Appendix B**. There are some flagged flood risks within the model output as shown below in **Figure 3**.

Pipe Number	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Infiltration Flow (l/s)	Infiltration Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
2.001	AJ2	8640 minute 100 year Summer I+10%	85.350	85.279	0.110	0.000	0.00			0.0	0.1	FLOOD RISK
4.002	AJ3	8640 minute 100 year Summer I+10%	85.350	85.279	0.109	0.000	0.00			0.0	0.1	FLOOD RISK
5.001	AJ4	8640 minute 100 year Summer I+10%	85.350	85.279	0.109	0.000	0.00			0.0	0.1	FLOOD RISK
7.000	GR1.1	30 minute 100 year Winter I+10%	119.300	119.200	0.000	0.000	1.00			0.6	3.9	FLOOD RISK*
9.000	GR1.2	30 minute 100 year Winter I+10%	119.300	119.200	0.000	0.000	1.00			0.6	3.9	FLOOD RISK*
10.000	GR2.1	30 minute 100 year Summer I+10%	116.300	116.195	-0.005	0.000	1.00			0.6	3.9	FLOOD RISK*
7.004	DP4	10080 minute 100 year Summer I+10%	85.350	85.279	0.110	0.000	0.02			0.1	1.1	FLOOD RISK
7.005	IC4	8640 minute 100 year Summer I+10%	85.350	85.279	0.111	0.000	0.02			0.1	1.2	FLOOD RISK
2.003	FC3	8640 minute 100 year Summer I+10%	85.350	85.279	0.112	0.000	0.01	0.0	0.000	0.0	0.6	FLOOD RISK
12.002	AJ6	8640 minute 100 year Summer I+10%	85.350	85.262	0.093	0.000	0.00			0.0	0.2	FLOOD RISK
14.003	AJ7	8640 minute 100 year Summer I+10%	85.350	85.262	0.092	0.000	0.00			0.0	0.2	FLOOD RISK
12.005	AJ8	8640 minute 100 year Summer I+10%	85.350	85.262	0.096	0.000	0.01			0.0	0.5	FLOOD RISK
17.000	GR2.3	30 minute 100 year Summer I+10%	116.330	116.186	-0.044	0.000	0.61			0.5	2.4	FLOOD RISK*
17.002	IC5	8640 minute 100 year Summer I+10%	85.350	85.261	0.092	0.000	0.00			0.0	0.1	FLOOD RISK
16.001	AJ9	8640 minute 100 year Summer I+10%	85.350	85.262	0.095	0.000	0.02			0.0	0.3	FLOOD RISK
18.000	GR2.4	30 minute 100 year Summer I+10%	116.330	116.186	-0.044	0.000	0.61			0.5	2.4	FLOOD RISK*
18.002	IC6	8640 minute 100 year Summer I+10%	85.350	85.262	0.094	0.000	0.01			0.0	0.3	FLOOD RISK
16.002	AJ10	8640 minute 100 year Summer I+10%	85.350	85.262	0.096	0.000	0.02			0.0	0.8	FLOOD RISK
19.000	GR2.5	30 minute 100 year Summer I+10%	116.330	116.186	-0.044	0.000	0.61			0.5	2.4	FLOOD RISK*
19.002	IC7	8640 minute 100 year Summer I+10%	85.350	85.262	0.097	0.000	0.00			0.0	0.1	FLOOD RISK
2.007	FC4	8640 minute 100 year Summer I+10%	85.350	85.263	0.100	0.000	0.06	0.0	0.000	0.0	1.3	FLOOD RISK
21.000	GR3.1	30 minute 100 year Summer I+10%	110.300	110.177	-0.023	0.000	0.95			0.6	3.7	FLOOD RISK*
21.002	IC8	8640 minute 100 year Summer I+10%	85.350	85.209	0.043	0.000	0.00			0.0	0.2	FLOOD RISK
21.003	BR13	8640 minute 100 year Summer I+10%	85.350	85.209	0.044	0.000	0.01			0.0	0.4	FLOOD RISK
21.004	AJ11	8640 minute 100 year Summer I+10%	85.350	85.210	0.045	0.000	0.01			0.0	0.5	FLOOD RISK
23.000	GR3.2	30 minute 100 year Summer I+10%	110.300	110.177	-0.023	0.000	0.95			0.6	3.7	FLOOD RISK*
23.002	IC9	8640 minute 100 year Summer I+10%	85.350	85.209	0.042	0.000	0.00			0.0	0.2	FLOOD RISK
2.009	FC5	8640 minute 100 year Summer I+10%	85.350	85.231	0.070	0.000	0.03	0.0	0.000	0.1	1.6	FLOOD RISK
27.000	GR4.1	30 minute 100 year Summer I+10%	101.300	101.172	-0.028	0.000	0.86			0.6	3.4	FLOOD RISK*
28.000	GR3.3	30 minute 100 year Summer I+10%	110.300	110.177	-0.023	0.000	0.95			0.6	3.7	FLOOD RISK*
29.000	GR3.4	30 minute 100 year Summer I+10%	110.300	110.177	-0.023	0.000	0.95			0.6	3.7	FLOOD RISK*
30.000	GR4.2	30 minute 100 year Summer I+10%	101.300	101.172	-0.028	0.000	0.86			0.6	3.4	FLOOD RISK*
30.002	IC13	960 minute 100 year Summer I+10%	85.350	85.275	0.116	0.000	0.02			0.1	0.8	FLOOD RISK
30.005	FC8	960 minute 100 year Summer I+10%	85.350	85.274	0.118	0.000	0.13	0.0	0.000	0.2	2.7	FLOOD RISK
41.000	GR2.2	30 minute 100 year Summer I+10%	116.300	116.195	-0.005	0.000	1.00			0.6	3.9	FLOOD RISK*
49.000	GR5.1	120 minute 100 year Winter I+10%	128.300	128.200	0.000	0.000	1.13			0.6	4.5	FLOOD RISK*
51.000	GR5.2	120 minute 100 year Winter I+10%	128.300	128.200	0.000	0.000	1.13			0.6	4.5	FLOOD RISK*
53.000	GR5.3	120 minute 100 year Winter I+10%	128.300	128.200	0.000	0.000	1.13			0.6	4.5	FLOOD RISK*

Figure 3 – Extract sample of some flagged Flood Risks at Manholes in Surface Water network from the MicroDrainage model (R478-OCSC-MD-C-P07-SW).

For the cellular storage (permavoid 150) and OGCR base to the permeable paving SuDs components, the water level will reach within 150mm of the top / finish level and return a flood risk. The cellular storage (permavoid 150) and OGCR / permeable paving have been designed to fully utilise the storage volume in the voids of permeable paving build and is operating as intended. There is no flooding risk to these SUDs features including the cellular storage (permavoid 150) outlets and flow control chambers will be fitted with an overflow as specified on proposed SuDS Details Drg. No. *SFC-OCSC-XX-XX-DR-C-0510*. A schematic of the proposed protected-orifice control, with overflow is shown below in **Figure 4**. It should be noted that overflows have not been modelled in MicroDrainage.

Figure 4 – Extract sample and schematic of proposed flow control (ControFlow Level Invert or similar approved).

The proposed flood risk height (mm) has been set to 150mm below the top of the manhole, throughout the design. This is the level water must reach before the status of the manhole changes from surcharged to flood risk on the Summary of Results. It is noted that there is no requirement for freeboard to manholes for a 1% AEP + CC, in accordance with the GDSDS. The flood risk has been set at 150mm to be consistent with the minimum freeboard being provided for SuDS features, the distance between the top water level (TWL) and manhole cover level.

Further analysis was carried out to assess potential impact due to a 50% blockage of the flow control chambers, in accordance with DLRCC Development Plan 2016 – 2022. For this assessment the site flow control discharge rate has been reduced by half in the MicroDrainage outputs results to best simulate a 50% blockage.In this scenario, flooding from the network is only experienced in Manholes referenced 'HB' (development's outfall / flow control chamber) and ''MH4' immediately upstream. In such an occurrence, the excess water would flow overland to Blackthorn Drive.

A sensitivity check was also carried out on the extremely unlikely coincident event of a 1% AEP along with all flow control chambers within the development simultaneously blocking. This would result in flooding from some of the development's chambers, which would be directed to soft landscaped areas, within the development and / or overland to both Blackthorn Drive and Carmanhall Road. Refer to drawing SFC-OCSC-00-00-DR-C-0521 for details.

In summary, there is generally no significant increase in flooding or flood risks due to reduced rate, at the development outfall. This is due the drainage strategy to attenuate flows from sub catchments. There are some flooding risks as shown below in **Figure 5**.

Pipe Number	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Infiltration Flow (l/s)	Infiltration Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
7.000	GR1.1	30 minute 100 year Winter I+10%	119.300	119.200	0.000	0.000	1.00			0.6	3.9	FLOOD RISK*
9.000	GR1.2	30 minute 100 year Winter I+10%	119.300	119.200	0.000	0.000	1.00			0.6	3.9	FLOOD RISK*
10.000	GR2.1	30 minute 100 year Summer I+10%	116.300	116.195	-0.005	0.000	1.00			0.6	3.9	FLOOD RISK*
17.000	GR2.3	30 minute 100 year Summer I+10%	116.330	116.186	-0.044	0.000	0.61			0.5	2.4	FLOOD RISK*
18.000	GR2.4	30 minute 100 year Summer I+10%	116.330	116.186	-0.044	0.000	0.61			0.5	2.4	FLOOD RISK*
19.000	GR2.5	30 minute 100 year Summer I+10%	116.330	116.186	-0.044	0.000	0.61			0.5	2.4	FLOOD RISK*
21.000	GR3.1	30 minute 100 year Summer I+10%	110.300	110.177	-0.023	0.000	0.95			0.6	3.7	FLOOD RISK*
23.000	GR3.2	30 minute 100 year Summer I+10%	110.300	110.177	-0.023	0.000	0.95			0.6	3.7	FLOOD RISK*
25.004	AJ12	10080 minute 100 year Winter I+10%	85.350	85.348	0.190	0.000	0.02			0.0	0.7	FLOOD RISK
27.000	GR4.1	30 minute 100 year Summer I+10%	101.300	101.172	-0.028	0.000	0.86			0.6	3.4	FLOOD RISK*
27.002	IC12	10080 minute 100 year Winter I+10%	85.350	85.344	0.161	0.000	0.01			0.0	0.5	FLOOD RISK
28.000	GR3.3	30 minute 100 year Summer I+10%	110.300	110.177	-0.023	0.000	0.95			0.6	3.7	FLOOD RISK*
29.000	GR3.4	30 minute 100 year Summer I+10%	110.300	110.177	-0.023	0.000	0.95			0.6	3.7	FLOOD RISK*
30.000	GR4.2	30 minute 100 year Summer I+10%	101.300	101.172	-0.028	0.000	0.86			0.6	3.4	FLOOD RISK*
30.002	IC13	960 minute 100 year Summer I+10%	85.350	85.349	0.190	0.000	0.02			0.1	0.8	FLOOD RISK
41.000	GR2.2	30 minute 100 year Summer I+10%	116.300	116.195	-0.005	0.000	1.00			0.6	3.9	FLOOD RISK*
49.000	GR5.1	120 minute 100 year Winter I+10%	128.300	128.200	0.000	0.000	1.11			0.6	4.4	FLOOD RISK*
51.000	GR5.2	120 minute 100 year Winter I+10%	128.300	128.200	0.000	0.000	1.11			0.6	4.4	FLOOD RISK*
53.000	GR5.3	120 minute 100 year Winter I+10%	128.300	128.200	0.000	0.000	1.11			0.6	4.4	FLOOD RISK*
55.000	GR6.1	30 minute 100 year Summer I+10%	116.300	116.200	0.000	0.000	1.00			0.6	3.9	FLOOD RISK*
57.000	GR6.2	30 minute 100 year Winter I+10%	116.300	116.200	0.000	0.000	1.07			0.6	4.2	FLOOD RISK*
47.022	SWALE	960 minute 100 year Summer I+10%	82.750	82.719	-0.030	0.000	0.17			0.7	10.2	FLOOD RISK*
47.023	SWALE	960 minute 100 year Summer I+10%	82.734	82.717	-0.017	0.000	0.17			0.7	10.2	FLOOD RISK*
47.024	FC25	960 minute 100 year Summer I+10%	82.734	82.712	3.012	0.000	0.11	0.0	0.000	0.2	6.3	FLOOD RISK
59.000	GR4.3	30 minute 100 year Summer I+10%	101.300	101.172	-0.028	0.000	0.86			0.6	3.4	FLOOD RISK*
60.000	GR4.4	30 minute 100 year Summer I+10%	101.300	101.172	-0.028	0.000	0.86			0.6	3.4	FLOOD RISK*
59.005	MH5	2160 minute 100 year Summer I+10%	80.675	80.585	0.607	0.000	0.03			0.5	2.0	FLOOD RISK

Figure 5 – Extract sample of some flagged Flood Risks at Manholes in Surface Water network from the MicroDrainage model for 50% Blockage Scenario (R478-OCSC-MD-C-P07-SW-50 Percent).

The probability of simultaneous 50% blockage being experienced in all flow controls, across the entire network, is very low and further reduced by the proposed closed SuDS systems i.e. no traditional gullies and the provision of a maintenance regime. This minor flooding does not have any overland routes outside of site and is and will be contained in a low point / the area of the landscaping and there is generally no flooding or flood risks to the habitable spaces due to reduced rate.

A separate Site Specific Flood Risk Assessment (SSFRA) has been provided by RPS Group, under a separate cover, as part of this submission.

3.13 PERCENTAGE IMPERVIOUS (PIMP) CLASSIFICATION

Wallingford Procedure's Modified Rational Methodology suggests typical average global runoff coefficient of 0.84 for winter rainfall events, and 0.75 for summer rainfall events for typical catchment areas including houses, roads and pavements. A separate value for each different surface including green roofs, flat roofs, permeable paving and soft landscaping (including soft SuDs features) has been selected rather than an average runoff coefficient for the whole site.

For clarity the global runoff coefficient (Cv) of 1.0 has been applied to the development's MicroDrainage design criteria, for the whole site. This allows for a varying Percentage Impermeable (PIMP) classification values to be applied to THE different catchment area-types, so that MicroDrainage can apply a more realistic runoff coefficient to the different catchment types.

Run off coefficients have been specified using;

- Table E3 from BS EN 752 2008 - Drain and sewer systems outside buildings for flat roof, impermeable and grass surfaces,
- Table 11.4 from CIRIA C753 The SuDs Manual,Table 10.1 from CIRIA C644 - Building Greener for green roof surfaces.

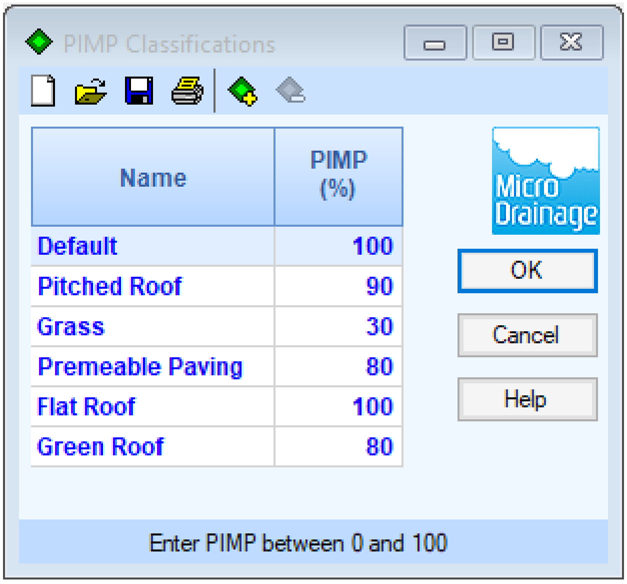

Figure 6 - *Extract of input figures for the Runoff Coefficients to be used in MicroDrainage.*

All impermeable road / pavement areas have been taken at 80% and all landscaped / grass areas (with possible infiltration below / outside podium) have be designed to have a 30% runoff coefficient. Small flat roof areas have been taken at 100% impermeable

These values result in a greater runoff than the runoff coefficients than that suggested for green roofs and permeable pavements in CIRIA C644 and CIRIA C753. OCSC's approach to the calculation of the runoff is therefore more conservative and has been used to address both the losses for each event and the runoff coefficient losses once the collection surface is wet.

Nature of connected area	Runoff Coefficient C	Comments
Impermeable areas and steeply sloping roofs [a]	0,9 to 1,0	Depending on depression storage
Large flat roofs	0,5	Over 10 000 m^2
Small flat roofs	1,0	Less than 100 m^2
Permeable areas	0,0 to 0,3	Depending on ground slope and cover
[a] Impermeable areas may be increased by 30 % of large vertical surfaces.		

Table 7– *Extract of the Runoff Coefficients from BS EN 752 2008*

Surface type	Runoff coefficient
Pitched roof with profiled metal sheeting	0.95
Pitched roof with tiles	0.90
Flat roof without gravel	0.80
Flat roof with gravel	0.60
Green roof, intensive[1]	0.30
Green roof, extensive[1]	0.60
Permeable pavement (concrete blocks)[2]	0.60
Road/pavement	0.75

Table 8 – *Extract of the Runoff Coefficients from C753*

The green roofs for this development will typically comprise of a 200mm build-up (200mm substrate) underneath a layer of sedum moss (or similar) with a roof outfall.

A green roof design calculator, which is part of the MicroDrainage software, has been applied to the Green Roofs, Raingarden / shallow depression landscaped storage and bio-retention areas on podium. This calculator models the rainfall runoff from the green roof areas, to the main drainage network, over an extended time period during a rainfall event, rather than applying a conventional time of concentration.

The green roof design tool has been developed by MicroDrainage, in collaboration with Sheffield University, in order to best represent the rainfall runoff response rate on a green roof. The tool is based on CIRIA C644 (Green Roof) Guideleines, current best practice and research carried out at Sheffield University, the location of the Green Roof Centre.

It is noted that OCSC have used the most conservative input values for the Time Area Diagram method to ensure a more robust design.

3.14 INFILTRATION

It is proposed to provide shallow raingardens / shallow depression landscaped storage areas to the north east landscaped corner of the site and below the paving to the north and south entrance boundaries as per OCSC Drawing No. SFC-OCSC-00-00-DR-C-0500. The raingardens / shallow depression landscaped storage area is to allow blanket infiltration, with an underdrain also provided, to direct water away from building foundations. These areas will also have a positive controlled drainage outfall and overflow for events above the design 1% AEP including climate change.

It is proposed to provide shallow raingardens and a conveyance swale adjacent to the basement wall. The raingarden and conveyance swale is to allow blanket infiltration, with an underdrain also provided, to direct water away from foundations. These SuDS proposals will also have a positive drainage outfall and overflow. Following discussions with the development's Structural Engineer, it has been confirmed that there is no risk to the structure due to the reduced proximity of the proposed SuDS to the basement wall.
As per the attached (Refer Appendix E) CIRIA factsheet 'Using SuDS close to buildings' published on ciria.org– "5 metres is given as a guideline, if foundation details and geotechnical data are available to show that a shorter distance is safe then it can be used." It is not proposed to provide a soakaway within 5m of foundations. It is noted that 5m separation distance relates to the BRE Guidance for point-soakaways. The basement structure will be a raft foundation bearing on rock, any soft deposits encountered will be excavated and backfilled with C16/20 concrete. Settlement is only considered a risk if the structure was bearing on loose soil with high void ratios. The structure will be constructing on top of well compacted dense fill or concrete. The basement will receive external waterproofing and will be designed for water pressure.

3.15 SPECIFIC SUDS MEASURES PROPOSED

It is proposed to provide a Sustainable Urban Drainage System (SuDS) in accordance with the Greater Dublin Strategic Drainage Study Regional Drainage Policy Volume 2 - New Development (GDSDS-RDP Volume 2). Specific design requirements for SuDS components are established by the Construction Industry Research and Information Association's publication CIRIA C753-SuDS Manual (C753).

An outline of the SuDS proposals are included on OCSC Drg no. *SFC-OCSC-XX-XX-DR-C-0500 & Drg. SFC-OCSC-XX-XX-DR-C-0510.* As the existing site is entirely covered in made ground, the following proposals are a significant improvement on the surface water discharge volumes and water quality from the site and best represent the runoff behaviour of a Greenfield site.

- Attenuation Storage will be provided to ensure that there is adequate attenuation storage for the required limited discharge of surface water volumes. The site has been divided into sub catchments to reduce flows, volumes and provide treatment of run-off, as part of the surface water management train. Attenuation will be provided for events up to, and including, the 1.0% AEP rainfall event of each sub-catchment SuDs component, totalled as follows:

SuDs Component	Volume (m^3)
Cellular storage (permavoid 150, or similar) on podium	918
OGCR under podium Bio-Retention Areas	125
OGCR Storage below permeable paving	203
Raingarden / Shallow Depression Storage	35
Filter Drains	18

Table 9 – *Summary of SuDS Storage Components Volumes*

- Limiting discharges to ensure that the site discharge rate is maintained below the greenfield runoff rate of 8.1/s (Q1) for SOIL Type 4. Flow control devices will be provided for each SuDs component to maximise storage on site, with a final flow control to be provided prior to discharge from site. All SuDS components have been designed with adequate attenuation storage for the specified limited discharge rates;

- Green roofs will provide interception and treatment storage at roof level. A 73% Green Roof coverage of the total roof area will be provided above the minimum 60% required as per DLRCC County Development Plan 2016-2022. The removal of pollutants, a reduction of surface water runoff and ecological value will be provided as a first level of treatment before discharging to the SuDs components downstream;

- Rainwater Harvesting was considered not a practical option for the proposed development, given the extensive area of green roof (described above) that is being provided as part of the proposed development;

- Cellular Storage (permavoid 150) / Permeable Paving / OGCR Sub Base will be limited / throttled to provide attenuation storage in the sub-base. The removal of pollutants at source and a reduction of surface water runoff will be provided. The surface water flows through the above soil medium of planters before entering the below storage, via a geotextile layer. This acts as first level of treatment of runoff before controlled release to SuDS components downstream;

- Raingarden / Shallow Landscaped Depression Storage will be provided for attenuation during an exceedance events. The raingarden / shallow depression storage is shallow with 3:1 side slope and have been designed with a maximum TWL of 50mm and includes a minimum 150mm freeboard to proposed ground level. These areas are located in public areas and will be useable, maintainable and safe. A perforated filter underdrain is to be provided for all these SuDS, to assist in draining the surface and enable use by the local community during and in the immediate times after frequent rainfall events.

  The frequency of larger events above 1 in 30 year storm is relatively rare. The raingarden / shallow depression storage area is offline storage and located off podium at existing ground level. The raingarden / shallow depression storage in landscaped areas has been designed with a maximum TWL of 50mm and includes a freeboard greater than 150mm to proposed finish level. A freeboard greater than 500mm from the lowest FFL to the top water of the open attenuation storage will be provided for the catchment area.

- Infiltration to natural ground for surface water runoff will be facilitated underneath filter drains, raingarden / shallow depression storage, landscaped areas and OGCR / permeable paving outside of podium and basement extent.

  Soakaway tests have been completed in accordance with the BRE Digest 365. The results are included in the Site Investigations Report **Appendix A**. The water level dropped too slowly to allow calculation of the soil infiltration rate and infiltration has not been input into the Micro Drainage model. However, the interface between the storage facility and the underlying soil will not be sealed to maximise the environmental benefits of the design but will be designed to ensure against a level of service failure.

Please note that the minimum interception for the first 10mm of rainfall as per the GDSDS. It is proposed to provide interception areas in excess of this requirement;

- <u>Trees Pits</u> are to be provided adjacent the public foot path areas to the north and south entrances of the site and act as a first level of treatment for surface water run-off in these locations;

3.16 LAYOUT

The existing site is currently drained at the north of the site, via 300mm connection to the 900mm public surface water network, on Blackthorn Drive. This sewer drains to Carysfort Maretimo Stream, which is located approx. 880m east of the site at Brewery Road before traveling north towards Blackrock. The drainage network flows through Sandyford, Stillorgan, and Blackrock, before discharging to Dublin Bay at Blackrock, east of Dún Laoghaire West Pier Wall.

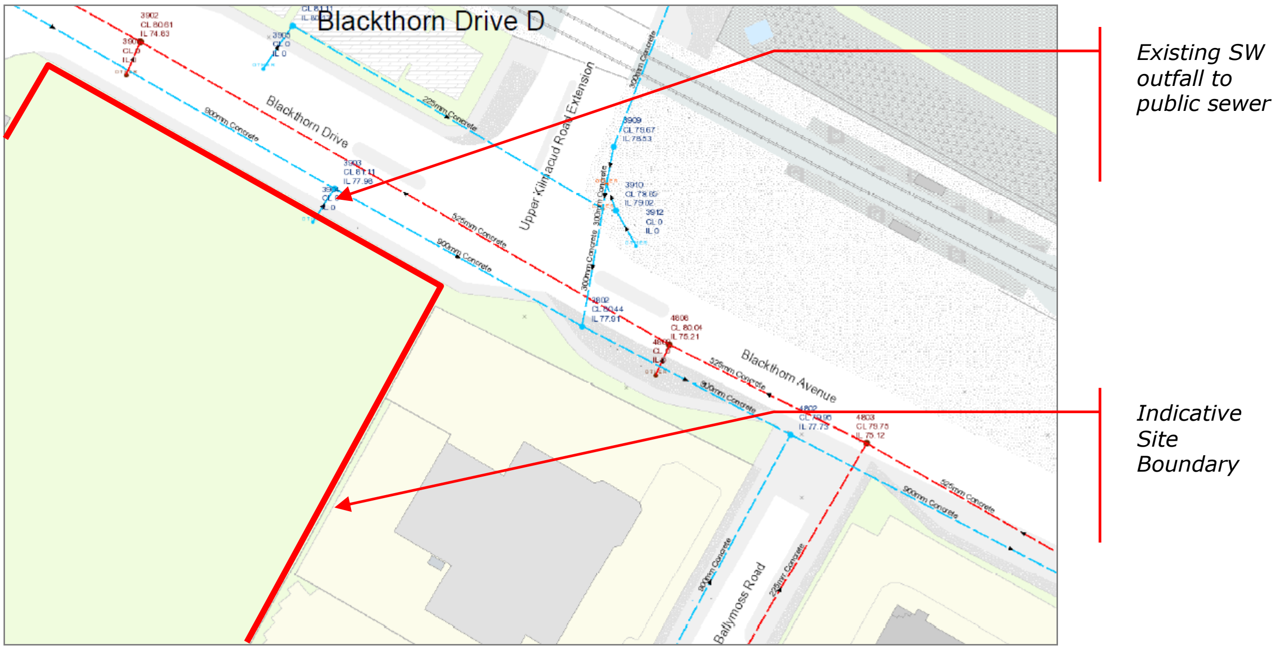

Figure 7 – *Existing Surface Water Infrastructure (Source: Irish Water Drainage Records)*

The proposed drainage layout and integrated SuDS network and storage arrangements are shown on OCSC Drg. No's *SFC-OCSC-XX-XX-DR-C-0500*.

The surface water design strategy is focused on reducing impermeable surfaces across the developed site, creating green spaces and utilising above-ground SuDS, where practicable, including green roofs with downpipes directed to the permeable paving sub-base and raingarden / shallow depression storage. Only limited infiltration is possible due clay overlaying rock on site. SuDS designed primarily to attenuate surface water runoff, rather than to encourage infiltration.

The proposed main surface water drainage network will consist integrated SuDs components designed in accordance with CIRIA C753-SuDS Manual (C753). The drainage network will have branch and conveyance pipes with the diameter of 150mm-300mm. All pipes outside of the site to be taken in charge will be compliant with the requirements of the Greater Dublin Regional Code of Practice for Drainage Works and full bore self-cleansing velocities of 1.0m/s.

The proposed finished floor levels within the site will be above the adjacent ground levels with access ramping up / stepping up to the threshold level to the north and south boundaries of the site. The finished floor levels for level 1 apartments will, likewise, be above the adjacent ground levels and be stepped in alignment with the existing fall in ground levels in this part of the site.

The proposed internal pipe network pipes are to be slung to the underside of the podium slab and will be in accordance with TGD H – Drainage specifications.

3.17 CONSULTATION

O'Connor Sutton Cronin have had a number of correspondences between March & April 2019 with DLRCC Drainage section and met with Bernard Egan on 10th April 2019 to introduce the principles of the surface water strategy.

Further correspondence, following the Section 247 pre-planning submission and subsequent Section 5 tri-partite meeting with An Bord Pleanala, was had with Ms Johanne Codd of Dun Laoghaire-Rathdown County Council Drainage Planning Department, to ensure that the drainage design was developed to the satisfaction of DLRCoCo. A record of the recent correspondence is included in ***Appendix D***.

3.18 CALCULATIONS

An integrated drainage and SuDS network model has been developed using the MicroDrainage Network Design software by Innovyze Inc. The rainfall intensity levels have been increased by 10% for predicted climate change (+CC) factors, in accordance with the GDSDS and Development Plan.

Final surface water calculations (Refer **Appendix B**) include all proposed SuDS components and flow control devices. All of the previously described SuDS components have been integrated into the model and have been designed with adequate attenuation storage including climate change factors for the specified limited discharge rates.

The runoff applied over the proposed green roof areas is intercepted / delayed prior to entering the network by applying the time area diagram (TAD) or Green roof Calculator within MicroDrainage, which has been developed by MicroDrainage in conjunction with Sheffield University and the UK's Green Roof Centre. The Green Roof calculator applies the rainfall runoff, in the form of a Time Area Diagram, for the green roof area prior to entering the drainage network. This approach has been developed in order to best represent the behaviour of rainfall runoff from a green roof. Remaining bio retention areas on podium are also calculated using the Green roof Calculator within MicroDrainage.

The development's storm network outfall chamber will be fitted with a site flow control device (Hydrobrake or similar approved). This will enable the storm water flows to be restricted to pre-development levels 8.1/s, Q1 for Soil Type 4. The allowable discharge calculations storage simulations for a 1.0% AEP rainfall event are included in ***Appendix B***.

3.19 GDSDS STORM WATER REVIEW

The Greater Dublin Strategic Drainage Study (GDSDS) requires that storm water is reviewed under four Criteria.

(i) Criterion 1 – River Water Quality Protection;
(ii) Criterion 2 – River Regime Protection;
(iii) Criterion 3 – Level of Service (Flooding) site;
(iv) Criterion 4 – River Flood Protection;

3.19.1 CRITERION 1 –RIVER WATER QUALITY PROTECTION

The drainage system for this development will contain a range of treatment methods for surface water as outlined above in Section 3.2, including green roofs, rain gardens, intensive landscaping, permeable paving and infiltration via open graded crush rock (OGCR) and planters.

3.19.2 CRITERION 2 – RIVER REGIME PROTECTION

The site discharge will be made to the public network via the proposed attenuation and flow control device (Hydrobrake). The limiting discharge will restrict the discharge to a rate of **8.1l/s** for the site prior to entering to the public system.

The GDSDS-RDP Volume 2, Appendix E Section E2.4 states that this ensures "that sufficient stormwater runoff retention is achieved to protect the river during extreme events."

3.19.3 CRITERION 3 – LEVEL OF SERVICE (FLOODING) SITE

There are 4 sub-criteria for level of service, as set out in the GDSDS-RDP Volume 2, Section 6.3.4 (Table 6.3):

(i) No flooding on site except where planned (30-year high intensity rainfall event);
(ii) No internal property flooding (100-year high intensity rainfall event);
(iii) No internal property flooding (100-year river event and critical duration for site) and;
(iv) No flood routing off site except where specifically planned, (100-year high intensity rainfall event).

It is proposed that storm water runoff from the development will typically be collected in pipes of diameter 150mm – 300mm. The proposed drainage layout is shown on OCSC Drg. No's SFC-OCSC-XX-XX-DR-C-0500. The proposed surface water long sections will be included with the detailed design submission.

Calculations for the design of storm drains will be completed with the Micro Drainage Network Design software, using the Modified Rational Method in accordance with EN752. Calculations for the Storm networks will be included with the detailed design submission.

3.19.3.1 SUB-CRITERION 3.1

The proposed drainage system will be analysed for a 30-year return period storm event using a MicroDrainage simulation.

3.19.3.2 SUB-CRITERION 3.2

The proposed drainage system will be analysed for a 100-year return period storm event using a MicroDrainage simulation.

3.19.3.3 SUB-CRITERION 3.3

The site topography slopes from Carmanhall Road to Blackthorn Drive with a fall of approximately 4.0m. The site topography is generally level with an existing concrete slab from a previous warehouse building at a level of approx. 81.3m. The site is not in the vicinity of coastal flooding. The maximum water level in the proposed attenuation will not pose a risk to the proposed buildings. In accordance with the requirements of Sub-Criterion 3.3, all buildings are a minimum of 500mm above the design 100-year water level in all open basin attenuation facilities. It is also noted that the surface water drainage network will be designed with no flooding experienced during a design 1 in 100-year rainfall event. MicroDrainage simulation results will be provided to confirm this.

3.19.3.4 SUB-CRITERION 3.4

The performance of the proposed drainage system will be designed and analysed for 100-year return period storm event. Sufficient storage will be provided to prevent flooding in the 100-year return period storm event. The surface water strategy will not provide for off-site overland flow in the 100-year return period storm event and this will be confirmed with MicroDrainage simulation results.

3.19.4 CRITERION 4 – RIVER FLOOD PROTECTION

In accordance with sub-criterion 4.3, runoff from the site will be limited to the green-field runoff level. By limiting the runoff to this flow rate (i.e. 8.1l/s), the GDSDS-RDP Volume 2, Appendix E Section E2.4 states that this ensures "that sufficient stormwater runoff retention is achieved to protect the river during extreme events". Attenuation storage is provided for the 100-year return period storm event. Control of runoff rates will be achieved through the use of vortex control devices (e.g. Hydrobrake), which reduce the risk of blockage in comparison with other flow control devices. Calculations of attenuation volume are included in ***Appendix B***.

4.0 STORM WATER AUDIT

A Storm water Audit is a requirement under DLR Development Plan Objectives for planning and post construction stages of any application to ensure that storm water management, rainfall attenuation and Sustainable (Urban) Drainage Measures (SuDS). Punch Consulting Engineers were engaged to carry out an independent review of the development's surface water network and SuDS design strategy.

Punch Consulting Engineers outlined a number of observations / comments, with respect to the design. All items have either been addressed or have been responded to satisfactorily.

Refer to **Appendix G** for a copy of the Storm Water Audit, with the signed and approved Designers Response form at the end of the audit.

5.0 FOUL WATER DRAINAGE

5.1 OVERVIEW

The exiting site is drained at the north of the site via 150mm connection to the 525mm public foul water network on Blackthorn Drive.

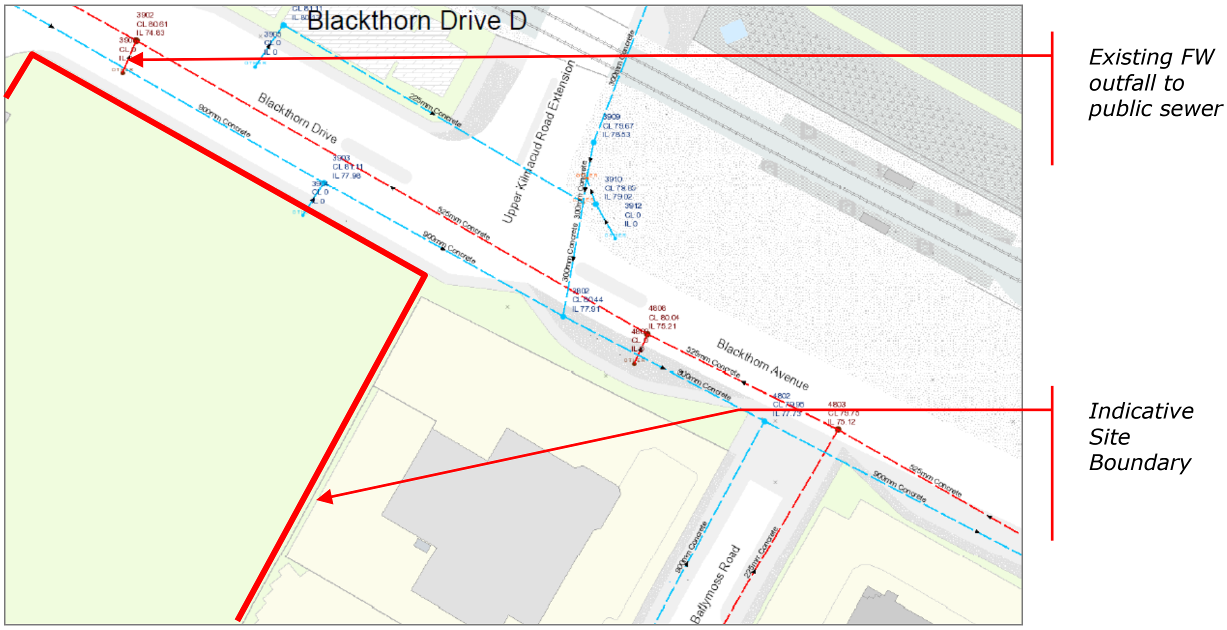

Figure 8 – *Existing Foul Drainage Infrastructure (Source: Irish Water Drainage Records)*

It is proposed to construct a new internal foul drainage network in accordance with Irish Water Code of Practice for Wastewater Infrastructure, The Building Regulations 'Part H' & the Regional Code of Practice for Drainage Works.

The sewers will be compliant with the requirements of the Irish Water Code or Practice for Wastewater Infrastructure and will be from 150mm to 225mm in diameter. Foul sewers within the building's plots may be as small as 100mm dia. in accordance with TGH H – Drainage specifications and with Irish Water Code of Practice.

It is proposed to reuse this connection from the site and or complete upgrade works and discharge to the public 525mm concrete sewer in Blackthorn Drive. Please refer to Drg. no. SFC-OCSC-XX-XX-DR-C-0506 for the proposed route of the public surface water pipe to the proposed outfall connection.

It is proposed that the site outfall pipe, downstream of the last private manhole, is taken in charge by Dún Laoghaire-Rathdown County Council / Irish Water. The on-site drains, suspended drains inside the side boundary will be maintained by the management company.

5.2 LAYOUT

Drainage calculations submitted in ***Appendix C*** have been generated by 'MicroDrainage' flow modelling software, and the 'Hydraulic Design for Gravity Sewers' method to Irish Water Code of Practice for Wastewater Infrastructure.

Following the submission of a pre-connection enquiry form for 600 units to Irish Water (Connection Reference No CDS19000358), Irish Water have confirmed that the existing sewer has adequate capacity to facilitate sewage from this development. Refer **Appendix E** for Confirmation of Feasibility from Irish Water, dated 1st March 2019.

Irish Water have confirmed acceptance by issuing Statement of Design Acceptance on 5th November 2019. Refer to **Appendix E** for a copy of the issued letter.

5.3 CALCULATIONS

Drainage calculations submitted in ***Appendix C*** have been generated by 'Micro Drainage' flow modelling software, and the 'Hydraulic Design for Gravity Sewers' method to Irish Water Code of Practice for Wastewater Infrastructure.

Sewers carrying wastewater from developments should be designated to carry a minimum wastewater volume of six times dry weather flow (6DWF). Dry weather flows DWF should be taken as 600 litres per dwelling (three persons per house and a per capita wastewater flow of 200 litres per head per day.

Gradients should be selected so that self-cleansing velocities can be maintained under normal operating conditions. The range of flow velocity within the sewers should be between 0.75m/s at low flow and 3.0m/s, when flowing full.

Subject to the limitations imposed by the foregoing, pipe sizes and gradients should be selected from approved pipe design tables, based on approved design approach, such as the use of the Colebrook White equation. However, to provide a self-cleansing regime within gravity foul sewers, the minimum flow velocity should be 0.75 m per second. Where this requirement cannot be met, then this criterion would be considered to be satisfied if:

- A 150mm nominal internal diameter gravity sewer is laid to a gradient not flatter than 1:150 where there are at least ten dwelling units connected or,

- A service connection with a nominal internal diameter of 100mm laid to a gradient not flatter than 1:80, where here is at least one WC connected and 1:40 if there is no WC connected.

In general, pipes of 100mm diameter should be laid at minimum gradients of between 1:60 and 1:100. Pipes of 150mm diameter should be laid at a minimum gradient of 1:150. Pipes of 225mm diameter or greater should have a minimum gradient of 1:200. Pipe gradients for private drainage should be constructed in accordance with that indicated above as a minimum, or with Building Regulation requirements.

These parameters should not be taken as a norm when the topography permits steeper gradients. Hydraulic studies indicate that these requirements may not necessarily achieve a self-cleansing regime.

The minimum size for a gravity foul service connection shall be 100mm. The minimum size for a gravity foul sewer serving less than 10 properties (30 P.E.) shall be 150mm diameter. The desirable pipe size for a collection sewer where more than 10 housing units (30 P.E.) are connected is 225mm diameter or greater subject to hydraulic design capacity assessment.

6.0 POTABLE WATER SUPPLY

6.1 OVERVIEW

It is proposed to provide a potable water supply in accordance with Irish Water Code of Practice for Water Infrastructure.

6.2 CONNECTION TO THE EXISTING NETWORK

There is significant existing infrastructure throughout the area, which served the existing buildings demolished on site. There is an existing 450mm AC main public water network on Carmanhall Road and an existing 6' asbestos watermain which traverses the site and connects to the existing 150mm Ductile Iron main 2010 public along the footpath on Blackthorn Drive.

It is proposed to complete diversions works of the existing watermain traversing the site and provide a new metered site network connection including associated hydrants and valves as per Irish Water requirements. The connection will be metered with ABB Magmaster electromagnetic flow meters or similar approved.

6.3 WATER SAVING DEVICES

In accordance with best practice, new water saving devices (low water usage appliances and aerated taps etc.) will be fitted as standard into the proposed new units.

6.4 WATER METERS

In accordance with the Dún Laoghaire-Rathdown County Council and Irish Water regulations, a water meter will be fitted on the incoming watermain into the estate and individual properties will be fitted with a Talbot Matrix meter box for billing purposes.

6.5 LAYOUT

See OCSC Drg. no. *SFC-OCSC-XX-XX-DR-C-0520* for the proposed watermain layout, which has been designed in accordance with Irish Water's Code of Practice for Water Infrastructure.

6.6 CONSULTATION

A pre-connection enquiry for has been submitted for 600 units to Irish Water (Connection Reference No CDS19000358). Irish Water have confirmed that the existing sewer has adequate capacity to facilitate water connection for this development. Please find the response to the pre-connection enquiry form located in ***Appendix E***.

Irish Water have confirmed acceptance of the proposed design by issuing a Statement of Design Acceptance on 5th November 2019. Refer to **Appendix E** for a copy of the issued letter.

APPENDIX A – SITE INVESTIGATION REPORT

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Ground Investigations Ireland

Sandyford Central

Ground Investigation Report

DOCUMENT CONTROL SHEET

Project Title	Sandyford Central
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CONTENTS

APPENDICES

1.0 Preamble

On the instructions of Richmond Homes and OCSC Consulting Engineers, a site investigation was carried out by Ground Investigations Ireland Ltd., between February & March 2019 at the site of the proposed development in Sandyford Business Park in South Co. Dublin.

2.0 Overview

2.1. Background

It is proposed to construct a new commercial/residential development with associated services, access roads and car parking at the proposed site. The site is currently vacant and was previously occupied by industrial/commercial buildings which have been removed over the majority of the site. The south portion of the site has a building in place and is being used as a temporary compound by Colleen Construction for works on the adjacent building. The proposed construction is envisaged to consist of conventional foundations and pavement make up with some local excavations for services and plant. There is proposed to be an under croft car park area constructed generally off the existing site level, however at the southern end of the site there will be a small amount of retaining/cutting into the rock required.

2.2. Purpose and Scope

The purpose of the site investigation was to investigate subsurface conditions utilising a variety of investigative methods in accordance with the project specification. The scope of the work undertaken for this project included the following:

- Visit project site to observe existing conditions
- Carry out 6 No. Trial Pits to a maximum depth of 3.1m BGL
- Carry out 2 No. Soakaways to determine a soil infiltration value to BRE digest 365
- Carry out 10 No. Rotary Core Boreholes to a maximum depth of 10.6m BGL
- Installation of 6 No. Groundwater monitoring wells
- Rock, Chemical & Environmental Laboratory testing
- Report with recommendations

3.0 Subsurface Exploration

3.1. General

During the ground investigation a programme of intrusive investigation specified by the Consulting Engineer was undertaken to determine the sub surface conditions at the proposed site. Regular sampling and in-situ testing was undertaken in the exploratory holes to facilitate the geotechnical descriptions and to enable laboratory testing to be carried out on the soil samples recovered during excavation and drilling.

The procedures used in this site investigation are in accordance with Eurocode 7 Part 2: Ground Investigation and testing (ISEN 1997 – 2:2007) and B.S. 5930:2015.

3.2. Trial Pits

The trial pits were excavated using a JCB 3CX excavator at the locations shown in the exploratory hole location plan in Appendix 1. The locations were checked using a CAT scan to minimise the potential for encountering services during the excavation. The trial pits were sampled, logged and photographed by a Geotechnical Engineer/Engineering Geologist prior to backfilling with arisings. Notes were made of any services, inclusions, pit stability, groundwater encountered and the characteristics of the strata encountered and are presented on the trial pit logs which are provided in Appendix 2 of this Report.

3.3. Soakaway Testing

The soakaway testing was carried out in selected trial pits at the locations shown in the exploratory hole location plan in Appendix 1. These pits were carefully excavated and filled with water to assess the infiltration characteristics of the proposed site. The pits were allowed to drain and the drop in water level was recorded over time as required by BRE Digest 365. The pits were logged prior to completing the soakaway test and were backfilled with arising's upon completion. The soakaway test results are provided in Appendix 3 of this Report.

3.4. Rotary Boreholes

The rotary coring was carried out by a track mounted T44 Beretta rig at the locations shown on the location plan in Appendix 1. The rotary boreholes were completed from the ground surface or alternatively, where noted on the individual borehole log, from the base of the cable percussion borehole where a temporary liner was installed to facilitate follow-on rotary coring.

The T44 Beretta is equipped with rubber tracks which allow for short travel on pavement surfaces avoiding any damage to the surface. The T44 Beretta utilises a triple tube core barrel system operated using a wireline drilling process. The outer barrel is rotated by the drill rods and at its lower end, carries the coring bit. The inner barrel is mounted on a swivel so that it does not rotate during the process. The third barrel or liner is placed within the second one to retain the core intact and to preserve as much as possible the fabric of the drilling stratum. The core is cut by the coring bit and passes to the inner liner. The core is brought up to the surface within the inner barrel on a small diameter wire rope or line attached to the “overshoot” recovery tool which is then placed into a core box in order of recovery. A drilling fluid, typically air mist or water flush is passed from the surface through hollow drill rods to the drill bit, and is used to cool the drill bit. Temporary casing is used in some situations to support unstable ground or to seal off fissures or voids.

It should be noted that the rotary coring can only achieve limited recovery in overburden, particularly granular or weakly cemented strata due to the flushing medium washing away the cohesive fraction during coring. The recovery achieved, where required is noted on the borehole logs and core photographs are provided to allow assessment of the core recovered. The rotary borehole logs are provided in Appendix 4 of this Report.

3.5. Surveying

The exploratory hole locations have been recorded using a Trimble R10 GNSS System which records the coordinates and elevation of the locations to ITM or Irish National Grid as required by the project specification. The coordinates and elevations are provided on the exploratory hole logs in the appendices of this Report.

3.6. Groundwater/Gas Monitoring Installations

Groundwater and or Gas Monitoring Installation were installed upon the completion of the boreholes to enable sampling and the determination of the equilibrium groundwater level. The typical groundwater monitoring installation consists of a 50mm HDPE slotted pipe with a pea gravel response zone and bentonite seal installed to the Engineers specification. Where required the standpipe is sealed with a gas tap and finished with a durable steel cover fixed in place with a concrete surround. The installation details are provided on the exploratory hole logs in the appendices of this Report.

3.7. Laboratory Testing

Samples were selected from the exploratory holes for a range of environmental testing to assist in the classification of soils and to provide information for the proposed design.
Environmental testing, including the Rialta Suite consisting of Solid and Leachate testing including Waste Acceptance Criteria (WAC), Loss on Ignition, pH and sulphate testing was carried out by the Exova Environmental Laboratory in the UK.
Rock strength testing including Point Load (Is_{50}) and Unconfined Compressive Strength (UCS) testing was carried out in Trinity College Dublin's Geotechnical Laboratory.
The results of the laboratory testing are included in Appendix 5 of this Report..

4.0 Ground Conditions

4.1. General

The ground conditions encountered during the investigation are summarised below with reference to insitu and laboratory test results. The full details of the strata encountered during the ground investigation are provided in the exploratory hole logs included in the appendices of this report.

The sequence of strata encountered were consistent across the site and are generally comprised;

- Surfacing
- FILL/ Made Ground
- Cohesive Deposits
- Granite Bedrock

SURFACING: Tarmac or Reinforced Concrete was encountered in all the exploratory holes and was present to a maximum depth of 0.15 to 0.3m BGL. Tarmac surfacing was present typically to a depth of 0.05m to 0.24m BGL.

FILL/MADE GROUND: Fill deposits were encountered beneath the Surfacing and was present to a relatively consistent depth of between 0.6m and 0.9m BGL and was typically described as Brown or Grey sandy clayey angular to sub angular Gravel (Crushed Rock Fill). Made Ground Deposits were encountered in TP3 and TP5 to a depth of 3.1m and 0.9m BGL respectively. These deposits were described generally as *brown or grey slightly sandy very gravelly CLAY with some cobbles and boulders and contained occasional fragments of plastic, concrete, red brick, metal glass and plastic.* The full details of these deposits are recorded on the trial pit logs in Appendix 2.

COHESIVE DEPOSITS: Cohesive deposits were encountered beneath the Fill or Made Ground and were described typically as *firm or stiff brown, grey or dark grey sandy gravelly CLAY with occasional cobbles and boulders*. The secondary sand and gravel constituents varied across the site and with depth, with granular lenses occasionally present in the glacial till matrix. The strength of the cohesive deposits typically increased with depth and was firm to stiff or stiff below 1.5m BGL in the majority of the exploratory holes with the exception of TP5 where it was noted as Firm to a depth of 3.1m BGL above rock. These deposits had some, occasional or frequent cobble and boulder content where noted on the exploratory hole logs.

GRANITE BEDROCK: In trial pits TP1 and TP2 weathered rock was encountered which was digable with the JCB 3CX excavator to a depth of up to 0.8m below the top of the stratum. The trial pits were terminated upon encountering the more competent bedrock, in which further excavation became more difficult. This material was recovered typically as angular gravel and cobbles of Granite however there was some variability in the fracture spacing and the ease at which the excavator could progress. Some clay and sand were also present with the rock mass either from weathering or as infilling to fractures which were opened upon excavation.

The rotary core boreholes recovered Granite Bedrock in each of the boreholes at depths of 1.5m to 5.5m BGL. The depth to rock varies from 1.5m BGL (79.8m OD) in BH04 and BH06 in the central portion of the site and is deeper towards the north eastern portion of the site to a maximum depth of 4.7m BGL (75.6m OD) in BH10. The total core recovery is good in the granite bedrock, typically 100% with some of the uppermost runs dropping to 80 or 90%. The SCR and RQD both are relatively poor in the upper weathered zone, often recovered as non-intact, however both indices show an increase with depth in each of the boreholes. The strength of the stratum varies from Extremely weak to Very Strong as noted on the logs with some portions of the core recovered as non-intact. The weathering is noted on the core logs and is typically distinctly weathered to partially weathered with occasional zones of where the granite was unweathered.

4.2. Groundwater

Groundwater strikes are noted on the exploratory hole logs where they occurred and where possible drilling was suspended for twenty minutes to allow the subsequent rise in groundwater to be recorded. We would point out that these exploratory holes did not remain open for sufficiently long periods of time to establish the hydrogeological regime and groundwater levels would be expected to vary with the tide, time of year, rainfall, nearby construction and other factors. For this reason, standpipes were installed in BH01, BH02, BH06, BH09 and BH10 to allow the equilibrium groundwater level to be determined.
The groundwater levels vary from a maximum of 0.7m BGL (79.45m OD) in RC09 to 4.0m BGL (78.45m OD) in RC02. The groundwater level was not apparent in the trial pits due to the short duration of the excavation and the impermeable nature of the cohesive deposits. The deeper response zone of the standpipes installed in the underlying bedrock present the readings from the aquifer within the bedrock and is likely to be confined by the boulder Clay present. The trial pits where weathered rock was encountered typically terminated above the elevations where groundwater was encountered in the standpipes. The groundwater monitoring is included in Appendix 6 of this Report.

4.3. Laboratory Testing

The pH and sulphate testing carried out indicate that pH results are near neutral and that the water soluble sulphate results is low when compared to the guideline values from BRE Special Digest 1:2005. The samples tested classify the soil as a Design Sulphate Level DS-1. The pH of the Made Ground in TP03 is above the normal range for the overburden at 10.65 and 10.74 at 0.0-1.0m and 2.0-3.1m BGL respectively.
The rock testing carried out on samples recovered from the boreholes reported Unconfined Compressive Strength (UCS) values ranging between 10.5 and 60.8 MPa while the point load testing gave Is50 values ranging between 0.17 to 1.99 MPa. The Is_{50} results correlate to the UCS values using a factor of approximately 20, giving values of 3.4 MPa and 39.8 MPa. These results correlate to the strength descriptions ranging between of Extremely Weak to Strong and confirming the variability of this stratum and the descriptions on the logs. The average of the UCS testing and associated correlated values from the point loading suggest the rock is typically on the border of weak to medium strong.

A number of samples were analysed for a suite of parameters which allows for the assessment of the sampled material in terms of total pollutant content for classification of materials as *hazardous* or *non-hazardous*. The suite also allows for the assessment of the sampled material in terms of suitability for placement at licenced landfills (inert, stable non-reactive, hazardous etc.). The parameter list for the suite includes analysis of the solid samples for arsenic, barium, cadmium, chromium, copper, cyanide, lead, nickel, mercury, zinc, speciated aliphatic and aromatic petroleum hydrocarbons, pH, sulphate, sulphide, moisture content, soil organic matter and an asbestos screen.
The suite also includes those parameters specified in the EU Council Decision establishing criteria for the acceptance of waste at Landfills (Council Decision 2003/33/EC), which for the solid samples are total organic carbon (TOC), speciated aliphatic and aromatic petroleum hydrocarbons, BTEX, phenol, polychlorinated biphenyls (PCB) and PAH.

As part of the suite a leachate is generated from the solid sample which is analysed for antimony, arsenic, barium, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium, zinc, chloride, fluoride, soluble sulphate, sulphide, phenols, dissolved organic carbon (DOC) and total dissolved solids (TDS).

While the laboratory report provides a comparison with the waste acceptance criteria limits it does not provide a waste classification of the material sampled. The possibility for contamination, not revealed by the testing undertaken should be borne in mind particularly where Made Ground deposits are present or the previous site use or location indicate a risk of environmental variation. The waste classification report is included under the cover of a sperate report by Ground Investigations Ireland.

The full laboratory report, which includes a section highlighting the waste acceptance criteria, is included in Appendix 5.

5.0 Geotechnical Design Parameters

5.1. General

The recommendations given and opinions expressed in this report are based on the findings as detailed in the exploratory hole records. Where an opinion is expressed on the material between exploratory hole locations, this is for guidance only and no liability can be accepted for its accuracy. No responsibility can be accepted for conditions which have not been revealed by the exploratory holes. Limited information has been provided at the ground investigation stage and any designs based on the recommendations or conclusions should be completed in accordance with the current design codes, taking into account the variation and the specific details contained within the exploratory hole logs.

5.2. Geotechnical Design Parameters

Preliminary geotechnical design parameters for the materials encountered during the ground investigation have been summarised in Table 1 Geotechnical Design Parameters. Both laboratory test and SPT N results, using standard empirical relationships, have been used to determine the geotechnical parameters of the overburden strata.

Shear strength parameters have been determined using laboratory testing and established empirical relationships for the relevant materials. Based on the relationship published by Stroud, the correlation of $Cu = f_1 \times N$ is used to estimate the undrained shear strength of the cohesive deposits, where f1 is determined using a correlation with the plasticity index.

The shear strength parameters from the granular stratum are provided using the effective shear strength parameters determined from the uncorrected SPT N values after Peck et al reported by Tomlinson Foundation Design and Construction 7th Ed. (2001).

A range is provided for the compressibility parameter mv based on correlations with the SPT N value based on the relationship published by Stroud, the correlation of $M_v = 1/(f_2 \times N)$ where f_2 is determined using a correlation with the plasticity index.

Table 1 Recommended Geotechnical Parameters based on GII GI Data

Stratum	Bulk Density (kN/m^3)	DPH Blow count	SPT 'N' Correlated	Undrained Shear Strength C_u (kN/m^2)	Effective Strength Parameters		Poisson's Ratio v (v_u)	Co-efficient of Compressibility
					Cohesion c' (kN/m^2)	ϕ' degrees		m_v (m^2/MN)
Granular Made Ground Deposits	18 – 22[*1]	1 – 10	1 - 20	n/a	-	28 – 30[*4]	0.1 – 0.3	n/a
Cohesive Made Ground Deposits	16 – 20[*1]	1 – 10	1 - 20	5 – 100[*2]	0	25 - 30[*4]	0.2 (0.5)	0.1-1.5[*3]
Soft Cohesive Deposits	16 – 20[*1]	1 - 3	1 - 8	5 - 40[*2]	0 - 1	25 - 28[*4]	0.2 (0.5)	0.1 – 1.5[*3]
Firm Cohesive Deposits	18 – 20[1]	4 – 7.5	8 – 15	40 - 75[*2]	0 - 3	28 – 30[*4]	0.2 (0.5)	0.1 – 0.3[*3]
Stiff Cohesive Deposits	20 – 22[*1]	7.5 - 25	15 - 50	75 - 150[*2]	0 - 5	28 - 33[*4]	0.2 (0.5)	0.05 – 0.1[*3]
Loose Granular Deposits[1]	16 – 18[*1]	1 - 5	1 - 10	n/a	n/a	28 – 30 [*4]	0.1 – 0.3	n/a
Medium Dense Granular Deposits[1]	18 – 21[*1]	5 - 15	10 - 30	n/a	n/a	30 – 36 [*4]	0.1 – 0.3	n/a
Dense Granular Deposits	20 – 23[*1]	15 - 25+	30 – 50+	n/a	n/a	35 – 40 [*4]	0.1 – 0.3	n/a

*1 Values for bulk density assumed

*2 Based on correlated SPT N values

*3 Based on correlated SPT N values and published data. Caution should be exercised when selecting design values for the variable Made Ground Stratum.

*4 Testing on undisturbed samples is recommended to determine the design value of this parameter for detailed design.

NOTE: The values in Table 1 represent a range of recommended values based on the typical soil types, insitu testing and laboratory testing scheduled by the Consulting Engineer. The values presented are recommended for outline guidance only and specific designs should derive design values based on the exploratory hole logs and lab testing for each specific site. To determine specific design values relevant to the design being undertaken in a particular area, reference should be made to the relevant specific exploratory hole logs. Further testing is recommended to determine the specific geotechnical parameters required for foundation design and temporary works design.

6.0 Recommendations & Conclusions

6.1. General

The recommendations given and opinions expressed in this report are based on the findings as detailed in the exploratory hole records. Where an opinion is expressed on the material between exploratory hole locations, this is for guidance only and no liability can be accepted for its accuracy. No responsibility can be accepted for conditions which have not been revealed by the exploratory holes. Limited information has been provided at the ground investigation stage and any designs based on the recommendations or conclusions should be completed in accordance with the current design codes, taking into account the variation and the specific details contained within the exploratory hole logs.

6.2. Foundations

Where shallow foundations are proposed on the stiff cohesive deposits, an allowable bearing capacity of 125 kN/m^2 is recommended with the exception of TP05 where 70 kN/m^2 is recommended for the firm cohesive deposits present to a depth of 3.1m BGL at this location.
An allowable bearing capacity of 500 kN/m^2 is recommended for conventional strip or pad foundations on the weathered Granite stratum where present at suitable depths for the proposed building.
An allowable bearing capacity of 1000 kN/m^2 is recommended for conventional strip or pad foundations on the intact Granite stratum where present at suitable depths for the proposed building, in the vicinity of BH07 and BH08 where the extremely weak to weak strength descriptions on the logs have been confirmed by the UCS and point load testing.
Elsewhere an allowable bearing capacity of 2000 kN/m^2 is recommended for conventional strip or pad foundations on the intact weak to medium strong Granite stratum where present at suitable depths. Any loose or weathered material should be excavated and removed with an excavator. Where a 13T excavator is unable to dig or easily remove the weathered granite, this is proposed as the suitable formation, subject to confirmation by inspection by the designer's representative. It should be noted that up to 0.9m of the weathered granite was excavated during the trial pitting completed with a JCB and 8T tracked excavator.

Where the rock is deeper in the northern portion of the site (BH09 and BH10 at 2.8m BGL (77.35m OD) and 4.7m BGL (75.6m OD) respectively), lean mix concrete or piles are recommended to bring the foundations to the same stratum as the southern portion. This would avoid problems with differential settlement should the foundations bear on strata of differing stiffness. The type, size and depth of the pile foundations should be confirmed by a specialist piling contractor based on the loading from the proposed building. The floor slab is recommended be suspended and also supported on the building piles.

In any part of the site, should part of the foundation bear on differing strata consisting of either cohesive, granular or bedrock units, we would recommend that all the foundations of the structure in question be lowered to the competent deeper stratum.

The possibility for variation in the depth of the cohesive or bedrock deposits in the vicinity of these foundations should be considered and foundation inspections should be carried out. Any soft spots encountered at the proposed foundation depths should be excavated and replaced with lean mix concrete.
A ground bearing floor slab is recommended to be based on the firm cohesive deposits with an appropriate depth of compacted hardcore specified by the consulting engineer and in accordance with the limits and guidelines in SR21:2014+A1:2016 and/or NRA SRW CL808 Type E granular stone fill.
The pH and sulphate testing completed on samples recovered from the trial pits indicates the pH results are near neutral and the sulphate results are low, when compared to the guideline values from BRE Special Digest 1:2005. No special precautions are required for concrete foundations to prevent sulphate attack, however the Made Ground in TP03 has a high pH and should be removed and replaced with a well compacted granular fill.

6.3. Excavations

Excavations in the Made Ground will require to be appropriately battered or the sides supported due to the low strength of these deposits. Short term temporary excavations in the cohesive deposits will remain stable for a limited time only and will require to be appropriately battered or the sides supported if the excavation is below 1.25m BGL or is required to permit man entry. The groundwater and stability noted on the trial pit logs should be consulted when determining the most appropriate construction methods for excavations.
The groundwater monitoring undertaken indicates the water level is between 0.7m and 3.65m BGL in the boreholes where the standpipes were installed. Generally, where significant excavations are required in water bearing granular deposits a cut-off wall may be more cost effective than extensive dewatering. The proposed basement excavation will require dewatering during construction, particularly where granular lenses are present or where the fractures in the granite bedrock are closely spaced or was recovered as non-intact. An assessment by a specialist dewatering contractor is recommended to determine the most cost effective approach to the proposed excavation.
Excavations in the Made Ground Deposits will require to be appropriately battered or the sides supported due to the low strength of these deposits.
A temporary batter of 2(H):1(V) is recommended in the Made Ground and firm brown cohesive deposits. A steeper batter of 1(H):1(V) is possible in the very stiff black cohesive deposits for excavations of a duration of less than six months, subject to regular inspection. Any seepage from the slope should be addressed with the installation of drainage and a reduction in the batter to maintain face stability. The high groundwater levels, the seepage and instability noted in the trial pits suggest that the construction of steep slopes below a depth of 1.2m to 1.5m may be problematic.
Where the existing road is adjacent to the proposed excavation, a batter of 2(H):1(V) is recommended with a minimum set back of 2m from the edge of the slope to any footpath or carriageway for the entire slope depth. A global stability check would be required to demonstrate the stability of the slope where loading is imposed from any walkways, traffic or plant. A kingpost or piled retaining wall may be more appropriate solutions for the temporary retention of the excavation sides where traffic, loading or space constraints are expected. Any battered slopes should be covered to prevent erosion and to protect from moisture ingress.

The groundwater and stability noted on the trial pit logs should be consulted when determining the most appropriate construction methods for excavations.

Excavations in the upper cohesive and weathered rock deposits are expected to be excavatable with conventional excavation equipment, with zones of more intact bedrock below this depth requiring rock breaking techniques. Based on the fracture spacing, the rock strength descriptions and Pettifer & Fookes (1994) Revised Excavatability Graph, the Granite ranges from hard digging to extremely hard ripping with hydraulic breaking (D9), however the zones recovered as non-intact should be easy to hard digging with a CAT345. The JCB excavator was able to excavate to depth of 0.4m to 0.8m below the top of the weathered rock in TP01 and TP02 only. Due to the depth at which the stratum was encountered, the excavator was unable to progress once the granite was encountered as it became difficult to excavate within the confines of the trial pit on encountering this stratum.
Material excavated from the site, if required to be disposed of off-site should be assessed using the environmental testing completed during the ground investigation. This testing is interpreted using the criteria established by the EPA for the classification as waste and is reported under the cover of a separate Waste Classification Report and dig plan by Ground Investigations Ireland.

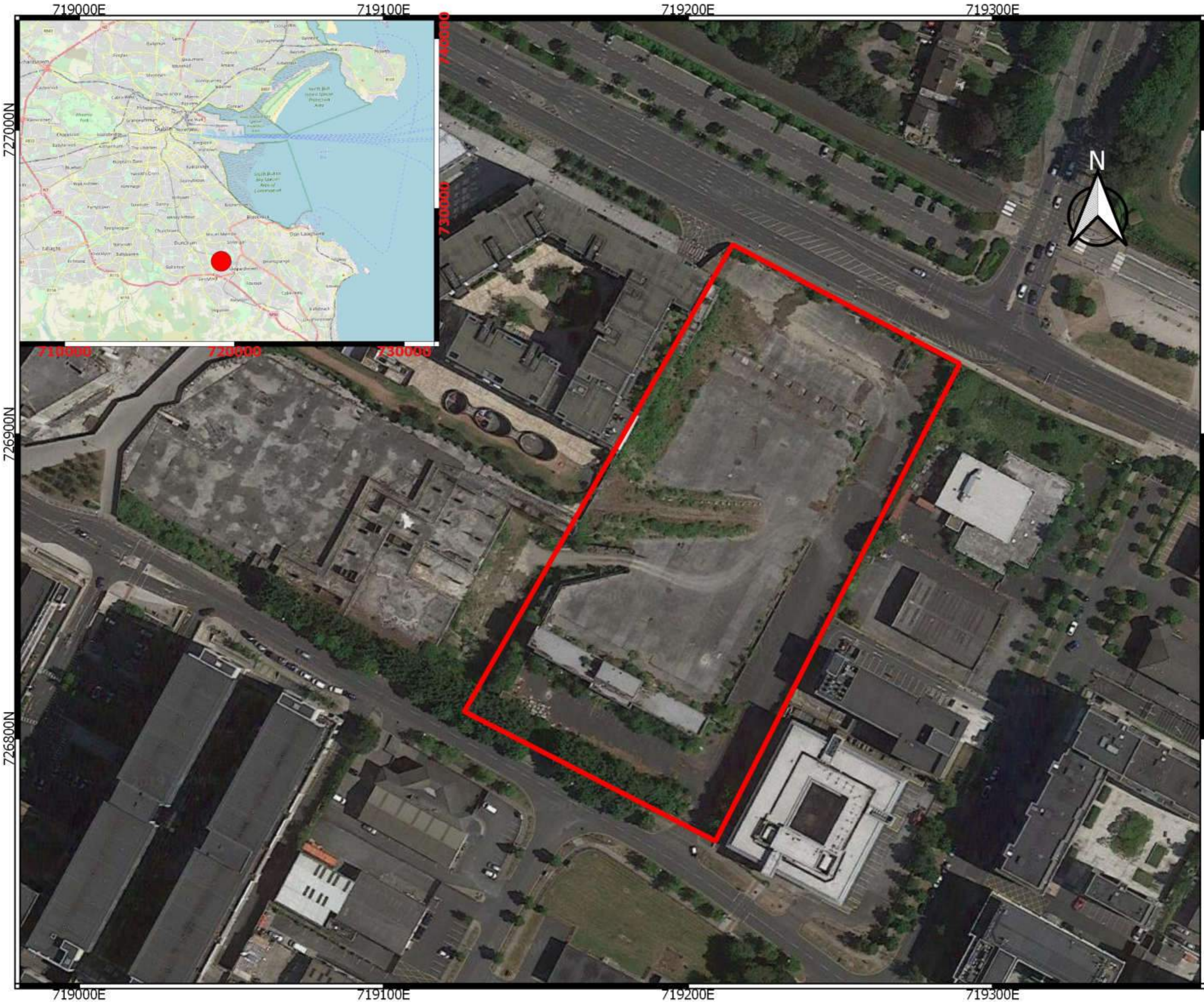
6.4. Soakaway Design

An Infiltration rate of $f=2.34 \times 10^{-5}$ m/s was calculated for the soakaway locations SA01 for the design and construction of a soakaway. At the location of SA02 the water level dropped too slowly to allow calculation of ‘f’ the soil infiltration rate. This location is therefore not recommended as suitable for soakaway design and construction.

The recommended SOIL type is S4 or 4 for the natural cohesive soils below the surfacing and made ground on the proposed site based on Table 4.5 from the Flood Studies Report. This is also confirmed by the approach advocated by the TII Publication DN-DNG-03064 Table 5/1 (adapted from the Agricultural Development and Advisory Service, ADAS).

The recommendations provided in this report should be verified in the design of the proposed buildings, using the full details of the loading conditions and taking into consideration the allowable tolerable settlements/movements that the building can accommodate. The founding strata should be inspected and verified by a suitably qualified engineer prior to construction of the building foundations.

APPENDIX 1 - Site Location Plan



Site Location

Site Boundary

Client:

Richmond Homes

Project Code:

8408-01-19

Project Title:

Sandyford Central

Drawing Title:

Figure 1 Site Location

GROUND INVESTIGATIONS IRELAND

Ground Investigations Ireland Ltd.
Catherinstown House,
Hazelhatch Road,
Newcastle, Co. Dublin
www.gii.ie 01-6015175/5176

0 10 20 30 40 50 60 m

Drawn By:	Date:
BS	27/03/2019

GROUND INVESTIGATIONS IRELAND

Ground Investigations Ireland Ltd.
Catherinstown House,
Hazelhatch Road,
Newcastle, Co. Dublin
www.gii.ie 01-6015175/5176

Client:

Richmond Homes

0 10 20 30 40 m

Project Title:
Sandyford Central

Drawing Title: Figure 2
SI Locations

GII Project Reference:
8459-02-19

Drawn By:
BS

Date:
27/03/2019

Site Boundary
Infiltration Test
Trial Pit
Borehole

APPENDIX 2 – Trial Pit Records

Ground Investigations Ireland Ltd www.gii.ie	Site: Sandyford Central	Trial Pit Number: TP01

Machine : 3CX JCB Method : Trial pit	Dimensions: 3.50m x 0.60m	Ground Level (mOD): 82.04	Client: Richmond Homes	Job Number: 8408-01-19
	Location (dGPS): 719234.4 E 726829.9 N	Dates: 19/02/2019	Project Contractor: Ground investigations Ireland Ltd	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.18)	Tarmacadam		
				81.86	0.18 (0.42)	MADE GROUND: Grey slightly sandy slightly clayey angular to sub-rounded fine to coarse GRAVEL		
0.60-1.60 0.80	EN B			81.44	0.60 (1.00)	Stiff brown mottled grey slightly sandy gravelly CLAY with some sub-angular to sub-rounded cobbles		
				80.44	1.60 (0.20)	Stiff light brown slightly sandy gravelly CLAY with some sub-angular to sub-rounded cobbles		
				80.24	1.80 (0.50)	Weathered Granite: Light brown sandy clayey angular to sub-angular fine to coarse GRAVEL with many angular to sub-angular cobbles		
				79.74	2.30	Obstruction due to Rock Complete at 2.30m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled on completion

Scale (approx)	Logged By	Figure No.
1:25	NM	8408-01-19.TP01

Ground Investigations Ireland Ltd
www.gii.ie

Machine : 3CX JCB **Method :** Trial pit	**Dimensions** 2.60m x. 0.60m	**Ground Level (mOD)** 81.39	**Client** Richmond Homes	**Job Number** 8408-01-19
	Location (dGPS) 719213.9 E 726862.5 N	**Dates** 19/02/2019-19/03/2019	**Project Contractor** Ground investigations Ireland Ltd	**Sheet** 1/1

Site: Sandyford Central
Trial Pit Number: TP02

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.23)	Reinforced Concrete.		
				81.16	0.23	MADE GROUND: Dark grey slightly sandy slightly clayey fine to medium angular to sub-angular GRAVEL		
0.60-1.00	EN				(0.77)			
0.90	B							
				80.39	1.00	Firm brown sandy very gravelly CLAY with many angular to sub-angular cobbles and boulders		
1.00-2.10	EN				(0.30)			
				80.09	1.30	Weathered Granite: Light brown sandy clayey fine to coarse angular to sub-angular GRAVEL with many angular to sub-angular cobbles and boulders		
1.50	B				(0.80)			
				79.29	2.10	Obstruction due to Rock Complete at 2.10m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled on completion

Scale (approx)	Logged By	Figure No.
1:25	NM	8408-01-19.TP02

Ground Investigations Ireland Ltd
www.gii.ie

Site: Sandyford Central			**Trial Pit Number**: TP03
Machine: 3CX JCB **Method**: Trial pit	**Dimensions**: 3.10m x 0.60m	**Ground Level (mOD)**: 81.40	**Client**: Richmond Homes — **Job Number**: 8408-01-19
	Location (dGPS): 719194.8 E 726911.2 N	**Dates**: 19/02/2019	**Project Contractor**: Ground investigations Ireland Ltd — **Sheet**: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-1.00	EN					MADE GROUND: Light brown grey slightly sand very gravelly CLAY with rebar, plastic, cloth and redbrick fragments with many some sub-angular to sub-rounded cobbles and boulders with grass rootlets.		
0.50	B				(1.00)			
1.00-2.00	EN			80.40	1.00	MADE GROUND: Brown grey slightly sandy very gravelly CLAY with many rebar, redbrick, cloth and plastic fragments with some sub-angular to sub-rounded boulders of tarmacadam and concrete.		
1.50	B				(1.40)			
2.00-3.10	EN							
2.50	B			79.00	2.40	MADE GROUND: Light brown slightly sandy very clayey angular to sub-rounded fine to coarse GRAVEL with many angular to sub-angular cobbles and boulders with old metal concrete fragments and plastic.		
					(0.70)			
				78.30	3.10	Obstruction due to Rock or Boulder Complete at 3.10m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled on completion

Scale (approx)	Logged By	Figure No.
1:25	NM	8408-01-19.TP03

Ground Investigations Ireland Ltd
www.gii.ie

Machine : 3CX JCB **Method :** Trial Pit	**Dimensions** 4.00m x 1.00m	**Ground Level (mOD)** 81.14	**Client** Richmond Homes	**Job Number** 8408-01-19
	Location (dGPS) 719242.9 E 726864.2 N	**Dates** 19/03/2019	**Project Contractor** Ground investigations Ireland Ltd	**Sheet** 1/1

Site: Sandyford Central

Trial Pit Number: TP04

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.18)	Tarmacadam		
				80.96	0.18 (0.27)	MADE GROUND: Grey slightly sandy slightly gravelly angular to sub-angular fine to medium GRAVEL.		
0.45-0.90 0.50	EN B			80.69	0.45 (0.45)	MADE GROUND: Grey/brown slightly sandy clayey angular to sub-angular fine to course GRAVEL with some sub-angular to sub-rounded cobbles.		
0.90-2.00 1.20	EN B			80.24	0.90 (0.40)	Stiff brown mottled grey slightly sandy gravelly CLAY		
1.50	B			79.84	1.30 (0.50)	Stiff dark grey slightly sandy gravelly CLAY with some sub-angular to sub-rounded cobbles.		
2.30	B			79.34	1.80 (0.60)	Stiff light brown slightly sandy very gravelly CLAY with many sub-angular to sub-rounded cobbles.		
				78.74	2.40	Obstruction due to Rock.		

Complete at 2.40m

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled on completion

Scale (approx)	Logged By	Figure No.
1:25	NM	8408-01-19.TP04

Ground Investigations Ireland Ltd www.gii.ie	Site: Sandyford Central	Trial Pit Number: TP05
Machine: 3CX JCB **Method**: Trial Pit	**Dimensions**: 3.50m x 0.60m **Ground Level (mOD)**: 80.14 **Client**: Richmond Homes	**Job Number**: 8408-01-19
	Location (dGPS): 719262.4 E 726902.8 N **Dates**: 19/02/2019 **Project Contractor**: Ground investigations Ireland Ltd	**Sheet**: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.25)	Reinforced Concrete		
				79.89	0.25 (0.10)	MADE GROUND: Grey slightly sandy slightly gravelly angular to sub-angular fine to coarse GRAVEL		
0.35-1.20	EN			79.79	0.35 (0.65)	MADE GROUND: Grey slightly sandy very gravelly CLAY with rare wood fragments occasional cobbles and sandy lenses		
0.50	B							
1.20-2.00	EN			79.14	1.00 (1.10)	Firm grey slightly sandy slightly gravelly CLAY with some sub-angular to sub-rounded cobbles		
1.30	B							
2.00-2.20	EN							
2.20	B			78.04	2.10 (1.00)	Firm grey slightly sandy slightly gravelly CLAY with many sub-angular to sub-rounded cobbles		
				77.04	3.10	Obstruction due to boulder. Complete at 3.10m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled on completion

Scale (approx)	Logged By	Figure No.
1:25	NM	8408-01-19.TP05

Ground Investigations Ireland Ltd www.gii.ie	Site Sandyford Central	Trial Pit Number **TP06**

Machine : 3CX JCB Method :	Dimensions 4.00m x 0.60m	Ground Level (mOD) 79.99	Client Richmond Homes	Job Number 8408-01-19
	Location (dGPS) 719242.6 E 726924.6 N	Dates 01/03/2019	Project Contractor Ground investigations Ireland Ltd	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.28)	Reinforced Concrete		
				79.71	0.28 (0.17)	MADE GROUND: Brown grey slightly sandy slightly clayey angular to sub-angular fine to coarse GRAVEL		
				79.54	0.45 (0.35)	MADE GROUND: Brown slightly sandy clayey angular to sub-angular fine to coarse GRAVEL with many angular to sub-angular cobbles		
0.80-1.00 1.00 1.00-2.00	EN B EN			79.19	0.80 (0.40)	Firm brown slightly sandy gravelly CLAY with some sub-angular to sub-rounded cobbles		
1.50 2.00-2.40	B EN			78.79	1.20 (1.20)	Stiff dark grey slightly sandy slightly gravelly CLAY with some sub-angular to sub-rounded cobbles		
2.40	B			77.59	2.40	Obstruction due to Boulder Complete at 2.40m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled on completion

Scale (approx)	Logged By	Figure No.
1:25	NM	8408-01-19.TP06

Sandyford Central -Richmond Homes

8408-01-19

TP-01

TP-01

TP-01

TP-02

TP-02

TP-02

TP-03

TP-03

TP-03

TP-04

TP-04

TP-04

TP-05

TP-05

TP-05

TP-06

TP-06

TP06

SA01

SA01

SA01

SA02

SA02

SA02

APPENDIX 3 – Soakaway Records

Ground Investigations Ireland Ltd www.gii.ie			Site: Sandyford Central	Trial Pit Number: SA01
Machine : 3CX JCB Method : Trial pit	Dimensions: 1.90m x 0.60m	Ground Level (mOD): 81.36	Client: Richmond Homes	Job Number: 8408-01-19
	Location (dGPS): 719157.3 E 726841.5 N	Dates: 20/02/2019	Project Contractor: Ground investigations Ireland Ltd	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.15)	Reinforced Concrete with DPM		
				81.21	0.15			
					(0.35)	MADE GROUND: Dark grey angular to sub-angular fine to coarse GRAVEL		
				80.86	0.50			
					(0.90)	Weathered Granite: Light brown slightly clayey sandy angular to sub-angular fine to coarse GRAVEL with angular to sub-angular cobbles		
				79.96	1.40	Obstruction due to gRANITE		
						Complete at 1.40m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled on completion

Scale (approx)	Logged By	Figure No.
1:25	NM	8408-01-19.SA01

Ground Investigations Ireland Ltd
www.gii.ie

Site: Sandyford Central			**Trial Pit Number**: SA02
Machine: 3CX JCB **Method**: Trial pit	**Dimensions**: 2.00m x 0.60m	**Ground Level (mOD)**: 80.37	**Client**: Richmond Homes
	Location (dGPS): 719271.9 E 726894.6 N	**Dates**: 20/02/2019	**Project Contractor**: Ground investigations Ireland Ltd

Job Number: 8408-01-19 — **Sheet**: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.22)	Reinforced Concrete		
				80.15	0.22 (0.28)	MADE GROUND: Dark grey slightly sandy slightly clayey angular to sub-angular fine to coarse GRAVEL		
0.50-1.00	EN			79.87	0.50 (0.30)	Soft to firm brown slightly sandy gravelly CLAY with rootlets		
1.00 1.00-1.80	B EN			79.57	0.80 (0.80)	Firm brown slightly sandy gravelly CLAY		
				78.77	1.60 (0.20)	Firm dark grey slightly sandy gravelly CLAY		
				78.57	1.80	Complete at 1.80m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled on completion

Scale (approx)	Logged By	Figure No.
1:25	NM	8408-01-19.SA02

SA01

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 1.90m x 0.60m 1.10m (L x W x D)

Date	Time	Water level (m bgl)
20/03/2019	0	-0.400
20/03/2019	3	-0.450
20/03/2019	8	-0.500
20/03/2019	18	-0.570
20/03/2019	26	-0.600
20/03/2019	50	-0.760
20/03/2019	76	-0.860
20/03/2019	116	-1.000
20/03/2019	135	-1.100

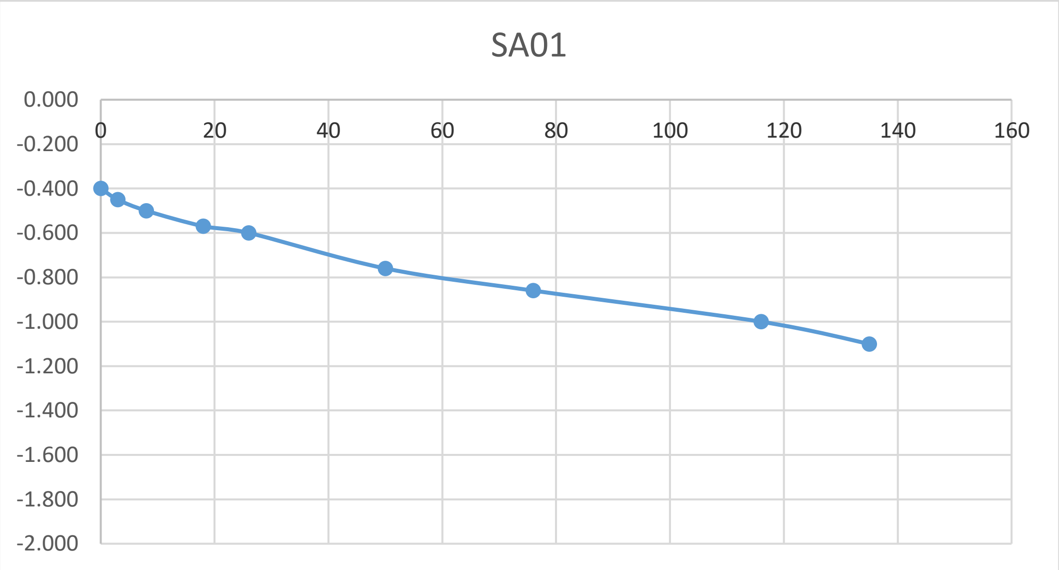
Start depth	Depth of Pit	Diff	75% full	25%full
0.40	1.100	0.700	0.575	0.925

Length of pit (m)	Width of pit (m)	75-25Ht (m)	Vp75-25 (m3)
1.900	0.600	0.350	0.40

Tp75-25 (from graph) (s) **5900**

50% Eff Depth	ap50 (m2)
0.350	2.89

f = 2.340E-05 m/s



SA02

Soakaway Test to BRE Digest 365

Trial Pit Dimensions: 2.00m x 0.60m 1.80m (L x W x D)

Date	Time	Water level (m bgl)
20/03/2019	0	-0.800
20/03/2019	15	-0.820
20/03/2019	40	-0.840
20/03/2019	81	-0.840
20/03/2019	124	-0.860
20/03/2019	190	-0.870
20/03/2019	215	-0.870
20/03/2019	253	-0.870

***Soakaway failed**

Start depth	Depth of Pit	Diff	75% full	25%full
0.80	**1.800**	**1.000**	**1.05**	**1.55**

APPENDIX 4 - Rotary Borehole Records

Ground Investigations Ireland Ltd

www.gii.ie

Machine : Beretta T46 **Flush :** water **Core Dia :** 68 mm **Method :** Rotary Cored	**Casing Diameter** 100mm cased to 8.40m	**Ground Level (mOD)** 82.20	**Site** Sandyford Central	**Borehole Number** **BH01**
			Client Richmond Homes	**Job Number** 8408-01-19
	Location 719153.4 E 726805.3 N	**Dates** 08/03/2019	**Project Contractor** Ground investigations Ireland Ltd	**Sheet** 1/1

Depth (m)	TCR	SCR	RQD	FI	Field Records
0.00 – 2.40	42				
2.40 – 3.90	92				
3.90 – 4.60	100	19	0	12 (3.45 – 4.60)	
4.60 – 5.40	100	0	0	10	
5.40 – 6.90	100	37	13	N.I (5.40 – 6.50)	
6.90 – 7.40	100	68	48	11 (6.50 – 7.90)	
7.40 – 8.40	100	50	35	N.I (7.90 – 8.40)	

Level (mOD)	Depth (m) (Thickness)	Description
82.10	0.10	Tarmacadam.
80.40	1.80 (1.70)	Driller notes: Dark brown sandy gravelly CLAY. Returns of sub-rounded to sub-angular gravel.
79.80	2.40 (0.60)	Driller notes: Boulder. Returns of granite boulder
78.75	3.45 (1.05)	Driller notes: Brown clay with rare cobbles Returns of stiff dark brown grey slightly sandy gravelly CLAY.
77.60	4.60 (1.15)	Weak to medium strong pinkish orange white coarsely crystalline GRANITE. Distinctly weathered. 3.45-4.60m - Two fracture sets. F1: very close to close spaced, 10-30 degrees, stepped rough, tight to open, stained brown, clay smearing. F2: closely spaced, 70-90 degrees, stepped rough, tight to open, stained brown, clay smearing.
75.30	6.90 (2.30)	Weak pinkish white coarsely crystalline GRANITE. Distinctly weathered. 4.60-5.40m - Two fracture set. F1: very close spaced, 80-90 degrees, stepped rough, tight to open with some clay smearing. F2: Very close to close 10-30 degrees undulating smooth tight to open with staining. 5.40-6.50m - Predominately non intact. Indicating two fracture sets of 10-30 degrees and 60-80 degrees.
73.80	8.40 (1.50)	Strong white coarsely crystalline GRANITE. Partially weathered. 6.50-7.90m - Two fracture sets. F1: closely spaced, 10-30 degrees, stepped rough, tight to open with some clay smearing and quartz sand. F2: close to medium spaced, 50-70 degrees, stepped rough, tight to open with some clay smearing. 7.90-8.20m - Mostly non intact
		Complete at 8.40m

Remarks
No groundwater encountered.
50mm slotted standpipe installed from 8.40m to 1.00m with pea gravel surround, plain pipe installed from 1.00m to ground level with bentonite seal and flush cover.
Borehole backfilled on completion.

Scale (approx)	Logged By
1:50	NM

Figure No. 8408-01-19.BH01

Ground Investigations Ireland Ltd www.gii.ie			Site: Sandyford Central	Borehole Number: BH02
Machine : Beretta T46; Flush : water; Core Dia : 68 mm; Method : Rotary Cored	Casing Diameter: 100mm cased to 10.60m	Ground Level (mOD): 82.45	Client: Richmond Homes	Job Number: 8408-01-19
	Location: 719228.8 E 726817.8 N	Dates: 26/02/2019	Project Contractor: Ground investigations Ireland Ltd	Sheet: 1/2

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00	21					82.30	(0.15) 0.15	Tarmacadam.			
								Driller notes: Dark grey slightly sandy gravelly CLAY. Returns of sub-rounded to sub-angular gravel and cobbles.			
1.50 1.50-1.55	16				25/50 SPT(C) 25*/50 50/0						
2.50 2.50-2.55	17				25/50 SPT(C) 25*/50 50/0		(5.35)				
4.00 4.00-4.05	13				25/50 SPT(C) 25*/50 50/0						
5.50 5.50-5.50	100	73	73		25/50 SPT(C) 25*/0 50/0	76.95	5.50	Medium strong to strong orangish white coarsely crystalline GRANITE partially weathered			
6.60	100	11	11	6			(2.60)	5.50-8.10m - Three fracture sets. F1: close to wide spaced, 0-20 degrees, stepped rough, tight to open, stained brown. F2: close to medium spaced, 70-80 degrees, planar smooth to rough, tight to open stained black. F3: wide spaced 80-90 degrees, planar smooth to rough, tight to open stained brown.			
8.10	100	93	65	6		74.35	8.10	Strong greyish white coarsely crystalline GRANITE unweathered to partially weathered.			
							(2.50)	8.10-10.60m - Two fracture sets. F1: close to medium spaced, 10-30 degrees, stepped rough, tight to open, stained brown with some clay smearing. F2: close to medium spaced, 70-80 degrees, planar rough, tight to open stained brown.			
9.60											

Remarks
No groundwater encountered.
50mm slotted standpipe installed from 10.00m to 1.00m with pea gravel surround, plain pipe installed from 1.00m to ground level with bentonite seal and flush cover.
Borehole backfilled on completion.

Scale (approx)	Logged By
1:50	NM

Figure No. 8408-01-19.BH02

Ground Investigations Ireland Ltd www.gii.ie	Site: Sandyford Central	Borehole Number: BH02

Machine : Beretta T46 Flush : water Core Dia : 68 mm Method : Rotary Cored	Casing Diameter: 100mm cased to 10.60m	Ground Level (mOD): 82.45	Client: Richmond Homes	Job Number: 8408-01-19
	Location: 719228.8 E 726817.8 N	Dates: 26/02/2019	Project Contractor: Ground investigations Ireland Ltd	Sheet: 2/2

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
	100	62	62								
10.60						71.85	10.60	Complete at 10.60m			

Remarks

Scale (approx)	Logged By
1:50	NM

Figure No. 8408-01-19.BH02

Ground Investigations Ireland Ltd
www.gii.ie

Machine : Beretta T46 **Flush :** water **Core Dia :** 68 mm **Method :** Rotary Cored	**Casing Diameter** 100mm cased to 8.00m	**Ground Level (mOD)** 81.37	**Client** Richmond Homes	**Job Number** 8408-01-19
	Location 719188.9 E 726824.6 N	**Dates** 26/02/2019	**Project Contractor** Ground investigations Ireland Ltd	**Sheet** 1/1

Site: Sandyford Central
Borehole Number: BH03

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00	18					81.14	(0.23) 0.23	Reinforced concrete.		
							(2.27)	Driller notes: Brown slightly sandy slightly gravelly CLAY with cobbles and boulders. Returns of gravel to boulder sized fragments.		
1.50 1.50-1.55	57				25/50 SPT(C) 25*/50 50/0					
2.20 2.20-2.20 2.50					25/50 SPT(C) 25*/0 50/0	78.87	2.50			
				6			(1.30)	Weak to medium strong brownish white fine to coarse crystalline GRANITE with quartz veins distinctly weathered. 2.50-2.90m - One fracture sets. F1: very close to medium spaced, 10-30 degrees, stepped rough, tight to open, some clay smearing.		
2.90	75	41	39	10				2.90-3.80m - Two fracture sets. F1: closely spaced, 10-30 degrees, stepped rough, tight to open. F2: Very closely spaced 60-80 degrees, undulating rough, open, stained brown.		
3.80	98	92	85			77.57	3.80	Strong to weak orangish grey white coarsely crystalline GRANITE. Partially weathered. 3.80-6.10m - Two fracture sets. F1: close to medium spaced, 10-30 degrees, stepped rough, tight to open, stained orangish brown. F2: widely spaced, 80 degrees, undulating rough, open, stained brown.		
4.80 5.00	100	100	100	4			(2.30)			
	93	77	73							
6.10				6		75.27	6.10 (0.40)	Weak to medium strong brownish white fine to coarse crystalline GRANITE with quartz veins distinctly weathered. 6.10-6.55m - One fracture set. F1:very closely spaced, 0-30 degrees, stepped rough, tight to open, quartz sand smearing.		
6.50 6.55 6.80				N.I		74.87	6.50	Weak to medium strong orangish white fine to coarse crystalline GRANITE. Partially weathered. 6.55-6.80m - Non Intact.		
	100	67	53	8			(1.50)	6.80-8.00m - Two fracture sets. F1: closely spaced, 10-20 degrees, stepped rough, tight to open, stained brown. F2: very close to medium spaced, 60-80 degrees, stepped rough, tight to open, stained brown.		
8.00						73.37	8.00	Complete at 8.00m		

Remarks
No groundwater encountered.
No standpipe installed.
Borehole backfilled on completion.

Scale (approx)	Logged By
1:50	NM

Figure No.
8408-01-19.BH03

Ground Investigations Ireland Ltd www.gii.ie	Site: Sandyford Central	Borehole Number: BH04

Machine: Beretta T46 / Flush: water / Core Dia: 68 mm / Method: Rotary Cored	Casing Diameter: 100mm cased to 5.00m	Ground Level (mOD): 81.37	Client: Richmond Homes	Job Number: 8408-01-19
	Location: 719176.6 E 726849.9 N	Dates: 25/02/2019	Project Contractor: Ground investigations Ireland Ltd	Sheet: 1/1

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00						81.12	(0.25) 0.25	Reinforced concrete.		
	11						(1.25)	Driller notes: Dark grey slightly sandy gravelly CLAY with occasional sub-angular to sub-rounded cobbles. Returns of gravel sized fragments.		
1.50 1.50-1.55	100	34	20	N.I	25/50 SPT(C) 25*/50 50/0	79.87	1.50 (0.50)	Weak to medium strong orangish white coarsely crystalline GRANITE Distinctly weathered. 1.50-2.00m - Non Intact.		
2.00	100	87	73	7		79.37	2.00 (1.50)	Medium strong orangish grey white coarsely crystalline GRANITE. Partially weathered. 2.00-3.50m - Two fracture sets. F1: very close to medium spaced, 10-30 degrees, stepped rough, tight to open, clay smearing. F2: close to medium spaced, 60-80 degrees, stepped rough, tight to open, stained brown.		
3.50	100	98	92	6		77.87	3.50 (1.50)	Strong greyish white pink coarsely crystalline GRANITE with occasional quartz veins partially weathered. 3.50-5.00m - Two fracture sets. F1: very close to medium spaced, 10-30 degrees, stepped rough, tight to open, stained brown. F2: close to medium spaced, 50-70 degrees, stepped rough, tight to open, stained brown.		
5.00						76.37	5.00	Complete at 5.00m		

Remarks
No groundwater encountered.
No standpipe installed.
Borehole backfilled on completion.

Scale (approx)	Logged By
1:50	NM

Figure No. 8408-01-19.BH04

Ground Investigations Ireland Ltd
www.gii.ie

Site Sandyford Central				**Borehole Number** BH05
Machine : Beretta T46 **Flush :** water **Core Dia :** 68 mm **Method :** Rotary Cored	**Casing Diameter** 100mm cased to 7.00m	**Ground Level (mOD)** 81.23	**Client** Richmond Homes	**Job Number** 8408-01-19
	Location 719194.7 E 726906.4 N	**Dates** 28/02/2019	**Project Contractor** Ground investigations Ireland Ltd	**Sheet** 1/1

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00	50						(1.00)	Driller notes: Fill. Returns of angular gravel sized granite and quartz with angular cobbles of granite concrete and Mudstone.		
1.00 1.00-1.10	0				25/50 SPT(C) 25*/50 50/50	80.23	1.00 (1.50)	Returns of gravel to cobble sized fragments.		
2.50 2.50-2.50	100	20	20	8	25/50 SPT(C) 25*/0 50/0	78.73	2.50 (0.50)	Weak to medium strong orangish white coarsely crystalline GRANITE. Partially weathered. 2.50-3.00m - Two fracture sets. F1: closely spaced, 60-80 degrees, stepped rough, tight to open, stained brown. F2: close to medium spaced, 20-40 degrees, stepped rough, tight to open, stained brown.		
3.00	100	60	52	5		78.23	3.00 (1.50)	Strong orangish grey coarsely crystalline GRANITE. Partially weathered 3.00-6.00m - Three fracture sets. F1: close to medium spaced, 0-20 degrees, stepped rough, tight to open, stained brown, clay smearing. F2: close to medium spaced, 40-60 degrees, stepped rough, tight to open, stained brown with some quartz sand on fractures. F3: closely spaced, 70-80 degrees stepped rough, tight to open stained brown.		
4.50	94	55	55			76.73	4.50 (1.50)	Strong greyish whitish grey coarsely crystalline GRANITE with frequent quartz veins. Partially weathered		
6.00	100	100	100	3		75.23	6.00 (1.00)	Strong to very strong grey coarsely crystalline GRANITE. Partially weathered 6.00-7.00m - One fracture set. F1: close to medium spaced, 10-20 degrees, stepped rough, tight to open, stained brown.		
7.00						74.23	7.00	Complete at 7.00m		

Remarks
No groundwater encountered.
No standpipe installed.
Borehole backfilled on completion.

Scale (approx)	Logged By
1:50	NM

Figure No. 8408-01-19.BH05

Ground Investigations Ireland Ltd www.gii.ie	Site: Sandyford Central	Borehole Number: BH06

Machine : Beretta T46 Flush : water Core Dia : 68 mm Method : Rotary Cored	Casing Diameter: 100mm cased to 6.50m	Ground Level (mOD): 81.39	Client: Richmond Homes	Job Number: 8408-01-19
	Location: 719216 E 726863.8 N	Dates: 26/02/2019	Project Contractor: Ground investigations Ireland Ltd	Sheet: 1/1

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description
0.00	34					81.15	(0.24) 0.24	Reinforced concrete.
							(1.26)	Driller Notes: Dark grey slightly sandy gravelly CLAY with occasional cobbles.
0.75 0.75-0.85	59				25/50 SPT(C) 25*/50 50/50			
1.50 1.50-1.60	30			N.I	25/50 SPT(C) 25*/50 50/50	79.89	1.50 (0.70)	Extremely weak to weak orangish white coarsely crystalline GRANITE. Distinctly weathered. 1.50-2.20m - Non intact.
2.00 2.20	47	55	55	4		79.19	2.20	Medium strong to strong orangish pink grey coarsely crystalline GRANITE. Partially weathered to weathered. 2.20-2.70m - One fracture set. F1: closely spaced, 60-80 degrees, stepped rough, tight to open, some clay smearing.
2.70 2.93				N.I				2.70-2.93m - Non intact.
3.50	100	53	53	6			(4.30)	2.93-5.00m - Two fracture set. F1: closely spaced, 70-90 degrees, stepped rough, tight to open, stained dark brown. F2: Closely spaced 0-20 degrees, undulating rough, tight to open.
5.00	100	65	45	10				5.00-6.50m - Two fracture sets. F1: close to medium spaced, 80-90 degrees undulating rough, tight to open, stained brown. F2: close to medium spaced, 40-50 degrees, planar smooth to rough, stained brown.
6.50						74.89	6.50	Complete at 6.50m

Remarks
No groundwater encountered.
50mm slotted standpipe installed from 6.50m to 1.00m with pea gravel surround, plain pipe installed from 1.00m to ground level with bentonite seal and flush cover.
Borehole backfilled on completion.

Scale (approx): 1:50
Logged By: NM
Figure No.: 8408-01-19.BH06

Ground Investigations Ireland Ltd
www.gii.ie

Machine : Beretta T46 **Flush :** water **Core Dia :** 68 mm **Method :** Rotary Cored	**Casing Diameter** 100mm cased to 7.00m	**Ground Level (mOD)** 81.24	**Client** Richmond Homes	**Job Number** 8408-01-19
	Location 719241.8 E 726862.5 N	**Dates** 27/02/2019	**Project Contractor** Ground investigations Ireland Ltd	**Sheet** 1/1

Site: Sandyford Central

Borehole Number: BH07

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00	33						(0.24)	Tarmacadam.		
						81.00	0.24	Recovery consists of dark grey, slightly sandy slightly gravelly CLAY with occasional sub-angular to sub-rounded cobbles		
1.00 1.00-1.10	32				25/50 SPT(C) 25*/50 50/50		(1.76)			
2.00 2.00-2.00	100	30	30	N.I	25/50 SPT(C) 25*/0 50/0	79.24	2.00	Weak whitish grey coarsely crystalline GRANITE. Distinctly weathered.		
2.50							(0.90)	2.00-2.90m - Non intact.		
2.90	100	49	40	10		78.34	2.90	Medium strong to strong whitish grey orange coarsely crystalline GRANITE. Partially weathered. 2.90-4.20m - Two fracture sets. F1: close to medium spaced, 0-20 degrees, stepped rough, tight to open, stained brown and some clay smearing. F2: Close to medium spaced 30-50 degrees, undulating rough, tight to open		
							(0.80)			
						77.54	3.70	Extremely weak to weak greyish orange coarsely crystalline GRANITE. Distinctly to partially weathered		
4.00 4.20	100	62	62	N.I						
4.70							(2.00)	4.20-4.70m - Non intact.		
5.00	100	78	69	8		75.54	5.70	Medium strong to strong pinkish white grey coarsely crystalline GRANITE. Partially weathered. 4.70-7.00m - Two fracture sets. F1: close to medium spaced, 10-30 degrees, stepped rough, tight to open, stained brown and some clay smearing. F2: closely spaced, 60-80 degrees, stepped rough, stained brown.		
							(1.30)			
6.50	100	86	56							
7.00						74.24	7.00	Complete at 7.00m		

Remarks
No groundwater encountered.
No standpipe installed.
Borehole backfilled on completion.

Scale (approx)	Logged By
1:50	NM

Figure No. 8408-01-19.BH07

Ground Investigations Ireland Ltd www.gii.ie	Site: Sandyford Central	Borehole Number: BH08

Machine : Beretta T46 Flush : water Core Dia : 68 mm Method : Rotary Cored	Casing Diameter: 100mm cased to 10.00m	Ground Level (mOD): 81.40	Client: Richmond Homes	Job Number: 8408-01-19
	Location: 719235.4 E 726909.9 N	Dates: 27/02/2019	Project Contractor: Ground investigations Ireland Ltd	Sheet: 1/2

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00	36						(0.30)	Reinforced concrete.			
						81.10	0.30	Driller notes: Fill. Dark grey slightly clayey medium to coarse sub angular GRAVEL with occasional sub-angular cobbles.Returns of gravel to cobble sized fragments			
1.00	19										
2.20 2.20-2.30	26				25/50 SPT(C) 25*/50 50/50		(4.40)				
3.50 3.50-3.60	50	0	0		25/50 SPT(C) 25*/50 50/50						
4.50 4.50-4.60 4.70	100	30	0		25/50 SPT(C) 25*/50 50/50	76.70	4.70	Extremely weak to weak pinkish orange coarsely crystalline GRANITE. Distinctly weathered.			
5.00	96	57	40	10			(2.60)	4.70-7.30m - One fracture set. F1: very close to close spaced, 10-20 degrees, stepped rough, tight to open, stained brown and black with some clay smearing and quartz sand on fracture surfaces.			
6.50											
7.30	88	46	39			74.10	7.30	Extremely weak to medium strong pinkish orange coarsely crystalline GRANITE. Distinctly weathered.			
							(1.20)	7.30-9.30m - Non intact.			
8.00				N.I		72.90	8.50	Extremely weak to medium strong pinkish orange coarsely crystalline GRANITE. Distinctly weathered to de-structured			
	93	17	17				(0.80)				
9.30						72.10	9.30	Extremely weak to weak pink coarsely crystalline GRANITE. Distinctly weathered.			
				4			(0.70)	9.30-10.00m - Two fracture sets. F1: close to medium spaced, 10-20 degrees, stepped rough, tight to open, stained brown with some			
10.00											

Remarks
No groundwater encountered.
50mm slotted standpipe installed from 10.00m to 1.00m with pea gravel surround, plain pipe installed from 1.00m to ground level with bentonite seal and flush cover.
Borehole backfilled on completion.

Scale (approx)	Logged By
1:50	NM

Figure No. 8408-01-19.BH08

Ground Investigations Ireland Ltd www.gii.ie			Site: Sandyford Central	Borehole Number: BH08
Machine: Beretta T46; Flush: water; Core Dia: 68 mm; Method: Rotary Cored	Casing Diameter: 100mm cased to 10.00m	Ground Level (mOD): 81.40	Client: Richmond Homes	Job Number: 8408-01-19
	Location: 719235.4 E 726909.9 N	Dates: 27/02/2019	Project Contractor: Ground investigations Ireland Ltd	Sheet: 2/2

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						71.40	10.00	clay smearing and quartz sand on fracture surfaces. F2: closely spaced, 80-90 degrees, stepped rough, tight to open with some clay smearing on fracture surfaces.			
								Complete at 10.00m			

Remarks	Scale (approx)	Logged By
	1:50	NM
	Figure No. 8408-01-19.BH08	

Ground Investigations Ireland Ltd www.gii.ie	Site: Sandyford Central	Borehole Number: BH09

Machine : Beretta T46	Casing Diameter	Ground Level (mOD)	Client	Job Number
Flush : water	100mm cased to 7.50m	80.15	Richmond Homes	8408-01-19
Core Dia : 68 mm	**Location**	**Dates**	**Project Contractor**	**Sheet**
Method : Rotary Cored	719218.9 E 726934.1 N	28/02/2019	Ground investigations Ireland Ltd	1/1

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00	45							Driller notes: Brown grey slightly sandy gravelly CLAY with occasional cobble sized fragments.Returns of gravel to cobble sized fragments.			
1.00 1.00-1.10	47				25/50 SPT(C) 25*/50 50/50		(2.80)				
2.20 2.20-2.30	67				25/50 SPT(C) 25*/50 50/50						
2.80	100	50	27	N.I		77.35	2.80	Weak to medium strong brownish white coarsely crystalline GRANITE. Distinctly weathered. 2.80-3.20m - Non intact.			
3.20				8			(1.50)	3.20-4.30m - Two fracture sets. F1: very close to closely spaced, 0-20 degrees, stepped rough, tight to open, stained brown. F2: medium to widely spaced, 45-55 degrees, stepped rough, tight to open, stained brown.			
4.30	100	63	43	N.I		75.85	4.30	Medium strong greyish white coarsely crystalline GRANITE. Weathered to partially weathered 4.30-4.50m - Non intact.			
4.50				8			(1.20)	4.30-5.50m - Two fracture sets. F1: very close to closely spaced, 0-30 degrees, stepped rough, tight to open, stained brown. F2: close to medium spaced, 70-80 degrees, stepped rough, tight to open, stained brown grey.			
5.50	100	97	91	5		74.65	5.50	Medium strong to strong whitish greyish pink coarse to fine crystalline GRANITE. Partially weathered			
							(2.00)	5.50-7.50m - One fracture set. F1: close to widely spaced, 50-70 degrees, stepped rough, tight to open, stained brown.			
7.00	80	40	20								
7.50						72.65	7.50	Complete at 7.50m			

Remarks
No groundwater encountered.
50mm slotted standpipe installed from 7.50m to 1.00m with pea gravel surround, plain pipe installed from 1.00m to ground level with bentonite seal and flush cover.
Borehole backfilled on completion.

Scale (approx)	Logged By
1:50	NM

Figure No. 8408-01-19.BH09

Ground Investigations Ireland Ltd www.gii.ie	Site: Sandyford Central	Borehole Number: BH10

Machine : Beretta T46	Casing Diameter	Ground Level (mOD)	Client	Job Number
Flush : water	100mm cased to 10.00m	80.32	Richmond Homes	8408-01-19
Core Dia: 68 mm	**Location**	**Dates**	**Project Contractor**	**Sheet**
Method : Rotary Cored	719273.8 E 726899.4 N	28/02/2019	Ground investigations Ireland Ltd	1/1

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00	27					80.08	(0.24) 0.24	Tarmacadam.			
						79.84	(0.24) 0.48	Driller notes: Dark grey medium to coarse sub-angular to sub-rounded GRAVEL.			
1.00 1.00-1.10	17				25/50 SPT(C) 25*/50 50/50		(4.22)	Recovery consists of stiff brown slightly sandy slightly gravelly CLAY with sub-angular to sub-rounded cobbles.			
2.20 2.20-2.30	41				25/50 SPT(C) 25*/50 50/50						
3.70 3.70-3.80	50				25/50 SPT(C) 25*/50 50/50						
4.70 4.70-4.70	100	100	100		25/50 SPT(C) 25*/0 50/0	75.62	4.70 (0.40)	Weak to medium strong orangish coarsely crystalline GRANITE. Partially weathered.			
5.10	94	34	30	5		75.22	5.10 (0.90)	Weak to strong orangish greyish white coarsely crystalline GRANITE. Partially weathered 4.70-6.00m - Two fracture sets. F1: widely spaced, 60-70 degrees, stepped rough, tight to open, stained brown with quartz sand on fracture surfaces. F2: close to medium spaced, 20-30 degrees, stepped rough, tight to open, stained brown with clay smearing.			
6.00						74.32	6.00 (1.80)	Extremely weak to weak orange coarsely crystalline GRANITE. Distinctly weathered. 6.00-7.80m - Two fracture sets. F1: close to medium spaced, 70-80 degrees, stepped rough, tight to open, stained brown with clay smearing. F2: close to medium spaced, 0-20 degrees, stepped rough, tight to open, stained brown with quartz sand on fracture surfaces.			
6.70	100	49	41	8							
7.80						72.52	7.80 (2.20)	Strong to very strong greyish white coarsely crystalline GRANITE. Partially weathered 7.80-10.00m - Two fracture sets. F1: close to medium spaced, 0-20 degrees, stepped rough, tight to open, stained brown with quartz sand on fracture surfaces. F2: widely spaced, 70-80 degrees, stepped rough, tight to open, stained brown with some clay smearing.			
8.20	100	88	77	7							
9.70	100	100	100								
10.00						70.32	10.00				

Remarks
No groundwater encountered.
50mm slotted standpipe installed from 10.00m to 1.00m with pea gravel surround, plain pipe installed from 1.00m to ground level with bentonite seal and flush cover.
Borehole backfilled on completion.

Scale (approx)	Logged By
1:50	NM

Figure No. 8408-01-19.BH010

Sandyford Central Rotary Core Photographs

RC01

RC01

RC01


GROUND
INVESTIGATIONS
IRELAND
Client: RICHMOND HOMES
Job Ref: 8408-01-19
Site: SANDYFORD CENTRAL
Date: 08/03/19
Borehole ref: BH-01
Depth: From 7.4 to 8.4
Box No: 3 of 3
8.4

RC 2
BOX 1

RC 2
BOX 2

RC 2
BOX 3

RC 3
BOX 1

RC 3
BOX 2

RC 3
BOX 3

RC 4
BOX 1

RC 4
BOX 2

RC 5
BOX 1

RC 5
BOX 2

RC 6
BOX 1

RC 6
BOX 2

RC 7
BOX 1

RC 7
BOX 2

RC 7
BOX 3

RC 8
BOX 1

RC 8
BOX 2

RC 8
BOX 3

RC 9
BOX 1

RC 9
BOX 2

RC 9
BOX 3

RC 10
BOX 1

RC 10
BOX 2

RC 10
BOX 3

APPENDIX 5 – Laboratory Testing

Exova Jones Environmental

Registered Office: Exova Environmental UK Limited, 10 Lower Grosvenor Place, London, SW1W 0EN. Reg No. 11371415

Unit 3 Deeside Point
Zone 3
Deeside Industrial Park
Deeside
CH5 2UA

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Ground Investigations Ireland
Catherinestown House
Hazelhatch Road
Newcastle
Co. Dublin
Ireland

Attention :	Conor Finnerty
Date :	21st March, 2019
Your reference :	8408.01.19
Our reference :	Test Report 19/3052 Batch 1
Location :	Sandyford Central
Date samples received :	25th February, 2019
Status :	Final report
Issue :	2

Sixteen samples were received for analysis on 25th February, 2019 of which sixteen were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Where Waste Acceptance Criteria Suite (EC Decision of 19 December 2002 (2003/33/EC)) has been requested, all analyses have been performed using the relevant EN methods where they exist.

Compiled By:

Bruce Leslie
Project Co-ordinator

Exova Jones Environmental

Client Name: Ground Investigations Ireland
Reference: 8408.01.19
Location: Sandyford Central
Contact: Conor Finnerty
JE Job No.: 19/3052

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

J E Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30			
Sample ID	TP01	TP06	TP02	TP06	TP02	TP06	TP03	TP03	TP03	TP04			
Depth	0.60-1.60	0.80-1.00	0.60-1.00	1.00-2.00	1.00-2.10	2.00-2.40	0.00-1.00	1.00-2.00	2.00-3.10	0.45-0.90			
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T			
Sample Date	19/02/2019	20/02/2019	20/02/2019	20/02/2019	20/02/2019	20/02/2019	19/02/2019	19/02/2019	19/02/2019	19/02/2019			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1	LOD/LOR	Units	Method No.
Date of Receipt	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019			
Antimony	2	3	2	2	<1	2	<1	2	<1	1	<1	mg/kg	TM30/PM15
Arsenic #	11.6	24.5	16.1	8.1	4.3	13.1	9.0	11.3	9.0	20.1	<0.5	mg/kg	TM30/PM15
Barium #	66	312	50	59	32	70	43	59	48	99	<1	mg/kg	TM30/PM15
Cadmium #	1.9	1.8	0.8	2.0	0.5	1.5	0.8	1.2	0.4	0.3	<0.1	mg/kg	TM30/PM15
Chromium #	27.3	46.4	30.5	42.1	29.3	28.4	29.5	53.1	29.3	54.8	<0.5	mg/kg	TM30/PM15
Copper #	27	37	16	28	8	22	13	22	12	20	<1	mg/kg	TM30/PM15
Lead #	47	34	16	17	13	20	20	22	17	10	<5	mg/kg	TM30/PM15
Mercury #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM30/PM15
Molybdenum #	2.1	4.8	2.0	4.6	1.9	3.0	1.2	2.3	2.3	2.1	<0.1	mg/kg	TM30/PM15
Nickel #	41.0	57.0	29.3	38.2	14.4	35.9	15.4	28.1	15.5	27.9	<0.7	mg/kg	TM30/PM15
Selenium #	<1	2	<1	3	<1	2	<1	1	<1	1	<1	mg/kg	TM30/PM15
Zinc #	100	146	75	94	55	92	61	85	66	97	<5	mg/kg	TM30/PM15
PAH MS													
Naphthalene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	TM4/PM8
Fluorene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Phenanthrene #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.15	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Anthracene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Fluoranthene #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Pyrene #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	mg/kg	TM4/PM8
Chrysene #	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Coronene	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
PAH 6 Total #	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	mg/kg	TM4/PM8
PAH 17 Total	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/kg	TM4/PM8
Benzo(j)fluoranthene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	mg/kg	TM4/PM8
PAH Surrogate % Recovery	91	90	92	94	93	79	94	95	94	95	<0	%	TM4/PM8
Mineral Oil (C10-C40)	<30	<30	<30	<30	<30	<30	130	164	74	<30	<30	mg/kg	TM5/PM8/PM16

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Client Name:	Ground Investigations Ireland	**Report :**	**Solid**
Reference:	8408.01.19		
Location:	Sandyford Central	**Solids:** V=60g VOC jar, J=250g glass jar, T=plastic tub	
Contact:	Conor Finnerty		
JE Job No.:	19/3052		

Please see attached notes for all abbreviations and acronyms

J E Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30			
Sample ID	TP01	TP06	TP02	TP06	TP02	TP06	TP03	TP03	TP03	TP04			
Depth	0.60-1.60	0.80-1.00	0.60-1.00	1.00-2.00	1.00-2.10	2.00-2.40	0.00-1.00	1.00-2.00	2.00-3.10	0.45-0.90			
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T			
Sample Date	19/02/2019	20/02/2019	20/02/2019	20/02/2019	20/02/2019	20/02/2019	19/02/2019	19/02/2019	19/02/2019	19/02/2019			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1	LOD/LOR	Units	Method No.
Date of Receipt	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019			
TPH CWG													
Aliphatics													
>C5-C6#	<0.1	<0.1	<0.1	<0.1^{SV}	<0.1	<0.1^{SV}	<0.1	<0.1^{SV}	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C6-C8#	<0.1	<0.1	<0.1	<0.1^{SV}	<0.1	<0.1^{SV}	<0.1	<0.1^{SV}	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C8-C10	<0.1	<0.1	<0.1	<0.1^{SV}	<0.1	<0.1^{SV}	<0.1	<0.1^{SV}	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C10-C12#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	mg/kg	TM5/PM8/PM16
>C12-C16#	<4	<4	<4	<4	<4	<4	11	27	<4	<4	<4	mg/kg	TM5/PM8/PM16
>C16-C21#	<7	<7	<7	<7	<7	<7	37	78	15	<7	<7	mg/kg	TM5/PM8/PM16
>C21-C35#	<7	<7	<7	<7	<7	<7	72	59	59	<7	<7	mg/kg	TM5/PM8/PM16
>C35-C40	<7	<7	<7	<7	<7	<7	10	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40	<26	<26	<26	<26	<26	<26	130	164	74	<26	<26	mg/kg	TM5/TM36/PM8/PM12/PM16
>C6-C10	<0.1	<0.1	<0.1	<0.1^{SV}	<0.1	<0.1^{SV}	<0.1	<0.1^{SV}	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C10-C25	<10	<10	<10	<10	<10	<10	66	133	33	<10	<10	mg/kg	TM5/PM8/PM16
>C25-C35	<10	<10	<10	<10	<10	<10	48	19	48	<10	<10	mg/kg	TM5/PM8/PM16
Aromatics													
>C5-EC7#	<0.1	<0.1	<0.1	<0.1^{SV}	<0.1	<0.1^{SV}	<0.1	<0.1^{SV}	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>EC7-EC8#	<0.1	<0.1	<0.1	<0.1^{SV}	<0.1	<0.1^{SV}	<0.1	<0.1^{SV}	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>EC8-EC10#	<0.1	<0.1	<0.1	<0.1^{SV}	<0.1	<0.1^{SV}	<0.1	<0.1^{SV}	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>EC10-EC12#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	4.6	<0.2^{SV}	<0.2	<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16#	<4	<4	<4	<4	<4	<4	<4	15	<4	<4	<4	mg/kg	TM5/PM8/PM16
>EC16-EC21#	<7	<7	<7	<7	<7	<7	9	38	<7	<7	<7	mg/kg	TM5/PM8/PM16
>EC21-EC35#	<7	<7	<7	<7	<7	<7	<7	22	34	<7	<7	mg/kg	TM5/PM8/PM16
>EC35-EC40	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40	<26	<26	<26	<26	<26	<26	<26	80	34	<26	<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-40)	<52	<52	<52	<52	<52	<52	130	244	108	<52	<52	mg/kg	TM5/TM36/PM8/PM12/PM16
>EC6-EC10#	<0.1	<0.1	<0.1	<0.1^{SV}	<0.1	<0.1^{SV}	<0.1	<0.1^{SV}	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>EC10-EC25	<10	<10	<10	<10	<10	<10	11	59	<10	<10	<10	mg/kg	TM5/PM8/PM16
>EC25-EC35	<10	<10	<10	<10	<10	<10	<10	<10	31	<10	<10	mg/kg	TM5/PM8/PM16
MTBE#	<5	<5	<5	<5^{SV}	<5	<5^{SV}	<5	<5^{SV}	<5	<5	<5	ug/kg	TM31/PM12
Benzene#	<5	<5	<5	<5^{SV}	<5	<5^{SV}	<5	<5^{SV}	<5	<5	<5	ug/kg	TM31/PM12
Toluene#	<5	<5	<5	<5^{SV}	<5	<5^{SV}	<5	<5^{SV}	<5	<5	<5	ug/kg	TM31/PM12
Ethylbenzene#	<5	<5	<5	<5^{SV}	<5	<5^{SV}	<5	<5^{SV}	<5	<5	<5	ug/kg	TM31/PM12
m/p-Xylene#	<5	<5	<5	<5^{SV}	<5	<5^{SV}	<5	<5^{SV}	<5	<5	<5	ug/kg	TM31/PM12
o-Xylene#	<5	<5	<5	<5^{SV}	<5	<5^{SV}	<5	<5^{SV}	<5	<5	<5	ug/kg	TM31/PM12
PCB 28#	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 52#	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 101#	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 118#	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 138#	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 153#	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 180#	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
Total 7 PCBs#	<35	<35	<35	<35	<35	<35	<35	<35	<35	<35	<35	ug/kg	TM17/PM8

Client Name: Ground Investigations Ireland
Reference: 8408.01.19
Location: Sandyford Central
Contact: Conor Finnerty
JE Job No.: 19/3052

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

J E Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30			
Sample ID	TP01	TP06	TP02	TP06	TP02	TP06	TP03	TP03	TP03	TP04			
Depth	0.60-1.60	0.80-1.00	0.60-1.00	1.00-2.00	1.00-2.10	2.00-2.40	0.00-1.00	1.00-2.00	2.00-3.10	0.45-0.90			
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T			
Sample Date	19/02/2019	20/02/2019	20/02/2019	20/02/2019	20/02/2019	20/02/2019	19/02/2019	19/02/2019	19/02/2019	19/02/2019			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1	LOD/LOR	Units	Method No.
Date of Receipt	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019			
Natural Moisture Content	12.1	25.2	14.6	9.4	8.6	10.5	10.0	11.9	12.1	10.2	<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	10.8	20.1	12.7	8.6	7.9	9.5	9.1	10.7	10.8	9.2	<0.1	%	PM4/PM0
Hexavalent Chromium #	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	mg/kg	TM38/PM20
Sulphate as SO4 (2:1 Ext) #	0.0644	-	-	0.1273	0.0856	-	-	0.2123	-	0.3265	<0.0015	g/l	TM38/PM20
Chromium III	27.3	46.4	30.5	42.1	29.3	28.4	29.5	53.1	29.3	54.8	<0.5	mg/kg	NONE/NONE
Total Organic Carbon #	0.36	0.40	0.22	0.66	0.15	0.44	0.34	0.34	0.20	0.26	<0.02	%	TM21/PM24
Loss on Ignition #	2.2	3.2	1.8	1.3	1.1	1.7	1.4	1.6	2.0	1.6	<1.0	%	TM22/PM0
pH #	8.67	8.59	8.56	8.48	8.80	8.52	10.65	9.35	10.74	8.97	<0.01	pH units	TM73/PM11
Mass of raw test portion	0.1004	0.1055	0.1019	0.0984	0.1007	0.0999	0.1005	0.1029	0.0982	0.0996		kg	NONE/PM17
Mass of dried test portion	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09		kg	NONE/PM17

Exova Jones Environmental

Client Name:	Ground Investigations Ireland	**Report :**	**Solid**
Reference:	8408.01.19		
Location:	Sandyford Central	**Solids:** V=60g VOC jar, J=250g glass jar, T=plastic tub	
Contact:	Conor Finnerty		
JE Job No.:	19/3052		

Please see attached notes for all abbreviations and acronyms

J E Sample No.	31-33	34-36	37-39	40-42	43-45	46-48			
Sample ID	TP04	TP05	TP05	TP05	SA02	SA02			
Depth	0.90-2.00	0.35-1.00	1.00-2.00	2.00-3.10	0.50-1.00	1.00-1.80			
COC No / misc									
Containers	V J T	V J T	V J T	V J T	V J T	V J T			
Sample Date	19/02/2019	19/02/2019	19/02/2019	19/02/2019	20/02/2019	20/02/2019			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1			
Date of Receipt	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019	LOD/LOR	Units	Method No.
Antimony	2	2	2	2	3	1	<1	mg/kg	TM30/PM15
Arsenic #	10.1	11.0	12.9	9.2	21.3	4.6	<0.5	mg/kg	TM30/PM15
Barium #	91	178	99	71	230	42	<1	mg/kg	TM30/PM15
Cadmium #	2.3	1.6	3.4	1.5	3.5	1.6	<0.1	mg/kg	TM30/PM15
Chromium #	27.8	74.3	26.7	43.1	53.2	29.0	<0.5	mg/kg	TM30/PM15
Copper #	32	18	30	26	29	17	<1	mg/kg	TM30/PM15
Lead #	18	22	20	19	34	11	<5	mg/kg	TM30/PM15
Mercury #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM30/PM15
Molybdenum #	4.0	4.4	3.6	3.8	3.6	2.2	<0.1	mg/kg	TM30/PM15
Nickel #	40.9	33.4	43.6	37.0	70.8	20.4	<0.7	mg/kg	TM30/PM15
Selenium #	2	<1	6	3	2	<1	<1	mg/kg	TM30/PM15
Zinc #	109	83	126	85	164	55	<5	mg/kg	TM30/PM15
PAH MS									
Naphthalene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	TM4/PM8
Fluorene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Phenanthrene #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Anthracene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Fluoranthene #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Pyrene #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	mg/kg	TM4/PM8
Chrysene #	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Coronene	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
PAH 6 Total #	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	mg/kg	TM4/PM8
PAH 17 Total	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/kg	TM4/PM8
Benzo(j)fluoranthene	<1	<1	<1	<1	<1	<1	<1	mg/kg	TM4/PM8
PAH Surrogate % Recovery	94	95	88	86	87	85	<0	%	TM4/PM8
Mineral Oil (C10-C40)	<30	<30	<30	<30	<30	<30	<30	mg/kg	TM5/PM8/PM16

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Exova Jones Environmental

Client Name:	Ground Investigations Ireland
Reference:	8408.01.19
Location:	Sandyford Central
Contact:	Conor Finnerty
JE Job No.:	19/3052

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

J E Sample No.	31-33	34-36	37-39	40-42	43-45	46-48							
Sample ID	TP04	TP05	TP05	TP05	SA02	SA02							
Depth	0.90-2.00	0.35-1.00	1.00-2.00	2.00-3.10	0.50-1.00	1.00-1.80							
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T							
Sample Date	19/02/2019	19/02/2019	19/02/2019	19/02/2019	20/02/2019	20/02/2019							
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil							
Batch Number	1	1	1	1	1	1					LOD/LOR	Units	Method No.
Date of Receipt	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019							
TPH CWG													
Aliphatics													
>C5-C6 #	<0.1 SV	<0.1	<0.1 SV	<0.1 SV	<0.1	<0.1					<0.1	mg/kg	TM36/PM12
>C6-C8 #	<0.1 SV	<0.1	<0.1 SV	<0.1 SV	<0.1	<0.1					<0.1	mg/kg	TM36/PM12
>C8-C10	<0.1 SV	<0.1	<0.1 SV	<0.1 SV	<0.1	<0.1					<0.1	mg/kg	TM36/PM12
>C10-C12 #	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2					<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 #	<4	<4	<4	<4	<4	<4					<4	mg/kg	TM5/PM8/PM16
>C16-C21 #	<7	<7	<7	<7	<7	<7					<7	mg/kg	TM5/PM8/PM16
>C21-C35 #	<7	<7	<7	<7	<7	<7					<7	mg/kg	TM5/PM8/PM16
>C35-C40	<7	<7	<7	<7	<7	<7					<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40	<26	<26	<26	<26	<26	<26					<26	mg/kg	TM5/TM36/PM8/PM12/PM16
>C6-C10	<0.1 SV	<0.1	<0.1 SV	<0.1 SV	<0.1	<0.1					<0.1	mg/kg	TM36/PM12
>C10-C25	<10	<10	<10	<10	<10	<10					<10	mg/kg	TM5/PM8/PM16
>C25-C35	<10	<10	<10	<10	<10	<10					<10	mg/kg	TM5/PM8/PM16
Aromatics													
>C5-EC7 #	<0.1 SV	<0.1	<0.1 SV	<0.1 SV	<0.1	<0.1					<0.1	mg/kg	TM36/PM12
>EC7-EC8 #	<0.1 SV	<0.1	<0.1 SV	<0.1 SV	<0.1	<0.1					<0.1	mg/kg	TM36/PM12
>EC8-EC10 #	<0.1 SV	<0.1	<0.1 SV	<0.1 SV	<0.1	<0.1					<0.1	mg/kg	TM36/PM12
>EC10-EC12 #	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2					<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 #	<4	<4	<4	<4	<4	<4					<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 #	<7	<7	<7	<7	<7	<7					<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 #	<7	<7	<7	<7	<7	<7					<7	mg/kg	TM5/PM8/PM16
>EC35-EC40	<7	<7	<7	<7	<7	<7					<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40	<26	<26	<26	<26	<26	<26					<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-40)	<52	<52	<52	<52	<52	<52					<52	mg/kg	TM5/TM36/PM8/PM12/PM16
>EC6-EC10 #	<0.1 SV	<0.1	<0.1 SV	<0.1 SV	<0.1	<0.1					<0.1	mg/kg	TM36/PM12
>EC10-EC25	<10	<10	<10	<10	<10	<10					<10	mg/kg	TM5/PM8/PM16
>EC25-EC35	<10	<10	<10	<10	<10	<10					<10	mg/kg	TM5/PM8/PM16
MTBE #	<5 SV	<5	<5 SV	<5 SV	<5	<5					<5	ug/kg	TM31/PM12
Benzene #	<5 SV	<5	<5 SV	<5 SV	<5	<5					<5	ug/kg	TM31/PM12
Toluene #	<5 SV	<5	<5 SV	<5 SV	<5	<5					<5	ug/kg	TM31/PM12
Ethylbenzene #	<5 SV	<5	<5 SV	<5 SV	<5	<5					<5	ug/kg	TM31/PM12
m/p-Xylene #	<5 SV	<5	<5 SV	<5 SV	<5	<5					<5	ug/kg	TM31/PM12
o-Xylene #	<5 SV	<5	<5 SV	<5 SV	<5	<5					<5	ug/kg	TM31/PM12
PCB 28 #	<5	<5	<5	<5	<5	<5					<5	ug/kg	TM17/PM8
PCB 52 #	<5	<5	<5	<5	<5	<5					<5	ug/kg	TM17/PM8
PCB 101 #	<5	<5	<5	<5	<5	<5					<5	ug/kg	TM17/PM8
PCB 118 #	<5	<5	<5	<5	<5	<5					<5	ug/kg	TM17/PM8
PCB 138 #	<5	<5	<5	<5	<5	<5					<5	ug/kg	TM17/PM8
PCB 153 #	<5	<5	<5	<5	<5	<5					<5	ug/kg	TM17/PM8
PCB 180 #	<5	<5	<5	<5	<5	<5					<5	ug/kg	TM17/PM8
Total 7 PCBs #	<35	<35	<35	<35	<35	<35					<35	ug/kg	TM17/PM8

Client Name:	Ground Investigations Ireland	**Report :**	**Solid**
Reference:	8408.01.19		
Location:	Sandyford Central	**Solids:** V=60g VOC jar, J=250g glass jar, T=plastic tub	
Contact:	Conor Finnerty		
JE Job No.:	19/3052		

J E Sample No.	31-33	34-36	37-39	40-42	43-45	46-48							
Sample ID	TP04	TP05	TP05	TP05	SA02	SA02					Please see attached notes for all abbreviations and acronyms		
Depth	0.90-2.00	0.35-1.00	1.00-2.00	2.00-3.10	0.50-1.00	1.00-1.80							
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T							
Sample Date	19/02/2019	19/02/2019	19/02/2019	19/02/2019	20/02/2019	20/02/2019							
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil							
Batch Number	1	1	1	1	1	1					LOD/LOR	Units	Method No.
Date of Receipt	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019							
Natural Moisture Content	10.4	11.4	14.0	9.7	19.5	12.2					<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	9.4	10.2	12.3	8.8	16.3	10.9					<0.1	%	PM4/PM0
Hexavalent Chromium #	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3					<0.3	mg/kg	TM38/PM20
Sulphate as SO4 (2:1 Ext) #	-	0.0412	-	-	-	-					<0.0015	g/l	TM38/PM20
Chromium III	27.8	74.3	26.7	43.1	53.2	29.0					<0.5	mg/kg	NONE/NONE
Total Organic Carbon #	0.51	0.33	0.75	0.60	0.31	0.43					<0.02	%	TM21/PM24
Loss on Ignition #	2.3	1.9	2.2	1.6	2.9	1.5					<1.0	%	TM22/PM0
pH #	8.74	8.48	8.68	8.43	8.28	8.67					<0.01	pH units	TM73/PM11
Mass of raw test portion	0.0993	0.1045	0.1012	0.1003	0.1053	0.1098						kg	NONE/PM17
Mass of dried test portion	0.09	0.09	0.09	0.09	0.09	0.09						kg	NONE/PM17

Client Name: Ground Investigations Ireland
Reference: 8408.01.19
Location: Sandyford Central
Contact: Conor Finnerty
JE Job No.: 19/3052

Report : **CEN 10:1 1 Batch**

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

J E Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30			
Sample ID	TP01	TP06	TP02	TP06	TP02	TP06	TP03	TP03	TP03	TP04			
Depth	0.60-1.60	0.80-1.00	0.60-1.00	1.00-2.00	1.00-2.10	2.00-2.40	0.00-1.00	1.00-2.00	2.00-3.10	0.45-0.90			
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T			
Sample Date	19/02/2019	20/02/2019	20/02/2019	20/02/2019	20/02/2019	20/02/2019	19/02/2019	19/02/2019	19/02/2019	19/02/2019			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1	LOD/LOR	Units	Method No.
Date of Receipt	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019			
Dissolved Antimony #	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	mg/l	TM30/PM17
Dissolved Antimony (A10) #	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/kg	TM30/PM17
Dissolved Arsenic #	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	0.0044	0.0035	0.0051	0.0040	<0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10) #	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.044	0.035	0.051	0.040	<0.025	mg/kg	TM30/PM17
Dissolved Barium #	0.005	0.006	0.006	0.055	0.008	0.045	0.004	0.010	0.007	<0.003	<0.003	mg/l	TM30/PM17
Dissolved Barium (A10) #	0.05	0.06	0.06	0.55	0.08	0.45	0.04	0.10	0.07	<0.03	<0.03	mg/kg	TM30/PM17
Dissolved Cadmium #	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	mg/l	TM30/PM17
Dissolved Cadmium (A10) #	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	mg/kg	TM30/PM17
Dissolved Chromium #	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	0.0020	0.0034	<0.0015	<0.0015	mg/l	TM30/PM17
Dissolved Chromium (A10) #	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	0.020	0.034	<0.015	<0.015	mg/kg	TM30/PM17
Dissolved Copper #	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	mg/l	TM30/PM17
Dissolved Copper (A10) #	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	mg/kg	TM30/PM17
Dissolved Lead #	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	mg/l	TM30/PM17
Dissolved Lead (A10) #	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	TM30/PM17
Dissolved Molybdenum #	0.006	0.007	0.002	0.019	<0.002	0.015	<0.002	0.006	0.003	0.005	<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) #	0.06	0.07	0.02	0.19	<0.02	0.15	<0.02	0.06	0.03	0.05	<0.02	mg/kg	TM30/PM17
Dissolved Nickel #	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	mg/l	TM30/PM17
Dissolved Nickel (A10) #	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/kg	TM30/PM17
Dissolved Selenium #	<0.003	<0.003	<0.003	0.029	<0.003	0.019	<0.003	0.006	<0.003	<0.003	<0.003	mg/l	TM30/PM17
Dissolved Selenium (A10) #	<0.03	<0.03	<0.03	0.29	<0.03	0.19	<0.03	0.06	<0.03	<0.03	<0.03	mg/kg	TM30/PM17
Dissolved Zinc #	<0.003	<0.003	<0.003	0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM30/PM17
Mercury Dissolved by CVAF #	<0.00001	<0.00001	<0.00001	0.00011	<0.00001	0.00006	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	mg/l	TM61/PM0
Mercury Dissolved by CVAF #	<0.0001	<0.0001	<0.0001	0.0011	<0.0001	0.0006	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	mg/kg	TM61/PM0
Phenol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/l	TM26/PM0
Phenol	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM26/PM0
Fluoride	0.4	0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	mg/l	TM173/PM0
Fluoride	4	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	5.2	1.2	18.5	26.4	10.6	18.4	36.6	69.7	44.3	11.7	<0.5	mg/l	TM38/PM0
Sulphate as SO4 #	52	12	185	264	106	184	366	697	443	117	<5	mg/kg	TM38/PM0
Chloride #	0.4	0.3	<0.3	9.8	<0.3	6.4	<0.3	0.5	0.3	0.3	<0.3	mg/l	TM38/PM0
Chloride #	4	<3	<3	98	<3	64	<3	5	<3	<3	<3	mg/kg	TM38/PM0
Dissolved Organic Carbon	<2	<2	<2	<2	<2	<2	<2	<2	2	<2	<2	mg/l	TM60/PM0
Dissolved Organic Carbon	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	mg/kg	TM60/PM0
pH	7.49	7.89	8.20	8.00	8.25	8.08	10.58	10.71	10.98	8.57	<0.01	pH units	TM73/PM0
Total Dissolved Solids #	92	58	86	106	100	85	153	220	158	106	<35	mg/l	TM20/PM0
Total Dissolved Solids #	920	580	860	1060	1000	850	1530	2199	1579	1060	<350	mg/kg	TM20/PM0

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Exova Jones Environmental

Client Name:	Ground Investigations Ireland	**Report :**	**CEN 10:1 1 Batch**
Reference:	8408.01.19		
Location:	Sandyford Central	**Solids:**	V=60g VOC jar, J=250g glass jar, T=plastic tub
Contact:	Conor Finnerty		
JE Job No.:	19/3052		

Please see attached notes for all abbreviations and acronyms

J E Sample No.	31-33	34-36	37-39	40-42	43-45	46-48	LOD/LOR	Units	Method No.
Sample ID	TP04	TP05	TP05	TP05	SA02	SA02			
Depth	0.90-2.00	0.35-1.00	1.00-2.00	2.00-3.10	0.50-1.00	1.00-1.80			
COC No / misc									
Containers	V J T	V J T	V J T	V J T	V J T	V J T			
Sample Date	19/02/2019	19/02/2019	19/02/2019	19/02/2019	20/02/2019	20/02/2019			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1			
Date of Receipt	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019			
Dissolved Antimony #	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	mg/l	TM30/PM17
Dissolved Antimony (A10) #	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/kg	TM30/PM17
Dissolved Arsenic #	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10) #	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	mg/kg	TM30/PM17
Dissolved Barium #	<0.003	0.137	0.052	0.055	0.006	0.005	<0.003	mg/l	TM30/PM17
Dissolved Barium (A10) #	<0.03	1.37	0.52	0.55	0.06	0.05	<0.03	mg/kg	TM30/PM17
Dissolved Cadmium #	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	mg/l	TM30/PM17
Dissolved Cadmium (A10) #	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	mg/kg	TM30/PM17
Dissolved Chromium #	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	mg/l	TM30/PM17
Dissolved Chromium (A10) #	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	mg/kg	TM30/PM17
Dissolved Copper #	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	mg/l	TM30/PM17
Dissolved Copper (A10) #	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	mg/kg	TM30/PM17
Dissolved Lead #	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	mg/l	TM30/PM17
Dissolved Lead (A10) #	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	TM30/PM17
Dissolved Molybdenum #	0.006	0.012	0.025	0.014	0.006	0.018	<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) #	0.06	0.12	0.25	0.14	0.06	0.18	<0.02	mg/kg	TM30/PM17
Dissolved Nickel #	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	mg/l	TM30/PM17
Dissolved Nickel (A10) #	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/kg	TM30/PM17
Dissolved Selenium #	0.069	<0.003	<0.003	0.024	<0.003	<0.003	<0.003	mg/l	TM30/PM17
Dissolved Selenium (A10) #	0.69	<0.03	<0.03	0.24	<0.03	<0.03	<0.03	mg/kg	TM30/PM17
Dissolved Zinc #	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM30/PM17
Mercury Dissolved by CVAF #	<0.00001	<0.00001	<0.00001	0.00008	<0.00001	<0.00001	<0.00001	mg/l	TM61/PM0
Mercury Dissolved by CVAF #	<0.0001	<0.0001	<0.0001	0.0008	<0.0001	<0.0001	<0.0001	mg/kg	TM61/PM0
Phenol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/l	TM26/PM0
Phenol	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM26/PM0
Fluoride	<0.3	<0.3	0.3	<0.3	0.8	<0.3	<0.3	mg/l	TM173/PM0
Fluoride	<3	<3	<3	<3	8	<3	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	4.8	16.2	0.5	23.1	1.8	3.2	<0.5	mg/l	TM38/PM0
Sulphate as SO4 #	48	162	<5	231	18	32	<5	mg/kg	TM38/PM0
Chloride #	0.3	<0.3	<0.3	8.5	0.4	0.4	<0.3	mg/l	TM38/PM0
Chloride #	3	<3	<3	85	4	4	<3	mg/kg	TM38/PM0
Dissolved Organic Carbon	3	3	2	<2	<2	<2	<2	mg/l	TM60/PM0
Dissolved Organic Carbon	30	30	<20	<20	<20	<20	<20	mg/kg	TM60/PM0
pH	8.34	8.23	8.20	7.56	8.02	8.17	<0.01	pH units	TM73/PM0
Total Dissolved Solids #	72	174	66	130	88	148	<35	mg/l	TM20/PM0
Total Dissolved Solids #	720	1739	660	1299	880	1480	<350	mg/kg	TM20/PM0

Exova Jones Environmental

Client Name: Ground Investigations Ireland
Reference: 8408.01.19
Location: Sandyford Central
Contact: Conor Finnerty
JE Job No.: 19/3052

Report : EN12457_2

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

J E Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30						
Sample ID	TP01	TP06	TP02	TP06	TP02	TP06	TP03	TP03	TP03	TP04						
Depth	0.60-1.60	0.80-1.00	0.60-1.00	1.00-2.00	1.00-2.10	2.00-2.40	0.00-1.00	1.00-2.00	2.00-3.10	0.45-0.90						
COC No / misc																
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T						
Sample Date	19/02/2019	20/02/2019	20/02/2019	20/02/2019	20/02/2019	20/02/2019	19/02/2019	19/02/2019	19/02/2019	19/02/2019						
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil						
Batch Number	1	1	1	1	1	1	1	1	1	1	Inert	Stable Non-reactive	Hazardous	LOD LOR	Units	Method No.
Date of Receipt	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019						
Solid Waste Analysis																
Total Organic Carbon #	0.36	0.40	0.22	0.66	0.15	0.44	0.34	0.34	0.20	0.26	3	5	6	<0.02	%	TM21/PM24
Sum of BTEX	<0.025	<0.025	<0.025	<0.025 SV	<0.025	<0.025 SV	<0.025	<0.025 SV	<0.025	<0.025	6	-	-	<0.025	mg/kg	TM31/PM12
Sum of 7 PCBs #	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	1	-	-	<0.035	mg/kg	TM17/PM8
Mineral Oil	<30	<30	<30	<30	<30	<30	130	164	74	<30	500	-	-	<30	mg/kg	TM5/PM8/PM16
PAH Sum of 6 #	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	-	-	-	<0.22	mg/kg	TM4/PM8
PAH Sum of 17	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	100	-	-	<0.64	mg/kg	TM4/PM8
CEN 10:1 Leachate																
Arsenic #	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.044	0.035	0.051	0.040	0.5	2	25	<0.025	mg/kg	TM30/PM17
Barium #	0.05	0.06	0.06	0.55	0.08	0.45	0.04	0.10	0.07	<0.03	20	100	300	<0.03	mg/kg	TM30/PM17
Cadmium #	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.04	1	5	<0.005	mg/kg	TM30/PM17
Chromium #	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	0.020	0.034	<0.015	0.5	10	70	<0.015	mg/kg	TM30/PM17
Copper #	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	2	50	100	<0.07	mg/kg	TM30/PM17
Mercury #	<0.0001	<0.0001	<0.0001	0.0011	<0.0001	0.0006	<0.0001	<0.0001	<0.0001	<0.0001	0.01	0.2	2	<0.0001	mg/kg	TM61/PM0
Molybdenum #	0.06	0.07	0.02	0.19	<0.02	0.15	<0.02	0.06	0.03	0.05	0.5	10	30	<0.02	mg/kg	TM30/PM17
Nickel #	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.4	10	40	<0.02	mg/kg	TM30/PM17
Lead #	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.5	10	50	<0.05	mg/kg	TM30/PM17
Antimony #	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.06	0.7	5	<0.02	mg/kg	TM30/PM17
Selenium #	<0.03	<0.03	<0.03	0.29	<0.03	0.19	<0.03	0.06	<0.03	<0.03	0.1	0.5	7	<0.03	mg/kg	TM30/PM17
Zinc #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	4	50	200	<0.03	mg/kg	TM30/PM17
Total Dissolved Solids #	920	580	860	1060	1000	850	1530	2199	1579	1060	4000	60000	100000	<350	mg/kg	TM20/PM0
Dissolved Organic Carbon	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	500	800	1000	<20	mg/kg	TM60/PM0
Mass of raw test portion	0.1004	0.1055	0.1019	0.0984	0.1007	0.0999	0.1005	0.1029	0.0982	0.0996	-	-	-		kg	NONE/PM17
Dry Matter Content Ratio	90.1	85.7	88.2	91.2	88.9	90.3	89.2	87.6	91.4	90.4	-	-	-	<0.1	%	NONE/PM4
Leachant Volume	0.89	0.885	0.888	0.891	0.889	0.89	0.889	0.887	0.891	0.89	-	-	-		l	NONE/PM17
Eluate Volume	0.7	0.85	0.7	0.69	0.85	0.64	0.8	0.8	0.8	0.8	-	-	-		l	NONE/PM17
pH #	8.67	8.59	8.56	8.48	8.80	8.52	10.65	9.35	10.74	8.97	-	-	-	<0.01	pH units	TM73/PM11
Phenol	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1	-	-	<0.1	mg/kg	TM26/PM0
Fluoride	4	<3	<3	<3	<3	<3	<3	<3	<3	<3	-	-	-	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	52	12	185	264	106	184	366	697	443	117	1000	20000	50000	<5	mg/kg	TM38/PM0
Chloride #	4	<3	<3	98	<3	64	<3	5	<3	<3	800	15000	25000	<3	mg/kg	TM38/PM0

Client Name: Ground Investigations Ireland
Reference: 8408.01.19
Location: Sandyford Central
Contact: Conor Finnerty
JE Job No.: 19/3052

Report : **EN12457_2**

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

J E Sample No.	31-33	34-36	37-39	40-42	43-45	46-48									
Sample ID	TP04	TP05	TP05	TP05	SA02	SA02									
Depth	0.90-2.00	0.35-1.00	1.00-2.00	2.00-3.10	0.50-1.00	1.00-1.80									
COC No / misc															
Containers	V J T	V J T	V J T	V J T	V J T	V J T									
Sample Date	19/02/2019	19/02/2019	19/02/2019	19/02/2019	20/02/2019	20/02/2019									
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil									
Batch Number	1	1	1	1	1	1					Inert	Stable Non-reactive	Hazardous	LOD LOR	Units	Method No.
Date of Receipt	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019	25/02/2019									
Solid Waste Analysis															
Total Organic Carbon #	0.51	0.33	0.75	0.60	0.31	0.43					3	5	6	<0.02	%	TM21/PM24
Sum of BTEX	<0.025 SV	<0.025	<0.025 SV	<0.025 SV	<0.025	<0.025					6	-	-	<0.025	mg/kg	TM31/PM12
Sum of 7 PCBs #	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035					1	-	-	<0.035	mg/kg	TM17/PM8
Mineral Oil	<30	<30	<30	<30	<30	<30					500	-	-	<30	mg/kg	TM5/PM8/PM16
PAH Sum of 6 #	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22					-	-	-	<0.22	mg/kg	TM4/PM8
PAH Sum of 17	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64					100	-	-	<0.64	mg/kg	TM4/PM8
CEN 10:1 Leachate															
Arsenic #	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025					0.5	2	25	<0.025	mg/kg	TM30/PM17
Barium #	<0.03	1.37	0.52	0.55	0.06	0.05					20	100	300	<0.03	mg/kg	TM30/PM17
Cadmium #	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005					0.04	1	5	<0.005	mg/kg	TM30/PM17
Chromium #	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015					0.5	10	70	<0.015	mg/kg	TM30/PM17
Copper #	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07					2	50	100	<0.07	mg/kg	TM30/PM17
Mercury #	<0.0001	<0.0001	<0.0001	0.0008	<0.0001	<0.0001					0.01	0.2	2	<0.0001	mg/kg	TM61/PM0
Molybdenum #	0.06	0.12	0.25	0.14	0.06	0.18					0.5	10	30	<0.02	mg/kg	TM30/PM17
Nickel #	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02					0.4	10	40	<0.02	mg/kg	TM30/PM17
Lead #	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05					0.5	10	50	<0.05	mg/kg	TM30/PM17
Antimony #	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02					0.06	0.7	5	<0.02	mg/kg	TM30/PM17
Selenium #	0.69	<0.03	<0.03	0.24	<0.03	<0.03					0.1	0.5	7	<0.03	mg/kg	TM30/PM17
Zinc #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03					4	50	200	<0.03	mg/kg	TM30/PM17
Total Dissolved Solids #	720	1739	660	1299	880	1480					4000	60000	100000	<350	mg/kg	TM20/PM0
Dissolved Organic Carbon	30	30	<20	<20	<20	<20					500	800	1000	<20	mg/kg	TM60/PM0
Mass of raw test portion	0.0993	0.1045	0.1012	0.1003	0.1053	0.1098					-	-	-		kg	NONE/PM17
Dry Matter Content Ratio	90.8	86.1	89.4	89.4	85.9	81.6					-	-	-	<0.1	%	NONE/PM4
Leachant Volume	0.891	0.885	0.889	0.889	0.885	0.88					-	-	-		l	NONE/PM17
Eluate Volume	0.8	0.8	0.85	0.7	0.8	0.78					-	-	-		l	NONE/PM17
pH #	8.74	8.48	8.68	8.43	8.28	8.67					-	-	-	<0.01	pH units	TM73/PM11
Phenol	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1					1	-	-	<0.1	mg/kg	TM26/PM0
Fluoride	<3	<3	<3	<3	8	<3					-	-	-	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	48	162	<5	231	18	32					1000	20000	50000	<5	mg/kg	TM38/PM0
Chloride #	3	<3	<3	85	4	4					800	15000	25000	<3	mg/kg	TM38/PM0

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Client Name: Ground Investigations Ireland

Reference: 8408.01.19

Location: Sandyford Central

Contact: Conor Finnerty

Matrix : Solid

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	EPH Interpretation
19/3052	1	TP01	0.60-1.60	1-3	No interpretation possible
19/3052	1	TP06	0.80-1.00	4-6	No interpretation possible
19/3052	1	TP02	0.60-1.00	7-9	No interpretation possible
19/3052	1	TP06	1.00-2.00	10-12	No interpretation possible
19/3052	1	TP02	1.00-2.10	13-15	No interpretation possible
19/3052	1	TP06	2.00-2.40	16-18	No interpretation possible
19/3052	1	TP03	0.00-1.00	19-21	Lubricating oil & Possible degraded diesel
19/3052	1	TP03	1.00-2.00	22-24	Degraded diesel
19/3052	1	TP03	2.00-3.10	25-27	Lubricating oil & Possible trace of degraded diesel
19/3052	1	TP04	0.45-0.90	28-30	No interpretation possible
19/3052	1	TP04	0.90-2.00	31-33	No interpretation possible
19/3052	1	TP05	0.35-1.00	34-36	No interpretation possible
19/3052	1	TP05	1.00-2.00	37-39	No interpretation possible
19/3052	1	TP05	2.00-3.10	40-42	No interpretation possible
19/3052	1	SA02	0.50-1.00	43-45	No interpretation possible
19/3052	1	SA02	1.00-1.80	46-48	No interpretation possible

Client Name: Ground Investigations Ireland
Reference: 8408.01.19
Location: Sandyford Central
Contact: Conor Finnerty

Note:

Asbestos Screen analysis is carried out in accordance with our documented in-house methods PM042 and TM065 and HSG 248 by Stereo and Polarised Light Microscopy using Dispersion Staining Techniques and is covered by our UKAS accreditation. Detailed Gravimetric Quantification and PCOM Fibre Analysis is carried out in accordance with our documented in-house methods PM042 and TM131 and HSG 248 using Stereo and Polarised Light Microscopy and Phase Contrast Optical Microscopy (PCOM). Samples are retained for not less than 6 months from the date of analysis unless specifically requested.

Opinions, including ACM type and Asbestos level less than 0.1%, lie outside the scope of our UKAS accreditation.

Where the sample is not taken by a Jones Environmental Laboratory consultant, Jones Environmental Laboratory cannot be responsible for inaccurate or unrepresentative sampling.

Signed on behalf of Jones Environmental Laboratory:

Ryan Butterworth
Asbestos Team Leader

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Date Of Analysis	Analysis	Result
19/3052	1	TP01	0.60-1.60	2	28/02/2019	**General Description (Bulk Analysis)**	soil-stones
					28/02/2019	**Asbestos Fibres**	NAD
					28/02/2019	**Asbestos ACM**	NAD
					28/02/2019	**Asbestos Type**	NAD
					28/02/2019	**Asbestos Level Screen**	NAD
19/3052	1	TP06	0.80-1.00	5	28/02/2019	**General Description (Bulk Analysis)**	soil-stones
					28/02/2019	**Asbestos Fibres**	NAD
					28/02/2019	**Asbestos ACM**	NAD
					28/02/2019	**Asbestos Type**	NAD
					28/02/2019	**Asbestos Level Screen**	NAD
19/3052	1	TP02	0.60-1.00	8	28/02/2019	**General Description (Bulk Analysis)**	soil-stones
					28/02/2019	**Asbestos Fibres**	NAD
					28/02/2019	**Asbestos ACM**	NAD
					28/02/2019	**Asbestos Type**	NAD
					28/02/2019	**Asbestos Level Screen**	NAD
19/3052	1	TP06	1.00-2.00	11	28/02/2019	**General Description (Bulk Analysis)**	soils-tones
					28/02/2019	**Asbestos Fibres**	NAD
					28/02/2019	**Asbestos ACM**	NAD
					28/02/2019	**Asbestos Type**	NAD
					28/02/2019	**Asbestos Level Screen**	NAD
19/3052	1	TP02	1.00-2.10	14	28/02/2019	**General Description (Bulk Analysis)**	soil-stones
					28/02/2019	**Asbestos Fibres**	NAD
					28/02/2019	**Asbestos ACM**	NAD
					28/02/2019	**Asbestos Type**	NAD
					28/02/2019	**Asbestos Level Screen**	NAD
19/3052	1	TP06	2.00-2.40	17	28/02/2019	**General Description (Bulk Analysis)**	soil-stones
					28/02/2019	**Asbestos Fibres**	NAD
					28/02/2019	**Asbestos ACM**	NAD
					28/02/2019	**Asbestos Type**	NAD
					28/02/2019	**Asbestos Level Screen**	NAD
19/3052	1	TP03	0.00-1.00	20	28/02/2019	**General Description (Bulk Analysis)**	Soil/Stones
					28/02/2019	**Asbestos Fibres**	NAD
					28/02/2019	**Asbestos ACM**	NAD

Client Name: Ground Investigations Ireland
Reference: 8408.01.19
Location: Sandyford Central
Contact: Conor Finnerty

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Date Of Analysis	Analysis	Result
19/3052	1	TP03	0.00-1.00	20	28/02/2019	**Asbestos Type**	NAD
					28/02/2019	**Asbestos Level Screen**	NAD
19/3052	1	TP03	1.00-2.00	23	28/02/2019	**General Description (Bulk Analysis)**	Soil/Stones
					28/02/2019	**Asbestos Fibres**	NAD
					28/02/2019	**Asbestos ACM**	NAD
					28/02/2019	**Asbestos Type**	NAD
					28/02/2019	**Asbestos Level Screen**	NAD
19/3052	1	TP03	2.00-3.10	26	28/02/2019	**General Description (Bulk Analysis)**	Soil/Stones
					28/02/2019	**Asbestos Fibres**	NAD
					28/02/2019	**Asbestos ACM**	NAD
					28/02/2019	**Asbestos Type**	NAD
					28/02/2019	**Asbestos Level Screen**	NAD
19/3052	1	TP04	0.45-0.90	29	28/02/2019	**General Description (Bulk Analysis)**	soil/stones
					28/02/2019	**Asbestos Fibres**	NAD
					28/02/2019	**Asbestos ACM**	NAD
					28/02/2019	**Asbestos Type**	NAD
					28/02/2019	**Asbestos Level Screen**	NAD
19/3052	1	TP04	0.90-2.00	32	28/02/2019	**General Description (Bulk Analysis)**	soil.stones
					28/02/2019	**Asbestos Fibres**	NAD
					28/02/2019	**Asbestos ACM**	NAD
					28/02/2019	**Asbestos Type**	NAD
					28/02/2019	**Asbestos Level Screen**	NAD
19/3052	1	TP05	0.35-1.00	35	28/02/2019	**General Description (Bulk Analysis)**	soil.stones
					28/02/2019	**Asbestos Fibres**	NAD
					28/02/2019	**Asbestos ACM**	NAD
					28/02/2019	**Asbestos Type**	NAD
					28/02/2019	**Asbestos Level Screen**	NAD
19/3052	1	TP05	1.00-2.00	38	28/02/2019	**General Description (Bulk Analysis)**	soil/stones
					28/02/2019	**Asbestos Fibres**	NAD
					28/02/2019	**Asbestos ACM**	NAD
					28/02/2019	**Asbestos Type**	NAD
					28/02/2019	**Asbestos Level Screen**	NAD
19/3052	1	TP05	2.00-3.10	41	28/02/2019	**General Description (Bulk Analysis)**	soil/stones
					28/02/2019	**Asbestos Fibres**	NAD
					28/02/2019	**Asbestos ACM**	NAD
					28/02/2019	**Asbestos Type**	NAD
					28/02/2019	**Asbestos Level Screen**	NAD
19/3052	1	SA02	0.50-1.00	44	28/02/2019	**General Description (Bulk Analysis)**	soil.stones
					28/02/2019	**Asbestos Fibres**	NAD
					28/02/2019	**Asbestos ACM**	NAD
					28/02/2019	**Asbestos Type**	NAD
					28/02/2019	**Asbestos Level Screen**	NAD
19/3052	1	SA02	1.00-1.80	47	28/02/2019	**General Description (Bulk Analysis)**	soil.stones
					28/02/2019	**Asbestos Fibres**	NAD

Client Name: Ground Investigations Ireland
Reference: 8408.01.19
Location: Sandyford Central
Contact: Conor Finnerty

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Date Of Analysis	Analysis	Result
19/3052	1	SA02	1.00-1.80	47	28/02/2019	**Asbestos ACM**	NAD
					28/02/2019	**Asbestos Type**	NAD
					28/02/2019	**Asbestos Level Screen**	NAD

Client Name: Ground Investigations Ireland
Reference: 8408.01.19
Location: Sandyford Central
Contact: Conor Finnerty

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Analysis	Reason
No deviating sample report results for job 19/3052						

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.
Only analyses which are accredited are recorded as deviating if set criteria are not met.

JE Job No.: 19/3052

SOILS

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overesitimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

Samples must be received in a condition appropriate to the requested analyses. All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. If this is not the case you will be informed and any test results that may be compromised highlighted on your deviating samples report.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa.
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
*	Analysis subcontracted to an Exova Jones Environmental approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

Appendix - Methods used for WAC (2003/33/EC)

JE Job No.: 19/3052

Leachate tests	
10l/kg; 4mm	I.S. EN 12457-2:2002 Specified particle size; water added to L/S ratio; capped; agitated for 24 ± 0.5 hours; eluate settled and filtered over 0.45 µm membrane filter.
Eluate analysis	
As	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Ba	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Cd	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Cr total	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Cu	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Hg	I.S. EN 13370 rec. EN 1483 (CVAAS)
Mo	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Ni	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Pb	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Sb	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Se	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Zn	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Chloride	I.S. EN 12506 rec. EN ISO 10304-part 1 (liquid chromatography of ions)
Fluoride	I.S. EN 12506 rec. EN ISO 10304-part 1 (liquid chromatography of ions)
Sulphate	I.S. EN 12506 rec. EN ISO 10304-part 1 (liquid chromatography of ions)
Phenol index	I.S. EN 13370 rec. ISO 6439 (4-Aminoantipyrine spectrometic methods after distillation)* (BY HPLC - Jones Env)
DOC	I.S. EN 1484
TDS	I.S. EN 15216
Compositional analysis	
TOC	I.S. EN 13137 Method B: carbonates removed with acid; TOC by combustion.
BTEX	GC-FID
PCB7**	I.S. EN 15308 analysis by GC-ECD.
Mineral oil	I.S. EN 14039 C10 to C40 analysis by GC-FID.
PAH17***	I.S. EN 15527 PAH17 analysis by GC-MS
Metals	I.S. EN 13657 - Aqua regia digestion: EN ISO 11885 (ICP-OES)
Other	
Dry matter	I.S. EN 14346 sample is dried to a constant mass in an oven at 105 ± 3 °C; Method B Water content by direct Karl-Fischer-titration and either volumetric or coulometric detection.
LOI	I.S. EN 15169 Difference in mass after heating in a furnace up to 550 ± 25 °C.
ANC	CEN/TS 15364 Determined by amouns of acid or base needed to cover the pH range

Notes:

*If not suitable due to LOD, precision, etc., any other suitable method can be used, e.g. AFS, ICP-MS
**PCB-28, PCB-52, PCB-101, PCB-118, PCB-138, PCB-153 and PCB-180

***Naphthalene, Acenaphthylene, Acenaphthene, Anthracene, Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(g,h,i)perylene, Benzo(a)pyrene, Chrysene, Coronene, Dibenzo(a,h)anthracene, Fluorene, Fluoranthene, Indeno(1,2,3-c,d)pyrene, Phenanthrene and Pyrene.

JE Job No: 19/3052

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465 and BS1377.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM16	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details			AR	Yes
TM17	Modified US EPA method 8270. Determination of specific Polychlorinated Biphenyl congeners by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM20	Modified BS 1377-3: 1990/USEPA 160.3 Gravimetric determination of Total Dissolved Solids/Total Solids	PM0	No preparation is required.	Yes		AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes

JE Job No: 19/3052

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM22	Modified BS1377-3:1990 Gravimetric determination of Loss on Ignition by temperature controlled Muffle Furnace (35C-440C). On request modified ASTM D2974-00 LOI (105C-440C)	PM0	No preparation is required.	Yes		AD	Yes
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			AR	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM17	Modified method BS EN12457-2 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.	Yes		AR	Yes
TM31	Modified USEPA 8015B. Determination of Methyltertbutylether, Benzene, Toluene, Ethylbenzene and Xylene by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM31	Modified USEPA 8015B. Determination of Methyltertbutylether, Benzene, Toluene, Ethylbenzene and Xylene by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM36	Modified US EPA method 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results can be confirmed using GCMS.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results can be confirmed using GCMS.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods 325.2 (Chloride), 375.4 (Sulphate), 365.2 (o-Phosphate), 353.1 (TON), 354.1 (Nitrite), 350.1 (NH4+) comparable to BS ISO 15923-1, 7196A (Hex Cr)	PM0	No preparation is required.	Yes		AR	Yes

JE Job No: 19/3052

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods 325.2 (Chloride), 375.4 (Sulphate), 365.2 (o-Phosphate), 353.1 (TON), 354.1 (Nitrite), 350.1 (NH4+) comparable to BS ISO 15923-1, 7196A (Hex Cr)	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AD	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods 325.2 (Chloride), 375.4 (Sulphate), 365.2 (o-Phosphate), 353.1 (TON), 354.1 (Nitrite), 350.1 (NH4+) comparable to BS ISO 15923-1, 7196A (Hex Cr)	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM60	TC/TOC analysis of Waters by High Temperature Combustion followed by NDIR detection. Based on the following modified standard methods: USEPA 9060, APHA Standard Methods for Examination of Water and Wastewater 5310B, ASTM D 7573, and USEPA 415.1.	PM0	No preparation is required.			AR	Yes
TM61	Modified US EPA methods 245.7 and 200.7. Determination of Mercury by Cold Vapour Atomic Fluorescence.	PM0	No preparation is required.	Yes		AR	Yes
TM65	Asbestos Bulk Identification method based on HSG 248.	PM42	Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 and 9045D and BS1377:1990. Determination of pH by Metrohm automated probe analyser.	PM0	No preparation is required.			AR	Yes
TM73	Modified US EPA methods 150.1 and 9045D and BS1377:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM173	Analysis of fluoride by ISE (Ion Selective Electrode) using modified ISE method 340.2	PM0	No preparation is required.			AR	Yes
NONE	No Method Code	NONE	No Method Code			AR	Yes
NONE	No Method Code	PM17	Modified method BS EN12457-2 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.				

JE Job No: 19/3052

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
NONE	No Method Code	PM17	Modified method BS EN12457-2 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.			AR	
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465 and BS1377.			AR	

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Ground Investigations Ireland Ltd,
Catherinestown House,
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Unconfined Compression Tests On Rock Cores

Project: Sandyford Central

Project No: 8408 - 01 - 19

Delivery Date: 27.03.2019

Test Date: 01.04.2019

Borehole Number	Depth (m)	Average Diameter (mm)	Height (mm)	Length/Dia. (Ratio)	Unconfined Compressive Strength (Mpa)	Density (Mg/m^3)
BH - 02	8.83 - 9.03	63.2	159.0	2.52	36.1	2.56
BH - 03	2.50 - 2.74	63.2	158.8	2.51	60.8	2.61
BH - 04	2.20 - 2.37	63.1	149.5	2.37	47.7	2.58
BH - 05	3.70 - 4.08	63.1	158.7	2.51	48.9	2.60
BH - 06	2.28 - 2.46	63.0	133.4	2.12	35.2	2.51
BH - 07	3.13 - 3.29	63.3	149.7	2.36	16.3	2.52
BH - 08	5.35 - 5.53	63.2	136.0	2.15	10.5	2.38
BH - 09	5.50 - 5.98	63.1	158.8	2.52	20.8	2.59
BH - 10	4.92 - 5.10	63.1	153.3	2.43	33.8	2.56

Prof. B. O'Kelly

Specimens prepared and tested in accordance with suggested method from International Society for Rock Mechanics (ISRM), 1985

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Co. Dublin

Point Load Index Tests (single diametral determination)

Project: Sandyford Central

Project No: 8408 - 01 - 19

Delivery date: 27.03.2019

Test Date: 02.04.2019

Diametric samples Borehole No.	Depth (m)	Is(50) (Mpa)
BH - 01	7.00 - 7.09	1.73
BH - 02	5.70 - 5.82	1.48
BH - 03	2.74 - 2.84	1.55
BH - 04	2.77 - 2.90	1.48
BH - 05	2.80 - 2.89	1.45
BH - 06	2.60 - 2.74	1.99
BH - 07	2.75 - 2.84	1.34
BH - 08	5.05 - 5.15	0.17
BH - 09	4.15 - 4.24	0.86
BH - 10	5.10 - 5.23	1.39

Prof. Brendan O'Kelly

Specimens prepared and tested in accordance with suggested method from International Society for Rock Mechanics (ISRM), 1985

APPENDIX 6 – Groundwater Monitoring

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Newcastle, Co Dublin.
Tel: 01 601 5175 / 5176 | Fax: 01 601 5173
Email: info@gii.ie | Web: gii.ie

GROUNDWATER MONITORING

Sandyford Central

BOREHOLE	DATE	TIME	GROUNDWATER (mBGL)	GROUNDWATER (mOD)	Comment
RC02	05.03.19	10.00	4.00	78.45	
RC06	05.03.19	10.05	3.00	78.39	
RC08	05.03.19	10.10	1.90	79.50	
RC09	05.03.19	9.50	0.70	79.45	
RC10	05.03.19	9.55	1.30	79.02	
RC02	08.03.19	8.20	3.65	78.80	
RC06	08.03.19	8.24	2.85	78.54	
RC08	08.03.19	8.30	1.90	79.50	
RC09	08.03.19	8.10	0.80	79.35	
RC10	08.03.19	8.15	1.40	78.92	

APPENDIX B – STORM WATER CALCULATIONS

APPENDIX B1 - Storage Estimation

HR Wallingford
Working with water

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	
Site name:	Sandyford Central
Site location:	Sandyford industrial Estate

This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the drainage scheme.

Site coordinates

Latitude:	53.27862° N
Longitude:	6.21262° W
Reference:	
Date:	2019-06-17 10:56

Methodology	IH124

Site characteristics

Total site area (ha)	1.54
Significant public open space (ha)	0
Area positively drained (ha)	1.54
Pervious area contribution (%)	30
Impermeable area (ha)	1.54
Percentage of drained area that is impermeable (%)	100
Impervious area drained via infiltration (ha)	0
Return period for infiltration system design (year)	10
Impervious area drained to rainwater harvesting systems (ha)	0
Return period for rainwater harvesting system design (year)	10
Compliance factor for rainwater harvesting system design (%)	66
Net site area for storage volume design (ha)	1.54
Net impermeable area for storage volume design (ha)	1.54

* Where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50 % of the 'area positively drained', the 'net site area' and the estimates of Qbar and other flow rates will have been reduced accordingly.

Design criteria

Volume control approach	Flow control to max of 2 l/s/ha or

	Default	Edited
Climate change allowance factor	1.1	1.1
Urban creep allowance factor	1.0	1.0
Interception rainfall depth (mm)	5	5
Minimum flow rate (l/s)	8.1	8.1

Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type

	Default	Edited
Qbar total site area (l/s)	0.39	--
SOIL type	1	4
HOST class	N/A	N/A
SPR	0.1	0.47

Hydrology

	Default	Edited
SAAR (mm)	985	850
M5-60 Rainfall Depth (mm)	17	17
'r' Ratio M5-60/M5-2 day	0.3	0.3
Rainfall 100 yrs 6 hrs	61	
Rainfall 100 yrs 12 hrs	73	
FEH/FSR conversion factor	1	1
Hydrological region	12	
Growth curve factor: 1 year	0.85	0.85
Growth curve factor: 10 year	1.72	1.70
Growth curve factor: 30 year	2.13	2.10
Growth curve factor: 100 year	2.61	2.60

Site discharge rates

	Default	Edited
Qbar total site area (l/s)	0.39	9.33
Qbar net site area (l/s)	0.39	9.33
1 in 1 year (l/s)	8.1	8.1
1 in 30 years (l/s)	8.1	9.3
1 in 100 years (l/s)	8.1	9.3

Estimated storage volumes

	Default	Edited
Interception storage (m^3)	62	62
Attenuation storage (m^3)	752	758
Long term storage (m^3)	0	0
Treatment storage (m^3)	185	185
Total storage *(excluding treatment)* (m^3)	814	820

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 319288, Northing: 226836,

	Interval		Years													
DURATION	6months	1year	2	3	4	5	10	20	30	50	75	100	150	200	250	500
5 mins	2.5	3.7	4.4	5.4	6.1	6.7	8.5	10.7	12.2	14.3	16.1	17.6	20.0	21.8	23.3	N/A
10 mins	3.5	5.2	6.1	7.6	8.5	9.3	11.9	14.9	17.0	19.9	22.5	24.6	27.8	30.3	32.5	N/A
15 mins	4.1	6.1	7.2	8.9	10.1	11.0	14.0	17.6	20.0	23.4	26.5	28.9	32.7	35.7	38.2	N/A
30 mins	5.5	8.0	9.4	11.5	12.9	14.0	17.8	22.1	25.0	29.2	32.9	35.9	40.4	44.0	46.9	N/A
1 hours	7.2	10.4	12.1	14.8	16.6	18.0	22.6	27.9	31.4	36.5	41.0	44.5	49.9	54.2	57.7	N/A
2 hours	9.5	13.6	15.7	19.0	21.2	23.0	28.7	35.2	39.5	45.5	50.9	55.2	61.7	66.7	70.9	N/A
3 hours	11.2	15.8	18.3	22.1	24.6	26.5	33.0	40.2	45.1	51.8	57.9	62.6	69.8	75.4	80.0	N/A
4 hours	12.6	17.7	20.4	24.5	27.3	29.4	36.4	44.3	49.5	56.8	63.4	68.4	76.2	82.2	87.2	N/A
6 hours	14.8	20.7	23.8	28.4	31.5	34.0	41.8	50.7	56.6	64.7	72.0	77.6	86.2	92.9	98.4	N/A
9 hours	17.4	24.1	27.7	32.9	36.5	39.2	48.1	58.1	64.6	73.7	81.8	88.0	97.5	104.9	111.0	N/A
12 hours	19.6	26.9	30.8	36.6	40.5	43.5	53.1	63.9	71.0	80.8	89.5	96.2	106.5	114.4	120.9	N/A
18 hours	23.0	31.4	35.9	42.4	46.8	50.2	61.1	73.2	81.1	92.1	101.7	109.1	120.5	129.3	136.5	N/A
24 hours	25.8	35.1	40.0	47.1	51.9	55.6	67.4	80.6	89.1	101.0	111.4	119.4	131.6	140.9	148.7	175.4
2 days	32.2	42.8	48.2	56.2	61.4	65.4	78.2	92.2	101.1	113.5	124.3	132.5	145.0	154.5	162.3	189.1
3 days	37.4	49.0	54.9	63.5	69.1	73.4	87.0	101.7	111.2	124.1	135.2	143.7	156.6	166.4	174.3	201.7
4 days	42.0	54.5	60.8	69.9	75.9	80.4	94.7	110.1	119.9	133.3	144.9	153.7	166.9	176.9	185.1	213.0
6 days	50.1	64.0	71.0	81.1	87.6	92.6	108.1	124.7	135.2	149.5	161.7	171.0	184.9	195.4	204.0	233.0
8 days	57.2	72.4	80.1	90.9	98.0	103.3	119.9	137.5	148.6	163.6	176.5	186.2	200.7	211.6	220.5	250.5
10 days	63.8	80.2	88.3	99.9	107.3	113.0	130.5	149.0	160.7	176.4	189.8	199.9	214.9	226.3	235.5	266.4
12 days	69.9	87.3	96.0	108.2	116.1	122.0	140.4	159.7	171.8	188.2	202.1	212.5	228.1	239.8	249.3	281.1
16 days	81.3	100.6	110.1	123.5	132.1	138.5	158.4	179.3	192.3	209.7	224.5	235.6	252.0	264.4	274.4	307.8
20 days	91.9	112.9	123.2	137.6	146.8	153.7	174.9	197.1	210.8	229.2	244.8	256.5	273.8	286.7	297.2	332.0
25 days	104.4	127.3	138.4	154.0	163.9	171.3	194.0	217.6	232.3	251.8	268.2	280.5	298.7	312.3	323.3	359.7

NOTES:
N/A Data not available
These values are derived from a Depth Duration Frequency (DDF) Model
For details refer to:
'Fitzgerald D. L. (2007), Estimates of Point Rainfall Frequencies, Technical Note No. 61, Met Eireann, Dublin',
Available for download at www.met.ie/climate/dataproducts/Estimation-of-Point-Rainfall-Frequencies_TN61.pdf

APPENDIX B2 - Rainfall Data

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes B.Regs Manhole Sizes B.Regs

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	5	Foul Sewage (l/s/ha)	0.000	Maximum Backdrop Height (m)	0.000
M5-60 (mm)	18.000	Volumetric Runoff Coeff.	1.000	Min Design Depth for Optimisation (m)	0.200
Ratio R	0.275	PIMP (%)	100	Min Vel for Auto Design only (m/s)	1.00
Maximum Rainfall (mm/hr)	150	Add Flow / Climate Change (%)	10	Min Slope for Optimisation (1:X)	500
Maximum Time of Concentration (mins)	30	Minimum Backdrop Height (m)	0.000		

Designed with Level Inverts

Time Area Diagram for Storm

Time (mins)	**Area (ha)**	**Time (mins)**	**Area (ha)**	**Time (mins)**	**Area (ha)**	**Time (mins)**	**Area (ha)**	**Time (mins)**	**Area (ha)**	**Time (mins)**	**Area (ha)**	**Time (mins)**	**Area (ha)**
0-4	0.153	4-8	0.176	8-12	0.090	12-16	0.108	16-20	0.044	20-24	0.027	24-28	0.000

Total Area Contributing (ha) = 0.597

Total Pipe Volume (m³) = 107.520

Network Design Table for Storm

Network Design Table for Storm

- Indicates pipe length does not match coordinates
« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	2.823	0.001	2823.0	0.000	4.00	0.0	0.600	o	300	Pipe/Conduit	
S1.001	5.913	0.001	5913.0	0.005	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.002	6.514	0.001	6514.0	0.005	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.003	4.969	0.001	4969.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.004	0.882	0.006	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.005	9.518	0.032	300.0	0.006	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.000	1.187	0.001	1187.0	0.003	4.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	71.94	4.16	84.855	0.000	0.0	0.0	0.0	0.29	20.3	0.0
S1.001	69.15	4.67	84.854	0.005	0.0	0.0	0.1	0.20	13.8	1.2
S1.002	66.24	5.25	84.853	0.010	0.0	0.0	0.2	0.19	13.1	2.6
S1.003	64.47	5.64	84.852	0.010	0.0	0.0	0.2	0.21	15.1	2.6
S1.004	72.80	4.02	84.400	0.000	4.0	0.0	0.4	0.82	14.5	4.0
S1.005	71.76	4.19	84.394	0.006	4.0	0.0	0.6	0.90	63.8	6.2
S2.000	72.64	4.04	84.870	0.003	0.0	0.0	0.1	0.45	31.7	0.9

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S3.000	1.363	0.001	1363.0	0.000	4.00	0.0	0.600	o	300	Pipe/Conduit	
S2.001	6.285	0.001	6285.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S4.000	1.774	0.001	1774.0	0.000	4.00	0.0	0.600	o	300	Pipe/Conduit	
S4.001	5.266	0.001	5266.0	0.005	0.00	0.0	0.600	o	300	Pipe/Conduit	
S4.002	10.094	0.001	10094.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S5.000	1.870	0.001	1870.0	0.002	4.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S3.000	72.58	4.05	84.870	0.000	0.0	0.0	0.0	0.42	29.5	0.0
S2.001	69.47	4.61	84.869	0.003	0.0	0.0	0.1	0.19	13.4	0.9
S4.000	72.42	4.08	84.872	0.000	0.0	0.0	0.0	0.36	25.8	0.0
S4.001	70.03	4.50	84.871	0.005	0.0	0.0	0.1	0.21	14.7	1.3
S4.002	64.45	5.65	84.870	0.005	0.0	0.0	0.1	0.15	10.4	1.3
S5.000	72.38	4.09	84.871	0.002	0.0	0.0	0.1	0.35	25.1	0.7

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S6.000	1.630	0.001	1630.0	0.000	4.00	0.0	0.600	o	300	Pipe/Conduit	
S5.001	5.396	0.001	5396.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S7.000	3.590	0.001	3590.0	0.000	4.00	0.0	0.600	o	100	Pipe/Conduit	
S7.001	0.960	0.006	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S7.002	14.093	0.001	14093.0	0.005	0.00	0.0	0.600	o	300	Pipe/Conduit	
S8.000	3.417	0.001	3417.0	0.000	4.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S6.000	72.48	4.07	84.871	0.000	0.0	0.0	0.0	0.38	26.9	0.0
S5.001	69.90	4.53	84.870	0.002	0.0	0.0	0.1	0.20	14.5	0.7
S7.000	70.06	4.50	119.100	0.000	0.0	0.0	0.0	0.12	0.9	0.0
S7.001	69.95	4.52	88.357	0.000	0.0	0.0	0.0	0.82	14.5	0.0
S7.002	61.26	6.42	88.351	0.005	0.0	0.0	0.1	0.12	8.7	1.3
S8.000	71.62	4.22	88.353	0.000	0.0	0.0	0.0	0.26	18.4	0.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S8.001	11.018	0.001	11018.0	0.004	0.00	0.0	0.600	o	300	Pipe/Conduit	
S8.002	22.196	0.001	22196.0	0.008	0.00	0.0	0.600	o	300	Pipe/Conduit	
S9.000	1.519	0.001	1519.4	0.000	4.00	0.0	0.600	o	100	Pipe/Conduit	
S9.001	1.146	0.008	150.0	0.005	0.00	0.0	0.600	o	150	Pipe/Conduit	
S9.002	2.978	0.001	2978.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S9.003	16.831	0.001	16831.0	0.005	0.00	0.0	0.600	o	300	Pipe/Conduit	
S10.000	1.479	0.001	1478.5	0.000	4.00	0.0	0.600	o	100	Pipe/Conduit	
S10.001	2.037	0.014	150.0	0.005	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S8.001	64.99	5.52	88.352	0.004	0.0	0.0	0.1	0.14	9.9	1.1
S8.002	52.04	9.34	88.351	0.013	0.0	0.0	0.2	0.10	6.9	2.6
S9.000	72.11	4.13	119.100	0.000	0.0	0.0	0.0	0.19	1.5	0.0
S9.001	71.98	4.16	88.362	0.005	0.0	0.0	0.1	0.82	14.5	1.5
S9.002	70.96	4.34	88.354	0.005	0.0	0.0	0.1	0.28	19.7	1.5
S9.003	59.71	6.83	88.353	0.010	0.0	0.0	0.2	0.11	7.9	2.4
S10.000	72.14	4.13	116.100	0.000	0.0	0.0	0.0	0.19	1.5	0.0
S10.001	71.90	4.17	88.368	0.005	0.0	0.0	0.1	0.82	14.5	1.4

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S10.002	3.928	0.001	3928.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S10.003	11.240	0.001	11240.0	0.003	0.00	0.0	0.600	o	300	Pipe/Conduit	
S9.004	7.756	0.001	7756.0	0.002	0.00	0.0	0.600	o	300	Pipe/Conduit	
S9.005	16.076	0.001	16076.0	0.007	0.00	0.0	0.600	o	300	Pipe/Conduit	
S7.003	0.752	0.003	300.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S7.004	1.218	0.001	1218.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S7.005	3.307	0.001	3307.0	0.003	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S10.002	70.37	4.44	88.354	0.005	0.0	0.0	0.1	0.24	17.1	1.4
S10.003	63.84	5.79	88.353	0.007	0.0	0.0	0.2	0.14	9.8	1.9
S9.004	57.09	7.59	88.352	0.020	0.0	0.0	0.4	0.17	12.0	4.5
S9.005	50.60	9.92	88.351	0.027	0.0	0.0	0.5	0.12	8.1	5.4
S7.003	72.82	4.01	84.872	0.000	4.0	0.0	0.4	0.90	63.8	4.0
S7.004	72.55	4.06	84.869	0.000	4.0	0.0	0.4	0.44	31.3	4.4
S7.005	71.34	4.27	84.868	0.003	4.0	0.0	0.5	0.26	18.7	5.3

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S4.003	13.467	0.001	13467.0	0.004	0.00	0.0	0.600	o	300	Pipe/Conduit	
S11.000	2.161	0.001	2161.0	0.000	4.00	0.0	0.600	o	300	Pipe/Conduit	
S2.002	5.209	0.001	5209.0	0.005	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.003	2.000	0.001	2000.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.004	14.659	0.001	14659.0	0.009	0.00	0.0	0.600	o	300	Pipe/Conduit	
S12.000	2.420	0.001	2420.0	0.000	4.00	0.0	0.600	o	300	Pipe/Conduit	
S12.001	5.978	0.001	5978.0	0.008	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S4.003	57.66	7.42	84.869	0.014	4.0	0.0	0.7	0.13	8.9	7.6
S11.000	72.25	4.11	84.869	0.000	0.0	0.0	0.0	0.33	23.3	0.0
S2.002	56.32	7.84	84.868	0.023	4.0	0.0	0.9	0.21	14.7	9.5
S2.003	72.33	4.10	84.867	0.000	4.0	0.0	0.4	0.34	24.2	4.0
S2.004	62.46	6.12	84.866	0.009	4.0	0.0	0.6	0.12	8.6	6.6
S12.000	72.13	4.13	84.871	0.000	0.0	0.0	0.0	0.31	22.0	0.0
S12.001	69.28	4.64	84.870	0.008	0.0	0.0	0.2	0.19	13.7	2.2

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S13.000	2.079	0.001	2079.0	0.000	4.00	0.0	0.600	o	300	Pipe/Conduit	
S13.001	4.886	0.001	4886.0	0.007	0.00	0.0	0.600	o	300	Pipe/Conduit	
S12.002	3.512	0.001	3512.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S12.003	10.571	0.001	10571.0	0.003	0.00	0.0	0.600	o	300	Pipe/Conduit	
S14.000	10.806	0.001	10806.0	0.007	4.00	0.0	0.600	o	300	Pipe/Conduit	
S14.001	8.975	0.001	8975.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S14.002	1.741	0.001	1741.0	0.004	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S13.000	72.29	4.10	84.871	0.000	0.0	0.0	0.0	0.34	23.7	0.0
S13.001	70.15	4.48	84.870	0.007	0.0	0.0	0.2	0.22	15.2	2.0
S12.002	68.10	4.87	84.869	0.015	0.0	0.0	0.4	0.26	18.1	4.1
S12.003	62.54	6.10	84.868	0.018	0.0	0.0	0.4	0.14	10.2	4.4
S14.000	66.18	5.27	84.873	0.007	0.0	0.0	0.2	0.14	10.1	1.9
S14.001	62.04	6.22	84.872	0.007	0.0	0.0	0.2	0.16	11.1	1.9
S14.002	61.72	6.30	84.871	0.011	0.0	0.0	0.2	0.37	26.0	2.7

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S14.003	3.639	0.001	3639.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S14.004	7.472	0.001	7472.0	0.005	0.00	0.0	0.600	o	300	Pipe/Conduit	
S14.005	7.839	0.001	7839.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S12.004	1.629	0.001	1629.0	0.002	0.00	0.0	0.600	o	300	Pipe/Conduit	
S15.000	3.407	0.001	3407.0	0.000	4.00	0.0	0.600	o	300	Pipe/Conduit	
S12.005	6.186	0.001	6186.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S14.003	60.79	6.54	84.870	0.011	0.0	0.0	0.2	0.25	17.8	2.7
S14.004	58.19	7.26	84.869	0.016	0.0	0.0	0.3	0.17	12.2	3.7
S14.005	55.69	8.04	84.868	0.016	0.0	0.0	0.3	0.17	11.9	3.7
S12.004	55.48	8.11	84.867	0.036	0.0	0.0	0.7	0.38	26.9	7.9
S15.000	71.62	4.22	84.867	0.000	0.0	0.0	0.0	0.26	18.4	0.0
S12.005	53.90	8.65	84.866	0.036	0.0	0.0	0.7	0.19	13.5	7.9

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S2.005	4.318	0.001	4318.0	0.004	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.006	5.343	0.001	5343.0	0.003	0.00	0.0	0.600	o	300	Pipe/Conduit	
S16.000	11.082	0.001	11082.0	0.011	4.00	0.0	0.600	o	300	Pipe/Conduit	
S17.000	1.330	0.001	1330.0	0.000	4.00	0.0	0.600	o	100	Pipe/Conduit	
S17.001	0.847	0.006	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S17.002	5.091	0.001	5091.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S17.003	2.150	0.001	2150.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S2.005	53.04	8.96	84.865	0.048	4.0	0.0	1.3	0.23	16.3	14.6
S2.006	51.90	9.40	84.864	0.052	4.0	0.0	1.4	0.21	14.6«	15.0
S16.000	65.94	5.32	84.868	0.011	0.0	0.0	0.3	0.14	9.9	2.8
S17.000	72.26	4.11	116.130	0.000	0.0	0.0	0.0	0.20	1.6	0.0
S17.001	72.15	4.13	84.875	0.000	0.0	0.0	0.0	0.82	14.5	0.0
S17.002	69.90	4.53	84.869	0.000	0.0	0.0	0.0	0.21	14.9	0.0
S17.003	69.32	4.64	84.868	0.000	0.0	0.0	0.0	0.33	23.3	0.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S16.001	13.718	0.001	13718.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S18.000	1.723	0.001	1723.0	0.000	4.00	0.0	0.600	o	100	Pipe/Conduit	
S18.001	1.794	0.012	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S18.002	2.124	0.001	2124.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S18.003	5.556	0.001	5556.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S16.002	4.414	0.001	4414.0	0.011	0.00	0.0	0.600	o	300	Pipe/Conduit	
S16.003	8.496	0.001	8496.0	0.004	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S16.001	63.67	5.82	84.867	0.000	4.0	0.0	0.4	0.13	8.9	4.0
S18.000	71.95	4.16	116.130	0.000	0.0	0.0	0.0	0.18	1.4	0.0
S18.001	71.74	4.20	84.880	0.000	0.0	0.0	0.0	0.82	14.5	0.0
S18.002	71.13	4.31	84.868	0.000	0.0	0.0	0.0	0.33	23.5	0.0
S18.003	68.65	4.76	84.867	0.000	0.0	0.0	0.0	0.20	14.3	0.0
S16.002	62.33	6.15	84.866	0.011	4.0	0.0	0.6	0.23	16.1	7.1
S16.003	68.07	4.88	84.865	0.000	4.0	0.0	0.4	0.16	11.4	4.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S19.000	1.541	0.001	1540.6	0.000	4.00	0.0	0.600	o	100	Pipe/Conduit	
S19.001	0.921	0.006	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S19.002	9.394	0.001	9394.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S16.004	5.498	0.001	5498.0	0.003	0.00	0.0	0.600	o	300	Pipe/Conduit	
S20.000	2.888	0.001	2888.0	0.000	4.00	0.0	0.600	o	300	Pipe/Conduit	
S2.007	13.043	0.001	13043.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S19.000	72.10	4.14	116.130	0.000	0.0	0.0	0.0	0.19	1.5	0.0
S19.001	71.99	4.16	84.871	0.000	0.0	0.0	0.0	0.82	14.5	0.0
S19.002	66.60	5.18	84.865	0.000	0.0	0.0	0.0	0.15	10.8	0.0
S16.004	64.52	5.63	84.864	0.003	4.0	0.0	0.5	0.20	14.3	5.3
S20.000	71.90	4.17	84.864	0.000	0.0	0.0	0.0	0.28	20.0	0.0
S2.007	64.26	5.69	84.863	0.000	4.0	0.0	0.4	0.13	9.1	4.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S21.000	2.035	0.001	2034.8	0.000	4.00	0.0	0.600	o	100	Pipe/Conduit	
S21.001	1.106	0.007	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S21.002	1.616	0.001	1616.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S21.003	7.363	0.001	7363.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S22.000	6.576	0.001	6576.0	0.008	4.00	0.0	0.600	o	300	Pipe/Conduit	
S22.001	6.576	0.001	6576.0	0.003	0.00	0.0	0.600	o	300	Pipe/Conduit	
S21.004	7.445	0.001	7445.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S21.000	71.68	4.21	110.100	0.000	0.0	0.0	0.0	0.16	1.3	0.0
S21.001	71.55	4.23	84.874	0.000	0.0	0.0	0.0	0.82	14.5	0.0
S21.002	71.15	4.30	84.867	0.000	0.0	0.0	0.0	0.38	27.0	0.0
S21.003	67.43	5.01	84.866	0.000	0.0	0.0	0.0	0.17	12.3	0.0
S22.000	69.55	4.59	84.867	0.008	0.0	0.0	0.2	0.18	13.1	2.3
S22.001	66.55	5.19	84.866	0.012	0.0	0.0	0.3	0.18	13.1	3.1
S21.004	68.90	4.72	84.865	0.000	4.0	0.0	0.4	0.17	12.2	4.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S23.000	2.003	0.001	2002.7	0.000	4.00	0.0	0.600	o	100	Pipe/Conduit	
S23.001	1.092	0.007	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S23.002	1.759	0.001	1759.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S23.003	4.862	0.001	4862.0	0.001	0.00	0.0	0.600	o	300	Pipe/Conduit	
S23.004	4.422	0.001	4422.0	0.002	0.00	0.0	0.600	o	300	Pipe/Conduit	
S21.005	9.791	0.001	9791.0	0.004	0.00	0.0	0.600	o	300	Pipe/Conduit	
S21.006	9.791	0.001	9791.0	0.008	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.008	2.495	0.001	2495.0	0.003	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S23.000	71.71	4.20	110.100	0.000	0.0	0.0	0.0	0.16	1.3	0.0
S23.001	71.58	4.23	84.874	0.000	0.0	0.0	0.0	0.82	14.5	0.0
S23.002	71.12	4.31	84.867	0.000	0.0	0.0	0.0	0.37	25.9	0.0
S23.003	69.08	4.68	84.866	0.001	0.0	0.0	0.0	0.22	15.3	0.3
S23.004	67.44	5.01	84.865	0.003	0.0	0.0	0.1	0.23	16.1	0.9
S21.005	62.55	6.09	84.864	0.007	4.0	0.0	0.6	0.15	10.6	6.3
S21.006	58.46	7.18	84.863	0.015	4.0	0.0	0.7	0.15	10.6	7.9
S2.008	58.00	7.32	84.862	0.019	8.0	0.0	1.2	0.31	21.6	13.1

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S24.000	3.068	0.001	3068.0	0.000	4.00	0.0	0.600	o	300	Pipe/Conduit	
S2.009	5.026	0.001	5026.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.010	7.521	0.001	7521.0	0.005	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.011	7.318	0.001	7318.0	0.002	0.00	0.0	0.600	o	300	Pipe/Conduit	
S25.000	3.181	0.001	3181.0	0.000	4.00	0.0	0.600	o	300	Pipe/Conduit	
S25.001	7.509	0.001	7509.0	0.004	0.00	0.0	0.600	o	300	Pipe/Conduit	
S25.002	4.162	0.001	4162.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S24.000	71.81	4.19	84.862	0.000	0.0	0.0	0.0	0.27	19.4	0.0
S2.009	70.63	4.39	84.861	0.000	4.0	0.0	0.4	0.21	15.0	4.0
S2.010	66.86	5.12	84.860	0.005	4.0	0.0	0.5	0.17	12.2	5.6
S2.011	63.69	5.82	84.859	0.007	4.0	0.0	0.6	0.17	12.3	6.2
S25.000	71.75	4.20	84.862	0.000	0.0	0.0	0.0	0.27	19.1	0.0
S25.001	67.84	4.92	84.861	0.004	0.0	0.0	0.1	0.17	12.2	1.1
S25.002	66.40	5.22	84.860	0.004	0.0	0.0	0.1	0.23	16.6	1.1

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S25.003	1.232	0.001	1232.0	0.004	0.00	0.0	0.600	o	300	Pipe/Conduit	
S25.004	6.710	0.001	6710.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.012	7.464	0.001	7464.0	0.004	0.00	0.0	0.600	o	300	Pipe/Conduit	
S26.000	7.325	0.001	7325.0	0.003	4.00	0.0	0.600	o	300	Pipe/Conduit	
S27.000	1.083	0.001	1083.0	0.000	4.00	0.0	0.600	o	100	Pipe/Conduit	
S27.001	2.591	0.017	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S27.002	3.185	0.001	3185.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S25.003	66.18	5.27	84.859	0.008	0.0	0.0	0.2	0.44	31.1	2.1
S25.004	63.45	5.88	84.858	0.008	0.0	0.0	0.2	0.18	12.9	2.1
S2.012	60.57	6.60	84.857	0.019	4.0	0.0	0.8	0.17	12.2	8.9
S26.000	68.99	4.70	84.861	0.003	0.0	0.0	0.1	0.17	12.3	0.8
S27.000	72.43	4.08	101.100	0.000	0.0	0.0	0.0	0.23	1.8	0.0
S27.001	72.12	4.13	84.901	0.000	0.0	0.0	0.0	0.82	14.5	0.0
S27.002	70.99	4.33	84.884	0.000	0.0	0.0	0.0	0.27	19.0	0.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S27.003	2.156	0.001	2156.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S27.004	25.456	0.001	25456.0	0.009	0.00	0.0	0.600	o	300	Pipe/Conduit	
S28.000	2.579	0.001	2579.1	0.000	4.00	0.0	0.600	o	100	Pipe/Conduit	
S28.001	1.045	0.007	150.0	0.005	0.00	0.0	0.600	o	150	Pipe/Conduit	
S28.002	5.537	0.001	5537.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S26.001	5.494	0.001	5494.0	0.004	0.00	0.0	0.600	o	300	Pipe/Conduit	
S26.002	10.459	0.001	10459.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S26.003	11.859	0.001	11859.0	0.009	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S27.003	70.38	4.44	84.861	0.000	0.0	0.0	0.0	0.33	23.3	0.0
S27.004	52.54	9.15	84.861	0.009	0.0	0.0	0.2	0.09	6.4	1.9
S28.000	71.16	4.30	110.100	0.000	0.0	0.0	0.0	0.14	1.1	0.0
S28.001	71.04	4.32	84.868	0.005	0.0	0.0	0.1	0.82	14.5	1.5
S28.002	68.58	4.78	84.861	0.005	0.0	0.0	0.1	0.20	14.3	1.5
S26.001	51.38	9.60	84.860	0.022	0.0	0.0	0.4	0.20	14.3	4.5
S26.002	66.47	5.20	84.859	0.000	4.0	0.0	0.4	0.14	10.2	4.0
S26.003	60.32	6.67	84.858	0.009	4.0	0.0	0.6	0.14	9.6	6.6

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S29.000	2.826	0.001	2825.6	0.000	4.00	0.0	0.600	o	100	Pipe/Conduit	
S29.001	1.623	0.011	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S29.002	2.581	0.001	2581.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S29.003	3.409	0.001	3409.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S26.004	6.243	0.001	6243.0	0.005	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.013	9.296	0.001	9296.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S29.000	70.90	4.35	110.100	0.000	0.0	0.0	0.0	0.14	1.1	0.0
S29.001	70.72	4.38	84.870	0.000	0.0	0.0	0.0	0.82	14.5	0.0
S29.002	69.93	4.52	84.859	0.000	0.0	0.0	0.0	0.30	21.2	0.0
S29.003	68.78	4.74	84.858	0.000	0.0	0.0	0.0	0.26	18.4	0.0
S26.004	58.36	7.21	84.857	0.014	4.0	0.0	0.7	0.19	13.4	7.6
S2.013	67.43	5.01	84.856	0.000	4.0	0.0	0.4	0.15	10.9	4.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S30.000	1.857	0.001	1857.0	0.000	4.00	0.0	0.600	o	100	Pipe/Conduit	
S30.001	1.133	0.008	150.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S30.002	3.473	0.001	3473.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S30.003	8.974	0.001	8974.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S30.004	11.357	0.001	11357.0	0.008	0.00	0.0	0.600	o	300	Pipe/Conduit	
S31.000	1.859	0.001	1859.0	0.000	4.00	0.0	0.600	o	300	Pipe/Conduit	
S31.001	8.106	0.001	8106.0	0.007	0.00	0.0	0.600	o	300	Pipe/Conduit	
S31.002	15.493	0.001	15493.0	0.010	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S30.000	71.83	4.18	101.100	0.000	0.0	0.0	0.0	0.17	1.3	0.0
S30.001	71.73	4.20	84.867	0.000	0.0	0.0	0.0	1.07	42.4	0.0
S30.002	70.47	4.42	84.859	0.000	0.0	0.0	0.0	0.26	18.2	0.0
S30.003	65.66	5.38	84.858	0.000	0.0	0.0	0.0	0.16	11.1	0.0
S30.004	60.03	6.74	84.857	0.008	0.0	0.0	0.2	0.14	9.8	1.9
S31.000	72.39	4.09	84.860	0.000	0.0	0.0	0.0	0.36	25.2	0.0
S31.001	67.94	4.90	84.859	0.007	0.0	0.0	0.2	0.17	11.7	1.8
S31.002	58.75	7.10	84.858	0.017	0.0	0.0	0.4	0.12	8.3	4.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S32.000	14.758	0.001	14758.0	0.005	4.00	0.0	0.600	o	300	Pipe/Conduit	
S31.003	1.864	0.001	1864.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S30.005	21.927	0.001	21927.0	0.004	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.014	6.412	0.001	6412.0	0.003	0.00	0.0	0.600	o	300	Pipe/Conduit	
S33.000	4.249	0.001	4249.0	0.000	4.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S32.000	62.77	6.04	84.858	0.005	0.0	0.0	0.1	0.12	8.5	1.2
S31.003	58.44	7.19	84.857	0.022	0.0	0.0	0.5	0.36	25.1	5.1
S30.005	56.60	7.74	84.856	0.000	4.0	0.0	0.4	0.10	6.9	4.0
S2.014	54.86	8.32	84.855	0.003	8.0	0.0	0.9	0.19	13.2	9.4
S33.000	71.13	4.31	84.855	0.000	0.0	0.0	0.0	0.23	16.4	0.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S2.015	9.786	0.001	9786.0	0.005	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.016	9.195	0.001	9195.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.017	1.036	0.007	150.0	0.004	0.00	0.0	0.600	o	150	Pipe/Conduit	
S2.018	9.095	0.030	300.0	0.002	0.00	0.0	0.600	o	300	Pipe/Conduit	
S34.000	1.781	0.001	1781.0	0.000	4.00	0.0	0.600	o	300	Pipe/Conduit	
S1.006	1.945	0.013	149.6	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.007	7.303	0.024	304.3	0.002	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S2.015	51.88	9.40	84.854	0.008	8.0	0.0	1.0	0.15	10.6	10.5
S2.016	67.51	4.99	84.853	0.000	4.0	0.0	0.4	0.15	10.9	4.0
S2.017	72.78	4.02	84.852	0.000	4.0	0.0	0.4	0.82	14.5	4.0
S2.018	71.79	4.19	84.392	0.002	4.0	0.0	0.4	0.90	63.8	4.9
S34.000	72.42	4.08	84.363	0.000	0.0	0.0	0.0	0.36	25.7	0.0
S1.006	72.67	4.04	84.362	0.000	4.0	0.0	0.4	0.82	14.5	4.0
S1.007	72.10	4.14	84.349	0.000	4.0	0.0	0.4	0.90	63.3	4.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S35.000	1.529	0.001	1529.0	0.000	4.00	0.0	0.600	o	300	Pipe/Conduit	
S1.008	1.606	0.011	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S36.000	2.111	0.014	150.0	0.027	4.00	0.0	0.600	o	150	Pipe/Conduit	
S36.001	4.790	0.001	4790.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S36.002	2.000	0.001	2000.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S36.003	13.092	0.044	300.0	0.006	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.009	3.242	0.011	300.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S35.000	72.52	4.06	82.757	0.000	0.0	0.0	0.0	0.39	27.8	0.0
S1.008	72.71	4.03	84.325	0.000	4.0	0.0	0.4	0.82	14.5	4.0
S36.000	72.65	4.04	83.264	0.027	0.0	0.0	0.7	0.82	14.5	7.9
S36.001	70.55	4.41	83.250	0.027	0.0	0.0	0.7	0.22	15.4	7.9
S36.002	72.33	4.10	83.249	0.000	4.0	0.0	0.4	0.34	24.2	4.0
S36.003	70.94	4.34	82.800	0.006	4.0	0.0	0.6	0.90	63.8	6.1
S1.009	70.60	4.40	82.756	0.006	8.0	0.0	1.0	0.90	63.8	10.5

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S37.000	3.106	0.001	3106.0	0.000	4.00	0.0	0.600	o	300	Pipe/Conduit	
S1.010	1.370	0.009	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.011	6.728	0.022	300.0	0.002	0.00	0.0	0.600	o	300	Pipe/Conduit	
S38.000	1.699	0.011	150.0	0.011	4.00	0.0	0.600	o	150	Pipe/Conduit	
S38.001	7.004	0.001	7004.4	0.000	0.00	0.0	0.600	\/	30	Pipe/Conduit	
S38.002	2.000#	0.007	300.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S38.003	14.132	0.047	300.0	0.004	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S37.000	71.79	4.19	82.756	0.000	0.0	0.0	0.0	0.27	19.3	0.0
S1.010	72.74	4.03	81.800	0.000	4.0	0.0	0.4	0.82	14.5	4.0
S1.011	72.00	4.15	81.360	0.002	4.0	0.0	0.5	0.90	63.8	5.1
S38.000	72.70	4.03	81.811	0.011	0.0	0.0	0.3	0.82	14.5	3.1
S38.001	71.54	4.23	81.811	0.011	0.0	0.0	0.3	0.59	1002.3	3.1
S38.002	72.68	4.04	81.810	0.000	4.0	0.0	0.4	0.90	63.8	4.0
S38.003	71.17	4.30	81.360	0.004	4.0	0.0	0.5	0.90	63.8	5.6

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S39.000	2.300	0.001	2300.0	0.000	4.00	0.0	0.600	o	300	Pipe/Conduit	
S1.012	3.581	0.012	300.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.013	1.267	0.013	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S40.000	6.287	0.001	6287.0	0.000	4.00	0.0	0.600	o	100	Pipe/Conduit	
S40.001	9.456	0.001	18912.0	0.006	0.00	0.0	0.600	o	150	Pipe/Conduit	
S41.000	1.413	0.001	1413.4	0.000	4.00	0.0	0.600	o	100	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S39.000	72.19	4.12	80.300	0.000	0.0	0.0	0.0	0.32	22.5	0.0
S1.012	72.51	4.07	80.300	0.000	4.0	0.0	0.4	0.90	63.8	4.0
S1.013	72.39	4.09	79.400	0.000	4.0	0.0	0.4	1.00	17.8	4.4
S40.000	66.59	5.18	88.352	0.000	0.0	0.0	0.0	0.09	0.7	0.0
S40.001	57.09	7.59	88.351	0.006	0.0	0.0	0.1	0.07	1.2«	1.3
S41.000	72.19	4.12	116.100	0.000	0.0	0.0	0.0	0.20	1.5	0.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S41.001	0.849	0.006	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S41.002	5.667	0.001	5667.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S40.002	9.456	0.001	9456.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S40.003	19.076	0.001	19076.0	0.007	0.00	0.0	0.600	o	300	Pipe/Conduit	
S40.004	5.917	0.039	150.0	0.007	0.00	0.0	0.600	o	300	Pipe/Conduit	
S40.005	0.812	0.005	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S40.006	11.328	0.038	300.0	0.003	0.00	0.0	0.600	o	300	Pipe/Conduit	
S42.000	4.004	0.001	4004.0	0.000	4.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S41.001	72.09	4.14	88.358	0.000	0.0	0.0	0.0	0.82	14.5	0.0
S41.002	69.46	4.61	88.352	0.000	0.0	0.0	0.0	0.20	14.1	0.0
S40.002	53.96	8.63	88.351	0.006	0.0	0.0	0.1	0.15	10.8	1.3
S40.003	46.83	11.65	88.350	0.013	0.0	0.0	0.2	0.11	7.4	2.3
S40.004	72.45	4.08	88.349	0.000	4.0	0.0	0.4	1.28	90.6	4.0
S40.005	72.35	4.09	83.358	0.000	4.0	0.0	0.4	0.82	14.5	4.4
S40.006	71.14	4.30	83.350	0.003	4.0	0.0	0.5	0.90	63.8	5.1
S42.000	71.28	4.28	88.402	0.000	0.0	0.0	0.0	0.24	16.9	0.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S42.001	1.150	0.001	1150.0	0.005	0.00	0.0	0.600	o	300	Pipe/Conduit	
S42.002	0.786	0.005	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S40.007	5.591	0.019	300.0	0.002	0.00	0.0	0.600	o	300	Pipe/Conduit	
S43.000	1.881	0.001	1881.0	0.000	4.00	0.0	0.600	o	300	Pipe/Conduit	
S43.001	1.122	0.001	1122.0	0.002	0.00	0.0	0.600	o	300	Pipe/Conduit	
S43.002	0.748	0.005	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S40.008	23.428	0.078	300.0	0.003	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S42.001	71.04	4.32	88.351	0.005	0.0	0.0	0.1	0.46	32.2	1.4
S42.002	70.95	4.34	83.358	0.005	0.0	0.0	0.1	0.82	14.5	1.4
S40.007	70.38	4.44	83.312	0.010	4.0	0.0	0.7	0.90	63.8	7.2
S43.000	72.38	4.09	88.352	0.000	0.0	0.0	0.0	0.35	25.0	0.0
S43.001	72.14	4.13	88.351	0.002	0.0	0.0	0.1	0.46	32.6	0.7
S43.002	72.05	4.14	83.358	0.002	0.0	0.0	0.1	0.82	14.5	0.7
S40.008	68.10	4.87	83.560	0.016	4.0	0.0	0.8	0.90	63.8	8.6

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S44.000	4.510	0.001	4510.0	0.000	4.00	0.0	0.600	o	300	Pipe/Conduit	
S44.001	1.120	0.001	1120.0	0.005	0.00	0.0	0.600	o	300	Pipe/Conduit	
S44.002	1.120	0.007	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S40.009	14.204	0.047	300.0	0.005	0.00	0.0	0.600	o	300	Pipe/Conduit	
S45.000	1.287	0.001	1287.0	0.000	4.00	0.0	0.600	o	300	Pipe/Conduit	
S45.001	1.145	0.001	1145.0	0.011	0.00	0.0	0.600	o	300	Pipe/Conduit	
S45.002	1.121	0.007	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S44.000	70.96	4.33	88.352	0.000	0.0	0.0	0.0	0.22	15.9	0.0
S44.001	72.66	4.04	88.351	0.000	4.0	0.0	0.4	0.46	32.6	4.0
S44.002	72.53	4.06	83.358	0.000	4.0	0.0	0.4	0.82	14.5	4.4
S40.009	66.80	5.14	83.351	0.021	8.0	0.0	1.3	0.90	63.8	14.3
S45.000	72.61	4.05	0.000	0.000	0.0	0.0	0.0	0.43	30.4	0.0
S45.001	72.65	4.04	88.351	0.000	4.0	0.0	0.4	0.46	32.3	4.0
S45.002	72.52	4.06	83.358	0.000	4.0	0.0	0.4	0.82	14.5	4.4

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S40.010	19.266	0.064	300.0	0.017	0.00	0.0	0.600	o	300	Pipe/Conduit	
S46.000	3.981	0.001	3981.0	0.001	4.00	0.0	0.600	o	300	Pipe/Conduit	
S46.001	0.621	0.001	621.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S46.002	1.322	0.009	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S40.011	1.557	0.005	300.0	0.003	0.00	0.0	0.600	o	300	Pipe/Conduit	
S40.012	3.046	0.020	150.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S40.013	32.848	1.639	20.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S40.010	65.14	5.49	83.303	0.038	12.0	0.0	2.1	0.90	63.8	23.1
S46.000	71.29	4.28	88.354	0.001	0.0	0.0	0.0	0.24	17.0	0.4
S46.001	72.80	4.02	88.353	0.000	4.0	0.0	0.4	0.62	44.1	4.0
S46.002	72.64	4.04	83.358	0.000	4.0	0.0	0.4	0.82	14.5	4.4
S40.011	65.01	5.52	83.239	0.041	16.0	0.0	2.6	0.90	63.8	28.1
S40.012	72.62	4.05	83.181	0.000	4.0	0.0	0.4	1.07	42.4	4.0
S40.013	71.53	4.23	83.352	0.000	4.0	0.0	0.4	2.94	116.7	4.4

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S40.014	134.137	0.894	150.0	0.032	0.00	0.0	0.600	o	225	Pipe/Conduit	
S47.000	20.440	0.001	20440.0	0.008	4.00	0.0	0.600	o	300	Pipe/Conduit	
S48.000	1.383	0.001	1383.0	0.000	4.00	0.0	0.600	o	300	Pipe/Conduit	
S49.000	1.841	0.001	1840.7	0.000	4.00	0.0	0.600	o	100	Pipe/Conduit	
S49.001	0.972	0.006	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S49.002	2.034	0.001	2034.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S49.003	19.799	0.001	19799.0	0.001	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S40.014	61.59	6.33	80.180	0.032	4.0	0.0	1.1	1.07	42.3	12.3
S47.000	57.85	7.36	84.856	0.008	0.0	0.0	0.2	0.10	7.2	1.8
S48.000	72.57	4.06	84.856	0.000	0.0	0.0	0.0	0.41	29.3	0.0
S49.000	71.85	4.18	128.100	0.000	0.0	0.0	0.0	0.17	1.3	0.0
S49.001	71.73	4.20	84.856	0.000	0.0	0.0	0.0	0.82	14.5	0.0
S49.002	71.16	4.30	84.850	0.000	0.0	0.0	0.0	0.34	24.0	0.0
S49.003	57.39	7.50	84.849	0.001	0.0	0.0	0.0	0.10	7.3	0.3

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S50.000	4.953	0.001	4953.0	0.000	4.00	0.0	0.600	o	300	Pipe/Conduit	
S51.000	2.597	0.001	2596.8	0.000	4.00	0.0	0.600	o	100	Pipe/Conduit	
S51.001	0.856	0.006	150.0	0.006	0.00	0.0	0.600	o	150	Pipe/Conduit	
S51.002	4.332	0.001	4332.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S49.004	4.808	0.001	4808.0	0.001	0.00	0.0	0.600	o	300	Pipe/Conduit	
S47.001	0.595	0.001	595.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S50.000	70.68	4.39	84.854	0.000	0.0	0.0	0.0	0.21	15.1	0.0
S51.000	71.14	4.30	128.100	0.000	0.0	0.0	0.0	0.14	1.1	0.0
S51.001	71.04	4.32	84.855	0.006	0.0	0.0	0.2	0.82	14.5	1.8
S51.002	69.33	4.64	84.849	0.006	0.0	0.0	0.2	0.23	16.2	1.8
S49.004	56.21	7.87	84.848	0.009	0.0	0.0	0.2	0.22	15.4	1.9
S47.001	72.81	4.02	83.150	0.000	4.0	0.0	0.4	0.64	45.1	4.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S47.002	0.500	0.002	250.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S47.003	4.121	0.016	250.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S47.004	7.549	0.030	250.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S47.005	4.501	0.018	250.0	0.001	0.00	0.0	0.600	o	300	Pipe/Conduit	
S52.000	3.552	0.001	3552.0	0.000	4.00	0.0	0.600	o	300	Pipe/Conduit	
S53.000	2.711	0.001	2710.9	0.000	4.00	0.0	0.600	o	100	Pipe/Conduit	
S53.001	0.933	0.006	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S53.002	1.121	0.001	1121.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S47.002	72.76	4.02	82.850	0.000	4.0	0.0	0.4	0.99	70.0	4.4
S47.003	72.35	4.09	82.848	0.000	4.0	0.0	0.4	0.99	70.0	4.4
S47.004	71.61	4.22	82.832	0.000	4.0	0.0	0.4	0.99	70.0	4.5
S47.005	71.18	4.30	82.801	0.001	4.0	0.0	0.4	0.99	70.0	4.8
S52.000	71.54	4.23	84.854	0.000	0.0	0.0	0.0	0.25	18.0	0.0
S53.000	71.02	4.32	128.100	0.000	0.0	0.0	0.0	0.14	1.1	0.0
S53.001	70.92	4.34	84.855	0.000	0.0	0.0	0.0	0.82	14.5	0.0
S53.002	70.69	4.38	84.849	0.000	0.0	0.0	0.0	0.46	32.6	0.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S52.001	4.211	0.001	4211.0	0.006	0.00	0.0	0.600	o	300	Pipe/Conduit	
S52.002	0.590	0.001	590.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S52.003	2.761	0.018	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S47.006	7.770	0.031	250.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S47.007	2.794	0.011	250.0	0.001	0.00	0.0	0.600	o	300	Pipe/Conduit	
S47.008	6.066	0.024	250.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S54.000	1.596	0.001	1596.0	0.014	4.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S52.001	69.07	4.68	84.853	0.006	0.0	0.0	0.1	0.23	16.5	1.5
S52.002	72.81	4.02	84.852	0.000	4.0	0.0	0.4	0.64	45.3	4.0
S52.003	72.57	4.06	83.150	0.000	4.0	0.0	0.4	0.82	14.5	4.0
S47.006	70.45	4.43	82.783	0.002	8.0	0.0	0.8	0.99	70.0	9.3
S47.007	70.19	4.47	82.752	0.003	8.0	0.0	0.9	0.99	70.0	9.5
S47.008	69.64	4.58	82.741	0.003	8.0	0.0	0.9	0.99	70.0	9.6
S54.000	72.25	4.11	84.855	0.014	0.0	0.0	0.4	0.24	4.3	3.9

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S54.001	7.744	0.001	7744.0	0.004	0.00	0.0	0.600	o	300	Pipe/Conduit	
S55.000	1.789	0.001	1789.1	0.000	4.00	0.0	0.600	o	100	Pipe/Conduit	
S55.001	0.941	0.001	941.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S55.002	2.251	0.001	2251.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S55.003	4.979	0.001	4979.0	0.003	0.00	0.0	0.600	o	300	Pipe/Conduit	
S56.000	4.535	0.001	4535.0	0.000	4.00	0.0	0.600	o	300	Pipe/Conduit	
S54.002	0.593	0.001	593.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S54.001	68.11	4.87	84.854	0.017	0.0	0.0	0.4	0.17	12.0	4.6
S55.000	71.89	4.17	116.100	0.000	0.0	0.0	0.0	0.17	1.4	0.0
S55.001	71.71	4.20	84.856	0.000	0.0	0.0	0.0	0.50	35.7	0.0
S55.002	71.05	4.32	84.855	0.000	0.0	0.0	0.0	0.32	22.8	0.0
S55.003	68.95	4.71	84.854	0.003	0.0	0.0	0.1	0.21	15.1	0.9
S56.000	70.95	4.34	84.854	0.000	0.0	0.0	0.0	0.22	15.8	0.0
S54.002	72.81	4.02	84.853	0.000	4.0	0.0	0.4	0.64	45.1	4.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S54.003	1.601	0.011	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S47.009	4.275	0.017	250.0	0.001	0.00	0.0	0.600	o	300	Pipe/Conduit	
S47.010	6.911	0.028	250.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S47.011	4.169	0.017	250.0	0.001	0.00	0.0	0.600	o	300	Pipe/Conduit	
S57.000	1.678	0.001	1678.5	0.000	4.00	0.0	0.600	o	100	Pipe/Conduit	
S57.001	0.826	0.006	150.0	0.005	0.00	0.0	0.600	o	150	Pipe/Conduit	
S57.002	1.497	0.001	1497.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S57.003	3.431	0.001	3431.0	0.003	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S54.003	72.71	4.03	83.150	0.000	4.0	0.0	0.4	0.82	14.5	4.0
S47.009	69.26	4.65	82.717	0.004	12.0	0.0	1.3	0.99	70.0	14.2
S47.010	68.65	4.76	82.700	0.004	12.0	0.0	1.3	0.99	70.0	14.3
S47.011	68.29	4.83	82.672	0.005	12.0	0.0	1.3	0.99	70.0	14.5
S57.000	71.98	4.16	116.100	0.000	0.0	0.0	0.0	0.18	1.4	0.0
S57.001	71.89	4.17	84.856	0.005	0.0	0.0	0.1	0.82	14.5	1.3
S57.002	71.53	4.24	84.850	0.005	0.0	0.0	0.1	0.40	28.1	1.3
S57.003	70.29	4.46	84.849	0.008	0.0	0.0	0.2	0.26	18.3	2.1

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S58.000	1.728	0.001	1728.0	0.000	4.00	0.0	0.600	o	300	Pipe/Conduit	
S57.004	3.134	0.001	3134.0	0.003	0.00	0.0	0.600	o	300	Pipe/Conduit	
S57.005	0.506	0.001	506.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S57.006	2.321	0.015	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S47.012	4.630	0.019	250.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S47.013	1.314	0.005	250.0	0.001	0.00	0.0	0.600	o	300	Pipe/Conduit	
S47.014	4.499	0.018	250.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S58.000	72.44	4.08	84.854	0.000	0.0	0.0	0.0	0.37	26.1	0.0
S57.004	69.26	4.65	84.853	0.010	0.0	0.0	0.3	0.27	19.2	2.8
S57.005	72.83	4.01	84.852	0.000	4.0	0.0	0.4	0.69	48.9	4.0
S57.006	72.62	4.05	83.150	0.000	4.0	0.0	0.4	0.82	14.5	4.0
S47.012	67.90	4.91	82.655	0.005	16.0	0.0	1.7	0.99	70.0	19.0
S47.013	67.78	4.93	82.637	0.006	16.0	0.0	1.7	0.99	70.0	19.2
S47.014	67.41	5.01	82.632	0.006	16.0	0.0	1.7	0.99	70.0	19.2

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S47.015	7.665	0.031	250.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S47.016	3.153	0.013	250.0	0.001	0.00	0.0	0.600	o	300	Pipe/Conduit	
S47.017	8.984	0.036	250.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S47.018	3.420	0.014	250.0	0.001	0.00	0.0	0.600	o	300	Pipe/Conduit	
S47.019	8.876	0.036	250.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S47.020	2.699	0.011	250.0	0.005	0.00	0.0	0.600	o	300	Pipe/Conduit	
S47.021	6.168	0.025	250.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S47.022	4.077	0.016	250.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S47.023	5.305	0.021	250.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S47.024	1.891	0.001	1891.0	0.004	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S47.015	66.78	5.14	82.614	0.006	16.0	0.0	1.8	0.99	70.0	19.3
S47.016	66.53	5.19	82.583	0.008	16.0	0.0	1.8	0.99	70.0	19.6
S47.017	65.81	5.34	82.570	0.008	16.0	0.0	1.8	0.99	70.0	19.7
S47.018	65.55	5.40	82.534	0.009	16.0	0.0	1.8	0.99	70.0	19.9
S47.019	64.87	5.55	82.521	0.009	16.0	0.0	1.8	0.99	70.0	20.0
S47.020	64.67	5.60	82.485	0.014	16.0	0.0	1.9	0.99	70.0	21.3
S47.021	64.21	5.70	82.474	0.014	16.0	0.0	1.9	0.99	70.0	21.3
S47.022	63.91	5.77	82.450	0.014	16.0	0.0	1.9	0.99	70.0	21.3
S47.023	63.53	5.86	82.433	0.014	16.0	0.0	1.9	0.99	70.0	21.3
S47.024	72.37	4.09	79.400	0.000	4.0	0.0	0.4	0.35	24.9	4.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.014	20.288	0.135	150.0	0.010	0.00	0.0	0.600	o	300	Pipe/Conduit	
S59.000	1.168	0.001	1167.6	0.000	4.00	0.0	0.600	o	100	Pipe/Conduit	
S59.001	1.048	0.007	150.0	0.004	0.00	0.0	0.600	o	150	Pipe/Conduit	
S59.002	5.956	0.074	80.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S59.003	41.950	0.140	300.0	0.029	0.00	0.0	0.600	o	300	Pipe/Conduit	
S60.000	1.991	0.001	1991.0	0.000	4.00	0.0	0.600	o	100	Pipe/Conduit	
S60.001	0.936	0.006	150.0	0.006	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.014	71.36	4.26	79.294	0.000	4.0	0.0	0.4	1.28	90.6	4.0
S59.000	72.37	4.09	101.100	0.000	0.0	0.0	0.0	0.22	1.7	0.0
S59.001	72.25	4.11	79.924	0.004	0.0	0.0	0.1	0.82	14.5	1.1
S59.002	71.73	4.20	79.917	0.004	0.0	0.0	0.1	1.12	19.9	1.1
S59.003	67.59	4.97	79.850	0.033	0.0	0.0	0.8	0.90	63.8	8.9
S60.000	71.72	4.20	101.100	0.000	0.0	0.0	0.0	0.16	1.3	0.0
S60.001	71.61	4.22	79.924	0.006	0.0	0.0	0.2	0.82	14.5	1.7

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S60.002	4.751	0.059	80.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S59.004	4.888	0.033	150.0	0.001	0.00	0.0	0.600	o	300	Pipe/Conduit	
S59.005	14.097	0.094	150.0	0.015	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.015	13.586	0.091	150.0	0.001	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S60.002	71.21	4.29	79.918	0.006	0.0	0.0	0.2	1.12	19.9	1.7
S59.004	72.52	4.06	79.710	0.000	4.0	0.0	0.4	1.28	90.6	4.0
S59.005	71.46	4.25	79.678	0.015	4.0	0.0	0.8	1.28	90.6	8.6
S1.015	71.86	4.18	79.150	0.000	8.1	0.0	0.7	1.28	90.6	8.1

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
BR1	85.350	0.495	Junction		S1.000	84.855	300				
BR1	85.350	0.496	Junction		S1.001	84.854	300	S1.000	84.854	300	
BR1	85.300	0.447	Junction		S1.002	84.853	300	S1.001	84.853	300	
AJ1	85.350	0.498	Open Manhole	450	S1.003	84.852	300	S1.002	84.852	300	
FC1	85.350	0.950	Open Manhole	600	S1.004	84.400	150	S1.003	84.851	300	601
FD1	85.350	0.956	Open Manhole	600	S1.005	84.394	300	S1.004	84.394	150	
BR2	85.350	0.480	Junction		S2.000	84.870	300				
BR2	85.350	0.480	Junction		S3.000	84.870	300				
AJ2	85.350	0.481	Open Manhole	450	S2.001	84.869	300	S2.000	84.869	300	
								S3.000	84.869	300	
BR3	85.350	0.478	Junction		S4.000	84.872	300				
BR3	85.350	0.479	Junction		S4.001	84.871	300	S4.000	84.871	300	
AJ3	85.350	0.480	Open Manhole	450	S4.002	84.870	300	S4.001	84.870	300	
BR4	85.350	0.479	Junction		S5.000	84.871	300				
BR4	85.350	0.479	Junction		S6.000	84.871	300				
AJ4	85.350	0.480	Open Manhole	450	S5.001	84.870	300	S5.000	84.870	300	
								S6.000	84.870	300	
GR1.1	119.300	0.200	Junction		S7.000	119.100	100				
DP1	119.300	30.943	Open Manhole	150	S7.001	88.357	150	S7.000	119.099	100	30692

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
IC1	88.850	0.499	Junction		S7.002	88.351	300	S7.001	88.351	150	
BR5	88.850	0.497	Junction		S8.000	88.353	300				
BR5	88.850	0.498	Junction		S8.001	88.352	300	S8.000	88.352	300	
BR5	88.850	0.499	Junction		S8.002	88.351	300	S8.001	88.351	300	
GR1.2	119.300	0.200	Junction		S9.000	119.100	100				
DP2	119.300	30.938	Open Manhole	150	S9.001	88.362	150	S9.000	119.099	100	30687
IC2	88.850	0.496	Open Manhole	600	S9.002	88.354	300	S9.001	88.354	150	
BR5	88.850	0.497	Junction		S9.003	88.353	300	S9.002	88.353	300	
GR2.1	116.300	0.200	Junction		S10.000	116.100	100				
DP3	116.300	27.932	Open Manhole	150	S10.001	88.368	150	S10.000	116.099	100	27681
IC3	88.850	0.496	Open Manhole	600	S10.002	88.354	300	S10.001	88.354	150	
BR5	88.850	0.497	Junction		S10.003	88.353	300	S10.002	88.353	300	
BR5	88.850	0.498	Junction		S9.004	88.352	300	S9.003	88.352	300	
								S10.003	88.352	300	
BR5	88.850	0.499	Junction		S9.005	88.351	300	S9.004	88.351	300	
FC2	88.850	3.978	Open Manhole	500	S7.003	84.872	300	S7.002	88.350	300	3478
								S8.002	88.350	300	3478
								S9.005	88.350	300	3478
DP4	85.350	0.481	Open Manhole	150	S7.004	84.869	300	S7.003	84.869	300	

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
IC4	85.350	0.482	Open Manhole	600	S7.005	84.868	300	S7.004	84.868	300	
BR6	85.350	0.483	Junction		S4.003	84.869	300	S4.002	84.869	300	
								S5.001	84.869	300	
								S7.005	84.867	300	
BR6	85.350	0.481	Junction		S11.000	84.869	300				
BR6	85.350	0.482	Junction		S2.002	84.868	300	S2.001	84.868	300	
								S4.003	84.868	300	
								S11.000	84.868	300	
FC3	85.350	0.483	Open Manhole	450	S2.003	84.867	300	S2.002	84.867	300	
BR7	85.350	0.484	Junction		S2.004	84.866	300	S2.003	84.866	300	
BR8	85.350	0.479	Junction		S12.000	84.871	300				
BR8	85.350	0.480	Junction		S12.001	84.870	300	S12.000	84.870	300	
BR8	85.350	0.479	Junction		S13.000	84.871	300				
BR8	85.350	0.480	Junction		S13.001	84.870	300	S13.000	84.870	300	
AJ6	85.350	0.481	Open Manhole	450	S12.002	84.869	300	S12.001	84.869	300	
								S13.001	84.869	300	
BR9	85.350	0.482	Junction		S12.003	84.868	300	S12.002	84.868	300	
BR10	85.350	0.477	Junction		S14.000	84.873	300				
BR10	85.350	0.478	Junction		S14.001	84.872	300	S14.000	84.872	300	

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
BR10	85.350	0.479	Junction		S14.002	84.871	300	S14.001	84.871	300	
AJ7	85.350	0.480	Open Manhole	450	S14.003	84.870	300	S14.002	84.870	300	
BR9	85.350	0.481	Junction		S14.004	84.869	300	S14.003	84.869	300	
BR9	85.350	0.482	Junction		S14.005	84.868	300	S14.004	84.868	300	
BR9	85.350	0.483	Junction		S12.004	84.867	300	S12.003	84.867	300	
								S14.005	84.867	300	
BR9	85.350	0.483	Junction		S15.000	84.867	300				
AJ8	85.350	0.484	Open Manhole	450	S12.005	84.866	300	S12.004	84.866	300	
								S15.000	84.866	300	
BR7	85.350	0.485	Junction		S2.005	84.865	300	S2.004	84.865	300	
								S12.005	84.865	300	
BR7	85.350	0.486	Junction		S2.006	84.864	300	S2.005	84.864	300	
BR11	85.350	0.482	Junction		S16.000	84.868	300				
GR2.3	116.330	0.200	Junction		S17.000	116.130	100				
DP5	116.300	31.425	Open Manhole	150	S17.001	84.875	150	S17.000	116.129	100	31204
IC5	85.350	0.481	Open Manhole	600	S17.002	84.869	300	S17.001	84.869	150	
BR11	85.350	0.482	Junction		S17.003	84.868	300	S17.002	84.868	300	
AJ9	85.350	0.483	Open Manhole	450	S16.001	84.867	300	S16.000	84.867	300	
								S17.003	84.867	300	

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
GR2.4	116.330	0.200	Junction		S18.000	116.130	100				
DP6	116.330	31.450	Open Manhole	150	S18.001	84.880	150	S18.000	116.129	100	31199
IC6	85.350	0.482	Open Manhole	600	S18.002	84.868	300	S18.001	84.868	150	
BR12	85.350	0.483	Junction		S18.003	84.867	300	S18.002	84.867	300	
AJ10	85.350	0.484	Open Manhole	450	S16.002	84.866	300	S16.001	84.866	300	
								S18.003	84.866	300	
BR7	85.350	0.485	Junction		S16.003	84.865	300	S16.002	84.865	300	
GR2.5	116.330	0.200	Junction		S19.000	116.130	100				
DP7	116.300	31.429	Open Manhole	150	S19.001	84.871	150	S19.000	116.129	100	31208
IC7	85.350	0.485	Open Manhole	600	S19.002	84.865	300	S19.001	84.865	150	
BR7	85.350	0.486	Junction		S16.004	84.864	300	S16.003	84.864	300	
								S19.002	84.864	300	
BR7	85.350	0.486	Junction		S20.000	84.864	300				
FC4	85.350	0.487	Open Manhole	500	S2.007	84.863	300	S2.006	84.863	300	
								S16.004	84.863	300	
								S20.000	84.863	300	
GR3.1	110.300	0.200	Junction		S21.000	110.100	100				
DP8	110.300	25.426	Open Manhole	150	S21.001	84.874	150	S21.000	110.099	100	25175
IC8	85.350	0.483	Open Manhole	600	S21.002	84.867	300	S21.001	84.867	150	

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
BR13	85.350	0.484	Open Manhole	600	S21.003	84.866	300	S21.002	84.866	300	
BR13	85.350	0.483	Junction		S22.000	84.867	300				
BR13	85.350	0.484	Junction		S22.001	84.866	300	S22.000	84.866	300	
AJ11	85.350	0.485	Open Manhole	500	S21.004	84.865	300	S21.003	84.865	300	
								S22.001	84.865	300	
GR3.2	110.300	0.200	Junction		S23.000	110.100	100				
DP9	110.300	25.426	Open Manhole	150	S23.001	84.874	150	S23.000	110.099	100	25175
IC9	85.350	0.483	Open Manhole	600	S23.002	84.867	300	S23.001	84.867	150	
BR14	85.350	0.484	Junction		S23.003	84.866	300	S23.002	84.866	300	
BR14	85.350	0.485	Junction		S23.004	84.865	300	S23.003	84.865	300	
BR14	85.350	0.486	Junction		S21.005	84.864	300	S21.004	84.864	300	
								S23.004	84.864	300	
BR14	85.350	0.487	Junction		S21.006	84.863	300	S21.005	84.863	300	
BR14	85.350	0.488	Junction		S2.008	84.862	300	S2.007	84.862	300	
								S21.006	84.862	300	
BR14	85.350	0.488	Junction		S24.000	84.862	300				
FC5	85.350	0.489	Open Manhole	500	S2.009	84.861	300	S2.008	84.861	300	
								S24.000	84.861	300	
BR16	85.350	0.490	Junction		S2.010	84.860	300	S2.009	84.860	300	

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
BR16	85.350	0.491	Junction		S2.011	84.859	300	S2.010	84.859	300	
BR15	85.350	0.488	Junction		S25.000	84.862	300				
BR15	85.350	0.489	Junction		S25.001	84.861	300	S25.000	84.861	300	
BR15	85.350	0.490	Junction		S25.002	84.860	300	S25.001	84.860	300	
BR15	85.350	0.491	Junction		S25.003	84.859	300	S25.002	84.859	300	
AJ12	85.350	0.492	Open Manhole	500	S25.004	84.858	300	S25.003	84.858	300	
BR16	85.350	0.493	Junction		S2.012	84.857	300	S2.011	84.858	300	1
								S25.004	84.857	300	
BR17	85.350	0.489	Junction		S26.000	84.861	300				
GR4.1	101.300	0.200	Junction		S27.000	101.100	100				
DP12	101.300	16.399	Open Manhole	150	S27.001	84.901	150	S27.000	101.099	100	16148
IC12	85.350	0.466	Open Manhole	600	S27.002	84.884	300	S27.001	84.884	150	
BR17	85.350	0.489	Junction		S27.003	84.861	300	S27.002	84.883	300	22
BR17	85.350	0.490	Junction		S27.004	84.861	300	S27.003	84.860	300	
GR3.3	110.300	0.200	Junction		S28.000	110.100	100				
DP10	110.300	25.432	Open Manhole	150	S28.001	84.868	150	S28.000	110.099	100	25181
IC10	85.350	0.489	Open Manhole	600	S28.002	84.861	300	S28.001	84.861	150	
BR17	85.350	0.490	Junction		S26.001	84.860	300	S26.000	84.860	300	
								S27.004	84.860	300	

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
								S28.002	84.860	300	
FC6	85.350	0.491	Open Manhole	500	S26.002	84.859	300	S26.001	84.859	300	
BR16	85.350	0.492	Junction		S26.003	84.858	300	S26.002	84.858	300	
GR3.4	110.300	0.200	Junction		S29.000	110.100	100				
DP11	110.300	25.430	Open Manhole	150	S29.001	84.870	150	S29.000	110.099	100	25179
IC11	85.350	0.491	Open Manhole	600	S29.002	84.859	300	S29.001	84.859	150	
BR16	85.350	0.492	Junction		S29.003	84.858	300	S29.002	84.858	300	
BR16	85.350	0.493	Junction		S26.004	84.857	300	S26.003	84.857	300	
								S29.003	84.857	300	
FC7	85.350	0.494	Open Manhole	500	S2.013	84.856	300	S2.012	84.856	300	
								S26.004	84.856	300	
GR4.2	101.300	0.200	Junction		S30.000	101.100	100				
DP13	101.300	16.433	Open Manhole	150	S30.001	84.867	225	S30.000	101.099	100	16107
IC13	85.350	0.491	Open Manhole	600	S30.002	84.859	300	S30.001	84.859	225	
BR18	85.350	0.492	Junction		S30.003	84.858	300	S30.002	84.858	300	
BR18	85.350	0.493	Junction		S30.004	84.857	300	S30.003	84.857	300	
BR16	85.350	0.490	Junction		S31.000	84.860	300				
BR18	85.350	0.491	Junction		S31.001	84.859	300	S31.000	84.859	300	
BR18	85.350	0.492	Junction		S31.002	84.858	300	S31.001	84.858	300	

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
BR18	85.350	0.492	Junction		S32.000	84.858	300				
BR18	85.350	0.493	Junction		S31.003	84.857	300	S31.002	84.857	300	
								S32.000	84.857	300	
FC8	85.350	0.494	Open Manhole	500	S30.005	84.856	300	S30.004	84.856	300	
								S31.003	84.856	300	
BR19	85.350	0.495	Junction		S2.014	84.855	300	S2.013	84.855	300	
								S30.005	84.855	300	
BR19	85.350	0.495	Junction		S33.000	84.855	300				
BR19	85.350	0.496	Junction		S2.015	84.854	300	S2.014	84.854	300	
								S33.000	84.854	300	
AJ13	85.350	0.497	Open Manhole	500	S2.016	84.853	300	S2.015	84.853	300	
FC9	85.350	0.498	Open Manhole	500	S2.017	84.852	150	S2.016	84.852	300	
FD2	85.350	0.958	Open Manhole	600	S2.018	84.392	300	S2.017	84.845	150	303
BR20	85.350	0.987	Junction		S34.000	84.363	300				
FC10	85.350	0.988	Open Manhole	500	S1.006	84.362	150	S1.005	84.362	300	
								S2.018	84.362	300	
								S34.000	84.362	300	
FD3	85.350	1.001	Open Manhole	600	S1.007	84.349	300	S1.006	84.349	150	
BR21	85.350	2.593	Junction		S35.000	82.757	300				

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
FC11	85.350	2.594	Open Manhole	500	S1.008	84.325	150	S1.007	84.325	300	
								S35.000	82.756	300	
DP14	83.700	0.436	Open Manhole	150	S36.000	83.264	150				
IC14	83.700	0.450	Open Manhole	600	S36.001	83.250	300	S36.000	83.250	150	
FC12	83.700	0.451	Open Manhole	600	S36.002	83.249	300	S36.001	83.249	300	
FD4	83.700	0.900	Open Manhole	600	S36.003	82.800	300	S36.002	83.248	300	448
FD5	85.350	2.594	Open Manhole	600	S1.009	82.756	300	S1.008	84.314	150	1408
								S36.003	82.756	300	
BR22	83.800	1.044	Junction		S37.000	82.756	300				
FC13	83.800	2.000	Open Manhole	500	S1.010	81.800	150	S1.009	82.746	300	1096
								S37.000	82.755	300	1105
FD6	82.260	0.900	Open Manhole	600	S1.011	81.360	300	S1.010	81.791	150	281
DP15	82.260	0.449	Open Manhole	150	S38.000	81.811	150				
IC15	82.260	0.460	Open Manhole	600	S38.001	81.811	30	S38.000	81.800	150	
FC14	82.695	0.885	Open Manhole	500	S38.002	81.810	300	S38.001	81.810	30	
FD7	82.260	0.900	Open Manhole	600	S38.003	81.360	300	S38.002	81.803	300	443
BR23	82.260	1.960	Junction		S39.000	80.300	300				
FC15	82.260	1.961	Open Manhole	500	S1.012	80.300	300	S1.011	81.338	300	1038
								S38.003	81.313	300	1013

<u>Manhole Schedules for Storm</u>

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
								S39.000	80.299	300	
MH1	82.260	2.860	Open Manhole	1200	S1.013	79.400	150	S1.012	80.288	300	1038
BR24	88.800	0.448	Junction		S40.000	88.352	100				
BR24	88.800	0.449	Junction		S40.001	88.351	150	S40.000	88.351	100	
GR2.2	116.300	0.200	Junction		S41.000	116.100	100				
DP16	116.300	27.942	Open Manhole	150	S41.001	88.358	150	S41.000	116.099	100	27691
IC16	88.800	0.448	Open Manhole	150	S41.002	88.352	300	S41.001	88.352	150	
BR24	88.800	0.450	Junction		S40.002	88.351	300	S40.001	88.351	150	
								S41.002	88.351	300	
BR24	88.800	0.450	Junction		S40.003	88.350	300	S40.002	88.350	300	
FC16	88.800	0.451	Open Manhole	500	S40.004	88.349	300	S40.003	88.349	300	
DP17	88.800	5.442	Open Manhole	150	S40.005	83.358	150	S40.004	88.310	300	5102
IC17	84.400	1.050	Open Manhole	600	S40.006	83.350	300	S40.005	83.353	150	
BR25	88.800	0.398	Junction		S42.000	88.402	300				
BR25	88.800	0.449	Junction		S42.001	88.351	300	S42.000	88.401	300	50
DP18	88.800	5.442	Open Manhole	150	S42.002	83.358	150	S42.001	88.350	300	5142
JC1	84.400	1.088	Junction		S40.007	83.312	300	S40.006	83.312	300	
								S42.002	83.353	150	
BR26	88.800	0.448	Junction		S43.000	88.352	300				

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
BR26	88.800	0.449	Junction		S43.001	88.351	300	S43.000	88.351	300	
DP19	88.800	5.442	Open Manhole	150	S43.002	83.358	150	S43.001	88.350	300	5142
JC2	84.400	1.106	Junction		S40.008	83.560	300	S40.007	83.294	300	
								S43.002	83.353	150	
BR27	88.800	0.448	Junction		S44.000	88.352	300				
FC17	88.800	0.449	Open Manhole	500	S44.001	88.351	300	S44.000	88.351	300	
DP21	88.800	5.442	Open Manhole	150	S44.002	83.358	150	S44.001	88.350	300	5142
JC3	84.400	1.049	Junction		S40.009	83.351	300	S40.008	83.482	300	131
								S44.002	83.351	150	
BR28	88.800	88.800	Junction		S45.000	0.000	300				
FC18	88.800	88.801	Open Manhole	500	S45.001	88.351	300	S45.000	-0.001	300	
DP20	88.800	5.442	Open Manhole	150	S45.002	83.358	150	S45.001	88.350	300	5142
JC4	84.400	1.097	Junction		S40.010	83.303	300	S40.009	83.303	300	
								S45.002	83.351	150	
BR29	88.800	0.446	Junction		S46.000	88.354	300				
FC19	88.800	0.447	Open Manhole	500	S46.001	88.353	300	S46.000	88.353	300	
DP21	88.800	5.442	Open Manhole	150	S46.002	83.358	150	S46.001	88.352	300	5144
JC5	84.400	1.161	Junction		S40.011	83.239	300	S40.010	83.239	300	
								S46.002	83.349	150	

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
FC20	84.400	1.219	Open Manhole	500	S40.012	83.181	225	S40.011	83.234	300	128
MH2	84.335	1.174	Open Manhole	1200	S40.013	83.352	225	S40.012	83.161	225	
MH3	84.852	4.672	Open Manhole	2100	S40.014	80.180	225	S40.013	81.713	225	1533
BR31	85.350	0.494	Junction		S47.000	84.856	300				
BR31	85.350	0.494	Junction		S48.000	84.856	300				
GR5.1	128.300	0.200	Junction		S49.000	128.100	100				
DP25	128.300	43.444	Open Manhole	150	S49.001	84.856	150	S49.000	128.099	100	43193
BR30	85.350	0.500	Junction		S49.002	84.850	300	S49.001	84.850	150	
BR30	85.350	0.501	Junction		S49.003	84.849	300	S49.002	84.849	300	
BR30	85.350	0.496	Junction		S50.000	84.854	300				
GR5.2	128.300	0.200	Junction		S51.000	128.100	100				
DP23	128.300	43.445	Open Manhole	150	S51.001	84.855	150	S51.000	128.099	100	43194
BR30	85.350	0.501	Junction		S51.002	84.849	300	S51.001	84.849	150	
FC22	85.350	0.502	Open Manhole	500	S49.004	84.848	300	S49.003	84.848	300	
								S50.000	84.853	300	5
								S51.002	84.848	300	1
FC21	85.350	2.200	Open Manhole	500	S47.001	83.150	300	S47.000	84.855	300	1705
								S48.000	84.855	300	1705
								S49.004	84.847	300	1697

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN (Pipe Out)	Pipe Out Invert Level (m)	Diameter (mm)	PN (Pipes In)	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
DP22	85.350	2.500	Open Manhole	150	S47.002	82.850	300	S47.001	83.149	300	299
SWALE	83.150	0.302	Junction		S47.003	82.848	300	S47.002	82.848	300	
SWALE	83.500	0.668	Junction		S47.004	82.832	300	S47.003	82.832	300	
SWALE	83.150	0.349	Junction		S47.005	82.801	300	S47.004	82.801	300	
BR32	85.350	0.496	Junction		S52.000	84.854	300				
GR5.3	128.300	0.200	Junction		S53.000	128.100	100				
DP24	128.300	43.445	Open Manhole	150	S53.001	84.855	150	S53.000	128.099	100	43194
BR32	85.350	0.501	Junction		S53.002	84.849	300	S53.001	84.849	150	
BR32	85.350	0.502	Junction		S52.001	84.853	300	S52.000	84.853	300	
								S53.002	84.848	300	
FC22	85.350	0.498	Open Manhole	500	S52.002	84.852	300	S52.001	84.852	300	
DP25	85.350	2.200	Open Manhole	150	S52.003	83.150	150	S52.002	84.851	300	1851
SWALE	83.500	0.717	Junction		S47.006	82.783	300	S47.005	82.783	300	
								S52.003	83.132	150	198
SWALE	83.150	0.398	Junction		S47.007	82.752	300	S47.006	82.752	300	
SWALE	85.150	2.409	Junction		S47.008	82.741	300	S47.007	82.741	300	
IC18	85.350	0.495	Open Manhole	600	S54.000	84.855	150				
BR33	85.350	0.496	Junction		S54.001	84.854	300	S54.000	84.854	150	
GR6.1	116.300	0.200	Junction		S55.000	116.100	100				

<u>Manhole Schedules for Storm</u>

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
DP26	116.300	31.444	Junction		S55.001	84.856	300	S55.000	116.099	100	31043
BR33	85.350	0.495	Junction		S55.002	84.855	300	S55.001	84.855	300	
BR33	85.350	0.496	Junction		S55.003	84.854	300	S55.002	84.854	300	
BR33	85.350	0.496	Junction		S56.000	84.854	300				
FC23	85.350	0.497	Open Manhole	500	S54.002	84.853	300	S54.001	84.853	300	
								S55.003	84.853	300	
								S56.000	84.853	300	
DP26	85.350	2.200	Sealed Manhole	150	S54.003	83.150	150	S54.002	84.852	300	1852
SWALE	85.350	2.633	Junction		S47.009	82.717	300	S47.008	82.717	300	
								S54.003	83.139	150	273
SWALE	83.150	0.450	Junction		S47.010	82.700	300	S47.009	82.700	300	
SWALE	83.150	0.478	Junction		S47.011	82.672	300	S47.010	82.672	300	
GR6.2	116.300	0.200	Junction		S57.000	116.100	100				
DP26	116.300	31.444	Junction		S57.001	84.856	150	S57.000	116.099	100	31193
BR34	85.350	0.500	Junction		S57.002	84.850	300	S57.001	84.850	150	
BR34	85.350	0.501	Junction		S57.003	84.849	300	S57.002	84.849	300	
BR34	85.350	0.496	Junction		S58.000	84.854	300				
BR34	85.350	0.502	Junction		S57.004	84.853	300	S57.003	84.848	300	
								S58.000	84.853	300	

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
FC24	85.350	0.498	Open Manhole	500	S57.005	84.852	300	S57.004	84.852	300	
DP27	85.350	2.200	Open Manhole	150	S57.006	83.150	150	S57.005	84.851	300	1851
SWALE	83.500	0.845	Junction		S47.012	82.655	300	S47.011	82.655	300	
								S57.006	83.135	150	329
SWALE	83.150	0.513	Junction		S47.013	82.637	300	S47.012	82.637	300	
SWALE	83.150	0.518	Junction		S47.014	82.632	300	S47.013	82.632	300	
SWALE	83.150	0.536	Junction		S47.015	82.614	300	S47.014	82.614	300	
SWALE	83.150	0.567	Junction		S47.016	82.583	300	S47.015	82.583	300	
SWALE	83.150	0.580	Junction		S47.017	82.570	300	S47.016	82.570	300	
SWALE	83.150	0.616	Junction		S47.018	82.534	300	S47.017	82.534	300	
SWALE	83.150	0.629	Junction		S47.019	82.521	300	S47.018	82.521	300	
SWALE	83.150	0.665	Junction		S47.020	82.485	300	S47.019	82.485	300	
SWALE	83.700	1.226	Junction		S47.021	82.474	300	S47.020	82.474	300	
SWALE	82.750	0.300	Junction		S47.022	82.450	300	S47.021	82.450	300	
SWALE	82.734	0.301	Junction		S47.023	82.433	300	S47.022	82.433	300	
FC25	82.734	3.334	Open Manhole	500	S47.024	79.400	300	S47.023	82.412	300	3012
MH4	80.550	1.264	Open Manhole	1200	S1.014	79.294	300	S1.013	79.387	150	
								S40.014	79.286	225	
								S47.024	79.399	300	105

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
GR4.3	101.300	0.200	Junction		S59.000	101.100	100				
DP28	101.300	21.376	Open Manhole	150	S59.001	79.924	150	S59.000	101.099	100	21125
IC19	80.900	0.983	Open Manhole	600	S59.002	79.917	150	S59.001	79.917	150	
IC20	80.900	1.057	Open Manhole	600	S59.003	79.850	300	S59.002	79.843	150	
GR4.4	101.300	0.200	Junction		S60.000	101.100	100				
DP29	101.300	21.376	Open Manhole	150	S60.001	79.924	150	S60.000	101.099	100	21125
IC21	80.800	0.882	Open Manhole	600	S60.002	79.918	150	S60.001	79.918	150	
FC26	80.800	1.090	Open Manhole	500	S59.004	79.710	300	S59.003	79.710	300	
								S60.002	79.858	150	
MH5	80.675	0.997	Open Manhole	900	S59.005	79.678	300	S59.004	79.678	300	
HB	80.550	1.400	Open Manhole	2100	S1.015	79.150	300	S1.014	79.159	300	9
								S59.005	79.584	300	434
EX SEWER	80.410	1.351	Open Manhole	1200		OUTFALL		S1.015	79.059	300	

PIPELINE SCHEDULES for Storm

Upstream Manhole

- Indicates pipe length does not match coordinates

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	300	BR1	85.350	84.855	0.195	Junction	
S1.001	o	300	BR1	85.350	84.854	0.196	Junction	
S1.002	o	300	BR1	85.300	84.853	0.147	Junction	
S1.003	o	300	AJ1	85.350	84.852	0.198	Open Manhole	450
S1.004	o	150	FC1	85.350	84.400	0.800	Open Manhole	600
S1.005	o	300	FD1	85.350	84.394	0.656	Open Manhole	600

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	2.823	2823.0	BR1	85.350	84.854	0.196	Junction	
S1.001	5.913	5913.0	BR1	85.300	84.853	0.147	Junction	
S1.002	6.514	6514.0	AJ1	85.350	84.852	0.198	Open Manhole	450
S1.003	4.969	4969.0	FC1	85.350	84.851	0.199	Open Manhole	600
S1.004	0.882	150.0	FD1	85.350	84.394	0.806	Open Manhole	600
S1.005	9.518	300.0	FC10	85.350	84.362	0.688	Open Manhole	500

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S2.000	o	300	BR2	85.350	84.870	0.180	Junction	
S3.000	o	300	BR2	85.350	84.870	0.180	Junction	
S2.001	o	300	AJ2	85.350	84.869	0.181	Open Manhole	450
S4.000	o	300	BR3	85.350	84.872	0.178	Junction	
S4.001	o	300	BR3	85.350	84.871	0.179	Junction	
S4.002	o	300	AJ3	85.350	84.870	0.180	Open Manhole	450

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S2.000	1.187	1187.0	AJ2	85.350	84.869	0.181	Open Manhole	450
S3.000	1.363	1363.0	AJ2	85.350	84.869	0.181	Open Manhole	450
S2.001	6.285	6285.0	BR6	85.350	84.868	0.182	Junction	
S4.000	1.774	1774.0	BR3	85.350	84.871	0.179	Junction	
S4.001	5.266	5266.0	AJ3	85.350	84.870	0.180	Open Manhole	450
S4.002	10.094	10094.0	BR6	85.350	84.869	0.181	Junction	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S5.000	o	300	BR4	85.350	84.871	0.179	Junction	
S6.000	o	300	BR4	85.350	84.871	0.179	Junction	
S5.001	o	300	AJ4	85.350	84.870	0.180	Open Manhole	450
S7.000	o	100	GR1.1	119.300	119.100	0.100	Junction	
S7.001	o	150	DP1	119.300	88.357	30.793	Open Manhole	150

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S5.000	1.870	1870.0	AJ4	85.350	84.870	0.180	Open Manhole	450
S6.000	1.630	1630.0	AJ4	85.350	84.870	0.180	Open Manhole	450
S5.001	5.396	5396.0	BR6	85.350	84.869	0.181	Junction	
S7.000	3.590	3590.0	DP1	119.300	119.099	0.101	Open Manhole	150
S7.001	0.960	150.0	IC1	88.850	88.351	0.349	Junction	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S7.002	o	300	IC1	88.850	88.351	0.199	Junction	
S8.000	o	300	BR5	88.850	88.353	0.197	Junction	
S8.001	o	300	BR5	88.850	88.352	0.198	Junction	
S8.002	o	300	BR5	88.850	88.351	0.199	Junction	
S9.000	o	100	GR1.2	119.300	119.100	0.100	Junction	
S9.001	o	150	DP2	119.300	88.362	30.788	Open Manhole	150
S9.002	o	300	IC2	88.850	88.354	0.196	Open Manhole	600

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S7.002	14.093	14093.0	FC2	88.850	88.350	0.200	Open Manhole	500
S8.000	3.417	3417.0	BR5	88.850	88.352	0.198	Junction	
S8.001	11.018	11018.0	BR5	88.850	88.351	0.199	Junction	
S8.002	22.196	22196.0	FC2	88.850	88.350	0.200	Open Manhole	500
S9.000	1.519	1519.4	DP2	119.300	119.099	0.101	Open Manhole	150
S9.001	1.146	150.0	IC2	88.850	88.354	0.346	Open Manhole	600
S9.002	2.978	2978.0	BR5	88.850	88.353	0.197	Junction	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S9.003	o	300	BR5	88.850	88.353	0.197	Junction	
S10.000	o	100	GR2.1	116.300	116.100	0.100	Junction	
S10.001	o	150	DP3	116.300	88.368	27.782	Open Manhole	150
S10.002	o	300	IC3	88.850	88.354	0.196	Open Manhole	600
S10.003	o	300	BR5	88.850	88.353	0.197	Junction	
S9.004	o	300	BR5	88.850	88.352	0.198	Junction	
S9.005	o	300	BR5	88.850	88.351	0.199	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S9.003	16.831	16831.0	BR5	88.850	88.352	0.198	Junction	
S10.000	1.479	1478.5	DP3	116.300	116.099	0.101	Open Manhole	150
S10.001	2.037	150.0	IC3	88.850	88.354	0.346	Open Manhole	600
S10.002	3.928	3928.0	BR5	88.850	88.353	0.197	Junction	
S10.003	11.240	11240.0	BR5	88.850	88.352	0.198	Junction	
S9.004	7.756	7756.0	BR5	88.850	88.351	0.199	Junction	
S9.005	16.076	16076.0	FC2	88.850	88.350	0.200	Open Manhole	500

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S7.003	o	300	FC2	88.850	84.872	3.678	Open Manhole	500
S7.004	o	300	DP4	85.350	84.869	0.181	Open Manhole	150
S7.005	o	300	IC4	85.350	84.868	0.182	Open Manhole	600
S4.003	o	300	BR6	85.350	84.869	0.181	Junction	
S11.000	o	300	BR6	85.350	84.869	0.181	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S7.003	0.752	300.0	DP4	85.350	84.869	0.181	Open Manhole	150
S7.004	1.218	1218.0	IC4	85.350	84.868	0.182	Open Manhole	600
S7.005	3.307	3307.0	BR6	85.350	84.867	0.183	Junction	
S4.003	13.467	13467.0	BR6	85.350	84.868	0.182	Junction	
S11.000	2.161	2161.0	BR6	85.350	84.868	0.182	Junction	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S2.002	o	300	BR6	85.350	84.868	0.182	Junction	
S2.003	o	300	FC3	85.350	84.867	0.183	Open Manhole	450
S2.004	o	300	BR7	85.350	84.866	0.184	Junction	
S12.000	o	300	BR8	85.350	84.871	0.179	Junction	
S12.001	o	300	BR8	85.350	84.870	0.180	Junction	
S13.000	o	300	BR8	85.350	84.871	0.179	Junction	
S13.001	o	300	BR8	85.350	84.870	0.180	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S2.002	5.209	5209.0	FC3	85.350	84.867	0.183	Open Manhole	450
S2.003	2.000	2000.0	BR7	85.350	84.866	0.184	Junction	
S2.004	14.659	14659.0	BR7	85.350	84.865	0.185	Junction	
S12.000	2.420	2420.0	BR8	85.350	84.870	0.180	Junction	
S12.001	5.978	5978.0	AJ6	85.350	84.869	0.181	Open Manhole	450
S13.000	2.079	2079.0	BR8	85.350	84.870	0.180	Junction	
S13.001	4.886	4886.0	AJ6	85.350	84.869	0.181	Open Manhole	450

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S12.002	o	300	AJ6	85.350	84.869	0.181	Open Manhole	450
S12.003	o	300	BR9	85.350	84.868	0.182	Junction	
S14.000	o	300	BR10	85.350	84.873	0.177	Junction	
S14.001	o	300	BR10	85.350	84.872	0.178	Junction	
S14.002	o	300	BR10	85.350	84.871	0.179	Junction	
S14.003	o	300	AJ7	85.350	84.870	0.180	Open Manhole	450
S14.004	o	300	BR9	85.350	84.869	0.181	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S12.002	3.512	3512.0	BR9	85.350	84.868	0.182	Junction	
S12.003	10.571	10571.0	BR9	85.350	84.867	0.183	Junction	
S14.000	10.806	10806.0	BR10	85.350	84.872	0.178	Junction	
S14.001	8.975	8975.0	BR10	85.350	84.871	0.179	Junction	
S14.002	1.741	1741.0	AJ7	85.350	84.870	0.180	Open Manhole	450
S14.003	3.639	3639.0	BR9	85.350	84.869	0.181	Junction	
S14.004	7.472	7472.0	BR9	85.350	84.868	0.182	Junction	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S14.005	o	300	BR9	85.350	84.868	0.182	Junction	
S12.004	o	300	BR9	85.350	84.867	0.183	Junction	
S15.000	o	300	BR9	85.350	84.867	0.183	Junction	
S12.005	o	300	AJ8	85.350	84.866	0.184	Open Manhole	450
S2.005	o	300	BR7	85.350	84.865	0.185	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S14.005	7.839	7839.0	BR9	85.350	84.867	0.183	Junction	
S12.004	1.629	1629.0	AJ8	85.350	84.866	0.184	Open Manhole	450
S15.000	3.407	3407.0	AJ8	85.350	84.866	0.184	Open Manhole	450
S12.005	6.186	6186.0	BR7	85.350	84.865	0.185	Junction	
S2.005	4.318	4318.0	BR7	85.350	84.864	0.186	Junction	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S2.006	o	300	BR7	85.350	84.864	0.186	Junction	
S16.000	o	300	BR11	85.350	84.868	0.182	Junction	
S17.000	o	100	GR2.3	116.330	116.130	0.100	Junction	
S17.001	o	150	DP5	116.300	84.875	31.275	Open Manhole	150
S17.002	o	300	IC5	85.350	84.869	0.181	Open Manhole	600
S17.003	o	300	BR11	85.350	84.868	0.182	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S2.006	5.343	5343.0	FC4	85.350	84.863	0.187	Open Manhole	500
S16.000	11.082	11082.0	AJ9	85.350	84.867	0.183	Open Manhole	450
S17.000	1.330	1330.0	DP5	116.300	116.129	0.071	Open Manhole	150
S17.001	0.847	150.0	IC5	85.350	84.869	0.331	Open Manhole	600
S17.002	5.091	5091.0	BR11	85.350	84.868	0.182	Junction	
S17.003	2.150	2150.0	AJ9	85.350	84.867	0.183	Open Manhole	450

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S16.001	o	300	AJ9	85.350	84.867	0.183	Open Manhole	450
S18.000	o	100	GR2.4	116.330	116.130	0.100	Junction	
S18.001	o	150	DP6	116.330	84.880	31.300	Open Manhole	150
S18.002	o	300	IC6	85.350	84.868	0.182	Open Manhole	600
S18.003	o	300	BR12	85.350	84.867	0.183	Junction	
S16.002	o	300	AJ10	85.350	84.866	0.184	Open Manhole	450
S16.003	o	300	BR7	85.350	84.865	0.185	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S16.001	13.718	13718.0	AJ10	85.350	84.866	0.184	Open Manhole	450
S18.000	1.723	1723.0	DP6	116.330	116.129	0.101	Open Manhole	150
S18.001	1.794	150.0	IC6	85.350	84.868	0.332	Open Manhole	600
S18.002	2.124	2124.0	BR12	85.350	84.867	0.183	Junction	
S18.003	5.556	5556.0	AJ10	85.350	84.866	0.184	Open Manhole	450
S16.002	4.414	4414.0	BR7	85.350	84.865	0.185	Junction	
S16.003	8.496	8496.0	BR7	85.350	84.864	0.186	Junction	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S19.000	o	100	GR2.5	116.330	116.130	0.100	Junction	
S19.001	o	150	DP7	116.300	84.871	31.279	Open Manhole	150
S19.002	o	300	IC7	85.350	84.865	0.185	Open Manhole	600
S16.004	o	300	BR7	85.350	84.864	0.186	Junction	
S20.000	o	300	BR7	85.350	84.864	0.186	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S19.000	1.541	1540.6	DP7	116.300	116.129	0.071	Open Manhole	150
S19.001	0.921	150.0	IC7	85.350	84.865	0.335	Open Manhole	600
S19.002	9.394	9394.0	BR7	85.350	84.864	0.186	Junction	
S16.004	5.498	5498.0	FC4	85.350	84.863	0.187	Open Manhole	500
S20.000	2.888	2888.0	FC4	85.350	84.863	0.187	Open Manhole	500

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S2.007	o	300	FC4	85.350	84.863	0.187	Open Manhole	500
S21.000	o	100	GR3.1	110.300	110.100	0.100	Junction	
S21.001	o	150	DP8	110.300	84.874	25.276	Open Manhole	150
S21.002	o	300	IC8	85.350	84.867	0.183	Open Manhole	600
S21.003	o	300	BR13	85.350	84.866	0.184	Open Manhole	600
S22.000	o	300	BR13	85.350	84.867	0.183	Junction	
S22.001	o	300	BR13	85.350	84.866	0.184	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S2.007	13.043	13043.0	BR14	85.350	84.862	0.188	Junction	
S21.000	2.035	2034.8	DP8	110.300	110.099	0.101	Open Manhole	150
S21.001	1.106	150.0	IC8	85.350	84.867	0.333	Open Manhole	600
S21.002	1.616	1616.0	BR13	85.350	84.866	0.184	Open Manhole	600
S21.003	7.363	7363.0	AJ11	85.350	84.865	0.185	Open Manhole	500
S22.000	6.576	6576.0	BR13	85.350	84.866	0.184	Junction	
S22.001	6.576	6576.0	AJ11	85.350	84.865	0.185	Open Manhole	500

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S21.004	o	300	AJ11	85.350	84.865	0.185	Open Manhole	500
S23.000	o	100	GR3.2	110.300	110.100	0.100	Junction	
S23.001	o	150	DP9	110.300	84.874	25.276	Open Manhole	150
S23.002	o	300	IC9	85.350	84.867	0.183	Open Manhole	600
S23.003	o	300	BR14	85.350	84.866	0.184	Junction	
S23.004	o	300	BR14	85.350	84.865	0.185	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S21.004	7.445	7445.0	BR14	85.350	84.864	0.186	Junction	
S23.000	2.003	2002.7	DP9	110.300	110.099	0.101	Open Manhole	150
S23.001	1.092	150.0	IC9	85.350	84.867	0.333	Open Manhole	600
S23.002	1.759	1759.0	BR14	85.350	84.866	0.184	Junction	
S23.003	4.862	4862.0	BR14	85.350	84.865	0.185	Junction	
S23.004	4.422	4422.0	BR14	85.350	84.864	0.186	Junction	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S21.005	o	300	BR14	85.350	84.864	0.186	Junction	
S21.006	o	300	BR14	85.350	84.863	0.187	Junction	
S2.008	o	300	BR14	85.350	84.862	0.188	Junction	
S24.000	o	300	BR14	85.350	84.862	0.188	Junction	
S2.009	o	300	FC5	85.350	84.861	0.189	Open Manhole	500
S2.010	o	300	BR16	85.350	84.860	0.190	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S21.005	9.791	9791.0	BR14	85.350	84.863	0.187	Junction	
S21.006	9.791	9791.0	BR14	85.350	84.862	0.188	Junction	
S2.008	2.495	2495.0	FC5	85.350	84.861	0.189	Open Manhole	500
S24.000	3.068	3068.0	FC5	85.350	84.861	0.189	Open Manhole	500
S2.009	5.026	5026.0	BR16	85.350	84.860	0.190	Junction	
S2.010	7.521	7521.0	BR16	85.350	84.859	0.191	Junction	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S2.011	o	300	BR16	85.350	84.859	0.191	Junction	
S25.000	o	300	BR15	85.350	84.862	0.188	Junction	
S25.001	o	300	BR15	85.350	84.861	0.189	Junction	
S25.002	o	300	BR15	85.350	84.860	0.190	Junction	
S25.003	o	300	BR15	85.350	84.859	0.191	Junction	
S25.004	o	300	AJ12	85.350	84.858	0.192	Open Manhole	500
S2.012	o	300	BR16	85.350	84.857	0.193	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S2.011	7.318	7318.0	BR16	85.350	84.858	0.192	Junction	
S25.000	3.181	3181.0	BR15	85.350	84.861	0.189	Junction	
S25.001	7.509	7509.0	BR15	85.350	84.860	0.190	Junction	
S25.002	4.162	4162.0	BR15	85.350	84.859	0.191	Junction	
S25.003	1.232	1232.0	AJ12	85.350	84.858	0.192	Open Manhole	500
S25.004	6.710	6710.0	BR16	85.350	84.857	0.193	Junction	
S2.012	7.464	7464.0	FC7	85.350	84.856	0.194	Open Manhole	500

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S26.000	o	300	BR17	85.350	84.861	0.189	Junction	
S27.000	o	100	GR4.1	101.300	101.100	0.100	Junction	
S27.001	o	150	DP12	101.300	84.901	16.249	Open Manhole	150
S27.002	o	300	IC12	85.350	84.884	0.166	Open Manhole	600
S27.003	o	300	BR17	85.350	84.861	0.189	Junction	
S27.004	o	300	BR17	85.350	84.861	0.189	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S26.000	7.325	7325.0	BR17	85.350	84.860	0.190	Junction	
S27.000	1.083	1083.0	DP12	101.300	101.099	0.101	Open Manhole	150
S27.001	2.591	150.0	IC12	85.350	84.884	0.316	Open Manhole	600
S27.002	3.185	3185.0	BR17	85.350	84.883	0.167	Junction	
S27.003	2.156	2156.0	BR17	85.350	84.860	0.190	Junction	
S27.004	25.456	25456.0	BR17	85.350	84.860	0.190	Junction	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S28.000	o	100	GR3.3	110.300	110.100	0.100	Junction	
S28.001	o	150	DP10	110.300	84.868	25.282	Open Manhole	150
S28.002	o	300	IC10	85.350	84.861	0.189	Open Manhole	600
S26.001	o	300	BR17	85.350	84.860	0.190	Junction	
S26.002	o	300	FC6	85.350	84.859	0.191	Open Manhole	500
S26.003	o	300	BR16	85.350	84.858	0.192	Junction	
S29.000	o	100	GR3.4	110.300	110.100	0.100	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S28.000	2.579	2579.1	DP10	110.300	110.099	0.101	Open Manhole	150
S28.001	1.045	150.0	IC10	85.350	84.861	0.339	Open Manhole	600
S28.002	5.537	5537.0	BR17	85.350	84.860	0.190	Junction	
S26.001	5.494	5494.0	FC6	85.350	84.859	0.191	Open Manhole	500
S26.002	10.459	10459.0	BR16	85.350	84.858	0.192	Junction	
S26.003	11.859	11859.0	BR16	85.350	84.857	0.193	Junction	
S29.000	2.826	2825.6	DP11	110.300	110.099	0.101	Open Manhole	150

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S29.001	o	150	DP11	110.300	84.870	25.280	Open Manhole	150
S29.002	o	300	IC11	85.350	84.859	0.191	Open Manhole	600
S29.003	o	300	BR16	85.350	84.858	0.192	Junction	
S26.004	o	300	BR16	85.350	84.857	0.193	Junction	
S2.013	o	300	FC7	85.350	84.856	0.194	Open Manhole	500
S30.000	o	100	GR4.2	101.300	101.100	0.100	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S29.001	1.623	150.0	IC11	85.350	84.859	0.341	Open Manhole	600
S29.002	2.581	2581.0	BR16	85.350	84.858	0.192	Junction	
S29.003	3.409	3409.0	BR16	85.350	84.857	0.193	Junction	
S26.004	6.243	6243.0	FC7	85.350	84.856	0.194	Open Manhole	500
S2.013	9.296	9296.0	BR19	85.350	84.855	0.195	Junction	
S30.000	1.857	1857.0	DP13	101.300	101.099	0.101	Open Manhole	150

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S30.001	o	225	DP13	101.300	84.867	16.208	Open Manhole	150
S30.002	o	300	IC13	85.350	84.859	0.191	Open Manhole	600
S30.003	o	300	BR18	85.350	84.858	0.192	Junction	
S30.004	o	300	BR18	85.350	84.857	0.193	Junction	
S31.000	o	300	BR16	85.350	84.860	0.190	Junction	
S31.001	o	300	BR18	85.350	84.859	0.191	Junction	
S31.002	o	300	BR18	85.350	84.858	0.192	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S30.001	1.133	150.0	IC13	85.350	84.859	0.266	Open Manhole	600
S30.002	3.473	3473.0	BR18	85.350	84.858	0.192	Junction	
S30.003	8.974	8974.0	BR18	85.350	84.857	0.193	Junction	
S30.004	11.357	11357.0	FC8	85.350	84.856	0.194	Open Manhole	500
S31.000	1.859	1859.0	BR18	85.350	84.859	0.191	Junction	
S31.001	8.106	8106.0	BR18	85.350	84.858	0.192	Junction	
S31.002	15.493	15493.0	BR18	85.350	84.857	0.193	Junction	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S32.000	o	300	BR18	85.350	84.858	0.192	Junction	
S31.003	o	300	BR18	85.350	84.857	0.193	Junction	
S30.005	o	300	FC8	85.350	84.856	0.194	Open Manhole	500
S2.014	o	300	BR19	85.350	84.855	0.195	Junction	
S33.000	o	300	BR19	85.350	84.855	0.195	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S32.000	14.758	14758.0	BR18	85.350	84.857	0.193	Junction	
S31.003	1.864	1864.0	FC8	85.350	84.856	0.194	Open Manhole	500
S30.005	21.927	21927.0	BR19	85.350	84.855	0.195	Junction	
S2.014	6.412	6412.0	BR19	85.350	84.854	0.196	Junction	
S33.000	4.249	4249.0	BR19	85.350	84.854	0.196	Junction	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S2.015	o	300	BR19	85.350	84.854	0.196	Junction	
S2.016	o	300	AJ13	85.350	84.853	0.197	Open Manhole	500
S2.017	o	150	FC9	85.350	84.852	0.348	Open Manhole	500
S2.018	o	300	FD2	85.350	84.392	0.658	Open Manhole	600
S34.000	o	300	BR20	85.350	84.363	0.687	Junction	
S1.006	o	150	FC10	85.350	84.362	0.838	Open Manhole	500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S2.015	9.786	9786.0	AJ13	85.350	84.853	0.197	Open Manhole	500
S2.016	9.195	9195.0	FC9	85.350	84.852	0.198	Open Manhole	500
S2.017	1.036	150.0	FD2	85.350	84.845	0.355	Open Manhole	600
S2.018	9.095	300.0	FC10	85.350	84.362	0.688	Open Manhole	500
S34.000	1.781	1781.0	FC10	85.350	84.362	0.688	Open Manhole	500
S1.006	1.945	149.6	FD3	85.350	84.349	0.851	Open Manhole	600

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.007	o	300	FD3	85.350	84.349	0.701	Open Manhole	600
S35.000	o	300	BR21	85.350	82.757	2.293	Junction	
S1.008	o	150	FC11	85.350	84.325	0.875	Open Manhole	500
S36.000	o	150	DP14	83.700	83.264	0.286	Open Manhole	150
S36.001	o	300	IC14	83.700	83.250	0.150	Open Manhole	600
S36.002	o	300	FC12	83.700	83.249	0.151	Open Manhole	600

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.007	7.303	304.3	FC11	85.350	84.325	0.725	Open Manhole	500
S35.000	1.529	1529.0	FC11	85.350	82.756	2.294	Open Manhole	500
S1.008	1.606	150.0	FD5	85.350	84.314	0.886	Open Manhole	600
S36.000	2.111	150.0	IC14	83.700	83.250	0.300	Open Manhole	600
S36.001	4.790	4790.0	FC12	83.700	83.249	0.151	Open Manhole	600
S36.002	2.000	2000.0	FD4	83.700	83.248	0.152	Open Manhole	600

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S36.003	o	300	FD4	83.700	82.800	0.600	Open Manhole	600
S1.009	o	300	FD5	85.350	82.756	2.294	Open Manhole	600
S37.000	o	300	BR22	83.800	82.756	0.744	Junction	
S1.010	o	150	FC13	83.800	81.800	1.850	Open Manhole	500
S1.011	o	300	FD6	82.260	81.360	0.600	Open Manhole	600

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S36.003	13.092	300.0	FD5	85.350	82.756	2.294	Open Manhole	600
S1.009	3.242	300.0	FC13	83.800	82.746	0.754	Open Manhole	500
S37.000	3.106	3106.0	FC13	83.800	82.755	0.745	Open Manhole	500
S1.010	1.370	150.0	FD6	82.260	81.791	0.319	Open Manhole	600
S1.011	6.728	300.0	FC15	82.260	81.338	0.622	Open Manhole	500

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S38.000	o	150	DP15	82.260	81.811	0.299	Open Manhole	150
S38.001	\/	30	IC15	82.260	81.811	-0.151	Open Manhole	600
S38.002	o	300	FC14	82.695	81.810	0.585	Open Manhole	500
S38.003	o	300	FD7	82.260	81.360	0.600	Open Manhole	600
S39.000	o	300	BR23	82.260	80.300	1.660	Junction	
S1.012	o	300	FC15	82.260	80.300	1.660	Open Manhole	500
S1.013	o	150	MH1	82.260	79.400	2.710	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S38.000	1.699	150.0	IC15	82.260	81.800	0.310	Open Manhole	600
S38.001	7.004	7004.4	FC14	82.695	81.810	0.285	Open Manhole	500
S38.002	2.000#	300.0	FD7	82.260	81.803	0.157	Open Manhole	600
S38.003	14.132	300.0	FC15	82.260	81.313	0.647	Open Manhole	500
S39.000	2.300	2300.0	FC15	82.260	80.299	1.661	Open Manhole	500
S1.012	3.581	300.0	MH1	82.260	80.288	1.672	Open Manhole	1200
S1.013	1.267	100.0	MH4	80.550	79.387	1.013	Open Manhole	1200

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S40.000	o	100	BR24	88.800	88.352	0.348	Junction	
S40.001	o	150	BR24	88.800	88.351	0.299	Junction	
S41.000	o	100	GR2.2	116.300	116.100	0.100	Junction	
S41.001	o	150	DP16	116.300	88.358	27.792	Open Manhole	150
S41.002	o	300	IC16	88.800	88.352	0.148	Open Manhole	150
S40.002	o	300	BR24	88.800	88.351	0.149	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S40.000	6.287	6287.0	BR24	88.800	88.351	0.349	Junction	
S40.001	9.456	18912.0	BR24	88.800	88.351	0.300	Junction	
S41.000	1.413	1413.4	DP16	116.300	116.099	0.101	Open Manhole	150
S41.001	0.849	150.0	IC16	88.800	88.352	0.298	Open Manhole	150
S41.002	5.667	5667.0	BR24	88.800	88.351	0.149	Junction	
S40.002	9.456	9456.0	BR24	88.800	88.350	0.150	Junction	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S40.003	o	300	BR24	88.800	88.350	0.150	Junction	
S40.004	o	300	FC16	88.800	88.349	0.151	Open Manhole	500
S40.005	o	150	DP17	88.800	83.358	5.292	Open Manhole	150
S40.006	o	300	IC17	84.400	83.350	0.750	Open Manhole	600
S42.000	o	300	BR25	88.800	88.402	0.098	Junction	
S42.001	o	300	BR25	88.800	88.351	0.149	Junction	
S42.002	o	150	DP18	88.800	83.358	5.292	Open Manhole	150

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S40.003	19.076	19076.0	FC16	88.800	88.349	0.151	Open Manhole	500
S40.004	5.917	150.0	DP17	88.800	88.310	0.190	Open Manhole	150
S40.005	0.812	150.0	IC17	84.400	83.353	0.897	Open Manhole	600
S40.006	11.328	300.0	JC1	84.400	83.312	0.788	Junction	
S42.000	4.004	4004.0	BR25	88.800	88.401	0.099	Junction	
S42.001	1.150	1150.0	DP18	88.800	88.350	0.150	Open Manhole	150
S42.002	0.786	150.0	JC1	84.400	83.353	0.897	Junction	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S40.007	o	300	JC1	84.400	83.312	0.788	Junction	
S43.000	o	300	BR26	88.800	88.352	0.148	Junction	
S43.001	o	300	BR26	88.800	88.351	0.149	Junction	
S43.002	o	150	DP19	88.800	83.358	5.292	Open Manhole	150
S40.008	o	300	JC2	84.400	83.560	0.540	Junction	
S44.000	o	300	BR27	88.800	88.352	0.148	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S40.007	5.591	300.0	JC2	84.400	83.294	0.806	Junction	
S43.000	1.881	1881.0	BR26	88.800	88.351	0.149	Junction	
S43.001	1.122	1122.0	DP19	88.800	88.350	0.150	Open Manhole	150
S43.002	0.748	150.0	JC2	84.400	83.353	0.897	Junction	
S40.008	23.428	300.0	JC3	84.400	83.482	0.618	Junction	
S44.000	4.510	4510.0	FC17	88.800	88.351	0.149	Open Manhole	500

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S44.001	o	300	FC17	88.800	88.351	0.149	Open Manhole	500
S44.002	o	150	DP21	88.800	83.358	5.292	Open Manhole	150
S40.009	o	300	JC3	84.400	83.351	0.749	Junction	
S45.000	o	300	BR28	88.800	0.000	88.500	Junction	
S45.001	o	300	FC18	88.800	88.351	0.149	Open Manhole	500
S45.002	o	150	DP20	88.800	83.358	5.292	Open Manhole	150

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S44.001	1.120	1120.0	DP21	88.800	88.350	0.150	Open Manhole	150
S44.002	1.120	150.0	JC3	84.400	83.351	0.899	Junction	
S40.009	14.204	300.0	JC4	84.400	83.303	0.797	Junction	
S45.000	1.287	1287.0	FC18	88.800	-0.001	88.501	Open Manhole	500
S45.001	1.145	1145.0	DP20	88.800	88.350	0.150	Open Manhole	150
S45.002	1.121	150.0	JC4	84.400	83.351	0.899	Junction	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S40.010	o	300	JC4	84.400	83.303	0.797	Junction	
S46.000	o	300	BR29	88.800	88.354	0.146	Junction	
S46.001	o	300	FC19	88.800	88.353	0.147	Open Manhole	500
S46.002	o	150	DP21	88.800	83.358	5.292	Open Manhole	150
S40.011	o	300	JC5	84.400	83.239	0.861	Junction	
S40.012	o	225	FC20	84.400	83.181	0.994	Open Manhole	500
S40.013	o	225	MH2	84.335	83.352	0.758	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S40.010	19.266	300.0	JC5	84.400	83.239	0.861	Junction	
S46.000	3.981	3981.0	FC19	88.800	88.353	0.147	Open Manhole	500
S46.001	0.621	621.0	DP21	88.800	88.352	0.148	Open Manhole	150
S46.002	1.322	150.0	JC5	84.400	83.349	0.901	Junction	
S40.011	1.557	300.0	FC20	84.400	83.234	0.866	Open Manhole	500
S40.012	3.046	150.0	MH2	84.335	83.161	0.949	Open Manhole	1200
S40.013	32.848	20.0	MH3	84.852	81.713	2.914	Open Manhole	2100

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S40.014	o	225	MH3	84.852	80.180	4.447	Open Manhole	2100
S47.000	o	300	BR31	85.350	84.856	0.194	Junction	
S48.000	o	300	BR31	85.350	84.856	0.194	Junction	
S49.000	o	100	GR5.1	128.300	128.100	0.100	Junction	
S49.001	o	150	DP25	128.300	84.856	43.294	Open Manhole	150
S49.002	o	300	BR30	85.350	84.850	0.200	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S40.014	134.137	150.0	MH4	80.550	79.286	1.039	Open Manhole	1200
S47.000	20.440	20440.0	FC21	85.350	84.855	0.195	Open Manhole	500
S48.000	1.383	1383.0	FC21	85.350	84.855	0.195	Open Manhole	500
S49.000	1.841	1840.7	DP25	128.300	128.099	0.101	Open Manhole	150
S49.001	0.972	150.0	BR30	85.350	84.850	0.350	Junction	
S49.002	2.034	2034.0	BR30	85.350	84.849	0.201	Junction	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S49.003	o	300	BR30	85.350	84.849	0.201	Junction	
S50.000	o	300	BR30	85.350	84.854	0.196	Junction	
S51.000	o	100	GR5.2	128.300	128.100	0.100	Junction	
S51.001	o	150	DP23	128.300	84.855	43.295	Open Manhole	150
S51.002	o	300	BR30	85.350	84.849	0.201	Junction	
S49.004	o	300	FC22	85.350	84.848	0.202	Open Manhole	500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S49.003	19.799	19799.0	FC22	85.350	84.848	0.202	Open Manhole	500
S50.000	4.953	4953.0	FC22	85.350	84.853	0.197	Open Manhole	500
S51.000	2.597	2596.8	DP23	128.300	128.099	0.101	Open Manhole	150
S51.001	0.856	150.0	BR30	85.350	84.849	0.351	Junction	
S51.002	4.332	4332.0	FC22	85.350	84.848	0.202	Open Manhole	500
S49.004	4.808	4808.0	FC21	85.350	84.847	0.203	Open Manhole	500

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S47.001	o	300	FC21	85.350	83.150	1.900	Open Manhole	500
S47.002	o	300	DP22	85.350	82.850	2.200	Open Manhole	150
S47.003	o	300	SWALE	83.150	82.848	0.002	Junction	
S47.004	o	300	SWALE	83.500	82.832	0.368	Junction	
S47.005	o	300	SWALE	83.150	82.801	0.049	Junction	
S52.000	o	300	BR32	85.350	84.854	0.196	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S47.001	0.595	595.0	DP22	85.350	83.149	1.901	Open Manhole	150
S47.002	0.500	250.0	SWALE	83.150	82.848	0.002	Junction	
S47.003	4.121	250.0	SWALE	83.500	82.832	0.368	Junction	
S47.004	7.549	250.0	SWALE	83.150	82.801	0.049	Junction	
S47.005	4.501	250.0	SWALE	83.500	82.783	0.417	Junction	
S52.000	3.552	3552.0	BR32	85.350	84.853	0.197	Junction	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S53.000	o	100	GR5.3	128.300	128.100	0.100	Junction	
S53.001	o	150	DP24	128.300	84.855	43.295	Open Manhole	150
S53.002	o	300	BR32	85.350	84.849	0.201	Junction	
S52.001	o	300	BR32	85.350	84.853	0.197	Junction	
S52.002	o	300	FC22	85.350	84.852	0.198	Open Manhole	500
S52.003	o	150	DP25	85.350	83.150	2.050	Open Manhole	150
S47.006	o	300	SWALE	83.500	82.783	0.417	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S53.000	2.711	2710.9	DP24	128.300	128.099	0.101	Open Manhole	150
S53.001	0.933	150.0	BR32	85.350	84.849	0.351	Junction	
S53.002	1.121	1121.0	BR32	85.350	84.848	0.202	Junction	
S52.001	4.211	4211.0	FC22	85.350	84.852	0.198	Open Manhole	500
S52.002	0.590	590.0	DP25	85.350	84.851	0.199	Open Manhole	150
S52.003	2.761	150.0	SWALE	83.500	83.132	0.218	Junction	
S47.006	7.770	250.0	SWALE	83.150	82.752	0.098	Junction	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S47.007	o	300	SWALE	83.150	82.752	0.098	Junction	
S47.008	o	300	SWALE	85.150	82.741	2.109	Junction	
S54.000	o	150	IC18	85.350	84.855	0.345	Open Manhole	600
S54.001	o	300	BR33	85.350	84.854	0.196	Junction	
S55.000	o	100	GR6.1	116.300	116.100	0.100	Junction	
S55.001	o	300	DP26	116.300	84.856	31.144	Junction	
S55.002	o	300	BR33	85.350	84.855	0.195	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S47.007	2.794	250.0	SWALE	85.150	82.741	2.109	Junction	
S47.008	6.066	250.0	SWALE	85.350	82.717	2.333	Junction	
S54.000	1.596	1596.0	BR33	85.350	84.854	0.346	Junction	
S54.001	7.744	7744.0	FC23	85.350	84.853	0.197	Open Manhole	500
S55.000	1.789	1789.1	DP26	116.300	116.099	0.101	Junction	
S55.001	0.941	941.0	BR33	85.350	84.855	0.195	Junction	
S55.002	2.251	2251.0	BR33	85.350	84.854	0.196	Junction	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S55.003	o	300	BR33	85.350	84.854	0.196	Junction	
S56.000	o	300	BR33	85.350	84.854	0.196	Junction	
S54.002	o	300	FC23	85.350	84.853	0.197	Open Manhole	500
S54.003	o	150	DP26	85.350	83.150	2.050	Sealed Manhole	150
S47.009	o	300	SWALE	85.350	82.717	2.333	Junction	
S47.010	o	300	SWALE	83.150	82.700	0.150	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S55.003	4.979	4979.0	FC23	85.350	84.853	0.197	Open Manhole	500
S56.000	4.535	4535.0	FC23	85.350	84.853	0.197	Open Manhole	500
S54.002	0.593	593.0	DP26	85.350	84.852	0.198	Sealed Manhole	150
S54.003	1.601	150.0	SWALE	85.350	83.139	2.061	Junction	
S47.009	4.275	250.0	SWALE	83.150	82.700	0.150	Junction	
S47.010	6.911	250.0	SWALE	83.150	82.672	0.178	Junction	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S47.011	o	300	SWALE	83.150	82.672	0.178	Junction	
S57.000	o	100	GR6.2	116.300	116.100	0.100	Junction	
S57.001	o	150	DP26	116.300	84.856	31.294	Junction	
S57.002	o	300	BR34	85.350	84.850	0.200	Junction	
S57.003	o	300	BR34	85.350	84.849	0.201	Junction	
S58.000	o	300	BR34	85.350	84.854	0.196	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S47.011	4.169	250.0	SWALE	83.500	82.655	0.545	Junction	
S57.000	1.678	1678.5	DP26	116.300	116.099	0.101	Junction	
S57.001	0.826	150.0	BR34	85.350	84.850	0.350	Junction	
S57.002	1.497	1497.0	BR34	85.350	84.849	0.201	Junction	
S57.003	3.431	3431.0	BR34	85.350	84.848	0.202	Junction	
S58.000	1.728	1728.0	BR34	85.350	84.853	0.197	Junction	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S57.004	o	300	BR34	85.350	84.853	0.197	Junction	
S57.005	o	300	FC24	85.350	84.852	0.198	Open Manhole	500
S57.006	o	150	DP27	85.350	83.150	2.050	Open Manhole	150
S47.012	o	300	SWALE	83.500	82.655	0.545	Junction	
S47.013	o	300	SWALE	83.150	82.637	0.213	Junction	
S47.014	o	300	SWALE	83.150	82.632	0.218	Junction	
S47.015	o	300	SWALE	83.150	82.614	0.236	Junction	
S47.016	o	300	SWALE	83.150	82.583	0.267	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S57.004	3.134	3134.0	FC24	85.350	84.852	0.198	Open Manhole	500
S57.005	0.506	506.0	DP27	85.350	84.851	0.199	Open Manhole	150
S57.006	2.321	150.0	SWALE	83.500	83.135	0.215	Junction	
S47.012	4.630	250.0	SWALE	83.150	82.637	0.213	Junction	
S47.013	1.314	250.0	SWALE	83.150	82.632	0.218	Junction	
S47.014	4.499	250.0	SWALE	83.150	82.614	0.236	Junction	
S47.015	7.665	250.0	SWALE	83.150	82.583	0.267	Junction	
S47.016	3.153	250.0	SWALE	83.150	82.570	0.280	Junction	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S47.017	o	300	SWALE	83.150	82.570	0.280	Junction	
S47.018	o	300	SWALE	83.150	82.534	0.316	Junction	
S47.019	o	300	SWALE	83.150	82.521	0.329	Junction	
S47.020	o	300	SWALE	83.150	82.485	0.365	Junction	
S47.021	o	300	SWALE	83.700	82.474	0.926	Junction	
S47.022	o	300	SWALE	82.750	82.450	0.000	Junction	
S47.023	o	300	SWALE	82.734	82.433	0.001	Junction	
S47.024	o	300	FC25	82.734	79.400	3.034	Open Manhole	500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S47.017	8.984	250.0	SWALE	83.150	82.534	0.316	Junction	
S47.018	3.420	250.0	SWALE	83.150	82.521	0.329	Junction	
S47.019	8.876	250.0	SWALE	83.150	82.485	0.365	Junction	
S47.020	2.699	250.0	SWALE	83.700	82.474	0.926	Junction	
S47.021	6.168	250.0	SWALE	82.750	82.450	0.000	Junction	
S47.022	4.077	250.0	SWALE	82.734	82.433	0.001	Junction	
S47.023	5.305	250.0	FC25	82.734	82.412	0.022	Open Manhole	500
S47.024	1.891	1891.0	MH4	80.550	79.399	0.851	Open Manhole	1200

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.014	o	300	MH4	80.550	79.294	0.956	Open Manhole	1200
S59.000	o	100	GR4.3	101.300	101.100	0.100	Junction	
S59.001	o	150	DP28	101.300	79.924	21.226	Open Manhole	150
S59.002	o	150	IC19	80.900	79.917	0.833	Open Manhole	600
S59.003	o	300	IC20	80.900	79.850	0.750	Open Manhole	600
S60.000	o	100	GR4.4	101.300	101.100	0.100	Junction	
S60.001	o	150	DP29	101.300	79.924	21.226	Open Manhole	150

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.014	20.288	150.0	HB	80.550	79.159	1.091	Open Manhole	2100
S59.000	1.168	1167.6	DP28	101.300	101.099	0.101	Open Manhole	150
S59.001	1.048	150.0	IC19	80.900	79.917	0.833	Open Manhole	600
S59.002	5.956	80.0	IC20	80.900	79.843	0.907	Open Manhole	600
S59.003	41.950	300.0	FC26	80.800	79.710	0.790	Open Manhole	500
S60.000	1.991	1991.0	DP29	101.300	101.099	0.101	Open Manhole	150
S60.001	0.936	150.0	IC21	80.800	79.918	0.732	Open Manhole	600

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S60.002	o	150	IC21	80.800	79.918	0.732	Open Manhole	600
S59.004	o	300	FC26	80.800	79.710	0.790	Open Manhole	500
S59.005	o	300	MH5	80.675	79.678	0.697	Open Manhole	900
S1.015	o	300	HB	80.550	79.150	1.100	Open Manhole	2100

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S60.002	4.751	80.0	FC26	80.800	79.858	0.792	Open Manhole	500
S59.004	4.888	150.0	MH5	80.675	79.678	0.697	Open Manhole	900
S59.005	14.097	150.0	HB	80.550	79.584	0.666	Open Manhole	2100
S1.015	13.586	150.0	EX SEWER	80.410	79.059	1.051	Open Manhole	1200

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.000	0.000	0.000
1.001	Classification	Premeable Paving	80	0.006	0.005	0.005
1.002	Classification	Premeable Paving	80	0.007	0.005	0.005
1.003	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.000	0.000	0.000
1.005	Classification	Premeable Paving	80	0.008	0.006	0.006
2.000	Classification	Premeable Paving	80	0.004	0.003	0.003
3.000	-	-	100	0.000	0.000	0.000
2.001	-	-	100	0.000	0.000	0.000
4.000	-	-	100	0.000	0.000	0.000
4.001	Classification	Premeable Paving	80	0.006	0.005	0.005
4.002	-	-	100	0.000	0.000	0.000
5.000	Classification	Premeable Paving	80	0.003	0.002	0.002
6.000	-	-	100	0.000	0.000	0.000
5.001	-	-	100	0.000	0.000	0.000
7.000	-	-	100	0.000	0.000	0.000
7.001	-	-	100	0.000	0.000	0.000
7.002	Classification	Premeable Paving	80	0.004	0.003	0.003
	Classification	Premeable Paving	80	0.003	0.003	0.005
8.000	-	-	100	0.000	0.000	0.000
8.001	Classification	Premeable Paving	80	0.003	0.003	0.003
	Classification	Premeable Paving	80	0.002	0.002	0.004
8.002	Classification	Premeable Paving	80	0.010	0.008	0.008
9.000	-	-	100	0.000	0.000	0.000
9.001	Classification	Flat Roof	100	0.005	0.005	0.005
9.002	-	-	100	0.000	0.000	0.000
9.003	Classification	Premeable Paving	80	0.006	0.005	0.005

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
10.000	-	-	100	0.000	0.000	0.000
10.001	Classification	Flat Roof	100	0.005	0.005	0.005
10.002	-	-	100	0.000	0.000	0.000
10.003	Classification	Premeable Paving	80	0.003	0.003	0.003
9.004	Classification	Premeable Paving	80	0.003	0.002	0.002
9.005	Classification	Premeable Paving	80	0.009	0.007	0.007
7.003	-	-	100	0.000	0.000	0.000
7.004	-	-	100	0.000	0.000	0.000
7.005	Classification	Premeable Paving	80	0.003	0.002	0.002
	Classification	Premeable Paving	80	0.001	0.001	0.003
4.003	Classification	Premeable Paving	80	0.001	0.001	0.001
	Classification	Premeable Paving	80	0.003	0.003	0.004
11.000	-	-	100	0.000	0.000	0.000
2.002	Classification	Premeable Paving	80	0.005	0.004	0.004
	Classification	Premeable Paving	80	0.002	0.001	0.005
2.003	-	-	100	0.000	0.000	0.000
2.004	Classification	Premeable Paving	80	0.011	0.009	0.009
12.000	-	-	100	0.000	0.000	0.000
12.001	Classification	Premeable Paving	80	0.010	0.008	0.008
13.000	-	-	100	0.000	0.000	0.000
13.001	Classification	Premeable Paving	80	0.009	0.007	0.007
12.002	-	-	100	0.000	0.000	0.000
12.003	Classification	Premeable Paving	80	0.003	0.003	0.003
14.000	Classification	Premeable Paving	80	0.009	0.007	0.007
14.001	-	-	100	0.000	0.000	0.000
14.002	Classification	Premeable Paving	80	0.005	0.004	0.004
14.003	-	-	100	0.000	0.000	0.000

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
14.004	Classification	Premeable Paving	80	0.006	0.005	0.005
14.005	-	-	100	0.000	0.000	0.000
12.004	Classification	Premeable Paving	80	0.003	0.002	0.002
15.000	-	-	100	0.000	0.000	0.000
12.005	-	-	100	0.000	0.000	0.000
2.005	Classification	Premeable Paving	80	0.005	0.004	0.004
2.006	Classification	Premeable Paving	80	0.004	0.003	0.003
16.000	Classification	Premeable Paving	80	0.013	0.011	0.011
17.000	-	-	100	0.000	0.000	0.000
17.001	-	-	100	0.000	0.000	0.000
17.002	-	-	100	0.000	0.000	0.000
17.003	-	-	100	0.000	0.000	0.000
16.001	-	-	100	0.000	0.000	0.000
18.000	-	-	100	0.000	0.000	0.000
18.001	-	-	100	0.000	0.000	0.000
18.002	-	-	100	0.000	0.000	0.000
18.003	-	-	100	0.000	0.000	0.000
16.002	Classification	Premeable Paving	80	0.005	0.004	0.004
	Classification	Premeable Paving	80	0.008	0.007	0.011
16.003	Classification	Premeable Paving	80	0.001	0.001	0.001
	Classification	Premeable Paving	80	0.003	0.003	0.004
19.000	-	-	100	0.000	0.000	0.000
19.001	-	-	100	0.000	0.000	0.000
19.002	-	-	100	0.000	0.000	0.000
16.004	Classification	Premeable Paving	80	0.003	0.002	0.002
	Classification	Premeable Paving	80	0.002	0.001	0.003
20.000	-	-	100	0.000	0.000	0.000

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
2.007	-	-	100	0.000	0.000	0.000
21.000	-	-	100	0.000	0.000	0.000
21.001	-	-	100	0.000	0.000	0.000
21.002	-	-	100	0.000	0.000	0.000
21.003	-	-	100	0.000	0.000	0.000
22.000	Classification	Premeable Paving	80	0.010	0.008	0.008
22.001	Classification	Premeable Paving	80	0.004	0.003	0.003
21.004	-	-	100	0.000	0.000	0.000
23.000	-	-	100	0.000	0.000	0.000
23.001	-	-	100	0.000	0.000	0.000
23.002	-	-	100	0.000	0.000	0.000
23.003	Classification	Premeable Paving	80	0.002	0.001	0.001
23.004	Classification	Premeable Paving	80	0.003	0.002	0.002
21.005	Classification	Premeable Paving	80	0.005	0.004	0.004
21.006	Classification	Premeable Paving	80	0.005	0.004	0.004
	Classification	Premeable Paving	80	0.005	0.004	0.008
2.008	Classification	Premeable Paving	80	0.004	0.003	0.003
24.000	-	-	100	0.000	0.000	0.000
2.009	-	-	100	0.000	0.000	0.000
2.010	Classification	Premeable Paving	80	0.006	0.005	0.005
2.011	Classification	Premeable Paving	80	0.001	0.001	0.001
	Classification	Premeable Paving	80	0.001	0.001	0.002
25.000	-	-	100	0.000	0.000	0.000
25.001	Classification	Premeable Paving	80	0.005	0.004	0.004
25.002	-	-	100	0.000	0.000	0.000
25.003	Classification	Premeable Paving	80	0.005	0.004	0.004
25.004	-	-	100	0.000	0.000	0.000

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
2.012	Classification	Premeable Paving	80	0.003	0.002	0.002
	Classification	Premeable Paving	80	0.002	0.001	0.004
26.000	Classification	Premeable Paving	80	0.004	0.003	0.003
27.000	-	-	100	0.000	0.000	0.000
27.001	-	-	100	0.000	0.000	0.000
27.002	-	-	100	0.000	0.000	0.000
27.003	-	-	100	0.000	0.000	0.000
27.004	Classification	Premeable Paving	80	0.011	0.009	0.009
28.000	-	-	100	0.000	0.000	0.000
28.001	Classification	Flat Roof	100	0.005	0.005	0.005
28.002	-	-	100	0.000	0.000	0.000
26.001	Classification	Premeable Paving	80	0.005	0.004	0.004
26.002	-	-	100	0.000	0.000	0.000
26.003	Classification	Premeable Paving	80	0.004	0.003	0.003
	Classification	Premeable Paving	80	0.008	0.006	0.009
29.000	-	-	100	0.000	0.000	0.000
29.001	-	-	100	0.000	0.000	0.000
29.002	-	-	100	0.000	0.000	0.000
29.003	-	-	100	0.000	0.000	0.000
26.004	Classification	Premeable Paving	80	0.006	0.005	0.005
2.013	-	-	100	0.000	0.000	0.000
30.000	-	-	100	0.000	0.000	0.000
30.001	-	-	100	0.000	0.000	0.000
30.002	-	-	100	0.000	0.000	0.000
30.003	-	-	100	0.000	0.000	0.000
30.004	Classification	Premeable Paving	80	0.010	0.008	0.008
31.000	-	-	100	0.000	0.000	0.000

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
31.001	Classification	Premeable Paving	80	0.008	0.007	0.007
31.002	Classification	Premeable Paving	80	0.013	0.010	0.010
32.000	Classification	Premeable Paving	80	0.006	0.005	0.005
31.003	-	-	100	0.000	0.000	0.000
30.005	Classification	Premeable Paving	80	0.005	0.004	0.004
2.014	Classification	Premeable Paving	80	0.003	0.003	0.003
33.000	-	-	100	0.000	0.000	0.000
2.015	Classification	Premeable Paving	80	0.007	0.005	0.005
2.016	-	-	100	0.000	0.000	0.000
2.017	Classification	Premeable Paving	80	0.005	0.004	0.004
2.018	Classification	Premeable Paving	80	0.002	0.002	0.002
34.000	-	-	100	0.000	0.000	0.000
1.006	-	-	100	0.000	0.000	0.000
1.007	Classification	Premeable Paving	80	0.002	0.002	0.002
35.000	-	-	100	0.000	0.000	0.000
1.008	-	-	100	0.000	0.000	0.000
36.000	Classification	Flat Roof	100	0.027	0.027	0.027
36.001	-	-	100	0.000	0.000	0.000
36.002	-	-	100	0.000	0.000	0.000
36.003	Classification	Premeable Paving	80	0.005	0.004	0.004
	Classification	Premeable Paving	80	0.003	0.002	0.006
1.009	-	-	100	0.000	0.000	0.000
37.000	-	-	100	0.000	0.000	0.000
1.010	-	-	100	0.000	0.000	0.000
1.011	Classification	Premeable Paving	80	0.003	0.002	0.002
38.000	Classification	Flat Roof	100	0.011	0.011	0.011
38.001	-	-	100	0.000	0.000	0.000

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
38.002	-	-	100	0.000	0.000	0.000
38.003	Classification	Premeable Paving	80	0.002	0.001	0.001
	Classification	Premeable Paving	80	0.003	0.003	0.004
39.000	-	-	100	0.000	0.000	0.000
1.012	-	-	100	0.000	0.000	0.000
1.013	-	-	100	0.000	0.000	0.000
40.000	-	-	100	0.000	0.000	0.000
40.001	Classification	Premeable Paving	80	0.007	0.006	0.006
41.000	-	-	100	0.000	0.000	0.000
41.001	-	-	100	0.000	0.000	0.000
41.002	-	-	100	0.000	0.000	0.000
40.002	-	-	100	0.000	0.000	0.000
40.003	Classification	Premeable Paving	80	0.009	0.007	0.007
40.004	Classification	Premeable Paving	80	0.009	0.007	0.007
40.005	-	-	100	0.000	0.000	0.000
40.006	Classification	Premeable Paving	80	0.003	0.003	0.003
42.000	-	-	100	0.000	0.000	0.000
42.001	Classification	Premeable Paving	80	0.005	0.004	0.004
	Classification	Premeable Paving	80	0.001	0.001	0.005
42.002	-	-	100	0.000	0.000	0.000
40.007	Classification	Premeable Paving	80	0.003	0.002	0.002
43.000	-	-	100	0.000	0.000	0.000
43.001	Classification	Premeable Paving	80	0.003	0.002	0.002
43.002	-	-	100	0.000	0.000	0.000
40.008	Classification	Premeable Paving	80	0.004	0.003	0.003
44.000	-	-	100	0.000	0.000	0.000
44.001	Classification	Premeable Paving	80	0.001	0.001	0.001

<u>Area Summary for Storm</u>

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
	Classification	Premeable Paving	80	0.005	0.004	0.005
44.002	-	-	100	0.000	0.000	0.000
40.009	Classification	Premeable Paving	80	0.006	0.004	0.004
	Classification	Grass	30	0.003	0.001	0.005
45.000	-	-	100	0.000	0.000	0.000
45.001	Classification	Premeable Paving	80	0.013	0.010	0.010
	Classification	Premeable Paving	80	0.001	0.001	0.011
45.002	-	-	100	0.000	0.000	0.000
40.010	Classification	Premeable Paving	80	0.014	0.011	0.011
	Classification	Premeable Paving	80	0.004	0.003	0.014
	Classification	Premeable Paving	80	0.004	0.003	0.017
46.000	Classification	Premeable Paving	80	0.002	0.001	0.001
46.001	-	-	100	0.000	0.000	0.000
46.002	-	-	100	0.000	0.000	0.000
40.011	Classification	Premeable Paving	80	0.002	0.001	0.001
	Classification	Grass	30	0.004	0.001	0.003
40.012	-	-	100	0.000	0.000	0.000
40.013	-	-	100	0.000	0.000	0.000
40.014	Classification	Default	100	0.032	0.032	0.032
47.000	Classification	Premeable Paving	80	0.010	0.008	0.008
48.000	-	-	100	0.000	0.000	0.000
49.000	-	-	100	0.000	0.000	0.000
49.001	-	-	100	0.000	0.000	0.000
49.002	-	-	100	0.000	0.000	0.000
49.003	Classification	Premeable Paving	80	0.002	0.001	0.001
50.000	-	-	100	0.000	0.000	0.000
51.000	-	-	100	0.000	0.000	0.000

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
51.001	Classification	Flat Roof	100	0.006	0.006	0.006
51.002	-	-	100	0.000	0.000	0.000
49.004	Classification	Premeable Paving	80	0.001	0.001	0.001
47.001	-	-	100	0.000	0.000	0.000
47.002	-	-	100	0.000	0.000	0.000
47.003	-	-	100	0.000	0.000	0.000
47.004	Classification	Grass	30	0.002	0.000	0.000
47.005	Classification	Grass	30	0.003	0.001	0.001
52.000	-	-	100	0.000	0.000	0.000
53.000	-	-	100	0.000	0.000	0.000
53.001	-	-	100	0.000	0.000	0.000
53.002	-	-	100	0.000	0.000	0.000
52.001	Classification	Premeable Paving	80	0.007	0.006	0.006
52.002	-	-	100	0.000	0.000	0.000
52.003	-	-	100	0.000	0.000	0.000
47.006	Classification	Grass	30	0.001	0.000	0.000
47.007	Classification	Grass	30	0.003	0.001	0.001
47.008	Classification	Grass	30	0.001	0.000	0.000
54.000	Classification	Flat Roof	100	0.014	0.014	0.014
54.001	Classification	Premeable Paving	80	0.004	0.004	0.004
55.000	-	-	100	0.000	0.000	0.000
55.001	-	-	100	0.000	0.000	0.000
55.002	-	-	100	0.000	0.000	0.000
55.003	Classification	Premeable Paving	80	0.004	0.003	0.003
56.000	-	-	100	0.000	0.000	0.000
54.002	-	-	100	0.000	0.000	0.000
54.003	-	-	100	0.000	0.000	0.000

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
47.009	Classification	Grass	30	0.002	0.001	0.001
47.010	Classification	Grass	30	0.001	0.000	0.000
47.011	Classification	Grass	30	0.002	0.001	0.001
57.000	-	-	100	0.000	0.000	0.000
57.001	Classification	Flat Roof	100	0.005	0.005	0.005
57.002	-	-	100	0.000	0.000	0.000
57.003	Classification	Premeable Paving	80	0.004	0.003	0.003
58.000	-	-	100	0.000	0.000	0.000
57.004	Classification	Premeable Paving	80	0.003	0.003	0.003
57.005	-	-	100	0.000	0.000	0.000
57.006	-	-	100	0.000	0.000	0.000
47.012	Classification	Grass	30	0.002	0.000	0.000
47.013	Classification	Grass	30	0.002	0.001	0.001
47.014	Classification	Grass	30	0.001	0.000	0.000
47.015	Classification	Grass	30	0.002	0.000	0.000
47.016	Classification	Grass	30	0.003	0.001	0.001
47.017	Classification	Grass	30	0.002	0.000	0.000
47.018	Classification	Grass	30	0.003	0.001	0.001
47.019	Classification	Grass	30	0.002	0.000	0.000
47.020	Classification	Default	100	0.005	0.005	0.005
47.021	-	-	100	0.000	0.000	0.000
47.022	-	-	100	0.000	0.000	0.000
47.023	-	-	100	0.000	0.000	0.000
47.024	Classification	Default	100	0.004	0.004	0.004
1.014	Classification	Grass	30	0.001	0.000	0.000
	Classification	Grass	30	0.001	0.000	0.001
	Classification	Premeable Paving	80	0.012	0.010	0.010

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
59.000	-	-	100	0.000	0.000	0.000
59.001	Classification	Flat Roof	100	0.004	0.004	0.004
59.002	-	-	100	0.000	0.000	0.000
59.003	Classification	Premeable Paving	80	0.036	0.029	0.029
	Classification	Grass	30	0.001	0.000	0.029
60.000	-	-	100	0.000	0.000	0.000
60.001	Classification	Flat Roof	100	0.006	0.006	0.006
60.002	-	-	100	0.000	0.000	0.000
59.004	Classification	Grass	30	0.002	0.000	0.000
	Classification	Grass	30	0.001	0.000	0.001
	Classification	Grass	30	0.001	0.000	0.001
59.005	Classification	Premeable Paving	80	0.007	0.006	0.006
	Classification	Flat Roof	100	0.009	0.009	0.015
1.015	Classification	Grass	30	0.002	0.000	0.000
	Classification	Grass	30	0.002	0.000	0.001
				Total	Total	Total
				0.743	0.597	0.597

Network Classifications for Storm

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
S1.000	BR1	300	0.195	0.196	Unclassified				Junction
S1.001	BR1	300	0.147	0.196	Unclassified				Junction
S1.002	BR1	300	0.147	0.198	Unclassified				Junction
S1.003	AJ1	300	0.198	0.199	Unclassified	450	0	0.198	Unclassified
S1.004	FC1	150	0.800	0.806	Unclassified	600	0	0.800	Unclassified
S1.005	FD1	300	0.656	0.688	Unclassified	600	0	0.656	Unclassified
S2.000	BR2	300	0.180	0.181	Unclassified				Junction
S3.000	BR2	300	0.180	0.181	Unclassified				Junction
S2.001	AJ2	300	0.181	0.182	Unclassified	450	0	0.181	Unclassified
S4.000	BR3	300	0.178	0.179	Unclassified				Junction
S4.001	BR3	300	0.179	0.180	Unclassified				Junction
S4.002	AJ3	300	0.180	0.181	Unclassified	450	0	0.180	Unclassified
S5.000	BR4	300	0.179	0.180	Unclassified				Junction
S6.000	BR4	300	0.179	0.180	Unclassified				Junction
S5.001	AJ4	300	0.180	0.181	Unclassified	450	0	0.180	Unclassified
S7.000	GR1.1	100	0.100	0.101	Unclassified				Junction
S7.001	DP1	150	0.349	30.793	Unclassified	150	0	30.793	Unclassified
S7.002	IC1	300	0.199	0.200	Unclassified				Junction
S8.000	BR5	300	0.197	0.198	Unclassified				Junction
S8.001	BR5	300	0.198	0.199	Unclassified				Junction
S8.002	BR5	300	0.199	0.200	Unclassified				Junction
S9.000	GR1.2	100	0.100	0.101	Unclassified				Junction
S9.001	DP2	150	0.346	30.788	Unclassified	150	0	30.788	Unclassified
S9.002	IC2	300	0.196	0.197	Unclassified	600	0	0.196	Unclassified
S9.003	BR5	300	0.197	0.198	Unclassified				Junction

Network Classifications for Storm

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
S10.000	GR2.1	100	0.100	0.101	Unclassified				Junction
S10.001	DP3	150	0.346	27.782	Unclassified	150	0	27.782	Unclassified
S10.002	IC3	300	0.196	0.197	Unclassified	600	0	0.196	Unclassified
S10.003	BR5	300	0.197	0.198	Unclassified				Junction
S9.004	BR5	300	0.198	0.199	Unclassified				Junction
S9.005	BR5	300	0.199	0.200	Unclassified				Junction
S7.003	FC2	300	0.181	3.678	Unclassified	500	0	3.678	Unclassified
S7.004	DP4	300	0.181	0.182	Unclassified	150	0	0.181	Unclassified
S7.005	IC4	300	0.182	0.183	Unclassified	600	0	0.182	Unclassified
S4.003	BR6	300	0.181	0.182	Unclassified				Junction
S11.000	BR6	300	0.181	0.182	Unclassified				Junction
S2.002	BR6	300	0.182	0.183	Unclassified				Junction
S2.003	FC3	300	0.183	0.184	Unclassified	450	0	0.183	Unclassified
S2.004	BR7	300	0.184	0.185	Unclassified				Junction
S12.000	BR8	300	0.179	0.180	Unclassified				Junction
S12.001	BR8	300	0.180	0.181	Unclassified				Junction
S13.000	BR8	300	0.179	0.180	Unclassified				Junction
S13.001	BR8	300	0.180	0.181	Unclassified				Junction
S12.002	AJ6	300	0.181	0.182	Unclassified	450	0	0.181	Unclassified
S12.003	BR9	300	0.182	0.183	Unclassified				Junction
S14.000	BR10	300	0.177	0.178	Unclassified				Junction
S14.001	BR10	300	0.178	0.179	Unclassified				Junction
S14.002	BR10	300	0.179	0.180	Unclassified				Junction
S14.003	AJ7	300	0.180	0.181	Unclassified	450	0	0.180	Unclassified
S14.004	BR9	300	0.181	0.182	Unclassified				Junction

<u>Network Classifications for Storm</u>

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
S14.005	BR9	300	0.182	0.183	Unclassified				Junction
S12.004	BR9	300	0.183	0.184	Unclassified				Junction
S15.000	BR9	300	0.183	0.184	Unclassified				Junction
S12.005	AJ8	300	0.184	0.185	Unclassified	450	0	0.184	Unclassified
S2.005	BR7	300	0.185	0.186	Unclassified				Junction
S2.006	BR7	300	0.186	0.187	Unclassified				Junction
S16.000	BR11	300	0.182	0.183	Unclassified				Junction
S17.000	GR2.3	100	0.071	0.100	Unclassified				Junction
S17.001	DP5	150	0.331	31.275	Unclassified	150	0	31.275	Unclassified
S17.002	IC5	300	0.181	0.182	Unclassified	600	0	0.181	Unclassified
S17.003	BR11	300	0.182	0.183	Unclassified				Junction
S16.001	AJ9	300	0.183	0.184	Unclassified	450	0	0.183	Unclassified
S18.000	GR2.4	100	0.100	0.101	Unclassified				Junction
S18.001	DP6	150	0.332	31.300	Unclassified	150	0	31.300	Unclassified
S18.002	IC6	300	0.182	0.183	Unclassified	600	0	0.182	Unclassified
S18.003	BR12	300	0.183	0.184	Unclassified				Junction
S16.002	AJ10	300	0.184	0.185	Unclassified	450	0	0.184	Unclassified
S16.003	BR7	300	0.185	0.186	Unclassified				Junction
S19.000	GR2.5	100	0.071	0.100	Unclassified				Junction
S19.001	DP7	150	0.335	31.279	Unclassified	150	0	31.279	Unclassified
S19.002	IC7	300	0.185	0.186	Unclassified	600	0	0.185	Unclassified
S16.004	BR7	300	0.186	0.187	Unclassified				Junction
S20.000	BR7	300	0.186	0.187	Unclassified				Junction
S2.007	FC4	300	0.187	0.188	Unclassified	500	0	0.187	Unclassified
S21.000	GR3.1	100	0.100	0.101	Unclassified				Junction

Network Classifications for Storm

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
S21.001	DP8	150	0.333	25.276	Unclassified	150	0	25.276	Unclassified
S21.002	IC8	300	0.183	0.184	Unclassified	600	0	0.183	Unclassified
S21.003	BR13	300	0.184	0.185	Unclassified	600	0	0.184	Unclassified
S22.000	BR13	300	0.183	0.184	Unclassified				Junction
S22.001	BR13	300	0.184	0.185	Unclassified				Junction
S21.004	AJ11	300	0.185	0.186	Unclassified	500	0	0.185	Unclassified
S23.000	GR3.2	100	0.100	0.101	Unclassified				Junction
S23.001	DP9	150	0.333	25.276	Unclassified	150	0	25.276	Unclassified
S23.002	IC9	300	0.183	0.184	Unclassified	600	0	0.183	Unclassified
S23.003	BR14	300	0.184	0.185	Unclassified				Junction
S23.004	BR14	300	0.185	0.186	Unclassified				Junction
S21.005	BR14	300	0.186	0.187	Unclassified				Junction
S21.006	BR14	300	0.187	0.188	Unclassified				Junction
S2.008	BR14	300	0.188	0.189	Unclassified				Junction
S24.000	BR14	300	0.188	0.189	Unclassified				Junction
S2.009	FC5	300	0.189	0.190	Unclassified	500	0	0.189	Unclassified
S2.010	BR16	300	0.190	0.191	Unclassified				Junction
S2.011	BR16	300	0.191	0.192	Unclassified				Junction
S25.000	BR15	300	0.188	0.189	Unclassified				Junction
S25.001	BR15	300	0.189	0.190	Unclassified				Junction
S25.002	BR15	300	0.190	0.191	Unclassified				Junction
S25.003	BR15	300	0.191	0.192	Unclassified				Junction
S25.004	AJ12	300	0.192	0.193	Unclassified	500	0	0.192	Unclassified
S2.012	BR16	300	0.193	0.194	Unclassified				Junction
S26.000	BR17	300	0.189	0.190	Unclassified				Junction

Network Classifications for Storm

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
S27.000	GR4.1	100	0.100	0.101	Unclassified				Junction
S27.001	DP12	150	0.316	16.249	Unclassified	150	0	16.249	Unclassified
S27.002	IC12	300	0.166	0.167	Unclassified	600	0	0.166	Unclassified
S27.003	BR17	300	0.189	0.190	Unclassified				Junction
S27.004	BR17	300	0.189	0.190	Unclassified				Junction
S28.000	GR3.3	100	0.100	0.101	Unclassified				Junction
S28.001	DP10	150	0.339	25.282	Unclassified	150	0	25.282	Unclassified
S28.002	IC10	300	0.189	0.190	Unclassified	600	0	0.189	Unclassified
S26.001	BR17	300	0.190	0.191	Unclassified				Junction
S26.002	FC6	300	0.191	0.192	Unclassified	500	0	0.191	Unclassified
S26.003	BR16	300	0.192	0.193	Unclassified				Junction
S29.000	GR3.4	100	0.100	0.101	Unclassified				Junction
S29.001	DP11	150	0.341	25.280	Unclassified	150	0	25.280	Unclassified
S29.002	IC11	300	0.191	0.192	Unclassified	600	0	0.191	Unclassified
S29.003	BR16	300	0.192	0.193	Unclassified				Junction
S26.004	BR16	300	0.193	0.194	Unclassified				Junction
S2.013	FC7	300	0.194	0.195	Unclassified	500	0	0.194	Unclassified
S30.000	GR4.2	100	0.100	0.101	Unclassified				Junction
S30.001	DP13	225	0.266	16.208	Unclassified	150	0	16.208	Unclassified
S30.002	IC13	300	0.191	0.192	Unclassified	600	0	0.191	Unclassified
S30.003	BR18	300	0.192	0.193	Unclassified				Junction
S30.004	BR18	300	0.193	0.194	Unclassified				Junction
S31.000	BR16	300	0.190	0.191	Unclassified				Junction
S31.001	BR18	300	0.191	0.192	Unclassified				Junction
S31.002	BR18	300	0.192	0.193	Unclassified				Junction

Network Classifications for Storm

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
S32.000	BR18	300	0.192	0.193	Unclassified				Junction
S31.003	BR18	300	0.193	0.194	Unclassified				Junction
S30.005	FC8	300	0.194	0.195	Unclassified	500	0	0.194	Unclassified
S2.014	BR19	300	0.195	0.196	Unclassified				Junction
S33.000	BR19	300	0.195	0.196	Unclassified				Junction
S2.015	BR19	300	0.196	0.197	Unclassified				Junction
S2.016	AJ13	300	0.197	0.198	Unclassified	500	0	0.197	Unclassified
S2.017	FC9	150	0.348	0.355	Unclassified	500	0	0.348	Unclassified
S2.018	FD2	300	0.658	0.688	Unclassified	600	0	0.658	Unclassified
S34.000	BR20	300	0.687	0.688	Unclassified				Junction
S1.006	FC10	150	0.838	0.851	Unclassified	500	0	0.838	Unclassified
S1.007	FD3	300	0.701	0.725	Unclassified	600	0	0.701	Unclassified
S35.000	BR21	300	2.293	2.294	Unclassified				Junction
S1.008	FC11	150	0.875	0.886	Unclassified	500	0	0.875	Unclassified
S36.000	DP14	150	0.286	0.300	Unclassified	150	0	0.286	Unclassified
S36.001	IC14	300	0.150	0.151	Unclassified	600	0	0.150	Unclassified
S36.002	FC12	300	0.151	0.152	Unclassified	600	0	0.151	Unclassified
S36.003	FD4	300	0.600	2.294	Unclassified	600	0	0.600	Unclassified
S1.009	FD5	300	0.754	2.294	Unclassified	600	0	2.294	Unclassified
S37.000	BR22	300	0.744	0.745	Unclassified				Junction
S1.010	FC13	150	0.319	1.850	Unclassified	500	0	1.850	Unclassified
S1.011	FD6	300	0.600	0.622	Unclassified	600	0	0.600	Unclassified
S38.000	DP15	150	0.299	0.310	Unclassified	150	0	0.299	Unclassified
S38.001	IC15	30	-0.151	0.285	Unclassified	600	0	-0.151	Unclassified
S38.002	FC14	300	0.157	0.585	Unclassified	500	0	0.585	Unclassified

Network Classifications for Storm

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
S38.003	FD7	300	0.600	0.647	Unclassified	600	0	0.600	Unclassified
S39.000	BR23	300	1.660	1.661	Unclassified				Junction
S1.012	FC15	300	1.660	1.672	Unclassified	500	0	1.660	Unclassified
S1.013	MH1	150	1.013	2.710	Unclassified	1200	0	2.710	Unclassified
S40.000	BR24	100	0.348	0.349	Unclassified				Junction
S40.001	BR24	150	0.299	0.300	Unclassified				Junction
S41.000	GR2.2	100	0.100	0.101	Unclassified				Junction
S41.001	DP16	150	0.298	27.792	Unclassified	150	0	27.792	Unclassified
S41.002	IC16	300	0.148	0.149	Unclassified	150	0	0.148	Unclassified
S40.002	BR24	300	0.149	0.150	Unclassified				Junction
S40.003	BR24	300	0.150	0.151	Unclassified				Junction
S40.004	FC16	300	0.151	0.190	Unclassified	500	0	0.151	Unclassified
S40.005	DP17	150	0.897	5.292	Unclassified	150	0	5.292	Unclassified
S40.006	IC17	300	0.750	0.788	Unclassified	600	0	0.750	Unclassified
S42.000	BR25	300	0.098	0.099	Unclassified				Junction
S42.001	BR25	300	0.149	0.150	Unclassified				Junction
S42.002	DP18	150	0.897	5.292	Unclassified	150	0	5.292	Unclassified
S40.007	JC1	300	0.788	0.806	Unclassified				Junction
S43.000	BR26	300	0.148	0.149	Unclassified				Junction
S43.001	BR26	300	0.149	0.150	Unclassified				Junction
S43.002	DP19	150	0.897	5.292	Unclassified	150	0	5.292	Unclassified
S40.008	JC2	300	0.540	0.618	Unclassified				Junction
S44.000	BR27	300	0.148	0.149	Unclassified				Junction
S44.001	FC17	300	0.149	0.150	Unclassified	500	0	0.149	Unclassified
S44.002	DP21	150	0.899	5.292	Unclassified	150	0	5.292	Unclassified

Network Classifications for Storm

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
S40.009	JC3	300	0.749	0.797	Unclassified				Junction
S45.000	BR28	300	88.500	88.501	Unclassified				Junction
S45.001	FC18	300	0.149	0.150	Unclassified	500	0	0.149	Unclassified
S45.002	DP20	150	0.899	5.292	Unclassified	150	0	5.292	Unclassified
S40.010	JC4	300	0.797	0.861	Unclassified				Junction
S46.000	BR29	300	0.146	0.147	Unclassified				Junction
S46.001	FC19	300	0.147	0.148	Unclassified	500	0	0.147	Unclassified
S46.002	DP21	150	0.901	5.292	Unclassified	150	0	5.292	Unclassified
S40.011	JC5	300	0.861	0.866	Unclassified				Junction
S40.012	FC20	225	0.949	0.994	Unclassified	500	0	0.994	Unclassified
S40.013	MH2	225	0.758	2.914	Unclassified	1200	0	0.758	Unclassified
S40.014	MH3	225	1.039	4.447	Unclassified	2100	0	4.447	Unclassified
S47.000	BR31	300	0.194	0.195	Unclassified				Junction
S48.000	BR31	300	0.194	0.195	Unclassified				Junction
S49.000	GR5.1	100	0.100	0.101	Unclassified				Junction
S49.001	DP25	150	0.350	43.294	Unclassified	150	0	43.294	Unclassified
S49.002	BR30	300	0.200	0.201	Unclassified				Junction
S49.003	BR30	300	0.201	0.202	Unclassified				Junction
S50.000	BR30	300	0.196	0.197	Unclassified				Junction
S51.000	GR5.2	100	0.100	0.101	Unclassified				Junction
S51.001	DP23	150	0.351	43.295	Unclassified	150	0	43.295	Unclassified
S51.002	BR30	300	0.201	0.202	Unclassified				Junction
S49.004	FC22	300	0.202	0.203	Unclassified	500	0	0.202	Unclassified
S47.001	FC21	300	1.900	1.901	Unclassified	500	0	1.900	Unclassified
S47.002	DP22	300	0.002	2.200	Unclassified	150	0	2.200	Unclassified

Network Classifications for Storm

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
S47.003	SWALE	300	0.002	0.368	Unclassified				Junction
S47.004	SWALE	300	0.049	0.368	Unclassified				Junction
S47.005	SWALE	300	0.049	0.417	Unclassified				Junction
S52.000	BR32	300	0.196	0.197	Unclassified				Junction
S53.000	GR5.3	100	0.100	0.101	Unclassified				Junction
S53.001	DP24	150	0.351	43.295	Unclassified	150	0	43.295	Unclassified
S53.002	BR32	300	0.201	0.202	Unclassified				Junction
S52.001	BR32	300	0.197	0.198	Unclassified				Junction
S52.002	FC22	300	0.198	0.199	Unclassified	500	0	0.198	Unclassified
S52.003	DP25	150	0.218	2.050	Unclassified	150	0	2.050	Unclassified
S47.006	SWALE	300	0.098	0.417	Unclassified				Junction
S47.007	SWALE	300	0.098	2.109	Unclassified				Junction
S47.008	SWALE	300	2.109	2.333	Unclassified				Junction
S54.000	IC18	150	0.345	0.346	Unclassified	600	0	0.345	Unclassified
S54.001	BR33	300	0.196	0.197	Unclassified				Junction
S55.000	GR6.1	100	0.100	0.101	Unclassified				Junction
S55.001	DP26	300	0.195	31.144	Unclassified				Junction
S55.002	BR33	300	0.195	0.196	Unclassified				Junction
S55.003	BR33	300	0.196	0.197	Unclassified				Junction
S56.000	BR33	300	0.196	0.197	Unclassified				Junction
S54.002	FC23	300	0.197	0.198	Unclassified	500	0	0.197	Unclassified
S54.003	DP26	150	2.050	2.061	Unclassified	150	0	2.050	Unclassified
S47.009	SWALE	300	0.150	2.333	Unclassified				Junction
S47.010	SWALE	300	0.150	0.178	Unclassified				Junction
S47.011	SWALE	300	0.178	0.545	Unclassified				Junction

Network Classifications for Storm

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
S57.000	GR6.2	100	0.100	0.101	Unclassified				Junction
S57.001	DP26	150	0.350	31.294	Unclassified				Junction
S57.002	BR34	300	0.200	0.201	Unclassified				Junction
S57.003	BR34	300	0.201	0.202	Unclassified				Junction
S58.000	BR34	300	0.196	0.197	Unclassified				Junction
S57.004	BR34	300	0.197	0.198	Unclassified				Junction
S57.005	FC24	300	0.198	0.199	Unclassified	500	0	0.198	Unclassified
S57.006	DP27	150	0.215	2.050	Unclassified	150	0	2.050	Unclassified
S47.012	SWALE	300	0.213	0.545	Unclassified				Junction
S47.013	SWALE	300	0.213	0.218	Unclassified				Junction
S47.014	SWALE	300	0.218	0.236	Unclassified				Junction
S47.015	SWALE	300	0.236	0.267	Unclassified				Junction
S47.016	SWALE	300	0.267	0.280	Unclassified				Junction
S47.017	SWALE	300	0.280	0.316	Unclassified				Junction
S47.018	SWALE	300	0.316	0.329	Unclassified				Junction
S47.019	SWALE	300	0.329	0.365	Unclassified				Junction
S47.020	SWALE	300	0.365	0.926	Unclassified				Junction
S47.021	SWALE	300	0.000	0.926	Unclassified				Junction
S47.022	SWALE	300	0.000	0.001	Unclassified				Junction
S47.023	SWALE	300	0.001	0.022	Unclassified				Junction
S47.024	FC25	300	0.851	3.034	Unclassified	500	0	3.034	Unclassified
S1.014	MH4	300	0.956	1.091	Unclassified	1200	0	0.956	Unclassified
S59.000	GR4.3	100	0.100	0.101	Unclassified				Junction
S59.001	DP28	150	0.833	21.226	Unclassified	150	0	21.226	Unclassified
S59.002	IC19	150	0.833	0.907	Unclassified	600	0	0.833	Unclassified

Network Classifications for Storm

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
S59.003	IC20	300	0.750	0.790	Unclassified	600	0	0.750	Unclassified
S60.000	GR4.4	100	0.100	0.101	Unclassified				Junction
S60.001	DP29	150	0.732	21.226	Unclassified	150	0	21.226	Unclassified
S60.002	IC21	150	0.732	0.792	Unclassified	600	0	0.732	Unclassified
S59.004	FC26	300	0.697	0.790	Unclassified	500	0	0.790	Unclassified
S59.005	MH5	300	0.666	0.697	Unclassified	900	0	0.697	Unclassified
S1.015	HB	300	1.051	1.100	Unclassified	2100	0	1.100	Unclassified

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.015	EX SEWER	80.410	79.059	78.440	1200	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	1.000	Manhole Headloss Coeff (Global)	0.500	Inlet Coeffiecient	0.800
Areal Reduction Factor	1.000	Foul Sewage per hectare (l/s)	0.000	Flow per Person per Day (l/per/day)	0.000
Hot Start (mins)	0	Additional Flow - % of Total Flow	0.000	Run Time (mins)	11520
Hot Start Level (mm)	0	MADD Factor * 10m³/ha Storage	2.000	Output Interval (mins)	24

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	57
Number of Online Controls	27	Number of Storage Structures	27	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	18.000	Cv (Summer)	0.750
Return Period (years)	100	Ratio R	0.275	Cv (Winter)	1.000
Region	Scotland and Ireland	Profile Type	Winter	Storm Duration (mins)	5760

APPENDIX B3.2 - Simulation Critera

Online Controls for Storm

Orifice Manhole: FC1, DS/PN: S1.004, Volume (m³): 0.6

Diameter (m) 0.060 Discharge Coefficient 0.600 Invert Level (m) 84.400

Orifice Manhole: FC2, DS/PN: S7.003, Volume (m³): 4.4

Diameter (m) 0.060 Discharge Coefficient 0.600 Invert Level (m) 84.872

Orifice Manhole: FC3, DS/PN: S2.003, Volume (m³): 0.4

Diameter (m) 0.060 Discharge Coefficient 0.600 Invert Level (m) 84.867

Orifice Manhole: FC4, DS/PN: S2.007, Volume (m³): 1.0

Diameter (m) 0.060 Discharge Coefficient 0.600 Invert Level (m) 84.863

Orifice Manhole: FC5, DS/PN: S2.009, Volume (m³): 0.5

Diameter (m) 0.060 Discharge Coefficient 0.600 Invert Level (m) 84.861

Orifice Manhole: FC6, DS/PN: S26.002, Volume (m³): 0.5

Diameter (m) 0.060 Discharge Coefficient 0.600 Invert Level (m) 84.859

Orifice Manhole: FC7, DS/PN: S2.013, Volume (m³): 1.0

Diameter (m) 0.060 Discharge Coefficient 0.600 Invert Level (m) 84.856

Orifice Manhole: FC8, DS/PN: S30.005, Volume (m³): 1.0

Diameter (m) 0.060 Discharge Coefficient 0.600 Invert Level (m) 84.856

Orifice Manhole: FC9, DS/PN: S2.017, Volume (m³): 0.7

Diameter (m) 0.060 Discharge Coefficient 0.600 Invert Level (m) 84.852

Orifice Manhole: FC10, DS/PN: S1.006, Volume (m³): 1.5

Diameter (m) 0.044 Discharge Coefficient 0.600 Invert Level (m) 84.362

Orifice Manhole: FC11, DS/PN: S1.008, Volume (m³): 0.8

Diameter (m) 0.044 Discharge Coefficient 0.600 Invert Level (m) 84.325

Orifice Manhole: FC12, DS/PN: S36.002, Volume (m³): 0.4

Diameter (m) 0.036 Discharge Coefficient 0.600 Invert Level (m) 83.249

Orifice Manhole: FC13, DS/PN: S1.010, Volume (m³): 0.8

Diameter (m) 0.044 Discharge Coefficient 0.600 Invert Level (m) 81.800

Orifice Manhole: FC14, DS/PN: S38.002, Volume (m³): 11.2

Diameter (m) 0.060 Discharge Coefficient 0.600 Invert Level (m) 81.810

Orifice Manhole: FC15, DS/PN: S1.012, Volume (m³): 1.9

Diameter (m) 0.044 Discharge Coefficient 0.600 Invert Level (m) 80.300

Orifice Manhole: FC16, DS/PN: S40.004, Volume (m³): 1.4

Diameter (m) 0.058 Discharge Coefficient 0.600 Invert Level (m) 88.349

Orifice Manhole: FC17, DS/PN: S44.001, Volume (m³): 0.4

Diameter (m) 0.060 Discharge Coefficient 0.600 Invert Level (m) 88.351

Orifice Manhole: FC18, DS/PN: S45.001, Volume (m³): 0.2

Diameter (m) 0.058 Discharge Coefficient 0.600 Invert Level (m) 88.351

Orifice Manhole: FC19, DS/PN: S46.001, Volume (m³): 0.4

Diameter (m) 0.058 Discharge Coefficient 0.600 Invert Level (m) 88.353

Orifice Manhole: FC20, DS/PN: S40.012, Volume (m³): 0.3

Diameter (m) 0.045 Discharge Coefficient 0.600 Invert Level (m) 83.181

Orifice Manhole: FC21, DS/PN: S47.001, Volume (m^3): 2.2

Diameter (m) 0.058 Discharge Coefficient 0.600 Invert Level (m) 83.150

Orifice Manhole: FC22, DS/PN: S52.002, Volume (m^3): 0.4

Diameter (m) 0.060 Discharge Coefficient 0.600 Invert Level (m) 84.852

Orifice Manhole: FC23, DS/PN: S54.002, Volume (m^3): 1.3

Diameter (m) 0.060 Discharge Coefficient 0.600 Invert Level (m) 84.853

Orifice Manhole: FC24, DS/PN: S57.005, Volume (m^3): 0.3

Diameter (m) 0.060 Discharge Coefficient 0.600 Invert Level (m) 84.852

Orifice Manhole: FC25, DS/PN: S47.024, Volume (m^3): 1.0

Diameter (m) 0.043 Discharge Coefficient 0.600 Invert Level (m) 79.400

Orifice Manhole: FC26, DS/PN: S59.004, Volume (m^3): 3.2

Diameter (m) 0.075 Discharge Coefficient 0.600 Invert Level (m) 79.710

Hydro-Brake® Optimum Manhole: HB, DS/PN: S1.015, Volume (m^3): 7.1

Unit Reference	MD-SHE-0134-8100-0900-8100	Design Flow (l/s)	8.1
Design Head (m)	0.900	Flush-Flo™	Calculated

Hydro-Brake® Optimum Manhole: HB, DS/PN: S1.015, Volume (m³): 7.1

Objective	Minimise upstream storage	Invert Level (m)	79.150
Application	Surface	Minimum Outlet Pipe Diameter (mm)	150
Sump Available	Yes	Suggested Manhole Diameter (mm)	1200
Diameter (mm)	134		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	8.1	Kick-Flo®	0.610	6.8
Flush-Flo™	0.274	8.1	Mean Flow over Head Range	-	6.9

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.8	0.600	6.9	1.600	10.6	2.600	13.4	5.000	18.3	7.500	22.2
0.200	8.0	0.800	7.7	1.800	11.2	3.000	14.3	5.500	19.1	8.000	22.9
0.300	8.1	1.000	8.5	2.000	11.8	3.500	15.4	6.000	19.9	8.500	23.6
0.400	7.9	1.200	9.3	2.200	12.3	4.000	16.4	6.500	20.7	9.000	24.2
0.500	7.6	1.400	10.0	2.400	12.9	4.500	17.4	7.000	21.5	9.500	24.8

Storage Structures for Storm

Complex Manhole: AJ1, DS/PN: S1.003

Cellular Storage

Invert Level (m) 84.852 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.30
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	178.0	0.0	0.150	178.0	0.0	0.151	0.0	0.0

Cellular Storage

Invert Level (m) 84.852 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	260.0	0.0	0.150	260.0	0.0	0.151	0.0	0.0

Complex Manhole: FC2, DS/PN: S7.003

Cellular Storage

Invert Level (m) 84.853 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	553.0	0.0	0.150	553.0	0.0	0.151	0.0	0.0

Cellular Storage

Invert Level (m) 85.003 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.30
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	260.0	0.0	0.150	260.0	0.0	0.151	0.0	0.0

Tank or Pond

Invert Level (m) 85.253

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	419.0	0.050	419.0	0.051	0.0

Complex Manhole: FC3, DS/PN: S2.003

Cellular Storage

Invert Level (m) 84.867 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.30
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	60.0	0.0	0.150	60.0	0.0	0.151	0.0	0.0

Cellular Storage

Invert Level (m) 84.867 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	165.0	0.0	0.150	165.0	0.0	0.151	0.0	0.0

Cellular Storage

Invert Level (m) 84.867 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	370.0	0.0	0.150	370.0	0.0	0.151	0.0	0.0

Cellular Storage

Invert Level (m) 85.017 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.30
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	215.0	0.0	0.150	215.0	0.0	0.151	0.0	0.0

Tank or Pond

Invert Level (m) 85.267

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	63.0	0.050	63.0	0.051	0.0

Complex Manhole: FC4, DS/PN: S2.007

Cellular Storage

Invert Level (m) 84.862 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	566.0	0.0	0.150	566.0	0.0	0.151	0.0	0.0

Cellular Storage

Invert Level (m) 85.012 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.30
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	400.0	0.0	0.150	400.0	0.0	0.151	0.0	0.0

Complex Manhole: FC5, DS/PN: S2.009

Cellular Storage

Invert Level (m) 84.860 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.30
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	250.0	0.0	0.150	250.0	0.0	0.151	0.0	0.0

Cellular Storage

Invert Level (m) 84.860 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	560.0	0.0	0.150	560.0	0.0	0.151	0.0	0.0

Complex Manhole: FC6, DS/PN: S26.002

Cellular Storage

Invert Level (m) 84.859 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.30
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	217.0	0.0	0.150	217.0	0.0	0.151	0.0	0.0

Cellular Storage

Invert Level (m) 84.859 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	432.0	0.0	0.150	432.0	0.0	0.151	0.0	0.0

Complex Manhole: FC7, DS/PN: S2.013

Cellular Storage

Invert Level (m) 84.854 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Cellular Storage

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	827.0	0.0	0.150	827.0	0.0	0.151	0.0	0.0

Cellular Storage

Invert Level (m) 85.004 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.30
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	600.0	0.0	0.150	600.0	0.0	0.151	0.0	0.0

Complex Manhole: FC8, DS/PN: S30.005

Cellular Storage

Invert Level (m) 84.851 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	240.0	0.0	0.150	240.0	0.0	0.151	0.0	0.0

Cellular Storage

Invert Level (m) 85.001 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.30
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	100.0	0.0	0.150	100.0	0.0	0.151	0.0	0.0

Complex Manhole: FC9, DS/PN: S2.017

Cellular Storage

Invert Level (m) 84.850 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	380.0	0.0	0.150	380.0	0.0	0.151	0.0	0.0

Cellular Storage

Invert Level (m) 85.000 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.30
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	380.0	0.0	0.150	380.0	0.0	0.151	0.0	0.0

Complex Manhole: FC10, DS/PN: S1.006

Filter Drain

Infiltration Coefficient Base (m/hr)	0.00000	Trench Width (m)	0.3	Slope (1:X)	300.0
Infiltration Coefficient Side (m/hr)	0.00000	Trench Length (m)	42.0	Cap Volume Depth (m)	0.600
Safety Factor	2.0	Pipe Diameter (m)	0.300	Cap Infiltration Depth (m)	0.000
Porosity	0.30	Pipe Depth above Invert (m)	0.000		
Invert Level (m)	84.362	Number of Pipes	1		

Tank or Pond

Invert Level (m) 85.262

Depth (m)	**Area (m²)**	**Depth (m)**	**Area (m²)**	**Depth (m)**	**Area (m²)**
0.000	57.0	0.050	57.0	0.051	0.0

Complex Manhole: FC11, DS/PN: S1.008

Filter Drain

Infiltration Coefficient Base (m/hr)	0.00000	Trench Width (m)	0.3	Slope (1:X)	300.0
Infiltration Coefficient Side (m/hr)	0.00000	Trench Length (m)	7.3	Cap Volume Depth (m)	0.600
Safety Factor	2.0	Pipe Diameter (m)	0.300	Cap Infiltration Depth (m)	0.000
Porosity	0.30	Pipe Depth above Invert (m)	0.000		
Invert Level (m)	84.325	Number of Pipes	1		

Tank or Pond

Invert Level (m) 85.225

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	19.7	0.050	19.7	0.051	0.0

Complex Manhole: FC12, DS/PN: S36.002

Cellular Storage

Invert Level (m) 83.239 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.30
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	50.0	0.0	0.150	50.0	0.0	0.151	0.0	0.0

Cellular Storage

Invert Level (m) 83.239 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	50.0	0.0	0.150	50.0	0.0	0.151	0.0	0.0

Complex Manhole: FC13, DS/PN: S1.010

Filter Drain

Infiltration Coefficient Base (m/hr)	0.00000	Trench Width (m)	0.3	Slope (1:X)	300.0
Infiltration Coefficient Side (m/hr)	0.00000	Trench Length (m)	16.2	Cap Volume Depth (m)	0.600
Safety Factor	2.0	Pipe Diameter (m)	0.300	Cap Infiltration Depth (m)	0.000
Porosity	0.30	Pipe Depth above Invert (m)	0.000		
Invert Level (m)	81.800	Number of Pipes	1		

Tank or Pond

Invert Level (m) 82.700

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	42.7	0.050	42.7	0.051	0.0

Cellular Storage

Invert Level (m)	81.800	Infiltration Coefficient Side (m/hr)	0.00000	Porosity	0.95
Infiltration Coefficient Base (m/hr)	0.00000	Safety Factor	2.0		

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	3.5	0.0	0.600	3.5	0.0	0.601	0.0	0.0

Complex Manhole: FC14, DS/PN: S38.002

Cellular Storage

Invert Level (m) 81.810 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.30
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m^2)	Inf. Area (m^2)	Depth (m)	Area (m^2)	Inf. Area (m^2)	Depth (m)	Area (m^2)	Inf. Area (m^2)
0.000	30.0	0.0	0.150	30.0	0.0	0.151	0.0	0.0

Cellular Storage

Invert Level (m) 81.810 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m^2)	Inf. Area (m^2)	Depth (m)	Area (m^2)	Inf. Area (m^2)	Depth (m)	Area (m^2)	Inf. Area (m^2)
0.000	30.0	0.0	0.150	30.0	0.0	0.151	0.0	0.0

Complex Manhole: FC16, DS/PN: S40.004

Cellular Storage

Invert Level (m) 88.349 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.30
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Cellular Storage

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	165.0	0.0	0.150	165.0	0.0	0.151	0.0	0.0

Cellular Storage

Invert Level (m) 88.349 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	360.0	0.0	0.150	360.0	0.0	0.151	0.0	0.0

Complex Manhole: FC17, DS/PN: S44.001

Cellular Storage

Invert Level (m) 88.351 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.30
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	80.0	0.0	0.150	80.0	0.0	0.151	0.0	0.0

Tank or Pond

Invert Level (m) 88.751

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	44.0	0.050	44.0	0.051	0.0

Complex Manhole: FC18, DS/PN: S45.001

Cellular Storage

Invert Level (m) 88.351 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.30
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	170.0	0.0	0.150	170.0	0.0	0.151	0.0	0.0

Tank or Pond

Invert Level (m) 88.751

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	102.0	0.050	102.0	0.051	0.0

Complex Manhole: FC19, DS/PN: S46.001

Cellular Storage

Invert Level (m) 88.353 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.30
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	47.0	0.0	0.150	47.0	0.0	0.151	0.0	0.0

Tank or Pond

Invert Level (m) 88.753

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	50.0	0.050	50.0	0.051	0.0

Complex Manhole: FC20, DS/PN: S40.012

Filter Drain

Infiltration Coefficient Base (m/hr)	0.00000	Invert Level (m)	83.181	Pipe Depth above Invert (m)	0.075
Infiltration Coefficient Side (m/hr)	0.00000	Trench Width (m)	0.6	Number of Pipes	1
Safety Factor	2.0	Trench Length (m)	75.0	Slope (1:X)	300.0
Porosity	0.30	Pipe Diameter (m)	0.300	Cap Volume Depth (m)	0.000

Filter Drain

Cap Infiltration Depth (m) 0.000

Cellular Storage

Invert Level (m) 83.181 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.30
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	274.0	0.0	0.300	274.0	0.0	0.301	0.0	0.0

Complex Manhole: FC21, DS/PN: S47.001

Cellular Storage

Invert Level (m) 83.150 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	100.0	0.0	0.150	100.0	0.0	0.151	0.0	0.0

Cellular Storage

Invert Level (m) 83.300 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.30
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Cellular Storage

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	62.0	0.0	0.150	62.0	0.0	0.151	0.0	0.0

Tank or Pond

Invert Level (m) 83.550

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	50.0	0.050	50.0	0.051	0.0

Complex Manhole: FC22, DS/PN: S52.002

Cellular Storage

Invert Level (m) 84.852 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	100.0	0.0	0.150	100.0	0.0	0.151	0.0	0.0

Cellular Storage

Invert Level (m) 85.002 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.30
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	62.0	0.0	0.150	62.0	0.0	0.151	0.0	0.0

Complex Manhole: FC23, DS/PN: S54.002

Cellular Storage

Invert Level (m) 84.851 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	100.0	0.0	0.150	100.0	0.0	0.151	0.0	0.0

Cellular Storage

Invert Level (m) 85.001 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.30
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	62.0	0.0	0.150	62.0	0.0	0.151	0.0	0.0

Complex Manhole: FC24, DS/PN: S57.005

Cellular Storage

Invert Level (m) 84.850 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	100.0	0.0	0.150	100.0	0.0	0.151	0.0	0.0

Cellular Storage

Invert Level (m) 85.000 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.30
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	62.0	0.0	0.150	62.0	0.0	0.151	0.0	0.0

Complex Manhole: FC25, DS/PN: S47.024

Filter Drain

Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.30 Trench Length (m) 92.0
Infiltration Coefficient Side (m/hr) 0.00000 Invert Level (m) 79.400 Pipe Diameter (m) 0.300
Safety Factor 2.0 Trench Width (m) 0.3 Pipe Depth above Invert (m) 0.000

Filter Drain

Number of Pipes 1 Cap Volume Depth (m) 0.600
Slope (1:X) 300.0 Cap Infiltration Depth (m) 0.000

Tank or Pond

Invert Level (m) 80.300

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	165.0	0.150	193.5	0.151	0.0

Cellular Storage

Invert Level (m) 79.400 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	120.0	0.0	0.300	120.0	0.0	0.301	0.0	0.0

Cellular Storage

Invert Level (m) 79.400 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	11.0	0.0	0.600	11.0	0.0	0.601	0.0	0.0

Cellular Storage Manhole: IC20, DS/PN: S59.003

Invert Level (m) 79.850 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.30
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	52.0	0.0	0.300	52.0	0.0	0.301	0.0	0.0

Complex Manhole: FC26, DS/PN: S59.004

Filter Drain

Infiltration Coefficient Base (m/hr)	0.00000	Trench Width (m)	0.6	Slope (1:X)	300.0
Infiltration Coefficient Side (m/hr)	0.00000	Trench Length (m)	40.0	Cap Volume Depth (m)	0.600
Safety Factor	2.0	Pipe Diameter (m)	0.300	Cap Infiltration Depth (m)	0.000
Porosity	0.30	Pipe Depth above Invert (m)	0.000		
Invert Level (m)	79.697	Number of Pipes	1		

Cellular Storage

Invert Level (m) 79.697 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.30
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	50.0	0.0	0.300	50.0	0.0	0.301	0.0	0.0

Cellular Storage

Invert Level (m) 79.697 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	163.0	0.0	0.150	163.0	0.0	0.151	0.0	0.0

Complex Manhole: HB, DS/PN: S1.015

Cellular Storage

Invert Level (m) 79.150 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.30
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	190.0	0.0	0.300	190.0	0.0	0.301	0.0	0.0

Cellular Storage

Invert Level (m) 79.150 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	100.0	0.0	1.200	100.0	0.0	1.201	0.0	0.0

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

Area (m³) 90 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.002967	20	24	0.000402	40	44	0.000054	60	64	0.000007	80	84	0.000001	100	104	0.000000
4	8	0.001989	24	28	0.000269	44	48	0.000036	64	68	0.000005	84	88	0.000001	104	108	0.000000
8	12	0.001333	28	32	0.000180	48	52	0.000024	68	72	0.000003	88	92	0.000000	108	112	0.000000
12	16	0.000894	32	36	0.000121	52	56	0.000016	72	76	0.000002	92	96	0.000000	112	116	0.000000
16	20	0.000599	36	40	0.000081	56	60	0.000011	76	80	0.000001	96	100	0.000000	116	120	0.000000

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

Area (m³) 20 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000659	20	24	0.000089	40	44	0.000012	60	64	0.000002	80	84	0.000000	100	104	0.000000
4	8	0.000442	24	28	0.000060	44	48	0.000008	64	68	0.000001	84	88	0.000000	104	108	0.000000
8	12	0.000296	28	32	0.000040	48	52	0.000005	68	72	0.000001	88	92	0.000000	108	112	0.000000
12	16	0.000199	32	36	0.000027	52	56	0.000004	72	76	0.000000	92	96	0.000000	112	116	0.000000
16	20	0.000133	36	40	0.000018	56	60	0.000002	76	80	0.000000	96	100	0.000000	116	120	0.000000

APPENDIX B3.5 - Green Roof & Podium Planter Time Area Diagram (TAD) Summary

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

Area (m³) 30 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000989	20	24	0.000134	40	44	0.000018	60	64	0.000002	80	84	0.000000	100	104	0.000000
4	8	0.000663	24	28	0.000090	44	48	0.000012	64	68	0.000002	84	88	0.000000	104	108	0.000000
8	12	0.000444	28	32	0.000060	48	52	0.000008	68	72	0.000001	88	92	0.000000	108	112	0.000000
12	16	0.000298	32	36	0.000040	52	56	0.000005	72	76	0.000001	92	96	0.000000	112	116	0.000000
16	20	0.000200	36	40	0.000027	56	60	0.000004	76	80	0.000000	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S6.000 (Storm)

Area (m³) 30 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000989	20	24	0.000134	40	44	0.000018	60	64	0.000002	80	84	0.000000	100	104	0.000000
4	8	0.000663	24	28	0.000090	44	48	0.000012	64	68	0.000002	84	88	0.000000	104	108	0.000000
8	12	0.000444	28	32	0.000060	48	52	0.000008	68	72	0.000001	88	92	0.000000	108	112	0.000000
12	16	0.000298	32	36	0.000040	52	56	0.000005	72	76	0.000001	92	96	0.000000	112	116	0.000000
16	20	0.000200	36	40	0.000027	56	60	0.000004	76	80	0.000000	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S7.000 (Storm)

Area (m³) 190 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.006264	20	24	0.000848	40	44	0.000115	60	64	0.000016	80	84	0.000002	100	104	0.000000
4	8	0.004199	24	28	0.000568	44	48	0.000077	64	68	0.000010	84	88	0.000001	104	108	0.000000
8	12	0.002815	28	32	0.000381	48	52	0.000052	68	72	0.000007	88	92	0.000001	108	112	0.000000
12	16	0.001887	32	36	0.000255	52	56	0.000035	72	76	0.000005	92	96	0.000001	112	116	0.000000
16	20	0.001265	36	40	0.000171	56	60	0.000023	76	80	0.000003	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S8.000 (Storm)

Area (m³) 420 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.013847	20	24	0.001874	40	44	0.000254	60	64	0.000034	80	84	0.000005	100	104	0.000001
4	8	0.009282	24	28	0.001256	44	48	0.000170	64	68	0.000023	84	88	0.000003	104	108	0.000000
8	12	0.006222	28	32	0.000842	48	52	0.000114	68	72	0.000015	88	92	0.000002	108	112	0.000000
12	16	0.004171	32	36	0.000564	52	56	0.000076	72	76	0.000010	92	96	0.000001	112	116	0.000000
16	20	0.002796	36	40	0.000378	56	60	0.000051	76	80	0.000007	96	100	0.000001	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S9.000 (Storm)

Area (m³) 190 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.006264	20	24	0.000848	40	44	0.000115	60	64	0.000016	80	84	0.000002	100	104	0.000000
4	8	0.004199	24	28	0.000568	44	48	0.000077	64	68	0.000010	84	88	0.000001	104	108	0.000000
8	12	0.002815	28	32	0.000381	48	52	0.000052	68	72	0.000007	88	92	0.000001	108	112	0.000000
12	16	0.001887	32	36	0.000255	52	56	0.000035	72	76	0.000005	92	96	0.000001	112	116	0.000000
16	20	0.001265	36	40	0.000171	56	60	0.000023	76	80	0.000003	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S10.000 (Storm)

Area (m³) 175 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.005769	20	24	0.000781	40	44	0.000106	60	64	0.000014	80	84	0.000002	100	104	0.000000
4	8	0.003867	24	28	0.000523	44	48	0.000071	64	68	0.000010	84	88	0.000001	104	108	0.000000
8	12	0.002592	28	32	0.000351	48	52	0.000047	68	72	0.000006	88	92	0.000001	108	112	0.000000
12	16	0.001738	32	36	0.000235	52	56	0.000032	72	76	0.000004	92	96	0.000001	112	116	0.000000
16	20	0.001165	36	40	0.000158	56	60	0.000021	76	80	0.000003	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S11.000 (Storm)

Area (m³) 60 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.001978	20	24	0.000268	40	44	0.000036	60	64	0.000005	80	84	0.000001	100	104	0.000000
4	8	0.001326	24	28	0.000179	44	48	0.000024	64	68	0.000003	84	88	0.000000	104	108	0.000000
8	12	0.000889	28	32	0.000120	48	52	0.000016	68	72	0.000002	88	92	0.000000	108	112	0.000000
12	16	0.000596	32	36	0.000081	52	56	0.000011	72	76	0.000001	92	96	0.000000	112	116	0.000000
16	20	0.000399	36	40	0.000054	56	60	0.000007	76	80	0.000001	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S12.000 (Storm)

Area (m³) 18 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000593	20	24	0.000080	40	44	0.000011	60	64	0.000001	80	84	0.000000	100	104	0.000000
4	8	0.000398	24	28	0.000054	44	48	0.000007	64	68	0.000001	84	88	0.000000	104	108	0.000000
8	12	0.000267	28	32	0.000036	48	52	0.000005	68	72	0.000001	88	92	0.000000	108	112	0.000000
12	16	0.000179	32	36	0.000024	52	56	0.000003	72	76	0.000000	92	96	0.000000	112	116	0.000000
16	20	0.000120	36	40	0.000016	56	60	0.000002	76	80	0.000000	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S13.000 (Storm)

Area (m³) 10 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000330	20	24	0.000045	40	44	0.000006	60	64	0.000001	80	84	0.000000	100	104	0.000000
4	8	0.000221	24	28	0.000030	44	48	0.000004	64	68	0.000001	84	88	0.000000	104	108	0.000000
8	12	0.000148	28	32	0.000020	48	52	0.000003	68	72	0.000000	88	92	0.000000	108	112	0.000000
12	16	0.000099	32	36	0.000013	52	56	0.000002	72	76	0.000000	92	96	0.000000	112	116	0.000000
16	20	0.000067	36	40	0.000009	56	60	0.000001	76	80	0.000000	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S14.001 (Storm)

Area (m³) 40 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.001319	20	24	0.000178	40	44	0.000024	60	64	0.000003	80	84	0.000000	100	104	0.000000
4	8	0.000884	24	28	0.000120	44	48	0.000016	64	68	0.000002	84	88	0.000000	104	108	0.000000
8	12	0.000593	28	32	0.000080	48	52	0.000011	68	72	0.000001	88	92	0.000000	108	112	0.000000
12	16	0.000397	32	36	0.000054	52	56	0.000007	72	76	0.000001	92	96	0.000000	112	116	0.000000
16	20	0.000266	36	40	0.000036	56	60	0.000005	76	80	0.000001	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S15.000 (Storm)

Area (m³) 60 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.001978	20	24	0.000268	40	44	0.000036	60	64	0.000005	80	84	0.000001	100	104	0.000000
4	8	0.001326	24	28	0.000179	44	48	0.000024	64	68	0.000003	84	88	0.000000	104	108	0.000000
8	12	0.000889	28	32	0.000120	48	52	0.000016	68	72	0.000002	88	92	0.000000	108	112	0.000000
12	16	0.000596	32	36	0.000081	52	56	0.000011	72	76	0.000001	92	96	0.000000	112	116	0.000000
16	20	0.000399	36	40	0.000054	56	60	0.000007	76	80	0.000001	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S17.000 (Storm)

Area (m³) 98 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.003231	20	24	0.000437	40	44	0.000059	60	64	0.000008	80	84	0.000001	100	104	0.000000
4	8	0.002166	24	28	0.000293	44	48	0.000040	64	68	0.000005	84	88	0.000001	104	108	0.000000
8	12	0.001452	28	32	0.000196	48	52	0.000027	68	72	0.000004	88	92	0.000000	108	112	0.000000
12	16	0.000973	32	36	0.000132	52	56	0.000018	72	76	0.000002	92	96	0.000000	112	116	0.000000
16	20	0.000652	36	40	0.000088	56	60	0.000012	76	80	0.000002	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S17.003 (Storm)

Area (m³) 90 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.002967	20	24	0.000402	40	44	0.000054	60	64	0.000007	80	84	0.000001	100	104	0.000000
4	8	0.001989	24	28	0.000269	44	48	0.000036	64	68	0.000005	84	88	0.000001	104	108	0.000000
8	12	0.001333	28	32	0.000180	48	52	0.000024	68	72	0.000003	88	92	0.000000	108	112	0.000000
12	16	0.000894	32	36	0.000121	52	56	0.000016	72	76	0.000002	92	96	0.000000	112	116	0.000000
16	20	0.000599	36	40	0.000081	56	60	0.000011	76	80	0.000001	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S18.000 (Storm)

Area (m³) 98 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.003231	20	24	0.000437	40	44	0.000059	60	64	0.000008	80	84	0.000001	100	104	0.000000
4	8	0.002166	24	28	0.000293	44	48	0.000040	64	68	0.000005	84	88	0.000001	104	108	0.000000
8	12	0.001452	28	32	0.000196	48	52	0.000027	68	72	0.000004	88	92	0.000000	108	112	0.000000
12	16	0.000973	32	36	0.000132	52	56	0.000018	72	76	0.000002	92	96	0.000000	112	116	0.000000
16	20	0.000652	36	40	0.000088	56	60	0.000012	76	80	0.000002	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S18.001 (Storm)

Area (m³) 147 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.004846	20	24	0.000656	40	44	0.000089	60	64	0.000012	80	84	0.000002	100	104	0.000000
4	8	0.003249	24	28	0.000440	44	48	0.000059	64	68	0.000008	84	88	0.000001	104	108	0.000000
8	12	0.002178	28	32	0.000295	48	52	0.000040	68	72	0.000005	88	92	0.000001	108	112	0.000000
12	16	0.001460	32	36	0.000198	52	56	0.000027	72	76	0.000004	92	96	0.000000	112	116	0.000000
16	20	0.000978	36	40	0.000132	56	60	0.000018	76	80	0.000002	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S18.003 (Storm)

Area (m³) 20 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000659	20	24	0.000089	40	44	0.000012	60	64	0.000002	80	84	0.000000	100	104	0.000000
4	8	0.000442	24	28	0.000060	44	48	0.000008	64	68	0.000001	84	88	0.000000	104	108	0.000000
8	12	0.000296	28	32	0.000040	48	52	0.000005	68	72	0.000001	88	92	0.000000	108	112	0.000000
12	16	0.000199	32	36	0.000027	52	56	0.000004	72	76	0.000000	92	96	0.000000	112	116	0.000000
16	20	0.000133	36	40	0.000018	56	60	0.000002	76	80	0.000000	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S19.000 (Storm)

Area (m³) 98 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.003231	20	24	0.000437	40	44	0.000059	60	64	0.000008	80	84	0.000001	100	104	0.000000
4	8	0.002166	24	28	0.000293	44	48	0.000040	64	68	0.000005	84	88	0.000001	104	108	0.000000
8	12	0.001452	28	32	0.000196	48	52	0.000027	68	72	0.000004	88	92	0.000000	108	112	0.000000
12	16	0.000973	32	36	0.000132	52	56	0.000018	72	76	0.000002	92	96	0.000000	112	116	0.000000
16	20	0.000652	36	40	0.000088	56	60	0.000012	76	80	0.000002	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S20.000 (Storm)

Area (m³) 120 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.003956	20	24	0.000535	40	44	0.000072	60	64	0.000010	80	84	0.000001	100	104	0.000000
4	8	0.002652	24	28	0.000359	44	48	0.000049	64	68	0.000007	84	88	0.000001	104	108	0.000000
8	12	0.001778	28	32	0.000241	48	52	0.000033	68	72	0.000004	88	92	0.000001	108	112	0.000000
12	16	0.001192	32	36	0.000161	52	56	0.000022	72	76	0.000003	92	96	0.000000	112	116	0.000000
16	20	0.000799	36	40	0.000108	56	60	0.000015	76	80	0.000002	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S21.000 (Storm)

Area (m³) 155 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.005110	20	24	0.000692	40	44	0.000094	60	64	0.000013	80	84	0.000002	100	104	0.000000
4	8	0.003425	24	28	0.000464	44	48	0.000063	64	68	0.000008	84	88	0.000001	104	108	0.000000
8	12	0.002296	28	32	0.000311	48	52	0.000042	68	72	0.000006	88	92	0.000001	108	112	0.000000
12	16	0.001539	32	36	0.000208	52	56	0.000028	72	76	0.000004	92	96	0.000001	112	116	0.000000
16	20	0.001032	36	40	0.000140	56	60	0.000019	76	80	0.000003	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S21.003 (Storm)

Area (m³) 130 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.004286	20	24	0.000580	40	44	0.000078	60	64	0.000011	80	84	0.000001	100	104	0.000000
4	8	0.002873	24	28	0.000389	44	48	0.000053	64	68	0.000007	84	88	0.000001	104	108	0.000000
8	12	0.001926	28	32	0.000261	48	52	0.000035	68	72	0.000005	88	92	0.000001	108	112	0.000000
12	16	0.001291	32	36	0.000175	52	56	0.000024	72	76	0.000003	92	96	0.000000	112	116	0.000000
16	20	0.000865	36	40	0.000117	56	60	0.000016	76	80	0.000002	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S23.000 (Storm)

Area (m³) 155 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.005110	20	24	0.000692	40	44	0.000094	60	64	0.000013	80	84	0.000002	100	104	0.000000
4	8	0.003425	24	28	0.000464	44	48	0.000063	64	68	0.000008	84	88	0.000001	104	108	0.000000
8	12	0.002296	28	32	0.000311	48	52	0.000042	68	72	0.000006	88	92	0.000001	108	112	0.000000
12	16	0.001539	32	36	0.000208	52	56	0.000028	72	76	0.000004	92	96	0.000001	112	116	0.000000
16	20	0.001032	36	40	0.000140	56	60	0.000019	76	80	0.000003	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S24.000 (Storm)

Area (m³) 80 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.002637	20	24	0.000357	40	44	0.000048	60	64	0.000007	80	84	0.000001	100	104	0.000000
4	8	0.001768	24	28	0.000239	44	48	0.000032	64	68	0.000004	84	88	0.000001	104	108	0.000000
8	12	0.001185	28	32	0.000160	48	52	0.000022	68	72	0.000003	88	92	0.000000	108	112	0.000000
12	16	0.000794	32	36	0.000108	52	56	0.000015	72	76	0.000002	92	96	0.000000	112	116	0.000000
16	20	0.000532	36	40	0.000072	56	60	0.000010	76	80	0.000001	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S25.000 (Storm)

Area (m³) 30 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000989	20	24	0.000134	40	44	0.000018	60	64	0.000002	80	84	0.000000	100	104	0.000000
4	8	0.000663	24	28	0.000090	44	48	0.000012	64	68	0.000002	84	88	0.000000	104	108	0.000000
8	12	0.000444	28	32	0.000060	48	52	0.000008	68	72	0.000001	88	92	0.000000	108	112	0.000000
12	16	0.000298	32	36	0.000040	52	56	0.000005	72	76	0.000001	92	96	0.000000	112	116	0.000000
16	20	0.000200	36	40	0.000027	56	60	0.000004	76	80	0.000000	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S25.002 (Storm)

Area (m³) 30 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000989	20	24	0.000134	40	44	0.000018	60	64	0.000002	80	84	0.000000	100	104	0.000000
4	8	0.000663	24	28	0.000090	44	48	0.000012	64	68	0.000002	84	88	0.000000	104	108	0.000000
8	12	0.000444	28	32	0.000060	48	52	0.000008	68	72	0.000001	88	92	0.000000	108	112	0.000000
12	16	0.000298	32	36	0.000040	52	56	0.000005	72	76	0.000001	92	96	0.000000	112	116	0.000000
16	20	0.000200	36	40	0.000027	56	60	0.000004	76	80	0.000000	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S27.000 (Storm)

Area (m³) 140 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.004616	20	24	0.000625	40	44	0.000085	60	64	0.000011	80	84	0.000002	100	104	0.000000
4	8	0.003094	24	28	0.000419	44	48	0.000057	64	68	0.000008	84	88	0.000001	104	108	0.000000
8	12	0.002074	28	32	0.000281	48	52	0.000038	68	72	0.000005	88	92	0.000001	108	112	0.000000
12	16	0.001390	32	36	0.000188	52	56	0.000025	72	76	0.000003	92	96	0.000000	112	116	0.000000
16	20	0.000932	36	40	0.000126	56	60	0.000017	76	80	0.000002	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S27.003 (Storm)

Area (m³) 250 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.008242	20	24	0.001115	40	44	0.000151	60	64	0.000020	80	84	0.000003	100	104	0.000000
4	8	0.005525	24	28	0.000748	44	48	0.000101	64	68	0.000014	84	88	0.000002	104	108	0.000000
8	12	0.003703	28	32	0.000501	48	52	0.000068	68	72	0.000009	88	92	0.000001	108	112	0.000000
12	16	0.002482	32	36	0.000336	52	56	0.000045	72	76	0.000006	92	96	0.000001	112	116	0.000000
16	20	0.001664	36	40	0.000225	56	60	0.000030	76	80	0.000004	96	100	0.000001	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S28.000 (Storm)

Area (m³) 155 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.005110	20	24	0.000692	40	44	0.000094	60	64	0.000013	80	84	0.000002	100	104	0.000000
4	8	0.003425	24	28	0.000464	44	48	0.000063	64	68	0.000008	84	88	0.000001	104	108	0.000000
8	12	0.002296	28	32	0.000311	48	52	0.000042	68	72	0.000006	88	92	0.000001	108	112	0.000000
12	16	0.001539	32	36	0.000208	52	56	0.000028	72	76	0.000004	92	96	0.000001	112	116	0.000000
16	20	0.001032	36	40	0.000140	56	60	0.000019	76	80	0.000003	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S29.000 (Storm)

Area (m³) 155 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.005110	20	24	0.000692	40	44	0.000094	60	64	0.000013	80	84	0.000002	100	104	0.000000
4	8	0.003425	24	28	0.000464	44	48	0.000063	64	68	0.000008	84	88	0.000001	104	108	0.000000
8	12	0.002296	28	32	0.000311	48	52	0.000042	68	72	0.000006	88	92	0.000001	108	112	0.000000
12	16	0.001539	32	36	0.000208	52	56	0.000028	72	76	0.000004	92	96	0.000001	112	116	0.000000
16	20	0.001032	36	40	0.000140	56	60	0.000019	76	80	0.000003	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S29.003 (Storm)

Area (m³) 110 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.003627	20	24	0.000491	40	44	0.000066	60	64	0.000009	80	84	0.000001	100	104	0.000000
4	8	0.002431	24	28	0.000329	44	48	0.000045	64	68	0.000006	84	88	0.000001	104	108	0.000000
8	12	0.001629	28	32	0.000221	48	52	0.000030	68	72	0.000004	88	92	0.000001	108	112	0.000000
12	16	0.001092	32	36	0.000148	52	56	0.000020	72	76	0.000003	92	96	0.000000	112	116	0.000000
16	20	0.000732	36	40	0.000099	56	60	0.000013	76	80	0.000002	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S30.000 (Storm)

Area (m³) 140 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.004616	20	24	0.000625	40	44	0.000085	60	64	0.000011	80	84	0.000002	100	104	0.000000
4	8	0.003094	24	28	0.000419	44	48	0.000057	64	68	0.000008	84	88	0.000001	104	108	0.000000
8	12	0.002074	28	32	0.000281	48	52	0.000038	68	72	0.000005	88	92	0.000001	108	112	0.000000
12	16	0.001390	32	36	0.000188	52	56	0.000025	72	76	0.000003	92	96	0.000000	112	116	0.000000
16	20	0.000932	36	40	0.000126	56	60	0.000017	76	80	0.000002	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S31.000 (Storm)

Area (m³) 410 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.013517	20	24	0.001829	40	44	0.000248	60	64	0.000034	80	84	0.000005	100	104	0.000001
4	8	0.009061	24	28	0.001226	44	48	0.000166	64	68	0.000022	84	88	0.000003	104	108	0.000000
8	12	0.006074	28	32	0.000822	48	52	0.000111	68	72	0.000015	88	92	0.000002	108	112	0.000000
12	16	0.004071	32	36	0.000551	52	56	0.000075	72	76	0.000010	92	96	0.000001	112	116	0.000000
16	20	0.002729	36	40	0.000369	56	60	0.000050	76	80	0.000007	96	100	0.000001	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S33.000 (Storm)

Area (m³) 30 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000989	20	24	0.000134	40	44	0.000018	60	64	0.000002	80	84	0.000000	100	104	0.000000
4	8	0.000663	24	28	0.000090	44	48	0.000012	64	68	0.000002	84	88	0.000000	104	108	0.000000
8	12	0.000444	28	32	0.000060	48	52	0.000008	68	72	0.000001	88	92	0.000000	108	112	0.000000
12	16	0.000298	32	36	0.000040	52	56	0.000005	72	76	0.000001	92	96	0.000000	112	116	0.000000
16	20	0.000200	36	40	0.000027	56	60	0.000004	76	80	0.000000	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S34.000 (Storm)

Area (m³) 90 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.002967	20	24	0.000402	40	44	0.000054	60	64	0.000007	80	84	0.000001	100	104	0.000000
4	8	0.001989	24	28	0.000269	44	48	0.000036	64	68	0.000005	84	88	0.000001	104	108	0.000000
8	12	0.001333	28	32	0.000180	48	52	0.000024	68	72	0.000003	88	92	0.000000	108	112	0.000000
12	16	0.000894	32	36	0.000121	52	56	0.000016	72	76	0.000002	92	96	0.000000	112	116	0.000000
16	20	0.000599	36	40	0.000081	56	60	0.000011	76	80	0.000001	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S35.000 (Storm)

Area (m³) 140 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.004616	20	24	0.000625	40	44	0.000085	60	64	0.000011	80	84	0.000002	100	104	0.000000
4	8	0.003094	24	28	0.000419	44	48	0.000057	64	68	0.000008	84	88	0.000001	104	108	0.000000
8	12	0.002074	28	32	0.000281	48	52	0.000038	68	72	0.000005	88	92	0.000001	108	112	0.000000
12	16	0.001390	32	36	0.000188	52	56	0.000025	72	76	0.000003	92	96	0.000000	112	116	0.000000
16	20	0.000932	36	40	0.000126	56	60	0.000017	76	80	0.000002	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S37.000 (Storm)

Area (m³) 50 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.001648	20	24	0.000223	40	44	0.000030	60	64	0.000004	80	84	0.000001	100	104	0.000000
4	8	0.001105	24	28	0.000150	44	48	0.000020	64	68	0.000003	84	88	0.000000	104	108	0.000000
8	12	0.000741	28	32	0.000100	48	52	0.000014	68	72	0.000002	88	92	0.000000	108	112	0.000000
12	16	0.000496	32	36	0.000067	52	56	0.000009	72	76	0.000001	92	96	0.000000	112	116	0.000000
16	20	0.000333	36	40	0.000045	56	60	0.000006	76	80	0.000001	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S39.000 (Storm)

Area (m³) 50 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.001648	20	24	0.000223	40	44	0.000030	60	64	0.000004	80	84	0.000001	100	104	0.000000
4	8	0.001105	24	28	0.000150	44	48	0.000020	64	68	0.000003	84	88	0.000000	104	108	0.000000
8	12	0.000741	28	32	0.000100	48	52	0.000014	68	72	0.000002	88	92	0.000000	108	112	0.000000
12	16	0.000496	32	36	0.000067	52	56	0.000009	72	76	0.000001	92	96	0.000000	112	116	0.000000
16	20	0.000333	36	40	0.000045	56	60	0.000006	76	80	0.000001	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S40.000 (Storm)

Area (m³) 190 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.006264	20	24	0.000848	40	44	0.000115	60	64	0.000016	80	84	0.000002	100	104	0.000000
4	8	0.004199	24	28	0.000568	44	48	0.000077	64	68	0.000010	84	88	0.000001	104	108	0.000000
8	12	0.002815	28	32	0.000381	48	52	0.000052	68	72	0.000007	88	92	0.000001	108	112	0.000000
12	16	0.001887	32	36	0.000255	52	56	0.000035	72	76	0.000005	92	96	0.000001	112	116	0.000000
16	20	0.001265	36	40	0.000171	56	60	0.000023	76	80	0.000003	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S41.000 (Storm)

Area (m³) 175 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.005769	20	24	0.000781	40	44	0.000106	60	64	0.000014	80	84	0.000002	100	104	0.000000
4	8	0.003867	24	28	0.000523	44	48	0.000071	64	68	0.000010	84	88	0.000001	104	108	0.000000
8	12	0.002592	28	32	0.000351	48	52	0.000047	68	72	0.000006	88	92	0.000001	108	112	0.000000
12	16	0.001738	32	36	0.000235	52	56	0.000032	72	76	0.000004	92	96	0.000001	112	116	0.000000
16	20	0.001165	36	40	0.000158	56	60	0.000021	76	80	0.000003	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S42.000 (Storm)

Area (m³) 32 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.001055	20	24	0.000143	40	44	0.000019	60	64	0.000003	80	84	0.000000	100	104	0.000000
4	8	0.000707	24	28	0.000096	44	48	0.000013	64	68	0.000002	84	88	0.000000	104	108	0.000000
8	12	0.000474	28	32	0.000064	48	52	0.000009	68	72	0.000001	88	92	0.000000	108	112	0.000000
12	16	0.000318	32	36	0.000043	52	56	0.000006	72	76	0.000001	92	96	0.000000	112	116	0.000000
16	20	0.000213	36	40	0.000029	56	60	0.000004	76	80	0.000001	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S43.000 (Storm)

Area (m³) 10 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000330	20	24	0.000045	40	44	0.000006	60	64	0.000001	80	84	0.000000	100	104	0.000000
4	8	0.000221	24	28	0.000030	44	48	0.000004	64	68	0.000001	84	88	0.000000	104	108	0.000000
8	12	0.000148	28	32	0.000020	48	52	0.000003	68	72	0.000000	88	92	0.000000	108	112	0.000000
12	16	0.000099	32	36	0.000013	52	56	0.000002	72	76	0.000000	92	96	0.000000	112	116	0.000000
16	20	0.000067	36	40	0.000009	56	60	0.000001	76	80	0.000000	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S44.000 (Storm)

Area (m³) 70 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.002308	20	24	0.000312	40	44	0.000042	60	64	0.000006	80	84	0.000001	100	104	0.000000
4	8	0.001547	24	28	0.000209	44	48	0.000028	64	68	0.000004	84	88	0.000001	104	108	0.000000
8	12	0.001037	28	32	0.000140	48	52	0.000019	68	72	0.000003	88	92	0.000000	108	112	0.000000
12	16	0.000695	32	36	0.000094	52	56	0.000013	72	76	0.000002	92	96	0.000000	112	116	0.000000
16	20	0.000466	36	40	0.000063	56	60	0.000009	76	80	0.000001	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S45.000 (Storm)

Area (m³) 170 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.005605	20	24	0.000758	40	44	0.000103	60	64	0.000014	80	84	0.000002	100	104	0.000000
4	8	0.003757	24	28	0.000508	44	48	0.000069	64	68	0.000009	84	88	0.000001	104	108	0.000000
8	12	0.002518	28	32	0.000341	48	52	0.000046	68	72	0.000006	88	92	0.000001	108	112	0.000000
12	16	0.001688	32	36	0.000228	52	56	0.000031	72	76	0.000004	92	96	0.000001	112	116	0.000000
16	20	0.001132	36	40	0.000153	56	60	0.000021	76	80	0.000003	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S46.000 (Storm)

Area (m³) 36 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.001187	20	24	0.000161	40	44	0.000022	60	64	0.000003	80	84	0.000000	100	104	0.000000
4	8	0.000796	24	28	0.000108	44	48	0.000015	64	68	0.000002	84	88	0.000000	104	108	0.000000
8	12	0.000533	28	32	0.000072	48	52	0.000010	68	72	0.000001	88	92	0.000000	108	112	0.000000
12	16	0.000357	32	36	0.000048	52	56	0.000007	72	76	0.000001	92	96	0.000000	112	116	0.000000
16	20	0.000240	36	40	0.000032	56	60	0.000004	76	80	0.000001	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S48.000 (Storm)

Area (m³) 130 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.004286	20	24	0.000580	40	44	0.000078	60	64	0.000011	80	84	0.000001	100	104	0.000000
4	8	0.002873	24	28	0.000389	44	48	0.000053	64	68	0.000007	84	88	0.000001	104	108	0.000000
8	12	0.001926	28	32	0.000261	48	52	0.000035	68	72	0.000005	88	92	0.000001	108	112	0.000000
12	16	0.001291	32	36	0.000175	52	56	0.000024	72	76	0.000003	92	96	0.000000	112	116	0.000000
16	20	0.000865	36	40	0.000117	56	60	0.000016	76	80	0.000002	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S49.000 (Storm)

Area (m³) 303 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.009989	20	24	0.001352	40	44	0.000183	60	64	0.000025	80	84	0.000003	100	104	0.000000
4	8	0.006696	24	28	0.000906	44	48	0.000123	64	68	0.000017	84	88	0.000002	104	108	0.000000
8	12	0.004489	28	32	0.000607	48	52	0.000082	68	72	0.000011	88	92	0.000002	108	112	0.000000
12	16	0.003009	32	36	0.000407	52	56	0.000055	72	76	0.000007	92	96	0.000001	112	116	0.000000
16	20	0.002017	36	40	0.000273	56	60	0.000037	76	80	0.000005	96	100	0.000001	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S50.000 (Storm)

Area (m³) 70 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.002308	20	24	0.000312	40	44	0.000042	60	64	0.000006	80	84	0.000001	100	104	0.000000
4	8	0.001547	24	28	0.000209	44	48	0.000028	64	68	0.000004	84	88	0.000001	104	108	0.000000
8	12	0.001037	28	32	0.000140	48	52	0.000019	68	72	0.000003	88	92	0.000000	108	112	0.000000
12	16	0.000695	32	36	0.000094	52	56	0.000013	72	76	0.000002	92	96	0.000000	112	116	0.000000
16	20	0.000466	36	40	0.000063	56	60	0.000009	76	80	0.000001	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S51.000 (Storm)

Area (m^3) 303 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.009989	20	24	0.001352	40	44	0.000183	60	64	0.000025	80	84	0.000003	100	104	0.000000
4	8	0.006696	24	28	0.000906	44	48	0.000123	64	68	0.000017	84	88	0.000002	104	108	0.000000
8	12	0.004489	28	32	0.000607	48	52	0.000082	68	72	0.000011	88	92	0.000002	108	112	0.000000
12	16	0.003009	32	36	0.000407	52	56	0.000055	72	76	0.000007	92	96	0.000001	112	116	0.000000
16	20	0.002017	36	40	0.000273	56	60	0.000037	76	80	0.000005	96	100	0.000001	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S52.000 (Storm)

Area (m^3) 30 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000989	20	24	0.000134	40	44	0.000018	60	64	0.000002	80	84	0.000000	100	104	0.000000
4	8	0.000663	24	28	0.000090	44	48	0.000012	64	68	0.000002	84	88	0.000000	104	108	0.000000
8	12	0.000444	28	32	0.000060	48	52	0.000008	68	72	0.000001	88	92	0.000000	108	112	0.000000
12	16	0.000298	32	36	0.000040	52	56	0.000005	72	76	0.000001	92	96	0.000000	112	116	0.000000
16	20	0.000200	36	40	0.000027	56	60	0.000004	76	80	0.000000	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S53.000 (Storm)

Area (m³) 303 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.009989	20	24	0.001352	40	44	0.000183	60	64	0.000025	80	84	0.000003	100	104	0.000000
4	8	0.006696	24	28	0.000906	44	48	0.000123	64	68	0.000017	84	88	0.000002	104	108	0.000000
8	12	0.004489	28	32	0.000607	48	52	0.000082	68	72	0.000011	88	92	0.000002	108	112	0.000000
12	16	0.003009	32	36	0.000407	52	56	0.000055	72	76	0.000007	92	96	0.000001	112	116	0.000000
16	20	0.002017	36	40	0.000273	56	60	0.000037	76	80	0.000005	96	100	0.000001	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S55.000 (Storm)

Area (m³) 180 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.005934	20	24	0.000803	40	44	0.000109	60	64	0.000015	80	84	0.000002	100	104	0.000000
4	8	0.003978	24	28	0.000538	44	48	0.000073	64	68	0.000010	84	88	0.000001	104	108	0.000000
8	12	0.002666	28	32	0.000361	48	52	0.000049	68	72	0.000007	88	92	0.000001	108	112	0.000000
12	16	0.001787	32	36	0.000242	52	56	0.000033	72	76	0.000004	92	96	0.000001	112	116	0.000000
16	20	0.001198	36	40	0.000162	56	60	0.000022	76	80	0.000003	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S56.000 (Storm)

Area (m³) 20 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000659	20	24	0.000089	40	44	0.000012	60	64	0.000002	80	84	0.000000	100	104	0.000000
4	8	0.000442	24	28	0.000060	44	48	0.000008	64	68	0.000001	84	88	0.000000	104	108	0.000000
8	12	0.000296	28	32	0.000040	48	52	0.000005	68	72	0.000001	88	92	0.000000	108	112	0.000000
12	16	0.000199	32	36	0.000027	52	56	0.000004	72	76	0.000000	92	96	0.000000	112	116	0.000000
16	20	0.000133	36	40	0.000018	56	60	0.000002	76	80	0.000000	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S57.000 (Storm)

Area (m³) 200 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.006594	20	24	0.000892	40	44	0.000121	60	64	0.000016	80	84	0.000002	100	104	0.000000
4	8	0.004420	24	28	0.000598	44	48	0.000081	64	68	0.000011	84	88	0.000001	104	108	0.000000
8	12	0.002963	28	32	0.000401	48	52	0.000054	68	72	0.000007	88	92	0.000001	108	112	0.000000
12	16	0.001986	32	36	0.000269	52	56	0.000036	72	76	0.000005	92	96	0.000001	112	116	0.000000
16	20	0.001331	36	40	0.000180	56	60	0.000024	76	80	0.000003	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S58.000 (Storm)

Area (m³) 20 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**
0	4	0.000659	20	24	0.000089	40	44	0.000012	60	64	0.000002	80	84	0.000000	100	104	0.000000
4	8	0.000442	24	28	0.000060	44	48	0.000008	64	68	0.000001	84	88	0.000000	104	108	0.000000
8	12	0.000296	28	32	0.000040	48	52	0.000005	68	72	0.000001	88	92	0.000000	108	112	0.000000
12	16	0.000199	32	36	0.000027	52	56	0.000004	72	76	0.000000	92	96	0.000000	112	116	0.000000
16	20	0.000133	36	40	0.000018	56	60	0.000002	76	80	0.000000	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S59.000 (Storm)

Area (m³) 140 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**
0	4	0.004616	20	24	0.000625	40	44	0.000085	60	64	0.000011	80	84	0.000002	100	104	0.000000
4	8	0.003094	24	28	0.000419	44	48	0.000057	64	68	0.000008	84	88	0.000001	104	108	0.000000
8	12	0.002074	28	32	0.000281	48	52	0.000038	68	72	0.000005	88	92	0.000001	108	112	0.000000
12	16	0.001390	32	36	0.000188	52	56	0.000025	72	76	0.000003	92	96	0.000000	112	116	0.000000
16	20	0.000932	36	40	0.000126	56	60	0.000017	76	80	0.000002	96	100	0.000000	116	120	0.000000

Time Area Diagram for Green Roof at Pipe Number S60.000 (Storm)

Area (m³) 140 Depression Storage (mm) 2 Evaporation (mm/day) 1 Decay Coefficient 0.100

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.004616	20	24	0.000625	40	44	0.000085	60	64	0.000011	80	84	0.000002	100	104	0.000000
4	8	0.003094	24	28	0.000419	44	48	0.000057	64	68	0.000008	84	88	0.000001	104	108	0.000000
8	12	0.002074	28	32	0.000281	48	52	0.000038	68	72	0.000005	88	92	0.000001	108	112	0.000000
12	16	0.001390	32	36	0.000188	52	56	0.000025	72	76	0.000003	92	96	0.000000	112	116	0.000000
16	20	0.000932	36	40	0.000126	56	60	0.000017	76	80	0.000002	96	100	0.000000	116	120	0.000000

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

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 57
Number of Online Controls 27 Number of Storage Structures 27 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.000 Cv (Summer) 1.000
Region Scotland and Ireland Ratio R 0.275 Cv (Winter) 1.000

Margin for Flood Risk Warning (mm) 150.0 DVD Status ON
Analysis Timestep 2.5 Second Increment (Extended) Inertia Status ON
DTS Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 100
Climate Change (%) 10

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Infil. Flow (l/s)	Infil. Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S1.000	BR1	15 minute 100 year Summer I+10%	85.350	84.930	-0.225	0.000	0.03			0.2	2.1	OK*

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

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Infil. Flow (l/s)	Infil. Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S1.001	BR1	15 minute 100 year Summer I+10%	85.350	84.929	-0.225	0.000	0.07			0.3	4.4	OK*
S1.002	BR1	15 minute 100 year Summer I+10%	85.300	84.924	-0.229	0.000	0.12			0.6	7.2	OK*
S1.003	AJ1	360 minute 100 year Summer I+10%	85.350	84.876	-0.276	0.000	0.02	0.0	0.000	0.3	0.8	OK
S1.004	FC1	240 minute 100 year Summer I+10%	85.350	84.871	0.321	0.000	0.07			0.0	0.8	SURCHARGED
S1.005	FD1	240 minute 100 year Summer I+10%	85.350	84.855	0.160	0.000	0.03			0.1	1.4	SURCHARGED
S2.000	BR2	7200 minute 100 year Summer I+10%	85.350	85.170	0.000	0.000	0.00			0.0	0.0	SURCHARGED*
S3.000	BR2	7200 minute 100 year Summer I+10%	85.350	85.170	0.000	0.000	0.00			0.0	0.0	SURCHARGED*
S2.001	AJ2	8640 minute 100 year Summer I+10%	85.350	85.279	0.110	0.000	0.00			0.0	0.1	FLOOD RISK
S4.000	BR3	7200 minute 100 year Summer I+10%	85.350	85.172	0.000	0.000	0.00			0.0	0.0	SURCHARGED*
S4.001	BR3	7200 minute 100 year Summer I+10%	85.350	85.171	0.000	0.000	0.00			0.0	0.1	SURCHARGED*
S4.002	AJ3	8640 minute 100 year Summer I+10%	85.350	85.279	0.109	0.000	0.00			0.0	0.1	FLOOD RISK
S5.000	BR4	7200 minute 100 year Summer I+10%	85.350	85.171	0.000	0.000	0.00			0.0	0.0	SURCHARGED*
S6.000	BR4	7200 minute 100 year Summer I+10%	85.350	85.171	0.000	0.000	0.00			0.0	0.0	SURCHARGED*
S5.001	AJ4	8640 minute 100 year Summer I+10%	85.350	85.279	0.109	0.000	0.00			0.0	0.1	FLOOD RISK
S7.000	GR1.1	30 minute 100 year Winter I+10%	119.300	119.200	0.000	0.000	1.00			0.6	3.9	FLOOD RISK*
S7.001	DP1	15 minute 100 year Summer I+10%	119.300	88.455	-0.052	0.000	0.36			0.4	3.9	OK
S7.002	IC1	15 minute 100 year Summer I+10%	88.850	88.452	-0.198	0.000	0.24			0.3	6.6	OK*
S8.000	BR5	30 minute 100 year Summer I+10%	88.850	88.540	-0.113	0.000	0.17			0.2	10.2	OK*
S8.001	BR5	30 minute 100 year Summer I+10%	88.850	88.539	-0.113	0.000	0.34			0.3	11.9	OK*
S8.002	BR5	30 minute 100 year Summer I+10%	88.850	88.530	-0.121	0.000	0.66			0.3	15.2	OK*
S9.000	GR1.2	30 minute 100 year Winter I+10%	119.300	119.200	0.000	0.000	1.00			0.6	3.9	FLOOD RISK*
S9.001	DP2	30 minute 100 year Summer I+10%	119.300	88.561	0.049	0.000	0.60			0.4	6.5	SURCHARGED
S9.002	IC2	30 minute 100 year Summer I+10%	88.850	88.557	-0.097	0.000	0.13			0.2	6.4	OK
S9.003	BR5	30 minute 100 year Summer I+10%	88.850	88.555	-0.098	0.000	0.34			0.2	8.2	OK*
S10.000	GR2.1	30 minute 100 year Summer I+10%	116.300	116.195	-0.005	0.000	1.00			0.6	3.9	FLOOD RISK*

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

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Infil. Flow (l/s)	Infil. Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S10.001	DP3	30 minute 100 year Summer I+10%	116.300	88.558	0.040	0.000	0.58			0.4	6.3	SURCHARGED
S10.002	IC3	30 minute 100 year Summer I+10%	88.850	88.552	-0.103	0.000	0.13			0.2	6.2	OK
S10.003	BR5	30 minute 100 year Summer I+10%	88.850	88.550	-0.104	0.000	0.20			0.2	6.8	OK*
S9.004	BR5	30 minute 100 year Summer I+10%	88.850	88.546	-0.106	0.000	0.31			0.3	15.1	OK*
S9.005	BR5	30 minute 100 year Summer I+10%	88.850	88.539	-0.112	0.000	0.71			0.4	17.4	OK*
S7.003	FC2	10080 minute 100 year Summer I+10%	88.850	85.298	0.126	0.000	0.02	0.0	0.000	0.1	1.1	SURCHARGED
S7.004	DP4	10080 minute 100 year Summer I+10%	85.350	85.279	0.110	0.000	0.02			0.1	1.1	FLOOD RISK
S7.005	IC4	8640 minute 100 year Summer I+10%	85.350	85.279	0.111	0.000	0.02			0.1	1.2	FLOOD RISK
S4.003	BR6	7200 minute 100 year Summer I+10%	85.350	85.169	0.000	0.000	0.06			0.1	1.6	SURCHARGED*
S11.000	BR6	7200 minute 100 year Summer I+10%	85.350	85.169	0.000	0.000	0.00			0.0	0.1	SURCHARGED*
S2.002	BR6	7200 minute 100 year Summer I+10%	85.350	85.168	0.000	0.000	0.03			0.4	1.8	SURCHARGED*
S2.003	FC3	8640 minute 100 year Summer I+10%	85.350	85.279	0.112	0.000	0.01	0.0	0.000	0.0	0.6	FLOOD RISK
S2.004	BR7	7200 minute 100 year Summer I+10%	85.350	85.166	0.000	0.000	0.03			0.0	0.6	SURCHARGED*
S12.000	BR8	7200 minute 100 year Summer I+10%	85.350	85.171	0.000	0.000	0.00			0.0	0.0	SURCHARGED*
S12.001	BR8	7200 minute 100 year Summer I+10%	85.350	85.170	0.000	0.000	0.00			0.0	0.1	SURCHARGED*
S13.000	BR8	7200 minute 100 year Summer I+10%	85.350	85.171	0.000	0.000	0.00			0.0	0.0	SURCHARGED*
S13.001	BR8	7200 minute 100 year Summer I+10%	85.350	85.170	0.000	0.000	0.00			0.0	0.1	SURCHARGED*
S12.002	AJ6	8640 minute 100 year Summer I+10%	85.350	85.262	0.093	0.000	0.00			0.0	0.2	FLOOD RISK
S12.003	BR9	7200 minute 100 year Summer I+10%	85.350	85.168	0.000	0.000	0.01			0.0	0.3	SURCHARGED*
S14.000	BR10	7200 minute 100 year Summer I+10%	85.350	85.173	0.000	0.000	0.00			0.0	0.1	SURCHARGED*
S14.001	BR10	7200 minute 100 year Summer I+10%	85.350	85.172	0.000	0.000	0.00			0.0	0.1	SURCHARGED*
S14.002	BR10	7200 minute 100 year Summer I+10%	85.350	85.171	0.000	0.000	0.00			0.0	0.2	SURCHARGED*
S14.003	AJ7	8640 minute 100 year Summer I+10%	85.350	85.262	0.092	0.000	0.00			0.0	0.2	FLOOD RISK
S14.004	BR9	7200 minute 100 year Summer I+10%	85.350	85.169	0.000	0.000	0.00			0.0	0.3	SURCHARGED*
S14.005	BR9	7200 minute 100 year Summer I+10%	85.350	85.168	0.000	0.000	0.01			0.0	0.2	SURCHARGED*

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

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Infil. Flow (l/s)	Infil. Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S12.004	BR9	7200 minute 100 year Summer I+10%	85.350	85.167	0.000	0.000	0.01			0.0	0.5	SURCHARGED*
S15.000	BR9	7200 minute 100 year Summer I+10%	85.350	85.167	0.000	0.000	0.00			0.0	0.1	SURCHARGED*
S12.005	AJ8	8640 minute 100 year Summer I+10%	85.350	85.262	0.096	0.000	0.01			0.0	0.5	FLOOD RISK
S2.005	BR7	7200 minute 100 year Summer I+10%	85.350	85.165	0.000	0.000	0.01			0.1	0.8	SURCHARGED*
S2.006	BR7	7200 minute 100 year Summer I+10%	85.350	85.164	0.000	0.000	0.01			0.1	0.8	SURCHARGED*
S16.000	BR11	7200 minute 100 year Summer I+10%	85.350	85.168	0.000	0.000	0.00			0.0	0.2	SURCHARGED*
S17.000	GR2.3	30 minute 100 year Summer I+10%	116.330	116.186	-0.044	0.000	0.61			0.5	2.4	FLOOD RISK*
S17.001	DP5	8640 minute 100 year Summer I+10%	116.300	85.262	0.237	0.000	0.01			0.0	0.1	SURCHARGED
S17.002	IC5	8640 minute 100 year Summer I+10%	85.350	85.261	0.092	0.000	0.00			0.0	0.1	FLOOD RISK
S17.003	BR11	7200 minute 100 year Summer I+10%	85.350	85.168	0.000	0.000	0.00			0.0	0.3	SURCHARGED*
S16.001	AJ9	8640 minute 100 year Summer I+10%	85.350	85.262	0.095	0.000	0.02			0.0	0.3	FLOOD RISK
S18.000	GR2.4	30 minute 100 year Summer I+10%	116.330	116.186	-0.044	0.000	0.61			0.5	2.4	FLOOD RISK*
S18.001	DP6	8640 minute 100 year Summer I+10%	116.330	85.262	0.232	0.000	0.03			0.1	0.3	SURCHARGED
S18.002	IC6	8640 minute 100 year Summer I+10%	85.350	85.262	0.094	0.000	0.01			0.0	0.3	FLOOD RISK
S18.003	BR12	7200 minute 100 year Summer I+10%	85.350	85.167	0.000	0.000	0.01			0.0	0.4	SURCHARGED*
S16.002	AJ10	8640 minute 100 year Summer I+10%	85.350	85.262	0.096	0.000	0.02			0.0	0.8	FLOOD RISK
S16.003	BR7	7200 minute 100 year Summer I+10%	85.350	85.165	0.000	0.000	0.02			0.1	1.0	SURCHARGED*
S19.000	GR2.5	30 minute 100 year Summer I+10%	116.330	116.186	-0.044	0.000	0.61			0.5	2.4	FLOOD RISK*
S19.001	DP7	8640 minute 100 year Summer I+10%	116.300	85.262	0.241	0.000	0.01			0.0	0.1	SURCHARGED
S19.002	IC7	8640 minute 100 year Summer I+10%	85.350	85.262	0.097	0.000	0.00			0.0	0.1	FLOOD RISK
S16.004	BR7	7200 minute 100 year Summer I+10%	85.350	85.164	0.000	0.000	0.02			0.1	1.1	SURCHARGED*
S20.000	BR7	7200 minute 100 year Summer I+10%	85.350	85.164	0.000	0.000	0.00			0.0	0.2	SURCHARGED*
S2.007	FC4	8640 minute 100 year Summer I+10%	85.350	85.263	0.100	0.000	0.06	0.0	0.000	0.0	1.3	FLOOD RISK
S21.000	GR3.1	30 minute 100 year Summer I+10%	110.300	110.177	-0.023	0.000	0.95			0.6	3.7	FLOOD RISK*
S21.001	DP8	8640 minute 100 year Summer I+10%	110.300	85.210	0.186	0.000	0.02			0.1	0.2	SURCHARGED

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

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Infil. Flow (l/s)	Infil. Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S21.002	IC8	8640 minute 100 year Summer I+10%	85.350	85.209	0.043	0.000	0.00			0.0	0.2	FLOOD RISK
S21.003	BR13	8640 minute 100 year Summer I+10%	85.350	85.209	0.044	0.000	0.01			0.0	0.4	FLOOD RISK
S22.000	BR13	7200 minute 100 year Summer I+10%	85.350	85.167	0.000	0.000	0.00			0.0	0.1	SURCHARGED*
S22.001	BR13	7200 minute 100 year Summer I+10%	85.350	85.166	0.000	0.000	0.00			0.0	0.2	SURCHARGED*
S21.004	AJ11	8640 minute 100 year Summer I+10%	85.350	85.210	0.045	0.000	0.01			0.0	0.5	FLOOD RISK
S23.000	GR3.2	30 minute 100 year Summer I+10%	110.300	110.177	-0.023	0.000	0.95			0.6	3.7	FLOOD RISK*
S23.001	DP9	8640 minute 100 year Summer I+10%	110.300	85.209	0.185	0.000	0.02			0.1	0.2	SURCHARGED
S23.002	IC9	8640 minute 100 year Summer I+10%	85.350	85.209	0.042	0.000	0.00			0.0	0.2	FLOOD RISK
S23.003	BR14	7200 minute 100 year Summer I+10%	85.350	85.166	0.000	0.000	0.00			0.0	0.2	SURCHARGED*
S23.004	BR14	7200 minute 100 year Summer I+10%	85.350	85.165	0.000	0.000	0.00			0.0	0.3	SURCHARGED*
S21.005	BR14	7200 minute 100 year Summer I+10%	85.350	85.164	0.000	0.000	0.02			0.1	0.9	SURCHARGED*
S21.006	BR14	7200 minute 100 year Summer I+10%	85.350	85.163	0.000	0.000	0.03			0.1	1.0	SURCHARGED*
S2.008	BR14	7200 minute 100 year Summer I+10%	85.350	85.162	0.000	0.000	0.03			0.1	1.8	SURCHARGED*
S24.000	BR14	7200 minute 100 year Summer I+10%	85.350	85.162	0.000	0.000	0.00			0.0	0.2	SURCHARGED*
S2.009	FC5	8640 minute 100 year Summer I+10%	85.350	85.231	0.070	0.000	0.03	0.0	0.000	0.1	1.6	FLOOD RISK
S2.010	BR16	10080 minute 100 year Summer I+10%	85.350	85.116	-0.044	0.000	0.03			0.0	1.5	OK*
S2.011	BR16	10080 minute 100 year Summer I+10%	85.350	85.116	-0.043	0.000	0.03			0.0	1.5	OK*
S25.000	BR15	10080 minute 100 year Summer I+10%	85.350	85.115	-0.047	0.000	0.00			0.0	0.0	OK*
S25.001	BR15	10080 minute 100 year Summer I+10%	85.350	85.115	-0.046	0.000	0.00			0.0	0.1	OK*
S25.002	BR15	10080 minute 100 year Summer I+10%	85.350	85.115	-0.045	0.000	0.00			0.0	0.1	OK*
S25.003	BR15	10080 minute 100 year Summer I+10%	85.350	85.115	-0.044	0.000	0.00			0.0	0.2	OK*
S25.004	AJ12	10080 minute 100 year Summer I+10%	85.350	85.115	-0.043	0.000	0.00			0.0	0.2	OK
S2.012	BR16	10080 minute 100 year Summer I+10%	85.350	85.115	-0.042	0.000	0.03			0.1	1.6	OK*
S26.000	BR17	10080 minute 100 year Summer I+10%	85.350	85.159	-0.002	0.000	0.00			0.0	0.0	OK*
S27.000	GR4.1	30 minute 100 year Summer I+10%	101.300	101.172	-0.028	0.000	0.86			0.6	3.4	FLOOD RISK*

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

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Infil. Flow (l/s)	Infil. Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S27.001	DP12	10080 minute 100 year Summer I+10%	101.300	85.160	0.109	0.000	0.01			0.1	0.2	SURCHARGED
S27.002	IC12	10080 minute 100 year Summer I+10%	85.350	85.159	-0.024	0.000	0.00			0.0	0.2	OK
S27.003	BR17	10080 minute 100 year Summer I+10%	85.350	85.159	-0.002	0.000	0.01			0.0	0.4	OK*
S27.004	BR17	10080 minute 100 year Summer I+10%	85.350	85.159	-0.002	0.000	0.02			0.0	0.5	OK*
S28.000	GR3.3	30 minute 100 year Summer I+10%	110.300	110.177	-0.023	0.000	0.95			0.6	3.7	FLOOD RISK*
S28.001	DP10	10080 minute 100 year Summer I+10%	110.300	85.160	0.142	0.000	0.02			0.1	0.2	SURCHARGED
S28.002	IC10	10080 minute 100 year Summer I+10%	85.350	85.159	-0.002	0.000	0.01			0.0	0.2	OK
S26.001	BR17	10080 minute 100 year Summer I+10%	85.350	85.159	-0.001	0.000	0.01			0.1	0.9	OK*
S26.002	FC6	10080 minute 100 year Summer I+10%	85.350	85.159	0.000	0.000	0.02	0.0	0.000	0.0	0.5	OK
S26.003	BR16	10080 minute 100 year Summer I+10%	85.350	85.115	-0.043	0.000	0.02			0.0	0.5	OK*
S29.000	GR3.4	30 minute 100 year Summer I+10%	110.300	110.177	-0.023	0.000	0.95			0.6	3.7	FLOOD RISK*
S29.001	DP11	10080 minute 100 year Summer I+10%	110.300	85.115	0.095	0.000	0.02			0.1	0.2	SURCHARGED
S29.002	IC11	10080 minute 100 year Summer I+10%	85.350	85.115	-0.045	0.000	0.00			0.0	0.2	OK
S29.003	BR16	10080 minute 100 year Summer I+10%	85.350	85.115	-0.044	0.000	0.00			0.0	0.3	OK*
S26.004	BR16	10080 minute 100 year Summer I+10%	85.350	85.115	-0.042	0.000	0.01			0.0	0.7	OK*
S2.013	FC7	10080 minute 100 year Summer I+10%	85.350	85.115	-0.041	0.000	0.06	0.0	0.000	0.1	1.8	OK
S30.000	GR4.2	30 minute 100 year Summer I+10%	101.300	101.172	-0.028	0.000	0.86			0.6	3.4	FLOOD RISK*
S30.001	DP13	960 minute 100 year Summer I+10%	101.300	85.275	0.183	0.000	0.03			0.1	0.8	SURCHARGED
S30.002	IC13	960 minute 100 year Summer I+10%	85.350	85.275	0.116	0.000	0.02			0.1	0.8	FLOOD RISK
S30.003	BR18	480 minute 100 year Summer I+10%	85.350	85.158	0.000	0.000	0.03			0.1	1.2	SURCHARGED*
S30.004	BR18	480 minute 100 year Summer I+10%	85.350	85.157	0.000	0.000	0.06			0.1	1.9	SURCHARGED*
S31.000	BR16	600 minute 100 year Summer I+10%	85.350	85.160	0.000	0.000	0.05			0.1	3.3	SURCHARGED*
S31.001	BR18	600 minute 100 year Summer I+10%	85.350	85.159	0.000	0.000	0.08			0.1	3.8	SURCHARGED*
S31.002	BR18	480 minute 100 year Summer I+10%	85.350	85.158	0.000	0.000	0.21			0.2	5.3	SURCHARGED*
S32.000	BR18	480 minute 100 year Summer I+10%	85.350	85.158	0.000	0.000	0.02			0.0	0.5	SURCHARGED*

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

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Infil. Flow (l/s)	Infil. Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S31.003	BR18	480 minute 100 year Summer I+10%	85.350	85.157	0.000	0.000	0.09			0.4	5.5	SURCHARGED*
S30.005	FC8	960 minute 100 year Summer I+10%	85.350	85.274	0.118	0.000	0.13	0.0	0.000	0.2	2.7	FLOOD RISK
S2.014	BR19	10080 minute 100 year Summer I+10%	85.350	84.969	-0.186	0.000	0.04			0.1	2.2	OK*
S33.000	BR19	10080 minute 100 year Summer I+10%	85.350	84.968	-0.187	0.000	0.00			0.0	0.0	OK*
S2.015	BR19	10080 minute 100 year Summer I+10%	85.350	84.968	-0.186	0.000	0.06			0.1	2.2	OK*
S2.016	AJ13	10080 minute 100 year Summer I+10%	85.350	84.967	-0.186	0.000	0.07			0.1	2.2	OK
S2.017	FC9	10080 minute 100 year Summer I+10%	85.350	84.966	-0.036	0.000	0.18	0.0	0.000	0.6	2.0	OK
S2.018	FD2	240 minute 100 year Summer I+10%	85.350	84.854	0.162	0.000	0.01			0.0	0.7	SURCHARGED
S34.000	BR20	360 minute 100 year Winter I+10%	85.350	84.663	0.000	0.000	0.01			0.1	0.6	SURCHARGED*
S1.006	FC10	240 minute 100 year Summer I+10%	85.350	84.854	0.342	0.000	0.15	0.0	0.000	0.1	1.7	SURCHARGED
S1.007	FD3	180 minute 100 year Summer I+10%	85.350	84.725	0.076	0.000	0.04			0.3	1.7	SURCHARGED
S35.000	BR21	360 minute 100 year Winter I+10%	85.350	83.057	0.000	0.000	0.02			0.0	1.0	SURCHARGED*
S1.008	FC11	180 minute 100 year Summer I+10%	85.350	84.724	0.249	0.000	0.23	0.0	0.000	0.6	2.5	SURCHARGED
S36.000	DP14	240 minute 100 year Summer I+10%	83.700	83.510	0.096	0.000	0.40			0.5	4.4	SURCHARGED
S36.001	IC14	240 minute 100 year Summer I+10%	83.700	83.509	-0.041	0.000	0.09			0.3	4.4	OK
S36.002	FC12	240 minute 100 year Summer I+10%	83.700	83.508	-0.041	0.000	0.02	0.0	0.000	0.2	1.3	OK
S36.003	FD4	15 minute 100 year Summer I+10%	83.700	82.852	-0.248	0.000	0.07			0.4	3.5	OK
S1.009	FD5	240 minute 100 year Summer I+10%	85.350	82.813	-0.243	0.000	0.08			0.4	4.1	OK
S37.000	BR22	30 minute 100 year Summer I+10%	83.800	82.784	-0.272	0.000	0.02			0.4	1.2	OK*
S1.010	FC13	240 minute 100 year Summer I+10%	83.800	82.723	0.773	0.000	0.35	0.0	0.000	0.7	3.8	SURCHARGED
S1.011	FD6	240 minute 100 year Summer I+10%	82.260	81.884	0.224	0.000	0.09			0.4	4.1	SURCHARGED
S38.000	DP15	15 minute 100 year Summer I+10%	82.260	81.891	-0.070	0.000	0.56			0.6	6.0	OK
S38.001	IC15	120 minute 100 year Summer I+10%	82.260	81.878	-0.899	0.000	0.00			0.1	2.7	OK
S38.002	FC14	120 minute 100 year Summer I+10%	82.695	81.878	-0.232	0.000	0.02	0.0	0.000	0.4	1.3	OK
S38.003	FD7	240 minute 100 year Summer I+10%	82.260	81.888	0.228	0.000	0.03			0.4	1.6	SURCHARGED

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

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Infil. Flow (l/s)	Infil. Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S39.000	BR23	360 minute 100 year Winter I+10%	82.260	80.600	0.000	0.000	0.01			0.0	0.5	SURCHARGED*
S1.012	FC15	240 minute 100 year Summer I+10%	82.260	81.896	1.296	0.000	0.10			0.5	4.9	SURCHARGED
S1.013	MH1	960 minute 100 year Summer I+10%	82.260	79.992	0.442	0.000	0.39			0.6	4.2	SURCHARGED
S40.000	BR24	240 minute 100 year Winter I+10%	88.800	88.452	0.000	0.000	0.57			0.2	1.9	SURCHARGED*
S40.001	BR24	15 minute 100 year Winter I+10%	88.800	88.501	0.000	0.000	0.87			0.3	5.7	SURCHARGED*
S41.000	GR2.2	30 minute 100 year Summer I+10%	116.300	116.195	-0.005	0.000	1.00			0.6	3.9	FLOOD RISK*
S41.001	DP16	30 minute 100 year Summer I+10%	116.300	88.524	0.016	0.000	0.36			0.2	3.9	SURCHARGED
S41.002	IC16	30 minute 100 year Summer I+10%	88.800	88.522	-0.131	0.000	0.09			0.1	3.9	OK
S40.002	BR24	30 minute 100 year Summer I+10%	88.800	88.520	-0.131	0.000	0.26			0.3	10.5	OK*
S40.003	BR24	30 minute 100 year Summer I+10%	88.800	88.514	-0.136	0.000	0.57			0.3	12.9	OK*
S40.004	FC16	720 minute 100 year Summer I+10%	88.800	88.420	-0.229	0.000	0.02	0.0	0.000	0.5	1.3	OK
S40.005	DP17	1440 minute 100 year Summer I+10%	88.800	83.710	0.202	0.000	0.12			0.1	1.2	SURCHARGED
S40.006	IC17	1440 minute 100 year Summer I+10%	84.400	83.709	0.059	0.000	0.03			0.0	1.3	SURCHARGED
S42.000	BR25	30 minute 100 year Summer I+10%	88.800	88.420	-0.282	0.000	0.01			0.4	0.8	OK*
S42.001	BR25	15 minute 100 year Summer I+10%	88.800	88.397	-0.254	0.000	0.06			0.5	3.5	OK*
S42.002	DP18	1440 minute 100 year Summer I+10%	88.800	83.708	0.200	0.000	0.04			0.0	0.4	SURCHARGED
S40.007	JC1	960 minute 100 year Winter I+10%	84.400	83.612	0.000	0.000	0.02			0.0	1.5	SURCHARGED*
S43.000	BR26	15 minute 100 year Summer I+10%	88.800	88.383	-0.269	0.000	0.01			0.2	0.3	OK*
S43.001	BR26	15 minute 100 year Summer I+10%	88.800	88.383	-0.268	0.000	0.02			0.4	1.5	OK*
S43.002	DP19	1440 minute 100 year Summer I+10%	88.800	83.708	0.200	0.000	0.01			0.0	0.2	SURCHARGED
S40.008	JC2	1440 minute 100 year Summer I+10%	84.400	83.708	-0.152	0.000	0.03			0.5	1.8	OK*
S44.000	BR27	120 minute 100 year Summer I+10%	88.800	88.430	-0.222	0.000	0.02			0.1	1.2	OK*
S44.001	FC17	120 minute 100 year Summer I+10%	88.800	88.429	-0.222	0.000	0.03	0.0	0.000	0.2	1.6	OK
S44.002	DP21	1440 minute 100 year Summer I+10%	88.800	83.706	0.198	0.000	0.05			0.3	0.5	SURCHARGED
S40.009	JC3	1440 minute 100 year Summer I+10%	84.400	83.706	0.055	0.000	0.04			0.4	2.5	SURCHARGED*

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

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Infil. Flow (l/s)	Infil. Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S45.000	BR28	360 minute 100 year Winter I+10%	88.800	0.300	0.000	0.000	0.00			0.0	0.0	SURCHARGED*
S45.001	FC18	360 minute 100 year Winter I+10%	88.800	56.651	-32.000	0.000	0.00	0.0	0.000	0.0	0.0	OK
S45.002	DP20	1440 minute 100 year Summer I+10%	88.800	83.705	0.197	0.000	0.00			0.0	0.0	SURCHARGED
S40.010	JC4	720 minute 100 year Summer I+10%	84.400	83.603	0.000	0.000	0.07			0.5	4.4	SURCHARGED*
S46.000	BR29	120 minute 100 year Summer I+10%	88.800	88.391	-0.263	0.000	0.01			0.2	0.6	OK*
S46.001	FC19	120 minute 100 year Summer I+10%	88.800	88.390	-0.263	0.000	0.01	0.0	0.000	0.2	0.5	OK
S46.002	DP21	1440 minute 100 year Summer I+10%	88.800	83.703	0.195	0.000	0.01			0.2	0.2	SURCHARGED
S40.011	JC5	1440 minute 100 year Winter I+10%	84.400	83.539	0.000	0.000	0.04			0.4	2.5	SURCHARGED*
S40.012	FC20	1440 minute 100 year Summer I+10%	84.400	83.702	0.296	0.000	0.09	0.0	0.000	0.1	2.4	SURCHARGED
S40.013	MH2	1440 minute 100 year Summer I+10%	84.335	83.375	-0.202	0.000	0.02			1.4	2.4	OK
S40.014	MH3	15 minute 100 year Summer I+10%	84.852	80.283	-0.122	0.000	0.35			1.0	14.7	OK
S47.000	BR31	180 minute 100 year Summer I+10%	85.350	85.024	-0.132	0.000	0.07			0.2	1.6	OK*
S48.000	BR31	180 minute 100 year Summer I+10%	85.350	85.024	-0.132	0.000	0.03			0.4	2.0	OK*
S49.000	GR5.1	120 minute 100 year Winter I+10%	128.300	128.200	0.000	0.000	1.13			0.6	4.5	FLOOD RISK*
S49.001	DP25	180 minute 100 year Summer I+10%	128.300	85.032	0.026	0.000	0.44			0.3	4.7	SURCHARGED
S49.002	BR30	180 minute 100 year Summer I+10%	85.350	85.031	-0.119	0.000	0.08			0.2	4.7	OK*
S49.003	BR30	180 minute 100 year Summer I+10%	85.350	85.030	-0.118	0.000	0.22			0.2	4.9	OK*
S50.000	BR30	180 minute 100 year Summer I+10%	85.350	85.027	-0.127	0.000	0.02			0.1	1.1	OK*
S51.000	GR5.2	120 minute 100 year Winter I+10%	128.300	128.200	0.000	0.000	1.13			0.6	4.5	FLOOD RISK*
S51.001	DP23	180 minute 100 year Summer I+10%	128.300	85.029	0.024	0.000	0.53			0.5	5.8	SURCHARGED
S51.002	BR30	180 minute 100 year Summer I+10%	85.350	85.027	-0.122	0.000	0.09			0.3	5.7	OK*
S49.004	FC22	180 minute 100 year Summer I+10%	85.350	85.027	-0.121	0.000	0.25			0.6	11.8	OK
S47.001	FC21	180 minute 100 year Summer I+10%	85.350	85.024	1.574	0.000	0.16	0.0	0.000	0.5	9.5	SURCHARGED
S47.002	DP22	180 minute 100 year Summer I+10%	85.350	82.930	-0.220	0.000	0.16			0.6	9.5	OK
S47.003	SWALE	180 minute 100 year Summer I+10%	83.150	82.927	-0.221	0.000	0.16			0.6	9.5	OK*

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

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Infil. Flow (l/s)	Infil. Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S47.004	SWALE	180 minute 100 year Summer I+10%	83.500	82.910	-0.221	0.000	0.16			0.6	9.6	OK*
S47.005	SWALE	180 minute 100 year Summer I+10%	83.150	82.884	-0.217	0.000	0.16			0.6	9.6	OK*
S52.000	BR32	180 minute 100 year Summer I+10%	85.350	84.970	-0.184	0.000	0.01			0.0	0.4	OK*
S53.000	GR5.3	120 minute 100 year Winter I+10%	128.300	128.200	0.000	0.000	1.13			0.6	4.5	FLOOD RISK*
S53.001	DP24	180 minute 100 year Summer I+10%	128.300	84.971	-0.034	0.000	0.44			0.5	4.7	OK
S53.002	BR32	180 minute 100 year Summer I+10%	85.350	84.970	-0.178	0.000	0.08			0.3	4.7	OK*
S52.001	BR32	180 minute 100 year Summer I+10%	85.350	84.970	-0.183	0.000	0.10			0.5	5.9	OK*
S52.002	FC22	180 minute 100 year Summer I+10%	85.350	84.970	-0.182	0.000	0.04	0.0	0.000	0.3	2.2	OK
S52.003	DP25	180 minute 100 year Summer I+10%	85.350	83.196	-0.104	0.000	0.21			0.5	2.2	OK
S47.006	SWALE	180 minute 100 year Summer I+10%	83.500	82.872	-0.211	0.000	0.19			0.7	11.8	OK*
S47.007	SWALE	180 minute 100 year Summer I+10%	83.150	82.841	-0.211	0.000	0.19			0.7	11.8	OK*
S47.008	SWALE	180 minute 100 year Summer I+10%	85.150	82.832	-0.209	0.000	0.19			0.7	11.8	OK*
S54.000	IC18	240 minute 100 year Summer I+10%	85.350	84.974	-0.031	0.000	0.20			0.3	2.2	OK
S54.001	BR33	240 minute 100 year Summer I+10%	85.350	84.973	-0.181	0.000	0.06			0.2	2.7	OK*
S55.000	GR6.1	30 minute 100 year Summer I+10%	116.300	116.200	0.000	0.000	1.00			0.6	3.9	FLOOD RISK*
S55.001	DP26	240 minute 100 year Summer I+10%	116.300	84.974	-0.182	0.000	0.04			0.2	2.4	OK*
S55.002	BR33	240 minute 100 year Summer I+10%	85.350	84.974	-0.181	0.000	0.04			0.2	2.4	OK*
S55.003	BR33	240 minute 100 year Summer I+10%	85.350	84.973	-0.181	0.000	0.05			0.2	2.8	OK*
S56.000	BR33	240 minute 100 year Summer I+10%	85.350	84.973	-0.181	0.000	0.00			0.0	0.2	OK*
S54.002	FC23	240 minute 100 year Summer I+10%	85.350	84.973	-0.180	0.000	0.04	0.0	0.000	0.3	2.3	OK
S54.003	DP26	240 minute 100 year Summer I+10%	85.350	83.196	-0.104	0.000	0.21			0.5	2.3	OK
S47.009	SWALE	180 minute 100 year Summer I+10%	85.350	82.814	-0.203	0.000	0.23			0.7	14.1	OK*
S47.010	SWALE	180 minute 100 year Summer I+10%	83.150	82.797	-0.203	0.000	0.23			0.7	14.1	OK*
S47.011	SWALE	180 minute 100 year Summer I+10%	83.150	82.772	-0.200	0.000	0.23			0.7	14.2	OK*
S57.000	GR6.2	30 minute 100 year Winter I+10%	116.300	116.200	0.000	0.000	1.07			0.6	4.2	FLOOD RISK*

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

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Infil. Flow (l/s)	Infil. Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S57.001	DP26	240 minute 100 year Summer I+10%	116.300	84.949	-0.057	0.000	0.31			0.4	3.4	OK*
S57.002	BR34	240 minute 100 year Summer I+10%	85.350	84.949	-0.201	0.000	0.05			0.3	3.3	OK*
S57.003	BR34	240 minute 100 year Summer I+10%	85.350	84.949	-0.201	0.000	0.06			0.3	3.8	OK*
S58.000	BR34	240 minute 100 year Summer I+10%	85.350	84.949	-0.205	0.000	0.00			0.0	0.2	OK*
S57.004	BR34	240 minute 100 year Summer I+10%	85.350	84.949	-0.204	0.000	0.07			0.4	4.4	OK*
S57.005	FC24	240 minute 100 year Summer I+10%	85.350	84.948	-0.204	0.000	0.03	0.0	0.000	0.3	1.9	OK
S57.006	DP27	240 minute 100 year Summer I+10%	85.350	83.192	-0.108	0.000	0.18			0.5	1.9	OK
S47.012	SWALE	180 minute 100 year Summer I+10%	83.500	82.759	-0.196	0.000	0.26			0.7	16.1	OK*
S47.013	SWALE	180 minute 100 year Summer I+10%	83.150	82.741	-0.196	0.000	0.26			0.7	16.2	OK*
S47.014	SWALE	180 minute 100 year Summer I+10%	83.150	82.736	-0.196	0.000	0.26			0.7	16.2	OK*
S47.015	SWALE	180 minute 100 year Summer I+10%	83.150	82.718	-0.196	0.000	0.26			0.7	16.2	OK*
S47.016	SWALE	240 minute 100 year Summer I+10%	83.150	82.687	-0.196	0.000	0.26			0.7	16.2	OK*
S47.017	SWALE	240 minute 100 year Summer I+10%	83.150	82.675	-0.196	0.000	0.27			0.7	16.3	OK*
S47.018	SWALE	720 minute 100 year Summer I+10%	83.150	82.666	-0.168	0.000	0.20			0.7	12.4	OK*
S47.019	SWALE	720 minute 100 year Summer I+10%	83.150	82.665	-0.155	0.000	0.20			0.7	12.4	OK*
S47.020	SWALE	720 minute 100 year Summer I+10%	83.150	82.662	-0.123	0.000	0.21			0.7	12.7	OK*
S47.021	SWALE	720 minute 100 year Summer I+10%	83.700	82.661	-0.113	0.000	0.21			0.7	12.7	OK*
S47.022	SWALE	720 minute 100 year Summer I+10%	82.750	82.659	-0.091	0.000	0.21			0.7	12.7	FLOOD RISK*
S47.023	SWALE	720 minute 100 year Summer I+10%	82.734	82.658	-0.076	0.000	0.21			0.7	12.7	FLOOD RISK*
S47.024	FC25	720 minute 100 year Summer I+10%	82.734	82.656	2.956	0.000	0.12	0.0	0.000	0.3	6.7	FLOOD RISK
S1.014	MH4	960 minute 100 year Summer I+10%	80.550	79.990	0.396	0.000	0.18			0.7	13.9	SURCHARGED
S59.000	GR4.3	30 minute 100 year Summer I+10%	101.300	101.172	-0.028	0.000	0.86			0.6	3.4	FLOOD RISK*
S59.001	DP28	30 minute 100 year Summer I+10%	101.300	79.997	-0.077	0.000	0.47			0.6	5.1	OK
S59.002	IC19	15 minute 100 year Summer I+10%	80.900	79.981	-0.086	0.000	0.30			0.7	4.9	OK
S59.003	IC20	15 minute 100 year Summer I+10%	80.900	79.967	-0.183	0.000	0.32	0.0	0.000	0.8	18.8	OK

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

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Infil. Flow (l/s)	Infil. Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S60.000	GR4.4	30 minute 100 year Summer I+10%	101.300	101.172	-0.028	0.000	0.86			0.6	3.4	FLOOD RISK*
S60.001	DP29	15 minute 100 year Summer I+10%	101.300	80.007	-0.067	0.000	0.56			0.6	6.1	OK
S60.002	IC21	15 minute 100 year Summer I+10%	80.800	79.985	-0.082	0.000	0.40			0.8	6.0	OK
S59.004	FC26	960 minute 100 year Summer I+10%	80.800	79.878	-0.132	0.000	0.05	0.0	0.000	0.5	3.2	OK
S59.005	MH5	1440 minute 100 year Summer I+10%	80.675	79.980	0.002	0.000	0.05			0.5	3.5	SURCHARGED
S1.015	HB	960 minute 100 year Summer I+10%	80.550	79.980	0.530	0.000	0.11	0.0	0.000	0.8	8.1	SURCHARGED

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

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 57
Number of Online Controls 27 Number of Storage Structures 27 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.000 Cv (Summer) 1.000
Region Scotland and Ireland Ratio R 0.275 Cv (Winter) 1.000

Margin for Flood Risk Warning (mm) 150.0 DTS Status OFF Inertia Status ON
Analysis Timestep Fine DVD Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 100
Climate Change (%) 10

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
S1.000	BR1	10080 Summer	100	+10%					84.942	-0.213	0.000	0.00		0.1	OK*
S1.001	BR1	10080 Summer	100	+10%					84.942	-0.212	0.000	0.00		0.2	OK*

APPENDIX B4.1 - 50% Blockage Analysis

of all flow control chambers, at the same time, during 1% AEP event

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

PN	US/MH Name	Level Exceeded
S1.000	BR1	
S1.001	BR1	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)
S1.002	BR1	10080 Summer	100	+10%					84.942	-0.211	0.000	0.00	
S1.003	AJ1	10080 Summer	100	+10%					84.942	-0.210	0.000	0.01	
S1.004	FC1	10080 Summer	100	+10%	100/15 Summer				85.045	0.495	0.000	0.04	
S1.005	FD1	10080 Summer	100	+10%	100/60 Summer				84.980	0.286	0.000	0.01	
S2.000	BR2	7200 Summer	100	+10%					85.170	0.000	0.000	0.00	
S3.000	BR2	7200 Summer	100	+10%					85.170	0.000	0.000	0.00	
S2.001	AJ2	10080 Summer	100	+10%	100/2160 Summer	100/2880 Summer			90.478	5.309	5178.666	1.95	
S4.000	BR3	7200 Summer	100	+10%					85.172	0.000	0.000	0.00	
S4.001	BR3	7200 Summer	100	+10%					85.171	0.000	0.000	0.00	
S4.002	AJ3	10080 Winter	100	+10%	100/2160 Summer	100/2880 Summer			90.645	5.475	5322.074	2.21	
S5.000	BR4	7200 Summer	100	+10%					85.171	0.000	0.000	0.00	
S6.000	BR4	7200 Summer	100	+10%					85.171	0.000	0.000	0.00	
S5.001	AJ4	10080 Winter	100	+10%	100/2160 Summer	100/2880 Summer			91.064	5.894	5733.139	1.71	
S7.000	GR1.1	30 Winter	100	+10%					119.200	0.000	0.000	1.00	
S7.001	DP1	10080 Summer	100	+10%	100/5760 Summer				90.916	2.409	0.000	0.02	
S7.002	IC1	10080 Winter	100	+10%					88.651	0.000	0.000	0.01	
S8.000	BR5	10080 Winter	100	+10%					88.653	0.000	0.000	0.01	
S8.001	BR5	10080 Winter	100	+10%					88.652	0.000	0.000	0.01	
S8.002	BR5	10080 Winter	100	+10%					88.651	0.000	0.000	0.02	
S9.000	GR1.2	30 Winter	100	+10%					119.200	0.000	0.000	1.00	
S9.001	DP2	10080 Summer	100	+10%	100/15 Summer				91.176	2.664	0.000	0.03	
S9.002	IC2	10080 Summer	100	+10%	100/7200 Summer	100/7200 Summer			91.176	2.522	2327.521	0.27	
S9.003	BR5	10080 Winter	100	+10%					88.653	0.000	0.000	0.06	
S10.000	GR2.1	30 Summer	100	+10%					116.195	-0.005	0.000	1.00	
S10.001	DP3	10080 Summer	100	+10%	100/15 Summer				91.252	2.734	0.000	0.02	

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

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
S1.002	BR1	0.2	OK*	
S1.003	AJ1	0.4	OK	
S1.004	FC1	0.4	SURCHARGED	
S1.005	FD1	0.4	SURCHARGED	
S2.000	BR2	0.1	SURCHARGED*	
S3.000	BR2	0.1	SURCHARGED*	
S2.001	AJ2	83.6	FLOOD	8
S4.000	BR3	0.0	SURCHARGED*	
S4.001	BR3	0.1	SURCHARGED*	
S4.002	AJ3	65.5	FLOOD	8
S5.000	BR4	0.1	SURCHARGED*	
S6.000	BR4	0.1	SURCHARGED*	
S5.001	AJ4	77.8	FLOOD	8
S7.000	GR1.1	3.9	FLOOD RISK*	
S7.001	DP1	0.2	SURCHARGED	
S7.002	IC1	0.3	SURCHARGED*	
S8.000	BR5	0.8	SURCHARGED*	
S8.001	BR5	0.4	SURCHARGED*	
S8.002	BR5	0.5	SURCHARGED*	
S9.000	GR1.2	3.9	FLOOD RISK*	
S9.001	DP2	0.3	SURCHARGED	
S9.002	IC2	13.6	FLOOD	5
S9.003	BR5	1.5	SURCHARGED*	
S10.000	GR2.1	3.9	FLOOD RISK*	

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

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
S10.001	DP3	0.3	SURCHARGED	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)
S10.002	IC3	10080 Summer	100	+10%	100/7200 Summer	100/7200 Summer			91.252	2.597	2401.692	0.27	
S10.003	BR5	10080 Winter	100	+10%					88.653	0.000	0.000	0.06	
S9.004	BR5	10080 Winter	100	+10%					88.652	0.000	0.000	0.44	
S9.005	BR5	10080 Winter	100	+10%					88.651	0.000	0.000	1.13	
S7.003	FC2	10080 Summer	100	+10%	100/2160 Summer	100/7200 Summer			90.915	5.743	2026.738	0.05	
S7.004	DP4	10080 Summer	100	+10%	100/2160 Summer	100/2880 Summer			90.931	5.761	5581.761	0.47	
S7.005	IC4	10080 Summer	100	+10%	100/2160 Summer	100/2880 Summer			90.930	5.762	5607.268	1.27	
S4.003	BR6	7200 Summer	100	+10%					85.169	0.000	0.000	3.78	
S11.000	BR6	7200 Summer	100	+10%					85.169	0.000	0.000	0.13	
S2.002	BR6	7200 Summer	100	+10%					85.168	0.000	0.000	2.11	
S2.003	FC3	10080 Summer	100	+10%	100/2160 Summer	100/2880 Summer			90.071	4.904	4679.574	0.09	
S2.004	BR7	7200 Summer	100	+10%					85.166	0.000	0.000	0.18	
S12.000	BR8	7200 Summer	100	+10%					85.171	0.000	0.000	0.00	
S12.001	BR8	7200 Summer	100	+10%					85.170	0.000	0.000	0.00	
S13.000	BR8	7200 Summer	100	+10%					85.171	0.000	0.000	0.00	
S13.001	BR8	7200 Summer	100	+10%					85.170	0.000	0.000	0.00	
S12.002	AJ6	10080 Summer	100	+10%	100/1440 Summer	100/2880 Summer			85.561	0.392	211.342	0.01	
S12.003	BR9	7200 Summer	100	+10%					85.168	0.000	0.000	0.01	
S14.000	BR10	7200 Summer	100	+10%					85.173	0.000	0.000	0.01	
S14.001	BR10	7200 Summer	100	+10%					85.172	0.000	0.000	0.01	
S14.002	BR10	7200 Summer	100	+10%					85.171	0.000	0.000	0.00	
S14.003	AJ7	10080 Summer	100	+10%	100/1440 Summer	100/2160 Summer			85.561	0.391	211.148	0.01	
S14.004	BR9	7200 Summer	100	+10%					85.169	0.000	0.000	0.01	
S14.005	BR9	7200 Summer	100	+10%					85.168	0.000	0.000	0.01	
S12.004	BR9	7200 Summer	100	+10%					85.167	0.000	0.000	0.02	

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

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
S10.002	IC3	13.0	FLOOD	5
S10.003	BR5	1.9	SURCHARGED*	
S9.004	BR5	21.7	SURCHARGED*	
S9.005	BR5	27.6	SURCHARGED*	
S7.003	FC2	2.8	FLOOD	5
S7.004	DP4	27.0	FLOOD	8
S7.005	IC4	64.0	FLOOD	8
S4.003	BR6	106.7	SURCHARGED*	
S11.000	BR6	8.0	SURCHARGED*	
S2.002	BR6	129.6	SURCHARGED*	
S2.003	FC3	4.7	FLOOD	8
S2.004	BR7	4.8	SURCHARGED*	
S12.000	BR8	0.2	SURCHARGED*	
S12.001	BR8	0.3	SURCHARGED*	
S13.000	BR8	0.2	SURCHARGED*	
S13.001	BR8	0.3	SURCHARGED*	
S12.002	AJ6	0.6	FLOOD	8
S12.003	BR9	0.4	SURCHARGED*	
S14.000	BR10	0.2	SURCHARGED*	
S14.001	BR10	0.2	SURCHARGED*	
S14.002	BR10	0.3	SURCHARGED*	
S14.003	AJ7	0.3	FLOOD	9
S14.004	BR9	0.4	SURCHARGED*	
S14.005	BR9	0.4	SURCHARGED*	

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

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
S12.004	BR9	1.4	SURCHARGED*	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)
S15.000	BR9	7200 Summer	100	+10%					85.167	0.000	0.000	0.01	
S12.005	AJ8	10080 Summer	100	+10%	100/1440 Summer	100/2880 Summer			85.562	0.396	212.013	0.04	
S2.005	BR7	7200 Summer	100	+10%					85.165	0.000	0.000	0.07	
S2.006	BR7	7200 Summer	100	+10%					85.164	0.000	0.000	0.07	
S16.000	BR11	7200 Summer	100	+10%					85.168	0.000	0.000	0.01	
S17.000	GR2.3	30 Summer	100	+10%					116.186	-0.044	0.000	0.61	
S17.001	DP5	10080 Summer	100	+10%	100/15 Summer				85.557	0.532	0.000	0.01	
S17.002	IC5	10080 Summer	100	+10%	100/1440 Summer	100/2880 Summer			85.557	0.388	206.931	0.00	
S17.003	BR11	7200 Summer	100	+10%					85.168	0.000	0.000	0.01	
S16.001	AJ9	10080 Summer	100	+10%	100/1440 Summer	100/2880 Summer			85.557	0.390	207.309	0.02	
S18.000	GR2.4	30 Summer	100	+10%					116.186	-0.044	0.000	0.61	
S18.001	DP6	10080 Summer	100	+10%	100/30 Summer				85.558	0.528	0.000	0.03	
S18.002	IC6	10080 Summer	100	+10%	100/1440 Summer	100/2880 Summer			85.558	0.390	207.624	0.01	
S18.003	BR12	7200 Summer	100	+10%					85.167	0.000	0.000	0.01	
S16.002	AJ10	10080 Summer	100	+10%	100/1440 Summer	100/2880 Summer			85.558	0.392	208.016	0.02	
S16.003	BR7	7200 Summer	100	+10%					85.165	0.000	0.000	0.03	
S19.000	GR2.5	30 Summer	100	+10%					116.186	-0.044	0.000	0.61	
S19.001	DP7	10080 Summer	100	+10%	100/180 Summer				85.563	0.542	0.000	0.01	
S19.002	IC7	10080 Summer	100	+10%	100/1440 Summer	100/2880 Summer			85.560	0.395	209.514	0.01	
S16.004	BR7	7200 Summer	100	+10%					85.164	0.000	0.000	0.03	
S20.000	BR7	7200 Summer	100	+10%					85.164	0.000	0.000	0.01	
S2.007	FC4	10080 Summer	100	+10%	100/1440 Summer	100/1440 Summer			85.561	0.398	210.658	0.14	
S21.000	GR3.1	30 Summer	100	+10%					110.177	-0.023	0.000	0.95	
S21.001	DP8	10080 Summer	100	+10%	100/15 Summer				85.390	0.366	0.000	0.02	
S21.002	IC8	10080 Summer	100	+10%	100/1440 Winter	100/7200 Summer			85.390	0.223	39.582	0.00	

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

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
S15.000	BR9	0.3	SURCHARGED*	
S12.005	AJ8	1.6	FLOOD	8
S2.005	BR7	4.2	SURCHARGED*	
S2.006	BR7	4.2	SURCHARGED*	
S16.000	BR11	0.3	SURCHARGED*	
S17.000	GR2.3	2.4	FLOOD RISK*	
S17.001	DP5	0.1	SURCHARGED	
S17.002	IC5	0.1	FLOOD	8
S17.003	BR11	0.3	SURCHARGED*	
S16.001	AJ9	0.5	FLOOD	8
S18.000	GR2.4	2.4	FLOOD RISK*	
S18.001	DP6	0.3	SURCHARGED	
S18.002	IC6	0.3	FLOOD	8
S18.003	BR12	0.4	SURCHARGED*	
S16.002	AJ10	0.8	FLOOD	8
S16.003	BR7	1.3	SURCHARGED*	
S19.000	GR2.5	2.4	FLOOD RISK*	
S19.001	DP7	0.1	SURCHARGED	
S19.002	IC7	0.4	FLOOD	8
S16.004	BR7	1.8	SURCHARGED*	
S20.000	BR7	0.4	SURCHARGED*	
S2.007	FC4	3.3	FLOOD	14
S21.000	GR3.1	3.7	FLOOD RISK*	
S21.001	DP8	0.2	SURCHARGED	

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

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
S21.002	IC8	0.2	FLOOD	5

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)
S21.003	BR13	10080 Summer	100	+10%	100/1440 Winter	100/7200 Summer			85.390	0.224	39.663	0.02	
S22.000	BR13	7200 Summer	100	+10%					85.167	0.000	0.000	0.00	
S22.001	BR13	7200 Summer	100	+10%					85.166	0.000	0.000	0.01	
S21.004	AJ11	10080 Summer	100	+10%	100/1440 Winter	100/7200 Summer			85.390	0.225	40.112	0.03	
S23.000	GR3.2	30 Summer	100	+10%					110.177	-0.023	0.000	0.95	
S23.001	DP9	10080 Summer	100	+10%	100/15 Summer				85.390	0.366	0.000	0.02	
S23.002	IC9	10080 Summer	100	+10%	100/1440 Winter	100/4320 Summer			85.388	0.221	38.352	0.01	
S23.003	BR14	7200 Summer	100	+10%					85.166	0.000	0.000	0.01	
S23.004	BR14	7200 Summer	100	+10%					85.165	0.000	0.000	0.01	
S21.005	BR14	7200 Summer	100	+10%					85.164	0.000	0.000	0.04	
S21.006	BR14	7200 Summer	100	+10%					85.163	0.000	0.000	0.04	
S2.008	BR14	7200 Summer	100	+10%					85.162	0.000	0.000	0.05	
S24.000	BR14	7200 Summer	100	+10%					85.162	0.000	0.000	0.01	
S2.009	FC5	10080 Summer	100	+10%	100/1440 Summer	100/960 Summer			85.396	0.235	46.405	0.07	
S2.010	BR16	7200 Summer	100	+10%					85.160	0.000	0.000	0.06	
S2.011	BR16	5760 Summer	100	+10%					85.159	0.000	0.000	0.05	
S25.000	BR15	5760 Summer	100	+10%					85.162	0.000	0.000	0.00	
S25.001	BR15	5760 Summer	100	+10%					85.161	0.000	0.000	0.01	
S25.002	BR15	5760 Summer	100	+10%					85.160	0.000	0.000	0.00	
S25.003	BR15	5760 Summer	100	+10%					85.159	0.000	0.000	0.01	
S25.004	AJ12	10080 Winter	100	+10%	100/2880 Summer				85.348	0.190	0.000	0.02	
S2.012	BR16	5760 Summer	100	+10%	100/2880 Summer				85.158	0.001	0.000	0.06	
S26.000	BR17	7200 Summer	100	+10%					85.161	0.000	0.000	0.01	
S27.000	GR4.1	30 Summer	100	+10%					101.172	-0.028	0.000	0.86	
S27.001	DP12	7200 Summer	100	+10%	100/4320 Summer				85.347	0.296	0.000	0.02	

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

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
S21.003	BR13	0.6	FLOOD	5
S22.000	BR13	0.3	SURCHARGED*	
S22.001	BR13	0.4	SURCHARGED*	
S21.004	AJ11	1.1	FLOOD	5
S23.000	GR3.2	3.7	FLOOD RISK*	
S23.001	DP9	0.2	SURCHARGED	
S23.002	IC9	0.3	FLOOD	5
S23.003	BR14	0.6	SURCHARGED*	
S23.004	BR14	0.5	SURCHARGED*	
S21.005	BR14	1.7	SURCHARGED*	
S21.006	BR14	1.5	SURCHARGED*	
S2.008	BR14	3.2	SURCHARGED*	
S24.000	BR14	0.6	SURCHARGED*	
S2.009	FC5	3.2	FLOOD	16
S2.010	BR16	3.1	SURCHARGED*	
S2.011	BR16	2.8	SURCHARGED*	
S25.000	BR15	0.2	SURCHARGED*	
S25.001	BR15	0.3	SURCHARGED*	
S25.002	BR15	0.3	SURCHARGED*	
S25.003	BR15	0.5	SURCHARGED*	
S25.004	AJ12	0.7	FLOOD RISK	
S2.012	BR16	2.9	SURCHARGED*	
S26.000	BR17	0.3	SURCHARGED*	
S27.000	GR4.1	3.4	FLOOD RISK*	

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

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
S27.001	DP12	0.2	SURCHARGED	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)
S27.002	IC12	10080 Winter	100	+10%	100/4320 Summer				85.344	0.161	0.000	0.01	
S27.003	BR17	7200 Summer	100	+10%	100/4320 Summer				85.183	0.022	0.000	0.01	
S27.004	BR17	7200 Summer	100	+10%					85.161	0.000	0.000	0.03	
S28.000	GR3.3	30 Summer	100	+10%					110.177	-0.023	0.000	0.95	
S28.001	DP10	7200 Winter	100	+10%	100/2160 Winter				85.346	0.328	0.000	0.02	
S28.002	IC10	10080 Summer	100	+10%	100/4320 Summer	100/4320 Winter			85.345	0.184	1.947	0.01	
S26.001	BR17	7200 Summer	100	+10%					85.160	0.000	0.000	0.04	
S26.002	FC6	10080 Winter	100	+10%	100/4320 Winter	100/2160 Winter			85.350	0.191	0.959	0.05	
S26.003	BR16	7200 Summer	100	+10%					85.158	0.000	0.000	0.04	
S29.000	GR3.4	30 Summer	100	+10%					110.177	-0.023	0.000	0.95	
S29.001	DP11	8640 Winter	100	+10%	100/2160 Summer				85.349	0.329	0.000	0.01	
S29.002	IC11	10080 Summer	100	+10%	100/2880 Summer	100/5760 Summer			85.349	0.190	0.314	0.00	
S29.003	BR16	5760 Summer	100	+10%					85.158	0.000	0.000	0.01	
S26.004	BR16	5760 Summer	100	+10%					85.157	0.000	0.000	0.02	
S2.013	FC7	8640 Winter	100	+10%	100/2880 Summer	100/4320 Summer			85.350	0.194	1.002	0.10	
S30.000	GR4.2	30 Summer	100	+10%					101.172	-0.028	0.000	0.86	
S30.001	DP13	960 Summer	100	+10%	100/180 Winter				85.350	0.258	0.000	0.03	
S30.002	IC13	960 Summer	100	+10%	100/480 Summer				85.349	0.190	0.000	0.02	
S30.003	BR18	600 Summer	100	+10%					85.158	0.000	0.000	0.02	
S30.004	BR18	600 Summer	100	+10%					85.157	0.000	0.000	0.05	
S31.000	BR16	600 Summer	100	+10%					85.160	0.000	0.000	0.05	
S31.001	BR18	600 Summer	100	+10%					85.159	0.000	0.000	0.08	
S31.002	BR18	600 Summer	100	+10%					85.158	0.000	0.000	0.18	
S32.000	BR18	600 Summer	100	+10%					85.158	0.000	0.000	0.02	
S31.003	BR18	600 Summer	100	+10%					85.157	0.000	0.000	0.08	

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

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
S27.002	IC12	0.5	FLOOD RISK	
S27.003	BR17	0.6	SURCHARGED*	
S27.004	BR17	0.7	SURCHARGED*	
S28.000	GR3.3	3.7	FLOOD RISK*	
S28.001	DP10	0.2	SURCHARGED	
S28.002	IC10	0.4	FLOOD	
S26.001	BR17	2.2	SURCHARGED*	
S26.002	FC6	1.4	FLOOD	9
S26.003	BR16	1.4	SURCHARGED*	
S29.000	GR3.4	3.7	FLOOD RISK*	
S29.001	DP11	0.1	SURCHARGED	
S29.002	IC11	0.2	FLOOD	
S29.003	BR16	0.4	SURCHARGED*	
S26.004	BR16	1.4	SURCHARGED*	
S2.013	FC7	3.0	FLOOD	6
S30.000	GR4.2	3.4	FLOOD RISK*	
S30.001	DP13	0.8	SURCHARGED	
S30.002	IC13	0.8	FLOOD RISK	
S30.003	BR18	1.1	SURCHARGED*	
S30.004	BR18	1.6	SURCHARGED*	
S31.000	BR16	3.3	SURCHARGED*	
S31.001	BR18	3.8	SURCHARGED*	
S31.002	BR18	4.5	SURCHARGED*	
S32.000	BR18	0.5	SURCHARGED*	

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

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
S31.003	BR18	4.6	SURCHARGED*	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)
S30.005	FC8	1440 Summer	100	+10%	100/480 Summer	100/480 Summer			85.350	0.194	0.239	0.13	
S2.014	BR19	10080 Winter	100	+10%					85.155	0.000	0.000	0.07	
S33.000	BR19	10080 Winter	100	+10%					85.155	0.000	0.000	0.00	
S2.015	BR19	10080 Winter	100	+10%					85.154	0.000	0.000	0.10	
S2.016	AJ13	7200 Winter	100	+10%	100/7200 Winter				85.153	0.000	0.000	0.15	
S2.017	FC9	10080 Winter	100	+10%	100/7200 Summer				85.150	0.148	0.000	0.28	
S2.018	FD2	10080 Summer	100	+10%	100/60 Summer				84.983	0.291	0.000	0.06	
S34.000	BR20	360 Winter	100	+10%					84.663	0.000	0.000	0.01	
S1.006	FC10	10080 Summer	100	+10%	100/15 Summer				84.982	0.470	0.000	0.21	
S1.007	FD3	180 Summer	100	+10%	100/120 Summer				84.738	0.089	0.000	0.04	
S35.000	BR21	360 Winter	100	+10%					83.057	0.000	0.000	0.07	
S1.008	FC11	180 Summer	100	+10%	100/15 Summer				84.737	0.262	0.000	0.34	
S36.000	DP14	240 Summer	100	+10%	100/15 Summer				83.508	0.094	0.000	0.39	
S36.001	IC14	240 Summer	100	+10%					83.507	-0.043	0.000	0.09	
S36.002	FC12	240 Summer	100	+10%					83.507	-0.042	0.000	0.02	
S36.003	FD4	180 Winter	100	+10%	100/180 Winter				83.387	0.287	0.000	0.03	
S1.009	FD5	180 Winter	100	+10%	100/180 Winter				83.376	0.319	0.000	0.12	
S37.000	BR22	180 Winter	100	+10%					83.056	0.000	0.000	0.01	
S1.010	FC13	180 Winter	100	+10%	100/15 Summer				83.377	1.427	0.000	0.46	
S1.011	FD6	180 Winter	100	+10%	100/120 Summer	100/180 Winter			82.191	0.531	0.153	0.13	
S38.000	DP15	15 Summer	100	+10%					81.891	-0.070	0.000	0.56	
S38.001	IC15	180 Winter	100	+10%					81.885	-0.892	0.000	0.00	
S38.002	FC14	180 Winter	100	+10%					81.885	-0.225	0.000	0.02	
S38.003	FD7	180 Winter	100	+10%	100/120 Summer	100/180 Winter			82.091	0.431	0.149	0.02	
S39.000	BR23	360 Winter	100	+10%					80.600	0.000	0.000	0.04	

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

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
S30.005	FC8	2.7	FLOOD	4
S2.014	BR19	4.0	SURCHARGED*	
S33.000	BR19	0.0	SURCHARGED*	
S2.015	BR19	4.0	SURCHARGED*	
S2.016	AJ13	4.8	SURCHARGED	
S2.017	FC9	3.0	SURCHARGED	
S2.018	FD2	3.0	SURCHARGED	
S34.000	BR20	0.6	SURCHARGED*	
S1.006	FC10	2.3	SURCHARGED	
S1.007	FD3	1.7	SURCHARGED	
S35.000	BR21	4.5	SURCHARGED*	
S1.008	FC11	3.7	SURCHARGED	
S36.000	DP14	4.2	SURCHARGED	
S36.001	IC14	4.2	OK	
S36.002	FC12	1.3	OK	
S36.003	FD4	1.5	SURCHARGED	
S1.009	FD5	5.9	SURCHARGED	
S37.000	BR22	0.6	SURCHARGED*	
S1.010	FC13	5.0	SURCHARGED	
S1.011	FD6	5.7	FLOOD	
S38.000	DP15	6.0	OK	
S38.001	IC15	1.4	OK	
S38.002	FC14	1.3	OK	
S38.003	FD7	1.3	FLOOD	

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

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
S39.000	BR23	2.6	SURCHARGED*	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
S1.012	FC15	180 Winter	100	+10%	100/15 Summer	100/120 Summer			82.260	1.660	0.243	0.10		5.1
S1.013	MH1	2160 Summer	100	+10%	100/120 Summer				80.593	1.043	0.000	0.34		3.7
S40.000	BR24	240 Winter	100	+10%					88.452	0.000	0.000	0.57		1.9
S40.001	BR24	15 Winter	100	+10%					88.501	0.000	0.000	0.87		5.7
S41.000	GR2.2	30 Summer	100	+10%					116.195	-0.005	0.000	1.00		3.9
S41.001	DP16	30 Summer	100	+10%	100/15 Summer				88.524	0.016	0.000	0.36		3.9
S41.002	IC16	30 Summer	100	+10%					88.522	-0.131	0.000	0.09		3.9
S40.002	BR24	30 Summer	100	+10%					88.520	-0.131	0.000	0.26		10.5
S40.003	BR24	30 Summer	100	+10%					88.514	-0.136	0.000	0.57		12.9
S40.004	FC16	720 Summer	100	+10%					88.420	-0.229	0.000	0.02		1.3
S40.005	DP17	960 Summer	100	+10%	100/15 Summer				84.117	0.609	0.000	0.12		1.3
S40.006	IC17	960 Summer	100	+10%	100/240 Summer				84.114	0.464	0.000	0.03		1.4
S42.000	BR25	30 Summer	100	+10%					88.420	-0.282	0.000	0.01		0.8
S42.001	BR25	15 Summer	100	+10%					88.397	-0.254	0.000	0.06		3.5
S42.002	DP18	960 Summer	100	+10%	100/15 Summer				84.116	0.608	0.000	0.05		0.5
S40.007	JC1	1440 Winter	100	+10%					83.612	0.000	0.000	0.02		1.4
S43.000	BR26	15 Summer	100	+10%					88.383	-0.269	0.000	0.01		0.3
S43.001	BR26	15 Summer	100	+10%					88.383	-0.268	0.000	0.02		1.5
S43.002	DP19	960 Summer	100	+10%	100/15 Summer				84.114	0.606	0.000	0.02		0.2
S40.008	JC2	720 Summer	100	+10%					83.860	0.000	0.000	0.03		2.2
S44.000	BR27	120 Summer	100	+10%					88.430	-0.222	0.000	0.02		1.2
S44.001	FC17	120 Summer	100	+10%					88.429	-0.222	0.000	0.03		1.5
S44.002	DP21	960 Summer	100	+10%	100/120 Winter				84.111	0.603	0.000	0.06		0.6
S40.009	JC3	960 Summer	100	+10%	100/240 Summer				83.782	0.131	0.000	0.04		2.4
S45.000	BR28	360 Winter	100	+10%					0.300	0.000	0.000	0.01		0.9

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

PN	US/MH Name	Status	Level Exceeded
S1.012	FC15	FLOOD	1
S1.013	MH1	SURCHARGED	
S40.000	BR24	SURCHARGED*	
S40.001	BR24	SURCHARGED*	
S41.000	GR2.2	FLOOD RISK*	
S41.001	DP16	SURCHARGED	
S41.002	IC16	OK	
S40.002	BR24	OK*	
S40.003	BR24	OK*	
S40.004	FC16	OK	
S40.005	DP17	SURCHARGED	
S40.006	IC17	SURCHARGED	
S42.000	BR25	OK*	
S42.001	BR25	OK*	
S42.002	DP18	SURCHARGED	
S40.007	JC1	SURCHARGED*	
S43.000	BR26	OK*	
S43.001	BR26	OK*	
S43.002	DP19	SURCHARGED	
S40.008	JC2	SURCHARGED*	
S44.000	BR27	OK*	
S44.001	FC17	OK	
S44.002	DP21	SURCHARGED	
S40.009	JC3	SURCHARGED*	

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

PN	US/MH Name	Status	Level Exceeded
S45.000	BR28	SURCHARGED*	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
S45.001	FC18	240 Summer	100	+10%					88.474	-0.177	0.000	0.04		2.1
S45.002	DP20	960 Summer	100	+10%	100/120 Winter				84.111	0.603	0.000	0.13		1.5
S40.010	JC4	1440 Winter	100	+10%					83.603	0.000	0.000	0.05		2.9
S46.000	BR29	120 Summer	100	+10%					88.391	-0.263	0.000	0.01		0.6
S46.001	FC19	120 Summer	100	+10%					88.390	-0.263	0.000	0.01		0.5
S46.002	DP21	960 Summer	100	+10%	100/120 Winter				84.108	0.600	0.000	0.02		0.2
S40.011	JC5	4320 Winter	100	+10%					83.539	0.000	0.000	0.03		1.8
S40.012	FC20	960 Summer	100	+10%	100/60 Summer				84.106	0.700	0.000	0.13		3.6
S40.013	MH2	960 Summer	100	+10%					83.378	-0.199	0.000	0.03		3.6
S40.014	MH3	2160 Summer	100	+10%	100/480 Summer				80.596	0.191	0.000	0.09		3.8
S47.000	BR31	180 Summer	100	+10%					85.024	-0.132	0.000	0.07		1.5
S48.000	BR31	120 Summer	100	+10%					85.024	-0.132	0.000	0.04		2.4
S49.000	GR5.1	120 Winter	100	+10%					128.200	0.000	0.000	1.11		4.4
S49.001	DP25	180 Summer	100	+10%	100/30 Summer				85.033	0.027	0.000	0.43		4.7
S49.002	BR30	180 Summer	100	+10%					85.030	-0.119	0.000	0.08		4.7
S49.003	BR30	180 Summer	100	+10%					85.030	-0.119	0.000	0.22		4.9
S50.000	BR30	180 Summer	100	+10%					85.027	-0.127	0.000	0.02		1.1
S51.000	GR5.2	120 Winter	100	+10%					128.200	0.000	0.000	1.11		4.4
S51.001	DP23	180 Summer	100	+10%	100/120 Summer				85.030	0.025	0.000	0.52		5.7
S51.002	BR30	180 Summer	100	+10%					85.027	-0.122	0.000	0.09		5.7
S49.004	FC22	180 Summer	100	+10%					85.027	-0.121	0.000	0.25		11.6
S47.001	FC21	180 Summer	100	+10%	100/30 Summer				85.024	1.574	0.000	0.16		9.5
S47.002	DP22	120 Summer	100	+10%					82.930	-0.220	0.000	0.16		9.5
S47.003	SWALE	120 Summer	100	+10%					82.927	-0.221	0.000	0.16		9.5
S47.004	SWALE	180 Summer	100	+10%					82.910	-0.221	0.000	0.16		9.6

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

PN	US/MH Name	Status	Level Exceeded
S45.001	FC18	OK	
S45.002	DP20	SURCHARGED	
S40.010	JC4	SURCHARGED*	
S46.000	BR29	OK*	
S46.001	FC19	OK	
S46.002	DP21	SURCHARGED	
S40.011	JC5	SURCHARGED*	
S40.012	FC20	SURCHARGED	
S40.013	MH2	OK	
S40.014	MH3	SURCHARGED	
S47.000	BR31	OK*	
S48.000	BR31	OK*	
S49.000	GR5.1	FLOOD RISK*	
S49.001	DP25	SURCHARGED	
S49.002	BR30	OK*	
S49.003	BR30	OK*	
S50.000	BR30	OK*	
S51.000	GR5.2	FLOOD RISK*	
S51.001	DP23	SURCHARGED	
S51.002	BR30	OK*	
S49.004	FC22	OK	
S47.001	FC21	SURCHARGED	
S47.002	DP22	OK	
S47.003	SWALE	OK*	

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

PN	US/MH Name	Status	Level Exceeded
S47.004	SWALE	OK*	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
S47.005	SWALE	180 Summer	100	+10%					82.884	-0.217	0.000	0.16		9.6
S52.000	BR32	180 Summer	100	+10%					84.970	-0.184	0.000	0.01		0.4
S53.000	GR5.3	120 Winter	100	+10%					128.200	0.000	0.000	1.11		4.4
S53.001	DP24	180 Summer	100	+10%					84.971	-0.034	0.000	0.43		4.7
S53.002	BR32	180 Summer	100	+10%					84.970	-0.179	0.000	0.08		4.7
S52.001	BR32	180 Summer	100	+10%					84.970	-0.183	0.000	0.10		5.9
S52.002	FC22	180 Summer	100	+10%					84.970	-0.182	0.000	0.04		2.2
S52.003	DP25	180 Summer	100	+10%					83.196	-0.104	0.000	0.21		2.2
S47.006	SWALE	180 Summer	100	+10%					82.872	-0.211	0.000	0.19		11.8
S47.007	SWALE	180 Summer	100	+10%					82.841	-0.211	0.000	0.19		11.8
S47.008	SWALE	180 Summer	100	+10%					82.832	-0.209	0.000	0.19		11.8
S54.000	IC18	240 Summer	100	+10%					84.974	-0.031	0.000	0.20		2.1
S54.001	BR33	240 Summer	100	+10%					84.973	-0.181	0.000	0.05		2.6
S55.000	GR6.1	30 Summer	100	+10%					116.200	0.000	0.000	1.00		3.9
S55.001	DP26	240 Summer	100	+10%					84.973	-0.183	0.000	0.04		2.4
S55.002	BR33	240 Summer	100	+10%					84.973	-0.182	0.000	0.04		2.4
S55.003	BR33	240 Summer	100	+10%					84.973	-0.181	0.000	0.05		2.8
S56.000	BR33	240 Summer	100	+10%					84.973	-0.181	0.000	0.00		0.2
S54.002	FC23	240 Summer	100	+10%					84.973	-0.180	0.000	0.04		2.3
S54.003	DP26	240 Summer	100	+10%					83.196	-0.104	0.000	0.21		2.3
S47.009	SWALE	180 Summer	100	+10%					82.814	-0.203	0.000	0.23		14.1
S47.010	SWALE	180 Summer	100	+10%					82.797	-0.203	0.000	0.23		14.1
S47.011	SWALE	180 Summer	100	+10%					82.772	-0.200	0.000	0.23		14.2
S57.000	GR6.2	30 Winter	100	+10%					116.200	0.000	0.000	1.07		4.2
S57.001	DP26	240 Summer	100	+10%					84.949	-0.057	0.000	0.31		3.3

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

PN	US/MH Name	Status	Level Exceeded
S47.005	SWALE	OK*	
S52.000	BR32	OK*	
S53.000	GR5.3	FLOOD RISK*	
S53.001	DP24	OK	
S53.002	BR32	OK*	
S52.001	BR32	OK*	
S52.002	FC22	OK	
S52.003	DP25	OK	
S47.006	SWALE	OK*	
S47.007	SWALE	OK*	
S47.008	SWALE	OK*	
S54.000	IC18	OK	
S54.001	BR33	OK*	
S55.000	GR6.1	FLOOD RISK*	
S55.001	DP26	OK*	
S55.002	BR33	OK*	
S55.003	BR33	OK*	
S56.000	BR33	OK*	
S54.002	FC23	OK	
S54.003	DP26	OK	
S47.009	SWALE	OK*	
S47.010	SWALE	OK*	
S47.011	SWALE	OK*	
S57.000	GR6.2	FLOOD RISK*	

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

PN	US/MH Name	Status	Level Exceeded
S57.001	DP26	OK*	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
S57.002	BR34	240 Summer	100	+10%					84.949	-0.202	0.000	0.05		3.3
S57.003	BR34	240 Summer	100	+10%					84.949	-0.201	0.000	0.06		3.7
S58.000	BR34	240 Summer	100	+10%					84.948	-0.206	0.000	0.00		0.2
S57.004	BR34	240 Summer	100	+10%					84.949	-0.204	0.000	0.07		4.3
S57.005	FC24	240 Summer	100	+10%					84.948	-0.204	0.000	0.03		1.9
S57.006	DP27	240 Summer	100	+10%					83.192	-0.108	0.000	0.18		1.9
S47.012	SWALE	180 Summer	100	+10%					82.759	-0.196	0.000	0.26		16.1
S47.013	SWALE	180 Summer	100	+10%					82.741	-0.196	0.000	0.26		16.1
S47.014	SWALE	180 Summer	100	+10%					82.736	-0.196	0.000	0.26		16.1
S47.015	SWALE	960 Summer	100	+10%					82.733	-0.181	0.000	0.16		9.9
S47.016	SWALE	960 Summer	100	+10%					82.730	-0.153	0.000	0.16		9.9
S47.017	SWALE	960 Summer	100	+10%					82.729	-0.141	0.000	0.16		9.9
S47.018	SWALE	960 Summer	100	+10%					82.726	-0.108	0.000	0.16		10.0
S47.019	SWALE	960 Summer	100	+10%					82.725	-0.096	0.000	0.16		10.0
S47.020	SWALE	960 Summer	100	+10%					82.722	-0.063	0.000	0.17		10.2
S47.021	SWALE	960 Summer	100	+10%					82.722	-0.053	0.000	0.17		10.2
S47.022	SWALE	960 Summer	100	+10%					82.719	-0.030	0.000	0.17		10.2
S47.023	SWALE	960 Summer	100	+10%					82.717	-0.017	0.000	0.17		10.2
S47.024	FC25	960 Summer	100	+10%	100/60 Summer				82.712	3.012	0.000	0.11		6.3
S1.014	MH4	2160 Summer	100	+10%	100/120 Summer	100/480 Summer			80.589	0.995	39.647	0.15		11.9
S59.000	GR4.3	30 Summer	100	+10%					101.172	-0.028	0.000	0.86		3.4
S59.001	DP28	2880 Summer	100	+10%	100/240 Summer				80.595	0.521	0.000	0.05		0.5
S59.002	IC19	2160 Summer	100	+10%	100/240 Summer				80.593	0.526	0.000	0.04		0.6
S59.003	IC20	2160 Summer	100	+10%	100/360 Summer				80.594	0.444	0.000	0.03		1.6
S60.000	GR4.4	30 Summer	100	+10%					101.172	-0.028	0.000	0.86		3.4

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

PN	US/MH Name	Status	Level Exceeded
S57.002	BR34	OK*	
S57.003	BR34	OK*	
S58.000	BR34	OK*	
S57.004	BR34	OK*	
S57.005	FC24	OK	
S57.006	DP27	OK	
S47.012	SWALE	OK*	
S47.013	SWALE	OK*	
S47.014	SWALE	OK*	
S47.015	SWALE	OK*	
S47.016	SWALE	OK*	
S47.017	SWALE	OK*	
S47.018	SWALE	OK*	
S47.019	SWALE	OK*	
S47.020	SWALE	OK*	
S47.021	SWALE	OK*	
S47.022	SWALE	FLOOD RISK*	
S47.023	SWALE	FLOOD RISK*	
S47.024	FC25	FLOOD RISK	
S1.014	MH4	FLOOD	18
S59.000	GR4.3	FLOOD RISK*	
S59.001	DP28	SURCHARGED	
S59.002	IC19	SURCHARGED	
S59.003	IC20	SURCHARGED	

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

PN	US/MH Name	Status	Level Exceeded
S60.000	GR4.4	FLOOD RISK*	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
S60.001	DP29	2160 Summer	100	+10%	100/240 Summer				80.595	0.521	0.000	0.06		0.7
S60.002	IC21	2160 Summer	100	+10%	100/240 Summer				80.595	0.528	0.000	0.05		0.7
S59.004	FC26	2160 Summer	100	+10%	100/240 Summer				80.598	0.588	0.000	0.03		1.5
S59.005	MH5	2160 Summer	100	+10%	100/180 Summer				80.585	0.607	0.000	0.03		2.0
S1.015	HB	2160 Summer	100	+10%	100/120 Summer	100/480 Summer			80.585	1.135	34.669	0.07		5.0

PN	US/MH Name	Status	Level Exceeded
S60.001	DP29	SURCHARGED	
S60.002	IC21	SURCHARGED	
S59.004	FC26	SURCHARGED	
S59.005	MH5	FLOOD RISK	
S1.015	HB	FLOOD	18

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes B.Regs Manhole Sizes B.Regs

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	5	Foul Sewage (l/s/ha)	0.000	Maximum Backdrop Height (m)	0.000
M5-60 (mm)	18.000	Volumetric Runoff Coeff.	1.000	Min Design Depth for Optimisation (m)	0.200
Ratio R	0.275	PIMP (%)	100	Min Vel for Auto Design only (m/s)	1.00
Maximum Rainfall (mm/hr)	150	Add Flow / Climate Change (%)	10	Min Slope for Optimisation (1:X)	500
Maximum Time of Concentration (mins)	30	Minimum Backdrop Height (m)	0.000		

Designed with Level Inverts

Time Area Diagram for Storm

Time (mins)	**Area (ha)**	**Time (mins)**	**Area (ha)**	**Time (mins)**	**Area (ha)**	**Time (mins)**	**Area (ha)**	**Time (mins)**	**Area (ha)**	**Time (mins)**	**Area (ha)**	**Time (mins)**	**Area (ha)**
0-4	0.153	4-8	0.176	8-12	0.090	12-16	0.108	16-20	0.044	20-24	0.027	24-28	0.000

Total Area Contributing (ha) = 0.597

Total Pipe Volume (m³) = 107.520

APPENDIX B4.2 - 50% Blockage Analysis

of development outflow chamber,
during 1% AEP event

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.000	0.000	0.000
1.001	Classification	Premeable Paving	80	0.006	0.005	0.005
1.002	Classification	Premeable Paving	80	0.007	0.005	0.005
1.003	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.000	0.000	0.000
1.005	Classification	Premeable Paving	80	0.008	0.006	0.006
2.000	Classification	Premeable Paving	80	0.004	0.003	0.003
3.000	-	-	100	0.000	0.000	0.000
2.001	-	-	100	0.000	0.000	0.000
4.000	-	-	100	0.000	0.000	0.000
4.001	Classification	Premeable Paving	80	0.006	0.005	0.005
4.002	-	-	100	0.000	0.000	0.000
5.000	Classification	Premeable Paving	80	0.003	0.002	0.002
6.000	-	-	100	0.000	0.000	0.000
5.001	-	-	100	0.000	0.000	0.000
7.000	-	-	100	0.000	0.000	0.000
7.001	-	-	100	0.000	0.000	0.000
7.002	Classification	Premeable Paving	80	0.004	0.003	0.003
	Classification	Premeable Paving	80	0.003	0.003	0.005
8.000	-	-	100	0.000	0.000	0.000
8.001	Classification	Premeable Paving	80	0.003	0.003	0.003
	Classification	Premeable Paving	80	0.002	0.002	0.004
8.002	Classification	Premeable Paving	80	0.010	0.008	0.008
9.000	-	-	100	0.000	0.000	0.000
9.001	Classification	Flat Roof	100	0.005	0.005	0.005
9.002	-	-	100	0.000	0.000	0.000
9.003	Classification	Premeable Paving	80	0.006	0.005	0.005
10.000	-	-	100	0.000	0.000	0.000
10.001	Classification	Flat Roof	100	0.005	0.005	0.005
10.002	-	-	100	0.000	0.000	0.000
10.003	Classification	Premeable Paving	80	0.003	0.003	0.003
9.004	Classification	Premeable Paving	80	0.003	0.002	0.002
9.005	Classification	Premeable Paving	80	0.009	0.007	0.007
7.003	-	-	100	0.000	0.000	0.000
7.004	-	-	100	0.000	0.000	0.000
7.005	Classification	Premeable Paving	80	0.003	0.002	0.002
	Classification	Premeable Paving	80	0.001	0.001	0.003
4.003	Classification	Premeable Paving	80	0.001	0.001	0.001

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
	Classification	Premeable Paving	80	0.003	0.003	0.004
11.000	-	-	100	0.000	0.000	0.000
2.002	Classification	Premeable Paving	80	0.005	0.004	0.004
	Classification	Premeable Paving	80	0.002	0.001	0.005
2.003	-	-	100	0.000	0.000	0.000
2.004	Classification	Premeable Paving	80	0.011	0.009	0.009
12.000	-	-	100	0.000	0.000	0.000
12.001	Classification	Premeable Paving	80	0.010	0.008	0.008
13.000	-	-	100	0.000	0.000	0.000
13.001	Classification	Premeable Paving	80	0.009	0.007	0.007
12.002	-	-	100	0.000	0.000	0.000
12.003	Classification	Premeable Paving	80	0.003	0.003	0.003
14.000	Classification	Premeable Paving	80	0.009	0.007	0.007
14.001	-	-	100	0.000	0.000	0.000
14.002	Classification	Premeable Paving	80	0.005	0.004	0.004
14.003	-	-	100	0.000	0.000	0.000
14.004	Classification	Premeable Paving	80	0.006	0.005	0.005
14.005	-	-	100	0.000	0.000	0.000
12.004	Classification	Premeable Paving	80	0.003	0.002	0.002
15.000	-	-	100	0.000	0.000	0.000
12.005	-	-	100	0.000	0.000	0.000
2.005	Classification	Premeable Paving	80	0.005	0.004	0.004
2.006	Classification	Premeable Paving	80	0.004	0.003	0.003
16.000	Classification	Premeable Paving	80	0.013	0.011	0.011
17.000	-	-	100	0.000	0.000	0.000
17.001	-	-	100	0.000	0.000	0.000
17.002	-	-	100	0.000	0.000	0.000
17.003	-	-	100	0.000	0.000	0.000
16.001	-	-	100	0.000	0.000	0.000
18.000	-	-	100	0.000	0.000	0.000
18.001	-	-	100	0.000	0.000	0.000
18.002	-	-	100	0.000	0.000	0.000
18.003	-	-	100	0.000	0.000	0.000
16.002	Classification	Premeable Paving	80	0.005	0.004	0.004
	Classification	Premeable Paving	80	0.008	0.007	0.011
16.003	Classification	Premeable Paving	80	0.001	0.001	0.001
	Classification	Premeable Paving	80	0.003	0.003	0.004
19.000	-	-	100	0.000	0.000	0.000

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
19.001	-	-	100	0.000	0.000	0.000
19.002	-	-	100	0.000	0.000	0.000
16.004	Classification	Premeable Paving	80	0.003	0.002	0.002
	Classification	Premeable Paving	80	0.002	0.001	0.003
20.000	-	-	100	0.000	0.000	0.000
2.007	-	-	100	0.000	0.000	0.000
21.000	-	-	100	0.000	0.000	0.000
21.001	-	-	100	0.000	0.000	0.000
21.002	-	-	100	0.000	0.000	0.000
21.003	-	-	100	0.000	0.000	0.000
22.000	Classification	Premeable Paving	80	0.010	0.008	0.008
22.001	Classification	Premeable Paving	80	0.004	0.003	0.003
21.004	-	-	100	0.000	0.000	0.000
23.000	-	-	100	0.000	0.000	0.000
23.001	-	-	100	0.000	0.000	0.000
23.002	-	-	100	0.000	0.000	0.000
23.003	Classification	Premeable Paving	80	0.002	0.001	0.001
23.004	Classification	Premeable Paving	80	0.003	0.002	0.002
21.005	Classification	Premeable Paving	80	0.005	0.004	0.004
21.006	Classification	Premeable Paving	80	0.005	0.004	0.004
	Classification	Premeable Paving	80	0.005	0.004	0.008
2.008	Classification	Premeable Paving	80	0.004	0.003	0.003
24.000	-	-	100	0.000	0.000	0.000
2.009	-	-	100	0.000	0.000	0.000
2.010	Classification	Premeable Paving	80	0.006	0.005	0.005
2.011	Classification	Premeable Paving	80	0.001	0.001	0.001
	Classification	Premeable Paving	80	0.001	0.001	0.002
25.000	-	-	100	0.000	0.000	0.000
25.001	Classification	Premeable Paving	80	0.005	0.004	0.004
25.002	-	-	100	0.000	0.000	0.000
25.003	Classification	Premeable Paving	80	0.005	0.004	0.004
25.004	-	-	100	0.000	0.000	0.000
2.012	Classification	Premeable Paving	80	0.003	0.002	0.002
	Classification	Premeable Paving	80	0.002	0.001	0.004
26.000	Classification	Premeable Paving	80	0.004	0.003	0.003
27.000	-	-	100	0.000	0.000	0.000
27.001	-	-	100	0.000	0.000	0.000
27.002	-	-	100	0.000	0.000	0.000

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
27.003	-	-	100	0.000	0.000	0.000
27.004	Classification	Premeable Paving	80	0.011	0.009	0.009
28.000	-	-	100	0.000	0.000	0.000
28.001	Classification	Flat Roof	100	0.005	0.005	0.005
28.002	-	-	100	0.000	0.000	0.000
26.001	Classification	Premeable Paving	80	0.005	0.004	0.004
26.002	-	-	100	0.000	0.000	0.000
26.003	Classification	Premeable Paving	80	0.004	0.003	0.003
	Classification	Premeable Paving	80	0.008	0.006	0.009
29.000	-	-	100	0.000	0.000	0.000
29.001	-	-	100	0.000	0.000	0.000
29.002	-	-	100	0.000	0.000	0.000
29.003	-	-	100	0.000	0.000	0.000
26.004	Classification	Premeable Paving	80	0.006	0.005	0.005
2.013	-	-	100	0.000	0.000	0.000
30.000	-	-	100	0.000	0.000	0.000
30.001	-	-	100	0.000	0.000	0.000
30.002	-	-	100	0.000	0.000	0.000
30.003	-	-	100	0.000	0.000	0.000
30.004	Classification	Premeable Paving	80	0.010	0.008	0.008
31.000	-	-	100	0.000	0.000	0.000
31.001	Classification	Premeable Paving	80	0.008	0.007	0.007
31.002	Classification	Premeable Paving	80	0.013	0.010	0.010
32.000	Classification	Premeable Paving	80	0.006	0.005	0.005
31.003	-	-	100	0.000	0.000	0.000
30.005	Classification	Premeable Paving	80	0.005	0.004	0.004
2.014	Classification	Premeable Paving	80	0.003	0.003	0.003
33.000	-	-	100	0.000	0.000	0.000
2.015	Classification	Premeable Paving	80	0.007	0.005	0.005
2.016	-	-	100	0.000	0.000	0.000
2.017	Classification	Premeable Paving	80	0.005	0.004	0.004
2.018	Classification	Premeable Paving	80	0.002	0.002	0.002
34.000	-	-	100	0.000	0.000	0.000
1.006	-	-	100	0.000	0.000	0.000
1.007	Classification	Premeable Paving	80	0.002	0.002	0.002
35.000	-	-	100	0.000	0.000	0.000
1.008	-	-	100	0.000	0.000	0.000
36.000	Classification	Flat Roof	100	0.027	0.027	0.027

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
36.001	-	-	100	0.000	0.000	0.000
36.002	-	-	100	0.000	0.000	0.000
36.003	Classification	Premeable Paving	80	0.005	0.004	0.004
	Classification	Premeable Paving	80	0.003	0.002	0.006
1.009	-	-	100	0.000	0.000	0.000
37.000	-	-	100	0.000	0.000	0.000
1.010	-	-	100	0.000	0.000	0.000
1.011	Classification	Premeable Paving	80	0.003	0.002	0.002
38.000	Classification	Flat Roof	100	0.011	0.011	0.011
38.001	-	-	100	0.000	0.000	0.000
38.002	-	-	100	0.000	0.000	0.000
38.003	Classification	Premeable Paving	80	0.002	0.001	0.001
	Classification	Premeable Paving	80	0.003	0.003	0.004
39.000	-	-	100	0.000	0.000	0.000
1.012	-	-	100	0.000	0.000	0.000
1.013	-	-	100	0.000	0.000	0.000
40.000	-	-	100	0.000	0.000	0.000
40.001	Classification	Premeable Paving	80	0.007	0.006	0.006
41.000	-	-	100	0.000	0.000	0.000
41.001	-	-	100	0.000	0.000	0.000
41.002	-	-	100	0.000	0.000	0.000
40.002	-	-	100	0.000	0.000	0.000
40.003	Classification	Premeable Paving	80	0.009	0.007	0.007
40.004	Classification	Premeable Paving	80	0.009	0.007	0.007
40.005	-	-	100	0.000	0.000	0.000
40.006	Classification	Premeable Paving	80	0.003	0.003	0.003
42.000	-	-	100	0.000	0.000	0.000
42.001	Classification	Premeable Paving	80	0.005	0.004	0.004
	Classification	Premeable Paving	80	0.001	0.001	0.005
42.002	-	-	100	0.000	0.000	0.000
40.007	Classification	Premeable Paving	80	0.003	0.002	0.002
43.000	-	-	100	0.000	0.000	0.000
43.001	Classification	Premeable Paving	80	0.003	0.002	0.002
43.002	-	-	100	0.000	0.000	0.000
40.008	Classification	Premeable Paving	80	0.004	0.003	0.003
44.000	-	-	100	0.000	0.000	0.000
44.001	Classification	Premeable Paving	80	0.001	0.001	0.001
	Classification	Premeable Paving	80	0.005	0.004	0.005

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
44.002	-	-	100	0.000	0.000	0.000
40.009	Classification	Premeable Paving	80	0.006	0.004	0.004
	Classification	Grass	30	0.003	0.001	0.005
45.000	-	-	100	0.000	0.000	0.000
45.001	Classification	Premeable Paving	80	0.013	0.010	0.010
	Classification	Premeable Paving	80	0.001	0.001	0.011
45.002	-	-	100	0.000	0.000	0.000
40.010	Classification	Premeable Paving	80	0.014	0.011	0.011
	Classification	Premeable Paving	80	0.004	0.003	0.014
	Classification	Premeable Paving	80	0.004	0.003	0.017
46.000	Classification	Premeable Paving	80	0.002	0.001	0.001
46.001	-	-	100	0.000	0.000	0.000
46.002	-	-	100	0.000	0.000	0.000
40.011	Classification	Premeable Paving	80	0.002	0.001	0.001
	Classification	Grass	30	0.004	0.001	0.003
40.012	-	-	100	0.000	0.000	0.000
40.013	-	-	100	0.000	0.000	0.000
40.014	Classification	Default	100	0.032	0.032	0.032
47.000	Classification	Premeable Paving	80	0.010	0.008	0.008
48.000	-	-	100	0.000	0.000	0.000
49.000	-	-	100	0.000	0.000	0.000
49.001	-	-	100	0.000	0.000	0.000
49.002	-	-	100	0.000	0.000	0.000
49.003	Classification	Premeable Paving	80	0.002	0.001	0.001
50.000	-	-	100	0.000	0.000	0.000
51.000	-	-	100	0.000	0.000	0.000
51.001	Classification	Flat Roof	100	0.006	0.006	0.006
51.002	-	-	100	0.000	0.000	0.000
49.004	Classification	Premeable Paving	80	0.001	0.001	0.001
47.001	-	-	100	0.000	0.000	0.000
47.002	-	-	100	0.000	0.000	0.000
47.003	-	-	100	0.000	0.000	0.000
47.004	Classification	Grass	30	0.002	0.000	0.000
47.005	Classification	Grass	30	0.003	0.001	0.001
52.000	-	-	100	0.000	0.000	0.000
53.000	-	-	100	0.000	0.000	0.000
53.001	-	-	100	0.000	0.000	0.000
53.002	-	-	100	0.000	0.000	0.000

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
52.001	Classification	Premeable Paving	80	0.007	0.006	0.006
52.002	-	-	100	0.000	0.000	0.000
52.003	-	-	100	0.000	0.000	0.000
47.006	Classification	Grass	30	0.001	0.000	0.000
47.007	Classification	Grass	30	0.003	0.001	0.001
47.008	Classification	Grass	30	0.001	0.000	0.000
54.000	Classification	Flat Roof	100	0.014	0.014	0.014
54.001	Classification	Premeable Paving	80	0.004	0.004	0.004
55.000	-	-	100	0.000	0.000	0.000
55.001	-	-	100	0.000	0.000	0.000
55.002	-	-	100	0.000	0.000	0.000
55.003	Classification	Premeable Paving	80	0.004	0.003	0.003
56.000	-	-	100	0.000	0.000	0.000
54.002	-	-	100	0.000	0.000	0.000
54.003	-	-	100	0.000	0.000	0.000
47.009	Classification	Grass	30	0.002	0.001	0.001
47.010	Classification	Grass	30	0.001	0.000	0.000
47.011	Classification	Grass	30	0.002	0.001	0.001
57.000	-	-	100	0.000	0.000	0.000
57.001	Classification	Flat Roof	100	0.005	0.005	0.005
57.002	-	-	100	0.000	0.000	0.000
57.003	Classification	Premeable Paving	80	0.004	0.003	0.003
58.000	-	-	100	0.000	0.000	0.000
57.004	Classification	Premeable Paving	80	0.003	0.003	0.003
57.005	-	-	100	0.000	0.000	0.000
57.006	-	-	100	0.000	0.000	0.000
47.012	Classification	Grass	30	0.002	0.000	0.000
47.013	Classification	Grass	30	0.002	0.001	0.001
47.014	Classification	Grass	30	0.001	0.000	0.000
47.015	Classification	Grass	30	0.002	0.000	0.000
47.016	Classification	Grass	30	0.003	0.001	0.001
47.017	Classification	Grass	30	0.002	0.000	0.000
47.018	Classification	Grass	30	0.003	0.001	0.001
47.019	Classification	Grass	30	0.002	0.000	0.000
47.020	Classification	Default	100	0.005	0.005	0.005
47.021	-	-	100	0.000	0.000	0.000
47.022	-	-	100	0.000	0.000	0.000
47.023	-	-	100	0.000	0.000	0.000

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
47.024	Classification	Default	100	0.004	0.004	0.004
1.014	Classification	Grass	30	0.001	0.000	0.000
	Classification	Grass	30	0.001	0.000	0.001
	Classification	Premeable Paving	80	0.012	0.010	0.010
59.000	-	-	100	0.000	0.000	0.000
59.001	Classification	Flat Roof	100	0.004	0.004	0.004
59.002	-	-	100	0.000	0.000	0.000
59.003	Classification	Premeable Paving	80	0.036	0.029	0.029
	Classification	Grass	30	0.001	0.000	0.029
60.000	-	-	100	0.000	0.000	0.000
60.001	Classification	Flat Roof	100	0.006	0.006	0.006
60.002	-	-	100	0.000	0.000	0.000
59.004	Classification	Grass	30	0.002	0.000	0.000
	Classification	Grass	30	0.001	0.000	0.001
	Classification	Grass	30	0.001	0.000	0.001
59.005	Classification	Premeable Paving	80	0.007	0.006	0.006
	Classification	Flat Roof	100	0.009	0.009	0.015
1.015	Classification	Grass	30	0.002	0.000	0.000
	Classification	Grass	30	0.002	0.000	0.001
				Total	Total	Total
				0.743	0.597	0.597

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.015	EX SEWER	80.410	79.059	78.440	1200	0

Online Controls for Storm

Orifice Manhole: FC1, DS/PN: S1.004, Volume (m³): 0.6

Diameter (m) 0.060 Discharge Coefficient 0.600 Invert Level (m) 84.400

Orifice Manhole: FC2, DS/PN: S7.003, Volume (m³): 4.4

Diameter (m) 0.060 Discharge Coefficient 0.600 Invert Level (m) 84.872

Orifice Manhole: FC3, DS/PN: S2.003, Volume (m³): 0.4

Diameter (m) 0.060 Discharge Coefficient 0.600 Invert Level (m) 84.867

Orifice Manhole: FC4, DS/PN: S2.007, Volume (m³): 1.0

Diameter (m) 0.060 Discharge Coefficient 0.600 Invert Level (m) 84.863

Orifice Manhole: FC5, DS/PN: S2.009, Volume (m³): 0.5

Diameter (m) 0.060 Discharge Coefficient 0.600 Invert Level (m) 84.861

Orifice Manhole: FC6, DS/PN: S26.002, Volume (m³): 0.5

Diameter (m) 0.060 Discharge Coefficient 0.600 Invert Level (m) 84.859

Orifice Manhole: FC7, DS/PN: S2.013, Volume (m³): 1.0

Diameter (m) 0.060 Discharge Coefficient 0.600 Invert Level (m) 84.856

Orifice Manhole: FC8, DS/PN: S30.005, Volume (m³): 1.0

Diameter (m) 0.060 Discharge Coefficient 0.600 Invert Level (m) 84.856

Orifice Manhole: FC9, DS/PN: S2.017, Volume (m^3): 0.7

Diameter (m) 0.060 Discharge Coefficient 0.600 Invert Level (m) 84.852

Orifice Manhole: FC10, DS/PN: S1.006, Volume (m^3): 1.5

Diameter (m) 0.044 Discharge Coefficient 0.600 Invert Level (m) 84.362

Orifice Manhole: FC11, DS/PN: S1.008, Volume (m^3): 0.8

Diameter (m) 0.044 Discharge Coefficient 0.600 Invert Level (m) 84.325

Orifice Manhole: FC12, DS/PN: S36.002, Volume (m^3): 0.4

Diameter (m) 0.036 Discharge Coefficient 0.600 Invert Level (m) 83.249

Orifice Manhole: FC13, DS/PN: S1.010, Volume (m^3): 0.8

Diameter (m) 0.044 Discharge Coefficient 0.600 Invert Level (m) 81.800

Orifice Manhole: FC14, DS/PN: S38.002, Volume (m^3): 11.2

Diameter (m) 0.060 Discharge Coefficient 0.600 Invert Level (m) 81.810

Orifice Manhole: FC15, DS/PN: S1.012, Volume (m^3): 1.9

Diameter (m) 0.044 Discharge Coefficient 0.600 Invert Level (m) 80.300

Orifice Manhole: FC16, DS/PN: S40.004, Volume (m^3): 1.4

Diameter (m) 0.058 Discharge Coefficient 0.600 Invert Level (m) 88.349

Orifice Manhole: FC17, DS/PN: S44.001, Volume (m^3): 0.4

Diameter (m) 0.060 Discharge Coefficient 0.600 Invert Level (m) 88.351

Orifice Manhole: FC18, DS/PN: S45.001, Volume (m³): 0.2

Diameter (m) 0.058 Discharge Coefficient 0.600 Invert Level (m) 88.351

Orifice Manhole: FC19, DS/PN: S46.001, Volume (m³): 0.4

Diameter (m) 0.058 Discharge Coefficient 0.600 Invert Level (m) 88.353

Orifice Manhole: FC20, DS/PN: S40.012, Volume (m³): 0.3

Diameter (m) 0.045 Discharge Coefficient 0.600 Invert Level (m) 83.181

Orifice Manhole: FC21, DS/PN: S47.001, Volume (m³): 2.2

Diameter (m) 0.058 Discharge Coefficient 0.600 Invert Level (m) 83.150

Orifice Manhole: FC22, DS/PN: S52.002, Volume (m³): 0.4

Diameter (m) 0.060 Discharge Coefficient 0.600 Invert Level (m) 84.852

Orifice Manhole: FC23, DS/PN: S54.002, Volume (m³): 1.3

Diameter (m) 0.060 Discharge Coefficient 0.600 Invert Level (m) 84.853

Orifice Manhole: FC24, DS/PN: S57.005, Volume (m³): 0.3

Diameter (m) 0.060 Discharge Coefficient 0.600 Invert Level (m) 84.852

Orifice Manhole: FC25, DS/PN: S47.024, Volume (m³): 1.0

Diameter (m) 0.043 Discharge Coefficient 0.600 Invert Level (m) 79.400

Orifice Manhole: FC26, DS/PN: S59.004, Volume (m³): 3.2

Diameter (m) 0.075 Discharge Coefficient 0.600 Invert Level (m) 79.710

Hydro-Brake® Optimum Manhole: HB, DS/PN: S1.015, Volume (m^3): 7.1

Unit Reference	MD-SHE-0097-4100-0900-4100	Sump Available	Yes
Design Head (m)	0.900	Diameter (mm)	97
Design Flow (l/s)	4.1	Invert Level (m)	79.150
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	150
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	4.1	Kick-Flo®	0.578	3.3
Flush-Flo™	0.265	4.1	Mean Flow over Head Range	-	3.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.2	0.600	3.4	1.600	5.4	2.600	6.7	5.000	9.2	7.500	11.1
0.200	4.0	0.800	3.9	1.800	5.7	3.000	7.2	5.500	9.6	8.000	11.4
0.300	4.1	1.000	4.3	2.000	5.9	3.500	7.7	6.000	10.0	8.500	11.8
0.400	4.0	1.200	4.7	2.200	6.2	4.000	8.2	6.500	10.4	9.000	12.1
0.500	3.8	1.400	5.0	2.400	6.5	4.500	8.7	7.000	10.7	9.500	12.4

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

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 57
Number of Online Controls 27 Number of Storage Structures 27 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.000 Cv (Summer) 1.000
Region Scotland and Ireland Ratio R 0.275 Cv (Winter) 1.000

Margin for Flood Risk Warning (mm) 150.0 DVD Status ON
Analysis Timestep 2.5 Second Increment (Extended) Inertia Status ON
DTS Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 100
Climate Change (%) 10

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Infil. Vol (m³)	Maximum Vol (m³)	Discharge Vol (m³)	Pipe Flow (l/s)	Status
S1.000	BR1	15 minute 100 year Summer I+10%	85.350	84.930	-0.225	0.000	0.03		0.070	1.772	2.1	OK*
S1.001	BR1	15 minute 100 year Summer I+10%	85.350	84.929	-0.225	0.000	0.07		0.095	2.756	4.4	OK*
S1.002	BR1	15 minute 100 year Summer I+10%	85.300	84.924	-0.229	0.000	0.12		0.115	3.902	7.2	OK*
S1.003	AJ1	360 minute 100 year Summer I+10%	85.350	84.876	-0.276	0.000	0.02	0.000	7.290	11.659	0.8	OK
S1.004	FC1	240 minute 100 year Summer I+10%	85.350	84.871	0.321	0.000	0.07		0.139	9.430	0.8	SURCHARGED
S1.005	FD1	240 minute 100 year Summer I+10%	85.350	84.855	0.160	0.000	0.03		0.134	13.278	1.4	SURCHARGED
S2.000	BR2	7200 minute 100 year Summer I+10%	85.350	85.170	0.000	0.000	0.00		0.401	5.144	0.0	SURCHARGED*
S3.000	BR2	7200 minute 100 year Summer I+10%	85.350	85.170	0.000	0.000	0.00		0.401	2.958	0.0	SURCHARGED*
S2.001	AJ2	8640 minute 100 year Summer I+10%	85.350	85.279	0.110	0.000	0.00		0.213	8.489	0.1	FLOOD RISK
S4.000	BR3	7200 minute 100 year Summer I+10%	85.350	85.172	0.000	0.000	0.00		0.399	4.500	0.0	SURCHARGED*
S4.001	BR3	7200 minute 100 year Summer I+10%	85.350	85.171	0.000	0.000	0.00		0.526	12.109	0.1	SURCHARGED*
S4.002	AJ3	8640 minute 100 year Summer I+10%	85.350	85.279	0.109	0.000	0.00		0.421	12.656	0.1	FLOOD RISK

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

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Infil. Vol (m³)	Maximum Vol (m³)	Discharge Vol (m³)	Pipe Flow (l/s)	Status
S5.000	BR4	7200 minute 100 year Summer I+10%	85.350	85.171	0.000	0.000	0.00		0.400	3.639	0.0	SURCHARGED*
S6.000	BR4	7200 minute 100 year Summer I+10%	85.350	85.171	0.000	0.000	0.00		0.400	4.499	0.0	SURCHARGED*
S5.001	AJ4	8640 minute 100 year Summer I+10%	85.350	85.279	0.109	0.000	0.00		0.280	8.505	0.1	FLOOD RISK
S7.000	GR1.1	30 minute 100 year Winter I+10%	119.300	119.200	0.000	0.000	1.00		0.107	5.288	3.9	FLOOD RISK*
S7.001	DP1	15 minute 100 year Summer I+10%	119.300	88.455	-0.052	0.000	0.36		0.002	3.741	3.9	OK
S7.002	IC1	15 minute 100 year Summer I+10%	88.850	88.452	-0.198	0.000	0.24		0.105	4.933	6.6	OK*
S8.000	BR5	30 minute 100 year Summer I+10%	88.850	88.540	-0.113	0.000	0.17		0.182	11.688	10.2	OK*
S8.001	BR5	30 minute 100 year Summer I+10%	88.850	88.539	-0.113	0.000	0.34		0.305	12.983	11.9	OK*
S8.002	BR5	30 minute 100 year Summer I+10%	88.850	88.530	-0.121	0.000	0.66		0.547	15.490	15.2	OK*
S9.000	GR1.2	30 minute 100 year Winter I+10%	119.300	119.200	0.000	0.000	1.00		0.098	5.288	3.9	FLOOD RISK*
S9.001	DP2	30 minute 100 year Summer I+10%	119.300	88.561	0.049	0.000	0.60		0.003	6.867	6.5	SURCHARGED
S9.002	IC2	30 minute 100 year Summer I+10%	88.850	88.557	-0.097	0.000	0.13		0.069	6.867	6.4	OK
S9.003	BR5	30 minute 100 year Summer I+10%	88.850	88.555	-0.098	0.000	0.34		0.306	8.289	8.2	OK*
S10.000	GR2.1	30 minute 100 year Summer I+10%	116.300	116.195	-0.005	0.000	1.00		0.090	4.870	3.9	FLOOD RISK*
S10.001	DP3	30 minute 100 year Summer I+10%	116.300	88.558	0.040	0.000	0.58		0.003	6.357	6.3	SURCHARGED
S10.002	IC3	30 minute 100 year Summer I+10%	88.850	88.552	-0.103	0.000	0.13		0.083	6.357	6.2	OK
S10.003	BR5	30 minute 100 year Summer I+10%	88.850	88.550	-0.104	0.000	0.20		0.332	7.109	6.8	OK*
S9.004	BR5	30 minute 100 year Summer I+10%	88.850	88.546	-0.106	0.000	0.31		1.257	16.048	15.1	OK*
S9.005	BR5	30 minute 100 year Summer I+10%	88.850	88.539	-0.112	0.000	0.71		0.466	18.134	17.4	OK*
S7.003	FC2	10080 minute 100 year Summer I+10%	88.850	85.298	0.126	0.000	0.02	0.000	109.470	174.316	1.1	SURCHARGED
S7.004	DP4	10080 minute 100 year Summer I+10%	85.350	85.279	0.110	0.000	0.02		0.037	174.509	1.1	FLOOD RISK
S7.005	IC4	8640 minute 100 year Summer I+10%	85.350	85.279	0.111	0.000	0.02		0.174	166.010	1.2	FLOOD RISK
S4.003	BR6	7200 minute 100 year Summer I+10%	85.350	85.169	0.000	0.000	0.06		1.680	176.726	1.6	SURCHARGED*
S11.000	BR6	7200 minute 100 year Summer I+10%	85.350	85.169	0.000	0.000	0.00		0.402	9.117	0.1	SURCHARGED*
S2.002	BR6	7200 minute 100 year Summer I+10%	85.350	85.168	0.000	0.000	0.03		1.936	201.884	1.8	SURCHARGED*
S2.003	FC3	8640 minute 100 year Summer I+10%	85.350	85.279	0.112	0.000	0.01	0.000	89.952	113.075	0.6	FLOOD RISK
S2.004	BR7	7200 minute 100 year Summer I+10%	85.350	85.166	0.000	0.000	0.03		0.515	112.763	0.6	SURCHARGED*
S12.000	BR8	7200 minute 100 year Summer I+10%	85.350	85.171	0.000	0.000	0.00		0.385	2.658	0.0	SURCHARGED*
S12.001	BR8	7200 minute 100 year Summer I+10%	85.350	85.170	0.000	0.000	0.00		0.556	15.207	0.1	SURCHARGED*
S13.000	BR8	7200 minute 100 year Summer I+10%	85.350	85.171	0.000	0.000	0.00		0.385	1.426	0.0	SURCHARGED*
S13.001	BR8	7200 minute 100 year Summer I+10%	85.350	85.170	0.000	0.000	0.00		0.532	12.754	0.1	SURCHARGED*
S12.002	AJ6	8640 minute 100 year Summer I+10%	85.350	85.262	0.093	0.000	0.00		0.793	29.312	0.2	FLOOD RISK
S12.003	BR9	7200 minute 100 year Summer I+10%	85.350	85.168	0.000	0.000	0.01		0.619	31.843	0.3	SURCHARGED*
S14.000	BR10	7200 minute 100 year Summer I+10%	85.350	85.173	0.000	0.000	0.00		0.383	11.630	0.1	SURCHARGED*
S14.001	BR10	7200 minute 100 year Summer I+10%	85.350	85.172	0.000	0.000	0.00		1.141	17.499	0.1	SURCHARGED*
S14.002	BR10	7200 minute 100 year Summer I+10%	85.350	85.171	0.000	0.000	0.00		1.014	23.542	0.2	SURCHARGED*

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

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Infil. Vol (m^3)	Maximum Vol (m^3)	Discharge Vol (m^3)	Pipe Flow (l/s)	Status
S14.003	AJ7	8640 minute 100 year Summer I+10%	85.350	85.262	0.092	0.000	0.00		0.168	24.824	0.2	FLOOD RISK
S14.004	BR9	7200 minute 100 year Summer I+10%	85.350	85.169	0.000	0.000	0.00		0.627	30.924	0.3	SURCHARGED*
S14.005	BR9	7200 minute 100 year Summer I+10%	85.350	85.168	0.000	0.000	0.01		0.913	30.673	0.2	SURCHARGED*
S12.004	BR9	7200 minute 100 year Summer I+10%	85.350	85.167	0.000	0.000	0.01		1.683	65.491	0.5	SURCHARGED*
S15.000	BR9	7200 minute 100 year Summer I+10%	85.350	85.167	0.000	0.000	0.00		0.390	9.124	0.1	SURCHARGED*
S12.005	AJ8	8640 minute 100 year Summer I+10%	85.350	85.262	0.096	0.000	0.01		0.385	78.775	0.5	FLOOD RISK
S2.005	BR7	7200 minute 100 year Summer I+10%	85.350	85.165	0.000	0.000	0.01		1.842	192.734	0.8	SURCHARGED*
S2.006	BR7	7200 minute 100 year Summer I+10%	85.350	85.164	0.000	0.000	0.01		0.697	197.812	0.8	SURCHARGED*
S16.000	BR11	7200 minute 100 year Summer I+10%	85.350	85.168	0.000	0.000	0.00		0.388	16.989	0.2	SURCHARGED*
S17.000	GR2.3	30 minute 100 year Summer I+10%	116.330	116.186	-0.044	0.000	0.61		0.051	2.727	2.4	FLOOD RISK*
S17.001	DP5	8640 minute 100 year Summer I+10%	116.300	85.262	0.237	0.000	0.01		0.007	15.884	0.1	SURCHARGED
S17.002	IC5	8640 minute 100 year Summer I+10%	85.350	85.261	0.092	0.000	0.00		0.118	15.848	0.1	FLOOD RISK
S17.003	BR11	7200 minute 100 year Summer I+10%	85.350	85.168	0.000	0.000	0.00		0.724	28.780	0.3	SURCHARGED*
S16.001	AJ9	8640 minute 100 year Summer I+10%	85.350	85.262	0.095	0.000	0.02		0.960	47.869	0.3	FLOOD RISK
S18.000	GR2.4	30 minute 100 year Summer I+10%	116.330	116.186	-0.044	0.000	0.61		0.051	2.727	2.4	FLOOD RISK*
S18.001	DP6	8640 minute 100 year Summer I+10%	116.330	85.262	0.232	0.000	0.03		0.007	39.712	0.3	SURCHARGED
S18.002	IC6	8640 minute 100 year Summer I+10%	85.350	85.262	0.094	0.000	0.01		0.135	39.665	0.3	FLOOD RISK
S18.003	BR12	7200 minute 100 year Summer I+10%	85.350	85.167	0.000	0.000	0.01		0.518	40.770	0.4	SURCHARGED*
S16.002	AJ10	8640 minute 100 year Summer I+10%	85.350	85.262	0.096	0.000	0.02		1.370	108.661	0.8	FLOOD RISK
S16.003	BR7	7200 minute 100 year Summer I+10%	85.350	85.165	0.000	0.000	0.02		0.686	109.287	1.0	SURCHARGED*
S19.000	GR2.5	30 minute 100 year Summer I+10%	116.330	116.186	-0.044	0.000	0.61		0.051	2.727	2.4	FLOOD RISK*
S19.001	DP7	8640 minute 100 year Summer I+10%	116.300	85.262	0.241	0.000	0.01		0.007	15.884	0.1	SURCHARGED
S19.002	IC7	8640 minute 100 year Summer I+10%	85.350	85.262	0.097	0.000	0.00		0.121	15.846	0.1	FLOOD RISK
S16.004	BR7	7200 minute 100 year Summer I+10%	85.350	85.164	0.000	0.000	0.02		1.631	129.455	1.1	SURCHARGED*
S20.000	BR7	7200 minute 100 year Summer I+10%	85.350	85.164	0.000	0.000	0.00		0.393	18.362	0.2	SURCHARGED*
S2.007	FC4	8640 minute 100 year Summer I+10%	85.350	85.263	0.100	0.000	0.06	0.000	99.867	308.387	1.3	FLOOD RISK
S21.000	GR3.1	30 minute 100 year Summer I+10%	110.300	110.177	-0.023	0.000	0.95		0.072	4.314	3.7	FLOOD RISK*
S21.001	DP8	8640 minute 100 year Summer I+10%	110.300	85.210	0.186	0.000	0.02		0.006	25.124	0.2	SURCHARGED
S21.002	IC8	8640 minute 100 year Summer I+10%	85.350	85.209	0.043	0.000	0.00		0.108	25.096	0.2	FLOOD RISK
S21.003	BR13	8640 minute 100 year Summer I+10%	85.350	85.209	0.044	0.000	0.01		0.165	46.082	0.4	FLOOD RISK
S22.000	BR13	7200 minute 100 year Summer I+10%	85.350	85.167	0.000	0.000	0.00		0.337	13.406	0.1	SURCHARGED*
S22.001	BR13	7200 minute 100 year Summer I+10%	85.350	85.166	0.000	0.000	0.00		0.786	18.731	0.2	SURCHARGED*
S21.004	AJ11	8640 minute 100 year Summer I+10%	85.350	85.210	0.045	0.000	0.01		0.963	65.684	0.5	FLOOD RISK
S23.000	GR3.2	30 minute 100 year Summer I+10%	110.300	110.177	-0.023	0.000	0.95		0.072	4.314	3.7	FLOOD RISK*
S23.001	DP9	8640 minute 100 year Summer I+10%	110.300	85.209	0.185	0.000	0.02		0.006	25.124	0.2	SURCHARGED
S23.002	IC9	8640 minute 100 year Summer I+10%	85.350	85.209	0.042	0.000	0.00		0.108	25.096	0.2	FLOOD RISK

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

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Infil. Vol (m^3)	Maximum Vol (m^3)	Discharge Vol (m^3)	Pipe Flow (l/s)	Status
S23.003	BR14	7200 minute 100 year Summer I+10%	85.350	85.166	0.000	0.000	0.00		0.437	25.790	0.2	SURCHARGED*
S23.004	BR14	7200 minute 100 year Summer I+10%	85.350	85.165	0.000	0.000	0.00		0.671	29.239	0.3	SURCHARGED*
S21.005	BR14	7200 minute 100 year Summer I+10%	85.350	85.164	0.000	0.000	0.02		1.133	98.003	0.9	SURCHARGED*
S21.006	BR14	7200 minute 100 year Summer I+10%	85.350	85.163	0.000	0.000	0.03		1.011	110.324	1.0	SURCHARGED*
S2.008	BR14	7200 minute 100 year Summer I+10%	85.350	85.162	0.000	0.000	0.03		1.899	391.545	1.8	SURCHARGED*
S24.000	BR14	7200 minute 100 year Summer I+10%	85.350	85.162	0.000	0.000	0.00		0.350	12.244	0.2	SURCHARGED*
S2.009	FC5	8640 minute 100 year Summer I+10%	85.350	85.231	0.070	0.000	0.03	0.000	91.675	387.789	1.6	FLOOD RISK
S2.010	BR16	10080 minute 100 year Summer I+10%	85.350	85.116	-0.044	0.000	0.03		0.510	434.400	1.5	OK*
S2.011	BR16	10080 minute 100 year Summer I+10%	85.350	85.116	-0.043	0.000	0.03		0.660	438.354	1.5	OK*
S25.000	BR15	10080 minute 100 year Summer I+10%	85.350	85.115	-0.047	0.000	0.00		0.248	4.990	0.0	OK*
S25.001	BR15	10080 minute 100 year Summer I+10%	85.350	85.115	-0.046	0.000	0.00		0.420	12.285	0.1	OK*
S25.002	BR15	10080 minute 100 year Summer I+10%	85.350	85.115	-0.045	0.000	0.00		0.655	17.215	0.1	OK*
S25.003	BR15	10080 minute 100 year Summer I+10%	85.350	85.115	-0.044	0.000	0.00		0.477	24.004	0.2	OK*
S25.004	AJ12	10080 minute 100 year Summer I+10%	85.350	85.115	-0.043	0.000	0.00		0.103	23.984	0.2	OK
S2.012	BR16	10080 minute 100 year Summer I+10%	85.350	85.115	-0.042	0.000	0.03		1.005	468.582	1.6	OK*
S26.000	BR17	10080 minute 100 year Summer I+10%	85.350	85.159	-0.002	0.000	0.00		0.293	5.385	0.0	OK*
S27.000	GR4.1	30 minute 100 year Summer I+10%	101.300	101.172	-0.028	0.000	0.86		0.067	3.896	3.4	FLOOD RISK*
S27.001	DP12	10080 minute 100 year Summer I+10%	101.300	85.160	0.109	0.000	0.01		0.004	23.601	0.2	SURCHARGED
S27.002	IC12	10080 minute 100 year Summer I+10%	85.350	85.159	-0.024	0.000	0.00		0.116	23.577	0.2	OK
S27.003	BR17	10080 minute 100 year Summer I+10%	85.350	85.159	-0.002	0.000	0.01		0.468	65.548	0.4	OK*
S27.004	BR17	10080 minute 100 year Summer I+10%	85.350	85.159	-0.002	0.000	0.02		0.435	81.699	0.5	OK*
S28.000	GR3.3	30 minute 100 year Summer I+10%	110.300	110.177	-0.023	0.000	0.95		0.072	4.314	3.7	FLOOD RISK*
S28.001	DP10	10080 minute 100 year Summer I+10%	110.300	85.160	0.142	0.000	0.02		0.005	35.878	0.2	SURCHARGED
S28.002	IC10	10080 minute 100 year Summer I+10%	85.350	85.159	-0.002	0.000	0.01		0.095	35.853	0.2	OK
S26.001	BR17	10080 minute 100 year Summer I+10%	85.350	85.159	-0.001	0.000	0.01		2.771	130.105	0.9	OK*
S26.002	FC6	10080 minute 100 year Summer I+10%	85.350	85.159	0.000	0.000	0.02	0.000	71.884	93.180	0.5	OK
S26.003	BR16	10080 minute 100 year Summer I+10%	85.350	85.115	-0.043	0.000	0.02		0.806	109.376	0.5	OK*
S29.000	GR3.4	30 minute 100 year Summer I+10%	110.300	110.177	-0.023	0.000	0.95		0.072	4.314	3.7	FLOOD RISK*
S29.001	DP11	10080 minute 100 year Summer I+10%	110.300	85.115	0.095	0.000	0.02		0.004	26.129	0.2	SURCHARGED
S29.002	IC11	10080 minute 100 year Summer I+10%	85.350	85.115	-0.045	0.000	0.00		0.093	26.104	0.2	OK
S29.003	BR16	10080 minute 100 year Summer I+10%	85.350	85.115	-0.044	0.000	0.00		0.375	44.533	0.3	OK*
S26.004	BR16	10080 minute 100 year Summer I+10%	85.350	85.115	-0.042	0.000	0.01		1.086	162.233	0.7	OK*
S2.013	FC7	10080 minute 100 year Summer I+10%	85.350	85.115	-0.041	0.000	0.06	0.000	138.788	573.929	1.8	OK
S30.000	GR4.2	30 minute 100 year Summer I+10%	101.300	101.172	-0.028	0.000	0.86		0.067	3.896	3.4	FLOOD RISK*
S30.001	DP13	960 minute 100 year Summer I+10%	101.300	85.275	0.183	0.000	0.03		0.007	12.376	0.8	SURCHARGED
S30.002	IC13	960 minute 100 year Summer I+10%	85.350	85.275	0.116	0.000	0.02		0.146	12.345	0.8	FLOOD RISK

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

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Infil. Vol (m^3)	Maximum Vol (m^3)	Discharge Vol (m^3)	Pipe Flow (l/s)	Status
S30.003	BR18	480 minute 100 year Summer I+10%	85.350	85.158	0.000	0.000	0.03		0.574	9.869	1.2	SURCHARGED*
S30.004	BR18	480 minute 100 year Summer I+10%	85.350	85.157	0.000	0.000	0.06		0.974	15.609	1.9	SURCHARGED*
S31.000	BR16	600 minute 100 year Summer I+10%	85.350	85.160	0.000	0.000	0.05		0.388	31.232	3.3	SURCHARGED*
S31.001	BR18	600 minute 100 year Summer I+10%	85.350	85.159	0.000	0.000	0.08		0.520	36.255	3.8	SURCHARGED*
S31.002	BR18	480 minute 100 year Summer I+10%	85.350	85.158	0.000	0.000	0.21		0.915	41.315	5.3	SURCHARGED*
S32.000	BR18	480 minute 100 year Summer I+10%	85.350	85.158	0.000	0.000	0.02		0.356	3.561	0.5	SURCHARGED*
S31.003	BR18	480 minute 100 year Summer I+10%	85.350	85.157	0.000	0.000	0.09		2.441	44.262	5.5	SURCHARGED*
S30.005	FC8	960 minute 100 year Summer I+10%	85.350	85.274	0.118	0.000	0.13	0.000	39.767	56.220	2.7	FLOOD RISK
S2.014	BR19	10080 minute 100 year Summer I+10%	85.350	84.969	-0.186	0.000	0.04		0.577	722.539	2.2	OK*
S33.000	BR19	10080 minute 100 year Summer I+10%	85.350	84.968	-0.187	0.000	0.00		0.108	5.027	0.0	OK*
S2.015	BR19	10080 minute 100 year Summer I+10%	85.350	84.968	-0.186	0.000	0.06		0.273	736.894	2.2	OK*
S2.016	AJ13	10080 minute 100 year Summer I+10%	85.350	84.967	-0.186	0.000	0.07		0.168	736.856	2.2	OK
S2.017	FC9	10080 minute 100 year Summer I+10%	85.350	84.966	-0.036	0.000	0.18	0.000	42.024	732.972	2.0	OK
S2.018	FD2	240 minute 100 year Summer I+10%	85.350	84.854	0.162	0.000	0.01		0.130	12.466	0.7	SURCHARGED
S34.000	BR20	360 minute 100 year Winter I+10%	85.350	84.663	0.000	0.000	0.01		0.447	5.722	0.6	SURCHARGED*
S1.006	FC10	240 minute 100 year Summer I+10%	85.350	84.854	0.342	0.000	0.15	0.000	5.116	28.837	1.7	SURCHARGED
S1.007	FD3	180 minute 100 year Summer I+10%	85.350	84.725	0.076	0.000	0.04		0.129	22.216	1.7	SURCHARGED
S35.000	BR21	360 minute 100 year Winter I+10%	85.350	83.057	0.000	0.000	0.02		1.887	7.398	1.0	SURCHARGED*
S1.008	FC11	180 minute 100 year Summer I+10%	85.350	84.724	0.249	0.000	0.23	0.000	1.543	27.278	2.5	SURCHARGED
S36.000	DP14	240 minute 100 year Summer I+10%	83.700	83.510	0.096	0.000	0.40		0.004	16.445	4.4	SURCHARGED
S36.001	IC14	240 minute 100 year Summer I+10%	83.700	83.509	-0.041	0.000	0.09		0.102	16.439	4.4	OK
S36.002	FC12	240 minute 100 year Summer I+10%	83.700	83.508	-0.041	0.000	0.02	0.000	9.702	14.530	1.3	OK
S36.003	FD4	15 minute 100 year Summer I+10%	83.700	82.852	-0.248	0.000	0.07		0.013	5.528	3.5	OK
S1.009	FD5	240 minute 100 year Summer I+10%	85.350	82.813	-0.243	0.000	0.08		0.097	53.712	4.1	OK
S37.000	BR22	30 minute 100 year Summer I+10%	83.800	82.784	-0.272	0.000	0.02		0.023	1.391	1.2	OK*
S1.010	FC13	240 minute 100 year Summer I+10%	83.800	82.723	0.773	0.000	0.35	0.000	4.824	56.168	3.8	SURCHARGED
S1.011	FD6	240 minute 100 year Summer I+10%	82.260	81.884	0.224	0.000	0.09		0.153	57.586	4.1	SURCHARGED
S38.000	DP15	15 minute 100 year Summer I+10%	82.260	81.891	-0.070	0.000	0.56		0.001	2.352	6.0	OK
S38.001	IC15	120 minute 100 year Summer I+10%	82.260	81.878	-0.899	0.000	0.00		0.031	5.258	2.7	OK
S38.002	FC14	120 minute 100 year Summer I+10%	82.695	81.878	-0.232	0.000	0.02	0.000	2.640	4.838	1.3	OK
S38.003	FD7	240 minute 100 year Summer I+10%	82.260	81.888	0.228	0.000	0.03		0.162	9.149	1.6	SURCHARGED
S39.000	BR23	360 minute 100 year Winter I+10%	82.260	80.600	0.000	0.000	0.01		1.309	3.240	0.5	SURCHARGED*
S1.012	FC15	240 minute 100 year Summer I+10%	82.260	81.896	1.296	0.000	0.10		1.854	69.519	4.9	SURCHARGED
S1.013	MH1	2160 minute 100 year Summer I+10%	82.260	80.576	1.026	0.000	0.31		1.489	309.248	3.4	SURCHARGED
S40.000	BR24	240 minute 100 year Winter I+10%	88.800	88.452	0.000	0.000	0.57		0.114	11.000	1.9	SURCHARGED*
S40.001	BR24	15 minute 100 year Winter I+10%	88.800	88.501	0.000	0.000	0.87		0.217	4.900	5.7	SURCHARGED*

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S41.000	GR2.2	30 minute 100 year Summer I+10%	116.300	116.195	-0.005	0.000	1.00		0.090	4.870	3.9	FLOOD RISK*
S41.001	DP16	30 minute 100 year Summer I+10%	116.300	88.524	0.016	0.000	0.36		0.003	4.870	3.9	SURCHARGED
S41.002	IC16	30 minute 100 year Summer I+10%	88.800	88.521	-0.131	0.000	0.09		0.013	4.868	3.9	OK
S40.002	BR24	30 minute 100 year Summer I+10%	88.800	88.520	-0.131	0.000	0.26		0.479	11.690	10.5	OK*
S40.003	BR24	30 minute 100 year Summer I+10%	88.800	88.514	-0.136	0.000	0.57		0.439	13.709	12.9	OK*
S40.004	FC16	720 minute 100 year Summer I+10%	88.800	88.420	-0.229	0.000	0.02	0.000	27.930	39.300	1.3	OK
S40.005	DP17	1440 minute 100 year Summer I+10%	88.800	83.710	0.202	0.000	0.12		0.006	53.093	1.2	SURCHARGED
S40.006	IC17	1440 minute 100 year Summer I+10%	84.400	83.709	0.059	0.000	0.03		0.108	55.606	1.3	SURCHARGED
S42.000	BR25	30 minute 100 year Summer I+10%	88.800	88.420	-0.282	0.000	0.01		0.013	0.891	0.8	OK*
S42.001	BR25	15 minute 100 year Summer I+10%	88.800	88.397	-0.254	0.000	0.06		0.046	1.739	3.5	OK*
S42.002	DP18	1440 minute 100 year Summer I+10%	88.800	83.708	0.200	0.000	0.04		0.006	8.411	0.4	SURCHARGED
S40.007	JC1	960 minute 100 year Winter I+10%	84.400	83.612	0.000	0.000	0.02		1.126	55.934	1.5	SURCHARGED*
S43.000	BR26	15 minute 100 year Summer I+10%	88.800	88.383	-0.269	0.000	0.01		0.026	0.197	0.3	OK*
S43.001	BR26	15 minute 100 year Summer I+10%	88.800	88.383	-0.268	0.000	0.02		0.033	0.717	1.5	OK*
S43.002	DP19	1440 minute 100 year Summer I+10%	88.800	83.708	0.200	0.000	0.01		0.006	3.444	0.2	SURCHARGED
S40.008	JC2	1440 minute 100 year Summer I+10%	84.400	83.708	-0.152	0.000	0.03		0.816	71.687	1.8	OK*
S44.000	BR27	120 minute 100 year Summer I+10%	88.800	88.430	-0.222	0.000	0.02		0.073	3.257	1.2	OK*
S44.001	FC17	120 minute 100 year Summer I+10%	88.800	88.429	-0.222	0.000	0.03	0.000	1.933	5.349	1.6	OK
S44.002	DP21	1440 minute 100 year Summer I+10%	88.800	83.706	0.198	0.000	0.05		0.006	11.780	0.5	SURCHARGED
S40.009	JC3	1440 minute 100 year Summer I+10%	84.400	83.706	0.055	0.000	0.04		1.392	88.752	2.5	SURCHARGED*
S45.000	BR28	360 minute 100 year Winter I+10%	88.800	0.300	0.000	0.000	0.00		15.410	-4.266	0.0	SURCHARGED*
S45.001	FC18	360 minute 100 year Winter I+10%	88.800	56.651	-32.000	0.000	0.00	0.000	11.196	0.000	0.0	OK
S45.002	DP20	1440 minute 100 year Summer I+10%	88.800	83.705	0.197	0.000	0.00		0.006	0.000	0.0	SURCHARGED
S40.010	JC4	720 minute 100 year Summer I+10%	84.400	83.603	0.000	0.000	0.07		1.348	82.379	4.4	SURCHARGED*
S46.000	BR29	120 minute 100 year Summer I+10%	88.800	88.391	-0.263	0.000	0.01		0.032	1.677	0.6	OK*
S46.001	FC19	120 minute 100 year Summer I+10%	88.800	88.390	-0.263	0.000	0.01	0.000	0.551	1.613	0.5	OK
S46.002	DP21	1440 minute 100 year Summer I+10%	88.800	83.703	0.195	0.000	0.01		0.006	3.580	0.2	SURCHARGED
S40.011	JC5	1440 minute 100 year Winter I+10%	84.400	83.539	0.000	0.000	0.04		1.789	112.173	2.5	SURCHARGED*
S40.012	FC20	1440 minute 100 year Summer I+10%	84.400	83.702	0.296	0.000	0.09	0.000	33.749	96.053	2.4	SURCHARGED
S40.013	MH2	1440 minute 100 year Summer I+10%	84.335	83.375	-0.202	0.000	0.02		0.311	95.774	2.4	OK
S40.014	MH3	2160 minute 100 year Summer I+10%	84.852	80.581	0.176	0.000	0.07		1.371	149.596	3.0	SURCHARGED
S47.000	BR31	180 minute 100 year Summer I+10%	85.350	85.024	-0.132	0.000	0.07		0.163	4.359	1.6	OK*
S48.000	BR31	180 minute 100 year Summer I+10%	85.350	85.024	-0.132	0.000	0.03		0.163	6.911	2.0	OK*
S49.000	GR5.1	120 minute 100 year Winter I+10%	128.300	128.200	0.000	0.000	1.13		0.115	14.112	4.5	FLOOD RISK*
S49.001	DP25	180 minute 100 year Summer I+10%	128.300	85.032	0.026	0.000	0.44		0.003	16.107	4.7	SURCHARGED
S49.002	BR30	180 minute 100 year Summer I+10%	85.350	85.031	-0.119	0.000	0.08		0.190	16.107	4.7	OK*

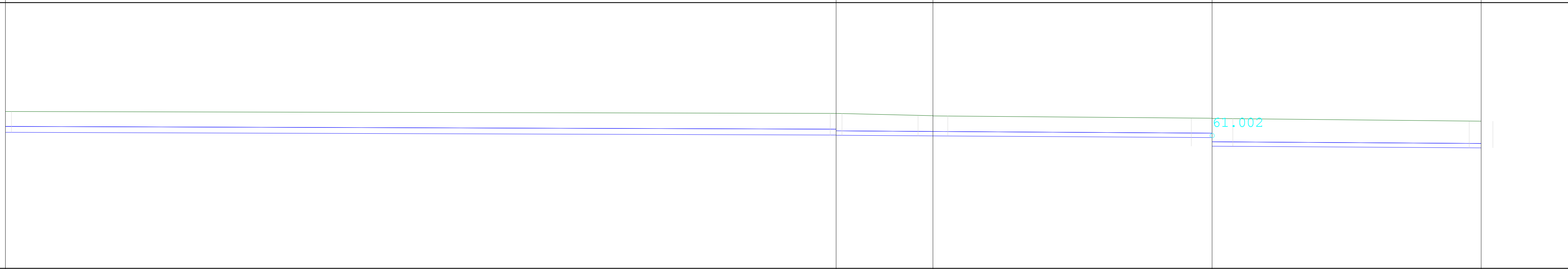
Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Infil. Vol (m³)	Maximum Vol (m³)	Discharge Vol (m³)	Pipe Flow (l/s)	Status
S49.003	BR30	180 minute 100 year Summer I+10%	85.350	85.030	-0.118	0.000	0.22		0.247	16.913	4.9	OK*
S50.000	BR30	180 minute 100 year Summer I+10%	85.350	85.027	-0.127	0.000	0.02		0.168	3.721	1.1	OK*
S51.000	GR5.2	120 minute 100 year Winter I+10%	128.300	128.200	0.000	0.000	1.13		0.115	14.112	4.5	FLOOD RISK*
S51.001	DP23	180 minute 100 year Summer I+10%	128.300	85.029	0.024	0.000	0.53		0.003	19.656	5.8	SURCHARGED
S51.002	BR30	180 minute 100 year Summer I+10%	85.350	85.027	-0.122	0.000	0.09		0.185	19.656	5.7	OK*
S49.004	FC22	180 minute 100 year Summer I+10%	85.350	85.027	-0.121	0.000	0.25		0.986	40.664	11.8	OK
S47.001	FC21	180 minute 100 year Summer I+10%	85.350	85.024	1.574	0.000	0.16	0.000	21.020	49.126	9.5	SURCHARGED
S47.002	DP22	180 minute 100 year Summer I+10%	85.350	82.930	-0.220	0.000	0.16		0.001	49.121	9.5	OK
S47.003	SWALE	180 minute 100 year Summer I+10%	83.150	82.927	-0.221	0.000	0.16		0.078	49.116	9.5	OK*
S47.004	SWALE	180 minute 100 year Summer I+10%	83.500	82.910	-0.221	0.000	0.16		0.112	49.384	9.6	OK*
S47.005	SWALE	180 minute 100 year Summer I+10%	83.150	82.884	-0.217	0.000	0.16		0.153	49.842	9.6	OK*
S52.000	BR32	180 minute 100 year Summer I+10%	85.350	84.970	-0.184	0.000	0.01		0.111	1.578	0.4	OK*
S53.000	GR5.3	120 minute 100 year Winter I+10%	128.300	128.200	0.000	0.000	1.13		0.115	14.112	4.5	FLOOD RISK*
S53.001	DP24	180 minute 100 year Summer I+10%	128.300	84.971	-0.034	0.000	0.44		0.002	16.107	4.7	OK
S53.002	BR32	180 minute 100 year Summer I+10%	85.350	84.970	-0.178	0.000	0.08		0.126	16.085	4.7	OK*
S52.001	BR32	180 minute 100 year Summer I+10%	85.350	84.970	-0.183	0.000	0.10		0.195	20.750	5.9	OK*
S52.002	FC22	180 minute 100 year Summer I+10%	85.350	84.970	-0.182	0.000	0.04	0.000	11.269	18.682	2.2	OK
S52.003	DP25	180 minute 100 year Summer I+10%	85.350	83.196	-0.104	0.000	0.21		0.001	18.679	2.2	OK
S47.006	SWALE	180 minute 100 year Summer I+10%	83.500	82.872	-0.211	0.000	0.19		0.132	68.753	11.8	OK*
S47.007	SWALE	180 minute 100 year Summer I+10%	83.150	82.841	-0.211	0.000	0.19		0.167	69.195	11.8	OK*
S47.008	SWALE	180 minute 100 year Summer I+10%	85.150	82.832	-0.209	0.000	0.19		0.117	69.338	11.8	OK*
S54.000	IC18	240 minute 100 year Summer I+10%	85.350	84.974	-0.031	0.000	0.20		0.032	8.201	2.2	OK
S54.001	BR33	240 minute 100 year Summer I+10%	85.350	84.973	-0.181	0.000	0.06		0.129	10.349	2.7	OK*
S55.000	GR6.1	30 minute 100 year Summer I+10%	116.300	116.200	0.000	0.000	1.00		0.101	5.009	3.9	FLOOD RISK*
S55.001	DP26	240 minute 100 year Summer I+10%	116.300	84.974	-0.182	0.000	0.04		0.113	10.471	2.4	OK*
S55.002	BR33	240 minute 100 year Summer I+10%	85.350	84.974	-0.181	0.000	0.04		0.129	10.461	2.4	OK*
S55.003	BR33	240 minute 100 year Summer I+10%	85.350	84.973	-0.181	0.000	0.05		0.152	12.407	2.8	OK*
S56.000	BR33	240 minute 100 year Summer I+10%	85.350	84.973	-0.181	0.000	0.00		0.114	1.153	0.2	OK*
S54.002	FC23	240 minute 100 year Summer I+10%	85.350	84.973	-0.180	0.000	0.04	0.000	11.907	22.131	2.3	OK
S54.003	DP26	240 minute 100 year Summer I+10%	85.350	83.196	-0.104	0.000	0.21		0.001	22.129	2.3	OK
S47.009	SWALE	180 minute 100 year Summer I+10%	85.350	82.814	-0.203	0.000	0.23		0.163	89.141	14.1	OK*
S47.010	SWALE	180 minute 100 year Summer I+10%	83.150	82.797	-0.203	0.000	0.23		0.142	89.365	14.1	OK*
S47.011	SWALE	180 minute 100 year Summer I+10%	83.150	82.772	-0.200	0.000	0.23		0.178	89.730	14.2	OK*
S57.000	GR6.2	30 minute 100 year Winter I+10%	116.300	116.200	0.000	0.000	1.07		0.113	5.566	4.2	FLOOD RISK*
S57.001	DP26	240 minute 100 year Summer I+10%	116.300	84.949	-0.057	0.000	0.31		0.089	14.373	3.4	OK*
S57.002	BR34	240 minute 100 year Summer I+10%	85.350	84.949	-0.201	0.000	0.05		0.102	14.361	3.3	OK*

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

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Infil. Vol (m³)	Maximum Vol (m³)	Discharge Vol (m³)	Pipe Flow (l/s)	Status
S57.003	BR34	240 minute 100 year Summer I+10%	85.350	84.949	-0.201	0.000	0.06		0.113	16.212	3.8	OK*
S58.000	BR34	240 minute 100 year Summer I+10%	85.350	84.949	-0.205	0.000	0.00		0.090	1.155	0.2	OK*
S57.004	BR34	240 minute 100 year Summer I+10%	85.350	84.949	-0.204	0.000	0.07		0.156	18.879	4.4	OK*
S57.005	FC24	240 minute 100 year Summer I+10%	85.350	84.948	-0.204	0.000	0.03	0.000	9.394	17.242	1.9	OK
S57.006	DP27	240 minute 100 year Summer I+10%	85.350	83.192	-0.108	0.000	0.18		0.001	17.241	1.9	OK
S47.012	SWALE	180 minute 100 year Summer I+10%	83.500	82.759	-0.196	0.000	0.26		0.152	105.075	16.1	OK*
S47.013	SWALE	180 minute 100 year Summer I+10%	83.150	82.741	-0.196	0.000	0.26		0.158	105.363	16.2	OK*
S47.014	SWALE	180 minute 100 year Summer I+10%	83.150	82.736	-0.196	0.000	0.26		0.116	105.439	16.2	OK*
S47.015	SWALE	720 minute 100 year Summer I+10%	83.150	82.720	-0.193	0.000	0.20		0.162	173.836	12.2	OK*
S47.016	SWALE	720 minute 100 year Summer I+10%	83.150	82.717	-0.166	0.000	0.20		0.291	174.688	12.3	OK*
S47.017	SWALE	720 minute 100 year Summer I+10%	83.150	82.716	-0.154	0.000	0.20		0.218	175.083	12.3	OK*
S47.018	SWALE	720 minute 100 year Summer I+10%	83.150	82.713	-0.121	0.000	0.20		0.478	175.813	12.4	OK*
S47.019	SWALE	720 minute 100 year Summer I+10%	83.150	82.712	-0.109	0.000	0.20		0.314	176.211	12.4	OK*
S47.020	SWALE	720 minute 100 year Summer I+10%	83.150	82.709	-0.076	0.000	0.21		0.628	180.358	12.7	OK*
S47.021	SWALE	720 minute 100 year Summer I+10%	83.700	82.708	-0.066	0.000	0.21		0.360	180.358	12.7	OK*
S47.022	SWALE	720 minute 100 year Summer I+10%	82.750	82.706	-0.043	0.000	0.21		0.587	180.357	12.7	FLOOD RISK*
S47.023	SWALE	720 minute 100 year Summer I+10%	82.734	82.704	-0.029	0.000	0.21		0.503	180.357	12.7	FLOOD RISK*
S47.024	FC25	720 minute 100 year Summer I+10%	82.734	82.701	3.001	0.000	0.12	0.000	78.311	136.017	6.4	FLOOD RISK
S1.014	MH4	2160 minute 100 year Summer I+10%	80.550	80.574	0.980	24.019	0.15		30.786	724.816	11.5	FLOOD
S59.000	GR4.3	30 minute 100 year Summer I+10%	101.300	101.172	-0.028	0.000	0.86		0.067	3.896	3.4	FLOOD RISK*
S59.001	DP28	2160 minute 100 year Summer I+10%	101.300	80.579	0.505	0.000	0.06		0.011	20.036	0.6	SURCHARGED
S59.002	IC19	2160 minute 100 year Summer I+10%	80.900	80.579	0.512	0.000	0.04		0.198	20.036	0.6	SURCHARGED
S59.003	IC20	2160 minute 100 year Summer I+10%	80.900	80.579	0.429	0.000	0.03	0.000	4.987	53.991	1.6	SURCHARGED
S60.000	GR4.4	30 minute 100 year Summer I+10%	101.300	101.172	-0.028	0.000	0.86		0.067	3.896	3.4	FLOOD RISK*
S60.001	DP29	2160 minute 100 year Summer I+10%	101.300	80.579	0.505	0.000	0.06		0.011	22.645	0.7	SURCHARGED
S60.002	IC21	2160 minute 100 year Summer I+10%	80.800	80.579	0.511	0.000	0.05		0.195	22.645	0.7	SURCHARGED
S59.004	FC26	2160 minute 100 year Summer I+10%	80.800	80.579	0.569	0.000	0.06	0.000	37.256	75.029	3.4	SURCHARGED
S59.005	MH5	2160 minute 100 year Summer I+10%	80.675	80.569	0.592	0.000	0.05		0.860	91.903	3.6	FLOOD RISK
S1.015	HB	2160 minute 100 year Summer I+10%	80.550	80.569	1.119	19.144	0.07	0.000	157.334	811.951	5.0	FLOOD

O'Connor Sutton Cronin		Page 1
9 Prussia Street Dublin 7 Ireland	Residential Development at Sandyford Central	Micro Drainage
Date 19/07/2019 16:55 File R478-OCSC-MD-C-P05.mdx	Designed by JB Checked by MK	
XP Solutions	Network 2018.1	



Hor Scale 250

Ver Scale 250

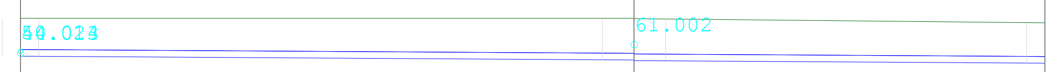
Datum (m) 73.000

MH Name	IC		IC		MH		HB		EX SEWER
PN		S61.000		S61.001		S61.002		S6.015	
Dia (mm)		300		225		225		225	
Slope (1:X)		300.0		150.0		150.0		149.3	
Cover Level (m)	80.900		80.800		80.675		80.550		80.410
Invert Level (m)	79.850		79.710 / 79.697		79.664 / 79.664		79.570 / 79.150		79.059
Length (m)		41.950		4.888		14.097		13.586	

APPENDIX B5.0 - Longsections

O'Connor Sutton Cronin		Page 1
9 Prussia Street Dublin 7 Ireland	Residential Development at Sandyford Central	
Date 19/07/2019 16:53 File R478-OCSC-MD-C-P05.mdx	Designed by JB Checked by MK	
XP Solutions	Network 2018.1	

MH Name	MH		HB		EX SEWER
Hor Scale 250 Ver Scale 250 Datum (m)73.000					
PN		S6.014		S6.015	
Dia (mm)		225		225	
Slope (1:X)		150.0		149.3	
Cover Level (m)	80.550		80.550		80.410
Invert Level (m)	79.294	79.159	79.150	79.059	
Length (m)		20.288		13.586	



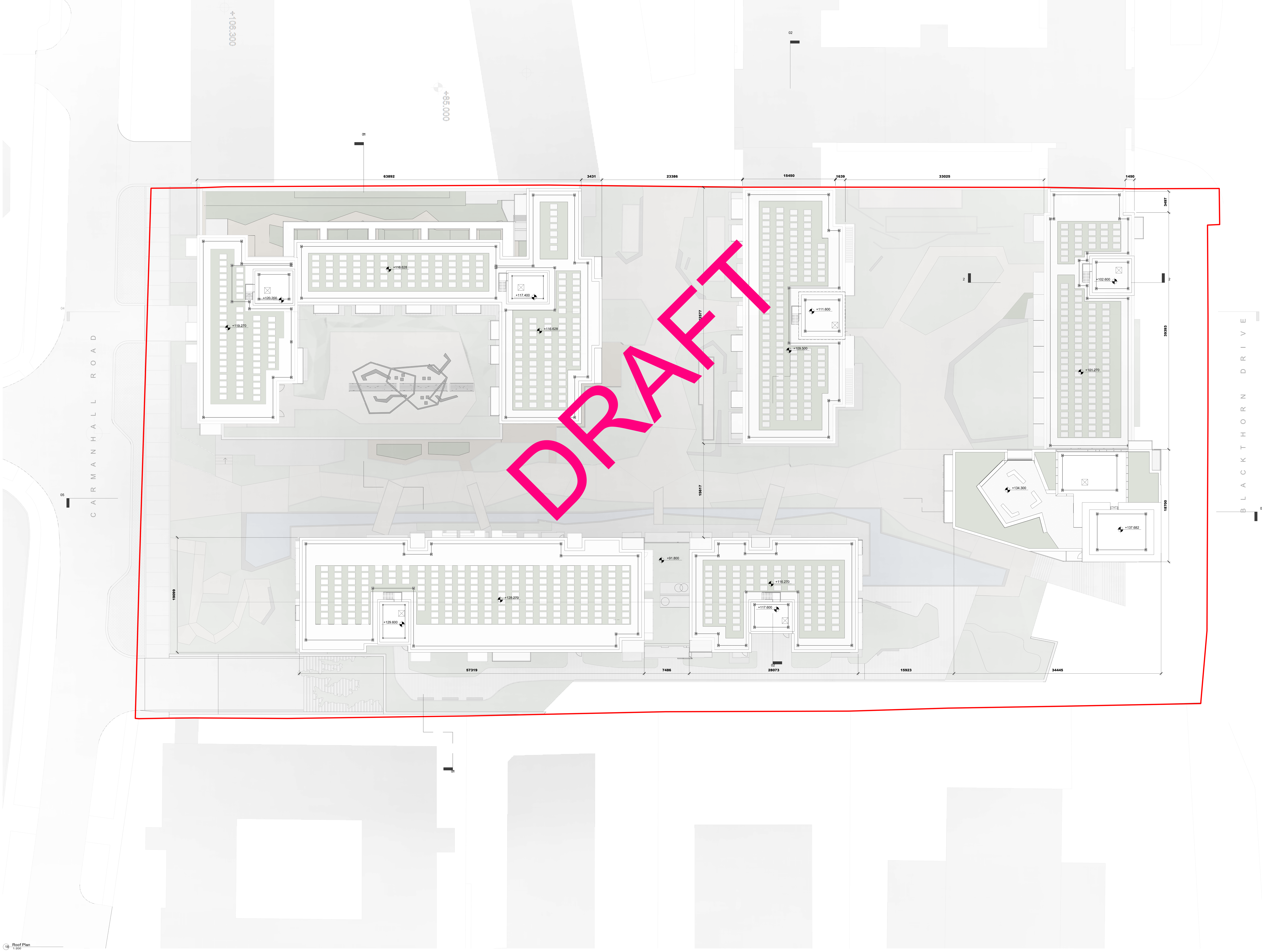
APPENDIX B6.1 - Maintenance Regime

SuDs and Landscaping Maintenance Regime - Summary		
Designer Company: O'Connor Sutton Cronin	Project: Sandyford Central Ref No: SFC	OCSC O'CONNOR | SUTTON | CRONIN Multidisciplinary Consulting Engineers
Designer: JB	Date: July 2019	
Checker: MK	Design Stage: Planning	

No.	Regular Maintenance	Frequency
1.0	LITTER MANAGEMENT	
1.1	Pick up liter in SuDs and Landscaping areas and remove from site	At least once a month or following storm event
2.0	GREEN ROOFS / BLUE ROOFS	
2.1	Inspection of green roof surface	Once a month or following roof works
2.2	Litter, debris and dead vegetation removed during inspections	As required
2.3	Weed and invasive plant control	As required or monthly
2.4	Remove lids and inspect flow control orifice, over flow pipes and leaf filters	Every month
	Remove dead vegetation, plant encroachment, debris and litter from flow control orifice, over flow pipes and leaf filters	Every 6 months
3.0	INLTETS & OUTLETS	
3.1	Inspect monthly, remove any silt and debris from inlet aprons	Once a month
4.0	PERMEABLE PAVING	
4.1	Sweep all paving regularly cleaned of silt and other sediments to preserve their infiltration capacity. Sweep and suction brush permeable paving in Autumn after leaf fall.	Once a year
5.0	GRASS MAINTENANCE	
5.1	Mow all grass verges, paths and amenity at 35-50mm with 75mm max. leaving grass in situ.	As required or monthly
5.2	Mow all dry SuDs basins and margins to flow channels and other SuDs features at 100mm with 150mm max. All cuttings removed to wildlife piles or from site	6 times a year or as required
	Occasional Maintenance	
6.0	Inspection of flow control chambers	Once every 6 months and after significant storm events
6.1	Check all catch pits, proprietary filters and sumps are free from silt and removal as required	Once a year

6.2	Vegetation replacement of basins, green roofs and raingardens	Once a year or following storm event
6.3	Weed and invasive plant control	Once a year during growing season late March - September
7.1	Vegetation to be cut at 100mm. All cuttings removed to wildlife piles or from site.	30% cut each year on 2-3 year rotations
7.2	Vegetation replacement of basins, green roofs and raingardens	Once a year during growing season late March - September
7.3	Fertilise to shallow growing mediums like green roofs	Once a year March / April
7.4	Irrigation during drought conditions particular green roofs. Initially water for 2-3 hours at dawn or dusk, then once every 4-6 days for the duration of the hot weather conditions	During prolonged periods of hot, dry weather, or if the sedum plants are showing signs of distress
8.0	SILT MANAGEMENT	
8.1	Inspect permeable paving, basins, filter drains and raingardens for built up. Generally not applicable as these systems are sealed and sediments are captured upstream of these storage features.	Once a year
9.0	Remove silt with hand tools, stack and dry away from SuDs features to dry and spread on surrounding land with seeding. Avoid damage to topsoil with sediment removal.	As required
	Remedial Work	
10.0	Inspect SuDs systems regularly to check for damage or failure	As required or following storm events
10.1	Repair green roof bare patches	As required during growing season late March – September
10.2	Infiltration surface reconditioning may be required for permeable paving, basins, filter drains and raingardens	As required or every 10 -25 years
10.3	Filter drains may require removal of the gravel infill which can be either cleaned and reused or replacement with new material	Typically Every 10 – 25 Years or as required

APPENDIX B6.2 - Roof Maintenance Access



ALL DIMENSIONS TO BE CHECKED ON SITE
NO DIMENSIONS TO BE SCALED FROM THIS DRAWING
DRAWING IS TO BE READ IN CONJUNCTION WITH RELEVANT CONSULTANTS DRAWINGS

N

NOTE:

REV	DATE	DESCRIPTION	CKH	DRN
A1	18.07.2019	ISSUED FOR ABP PRE APPLICATION	RJ	BM

STATUS CODE DESCRIPTION
ISSUED FOR ABP PRE APPLICATION REQUEST

CLIENT
SANDYFORD GP Ltd.

PROJECT
SANDYFORD CENTRAL

DRAWING
PROPOSED GA - 18 - ROOF PLAN

PROJECT NUMBER
950572

DATE
18/07/2019

SCALE@ A0:
1 : 200

DRAWN/CHECKED:
BM/ RJ

STATUS CODE: A
DRAWING NUMBER: SFC-HJL-00-18-DR-A-1028
REVISION: A1

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APPENDIX C – FOUL WATER CALCULATIONS

FOUL SEWERAGE DESIGN

Design Criteria for Foul - Main

Pipe Sizes IW Manhole Sizes IW

Industrial Flow (l/s/ha)	0.00	Domestic (l/s/ha)	0.00	Maximum Backdrop Height (m)	1.500
Industrial Peak Flow Factor	0.00	Domestic Peak Flow Factor	3.00	Min Design Depth for Optimisation (m)	1.200
Flow Per Person (l/per/day)	148.60	Add Flow / Climate Change (%)	0	Min Vel for Auto Design only (m/s)	0.75
Persons per House	3.00	Minimum Backdrop Height (m)	0.200	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F1.000	12.739	0.159	80.0	0.000	600	0.0	1.500	o	150	Pipe/Conduit	
F1.001	4.080	0.041	100.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.000	79.400	0.000	0.0	600	0.0	78	1.00	0.98	17.3	9.3
F1.001	79.166	0.000	0.0	600	0.0	69	0.90	1.15	45.6	9.3

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F1.002	4.970	0.050	100.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.002	79.125	0.000	0.0	600	0.0	69	0.90	1.15	45.6	9.3

Manhole Schedules for Foul - Main

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
F1	80.900	1.500	Open Manhole	1200 x 1200	F1.000	79.400	150				
F2	80.900	1.734	Open Manhole	1200 x 1200	F1.001	79.166	225	F1.000	79.241	150	
F3	80.900	1.775	Open Manhole	1200 x 1200	F1.002	79.125	225	F1.001	79.125	225	
F	0.000		Open Manhole	0		OUTFALL		F1.002	79.075	225	

OCSC
O'CONNOR | SUTTON | CRONIN
Multidisciplinary
Consulting Engineers

APPENDIX D – CORRESPONDENCES

MEETING MINUTES

DATE:	10th April 2019
VENUE:	Dún Laoghaire–Rathdown County Council (DLRC) Offices
ATTENDANCE	Bernard Egan (DLRC), Amy Lee (Richmond Homes), Anthony Horan (OCSC) & Jonathan Burke (OCSC)
CIRCULATION	All of the Above

OCSC
O'CONNOR | SUTTON | CRONIN
Multidisciplinary Consulting Engineers

ITEM	DISCUSSION	ACTION
1.0	**DRAINAGE**	
1.1	An introduction of the proposed new scheme for the former Tivway site was provided by Amy Lee (AL). Generally the scheme is as per the pervious granted planning permission (ABP Ref. 301428-18) compromising of 459 no. units across six blocks. This application is on the same footprint for 557 no. units.	Note
1.2	OCSC presented an overview of the proposed drainage layout. This included a preliminary SuDs design which is intended to improve on the current permission drainage and includes; - Blue Roofs, - Raingardens, - Attenuation storage on podium using Open Graded Crushed Rock (OGCR), - Swales above filter drains, - Basins, Bernard Egan (BE) requested an explanation on the proposed complex flow controls for the proposed drainage / SuDs design.	Note/ OCSC
1.3	OCSC noted there are some minor differences in the drainage approach for this application. The proposed discharge rate has been increased to the Greenfield Run-Off value to 8.1l/s. The site is largely urbanised and site investigations have classified the soil type (below made ground) as Type 4 in accordance with Table 4.0 of the Flood Studies Report (FSR). BE requested that this is justified and the site investigation information set out clearly in the submission.	OCSC
1.4	OCSC noted that there is potential areas adjacent the roads to the north and south of the site which may be offered up for takin in charge (TIC). These areas where shown on the preliminary drawing presented in the meeting and it was suggested that these public footpath areas drain onto the road. BE that requested an explanation for the drainage proposed TIC areas.	OCSC
1.5	A Maintenance Plan should be provided with the submission for all proposed SuDs features.	OCSC
2.0	**SITE FLOOD RISKS**	
2.1	OCSC noted the intention to provide a revised Site Specific Flood Risk Assessment (SSFRA) with the same approach as the granted application.	
2.2	BE noted that modelling should be completed and developed further due to omissions in the current application and requested the following additional information;	OCSC

- Outline the baseline for flooding on the Rockford Site. The sites are interlinked and this was a recommendation ABP,
- Assess the impacts on the neighbouring site pre & post development,
- Include assessment for the scenario should the neighbouring site not be developed,
- There was an omission on the pervious grant. No levels where provided on the extent of flooding comparison map (IBE1274_003). This is required with next application,
- The RPS flood modelling report noted that the flooding related to the surcharging of the local drainage network and not the overland flow from the culvert. This should be amended in the next application,
- A reference to be made to the Moylans QBar value (2l/s/ha) for the pervious SSFRA and the difference and increase in the proposed Qbar as has been confirmed by Soil type 4 with Site investigation Results.

MEETING MINUTES

DATE:	26th June 2019
VENUE:	Dún Laoghaire–Rathdown County Council (DLRC) Offices
ATTENDANCE	Bernard Egan (DLRC), Johann Cobb (DLRC), Amy Lee (Richmond Homes), Frances Carragher (RPS), Anthony Horan (OCSC) & Jonathan Burke (OCSC).
CIRCULATION	All of the Above

ITEM	DISCUSSION	ACTION
1.0	**INTRODUCTION**	
1.1	A brief introduction of all in attendance was completed.	Note
1.2	Amy Lee (AL) provided a short overview with some background information and the current project programme status since the last meeting with Dún Laoghaire–Rathdown County Council (DLRC) Drainage Department held on 10th April 2019 in DLRCC Offices.	Note
2.0	**SITE FLOOD RISKS**	
2.1	Frances Carragher (FC) presented an overview of the Flood Risks for the site which are covered under separate minutes prepared and issued by RPS.	Note
3.0	**DRAINAGE**	
3.1	Bernard Egan (BE) provided feedback on the preliminary Engineering Services Report (ESR) issued to DLRCC via email on 17th June 2019. The following queries / comments were discussed; • The reference to the source information for the Standard Annual Average Rainfall (SAAR) valve is to be clarified; • BE was in agreement with the proposed SOIL Type 4 for the site based on the site investigation information and in accordance with the Flood Studies Report SOIL Type classification; • BE queried the area values used in the Interception calculation. OCSC confirmed that this is a sample area / calculation example; • OCSC clarified that the reference to overflows within the report relates to high level overflow for proposed flow control devices which will overflow into downstream storage. All flows are restricted from discharging the site outfall at the specified greenfield run-off rate; • OCSC confirmed that all roofs will be Blue Roofs and 60% of roofs will be Extensive Green Roofs (Sedum) in accordance with DLRCC Development Plan; • BE requested a sub catchment drawing showing the total storage is provided with the final submission; • OCSC agreed to check the interception calculation and volumes for the Blue / Green Roof coverage.	Note / OCSC
3.2	Generally, it was confirmed that OCSC's Drainage Strategy, ESR format and data source information (including PIMP's values) will be per the agreed methodology with a recent SHD application submitted to DLRCC. The report and drawings will be developed to reflect this for the final submission.	Note / OCSC
3.3	BE raised a query in relation to the input valves for the UkSuDs storage tool provided in Appendix B of the preliminary ESR. OCSC agreed to review and revert with a technical response.	Note / OCSC

Jonathan Burke

From: Jonathan Burke
Sent: 27 September 2019 11:41
To: Codd Johanne; Danciu Marin; Carroll Elaine B.
Cc: Anthony Horan; Patrick Raggett; Kenneth Beirne - Richmond Homes
Subject: FW: PAC SHD 138 19 - Sandyford Central (Tivway Site) 2019 Carmenhall Road

Johanne,

Following our meeting on Wednesday 25th September, please find below some background information for use of the current rainfall data within Micro Drainage.

Micro Drainage software applies the Modified Rational Method which is a uniform intensity design method. The Modified Rational Method requires an average rate of rainfall for a return period over a number of durations to give a total depth for return periods over a given period of time.

The computer software calculations are based on the M5-60 min and Ratio-R. M5-60 is the rainfall depth (specified in mm) for a 60 minute storm with a 5 year return period and Ratio-R is the ratio of the rainfall depths from the 60 minute storm to the 2-day storm (both have return period of 5 years), i.e. M5-60 / M5 -2 day as per Fig A1 & A.2. Of "Design and Analysis of Urban Storm Drainage" - The Wallingford Procedure, Volume 3 October 1981.

Micro Drainage applies rainfall intensities using the following approach;

- The rainfall depth for M5-60min and the Ratio R is input by the user. (OCSC override the default information with data from Met Eireann);
- The software determines the rainfall depths of the five year period for all the required durations;
- The software extrapolates the 5 year rainfall depths to rainfall depths of the other return periods;
- The software converts the rainfall depths into the point intensities;
- The above is used for design analysis and simulation.

In summary, several equations are applied within Micro Drainage in accordance with the Modified Rational Method that links the rainfall depths of the different return periods for a specific duration to those of the 5 years return period.

Below in figure 1 is the default FSR rainfall data built into Micro Drainage which selected for the site using the map. OCSC do not use the default rainfall data in storm designs.

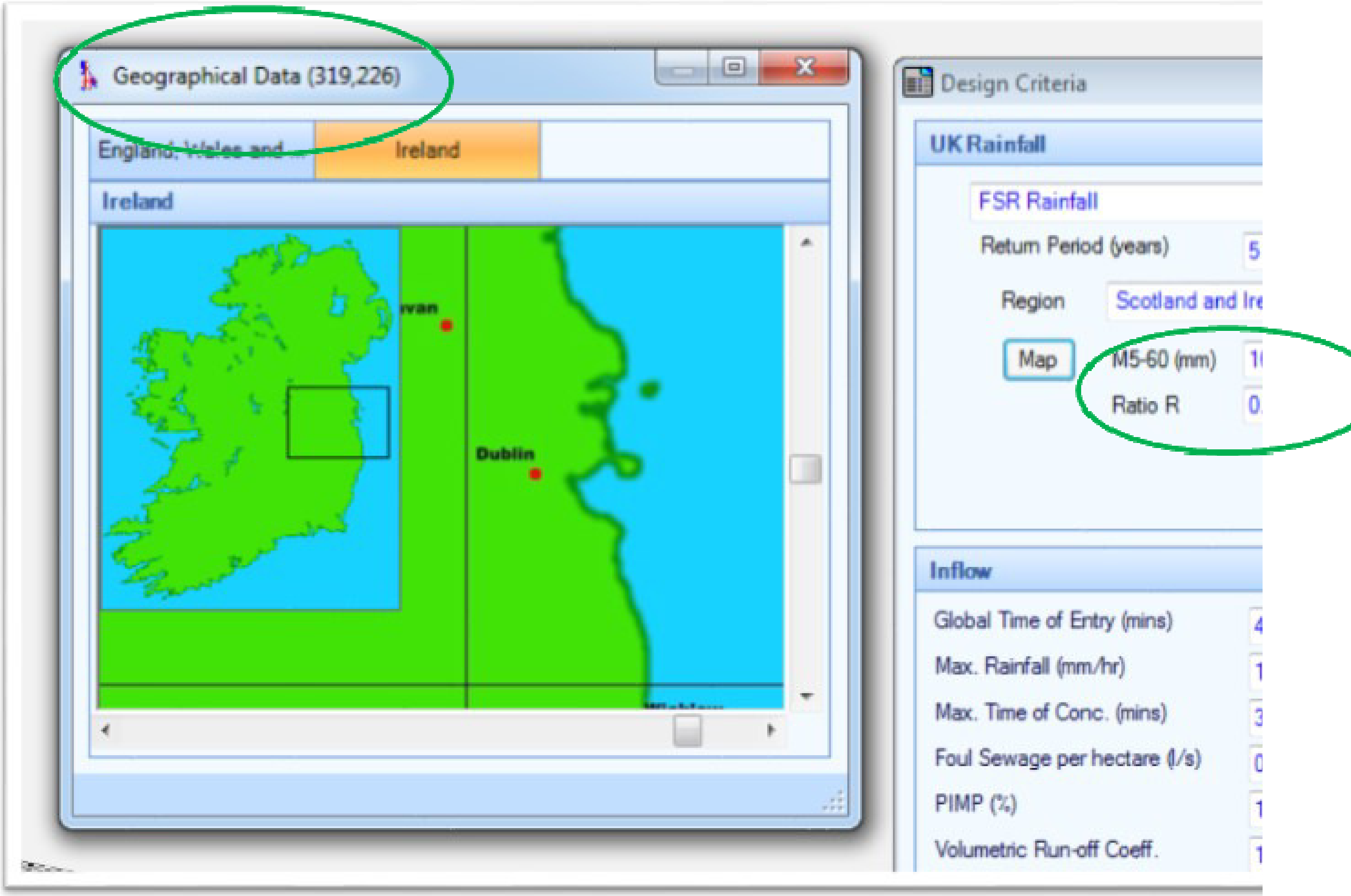

Figure 1 – *Extract of Micro Drainage Map and default rainfall design data.*

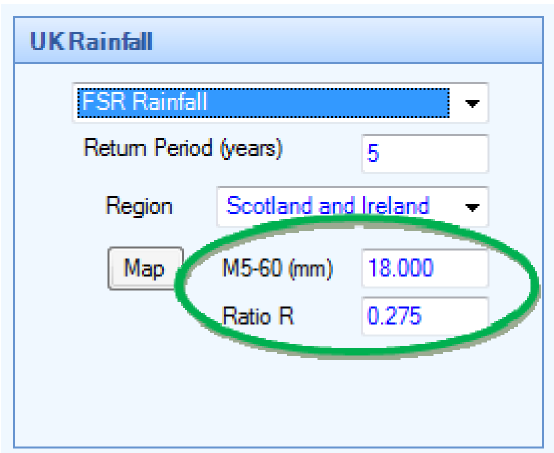

Figure 2 - *Extract of input figures from Micro Drainage for specific site. Not default FSR values.*

As outlined in meeting, OCSC input the M5 current available rainfall data as shown in figure 2, which is sourced from Met Eireann for the site. The values from the Rainfall Return Period table as shown below in figure 3 are derived from a Depth Duration Frequency (DDF) Model from Met Eireann and this is the same as rainfall data used with Flood Studies Update (FSU), and as applied by OCSC within the Micro Drainage software.

Met Eireann
Return Period Rainfall Depths for sliding D
Irish Grid: Easting: 319288, Northing: 22

DURATION	Interval 6months,	1year,	2,	3,	4,	5,	10,	Yea
5 mins	2.5,	3.7,	4.4,	5.4,	6.1,	6.7,	8.5,	10
10 mins	3.5,	5.2,	6.1,	7.6,	8.5,	9.3,	11.9,	14
15 mins	4.1,	6.1,	7.2,	8.9,	10.1,	11.0,	14.0,	17
30 mins	5.5,	8.0,	9.4,	11.5,	12.9,	14.0,	17.8,	22
1 hours	7.2,	10.4,	12.1,	14.8,	16.6,	18.0,	22.6,	27
2 hours	9.5,	13.6,	15.7,	19.0,	21.2,	23.0,	28.7,	35
3 hours	11.2,	15.8,	18.3,	22.1,	24.6,	26.5,	33.0,	40
4 hours	12.6,	17.7,	20.4,	24.5,	27.3,	29.4,	36.4,	44
6 hours	14.8,	20.7,	23.8,	28.4,	31.5,	34.0,	41.8,	50
9 hours	17.4,	24.1,	27.7,	32.9,	36.5,	39.2,	48.1,	58
12 hours	19.6,	26.9,	30.8,	36.6,	40.5,	43.5,	53.1,	63
18 hours	23.0,	31.4,	35.9,	42.4,	46.8,	50.2,	61.1,	73
24 hours	25.8,	35.1,	40.0,	47.1,	51.9,	55.6,	67.4,	80
2 days	32.2,	42.8,	48.2,	56.2,	61.4,	65.4,	78.2,	92
3 days	37.4,	49.0,	54.9,	63.5,	69.1,	73.4,	87.0,	101
4 days	42.0,	54.5,	60.8,	69.9,	75.9,	80.4,	94.7,	110
6 days	50.1,	64.0,	71.0,	81.1,	87.6,	92.6,	108.1,	124
8 days	57.2,	72.4,	80.1,	90.9,	98.0,	103.3,	119.9,	137
10 days	63.8,	80.2,	88.3,	99.9,	107.3,	113.0,	130.5,	149
12 days	69.9,	87.3,	96.0,	108.2,	116.1,	122.0,	140.4,	159
16 days	81.3,	100.6,	110.1,	123.5,	132.1,	138.5,	158.4,	179
20 days	91.9,	112.9,	123.2,	137.6,	146.8,	153.7,	174.9,	197
25 days	104.4,	127.3,	138.4,	154.0,	163.9,	171.3,	194.0,	217

NOTES:
N/A Data not available
These values are derived from a Depth Duration Frequency (DDF) Model
For details refer to:
'Fitzgerald D. L. (2007), Estimates of Point Rainfall Frequencies, Te
Available for download at www.met.ie/climate/dataproducts/Estimation

Figure 3 - Extract of input figures from Met Eireann

Further to this and following discussions with Oliver Nicholson of the OPW, it has been confirmed that the FSU applied the same rainfall profile as the FSR & FEH for flood frequency analysis.

Therefore, based on the above, we confirm that OCSC applies the most up to date rainfall data, for each development site, which is similar to that from the FSU. While Micro Drainage applies the inputted data to the correct profile while analysing and simulating the design network against the required range of rainfall events.

The above process is in accordance with the GDSDS and other best practise requirements.

We trust you find this in order.

Regards,
Jonathan Burke

From: Jonathan Burke
Sent: 24 September 2019 14:41
To: Codd Johanne <jcodd@DLRCOCO.IE>; Danciu Marin <mdanciu@DLRCOCO.IE>; Carroll Elaine B. <ebcarroll@DLRCOCO.IE>
Cc: Anthony Horan <anthony.horan@ocsc.ie>; Patrick Raggett <patrick.raggett@ocsc.ie>; Amy Lee - Richmond Homes <ALee@richmondhomes.ie>; Kenneth Beirne - Richmond Homes <KBeirne@richmondhomes.ie>
Subject: RE: PAC SHD 138 19 - Sandyford Central (Tivway Site) 2019 Carmenhall Road

Hi Johanne,

Please find attached revised surface water layout (Drg. no. 0500), details (Drg. no. 0510) and micro drainage output calculations (R478-OCSC-MD-C-P05-SW.pdf) and model schematic in dxf. (R478-OCSC-MD-C-P05-SW.dxf) for your information before tomorrow's meeting. The Micro drainage outputs included the catchment areas and time area diagrams for the green roofs and landscaping on podium.

With the omission of the blue roofs, we have provided 150Dp. cellular storage on in areas on podium. We note that some areas of the model are to be tweaked due to unstable analysis before final submission. We hope to discuss this further.

Also attached is a draft response to DLRCC opinion for review tomorrow.

Regards,
Jonathan Burke

Please consider the environment before printing this email.

From: Codd Johanne [mailto:jcodd@DLRCOCO.IE]
Sent: 11 September 2019 14:26
To: Jonathan Burke <jonathan.burke@ocsc.ie>; Danciu Marin <mdanciu@DLRCOCO.IE>; Carroll Elaine B. <ebcarroll@DLRCOCO.IE>
Cc: Anthony Horan <anthony.horan@ocsc.ie>; Patrick Raggett <patrick.raggett@ocsc.ie>
Subject: RE: PAC SHD 138 19 - Sandyford Central (Tivway Site) 2019 Carmenhall Road

Jonathan,

Following on from todays meeting and discussion with Anthony, please submit the revised data and once reviewed I can arrange a meeting to discuss any outstanding items.

If you could highlight, in particular, the use of the localised rainfall data within Microdrainage that would be great. And as noted with Anthony, as long as you meet the green roof requirements, and provide the required volume of storage, the revisions to the blue roof should be acceptable.

Regards,

Johanne Codd | Executive Engineer
Drainage Planning, Municipal Services
Dún Laoghaire-Rathdown County Council, County Hall, Marine Road, Dún Laoghaire, Co. Dublin, Ireland.

From: Jonathan Burke [mailto:jonathan.burke@ocsc.ie]
Sent: 10 September 2019 11:22
To: Codd Johanne <jcodd@DLRCOCO.IE>; Danciu Marin <mdanciu@DLRCOCO.IE>; Carroll Elaine B. <ebcarroll@DLRCOCO.IE>
Cc: Anthony Horan <anthony.horan@ocsc.ie>; Patrick Raggett <patrick.raggett@ocsc.ie>
Subject: FW: PAC SHD 138 19 - Sandyford Central (Tivway Site) 2019 Carmenhall Road

Hi Johanne,

Would you please facilitate a meeting as request below in Bernard's absence?

Regards,
Jonathan Burke

Please consider the environment before printing this email.

I will be out of the office until Monday 30th September 2019.

For Drainage Planning queries please contact one of my colleagues, Marin Danciu (mdanciu@dlrcoco.ie), Elaine Carroll (ebcarroll@dlrcoco.ie) or Johanne Codd (jcodd@dlrcoco.ie).

From: Jonathan Burke
Sent: 09 September 2019 17:19
To: 'Egan Bernard' <began@DLRCOCO.IE>
Cc: Anthony Horan <anthony.horan@ocsc.ie>; Patrick Raggett <patrick.raggett@ocsc.ie>
Subject: FW: PAC SHD 138 19 - Sandyford Central (Tivway Site) 2019 Carmenhall Road

Bernard,

In relation to the Sandyford Central Scheme I would like to inform you of our progress. There are three key elements that I would like to inform you of. They are:

1. OCSC's update on DLRCC's query No. 1 on your opinion report regarding "latest rainfall data" and the FSU vs FSR question;
2. Update to the roof strategy;
3. Update on the remainder of your queries.

1. FSU vs FSR

Following on from your correspondence on the 12th July 2019 and 8th August 2019 and item 1 of DLRCC Drainage opinion report regarding FSU:

a) OCSC met with Oliver Nicholson, Civil Engineer in the Hydrology & Coastal Section of OPW on Wednesday 28th August 2019 to discuss the use of FSU rainfall data in urban drainage designs;

b) Oliver Nicholson provided an overview and history on the development of FSU. It was noted that rainfall data used in FSU is Depth Duration Frequency (DDF) from Met Éireann;

c) As standard procedure, OCSC request the current rainfall data from Met Eireann for each site. Met Eireann provide a Rainfall Return Period table, see attached, which used to extract the M5-60 and Ratio R rainfall parameters for each specific site and this is input into MicroDrainage Design software;

d) The values from the Rainfall Return Period table are derived from a Depth Duration Frequency (DDF) Model from Met Éireann and this is the same as rainfall data used with FSU.

We therefore confirm the usage of current available rainfall data in the simulation of design storms and in the hydraulic modelling process of our design.

We trust that Item 1 of DLRCC Drainage opinion report has been addressed and closed out. A commentary on the above will be included within the Engineering Service Report included in the next submission.

2. **Blue Roofs**

Our Client has gone to the market of insurance providers and there is a reticence to provide insurance cover for the buildings at an economically comparable rate to that of traditional flat roofs or green roofs. On the basis of this issue it is the intention to amend our design as follows:

- Replace blue roofs on the building roofs with green roofs;
- Retain the blue roof on podium (our on podium storage is a blue roof, this is an acceptable risk to insurance companies, as the consequence of a leak in the podium is lower than the consequence of a leak in a building roof);
- Re model the system based on the removal of the flow controls at roof level.

3. **DLRCC Comments on Storm Drainage Design**

In relation to the remaining items of DLRCC Drainage opinion report. We have taken note of all comments / request for clarification and will we close out each relevant item in the next drawing issue. We have satisfied ourselves that all of your queries are resolvable for us and in the main are minor. It is our intention to meet you ,on or close to the 23rd of September. Please confirm your availability. At that stage we expect to have a full pack for review with you where we hope to demonstrate closure of the items that you raised as well as walking you through the revised design proposal.

Regards,
Jonathan Burke

Please consider the environment before printing this email.

From: Jonathan Burke
Sent: 08 August 2019 15:47
To: Egan Bernard <began@DLRCOCO.IE>
Cc: Codd Johanne <jcodd@DLRCOCO.IE>; Anthony Horan <anthony.horan@ocsc.ie>; Patrick Raggett <patrick.raggett@ocsc.ie>
Subject: RE: PAC SHD 138 19 - Sandyford Central (Tivway Site) 2019 Carmenhall Road

Hi Bernard,

I called you at the office to discuss.

Regards,
Jonathan Burke

Please consider the environment before printing this email.

From: Egan Bernard [mailto:began@DLRCOCO.IE]
Sent: 08 August 2019 15:14
To: Jonathan Burke <jonathan.burke@ocsc.ie>
Cc: Codd Johanne <jcodd@DLRCOCO.IE>; Anthony Horan <anthony.horan@ocsc.ie>; Patrick Raggett <patrick.raggett@ocsc.ie>
Subject: PAC SHD 138 19 - Sandyford Central (Tivway Site) 2019 Carmenhall Road

Hi Jonathan,

I think it would be better if discussions were to be confined between OCSC and DLRCC. Any such discussions would not preclude either yourselves or ourselves seeking the advice/opinion of the OPW on issues of the appropriate usage of FSU data.

Bernard Egan,
Senior Executive Engineer,

Drainage Planning
Municipal Services Department,
Dun Laoghaire Rathdown County Council,
Marine Road,
Dun Laoghaire.
Main Telephone No. 00 353 1 2054700
Direct Line : 00 353 1 2054815
Fax : 00 353 1 2047939
Email: began@dlrcoco.ie
Web https://clicktime.symantec.com/3MiH2sfJV7cjnmCz8dDrnYH6H2?u=www.dlrcoco.ie

Regards,

From: Jonathan Burke [mailto:jonathan.burke@ocsc.ie]
Sent: 08 August 2019 09:51
To: Egan Bernard <began@DLRCOCO.IE>
Cc: Codd Johanne <jcodd@DLRCOCO.IE>; Anthony Horan <anthony.horan@ocsc.ie>; Patrick Raggett <patrick.raggett@ocsc.ie>
Subject: RE: PAC SHD 138 19 - Sandyford Central (Tivway Site) 2019 Carmenhall Road

Bernard,

Further to the below, we have been in contact with the OPW and propose a meeting between DLRCC , OPW and OCSC to discuss the use of FSU Rainfall data in drainage network design.

We await confirmation from OPW for a date next week and will revert.

Can you confirm your availability also please.

Regards,
Jonathan Burke

From: Egan Bernard [mailto:began@DLRCOCO.IE]
Sent: 12 July 2019 16:11
To: Jonathan Burke <jonathan.burke@ocsc.ie>
Cc: Codd Johanne <jcodd@DLRCOCO.IE>
Subject: PAC SHD 138 19 - Sandyford Central (Tivway Site) 2019 Carmenhall Road

Hi Jonathan,

Thank you for your email and attachments.

From the correspondence between OCSC and HR Wallingford there would not appear to be any obstacle to using the most up to date rainfall data for Ireland.

The default 100yrs 6 hrs. and 12 hrs. figures of 61 mm and 73 mm respectively that are used in the estimation tool would appear to be mid-range values from Figures A3.1 and A3.2 of Report – SC030219. Figures A6.3.3 and A6.3.4 show FEH/FSR conversion factors in the range of approximately 0.9 to 1.2 for those mid-range areas. From a (cursory) retrospective check on SHD applications in the DLRCC area using MET Éireann rainfall data we are getting conversion factors in the range of 0.9 to

1.38. This wider range is reflective of the known localised rainfall patterns across the small County of Dun Laoghaire-Rathdown. Having said that, we have always accepted that the UKSuDS Storage estimation tool is just that i.e. an estimation tool.

You also say that FSU rainfall data is not applied to the design in urban Drainage Design. Again, as above, we cannot see any justification for not using the most up to date rainfall data for Ireland in the design of Urban Drainage Systems, particularly in the calculation of attenuation storage volumes. We will therefore require the usage of available rainfall data (to be used in the simulation of design storms) in the hydraulic modelling process outlined in your email.

Regards,
Bernard Egan,
Senior Executive Engineer,

Drainage Planning
Municipal Services Department,
Dun Laoghaire Rathdown County Council,
Marine Road,
Dun Laoghaire.
Main Telephone No. 00 353 1 2054700
Direct Line : 00 353 1 2054815
Fax : 00 353 1 2047939
Email: began@dlrcoco.ie
Web https://clicktime.symantec.com/3TpnZUNVF2exJqPCc7kd4gN6H2?u=www.dlrcoco.ie

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From: Jonathan Burke [mailto:jonathan.burke@ocsc.ie]
Sent: 09 July 2019 17:35
To: Egan Bernard <began@DLRCOCO.IE>
Cc: Codd Johanne <jcodd@DLRCOCO.IE>; Anthony Horan <anthony.horan@ocsc.ie>
Subject: FW: PAC SHD 138 19 - Sandyford Central (Tivway Site) 2019 Carmenhall Road

Bernard,

A integrated drainage model is developed for sites using MicroDrainage provided by Innovyze. The design model demonstrates that the proposed drainage system achieves the performance criteria set out in the GDSDS.

The GDSDS recommends use of a detailed hydraulic model to demonstrate that the performance criteria (as established in GDSDS) are achieved. As set out in Section 6.6 Attenuation Storage Design in the GDSDS. The method for finding the stormwater attenuation volume is:

- Find the greenfield peak runoff rate for the site;
- Apply this rate as a throttle to the model of the development and run it with a range of duration events for design return periods in accordance with the design criteria.

An initial estimation of the storage volume is done to allow for the initial spatial planning of the development layout and to provide a starting point for the hydraulic modelling. In this case we are using the UKSuDs Tool.

Design using hydraulic modelling is an iterative process; an initial model is established and design storms are simulated to assess the performance of the system. On the basis of the results of these assessments, the design model is amended to improve performance; this includes the performance of the flow control device and the attenuation storage, which are integral parts of the hydraulic model.

The UkSuDs tool uses a conversion factor to apply FSR or FSU rainfall data to a FEH course mapping (catchment character descriptor) for the UK. See attached extract Figure A6.1.1 FSR/FEH rainfall depth ratios from the tool reference document (Rainfall runoff management for developments Report – SC030219) provided by HRW which shows no Irish mapping. With no FEH or FSR/FSU catchment descriptor for Ireland a conversion factor of 1.0 has been applied as noted in the attached correspondence. It is also noted that the use of FSU data is a suggestion from HR Wallingford and not a requirement.

FSU rainfall data is normally used for River Flood Flow Estimation within a catchment and is not applied to the design in Urban Drainage Systems. Applying FSU Data in this case will exaggerate the storage requirements estimate by changing the conversion factor.

Although the UKSuDS tool was not developed for sites in Ireland it is fit for the purpose intended (i.e. initial estimation for spatial planning) as the final design is subject to detailed hydraulic modelling.

Regards,
Jonathan Burke

Please consider the environment before printing this email.

From: Egan Bernard [mailto:began@DLRCOCO.IE]
Sent: 03 July 2019 09:42
To: Jonathan Burke <jonathan.burke@ocsc.ie>
Cc: Codd Johanne <jcodd@DLRCOCO.IE>; Anthony Horan <anthony.horan@ocsc.ie>
Subject: PAC SHD 138 19 - Sandyford Central (Tivway Site) 2019 Carmenhall Road

Hi Jonathan,

On reading the content of the exchange of emails between yourself and HR Wallingford we didn't reach the same conclusion as you did and thus we also contacted HR Wallingford, including Elizabeth Gorton.

There may have been a misunderstanding of either the question that you asked or the reply given by HR Wallingford, but HR Wallingford have advised us that we should update the default FSR rainfall with FSU rainfall data on the tool if we want to use the most up to date rainfall data.

Regards,
Bernard Egan,
Senior Executive Engineer,

Drainage Planning
Municipal Services Department,
Dun Laoghaire Rathdown County Council,
Marine Road,
Dun Laoghaire.
Main Telephone No. 00 353 1 2054700
Direct Line : 00 353 1 2054815
Fax : 00 353 1 2047939
Email: began@dlrcoco.ie
Web https://clicktime.symantec.com/38Cq1BjXBWqq8wATHR3q4XT6H2?u=www.dlrcoco.ie

---

From: Jonathan Burke [mailto:jonathan.burke@ocsc.ie]
Sent: 28 June 2019 12:35
To: Egan Bernard <began@DLRCOCO.IE>
Cc: Codd Johanne <jcodd@DLRCOCO.IE>; Anthony Horan <anthony.horan@ocsc.ie>
Subject: RE: PAC SHD 138 19 - Sandyford Central (Tivway Site) 2019 Carmenhall Road

Hi Bernard,

In response to your query raised on the input valves for the UkSuDs storage tool in meeting on Wednesday 26th June 2019, we have confirmed the following with HR Wallingford (HRW);

The editing of the default valves for the 100 yr 6 & 12 hrs rainfall data changes the FSR/FEH conversion factor using FEH13 rainfall data.

As we are using the IH124 methodology, these valves remain default. The defaults are the FSR rainfall which is the design methodology for use in Ireland. As FEH was not applied to Ireland, the FSR/ FEH relationship is set at 1.0.

The use of Met Eireann data would not be appropriate as it changes the FSR/FEH conversion factor.

Please see attached correspondence with HRW.

Regards,
Jonathan Burke

Please consider the environment before printing this email.

From: Egan Bernard [mailto:began@DLRCOCO.IE]
Sent: 18 June 2019 13:10
To: Jonathan Burke <jonathan.burke@ocsc.ie>
Subject: PAC SHD 138 19 - Sandyford Central (Tivway Site) 2019 Carmenhall Road

Hi Jonathan,

I can meet you next Wednesday 26th June. I have just had a conversation with Frances Carragher of RPS so you might wish to liaise further with her.

Regards,
Bernard

From: Jonathan Burke [mailto:jonathan.burke@ocsc.ie]
Sent: 18 June 2019 13:02
To: Egan Bernard <began@DLRCOCO.IE>
Subject: RE: Sandyford Central (2 of 2)

Bernard,

Following on from the below. Can you please confirm receipt and your availability for next week for a meeting to discuss the flooding issues with ourselves and RPS.

Would Wednesday 26th June at your offices suit?

Regards,
Jonathan Burke

Please consider the environment before printing this email.

From: Jonathan Burke
Sent: 18 June 2019 10:14
To: began@DLRCOCO.IE
Subject: RE: Sandyford Central (2 of 2)

Bernard,

See attached ESR with this mail.

Regards,
Jonathan Burke

Please consider the environment before printing this email.

From: Jonathan Burke
Sent: 18 June 2019 10:09
To: began@DLRCOCO.IE
Subject: FW: Sandyford Central (1 of 2)

Hi Bernard,

Please find attached preliminary layout drawings, details and Engineering service report and minutes of our meeting on the above project back in April.

We are at the pre planning consultation, Section 247, with a view to lodge in mid July 2019.

Following feedback from the pre planning consultation we will develop a integrated surface water drainage model and update the details and the report as required.

Regards,
Jonathan Burke

Please consider the environment before printing this email.

From: Jonathan Burke
Sent: 08 April 2019 17:23
To: 'Egan Bernard' <began@DLRCOCO.IE>
Cc: Anthony Horan <anthony.horan@ocsc.ie>
Subject: RE: Sandyford Central

Bernard,

Please find attached preliminary drawings and outline report for your information in advance of the meeting on the above this Wednesday 10th April 2019.

Regards,
Jonathan Burke

Please consider the environment before printing this email.

From: Egan Bernard [mailto:began@DLRCOCO.IE]
Sent: 25 March 2019 15:08
To: Jonathan Burke <jonathan.burke@ocsc.ie>
Subject: RE: Sandyford Central

Any time from 14:15 onwards.

From: Jonathan Burke [mailto:jonathan.burke@ocsc.ie]
Sent: 25 March 2019 15:07

To: Egan Bernard <began@DLRCOCO.IE>
Subject: RE: Sandyford Central

Ok Bernard,

What times in the afternoon and I can confirm if it suits with Anthony?

Regards,
Jonathan Burke

Please consider the environment before printing this email.

From: Egan Bernard [mailto:began@DLRCOCO.IE]
Sent: 25 March 2019 14:55
To: Jonathan Burke <jonathan.burke@ocsc.ie>
Subject: Sandyford Central

Hi Jonathan,
I have scheduled another meeting back to back with the Greenacres meeting, so if the Greenacres meeting can be rescheduled for the afternoon then it can run in to Sandyford Central without time pressures.

Regards,
Bernard

From: Jonathan Burke [mailto:jonathan.burke@ocsc.ie]
Sent: 25 March 2019 14:47
To: Egan Bernard <began@DLRCOCO.IE>
Cc: Anthony Horan <anthony.horan@ocsc.ie>
Subject: RE: Sandyford Central

Hi Bernard,

Following on from the below. The pre-planning application number has been requested and we should have it by Monday 1st April at the latest.

May we allocate some time , say 30 minutes at the end at the end of our scheduled Greencare's meeting on 10th April to have an introduction to the scheme?

Regards,
Jonathan Burke

Please consider the environment before printing this email.

From: Egan Bernard [mailto:began@DLRCOCO.IE]
Sent: 07 March 2019 09:38
To: Jonathan Burke <jonathan.burke@ocsc.ie>
Cc: Anthony Horan <anthony.horan@ocsc.ie>
Subject: Sandyford Central

Hi Jonathan,

Once a formal pre-planning application number has been assigned, I can facilitate a meeting. The significant issue on this site is flood risk and this will have to be included as part of any discussions that are scheduled.

Regards,
Bernard Egan,
Senior Executive Engineer,

Drainage Planning
Municipal Services Department,
Dun Laoghaire Rathdown County Council,
Marine Road,
Dun Laoghaire.
Main Telephone No. 00 353 1 2054700
Direct Line : 00 353 1 2054815
Fax : 00 353 1 2047939
Email: began@dlrcoco.ie
Web www.dlrcoco.ie

From: Jonathan Burke [mailto:jonathan.burke@ocsc.ie]
Sent: 05 March 2019 18:49
To: Egan Bernard <began@DLRCOCO.IE>
Cc: Anthony Horan <anthony.horan@ocsc.ie>
Subject: Sandyford Central

Bernard,

There is also a SHD application for the above site currently at the early stages.

We are proposing to have a similar SuDs surface water approach. See attached concept drawing.

We would hope to discuss also in meeting.

Regards,
Jonathan Burke

Civil Engineer
DD: +353 1 868 2000
Please consider the environment before printing this email.

30 YEARS OCSC

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Mark Killian

From:	Mark Killian <mark.killian@ocsc.ie>
Sent:	06 November 2019 17:13
To:	Codd Johanne
Cc:	Anthony Horan; Patrick Raggett
Subject:	RE: [OCSC: R478] RE: PAC SHD 138 19 - Sandyford Central (Tivway Site) 2019 Carmenhall Road
Attachments:	Sandyford Central Residential Development_Stage 1 Stormwater Audit_1_191....pdf; SFC-OCSC-MD-C-P07-50% Outfall.pdf
Categories:	Submitted to Gekko - Sent

Thanks, Johanne.

We have just received the Storm Water Audit report, from RPS Group, this morning, which provides acceptance of the proposed storm water strategy. Please find a copy attached, for information. With reference to your other points in the below email, we can confirm the following:

- The MicroDrainage results refer to a potential 50% blockage applied to ***all*** orifices and flow controls, across the site, at the same time. The noted flooding is experienced at the landscaped areas, through the centre of the site. We will develop an overland flow route drawing demonstrating this along with the overland flow route, towards Blackthorn Drive. It is noted that this is the worst case scenario and that coinciding blockages of all sub-catchments, during a 1% AEP event, is considered very unlikely.

  Therefore, in addition to the above scenario, I have just re-ran the MicroDrainage model to assess the impact of a 50% blockage to the Hydro-brake chamber at the development's outfall only, as a sensitivity check. The outfall flow control is considered at higher risk of blockage, relative to the others, as the sub-catchment flow controls are to have protected orifices / outlets; both as a result of the provision of geotextiles, OGCR and pervious paving, and the proposed contraflow product, described in the ESR. The results (Refer attached, for information) of this assessment indicate potential flooding from the outfall manhole, and the manhole immediately upstream, only. We will add this context to the ESR for further clarity also.

- The referenced figure should be 'Figure 6', and we have changed the reference text for the MicroDrainage model to 'Green Roof'. Please note that does not affect the outputs of the model, as it is purely descriptive.

I hope the above gives a clearer understanding and that our proposed design is now to the satisfaction of DLRCoCo Water Services.

Regards,
Mark

From: Codd Johanne [mailto:jcodd@DLRCOCO.IE]
Sent: 05 November 2019 16:30
To: Mark Killian <mark.killian@ocsc.ie>
Cc: Anthony Horan <anthony.horan@ocsc.ie>; Patrick Raggett <patrick.raggett@ocsc.ie>
Subject: RE: [OCSC: R478] RE: PAC SHD 138 19 - Sandyford Central (Tivway Site) 2019 Carmenhall Road

Thanks for the clarification,

Just some final points:

- I have not received a storm water audit yet. This should be submitted before submission of the application to ABP.
  (I know there was mention of mid-November for the full application)
- Figure 5 details flood risk during the 50% blockage event, however I think the Microdrainage shows flooding at a number of locations. Please review these and if they remain a comment on where the water will pond or travel to should be included. (it is not expected that storage should be provided, however consideration of where the water ends up should be identified)
- Minor point, Figure 4 Pg 24, (there are two figure 4's) identifies Blue roof, should be changed to Green Roof.

Thanks

Johanne Codd | Executive Engineer
Drainage Planning, Municipal Services
Dún Laoghaire-Rathdown County Council, County Hall, Marine Road, Dún Laoghaire, Co. Dublin, Ireland.

From: Mark Killian <mark.killian@ocsc.ie>
Sent: 05 November 2019 14:13
To: Codd Johanne <jcodd@DLRCOCO.IE>
Cc: Anthony Horan <anthony.horan@ocsc.ie>; Patrick Raggett <patrick.raggett@ocsc.ie>
Subject: RE: [OCSC: R478] RE: PAC SHD 138 19 - Sandyford Central (Tivway Site) 2019 Carmenhall Road

Thanks, Johanne.

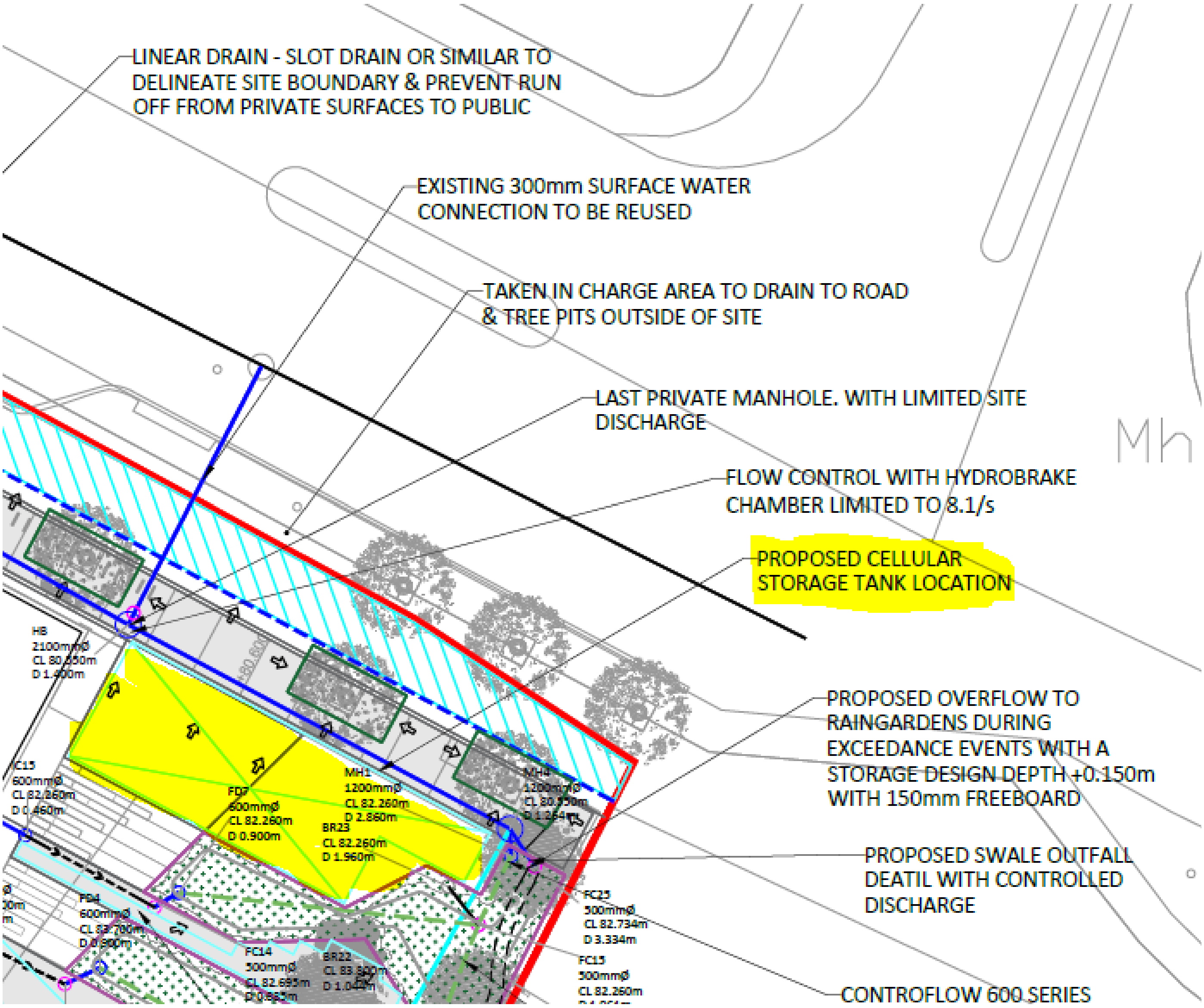
Yes, the 'tank' reference should be removed from here (we will revise this with a new layout shortly), as the liner is to be permeable.
However, there is 130m^3 of cellular storage, using layers of permavoid or similar, to be provided at this location underneath the paving, due to the surcharging experienced from the development's outfall flow control (8.1 l/s). This is accounted for in the podium cellular storage volumes within the ESR.

Regards,
Mark

From: Codd Johanne [mailto:jcodd@DLRCOCO.IE]
Sent: 05 November 2019 10:52
To: Mark Killian <mark.killian@ocsc.ie>
Cc: Anthony Horan <anthony.horan@ocsc.ie>; Patrick Raggett <patrick.raggett@ocsc.ie>
Subject: RE: [OCSC: R478] RE: PAC SHD 138 19 - Sandyford Central (Tivway Site) 2019 Carmenhall Road

Mark,

Thanks for that. I have not gone through it yet, but I note you say there is no tank been provided, it is still shown on the drawing.
Is this supposed to be something else, or an error on the drawing.
I have highlighted where it is.



Thanks

Johanne Codd | Executive Engineer
Drainage Planning, Municipal Services
Dún Laoghaire-Rathdown County Council, County Hall, Marine Road, Dún Laoghaire, Co. Dublin, Ireland.

From: Mark Killian <mark.killian@ocsc.ie>
Sent: 04 November 2019 17:25
To: Codd Johanne <jcodd@DLRCOCO.IE>
Cc: Anthony Horan <anthony.horan@ocsc.ie>; Patrick Raggett <patrick.raggett@ocsc.ie>
Subject: [OCSC: R478] RE: PAC SHD 138 19 - Sandyford Central (Tivway Site) 2019 Carmenhall Road

Hi Johanne,

I am following up on the below email, as Jonathan Burke no longer works at OCSC.

We have carried out a thorough review of both the ESR, drawings and design calculations, to ensure that full consistency is provided with respect to the noted areas and volumes. It is likely that some of the issues noted below are as a result of the totalled numbers not being updated following some of the design revisions.

I have provided response to each item below, in blue, for ease of reference, and hope that the correct representative numbers are now clear.

An updated ESR and design layout drawings can be downloaded from the WeTransfer link below:

OCSC - SANDYFORD CENTRAL DOWNLOAD

Regards,
Mark Killian

Chartered Civil Engineer
MSc BE CEng MIEI

Please consider the environment before printing this email.

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W: www.ocsc.ie

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From: Codd Johanne [mailto:jcodd@DLRCOCO.IE]
Sent: 16 October 2019 14:40
To: Jonathan Burke <jonathan.burke@ocsc.ie>
Cc: Anthony Horan <anthony.horan@ocsc.ie>; Patrick Raggett <patrick.raggett@ocsc.ie>; Kenneth Beirne - Richmond Homes <KBeirne@richmondhomes.ie>; Dermot Clancy - Richmond Homes <dclancy@richmondhomes.ie>; Mark Killian <mark.killian@ocsc.ie>
Subject: RE: PAC SHD 138 19 - Sandyford Central (Tivway Site) 2019 Carmenhall Road

Jonathan

I have the following comments on the details sent through:

Response to DLR Opinion:
Point 3: The answer doesn't seem to respond to the Qbar statement. (It may not require an answer, it can be noted?) Qbar was calculated using the HR Wallingford tool from www.uksuds.com. This calculator estimated the Qbar value at 8.1 l/s, when using the default values, however, an increased runoff value of 9.3 l/s was calculated when using site specific information for the calculation. The more conservative value of 8.1 l/s was used for the proposed design – refer screen shot below, taken from the uksuds printout:

Site discharge rates	Default	Edited
Qbar total site area (l/s)	0.39	9.33
Qbar net site area (l/s)	0.39	9.33
1 in 1 year (l/s)	8.1	8.1
1 in 30 years (l/s)	8.1	9.3
1 in 100 years (l/s)	8.1	9.3

Point 4: I don't think your answer addresses the issue. As I understand it, the area I referenced is the area input into Microdrainage, and the additional areas are accounted for in the time area assessment (which doesn't show up as

areas within Microdrainage). If you could flesh out that answer in the text to make it clear that the entire site has been accounted for in the analysis. The total area contributing to the surface water network, from hardstanding catchment areas (i.e. paved podium and flat roof areas), is 0.74ha. the remaining area has been applied to the integrated network model using a Time Area Diagram, to best represent the runoff behaviour from the green roof and external soft-landscaped areas. This is detailed further within the ESR
Point 13: The storage detail still seems to be different in table 3 and 10. The storage volumes noted in Table 3 and table 10 have been reviewed and coordinated. Please note that the total storage value indicated in Table 3 excludes interception & treated values, for clarity, as these are part of the overall volume.

Engineering Services Report
Please review all figures, as there are still inconsistencies with figures, ensuring the labelling is correct (eg Table 1: Catchment A - Green Roof 0.408 (I assume this should be roof area) Table 4 references Green Roof as 3,520m2, Section 3.9 Total roof area 4,924m2 - green roof 3,615m2.). This has been reviewed and coordinated throughout the report and drawings. The total roof area is approximately 4,924m^2, 3,629m^2 of which contributes via the green roof build-up.
Section 3.15 now references a tank. We need full details (plan section, inlet outlets etc) Also what is the volume of the tank. There is no tank being provided as part of the proposed integrated design.
There seems to be a contradiction between the Storage section 3.4, which states 1239m3 is to be provided, while table 10 seems to suggest a much higher volume. Table 10 erroneously included some storage volumes twice. Following review, and for clarity, a total of 1299m^3 storage is being provided throughout.
Section 3.14 notes an attached CIRIA factsheet, please include. The CIRIA factsheet is now appended to the ESR and also attached to this email as a standalone document for ease of reference.

Drawing
Can you provide a section of the footpath area on Blackthorn Drive, and provide detail of where that slot drain is connecting back into. This is currently being developed and will be issued to you shortly.

Regards,

Johanne Codd | Executive Engineer
Drainage Planning, Municipal Services
Dún Laoghaire-Rathdown County Council, County Hall, Marine Road, Dún Laoghaire, Co. Dublin, Ireland.

From: Jonathan Burke <jonathan.burke@ocsc.ie>
Sent: 03 October 2019 17:38
To: Codd Johanne <jcodd@DLRCOCO.IE>; Danciu Marin <mdanciu@DLRCOCO.IE>; Carroll Elaine B. <ebcarroll@DLRCOCO.IE>
Cc: Anthony Horan <anthony.horan@ocsc.ie>; Patrick Raggett <patrick.raggett@ocsc.ie>; Kenneth Beirne - Richmond Homes <KBeirne@richmondhomes.ie>; Dermot Clancy - Richmond Homes <dclancy@richmondhomes.ie>; Mark Killian <mark.killian@ocsc.ie>
Subject: RE: PAC SHD 138 19 - Sandyford Central (Tivway Site) 2019 Carmenhall Road

Johanne,

Further to our meeting last week. Please find attached a revised PAC for your information at the below link and response letter to DLRCC opinion.

https://we.tl/t-QJTp631aOE

Regards,
Jonathan Burke

Please consider the environment before printing this email.

APPENDIX E – IRISH WATER CORRESPONDENCE

Uisce Éireann
Bosca OP 6000
Baile Átha Cliath 1
Éire

Irish Water
PO Box 6000
Dublin 1
Ireland

T: +353 1 89 25000
F: +353 1 89 25001
www.water.ie

Amy Lee
Embassy House
Ballsbridge

1 March 2019

Dear Amy Lee,

Re: Connection Reference No CDS19000358 pre-connection enquiry - Subject to contract | Contract denied

Connection for Housing Development of 600 units at Carmanhall Road, Sandyford Business Park, Dublin 18.

Irish Water has reviewed your pre-connection enquiry in relation to a water connection at Carmanhall Road, Sandyford Business Park, Dublin 18.

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

Connection to the water network should be from the 450mm AC main in Carmanhall Road.

Receiving sewer for the wastewater should be the 525 concrete sewer in Blackthorn Avenue.

There is a 6'' asbestos water main running through the site. The Developer will be required to survey the site to determine the exact location of the infrastructure. Any trial investigations shall be carried out with the agreement and in the presence of LA Inspector.

You are advised that structures or works over or in close proximity to IW infrastructure that will inhibit access for maintenance or endanger structural or functional integrity of the infrastructure are not allowed. Diversion of the watermain within the site may be required subject to layout proposal of the development and separation distances. The diversion will be subject to customer entering diversion agreement with Irish Water. A wayleave in favour of Irish Water will be required over all Infrastructures on the site that is not located within the Public Space. For further information related to diversion please visit www.water.ie/connections/developer-services/diversions.

Strategic Housing Development

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

A. In advance of submitting your full application to An Bord Pleanala for assessment, you must have reviewed this development with Irish Water and received a Statement of Design Acceptance in relation to the layout of water and wastewater services.

B. You are advised that this correspondence does not constitute an offer in whole or in part to provide a connection to any Irish Water infrastructure and is provided subject to a connection agreement being signed and appropriate connection fee paid at a later date.

All infrastructure should be designed and installed in accordance with the Irish Water Codes of Practice and Standard Details.

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

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

Yours sincerely,

M O'Dwyer

Maria O'Dwyer

Connections and Developer Services

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

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

www.water.ie

Amy Lee
Embassy House
Ballsbridge
Dublin 4

15 November 2019

Re: Design Submission for Carmanhall Road, Sandyford Business Park, Dublin 18 (the "Development")
(the "Design Submission") / Connection Reference No: CDS19000358

Dear Amy Lee,

Many thanks for your recent Design Submission.

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

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

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

If you have any further questions, please contact your Irish Water representative:
Name: Marina Zivanovic Byrne
Phone: 01 89 25991
Email: mzbyrne@water.ie

Yours sincerely,

M O'Dwyer

Maria O'Dwyer
Connections and Developer Services

Appendix A

Document Title & Revision

- [SFC-OCSC-00-01-DR-C-0520-A1-C02] Proposed Watermain Layout
- [SFC-OCSC-00-00-DR-C-0501-A1-C02] Proposed Drainage Layout – Foul Water
- [SFC-OCSC-00-00-DR-C-0505-A1-C01] Proposed Drainage Long Sections – Foul Water

Standard Details/Code of Practice Exemption:

1. *Proposed Watermain and Wastewater Sewer within the site are to be slung underneath the concrete podium in basement and are outside the scope of this document.*

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

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

APPENDIX G – STORM WATER AUDIT

PUNCH consulting engineers

Carmanhall Road, Sandyford Business District, Dublin 18

Stormwater Audit Stage 1

November 2019

Document Control

Document Number: 192-334-SWA-S1

Revision	Description	Date	Prepared	Checked	Approved
PL0	First Issue	19/11/2019	J. Martin	D. Murphy	L. Brennan

Report by: ______________________ Date: 19th November 2019

Joshua Martin

Engineer (MEng)

PUNCH Consulting Engineers

Checked by: ______________________ Date: 19th November 2019

Donnagh Murphy

Engineer (BEng Hons PGrad Dip MIEI)

PUNCH Consulting Engineers

Approved by: ______________________ Date: 19th November 2019

Leonard Brennan

Technical Director (BE Dip Hy&Geo Eng PGDipHSC CEng MIEI)

PUNCH Consulting Engineers

Table of Contents

1.0 Introduction

1.1 Purpose of Report

This report presents a Stage 1 Stormwater Audit carried out for a proposed residential development at the former Aldi site on Carmanhall Road, Sandyford Business District, Dublin 18. The proposed development comprises of 564 no. residential units, a creche (354m^2) and a café (141m^2). The development will include a basement with 254 car parking spaces and a further 31 car parking spaces at ground level.

O'Conner/Sutton/Cronin Consulting Engineers (OCSC) were appointed to provide Engineering Services, which includes design of the surface water network and associated sustainable drainage systems (SuDS) proposed.

PUNCH Consulting Engineers have been appointed by OCSC to carry out an independent Stage 1 Stormwater Audit on the proposal in line with Dún Laoghaire-Rathdown County Council (DLRCC) requirements. The pre-planning reference number associated with this application is ABP-304965-19.

1.2 Site Details

The site is in Sandyford, Co. Dublin. It is bound to the north by Blackthorn Drive, to the east by commercial developments, to the south by Carmanhall Road and to the west by an existing apartment block (Rockbrook, Phase 1) and a vacant site.

The total site area is approximately 1.54 hectares and is almost 100% hardstanding.

The site rises from north to south resulting in a fall in levels from Carmanhall Road to Blackthorn Drive of approximately 4.0m. The site topography is generally level with an existing concrete slab from a previous warehouse building at a level of approximately 81.3m with a step up onto it at the northern end of the site. The site has a derelict structure to the south along with well established trees along the southern boundary. A large ramp is also present in the centre of the site.

1.3 Report Details

This Stormwater Audit was carried out by Joshua Martin, Donnagh Murphy and Leonard Brennan between the dates of November 14th and November 19th 2019.

This Stage 1 Audit has been carried out in accordance with the Dún Laoghaire-Rathdown County Council (DLRCC) Stormwater Audit Procedure Rev 0 January 2012. The auditor has examined only those issues within the design relating to surface water drainage implications of the scheme and has therefore not examined or verified the compliance of the design to any other criteria.

Appendix A contains copies of drawings and documents examined by the auditor. The drawings in Site Layout with Stage 1 Audit Findings Highlighted correspond to the Stage 1 Audit findings outlined in Section 2.0 of this report. Appendix C contains the Surface Water Audit Feedback form.

All the findings outlined in Section 2.0 of this report are considered by the auditor to require action in order to improve the stormwater credentials of the scheme.

1.4 Drawings & Documents Examined as Part of Audit

- SFC-OCSC-00-00-DR-C-0500-S2-P08 – Proposed Drainage Layout – Surface Water – *Dated 04.11.19*
- SFC-OCSC-00-00-DR-C-0508-S2-P03 - Proposed Drainage Layout – Surface Water Catchment Areas – *Dated 04.11.19*
- SFC-OCSC-00-00-DR-C-0515-A1-C01 – Drainage Details – *Dated 19.07.19*
- R478-OCSC-XX-XX-DR-C-0510-S2-P03 – SuDS Details – *Dated 12.11.19*
- SFC-OCSC-XX-XX-RP-C-0004-A1-C02 – Engineering Services Report – *Dated 18.11.19*

2.0 Stage 1 Audit Findings

The following section should be read in tandem with the drawings included in Appendix B.

2.1 Roads and Carparks

2.1.1 Proposed Permeable Paving System – Tanked or permeable

Problem: It is not clear on the drawings provided whether the proposed permeable paving system is a tanked system or a permeable system.

Recommendation: Consider utilising a permeable paving system, incorporating a geotextile with proven capabilities for hydrocarbon pollution treatment in sustainable drainage systems (SuDS). The stone layer within the build-up of the permeable system will have a dual effect of the cleaning the surface water run-off from contaminants, and attenuating the flow, reducing the rate at which surface water would flow from these areas. Please provide detail build-up.

2.1.2 Bypass Interceptor

Problem: Hardstanding surfaces could be a potential pollution source from hydrocarbons as they could enter into the surface water network via gullies, etc.

Recommendation: Consider using bypass interceptors, based on the drainage area, close to the potential pollution source or in the proximity of the surface water drainage system's discharge point.

PUNCH Comment on Completion of Audit: Bypass interceptor requirement to be reviewed at detailed design stage following completion of basement & internal car parking layout.

2.1.3 Sump Manholes

Problem: Silt entering the surface water drainage system including the attenuation tanks has the potential to cause blockages.

Recommendation: Consider utilisation of sump manholes upstream of both attenuation tanks to capture any excess silt therefore preventing entry into the tanked systems.

2.1.4 Road Gullies

Problem: It is not clear on proposed drainage layout, drawing no. 0500, the locations of the proposed road gullies and how surface water enters the network from internal roadways and hard standing surfaces. There is potential to reduce the surface water runoff and to improve runoff quality from roads around the development by incorporating SuDS measures in lieu of road gullies.

Recommendation: In place of connecting the proposed gullies directly into the proposed surface water network, consider connecting proposed gullies to a SuDS measure such as an infiltration drain, tree pits, swale, drainage ditch or bio-retention area with an overflow to the surface water network, as a means to further reduce the quantity and improve the quality of surface water runoff from the site.

2.1.5 Water Table

Problem: A high water table was evident from soil investigation surveys carried out within the development. The designer should ensure the formation level of the permeable paving is 1000mm above the highest ground water level.

Recommendation: Ensure the ground water level is not less than 1000mm below the formation level of the permeable paving build-up.

2.1.6 Attenuation Storage Tanks

Problem: Attenuation tanks have been designed to allow for infiltration to ground. Do existing ground conditions on site allow for sufficient infiltration rates for each individual tank? It is also important to note; construction activities can severely affect infiltration rates if care is not taken to protect against compaction or blockage from fines.

Recommendation: OCSC to confirm soil investigation results and infiltration testing carried out on site have confirmed that existing ground conditions are suitable to allow for infiltration of surface water.

2.1.7 CBR Values – Permeable Paving

Problem: Californian bearing ration (CBR) varies inversely with moisture content (as the latter increases the CBR value decreases). The equilibrium CBR value is the long-term value that occurs once the pavement is constructed and the moisture content of the subgrade soil comes in to equilibrium with the suction forces within the subgrade air spaces. Carrying out CBR tests will allow for appropriate permeable paving design including capping material if and where required. This capping is typically quite impermeable when compacted.

Recommendation: CBR tests to be performed on site to allow for appropriate permeable paving design. These CBR tests are to be carried out in accordance with BS 1377-4:1990.

2.1.8 Utility Survey

Problem: As per Chapter 29.3.6, Section E of The SuDS Manual, the location of all existing utilities and other site infrastructure should be confirmed before locating proposed SuDS measures.

Recommendation: Existing underground services are particularly challenging to locate in construction projects. Asset databases of buried infrastructure should not be considered as definite and should be checked with appropriate utility surveys and on-site checks.

2.1.9 Existing Natural Features on Site

Problem: Existing natural features on site include trees, hedgerows, or habitats of ecological value. For this proposed development, some of these features may potentially be affected.

Recommendation: Existing trees, hedgerows and habitats should be subject to pre-development surveys in accordance with relevant standards and undertaken by a qualified and competent person. If required, based on the relevant pre-development surveys, the construction of SuDS measures are to be co-ordinated with the existing features of the site.

2.1.10 Gradients and ground modelling

Problem: As per Chapter 29.2, Section E of The SuDS Manual, **s**uccessfully integrating SuDS measures including swales and filter drains require areas of ground modelling to ensure proposed SuDS measures are located in appropriate areas to ensure adequate drainage of the site.

Recommendation: It is recommended that the integration of each SuDS component be considered, and its contouring adjusted to allow the levels to flow towards to SuDS measure, in a naturalistic manner that is visually attractive, and accords with the local surrounding landscape.

2.1.11 Ground Level Parking

Problem: Ground level parking location not clearly indicated

Recommendation: Please provide roads layout drawing highlighting ground level parking. Also, please refer to point 2.1.2 and consider using a bypass interceptor close to the potential pollution source or in the proximity of the surface water drainage system's discharge point.

2.1.12 Basement Ramp

Problem: There is potential for surface water to run down the basement ramp

Recommendation: Consider incorporating an ACO channel that connect at the top of the ramp with potential discharge to a nearby SuDS measure.

2.1.13 Surface Water Catchment Areas

Problem: Surface Water Catchment Areas, drawing no. 508, is not transparent in highlighting all catchment areas. Some areas highlighted are not reflected in current legend (light and dark grey hatching).

Recommendation: Update legend to reflect all catchment areas and confirm whether these areas are to be attenuated.

2.1.14 Drawing Legend

Problem: Proposed drainage layout, drawing no. 0500, does not reflect microdrainage calculations.

Recommendation: Please revise drawings to include pipe numbers, invert levels and clear identification of all cellular/attenuation tank areas. Surface water network not clearly visible on drawing. Consider removing unnecessary items from drawings for clarity. Manholes, flow controls etc to be clearly labelled and visible on drawing.

2.1.15 Hydrobrake Details

Problem: Drainage details, drawing no. 0515, does not identify the corresponding cross sections in regard to the proposed Hydrobrake.

Recommendation: Label for clarity and also highlight each respective Hydrobrake's restricted forward flow discharge rate.

2.1.16 Green Roof Extents

Problem: Proposed drainage layout, drawing no. 0500, does not indicate various green roof proposals.

Recommendation: Update legend to include various hatches, if the hatches indicate the location of mechanical plant then consider the effect this will have on the green roof extents to give an accurate estimation of the true green roof extents that can be installed.

2.1.17 Cellular Storage Tank

Problem: Additional information required in regard to proposed attenuation/cellular storage tanks.

Recommendation: Provide details of all proposed cellular storage tanks including inlet/outlets, flow control locations, cover, liquid storage capacities and each respective contributing area throughout the development.

2.1.18 Proposed 300Dp. Storage Layer

Problem: Drawing no. 0500 outlines this storage layer in light blue. This is proposed throughout areas of the site that may not be applicable, for example openings in the slab and tree pits etc.

Recommendation: Assess blue outline and confirm all areas are applicable for this proposal. This proposed storage layer also seems to overlap with other attenuation proposals.

2.1.19 Surface Water Runoff from South of Site

Problem: Surface water pipe run appears to drop below basement level due to the colour change of the pipe (dark blue to light blue).

Recommendation: Confirm if this is the case and update legend to reflect. If this pipe drops below basement level, this will require localised pumping. If so, please provide additional details.

2.2 Buildings/Residential Units

2.2.1 Rainwater Harvesting Tanks

Problem: There is potential to install a rainwater harvesting facilities for the proposed units. The rainwater collected can be used for toilet flushing within the new units.

Recommendation: Consider incorporating rainwater harvesting tanks.

2.2.2 Podium Landscaping

Problem: The depth of substrate has not been noted for the podium landscaping.

Recommendation: Consider a deeper substrate depth (up to 400mm) and a lower substrate stone depth to increase the level of biodiversity possible within the planter areas, to improve the water discharged from the podium landscaping areas to provide attenuation storage. Consider discharging surface water run-off from roof areas to the podium landscaping areas, particularly roof areas that do not have green roof coverage.

2.2.3 Green Roofs

Problem: A greater amount of extensive green roofs have been proposed in lieu of intensive green roofs.

Recommendation: Where possible, consider changing the extensive green roof proposal to an intensive green roof proposal, which would double as a roof garden. This would be in line with the philosophy of SuDS providing additional benefits. The developments end user would noticeably benefit from the addition of intensive green roofs in the proposed development, as this would create additional useable spaces. This also has the benefit of additional biodiversity potential.

Appendix A Drawings Examined by the Auditor

EXISTING SURFACE WATER	
PROPOSED SURFACE WATER	
PROPOSED FLOW CONTROL	
BELOW FINISH SUDS FLOW PATHS	
INDICATES 1:80 PAVEMENT FALLS	
PROPOSED FILTER DRAIN	
PROPOSED GREEN ROOF	
AREA TO BE TAKEN IN CHARGE	
PROPOSED OGCR/PERMEABLE PAVING ON PODIUM	
PROPOSED BIORETENTION	
PROPOSED RAINGARDENS /DEPRESSION STORAGE	
PROPOSED TREE PIT	
PROPOSED 300Dp. STORAGE (150Dp. PERMAVOID WITH 150Dp. OGCR ABOVE)	

TOTAL SITE AREA = 1.54ha
SITE Qmax: 8.1 l/s (Q1) SOIL TYPE 4

TOTAL SITE IMPERMEABLE RUNOFF = 1.429ha

5mm INTERCEPTION
3,650m² GREEN ROOFS & 2,780m² BIO RETENTION / PLANTER ON PODIUM (6,430m² @ 5mm) = 32.0m³
510m² OGCR BELOW PERMEABLE PAVING (300mm Dp. @ 30% VOIDS) = 46m³

ATTENUATION
6,442m² CELLULAR STORAGE SUB BASE (150mm Dp. @ 95% VOIDS) = 918m³
6,089m² OGCR ABOVE CELLULAR STORAGE SUB BASE (150mm Dp. @ 30% VOIDS) = 317m³
510m² OGCR BELOW PERMEABLE PAVING (300mm Dp. @ 30% VOIDS) = 46m³
170m FILTER DRAINS (600mm² @ 30% VOIDS) = 18m³

TREATMENT
3,650m² GREEN ROOFS & 2,780m² BIO RETENTION / PLANTER ON PODIUM (200mm + 150mm Dp. @ 30% VOIDS) = 219m³ + 125.1m³ = 344m³
510m² OGCR BELOW PERMEABLE PAVING (300mm Dp. @ 30% VOIDS) = 46.0m³
710m² RAINGARDEN / SHALLOW DEPRESSION STORAGE @ 50mm = 35.5m³
170m FILTER DRAINS (600mm² @ 30% VOIDS) = 18.0m³

TOTAL STORAGE PROVIDED (EXCLUDING INTERCEPTION & TREATMENT STORAGE) & VERIFIED BY MODEL = 1,299m³

NOTE: PRELIMINARY DESIGN - SUBJECT TO DETAIL DESIGN FOR CONSTRUCTION, FINAL COORDINATION WITH LANDSCAPE ARCHITECT, ARBORIST AND M&E.

GR	- GREEN ROOF
BR	- BLUE ROOF / BIO RETENTION
DP	- DOWN PIPE
BP	- BRANCH PIPE CONNECTION
FD	- 300Ø FILTER DRAIN
AJ	- 350Ø ARMSTRONG JUNCTION < 600mm
IC	- 450Ø INSPECTION CHAMBER 600 - 1200mm
MH	- 1200Ø MANHOLE 1200 - 1500mm
HB	- 1200Ø HYDROBRAKE CHAMBER
FC	- 500Ø FLOW CONTROL CHAMBER

FOR THE SUB CATCHMENT AREA OVERVIEW, REFER TO Drg. SFC-OCSC-XX-XX-DR-C-0508

REFER TO ENGINEERS SERVICE REPORT FOR PIPE DESIGN CALCULATION AND DRAINAGE LONGSECTIONS

REFER TO Drg. SFC-OCSC-XX-XX-DR-C-0510 FOR SuDs DRAINAGE DETAILS AND Drg. SFC-OCSC-XX-XX-DR-C-0515 FOR TYPICAL DRAINAGE DETAILS

NOTES:
1. ALL PIPES TO BE SIZED AND LAID AS NOTED;
2. ALL POP-UP LOCATIONS AND SIZES TO BE CONFIRMED WITH ARCHITECTS & M&E DRAWINGS;
3. ALL FOUL AND SURFACE WATER PIPES >150mmØ TO BE CONCRETE OR SIMILAR APPROVED;
4. ALL INTERNAL DRAINAGE IN ACCORDANCE TO THE BUILDING REGULATIONS PART H;
5. ALL 100mmØ SURFACE PIPES TO BE uPVC LAID @ 1:100 GRADIENT UNLESS OTHERWISE NOTED;
6. ALL 150mmØ FOUL PIPES TO BE uPVC LAID @ 1:100 GRADIENT UNLESS OTHERWISE NOTED;
7. NON RETURN VALVES TO BE TIDEFLEX IN LINE CHECK VALVE OR SIMILAR APPROVED AT PIPE OUTLETS;
8. ALL CHAMBER COVERS TO BE D400 RATED;
9. ALL FOUL CHAMBERS TO HAVE DOUBLE-SEALED COVERS;
10. SADDLE CONNECTIONS TO BE PROVIDED AT ALL BRANCH CONNECTIONS TO MAIN DRAINAGE NETWORKS, UNLESS AT MANHOLE;
11. ALL NOTED PIPE DIAMETERS ARE INTERNAL.

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P01	14.06.19	SUITABLE FOR INFORMATION	JB	AH
P02	28.02.19	ISSUED FOR INORMATION	JB	AH
P03	14.06.19	ISSUED FOR INFORMATION	JB	PR
P04	17.06.19	ISSUED FOR INFORMATION	JB	PR
P05	17.07.19	ISSUED FOR INFORMATION	JS	JB
P06	24.09.19	ISSUED FOR INFORMATION	JB	AH
P07	03.10.19	ISSUED FOR INFORMATION	JB	AH
P08	04.11.19	ISSUED FOR INFORMATION	SVM	PR

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Multidisciplinary Consulting Engineers

Dublin | London | Belfast | Galway | Cork

Client: Sandyford GP Limited.
Project: Sandyford Central
Title: Proposed Drainage Layout - Surface Water

Code	Originator	Zone	Level	Type	Role	Number	Status	Revision
SFC	OCSC	00	01	DR	C	0500	S2	P08

Date: 21.02.19 Scale:1:350 @ A1 Drn by:JB Chkd by:AH Aprvd by:MOR

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C01	19.07.19	PAC SUBMISSION	JB	AH
P01	25.09.19	ISSUED FOR INFORMATION	JB	AH
P02	03.10.19	ISSUED FOR INFORMATION	JB	AH
P03	04.11.19	ISSUED FOR INFORMATION	SVM	PR

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Client: Sandyford GP Limited.
Project: Sandyford Central

Title: Proposed Drainage Layout - Surface Water Catchment Areas.

Code	Originator	Zone	Level	Type	Role	Number	Status	Revision
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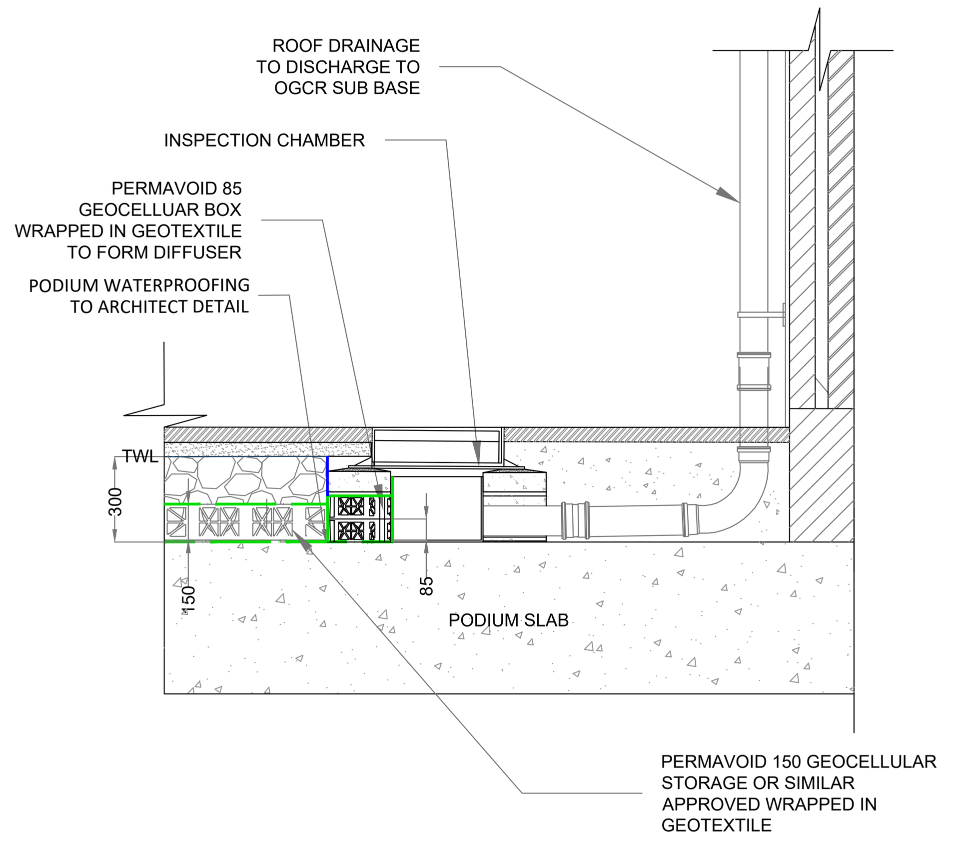
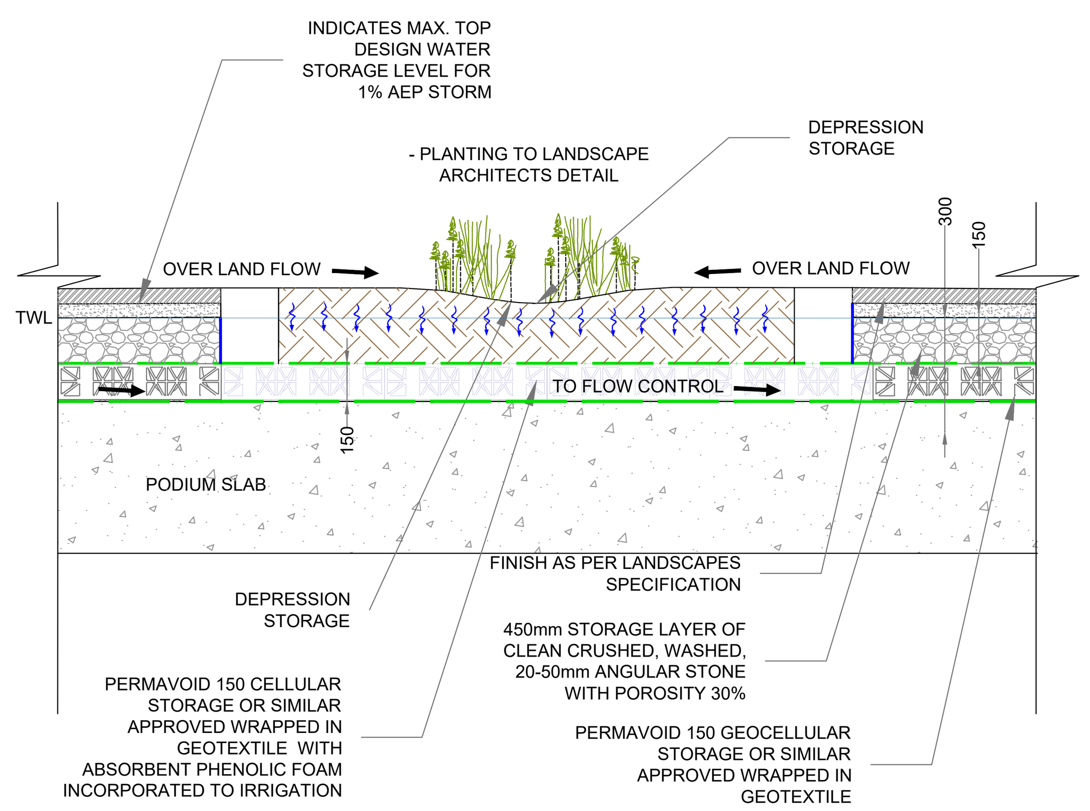
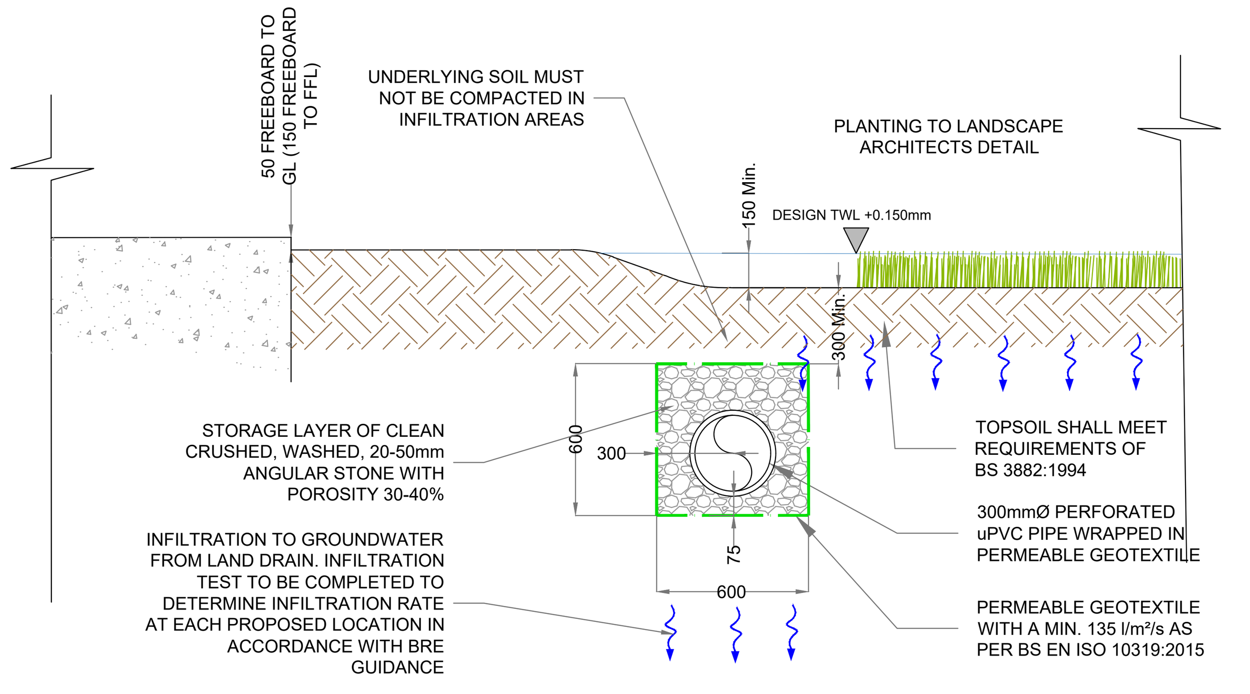
Date: 19.07.19 Scale: 1:350 @ A1 Drn by:JB Chkd by:AH Aprvd by:MM



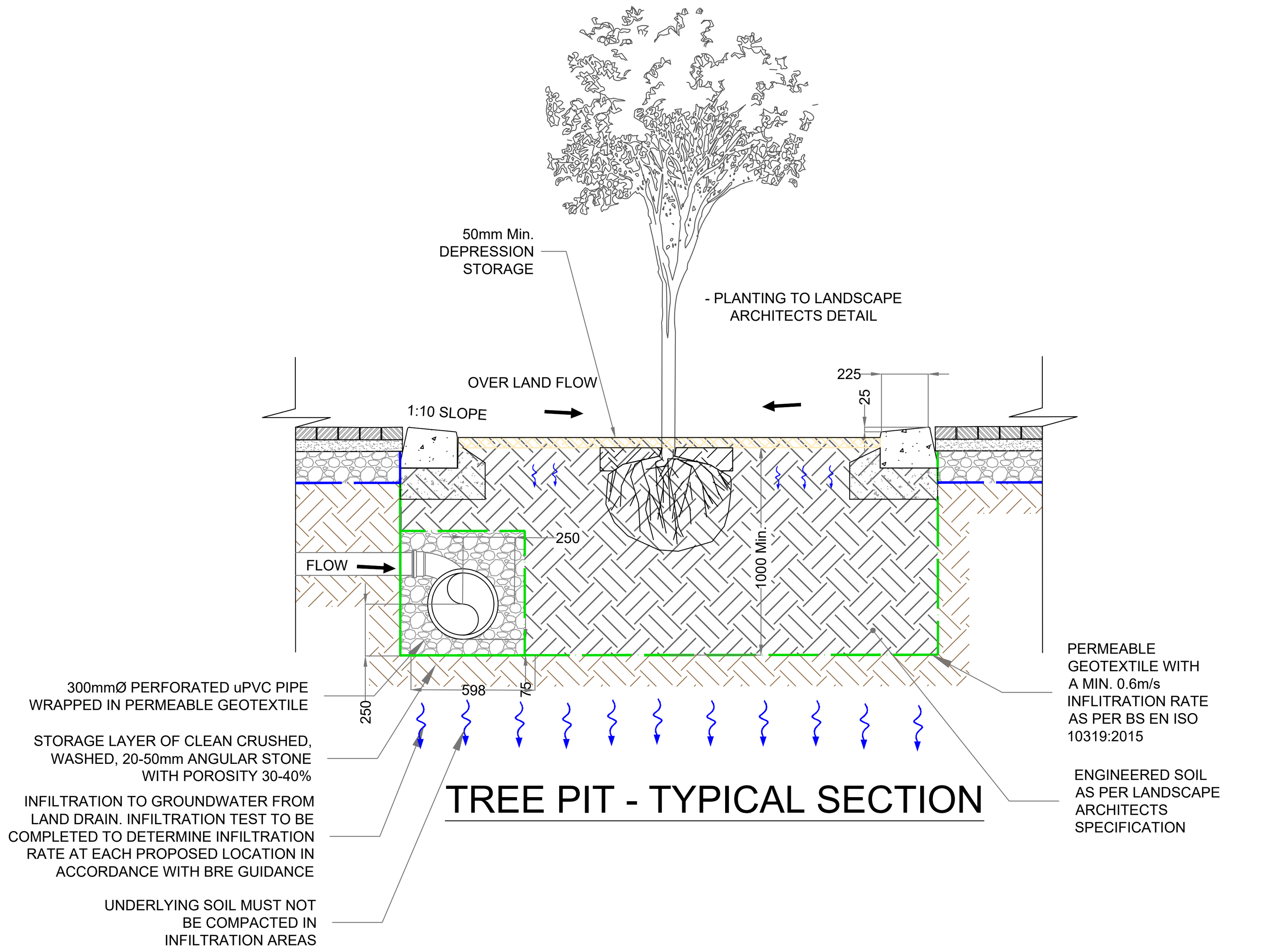
DOWNPIPE TO SUB BASE DETAIL



PODIUM PLANTER / BIORETENTION DETAIL

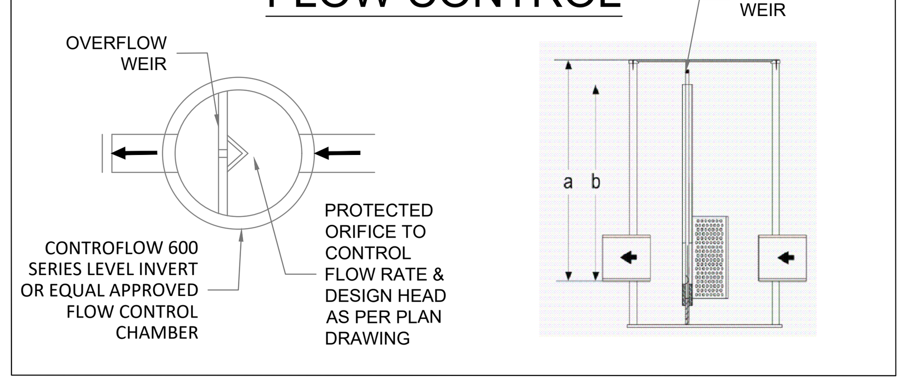


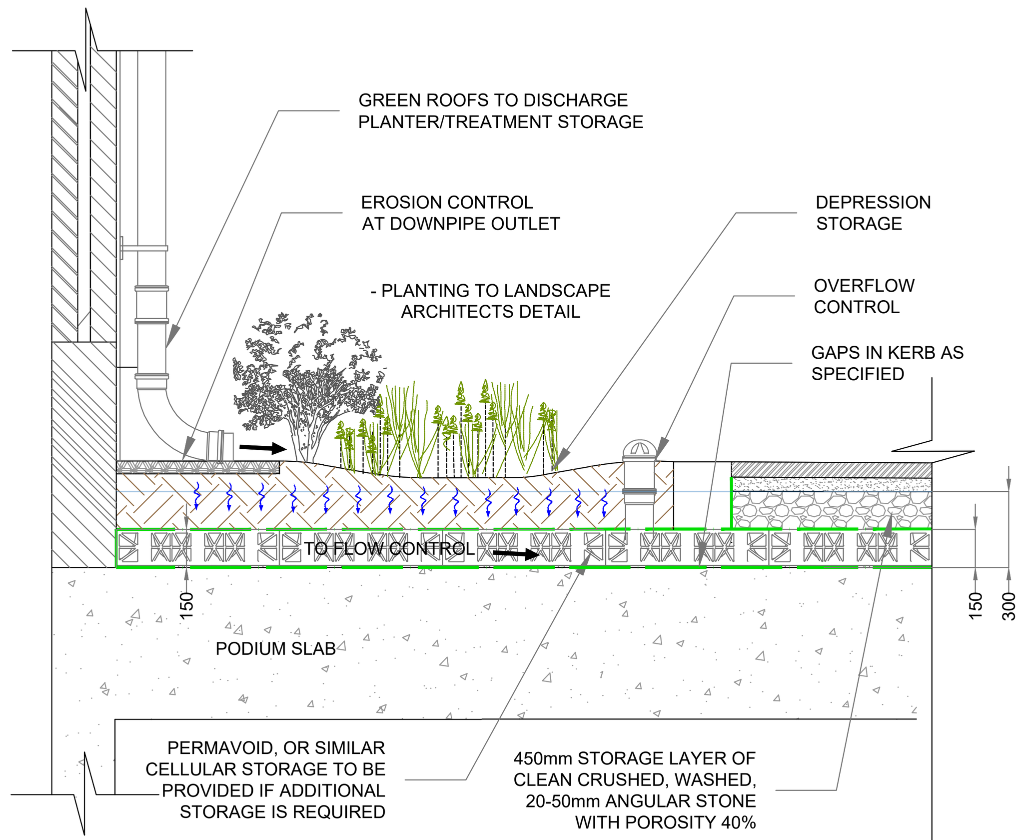
RAINGARDEN WITH FILTER DRAIN - TYPICAL SECTION



TREE PIT - TYPICAL SECTION

FLOW CONTROL





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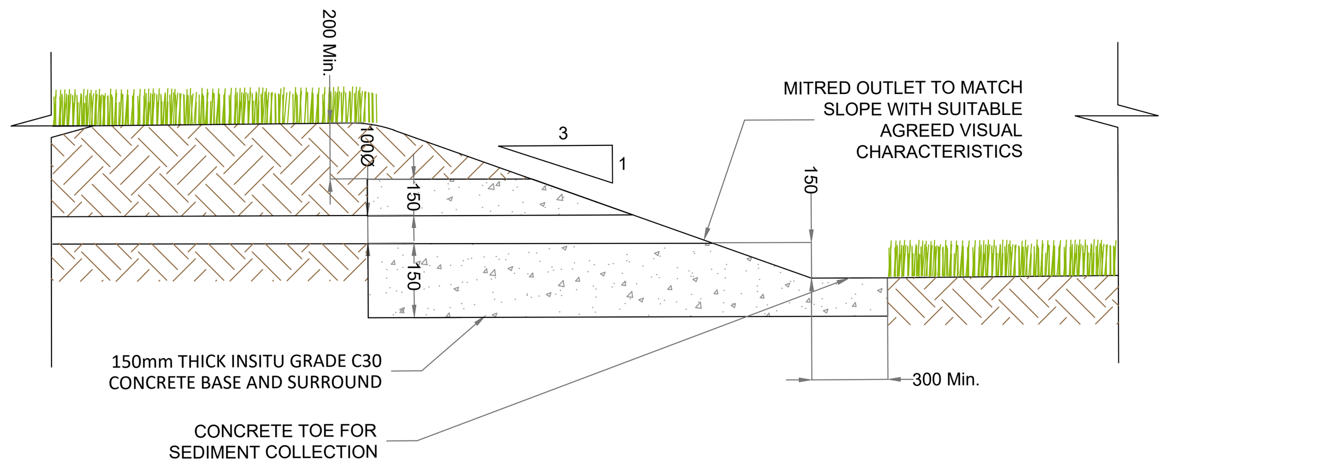
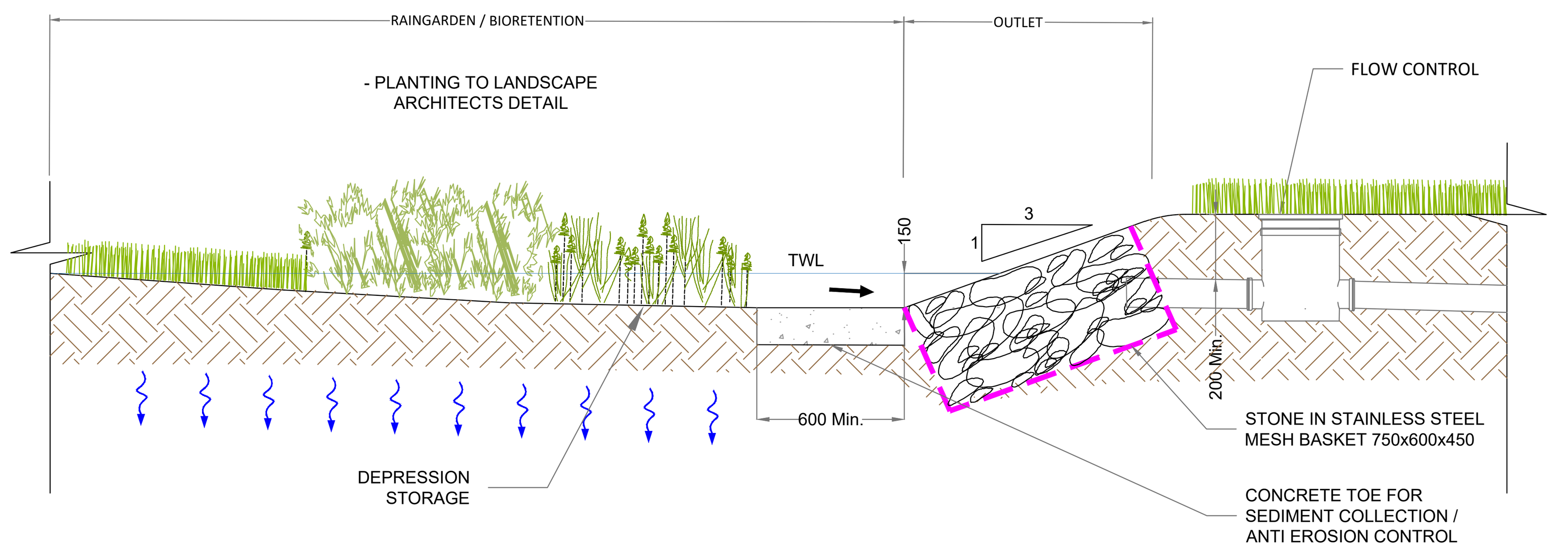
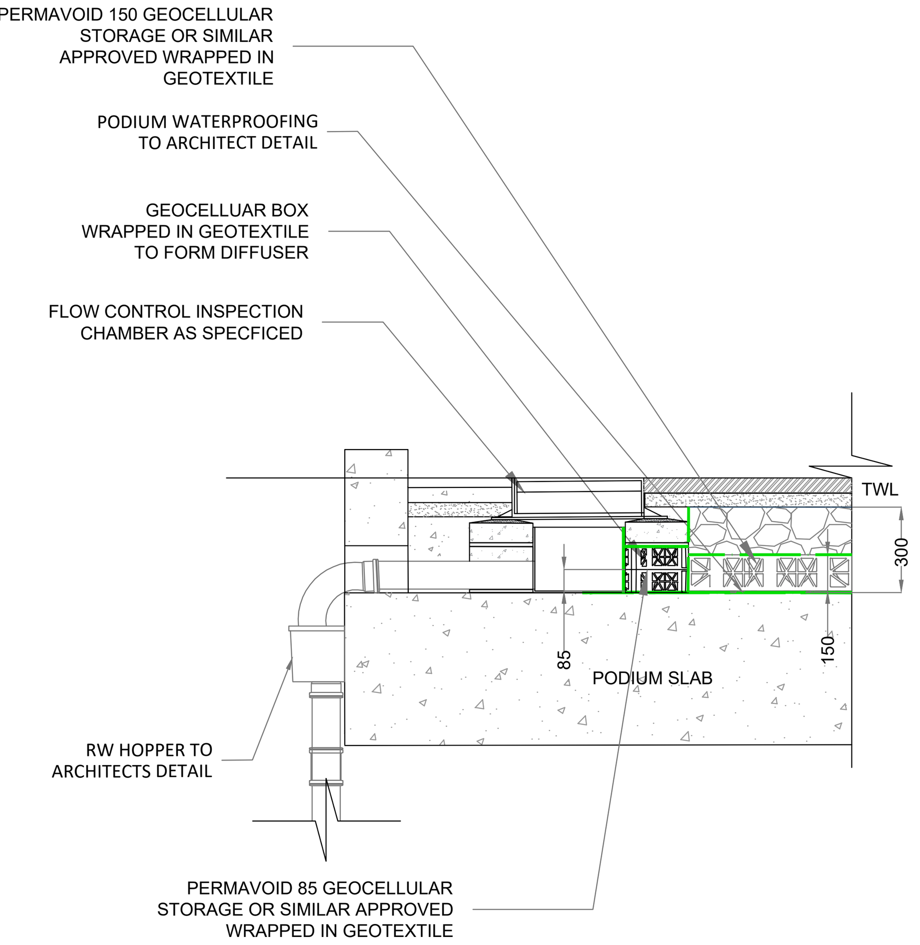


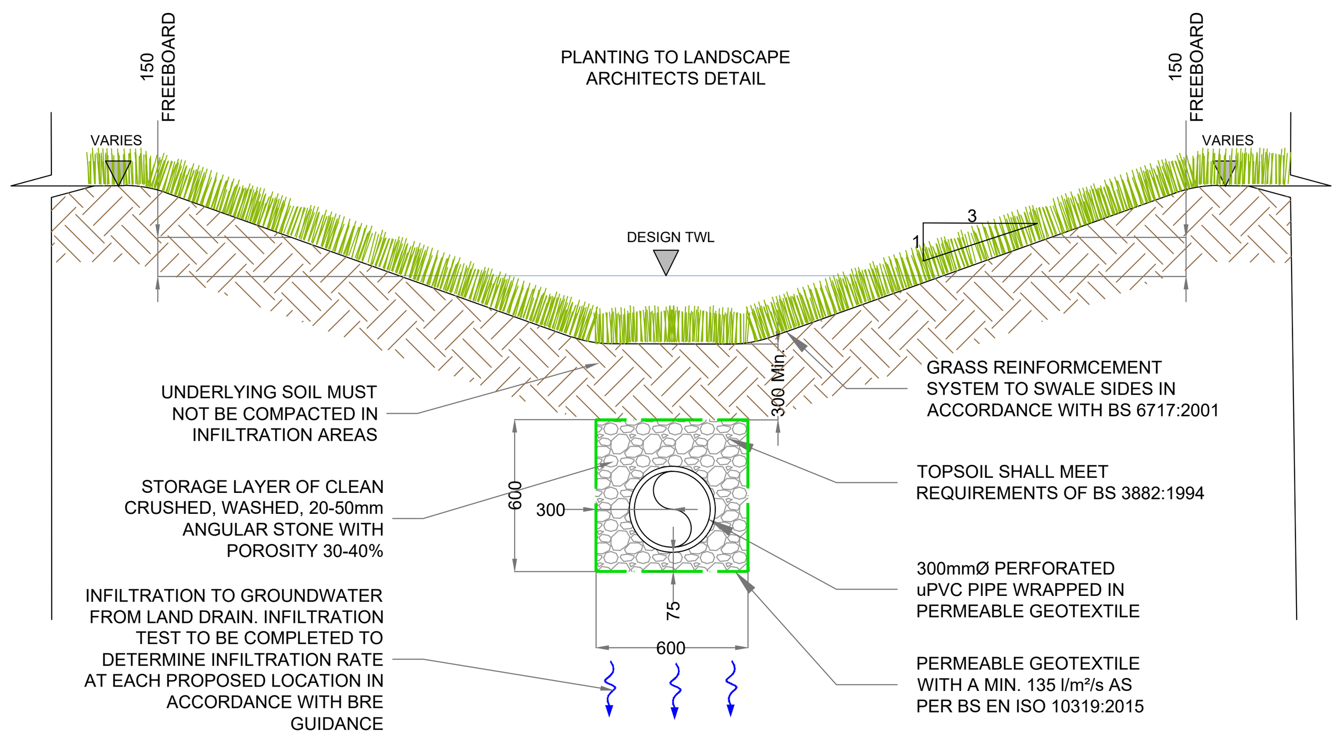
RAINGARDEN / BIORETENTION INLET DETAIL - TYPICAL SECTION



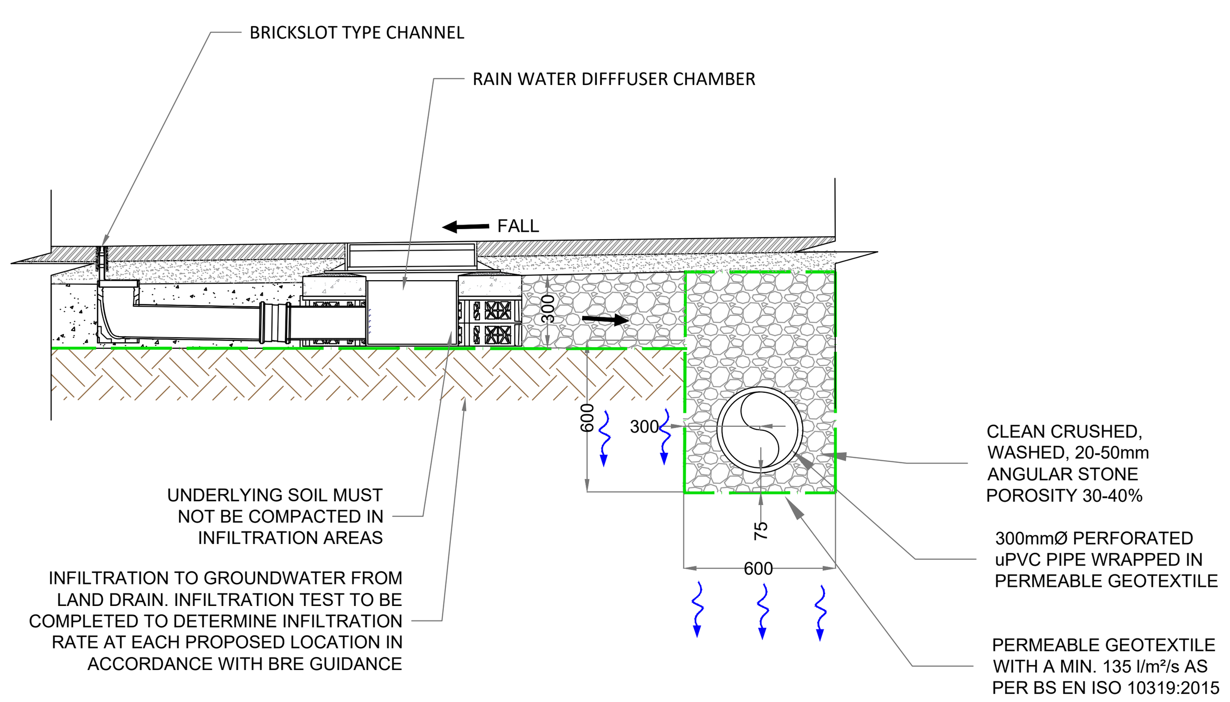
RAINGARDEN / BIORETENTION OUTFALL DETAIL - TYPICAL SECTION



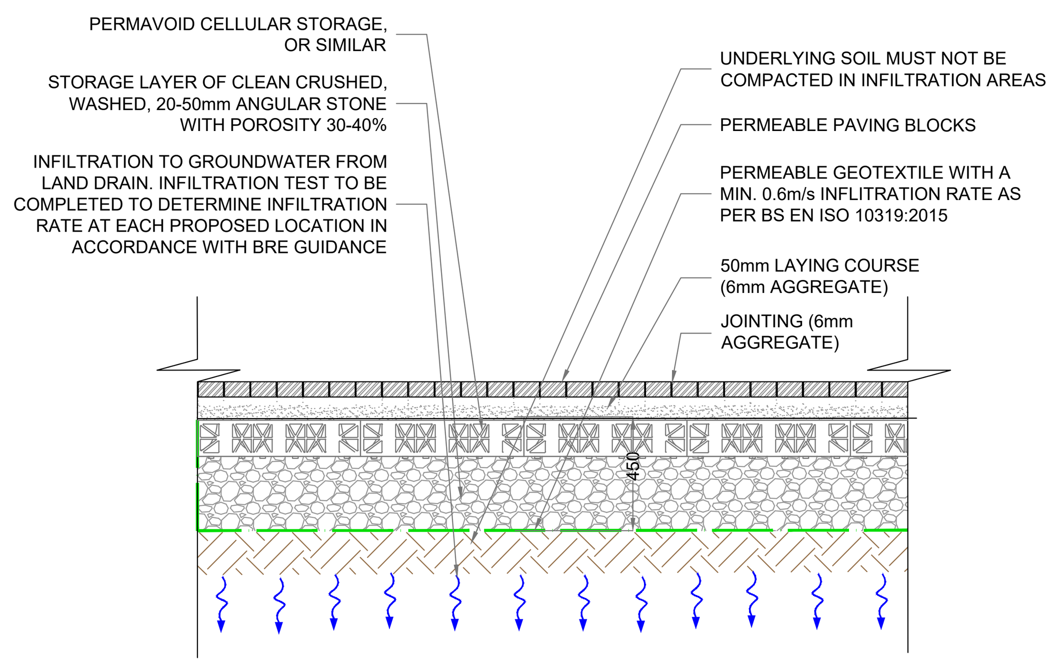
DOWNPIPE DROP OFF PODIUM



SWALE - TYPICAL SECTION



SLOT DRAIN & FILTER DRAIN - TYPICAL SECTION



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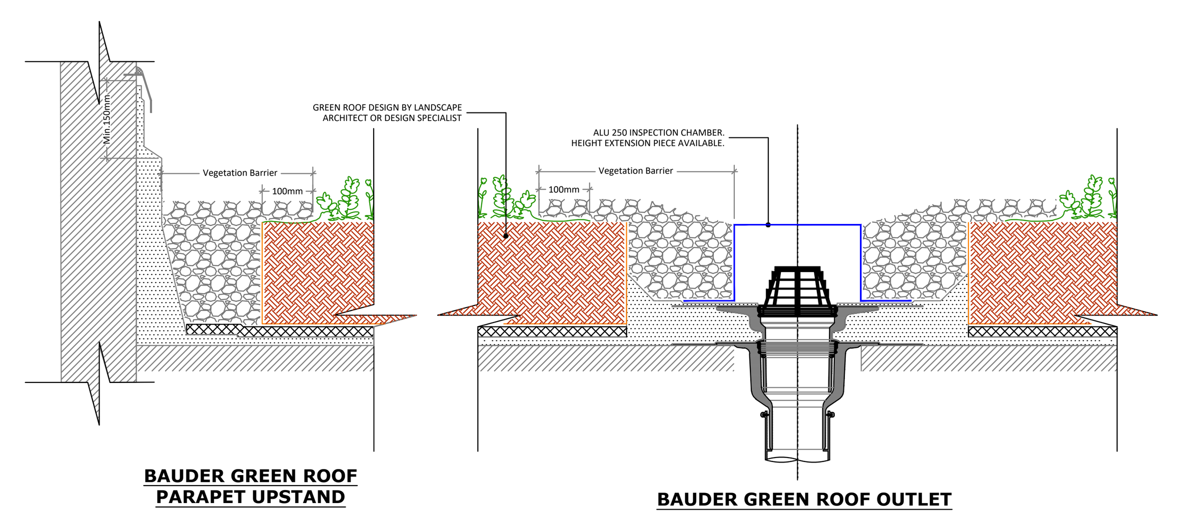

GREEN ROOF - TYPICAL SECTION

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P01	28.02.19	SUITABLE FOR INFORMATION	JB	AH
P02	14.06.19	SUITABLE FOR INFORMATION	JB	PR
C01	19.07.19	PAC SUBMISSION	JS	JB
P03	12.11.2019	SUITABLE FOR INFORMTION	MK	AH

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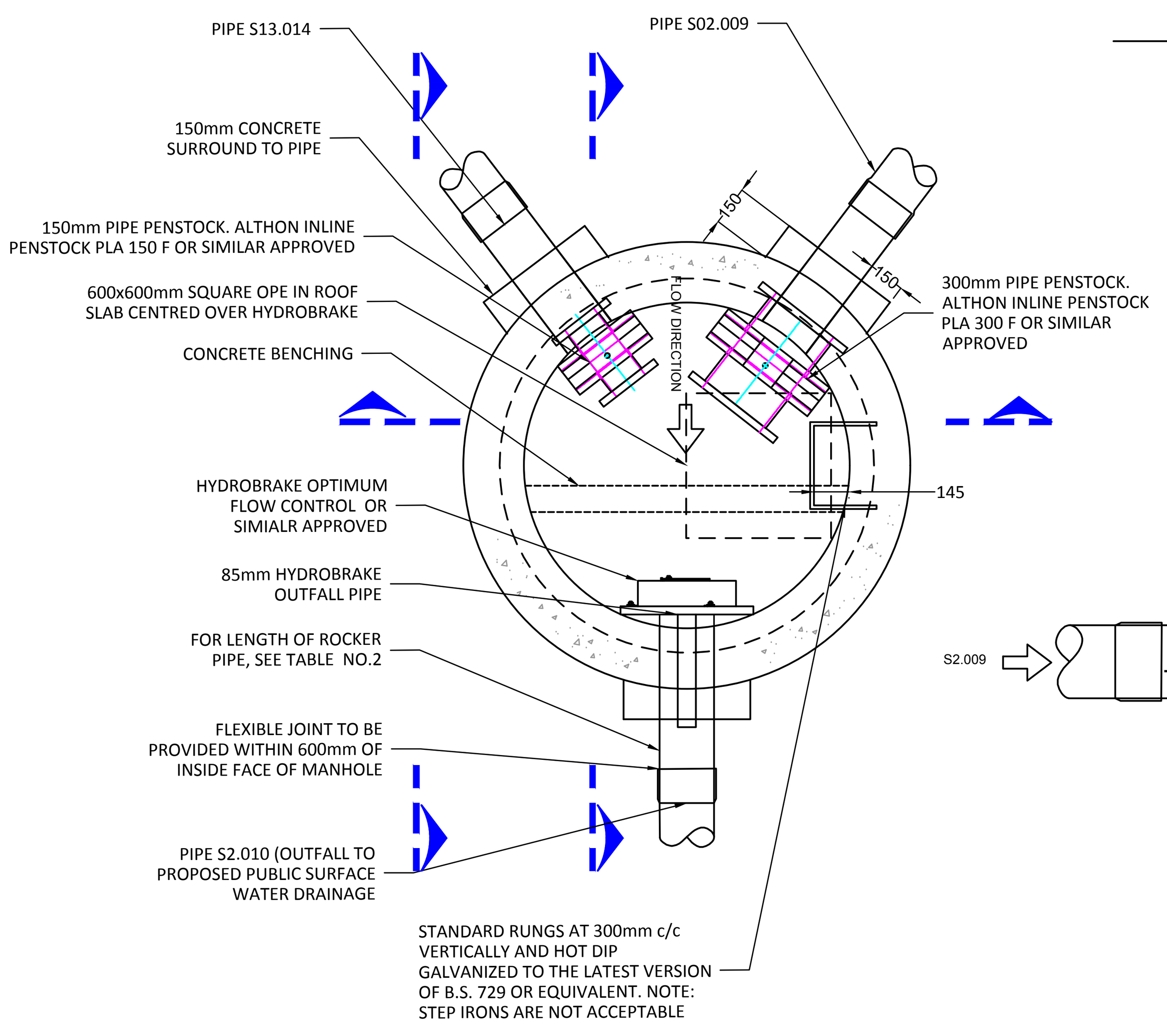
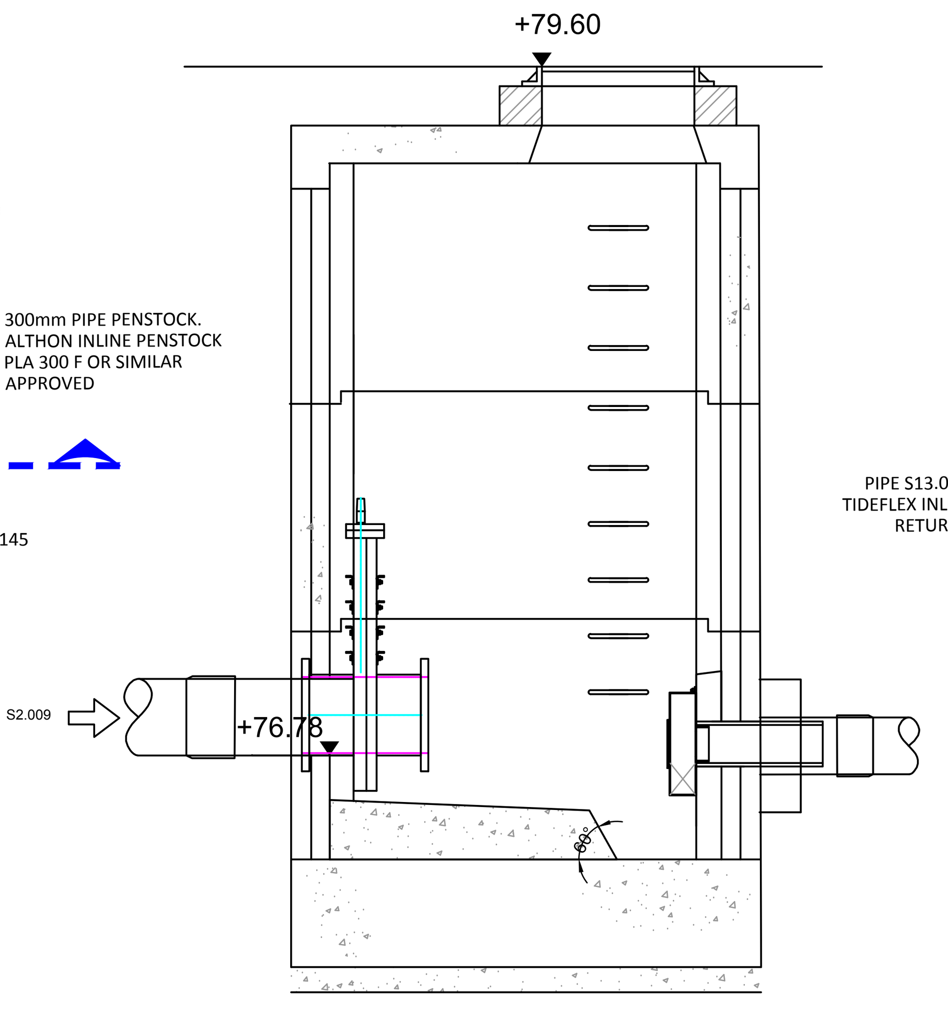
Client: Sandyford GP Limited.
Project: Sandyford Central
Title: SuDs Details

Code	Originator	Zone	Level	Type	Role	Number	Status	Revision
SFC	OCSC	00	XX	DR	C	0510	S2	P03

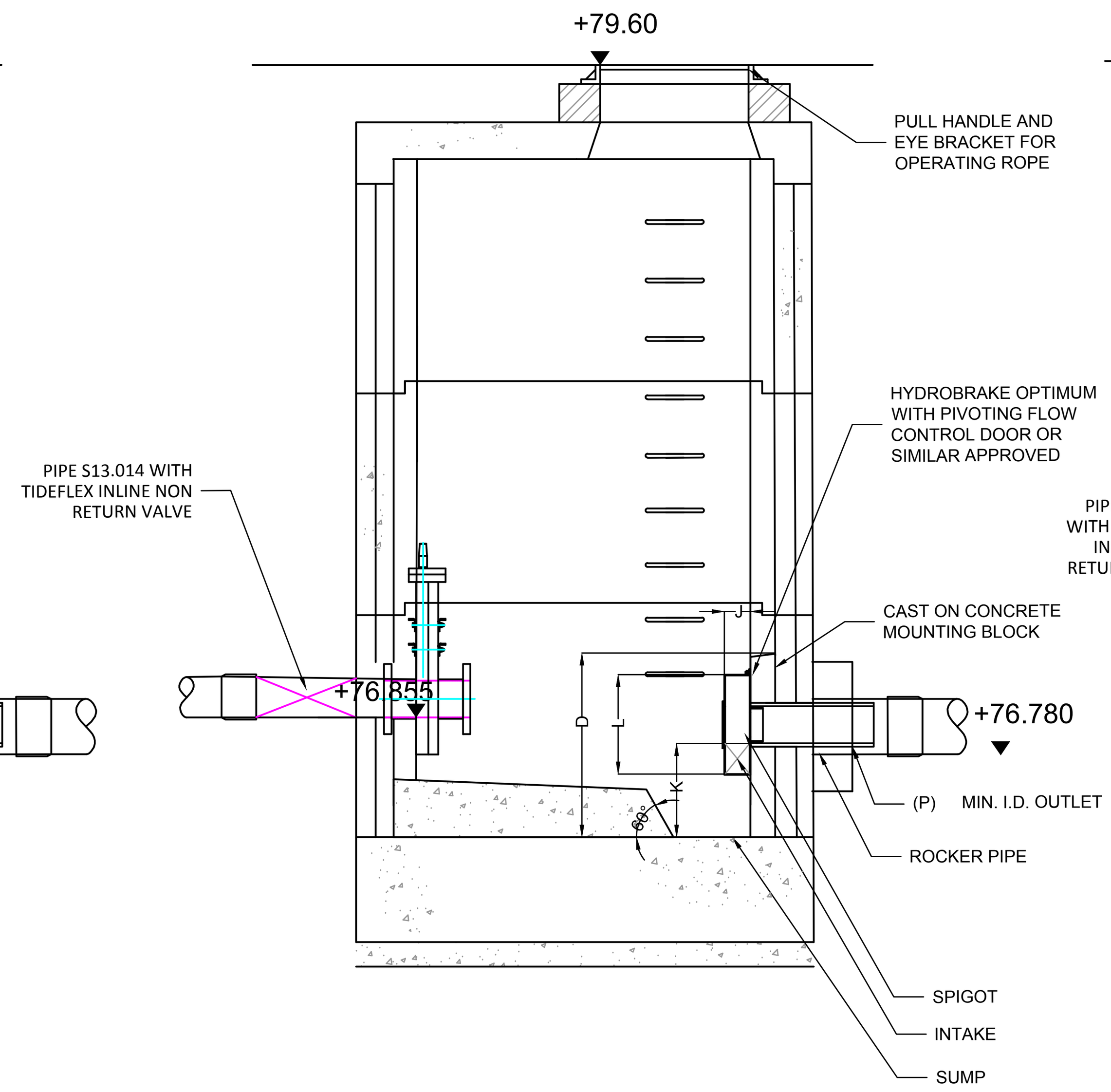
Date: 28.02.19 Scale: n.t.s. @ A1 Drn by: JB Chkd by: AH Aprvd by: MMcG



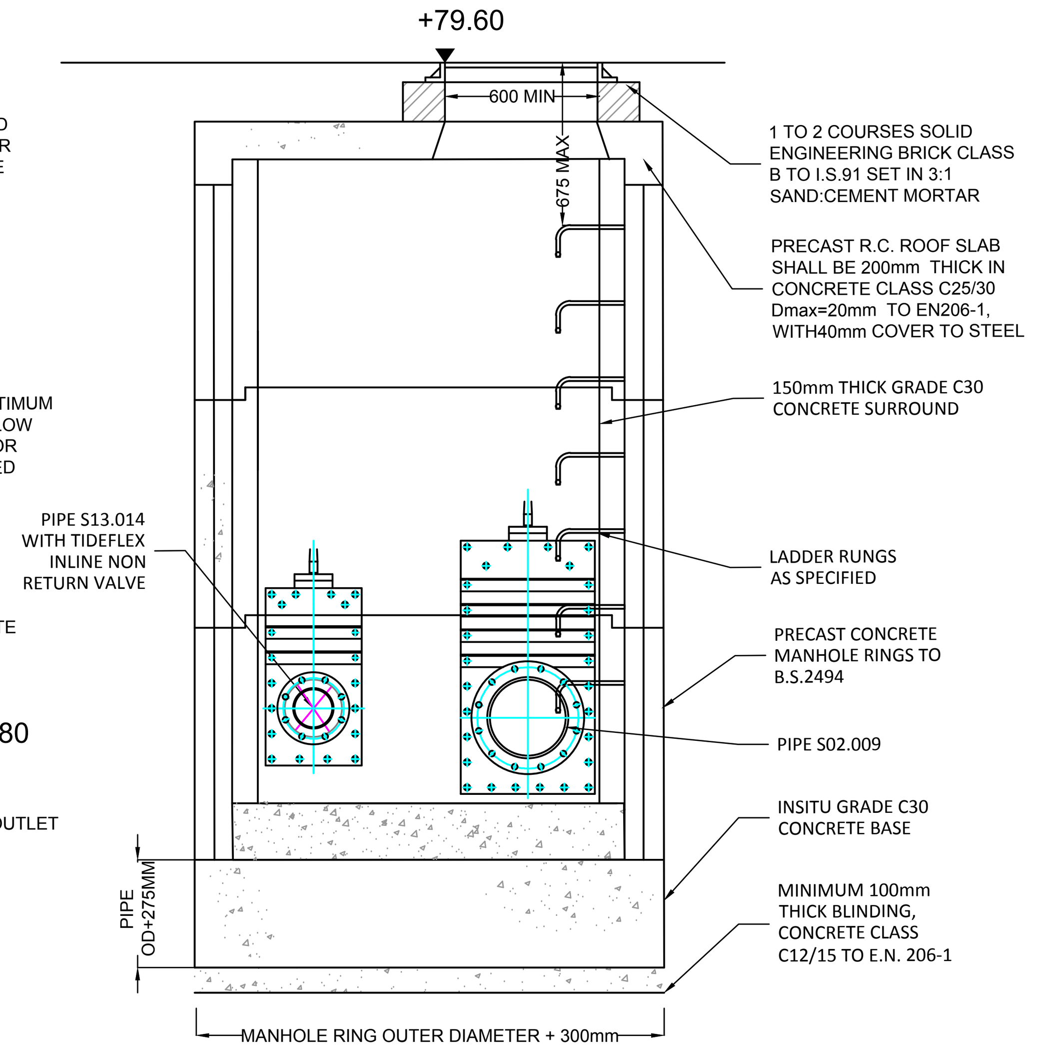
HYDROBRAKE PLAN



HYDROBRAKE SECTION A-A



HYDROBRAKE SECTION B-B



HYDROBRAKE SECTION C-C

TABLE NO. 2

DIA. OF PIPE (mm)	LENGTH OF ROCKER PIPE (mm)
150-600	600
675-750	1000
>750	1250

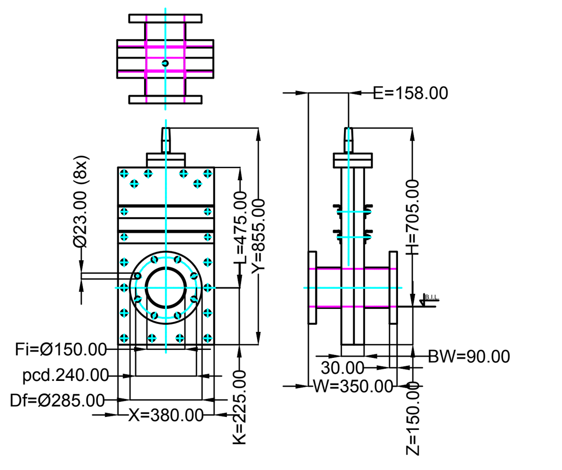
TABLE NO.3

Diameter of Incoming Pipe (mm)	Diameter of Backdrop Pipe (mm)
100	100
150	150
225	300
300	375
375	375
450	450
525	450
600	450
750	600

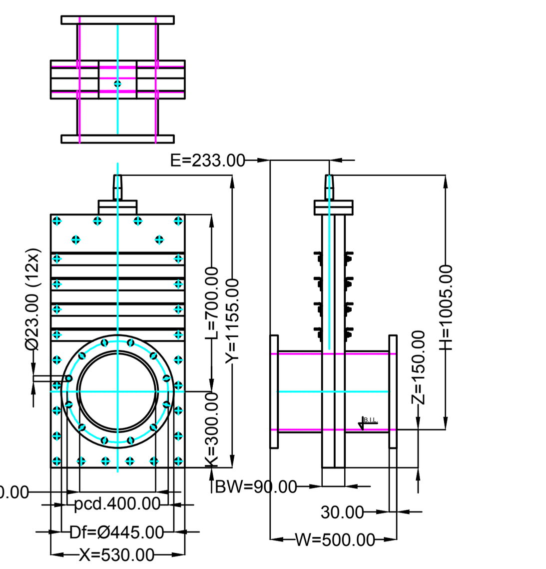
HYDROBRAKE SPECIFICATION

Techincal Specification		
Control Point	Head (m)	Flow (l/s)
Design Point	2.220	5.900
Flush Flow	0.425	4.770
Kick Flow	0.868	3.811
Mean Flow Overhead Range		4.618
Physical Specification		
Min. Block Width (L)	795mm	
Min. Block Height (D)	940mm	
Min. Sump Depth (K)	375mm	
Min. Sump Width (J)	210mm	
Min. Outlet Diameter (P)	97Ø	

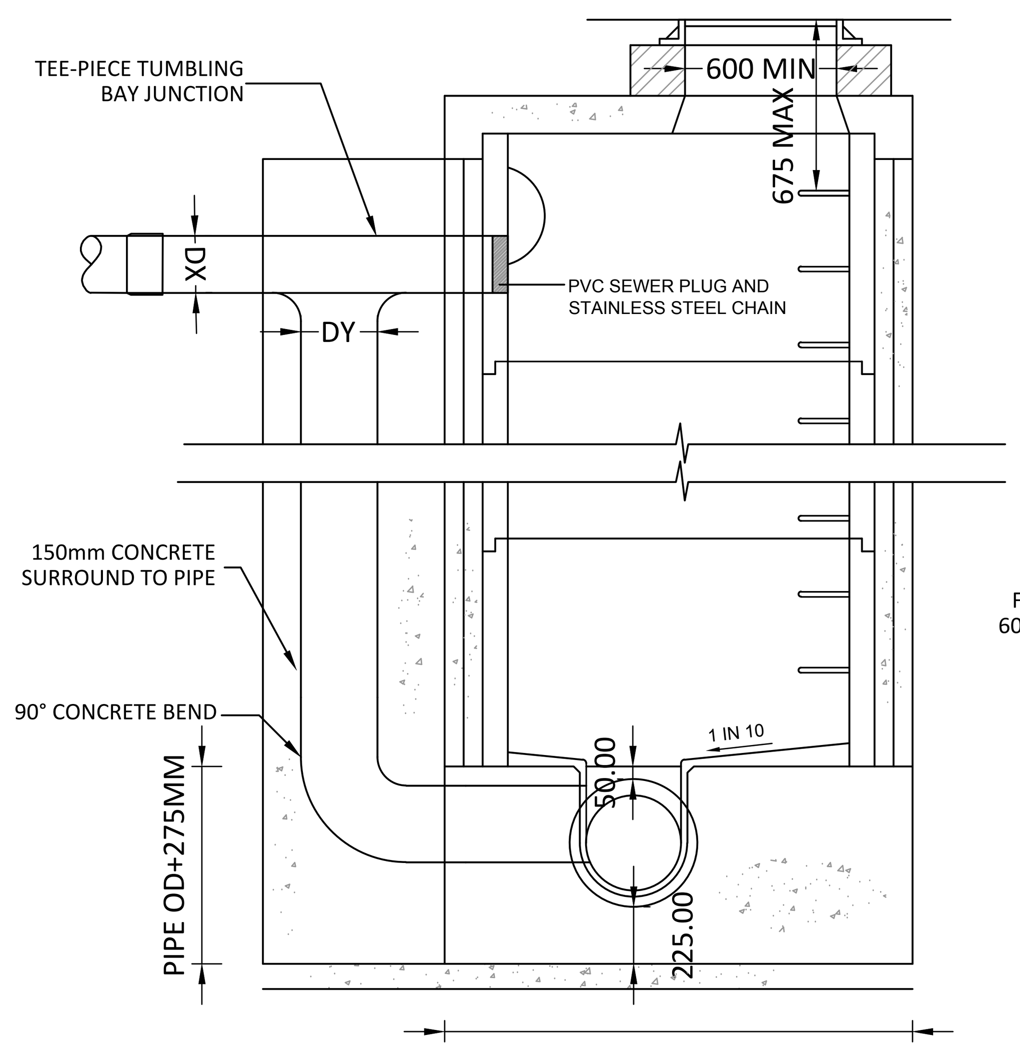
HYDROBRAKE OPTIMUM MODEL No.- SHE-0097-5900-2220-5900



150mm Pipe Penstock

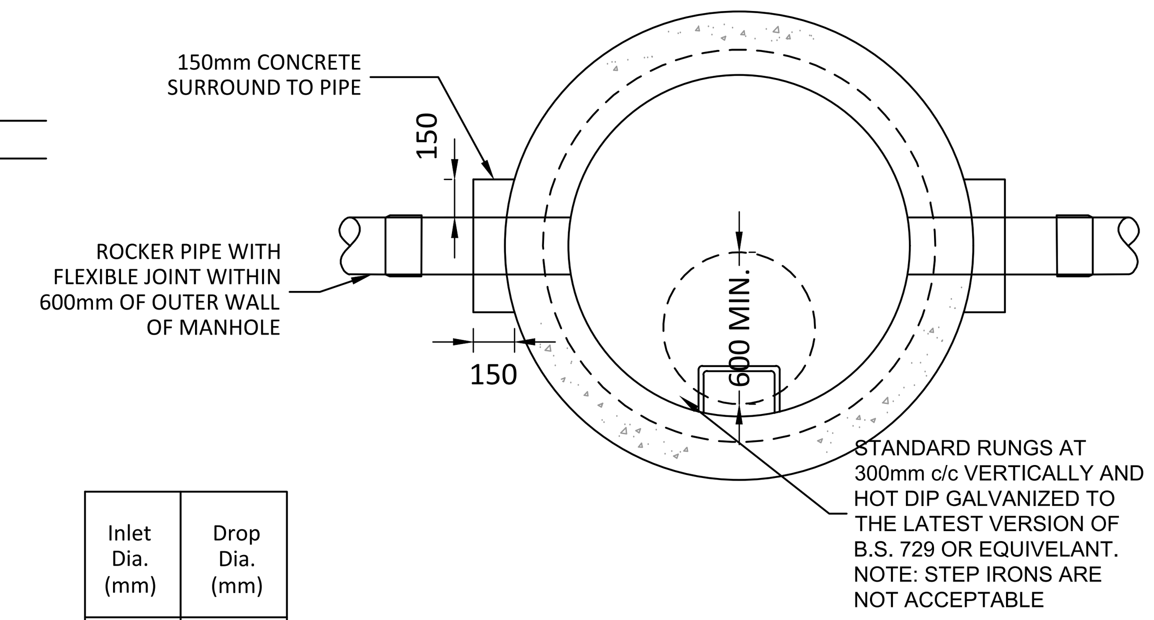


300mm Pipe Penstock



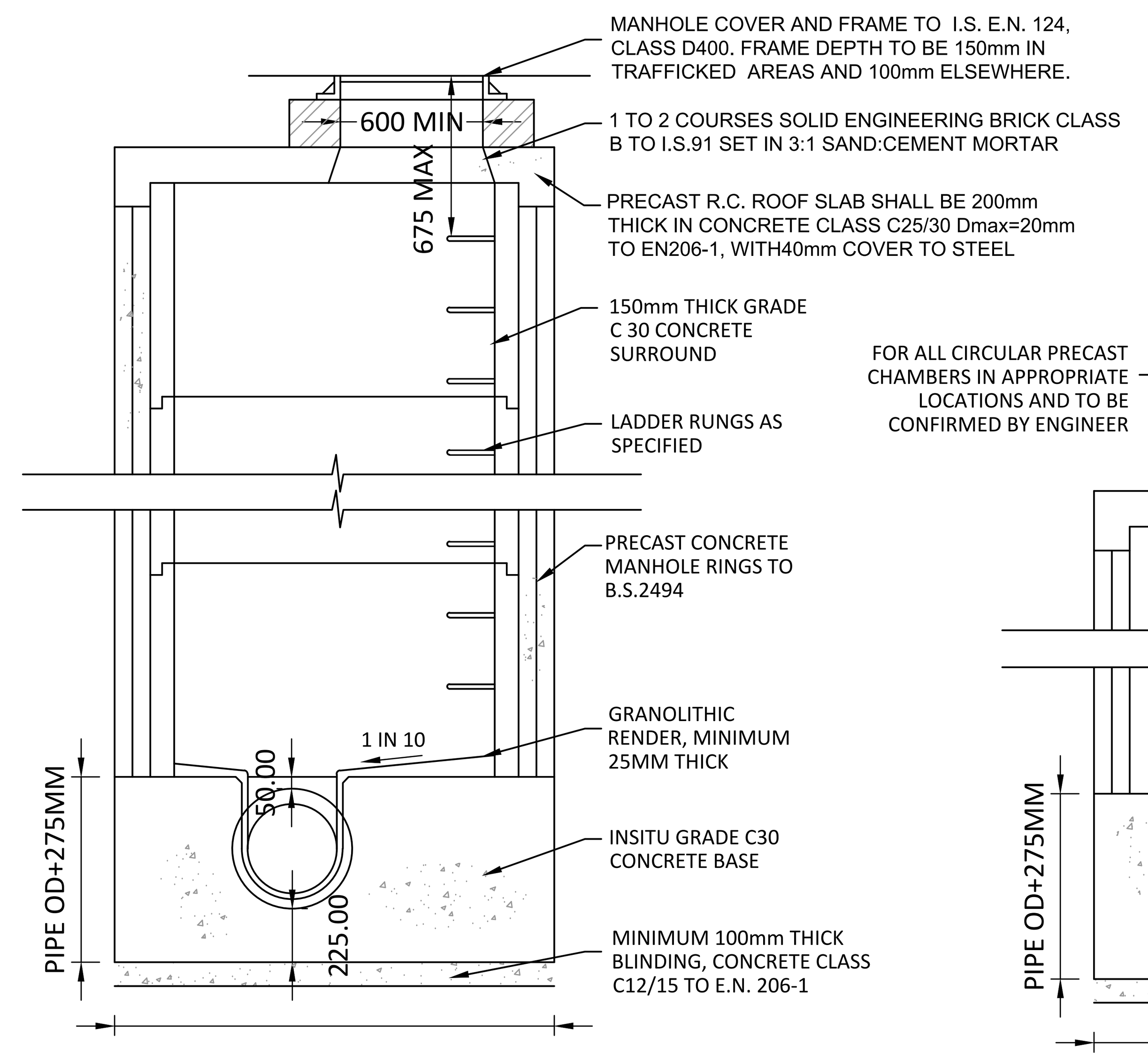
PRECAST BACKDROP

NOTE: ALL MANHOLES IN ROAD TO BE TAKEN IN CHARGE (T.I.C.) AND CAN NOT BE PRE CAST CONCRETE.



Inlet Dia. (mm)	Drop Dia. (mm)
225	300
300	375
375	375
450	450
525	450
600	450
750	600

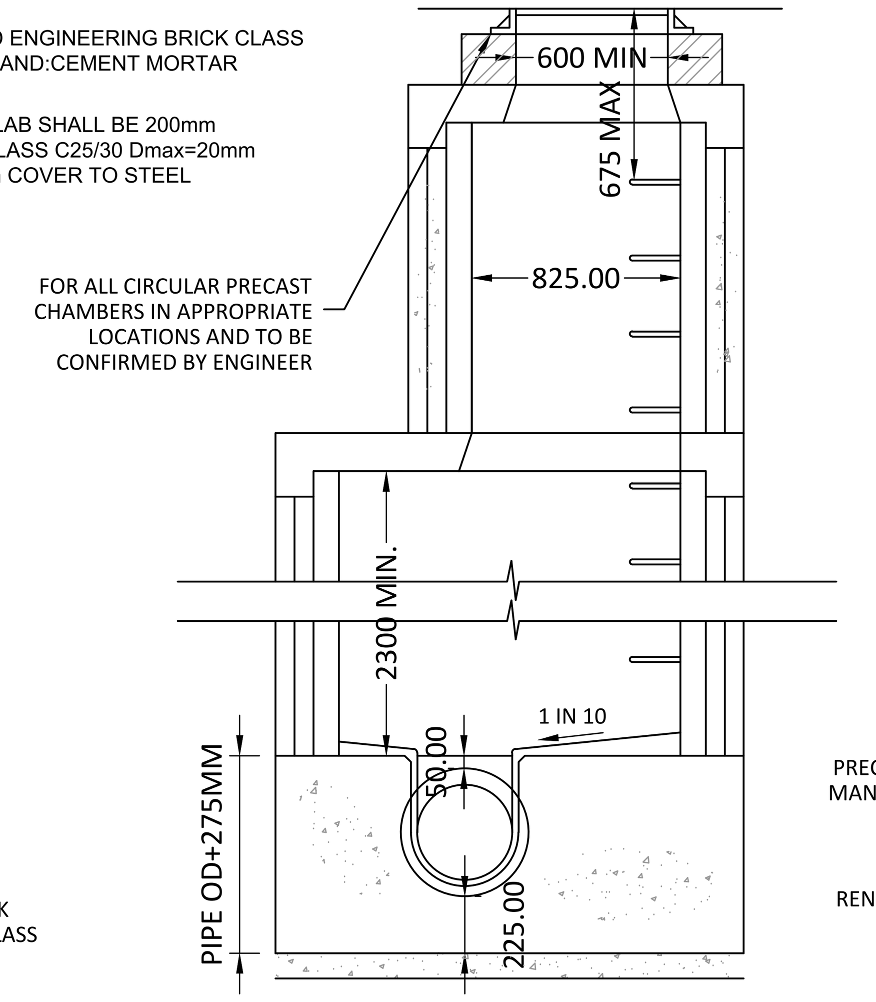
PRECAST MANHOLE PLAN



MANHOLE RING OUTER DIAMETER + 300mm

PRECAST MANHOLE

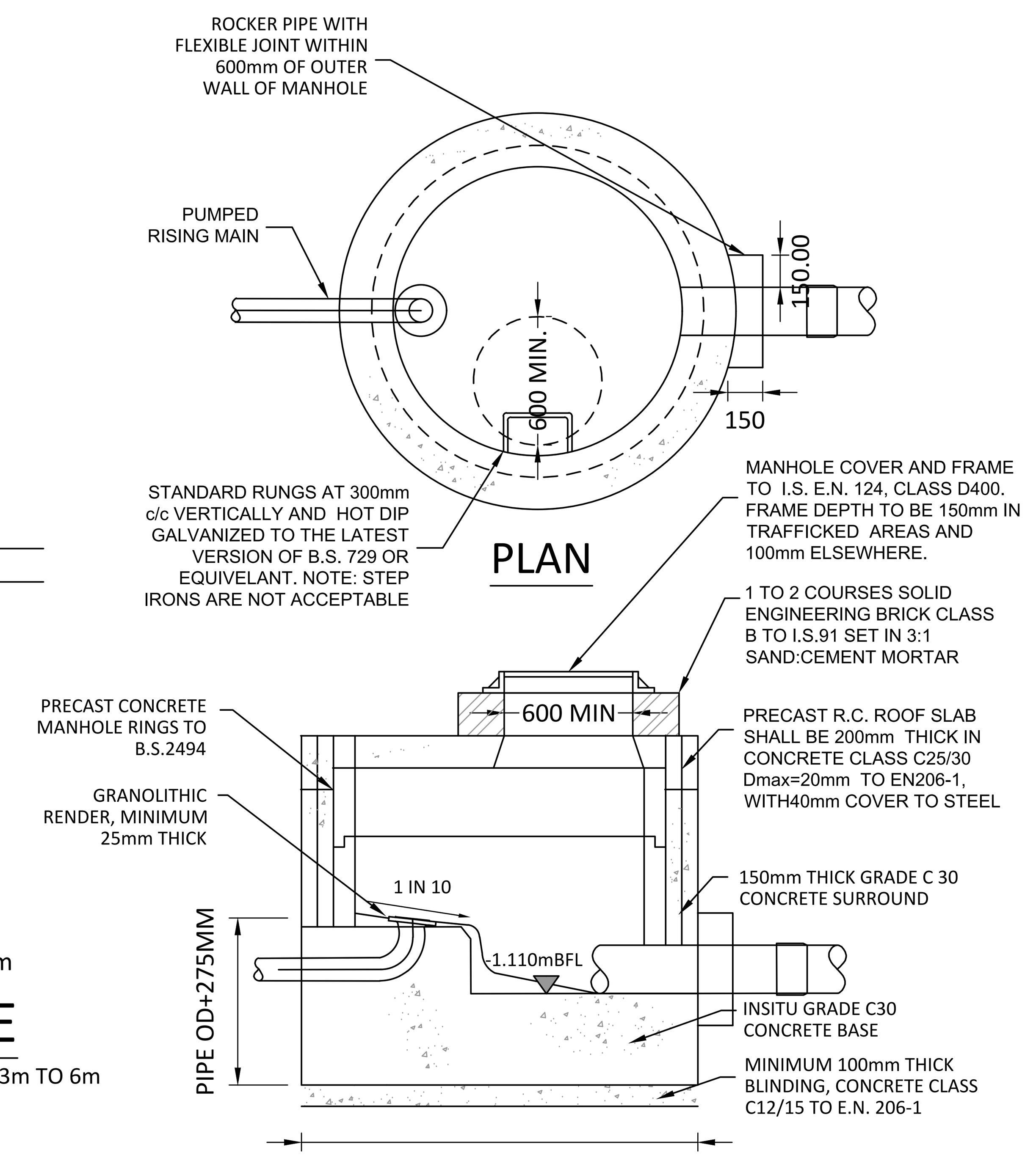
FOR PIPE DIA. 225 - 300 & DEPTH TO INVERT 2.7m TO 3.0m



MANHOLE RING OUTER DIAMETER + 300mm

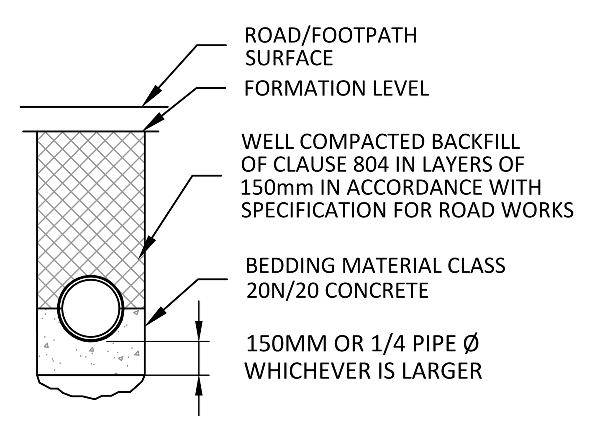
PRECAST MANHOLE

FOR PIPE DIA. 225 TO 450 & DEPTH TO INVERT 3m TO 6m

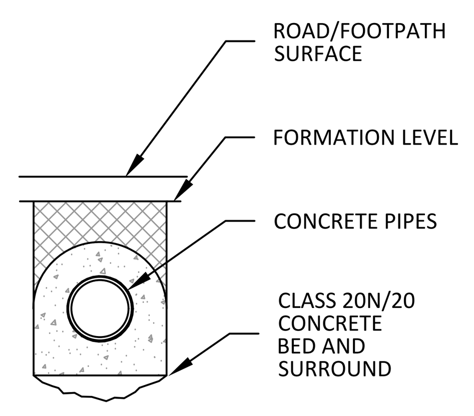


MANHOLE RING OUTER DIAMETER + 300mm

PRECAST STANDOFF MANHOLE

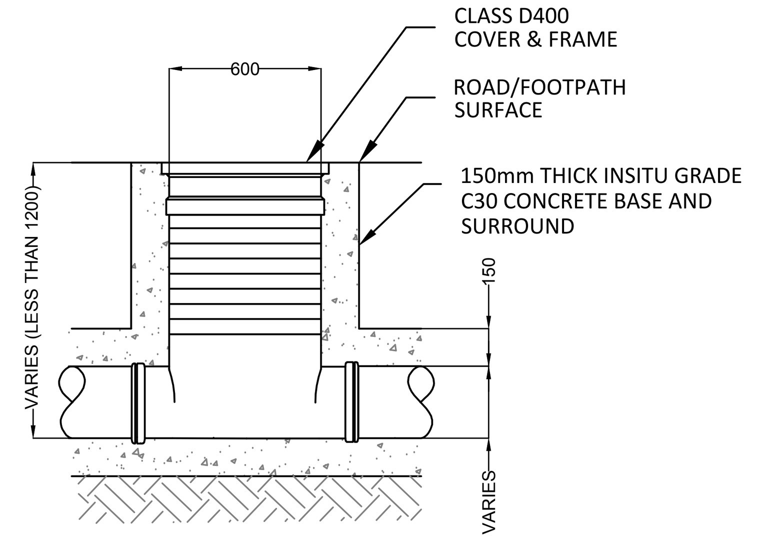


If depth of cover>1.2m



If depth of cover<1.2m

ROAD & FOOTPATH PIPE BEDDING DETAILS



CHAMBER BEDDING DETAIL

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Rev No.	Date	Revision Note	Drn by	Chkd by
C01	19.07.19	PAC SUBMISSION	JB	AH

Rev No.	Date	Revision Note	Drn by	Chkd by

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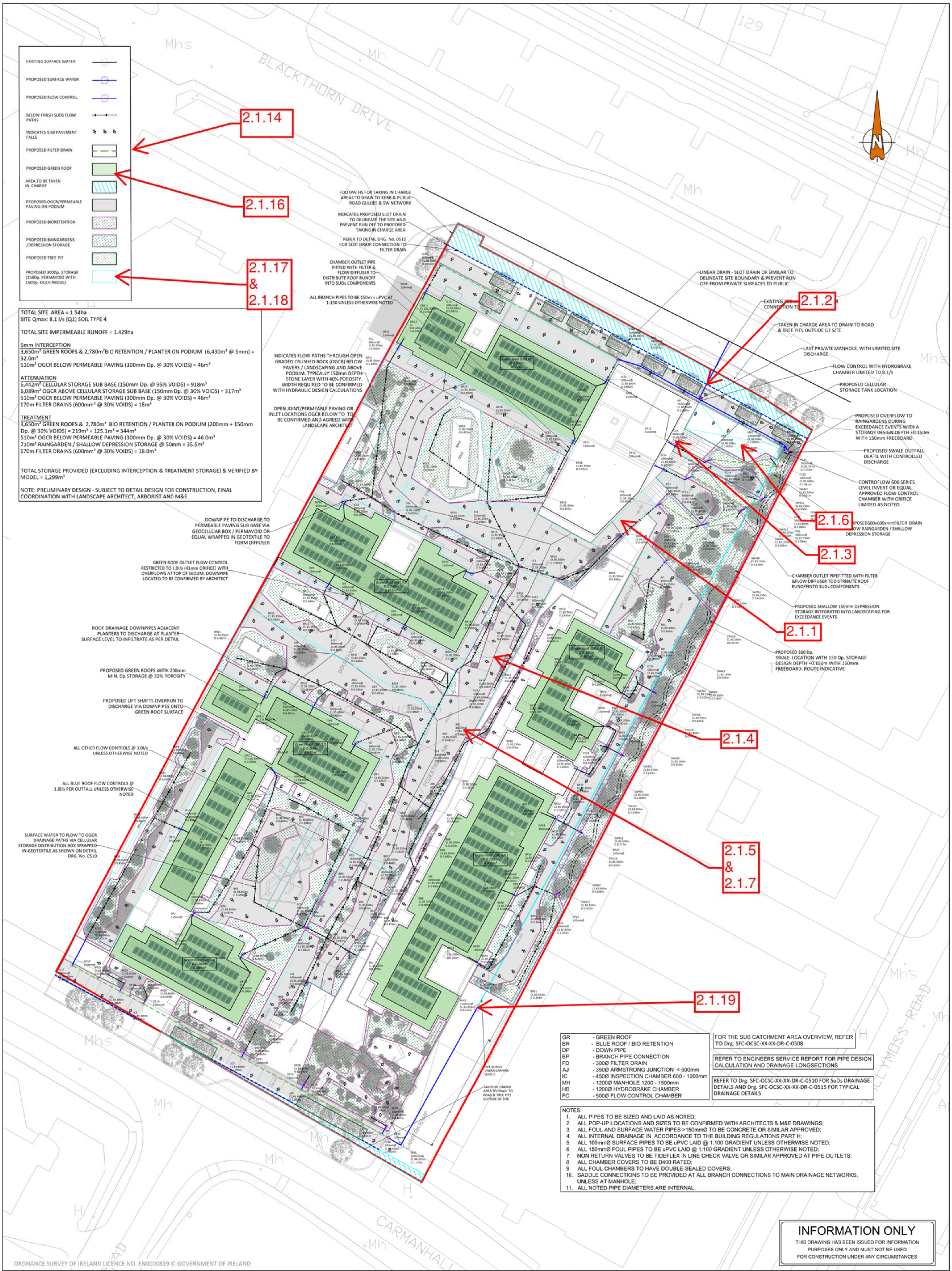
Client: Sandyford GP Limited.
Project: Sandyford Central
Title: DRAINAGE DETAILS

Code	Originator	Zone	Level	Type	Role	Number	Status	Revision
SFC	OCSC	00	XX	DR	C	0515	A1	C01

Date: 17.07.19 Scale: n.t.s. @ A1 Drn by: JB Chkd by: AH Aprvd by: MMcG

Appendix B Site Layout with Stage 1 Audit Findings Highlighted



TOTAL SITE AREA = 1.54ha
SITE Qmax: 8.1 l/s (Q1) SOIL TYPE 4

TOTAL SITE IMPERMEABLE RUNOFF = 1.429ha

5mm INTERCEPTION
3,650m² GREEN ROOFS & 2,780m² BIO RETENTION / PLANTER ON PODIUM (6,430m² @ 5mm) = 32.0m³
510m² OGCR BELOW PERMEABLE PAVING (300mm Dp. @ 30% VOIDS) = 46m³

ATTENUATION
6,442m² CELLULAR STORAGE SUB BASE (150mm Dp. @ 95% VOIDS) = 918m³
6,089m² OGCR ABOVE CELLULAR STORAGE SUB BASE (150mm Dp. @ 30% VOIDS) = 317m³
510m² OGCR BELOW PERMEABLE PAVING (300mm Dp. @ 30% VOIDS) = 46m³
170m FILTER DRAINS (600mm² @ 30% VOIDS) = 18m³

TREATMENT
3,650m² GREEN ROOFS & 2,780m² BIO RETENTION / PLANTER ON PODIUM (200mm + 150mm Dp. @ 30% VOIDS) = 219m³ + 125.1m³ = 344m³
510m² OGCR BELOW PERMEABLE PAVING (300mm Dp. @ 30% VOIDS) = 46.0m³
710m² RAINGARDEN / SHALLOW DEPRESSION STORAGE @ 50mm = 35.5m³
170m FILTER DRAINS (600mm² @ 30% VOIDS) = 18.0m³

TOTAL STORAGE PROVIDED (EXCLUDING INTERCEPTION & TREATMENT STORAGE) & VERIFIED BY MODEL = 1,299m³

NOTE: PRELIMINARY DESIGN - SUBJECT TO DETAIL DESIGN FOR CONSTRUCTION, FINAL COORDINATION WITH LANDSCAPE ARCHITECT, ARBORIST AND M&E.

GR	- GREEN ROOF
BR	- BLUE ROOF / BIO RETENTION
DP	- DOWN PIPE
BP	- BRANCH PIPE CONNECTION
FD	- 300Ø FILTER DRAIN
AJ	- 350Ø ARMSTRONG JUNCTION < 600mm
IC	- 450Ø INSPECTION CHAMBER 600 - 1200mm
MH	- 1200Ø MANHOLE 1200 - 1500mm
HB	- 1200Ø HYDROBRAKE CHAMBER
FC	- 500Ø FLOW CONTROL CHAMBER

FOR THE SUB CATCHMENT AREA OVERVIEW, REFER TO Drg. SFC-OCSC-XX-XX-DR-C-0508

REFER TO ENGINEERS SERVICE REPORT FOR PIPE DESIGN CALCULATION AND DRAINAGE LONGSECTIONS

REFER TO Drg. SFC-OCSC-XX-XX-DR-C-0510 FOR SuDs DRAINAGE DETAILS AND Drg. SFC-OCSC-XX-XX-DR-C-0515 FOR TYPICAL DRAINAGE DETAILS

NOTES:
1. ALL PIPES TO BE SIZED AND LAID AS NOTED;
2. ALL POP-UP LOCATIONS AND SIZES TO BE CONFIRMED WITH ARCHITECTS & M&E DRAWINGS;
3. ALL FOUL AND SURFACE WATER PIPES >150mmØ TO BE CONCRETE OR SIMILAR APPROVED;
4. ALL INTERNAL DRAINAGE IN ACCORDANCE TO THE BUILDING REGULATIONS PART H;
5. ALL 100mmØ SURFACE PIPES TO BE uPVC LAID @ 1:100 GRADIENT UNLESS OTHERWISE NOTED;
6. ALL 150mmØ FOUL PIPES TO BE uPVC LAID @ 1:100 GRADIENT UNLESS OTHERWISE NOTED;
7. NON RETURN VALVES TO BE TIDEFLEX IN LINE CHECK VALVE OR SIMILAR APPROVED AT PIPE OUTLETS;
8. ALL CHAMBER COVERS TO BE D400 RATED;
9. ALL FOUL CHAMBERS TO HAVE DOUBLE-SEALED COVERS;
10. SADDLE CONNECTIONS TO BE PROVIDED AT ALL BRANCH CONNECTIONS TO MAIN DRAINAGE NETWORKS, UNLESS AT MANHOLE;
11. ALL NOTED PIPE DIAMETERS ARE INTERNAL.

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P01	14.06.19	SUITABLE FOR INFORMATION	JB	AH
P02	28.02.19	ISSUED FOR INORMATION	JB	AH
P03	14.06.19	ISSUED FOR INFORMATION	JB	PR
P04	17.06.19	ISSUED FOR INFORMATION	JB	PR
P05	17.07.19	ISSUED FOR INFORMATION	JS	JB
P06	24.09.19	ISSUED FOR INFORMATION	JB	AH
P07	03.10.19	ISSUED FOR INFORMATION	JB	AH
P08	04.11.19	ISSUED FOR INFORMATION	SVM	PR

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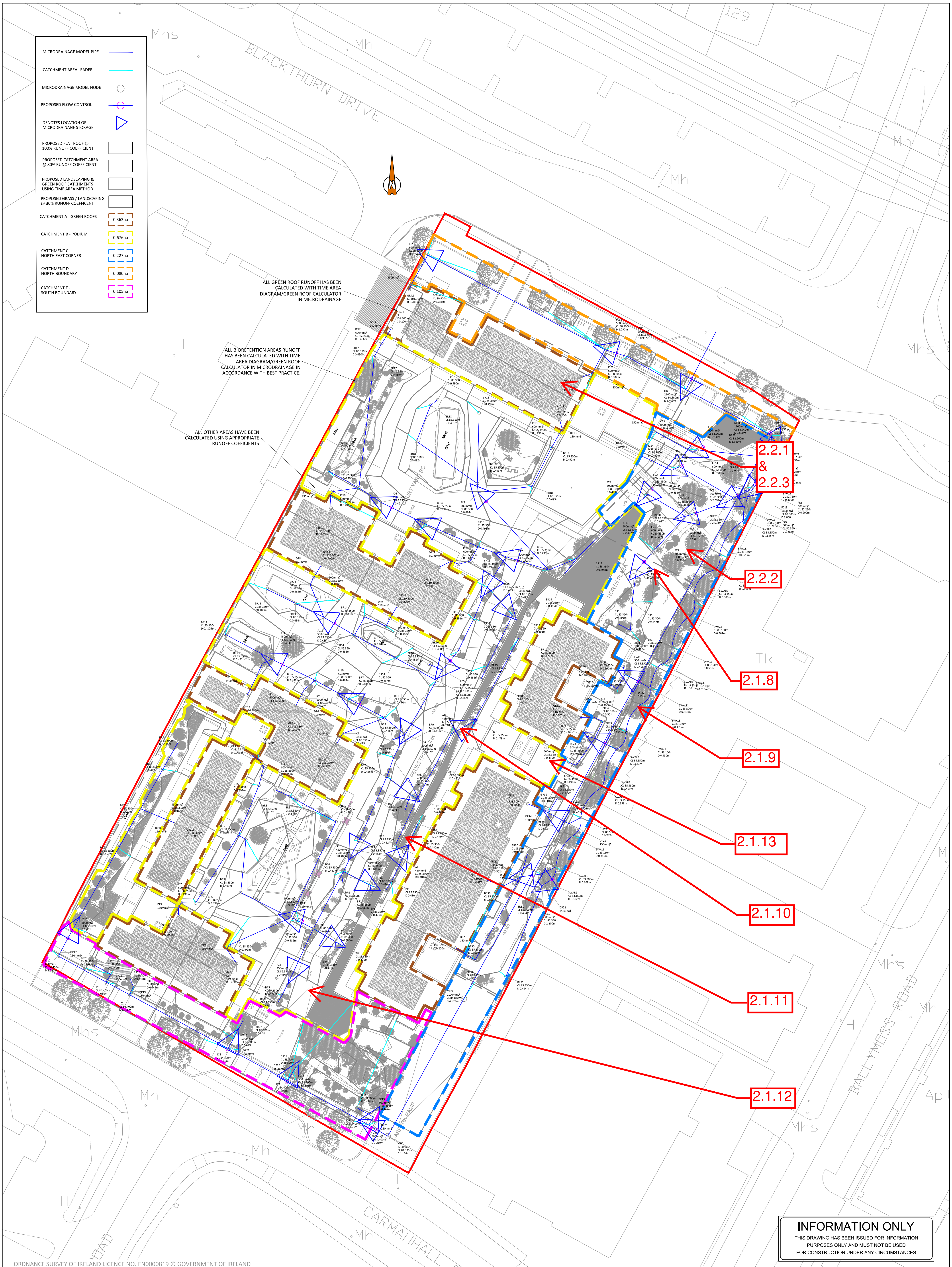
Client: Sandyford GP Limited.
Project: Sandyford Central
Title: Proposed Drainage Layout - Surface Water

Code	Originator	Zone	Level	Type	Role	Number	Status	Revision
SFC	OCSC	00	01	DR	C	0500	S2	P08

Date: 21.02.19 Scale:1:350 @ A1 Drn by:JB Chkd by:AH Aprvd by:MOR



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C01	19.07.19	PAC SUBMISSION	JB	AH
P01	25.09.19	ISSUED FOR INFORMATION	JB	AH
P02	03.10.19	ISSUED FOR INFORMATION	JB	AH
P03	04.11.19	ISSUED FOR INFORMATION	SVM	PR

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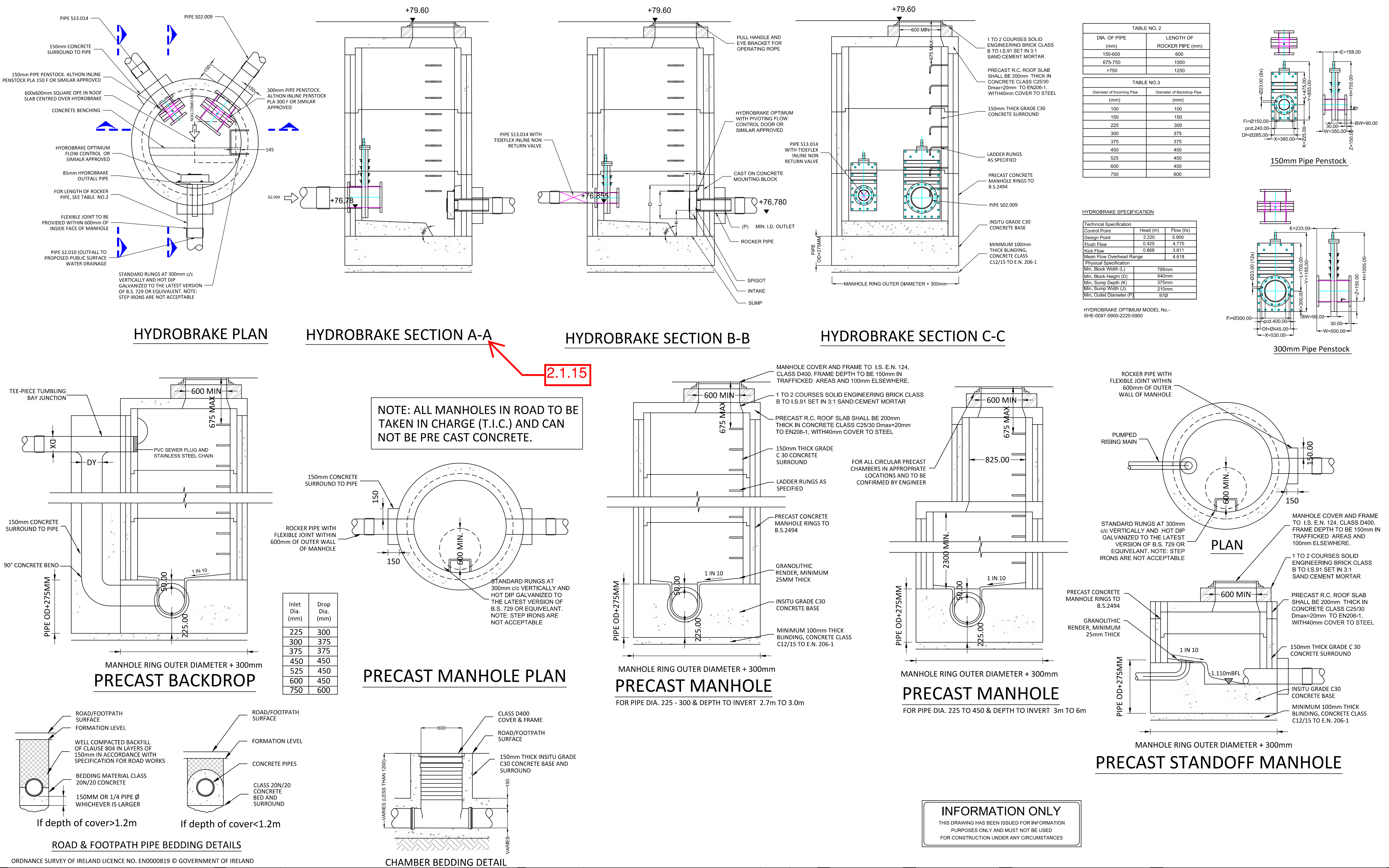
Client: Sandyford GP Limited.
Project: Sandyford Central
Title: Proposed Drainage Layout - Surface Water Catchment Areas.

Code	Originator	Zone	Level	Type	Role	Number	Status	Revision
SFC	OCSC	00	01	DR	C	0508	S2	P03

Date: 19.07.19 Scale:1:350 @ A1 Drn by:JB Chkd by:AH Aprvd by:MM



Inlet Dia. (mm)	Drop Dia. (mm)
225	300
300	375
375	375
450	450
525	450
600	450
750	600

TABLE NO. 2

DIA. OF PIPE (mm)	LENGTH OF ROCKER PIPE (mm)
150-600	600
675-750	1000
>750	1250

TABLE NO.3

Diameter of Incoming Pipe (mm)	Diameter of Backdrop Pipe (mm)
100	100
150	150
225	300
300	375
375	375
450	450
525	450
600	450
750	600

HYDROBRAKE SPECIFICATION

Technical Specification	Head (m)	Flow (l/s)
Control Point		
Design Point	2.220	5.900
Flush Flow	0.425	4.770
Kick Flow	0.868	3.811
Mean Flow Overhead Range		4.618
Physical Specification		
Min. Block Width (L)	795mm	
Min. Block Height (D)	940mm	
Min. Sump Depth (K)	375mm	
Min. Sump Width (J)	210mm	
Min. Outlet Diameter (P)	97Ø	

HYDROBRAKE OPTIMUM MODEL No.- SHE-0097-5900-2220-5900

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Client: Sandyford GP Limited.
Project: Sandyford Central
Title: DRAINAGE DETAILS

Code	Originator	Zone	Level	Type	Role	Number	Status	Revision
SFC	OCSC	00	XX	DR	C	0515	A1	C01

Date: 17.07.19 Scale: n.t.s. @ A1 Drn by:JB Chkd by:AH Aprvd by:MMcG

Appendix C Storm Water Audit Feedback Form

STORM WATER AUDIT FEEDBACK FORM

Scheme: Carmanhall Road, Sandyford Business District, Dublin 18

Area:

Audit Stage: 1 **Date Audit Completed:** 18/11/2019 **Our Ref :** 192334

Paragraph No. in Audit Report	Issue Accepted (Yes/No)	Recommended Measure Accepted (Yes/No)	Alternative Measures (described) [or reason problem not accepted]	Alternative Measures Accepted by Auditors (Yes/No)
2.1.1	No	Yes	The proposed permeable paving is a tanked system, where placed above podium slab, which will provide the same benefits as that outlined in the recommendation. The permeable paving is to be a permeable system, where provided off-podium, to the north of the site. A typical detail of the permeable paving is provided on drawing SFC-00-XX-DR-C-0510.	YES
2.1.2	No	No	The site is non-trafficable to vehicles, with the exception of Fire Tender access, which greatly minimises the likelihood of potential hydrocarbon pollution. Any such small risk is mitigated by use of permeable paving throughout, as mentioned in Item 2.1.1	BYPASS INTERCEPTOR REQUIREMENT TO BE REVIEWED AT DETAILED DESIGN STAGE FOLLOWING THE COMPLETION OF BASEMENT & INTERNAL CAR PARKING LAYOUT.
2.1.3	Yes	Yes	Silt traps are to be provided upstream of attenuation areas. As detailed within the report, all internal flow control chambers are to be the Controflow unit, or similar, which provides protection against blockage to the outfall pipe. This is to be clearly noted on any construction issue drawings.	—
2.1.4	No	No	There are no road gullies provided as part of this design. All external areas are to be drained via permeable paving, as outlined above, or via bio-retention areas and a swale along the eastern boundary. Refer to drawing SFC-OCSC-00-00-DR-C-0500 and SFC-OCSC-00-00-DR-C-0508 for detailed layouts.	YES
2.1.5	Yes	Yes	This will be ensured in areas off podium. The extent of basement covers the majority of the site and therefore, groundwater is not an issue to the permeable paving.	—

STORM WATER AUDIT FEEDBACK FORM

Paragraph No. in Audit Report	Issue Accepted (Yes/No)	Recommended Measure Accepted (Yes/No)	Alternative Measures (described) [or reason problem not accepted]	Alternative Measures Accepted by Auditors (Yes/No)
2.1.6	yes	Yes	The basement covers the vast majority of the site extent, with the exception of the eastern boundary landscaped area and the north eastern corner of the site. The cellular storage that is being provided at the north eastern corner of the site has been designed to allow for infiltration. A low infiltration rate of $f=2.34 \times 10^{-5}$ has been determined, as noted in the site investigation that is appended to the ESR. This area will be monitored prior to and during construction to ensure no impact to adjoining areas or impact from construction activities.	—
2.1.7	Yes	No	The permeable paving is to be provided above podium slab, so CBR values are typically not required. CBR tests are to be carried out to laying permeable paving build-up at the area immediately to the north of the development, inside site boundary. It is noted again however, that these areas are not to be trafficable by vehicles, with the exception of Fire Tender	YES
2.1.8	Yes	Yes	As the basement extent covers the majority of the site area, no existing underground utilities are envisaged to clash.	—
2.1.9	Yes	Yes	There are no trees or habitats of importance on site that are being retained. The entire site is currently brownfield and is to be excavated for basement construction	—
2.1.10	Yes	Yes		—
2.1.11	No	No	There is no ground level parking. All parking is within the basement.	BYPASS INTERCEPTOR REQUIREMENT TO BE REVIEWED AT DETAILED DESIGN STAGE FOLLOWING THE COMPLETION OF BASEMENT & INTERNAL CAR PARKING LAYOUT.
2.1.12	Yes	Yes	An ACO across the top of the ramp is to be provided, which will discharge to the basecourse of the adjacent permeable paving.	—

STORM WATER AUDIT FEEDBACK FORM

Paragraph No. in Audit Report	Issue Accepted (Yes/No)	Recommended Measure Accepted (Yes/No)	Alternative Measures (described) [or reason problem not accepted]	Alternative Measures Accepted by Auditors (Yes/No)
2.1.13	Yes	Yes	Legend and catchment delineators to be revised to provide more clarity.	
2.1.14	Yes	Yes	All pipes and manholes are coordinated with the microdrainage design files flow controls and manholes are clearly identified by the legend. Detailed drawings are to be provided to the contractor, to reflect design, in advance of construction.	
2.1.15	Yes	Yes	The detail shown on drawing 0515 for the flow control is for the proposed Controflow device. This is a proprietary device and there are several of these being provided throughout the development. These will be designed to suit the requirements of the drainage design, with the flow rates contained in the ESR Appendix B. All design information is to be clearly provided to contractor prior to construction.	
2.1.16	Yes	Yes	The green roof is to be provided over the full extent shown on drawing SFC-OCSC-00-00-DR-C-0500. This is to be as typically as per the detail on drawing SFC-OCSC-00-00-DR-C-0510. Solar panels are also to be provided, integrated with the green roof build-up, in some areas.	
2.1.17	Yes	No	The proposed attenuation systems provided are detailed within the ESR, with the inlets / outlets as per drawing SFC-OCSC-00-00-DR-C-0500.	YES
2.1.18	Yes	Yes	Confirmed. All areas outlined in Cyan colour are to provide a layer of permavoid (or similar) and OGCR, underneath either permeable paving or landscaped areas. The construction methodology for these areas is to be carried out in advance of construction.	
2.1.19	Yes	No	This pipe is located under podium slab, and routed as far as the development outfall. No pumping is required.	YES

STORM WATER AUDIT FEEDBACK FORM

Paragraph No. in Audit Report	Issue Accepted (Yes/No)	Recommended Measure Accepted (Yes/No)	Alternative Measures (described) [or reason problem not accepted]	Alternative Measures Accepted by Auditors (Yes/No)
2.2.1	Yes	No	Rainwater harvesting was considered not practicable for this development, considering the small available roof area that is not proposed as green roof.	YES
2.2.2	Yes	Yes	The depth of substrate varies throughout. The roof drainage does drain to both landscaped areas and base course of the permeable paving	—
2.2.3	No	No	The roof areas are not to be accessible as useable space and therefore is to be extensive green roof, with a typical substrate of 200mm.	YES

Signed: Mark Killian **Design Team Project Manager** **Date:** 18.11.2019

Please complete and return to the auditor

Auditor Signed Off: DONNAGH MURPHY ENGINEER **Date:** 19.11.2019.

PUNCH CONSULTING ENGINEERS