Dunshaughlin East SHD Stormwater Assessment

Final Report

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JOR Engineering

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Co. Meath

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Contract

This report describes work commissioned by Joseph O'Reilly, on behalf of JOR Engineering, by a letter dated 09-07-2018. David Casey and Hannah Moore of JBA Consulting carried out this work.

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Purpose

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Abbreviations

AEP	Annual Exceedance Potential
DTM	Digital Terrain Model
FEH	Flood Estimation Handbook
FSR	Flood Studies Report
IH	Institute of Hydrology
MRFS	Medium Range Forecast Scenario
RR	Rainfall-Runoff
SW	Stormwater

1 Introduction

JBA Consulting (JBA) was appointed by Joseph O'Reilly of JOR Consulting Engineers to undertake a review of the provided stormwater (SW) design for a development located in Dunshaughlin, Co. Meath. Refer to Figure 1-1 for the site location.

There were two main stages involved in the assessment:

1. Obtain the 1% and 0.1% AEP event flood levels at the proposed stormwater outlets within the site, and assess flows across the site using a 1D-2D hydraulic model.
2. Build a WinDes model of the proposed SW design while incorporating the downstream 1% AEP event flood level.

Sections 2-4, primarily cover the estimation of the hydrology and hydraulic modelling, while Section 5 and Appendix A covers the Windes modelling process.

The primary aim of this review is to ensure that the proposed SW system will operate as intended during a 1% AEP (1 in 100 year) flood event and are sufficiently designed to reduce risks due to climate change. The proposed development layout and stormwater discharge outlets are presented in

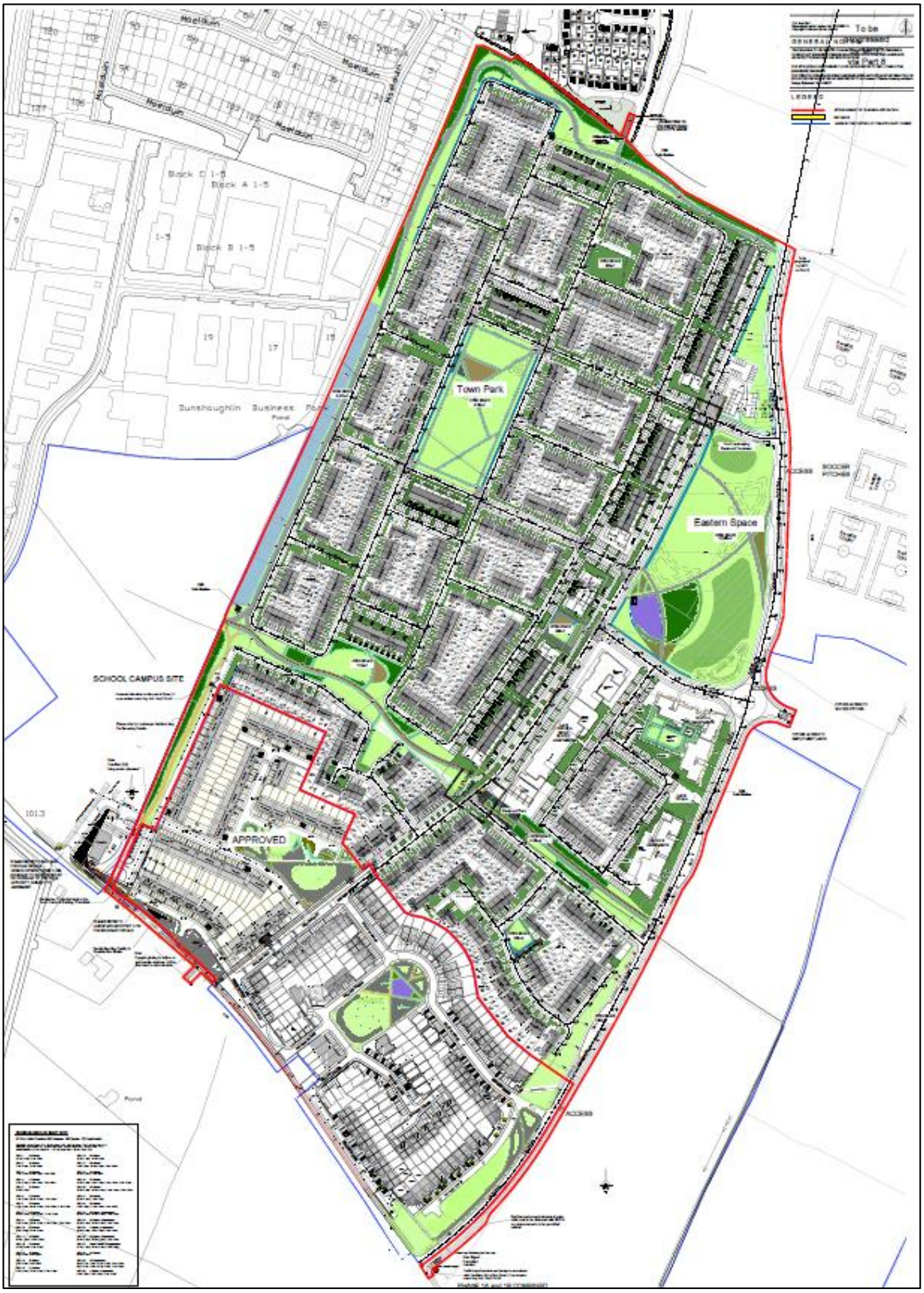


Figure 1-2. Flows across the site discharging from the business park upstream have also been assessed to ensure the 1%AEP and 0.1%AEP flood events are contained within flood drainage assets across the site.

Figure 1-1: Site Location

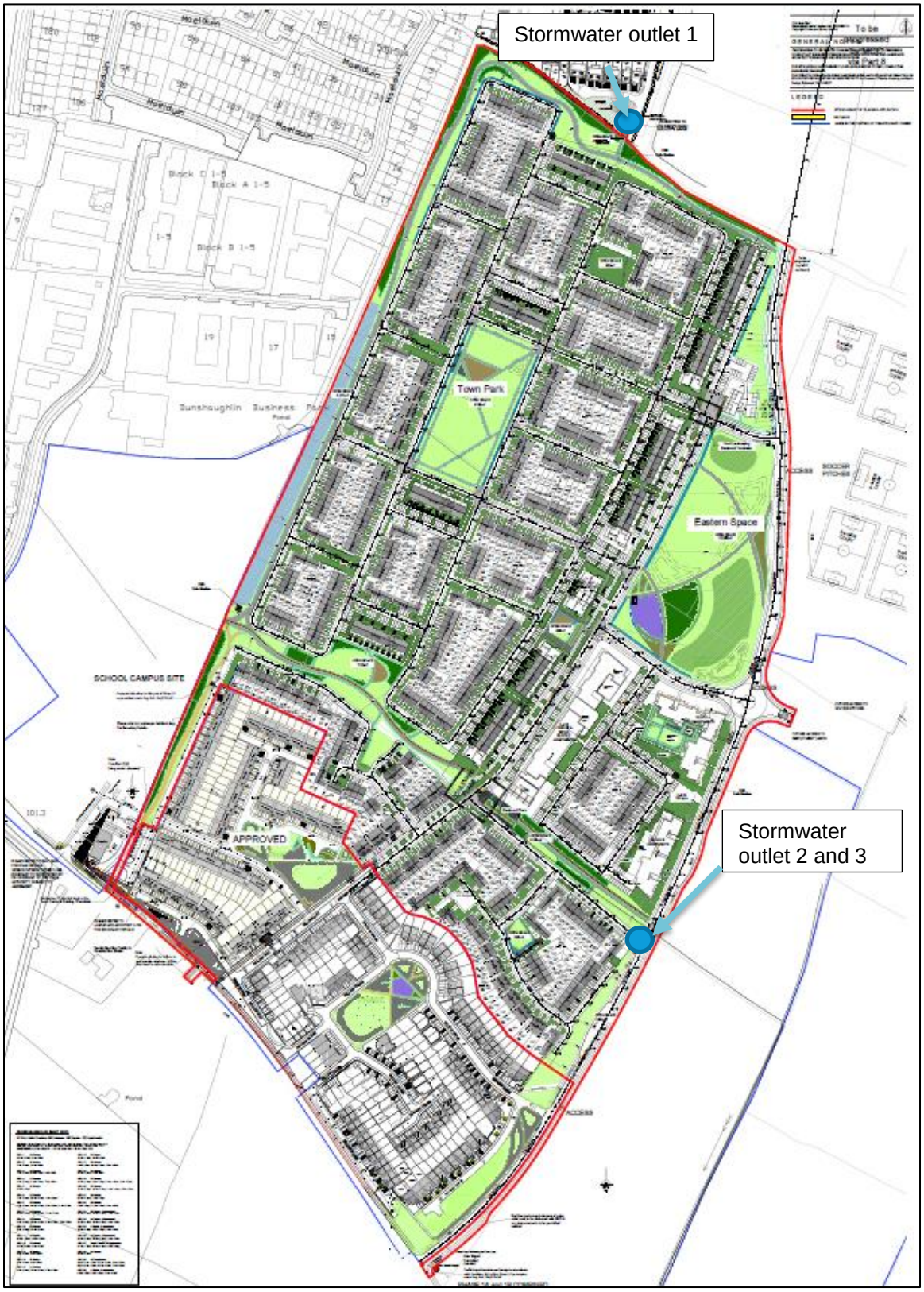


Figure 1-2: Proposed Site Layout

2 Hydrology

2.1 Description of watercourses

Figure 2-1 shows the hydrological features within the site and surrounding area. The site is located in the upper catchment area of the OPW drainage ditch C1/11. The stream begins within the site boundary and receives surface water from the surrounding area via a network of drainage ditches. The stream predominately flows in an easterly direction across the site before flowing north and ultimately merging with the Broadmeadow River approximately 2km northeast of the site.

A second watercourse, identified as the Northern Stream, begins at the site's northern boundary from where it flows north and merges with the Broadmeadow River, approximately 1.3km north of the site.

A number of drainage ditches are located onsite and within the surrounding area that drain predominantly to ditch C1/11.

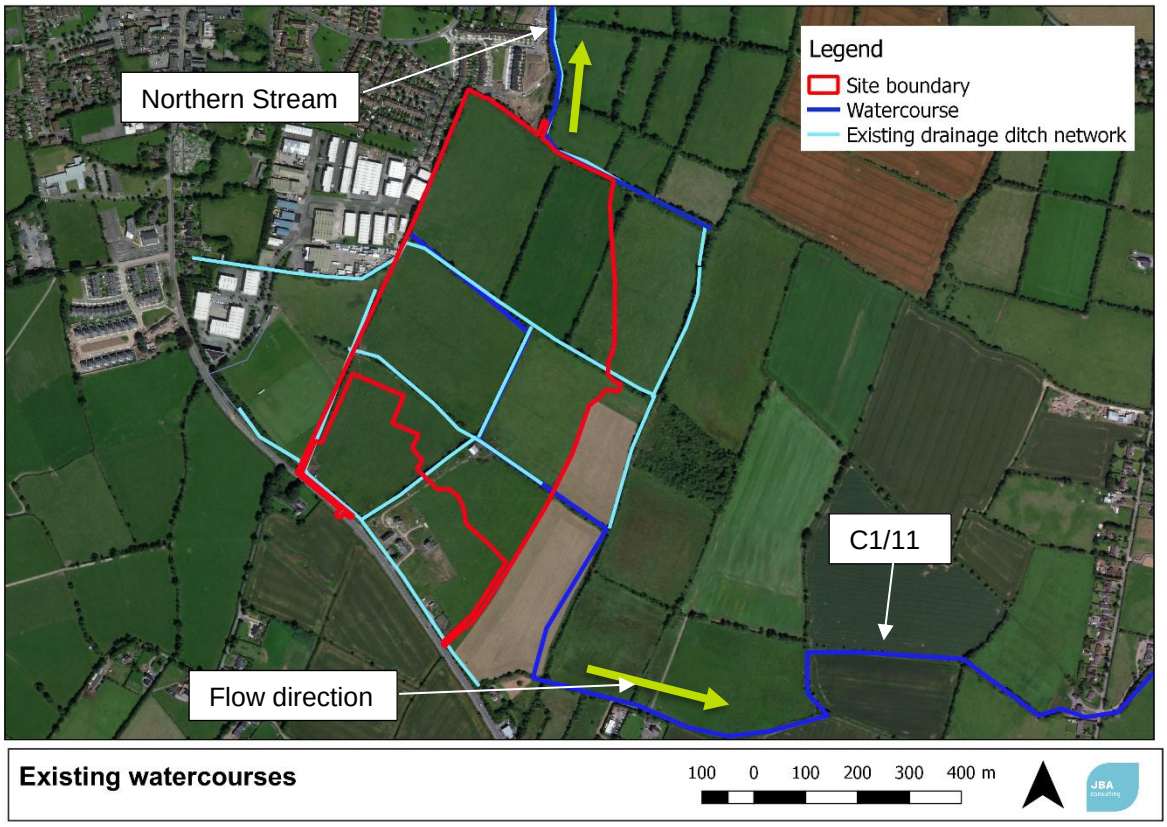


Figure 2-1: Existing watercourses

2.2 Determination of 1% and 0.1% AEP flows - C1/11 Catchment

Based on the catchment area, two methods were chosen to estimate the peak flow rates at the site, these were the IH 124 and FSR RR methods. Both methods are most applicable to small area catchments and so are ideal to use for this study. The hydrological estimation process involves estimating the baseline greenfield flow rates and applying a growth factor to obtain the 1% and 0.1% AEP flow events. As the study area is classified as land benefitting from arterial drainage, a drainage factor of 1.6 was applied.

The estimated peak flows are presented in Table 2-1. As the catchment area is less the 10km^2 the IH 124 value has been taken forward as a more reliable estimate as it generally better represents small catchments. It is also the more conservative estimate of the 1%AEP event. Therefore, the final 1% and 0.1% AEP flow rates for the total catchment are 2.18m^3/s and 2.91m^3/s respectively.

Table 2-1: Calculated Peak Flow Rates

Annual Exceedance Probability (%)	FSR RR (m^3/s)	IH124 (m^3/s)
50% (2yr)	0.73	1.06
20% (5yr)	1.02	1.33
10% (10yr)	1.22	1.52
4% (25yr)	1.48	1.78
2% (50yr)	1.7	1.97
1% (100yr)	1.94	2.18
0.1% (1000yr)	2.97	2.91

2.2.1 Sub-Catchment delineation

Seven sub-catchments were identified in the study area, which are referred as the Main, Southern Western Residential, and Western Catchments, the north and south business parks, and the Northern Stream Catchment (see Figure 2-2). The peak flows determined for each sub-catchment are given in Table 2-2.

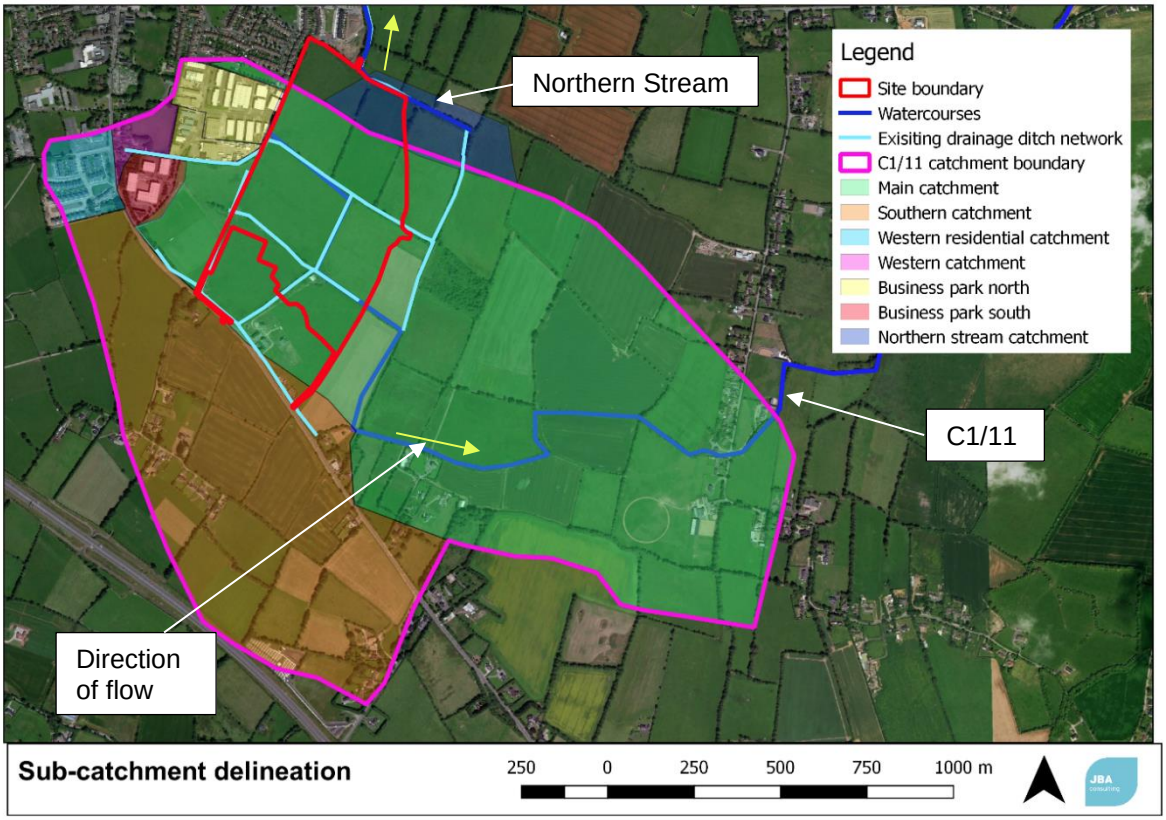


Figure 2-2: Sub-catchment delineation

Table 2-2: Peak flows for each sub-catchment

Catchment	Total Area (km^2)	1% AEP Flow (m^3/s)	1% AEP + MRFS Flow (m^3/s)	0.1% AEP Flow (m^3/s)
C1/11 Catchment Total Area	2.42	2.18	2.62	2.9
Western Catchment (km^2)	0.025	0.022	0.026	0.029
Western Residential Catchment	0.048	0.043	0.052	0.057
Southern Catchment (km^2)	0.699	0.63	0.76	0.84
Main Catchment (km^2)	1.557	1.40	1.68	1.86
Business park north	0.071	1.55	1.77	2.00
Business park south	0.029	0.332	0.338	0.423
Northern Stream Catchment	0.075	0.06	-	-

2.3 Determination of 1% and 0.1% AEP flows - Dunshaughlin Business Park catchments

The Dunshaughlin Business Park is located at the upstream area of the proposed development and contributes flows to the drainage network surrounding the site. Refer to Figure 2-2 for the location of the business park.

The Business park north catchment discharges directly to a drainage ditch via two culverts (300mm and 450mm in diameter). Currently, this drainage ditch flows through the proposed development site and discharges into the open channel C1/11 drainage ditch downstream.

The south business park catchment discharges to a drainage ditch via a 300mm diameter culvert that connects to an existing 750mm culvert running along the R147. This culvert runs parallel to the R147 and discharges to the C1/11 drainage ditch downstream of the site.

To estimate the peak flood hydrology from the business parks Met Eireann rainfall data for the site was used. A rainfall runoff model for the business parks assessed the relevant rainfall profile for a number of flood events, for various durations including 10min, 15min, 1 hour and 6 hour storms. The rainfall return period table for the site was obtained from met.ie and provides the total rainfall for each return period and duration. A conservative estimate of 85% effective rainfall-runoff was assumed for both business parks given the density of impervious surfaces within them.

For use in the hydraulic model, the total rainfall needed to be converted into a hyetograph based on the total rainfall and duration. A summer profile was used to produce the hyetographs as this produces higher peak flows allowing a more conservative estimate. The conversion process is based on the FEH methodology. The resulting depth per timestep profiles are then applied in the final hydraulic model. An example of a 1 hour hyetograph for the park is presented in Figure 2-3.

Analysis of the various hyetographs produced for the business park revealed that the 1 hour duration 1% and 0.1% AEP storm events were the critical events as the 1 hour storms generated the highest flow values.

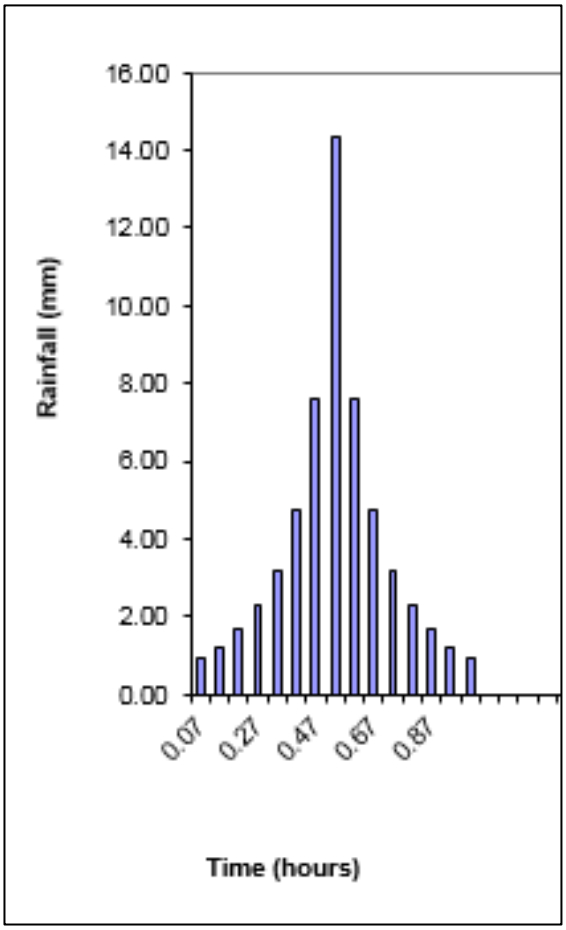


Figure 2-3: 1 hour hyetograph

2.4 Determination of 1% AEP flows and flood levels - Northern Stream Catchment

The north eastern of the proposed site is located within the uppermost catchment area of the Northern Stream as shown in Figure 2-4. The catchment for the Northern Stream in the vicinity of the site has been estimated at 0.075km^2. Using the FSR RR methodology, the 1% AEP peak flow was estimated to be 0.06m^3/s.

To determine whether the Northern Stream will influence the site and drainage scheme the flood level at stormwater outlet 1 (located within the upper catchment area determined) has been assessed using the Manning's Equation. This equation calculates the flood level based on the channel slope, roughness and hydraulic radius data which was collected during the site survey.

Based on the site survey data the, width of the channel is 5m, slope=0.009 and roughness= 0.04

Manning's Equation = Q=(1/n).A.R2/3. S1/2
Where, Q-Flow (m3/s), A= Area, R= Hydraulic Radius, S- Slope

From the equation, the estimated flood depth for a flow of 0.06m^3/s is <0.1m which corresponds to a final 1% AEP flood level of 98.87mOD. This flood level is below the invert of the stormwater outlet 1 (98.927mOD), therefore the Northern Stream poses no flood risk to the site and the stormwater system. As a result, the Northern Stream has been screened out at this stage and is not considered in the final hydraulic model.

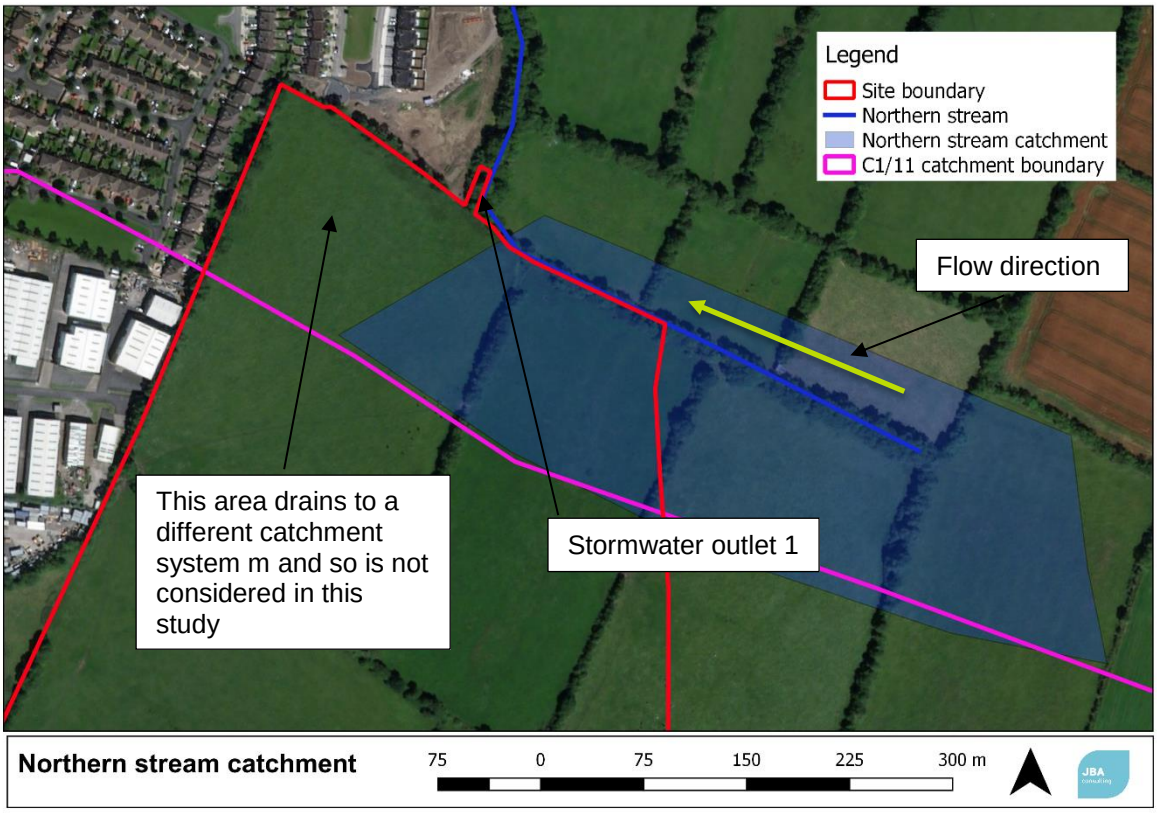


Figure 2-4: Northern Stream catchment

3 Hydraulic Modelling

To accurately represent the drainage characteristics of the proposed development and assess discharge from Dunshaughlin Business Park, it was necessary to construct a hydraulic model of the study area. Figure 3-1 shows the model structure. Storm durations of 10 minutes, 15 minutes, 6 and 24 hours were run for the model. The 1 hour storm was identified as the critical duration in terms of both peak flow and peak volume for the site. Therefore the 1% AEP, 1% AEP MRFS and 0.1% AEP flows for the 1 hour storm are the key events applied to the model and are presented within this assessment.

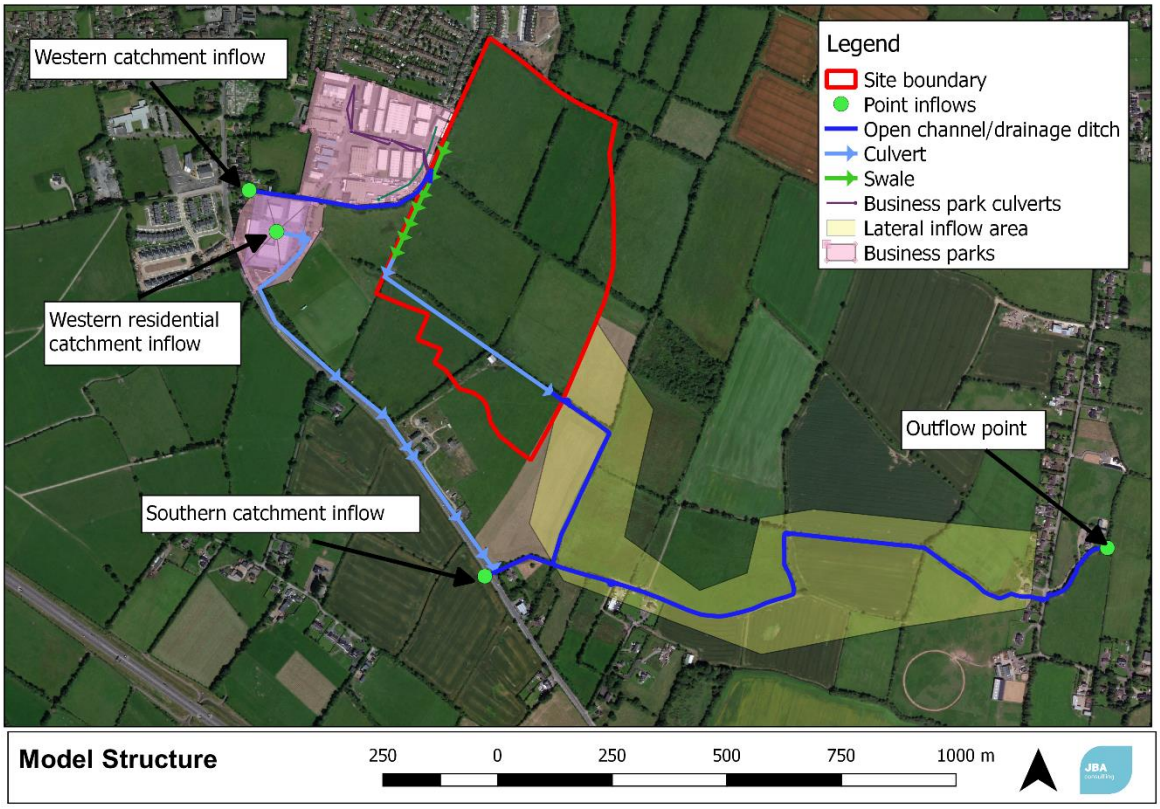


Figure 3-1: Model structure

3.1 Model boundaries

As hydrology for the site was divided into several sub-catchments multiple inflow boundaries were included in the model. The application of the sub-catchment flows determined in Chapter 2

The Northern Stream Catchment was calculated from first principles and flows away from the main catchment area. It is therefore not directly included within the hydraulic model.

3.1.1 Point inflow boundaries

As illustrated in Figure 3-1, three point inflow boundaries are used within the model to apply flows from the Western, Western Residential, and Southern Catchments as delineated in Figure 2-2.

The inflow point in the Western Catchment is connected to the existing drainage ditch that conveys the flow represented in the model while the Western Residential Catchment inflow point is applied directly to the 300mm culvert within the southern section of the business park.

The point inflow for the Southern Catchment is applied downstream of the site directly on to the drainage ditch at the outflow of the 750mm culvert running beside the R147.

3.1.2 Lateral inflow boundary

The flow for the Main Catchment is applied via a lateral flow, this was done to replicate the movement of the surface water across the greenfield catchment. The flow in the model enters the existing drainage ditches downstream of the site.

3.1.3 Rainfall inflow boundaries

The flows for both business parks were applied via a rain on grid approach. The flows were applied directly to the existing culverts within the business park areas which ensured that the culverts operated at full capacity prior to surcharged overland flow occurring. When the maximum culvert capacities are reached, surcharging of the system occurs as illustrated in Figure 3-2. The excess water within the model not carried by the culverts when surcharging occurs is represented as 2D surface flow. Figure 3-3 for flow hydrographs for the different flows. The resulting discharge from the site via the culverts and the overland flow pathway are plotted in Figure 3-3 for the 1%AEP flood event.

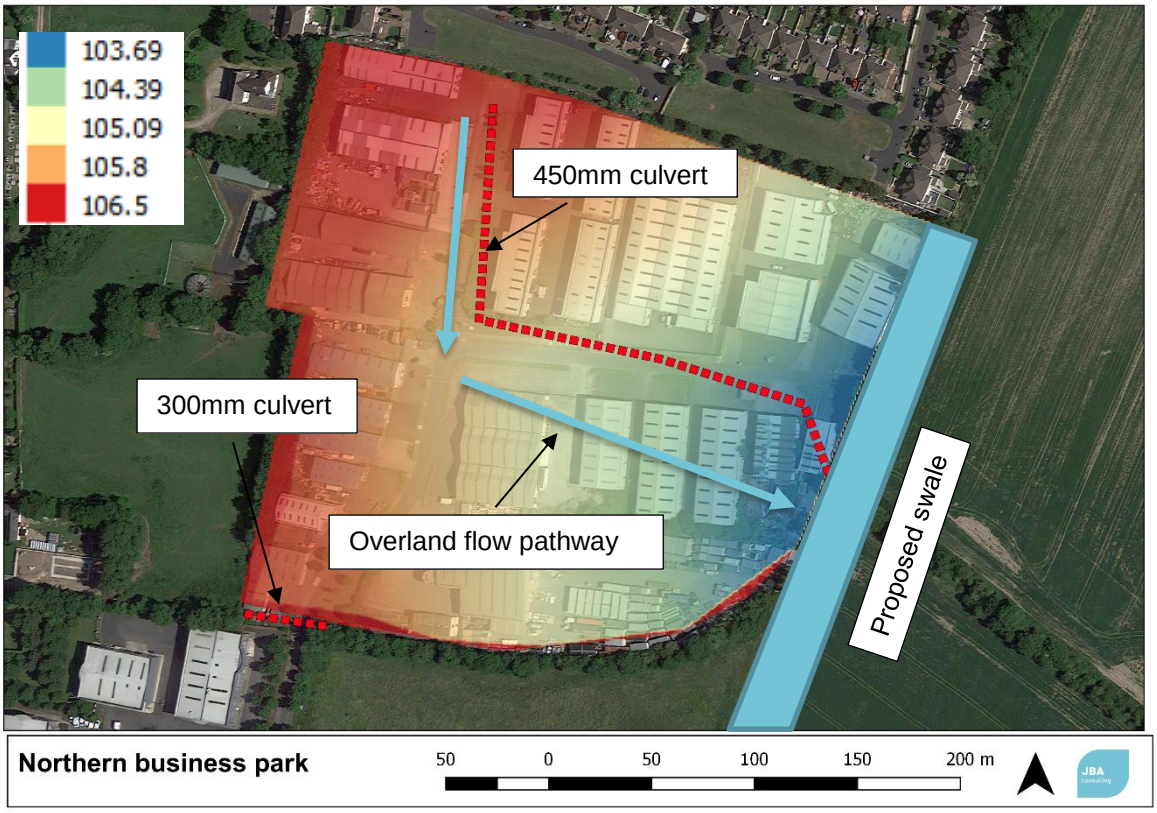


Figure 3-2: North business park flow pathways

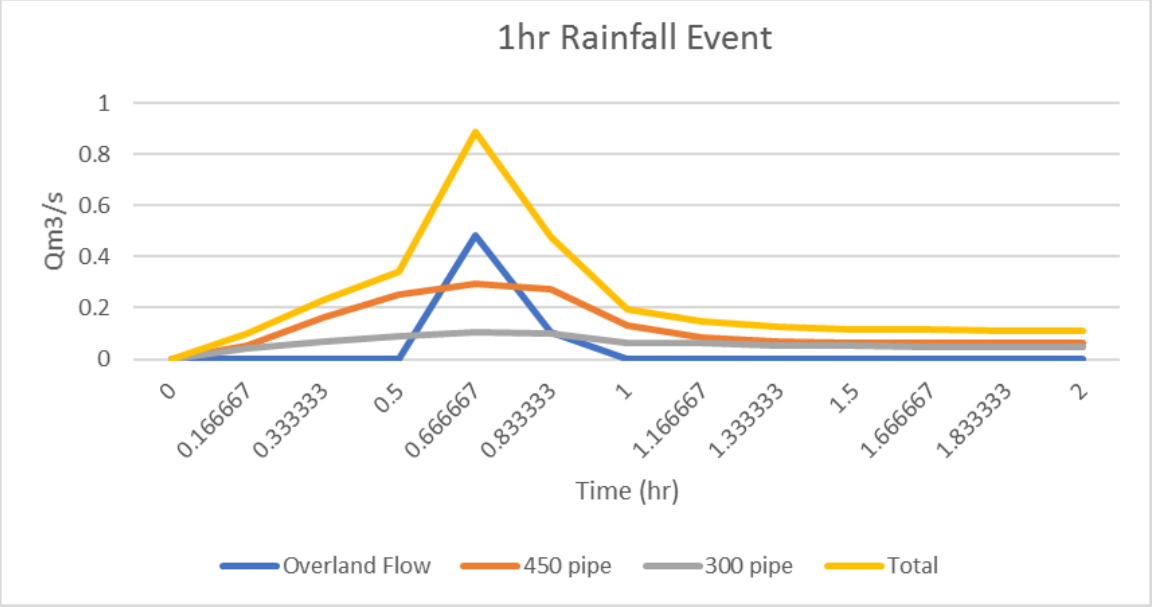


Figure 3-3: North business park catchment flows discharging into proposed swale

3.2 Watercourse and drainage representation

All the drainage ditches within the model are represented as open channel streams with the channel shape being taken from survey data.

The proposed design includes an attenuation swale along the site's western boundary, this is also modelled as open channel. The purpose of the swale is to capture and retain flow from the northern business park (from culverts and overland flow). The flows attenuated in the swale will discharge to a proposed 600mm culvert. The swale is 275m in length; the width of the swale increases from 9m at the northern end to 14.1m at the southern end. Bank slopes of 1:4 and 1:2 have been applied to the swale to allow for maintenance. Figure 3-4 shows the proposed swale location.

A 600mm circular culvert is proposed within the design to convey flows from the swale to the existing upstream extent of the Eastern Stream.

The model extends approximately 2km downstream of the site and includes all culverts and bridges that would impact upon flood flows through the watercourse. The dimensions for each of these downstream structures were obtained from survey data. Key structures included in the model are presented in Figure 3-5.

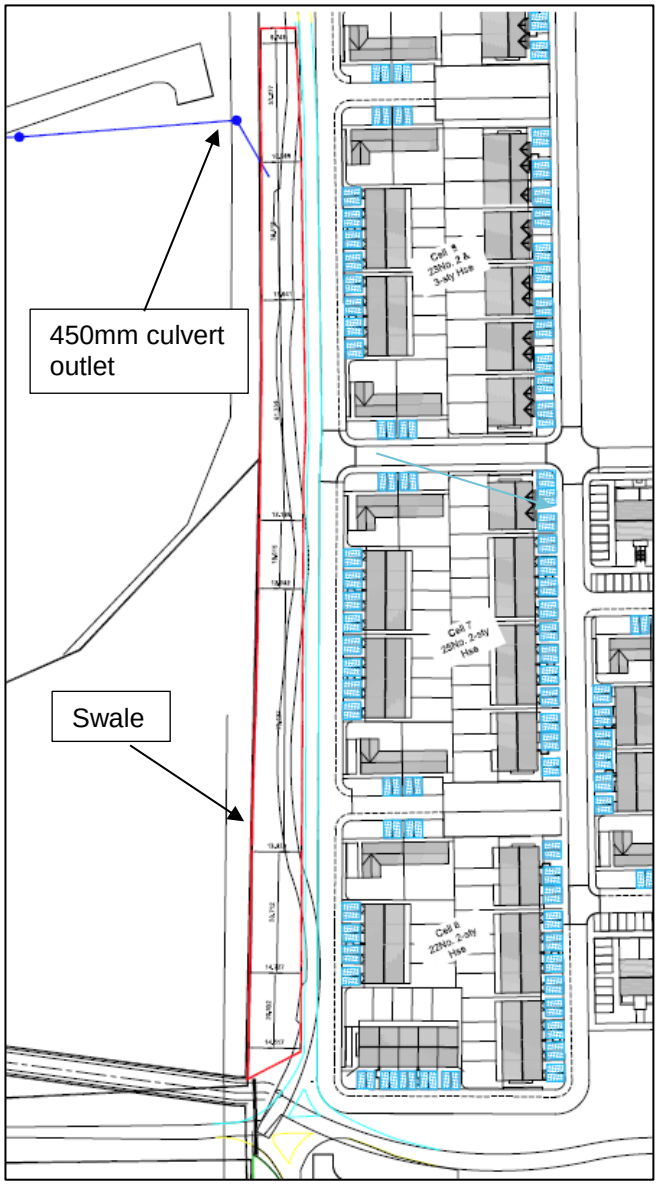


Figure 3-4: Proposed swale

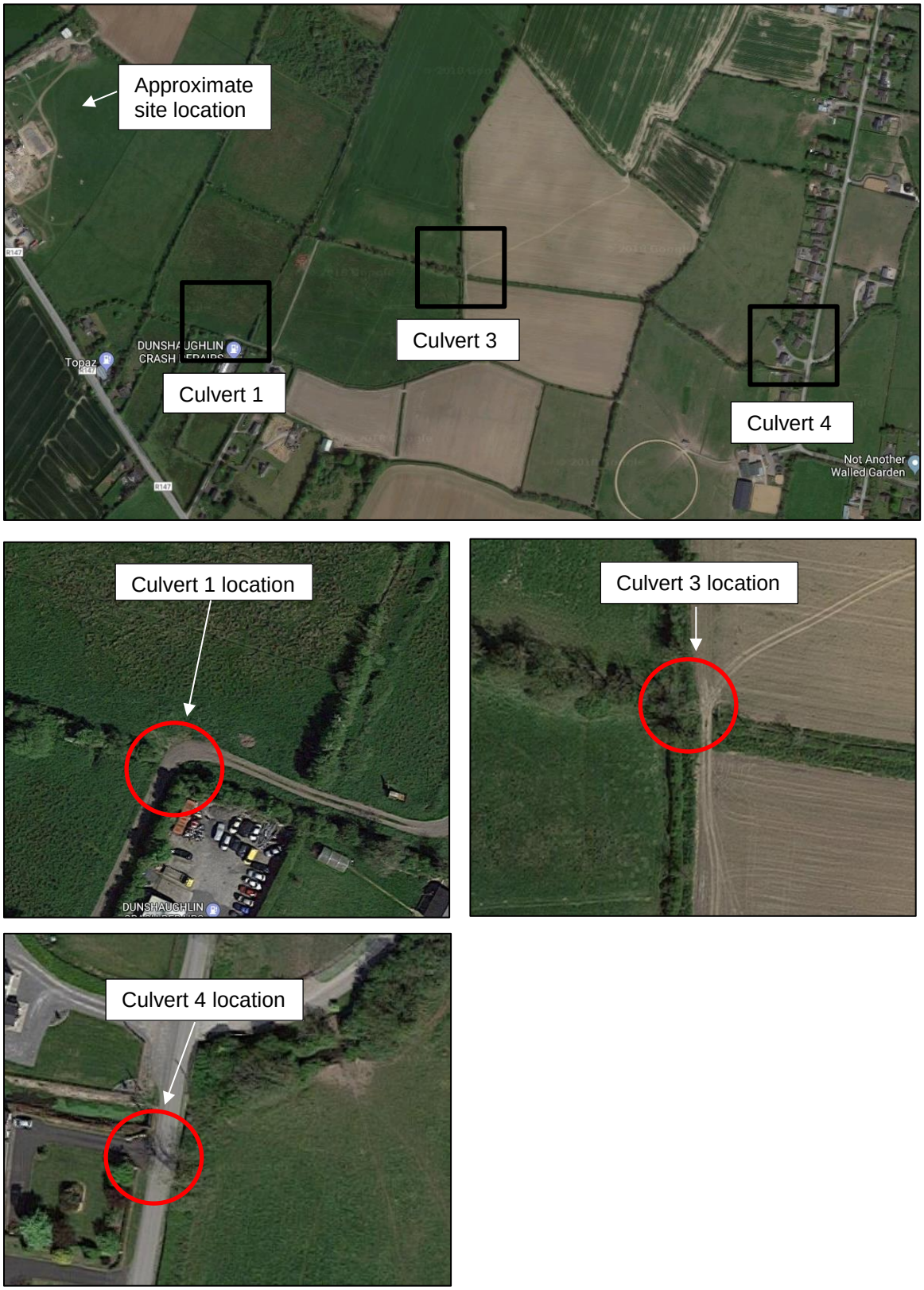
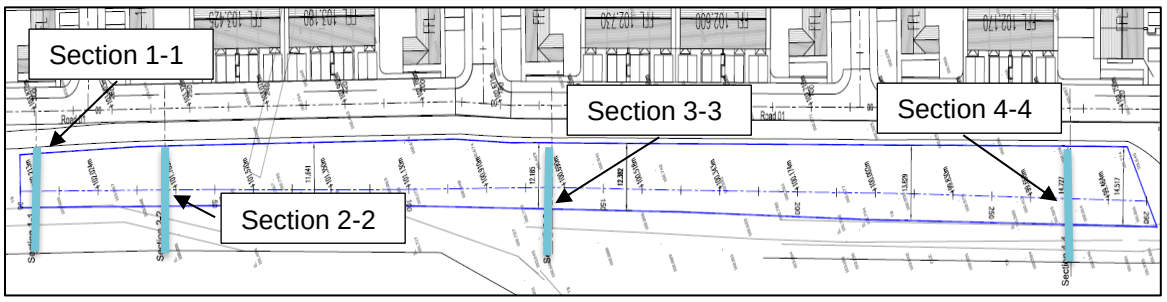
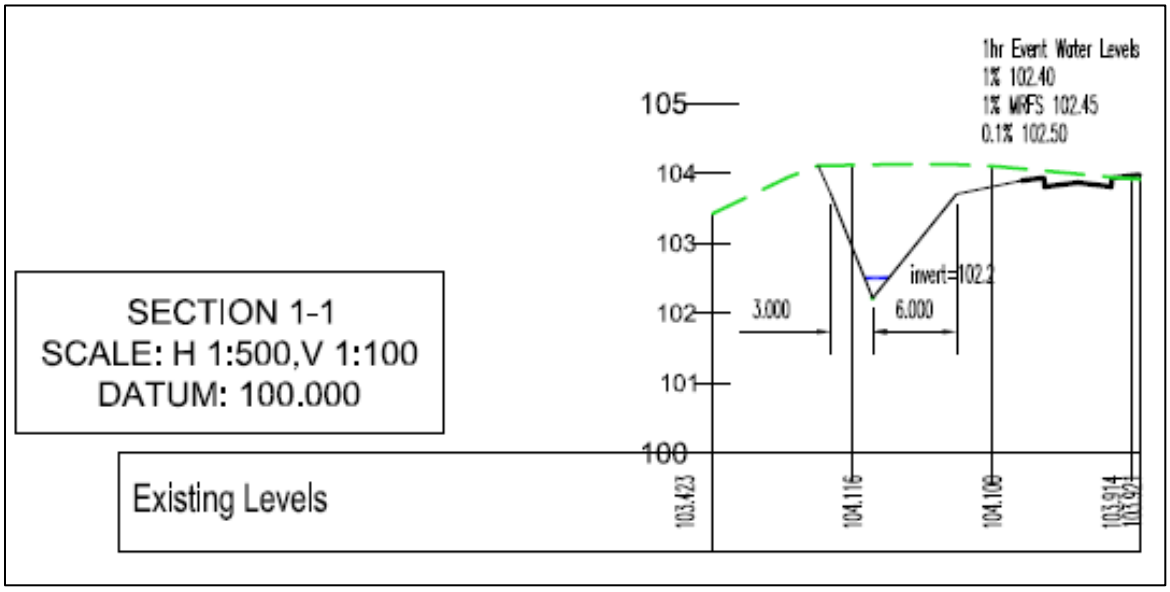


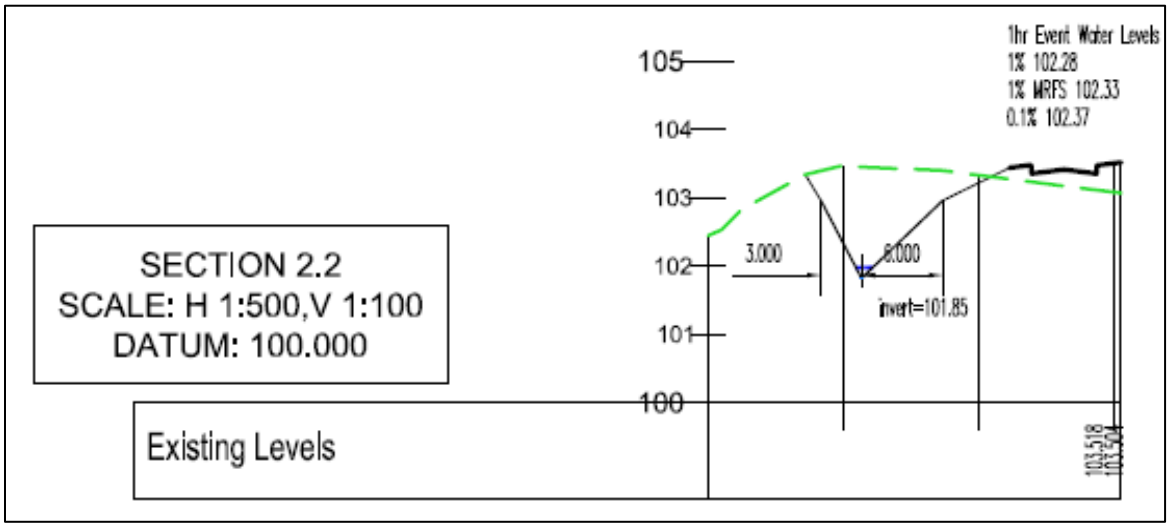
Figure 3-5: Surveyed structures downstream of site

4 Results

The proposed swale design is large enough to contain the peak water levels of the 1%AEP 1%AEP MRFS and the 0.1%AEP flood events. The swale design provides a freeboard of at least 500mm above the 1% AEP+MRFS. These freeboards values are sufficient to mitigate the risk of flooding to the road and proposed site during the assessed storm events.







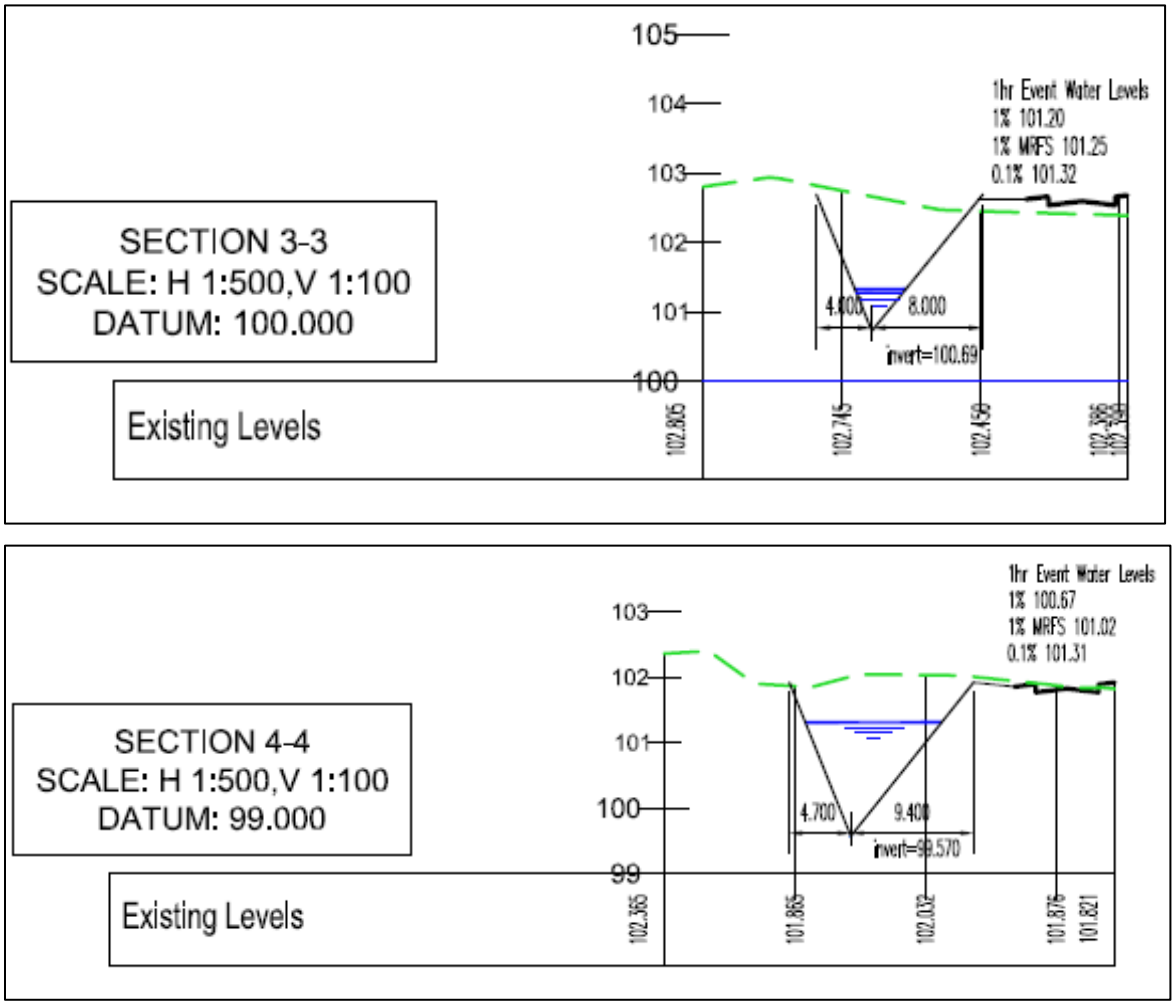


Figure 4-1: Proposed swale cross sections with modelled water levels.

4.1 Flood level at Site

Based on the flows presented in Table 2-2 and the corresponding 1% AEP peak flow for the catchment, the 1% AEP flood level was estimated at the stormwater discharge points of the development. The peak flood level was modelled at 96.5mOD at Stormwater outlet 2 and 3 (refer to Figure 4-2).

Regarding the outlet Stormwater outlet 1, as discussed in Section 2.4, there is no impact on the discharge from the northern stormwater system and therefore no requirement to include this system in the Windes model.

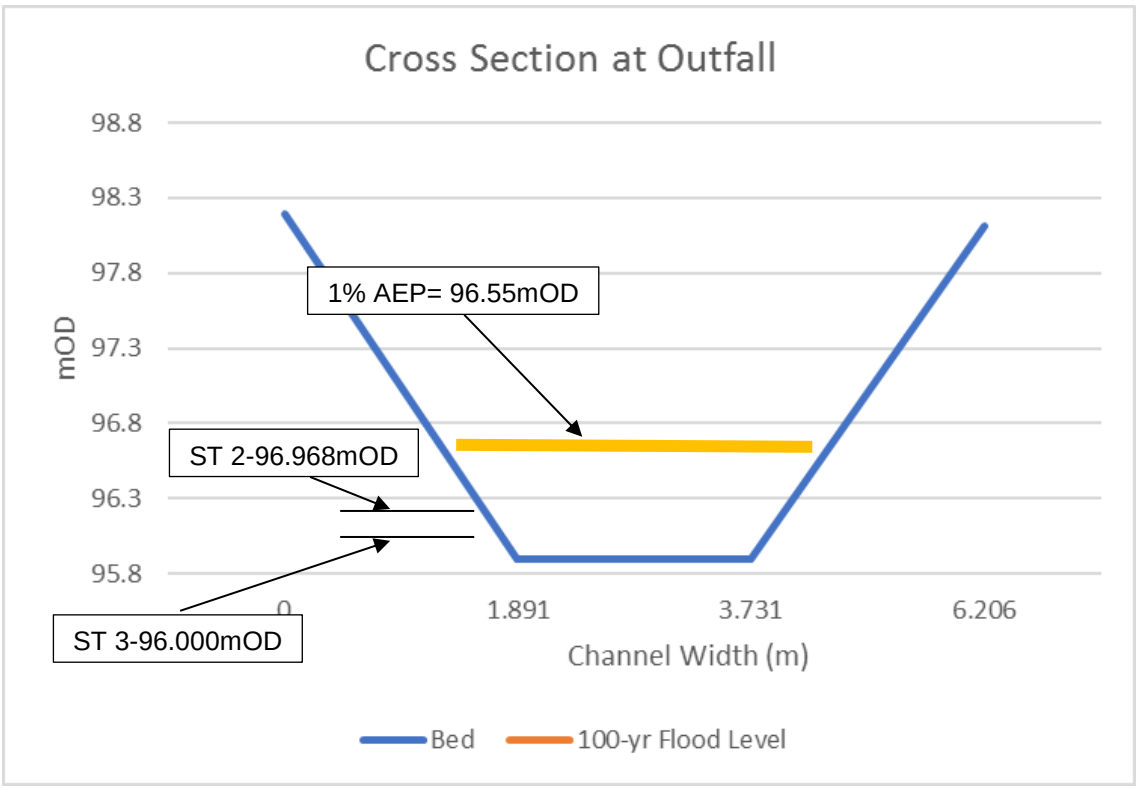


Figure 4-2: SW Outfall Flood Level

5 Windes Analysis

As outlined in Section 1, one of the main outcomes of this assessment was to appraise the potential impact that a 1% AEP flood event could have on the operation of the development's stormwater system. It was therefore necessary to apply the calculated 1% AEP flood level at the stormwater system outlets. The stormwater layout is provided in Appendix C.

To undertake the analysis, the proposed stormwater design was built into a Windes model to test the system against the current design standards to ensure compliance. Once the baseline was tested and confirmed that it operates as intended, a second scenario was developed with the calculated 1% AEP flood levels to test the impact on the system.

The results confirm that the system will operate in accordance to the design standards during a 1% AEP flood event and does not present a flood risk to the development.

A full technical report outlining the model development, methodology employed, and results are contained in Appendix A.

6 Conclusion

JBA Consulting was appointed to ensure that the proposed stormwater design for a residential development will operate as intended during a 1%, 1%+MRFS, and 0.1% AEP flood event.

This analysis was achieved by estimating the relevant 1% peak flow rate through the site from various sources which was subsequently input into a hydraulic model. The main contributary inflows to the site were accounted for including potential overland flow from the Dunshaughlin Business Park following surcharging of their stormwater system.

The hydraulic model provided the relevant flood levels at the proposed stormwater discharge points. A proposed diversionary swale was tested as part of the hydraulic modelling and found to be of sufficient capacity to convey the predicted inflows without overtopping. The proposed swale will discharge into a proposed 600mm culvert which conveys flow across the site to the existing upstream extent of the Eastern Stream.

A Windes model was built of the proposed stormwater system to ensure that the system operates as intended and to the design standards.

In summary, the system has been tested during a 1%, 1%+MRFS, and 0.1% AEP flood with no risk of flooding found to the proposed development and no increased flood risk to adjacent lands.

Appendices

A Windes Report

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 297470, Northing: 251541,

DURATION	Interval 6months,	1year,	Years 2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.5,	3.5,	4.1,	4.9,	5.4,	5.8,	7.2,	8.7,	9.7,	11.1,	12.3,	13.3,	14.8,	15.9,	16.9,	N/A ,
10 mins	3.5,	4.9,	5.7,	6.8,	7.5,	8.1,	10.0,	12.1,	13.5,	15.5,	17.2,	18.5,	20.6,	22.2,	23.5,	N/A ,
15 mins	4.1,	5.8,	6.7,	8.0,	8.8,	9.5,	11.7,	14.2,	15.9,	18.2,	20.2,	21.8,	24.2,	26.1,	27.7,	N/A ,
30 mins	5.5,	7.5,	8.6,	10.3,	11.3,	12.2,	14.9,	17.9,	19.9,	22.7,	25.1,	27.0,	29.9,	32.1,	33.9,	N/A ,
1 hours	7.2,	9.8,	11.2,	13.2,	14.5,	15.6,	18.9,	22.5,	24.9,	28.2,	31.1,	33.3,	36.7,	39.4,	41.5,	N/A ,
2 hours	9.6,	12.8,	14.5,	17.0,	18.6,	19.9,	23.9,	28.3,	31.2,	35.1,	38.6,	41.2,	45.2,	48.3,	50.8,	N/A ,
3 hours	11.3,	15.0,	16.9,	19.7,	21.6,	23.0,	27.5,	32.4,	35.6,	40.0,	43.8,	46.7,	51.1,	54.5,	57.2,	N/A ,
4 hours	12.7,	16.7,	18.8,	21.9,	23.9,	25.4,	30.3,	35.6,	39.1,	43.8,	47.9,	51.0,	55.7,	59.3,	62.3,	N/A ,
6 hours	14.9,	19.6,	21.9,	25.4,	27.6,	29.4,	34.8,	40.8,	44.6,	49.8,	54.3,	57.7,	62.9,	66.9,	70.1,	N/A ,
9 hours	17.5,	22.8,	25.5,	29.4,	32.0,	33.9,	40.0,	46.6,	50.8,	56.6,	61.6,	65.3,	71.0,	75.4,	78.9,	N/A ,
12 hours	19.7,	25.5,	28.4,	32.7,	35.4,	37.5,	44.1,	51.3,	55.8,	62.0,	67.3,	71.4,	77.4,	82.1,	85.8,	N/A ,
18 hours	23.2,	29.8,	33.1,	37.9,	41.0,	43.3,	50.7,	58.6,	63.6,	70.5,	76.3,	80.8,	87.5,	92.5,	96.6,	N/A ,
24 hours	26.0,	33.3,	36.9,	42.1,	45.4,	48.0,	56.0,	64.5,	69.9,	77.2,	83.5,	88.2,	95.3,	100.7,	105.1,	119.9,
2 days	32.6,	40.8,	44.9,	50.6,	54.3,	57.1,	65.7,	74.8,	80.5,	88.1,	94.7,	99.6,	106.9,	112.4,	116.9,	131.9,
3 days	38.1,	47.1,	51.5,	57.7,	61.7,	64.7,	73.9,	83.5,	89.5,	97.5,	104.4,	109.5,	117.1,	122.8,	127.4,	142.7,
4 days	43.0,	52.7,	57.4,	64.0,	68.3,	71.4,	81.1,	91.3,	97.5,	105.9,	113.0,	118.3,	126.2,	132.1,	136.8,	152.6,
6 days	51.8,	62.7,	67.9,	75.3,	79.9,	83.4,	94.0,	105.0,	111.8,	120.8,	128.4,	134.0,	142.4,	148.6,	153.6,	170.2,
8 days	59.7,	71.6,	77.4,	85.3,	90.3,	94.1,	105.5,	117.2,	124.4,	134.0,	142.0,	147.9,	156.7,	163.3,	168.5,	185.9,
10 days	67.1,	79.9,	86.1,	94.6,	99.9,	103.9,	116.0,	128.4,	136.0,	146.1,	154.5,	160.7,	169.9,	176.7,	182.2,	200.2,
12 days	74.1,	87.8,	94.3,	103.3,	109.0,	113.2,	125.9,	138.9,	146.9,	157.4,	166.1,	172.6,	182.2,	189.2,	194.9,	213.6,
16 days	87.2,	102.5,	109.7,	119.6,	125.8,	130.4,	144.3,	158.4,	167.0,	178.3,	187.7,	194.7,	204.9,	212.4,	218.4,	238.2,
20 days	99.6,	116.2,	124.0,	134.8,	141.5,	146.4,	161.3,	176.4,	185.6,	197.6,	207.6,	215.0,	225.7,	233.7,	240.0,	260.9,
25 days	114.4,	132.5,	141.1,	152.7,	160.0,	165.3,	181.4,	197.6,	207.4,	220.2,	230.8,	238.6,	250.1,	258.5,	265.2,	287.2,

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

NOTE TO FILE

JBA Project Code	2018s0900
Contract	Dunshaughlin East SHD, Meath SW Review
Client	Joseph O'Reilly Consulting Civil & Structural Engineers
Day, Date and Time	12/12/2018
Author	Leanne Leonard
Subject	Modelling Notes v7.0

1 Introduction

JBA Consulting (JBA) was appointed by Joseph O'Reilly of JOR Consulting Engineers to undertake a review of the provided stormwater design for a development located in Dunshaughlin, Co. Meath. Details of the proposed stormwater networks were provided by JOR Consulting. Models of these networks were built and simulated in MicroDrainage for the 100 year rainfall event. A flood model was created separately and the findings of this incorporated into the outfall conditions.

2 Model Build Notes

2.1 Documents used for reference

The MicroDrainage models are based on the documents received from JOR Consulting, which are listed below:

Received from JOR on 5th December 2018:

- JOR Summary table for areas contributing to each catchment and the maximum allowable discharge
- Storm 1.xls
- Storm 2.xls
- Storm 3.xls
- Storm 4.xls
- Storm 5.xls
- Storm 6.xls
- Storm 7.xls
- Storm 8.xls
- Storm 9.xls
- Storm 10.xls

  Attenuation System 1 Outfall.xls
- Attenuation System 2 Outfall.xls
- Attenuation System 3 Outfall.xls
- Dunshaughlin SHD R17.mdx

Received from JOR on 7th December 2018:

- J18-01-012-3 (Storm Sheet 1).pdf
- J18-01-013-3 (Storm Sheet 2).pdf

- GDSDS
- Meath County Development Plan 2013-2019

Details for the base model were provided by JOR and JBA have not had any input into the design parameters for the drainage design.

2.2 Methodology

An .mdx file was produced by JOR including all branches as separate networks. A model was then built for each catchment using the information within this .mdx file. These models were simulated to assess the current design for the 30 year and 100 year return period.

2.2.1 Hydro-Brakes

Each Hydro-Brake design flow rate was set in accordance with the figures provided by JOR. The design head was determined as the maximum of the difference between a) the top water level (TWL) of each attenuation tank and the invert level of the associated Hydro-Brake or b) the cover level and the invert level of the Hydro-Brake manhole.

2.2.2 Tanks

There are three concrete attenuation tanks, one serving each of the three catchments. The networks have been named Catchment 1, Catchment 2 and Catchment 3. The attenuation systems in each catchment have been named Attenuation system 1, Attenuation system 2 and Attenuation system 3 to match each catchment.

Tank details proposed by JOR and tested in the baseline model are shown in the table below.

Table 2-1

	Attenuation System		
	1	2	3
Cover Level	102.000	99.800	98.400
Invert level	99.050	97.650	96.200
Depth (m)	1.725	1.675	1.700
Area (m^2)	1160	2114	1400
Length (m)	52.00	211.00	125.80
Width (m)	22.300	7m & 14m	11.260

2.2.3 Outfall conditions and the Watercourse

There are two outfall locations, one at the north of the site and one at the south/east. The watercourses were modelled separately to derive maximum water levels for the 1 in 100-year storm event which was then used to set the level of the surcharged outfall of the networks.

Attenuation system 1 discharges to outfall 1 at an invert level of 98.927m and the top water level of the watercourse in a 100 year flood event is 98.90m. Therefore, the outfall will be unaffected during a 100 year flood event.

Attenuation system 2 discharges to outfall 2 at the south/east of the site at an invert level of 96.968m and the top water level of the receiving watercourse for the in a 100 year flood event is 96.500m. Therefore, the outfall will be unaffected during a 100 year flood event.

Attenuation system 3 discharges to outfall 2 at an invert level of 95.999m and the top water level of the receiving watercourse for the 100 year flood event is 96.500m. Therefore, the outfall is surcharged by a depth of 0.501m in the 100 year flood event.

2.2.4 Level of Service

Each of the networks were designed for a five year return period. The models were then simulated for the 30 year and 100 year rainfall events. An additional 10% allowance for climate change was included in the simulations, in accordance with the Meath County Development Plan 2013-2019, the Greater Dublin Regional Code of Practice for Drainage Works V6 and the Greater Dublin Strategic Drainage Study.

The M5_60 value of 15.5 and ratio R = 0.272 were obtained from the Met Éireann depth duration frequency table for the site location.

3 Alterations and assumptions

3.1 Attenuation System 1 network

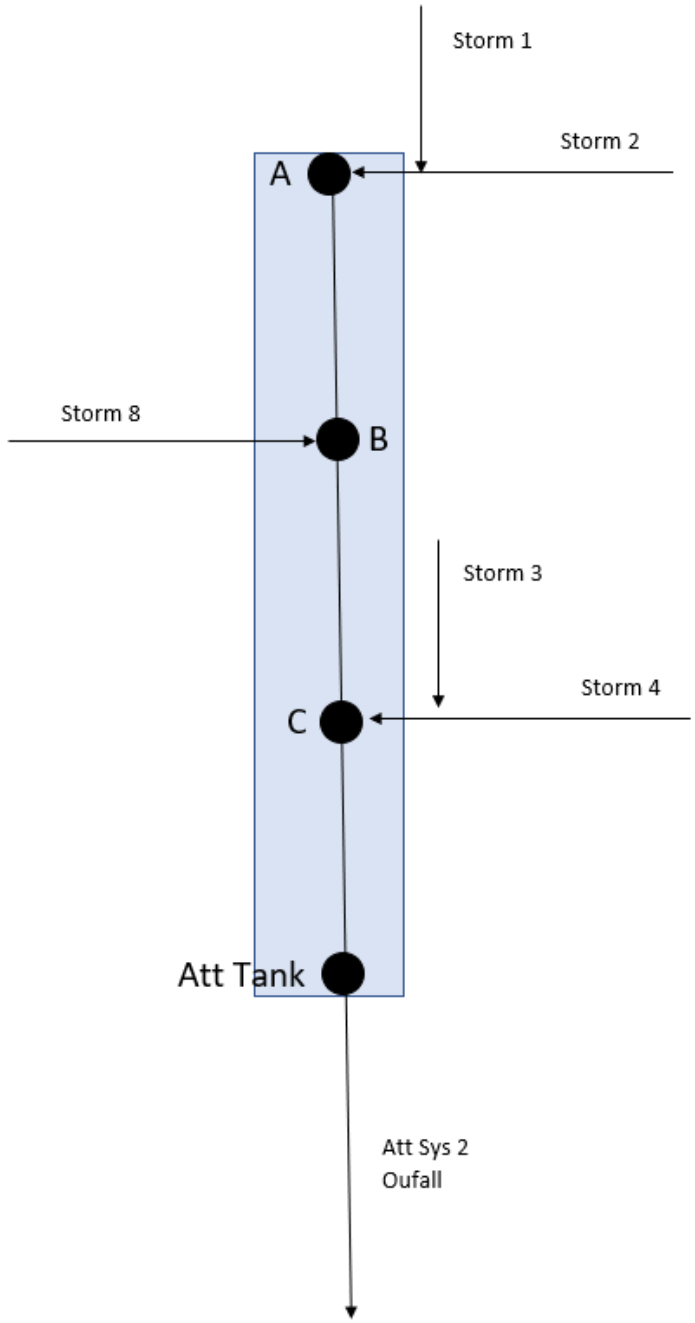
The baseline model built in accordance with the information provided by JOR Consulting was simulated for the 30 year and 100 year rainfall events including 10% allowance for climate change. The MicroDrainage analysis does not show flooding at any manhole and therefore no alterations were deemed necessary to the system.

3.2 Attenuation System 2 network

To most accurately represent the surface water network system in Catchment 2 the baseline model was built as per Figure 3-1. Four additional manholes; A, B, C and 'Att Tank' to represent the fact that there are three inlets discharging separately to the attenuation tank and will not physically be present.

The model was simulated for the 30 year and 100 year rainfall events including 10% allowance for climate change. The MicroDrainage analysis does not show flooding at any manhole and therefore no alterations were deemed necessary to the system.

Figure 3-1

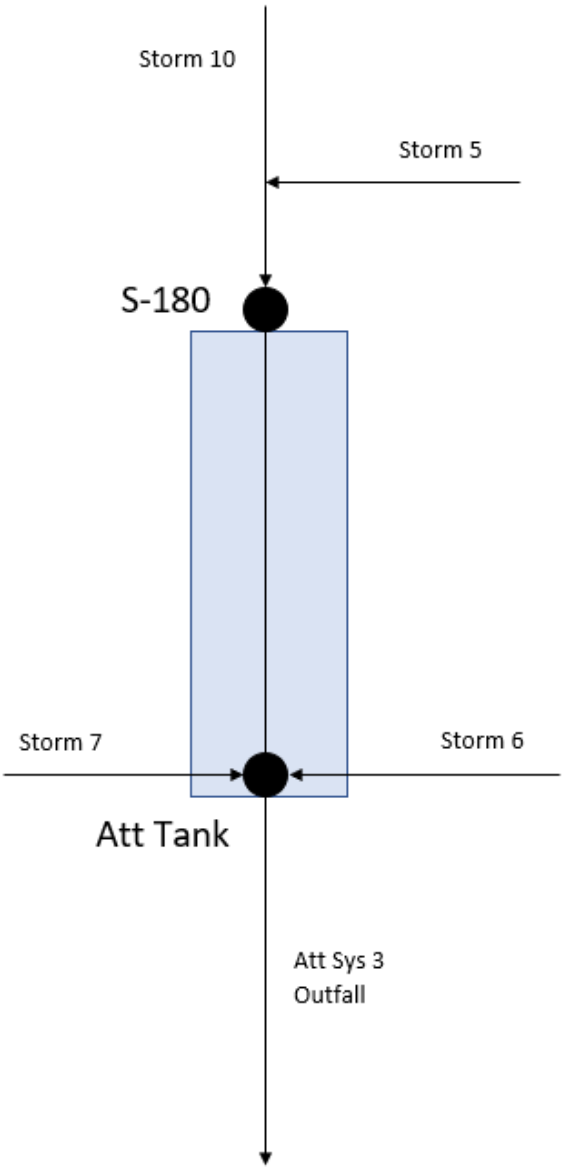


3.3 Attenuation system 3 network

To most accurately represent the surface water network system in Catchment 3 the model was built as per Figure 3-2.

The model was simulated for the 30 year and 100 year rainfall events including 10% allowance for climate change. The MicroDrainage analysis shows that there is one manhole in the system that floods in the 30 minute 100 year winter storm. As the flood volume is just 9.25m3 and the measures required to remove this flooding include increasing pipe diameters throughout the system, reducing invert levels and increasing the ground level at this point it is recommended that instead the flooded volume be managed via an exceedance route.

Figure 3-2



4 Assumptions and comments

- The model has been based on the assumption that no low points are assumed to occur below manhole cover levels provided. Should this be the case flooding may result from surcharging of gullies.
- The top water level of attenuation system 1 is 100.775m therefore, adjacent FFL's should be a minimum of 101.275m.
- The top water level of attenuation system 2 is 99.325m therefore, adjacent FFL's should be a minimum of 99.825m.
- The top water level of attenuation system 3 is 97.900m therefore, adjacent FFL's should be a minimum of 98.400m.
- Based on the information provided the outfall of attenuation system 3 has been modelled as a constant surcharged head, which in practice would not be the case.
- In the MicroDrainage outputs where the status reads 'Surcharged' in the Critical Summary of Results this indicates that water level in the manhole is above the soffit of the outgoing pipe. Therefore, storage within the manhole is being utilised.
- In the MicroDrainage outputs where the status reads 'Flood Risk' in the Critical Summary of Results this indicates that the water in the manhole is surcharged to within 100mm of the cover level.

5 Conclusions

JBA Consulting were appointed to undertake a review of the supplied drainage design for a proposed residential development in Dunshaughlin, Co. Meath. The purpose of this review was to assess how the proposed drainage networks performed in the 100 year rainfall event. A separate flood model of the watercourse was undertaken and the downstream flood levels for the 1% AEP fluvial flood event were incorporated into the outfall conditions of the MicroDrainage model. All details including cover levels, invert levels, pipe sizes, allowable discharge rates, attenuation structure details etc. were provided by JOR Consulting and built into the model. Following completion of the initial runs no alterations are deemed necessary. Manhole S-176 in Catchment 3 is predicted to flood by 9.25m3 in the 30 minute 100 year winter storm. The GDSDS requires no surface flooding in a 30 year rainfall event and no internal property flooding in the 100 year rainfall event. As the flooded volume is small, it is recommended that this flood volume is managed via an exceedance flow route along the roadways, therefore complying with the GDSDS.

Following discussions between JOR Consulting and Meath County Council concrete attenuation tanks have been proposed within the development in place of Stormtech structures.

Assessing the compliance of water quality with the GDSDS was outside the scope of this review, however the use of suitable SuDS techniques appropriate for the site is advised.

NOTE TO FILE

JBA Project Code	2018s0900
Contract	Dunshaughlin East SHD, Meath SW Review
Client	Joseph O'Reilly Consulting Civil & Structural Engineers
Day, Date and Time	12/12/2018
Author	Leanne Leonard
Subject	Modelling Notes v7.0

A Appendix A - MicroDrainage outputs for Catchment 1

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Attenuation System 1

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	5	Foul Sewage (l/s/ha)	0.000	Maximum Backdrop Height (m)	1.500
M5-60 (mm)	15.500	Volumetric Runoff Coeff.	0.750	Min Design Depth for Optimisation (m)	1.200
Ratio R	0.272	PIMP (%)	100	Min Vel for Auto Design only (m/s)	1.00
Maximum Rainfall (mm/hr)	50	Add Flow / Climate Change (%)	0	Min Slope for Optimisation (1:X)	500
Maximum Time of Concentration (mins)	60	Minimum Backdrop Height (m)	0.000		

Designed with Level Soffits

Time Area Diagram for Attenuation System 1

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.704	4-8	1.781	8-12	0.130

Total Area Contributing (ha) = 2.614

Total Pipe Volume (m^3) = 97.953

Network Design Table for Attenuation System 1

Network Design Table for Attenuation System 1

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

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)

Network Design Table for Attenuation System 1

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	60.619	0.611	99.2	0.134	4.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	59.199	0.488	121.3	0.079	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	57.134	1.245	45.9	0.076	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	67.877	0.491	138.2	0.120	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.004	14.730	0.107	137.7	0.015	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.000	32.657	0.218	149.8	0.099	4.00	0.0	0.600	o	150	Pipe/Conduit	
S3.000	26.056	0.174	149.7	0.041	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)
S1.000	50.00	4.77	102.818	0.134	0.0	0.0	0.0	1.31	52.2	18.1
S1.001	50.00	5.60	102.207	0.213	0.0	0.0	0.0	1.19	47.2	28.8
S1.002	50.00	6.09	101.719	0.289	0.0	0.0	0.0	1.94	77.0	39.1
S1.003	50.00	6.94	100.399	0.409	0.0	0.0	0.0	1.34	94.4	55.4
S1.004	50.00	7.12	99.908	0.424	0.0	0.0	0.0	1.34	94.6	57.4
S2.000	50.00	4.66	102.350	0.099	0.0	0.0	0.0	0.82	14.5	13.4
S3.000	50.00	4.53	102.583	0.041	0.0	0.0	0.0	0.82	14.5	5.5

Network Design Table for Attenuation System 1

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S2.001	35.772	0.213	167.9	0.081	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.000	55.594	0.505	110.1	0.154	4.00	0.0	0.600	o	225	Pipe/Conduit	
S2.002	54.999	0.436	126.1	0.114	0.00	0.0	0.600	o	300	Pipe/Conduit	
S5.000	32.581	0.220	148.1	0.098	4.00	0.0	0.600	o	150	Pipe/Conduit	
S2.003	34.496	0.334	103.3	0.068	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)
S2.001	50.00	5.26	102.057	0.221	0.0	0.0	0.0	1.01	40.0	29.9
S4.000	50.00	4.74	102.760	0.154	0.0	0.0	0.0	1.25	49.5	20.8
S2.002	50.00	5.91	101.769	0.488	0.0	0.0	0.0	1.40	98.9	66.1
S5.000	50.00	4.66	101.204	0.098	0.0	0.0	0.0	0.82	14.6	13.2
S2.003	50.00	6.28	100.834	0.654	0.0	0.0	0.0	1.55	109.3	88.5

Network Design Table for Attenuation System 1

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	37.112	0.427	86.9	0.071	4.00	0.0	0.600	o	150	Pipe/Conduit	
S7.000	19.902	0.181	110.0	0.014	4.00	0.0	0.600	o	150	Pipe/Conduit	
S6.001	78.906	0.939	84.0	0.155	0.00	0.0	0.600	o	225	Pipe/Conduit	
S8.000	49.548	0.780	63.5	0.180	4.00	0.0	0.600	o	225	Pipe/Conduit	
S8.001	66.439	0.274	242.5	0.152	0.00	0.0	0.600	o	300	Pipe/Conduit	
S9.000	72.490	1.239	58.5	0.094	4.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S6.000	50.00	4.57	102.136	0.071	0.0	0.0	0.0	1.08	19.1	9.6
S7.000	50.00	4.35	102.248	0.014	0.0	0.0	0.0	0.96	16.9	1.9
S6.001	50.00	5.49	101.634	0.241	0.0	0.0	0.0	1.43	56.8	32.6
S8.000	50.00	4.50	102.361	0.180	0.0	0.0	0.0	1.64	65.4	24.3
S8.001	50.00	5.60	101.506	0.331	0.0	0.0	0.0	1.01	71.1	44.9
S9.000	50.00	4.71	102.960	0.094	0.0	0.0	0.0	1.71	68.1	12.7

Network Design Table for Attenuation System 1

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
S9.001	57.676	0.882	65.4	0.066	0.00	0.0	0.600	o	225	Pipe/Conduit	
S9.002	11.204	0.067	167.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S8.002	43.248	0.179	241.6	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S6.002	45.609	0.221	206.4	0.098	0.00	0.0	0.600	o	375	Pipe/Conduit	
S6.003	58.509	0.290	201.8	0.047	0.00	0.0	0.600	o	375	Pipe/Conduit	
S10.000	35.407	0.322	110.0	0.073	4.00	0.0	0.600	o	150	Pipe/Conduit	
S10.001	31.081	0.313	99.3	0.023	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)
S9.001	50.00	5.30	101.721	0.160	0.0	0.0	0.0	1.62	64.4	21.7
S9.002	50.00	5.48	100.839	0.160	0.0	0.0	0.0	1.01	40.1	21.7
S8.002	50.00	6.32	100.697	0.491	0.0	0.0	0.0	1.01	71.2	66.6
S6.002	50.00	6.92	100.443	0.830	0.0	0.0	0.0	1.26	138.9	112.4
S6.003	48.63	7.69	100.222	0.877	0.0	0.0	0.0	1.27	140.5	115.5
S10.000	50.00	4.62	102.469	0.073	0.0	0.0	0.0	0.96	16.9	9.8
S10.001	50.00	5.13	102.147	0.096	0.0	0.0	0.0	1.01	17.8	13.0

Network Design Table for Attenuation System 1

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
S11.000	68.120	0.303	224.8	0.243	4.00	0.0	0.600	o	225	Pipe/Conduit	
S10.002	31.009	0.138	224.7	0.094	0.00	0.0	0.600	o	300	Pipe/Conduit	
S12.000	35.150	0.234	150.2	0.067	4.00	0.0	0.600	o	150	Pipe/Conduit	
S10.003	31.009	0.131	236.7	0.047	0.00	0.0	0.600	o	375	Pipe/Conduit	
S13.000	26.708	0.179	149.2	0.020	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)
S11.000	50.00	5.31	102.144	0.243	0.0	0.0	0.0	0.87	34.5	32.9
S10.002	50.00	5.80	101.684	0.432	0.0	0.0	0.0	1.04	73.8	58.6
S12.000	50.00	4.72	101.950	0.067	0.0	0.0	0.0	0.82	14.4	9.1
S10.003	50.00	6.24	101.471	0.546	0.0	0.0	0.0	1.17	129.6	74.0
S13.000	50.00	4.54	101.470	0.020	0.0	0.0	0.0	0.82	14.5	2.7

Network Design Table for Attenuation System 1

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
S10.004	31.201	1.064	29.3	0.038	0.00	0.0	0.600	o	375	Pipe/Conduit	
S6.004	15.080	0.038	396.8	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
S6.005	55.810	0.139	401.5	0.056	0.00	0.0	0.600	o	525	Pipe/Conduit	
S2.004	13.390	0.027	495.9	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.005	5.459	0.067	81.5	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.006	8.728	0.039	223.8	0.000	0.00	0.0	0.600	o	600	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)
S10.004	50.00	6.40	101.066	0.604	0.0	0.0	0.0	3.36	370.8	81.7
S6.004	48.02	7.92	99.782	1.481	0.0	0.0	0.0	1.12	242.1	192.6
S6.005	45.93	8.75	99.744	1.536	0.0	0.0	0.0	1.11	240.6	192.6
S2.004	45.45	8.96	99.530	2.190	0.0	0.0	0.0	1.09	307.3	269.6
S1.005	45.37	8.99	99.501	2.614	0.0	0.0	0.0	2.70	763.2	321.2
S1.006	45.17	9.08	99.050	2.614	0.0	0.0	0.0	1.62	459.1	321.2

Network Design Table for Attenuation System 1

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
S1.007	18.867	0.084	224.6	0.000	0.00	0.0	0.600	o	600	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)
S1.007	44.73	9.28	99.011	2.614	0.0	0.0	0.0	1.62	458.3	321.2

Manhole Schedules for Attenuation System 1

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)
SS-1	104.168	1.350	Open Manhole	1200	S1.000	102.818	225				
SS-2	103.957	1.750	Open Manhole	1200	S1.001	102.207	225	S1.000	102.207	225	
SS-3	103.069	1.350	Open Manhole	1200	S1.002	101.719	225	S1.001	101.719	225	
SS-4	101.825	1.426	Open Manhole	1200	S1.003	100.399	300	S1.002	100.474	225	
SS-5	101.334	1.426	Open Manhole	1200	S1.004	99.908	300	S1.003	99.908	300	
SS-7	103.957	1.607	Open Manhole	1200	S2.000	102.350	150				
SS-9	103.997	1.414	Open Manhole	1200	S3.000	102.583	150				
SS-8	104.291	2.234	Open Manhole	1200	S2.001	102.057	225	S2.000	102.132	150	
								S3.000	102.409	150	277
SS-11	104.185	1.425	Open Manhole	1200	S4.000	102.760	225				
SS-10	104.052	2.283	Open Manhole	1200	S2.002	101.769	300	S2.001	101.844	225	
								S4.000	102.255	225	411
SS-13	102.672	1.468	Open Manhole	1200	S5.000	101.204	150				
SS-12	102.833	1.999	Open Manhole	1200	S2.003	100.834	300	S2.002	101.333	300	499
								S5.000	100.984	150	
SS-23	103.580	1.444	Open Manhole	1200	S6.000	102.136	150				
SS-25	103.428	1.180	Open Manhole	1200	S7.000	102.248	150				
SS-24	103.234	1.600	Open Manhole	1200	S6.001	101.634	225	S6.000	101.709	150	
								S7.000	102.067	150	358

Manhole Schedules for Attenuation System 1

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)
SS-30	103.786	1.425	Open Manhole	1200	S8.000	102.361	225				
SS-31	103.006	1.500	Open Manhole	1200	S8.001	101.506	300	S8.000	101.581	225	
SS-33	104.522	1.562	Open Manhole	1200	S9.000	102.960	225				
SS-34	103.695	1.974	Open Manhole	1200	S9.001	101.721	225	S9.000	101.721	225	
SS-35	102.264	1.425	Open Manhole	1200	S9.002	100.839	225	S9.001	100.839	225	
SS-32	103.000	2.303	Open Manhole	1200	S8.002	100.697	300	S8.001	101.232	300	535
								S9.002	100.772	225	
SS-26	102.120	1.677	Open Manhole	1350	S6.002	100.443	375	S6.001	100.695	225	102
								S8.002	100.518	300	
SS-27	102.150	1.928	Open Manhole	1350	S6.003	100.222	375	S6.002	100.222	375	
SS-15	103.878	1.409	Open Manhole	1200	S10.000	102.469	150				
SS-16	103.494	1.347	Open Manhole	1200	S10.001	102.147	150	S10.000	102.147	150	
SS-18	103.569	1.425	Open Manhole	1200	S11.000	102.144	225				
SS-17	103.447	1.763	Open Manhole	1200	S10.002	101.684	300	S10.001	101.834	150	
								S11.000	101.841	225	82
SS-20	103.300	1.350	Open Manhole	1200	S12.000	101.950	150				
SS-19	103.244	1.773	Open Manhole	1350	S10.003	101.471	375	S10.002	101.546	300	
								S12.000	101.716	150	20
SS-22	102.712	1.242	Open Manhole	1200	S13.000	101.470	150				

Manhole Schedules for Attenuation System 1

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)
SS-21	102.829	1.763	Open Manhole	1350	S10.004	101.066	375	S10.003	101.340	375	274
								S13.000	101.291	150	
SS-28	101.577	1.795	Open Manhole	1500	S6.004	99.782	525	S6.003	99.932	375	
								S10.004	100.002	375	70
SS-29	102.100	2.356	Open Manhole	1500	S6.005	99.744	525	S6.004	99.744	525	
SS-14	102.000	2.470	Open Manhole	1500	S2.004	99.530	600	S2.003	100.500	300	670
								S6.005	99.605	525	
SS-6	101.700	2.199	Open Manhole	1500	S1.005	99.501	600	S1.004	99.801	300	
								S2.004	99.503	600	2
SS-197	102.000	2.950	Open Manhole	1500	S1.006	99.050	600	S1.005	99.434	600	384
S198	102.000	2.989	Open Manhole	1500	S1.007	99.011	600	S1.006	99.011	600	
SS-Outfall 1	101.429	2.502	Open Manhole	0		OUTFALL		S1.007	98.927	600	

PIPELINE SCHEDULES for Attenuation System 1

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	225	SS-1	104.168	102.818	1.125	Open Manhole	1200
S1.001	o	225	SS-2	103.957	102.207	1.525	Open Manhole	1200
S1.002	o	225	SS-3	103.069	101.719	1.125	Open Manhole	1200
S1.003	o	300	SS-4	101.825	100.399	1.126	Open Manhole	1200
S1.004	o	300	SS-5	101.334	99.908	1.126	Open Manhole	1200
S2.000	o	150	SS-7	103.957	102.350	1.457	Open Manhole	1200
S3.000	o	150	SS-9	103.997	102.583	1.264	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	60.619	99.2	SS-2	103.957	102.207	1.525	Open Manhole	1200
S1.001	59.199	121.3	SS-3	103.069	101.719	1.125	Open Manhole	1200
S1.002	57.134	45.9	SS-4	101.825	100.474	1.126	Open Manhole	1200
S1.003	67.877	138.2	SS-5	101.334	99.908	1.126	Open Manhole	1200
S1.004	14.730	137.7	SS-6	101.700	99.801	1.599	Open Manhole	1500
S2.000	32.657	149.8	SS-8	104.291	102.132	2.009	Open Manhole	1200
S3.000	26.056	149.7	SS-8	104.291	102.409	1.732	Open Manhole	1200

PIPELINE SCHEDULES for Attenuation System 1

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)
S2.001	o	225	SS-8	104.291	102.057	2.009	Open Manhole	1200
S4.000	o	225	SS-11	104.185	102.760	1.200	Open Manhole	1200
S2.002	o	300	SS-10	104.052	101.769	1.983	Open Manhole	1200
S5.000	o	150	SS-13	102.672	101.204	1.318	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)
S2.001	35.772	167.9	SS-10	104.052	101.844	1.983	Open Manhole	1200
S4.000	55.594	110.1	SS-10	104.052	102.255	1.572	Open Manhole	1200
S2.002	54.999	126.1	SS-12	102.833	101.333	1.200	Open Manhole	1200
S5.000	32.581	148.1	SS-12	102.833	100.984	1.699	Open Manhole	1200

PIPELINE SCHEDULES for Attenuation System 1

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)
S2.003	o	300	SS-12	102.833	100.834	1.699	Open Manhole	1200
S6.000	o	150	SS-23	103.580	102.136	1.294	Open Manhole	1200
S7.000	o	150	SS-25	103.428	102.248	1.030	Open Manhole	1200
S6.001	o	225	SS-24	103.234	101.634	1.375	Open Manhole	1200
S8.000	o	225	SS-30	103.786	102.361	1.200	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)
S2.003	34.496	103.3	SS-14	102.000	100.500	1.200	Open Manhole	1500
S6.000	37.112	86.9	SS-24	103.234	101.709	1.375	Open Manhole	1200
S7.000	19.902	110.0	SS-24	103.234	102.067	1.017	Open Manhole	1200
S6.001	78.906	84.0	SS-26	102.120	100.695	1.200	Open Manhole	1350
S8.000	49.548	63.5	SS-31	103.006	101.581	1.200	Open Manhole	1200

PIPELINE SCHEDULES for Attenuation System 1

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)
S8.001	o	300	SS-31	103.006	101.506	1.200	Open Manhole	1200
S9.000	o	225	SS-33	104.522	102.960	1.337	Open Manhole	1200
S9.001	o	225	SS-34	103.695	101.721	1.749	Open Manhole	1200
S9.002	o	225	SS-35	102.264	100.839	1.200	Open Manhole	1200
S8.002	o	300	SS-32	103.000	100.697	2.003	Open Manhole	1200
S6.002	o	375	SS-26	102.120	100.443	1.302	Open Manhole	1350

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S8.001	66.439	242.5	SS-32	103.000	101.232	1.468	Open Manhole	1200
S9.000	72.490	58.5	SS-34	103.695	101.721	1.749	Open Manhole	1200
S9.001	57.676	65.4	SS-35	102.264	100.839	1.200	Open Manhole	1200
S9.002	11.204	167.2	SS-32	103.000	100.772	2.003	Open Manhole	1200
S8.002	43.248	241.6	SS-26	102.120	100.518	1.302	Open Manhole	1350
S6.002	45.609	206.4	SS-27	102.150	100.222	1.553	Open Manhole	1350

PIPELINE SCHEDULES for Attenuation System 1

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)
S6.003	o	375	SS-27	102.150	100.222	1.553	Open Manhole	1350
S10.000	o	150	SS-15	103.878	102.469	1.259	Open Manhole	1200
S10.001	o	150	SS-16	103.494	102.147	1.197	Open Manhole	1200
S11.000	o	225	SS-18	103.569	102.144	1.200	Open Manhole	1200
S10.002	o	300	SS-17	103.447	101.684	1.463	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)
S6.003	58.509	201.8	SS-28	101.577	99.932	1.270	Open Manhole	1500
S10.000	35.407	110.0	SS-16	103.494	102.147	1.197	Open Manhole	1200
S10.001	31.081	99.3	SS-17	103.447	101.834	1.463	Open Manhole	1200
S11.000	68.120	224.8	SS-17	103.447	101.841	1.381	Open Manhole	1200
S10.002	31.009	224.7	SS-19	103.244	101.546	1.398	Open Manhole	1350

PIPELINE SCHEDULES for Attenuation System 1

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)
S12.000	o	150	SS-20	103.300	101.950	1.200	Open Manhole	1200
S10.003	o	375	SS-19	103.244	101.471	1.398	Open Manhole	1350
S13.000	o	150	SS-22	102.712	101.470	1.092	Open Manhole	1200
S10.004	o	375	SS-21	102.829	101.066	1.388	Open Manhole	1350
S6.004	o	525	SS-28	101.577	99.782	1.270	Open Manhole	1500

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)
S12.000	35.150	150.2	SS-19	103.244	101.716	1.378	Open Manhole	1350
S10.003	31.009	236.7	SS-21	102.829	101.340	1.114	Open Manhole	1350
S13.000	26.708	149.2	SS-21	102.829	101.291	1.388	Open Manhole	1350
S10.004	31.201	29.3	SS-28	101.577	100.002	1.200	Open Manhole	1500
S6.004	15.080	396.8	SS-29	102.100	99.744	1.831	Open Manhole	1500

PIPELINE SCHEDULES for Attenuation System 1

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)
S6.005	o	525	SS-29	102.100	99.744	1.831	Open Manhole	1500
S2.004	o	600	SS-14	102.000	99.530	1.870	Open Manhole	1500
S1.005	o	600	SS-6	101.700	99.501	1.599	Open Manhole	1500
S1.006	o	600	SS-197	102.000	99.050	2.350	Open Manhole	1500
S1.007	o	600	S198	102.000	99.011	2.389	Open Manhole	1500

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)
S6.005	55.810	401.5	SS-14	102.000	99.605	1.870	Open Manhole	1500
S2.004	13.390	495.9	SS-6	101.700	99.503	1.597	Open Manhole	1500
S1.005	5.459	81.5	SS-197	102.000	99.434	1.966	Open Manhole	1500
S1.006	8.728	223.8	S198	102.000	99.011	2.389	Open Manhole	1500
S1.007	18.867	224.6	SS-Outfall 1	101.429	98.927	1.902	Open Manhole	0

Free Flowing Outfall Details for Attenuation System 1

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.007	SS-Outfall 1	101.429	98.927	98.900	0	0

Simulation Criteria for Attenuation System 1

Volumetric Runoff Coeff	0.750	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)	60
Hot Start Level (mm)	0	MADD Factor * 10m³/ha Storage	2.000	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	15.500	Cv (Summer)	0.750
Return Period (years)	5	Ratio R	0.272	Cv (Winter)	0.840
Region	Scotland and Ireland	Profile Type	Summer	Storm Duration (mins)	30

Online Controls for Attenuation System 1

Hydro-Brake® Optimum Manhole: S198, DS/PN: S1.007, Volume (m³): 7.3

Unit Reference	MD-SHE-0245-3580-1764-3580	Sump Available	Yes
Design Head (m)	1.764	Diameter (mm)	245
Design Flow (l/s)	35.8	Invert Level (m)	99.011
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	300
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1800
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.764	35.7	Kick-Flo®	1.169	29.4
Flush-Flo™	0.536	35.6	Mean Flow over Head Range	-	30.7

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	8.0	0.600	35.6	1.600	34.1	2.600	43.1	5.000	59.1	7.500	71.9
0.200	25.0	0.800	34.8	1.800	36.1	3.000	46.2	5.500	61.9	8.000	74.2
0.300	33.7	1.000	33.1	2.000	38.0	3.500	49.7	6.000	64.6	8.500	76.5
0.400	35.1	1.200	29.7	2.200	39.7	4.000	53.0	6.500	67.1	9.000	78.6
0.500	35.6	1.400	32.0	2.400	41.4	4.500	56.1	7.000	69.6	9.500	80.7

Storage Structures for Attenuation System 1

Tank or Pond Manhole: SS-197, DS/PN: S1.006

Invert Level (m) 99.050

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1160.0	1.725	1160.0	1.726	0.0

Summary of Critical Results by Maximum Level (Rank 1) for Attenuation System 1

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 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 15.500 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.272 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 100.0 DTS Status ON 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)	1, 30, 100
Climate Change (%)	0, 10, 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)
S1.000	SS-1	15 Winter	100	+10%	100/15 Summer				103.177	0.134	0.000	0.81		41.1
S1.001	SS-2	15 Winter	100	+10%	30/15 Summer				102.829	0.397	0.000	1.24		56.4

Summary of Critical Results by Maximum Level (Rank 1) for Attenuation System 1

PN	US/MH Name	Status	Level Exceeded
S1.000	SS-1	SURCHARGED	
S1.001	SS-2	SURCHARGED	

Summary of Critical Results by Maximum Level (Rank 1) for Attenuation System 1

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)
S1.002	SS-3	15 Winter	100	+10%	100/15 Summer				102.089	0.145	0.000	0.95		70.7
S1.003	SS-4	15 Winter	100	+10%	30/15 Winter				100.970	0.271	0.000	1.11		99.8
S1.004	SS-5	15 Winter	100	+10%	30/15 Summer				100.447	0.239	0.000	1.19		94.1
S2.000	SS-7	15 Winter	100	+10%	30/15 Summer				103.619	1.119	0.000	1.72		24.0
S3.000	SS-9	15 Winter	100	+10%	100/15 Summer				103.052	0.319	0.000	0.93		12.9
S2.001	SS-8	15 Winter	100	+10%	30/15 Summer				102.962	0.680	0.000	1.42		53.8
S4.000	SS-11	15 Winter	100	+10%	100/15 Summer				103.080	0.095	0.000	1.07		50.8
S2.002	SS-10	15 Winter	100	+10%	30/15 Summer				102.518	0.449	0.000	1.39		130.2
S5.000	SS-13	15 Winter	100	+10%	30/15 Summer				102.349	0.995	0.000	1.74		24.3
S2.003	SS-12	15 Winter	100	+10%	30/15 Summer				101.688	0.554	0.000	1.64		164.8
S6.000	SS-23	15 Winter	100	+10%	30/15 Summer				102.808	0.522	0.000	0.97		17.9
S7.000	SS-25	15 Winter	100	+10%	100/15 Winter				102.448	0.050	0.000	0.32		5.1
S6.001	SS-24	15 Winter	100	+10%	30/15 Summer				102.439	0.580	0.000	1.09		60.3
S8.000	SS-30	15 Winter	100	+10%	100/15 Summer				102.782	0.196	0.000	0.89		55.5
S8.001	SS-31	15 Winter	100	+10%	30/15 Summer				102.360	0.554	0.000	1.43		97.2
S9.000	SS-33	15 Winter	100	+10%					103.073	-0.112	0.000	0.49		32.4
S9.001	SS-34	15 Winter	100	+10%	100/15 Summer				102.364	0.418	0.000	0.76		47.0
S9.002	SS-35	15 Winter	100	+10%	30/15 Summer				102.201	1.137	0.000	1.06		35.9
S8.002	SS-32	15 Winter	100	+10%	30/15 Summer				102.120	1.123	0.000	1.54		102.7
S6.002	SS-26	15 Winter	100	+10%	30/15 Summer				101.737	0.919	0.000	1.25		160.0
S6.003	SS-27	15 Winter	100	+10%	30/15 Summer				101.389	0.792	0.000	1.24		163.1
S10.000	SS-15	15 Winter	100	+10%	30/15 Summer				103.164	0.545	0.000	1.15		18.7
S10.001	SS-16	15 Winter	100	+10%	30/15 Summer				102.772	0.475	0.000	1.33		22.8
S11.000	SS-18	15 Winter	100	+10%	30/15 Summer				103.432	1.063	0.000	1.92		64.3
S10.002	SS-17	15 Winter	100	+10%	30/15 Summer				102.214	0.230	0.000	1.55		104.6

Summary of Critical Results by Maximum Level (Rank 1) for Attenuation System 1

PN	US/MH Name	Status	Level Exceeded
S1.002	SS-3	SURCHARGED	
S1.003	SS-4	SURCHARGED	
S1.004	SS-5	SURCHARGED	
S2.000	SS-7	SURCHARGED	
S3.000	SS-9	SURCHARGED	
S2.001	SS-8	SURCHARGED	
S4.000	SS-11	SURCHARGED	
S2.002	SS-10	SURCHARGED	
S5.000	SS-13	SURCHARGED	
S2.003	SS-12	SURCHARGED	
S6.000	SS-23	SURCHARGED	
S7.000	SS-25	SURCHARGED	
S6.001	SS-24	SURCHARGED	
S8.000	SS-30	SURCHARGED	
S8.001	SS-31	SURCHARGED	
S9.000	SS-33	OK	
S9.001	SS-34	SURCHARGED	
S9.002	SS-35	FLOOD RISK	
S8.002	SS-32	SURCHARGED	
S6.002	SS-26	SURCHARGED	
S6.003	SS-27	SURCHARGED	
S10.000	SS-15	SURCHARGED	
S10.001	SS-16	SURCHARGED	
S11.000	SS-18	SURCHARGED	

Summary of Critical Results by Maximum Level (Rank 1) for Attenuation System 1

PN	US/MH Name	Status	Level Exceeded
S10.002	SS-17	SURCHARGED	

Summary of Critical Results by Maximum Level (Rank 1) for Attenuation System 1

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)
S12.000	SS-20	15 Winter	100	+10%	30/15 Summer				102.416	0.316	0.000	1.49		20.8
S10.003	SS-19	15 Winter	100	+10%	100/15 Summer				101.873	0.027	0.000	1.15		132.6
S13.000	SS-22	15 Winter	100	+10%					101.546	-0.074	0.000	0.51		7.1
S10.004	SS-21	15 Winter	100	+10%					101.240	-0.201	0.000	0.44		143.7
S6.004	SS-28	15 Winter	100	+10%	30/15 Summer				100.937	0.630	0.000	1.92		298.3
S6.005	SS-29	15 Winter	100	+10%	30/15 Summer				100.787	0.518	0.000	1.38		300.3
S2.004	SS-14	15 Winter	100	+10%	30/15 Summer				100.513	0.383	0.000	2.78		455.1
S1.005	SS-6	15 Winter	100	+10%	30/15 Summer				100.304	0.203	0.000	1.58		547.1
S1.006	SS-197	480 Winter	100	+10%	30/180 Winter				100.047	0.397	0.000	0.14		39.7
S1.007	S198	480 Winter	100	+10%	30/120 Winter	100/960 Summer			100.797	1.186	0.000	0.10		35.6

PN	US/MH Name	Status	Level Exceeded
S12.000	SS-20	SURCHARGED	
S10.003	SS-19	SURCHARGED	
S13.000	SS-22	OK	
S10.004	SS-21	OK	
S6.004	SS-28	SURCHARGED	
S6.005	SS-29	SURCHARGED	
S2.004	SS-14	SURCHARGED	
S1.005	SS-6	SURCHARGED	
S1.006	SS-197	SURCHARGED	

Summary of Critical Results by Maximum Level (Rank 1) for Attenuation System 1

PN	US/MH Name	Status	Level Exceeded
S1.007	S198	SURCHARGED	

NOTE TO FILE

JBA Project Code	2018s0900
Contract	Dunshaughlin East SHD, Meath SW Review
Client	Joseph O'Reilly Consulting Civil & Structural Engineers
Day, Date and Time	12/12/2018
Author	Leanne Leonard
Subject	Modelling Notes v7.0

B Appendix B - MicroDrainage outputs for Catchment 2

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Attenuation System 2

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	5	Foul Sewage (l/s/ha)	0.000	Maximum Backdrop Height (m)	1.500
M5-60 (mm)	15.500	Volumetric Runoff Coeff.	0.750	Min Design Depth for Optimisation (m)	1.200
Ratio R	0.272	PIMP (%)	100	Min Vel for Auto Design only (m/s)	1.00
Maximum Rainfall (mm/hr)	50	Add Flow / Climate Change (%)	0	Min Slope for Optimisation (1:X)	500
Maximum Time of Concentration (mins)	500	Minimum Backdrop Height (m)	0.000		

Designed with Level Soffits

Time Area Diagram for Attenuation System 2

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.000	4-8	0.769	8-12	3.718	12-16	0.758

Total Area Contributing (ha) = 5.245

Total Pipe Volume (m³) = 239.711

Network Design Table for Attenuation System 2

« - Indicates pipe capacity < flow

Network Design Table for Attenuation System 2

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	27.026	0.180	150.1	0.045	4.00	0.0	0.600	o	150	Pipe/Conduit	
S1.001	44.423	0.939	47.3	0.091	0.00	0.0	0.600	o	150	Pipe/Conduit	
S2.000	27.532	0.184	149.6	0.024	4.00	0.0	0.600	o	150	Pipe/Conduit	
S1.002	101.096	1.116	90.6	0.211	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.000	18.674	0.124	150.6	0.015	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)
S1.000	50.00	4.55	102.307	0.045	0.0	0.0	0.0	0.82	14.5	6.1
S1.001	50.00	5.06	102.127	0.136	0.0	0.0	0.0	1.47	25.9	18.4
S2.000	50.00	4.56	101.500	0.024	0.0	0.0	0.0	0.82	14.5	3.2
S1.002	50.00	6.28	101.113	0.371	0.0	0.0	0.0	1.37	54.6	50.2
S3.000	50.00	4.38	100.213	0.015	0.0	0.0	0.0	0.82	14.4	2.0

Network Design Table for Attenuation System 2

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
S4.000	31.665	0.211	150.1	0.028	4.00	0.0	0.600	o	150	Pipe/Conduit	
S1.003	40.331	0.545	74.0	0.113	0.00	0.0	0.600	o	300	Pipe/Conduit	
S5.000	25.156	0.169	148.9	0.084	4.00	0.0	0.600	o	150	Pipe/Conduit	
S1.004	57.576	0.185	311.2	0.181	0.00	0.0	0.600	o	375	Pipe/Conduit	
S6.000	30.873	0.205	150.6	0.025	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)
S4.000	50.00	4.65	100.848	0.028	0.0	0.0	0.0	0.82	14.5	3.8
S1.003	50.00	6.65	99.922	0.527	0.0	0.0	0.0	1.83	129.3	71.4
S5.000	50.00	4.51	99.764	0.084	0.0	0.0	0.0	0.82	14.5	11.4
S1.004	48.91	7.59	99.302	0.792	0.0	0.0	0.0	1.02	112.8	104.9
S6.000	50.00	4.63	100.218	0.025	0.0	0.0	0.0	0.82	14.4	3.4

Network Design Table for Attenuation System 2

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
S1.005	27.094	0.089	304.4	0.053	0.00	0.0	0.600	o	375	Pipe/Conduit	
S7.000	24.841	0.166	149.6	0.083	4.00	0.0	0.600	o	150	Pipe/Conduit	
S1.006	54.618	0.341	160.2	0.120	0.00	0.0	0.600	o	375	Pipe/Conduit	
S8.000	44.019	0.753	58.5	0.073	4.00	0.0	0.600	o	225	Pipe/Conduit	
S9.000	28.396	0.189	150.2	0.062	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)
S1.005	47.74	8.03	99.117	0.871	0.0	0.0	0.0	1.03	114.1	112.6
S7.000	50.00	4.51	99.605	0.083	0.0	0.0	0.0	0.82	14.5	11.2
S1.006	46.14	8.66	99.028	1.073	0.0	0.0	0.0	1.43	157.8	134.1
S8.000	50.00	4.43	102.751	0.073	0.0	0.0	0.0	1.71	68.1	9.9
S9.000	50.00	4.58	102.172	0.062	0.0	0.0	0.0	0.82	14.4	8.5

Network Design Table for Attenuation System 2

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	101.711	1.266	80.3	0.146	0.00	0.0	0.600	o	225	Pipe/Conduit	
S10.000	30.665	0.204	150.3	0.073	4.00	0.0	0.600	o	150	Pipe/Conduit	
S8.002	96.649	0.584	165.5	0.139	0.00	0.0	0.600	o	300	Pipe/Conduit	
S11.000	31.845	0.212	150.2	0.063	4.00	0.0	0.600	o	150	Pipe/Conduit	
S8.003	83.884	0.437	192.0	0.096	0.00	0.0	0.600	o	375	Pipe/Conduit	
S8.004	72.216	0.241	299.7	0.089	0.00	0.0	0.600	o	375	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S8.001	50.00	5.74	101.908	0.282	0.0	0.0	0.0	1.46	58.1	38.2
S10.000	50.00	4.63	101.021	0.073	0.0	0.0	0.0	0.82	14.4	9.9
S8.002	50.00	7.06	100.567	0.494	0.0	0.0	0.0	1.22	86.2	66.9
S11.000	50.00	4.65	100.545	0.063	0.0	0.0	0.0	0.82	14.4	8.5
S8.003	47.46	8.13	99.908	0.653	0.0	0.0	0.0	1.30	144.1	83.9
S8.004	44.70	9.29	99.471	0.742	0.0	0.0	0.0	1.04	115.0	89.8

Network Design Table for Attenuation System 2

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
S1.007	10.041	0.022	456.4	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
S1.008	95.000	0.482	197.1	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S12.000	75.843	0.337	225.1	0.180	4.00	0.0	0.600	o	225	Pipe/Conduit	
S12.001	55.899	0.333	167.9	0.066	0.00	0.0	0.600	o	225	Pipe/Conduit	
S12.002	29.551	0.176	167.9	0.008	0.00	0.0	0.600	o	225	Pipe/Conduit	
S13.000	11.603	0.133	87.2	0.041	4.00	0.0	0.600	o	150	Pipe/Conduit	
S13.001	7.951	0.080	99.4	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)
S1.007	44.35	9.45	98.537	1.815	0.0	0.0	0.0	1.04	225.5	218.0
S1.008	42.48	10.36	98.515	1.815	0.0	0.0	0.0	1.73	489.4	218.0
S12.000	50.00	5.46	99.000	0.180	0.0	0.0	0.0	0.87	34.5	24.4
S12.001	50.00	6.38	98.663	0.246	0.0	0.0	0.0	1.01	40.0	33.4
S12.002	50.00	6.87	98.330	0.254	0.0	0.0	0.0	1.01	40.0	34.5
S13.000	50.00	4.18	98.571	0.041	0.0	0.0	0.0	1.08	19.0	5.6
S13.001	50.00	4.31	98.438	0.041	0.0	0.0	0.0	1.01	17.8	5.6

Network Design Table for Attenuation System 2

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
S14.000	25.638	0.171	149.9	0.089	4.00	0.0	0.600	o	150	Pipe/Conduit	
S13.002	16.633	0.074	224.8	0.059	0.00	0.0	0.600	o	225	Pipe/Conduit	
S15.000	25.114	0.167	150.4	0.060	4.00	0.0	0.600	o	150	Pipe/Conduit	
S13.003	13.350	0.059	226.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S13.004	19.652	0.087	225.9	0.058	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)
S14.000	50.00	4.52	98.551	0.089	0.0	0.0	0.0	0.82	14.5	12.0
S13.002	50.00	4.84	98.358	0.189	0.0	0.0	0.0	0.87	34.5	25.6
S15.000	50.00	4.51	98.628	0.060	0.0	0.0	0.0	0.82	14.4	8.2
S13.003	50.00	5.10	98.284	0.249	0.0	0.0	0.0	0.87	34.4	33.7
S13.004	50.00	5.41	98.225	0.307	0.0	0.0	0.0	1.04	73.7	41.6

Network Design Table for Attenuation System 2

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
S12.003	11.582	0.105	110.3	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.009	34.000	0.206	165.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S16.000	23.242	0.573	40.6	0.040	4.00	0.0	0.600	o	225	Pipe/Conduit	
S17.000	33.476	0.892	37.5	0.097	4.00	0.0	0.600	o	150	Pipe/Conduit	
S18.000	26.141	0.297	88.0	0.013	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)
S12.003	50.00	7.00	98.138	0.562	0.0	0.0	0.0	1.50	105.8	76.1
S1.009	41.90	10.66	98.033	2.377	0.0	0.0	0.0	1.89	535.2	269.7
S16.000	50.00	4.19	102.051	0.040	0.0	0.0	0.0	2.06	81.9	5.4
S17.000	50.00	4.34	102.184	0.097	0.0	0.0	0.0	1.65	29.1	13.2
S18.000	50.00	4.41	102.338	0.013	0.0	0.0	0.0	1.07	18.9	1.8

Network Design Table for Attenuation System 2

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	74.702	0.843	88.6	0.194	0.00	0.0	0.600	o	225	Pipe/Conduit	
S19.000	36.535	0.717	51.0	0.107	4.00	0.0	0.600	o	150	Pipe/Conduit	
S20.000	13.999	0.240	58.3	0.000	4.00	0.0	0.600	o	150	Pipe/Conduit	
S16.002	10.785	0.086	125.4	0.010	0.00	0.0	0.600	o	300	Pipe/Conduit	
S16.003	60.928	0.991	61.5	0.177	0.00	0.0	0.600	o	300	Pipe/Conduit	
S21.000	23.169	0.156	148.5	0.026	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)
S16.001	50.00	5.30	101.217	0.344	0.0	0.0	0.0	1.39	55.3	46.6
S19.000	50.00	4.43	101.166	0.107	0.0	0.0	0.0	1.41	25.0	14.5
S20.000	50.00	4.18	100.700	0.000	0.0	0.0	0.0	1.32	23.3	0.0
S16.002	50.00	5.43	100.299	0.461	0.0	0.0	0.0	1.40	99.1	62.5
S16.003	50.00	5.94	100.213	0.638	0.0	0.0	0.0	2.01	142.0	86.4
S21.000	50.00	4.47	100.122	0.026	0.0	0.0	0.0	0.82	14.5	3.5

Network Design Table for Attenuation System 2

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
S22.000	40.708	0.541	75.2	0.133	4.00	0.0	0.600	o	150	Pipe/Conduit	
S16.004	72.647	0.577	125.9	0.205	0.00	0.0	0.600	o	375	Pipe/Conduit	
S23.000	41.250	0.278	148.4	0.081	4.00	0.0	0.600	o	150	Pipe/Conduit	
S24.000	11.233	0.076	147.8	0.000	4.00	0.0	0.600	o	150	Pipe/Conduit	
S16.005	67.567	0.409	165.2	0.227	0.00	0.0	0.600	o	450	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)
S22.000	50.00	4.58	99.913	0.133	0.0	0.0	0.0	1.16	20.5	18.1
S16.004	50.00	6.69	99.147	1.003	0.0	0.0	0.0	1.61	178.2	135.8
S23.000	50.00	4.84	99.537	0.081	0.0	0.0	0.0	0.82	14.5	11.0
S24.000	50.00	4.23	99.044	0.000	0.0	0.0	0.0	0.82	14.6	0.0
S16.005	49.44	7.40	98.495	1.311	0.0	0.0	0.0	1.58	251.1	175.6

Network Design Table for Attenuation System 2

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
S25.000	16.032	0.107	149.8	0.000	4.00	0.0	0.600	o	150	Pipe/Conduit	
S16.006	69.816	0.077	906.7	0.202	0.00	0.0	0.600	o	600	Pipe/Conduit	
S26.000	12.805	0.085	150.7	0.000	4.00	0.0	0.600	o	225	Pipe/Conduit	
S27.000	19.381	0.211	91.9	0.077	4.00	0.0	0.600	o	225	Pipe/Conduit	
S28.000	24.578	0.372	66.1	0.048	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)
S25.000	50.00	4.33	98.766	0.000	0.0	0.0	0.0	0.82	14.5	0.0
S16.006	45.69	8.85	97.936	1.514	0.0	0.0	0.0	0.80	226.3	187.3
S26.000	50.00	4.20	98.225	0.000	0.0	0.0	0.0	1.06	42.3	0.0
S27.000	50.00	4.24	102.000	0.077	0.0	0.0	0.0	1.36	54.3	10.5
S28.000	50.00	4.33	102.332	0.048	0.0	0.0	0.0	1.24	21.9	6.4

Network Design Table for Attenuation System 2

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	42.840	0.286	149.8	0.102	4.00	0.0	0.600	o	225	Pipe/Conduit	
S27.001	75.494	1.238	61.0	0.142	0.00	0.0	0.600	o	225	Pipe/Conduit	
S30.000	40.806	0.586	69.6	0.103	4.00	0.0	0.600	o	150	Pipe/Conduit	
S27.002	69.807	1.040	67.1	0.140	0.00	0.0	0.600	o	300	Pipe/Conduit	
S31.000	33.250	0.222	149.8	0.069	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)
S29.000	50.00	4.67	102.218	0.102	0.0	0.0	0.0	1.07	42.4	13.9
S27.001	50.00	5.42	101.789	0.370	0.0	0.0	0.0	1.68	66.7	50.0
S30.000	50.00	4.56	101.212	0.103	0.0	0.0	0.0	1.21	21.3	14.0
S27.002	50.00	6.03	100.476	0.613	0.0	0.0	0.0	1.92	135.9	83.0
S31.000	50.00	4.68	100.320	0.069	0.0	0.0	0.0	0.82	14.5	9.3

Network Design Table for Attenuation System 2

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	31.066	0.208	149.4	0.052	4.00	0.0	0.600	o	150	Pipe/Conduit	
S27.003	39.207	0.373	105.1	0.028	0.00	0.0	0.600	o	300	Pipe/Conduit	
S33.000	30.467	0.204	149.3	0.033	4.00	0.0	0.600	o	150	Pipe/Conduit	
S27.004	32.024	0.202	158.5	0.108	0.00	0.0	0.600	o	375	Pipe/Conduit	
S34.000	27.193	0.406	67.0	0.053	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)
S32.000	50.00	4.63	100.083	0.052	0.0	0.0	0.0	0.82	14.5	7.0
S27.003	50.00	6.45	99.436	0.762	0.0	0.0	0.0	1.53	108.4	103.1
S33.000	50.00	4.62	99.767	0.033	0.0	0.0	0.0	0.82	14.5	4.5
S27.004	50.00	6.82	98.988	0.903	0.0	0.0	0.0	1.44	158.7	122.2
S34.000	50.00	4.37	99.614	0.053	0.0	0.0	0.0	1.23	21.7	7.1

Network Design Table for Attenuation System 2

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
S27.005	52.097	0.347	150.1	0.125	0.00	0.0	0.600	o	375	Pipe/Conduit	
S35.000	30.268	0.404	74.9	0.081	4.00	0.0	0.600	o	150	Pipe/Conduit	
S27.006	32.287	0.080	403.6	0.061	0.00	0.0	0.600	o	450	Pipe/Conduit	
S27.007	38.049	0.095	400.5	0.041	0.00	0.0	0.600	o	450	Pipe/Conduit	
S27.008	66.069	0.165	400.4	0.092	0.00	0.0	0.600	o	450	Pipe/Conduit	
S16.007	3.425	0.032	107.0	0.000	0.00	0.0	0.600	o	600	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)
S27.005	49.41	7.41	98.786	1.080	0.0	0.0	0.0	1.48	163.1	144.6
S35.000	50.00	4.43	99.742	0.081	0.0	0.0	0.0	1.16	20.5	10.9
S27.006	47.94	7.95	98.364	1.222	0.0	0.0	0.0	1.01	160.0	158.6
S27.007	46.36	8.57	98.284	1.262	0.0	0.0	0.0	1.01	160.6	158.6
S27.008	43.89	9.66	98.189	1.355	0.0	0.0	0.0	1.01	160.6«	161.0
S16.007	43.84	9.69	97.859	2.868	0.0	0.0	0.0	2.35	665.5	340.6

Network Design Table for Attenuation System 2

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
S1.010	12.000	0.177	67.7	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.011	5.000	0.050	100.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.012	46.931	0.125	375.4	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.013	168.566	0.450	374.6	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.014	21.334	0.057	374.3	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.010	41.78	10.73	97.827	5.245	0.0	0.0	0.0	2.96	837.7	593.4
S1.011	41.71	10.76	97.650	5.245	0.0	0.0	0.0	2.44	688.6	593.4
S1.012	40.22	11.61	97.600	5.245	0.0	0.0	0.0	0.93	102.6«	593.4
S1.013	35.80	14.63	97.475	5.245	0.0	0.0	0.0	0.93	102.7«	593.4
S1.014	35.33	15.01	97.025	5.245	0.0	0.0	0.0	0.93	102.8«	593.4

Manhole Schedules for Attenuation System 2

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)
SS-50	103.947	1.640	Open Manhole	1200	S1.000	102.307	150				
SS-51	103.756	1.629	Open Manhole	1200	S1.001	102.127	150	S1.000	102.127	150	
SS-53	103.322	1.822	Open Manhole	1200	S2.000	101.500	150				
SS-52	102.911	1.798	Open Manhole	1200	S1.002	101.113	225	S1.001	101.188	150	
								S2.000	101.316	150	128
SS-56	101.659	1.446	Open Manhole	1200	S3.000	100.213	150				
SS-55	102.164	1.316	Open Manhole	1200	S4.000	100.848	150				
SS-54	101.766	1.844	Open Manhole	1200	S1.003	99.922	300	S1.002	99.997	225	
								S3.000	100.089	150	17
								S4.000	100.637	150	565
SS-58	101.707	1.943	Open Manhole	1200	S5.000	99.764	150				
SS-57	101.622	2.320	Open Manhole	1350	S1.004	99.302	375	S1.003	99.377	300	
								S5.000	99.595	150	68
SS-60	101.730	1.512	Open Manhole	1200	S6.000	100.218	150				
SS-59	101.364	2.247	Open Manhole	1350	S1.005	99.117	375	S1.004	99.117	375	
								S6.000	100.013	150	671
SS-62	101.235	1.630	Open Manhole	1200	S7.000	99.605	150				
SS-61	101.068	2.040	Open Manhole	1350	S1.006	99.028	375	S1.005	99.028	375	
								S7.000	99.439	150	186

Manhole Schedules for Attenuation System 2

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)
SS-40	104.094	1.343	Open Manhole	1200	S8.000	102.751	225				
SS-42	103.367	1.195	Open Manhole	1200	S9.000	102.172	150				
SS-41	103.650	1.742	Open Manhole	1200	S8.001	101.908	225	S8.000	101.998	225	90
								S9.000	101.983	150	
SS-44	102.260	1.239	Open Manhole	1200	S10.000	101.021	150				
SS-43	102.672	2.105	Open Manhole	1200	S8.002	100.567	300	S8.001	100.642	225	
								S10.000	100.817	150	100
SS-46	101.741	1.196	Open Manhole	1200	S11.000	100.545	150				
SS-45	102.142	2.234	Open Manhole	1350	S8.003	99.908	375	S8.002	99.983	300	
								S11.000	100.333	150	200
SS-47	101.679	2.208	Open Manhole	1350	S8.004	99.471	375	S8.003	99.471	375	
SS-63	100.726	2.189	Open Manhole	1500	S1.007	98.537	525	S1.006	98.687	375	
								S8.004	99.230	375	543
SA	100.732	2.217	Open Manhole	1500	S1.008	98.515	600	S1.007	98.515	525	
SS-160	101.254	2.254	Open Manhole	1200	S12.000	99.000	225				
SS-161	100.612	1.949	Open Manhole	1200	S12.001	98.663	225	S12.000	98.663	225	
SS-162	100.137	1.807	Open Manhole	1200	S12.002	98.330	225	S12.001	98.330	225	
SS-163	99.894	1.323	Open Manhole	1200	S13.000	98.571	150				
SS-164	99.835	1.397	Open Manhole	1200	S13.001	98.438	150	S13.000	98.438	150	

Manhole Schedules for Attenuation System 2

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)
SS-165	99.972	1.421	Open Manhole	1200	S14.000	98.551	150				
SS-166	99.903	1.545	Open Manhole	1200	S13.002	98.358	225	S13.001	98.358	150	
								S14.000	98.380	150	
SS-167	99.570	0.942	Open Manhole	1200	S15.000	98.628	150				
SS-168	99.705	1.421	Open Manhole	1200	S13.003	98.284	225	S13.002	98.284	225	
								S15.000	98.461	150	102
SS-169	99.621	1.396	Open Manhole	1200	S13.004	98.225	300	S13.003	98.225	225	
SS-170	99.547	1.409	Open Manhole	1200	S12.003	98.138	300	S12.002	98.154	225	
								S13.004	98.138	300	
SB	100.732	2.699	Open Manhole	1500	S1.009	98.033	600	S1.008	98.033	600	
								S12.003	98.033	300	
SS-90	103.576	1.525	Open Manhole	1200	S16.000	102.051	225				
SS-91	103.574	1.390	Open Manhole	1200	S17.000	102.184	150				
SS-93	103.494	1.156	Open Manhole	1200	S18.000	102.338	150				
SS-92	103.340	2.123	Open Manhole	1200	S16.001	101.217	225	S16.000	101.478	225	261
								S17.000	101.292	150	
								S18.000	102.041	150	749
SS-95	102.591	1.425	Open Manhole	1200	S19.000	101.166	150				
SS-96	102.300	1.600	Open Manhole	1200	S20.000	100.700	150				

Manhole Schedules for Attenuation System 2

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)
SS-94	102.173	1.874	Open Manhole	1200	S16.002	100.299	300	S16.001	100.374	225	
								S19.000	100.449	150	
								S20.000	100.460	150	11
SS-97	102.012	1.799	Open Manhole	1200	S16.003	100.213	300	S16.002	100.213	300	
SS-100	101.472	1.350	Open Manhole	1200	S21.000	100.122	150				
SS-99	101.475	1.562	Open Manhole	1200	S22.000	99.913	150				
SS-98	101.232	2.085	Open Manhole	1350	S16.004	99.147	375	S16.003	99.222	300	
								S21.000	99.966	150	594
								S22.000	99.372	150	
SS-102	101.005	1.468	Open Manhole	1200	S23.000	99.537	150				
SS-103	100.394	1.350	Open Manhole	1200	S24.000	99.044	150				
SS-101	100.697	2.202	Open Manhole	1350	S16.005	98.495	450	S16.004	98.570	375	
								S23.000	99.259	150	464
								S24.000	98.968	150	173
SS-105	100.151	1.385	Open Manhole	1200	S25.000	98.766	150				
SS-104	100.259	2.323	Open Manhole	1500	S16.006	97.936	600	S16.005	98.086	450	
								S25.000	98.659	150	273
SS-108	99.650	1.425	Open Manhole	1200	S26.000	98.225	225				
SS-70	103.403	1.403	Open Manhole	1200	S27.000	102.000	225				

Manhole Schedules for Attenuation System 2

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)
SS-71	103.771	1.439	Open Manhole	1200	S28.000	102.332	150				
SS-73	103.568	1.350	Open Manhole	1200	S29.000	102.218	225				
SS-72	103.289	1.500	Open Manhole	1200	S27.001	101.789	225	S27.000	101.789	225	
								S28.000	101.960	150	96
								S29.000	101.932	225	143
SS-75	102.590	1.378	Open Manhole	1200	S30.000	101.212	150				
SS-74	102.205	1.729	Open Manhole	1200	S27.002	100.476	300	S27.001	100.551	225	
								S30.000	100.626	150	
SS-78	101.570	1.250	Open Manhole	1200	S31.000	100.320	150				
SS-77	101.600	1.517	Open Manhole	1200	S32.000	100.083	150				
SS-76	101.719	2.283	Open Manhole	1200	S27.003	99.436	300	S27.002	99.436	300	
								S31.000	100.098	150	512
								S32.000	99.875	150	289
SS-80	101.723	1.956	Open Manhole	1200	S33.000	99.767	150				
SS-79	101.487	2.499	Open Manhole	1350	S27.004	98.988	375	S27.003	99.063	300	
								S33.000	99.563	150	350
SS-82	101.127	1.513	Open Manhole	1200	S34.000	99.614	150				
SS-81	101.318	2.532	Open Manhole	1350	S27.005	98.786	375	S27.004	98.786	375	
								S34.000	99.208	150	197

Manhole Schedules for Attenuation System 2

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)
SS-84	101.230	1.488	Open Manhole	1200	S35.000	99.742	150				
SS-83	100.912	2.548	Open Manhole	1350	S27.006	98.364	450	S27.005	98.439	375	
								S35.000	99.338	150	674
SS-85	100.693	2.409	Open Manhole	1350	S27.007	98.284	450	S27.006	98.284	450	
SS-86	100.500	2.311	Open Manhole	1350	S27.008	98.189	450	S27.007	98.189	450	
SS-106	99.754	1.895	Open Manhole	1500	S16.007	97.859	600	S16.006	97.859	600	
								S26.000	98.140	225	
								S27.008	98.024	450	15
SC	99.784	1.957	Open Manhole	1500	S1.010	97.827	600	S1.009	97.827	600	
								S16.007	97.827	600	
SATT TANK	99.800	2.150	Open Manhole	1500	S1.011	97.650	600	S1.010	97.650	600	
SS-190	99.850	2.250	Open Manhole	1500	S1.012	97.600	375	S1.011	97.600	600	
SS-191	98.700	1.225	Open Manhole	1350	S1.013	97.475	375	S1.012	97.475	375	
SS-192	97.900	0.875	Open Manhole	1350	S1.014	97.025	375	S1.013	97.025	375	
SS-OUTFALL 2	102.000	5.032	Open Manhole	0		OUTFALL		S1.014	96.968	375	

PIPELINE SCHEDULES for Attenuation System 2

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	150	SS-50	103.947	102.307	1.490	Open Manhole	1200
S1.001	o	150	SS-51	103.756	102.127	1.479	Open Manhole	1200
S2.000	o	150	SS-53	103.322	101.500	1.672	Open Manhole	1200
S1.002	o	225	SS-52	102.911	101.113	1.573	Open Manhole	1200
S3.000	o	150	SS-56	101.659	100.213	1.296	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	27.026	150.1	SS-51	103.756	102.127	1.479	Open Manhole	1200
S1.001	44.423	47.3	SS-52	102.911	101.188	1.573	Open Manhole	1200
S2.000	27.532	149.6	SS-52	102.911	101.316	1.445	Open Manhole	1200
S1.002	101.096	90.6	SS-54	101.766	99.997	1.544	Open Manhole	1200
S3.000	18.674	150.6	SS-54	101.766	100.089	1.527	Open Manhole	1200

PIPELINE SCHEDULES for Attenuation System 2

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)
S4.000	o	150	SS-55	102.164	100.848	1.166	Open Manhole	1200
S1.003	o	300	SS-54	101.766	99.922	1.544	Open Manhole	1200
S5.000	o	150	SS-58	101.707	99.764	1.793	Open Manhole	1200
S1.004	o	375	SS-57	101.622	99.302	1.945	Open Manhole	1350
S6.000	o	150	SS-60	101.730	100.218	1.362	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)
S4.000	31.665	150.1	SS-54	101.766	100.637	0.979	Open Manhole	1200
S1.003	40.331	74.0	SS-57	101.622	99.377	1.945	Open Manhole	1350
S5.000	25.156	148.9	SS-57	101.622	99.595	1.877	Open Manhole	1350
S1.004	57.576	311.2	SS-59	101.364	99.117	1.872	Open Manhole	1350
S6.000	30.873	150.6	SS-59	101.364	100.013	1.201	Open Manhole	1350

PIPELINE SCHEDULES for Attenuation System 2

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)
S1.005	o	375	SS-59	101.364	99.117	1.872	Open Manhole	1350
S7.000	o	150	SS-62	101.235	99.605	1.480	Open Manhole	1200
S1.006	o	375	SS-61	101.068	99.028	1.665	Open Manhole	1350
S8.000	o	225	SS-40	104.094	102.751	1.118	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.005	27.094	304.4	SS-61	101.068	99.028	1.665	Open Manhole	1350
S7.000	24.841	149.6	SS-61	101.068	99.439	1.479	Open Manhole	1350
S1.006	54.618	160.2	SS-63	100.726	98.687	1.664	Open Manhole	1500
S8.000	44.019	58.5	SS-41	103.650	101.998	1.427	Open Manhole	1200

PIPELINE SCHEDULES for Attenuation System 2

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)
S9.000	o	150	SS-42	103.367	102.172	1.045	Open Manhole	1200
S8.001	o	225	SS-41	103.650	101.908	1.517	Open Manhole	1200
S10.000	o	150	SS-44	102.260	101.021	1.089	Open Manhole	1200
S8.002	o	300	SS-43	102.672	100.567	1.805	Open Manhole	1200
S11.000	o	150	SS-46	101.741	100.545	1.046	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)
S9.000	28.396	150.2	SS-41	103.650	101.983	1.517	Open Manhole	1200
S8.001	101.711	80.3	SS-43	102.672	100.642	1.805	Open Manhole	1200
S10.000	30.665	150.3	SS-43	102.672	100.817	1.705	Open Manhole	1200
S8.002	96.649	165.5	SS-45	102.142	99.983	1.859	Open Manhole	1350
S11.000	31.845	150.2	SS-45	102.142	100.333	1.659	Open Manhole	1350

PIPELINE SCHEDULES for Attenuation System 2

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)
S8.003	o	375	SS-45	102.142	99.908	1.859	Open Manhole	1350
S8.004	o	375	SS-47	101.679	99.471	1.833	Open Manhole	1350
S1.007	o	525	SS-63	100.726	98.537	1.664	Open Manhole	1500
S1.008	o	600	SA	100.732	98.515	1.617	Open Manhole	1500
S12.000	o	225	SS-160	101.254	99.000	2.029	Open Manhole	1200
S12.001	o	225	SS-161	100.612	98.663	1.724	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)
S8.003	83.884	192.0	SS-47	101.679	99.471	1.833	Open Manhole	1350
S8.004	72.216	299.7	SS-63	100.726	99.230	1.121	Open Manhole	1500
S1.007	10.041	456.4	SA	100.732	98.515	1.692	Open Manhole	1500
S1.008	95.000	197.1	SB	100.732	98.033	2.099	Open Manhole	1500
S12.000	75.843	225.1	SS-161	100.612	98.663	1.724	Open Manhole	1200
S12.001	55.899	167.9	SS-162	100.137	98.330	1.582	Open Manhole	1200

PIPELINE SCHEDULES for Attenuation System 2

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	225	SS-162	100.137	98.330	1.582	Open Manhole	1200
S13.000	o	150	SS-163	99.894	98.571	1.173	Open Manhole	1200
S13.001	o	150	SS-164	99.835	98.438	1.247	Open Manhole	1200
S14.000	o	150	SS-165	99.972	98.551	1.271	Open Manhole	1200
S13.002	o	225	SS-166	99.903	98.358	1.320	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)
S12.002	29.551	167.9	SS-170	99.547	98.154	1.168	Open Manhole	1200
S13.000	11.603	87.2	SS-164	99.835	98.438	1.247	Open Manhole	1200
S13.001	7.951	99.4	SS-166	99.903	98.358	1.395	Open Manhole	1200
S14.000	25.638	149.9	SS-166	99.903	98.380	1.373	Open Manhole	1200
S13.002	16.633	224.8	SS-168	99.705	98.284	1.196	Open Manhole	1200

PIPELINE SCHEDULES for Attenuation System 2

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)
S15.000	o	150	SS-167	99.570	98.628	0.792	Open Manhole	1200
S13.003	o	225	SS-168	99.705	98.284	1.196	Open Manhole	1200
S13.004	o	300	SS-169	99.621	98.225	1.096	Open Manhole	1200
S12.003	o	300	SS-170	99.547	98.138	1.109	Open Manhole	1200
S1.009	o	600	SB	100.732	98.033	2.099	Open Manhole	1500

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)
S15.000	25.114	150.4	SS-168	99.705	98.461	1.094	Open Manhole	1200
S13.003	13.350	226.3	SS-169	99.621	98.225	1.171	Open Manhole	1200
S13.004	19.652	225.9	SS-170	99.547	98.138	1.109	Open Manhole	1200
S12.003	11.582	110.3	SB	100.732	98.033	2.399	Open Manhole	1500
S1.009	34.000	165.0	SC	99.784	97.827	1.357	Open Manhole	1500

PIPELINE SCHEDULES for Attenuation System 2

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)
S16.000	o	225	SS-90	103.576	102.051	1.300	Open Manhole	1200
S17.000	o	150	SS-91	103.574	102.184	1.240	Open Manhole	1200
S18.000	o	150	SS-93	103.494	102.338	1.006	Open Manhole	1200
S16.001	o	225	SS-92	103.340	101.217	1.898	Open Manhole	1200
S19.000	o	150	SS-95	102.591	101.166	1.275	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)
S16.000	23.242	40.6	SS-92	103.340	101.478	1.637	Open Manhole	1200
S17.000	33.476	37.5	SS-92	103.340	101.292	1.898	Open Manhole	1200
S18.000	26.141	88.0	SS-92	103.340	102.041	1.149	Open Manhole	1200
S16.001	74.702	88.6	SS-94	102.173	100.374	1.574	Open Manhole	1200
S19.000	36.535	51.0	SS-94	102.173	100.449	1.574	Open Manhole	1200

PIPELINE SCHEDULES for Attenuation System 2

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)
S20.000	o	150	SS-96	102.300	100.700	1.450	Open Manhole	1200
S16.002	o	300	SS-94	102.173	100.299	1.574	Open Manhole	1200
S16.003	o	300	SS-97	102.012	100.213	1.499	Open Manhole	1200
S21.000	o	150	SS-100	101.472	100.122	1.200	Open Manhole	1200
S22.000	o	150	SS-99	101.475	99.913	1.412	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)
S20.000	13.999	58.3	SS-94	102.173	100.460	1.563	Open Manhole	1200
S16.002	10.785	125.4	SS-97	102.012	100.213	1.499	Open Manhole	1200
S16.003	60.928	61.5	SS-98	101.232	99.222	1.710	Open Manhole	1350
S21.000	23.169	148.5	SS-98	101.232	99.966	1.116	Open Manhole	1350
S22.000	40.708	75.2	SS-98	101.232	99.372	1.710	Open Manhole	1350

PIPELINE SCHEDULES for Attenuation System 2

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)
S16.004	o	375	SS-98	101.232	99.147	1.710	Open Manhole	1350
S23.000	o	150	SS-102	101.005	99.537	1.318	Open Manhole	1200
S24.000	o	150	SS-103	100.394	99.044	1.200	Open Manhole	1200
S16.005	o	450	SS-101	100.697	98.495	1.752	Open Manhole	1350

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S16.004	72.647	125.9	SS-101	100.697	98.570	1.752	Open Manhole	1350
S23.000	41.250	148.4	SS-101	100.697	99.259	1.288	Open Manhole	1350
S24.000	11.233	147.8	SS-101	100.697	98.968	1.579	Open Manhole	1350
S16.005	67.567	165.2	SS-104	100.259	98.086	1.723	Open Manhole	1500

PIPELINE SCHEDULES for Attenuation System 2

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)
S25.000	o	150	SS-105	100.151	98.766	1.235	Open Manhole	1200
S16.006	o	600	SS-104	100.259	97.936	1.723	Open Manhole	1500
S26.000	o	225	SS-108	99.650	98.225	1.200	Open Manhole	1200
S27.000	o	225	SS-70	103.403	102.000	1.178	Open Manhole	1200
S28.000	o	150	SS-71	103.771	102.332	1.289	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)
S25.000	16.032	149.8	SS-104	100.259	98.659	1.450	Open Manhole	1500
S16.006	69.816	906.7	SS-106	99.754	97.859	1.295	Open Manhole	1500
S26.000	12.805	150.7	SS-106	99.754	98.140	1.389	Open Manhole	1500
S27.000	19.381	91.9	SS-72	103.289	101.789	1.275	Open Manhole	1200
S28.000	24.578	66.1	SS-72	103.289	101.960	1.179	Open Manhole	1200

PIPELINE SCHEDULES for Attenuation System 2

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)
S29.000	o	225	SS-73	103.568	102.218	1.125	Open Manhole	1200
S27.001	o	225	SS-72	103.289	101.789	1.275	Open Manhole	1200
S30.000	o	150	SS-75	102.590	101.212	1.228	Open Manhole	1200
S27.002	o	300	SS-74	102.205	100.476	1.429	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)
S29.000	42.840	149.8	SS-72	103.289	101.932	1.132	Open Manhole	1200
S27.001	75.494	61.0	SS-74	102.205	100.551	1.429	Open Manhole	1200
S30.000	40.806	69.6	SS-74	102.205	100.626	1.429	Open Manhole	1200
S27.002	69.807	67.1	SS-76	101.719	99.436	1.983	Open Manhole	1200

PIPELINE SCHEDULES for Attenuation System 2

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)
S31.000	o	150	SS-78	101.570	100.320	1.100	Open Manhole	1200
S32.000	o	150	SS-77	101.600	100.083	1.367	Open Manhole	1200
S27.003	o	300	SS-76	101.719	99.436	1.983	Open Manhole	1200
S33.000	o	150	SS-80	101.723	99.767	1.806	Open Manhole	1200
S27.004	o	375	SS-79	101.487	98.988	2.124	Open Manhole	1350

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S31.000	33.250	149.8	SS-76	101.719	100.098	1.471	Open Manhole	1200
S32.000	31.066	149.4	SS-76	101.719	99.875	1.694	Open Manhole	1200
S27.003	39.207	105.1	SS-79	101.487	99.063	2.124	Open Manhole	1350
S33.000	30.467	149.3	SS-79	101.487	99.563	1.774	Open Manhole	1350
S27.004	32.024	158.5	SS-81	101.318	98.786	2.157	Open Manhole	1350

PIPELINE SCHEDULES for Attenuation System 2

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)
S34.000	o	150	SS-82	101.127	99.614	1.363	Open Manhole	1200
S27.005	o	375	SS-81	101.318	98.786	2.157	Open Manhole	1350
S35.000	o	150	SS-84	101.230	99.742	1.338	Open Manhole	1200
S27.006	o	450	SS-83	100.912	98.364	2.098	Open Manhole	1350
S27.007	o	450	SS-85	100.693	98.284	1.959	Open Manhole	1350

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S34.000	27.193	67.0	SS-81	101.318	99.208	1.960	Open Manhole	1350
S27.005	52.097	150.1	SS-83	100.912	98.439	2.098	Open Manhole	1350
S35.000	30.268	74.9	SS-83	100.912	99.338	1.424	Open Manhole	1350
S27.006	32.287	403.6	SS-85	100.693	98.284	1.959	Open Manhole	1350
S27.007	38.049	400.5	SS-86	100.500	98.189	1.861	Open Manhole	1350

PIPELINE SCHEDULES for Attenuation System 2

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)
S27.008	o	450	SS-86	100.500	98.189	1.861	Open Manhole	1350
S16.007	o	600	SS-106	99.754	97.859	1.295	Open Manhole	1500
S1.010	o	600	SC	99.784	97.827	1.357	Open Manhole	1500
S1.011	o	600	SATT TANK	99.800	97.650	1.550	Open Manhole	1500
S1.012	o	375	SS-190	99.850	97.600	1.875	Open Manhole	1500
S1.013	o	375	SS-191	98.700	97.475	0.850	Open Manhole	1350
S1.014	o	375	SS-192	97.900	97.025	0.500	Open Manhole	1350

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S27.008	66.069	400.4	SS-106	99.754	98.024	1.280	Open Manhole	1500
S16.007	3.425	107.0	SC	99.784	97.827	1.357	Open Manhole	1500
S1.010	12.000	67.7	SATT TANK	99.800	97.650	1.550	Open Manhole	1500
S1.011	5.000	100.0	SS-190	99.850	97.600	1.650	Open Manhole	1500
S1.012	46.931	375.4	SS-191	98.700	97.475	0.850	Open Manhole	1350
S1.013	168.566	374.6	SS-192	97.900	97.025	0.500	Open Manhole	1350
S1.014	21.334	374.3	SS-OUTFALL 2	102.000	96.968	4.657	Open Manhole	0

Free Flowing Outfall Details for Attenuation System 2

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.014	SS-OUTFALL 2	102.000	96.968	95.900	0	0

Simulation Criteria for Attenuation System 2

Volumetric Runoff Coeff	0.750	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)	60
Hot Start Level (mm)	0	MADD Factor * 10m³/ha Storage	2.000	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	15.500	Cv (Summer)	0.750
Return Period (years)	5	Ratio R	0.272	Cv (Winter)	0.840
Region	Scotland and Ireland	Profile Type	Summer	Storm Duration (mins)	30

Online Controls for Attenuation System 2

Hydro-Brake® Optimum Manhole: SS-190, DS/PN: S1.012, Volume (m³): 5.0

Unit Reference	MD-SHE-0301-5980-2250-5980
Design Head (m)	2.250
Design Flow (l/s)	59.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	301
Invert Level (m)	97.600
Minimum Outlet Pipe Diameter (mm)	375
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.250	59.8	Kick-Flo®	1.483	48.9
Flush-Flo™	0.682	59.8	Mean Flow over Head Range	-	51.6

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	9.2	0.400	57.0	0.800	59.6	1.400	52.1	2.000	56.5	2.600	64.1
0.200	31.0	0.500	58.8	1.000	58.4	1.600	50.7	2.200	59.2	3.000	68.7
0.300	52.7	0.600	59.6	1.200	56.4	1.800	53.7	2.400	61.7	3.500	74.1

Hydro-Brake® Optimum Manhole: SS-190, DS/PN: S1.012, Volume (m³): 5.0

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)
4.000	79.0	5.000	88.1	6.000	96.2	7.000	103.7	8.000	110.7	9.000	117.3
4.500	83.7	5.500	92.2	6.500	100.1	7.500	107.3	8.500	114.0	9.500	120.4

Storage Structures for Attenuation System 2

Tank or Pond Manhole: SATT TANK, DS/PN: S1.011

Invert Level (m) 97.650

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2114.0	1.675	2114.0	1.676	0.0

Summary of Critical Results by Maximum Level (Rank 1) for Attenuation System 2

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 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 15.500 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.272 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 10, 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)
S1.000	SS-50	15 Winter	100	+10%	30/15 Summer				103.658	1.201	0.000	0.72		10.0

Summary of Critical Results by Maximum Level (Rank 1) for **Attenuation System 2**

PN	US/MH Name	Status	Level Exceeded
S1.000	SS-50	SURCHARGED	

Summary of Critical Results by Maximum Level (Rank 1) for Attenuation System 2

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)
S1.001	SS-51	15 Winter	100	+10%	30/15 Summer				103.608	1.331	0.000	1.00		25.1
S2.000	SS-53	15 Winter	100	+10%	30/15 Summer				102.835	1.185	0.000	0.53		7.3
S1.002	SS-52	15 Winter	100	+10%	30/15 Summer				102.812	1.474	0.000	1.30		69.3
S3.000	SS-56	15 Winter	100	+10%	30/15 Winter				100.914	0.551	0.000	0.35		4.7
S4.000	SS-55	15 Winter	100	+10%					100.942	-0.056	0.000	0.71		9.9
S1.003	SS-54	15 Winter	100	+10%	30/15 Summer				100.903	0.681	0.000	0.81		97.8
S5.000	SS-58	15 Winter	100	+10%	30/15 Summer				100.881	0.967	0.000	1.45		20.0
S1.004	SS-57	30 Winter	100	+10%	30/15 Summer				100.567	0.890	0.000	1.36		143.5
S6.000	SS-60	15 Winter	100	+10%					100.306	-0.062	0.000	0.65		9.0
S1.005	SS-59	30 Winter	100	+10%	30/15 Summer				100.255	0.763	0.000	1.56		155.8
S7.000	SS-62	15 Winter	100	+10%	30/15 Summer				100.338	0.583	0.000	1.76		24.2
S1.006	SS-61	30 Winter	100	+10%	30/15 Summer				100.050	0.647	0.000	1.35		197.7
S8.000	SS-40	15 Winter	100	+10%	100/15 Summer				103.076	0.100	0.000	0.39		25.1
S9.000	SS-42	15 Winter	100	+10%	30/15 Summer				103.187	0.865	0.000	1.09		15.0
S8.001	SS-41	15 Winter	100	+10%	30/15 Summer				103.028	0.895	0.000	1.10		62.8
S10.000	SS-44	15 Winter	100	+10%	30/15 Summer				101.767	0.596	0.000	1.30		18.1
S8.002	SS-43	15 Winter	100	+10%	30/15 Summer				101.429	0.562	0.000	1.29		108.0
S11.000	SS-46	15 Winter	100	+10%	30/15 Summer				100.939	0.244	0.000	1.45		20.2
S8.003	SS-45	15 Winter	100	+10%	100/15 Summer				100.435	0.152	0.000	0.98		134.9
S8.004	SS-47	30 Winter	100	+10%	30/15 Summer				100.014	0.168	0.000	1.32		144.0
S1.007	SS-63	30 Winter	100	+10%	30/15 Summer				99.551	0.489	0.000	2.65		321.1
S1.008	SA	30 Winter	100	+10%	100/15 Summer				99.376	0.261	0.000	0.71		320.9
S12.000	SS-160	30 Winter	100	+10%	30/15 Summer				100.255	1.030	0.000	1.20		40.1
S12.001	SS-161	30 Winter	100	+10%	30/15 Summer				99.958	1.070	0.000	1.21		46.5
S12.002	SS-162	30 Winter	100	+10%	30/15 Summer				99.514	0.959	0.000	1.24		46.1

Summary of Critical Results by Maximum Level (Rank 1) for **Attenuation System 2**

PN	US/MH Name	Status	Level Exceeded
S1.001	SS-51	SURCHARGED	
S2.000	SS-53	SURCHARGED	
S1.002	SS-52	FLOOD RISK	
S3.000	SS-56	SURCHARGED	
S4.000	SS-55	OK	
S1.003	SS-54	SURCHARGED	
S5.000	SS-58	SURCHARGED	
S1.004	SS-57	SURCHARGED	
S6.000	SS-60	OK	
S1.005	SS-59	SURCHARGED	
S7.000	SS-62	SURCHARGED	
S1.006	SS-61	SURCHARGED	
S8.000	SS-40	SURCHARGED	
S9.000	SS-42	SURCHARGED	
S8.001	SS-41	SURCHARGED	
S10.000	SS-44	SURCHARGED	
S8.002	SS-43	SURCHARGED	
S11.000	SS-46	SURCHARGED	
S8.003	SS-45	SURCHARGED	
S8.004	SS-47	SURCHARGED	
S1.007	SS-63	SURCHARGED	
S1.008	SA	SURCHARGED	
S12.000	SS-160	SURCHARGED	
S12.001	SS-161	SURCHARGED	

Summary of Critical Results by Maximum Level (Rank 1) for **Attenuation System 2**

PN	US/MH Name	Status	Level Exceeded
S12.002	SS-162	SURCHARGED	

Summary of Critical Results by Maximum Level (Rank 1) for Attenuation System 2

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)
S13.000	SS-163	30 Winter	100	+10%	30/15 Summer				99.523	0.802	0.000	0.47		8.1
S13.001	SS-164	30 Winter	100	+10%	30/15 Summer				99.502	0.914	0.000	0.35		5.5
S14.000	SS-165	30 Winter	100	+10%	30/15 Summer				99.644	0.943	0.000	1.32		18.2
S13.002	SS-166	30 Winter	100	+10%	30/15 Summer				99.486	0.903	0.000	1.12		34.2
S15.000	SS-167	30 Winter	100	+10%	30/15 Summer				99.472	0.694	0.000	0.95		13.0
S13.003	SS-168	30 Winter	100	+10%	30/15 Summer				99.416	0.907	0.000	1.44		42.9
S13.004	SS-169	30 Winter	100	+10%	30/15 Summer				99.339	0.814	0.000	0.84		53.7
S12.003	SS-170	30 Winter	100	+10%	30/15 Summer				99.253	0.815	0.000	1.09		88.2
S1.009	SB	30 Winter	100	+10%	30/15 Summer				99.136	0.503	0.000	0.90		400.8
S16.000	SS-90	15 Winter	100	+10%	100/15 Summer				102.804	0.528	0.000	0.15		11.3
S17.000	SS-91	15 Winter	100	+10%	30/15 Summer				103.273	0.939	0.000	0.79		22.1
S18.000	SS-93	15 Winter	100	+10%	100/15 Summer				102.803	0.315	0.000	0.31		5.5
S16.001	SS-92	15 Winter	100	+10%	30/15 Summer				102.790	1.348	0.000	1.37		73.8
S19.000	SS-95	15 Winter	100	+10%	30/15 Summer				101.999	0.683	0.000	1.11		26.8
S20.000	SS-96	15 Winter	100	+10%	100/15 Summer				101.227	0.377	0.000	0.17		3.6
S16.002	SS-94	15 Winter	100	+10%	30/15 Summer				101.228	0.629	0.000	1.35		99.3
S16.003	SS-97	15 Winter	100	+10%	30/15 Summer				101.092	0.579	0.000	0.95		127.8
S21.000	SS-100	30 Winter	100	+10%	100/30 Winter				100.356	0.084	0.000	0.53		7.3
S22.000	SS-99	15 Winter	100	+10%	30/15 Summer				101.414	1.351	0.000	1.52		30.2
S16.004	SS-98	30 Winter	100	+10%	30/15 Summer				100.339	0.817	0.000	1.14		191.5
S23.000	SS-102	15 Winter	100	+10%	30/15 Summer				100.237	0.550	0.000	1.71		24.1
S24.000	SS-103	30 Winter	100	+10%	30/15 Winter				99.698	0.504	0.000	0.15		2.0
S16.005	SS-101	30 Winter	100	+10%	30/15 Summer				99.705	0.760	0.000	1.00		233.2
S25.000	SS-105	30 Winter	100	+10%	30/15 Winter				99.309	0.393	0.000	0.12		1.6
S16.006	SS-104	30 Winter	100	+10%	30/15 Summer				99.310	0.774	0.000	1.27		260.0

Summary of Critical Results by Maximum Level (Rank 1) for **Attenuation System 2**

PN	US/MH Name	Status	Level Exceeded
S13.000	SS-163	SURCHARGED	
S13.001	SS-164	SURCHARGED	
S14.000	SS-165	SURCHARGED	
S13.002	SS-166	SURCHARGED	
S15.000	SS-167	FLOOD RISK	
S13.003	SS-168	SURCHARGED	
S13.004	SS-169	SURCHARGED	
S12.003	SS-170	SURCHARGED	
S1.009	SB	SURCHARGED	
S16.000	SS-90	SURCHARGED	
S17.000	SS-91	SURCHARGED	
S18.000	SS-93	SURCHARGED	
S16.001	SS-92	SURCHARGED	
S19.000	SS-95	SURCHARGED	
S20.000	SS-96	SURCHARGED	
S16.002	SS-94	SURCHARGED	
S16.003	SS-97	SURCHARGED	
S21.000	SS-100	SURCHARGED	
S22.000	SS-99	FLOOD RISK	
S16.004	SS-98	SURCHARGED	
S23.000	SS-102	SURCHARGED	
S24.000	SS-103	SURCHARGED	
S16.005	SS-101	SURCHARGED	
S25.000	SS-105	SURCHARGED	

Summary of Critical Results by Maximum Level (Rank 1) for **Attenuation System 2**

PN	US/MH Name	Status	Level Exceeded
S16.006	SS-104	SURCHARGED	

Summary of Critical Results by Maximum Level (Rank 1) for Attenuation System 2

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)
S26.000	SS-108	30 Winter	100	+10%	30/15 Summer				99.189	0.739	0.000	0.07		2.6
S27.000	SS-70	15 Winter	100	+10%	30/15 Summer				103.156	0.931	0.000	0.36		17.8
S28.000	SS-71	15 Winter	100	+10%	30/15 Winter				103.187	0.705	0.000	0.66		13.6
S29.000	SS-73	15 Winter	100	+10%	30/15 Summer				103.193	0.750	0.000	0.69		27.8
S27.001	SS-72	15 Winter	100	+10%	30/15 Summer				103.130	1.116	0.000	1.12		72.6
S30.000	SS-75	15 Winter	100	+10%	30/15 Summer				102.252	0.890	0.000	1.16		24.0
S27.002	SS-74	15 Winter	100	+10%	30/15 Summer				101.735	0.959	0.000	0.88		114.9
S31.000	SS-78	30 Winter	100	+10%	30/15 Summer				101.194	0.724	0.000	1.21		16.9
S32.000	SS-77	30 Winter	100	+10%	30/15 Summer				101.141	0.908	0.000	0.87		12.1
S27.003	SS-76	30 Winter	100	+10%	30/15 Summer				101.083	1.347	0.000	1.24		124.6
S33.000	SS-80	30 Winter	100	+10%	30/30 Winter				100.550	0.633	0.000	0.65		9.1
S27.004	SS-79	30 Winter	100	+10%	30/15 Summer				100.526	1.163	0.000	1.02		144.1
S34.000	SS-82	30 Winter	100	+10%	30/30 Winter				100.366	0.602	0.000	0.68		14.2
S27.005	SS-81	30 Winter	100	+10%	30/15 Summer				100.314	1.153	0.000	1.14		172.2
S35.000	SS-84	15 Winter	100	+10%	30/15 Summer				100.179	0.287	0.000	1.30		25.7
S27.006	SS-83	30 Winter	100	+10%	30/15 Summer				99.867	1.053	0.000	1.41		196.4
S27.007	SS-85	30 Winter	100	+10%	30/15 Summer				99.713	0.979	0.000	1.41		200.7
S27.008	SS-86	30 Winter	100	+10%	30/15 Summer				99.527	0.888	0.000	1.43		213.5
S16.007	SS-106	30 Winter	100	+10%	30/15 Summer				99.189	0.730	0.000	1.66		472.3
S1.010	SC	30 Winter	100	+10%	30/15 Summer				98.968	0.541	0.000	2.05		866.4
S1.011	SATT TANK	480 Winter	100	+10%	30/240 Winter				98.477	0.227	0.000	0.23		77.5
S1.012	SS-190	360 Winter	100	+10%	30/30 Summer				98.576	0.601	0.000	0.63		59.6
S1.013	SS-191	720 Winter	100	+10%					97.683	-0.167	0.000	0.59		59.6
S1.014	SS-192	720 Winter	100	+10%					97.253	-0.147	0.000	0.68		59.6

Summary of Critical Results by Maximum Level (Rank 1) for **Attenuation System 2**

PN	US/MH Name	Status	Level Exceeded
S26.000	SS-108	SURCHARGED	
S27.000	SS-70	SURCHARGED	
S28.000	SS-71	SURCHARGED	
S29.000	SS-73	SURCHARGED	
S27.001	SS-72	SURCHARGED	
S30.000	SS-75	SURCHARGED	
S27.002	SS-74	SURCHARGED	
S31.000	SS-78	SURCHARGED	
S32.000	SS-77	SURCHARGED	
S27.003	SS-76	SURCHARGED	
S33.000	SS-80	SURCHARGED	
S27.004	SS-79	SURCHARGED	
S34.000	SS-82	SURCHARGED	
S27.005	SS-81	SURCHARGED	
S35.000	SS-84	SURCHARGED	
S27.006	SS-83	SURCHARGED	
S27.007	SS-85	SURCHARGED	
S27.008	SS-86	SURCHARGED	
S16.007	SS-106	SURCHARGED	
S1.010	SC	SURCHARGED	
S1.011	SATT TANK	SURCHARGED	
S1.012	SS-190	SURCHARGED	
S1.013	SS-191	OK	
S1.014	SS-192	OK	

NOTE TO FILE

JBA Project Code	2018s0900
Contract	Dunshaughlin East SHD, Meath SW Review
Client	Joseph O'Reilly Consulting Civil & Structural Engineers
Day, Date and Time	12/12/2018
Author	Leanne Leonard
Subject	Modelling Notes v7.0

C Appendix C - MicroDrainage outputs for Catchment 3

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Attenuation System 3

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	5	Foul Sewage (l/s/ha)	0.000	Maximum Backdrop Height (m)	1.500
M5-60 (mm)	15.500	Volumetric Runoff Coeff.	0.750	Min Design Depth for Optimisation (m)	1.200
Ratio R	0.272	PIMP (%)	100	Min Vel for Auto Design only (m/s)	1.00
Maximum Rainfall (mm/hr)	50	Add Flow / Climate Change (%)	0	Min Slope for Optimisation (1:X)	500
Maximum Time of Concentration (mins)	60	Minimum Backdrop Height (m)	0.200		

Designed with Level Soffits

Time Area Diagram for Attenuation System 3

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	1.069	4-8	3.025	8-12	0.316

Total Area Contributing (ha) = 4.410

Total Pipe Volume (m³) = 187.275

Network Design Table for Attenuation System 3

« - Indicates pipe capacity < flow

Network Design Table for Attenuation System 3

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	47.597	0.159	299.4	0.206	4.00	0.0	0.600	o	300	Pipe/Conduit	
S1.001	54.161	0.241	224.7	0.181	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.002	12.409	0.041	302.7	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.000	35.793	0.732	48.9	0.067	4.00	0.0	0.600	o	225	Pipe/Conduit	
S2.001	82.519	1.126	73.3	0.094	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.002	63.609	1.079	59.0	0.092	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.000	20.326	0.199	102.1	0.011	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)
S1.000	50.00	4.88	97.482	0.206	0.0	0.0	0.0	0.90	63.9	27.8
S1.001	50.00	5.74	97.322	0.387	0.0	0.0	0.0	1.04	73.8	52.4
S1.002	50.00	5.97	97.081	0.387	0.0	0.0	0.0	0.90	63.5	52.4
S2.000	50.00	4.32	102.580	0.067	0.0	0.0	0.0	1.88	74.6	9.1
S2.001	50.00	5.22	101.848	0.161	0.0	0.0	0.0	1.53	60.8	21.8
S2.002	50.00	5.84	100.722	0.253	0.0	0.0	0.0	1.71	67.9	34.2
S3.000	50.00	4.34	99.917	0.011	0.0	0.0	0.0	0.99	17.6	1.5

Network Design Table for Attenuation System 3

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
S2.003	59.822	0.358	167.1	0.070	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.004	75.937	0.481	157.9	0.080	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.005	77.125	0.552	139.7	0.099	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.006	20.968	0.153	137.0	0.010	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.003	34.993	0.093	376.3	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.004	125.800	1.747	72.0	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
S4.000	29.277	0.682	42.9	0.042	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)
S2.003	50.00	6.66	99.568	0.334	0.0	0.0	0.0	1.21	85.8	45.3
S2.004	48.67	7.67	99.210	0.414	0.0	0.0	0.0	1.25	88.3	54.6
S2.005	46.19	8.64	98.729	0.513	0.0	0.0	0.0	1.33	93.9	64.2
S2.006	45.58	8.90	98.177	0.523	0.0	0.0	0.0	1.34	94.8	64.5
S1.003	43.97	9.63	97.040	0.910	0.0	0.0	0.0	0.80	56.9«	108.3
S1.004	42.37	10.42	97.947	0.910	0.0	0.0	0.0	2.64	571.9	108.3
S4.000	50.00	4.32	98.918	0.042	0.0	0.0	0.0	1.54	27.2	5.7

Network Design Table for Attenuation System 3

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
S5.000	39.019	0.393	99.3	0.067	4.00	0.0	0.600	o	150	Pipe/Conduit	
S4.001	71.490	0.296	241.5	0.298	0.00	0.0	0.600	o	300	Pipe/Conduit	
S4.002	96.665	0.301	321.1	0.361	0.00	0.0	0.600	o	375	Pipe/Conduit	
S4.003	69.756	0.700	99.7	0.111	0.00	0.0	0.600	o	375	Pipe/Conduit	
S6.000	19.128	0.129	148.3	0.313	4.00	0.0	0.600	o	225	Pipe/Conduit	
S6.001	50.968	0.501	101.7	0.096	0.00	0.0	0.600	o	300	Pipe/Conduit	
S6.002	45.613	0.575	79.3	0.123	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)
S5.000	50.00	4.64	99.290	0.067	0.0	0.0	0.0	1.01	17.8	9.0
S4.001	50.00	5.83	98.086	0.407	0.0	0.0	0.0	1.01	71.2	55.1
S4.002	49.35	7.43	97.715	0.767	0.0	0.0	0.0	1.01	111.1	102.6
S4.003	47.62	8.07	97.414	0.879	0.0	0.0	0.0	1.82	200.5	113.3
S6.000	50.00	4.30	98.636	0.313	0.0	0.0	0.0	1.07	42.6	42.4
S6.001	50.00	4.84	98.432	0.408	0.0	0.0	0.0	1.56	110.2	55.3
S6.002	50.00	5.27	97.931	0.531	0.0	0.0	0.0	1.77	124.9	71.9

Network Design Table for Attenuation System 3

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
S6.003	51.474	0.567	90.8	0.054	0.00	0.0	0.600	o	300	Pipe/Conduit	
S4.004	24.910	0.062	401.8	0.027	0.00	0.0	0.600	o	525	Pipe/Conduit	
S7.000	6.932	0.041	169.1	0.175	4.00	0.0	0.600	o	225	Pipe/Conduit	
S4.005	15.618	0.039	400.5	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
S8.000	75.007	1.829	41.0	0.128	4.00	0.0	0.600	o	225	Pipe/Conduit	
S8.001	43.887	0.646	67.9	0.065	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)
S6.003	50.00	5.79	97.356	0.585	0.0	0.0	0.0	1.65	116.7	79.2
S4.004	46.67	8.44	96.564	1.490	0.0	0.0	0.0	1.11	240.6	188.4
S7.000	50.00	4.12	97.348	0.175	0.0	0.0	0.0	1.00	39.9	23.8
S4.005	46.11	8.68	96.502	1.666	0.0	0.0	0.0	1.11	241.0	208.0
S8.000	50.00	4.61	102.846	0.128	0.0	0.0	0.0	2.05	81.5	17.3
S8.001	50.00	5.07	101.017	0.192	0.0	0.0	0.0	1.59	63.2	26.0

Network Design Table for Attenuation System 3

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
S8.002	43.852	1.224	35.8	0.069	0.00	0.0	0.600	o	225	Pipe/Conduit	
S8.003	18.129	0.355	51.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S8.004	6.593	0.039	169.1	0.034	0.00	0.0	0.600	o	225	Pipe/Conduit	
S8.005	18.588	0.249	74.7	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S8.006	18.734	0.077	243.3	0.082	0.00	0.0	0.600	o	300	Pipe/Conduit	
S8.007	16.215	0.067	242.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S8.008	14.598	0.184	79.3	0.107	0.00	0.0	0.600	o	300	Pipe/Conduit	
S9.000	21.451	0.095	225.8	0.000	4.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S8.002	50.00	5.40	100.371	0.261	0.0	0.0	0.0	2.19	87.2	35.3
S8.003	50.00	5.57	99.147	0.261	0.0	0.0	0.0	1.83	72.9	35.3
S8.004	50.00	5.68	98.792	0.295	0.0	0.0	0.0	1.00	39.9«	39.9
S8.005	50.00	5.88	98.753	0.295	0.0	0.0	0.0	1.52	60.2	39.9
S8.006	50.00	6.19	98.429	0.377	0.0	0.0	0.0	1.00	70.9	51.0
S8.007	50.00	6.46	98.352	0.377	0.0	0.0	0.0	1.01	71.1	51.0
S8.008	50.00	6.60	98.285	0.483	0.0	0.0	0.0	1.77	124.9	65.4
S9.000	50.00	4.41	98.260	0.000	0.0	0.0	0.0	0.87	34.4	0.0

Network Design Table for Attenuation System 3

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
S8.009	12.571	0.172	73.1	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S8.010	49.264	0.420	117.3	0.091	0.00	0.0	0.600	o	375	Pipe/Conduit	
S8.011	89.687	0.773	116.0	0.135	0.00	0.0	0.600	o	375	Pipe/Conduit	
S8.012	17.835	0.107	166.7	0.057	0.00	0.0	0.600	o	375	Pipe/Conduit	
S8.013	16.211	0.061	265.8	0.000	0.00	0.0	0.600	o	575	Pipe/Conduit	
S4.006	10.105	0.022	459.3	0.000	0.00	0.0	0.600	o	575	Pipe/Conduit	
S10.000	22.004	0.147	149.7	0.170	4.00	0.0	0.600	o	225	Pipe/Conduit	
S10.001	48.264	0.483	99.9	0.031	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)
S8.009	50.00	6.71	98.090	0.483	0.0	0.0	0.0	1.84	130.2	65.4
S8.010	50.00	7.20	97.843	0.575	0.0	0.0	0.0	1.67	184.7	77.8
S8.011	47.56	8.09	97.423	0.710	0.0	0.0	0.0	1.68	185.7	91.5
S8.012	47.02	8.31	96.650	0.767	0.0	0.0	0.0	1.40	154.7	97.7
S8.013	46.56	8.49	96.343	0.767	0.0	0.0	0.0	1.45	376.5	97.7
S4.006	45.74	8.83	96.282	2.433	0.0	0.0	0.0	1.10	285.6«	301.5
S10.000	50.00	4.34	98.200	0.170	0.0	0.0	0.0	1.07	42.4	23.0
S10.001	50.00	4.96	98.053	0.202	0.0	0.0	0.0	1.31	52.0	27.3

Network Design Table for Attenuation System 3

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	33.161	0.197	168.3	0.064	0.00	0.0	0.600	o	225	Pipe/Conduit	
S11.000	23.568	0.214	110.1	0.032	4.00	0.0	0.600	o	150	Pipe/Conduit	
S10.003	21.508	0.128	168.0	0.019	0.00	0.0	0.600	o	300	Pipe/Conduit	
S10.004	24.411	0.171	142.8	0.105	0.00	0.0	0.600	o	300	Pipe/Conduit	
S10.005	27.170	0.112	242.6	0.065	0.00	0.0	0.600	o	300	Pipe/Conduit	
S12.000	14.447	0.096	150.5	0.000	4.00	0.0	0.600	o	150	Pipe/Conduit	
S12.001	8.946	0.060	149.1	0.034	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)
S10.002	50.00	5.51	97.570	0.266	0.0	0.0	0.0	1.00	40.0	36.0
S11.000	50.00	4.41	97.704	0.032	0.0	0.0	0.0	0.96	16.9	4.3
S10.003	50.00	5.81	97.298	0.317	0.0	0.0	0.0	1.21	85.5	42.9
S10.004	50.00	6.11	97.170	0.422	0.0	0.0	0.0	1.31	92.9	57.2
S10.005	50.00	6.57	96.999	0.487	0.0	0.0	0.0	1.01	71.0	66.0
S12.000	50.00	4.29	97.400	0.000	0.0	0.0	0.0	0.82	14.4	0.0
S12.001	50.00	4.48	97.304	0.034	0.0	0.0	0.0	0.82	14.5	4.6

Network Design Table for Attenuation System 3

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
S10.006	57.066	0.236	241.8	0.125	0.00	0.0	0.600	o	375	Pipe/Conduit	
S10.007	38.878	0.177	219.6	0.016	0.00	0.0	0.600	o	375	Pipe/Conduit	
S13.000	82.503	0.717	115.1	0.128	4.00	0.0	0.600	o	225	Pipe/Conduit	
S14.000	12.031	0.080	150.4	0.053	4.00	0.0	0.600	o	150	Pipe/Conduit	
S14.001	47.766	0.476	100.3	0.087	0.00	0.0	0.600	o	225	Pipe/Conduit	
S13.001	51.951	0.310	167.6	0.072	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)
S10.006	49.48	7.38	96.812	0.646	0.0	0.0	0.0	1.16	128.2	86.6
S10.007	48.02	7.92	96.576	0.663	0.0	0.0	0.0	1.22	134.6	86.6
S13.000	50.00	5.13	98.000	0.128	0.0	0.0	0.0	1.22	48.4	17.3
S14.000	50.00	4.25	97.683	0.053	0.0	0.0	0.0	0.82	14.4	7.1
S14.001	50.00	4.86	97.528	0.140	0.0	0.0	0.0	1.31	51.9	18.9
S13.001	50.00	5.84	96.977	0.339	0.0	0.0	0.0	1.21	85.6	45.9

Network Design Table for Attenuation System 3

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
S13.002	36.670	0.273	134.3	0.065	0.00	0.0	0.600	o	300	Pipe/Conduit	
S10.008	8.782	0.023	381.8	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S10.009	9.310	0.021	443.3	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.005	5.000	0.100	50.0	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
S1.006	12.236	0.049	249.7	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
S1.007	17.030	0.049	347.6	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
S1.008	1.000	0.003	333.3	0.000	0.00	0.0	0.600	o	525	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)
S13.002	50.00	6.29	96.667	0.405	0.0	0.0	0.0	1.35	95.8	54.8
S10.008	47.65	8.06	96.244	1.067	0.0	0.0	0.0	1.03	164.5	137.7
S10.009	47.24	8.22	96.221	1.067	0.0	0.0	0.0	0.96	152.5	137.7
S1.005	42.32	10.45	96.200	4.410	0.0	0.0	0.0	3.17	686.9	505.4
S1.006	42.04	10.59	96.100	4.410	0.0	0.0	0.0	1.41	305.9«	505.4
S1.007	41.60	10.83	96.051	4.410	0.0	0.0	0.0	1.20	258.8«	505.4
S1.008	41.57	10.84	96.002	4.410	0.0	0.0	0.0	1.22	264.4«	505.4

Manhole Schedules for Attenuation System 3

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)
SS-176	99.111	1.629	Open Manhole	1200	S1.000	97.482	300				
SS-177	99.424	2.102	Open Manhole	1200	S1.001	97.322	300	S1.000	97.323	300	1
SS-178	99.619	2.538	Open Manhole	1200	S1.002	97.081	300	S1.001	97.081	300	
SS-115	104.005	1.425	Open Manhole	1200	S2.000	102.580	225				
SS-116	103.587	1.739	Open Manhole	1200	S2.001	101.848	225	S2.000	101.848	225	
SS-117	102.147	1.425	Open Manhole	1200	S2.002	100.722	225	S2.001	100.722	225	
SS-119	101.452	1.535	Open Manhole	1200	S3.000	99.917	150				
SS-118	101.190	1.622	Open Manhole	1200	S2.003	99.568	300	S2.002	99.643	225	
								S3.000	99.718	150	
SS-120	100.820	1.610	Open Manhole	1200	S2.004	99.210	300	S2.003	99.210	300	
SS-121	100.322	1.593	Open Manhole	1200	S2.005	98.729	300	S2.004	98.729	300	
SS-122	99.809	1.632	Open Manhole	1200	S2.006	98.177	300	S2.005	98.177	300	
SS-179	99.404	2.364	Open Manhole	1200	S1.003	97.040	300	S1.002	97.040	300	
								S2.006	98.024	300	984
S180	99.404	2.457	Open Manhole	1500	S1.004	97.947	525	S1.003	96.947	300	
SS-125	101.003	2.085	Open Manhole	1200	S4.000	98.918	150				
SS-127	100.640	1.350	Open Manhole	1200	S5.000	99.290	150				
SS-126	101.134	3.048	Open Manhole	1200	S4.001	98.086	300	S4.000	98.236	150	
								S5.000	98.897	150	661

Manhole Schedules for Attenuation System 3

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)
SS-128	100.406	2.691	Open Manhole	1350	S4.002	97.715	375	S4.001	97.790	300	
SS-134	99.793	2.379	Open Manhole	1350	S4.003	97.414	375	S4.002	97.414	375	
SS-130	100.061	1.425	Open Manhole	1200	S6.000	98.636	225				
SS-129	100.144	1.712	Open Manhole	1200	S6.001	98.432	300	S6.000	98.507	225	
SS-131	99.431	1.500	Open Manhole	1200	S6.002	97.931	300	S6.001	97.931	300	
SS-132	98.856	1.500	Open Manhole	1200	S6.003	97.356	300	S6.002	97.356	300	
SS-133	98.289	1.725	Open Manhole	1500	S4.004	96.564	525	S4.003	96.714	375	
								S6.003	96.789	300	
SS-136	98.773	1.425	Open Manhole	1200	S7.000	97.348	225				
SS-135	99.000	2.498	Open Manhole	1500	S4.005	96.502	525	S4.004	96.502	525	
								S7.000	97.307	225	505
SS-200	104.271	1.425	Open Manhole	1200	S8.000	102.846	225				
SS-201	102.768	1.751	Open Manhole	1200	S8.001	101.017	225	S8.000	101.017	225	
SS-202	101.796	1.425	Open Manhole	1200	S8.002	100.371	225	S8.001	100.371	225	
SS-203	100.572	1.425	Open Manhole	1200	S8.003	99.147	225	S8.002	99.147	225	
SS-204	100.217	1.425	Open Manhole	1200	S8.004	98.792	225	S8.003	98.792	225	
SS-205	100.257	1.504	Open Manhole	1200	S8.005	98.753	225	S8.004	98.753	225	
SS-206	99.929	1.500	Open Manhole	1200	S8.006	98.429	300	S8.005	98.504	225	
SS-207	100.050	1.698	Open Manhole	1200	S8.007	98.352	300	S8.006	98.352	300	

Manhole Schedules for Attenuation System 3

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)
SS-208	100.000	1.715	Open Manhole	1200	S8.008	98.285	300	S8.007	98.285	300	
SS-214	99.600	1.340	Open Manhole	1200	S9.000	98.260	225				
SS-209	99.600	1.510	Open Manhole	1200	S8.009	98.090	300	S8.008	98.101	300	11
								S9.000	98.165	225	
SS-210	99.418	1.575	Open Manhole	1350	S8.010	97.843	375	S8.009	97.918	300	
SS-211	98.998	1.575	Open Manhole	1350	S8.011	97.423	375	S8.010	97.423	375	
SS-212	98.225	1.575	Open Manhole	1350	S8.012	96.650	375	S8.011	96.650	375	
SS-213	98.073	1.730	Open Manhole	1500	S8.013	96.343	575	S8.012	96.543	375	
SS-138	98.500	2.218	Open Manhole	1500	S4.006	96.282	575	S4.005	96.463	525	131
								S8.013	96.282	575	
SS-145	99.550	1.350	Open Manhole	1200	S10.000	98.200	225				
SS-146	99.458	1.405	Open Manhole	1200	S10.001	98.053	225	S10.000	98.053	225	
SS-147	99.213	1.643	Open Manhole	1200	S10.002	97.570	225	S10.001	97.570	225	
SS-148	99.165	1.461	Open Manhole	1200	S11.000	97.704	150				
SS-149	99.048	1.750	Open Manhole	1200	S10.003	97.298	300	S10.002	97.373	225	
								S11.000	97.490	150	42
SS-150	98.916	1.746	Open Manhole	1200	S10.004	97.170	300	S10.003	97.170	300	
SS-151	98.785	1.786	Open Manhole	1200	S10.005	96.999	300	S10.004	96.999	300	
SS-158	98.749	1.349	Open Manhole	1200	S12.000	97.400	150				

Manhole Schedules for Attenuation System 3

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)
SS-152	98.675	1.371	Open Manhole	1200	S12.001	97.304	150	S12.000	97.304	150	
SS-153	98.624	1.812	Open Manhole	1350	S10.006	96.812	375	S10.005	96.887	300	
								S12.001	97.244	150	207
SS-154	98.935	2.359	Open Manhole	1350	S10.007	96.576	375	S10.006	96.576	375	
SS-140	99.527	1.527	Open Manhole	1200	S13.000	98.000	225				
SS-143	99.201	1.518	Open Manhole	1200	S14.000	97.683	150				
SS-144	99.190	1.662	Open Manhole	1200	S14.001	97.528	225	S14.000	97.603	150	
SS-141	99.126	2.149	Open Manhole	1200	S13.001	96.977	300	S13.000	97.283	225	231
								S14.001	97.052	225	
SS-142	98.731	2.064	Open Manhole	1200	S13.002	96.667	300	S13.001	96.667	300	
SS-155	98.404	2.160	Open Manhole	1350	S10.008	96.244	450	S10.007	96.399	375	80
								S13.002	96.394	300	
SS-156	98.000	1.779	Open Manhole	1350	S10.009	96.221	450	S10.008	96.221	450	
SATT TANK	98.400	2.200	Open Manhole	1500	S1.005	96.200	525	S1.004	96.200	525	
								S4.006	96.260	575	110
								S10.009	96.200	450	
SS-195	98.000	1.900	Open Manhole	1500	S1.006	96.100	525	S1.005	96.100	525	
SS-196	98.000	1.949	Open Manhole	1500	S1.007	96.051	525	S1.006	96.051	525	
SNon-Return Valve	98.000	1.998	Open Manhole	1500	S1.008	96.002	525	S1.007	96.002	525	

The Old School House St. Joseph's Street Tadcaster LS24 9HA	Dunshaughlin East SHD, Dunshaughlin, Co. Meath - Rev 5
Date 11/12/2018 File Attenuation System 3.MDX	Designed by LL Checked by CJW
Micro Drainage	Network 2018.1.1

Manhole Schedules for Attenuation System 3

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)
SS-Outfall 2	97.900	1.901	Open Manhole	0	OUTFALL			S1.008	95.999	525	

PIPELINE SCHEDULES for Attenuation System 3

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	300	SS-176	99.111	97.482	1.329	Open Manhole	1200
S1.001	o	300	SS-177	99.424	97.322	1.802	Open Manhole	1200
S1.002	o	300	SS-178	99.619	97.081	2.238	Open Manhole	1200
S2.000	o	225	SS-115	104.005	102.580	1.200	Open Manhole	1200
S2.001	o	225	SS-116	103.587	101.848	1.514	Open Manhole	1200
S2.002	o	225	SS-117	102.147	100.722	1.200	Open Manhole	1200
S3.000	o	150	SS-119	101.452	99.917	1.385	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	47.597	299.4	SS-177	99.424	97.323	1.801	Open Manhole	1200
S1.001	54.161	224.7	SS-178	99.619	97.081	2.238	Open Manhole	1200
S1.002	12.409	302.7	SS-179	99.404	97.040	2.064	Open Manhole	1200
S2.000	35.793	48.9	SS-116	103.587	101.848	1.514	Open Manhole	1200
S2.001	82.519	73.3	SS-117	102.147	100.722	1.200	Open Manhole	1200
S2.002	63.609	59.0	SS-118	101.190	99.643	1.322	Open Manhole	1200
S3.000	20.326	102.1	SS-118	101.190	99.718	1.322	Open Manhole	1200

PIPELINE SCHEDULES for Attenuation System 3

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)
S2.003	o	300	SS-118	101.190	99.568	1.322	Open Manhole	1200
S2.004	o	300	SS-120	100.820	99.210	1.310	Open Manhole	1200
S2.005	o	300	SS-121	100.322	98.729	1.293	Open Manhole	1200
S2.006	o	300	SS-122	99.809	98.177	1.332	Open Manhole	1200
S1.003	o	300	SS-179	99.404	97.040	2.064	Open Manhole	1200
S1.004	o	525	S180	99.404	97.947	0.932	Open Manhole	1500

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)
S2.003	59.822	167.1	SS-120	100.820	99.210	1.310	Open Manhole	1200
S2.004	75.937	157.9	SS-121	100.322	98.729	1.293	Open Manhole	1200
S2.005	77.125	139.7	SS-122	99.809	98.177	1.332	Open Manhole	1200
S2.006	20.968	137.0	SS-179	99.404	98.024	1.080	Open Manhole	1200
S1.003	34.993	376.3	S180	99.404	96.947	2.157	Open Manhole	1500
S1.004	125.800	72.0	SATT TANK	98.400	96.200	1.675	Open Manhole	1500

PIPELINE SCHEDULES for Attenuation System 3

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)
S4.000	o	150	SS-125	101.003	98.918	1.935	Open Manhole	1200
S5.000	o	150	SS-127	100.640	99.290	1.200	Open Manhole	1200
S4.001	o	300	SS-126	101.134	98.086	2.748	Open Manhole	1200
S4.002	o	375	SS-128	100.406	97.715	2.316	Open Manhole	1350
S4.003	o	375	SS-134	99.793	97.414	2.004	Open Manhole	1350
S6.000	o	225	SS-130	100.061	98.636	1.200	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)
S4.000	29.277	42.9	SS-126	101.134	98.236	2.748	Open Manhole	1200
S5.000	39.019	99.3	SS-126	101.134	98.897	2.087	Open Manhole	1200
S4.001	71.490	241.5	SS-128	100.406	97.790	2.316	Open Manhole	1350
S4.002	96.665	321.1	SS-134	99.793	97.414	2.004	Open Manhole	1350
S4.003	69.756	99.7	SS-133	98.289	96.714	1.200	Open Manhole	1500
S6.000	19.128	148.3	SS-129	100.144	98.507	1.412	Open Manhole	1200

PIPELINE SCHEDULES for Attenuation System 3

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)
S6.001	o	300	SS-129	100.144	98.432	1.412	Open Manhole	1200
S6.002	o	300	SS-131	99.431	97.931	1.200	Open Manhole	1200
S6.003	o	300	SS-132	98.856	97.356	1.200	Open Manhole	1200
S4.004	o	525	SS-133	98.289	96.564	1.200	Open Manhole	1500
S7.000	o	225	SS-136	98.773	97.348	1.200	Open Manhole	1200
S4.005	o	525	SS-135	99.000	96.502	1.973	Open Manhole	1500

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)
S6.001	50.968	101.7	SS-131	99.431	97.931	1.200	Open Manhole	1200
S6.002	45.613	79.3	SS-132	98.856	97.356	1.200	Open Manhole	1200
S6.003	51.474	90.8	SS-133	98.289	96.789	1.200	Open Manhole	1500
S4.004	24.910	401.8	SS-135	99.000	96.502	1.973	Open Manhole	1500
S7.000	6.932	169.1	SS-135	99.000	97.307	1.468	Open Manhole	1500
S4.005	15.618	400.5	SS-138	98.500	96.463	1.512	Open Manhole	1500

PIPELINE SCHEDULES for Attenuation System 3

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)
S8.000	o	225	SS-200	104.271	102.846	1.200	Open Manhole	1200
S8.001	o	225	SS-201	102.768	101.017	1.526	Open Manhole	1200
S8.002	o	225	SS-202	101.796	100.371	1.200	Open Manhole	1200
S8.003	o	225	SS-203	100.572	99.147	1.200	Open Manhole	1200
S8.004	o	225	SS-204	100.217	98.792	1.200	Open Manhole	1200
S8.005	o	225	SS-205	100.257	98.753	1.279	Open Manhole	1200
S8.006	o	300	SS-206	99.929	98.429	1.200	Open Manhole	1200
S8.007	o	300	SS-207	100.050	98.352	1.398	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)
S8.000	75.007	41.0	SS-201	102.768	101.017	1.526	Open Manhole	1200
S8.001	43.887	67.9	SS-202	101.796	100.371	1.200	Open Manhole	1200
S8.002	43.852	35.8	SS-203	100.572	99.147	1.200	Open Manhole	1200
S8.003	18.129	51.1	SS-204	100.217	98.792	1.200	Open Manhole	1200
S8.004	6.593	169.1	SS-205	100.257	98.753	1.279	Open Manhole	1200
S8.005	18.588	74.7	SS-206	99.929	98.504	1.200	Open Manhole	1200
S8.006	18.734	243.3	SS-207	100.050	98.352	1.398	Open Manhole	1200
S8.007	16.215	242.0	SS-208	100.000	98.285	1.415	Open Manhole	1200

PIPELINE SCHEDULES for Attenuation System 3

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)
S8.008	o	300	SS-208	100.000	98.285	1.415	Open Manhole	1200
S9.000	o	225	SS-214	99.600	98.260	1.115	Open Manhole	1200
S8.009	o	300	SS-209	99.600	98.090	1.210	Open Manhole	1200
S8.010	o	375	SS-210	99.418	97.843	1.200	Open Manhole	1350
S8.011	o	375	SS-211	98.998	97.423	1.200	Open Manhole	1350
S8.012	o	375	SS-212	98.225	96.650	1.200	Open Manhole	1350
S8.013	o	575	SS-213	98.073	96.343	1.155	Open Manhole	1500

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)
S8.008	14.598	79.3	SS-209	99.600	98.101	1.199	Open Manhole	1200
S9.000	21.451	225.8	SS-209	99.600	98.165	1.210	Open Manhole	1200
S8.009	12.571	73.1	SS-210	99.418	97.918	1.200	Open Manhole	1350
S8.010	49.264	117.3	SS-211	98.998	97.423	1.200	Open Manhole	1350
S8.011	89.687	116.0	SS-212	98.225	96.650	1.200	Open Manhole	1350
S8.012	17.835	166.7	SS-213	98.073	96.543	1.155	Open Manhole	1500
S8.013	16.211	265.8	SS-138	98.500	96.282	1.643	Open Manhole	1500

PIPELINE SCHEDULES for Attenuation System 3

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)
S4.006	o	575	SS-138	98.500	96.282	1.643	Open Manhole	1500
S10.000	o	225	SS-145	99.550	98.200	1.125	Open Manhole	1200
S10.001	o	225	SS-146	99.458	98.053	1.180	Open Manhole	1200
S10.002	o	225	SS-147	99.213	97.570	1.418	Open Manhole	1200
S11.000	o	150	SS-148	99.165	97.704	1.311	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)
S4.006	10.105	459.3	SATT TANK	98.400	96.260	1.565	Open Manhole	1500
S10.000	22.004	149.7	SS-146	99.458	98.053	1.180	Open Manhole	1200
S10.001	48.264	99.9	SS-147	99.213	97.570	1.418	Open Manhole	1200
S10.002	33.161	168.3	SS-149	99.048	97.373	1.450	Open Manhole	1200
S11.000	23.568	110.1	SS-149	99.048	97.490	1.408	Open Manhole	1200

PIPELINE SCHEDULES for Attenuation System 3

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)
S10.003	o	300	SS-149	99.048	97.298	1.450	Open Manhole	1200
S10.004	o	300	SS-150	98.916	97.170	1.446	Open Manhole	1200
S10.005	o	300	SS-151	98.785	96.999	1.486	Open Manhole	1200
S12.000	o	150	SS-158	98.749	97.400	1.199	Open Manhole	1200
S12.001	o	150	SS-152	98.675	97.304	1.221	Open Manhole	1200
S10.006	o	375	SS-153	98.624	96.812	1.437	Open Manhole	1350
S10.007	o	375	SS-154	98.935	96.576	1.984	Open Manhole	1350

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S10.003	21.508	168.0	SS-150	98.916	97.170	1.446	Open Manhole	1200
S10.004	24.411	142.8	SS-151	98.785	96.999	1.486	Open Manhole	1200
S10.005	27.170	242.6	SS-153	98.624	96.887	1.437	Open Manhole	1350
S12.000	14.447	150.5	SS-152	98.675	97.304	1.221	Open Manhole	1200
S12.001	8.946	149.1	SS-153	98.624	97.244	1.230	Open Manhole	1350
S10.006	57.066	241.8	SS-154	98.935	96.576	1.984	Open Manhole	1350
S10.007	38.878	219.6	SS-155	98.404	96.399	1.630	Open Manhole	1350

PIPELINE SCHEDULES for Attenuation System 3

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)
S13.000	o	225	SS-140	99.527	98.000	1.302	Open Manhole	1200
S14.000	o	150	SS-143	99.201	97.683	1.368	Open Manhole	1200
S14.001	o	225	SS-144	99.190	97.528	1.437	Open Manhole	1200
S13.001	o	300	SS-141	99.126	96.977	1.849	Open Manhole	1200
S13.002	o	300	SS-142	98.731	96.667	1.764	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)
S13.000	82.503	115.1	SS-141	99.126	97.283	1.618	Open Manhole	1200
S14.000	12.031	150.4	SS-144	99.190	97.603	1.437	Open Manhole	1200
S14.001	47.766	100.3	SS-141	99.126	97.052	1.849	Open Manhole	1200
S13.001	51.951	167.6	SS-142	98.731	96.667	1.764	Open Manhole	1200
S13.002	36.670	134.3	SS-155	98.404	96.394	1.710	Open Manhole	1350

PIPELINE SCHEDULES for Attenuation System 3

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)
S10.008	o	450	SS-155	98.404	96.244	1.710	Open Manhole	1350
S10.009	o	450	SS-156	98.000	96.221	1.329	Open Manhole	1350
S1.005	o	525	SATT TANK	98.400	96.200	1.675	Open Manhole	1500
S1.006	o	525	SS-195	98.000	96.100	1.375	Open Manhole	1500
S1.007	o	525	SS-196	98.000	96.051	1.424	Open Manhole	1500
S1.008	o	525	SNon-Return Valve	98.000	96.002	1.473	Open Manhole	1500

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)
S10.008	8.782	381.8	SS-156	98.000	96.221	1.329	Open Manhole	1350
S10.009	9.310	443.3	SATT TANK	98.400	96.200	1.750	Open Manhole	1500
S1.005	5.000	50.0	SS-195	98.000	96.100	1.375	Open Manhole	1500
S1.006	12.236	249.7	SS-196	98.000	96.051	1.424	Open Manhole	1500
S1.007	17.030	347.6	SNon-Return Valve	98.000	96.002	1.473	Open Manhole	1500
S1.008	1.000	333.3	SS-Outfall 2	97.900	95.999	1.376	Open Manhole	0

Surcharged Outfall Details for Attenuation System 3

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.008	SS-Outfall 2	97.900	95.999	95.900	0	0

Datum (m) 0.000 Offset (mins) 0

Time (mins)	Depth (m)	Time (mins)	Depth (m)
5400	0.501	10800	0.501

Simulation Criteria for Attenuation System 3

Volumetric Runoff Coeff	0.750	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)	60
Hot Start Level (mm)	0	MADD Factor * 10m³/ha Storage	2.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	2	Number of Storage Structures	1	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Region	Scotland and Ireland	Ratio R	0.272
Return Period (years)	5	M5-60 (mm)	15.500	Profile Type	Summer

Synthetic Rainfall Details

Cv (Summer) 0.750 Cv (Winter) 0.840 Storm Duration (mins) 30

Online Controls for Attenuation System 3

Hydro-Brake® Optimum Manhole: SS-196, DS/PN: S1.007, Volume (m³): 5.8

Unit Reference	MD-SHE-0311-6130-1849-6130
Design Head (m)	1.849
Design Flow (l/s)	61.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	311
Invert Level (m)	96.051
Minimum Outlet Pipe Diameter (mm)	375
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.849	61.3	Kick-Flo®	1.275	51.2
Flush-Flo™	0.587	61.3	Mean Flow over Head Range	-	52.3

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	9.4	0.400	59.8	0.800	60.4	1.400	53.6	2.000	63.7	2.600	72.3
0.200	31.9	0.500	61.0	1.000	58.5	1.600	57.2	2.200	66.7	3.000	77.5
0.300	55.1	0.600	61.3	1.200	54.3	1.800	60.5	2.400	69.5	3.500	83.5

Hydro-Brake® Optimum Manhole: SS-196, DS/PN: S1.007, Volume (m³): 5.8

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)
4.000	89.1	5.000	99.3	6.000	108.5	7.000	117.0	8.000	124.9	9.000	132.3
4.500	94.4	5.500	104.0	6.500	112.9	7.500	121.0	8.500	128.7	9.500	135.8

Non Return Valve Manhole: SNon-Return Valve, DS/PN: S1.008, Volume (m³): 6.9

Storage Structures for Attenuation System 3

Tank or Pond Manhole: SATT TANK, DS/PN: S1.005

Invert Level (m) 96.200

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1400.0	1.700	1400.0	1.701	0.0

Summary of Critical Results by Maximum Level (Rank 1) for Attenuation System 3

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 0
Number of Online Controls 2 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 15.500 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.272 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 10, 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	SS-176	30 Winter	100	+10%	1/15 Summer	100/15 Summer			99.120	1.338	9.250	0.65		38.8	FLOOD

Summary of Critical Results by Maximum Level (Rank 1) for Attenuation System 3

PN	US/MH Name	Level Exceeded
S1.000	SS-176	6

Summary of Critical Results by Maximum Level (Rank 1) for Attenuation System 3

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)
S1.001	SS-177	30 Summer	100	+10%	1/15 Summer				99.123	1.501	0.000	1.18		82.7
S1.002	SS-178	30 Winter	100	+10%	1/15 Summer				98.958	1.577	0.000	1.48		75.9
S2.000	SS-115	15 Winter	100	+10%					102.670	-0.135	0.000	0.34		23.8
S2.001	SS-116	15 Winter	100	+10%					102.073	0.000	0.000	0.88		52.0
S2.002	SS-117	15 Winter	100	+10%	100/15 Summer				101.326	0.379	0.000	1.05		69.0
S3.000	SS-119	30 Winter	100	+10%	100/15 Summer				100.361	0.294	0.000	0.26		4.3
S2.003	SS-118	30 Winter	100	+10%	30/15 Winter				100.354	0.486	0.000	0.95		77.4
S2.004	SS-120	30 Winter	100	+10%	30/15 Summer				100.117	0.607	0.000	0.93		78.9
S2.005	SS-121	30 Winter	100	+10%	30/15 Summer				99.701	0.672	0.000	1.04		93.5
S2.006	SS-122	30 Winter	100	+10%	30/15 Summer				99.087	0.610	0.000	1.15		95.4
S1.003	SS-179	30 Winter	100	+10%	1/15 Summer				98.889	1.549	0.000	2.84		148.4
S1.004	S180	30 Winter	100	+10%					98.133	-0.339	0.000	0.27		147.8
S4.000	SS-125	15 Winter	100	+10%	30/15 Summer				99.849	0.781	0.000	0.54		14.0
S5.000	SS-127	15 Winter	100	+10%	30/15 Summer				100.041	0.601	0.000	1.09		18.9
S4.001	SS-126	15 Winter	100	+10%	30/15 Summer				99.730	1.344	0.000	1.54		104.8
S4.002	SS-128	15 Winter	100	+10%	30/15 Summer				98.958	0.868	0.000	1.76		187.8
S4.003	SS-134	15 Winter	100	+10%	100/15 Summer				98.155	0.366	0.000	0.98		185.6
S6.000	SS-130	15 Winter	100	+10%	30/15 Summer				99.822	0.961	0.000	2.24		85.9
S6.001	SS-129	15 Winter	100	+10%	30/15 Winter				99.277	0.545	0.000	1.04		107.9
S6.002	SS-131	15 Winter	100	+10%	30/15 Summer				98.852	0.621	0.000	1.07		125.5
S6.003	SS-132	15 Winter	100	+10%	30/15 Summer				98.222	0.566	0.000	1.19		130.5
S4.004	SS-133	15 Winter	100	+10%	30/15 Summer				97.441	0.352	0.000	1.59		311.5
S7.000	SS-136	15 Summer	100	+10%	30/15 Summer				97.721	0.148	0.000	2.09		62.5
S4.005	SS-135	15 Winter	100	+10%	30/15 Summer				97.275	0.248	0.000	2.08		328.3
S8.000	SS-200	15 Winter	100	+10%					102.968	-0.103	0.000	0.56		44.4

Summary of Critical Results by Maximum Level (Rank 1) for Attenuation System 3

PN	US/MH Name	Status	Level Exceeded
S1.001	SS-177	SURCHARGED	
S1.002	SS-178	SURCHARGED	
S2.000	SS-115	OK	
S2.001	SS-116	OK	
S2.002	SS-117	SURCHARGED	
S3.000	SS-119	SURCHARGED	
S2.003	SS-118	SURCHARGED	
S2.004	SS-120	SURCHARGED	
S2.005	SS-121	SURCHARGED	
S2.006	SS-122	SURCHARGED	
S1.003	SS-179	SURCHARGED	
S1.004	S180	OK	
S4.000	SS-125	SURCHARGED	
S5.000	SS-127	SURCHARGED	
S4.001	SS-126	SURCHARGED	
S4.002	SS-128	SURCHARGED	
S4.003	SS-134	SURCHARGED	
S6.000	SS-130	SURCHARGED	
S6.001	SS-129	SURCHARGED	
S6.002	SS-131	SURCHARGED	
S6.003	SS-132	SURCHARGED	
S4.004	SS-133	SURCHARGED	
S7.000	SS-136	SURCHARGED	
S4.005	SS-135	SURCHARGED	

Summary of Critical Results by Maximum Level (Rank 1) for Attenuation System 3

PN	US/MH Name	Status	Level Exceeded
S8.000	SS-200	OK	

Summary of Critical Results by Maximum Level (Rank 1) for Attenuation System 3

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)
S8.001	SS-201	15 Winter	100	+10%	100/15 Summer				101.454	0.212	0.000	0.98		59.1
S8.002	SS-202	15 Winter	100	+10%	100/15 Summer				100.920	0.324	0.000	0.85		70.9
S8.003	SS-203	15 Winter	100	+10%	30/15 Summer				100.092	0.720	0.000	1.05		69.0
S8.004	SS-204	15 Winter	100	+10%	30/15 Summer				99.709	0.692	0.000	2.49		74.6
S8.005	SS-205	15 Winter	100	+10%	30/15 Summer				99.430	0.452	0.000	1.40		75.7
S8.006	SS-206	15 Winter	100	+10%	30/15 Summer				98.980	0.251	0.000	1.49		91.2
S8.007	SS-207	15 Winter	100	+10%	30/15 Summer				98.806	0.154	0.000	1.52		91.8
S8.008	SS-208	15 Winter	100	+10%	100/15 Summer				98.655	0.070	0.000	1.13		117.3
S9.000	SS-214	15 Winter	100	+10%					98.415	-0.070	0.000	0.03		0.9
S8.009	SS-209	15 Winter	100	+10%	100/15 Summer				98.421	0.031	0.000	1.11		114.9
S8.010	SS-210	15 Winter	100	+10%					98.173	-0.045	0.000	0.78		132.4
S8.011	SS-211	15 Winter	100	+10%	100/15 Summer				97.912	0.114	0.000	0.88		155.6
S8.012	SS-212	15 Winter	100	+10%	30/15 Summer				97.323	0.298	0.000	1.31		166.6
S8.013	SS-213	360 Winter	100	+10%	1/15 Winter				97.173	0.255	0.000	0.16		43.4
S4.006	SS-138	360 Winter	100	+10%	30/15 Summer				97.171	0.314	0.000	0.93		138.3
S10.000	SS-145	15 Winter	100	+10%	30/15 Summer				99.091	0.666	0.000	1.18		45.7
S10.001	SS-146	15 Winter	100	+10%	30/15 Summer				98.934	0.656	0.000	0.95		47.3
S10.002	SS-147	15 Winter	100	+10%	30/15 Summer				98.532	0.737	0.000	1.59		59.8
S11.000	SS-148	15 Winter	100	+10%	100/15 Summer				98.069	0.215	0.000	0.65		10.4
S10.003	SS-149	15 Winter	100	+10%	30/15 Summer				98.044	0.446	0.000	0.92		69.4
S10.004	SS-150	15 Winter	100	+10%	30/15 Summer				97.938	0.468	0.000	1.09		90.3
S10.005	SS-151	15 Winter	100	+10%	30/15 Summer				97.738	0.439	0.000	1.62		103.6
S12.000	SS-158	15 Winter	100	+10%					97.448	-0.102	0.000	0.03		0.4
S12.001	SS-152	15 Winter	100	+10%	100/15 Winter				97.466	0.012	0.000	0.95		12.1
S10.006	SS-153	15 Winter	100	+10%	100/15 Summer				97.452	0.265	0.000	1.15		137.7

Summary of Critical Results by Maximum Level (Rank 1) for Attenuation System 3

PN	US/MH Name	Status	Level Exceeded
S8.001	SS-201	SURCHARGED	
S8.002	SS-202	SURCHARGED	
S8.003	SS-203	SURCHARGED	
S8.004	SS-204	SURCHARGED	
S8.005	SS-205	SURCHARGED	
S8.006	SS-206	SURCHARGED	
S8.007	SS-207	SURCHARGED	
S8.008	SS-208	SURCHARGED	
S9.000	SS-214	OK	
S8.009	SS-209	SURCHARGED	
S8.010	SS-210	OK	
S8.011	SS-211	SURCHARGED	
S8.012	SS-212	SURCHARGED	
S8.013	SS-213	SURCHARGED	
S4.006	SS-138	SURCHARGED	
S10.000	SS-145	SURCHARGED	
S10.001	SS-146	SURCHARGED	
S10.002	SS-147	SURCHARGED	
S11.000	SS-148	SURCHARGED	
S10.003	SS-149	SURCHARGED	
S10.004	SS-150	SURCHARGED	
S10.005	SS-151	SURCHARGED	
S12.000	SS-158	OK	
S12.001	SS-152	SURCHARGED	

Summary of Critical Results by Maximum Level (Rank 1) for Attenuation System 3

PN	US/MH Name	Status	Level Exceeded
S10.006	SS-153	SURCHARGED	

Summary of Critical Results by Maximum Level (Rank 1) for Attenuation System 3

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)
S10.007	SS-154	360 Winter	100	+10%	30/15 Summer				97.181	0.230	0.000	0.30	
S13.000	SS-140	15 Winter	100	+10%					98.175	-0.050	0.000	0.92	
S14.000	SS-143	15 Winter	100	+10%	30/15 Summer				97.989	0.156	0.000	1.32	
S14.001	SS-144	15 Winter	100	+10%	100/15 Summer				97.895	0.142	0.000	0.86	
S13.001	SS-141	15 Winter	100	+10%	30/15 Summer				97.649	0.372	0.000	1.12	
S13.002	SS-142	15 Winter	100	+10%	30/15 Summer				97.308	0.341	0.000	1.13	
S10.008	SS-155	360 Winter	100	+10%	30/15 Summer				97.173	0.479	0.000	0.61	
S10.009	SS-156	360 Winter	100	+10%	30/15 Summer				97.169	0.498	0.000	0.69	
S1.005	SATT TANK	360 Winter	100	+10%	30/60 Winter				97.166	0.441	0.000	0.50	
S1.006	SS-195	180 Winter	100	+10%	30/30 Winter				97.492	0.867	0.000	0.42	
S1.007	SS-196	180 Winter	100	+10%	30/30 Summer				97.647	1.071	0.000	0.32	
S1.008	SNon-Return Valve	180 Winter	30	+10%					96.211	-0.316	0.000	0.34	

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
S10.007	SS-154	37.2	SURCHARGED	
S13.000	SS-140	43.4	OK	
S14.000	SS-143	17.3	SURCHARGED	
S14.001	SS-144	42.5	SURCHARGED	
S13.001	SS-141	90.8	SURCHARGED	
S13.002	SS-142	99.7	SURCHARGED	
S10.008	SS-155	59.8	SURCHARGED	

Summary of Critical Results by Maximum Level (Rank 1) for Attenuation System 3

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
S10.009	SS-156	59.4	SURCHARGED	
S1.005	SATT TANK	125.3	SURCHARGED	
S1.006	SS-195	89.4	SURCHARGED	
S1.007	SS-196	61.3	SURCHARGED	
S1.008	SNon-Return Valve	61.2	OK	

C Stormwater Layout

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