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RESIDENTIAL DEVELOPMENT, ARDAROSTIG, BISHOPSTOWN, CORK

INFRASTRUCTURE REPORT

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1 Introduction

Denis O'Sullivan & Associates were engaged as Consulting Engineers for the proposed development at Ardarostig, Bishopstown in Cork.

1.1 Objectives

Denis O'Sullivan & Associates carried out a number of site investigations and their findings have been incorporated to deal with solutions to:

- Surface Water Drainage Network
- Foul Drainage Network
- Water Supply

The proposals for the foul sewer & water infrastructure associated with this development were discussed with Mr. Brian O' Mahony, Design Engineer, Southern Region, Irish Water. The Statement of Design Acceptance as issued by Irish Water is included in Appendix A of this Report.

The proposals for the proposed stormwater infrastructure were discussed with Ms. Valerie Fenton, Senior Executive Engineer, Cork City Council & Mr. Simon Lyons, Senior Executive Engineer, Environment – Water Services (Drainage), Cork City Council.

1.2 Site Location

The subject site (currently greenfield) is located approximately 5.0km southeast of Cork City Centre in Bishopstown in the townland of Ardarostig to the south of the Waterfall Road. The site is a greenfield site characterised by its undulating topography and its steep slope rising at the southern end. Waterfall Road runs along the site's northern edge, and the site is surrounded on the other 3 sides by farmland, woodland and stand-alone detached dwellings.

A snapshot of the application boundary is outlined in Figure 1 below.

Figure 1 – Context Map

1.3 Site Topography

The topography of the site slopes northwards to the public road. It comprises one large single field across which the levels vary from +20m O.D. and +30m O.D. along the Waterfall Road to +60m O.D. at its most elevated southern extremity. Refer to Topographic Survey Plans indicated on DOSA Drawing No.'s 5181-0405 & 5181-0406 for further details.

1.4 Proposed Development

The proposed new development will comprise a mixed-use residential development with commercial space, crèche, landscaping, road improvement, pedestrian / cycleway and site development works. The proposed development will consist of 137 houses comprising 29 no. 4-bed and 108 no. 3-bed detached, semi-detached and terraced dwellings and 139 no. apartments comprising a mix of 20 no. 3-bed duplex units, 65 no. 2-bed apartments and 54 no. 1-bed apartments over 5 apartment blocks. The proposed development will provide for new vehicular and pedestrian entrances onto Waterfall Road, a two-way cycle track and pedestrian footpath linking to existing

shared surface pathway south of the N40, upgrades to this shared surface path to provide two-way cycle track and pedestrian footpath, pedestrian crossings to the east of the site and on waterfall road, infrastructure development works comprising the relocation/undergrounding of ESB powerlines, wastewater treatment proposals, surface water attenuation, water utility services and all ancillary site development.

2 Surface Water Management

2.1 Surface Water Design

The public stormwater network on the adjacent Waterfall Rd which bounds the site to the north (as described in Section 1.3 above) is expected to provide suitable surface water discharge point for the proposed development. There will be one no. surface water discharge point to service the developed site. Refer to DOSA Drawing No's. 5181-0420, 5181-0421, 5181-0422 & 5181-0423 for details of the proposed surface water outfall. Surface water discharge rates from the proposed surface water drainage network will be controlled by a vortex flow control device (Hydrobrake or equivalent) and associated attenuation tanks. Surface water discharge will also pass via a full retention fuel / oil separator (sized in accordance with permitted discharge from the site).

The proposed surface water drainage network will collect surface water runoff from the site via a piped network prior to discharging off site via the attenuation tank, flow control device and separator arrangement as noted above. Surface water runoff from the site's road network will be directed to the proposed pipe network via conventional road gullies with additional surface water runoff from driveways and roofs also routed to the proposed surface water pipe network.

2.2 Compliance with GDSDS Surface Water Drainage Policy

The site's surface water management infrastructure has been designed in accordance with the Greater Dublin Strategic Drainage Study (GDSDS). The GDSDS (Vol. 2, Chapter 6.3.4) requires that the following design criteria are applied to all sites:

Criterion 1: River Water Quality Protection

Satisfied by providing stormwater attenuation tanks and treatment of surface water run-off by SUDS features such full retention fuel/oil separators at surface water discharge points.

Criterion 2: River Regime Protection

Satisfied by attenuating surface water run-off in association with flow control devices prior to discharge off site at Greenfield runoff rate. Site critical duration storm used to assess attenuation volume.

Criterion 3: Level of Service (Flooding) for the Site

Satisfied by reviewing available flood hazard information (e.g. Lee CFRAM Study as outlined in Appendix C) relating to the site's proximity to tidal and fluvial flood plains (up to 1 in 100-year flood event).

Criterion 4: River Flood Protection

Satisfied by attenuating surface water discharge to greenfield runoff rates, addressing flood risk associated with the 1 in 100-year storm and avoiding development in flood plains.

Following a comprehensive review of the design of the storm water drainage system we considered all options under the SuDS guidance policies referred to in the Greater Dublin Drainage Strategy. A preliminary feasibility of the applicable SuDS Techniques was carried out using the facility on the website of Irishsuds.ie (Guidance and Tools). The preliminary analysis indicated that the following

techniques were possibly suitable Attenuation Tanks, Basins, Permeable Paving, Soakaways, Swales and Rainwater Harvesting.

Each proposal was examined and evaluated on its merits / suitability under site specific constraints for use in the proposed development site. Our design approach summary is as follows:

2.3 SuDS Appraisal

The SUDS selection process used for this site is in accordance with SUDS selection flow chart, Volume 3, Section 6.5, Figure 48 of the GDSDS. The characteristics of the site are utilised to select the various SUDS techniques that would be applicable.

The following methodologies are being implemented as part of a SuDS treatment train approach:

2.3.1 Permeable Pavement

Permeable pavement reduces the overall impermeable area of the hard-standing area, which will reduce the impact of the discharge and improve the quality of the effluent from the proposed development. Permeable pavement will be provided in private driveway areas as indicated on the drainage drawings included as part of the precedent condition submission. The permeable paving is provided for the purposes of improving the quality of the surface water runoff. No reduction in the rate of run-off as a result of the permeable paving provision is allowed for in the surface water calculations which assumes the system is in a saturated state.

2.3.2 Green Roofs

Green roofs are proposed to be installed on the apartment blocks for the purposes of improving the quality of the surface water runoff. Although the green roof also helps control storm water runoff and retention no reduction in the rate of run-off as a result of the green roofs is allowed for in the surface water calculations.

2.3.3 Rainwater Harvesting

In relation to rainwater harvesting an option is to provide a water butt with each individual dwelling. This will be located to the rear of each unit. This water butt will only have the ability to catch the rear sloping side of the dwelling and the reuse would be for watering plants.

2.3.4 Tree Pits

It is also proposed, where possible to fit tree pits along the estate road to drain and treat surface water runoff from the road network. This will allow for treatment of first flush and low flows., and high flows will discharge into the surface water network during extreme rainfall events. Rain water gullies will still be provided downstream of any tree pit to drain runoff during an extreme rainfall event.

2.3.5 Attenuation Tanks

The proposed attenuation system attenuates surface water to restrict the outflow to the equivalent of the existing agricultural runoff. This ensures the development will not give rise to any impact downstream of the site.

2.3.6 Flow Control Device

It is proposed to provide a hydrobrake, or similar approved, at the outfall of the surface water catchment to restrict the outflow of water from the subject site. The hydro-brakes will be fitted with a pull cord bypass and a penstock valve installed on the inlet to the manhole for maintenance purposes.

2.3.7 Petrol Interceptor

It is proposed to provide a petrol interceptor upstream of the attenuation tanks to ensure that any remaining hydro-carbons or pollutants within the runoff from trafficked areas are treated prior to outfall to the existing watercourse. It is proposed to provide a Conder Bypass Separator Types or similar approved.

In conclusion the water quality from this catchment should be of a high quality due to the above-mentioned measures, which are applied in a treatment train to treat the water before discharge at a restricted rate to the local network.

The above measures ensure a suitable management train is provided.

2.3.8 Management Train

The management train commences with source control through the provision of permeable paving within the driveway of each unit and rain water butts in the rear gardens. This will also reduce the water consumption required of each housing unit. This employment of these source controls along with the usage of localised tree pts will aid to reduce the peak runoff rate, placing less stress on the facilities downstream.

The second stage of the management train, site control, is provided by the introduction of the hydrocarbon interceptors, which provide a degree of treatment before discharging to the attenuation system.

The attenuation tanks offer a third stage of treatment, regional control, by slowing the storm water discharge down and removing additional silts which may remain in the storm water.

2.4 Maintenance Regime for SuDS Devices

The permeable paving has a design life equivalent to standard block paving. The surface blocks require routine maintenance. There are four levels of cleaning that can be carried out on a paved area:

1. General dirt should be removed by regular dry brushing.
2. Where the paving has become dull, showing a loss of colour, a wet wash with a stiff bristle brush and garden hose can be adequate.
3. For more stubborn areas a power washer can be used, taking care not to remove the jointing materials (sand or mortar). The washer should be on a medium pressure setting or lower, and should not be aimed directly at the paving surface, but at an angle of 30° approximately.

Cleaning detergents can be used; however, some detergents are acidic and overuse can damage some paving products. It is advisable to follow the manufacturer's instructions and rinse the areas fully. The resulting runoff should be carefully channelled to either drainage points or containers from where it can be safely disposed. Replace any washed-out jointing sand with new dried sand once the paving has dried.

The attenuation tanks will require regular maintenance to ensure continuing operation to design performance standards.

2.5 Flood Risk

A search for recorded flood events near the subject site was carried out using the OPW's website, www.floodmaps.ie and using a general internet search. The OPW floodmaps.ie website provides information on recorded flood events nationwide. Refer to Figure 2 below for an extract of the OPW www.floodmaps.ie recorded flood incidences for the area. A search of the subject site does not show any instances of historic flooding within the subject site but there is flooding in areas closer to the site. A copy of the relevant flood results for the area in question is included in Appendix B.

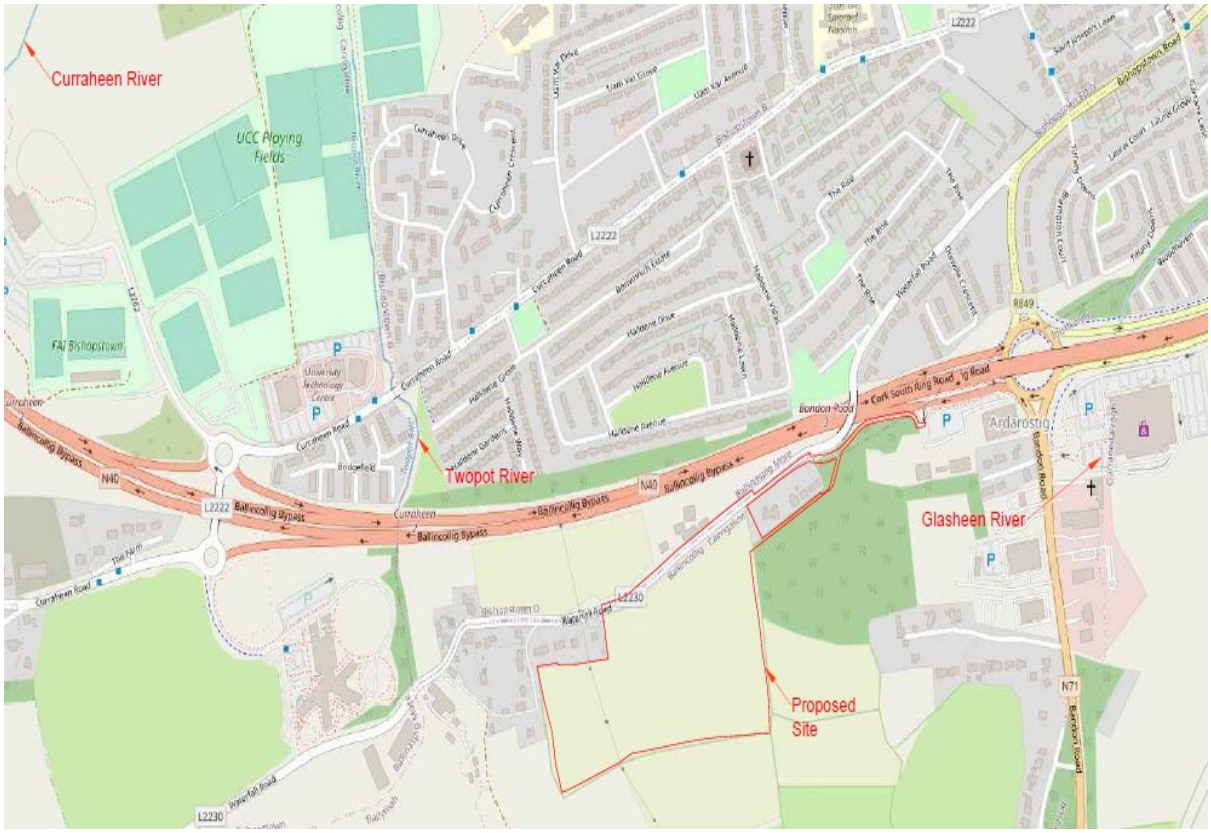


Figure 2– Floodmaps.ie Map

2.6 Results of Predictive Flood Extent Mapping

The CFRAM study of the River Lee only took account of the current scenario and did not include for the mid-range (MRFS) and high end (HEFS) future scenarios. A full copy of the relevant map for the area in question is included in Appendix C. A copy of the PFRA estimate flood extend mapping for the site is included in Figure 3 & Figure 4 below. It does not identify any pluvial or tidal flooding within any developed portion of the site.

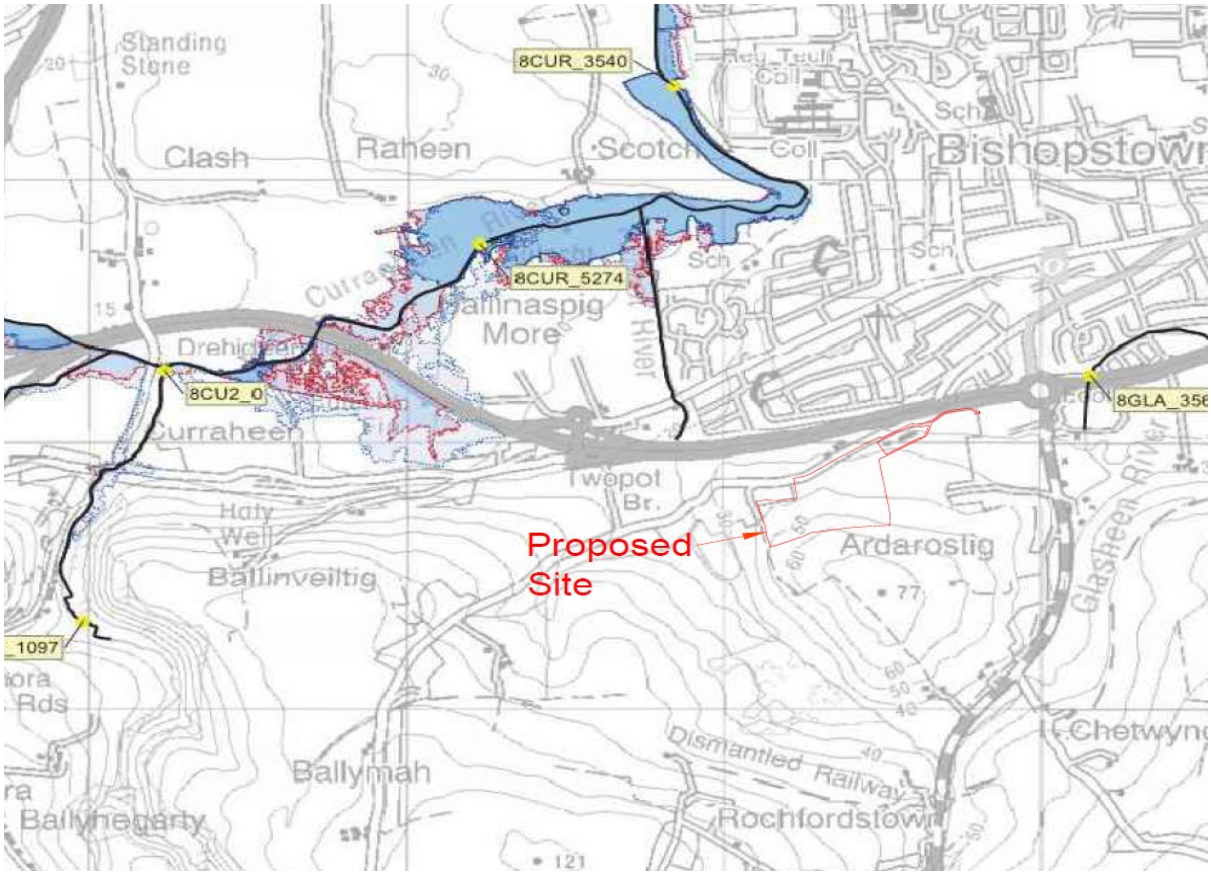


Figure 3– Lee CFRAM Fluvial Map

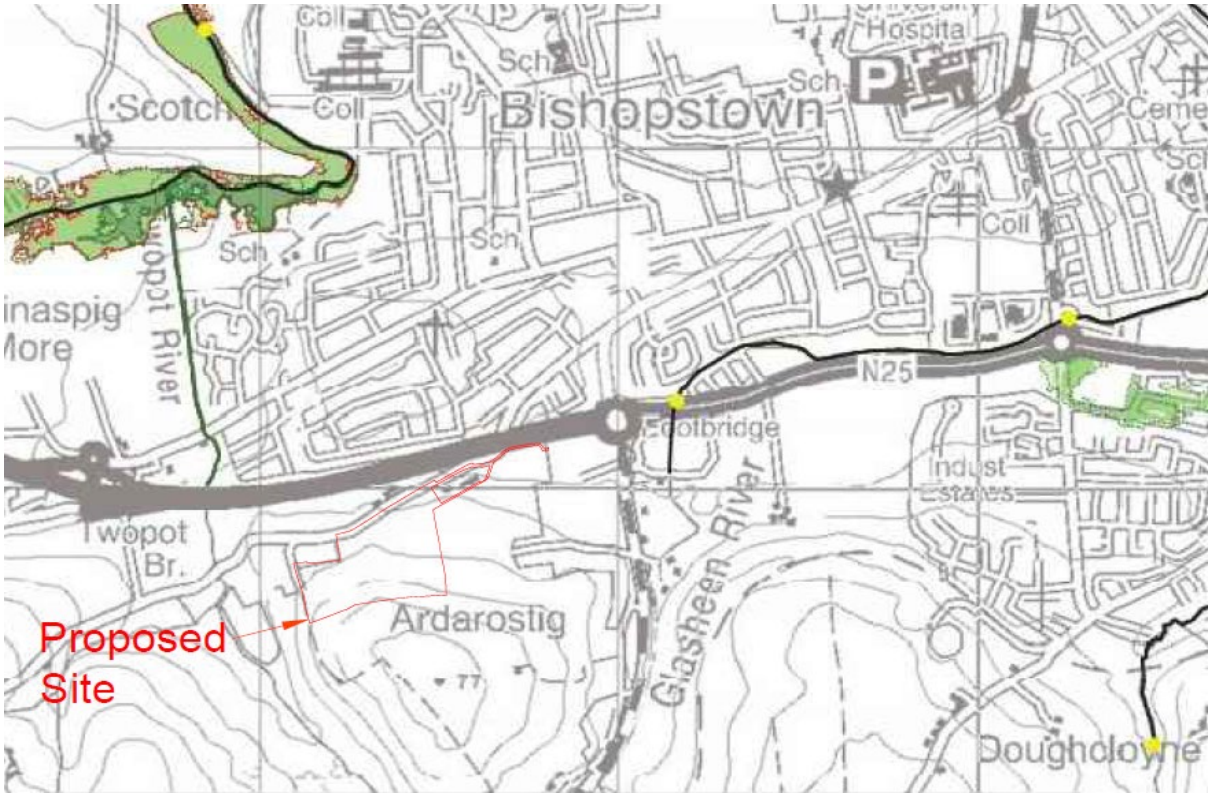


Figure 4– Lee CFRAM Tidal Map

2.7 Surface Water System

The existing public stormwater network on the adjoining Waterfall Road which bounds the site to the north has been chosen as the suitable surface water discharge point for the proposed development.

In order to reduce the effects of the surface runoff on potential flooding, a Stormwater Management Plan will be applied to surface water discharges into adjacent watercourses. The Stormwater Management Plan can be applied to control the rate of runoff from new development. The maximum permitted surface water outflow from the new development is to be restricted to that of the existing Greenfield site by the usage of attenuation storage.

Control of runoff by attenuation methods requires a hydraulic control to restrict the magnitude of flows passing downstream, together with an upstream storage capacity to contain the volume of runoff held back by the hydraulic control. The flows are proposed to be attenuated in the surface water system by adopting a flood storage attenuation tanks along with restricted outlets as the control devise. The storage volume required has been designed using the computer aided design package Windes 10.4.

The attenuation strategy for the site is for the detention of flows in interlinked attenuation tanks.

2.8 Surface Water Drainage Network

The surface water drainage network for the proposed development was modelled using the Microdrainage software application. The surface water pipe lengths, slopes, contributing impermeable areas, upstream invert levels, upstream cover levels and pipe diameters were entered into the model using the drawings supplied. Appendices E, F & H show the proposed surface water drainage network layout, pipe and manhole numbering.

2.9 Design Criteria:

The proposed surface water drains have been designed in accordance with the Greater Dublin Strategic Drainage Study (GDSDS), the Department of the Environment's Recommendations for Site Development Works for Housing Areas, the Department of the Environment's Building Regulations "Technical Guidance Document Part H Drainage and Waste Water Disposal" and BS EN 752: 2008 Drain and Sewer Systems Outside Buildings.

- Return period for pipe work design — 2 years
- Return period for attenuation design — 100 years
- Soil Type — 2
- Allowable Outflow — 24.90 l/sec
- Time of entry — 5 minutes
- M5 – 60 — 18.80 mm
- Ratio "r" — 0.30
- Pipe Friction (Ks) — 0.6 mm
- Minimum Velocity (based on pipe flowing full) — 1.0 m/s
- Rainfall Runoff from Roads and Footpaths — 100%
- Rainfall Runoff from Roofs — 80%

- Rainfall Runoff from Driveways 80%
- Rainfall Runoff from Green Areas 20%
- Rainfall Depth Factored for Climate Change (as per GDSDS) 20%

(in accordance with GDSDS Volume 2, Chapter 6, Table 6.2 – see below)

Climate Change Category	Characteristics
River flows	20% increase in flows for all return periods up to 100 years
Sea level	400+mm rise (see Climate Change policy document for sea levels as a function of return period)
Rainfall	10% increase in depth (factor all intensities by 1.1)
	Modify time series rainfall in accordance with the GDSDS climate change policy document

Table 6.2 Climate Change Factors to be Applied to Drainage Design

The global variables required for the model were the M5-60 and Rainfall Ratio. These two factors may be read from maps contained in the Wallingford procedure. They enable the program to calculate the intensity, duration and frequency characteristics of storms.

M5-60 is the rainfall depth based on a 60-minute storm of 5 years return period. Ratio R is the ratio of the 60-minute storm to the 2-day storm for the 5-year return period events. These values are as follows:

- M5-60 = 18.80mm
- Ratio R = 0.30

Microdrainage generates design storms using the principles set out in the Flood Studies Report (NERC 1975).

A summer rainfall profile was used for the design of the pipework and a winter rainfall profile was used for the design of the storm water attenuation to give the critical design. A summer profile gives higher rainfall intensities and results in higher runoff rates and is used to determine the required capacity of the pipework. A winter rainfall profile gives a flatter more sustained profile and results in higher runoff volumes and is used to determine the attenuation/storage requirements.

The surface water drainage network was assessed for compliance with maximum and minimum velocities, pipe length etc. The network was designed to ensure velocities in the network and pipe gradients did not exceed the maximum velocity of 4.0m/s. The minimum velocity allowed was 1.00m/s.

The design of the drainage network was assessed using events with a range of different durations to determine the critical event for each return period analysed as follows:

- 1 in 2-year return period events were used to ensure that the system did not surcharge;
- 1 in 100 year return period events were used to ensure that flooding did not occur.

The layout of the proposed storm water network is shown on the Proposed Stormwater & Foul Sewer Layout Plan Drawing No.'s 5181-0420, 5181-0421, 5181-0422, 5181-0423, 5181-0470, 5181-0471 & 5181-0472.

2.10 Stormwater Attenuation Strategy

2.10.1 Pre-Development Conditions

The catchment area of this proposed development is 7.77hectares (ha). For this development, the permissible outflow is calculated using the estimation method contained in the Institute of Hydrology Report No. 124: Flood estimation for small catchments.

$$QBAR = 0.00108 \times (AREA)^{0.89} \times (SAAR)^{1.17} \times (SOIL)^{2.17}$$

QBAR = The Mean Annual Peak Flow (Permissible outflow in m3.sec

AREA = Area of the Catchment (site) in km^2

SAAR = Standard Annual Average Rainfall

SOIL = Soil index

As the development is smaller than 50 ha, the analysis for determining the permissible outflow uses 50 ha in the formula and linearly interpolates the flow rate value based on the ratio of the development to 50 ha. This is a statistical based method within the Microdrainage Software utilizing the Regional Flood Frequency by Catchment Characteristics to give the Index Flood (QBAR)

Design summary sheets for the QBAR value are contained in Appendix D.

The Mean Annual Peak Flow (permissible outflow) was calculated for the particular design development areas.

The allowable runoff estimation method utilises IH 124 and the Soil Index value taken from the Micrcodrainage Design Package mapping system gives a Soil Index of 0.3.

2.10.2 Post-Development Conditions

The stormwater management plan adopted for the particular development involves using interlinked attenuation tanks located in the green areas of the site.

All surface water runoff arising from the paved development will be drained away from the site. The attenuation tanks will be designed for a 100-year storm event. The maximum discharge from the tanks will be limited to calculated permissible runoff (QBAR) for the catchment area.

Based on the proposed development design there will be a change in the land surface. Therefore, due to this proposed change a corresponding increase in the peak rate of surface runoff from the site will arise during times of high rainfall.

Fig 5.0 Catchment Plan

Contributing Area	Permissible Outflow (l/sec)
Catchment Area No. 1	6.70 l/sec
Catchment Area No. 2	7.40 l/sec
Catchment Area No. 3	6.30 l/sec
Catchment Area No. 4	3.30 l/sec
Catchment Area No. 5	1.20 l/sec

The flood peak runoff rates from the post-development grassy permeable area (Q_p grass) and the post-development impervious area (Q_p imp.) using the Rational Method (100% impermeability of hard surfaces) are calculated using Windes 10.4. The Sources Control Module of the Microdrainage Software was used to design the attenuation tank capacities. This module also provides the critical storm duration for the attenuation tank during the design process.

It should be noted that climate change has been accounted for in the design. As per volume 5 of the GDSDS a factor of 20% has been incorporated into the design.

The allowable runoff utilising IH 124 of 24.90 l/second from the combined Catchment Area for the proposed development equates to 3.20 l/second/hectare.

2.11 Attenuation Tanks

2.11.1 Volume of Attenuation Tanks

The capacity of the attenuation tanks is designed to cater for the capacity required for a 1 in 100-year ARI event. These capacities are summarised as follows:

Tank No.	Capacity (m^3)	Restricted Outlet (l/sec)
1	551.0	6.70 l/sec
2	551.0	7.40 l/sec
3	560.0	6.30 l/sec
4	297.0	3.30 l/sec
5	105.0	1.20 l/sec

2.12 Hydrocarbon Treatment

A petrol interceptor is a trap used to filter out hydrocarbon pollutants from rainwater runoff. It is used in construction to prevent fuel contamination of streams carrying away the runoff.

Petrol interceptors work on the premise that some hydrocarbons such as petroleum and diesel float on the top of water. The contaminated water enters the interceptor typically after flowing off roads or hardstanding areas before being deposited into the first tank inside the interceptor.

The first tank builds up a layer of the hydrocarbon as well as other scum. Typically, petrol interceptors have 3 separate tanks each connected with a dip pipe, as more liquid enters the interceptor the water enters into the second tank leaving the majority of the hydrocarbon behind as it cannot enter the dip pipe, whose opening into the second tank is below the surface.

However, some of the contaminants may by chance enter the second tank. This second tank will not build up as much of the hydrocarbon on its surface. As before, the water is pushed into the third tank and more water enters the second.

The third tank should be practically clear of any hydrocarbon floating on its surface. As a precaution, the outlet pipe is also a dip pipe. When the water leaves the third tank via the outlet pipe it should be contaminant free.

In this project there are a number of catchment areas and attenuation tanks that eventually discharge to the adjoining public network on the Waterfall Road.

A summary of the proposed interceptor is as per the table below.

Table 2.4 – Petrol Interceptor Details

Catchment Reference	Petrol Interceptor Make & Model	Oil Storage Capacity (l)
Catchment Area No. 1	1 No. Conder CSNB20s	300.0 litres
Catchment Area No. 2	1 No. Conder CSNB20s	300.0 litres
Catchment Area No. 3	1 No. Conder CSNB20s & 1 No. Conder CSNB6s	300.0 litres & 90.0 litres
Catchment Area No. 4	1 No. Conder CSNB20s & 1 No. Conder CSNB6s	300.0 litres & 90.0 litres
Catchment Area No. 5	1 No. Conder CSNB6s	90.0 litres

2.13 Silt Control

The proposed petrol interceptor from Conder Environmental also includes a silt storage capacity in addition to the oil storage capacity that allow silt to be collected in the interceptor prior to discharge to the proposed attenuation tanks. This silt build-up can then be removed from the tanks. The amount of silt storage from the proposed petrol interceptor is outlined in Table 2.5 below.

Table 2.5 – Petrol Interceptor Silt Storage Details

Catchment Reference	Petrol Interceptor Make & Model	Silt Storage Capacity (l)
Catchment Area No. 1	1 No. Conder CSNB20s	2000.0 litres
Catchment Area No. 2	1 No. Conder CSNB20s	2000.0 litres
Catchment Area No. 3	1 No. Conder CSNB20s & 1 No. Conder CSNB6s	2000.0 litres & 300.0 litres
Catchment Area No. 4	1 No. Conder CSNB20s & 1 No. Conder CSNB6s	2000.0 litres & 300.0 litres

Catchment Area No. 5	1 No. Conder CSNB6s	300.0 litres

2.14 Construction & Operational Stage Run-Off

Both construction and operational phase surface-water drainage from the proposed development site will ultimately discharge into the adjacent stormwater network on the Waterfall Rd. Where surface-water run-off occurs at the site during the construction phase, it will be managed and controlled prior to discharge into the environment by implementing standard environmental controls. Temporary banks shall be in place to ensure that runoff is directed to a temporary detention pond which shall be provided to reduce the amount of silt in the run-off. The location of these banks and temporary detention ponds will be indicated and confirmed in a Construction Stage Construction & Environmental Management Plan. The development will also include the construction of a gravity surface-water drainage network throughout the site. The surface-water drainage network will include the installation of dedicated attenuation facilities upstream of proposed outfall to the public network, to attenuate discharges to the undeveloped Greenfield run-off rates with the operation of proprietary hydrobrake flow-control devices. The attenuation facility is sized on the basis of a design storm with a 100-year return period and an additional 20% allowance for the effect of climate change.

The attenuation facilities will be in the form of a series of interlinked attenuation tanks. They will be an off-line component of the drainage network into which runoff is diverted once flows reach a specified threshold.

3 Foul Sewer System

3.1 Foul Sewer Design

A Pre-Connection Enquiry was submitted to Irish Water on 19th December 2019. The Irish Water Reference Number for this enquiry is CDS19008826. The response to this Enquiry was issued by Irish Water on 15th December 2020. This confirmed that, subject to a valid connection agreement being put in place, the proposed connection to the Irish Water network could be facilitated. There is an existing pumping station serving four houses adjacent to the proposed development. In order to connect to the wastewater network it will be necessary to decommission this and construct a new pumping station to pump wastewater within the confines of the existing pumping station compound across the N40 South Link road into the Cork City sewer network. The sewer network in the Bishopstown area is currently overloaded. Upgrades to this sewer network will be required to facilitate this connection. There is an ongoing study in this area to identify the precise upgrades required to facilitate development in the area. The exact scope of upgrades will be identified when this study is completed. No third-party consents will be required for these upgrade works.

The foul sewer has been designed using the System 1 and Simulation Modules of the Micro-drainage package. The foul network design addresses present day design issues and can view velocities at Full Bore, Proportional Depth and 1/3 flow.

A model of the proposed foul drainage network was built using the micro-drainage software applications. The model was analysed and amended until the results met with the design criteria specified.

The network has been designed to achieve self-cleansing velocities at 1/3 flow whilst maintaining minimum gradients. Design summary sheets are contained in Appendix G.

3.1.1 Development Breakdown

137 No. Dwellings & 139 No. Apartments

Section 3.6 of The Irish Water Code of Practice Wastewater Infrastructure states that for the gravity sewers shall be designed to carry a minimum wastewater volume of 6 times the dry weather flow (6DWF) which is to be taken as 446 litres per dwelling

Loading = (276) (446) / (24) (60) (60) = 1.425 litres/second

6DWF =8.550 litres/second

The layout of the proposed foul sewer network is shown on the Proposed Stormwater & Foul Sewer Layout Plan Drawing No.'s 5181-0420, 5181-0421, 5181-0422, 5181-0423, 5181-0424, 5181-0460, 5181-0461 & 5181-0462.

The overall quantity of wastewater for the proposed development is estimated at 123.10m^3 per day.

This is based on the unit schedule submitted by the architect. The foul waste within the development will be collected via an internal gravity network and will discharge to the public foul sewer via the upgraded pumping station and utilising the existing rising main which has been taken in charge by Cork County Council/Irish Water.

All works will be in accordance with Irish Water Code of Practice for Wastewater Supply & the Wastewater Infrastructure Standard Details Document Number: IW-CDS-5030-01.

3.2 Pumping Station Design

The pumping stations will be designated as a Type-3 pumping station as per the Irish Water Code of Practice. The storage provided in both pumping stations shall equate to 24-hour storage capacity at dry weather flow (DWF) or 446l/dwelling.

All details relating to the size, location & layout of the pumping station will be in accordance with Part 5 - Pumping Stations of the IW Code of Practice.

Based on the development breakdown of 276 no. dwellings this will require a storage volume of;

Proposed Storage = 24 hours

Storage Capacity required = (276units) (446l/unit)

= 123,096 liters or 123.09m^3

4 Water Supply

As with the drainage network, a Pre-Connection Enquiry was submitted to Irish Water under Reference No. CDS19008826. This confirmed that, subject to a valid connection agreement being put in place, the proposed connection to the Irish Water network could be facilitated. The Statement of Design Acceptance as issued by Irish Water is included in Appendix A of this Report.

It is proposed to provide a new 100mm/150mm (internal diameter) HDPE connection to the public watermain on the Waterfall Road with associated valves and metering requirements. Internally within the development it is proposed to have a series of 100mm Ø branches and loops with associated hydrants, valves and metering requirements.

Water distribution supply to each building will be sized to cater for the requirements of those particular uses. Metered connections will be made to the main in accordance with Irish Water specifications and details.

The layout of the proposed watermain network is shown on the Proposed Watermain Layout Plan Drawing No.'s 5181-0431 & 5181-0432.

All works will be in accordance with Irish Water Code of Practice for Water Supply & the Water Infrastructure Standard Details Document Number: IW-CDS-5020-01.

5 Summary of Results

The storm water network was built and analysed using the Microdrainage Software application and were assessed for a 1 in 2 year storm & 1 in 100 year storm. A summary of the results is shown in Tables 5.1 below and in the Microdrainage outputs in the Appendices.

The global variables, pipeline and manhole schedules for both the surface water network and foul network were printed and are included in the Appendices. These show the basic pipe details such as pipe length, diameter, roughness coefficient, upstream invert, velocity, etc.

Table 5.1 Summary of Surcharge and Flooding

Attenuation Tank Reference	Storm Event	Results
Attenuation Tank No. 1	1 in 2 year	No surcharge of the stormwater network
	1 in 100 year	Surcharge
Attenuation Tank No. 2	1 in 2 year	No surcharge of the stormwater network
	1 in 100 year	Surcharge
Attenuation Tank No. 3	1 in 2 year	No surcharge of the stormwater network
	1 in 100 year	Surcharge
Attenuation Tank No. 4	1 in 2 year	No surcharge of the stormwater network
	1 in 100 year	Surcharge
Attenuation Tank No. 5	1 in 2 year	No surcharge of the stormwater network
	1 in 100 year	Surcharge

The stormwater system is designed to ensure no surcharge occurs during a 1 in 2-year return period event.

No flooding was predicted to occur for the 1 in 100-year return period event. Surcharging and flood risk occurred for a number of critical storm events but this is allowed and does not compromise the network.

Table 5.2 Outlet Control Summary

Attenuation Tank Reference	Hydrobrake Reference	Limiting Discharge (l/s)	Design Head (m)	Hydrobrake Diameter (mm)
Attenuation Tank No. 1	MD4	6.70 l/sec	2.50	74
Attenuation Tank No. 2	MD4	7.40 l/sec	2.50	78
Attenuation Tank No. 3	MD4	6.30 l/sec	2.50	129
Attenuation Tank No. 4	MD4	3.30 l/sec	2.00	147
Attenuation Tank No. 5	MD4	1.20 l/sec	1.50	36

Table 5.3: Storage Tank Summary

Tank No.	Storage Type	Capacity (m^3)	Invert Level (m)	Maximum Storage Level (m)
Attenuation Tank No. 1	Concrete Attenuation Tank	551.0	31.000	33.500
Attenuation Tank No. 2	Concrete Attenuation Tank	551.0	32.000	34.500
Attenuation Tank No. 3	Concrete Attenuation Tank	560.0	27.000	29.500
Attenuation Tank No. 4	Concrete Attenuation Tank	297.0	20.000	22.000
Attenuation Tank No. 5	Concrete Attenuation Tank	105.0	18.250	19.750

The foul water network model was built and analysed using the Micro-drainage Software application and was assessed to ensure velocities maintained a self-cleansing velocity. The system will consist of an internal gravity network discharging to the existing Irish Water asset.

Appendix A –Irish Water Pre-Connection Enquiry & Statement of Design Acceptance

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

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

www.water.ie

Stephen O' Grady
DOSA Consulting Engineers
Joyce House
Barrack Square
Ballincollig,
Co. Cork
P31KP84

12 February 2021

Re: Design Submission for Ardarostig, Bishopstown, Co. Cork (the "Development") (the "Design Submission") / Connection Reference No: CDS19008826

Dear Stephen O' Grady,

Many thanks for your recent Design Submission.

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

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

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

If you have any further questions, please contact your Irish Water representative:
Name: Dario Alvarez
Email: dalvarez@water.ie

Yours sincerely,

Yvonne Harris

Yvonne Harris
Head of Customer Operations

Stiúrthóirí / Directors: Cathal Marley (Chairman), Niall Gleeson, Eamon Gallen, Yvonne Harris, Brendan Murphy, Maria O'Dwyer
Oifig Chláraithe / Registered Office: Teach Colvill, 24-26 Sráid Thalbóid, Baile Átha Cliath 1, D01 NP86 / Colvill House, 24-26 Talbot Street, Dublin 1, D01 NP86
Is cuideachta ghníomhaíochta ainmnithe atá faoi theorainn scaireanna é Uisce Éireann / Irish Water is a designated activity company, limited by shares.
Uimhir Chláraithe in Éirinn / Registered in Ireland No.: 530363

IW-HP-MD

REV012

Appendix A

Document Title & Revision

- [5181-0431 –Rev. D - Proposed watermain layout 1]
- [5181-0432 –Rev. C - Proposed watermain layout 2]
- [5181-0422 –Rev. C - Proposed drainage layout 1]
- [5181-0423 –Rev. C - Proposed drainage layout 2]
- [5181-0460 –Rev. B - Proposed foul drainage longitudinal sections 1]
- [5181-0461 –Rev. A - Proposed foul drainage longitudinal sections 2]
- [5181-0462 –Rev. A - Proposed foul drainage longitudinal sections 3]

Standard Details/Code of Practice Exemption: N/A

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

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

Stephen O' Grady

Joyce House
Barrack Square
Ballincollig
Co. Cork
P31KP84

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

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

www.water.ie

15 December 2020

Re: CDS19008826 pre-connection enquiry - Subject to contract | Contract denied

Connection for Housing Development of 275 unit(s) at Ardarostig, Bishopstown, Co. Cork

Dear Sir/Madam,

Irish Water has reviewed your pre-connection enquiry in relation to a Water & Wastewater connection at Ardarostig, Bishopstown, Co. Cork (the **Premises**). Based upon the details you have provided with your pre-connection enquiry and on our desk top analysis of the capacity currently available in the Irish Water network(s) as assessed by Irish Water, we wish to advise you that your proposed connection to the Irish Water network(s) can be facilitated at this moment in time.

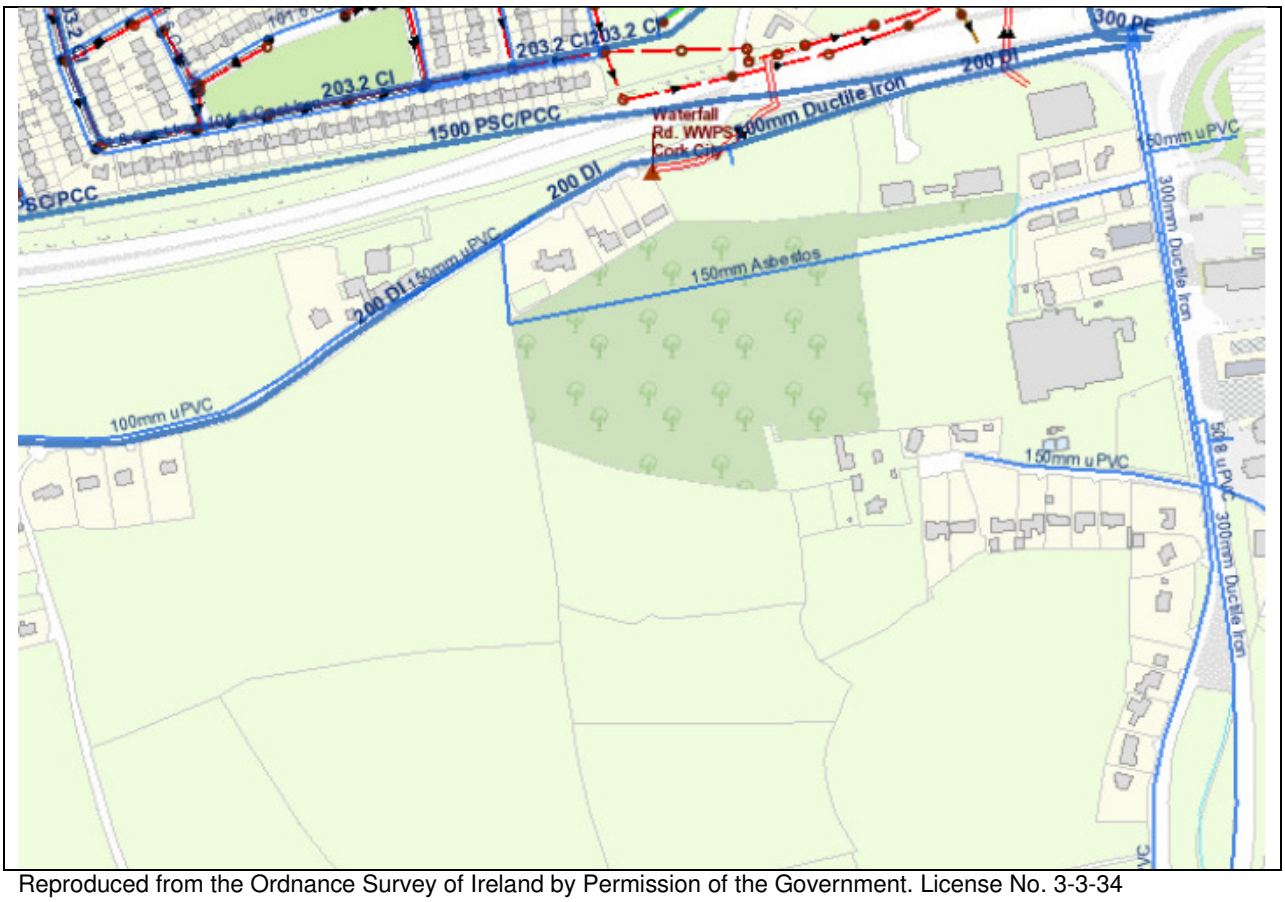
This letter supersedes the letter issue on 17th February 2020. As Irish Water have already made our submission to An Bord Pleanála, this revised position will be advised An Bord Pleanála at connection application stage.

SERVICE	**OUTCOME OF PRE-CONNECTION ENQUIRY** **THIS IS NOT A CONNECTION OFFER. YOU MUST APPLY FOR A CONNECTION(S) TO THE IRISH WATER NETWORK(S) IF YOU WISH TO PROCEED.**
Water Connection	Feasible without upgrades
Wastewater Connection	Feasible subject to upgrades
SITE SPECIFIC COMMENTS	
Water Connection	Feasible without upgrades
Wastewater Connection	The sewer network in the Bishopstown area is currently overloaded. Upgrades to this sewer network will be required to facilitate this connection. There is an ongoing study in this area to identify the precise upgrades required to facilitate development in the area. The exact scope of upgrades will be identified when this study is completed. No third party consents will be required for these upgrade works.

Stiúrthóirí / Directors: Cathal Marley (Chairman), Niall Gleeson, Eamon Gallen, Yvonne Harris, Brendan Murphy, Maria O'Dwyer
Oifig Chláraithe / Registered Office: Teach Colvill, 24-26 Sráid Thalbóid, Baile Átha Cliath 1, D01 NP86 / Colvill House, 24-26 Talbot Street, Dublin 1, D01 NP86
Is cuideachta ghníomhaíochta ainmnithe atá faoi theorainn scaireanna é Uisce Éireann / Irish Water is a designated activity company, limited by shares.
Uimhir Chláraithe in Éirinn / Registered in Ireland No.: 530363

The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this development shall comply with the Irish Water Connections and Developer Services Standard Details and Codes of Practice that are available on the Irish Water website. Irish Water reserves the right to supplement these requirements with Codes of Practice and these will be issued with the connection agreement.

The map included below outlines the current Irish Water infrastructure adjacent to your site:



Reproduced from the Ordnance Survey of Ireland by Permission of the Government. License No. 3-3-34

Whilst every care has been taken in its compilation Irish Water gives this information as to the position of its underground network as a general guide only on the strict understanding that it is based on the best available information provided by each Local Authority in Ireland to Irish Water. Irish Water can assume no responsibility for and give no guarantees, undertakings or warranties concerning the accuracy, completeness or up to date nature of the information provided and does not accept any liability whatsoever arising from any errors or omissions. This information should not be relied upon in the event of excavations or any other works being carried out in the vicinity of the Irish Water underground network. The onus is on the parties carrying out excavations or any other works to ensure the exact location of the Irish Water underground network is identified prior to excavations or any other works being carried out. Service connection pipes are not generally shown but their presence should be anticipated.

General Notes:

1) The initial assessment referred to above is carried out taking into account water demand and wastewater discharge volumes and infrastructure details on the date of the assessment. **The availability of capacity may change at any date after this assessment.**

2) This feedback does not constitute a contract in whole or in part to provide a connection to any Irish Water infrastructure. All feasibility assessments are subject to the constraints of the Irish Water Capital Investment Plan.
3) The feedback provided is subject to a Connection Agreement/contract being signed at a later date.
4) A Connection Agreement will be required to commencing the connection works associated with the enquiry this can be applied for at https://www.water.ie/connections/get-connected/
5) A Connection Agreement cannot be issued until all statutory approvals are successfully in place.
6) Irish Water Connection Policy/ Charges can be found at https://www.water.ie/connections/information/connection-charges/
7) Please note the Confirmation of Feasibility does not extend to your fire flow requirements.
8) Irish Water is not responsible for the management or disposal of storm water or ground waters. You are advised to contact the relevant Local Authority to discuss the management or disposal of proposed storm water or ground water discharges
9) To access Irish Water Maps email datarequests@water.ie
10) All works to the Irish Water infrastructure, including works in the Public Space, shall have to be carried out by Irish Water.

If you have any further questions, please contact Brian O'Mahony from the design team on 022 52205 or email bomahony@water.ie For further information, visit **www.water.ie/connections.**

Yours sincerely,

Yvonne Harris

Head of Customer Operations

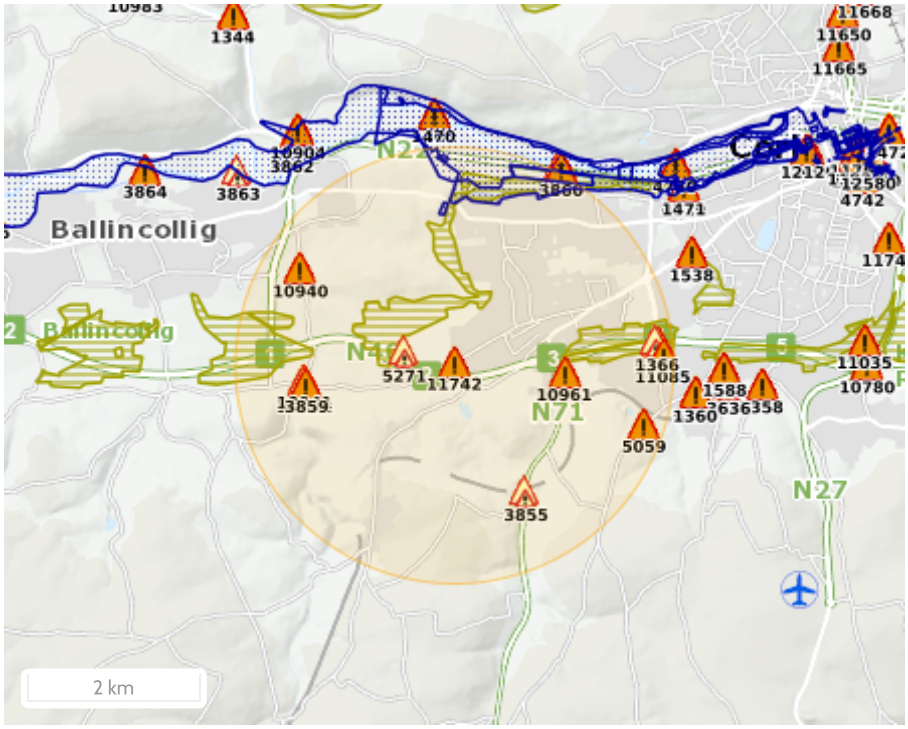
Appendix B – Floodinfo.ie Extract

Past Flood Event Local Area Summary Report

Report Produced: **26/1/2021 21:37**

This Past Flood Event Summary Report summarises all past flood events within 2.5 kilometres of the map centre.

This report has been downloaded from www.floodinfo.ie (the "**Website**"). The users should take account of the restrictions and limitations relating to the content and use of the Website that are explained in the Terms and Conditions. It is a condition of use of the Website that you agree to be bound by the disclaimer and other terms and conditions set out on the Website and to the privacy policy on the Website.



Map Legend

- Single Flood Event
- Recurring Flood Event
- Past Flood Event Extents
- Drainage Districts Benefited Lands*
- Land Commission Benefited Lands*
- Arterial Drainage Schemes Benefited Lands*

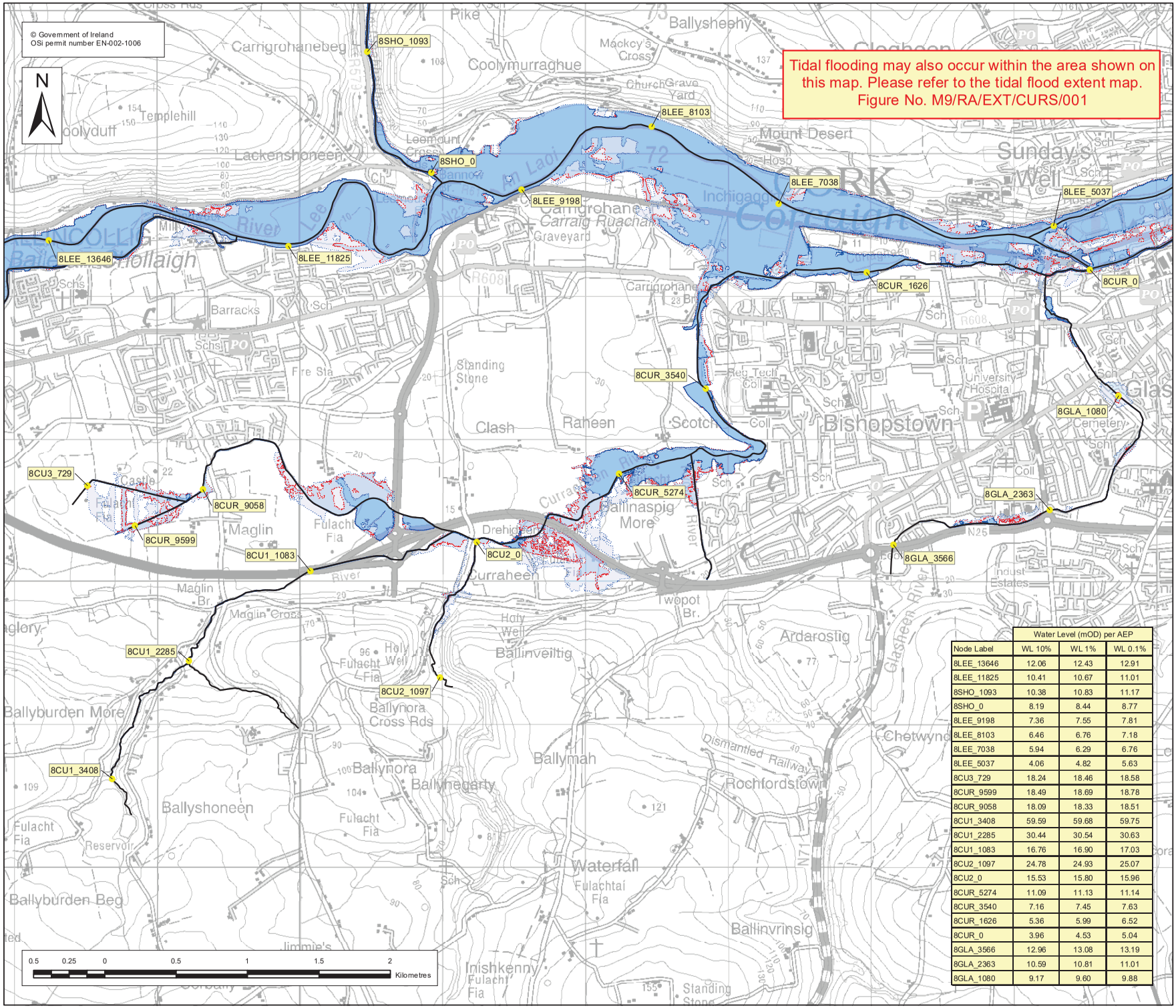
* Important: These maps do not indicate flood hazard or flood extent. Their purpose and scope is explained on Floodinfo.ie

15 Results

	Name (Flood_ID)	Start Date	Event Location
1.	Road flooding N71 viaduct Co. Cork Recurring (ID-3855)	n/a	Approximate Point
	Additional Information: Reports (3) Press Archive (0)		
2.	Curraheen River Clash road Recurring (ID-3859)	n/a	Approximate Point
	Additional Information: Reports (3) Press Archive (1)		
3.	Sarsfield Road Wilton Cork City Jan 1993 (ID-1366)	08/08/1993	Approximate Point
	Additional Information: Reports (3) Press Archive (0)		
4.	Lee Inniscarra to Cork City Aug 1986 (ID-492)	05/08/1986	Area
	Additional Information: Reports (8) Press Archive (3)		
5.	Spur Hill LP2452 Nov 2002 (ID-5059)	27/11/2002	Approximate Point
	Additional Information: Reports (3) Press Archive (0)		
6.	Curraheen Bishopstown recurring (ID-5271)	n/a	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		

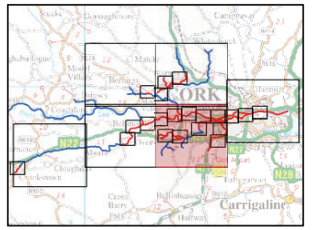
	Name (Flood_ID)	Start Date	Event Location
7.	Sarsfield Road, Wilton, Cork City recurring (ID-5325)	n/a	Approximate Point
	Additional Information: Reports (2) Press Archive (0)		
8.	Curragheen Technology Park, Cork on 28th.June 2012 (ID-11742)	27/06/2012	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		
9.	Cork City Flooding 19th.Nov. 2009 (ID-10820)	19/11/2009	Area
	Additional Information: Reports (4) Press Archive (0)		
10.	Clash Road Ballincollig Co.Cork 19th.Nov.09 (ID-10940)	19/11/2009	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		
11.	Curraheen,Ballincollig,Co.Cork.Flooding 19th.Nov.2009 (ID-10941)	19/11/2009	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		
12.	Flooding at Bishopstown Co Cork Nov 2009 (ID-10961)	19/11/2009	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		
13.	Sarsfield Road Roundabout N22 Cork 12th January 2010 (ID-11085)	12/01/2010	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		
14.	Curraheen,Ballincollig,Co.Cork. Dec.2009 and Jan.2010 (ID-11422)	n/a	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		
15.	Curraheen, Co.Cork. 28th June 2012 (ID-11671)	28/06/2012	Approximate Point
	Additional Information: Reports (2) Press Archive (0)		

Appendix C – CFRAMS Map



Node Label	Water Level (mOD) per AEP		
	WL 10%	WL 1%	WL 0.1%
8LEE_13646	12.06	12.43	12.91
8LEE_11825	10.41	10.67	11.01
8SHO_1093	10.38	10.83	11.17
8SHO_0	8.19	8.44	8.77
8LEE_9198	7.36	7.55	7.81
8LEE_8103	6.46	6.76	7.18
8LEE_7038	5.94	6.29	6.76
8LEE_5037	4.06	4.82	5.63
8CU3_729	18.24	18.46	18.58
8CUR_9599	18.49	18.69	18.78
8CUR_9058	18.09	18.33	18.51
8CU1_3408	59.59	59.68	59.75
8CU1_2285	30.44	30.54	30.63
8CU1_1083	16.76	16.90	17.03
8CU2_1097	24.78	24.93	25.07
8CU2_0	15.53	15.80	15.96
8CUR_5274	11.09	11.13	11.14
8CUR_3540	7.16	7.45	7.63
8CUR_1626	5.36	5.99	6.52
8CUR_0	3.96	4.53	5.04
8GLA_3566	12.96	13.08	13.19
8GLA_2363	10.59	10.81	11.01
8GLA_1080	9.17	9.60	9.88

Location Plan :



EXTENT MAP

Legend:

- 10 % AEP Flood Extent (1 in 10 chance in any given year)
- 1 % AEP Flood Extent (1 in 100 chance in any given year)
- 0.1 % AEP Flood Extent (1 in 1000 chance in any given year)
- Defended area
- High Confidence (<20m) (10% AEP)
- Medium Confidence (<40m) (10% AEP)
- Low Confidence (>40m) (10% and 0.1% AEP)
- High Confidence (<20m) (1% AEP)
- Medium Confidence (<40m) (1% AEP)
- Low Confidence (>40m) (1% AEP)
- River Centreline
- Node Point
- 8OWG_376 Node Label (refer to table)

USER NOTE :

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Ireland

OPW
Office of Public Works
17-19 Lower Hatch Street
Dublin 2
Ireland

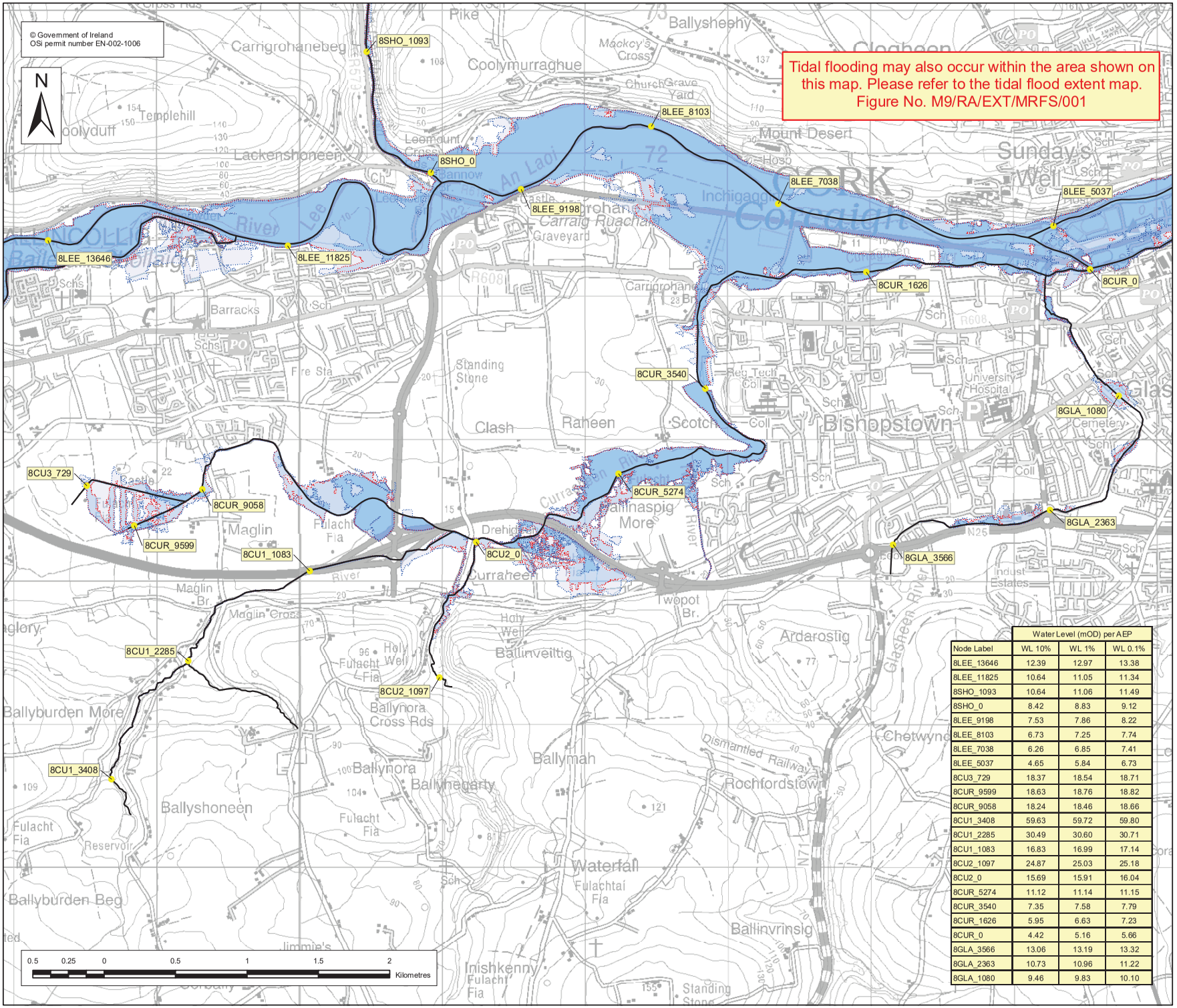
Project :
LEE CATCHMENT FLOOD RISK ASSESSMENT AND MANAGEMENT STUDY

Map :
LOWER LEE MODEL FLOOD EXTENT MAP

Map Type :	FLOOD EXTENT		
Source :	FLUVIAL FLOODING		
Map area :	RURAL AREA		
Scenario :	CURRENT		
Figure By :	Valeria Medina	Date :	10 March 2014
Checked By :	Ricardo Santaella	Date :	10 March 2014
Approved By :	Clare Dewar	Date :	10 March 2014

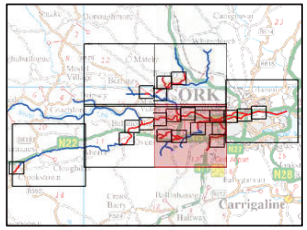
Figure No. : M8/RA/EXT/CURS/005
Revision 2

Drawing Scale : 1:25,000 Plot Scale : 1:1 @ A3



Node Label	Water Level (mOD) per AEP		
	WL 10%	WL 1%	WL 0.1%
8LEE_13646	12.39	12.97	13.38
8LEE_11825	10.64	11.05	11.34
8SHO_1093	10.64	11.06	11.49
8SHO_0	8.42	8.83	9.12
8LEE_9198	7.53	7.86	8.22
8LEE_8103	6.73	7.25	7.74
8LEE_7038	6.26	6.85	7.41
8LEE_5037	4.65	5.84	6.73
8CU3_729	18.37	18.54	18.71
8CUR_9599	18.63	18.76	18.82
8CUR_9058	18.24	18.46	18.66
8CU1_3408	59.63	59.72	59.80
8CU1_2285	30.49	30.60	30.71
8CU1_1083	16.83	16.99	17.14
8CU2_1097	24.87	25.03	25.18
8CU2_0	15.69	15.91	16.04
8CUR_5274	11.12	11.14	11.15
8CUR_3540	7.35	7.58	7.79
8CUR_1626	5.95	6.63	7.23
8CUR_0	4.42	5.16	5.66
8GLA_3566	13.06	13.19	13.32
8GLA_2363	10.73	10.96	11.22
8GLA_1080	9.46	9.83	10.10

Location Plan :



EXTENT MAP

Legend:

- 10 % AEP Flood Extent (1 in 10 chance in any given year)
- 1 % AEP Flood Extent (1 in 100 chance in any given year)
- 0.1 % AEP Flood Extent (1 in 1000 chance in any given year)
- Defended area
- High Confidence (<20m) (10% AEP)
- Medium Confidence (<40m) (10% AEP)
- Low Confidence (>40m) (10% and 0.1% AEP)
- High Confidence (<20m) (1% AEP)
- Medium Confidence (<40m) (1% AEP)
- Low Confidence (>40m) (1% AEP)
- River Centreline
- Node Point
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17-19 Lower Hatch Street
Dublin 2
Ireland

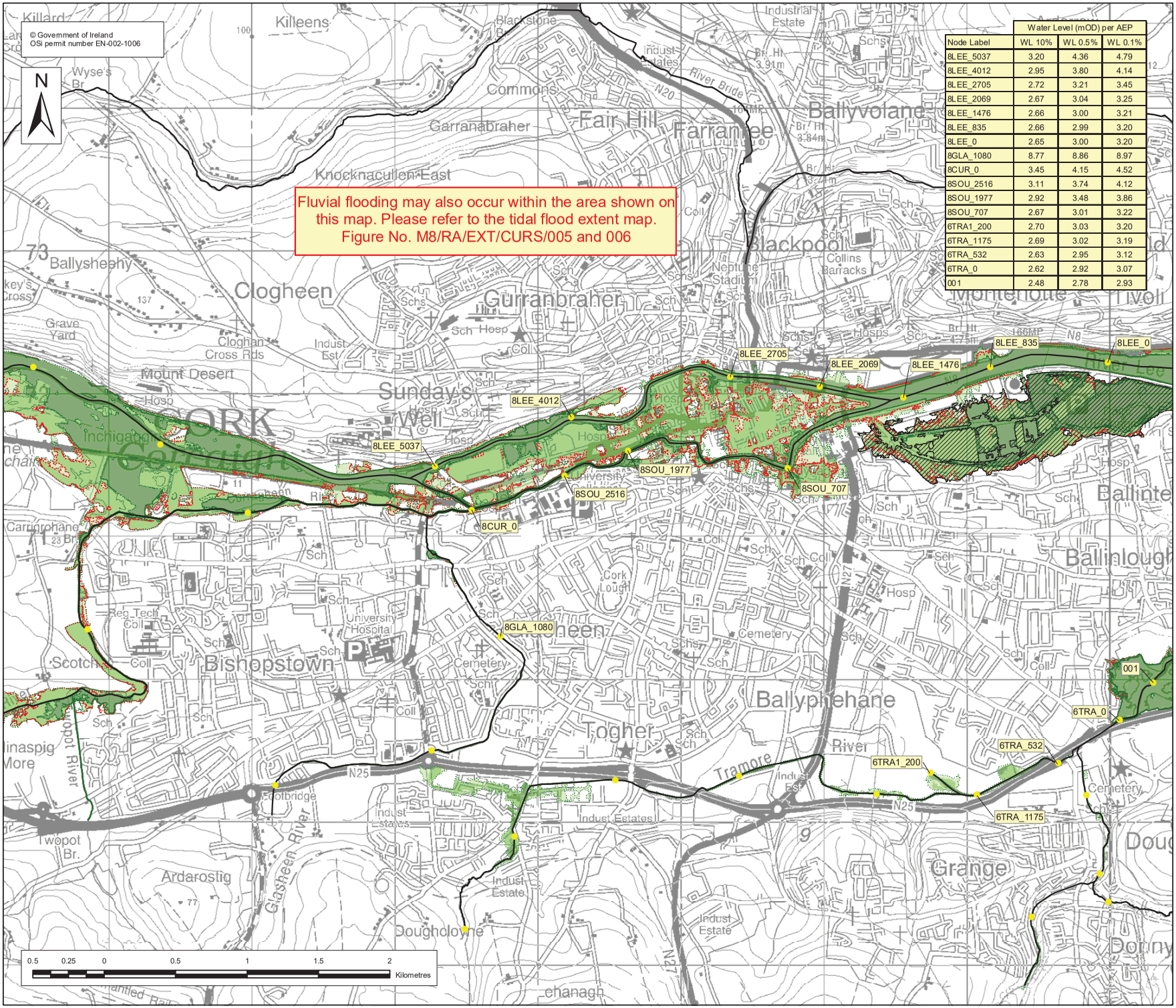
Project :
LEE CATCHMENT FLOOD RISK ASSESSMENT AND MANAGEMENT STUDY

Map :
LOWER LEE MODEL FLOOD EXTENT MAP

Map Type :	FLOOD EXTENT		
Source :	FLUVIAL FLOODING		
Map area :	RURAL AREA		
Scenario :	MID RANGE FUTURE SCENARIO		
Figure By :	Valeria Medina	Date :	10 March 2014
Checked By :	Ricardo Santaella	Date :	10 March 2014
Approved By :	Clare Dewar	Date :	10 March 2014

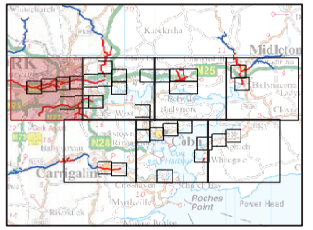
Figure No. : M8/RA/EXT/MRFS/005
Revision 2

Drawing Scale : 1:25,000 Plot Scale : 1:1 @ A3



	Water Level (mOD) per AEP		
Node Label	WL 10%	WL 0.5%	WL 0.1%
8LEE_5037	3.20	4.36	4.79
8LEE_4012	2.95	3.80	4.14
8LEE_2705	2.72	3.21	3.45
8LEE_2069	2.67	3.04	3.25
8LEE_1476	2.66	3.00	3.21
8LEE_835	2.66	2.99	3.20
8LEE_0	2.65	3.00	3.20
8GLA_1080	8.77	8.86	8.97
8CUR_0	3.45	4.15	4.52
8SOU_2516	3.11	3.74	4.12
8SOU_1977	2.92	3.48	3.86
8SOU_707	2.67	3.01	3.22
6TRA1_200	2.70	3.03	3.20
6TRA_1175	2.69	3.02	3.19
6TRA_532	2.63	2.95	3.12
6TRA_0	2.62	2.92	3.07
001	2.48	2.78	2.93

Location Plan :



EXTENT MAP

Legend:

- 10 % AEP Flood Extent (1 in 10 chance in any given year)
- 0.5 % AEP Flood Extent (1 in 200 chance in any given year)
- 0.1 % AEP Flood Extent (1 in 1000 chance in any given year)
- Defended area
- High Confidence (<20m) (10% AEP)
- Medium Confidence (<40m) (10% AEP)
- Low Confidence (> 40m) (10% and 0.1% AEP)
- High Confidence (<20m) (0.5% AEP)
- Medium Confidence (<40m) (0.5% AEP)
- Low Confidence (>40m) (0.5% AEP)
- River Centreline
- Node Point
- 001 Node Label (refer to table)

USER NOTE :

USERS OF THESE MAPS SHOULD REFER TO THE DETAILED DESCRIPTION OF THEIR DERIVATION, LIMITATIONS IN ACCURACY AND GUIDANCE AND CONDITIONS OF USE PROVIDED AT THE FRONT OF THIS BOUND VOLUME. IF THIS MAP DOES NOT FORM PART OF A BOUND VOLUME, IT SHOULD NOT BE USED FOR ANY PURPOSE.

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Dublin 2
Ireland

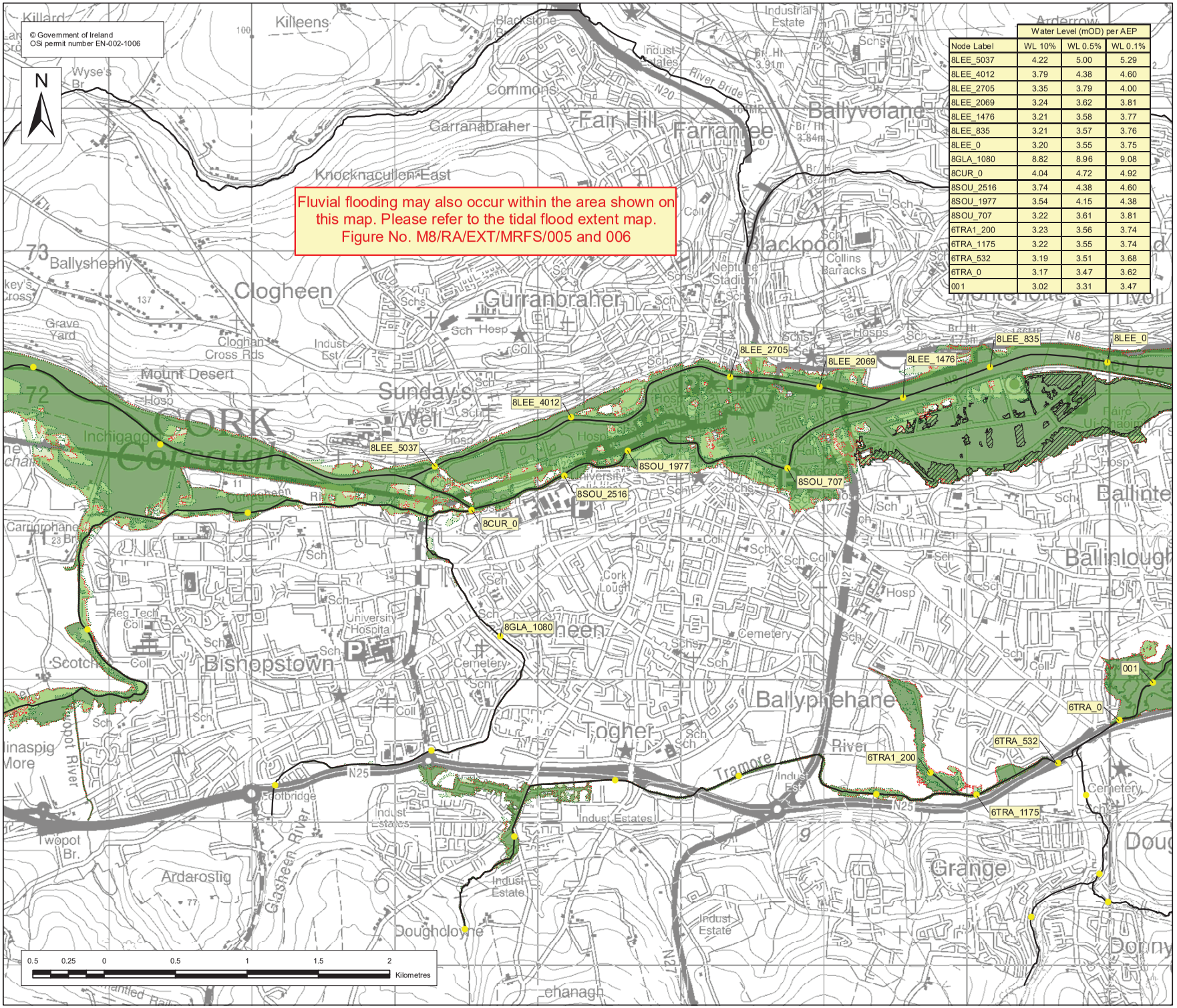
Project :
LEE CATCHMENT FLOOD RISK ASSESSMENT AND MANAGEMENT STUDY

Map :
HARBOUR MODEL FLOOD EXTENT MAP

Map Type :	FLOOD EXTENT		
Source :	TIDAL FLOODING		
Map area :	RURAL AREA		
Scenario :	CURRENT		
Figure By :	Valeria Medina	Date :	10 March 2014
Checked By :	Ricardo Santaella	Date :	10 March 2014
Approved By :	Clare Dewar	Date :	10 March 2014

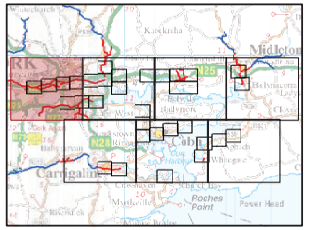
Figure No. : M9/RA/EXT/CURS/001
Revision 2

Drawing Scale : 1:25,000 Plot Scale : 1:1 @ A3



Node Label	Water Level (mOD) per AEP		
	WL 10%	WL 0.5%	WL 0.1%
8LEE_5037	4.22	5.00	5.29
8LEE_4012	3.79	4.38	4.60
8LEE_2705	3.35	3.79	4.00
8LEE_2069	3.24	3.62	3.81
8LEE_1476	3.21	3.58	3.77
8LEE_835	3.21	3.57	3.76
8LEE_0	3.20	3.55	3.75
8GLA_1080	8.82	8.96	9.08
8CUR_0	4.04	4.72	4.92
8SOU_2516	3.74	4.38	4.60
8SOU_1977	3.54	4.15	4.38
8SOU_707	3.22	3.61	3.81
6TRA1_200	3.23	3.56	3.74
6TRA_1175	3.22	3.55	3.74
6TRA_532	3.19	3.51	3.68
6TRA_0	3.17	3.47	3.62
001	3.02	3.31	3.47

Location Plan :



EXTENT MAP

Legend:

- 10 % AEP Flood Extent (1 in 10 chance in any given year)
- 0.5 % AEP Flood Extent (1 in 200 chance in any given year)
- 0.1 % AEP Flood Extent (1 in 1000 chance in any given year)
- Defended area
- High Confidence (<20m) (10% AEP)
- Medium Confidence (<40m) (10% AEP)
- Low Confidence (> 40m) (10% and 0.1% AEP)
- High Confidence (<20m) (0.5% AEP)
- Medium Confidence (<40m) (0.5% AEP)
- Low Confidence (>40m) (0.5% AEP)
- River Centreline
- Node Point
- Node Label (refer to table)

USER NOTE :

USERS OF THESE MAPS SHOULD REFER TO THE DETAILED DESCRIPTION OF THEIR DERIVATION, LIMITATIONS IN ACCURACY AND GUIDANCE AND CONDITIONS OF USE PROVIDED AT THE FRONT OF THIS BOUND VOLUME. IF THIS MAP DOES NOT FORM PART OF A BOUND VOLUME, IT SHOULD NOT BE USED FOR ANY PURPOSE.

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Dublin 2
Ireland

Project :
LEE CATCHMENT FLOOD RISK ASSESSMENT AND MANAGEMENT STUDY

Map :
HARBOUR MODEL FLOOD EXTENT MAP

Map Type :	FLOOD EXTENT		
Source :	TIDAL FLOODING		
Map area :	RURAL AREA		
Scenario :	MID RANGE FUTURE SCENARIO		
Figure By :	Valeria Medina	Date :	10 March 2014
Checked By :	Ricardo Santaella	Date :	10 March 2014
Approved By :	Clare Dewar	Date :	10 March 2014

Figure No. : M9/RA/EXT/MRFS/001
Revision 2

Drawing Scale : 1:25,000 Plot Scale : 1:1 @ A3

Appendix D – Allowable Runoff QBAR Values

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.300
Area (ha)	2.090	Urban	0.000
SAAR (mm)	1131	Region Number	Ireland South

Results l/s

QBAR Rural	6.7
QBAR Urban	6.7
Q100 years	12.3
Q1 year	5.7
Q30 years	10.6
Q100 years	12.3

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ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.300
Area (ha)	2.310	Urban	0.000
SAAR (mm)	1131	Region Number	Ireland South

Results l/s

QBAR Rural	7.4
QBAR Urban	7.4
Q100 years	13.6
Q1 year	6.3
Q30 years	11.7
Q100 years	13.6

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Denis O'Sullivan & Associates		Page 1
Unit 5, Joyce House Barrack Square Ballincollig, Co. Cork	Catchment Area No. 3 Residential Development Ardarostig, Bishopstown	
Date 19/01/2021 File	Designed By S.O.'Grady Checked By	
Micro Drainage	Source Control W.12.4	

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.300
Area (ha)	1.960	Urban	0.000
SAAR (mm)	1131	Region Number	Ireland South

Results l/s

QBAR Rural	6.3
QBAR Urban	6.3
Q100 years	11.5
Q1 year	5.3
Q30 years	10.0
Q100 years	11.5

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ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.300
Area (ha)	1.030	Urban	0.000
SAAR (mm)	1131	Region Number	Ireland South

Results l/s

QBAR Rural	3.3
QBAR Urban	3.3
Q100 years	6.1
Q1 year	2.8
Q30 years	5.2
Q100 years	6.1

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ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.300
Area (ha)	0.380	Urban	0.000
SAAR (mm)	1131	Region Number	Ireland South

Results l/s

QBAR Rural	1.2
QBAR Urban	1.2
Q100 years	2.2
Q1 year	1.0
Q30 years	1.9
Q100 years	2.2

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Appendix E – 1 in 2 Year Design Sheets

Denis O'Sullivan & Associates		Page 1
Unit 5, Joyce House Barrack Square Ballincollig, Co. Cork	Resdiential Development Ardarostig Bishopstown, Cork	
Date 15/01/2021 File SW MOdel.MDX	Designed By S.O.'Grady Checked By	
Micro Drainage	Network W.12.4	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	100	Add Flow / Climate Change (%)	10
M5-60 (mm)	18.800	Minimum Backdrop Height (m)	0.200
Ratio R	0.300	Maximum Backdrop Height (m)	1.500
Maximum Rainfall (mm/hr)	50	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Time Area Diagram for Storm at outfall SEXIS SW01 (pipe S1.020)

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	1.238	4-8	2.367	8-12	0.250

Total Area Contributing (ha) = 3.855

Total Pipe Volume (m³) = 80.844

Time Area Diagram at outfall SExis SW01 (pipe S14.006)

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.232	4-8	0.083

Total Area Contributing (ha) = 0.315

Total Pipe Volume (m³) = 5.690

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S1.000	32.250	0.750	43.0	0.098	5.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	5.27	35.250	0.098	0.0	0.0	1.3	2.00	79.5	14.6

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S1.001	53.600	0.319	168.0	0.064	0.00	0.0	0.600	o	225
S1.002	50.800	0.302	168.2	0.064	0.00	0.0	0.600	o	225
S2.000	19.950	0.850	23.5	0.087	5.00	0.0	0.600	o	225
S1.003	51.700	0.308	167.9	0.040	0.00	0.0	0.600	o	300
S3.000	21.650	0.350	61.9	0.114	5.00	0.0	0.600	o	225
S4.000	57.250	1.150	49.8	0.134	5.00	0.0	0.600	o	225
S1.004	61.700	1.146	53.8	0.221	0.00	0.0	0.600	o	300
S1.005	56.500	0.336	168.2	0.129	0.00	0.0	0.600	o	375
S1.006	4.500	0.027	166.7	0.000	0.00	0.0	0.600	o	375
S1.007	2.000	0.010	200.0	0.000	0.00	0.0	0.600	o	450
S1.008	7.000	0.035	200.0	0.000	0.00	0.0	0.600	o	450
S1.009	37.950	0.190	199.7	0.117	0.00	0.0	0.600	o	225
S1.010	53.200	1.775	30.0	0.139	0.00	0.0	0.600	o	225
S5.000	23.500	0.350	67.1	0.090	5.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.001	50.00	6.16	34.500	0.162	0.0	0.0	2.2	1.01	40.0	24.1
S1.002	50.00	7.00	34.181	0.226	0.0	0.0	3.1	1.01	40.0	33.7
S2.000	50.00	5.12	36.200	0.087	0.0	0.0	1.2	2.71	107.8	13.0
S1.003	50.00	7.71	33.879	0.353	0.0	0.0	4.8	1.21	85.6	52.6
S3.000	50.00	5.22	36.100	0.114	0.0	0.0	1.5	1.67	66.2	17.0
S4.000	50.00	5.51	36.900	0.134	0.0	0.0	1.8	1.86	73.9	20.0
S1.004	50.00	8.19	33.571	0.822	0.0	0.0	11.1	2.15	151.8	122.4
S1.005	50.00	8.87	32.425	0.951	0.0	0.0	12.9	1.39	154.0	141.7
S1.006	50.00	8.92	32.089	0.951	0.0	0.0	12.9	1.40	154.7	141.7
S1.007	50.00	8.94	32.062	0.951	0.0	0.0	12.9	1.43	228.1	141.7
S1.008	50.00	9.02	31.000	0.951	0.0	0.0	12.9	1.43	228.1	141.7
S1.009	50.00	5.69	30.965	0.000	6.7	0.0	0.6	0.92	36.6	6.7
S1.010	50.00	6.06	30.775	0.139	6.7	0.0	2.6	2.40	95.4	28.1
S5.000	50.00	5.25	29.350	0.090	0.0	0.0	1.2	1.60	63.6	13.4

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S1.011	25.400	0.600	42.3	0.067	0.00	0.0	0.600	o	225
S1.012	23.200	0.139	166.9	0.042	0.00	0.0	0.600	o	300
S6.000	12.950	0.350	37.0	0.060	5.00	0.0	0.600	o	225
S7.000	21.000	0.400	52.5	0.047	5.00	0.0	0.600	o	225
S6.001	66.000	1.500	44.0	0.182	0.00	0.0	0.600	o	225
S8.000	15.550	0.500	31.1	0.100	5.00	0.0	0.600	o	225
S6.002	71.700	3.500	20.5	0.142	0.00	0.0	0.600	o	225
S9.000	15.350	0.350	43.9	0.113	5.00	0.0	0.600	o	225
S6.003	24.150	1.150	21.0	0.037	0.00	0.0	0.600	o	225
S6.004	64.500	3.250	19.8	0.146	0.00	0.0	0.600	o	300
S6.005	11.700	0.059	200.0	0.027	0.00	0.0	0.600	o	375
S6.006	10.000	0.050	200.0	0.000	0.00	0.0	0.600	o	375

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.011	50.00	6.27	29.000	0.296	6.7	0.0	4.7	2.02	80.2	51.5
S1.012	50.00	6.58	28.400	0.338	6.7	0.0	5.2	1.21	85.8	57.7
S6.000	50.00	5.10	43.850	0.060	0.0	0.0	0.8	2.16	85.8	8.9
S7.000	50.00	5.19	43.900	0.047	0.0	0.0	0.6	1.81	71.9	7.0
S6.001	50.00	5.75	43.500	0.289	0.0	0.0	3.9	1.98	78.6	43.0
S8.000	50.00	5.11	42.500	0.100	0.0	0.0	1.4	2.35	93.6	14.9
S6.002	50.00	6.16	42.000	0.531	0.0	0.0	7.2	2.90	115.5	79.1
S9.000	50.00	5.13	38.850	0.113	0.0	0.0	1.5	1.98	78.8	16.8
S6.003	50.00	6.30	38.500	0.681	0.0	0.0	9.2	2.87	114.0	101.4
S6.004	50.00	6.60	37.350	0.827	0.0	0.0	11.2	3.55	250.6	123.2
S6.005	50.00	6.76	34.100	0.854	0.0	0.0	11.6	1.28	141.1	127.2
S6.006	50.00	6.89	32.000	0.854	0.0	0.0	11.6	1.28	141.1	127.2

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S10.000	77.900	2.400	32.5	0.225	5.00	0.0	0.600	o	225
S10.001	37.500	0.600	62.5	0.064	0.00	0.0	0.600	o	225
S10.002	6.500	0.108	60.0	0.000	0.00	0.0	0.600	o	225
S10.003	10.000	0.060	167.0	0.000	0.00	0.0	0.600	o	300
S6.007	90.000	2.500	36.0	0.220	0.00	0.0	0.600	o	225
S11.000	70.900	3.100	22.9	0.224	5.00	0.0	0.600	o	225
S11.001	66.700	1.560	42.8	0.169	0.00	0.0	0.600	o	225
S6.008	11.900	0.238	50.0	0.000	0.00	0.0	0.600	o	225
S6.009	10.000	0.050	200.0	0.000	0.00	0.0	0.600	o	300
S1.013	5.000	0.025	200.0	0.000	0.00	0.0	0.600	o	375
S1.014	5.000	0.025	200.0	0.000	0.00	0.0	0.600	o	225
S1.015	27.500	2.292	12.0	0.087	0.00	0.0	0.600	o	225
S12.000	27.250	2.000	13.6	0.082	5.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S10.000	50.00	5.56	36.900	0.225	0.0	0.0	3.0	2.30	91.6	33.5
S10.001	50.00	5.94	34.500	0.289	0.0	0.0	3.9	1.66	65.9	43.0
S10.002	50.00	6.00	33.900	0.289	0.0	0.0	3.9	1.69	67.3	43.0
S10.003	50.00	6.14	32.000	0.289	0.0	0.0	3.9	1.21	85.8	43.0
S6.007	50.00	5.69	31.940	0.000	7.4	0.0	0.7	2.19	87.0	7.4
S11.000	50.00	5.43	34.100	0.224	0.0	0.0	3.0	2.75	109.3	33.4
S11.001	50.00	5.98	31.000	0.393	0.0	0.0	5.3	2.01	79.8	58.5
S6.008	50.00	6.09	29.440	0.393	7.4	0.0	6.1	1.85	73.7	66.7
S6.009	50.00	6.24	27.000	0.393	7.4	0.0	6.1	1.11	78.3	66.7
S1.013	50.00	6.65	26.950	0.731	14.1	0.0	11.3	1.28	141.1	124.4
S1.014	50.00	5.09	26.925	0.000	20.4	0.0	1.9	0.92	36.6	20.4
S1.015	50.00	5.21	26.900	0.087	20.4	0.0	3.2	3.80	151.0	35.4
S12.000	50.00	5.13	26.500	0.082	0.0	0.0	1.1	3.56	141.7	12.2

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S1.016	21.500	1.792	12.0	0.085	0.00	0.0	0.600	o	225
S1.017	14.000	1.167	12.0	0.000	0.00	0.0	0.600	o	225
S13.000	26.000	1.000	26.0	0.168	5.00	0.0	0.600	o	225
S13.001	45.500	1.000	45.5	0.032	0.00	0.0	0.600	o	225
S13.002	37.500	1.600	23.4	0.081	0.00	0.0	0.600	o	225
S13.003	36.350	2.400	15.1	0.061	0.00	0.0	0.600	o	225
S13.004	46.350	3.200	14.5	0.087	0.00	0.0	0.600	o	225
S13.005	14.100	0.450	31.3	0.010	0.00	0.0	0.600	o	225
S13.006	18.400	1.350	13.6	0.000	0.00	0.0	0.600	o	225
S1.018	10.000	0.050	200.0	0.000	0.00	0.0	0.600	o	375
S1.019	10.300	0.052	198.1	0.000	0.00	0.0	0.600	o	225
S1.020	39.400	1.898	20.8	0.000	0.00	0.0	0.600	o	225
S14.000	56.000	2.750	20.4	0.145	5.00	0.0	0.600	o	225
S14.001	8.000	0.350	22.9	0.020	0.00	0.0	0.600	o	225
S14.002	25.500	1.050	24.3	0.100	0.00	0.0	0.600	o	225
S14.003	30.600	2.550	12.0	0.050	0.00	0.0	0.600	o	225
S14.004	5.100	0.050	102.0	0.000	0.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.016	50.00	5.31	24.500	0.254	20.4	0.0	5.5	3.80	151.0	60.3
S1.017	50.00	5.37	21.250	0.254	20.4	0.0	5.5	3.80	151.0	60.3
S13.000	50.00	5.17	32.000	0.168	0.0	0.0	2.3	2.58	102.4	25.0
S13.001	50.00	5.56	31.000	0.200	0.0	0.0	2.7	1.94	77.3	29.8
S13.002	50.00	5.79	30.000	0.281	0.0	0.0	3.8	2.71	107.9	41.9
S13.003	50.00	5.97	28.400	0.342	0.0	0.0	4.6	3.38	134.4	50.9
S13.004	50.00	6.19	26.000	0.429	0.0	0.0	5.8	3.46	137.4	63.9
S13.005	50.00	6.29	22.800	0.439	0.0	0.0	5.9	2.35	93.3	65.4
S13.006	50.00	6.38	22.350	0.439	0.0	0.0	5.9	3.56	141.7	65.4
S1.018	50.00	6.51	20.000	0.693	20.4	0.0	11.4	1.28	141.1	125.7
S1.019	50.00	5.19	19.950	0.000	23.7	0.0	2.2	0.93	36.8	23.7
S1.020	50.00	5.41	19.898	0.000	23.7	0.0	2.4	2.88	114.7	26.1
S14.000	50.00	5.32	30.000	0.145	0.0	0.0	2.0	2.91	115.8	21.6
S14.001	50.00	5.37	27.250	0.165	0.0	0.0	2.2	2.75	109.3	24.6
S14.002	50.00	5.53	26.900	0.265	0.0	0.0	3.6	2.67	106.0	39.5
S14.003	50.00	5.66	22.050	0.315	0.0	0.0	4.3	3.80	151.0	46.9
S14.004	50.00	5.73	19.500	0.315	0.0	0.0	4.3	1.29	51.5	46.9

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S14.005	5.000	0.043	116.3	0.000	0.00	0.0	0.600	o	225
S14.006	12.900	0.086	150.0	0.000	0.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S14.005	50.00	5.80	18.250	0.315	0.0	0.0	4.3	1.21	48.2	46.9
S14.006	50.00	5.20	18.207	0.000	1.2	0.0	0.1	1.07	42.4	1.2

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	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)
SSW.021	36.750	1.500	1050	S1.000	35.250	225				
SSW.020	36.000	1.500	1050	S1.001	34.500	225	S1.000	34.500	225	
SSW.019	36.400	2.219	1200	S1.002	34.181	225	S1.001	34.181	225	
SSW.022	37.600	1.400	1050	S2.000	36.200	225				
SSW.018	36.750	2.871	1200	S1.003	33.879	300	S1.002	33.879	225	
							S2.000	35.350	225	1396
SSW.023	37.600	1.500	1050	S3.000	36.100	225				
SSW.024	38.400	1.500	1050	S4.000	36.900	225				
SSW.017	37.250	3.679	1200	S1.004	33.571	300	S1.003	33.571	300	
							S3.000	35.750	225	2104
							S4.000	35.750	225	2104
SSW.016	34.000	1.575	1350	S1.005	32.425	375	S1.004	32.425	300	
SSW.015	34.050	1.961	1350	S1.006	32.089	375	S1.005	32.089	375	
SSW.014	34.000	1.938	1350	S1.007	32.062	450	S1.006	32.062	375	
SSW.013	34.000	3.000	1350	S1.008	31.000	450	S1.007	32.052	450	1052
SSW.012	33.900	2.935	1350	S1.009	30.965	225	S1.008	30.965	450	
SSW.011	32.750	1.975	1200	S1.010	30.775	225	S1.009	30.775	225	
SSW.027	30.850	1.500	1050	S5.000	29.350	225				
SSW.010	30.500	1.500	1050	S1.011	29.000	225	S1.010	29.000	225	
							S5.000	29.000	225	
SSW.009	29.900	1.500	1050	S1.012	28.400	300	S1.011	28.400	225	
SSW.035	45.350	1.500	1050	S6.000	43.850	225				
SSW.059	45.400	1.500	1050	S7.000	43.900	225				
SSW.034	45.000	1.500	1050	S6.001	43.500	225	S6.000	43.500	225	
							S7.000	43.500	225	
SSW.036	44.000	1.500	1050	S8.000	42.500	225				
SSW.033	43.500	1.500	1050	S6.002	42.000	225	S6.001	42.000	225	
							S8.000	42.000	225	
SSW.037	40.350	1.500	1050	S9.000	38.850	225				
SSW.032	40.000	1.500	1050	S6.003	38.500	225	S6.002	38.500	225	
							S9.000	38.500	225	
SSW.031	38.850	1.500	1050	S6.004	37.350	300	S6.003	37.350	225	
SSW.030	35.600	1.500	1350	S6.005	34.100	375	S6.004	34.100	300	
SSW.029	35.500	3.500	1350	S6.006	32.000	375	S6.005	34.042	375	2042
SSW.041	38.400	1.500	1050	S10.000	36.900	225				
SSW.040	36.000	1.500	1050	S10.001	34.500	225	S10.000	34.500	225	
SSW.039	35.400	1.500	1050	S10.002	33.900	225	S10.001	33.900	225	
SSW.038	35.500	3.500	1200	S10.003	32.000	300	S10.002	33.792	225	1717
SSW.028	35.250	3.310	1350	S6.007	31.940	225	S6.006	31.950	375	160
							S10.003	31.940	300	
SSW.043	35.600	1.500	1050	S11.000	34.100	225				
SSW.042	32.500	1.500	1050	S11.001	31.000	225	S11.000	31.000	225	
SSW.027	31.000	1.560	1050	S6.008	29.440	225	S6.007	29.440	225	
							S11.001	29.440	225	
SSW.026	31.000	4.000	1200	S6.009	27.000	300	S6.008	29.202	225	2127
SSW.008	30.350	3.400	1350	S1.013	26.950	375	S1.012	28.261	300	1236

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
							S6.009	26.950	300	
SSW.007	30.250	3.325	1350	S1.014	26.925	225	S1.013	26.925	375	
SSW.006	30.000	3.100	1200	S1.015	26.900	225	S1.014	26.900	225	
SSW.057	28.000	1.500	1050	S12.000	26.500	225				
SSW.005	26.000	1.500	1050	S1.016	24.500	225	S1.015	24.608	225	108
							S12.000	24.500	225	
SSW.004	25.000	3.750	1200	S1.017	21.250	225	S1.016	22.708	225	1458
SSW.050	33.500	1.500	1050	S13.000	32.000	225				
SSW.049	32.500	1.500	1050	S13.001	31.000	225	S13.000	31.000	225	
SSW.048	31.500	1.500	1050	S13.002	30.000	225	S13.001	30.000	225	
SSW.047	29.900	1.500	1050	S13.003	28.400	225	S13.002	28.400	225	
SSW.046	27.500	1.500	1050	S13.004	26.000	225	S13.003	26.000	225	
SSW.045	24.300	1.500	1050	S13.005	22.800	225	S13.004	22.800	225	
SSW.044	23.800	1.450	1050	S13.006	22.350	225	S13.005	22.350	225	
SSW.003	22.500	2.500	1350	S1.018	20.000	375	S1.017	20.083	225	
							S13.006	21.000	225	850
SSW.002	21.500	1.550	1350	S1.019	19.950	225	S1.018	19.950	375	
SSW.001	21.000	1.102	1050	S1.020	19.898	225	S1.019	19.898	225	
SEXIS SW01	19.330	1.330	0		OUTFALL		S1.020	18.000	225	
SSW.058	31.500	1.500	1050	S14.000	30.000	225				
SSW.057	28.750	1.500	1050	S14.001	27.250	225	S14.000	27.250	225	
SSW.056	28.400	1.500	1050	S14.002	26.900	225	S14.001	26.900	225	
SSW.055	27.350	5.300	1200	S14.003	22.050	225	S14.002	25.850	225	3800
SSW.054	20.500	1.000	1050	S14.004	19.500	225	S14.003	19.500	225	
SSW.053	20.250	2.000	1200	S14.005	18.250	225	S14.004	19.450	225	1200
SSW.052	20.000	1.793	1200	S14.006	18.207	225	S14.005	18.207	225	
SExis SW01	19.330	1.209	0		OUTFALL		S14.006	18.121	225	

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.000	o	225	SSW.021	36.750	35.250	1.275	1050
S1.001	o	225	SSW.020	36.000	34.500	1.275	1050
S1.002	o	225	SSW.019	36.400	34.181	1.994	1200
S2.000	o	225	SSW.022	37.600	36.200	1.175	1050
S1.003	o	300	SSW.018	36.750	33.879	2.571	1200
S3.000	o	225	SSW.023	37.600	36.100	1.275	1050
S4.000	o	225	SSW.024	38.400	36.900	1.275	1050
S1.004	o	300	SSW.017	37.250	33.571	3.379	1200
S1.005	o	375	SSW.016	34.000	32.425	1.200	1350
S1.006	o	375	SSW.015	34.050	32.089	1.586	1350
S1.007	o	450	SSW.014	34.000	32.062	1.488	1350
S1.008	o	450	SSW.013	34.000	31.000	2.550	1350
S1.009	o	225	SSW.012	33.900	30.965	2.710	1350
S1.010	o	225	SSW.011	32.750	30.775	1.750	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.000	32.250	43.0	SSW.020	36.000	34.500	1.275	1050
S1.001	53.600	168.0	SSW.019	36.400	34.181	1.994	1200
S1.002	50.800	168.2	SSW.018	36.750	33.879	2.646	1200
S2.000	19.950	23.5	SSW.018	36.750	35.350	1.175	1200
S1.003	51.700	167.9	SSW.017	37.250	33.571	3.379	1200
S3.000	21.650	61.9	SSW.017	37.250	35.750	1.275	1200
S4.000	57.250	49.8	SSW.017	37.250	35.750	1.275	1200
S1.004	61.700	53.8	SSW.016	34.000	32.425	1.275	1350
S1.005	56.500	168.2	SSW.015	34.050	32.089	1.586	1350
S1.006	4.500	166.7	SSW.014	34.000	32.062	1.563	1350
S1.007	2.000	200.0	SSW.013	34.000	32.052	1.498	1350
S1.008	7.000	200.0	SSW.012	33.900	30.965	2.485	1350
S1.009	37.950	199.7	SSW.011	32.750	30.775	1.750	1200
S1.010	53.200	30.0	SSW.010	30.500	29.000	1.275	1050

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S5.000	o	225	SSW.027	30.850	29.350	1.275	1050
S1.011	o	225	SSW.010	30.500	29.000	1.275	1050
S1.012	o	300	SSW.009	29.900	28.400	1.200	1050
S6.000	o	225	SSW.035	45.350	43.850	1.275	1050
S7.000	o	225	SSW.059	45.400	43.900	1.275	1050
S6.001	o	225	SSW.034	45.000	43.500	1.275	1050
S8.000	o	225	SSW.036	44.000	42.500	1.275	1050
S6.002	o	225	SSW.033	43.500	42.000	1.275	1050
S9.000	o	225	SSW.037	40.350	38.850	1.275	1050
S6.003	o	225	SSW.032	40.000	38.500	1.275	1050

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S5.000	23.500	67.1	SSW.010	30.500	29.000	1.275	1050
S1.011	25.400	42.3	SSW.009	29.900	28.400	1.275	1050
S1.012	23.200	166.9	SSW.008	30.350	28.261	1.789	1350
S6.000	12.950	37.0	SSW.034	45.000	43.500	1.275	1050
S7.000	21.000	52.5	SSW.034	45.000	43.500	1.275	1050
S6.001	66.000	44.0	SSW.033	43.500	42.000	1.275	1050
S8.000	15.550	31.1	SSW.033	43.500	42.000	1.275	1050
S6.002	71.700	20.5	SSW.032	40.000	38.500	1.275	1050
S9.000	15.350	43.9	SSW.032	40.000	38.500	1.275	1050
S6.003	24.150	21.0	SSW.031	38.850	37.350	1.275	1050

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S6.004	o	300	SSW.031	38.850	37.350	1.200	1050
S6.005	o	375	SSW.030	35.600	34.100	1.125	1350
S6.006	o	375	SSW.029	35.500	32.000	3.125	1350
S10.000	o	225	SSW.041	38.400	36.900	1.275	1050
S10.001	o	225	SSW.040	36.000	34.500	1.275	1050
S10.002	o	225	SSW.039	35.400	33.900	1.275	1050
S10.003	o	300	SSW.038	35.500	32.000	3.200	1200
S6.007	o	225	SSW.028	35.250	31.940	3.085	1350
S11.000	o	225	SSW.043	35.600	34.100	1.275	1050
S11.001	o	225	SSW.042	32.500	31.000	1.275	1050
S6.008	o	225	SSW.027	31.000	29.440	1.335	1050
S6.009	o	300	SSW.026	31.000	27.000	3.700	1200
S1.013	o	375	SSW.008	30.350	26.950	3.025	1350
S1.014	o	225	SSW.007	30.250	26.925	3.100	1350

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S6.004	64.500	19.8	SSW.030	35.600	34.100	1.200	1350
S6.005	11.700	200.0	SSW.029	35.500	34.042	1.084	1350
S6.006	10.000	200.0	SSW.028	35.250	31.950	2.925	1350
S10.000	77.900	32.5	SSW.040	36.000	34.500	1.275	1050
S10.001	37.500	62.5	SSW.039	35.400	33.900	1.275	1050
S10.002	6.500	60.0	SSW.038	35.500	33.792	1.483	1200
S10.003	10.000	167.0	SSW.028	35.250	31.940	3.010	1350
S6.007	90.000	36.0	SSW.027	31.000	29.440	1.335	1050
S11.000	70.900	22.9	SSW.042	32.500	31.000	1.275	1050
S11.001	66.700	42.8	SSW.027	31.000	29.440	1.335	1050
S6.008	11.900	50.0	SSW.026	31.000	29.202	1.573	1200
S6.009	10.000	200.0	SSW.008	30.350	26.950	3.100	1350
S1.013	5.000	200.0	SSW.007	30.250	26.925	2.950	1350
S1.014	5.000	200.0	SSW.006	30.000	26.900	2.875	1200

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.015	o	225	SSW.006	30.000	26.900	2.875	1200
S12.000	o	225	SSW.057	28.000	26.500	1.275	1050
S1.016	o	225	SSW.005	26.000	24.500	1.275	1050
S1.017	o	225	SSW.004	25.000	21.250	3.525	1200
S13.000	o	225	SSW.050	33.500	32.000	1.275	1050
S13.001	o	225	SSW.049	32.500	31.000	1.275	1050
S13.002	o	225	SSW.048	31.500	30.000	1.275	1050
S13.003	o	225	SSW.047	29.900	28.400	1.275	1050
S13.004	o	225	SSW.046	27.500	26.000	1.275	1050
S13.005	o	225	SSW.045	24.300	22.800	1.275	1050
S13.006	o	225	SSW.044	23.800	22.350	1.225	1050
S1.018	o	375	SSW.003	22.500	20.000	2.125	1350
S1.019	o	225	SSW.002	21.500	19.950	1.325	1350
S1.020	o	225	SSW.001	21.000	19.898	0.877	1050

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.015	27.500	12.0	SSW.005	26.000	24.608	1.167	1050
S12.000	27.250	13.6	SSW.005	26.000	24.500	1.275	1050
S1.016	21.500	12.0	SSW.004	25.000	22.708	2.067	1200
S1.017	14.000	12.0	SSW.003	22.500	20.083	2.192	1350
S13.000	26.000	26.0	SSW.049	32.500	31.000	1.275	1050
S13.001	45.500	45.5	SSW.048	31.500	30.000	1.275	1050
S13.002	37.500	23.4	SSW.047	29.900	28.400	1.275	1050
S13.003	36.350	15.1	SSW.046	27.500	26.000	1.275	1050
S13.004	46.350	14.5	SSW.045	24.300	22.800	1.275	1050
S13.005	14.100	31.3	SSW.044	23.800	22.350	1.225	1050
S13.006	18.400	13.6	SSW.003	22.500	21.000	1.275	1350
S1.018	10.000	200.0	SSW.002	21.500	19.950	1.175	1350
S1.019	10.300	198.1	SSW.001	21.000	19.898	0.877	1050
S1.020	39.400	20.8	SEXIS SW01	19.330	18.000	1.105	0

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S14.000	o	225	SSW.058	31.500	30.000	1.275	1050
S14.001	o	225	SSW.057	28.750	27.250	1.275	1050
S14.002	o	225	SSW.056	28.400	26.900	1.275	1050
S14.003	o	225	SSW.055	27.350	22.050	5.075	1200
S14.004	o	225	SSW.054	20.500	19.500	0.775	1050
S14.005	o	225	SSW.053	20.250	18.250	1.775	1200
S14.006	o	225	SSW.052	20.000	18.207	1.568	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S14.000	56.000	20.4	SSW.057	28.750	27.250	1.275	1050
S14.001	8.000	22.9	SSW.056	28.400	26.900	1.275	1050
S14.002	25.500	24.3	SSW.055	27.350	25.850	1.275	1200
S14.003	30.600	12.0	SSW.054	20.500	19.500	0.775	1050
S14.004	5.100	102.0	SSW.053	20.250	19.450	0.575	1200
S14.005	5.000	116.3	SSW.052	20.000	18.207	1.568	1200
S14.006	12.900	150.0	SExis SW01	19.330	18.121	0.984	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.020	SEXIS SW01	19.330	18.000	18.000	0	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S14.006	SExis SW01	19.330	18.121	18.000	0	0

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Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Foul Sewage per hectare (l/s)	0.000
PIMP (% impervious)	100	Additional Flow - % of Total Flow	10.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Run Time (mins)	60
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	5
Number of Online Controls	5	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	18.800	Storm Duration (mins)	30
Ratio R	0.300		

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Online Controls for Storm

Hydro-Brake® Manhole: SSW.012, DS/PN: S1.009, Volume (m³): 5.1

Design Head (m) 2.500 Hydro-Brake® Type Md4 Invert Level (m) 30.965
Design Flow (l/s) 6.7 Diameter (mm) 74

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.2	1.200	4.7	3.000	7.4	7.000	11.3
0.200	2.7	1.400	5.0	3.500	8.0	7.500	11.7
0.300	2.5	1.600	5.4	4.000	8.5	8.000	12.1
0.400	2.7	1.800	5.7	4.500	9.1	8.500	12.4
0.500	3.0	2.000	6.0	5.000	9.5	9.000	12.8
0.600	3.3	2.200	6.3	5.500	10.0	9.500	13.2
0.800	3.8	2.400	6.6	6.000	10.5		
1.000	4.3	2.600	6.9	6.500	10.9		

Hydro-Brake® Manhole: SSW.028, DS/PN: S6.007, Volume (m³): 6.3

Design Head (m) 2.500 Hydro-Brake® Type Md4 Invert Level (m) 31.940
Design Flow (l/s) 7.4 Diameter (mm) 78

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.4	1.200	5.2	3.000	8.2	7.000	12.5
0.200	3.2	1.400	5.6	3.500	8.9	7.500	13.0
0.300	2.8	1.600	6.0	4.000	9.5	8.000	13.4
0.400	3.0	1.800	6.4	4.500	10.1	8.500	13.8
0.500	3.4	2.000	6.7	5.000	10.6	9.000	14.2
0.600	3.7	2.200	7.0	5.500	11.1	9.500	14.6
0.800	4.2	2.400	7.3	6.000	11.6		
1.000	4.7	2.600	7.6	6.500	12.1		

Hydro-Brake® Manhole: SSW.007, DS/PN: S1.014, Volume (m³): 5.2

Design Head (m) 2.500 Hydro-Brake® Type Md4 Invert Level (m) 26.925
Design Flow (l/s) 20.4 Diameter (mm) 129

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.6	1.200	14.2	3.000	22.5	7.000	34.3
0.200	10.3	1.400	15.3	3.500	24.3	7.500	35.5
0.300	11.7	1.600	16.4	4.000	25.9	8.000	36.7
0.400	10.3	1.800	17.4	4.500	27.5	8.500	37.8
0.500	9.8	2.000	18.3	5.000	29.0	9.000	38.9
0.600	10.2	2.200	19.2	5.500	30.4	9.500	40.0
0.800	11.6	2.400	20.1	6.000	31.8		
1.000	13.0	2.600	20.9	6.500	33.1		

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Hydro-Brake® Manhole: SSW.002, DS/PN: S1.019, Volume (m³): 3.2

Design Head (m) 2.000 Hydro-Brake® Type Md4 Invert Level (m) 19.950
Design Flow (l/s) 23.7 Diameter (mm) 147

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.8	1.200	18.4	3.000	29.2	7.000	44.6
0.200	12.4	1.400	19.9	3.500	31.5	7.500	46.1
0.300	16.5	1.600	21.3	4.000	33.7	8.000	47.6
0.400	15.2	1.800	22.6	4.500	35.7	8.500	49.1
0.500	13.8	2.000	23.8	5.000	37.7	9.000	50.5
0.600	13.7	2.200	25.0	5.500	39.5	9.500	51.9
0.800	15.1	2.400	26.1	6.000	41.2		
1.000	16.8	2.600	27.2	6.500	42.9		

Hydro-Brake® Manhole: SSW.052, DS/PN: S14.006, Volume (m³): 2.2

Design Head (m) 1.500 Hydro-Brake® Type Md4 Invert Level (m) 18.207
Design Flow (l/s) 1.2 Diameter (mm) 36

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.4	1.200	1.1	3.000	1.7	7.000	2.7
0.200	0.5	1.400	1.2	3.500	1.9	7.500	2.8
0.300	0.6	1.600	1.3	4.000	2.0	8.000	2.9
0.400	0.6	1.800	1.4	4.500	2.1	8.500	2.9
0.500	0.7	2.000	1.4	5.000	2.3	9.000	3.0
0.600	0.8	2.200	1.5	5.500	2.4	9.500	3.1
0.800	0.9	2.400	1.6	6.000	2.5		
1.000	1.0	2.600	1.6	6.500	2.6		

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Storage Structures for Storm

Tank or Pond Manhole: SSW.012, DS/PN: S1.009

Invert Level (m) 30.965

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	220.5	2.500	220.5

Tank or Pond Manhole: SSW.028, DS/PN: S6.007

Invert Level (m) 31.940

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	220.5	2.500	220.5

Tank or Pond Manhole: SSW.007, DS/PN: S1.014

Invert Level (m) 26.925

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	232.0	2.500	232.0

Tank or Pond Manhole: SSW.002, DS/PN: S1.019

Invert Level (m) 19.950

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	148.5	2.000	148.5

Tank or Pond Manhole: SSW.052, DS/PN: S14.006

Invert Level (m) 18.207

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	70.0	1.500	70.0

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

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 2
Climate Change (%) 0

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
S1.000	15 Winter	2	0%					
S1.001	15 Winter	2	0%					
S1.002	15 Winter	2	0%					
S2.000	15 Winter	2	0%					
S1.003	15 Winter	2	0%					
S3.000	15 Winter	2	0%					
S4.000	15 Winter	2	0%					
S1.004	15 Winter	2	0%					
S1.005	15 Winter	2	0%	2/15 Winter				
S1.006	15 Winter	2	0%	2/15 Summer				
S1.007	15 Winter	2	0%					
S1.008	960 Winter	2	0%	2/30 Winter				
S1.009	960 Winter	2	0%	2/15 Summer				
S1.010	15 Winter	2	0%					
S5.000	15 Winter	2	0%					
S1.011	15 Winter	2	0%					
S1.012	15 Winter	2	0%					
S6.000	15 Winter	2	0%					
S7.000	15 Winter	2	0%					
S6.001	15 Winter	2	0%					
S8.000	15 Winter	2	0%					
S6.002	15 Winter	2	0%					
S9.000	15 Winter	2	0%					
S6.003	15 Winter	2	0%	2/15 Winter				
S6.004	15 Winter	2	0%					
S6.005	15 Winter	2	0%	2/15 Summer				
S6.006	960 Winter	2	0%	2/15 Summer				
S10.000	15 Winter	2	0%					
S10.001	15 Winter	2	0%					
S10.002	15 Winter	2	0%					
S10.003	960 Winter	2	0%	2/15 Summer				
S6.007	960 Winter	2	0%	2/15 Summer				
S11.000	15 Winter	2	0%					
S11.001	15 Winter	2	0%					
S6.008	15 Winter	2	0%	2/15 Winter				
S6.009	960 Winter	2	0%	2/15 Summer				
S1.013	960 Winter	2	0%	2/15 Summer				
S1.014	960 Winter	2	0%	2/15 Winter				

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

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
S1.015	60 Summer	2	0%					
S12.000	15 Winter	2	0%					
S1.016	15 Winter	2	0%					
S1.017	15 Winter	2	0%					
S13.000	15 Winter	2	0%					
S13.001	15 Winter	2	0%					
S13.002	15 Winter	2	0%					
S13.003	15 Winter	2	0%					
S13.004	15 Winter	2	0%					
S13.005	15 Winter	2	0%					
S13.006	15 Winter	2	0%					
S1.018	480 Winter	2	0%	2/15 Winter				
S1.019	480 Winter	2	0%	2/15 Summer				
S1.020	240 Summer	2	0%					
S14.000	15 Winter	2	0%					
S14.001	15 Winter	2	0%					
S14.002	15 Winter	2	0%					
S14.003	15 Winter	2	0%					
S14.004	15 Winter	2	0%	2/15 Summer				
S14.005	1440 Winter	2	0%	2/15 Summer				
S14.006	1440 Winter	2	0%	2/15 Summer				

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
S1.000	SSW.021	35.323	-0.152	0.000	0.23	0.0	17.0	OK
S1.001	SSW.020	34.639	-0.086	0.000	0.67	0.0	25.6	OK
S1.002	SSW.019	34.349	-0.057	0.000	0.88	0.0	33.7	OK
S2.000	SSW.022	36.259	-0.166	0.000	0.16	0.0	15.2	OK
S1.003	SSW.018	34.056	-0.123	0.000	0.63	0.0	51.1	OK
S3.000	SSW.023	36.190	-0.135	0.000	0.33	0.0	19.9	OK
S4.000	SSW.024	36.989	-0.136	0.000	0.33	0.0	23.3	OK
S1.004	SSW.017	33.784	-0.087	0.000	0.84	0.0	121.0	OK
S1.005	SSW.016	32.826	-0.026	0.000	0.92	0.0	131.8	OK
S1.006	SSW.015	32.547	-0.083	0.000	1.41	0.0	128.2	OK
S1.007	SSW.014	32.441	-0.071	0.000	1.00	0.0	128.0	OK
S1.008	SSW.013	32.054	-0.004	0.000	0.11	0.0	15.5	OK
S1.009	SSW.012	32.054	-0.064	0.000	0.13	0.0	4.5	OK
S1.010	SSW.011	30.849	-0.151	0.000	0.24	0.0	21.7	OK
S5.000	SSW.027	29.430	-0.145	0.000	0.27	0.0	15.8	OK
S1.011	SSW.010	29.132	-0.093	0.000	0.64	0.0	47.1	OK
S1.012	SSW.009	28.586	-0.114	0.000	0.70	0.0	53.4	OK
S6.000	SSW.035	43.906	-0.169	0.000	0.14	0.0	10.5	OK
S7.000	SSW.059	43.953	-0.172	0.000	0.13	0.0	8.2	OK
S6.001	SSW.034	43.627	-0.098	0.000	0.60	0.0	45.4	OK
S8.000	SSW.036	42.570	-0.155	0.000	0.21	0.0	17.5	OK
S6.002	SSW.033	42.146	-0.079	0.000	0.74	0.0	83.2	OK
S9.000	SSW.037	38.932	-0.143	0.000	0.29	0.0	19.8	OK

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

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m^3)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
S6.003	SSW.032	38.741	0.016	0.000	1.01	0.0	105.6	OK
S6.004	SSW.031	37.505	-0.145	0.000	0.53	0.0	125.9	OK
S6.005	SSW.030	34.509	0.034	0.000	1.21	0.0	129.5	OK
S6.006	SSW.029	33.328	0.953	0.000	0.13	0.0	13.9	OK
S10.000	SSW.041	37.005	-0.120	0.000	0.43	0.0	38.7	OK
S10.001	SSW.040	34.650	-0.075	0.000	0.77	0.0	48.1	OK
S10.002	SSW.039	34.124	-0.001	0.000	1.01	0.0	46.8	OK
S10.003	SSW.038	33.327	1.027	0.000	0.08	0.0	4.7	OK
S6.007	SSW.028	33.327	1.162	0.000	0.07	0.0	5.6	OK
S11.000	SSW.043	34.195	-0.130	0.000	0.36	0.0	38.5	OK
S11.001	SSW.042	31.158	-0.067	0.000	0.82	0.0	63.4	OK
S6.008	SSW.027	29.678	0.013	0.000	1.04	0.0	65.5	OK
S6.009	SSW.026	27.708	0.408	0.000	0.18	0.0	10.8	OK
S1.013	SSW.008	27.703	0.378	0.000	0.23	0.0	19.7	OK
S1.014	SSW.007	27.701	0.551	0.000	0.44	0.0	11.7	OK
S1.015	SSW.006	26.955	-0.170	0.000	0.13	0.0	18.5	OK
S12.000	SSW.057	26.550	-0.175	0.000	0.11	0.0	14.4	OK
S1.016	SSW.005	24.585	-0.140	0.000	0.30	0.0	41.3	OK
S1.017	SSW.004	21.337	-0.138	0.000	0.31	0.0	41.4	OK
S13.000	SSW.050	32.086	-0.139	0.000	0.31	0.0	29.4	OK
S13.001	SSW.049	31.108	-0.117	0.000	0.46	0.0	33.9	OK
S13.002	SSW.048	30.107	-0.118	0.000	0.45	0.0	46.0	OK
S13.003	SSW.047	28.504	-0.121	0.000	0.43	0.0	55.1	OK
S13.004	SSW.046	26.115	-0.110	0.000	0.52	0.0	67.8	OK
S13.005	SSW.045	22.960	-0.065	0.000	0.85	0.0	69.2	OK
S13.006	SSW.044	22.468	-0.107	0.000	0.54	0.0	69.1	OK
S1.018	SSW.003	20.774	0.399	0.000	0.28	0.0	29.2	OK
S1.019	SSW.002	20.768	0.593	0.000	0.53	0.0	16.2	OK
S1.020	SSW.001	19.956	-0.167	0.000	0.15	0.0	16.3	OK
S14.000	SSW.058	30.073	-0.152	0.000	0.23	0.0	25.1	OK
S14.001	SSW.057	27.341	-0.134	0.000	0.34	0.0	28.0	OK
S14.002	SSW.056	27.005	-0.120	0.000	0.44	0.0	42.9	OK
S14.003	SSW.055	22.143	-0.132	0.000	0.36	0.0	50.5	OK
S14.004	SSW.054	19.794	0.069	0.000	1.61	0.0	50.6	OK
S14.005	SSW.053	19.337	0.862	0.000	0.13	0.0	3.9	OK
S14.006	SSW.052	19.336	0.904	0.000	0.03	0.0	1.1	OK

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Appendix F – 1 in 100 Year Design Sheets

Denis O'Sullivan & Associates		Page 1
Unit 5, Joyce House Barrack Square Ballincollig, Co. Cork	Resdiential Development Ardarostig Bishopstown, Cork	
Date 15/01/2021 File SW MOdel.MDX	Designed By S.O.'Grady Checked By	
Micro Drainage	Network W.12.4	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	100	Add Flow / Climate Change (%)	10
M5-60 (mm)	18.800	Minimum Backdrop Height (m)	0.200
Ratio R	0.300	Maximum Backdrop Height (m)	1.500
Maximum Rainfall (mm/hr)	50	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Time Area Diagram for Storm at outfall SEXIS SW01 (pipe S1.020)

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	1.238	4-8	2.367	8-12	0.250

Total Area Contributing (ha) = 3.855

Total Pipe Volume (m³) = 80.844

Time Area Diagram at outfall SExis SW01 (pipe S14.006)

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.232	4-8	0.083

Total Area Contributing (ha) = 0.315

Total Pipe Volume (m³) = 5.690

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S1.000	32.250	0.750	43.0	0.098	5.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	5.27	35.250	0.098	0.0	0.0	1.3	2.00	79.5	14.6

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S1.001	53.600	0.319	168.0	0.064	0.00	0.0	0.600	o	225
S1.002	50.800	0.302	168.2	0.064	0.00	0.0	0.600	o	225
S2.000	19.950	0.850	23.5	0.087	5.00	0.0	0.600	o	225
S1.003	51.700	0.308	167.9	0.040	0.00	0.0	0.600	o	300
S3.000	21.650	0.350	61.9	0.114	5.00	0.0	0.600	o	225
S4.000	57.250	1.150	49.8	0.134	5.00	0.0	0.600	o	225
S1.004	61.700	1.146	53.8	0.221	0.00	0.0	0.600	o	300
S1.005	56.500	0.336	168.2	0.129	0.00	0.0	0.600	o	375
S1.006	4.500	0.027	166.7	0.000	0.00	0.0	0.600	o	375
S1.007	2.000	0.010	200.0	0.000	0.00	0.0	0.600	o	450
S1.008	7.000	0.035	200.0	0.000	0.00	0.0	0.600	o	450
S1.009	37.950	0.190	199.7	0.117	0.00	0.0	0.600	o	225
S1.010	53.200	1.775	30.0	0.139	0.00	0.0	0.600	o	225
S5.000	23.500	0.350	67.1	0.090	5.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.001	50.00	6.16	34.500	0.162	0.0	0.0	2.2	1.01	40.0	24.1
S1.002	50.00	7.00	34.181	0.226	0.0	0.0	3.1	1.01	40.0	33.7
S2.000	50.00	5.12	36.200	0.087	0.0	0.0	1.2	2.71	107.8	13.0
S1.003	50.00	7.71	33.879	0.353	0.0	0.0	4.8	1.21	85.6	52.6
S3.000	50.00	5.22	36.100	0.114	0.0	0.0	1.5	1.67	66.2	17.0
S4.000	50.00	5.51	36.900	0.134	0.0	0.0	1.8	1.86	73.9	20.0
S1.004	50.00	8.19	33.571	0.822	0.0	0.0	11.1	2.15	151.8	122.4
S1.005	50.00	8.87	32.425	0.951	0.0	0.0	12.9	1.39	154.0	141.7
S1.006	50.00	8.92	32.089	0.951	0.0	0.0	12.9	1.40	154.7	141.7
S1.007	50.00	8.94	32.062	0.951	0.0	0.0	12.9	1.43	228.1	141.7
S1.008	50.00	9.02	31.000	0.951	0.0	0.0	12.9	1.43	228.1	141.7
S1.009	50.00	5.69	30.965	0.000	6.7	0.0	0.6	0.92	36.6	6.7
S1.010	50.00	6.06	30.775	0.139	6.7	0.0	2.6	2.40	95.4	28.1
S5.000	50.00	5.25	29.350	0.090	0.0	0.0	1.2	1.60	63.6	13.4

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S1.011	25.400	0.600	42.3	0.067	0.00	0.0	0.600	o	225
S1.012	23.200	0.139	166.9	0.042	0.00	0.0	0.600	o	300
S6.000	12.950	0.350	37.0	0.060	5.00	0.0	0.600	o	225
S7.000	21.000	0.400	52.5	0.047	5.00	0.0	0.600	o	225
S6.001	66.000	1.500	44.0	0.182	0.00	0.0	0.600	o	225
S8.000	15.550	0.500	31.1	0.100	5.00	0.0	0.600	o	225
S6.002	71.700	3.500	20.5	0.142	0.00	0.0	0.600	o	225
S9.000	15.350	0.350	43.9	0.113	5.00	0.0	0.600	o	225
S6.003	24.150	1.150	21.0	0.037	0.00	0.0	0.600	o	225
S6.004	64.500	3.250	19.8	0.146	0.00	0.0	0.600	o	300
S6.005	11.700	0.059	200.0	0.027	0.00	0.0	0.600	o	375
S6.006	10.000	0.050	200.0	0.000	0.00	0.0	0.600	o	375

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.011	50.00	6.27	29.000	0.296	6.7	0.0	4.7	2.02	80.2	51.5
S1.012	50.00	6.58	28.400	0.338	6.7	0.0	5.2	1.21	85.8	57.7
S6.000	50.00	5.10	43.850	0.060	0.0	0.0	0.8	2.16	85.8	8.9
S7.000	50.00	5.19	43.900	0.047	0.0	0.0	0.6	1.81	71.9	7.0
S6.001	50.00	5.75	43.500	0.289	0.0	0.0	3.9	1.98	78.6	43.0
S8.000	50.00	5.11	42.500	0.100	0.0	0.0	1.4	2.35	93.6	14.9
S6.002	50.00	6.16	42.000	0.531	0.0	0.0	7.2	2.90	115.5	79.1
S9.000	50.00	5.13	38.850	0.113	0.0	0.0	1.5	1.98	78.8	16.8
S6.003	50.00	6.30	38.500	0.681	0.0	0.0	9.2	2.87	114.0	101.4
S6.004	50.00	6.60	37.350	0.827	0.0	0.0	11.2	3.55	250.6	123.2
S6.005	50.00	6.76	34.100	0.854	0.0	0.0	11.6	1.28	141.1	127.2
S6.006	50.00	6.89	32.000	0.854	0.0	0.0	11.6	1.28	141.1	127.2

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S10.000	77.900	2.400	32.5	0.225	5.00	0.0	0.600	o	225
S10.001	37.500	0.600	62.5	0.064	0.00	0.0	0.600	o	225
S10.002	6.500	0.108	60.0	0.000	0.00	0.0	0.600	o	225
S10.003	10.000	0.060	167.0	0.000	0.00	0.0	0.600	o	300
S6.007	90.000	2.500	36.0	0.220	0.00	0.0	0.600	o	225
S11.000	70.900	3.100	22.9	0.224	5.00	0.0	0.600	o	225
S11.001	66.700	1.560	42.8	0.169	0.00	0.0	0.600	o	225
S6.008	11.900	0.238	50.0	0.000	0.00	0.0	0.600	o	225
S6.009	10.000	0.050	200.0	0.000	0.00	0.0	0.600	o	300
S1.013	5.000	0.025	200.0	0.000	0.00	0.0	0.600	o	375
S1.014	5.000	0.025	200.0	0.000	0.00	0.0	0.600	o	225
S1.015	27.500	2.292	12.0	0.087	0.00	0.0	0.600	o	225
S12.000	27.250	2.000	13.6	0.082	5.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S10.000	50.00	5.56	36.900	0.225	0.0	0.0	3.0	2.30	91.6	33.5
S10.001	50.00	5.94	34.500	0.289	0.0	0.0	3.9	1.66	65.9	43.0
S10.002	50.00	6.00	33.900	0.289	0.0	0.0	3.9	1.69	67.3	43.0
S10.003	50.00	6.14	32.000	0.289	0.0	0.0	3.9	1.21	85.8	43.0
S6.007	50.00	5.69	31.940	0.000	7.4	0.0	0.7	2.19	87.0	7.4
S11.000	50.00	5.43	34.100	0.224	0.0	0.0	3.0	2.75	109.3	33.4
S11.001	50.00	5.98	31.000	0.393	0.0	0.0	5.3	2.01	79.8	58.5
S6.008	50.00	6.09	29.440	0.393	7.4	0.0	6.1	1.85	73.7	66.7
S6.009	50.00	6.24	27.000	0.393	7.4	0.0	6.1	1.11	78.3	66.7
S1.013	50.00	6.65	26.950	0.731	14.1	0.0	11.3	1.28	141.1	124.4
S1.014	50.00	5.09	26.925	0.000	20.4	0.0	1.9	0.92	36.6	20.4
S1.015	50.00	5.21	26.900	0.087	20.4	0.0	3.2	3.80	151.0	35.4
S12.000	50.00	5.13	26.500	0.082	0.0	0.0	1.1	3.56	141.7	12.2

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S1.016	21.500	1.792	12.0	0.085	0.00	0.0	0.600	o	225
S1.017	14.000	1.167	12.0	0.000	0.00	0.0	0.600	o	225
S13.000	26.000	1.000	26.0	0.168	5.00	0.0	0.600	o	225
S13.001	45.500	1.000	45.5	0.032	0.00	0.0	0.600	o	225
S13.002	37.500	1.600	23.4	0.081	0.00	0.0	0.600	o	225
S13.003	36.350	2.400	15.1	0.061	0.00	0.0	0.600	o	225
S13.004	46.350	3.200	14.5	0.087	0.00	0.0	0.600	o	225
S13.005	14.100	0.450	31.3	0.010	0.00	0.0	0.600	o	225
S13.006	18.400	1.350	13.6	0.000	0.00	0.0	0.600	o	225
S1.018	10.000	0.050	200.0	0.000	0.00	0.0	0.600	o	375
S1.019	10.300	0.052	198.1	0.000	0.00	0.0	0.600	o	225
S1.020	39.400	1.898	20.8	0.000	0.00	0.0	0.600	o	225
S14.000	56.000	2.750	20.4	0.145	5.00	0.0	0.600	o	225
S14.001	8.000	0.350	22.9	0.020	0.00	0.0	0.600	o	225
S14.002	25.500	1.050	24.3	0.100	0.00	0.0	0.600	o	225
S14.003	30.600	2.550	12.0	0.050	0.00	0.0	0.600	o	225
S14.004	5.100	0.050	102.0	0.000	0.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.016	50.00	5.31	24.500	0.254	20.4	0.0	5.5	3.80	151.0	60.3
S1.017	50.00	5.37	21.250	0.254	20.4	0.0	5.5	3.80	151.0	60.3
S13.000	50.00	5.17	32.000	0.168	0.0	0.0	2.3	2.58	102.4	25.0
S13.001	50.00	5.56	31.000	0.200	0.0	0.0	2.7	1.94	77.3	29.8
S13.002	50.00	5.79	30.000	0.281	0.0	0.0	3.8	2.71	107.9	41.9
S13.003	50.00	5.97	28.400	0.342	0.0	0.0	4.6	3.38	134.4	50.9
S13.004	50.00	6.19	26.000	0.429	0.0	0.0	5.8	3.46	137.4	63.9
S13.005	50.00	6.29	22.800	0.439	0.0	0.0	5.9	2.35	93.3	65.4
S13.006	50.00	6.38	22.350	0.439	0.0	0.0	5.9	3.56	141.7	65.4
S1.018	50.00	6.51	20.000	0.693	20.4	0.0	11.4	1.28	141.1	125.7
S1.019	50.00	5.19	19.950	0.000	23.7	0.0	2.2	0.93	36.8	23.7
S1.020	50.00	5.41	19.898	0.000	23.7	0.0	2.4	2.88	114.7	26.1
S14.000	50.00	5.32	30.000	0.145	0.0	0.0	2.0	2.91	115.8	21.6
S14.001	50.00	5.37	27.250	0.165	0.0	0.0	2.2	2.75	109.3	24.6
S14.002	50.00	5.53	26.900	0.265	0.0	0.0	3.6	2.67	106.0	39.5
S14.003	50.00	5.66	22.050	0.315	0.0	0.0	4.3	3.80	151.0	46.9
S14.004	50.00	5.73	19.500	0.315	0.0	0.0	4.3	1.29	51.5	46.9

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S14.005	5.000	0.043	116.3	0.000	0.00	0.0	0.600	o	225
S14.006	12.900	0.086	150.0	0.000	0.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S14.005	50.00	5.80	18.250	0.315	0.0	0.0	4.3	1.21	48.2	46.9
S14.006	50.00	5.20	18.207	0.000	1.2	0.0	0.1	1.07	42.4	1.2

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.000	o	225	SSW.021	36.750	35.250	1.275	1050
S1.001	o	225	SSW.020	36.000	34.500	1.275	1050
S1.002	o	225	SSW.019	36.400	34.181	1.994	1200
S2.000	o	225	SSW.022	37.600	36.200	1.175	1050
S1.003	o	300	SSW.018	36.750	33.879	2.571	1200
S3.000	o	225	SSW.023	37.600	36.100	1.275	1050
S4.000	o	225	SSW.024	38.400	36.900	1.275	1050
S1.004	o	300	SSW.017	37.250	33.571	3.379	1200
S1.005	o	375	SSW.016	34.000	32.425	1.200	1350
S1.006	o	375	SSW.015	34.050	32.089	1.586	1350
S1.007	o	450	SSW.014	34.000	32.062	1.488	1350
S1.008	o	450	SSW.013	34.000	31.000	2.550	1350
S1.009	o	225	SSW.012	33.900	30.965	2.710	1350
S1.010	o	225	SSW.011	32.750	30.775	1.750	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.000	32.250	43.0	SSW.020	36.000	34.500	1.275	1050
S1.001	53.600	168.0	SSW.019	36.400	34.181	1.994	1200
S1.002	50.800	168.2	SSW.018	36.750	33.879	2.646	1200
S2.000	19.950	23.5	SSW.018	36.750	35.350	1.175	1200
S1.003	51.700	167.9	SSW.017	37.250	33.571	3.379	1200
S3.000	21.650	61.9	SSW.017	37.250	35.750	1.275	1200
S4.000	57.250	49.8	SSW.017	37.250	35.750	1.275	1200
S1.004	61.700	53.8	SSW.016	34.000	32.425	1.275	1350
S1.005	56.500	168.2	SSW.015	34.050	32.089	1.586	1350
S1.006	4.500	166.7	SSW.014	34.000	32.062	1.563	1350
S1.007	2.000	200.0	SSW.013	34.000	32.052	1.498	1350
S1.008	7.000	200.0	SSW.012	33.900	30.965	2.485	1350
S1.009	37.950	199.7	SSW.011	32.750	30.775	1.750	1200
S1.010	53.200	30.0	SSW.010	30.500	29.000	1.275	1050

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S5.000	o	225	SSW.027	30.850	29.350	1.275	1050
S1.011	o	225	SSW.010	30.500	29.000	1.275	1050
S1.012	o	300	SSW.009	29.900	28.400	1.200	1050
S6.000	o	225	SSW.035	45.350	43.850	1.275	1050
S7.000	o	225	SSW.059	45.400	43.900	1.275	1050
S6.001	o	225	SSW.034	45.000	43.500	1.275	1050
S8.000	o	225	SSW.036	44.000	42.500	1.275	1050
S6.002	o	225	SSW.033	43.500	42.000	1.275	1050
S9.000	o	225	SSW.037	40.350	38.850	1.275	1050
S6.003	o	225	SSW.032	40.000	38.500	1.275	1050

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S5.000	23.500	67.1	SSW.010	30.500	29.000	1.275	1050
S1.011	25.400	42.3	SSW.009	29.900	28.400	1.275	1050
S1.012	23.200	166.9	SSW.008	30.350	28.261	1.789	1350
S6.000	12.950	37.0	SSW.034	45.000	43.500	1.275	1050
S7.000	21.000	52.5	SSW.034	45.000	43.500	1.275	1050
S6.001	66.000	44.0	SSW.033	43.500	42.000	1.275	1050
S8.000	15.550	31.1	SSW.033	43.500	42.000	1.275	1050
S6.002	71.700	20.5	SSW.032	40.000	38.500	1.275	1050
S9.000	15.350	43.9	SSW.032	40.000	38.500	1.275	1050
S6.003	24.150	21.0	SSW.031	38.850	37.350	1.275	1050

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S6.004	o	300	SSW.031	38.850	37.350	1.200	1050
S6.005	o	375	SSW.030	35.600	34.100	1.125	1350
S6.006	o	375	SSW.029	35.500	32.000	3.125	1350
S10.000	o	225	SSW.041	38.400	36.900	1.275	1050
S10.001	o	225	SSW.040	36.000	34.500	1.275	1050
S10.002	o	225	SSW.039	35.400	33.900	1.275	1050
S10.003	o	300	SSW.038	35.500	32.000	3.200	1200
S6.007	o	225	SSW.028	35.250	31.940	3.085	1350
S11.000	o	225	SSW.043	35.600	34.100	1.275	1050
S11.001	o	225	SSW.042	32.500	31.000	1.275	1050
S6.008	o	225	SSW.027	31.000	29.440	1.335	1050
S6.009	o	300	SSW.026	31.000	27.000	3.700	1200
S1.013	o	375	SSW.008	30.350	26.950	3.025	1350
S1.014	o	225	SSW.007	30.250	26.925	3.100	1350

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S6.004	64.500	19.8	SSW.030	35.600	34.100	1.200	1350
S6.005	11.700	200.0	SSW.029	35.500	34.042	1.084	1350
S6.006	10.000	200.0	SSW.028	35.250	31.950	2.925	1350
S10.000	77.900	32.5	SSW.040	36.000	34.500	1.275	1050
S10.001	37.500	62.5	SSW.039	35.400	33.900	1.275	1050
S10.002	6.500	60.0	SSW.038	35.500	33.792	1.483	1200
S10.003	10.000	167.0	SSW.028	35.250	31.940	3.010	1350
S6.007	90.000	36.0	SSW.027	31.000	29.440	1.335	1050
S11.000	70.900	22.9	SSW.042	32.500	31.000	1.275	1050
S11.001	66.700	42.8	SSW.027	31.000	29.440	1.335	1050
S6.008	11.900	50.0	SSW.026	31.000	29.202	1.573	1200
S6.009	10.000	200.0	SSW.008	30.350	26.950	3.100	1350
S1.013	5.000	200.0	SSW.007	30.250	26.925	2.950	1350
S1.014	5.000	200.0	SSW.006	30.000	26.900	2.875	1200

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.015	o	225	SSW.006	30.000	26.900	2.875	1200
S12.000	o	225	SSW.057	28.000	26.500	1.275	1050
S1.016	o	225	SSW.005	26.000	24.500	1.275	1050
S1.017	o	225	SSW.004	25.000	21.250	3.525	1200
S13.000	o	225	SSW.050	33.500	32.000	1.275	1050
S13.001	o	225	SSW.049	32.500	31.000	1.275	1050
S13.002	o	225	SSW.048	31.500	30.000	1.275	1050
S13.003	o	225	SSW.047	29.900	28.400	1.275	1050
S13.004	o	225	SSW.046	27.500	26.000	1.275	1050
S13.005	o	225	SSW.045	24.300	22.800	1.275	1050
S13.006	o	225	SSW.044	23.800	22.350	1.225	1050
S1.018	o	375	SSW.003	22.500	20.000	2.125	1350
S1.019	o	225	SSW.002	21.500	19.950	1.325	1350
S1.020	o	225	SSW.001	21.000	19.898	0.877	1050

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.015	27.500	12.0	SSW.005	26.000	24.608	1.167	1050
S12.000	27.250	13.6	SSW.005	26.000	24.500	1.275	1050
S1.016	21.500	12.0	SSW.004	25.000	22.708	2.067	1200
S1.017	14.000	12.0	SSW.003	22.500	20.083	2.192	1350
S13.000	26.000	26.0	SSW.049	32.500	31.000	1.275	1050
S13.001	45.500	45.5	SSW.048	31.500	30.000	1.275	1050
S13.002	37.500	23.4	SSW.047	29.900	28.400	1.275	1050
S13.003	36.350	15.1	SSW.046	27.500	26.000	1.275	1050
S13.004	46.350	14.5	SSW.045	24.300	22.800	1.275	1050
S13.005	14.100	31.3	SSW.044	23.800	22.350	1.225	1050
S13.006	18.400	13.6	SSW.003	22.500	21.000	1.275	1350
S1.018	10.000	200.0	SSW.002	21.500	19.950	1.175	1350
S1.019	10.300	198.1	SSW.001	21.000	19.898	0.877	1050
S1.020	39.400	20.8	SEXIS SW01	19.330	18.000	1.105	0

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S14.000	o	225	SSW.058	31.500	30.000	1.275	1050
S14.001	o	225	SSW.057	28.750	27.250	1.275	1050
S14.002	o	225	SSW.056	28.400	26.900	1.275	1050
S14.003	o	225	SSW.055	27.350	22.050	5.075	1200
S14.004	o	225	SSW.054	20.500	19.500	0.775	1050
S14.005	o	225	SSW.053	20.250	18.250	1.775	1200
S14.006	o	225	SSW.052	20.000	18.207	1.568	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S14.000	56.000	20.4	SSW.057	28.750	27.250	1.275	1050
S14.001	8.000	22.9	SSW.056	28.400	26.900	1.275	1050
S14.002	25.500	24.3	SSW.055	27.350	25.850	1.275	1200
S14.003	30.600	12.0	SSW.054	20.500	19.500	0.775	1050
S14.004	5.100	102.0	SSW.053	20.250	19.450	0.575	1200
S14.005	5.000	116.3	SSW.052	20.000	18.207	1.568	1200
S14.006	12.900	150.0	SExis SW01	19.330	18.121	0.984	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.020	SEXIS SW01	19.330	18.000	18.000	0	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S14.006	SExis SW01	19.330	18.121	18.000	0	0

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Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Foul Sewage per hectare (l/s)	0.000
PIMP (% impervious)	100	Additional Flow - % of Total Flow	10.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Run Time (mins)	60
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	5
Number of Online Controls	5	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	18.800	Storm Duration (mins)	30
Ratio R	0.300		

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Online Controls for Storm

Hydro-Brake® Manhole: SSW.012, DS/PN: S1.009, Volume (m³): 5.1

Design Head (m) 2.500 Hydro-Brake® Type Md4 Invert Level (m) 30.965
Design Flow (l/s) 6.7 Diameter (mm) 74

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.2	1.200	4.7	3.000	7.4	7.000	11.3
0.200	2.7	1.400	5.0	3.500	8.0	7.500	11.7
0.300	2.5	1.600	5.4	4.000	8.5	8.000	12.1
0.400	2.7	1.800	5.7	4.500	9.1	8.500	12.4
0.500	3.0	2.000	6.0	5.000	9.5	9.000	12.8
0.600	3.3	2.200	6.3	5.500	10.0	9.500	13.2
0.800	3.8	2.400	6.6	6.000	10.5		
1.000	4.3	2.600	6.9	6.500	10.9		

Hydro-Brake® Manhole: SSW.028, DS/PN: S6.007, Volume (m³): 6.3

Design Head (m) 2.500 Hydro-Brake® Type Md4 Invert Level (m) 31.940
Design Flow (l/s) 7.4 Diameter (mm) 78

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.4	1.200	5.2	3.000	8.2	7.000	12.5
0.200	3.2	1.400	5.6	3.500	8.9	7.500	13.0
0.300	2.8	1.600	6.0	4.000	9.5	8.000	13.4
0.400	3.0	1.800	6.4	4.500	10.1	8.500	13.8
0.500	3.4	2.000	6.7	5.000	10.6	9.000	14.2
0.600	3.7	2.200	7.0	5.500	11.1	9.500	14.6
0.800	4.2	2.400	7.3	6.000	11.6		
1.000	4.7	2.600	7.6	6.500	12.1		

Hydro-Brake® Manhole: SSW.007, DS/PN: S1.014, Volume (m³): 5.2

Design Head (m) 2.500 Hydro-Brake® Type Md4 Invert Level (m) 26.925
Design Flow (l/s) 20.4 Diameter (mm) 129

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.6	1.200	14.2	3.000	22.5	7.000	34.3
0.200	10.3	1.400	15.3	3.500	24.3	7.500	35.5
0.300	11.7	1.600	16.4	4.000	25.9	8.000	36.7
0.400	10.3	1.800	17.4	4.500	27.5	8.500	37.8
0.500	9.8	2.000	18.3	5.000	29.0	9.000	38.9
0.600	10.2	2.200	19.2	5.500	30.4	9.500	40.0
0.800	11.6	2.400	20.1	6.000	31.8		
1.000	13.0	2.600	20.9	6.500	33.1		

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Hydro-Brake® Manhole: SSW.002, DS/PN: S1.019, Volume (m³): 3.2

Design Head (m) 2.000 Hydro-Brake® Type Md4 Invert Level (m) 19.950
Design Flow (l/s) 23.7 Diameter (mm) 147

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.8	1.200	18.4	3.000	29.2	7.000	44.6
0.200	12.4	1.400	19.9	3.500	31.5	7.500	46.1
0.300	16.5	1.600	21.3	4.000	33.7	8.000	47.6
0.400	15.2	1.800	22.6	4.500	35.7	8.500	49.1
0.500	13.8	2.000	23.8	5.000	37.7	9.000	50.5
0.600	13.7	2.200	25.0	5.500	39.5	9.500	51.9
0.800	15.1	2.400	26.1	6.000	41.2		
1.000	16.8	2.600	27.2	6.500	42.9		

Hydro-Brake® Manhole: SSW.052, DS/PN: S14.006, Volume (m³): 2.2

Design Head (m) 1.500 Hydro-Brake® Type Md4 Invert Level (m) 18.207
Design Flow (l/s) 1.2 Diameter (mm) 36

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.4	1.200	1.1	3.000	1.7	7.000	2.7
0.200	0.5	1.400	1.2	3.500	1.9	7.500	2.8
0.300	0.6	1.600	1.3	4.000	2.0	8.000	2.9
0.400	0.6	1.800	1.4	4.500	2.1	8.500	2.9
0.500	0.7	2.000	1.4	5.000	2.3	9.000	3.0
0.600	0.8	2.200	1.5	5.500	2.4	9.500	3.1
0.800	0.9	2.400	1.6	6.000	2.5		
1.000	1.0	2.600	1.6	6.500	2.6		

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Storage Structures for Storm

Tank or Pond Manhole: SSW.012, DS/PN: S1.009

Invert Level (m) 30.965

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	220.5	2.500	220.5

Tank or Pond Manhole: SSW.028, DS/PN: S6.007

Invert Level (m) 31.940

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	220.5	2.500	220.5

Tank or Pond Manhole: SSW.007, DS/PN: S1.014

Invert Level (m) 26.925

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	232.0	2.500	232.0

Tank or Pond Manhole: SSW.002, DS/PN: S1.019

Invert Level (m) 19.950

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	148.5	2.000	148.5

Tank or Pond Manhole: SSW.052, DS/PN: S14.006

Invert Level (m) 18.207

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	70.0	1.500	70.0

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

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 100
Climate Change (%) 0

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
S1.000	15 Winter	100	0%	100/15 Summer				
S1.001	15 Winter	100	0%	100/15 Summer	100/15 Summer			5
S1.002	15 Winter	100	0%	100/15 Summer	100/15 Winter			1
S2.000	15 Winter	100	0%	100/15 Winter				
S1.003	15 Winter	100	0%	100/15 Summer				
S3.000	15 Winter	100	0%	100/15 Winter				
S4.000	15 Winter	100	0%					
S1.004	15 Winter	100	0%	100/15 Summer				
S1.005	15 Winter	100	0%	100/15 Summer	100/15 Winter			1
S1.006	960 Winter	100	0%	100/15 Summer				
S1.007	960 Winter	100	0%	100/15 Summer				
S1.008	960 Winter	100	0%	100/15 Summer				
S1.009	960 Winter	100	0%	100/15 Summer				
S1.010	15 Winter	100	0%					
S5.000	15 Winter	100	0%	100/15 Summer				
S1.011	15 Winter	100	0%	100/15 Summer				
S1.012	15 Winter	100	0%	100/15 Summer				
S6.000	15 Summer	100	0%	100/15 Summer				
S7.000	15 Summer	100	0%	100/15 Summer				
S6.001	15 Winter	100	0%	100/15 Summer	100/15 Summer			2
S8.000	15 Winter	100	0%	100/15 Summer				
S6.002	15 Winter	100	0%	100/15 Summer	100/15 Summer			4
S9.000	15 Winter	100	0%	100/15 Summer				
S6.003	15 Winter	100	0%	100/15 Summer	100/15 Summer			4
S6.004	15 Winter	100	0%					
S6.005	960 Winter	100	0%	100/15 Summer				
S6.006	960 Winter	100	0%	100/15 Summer				
S10.000	15 Winter	100	0%	100/15 Summer				
S10.001	15 Winter	100	0%	100/15 Summer				
S10.002	960 Winter	100	0%	100/15 Summer				
S10.003	960 Winter	100	0%	100/15 Summer				
S6.007	960 Winter	100	0%	100/15 Summer				
S11.000	15 Winter	100	0%	100/15 Summer				
S11.001	15 Winter	100	0%	100/15 Summer	100/15 Summer			4
S6.008	30 Winter	100	0%	100/15 Summer				
S6.009	1440 Winter	100	0%	100/15 Summer				
S1.013	1440 Winter	100	0%	100/15 Summer				
S1.014	1440 Winter	100	0%	100/15 Summer				

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

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
S1.015	15 Winter	100	0%					
S12.000	15 Winter	100	0%					
S1.016	15 Winter	100	0%					
S1.017	480 Winter	100	0%	100/15 Summer				
S13.000	15 Winter	100	0%					
S13.001	15 Winter	100	0%	100/15 Summer				
S13.002	15 Winter	100	0%	100/15 Summer				
S13.003	15 Winter	100	0%	100/15 Summer				
S13.004	15 Winter	100	0%	100/15 Summer				
S13.005	15 Winter	100	0%	100/15 Summer				
S13.006	15 Winter	100	0%	100/15 Summer				
S1.018	480 Winter	100	0%	100/15 Summer				
S1.019	480 Winter	100	0%	100/15 Summer	100/120 Winter			11
S1.020	360 Summer	100	0%					
S14.000	15 Winter	100	0%					
S14.001	15 Winter	100	0%	100/15 Summer				
S14.002	15 Winter	100	0%	100/15 Summer				
S14.003	15 Winter	100	0%	100/15 Summer				
S14.004	15 Winter	100	0%	100/15 Summer				
S14.005	1440 Winter	100	0%	100/15 Summer	100/240 Winter			8
S14.006	1440 Winter	100	0%	100/15 Summer	100/240 Summer			10

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m^3)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
S1.000	SSW.021	36.217	0.742	0.000	0.52	0.0	38.5	SURCHARGED
S1.001	SSW.020	36.020	1.295	0.000	1.74	0.0	67.0	SURCHARGED
S1.002	SSW.019	36.400	1.994	0.000	1.74	0.0	66.8	SURCHARGED
S2.000	SSW.022	36.563	0.138	0.000	0.36	0.0	35.4	SURCHARGED
S1.003	SSW.018	36.487	2.308	0.000	0.94	0.0	76.2	SURCHARGED
S3.000	SSW.023	36.520	0.195	0.000	0.78	0.0	47.4	SURCHARGED
S4.000	SSW.024	37.053	-0.072	0.000	0.78	0.0	55.5	OK
S1.004	SSW.017	36.398	2.527	0.000	1.44	0.0	207.8	SURCHARGED
S1.005	SSW.016	34.000	1.200	0.000	1.67	0.0	239.9	SURCHARGED
S1.006	SSW.015	33.389	0.925	0.000	0.33	0.0	29.9	SURCHARGED
S1.007	SSW.014	33.388	0.876	0.000	0.23	0.0	29.8	SURCHARGED
S1.008	SSW.013	33.388	1.938	0.000	0.21	0.0	29.6	SURCHARGED
S1.009	SSW.012	33.386	2.196	0.000	0.19	0.0	6.6	SURCHARGED
S1.010	SSW.011	30.930	-0.070	0.000	0.70	0.0	64.0	OK
S5.000	SSW.027	30.404	0.829	0.000	0.61	0.0	35.8	SURCHARGED
S1.011	SSW.010	30.290	1.065	0.000	1.50	0.0	110.7	SURCHARGED
S1.012	SSW.009	28.928	0.228	0.000	1.64	0.0	124.7	SURCHARGED
S6.000	SSW.035	45.042	0.967	0.000	0.26	0.0	19.4	SURCHARGED
S7.000	SSW.059	45.041	0.916	0.000	0.23	0.0	15.1	SURCHARGED
S6.001	SSW.034	45.002	1.277	0.000	1.00	0.0	75.9	SURCHARGED
S8.000	SSW.036	43.639	0.914	0.000	0.49	0.0	40.7	SURCHARGED
S6.002	SSW.033	43.508	1.283	0.000	1.07	0.0	119.5	SURCHARGED
S9.000	SSW.037	40.152	1.077	0.000	0.64	0.0	44.7	SURCHARGED

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

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m^3)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
S6.003	SSW.032	40.002	1.277	0.000	1.46	0.0	152.6	SURCHARGED
S6.004	SSW.031	37.574	-0.076	0.000	0.88	0.0	211.0	OK
S6.005	SSW.030	35.081	0.606	0.000	0.26	0.0	28.1	SURCHARGED
S6.006	SSW.029	35.078	2.703	0.000	0.27	0.0	27.8	SURCHARGED
S10.000	SSW.041	37.671	0.546	0.000	0.86	0.0	76.9	SURCHARGED
S10.001	SSW.040	35.868	1.143	0.000	1.53	0.0	95.4	SURCHARGED
S10.002	SSW.039	35.079	0.954	0.000	0.20	0.0	9.5	SURCHARGED
S10.003	SSW.038	35.078	2.778	0.000	0.15	0.0	9.3	SURCHARGED
S6.007	SSW.028	35.076	2.911	0.000	0.10	0.0	8.4	SURCHARGED
S11.000	SSW.043	34.551	0.226	0.000	0.80	0.0	85.2	SURCHARGED
S11.001	SSW.042	32.511	1.286	0.000	1.27	0.0	97.8	SURCHARGED
S6.008	SSW.027	30.041	0.376	0.000	1.62	0.0	102.0	SURCHARGED
S6.009	SSW.026	28.808	1.508	0.000	0.26	0.0	16.2	SURCHARGED
S1.013	SSW.008	28.801	1.476	0.000	0.34	0.0	29.6	SURCHARGED
S1.014	SSW.007	28.797	1.647	0.000	0.66	0.0	17.6	SURCHARGED
S1.015	SSW.006	26.987	-0.138	0.000	0.31	0.0	42.9	OK
S12.000	SSW.057	26.579	-0.146	0.000	0.26	0.0	34.6	OK
S1.016	SSW.005	24.660	-0.065	0.000	0.84	0.0	115.1	OK
S1.017	SSW.004	22.043	0.568	0.000	0.20	0.0	25.8	SURCHARGED
S13.000	SSW.050	32.157	-0.068	0.000	0.75	0.0	70.8	OK
S13.001	SSW.049	31.699	0.474	0.000	1.02	0.0	75.5	SURCHARGED
S13.002	SSW.048	30.718	0.493	0.000	0.97	0.0	99.1	SURCHARGED
S13.003	SSW.047	29.336	0.711	0.000	0.91	0.0	115.0	SURCHARGED
S13.004	SSW.046	27.489	1.264	0.000	1.04	0.0	136.0	SURCHARGED
S13.005	SSW.045	24.075	1.050	0.000	1.69	0.0	137.6	SURCHARGED
S13.006	SSW.044	22.787	0.212	0.000	1.08	0.0	137.3	SURCHARGED
S1.018	SSW.003	22.011	1.636	0.000	0.47	0.0	49.2	SURCHARGED
S1.019	SSW.002	22.002	1.827	0.000	0.69	0.0	21.2	SURCHARGED
S1.020	SSW.001	19.965	-0.158	0.000	0.19	0.0	21.2	OK
S14.000	SSW.058	30.120	-0.105	0.000	0.54	0.0	60.5	OK
S14.001	SSW.057	27.550	0.075	0.000	0.81	0.0	67.8	SURCHARGED
S14.002	SSW.056	27.321	0.196	0.000	1.09	0.0	106.8	SURCHARGED
S14.003	SSW.055	22.471	0.196	0.000	0.88	0.0	124.8	SURCHARGED
S14.004	SSW.054	20.453	0.728	0.000	3.96	0.0	124.8	SURCHARGED
S14.005	SSW.053	20.284	1.809	0.000	0.25	0.0	7.5	SURCHARGED
S14.006	SSW.052	20.283	1.851	0.000	0.04	0.0	1.4	SURCHARGED

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Appendix G – Foul Sewer Design Sheets

FOUL SEWERAGE DESIGN

Design Criteria for Foul - Main

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Add Flow / Climate Change (%)	0
Industrial Peak Flow Factor	0.00	Minimum Backdrop Height (m)	0.200
Flow Per Person (l/per/day)	446.00	Maximum Backdrop Height (m)	1.500
Persons per House	1.00	Min Design Depth for Optimisation (m)	1.200
Domestic (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	0.75
Domestic Peak Flow Factor	6.00	Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
F1.000	32.800	0.750	43.7	0.000	4	0.0	1.500	o	150
F1.001	51.100	0.852	60.0	0.000	2	0.0	1.500	o	150
F1.002	50.600	0.843	60.0	0.000	2	0.0	1.500	o	150
F2.000	21.350	0.950	22.5	0.000	4	0.0	1.500	o	150
F1.003	51.650	0.344	150.0	0.000	0	0.0	1.500	o	150
F3.000	21.850	0.450	48.6	0.000	6	0.0	1.500	o	150
F4.000	59.450	1.200	49.5	0.000	6	0.0	1.500	o	150

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.000	34.900	0.000	0.0	4	0.0	8	0.33	1.33	23.5	0.1
F1.001	34.150	0.000	0.0	6	0.0	11	0.34	1.13	20.0	0.2
F1.002	33.298	0.000	0.0	8	0.0	12	0.37	1.13	20.0	0.2
F2.000	35.900	0.000	0.0	4	0.0	7	0.41	1.85	32.8	0.1
F1.003	32.455	0.000	0.0	12	0.0	18	0.31	0.71	12.6	0.4
F3.000	35.850	0.000	0.0	6	0.0	10	0.36	1.26	22.3	0.2
F4.000	36.600	0.000	0.0	6	0.0	10	0.36	1.25	22.0	0.2

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Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
F1.004	61.540	0.308	200.0	0.000	13	0.0	1.500	o	225
F1.005	67.250	0.336	200.0	0.000	5	0.0	1.500	o	225
F1.006	48.600	0.717	67.8	0.000	7	0.0	1.500	o	225
F1.007	76.100	2.700	28.2	0.000	0	0.0	1.500	o	225
F1.008	20.600	0.137	150.0	0.000	0	0.0	1.500	o	225
F5.000	17.300	0.500	34.6	0.000	3	0.0	1.500	o	150
F5.001	66.000	1.500	44.0	0.000	10	0.0	1.500	o	150
F6.000	21.000	0.700	30.0	0.000	6	0.0	1.500	o	150
F6.001	71.700	3.500	20.5	0.000	5	0.0	1.500	o	225
F7.000	19.350	0.450	43.0	0.000	6	0.0	1.500	o	150
F6.002	24.100	1.150	21.0	0.000	0	0.0	1.500	o	225
F6.003	67.100	3.250	20.6	0.000	7	0.0	1.500	o	225
F6.004	24.150	0.350	69.0	0.000	0	0.0	1.500	o	225
F8.000	78.250	2.400	32.6	0.000	13	0.0	1.500	o	150
F8.001	49.950	0.750	66.6	0.000	3	0.0	1.500	o	150

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.004	32.111	0.000	0.0	37	0.0	29	0.38	0.81	32.2	1.1
F1.005	31.803	0.000	0.0	42	0.0	31	0.39	0.81	32.2	1.3
F1.006	31.467	0.000	0.0	49	0.0	26	0.60	1.40	55.5	1.5
F1.007	30.750	0.000	0.0	49	0.0	21	0.81	2.17	86.2	1.5
F1.008	28.050	0.000	0.0	49	0.0	31	0.45	0.94	37.2	1.5
F5.000	43.650	0.000	0.0	3	0.0	7	0.32	1.49	26.4	0.1
F5.001	43.150	0.000	0.0	13	0.0	14	0.49	1.32	23.4	0.4
F6.000	42.350	0.000	0.0	6	0.0	9	0.43	1.60	28.3	0.2
F6.001	41.650	0.000	0.0	11	0.0	10	0.56	2.54	101.1	0.3
F7.000	38.600	0.000	0.0	6	0.0	10	0.38	1.34	23.7	0.2
F6.002	38.150	0.000	0.0	17	0.0	12	0.64	2.51	99.9	0.5
F6.003	37.000	0.000	0.0	24	0.0	14	0.72	2.53	100.7	0.7
F6.004	33.750	0.000	0.0	24	0.0	19	0.48	1.38	55.0	0.7
F8.000	36.550	0.000	0.0	13	0.0	13	0.54	1.54	27.2	0.4
F8.001	34.150	0.000	0.0	16	0.0	17	0.45	1.07	19.0	0.5

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Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
F6.005	85.950	4.250	20.2	0.000	14	0.0	1.500	o	225
F9.000	72.250	3.200	22.6	0.000	7	0.0	1.500	o	150
F9.001	66.700	1.500	44.5	0.000	9	0.0	1.500	o	225
F10.000	28.000	0.467	60.0	0.000	5	0.0	1.500	o	150
F6.006	29.200	2.223	13.1	0.000	0	0.0	1.500	o	225
F1.009	21.700	1.808	12.0	0.000	0	0.0	1.500	o	225
F1.010	45.600	3.800	12.0	0.000	0	0.0	1.500	o	225
F11.000	23.000	1.000	23.0	0.000	10	0.0	1.500	o	225
F11.001	47.000	1.050	44.8	0.000	0	0.0	1.500	o	225
F11.002	39.780	1.750	22.7	0.000	12	0.0	1.500	o	225
F11.003	46.450	2.250	20.6	0.000	10	0.0	1.500	o	225
F11.004	46.300	3.200	14.5	0.000	12	0.0	1.500	o	225
F11.005	67.300	3.600	18.7	0.000	0	0.0	1.500	o	225

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F6.005	33.400	0.000	0.0	54	0.0	20	0.94	2.56	101.7	1.7
F9.000	33.850	0.000	0.0	7	0.0	9	0.50	1.85	32.7	0.2
F9.001	30.650	0.000	0.0	16	0.0	14	0.49	1.72	68.5	0.5
F10.000	28.750	0.000	0.0	5	0.0	10	0.32	1.13	20.0	0.2
F6.006	28.283	0.000	0.0	75	0.0	21	1.21	3.18	126.3	2.3
F1.009	26.060	0.000	0.0	137	0.0	28	1.51	3.32	132.1	4.2
F1.010	22.650	0.000	0.0	137	0.0	28	1.51	3.32	132.1	4.2
F11.000	31.700	0.000	0.0	10	0.0	10	0.52	2.40	95.4	0.3
F11.001	30.700	0.000	0.0	10	0.0	11	0.42	1.72	68.3	0.3
F11.002	29.650	0.000	0.0	22	0.0	14	0.68	2.41	96.0	0.7
F11.003	27.900	0.000	0.0	32	0.0	16	0.79	2.53	100.7	1.0
F11.004	25.650	0.000	0.0	44	0.0	17	0.99	3.03	120.3	1.4
F11.005	22.450	0.000	0.0	44	0.0	18	0.90	2.66	105.8	1.4

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Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
F1.011	26.600	0.700	38.0	0.000	0	0.0	1.500	o	225
F1.012	67.650	1.940	34.9	0.000	0	0.0	1.500	o	225

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.011	18.850	0.000	0.0	181	0.0	42	1.10	1.87	74.2	5.6
F1.012	18.150	0.000	0.0	181	0.0	41	1.13	1.95	77.4	5.6

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Manhole Schedules for Foul - Main

MH Name	MH CL (m)	MH Depth (m)	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
FFS.017	36.750	1.850	1200	F1.000	34.900	150				
FFS.016	36.000	1.850	1200	F1.001	34.150	150	F1.000	34.150	150	
FFS.015	36.400	3.102	1200	F1.002	33.298	150	F1.001	33.298	150	
FFS.018	37.750	1.850	1200	F2.000	35.900	150				
FFS.014	36.750	4.295	1200	F1.003	32.455	150	F1.002	32.455	150	
							F2.000	34.950	150	2495
FFS.019	37.700	1.850	1200	F3.000	35.850	150				
FFS.020	37.450	0.850	1050	F4.000	36.600	150				
FFS.013	37.250	5.139	1200	F1.004	32.111	225	F1.003	32.111	150	
							F3.000	35.400	150	3214
							F4.000	35.400	150	3214
FFS.012	34.000	2.197	1200	F1.005	31.803	225	F1.004	31.803	225	
FFS.011	34.000	2.533	1200	F1.006	31.467	225	F1.005	31.467	225	
FFS.010	32.600	1.850	1200	F1.007	30.750	225	F1.006	30.750	225	
FFS.009	29.900	1.850	1200	F1.008	28.050	225	F1.007	28.050	225	
FFS.028	45.500	1.850	1200	F5.000	43.650	150				
FFS.027	45.000	1.850	1200	F5.001	43.150	150	F5.000	43.150	150	
FFS.029	44.200	1.850	1200	F6.000	42.350	150				
FFS.026	43.500	1.850	1200	F6.001	41.650	225	F6.000	41.650	150	
FFS.030	40.450	1.850	1200	F7.000	38.600	150				
FFS.025	40.000	1.850	1200	F6.002	38.150	225	F6.001	38.150	225	
							F7.000	38.150	150	
FFS.024	38.850	1.850	1200	F6.003	37.000	225	F6.002	37.000	225	
FFS.023	35.600	1.850	1200	F6.004	33.750	225	F6.003	33.750	225	
FFS.032	38.400	1.850	1200	F8.000	36.550	150				
FFS.031	36.000	1.850	1200	F8.001	34.150	150	F8.000	34.150	150	
FFS.022	35.250	1.850	1200	F6.005	33.400	225	F6.004	33.400	225	
							F8.001	33.400	150	
FFS.034	35.700	1.850	1200	F9.000	33.850	150				
FFS.033	32.500	1.850	1200	F9.001	30.650	225	F9.000	30.650	150	
FFS.035	30.600	1.850	1200	F10.000	28.750	150				
FFS.021	31.000	2.717	1200	F6.006	28.283	225	F6.005	29.150	225	867
							F9.001	29.150	225	867
							F10.000	28.283	150	
FFS.008	30.000	3.940	1200	F1.009	26.060	225	F1.008	27.912	225	1852
							F5.001	41.650	150	15515
							F6.006	26.060	225	
FFS.007	26.100	3.450	1200	F1.010	22.650	225	F1.009	24.252	225	1602
FFS.037	33.550	1.850	1200	F11.000	31.700	225				
FFS.036	32.550	1.850	1200	F11.001	30.700	225	F11.000	30.700	225	
FFS.006	31.500	1.850	1200	F11.002	29.650	225	F11.001	29.650	225	
FFS.005	29.750	1.850	1200	F11.003	27.900	225	F11.002	27.900	225	
FFS.004	27.500	1.850	1200	F11.004	25.650	225	F11.003	25.650	225	
FFS.003	24.300	1.850	1200	F11.005	22.450	225	F11.004	22.450	225	
FFS.002	20.700	1.850	1200	F1.011	18.850	225	F1.010	18.850	225	
							F11.005	18.850	225	

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Manhole Schedules for Foul - Main

MH Name	MH CL (m)	MH Depth (m)	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
FFS.001	20.000	1.850	1200	F1.012	18.150	225	F1.011	18.150	225	
FExis FS	17.630	1.420	0		OUTFALL		F1.012	16.210	225	

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PIPELINE SCHEDULES for Foul - Main

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
F1.000	o	150	FFS.017	36.750	34.900	1.700	1200
F1.001	o	150	FFS.016	36.000	34.150	1.700	1200
F1.002	o	150	FFS.015	36.400	33.298	2.952	1200
F2.000	o	150	FFS.018	37.750	35.900	1.700	1200
F1.003	o	150	FFS.014	36.750	32.455	4.145	1200
F3.000	o	150	FFS.019	37.700	35.850	1.700	1200
F4.000	o	150	FFS.020	37.450	36.600	0.700	1050
F1.004	o	225	FFS.013	37.250	32.111	4.914	1200
F1.005	o	225	FFS.012	34.000	31.803	1.972	1200
F1.006	o	225	FFS.011	34.000	31.467	2.308	1200
F1.007	o	225	FFS.010	32.600	30.750	1.625	1200
F1.008	o	225	FFS.009	29.900	28.050	1.625	1200
F5.000	o	150	FFS.028	45.500	43.650	1.700	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
F1.000	32.800	43.7	FFS.016	36.000	34.150	1.700	1200
F1.001	51.100	60.0	FFS.015	36.400	33.298	2.952	1200
F1.002	50.600	60.0	FFS.014	36.750	32.455	4.145	1200
F2.000	21.350	22.5	FFS.014	36.750	34.950	1.650	1200
F1.003	51.650	150.0	FFS.013	37.250	32.111	4.989	1200
F3.000	21.850	48.6	FFS.013	37.250	35.400	1.700	1200
F4.000	59.450	49.5	FFS.013	37.250	35.400	1.700	1200
F1.004	61.540	200.0	FFS.012	34.000	31.803	1.972	1200
F1.005	67.250	200.0	FFS.011	34.000	31.467	2.308	1200
F1.006	48.600	67.8	FFS.010	32.600	30.750	1.625	1200
F1.007	76.100	28.2	FFS.009	29.900	28.050	1.625	1200
F1.008	20.600	150.0	FFS.008	30.000	27.912	1.863	1200
F5.000	17.300	34.6	FFS.027	45.000	43.150	1.700	1200

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PIPELINE SCHEDULES for Foul - Main

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
F5.001	o	150	FFS.027	45.000	43.150	1.700	1200
F6.000	o	150	FFS.029	44.200	42.350	1.700	1200
F6.001	o	225	FFS.026	43.500	41.650	1.625	1200
F7.000	o	150	FFS.030	40.450	38.600	1.700	1200
F6.002	o	225	FFS.025	40.000	38.150	1.625	1200
F6.003	o	225	FFS.024	38.850	37.000	1.625	1200
F6.004	o	225	FFS.023	35.600	33.750	1.625	1200
F8.000	o	150	FFS.032	38.400	36.550	1.700	1200
F8.001	o	150	FFS.031	36.000	34.150	1.700	1200
F6.005	o	225	FFS.022	35.250	33.400	1.625	1200
F9.000	o	150	FFS.034	35.700	33.850	1.700	1200
F9.001	o	225	FFS.033	32.500	30.650	1.625	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
F5.001	66.000	44.0	FFS.008	30.000	41.650	-11.800	1200
F6.000	21.000	30.0	FFS.026	43.500	41.650	1.700	1200
F6.001	71.700	20.5	FFS.025	40.000	38.150	1.625	1200
F7.000	19.350	43.0	FFS.025	40.000	38.150	1.700	1200
F6.002	24.100	21.0	FFS.024	38.850	37.000	1.625	1200
F6.003	67.100	20.6	FFS.023	35.600	33.750	1.625	1200
F6.004	24.150	69.0	FFS.022	35.250	33.400	1.625	1200
F8.000	78.250	32.6	FFS.031	36.000	34.150	1.700	1200
F8.001	49.950	66.6	FFS.022	35.250	33.400	1.700	1200
F6.005	85.950	20.2	FFS.021	31.000	29.150	1.625	1200
F9.000	72.250	22.6	FFS.033	32.500	30.650	1.700	1200
F9.001	66.700	44.5	FFS.021	31.000	29.150	1.625	1200

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PIPELINE SCHEDULES for Foul - Main

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
F10.000	o	150	FFS.035	30.600	28.750	1.700	1200
F6.006	o	225	FFS.021	31.000	28.283	2.492	1200
F1.009	o	225	FFS.008	30.000	26.060	3.715	1200
F1.010	o	225	FFS.007	26.100	22.650	3.225	1200
F11.000	o	225	FFS.037	33.550	31.700	1.625	1200
F11.001	o	225	FFS.036	32.550	30.700	1.625	1200
F11.002	o	225	FFS.006	31.500	29.650	1.625	1200
F11.003	o	225	FFS.005	29.750	27.900	1.625	1200
F11.004	o	225	FFS.004	27.500	25.650	1.625	1200
F11.005	o	225	FFS.003	24.300	22.450	1.625	1200
F1.011	o	225	FFS.002	20.700	18.850	1.625	1200
F1.012	o	225	FFS.001	20.000	18.150	1.625	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
F10.000	28.000	60.0	FFS.021	31.000	28.283	2.567	1200
F6.006	29.200	13.1	FFS.008	30.000	26.060	3.715	1200
F1.009	21.700	12.0	FFS.007	26.100	24.252	1.623	1200
F1.010	45.600	12.0	FFS.002	20.700	18.850	1.625	1200
F11.000	23.000	23.0	FFS.036	32.550	30.700	1.625	1200
F11.001	47.000	44.8	FFS.006	31.500	29.650	1.625	1200
F11.002	39.780	22.7	FFS.005	29.750	27.900	1.625	1200
F11.003	46.450	20.6	FFS.004	27.500	25.650	1.625	1200
F11.004	46.300	14.5	FFS.003	24.300	22.450	1.625	1200
F11.005	67.300	18.7	FFS.002	20.700	18.850	1.625	1200
F1.011	26.600	38.0	FFS.001	20.000	18.150	1.625	1200
F1.012	67.650	34.9	FExis FS	17.630	16.210	1.195	0

Free Flowing Outfall Details for Foul - Main

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
F1.012	FExis FS	17.630	16.210	16.210	0	0

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Simulation Criteria for Foul - Main

Volumetric Runoff Coeff	0.750	Foul Sewage per hectare (l/s)	0.000
PIMP (% impervious)	100	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Run Time (mins)	60
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

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Appendix H – Storm Water Longitudinal Sections

MH Name	SSW.019	SSW.020	SSW.021	
Hor Scale 1000 Ver Scale 1000 Datum (m)12.000				
PN		S1.001	S1.000	
Dia (mm)		225	225	
Slope (1:X)		168.0	43.0	
Cover Level (m)	36.400	36.000	36.750	
Invert Level (m)		34.181	34.500 / 34.500	35.250
Length (m)		53.600	32.250	

MH Name	SSW.018	SSW.019	
Hor Scale 1000 Ver Scale 1000 Datum (m)12.000		2.000	
PN		S1.002	
Dia (mm)		225	
Slope (1:X)		168.2	
Cover Level (m)	36.750	36.400	
Invert Level (m)		33.879	34.181
Length (m)		50.800	

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MH Name	SSW.017	SSW.018	
Hor Scale 1000 Ver Scale 1000 Datum (m) 12.000			
PN		S1.003	
Dia (mm)		300	
Slope (1:X)		167.9	
Cover Level (m)	37.250	36.750	
Invert Level (m)		33.571	33.879
Length (m)		51.700	

MH Name	SSW.016	SSW.017	
Hor Scale 1000 Ver Scale 1000 Datum (m) 12.000			
PN		S1.004	
Dia (mm)		300	
Slope (1:X)		53.8	
Cover Level (m)	34.000	37.250	
Invert Level (m)		32.425	33.571
Length (m)		61.700	

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MH Name	SSW.012			SSW.016	
Hor Scale 1000 Ver Scale 1000 Datum (m) 9.000					
PN				S1.005	
Dia (mm)				375	
Slope (1:X)				168.2	
Cover Level (m)	33.900	34.000	34.050	34.000	
Invert Level (m)		31.000	32.089	32.089 32.425	
Length (m)				56.500	

MH Name	SSW.010	SSW.011		SSW.012	
Hor Scale 1000 Ver Scale 1000 Datum (m) 8.000		5.000			
PN		S1.010		S1.009	
Dia (mm)		225		225	
Slope (1:X)		30.0		199.7	
Cover Level (m)	30.500	32.750		33.900	
Invert Level (m)		29.000	30.775	30.775 30.965	
Length (m)		53.200		37.950	

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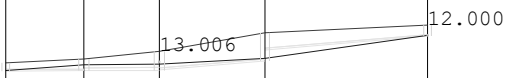
MH Name	SSW.005	SSW.006			SSW.009	SSW.010	
Hor Scale 1000 Ver Scale 1000 Datum (m) 4.000							
PN		S1.015			S1.012	S1.011	
Dia (mm)		225			300	225	
Slope (1:X)		12.0			166.9	42.3	
Cover Level (m)	26.000	30.000	30.250	30.350	29.900	30.500	
Invert Level (m)		24.608	26.900	26.925	26.950	28.261	28.400	28.400	29.000	
Length (m)		27.500			23.200	25.400	

MH Name	SSW.001			SSW.004	SSW.005	
Hor Scale 1000 Ver Scale 1000 Datum (m) 0.000						
PN				S1.017	S1.016	
Dia (mm)				225	225	
Slope (1:X)				12.0	12.0	
Cover Level (m)	21.000	21.500	22.500	25.000	26.000	
Invert Level (m)		19.898	19.950	19.950	20.000	20.083	21.250	22.708	24.500	
Length (m)				14.000	21.500	

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MH Name	SEXIS SW01	SSW.001	
Hor Scale 1000 Ver Scale 1000 Datum (m)-4.000			
PN		S1.020	
Dia (mm)		225	
Slope (1:X)		20.8	
Cover Level (m)	19.330	21.000	
Invert Level (m)	18.000	19.898	
Length (m)		39.400	

MH Name	SSW.018	SSW.022	
Hor Scale 1000 Ver Scale 1000 Datum (m)13.000		1.002	
PN		S2.000	
Dia (mm)		225	
Slope (1:X)		23.5	
Cover Level (m)	36.750	37.600	
Invert Level (m)		35.350	36.200
Length (m)		19.950	

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MH Name	SSW.017	SSW.023	
Hor Scale 1000 Ver Scale 1000 Datum (m)13.000		4.000 1.003	
PN		S3.000	
Dia (mm)		225	
Slope (1:X)		61.9	
Cover Level (m)	37.250	37.600	
Invert Level (m)		35.750	36.100
Length (m)		21.650	

MH Name	SSW.017	SSW.024	
Hor Scale 1000 Ver Scale 1000 Datum (m)13.000		3.000 1.003	
PN		S4.000	
Dia (mm)		225	
Slope (1:X)		49.8	
Cover Level (m)	37.250	38.400	
Invert Level (m)	35.750	36.900	
Length (m)		57.250	

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MH Name	SSW.010	SSW.027	
Hor Scale 1000 Ver Scale 1000 Datum (m) 7.000		1.010	
PN		S5.000	
Dia (mm)		225	
Slope (1:X)		67.1	
Cover Level (m)	30.500	30.850	
Invert Level (m)		29.000	29.350
Length (m)		23.500	

MH Name	SSW.033	SSW.034	SSW.035	
Hor Scale 1000 Ver Scale 1000 Datum (m) 21.000		8.000	7.000	
PN		S6.001	S6.000	
Dia (mm)		225	225	
Slope (1:X)		44.0	37.0	
Cover Level (m)	43.500	45.000	45.350	
Invert Level (m)		42.000 43.500	43.500 43.850	
Length (m)		66.000	12.950	

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MH Name	SSW.032	SSW.033	
Hor Scale 1000 Ver Scale 1000 Datum (m)18.000		9.000 8.000	
PN		S6.002	
Dia (mm)		225	
Slope (1:X)		20.5	
Cover Level (m)	40.000	43.500	
Invert Level (m)		38.500 42.000	
Length (m)		71.700	

MH Name	SSW.030	SSW.031	SSW.032	
Hor Scale 1000 Ver Scale 1000 Datum (m)14.000		9.000		
PN		S6.004	S6.003	
Dia (mm)		300	225	
Slope (1:X)		19.8	21.0	
Cover Level (m)	35.600	38.850	40.000	
Invert Level (m)		34.100 37.350	37.350 38.500	
Length (m)		64.500	24.150	

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MH Name	SSW.028			
Hor Scale 1000 Ver Scale 1000 Datum (m) 11.000		10.003		
PN				
Dia (mm)				
Slope (1:X)				
Cover Level (m)	35.250	35.500	35.600	
Invert Level (m)		31.950 32.000	34.042 34.100	
Length (m)				

MH Name	SSW.027	SSW.028	
Hor Scale 1000 Ver Scale 1000 Datum (m) 9.000		11.001	10.003
PN		S6.007	
Dia (mm)		225	
Slope (1:X)		36.0	
Cover Level (m)	31.000	35.250	
Invert Level (m)		29.440 31.940	
Length (m)		90.000	

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MH Name	SSW.008			
Hor Scale 1000 Ver Scale 1000 Datum (m) 6.000		1.012		11.001
PN				
Dia (mm)				
Slope (1:X)				
Cover Level (m)	30.350	31.000	31.000	
Invert Level (m)		26.950 27.000	29.202 29.440	
Length (m)				

MH Name	SSW.034	SSW.059	
Hor Scale 1000 Ver Scale 1000 Datum (m) 21.000		6.000	
PN		S7.000	
Dia (mm)		225	
Slope (1:X)		52.5	
Cover Level (m)	45.000	45.400	
Invert Level (m)		43.500 43.900	
Length (m)		21.000	

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MH Name	SSW.033	SSW.036	
Hor Scale 1000 Ver Scale 1000 Datum (m) 20.000		6.001	
PN		S8.000	
Dia (mm)		225	
Slope (1:X)		31.1	
Cover Level (m)	43.500	44.000	
Invert Level (m)		42.000	42.500
Length (m)		15.550	

MH Name	SSW.032	SSW.037	
Hor Scale 1000 Ver Scale 1000 Datum (m) 16.000		6.002	
PN		S9.000	
Dia (mm)		225	
Slope (1:X)		43.9	
Cover Level (m)	40.000	40.350	
Invert Level (m)		38.500	38.850
Length (m)		15.350	

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MH Name	SSW.040	SSW.041	
Hor Scale 1000 Ver Scale 1000 Datum (m)13.000			
PN		S10.000	
Dia (mm)		225	
Slope (1:X)		32.5	
Cover Level (m)	36.000	38.400	
Invert Level (m)		34.500	36.900
Length (m)		77.900	

MH Name	SSW.028			SSW.040	
Hor Scale 1000 Ver Scale 1000 Datum (m)11.000					
PN				S10.001	
Dia (mm)				225	
Slope (1:X)				62.5	
Cover Level (m)	35.250	35.500	35.400	36.000	
Invert Level (m)		31.940 32.000	33.900	33.900 34.500	
Length (m)				37.500	

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MH Name	SSW.042	SSW.043	
Hor Scale 1000 Ver Scale 1000 Datum (m)10.000			
PN		S11.000	
Dia (mm)		225	
Slope (1:X)		22.9	
Cover Level (m)	32.500	35.600	
Invert Level (m)		31.000	34.100
Length (m)		70.900	

MH Name	SSW.027	SSW.042	
Hor Scale 1000 Ver Scale 1000 Datum (m)8.000			
PN		S11.001	
Dia (mm)		225	
Slope (1:X)		42.8	
Cover Level (m)	31.000	32.500	
Invert Level (m)		29.440	31.000
Length (m)		66.700	

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MH Name	SSW.005	SSW.057	
Hor Scale 1000 Ver Scale 1000 Datum (m) 3.000		1.015	
PN		S12.000	
Dia (mm)		225	
Slope (1:X)		13.6	
Cover Level (m)	26.000	28.000	
Invert Level (m)		24.500	26.500
Length (m)		27.250	

MH Name	SSW.048	SSW.049	SSW.050	
Hor Scale 1000 Ver Scale 1000 Datum (m) 9.000				
PN		S13.001	S13.000	
Dia (mm)		225	225	
Slope (1:X)		45.5	26.0	
Cover Level (m)	31.500	32.500	33.500	
Invert Level (m)		30.000	31.000 31.000	32.000
Length (m)		45.500	26.000	

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MH Name	SSW.046	SSW.047	SSW.048	
Hor Scale 1000 Ver Scale 1000 Datum (m) 6.000				
PN		S13.003	S13.002	
Dia (mm)		225	225	
Slope (1:X)		15.1	23.4	
Cover Level (m)	27.500	29.900	31.500	
Invert Level (m)		26.000	28.400 / 28.400	30.000
Length (m)		36.350	37.500	

MH Name	SSW.003	SSW.044	SSW.045	SSW.046	
Hor Scale 1000 Ver Scale 1000 Datum (m) 1.000		1.017			
PN		S13.006	S13.005	S13.004	
Dia (mm)		225	225	225	
Slope (1:X)		13.6	31.3	14.5	
Cover Level (m)	22.500	23.800	24.300	27.500	
Invert Level (m)		21.000 / 22.350	22.350 / 22.800	22.800 / 26.000	
Length (m)		18.400	14.100	46.350	

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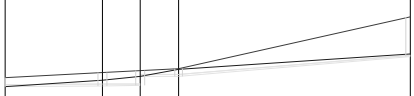
MH Name	SSW.055	SSW.056		SSW.058	
Hor Scale 1000 Ver Scale 1000 Datum (m) 4.000					
PN		S14.002		S14.000	
Dia (mm)		225		225	
Slope (1:X)		24.3		20.4	
Cover Level (m)	27.350	28.400	28.750	31.500	
Invert Level (m)		25.850 26.900	26.900 27.250	27.250 30.000	
Length (m)		25.500		56.000	

MH Name	SExis SW01	SSW.052			SSW.055	
Hor Scale 1000 Ver Scale 1000 Datum (m) 0.000						
PN		S14.006			S14.003	
Dia (mm)		225			225	
Slope (1:X)		150.0			12.0	
Cover Level (m)	19.330	20.000	20.250	20.500	27.350	
Invert Level (m)		18.121 18.207	18.250	19.500	19.500 22.050	
Length (m)		12.900			30.600	

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Appendix J – Foul Sewer Longitudinal Sections

Denis O'Sullivan & Associates		Page 1
Unit 5, Joyce House Barrack Square Ballincollig, Co. Cork	Residential Development Ardarostig Bishopstown, Cork	
Date 13/01/2021 File Foul Sewer Model.MDX	Designed By S.O.'Grady Checked By	
Micro Drainage	Network W.12.4	

MH Name	FFS.015	FFS.016	FFS.017	
Hor Scale 1000 Ver Scale 1000 Datum (m)12.000				
PN		F1.001	F1.000	
Dia (mm)		150	150	
Slope (1:X)		60.0	43.7	
Cover Level (m)	36.400	36.000	36.750	
Invert Level (m)		33.298 / 34.150	34.150 / 34.900	
Length (m)		51.100	32.800	

MH Name	FFS.014	FFS.015	
Hor Scale 1000 Ver Scale 1000 Datum (m)12.000		2.000	
PN		F1.002	
Dia (mm)		150	
Slope (1:X)		60.0	
Cover Level (m)	36.750	36.400	
Invert Level (m)		32.455 / 33.298	
Length (m)		50.600	

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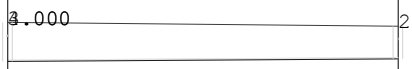
MH Name	FFS.013	FFS.014	
Hor Scale 1000 Ver Scale 1000 Datum (m) 12.000			
PN		F1.003	
Dia (mm)		150	
Slope (1:X)		150.0	
Cover Level (m)	37.250	36.750	
Invert Level (m)	32.111	32.455	
Length (m)		51.650	

MH Name	FFS.012	FFS.013	
Hor Scale 1000 Ver Scale 1000 Datum (m) 12.000			
PN		F1.004	
Dia (mm)		225	
Slope (1:X)		200.0	
Cover Level (m)	34.000	37.250	
Invert Level (m)	31.803	32.111	
Length (m)		61.540	

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MH Name	FFS.011	FFS.012	
Hor Scale 1000 Ver Scale 1000 Datum (m) 10.000			
PN		F1.005	
Dia (mm)		225	
Slope (1:X)		200.0	
Cover Level (m)	34.000	34.000	
Invert Level (m)	31.467	31.803	
Length (m)		67.250	

MH Name	FFS.010	FFS.011	
Hor Scale 1000 Ver Scale 1000 Datum (m) 9.000			
PN		F1.006	
Dia (mm)		225	
Slope (1:X)		67.8	
Cover Level (m)	32.600	34.000	
Invert Level (m)		30.750 31.467	
Length (m)		48.600	

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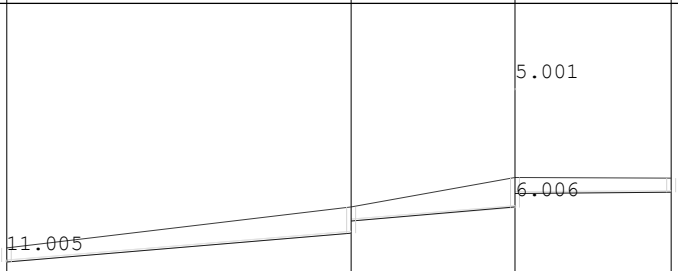
MH Name	FFS.009	FFS.010	
Hor Scale 1000 Ver Scale 1000 Datum (m) 7.000			
PN		F1.007	
Dia (mm)		225	
Slope (1:X)		28.2	
Cover Level (m)	29.900	32.600	
Invert Level (m)	28.050	30.750	
Length (m)		76.100	

MH Name	FFS.002	FFS.007	FFS.008	FFS.009	
Hor Scale 1000 Ver Scale 1000 Datum (m) 7.000					
PN		F1.010	F1.009	F1.008	
Dia (mm)		225	225	225	
Slope (1:X)		12.0	12.0	150.0	
Cover Level (m)	20.700	26.100	30.000	29.900	
Invert Level (m)	18.850	22.650 24.252	26.060 27.912	28.050	
Length (m)		45.600	21.700	20.600	

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MH Name	FFS.001	FFS.002	
Hor Scale 1000 Ver Scale 1000 Datum (m)-4.000			11.005
PN		F1.011	
Dia (mm)		225	
Slope (1:X)		38.0	
Cover Level (m)	20.000	20.700	
Invert Level (m)		18.150	18.850
Length (m)		26.600	

MH Name	FExis FS	FFS.001	
Hor Scale 1000 Ver Scale 1000 Datum (m)-5.000			
PN		F1.012	
Dia (mm)		225	
Slope (1:X)		34.9	
Cover Level (m)	17.630	20.000	
Invert Level (m)		16.210	18.150
Length (m)		67.650	

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MH Name	FFS.014	FFS.018	
Hor Scale 1000 Ver Scale 1000 Datum (m) 12.000		1.002	
PN		F2.000	
Dia (mm)		150	
Slope (1:X)		22.5	
Cover Level (m)	36.750	37.750	
Invert Level (m)		34.950 / 35.900	
Length (m)		21.350	

MH Name	FFS.013	FFS.019	
Hor Scale 1000 Ver Scale 1000 Datum (m) 12.000		4.000 1.003	
PN		F3.000	
Dia (mm)		150	
Slope (1:X)		48.6	
Cover Level (m)	37.250	37.700	
Invert Level (m)		35.400 / 35.850	
Length (m)		21.850	

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MH Name	FFS.013	FFS.020	
Hor Scale 1000 Ver Scale 1000 Datum (m) 12.000		3.000 1.003	
PN		F4.000	
Dia (mm)		150	
Slope (1:X)		49.5	
Cover Level (m)	37.250	37.450	
Invert Level (m)	35.400	36.600	
Length (m)		59.450	

MH Name	FFS.008	FFS.027	FFS.028	
Hor Scale 1000 Ver Scale 1000 Datum (m) 13.000		1.008 6.006		
PN		F5.001	F5.000	
Dia (mm)		150	150	
Slope (1:X)		44.0	34.6	
Cover Level (m)	30.000	45.000	45.500	
Invert Level (m)		41.650 43.150	43.150 43.650	
Length (m)		66.000	17.300	

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MH Name	FFS.026	FFS.029	
Hor Scale 1000 Ver Scale 1000 Datum (m) 20.000			
PN		F6.000	
Dia (mm)		150	
Slope (1:X)		30.0	
Cover Level (m)	43.500	44.200	
Invert Level (m)		41.650 42.350	
Length (m)		21.000	

MH Name	FFS.025	FFS.026	
Hor Scale 1000 Ver Scale 1000 Datum (m) 18.000			
PN		F6.001	
Dia (mm)		225	
Slope (1:X)		20.5	
Cover Level (m)	40.000	43.500	
Invert Level (m)	38.150	41.650	
Length (m)		71.700	

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MH Name	FFS.024	FFS.025	
Hor Scale 1000 Ver Scale 1000 Datum (m)15.000			7.000
PN		F6.002	
Dia (mm)		225	
Slope (1:X)		21.0	
Cover Level (m)	38.850	40.000	
Invert Level (m)		37.000	38.150
Length (m)		24.100	

MH Name	FFS.023	FFS.024	
Hor Scale 1000 Ver Scale 1000 Datum (m)13.000			
PN		F6.003	
Dia (mm)		225	
Slope (1:X)		20.6	
Cover Level (m)	35.600	38.850	
Invert Level (m)		33.750	37.000
Length (m)		67.100	

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MH Name	FFS.022	FFS.023	
Hor Scale 1000 Ver Scale 1000 Datum (m) 11.000		8.001	
PN		F6.004	
Dia (mm)		225	
Slope (1:X)		69.0	
Cover Level (m)	35.250	35.600	
Invert Level (m)		33.400	33.750
Length (m)		24.150	

MH Name	FFS.021	FFS.022	
Hor Scale 1000 Ver Scale 1000 Datum (m) 9.000		9.001 10.000	8.001
PN		F6.005	
Dia (mm)		225	
Slope (1:X)		20.2	
Cover Level (m)	31.000	35.250	
Invert Level (m)		29.150	33.400
Length (m)		85.950	

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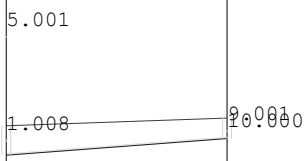
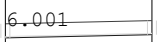
MH Name	FFS.008	FFS.021	
Hor Scale 1000 Ver Scale 1000 Datum (m) 11.000			
PN		F6.006	
Dia (mm)		225	
Slope (1:X)		13.1	
Cover Level (m)	30.000	31.000	
Invert Level (m)		26.060	28.283
Length (m)		29.200	

MH Name	FFS.025	FFS.030	
Hor Scale 1000 Ver Scale 1000 Datum (m) 16.000			
PN		F7.000	
Dia (mm)		150	
Slope (1:X)		43.0	
Cover Level (m)	40.000	40.450	
Invert Level (m)		38.150	38.600
Length (m)		19.350	

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MH Name	FFS.031	FFS.032	
Hor Scale 1000 Ver Scale 1000 Datum (m) 13.000			
PN		F8.000	
Dia (mm)		150	
Slope (1:X)		32.6	
Cover Level (m)	36.000	38.400	
Invert Level (m)		34.150	36.550
Length (m)		78.250	

MH Name	FFS.022	FFS.031	
Hor Scale 1000 Ver Scale 1000 Datum (m) 12.000			
PN		F8.001	
Dia (mm)		150	
Slope (1:X)		66.6	
Cover Level (m)	35.250	36.000	
Invert Level (m)		33.400	34.150
Length (m)		49.950	

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MH Name	FFS.033	FFS.034	
Hor Scale 1000 Ver Scale 1000 Datum (m) 10.000			
PN		F9.000	
Dia (mm)		150	
Slope (1:X)		22.6	
Cover Level (m)	32.500	35.700	
Invert Level (m)		30.650	33.850
Length (m)		72.250	

MH Name	FFS.021	FFS.033	
Hor Scale 1000 Ver Scale 1000 Datum (m) 7.000			
PN		F9.001	
Dia (mm)		225	
Slope (1:X)		44.5	
Cover Level (m)	31.000	32.500	
Invert Level (m)		29.150	30.650
Length (m)		66.700	

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MH Name	FFS.021	FFS.035	
Hor Scale 1000 Ver Scale 1000 Datum (m) 7.000			
PN		F10.000	
Dia (mm)		150	
Slope (1:X)		60.0	
Cover Level (m)	31.000	30.600	
Invert Level (m)		28.283 / 28.750	
Length (m)		28.000	

MH Name	FFS.006	FFS.036	FFS.037	
Hor Scale 1000 Ver Scale 1000 Datum (m) 9.000				
PN		F11.001	F11.000	
Dia (mm)		225	225	
Slope (1:X)		44.8	23.0	
Cover Level (m)	31.500	32.550	33.550	
Invert Level (m)	29.650	30.700	30.700 / 31.700	
Length (m)		47.000	23.000	

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MH Name	FFS.004	FFS.005	FFS.006	
Hor Scale 1000 Ver Scale 1000 Datum (m) 6.000				
PN		F11.003	F11.002	
Dia (mm)		225	225	
Slope (1:X)		20.6	22.7	
Cover Level (m)	27.500	29.750	31.500	
Invert Level (m)		25.650	27.900	27.900	29.650	
Length (m)		46.450	39.780	

MH Name	FFS.003	FFS.004	
Hor Scale 1000 Ver Scale 1000 Datum (m) 2.000			
PN		F11.004	
Dia (mm)		225	
Slope (1:X)		14.5	
Cover Level (m)	24.300	27.500	
Invert Level (m)		22.450	25.650	
Length (m)		46.300	

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MH Name	FFS.002	FFS.003	
Hor Scale 1000 Ver Scale 1000 Datum (m)-1.000		1.010	
PN		F11.005	
Dia (mm)		225	
Slope (1:X)		18.7	
Cover Level (m)	20.700	24.300	
Invert Level (m)	18.850	22.450	
Length (m)		67.300	

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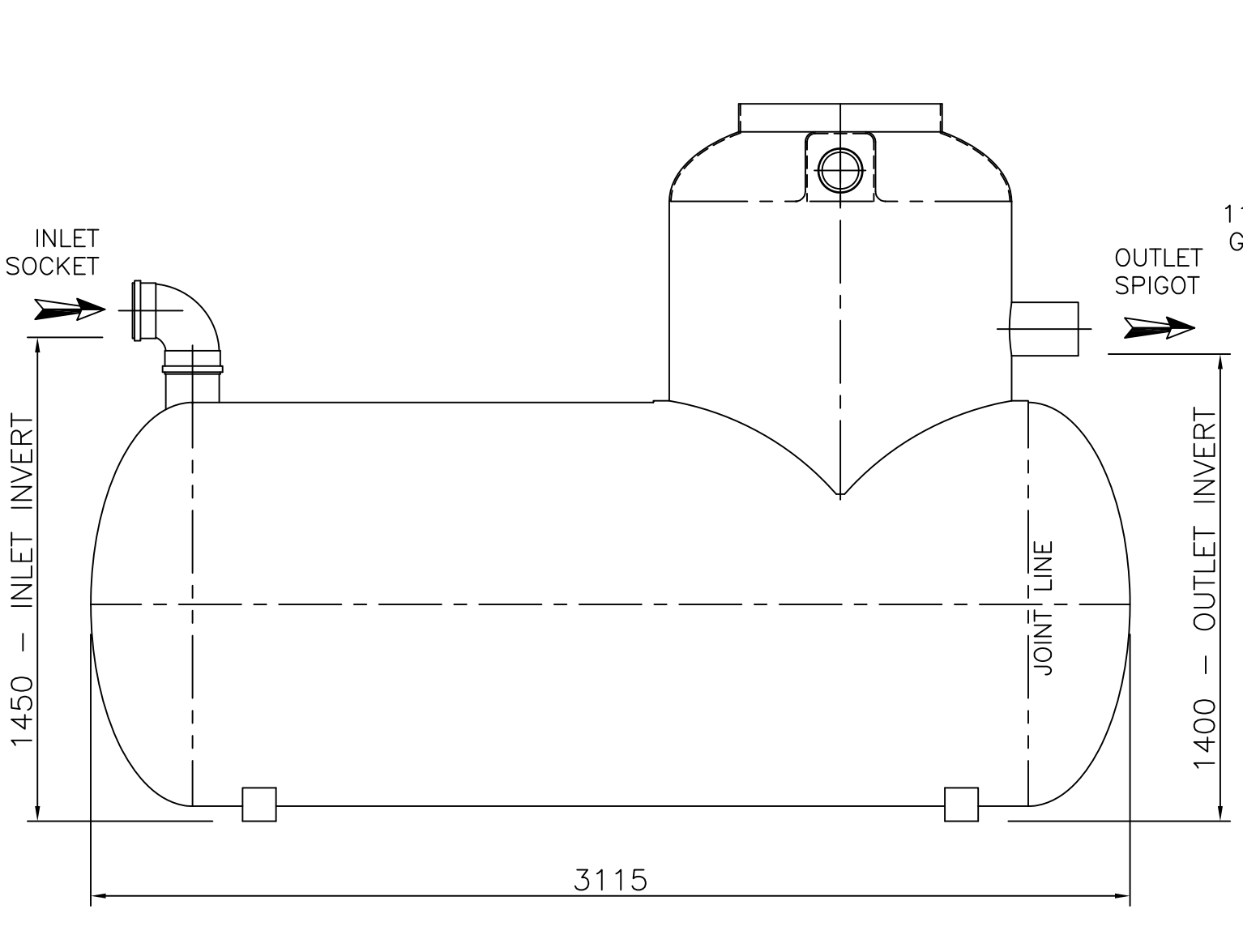
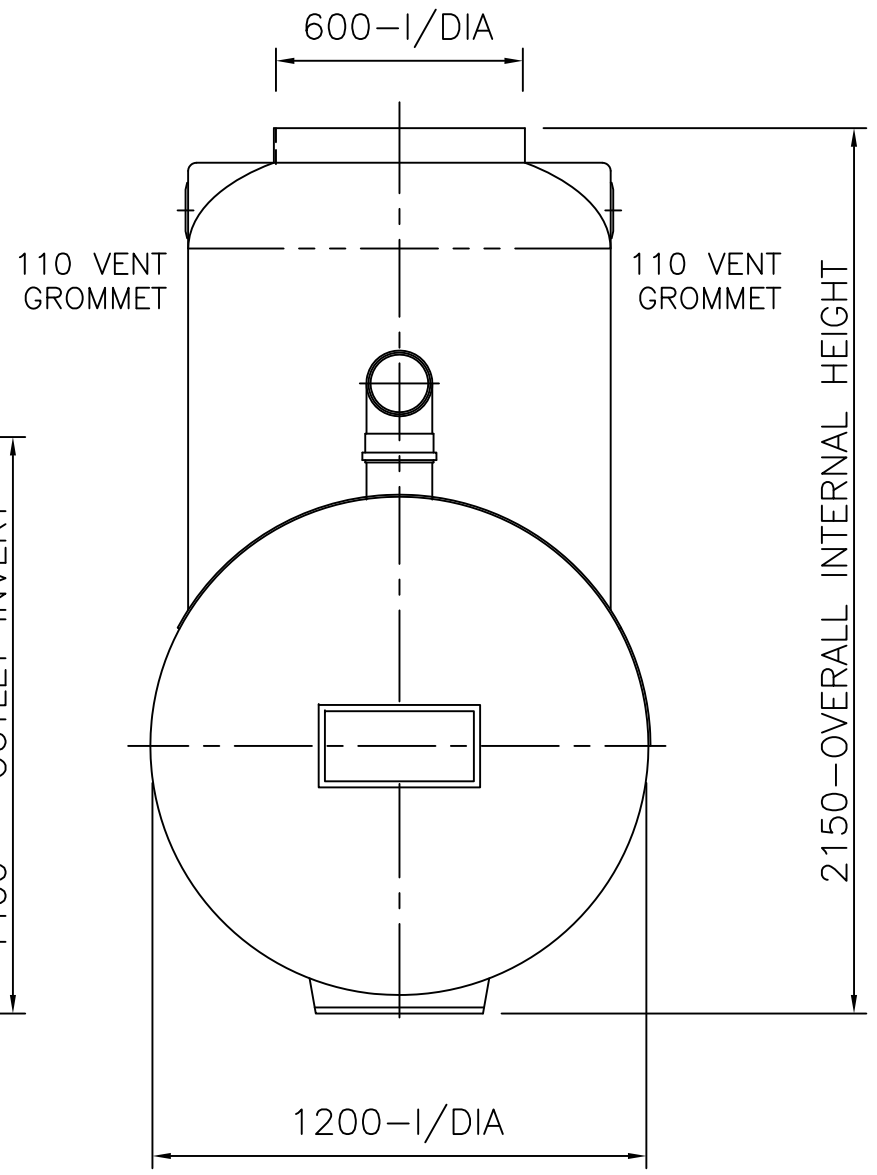
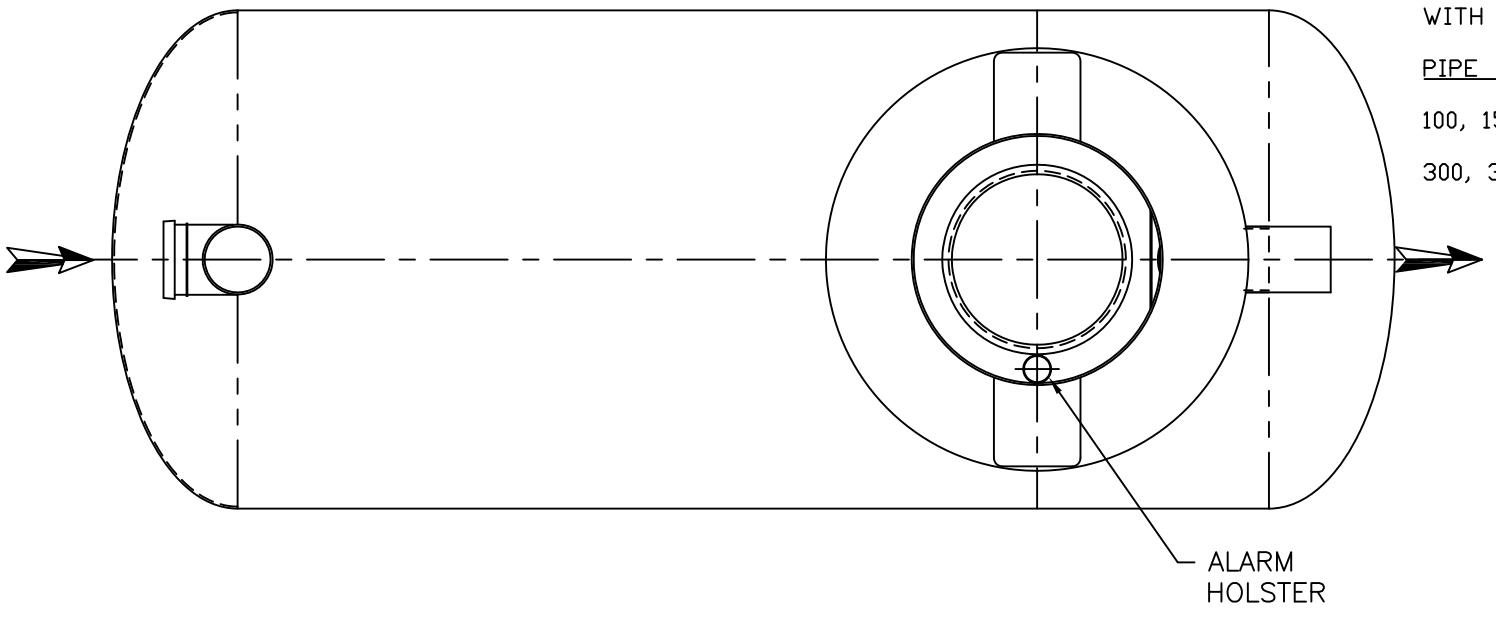
Appendix K – Petrol Interceptor Details







IMPORTANT NOTE

DUE TO THE COMPACT DESIGN AND EASE OF INSTALLATION, CONDER SEPARATORS ARE NOW SUPPLIED AS STANDARD WITH AN IN LINE CONFIGURATION.

PIPE SIZE VARIANTS

100, 150, 225 PVC

300, 375, GRP

NOTES:

1. PRODUCT INFORMATION

The Conder range of light liquid separators is produced from high grade GRP. Inlets are provided as sockets and outlets as spigots, Connections may be made by steel-banded flexible couplings, nitrile seal joints, rope-seal and mortar or any other appropriate jointing method.

Ventilation specifications should be in accordance with Local Authority requirements. Vent pipework from multiple chambers must never be manifolded below ground level.

2. PERFORMANCE CHARACTERISTICS

Separators are based on the requirements stated in European Standard EN858-1 and Environment Agency guideline PPG3, in particular:-

a. The nominal size has been established from performance tests where the residual oil at the outlet is less than 5mg/l for class 1 separators and less than 100mg/l for class 2 separators.

3. MAINTENANCE AND USE

It is important to recognise that light liquid separators require regular maintenance. The period between maintenance operations can vary depending on the location and use of the separator, therefore routine inspections shall be undertaken at least every six months and a log maintained of inspection date, depth of oil, depth of silt and any cleaning that is undertaken.

A Conder Alarm should be fitted to every separator to give automatic warning that the light liquid capacity has been reached.

Access to the separator should be kept clear and not used for storage.

4. PRODUCT DEVELOPMENT

In line with our policy of constant improvement and development, we reserve the right to change specification without prior notice.

IMPORTANT INVERT LEVEL NOTE (RIBBED TANKS ONLY!):

The inlet and outlet Invert Level(IL) shown on this drawing is to internals of the shell unless otherwise stated.

For Invert level to the outside of the shell ribs, see the conversion below:

Ø1.0m, 1.2m, 1.5m, 1.8m, 2.5m IL+50mm ('X')

Ø3.0m,4.0m IL+75mm ('X')

TANKS SUPPLIED WITH LOOSE SHAFTS DO NOT COME SUPPLIED WITH A FIXING KIT.
THIS IS THE RESPONSIBILITY OF THE SITE CONTRACTOR.

PREMIER TECH AQUA

1ST ANGLE PROJECTION

REV.	DATE	BY	CHKD.	APPD.	DESCRIPTION
7	11.04.13	DG	KB	RP	PIPE VARIANT SIZES AMENDED

A3 — DO NOT SCALE IF IN DOUBT ASK ALL DIMENSIONS IN MM

GENERAL TOLERANCES (unless noted otherwise)

GRP FABRICATED	LINEAR	± 5mm	ANGLE	±0.5°
MACHINED		± 2mm		±0.2°
		± 0.5mm		±0.1°

THIS DRAWING IS THE PROPERTY OF PREMIER TECH AQUA Ltd. AND IS NOT TO BE COPIED IN PART OR WHOLE WITHOUT WRITTEN PERMISSION

TITLE

CNSB20S/21/SALES BYPASS SEPARATOR

DRAWN BY	CHKD.	APPD.	SCALE	DRAWING No.	REVISION
RU	PB	RP	NTS	CNSB20S/21 SALES	7
DATE 23.03.09	DATE 23.03.09	DATE 23.03.09			

Appendix L – Hydrobrake Details

Hydro-Brake® Flow Control

Modelling Guide

Unit Selection Design Guide

Overview

Hydro-Brake® Flow Controls restrict the flow in surface/storm water or foul/combined sewer systems by inducing a vortex flow pattern in the water passing through the device, having the effect of increasing back-pressure.

Their 'hydrodynamic' rather than 'physical restriction' based operation provides flow regulation whilst maintaining larger clearances than most other types of flow control, making them less susceptible to blockage. Their unique "S"-shaped head-flow characteristic also enables them to pass greater flows at lower heads, which can enable more efficient use of upstream storage facilities.

This document provides guidance relating to the selection and use of Hydro-Brake® Flow Controls for use in surface/storm water and foul/combined sewer systems.

The information provided here is intended for the purposes of general guidance only - individual application requirements may differ. If in doubt, or to enquire about new product additions, please contact HRD Technologies Ltd.

STH Range of Hydro-Brake® Flow Controls

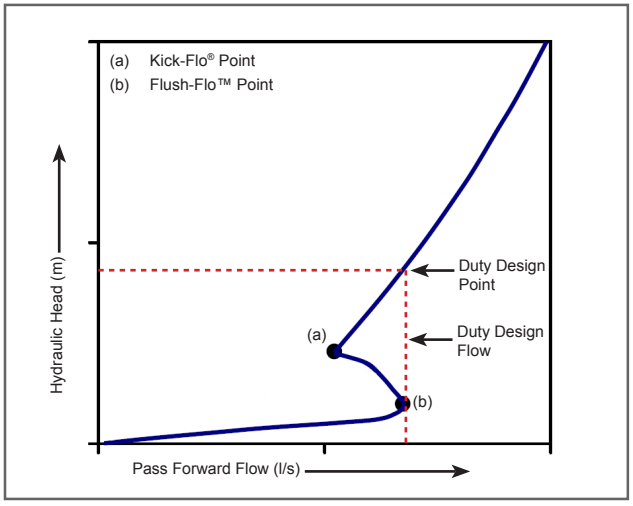
BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE No 08/4599

See back cover for details.

Hydraulic Characteristics and Specification

Hydro-Brake® Flow Controls should be selected such that the duty/design flow is not exceeded at any point on the head-flow curve, see illustration right. If this is not achievable using the initially selected unit, it may be appropriate to select an alternative option (see selection guidance overleaf).

While the primary aim of a flow control is to provide a particular flow rate at a given upstream head (giving a design/duty point), it is important to note that secondary opportunities, such as potential for optimised storage use, derive from consideration of the full hydraulic characteristic. It is therefore important to ensure that the same flow control, or one confirmed to provide equivalent hydraulic performance, is implemented in any final installation.



Typical Hydro-Brake® Head Versus Flow Characteristics

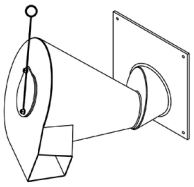
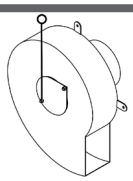
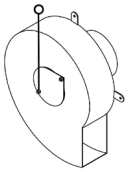
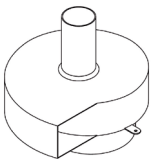
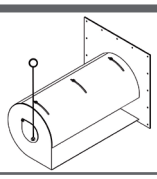
To ensure correct implementation a multiple design-point specification, defining the main hydraulic features of the selected flow control, can be provided by HRD Technologies Ltd. This should include at least the following information:

- outlet size and model of Hydro-Brake® Flow Control
- definition of the duty/design point (head and flow)
- definition of the Flush-Flo™ point (head and flow)
- definition of the Kick-Flo® point (head and flow)

To ensure that a drainage system performs as designed, it is strongly recommended that this information is reproduced on any technical specifications.

Hydro-Brake® Flow Control Models Supported in Micro Drainage

The Table below provides a summary of the Hydro-Brake® Flow Control models currently supported by the Micro Drainage programs, including details of unit styles, applications and design/installation considerations. Advice regarding unit selection is provided in subsequent sections.

WinDes® Reference Code	Style / Typical Shape	Application	Design / Installation Notes
Md1 Md2 Md4 Md14	**Conical** 	Foul / combined and surface / storm water.	With the exception of the Md14, conical units require benching into the intake (the Md14 has a piped intake). They generally require larger manholes than equivalent sump-type units.
Md5 Md6 Md7 Md12	**Sump-Type** 	Surface / storm water only.	Sump-type units require the provision of a sump to accommodate the flow control. As this will always be full of water, sump-type units are unsuitable for use in foul / combined systems.
Md13	**Sump-Type** BBA APPROVAL INSPECTION TESTING CERTIFICATION CERTIFICATE No 08/4599 STH Range of Hydro-Brake® Flow Controls 	Surface / storm water only.	The Md13 (STH) unit will always have an outlet size in excess of 75 mm and can always be fitted to a 225 mm diameter outlet pipe or larger.
Md8 Md9 Md11	**Vertical Discharge** 	Foul / combined and surface / storm water.	Vertical discharge units require a chamber design to accommodate the vertically directed outlet. They do not have S-shaped head / discharge curves and are for special applications only - please refer to HRD Technologies Ltd for advice.
Md10	**Tubular** 	Foul / combined and surface / storm water.	Tubular units require benching into the intake. They do not have S-shaped head / discharge curves and are for special applications only - please refer to HRD Technologies Ltd for advice.

Note: For system modelling using other software packages, HRD Technologies Ltd can provide individual unit head / flow characteristics in an appropriate format.

General Advice

Selection of the most appropriate Hydro-Brake® Flow Control for a particular application depends on a number of considerations, including the type of sewer system, the hydraulic characteristic of the device, device clearances and overall physical dimensions. The Micro Drainage programs provide outputs for hydraulic characteristic and outlet size.

The table opposite provides general selection guidance taking into account the considerations of type of sewer system, device clearances and overall physical dimensions. This should be considered along with other information provided here and in conjunction with the advice contained within the software design program that is being used.

The Table should be followed from the top, using the left hand column for surface/storm water applications and the right hand column for foul/combined applications. The 'general comments' provided are relevant to both applications.

HRD Technologies Ltd offer a free design service and can assist with unit selection.

General Guidance on Unit Selection

Surface / Storm Water Applications	Foul / Combined Applications
1) Select sump-type Md13 (STH) initially. This is a British Board of Agrément (BBA) approved product that is currently only available in certain sizes – if a size is not available for the specified duty/ design point go to 2) otherwise use Md13 (STH). The Md13 (STH) has a minimum outlet size in excess of 75 mm and can always be fitted to a 225 mm diameter outlet pipe (or greater).	1) Select conical-type Md4 (CX) initially provided the required outlet >150 mm. If the required manhole/ chamber size is too large go to 2) otherwise use Md4 (CX).
2) Select sump-type Md6 (SXH) initially provided the required outlet >75 mm (please seek advice if outlet <75 mm). If required outlet >200 mm go to 3) otherwise use Md6 (SXH).	2) Select conical-type Md2 (CH) provided the required outlet >150 mm. If the required manhole/chamber size is too large go to 3) otherwise use Md2 (CH).
3) Select sump-type Md5 (SH) or Md12 (SMXH) provided the required outlet >75 mm (please seek advice if outlet <75 mm). If required outlet >250 mm (Md5 - SH) or >300 mm (Md12 - SMXH) go to 4) otherwise use Md5 (SH) /Md12 (SMXH).	3) Select conical-type Md1 (C) provided the required outlet >429 mm. If the required manhole/chamber size is too large go to 4) otherwise use Md1 (C).
4) Select conical-type Md4 (CX) provided the required outlet >100 mm. This unit does not require a sump arrangement but requires benching into the intake. If the required manhole/ chamber size is too large go to 5), otherwise use Md4 (CX).	4) Vertical discharge units Md8 (SV), Md9 (SMV) and Md11 (SXV) can be considered if their outlets are >150 mm. Their physical dimensions should be considered - the Md9 (SMV) is typically used when the diameter of the Md8 (SV) and Md11 (SXV) >200 to 250 mm. If none of these units are suitable go to 5).
5) Select conical-type Md2 (CH) unit provided the required outlet >100 mm. This unit does not require a sump arrangement but requires benching into the intake. If the required manhole/ chamber size is too large go to 6), otherwise use Md2 (CH).	5) Select tubular-type Md10 (TH) provided the required outlet >333 mm. This is sometimes the only option that will meet a certain head/discharge relationship (eg. low head, low flow situations). It should only be used when there is no other alternative.
6) Select conical-type Md1 (C) provided the required outlet >285 mm. This unit does not require a sump arrangement but requires benching into the intake. If the required manhole/chamber size is too large go to 7), otherwise use Md1 (C).	For design assistance for any Hydro-Brake® Flow Control please call: **01-4013964** or **e-mail: enquiries@hrdtec.com**
7) Select sump-type Md7 (SMH) provided the required outlet >75 mm. If the required outlet >300 mm then go to 8), otherwise use Md7 (SMH).	
8) Vertical discharge units Md8 (SV), Md9 (SMV) and Md11 (SXV) can be considered provided the required outlet >75 mm. Their physical dimensions should be considered - the Md9 (SMV) is typically used when the diameter of the Md8 (SV) and Md11 (SXV) >200 to 250 mm. If none of these units are suitable go to 9).	
9) Select tubular-type Md10 (TH) provided the required outlet >222 mm. This is sometimes the only option that will meet a certain head/discharge relationship (eg. low head, low flow situations). It should only be used when there is no other alternative.	
General Comments: The minimum sizes quoted for Hydro-Brake® Flow Controls represent sizes based on experience as offering significant reduction in risk of blockage and hence maintenance and derive from general practice in flow control selection in the UK and Ireland. Sizes below the minimum recommended can be specified though it should be recognised these might incur increased risks of blockage and associated maintenance. Sizes above the maximum recommended can also be specified though may require oversized manholes/chambers. For the larger units, refer to HRD Technologies Ltd for advice.	

The information provided here is intended for the purposes of general guidance only - individual application requirements may differ. **If in doubt, please contact HRD Technologies Ltd.**

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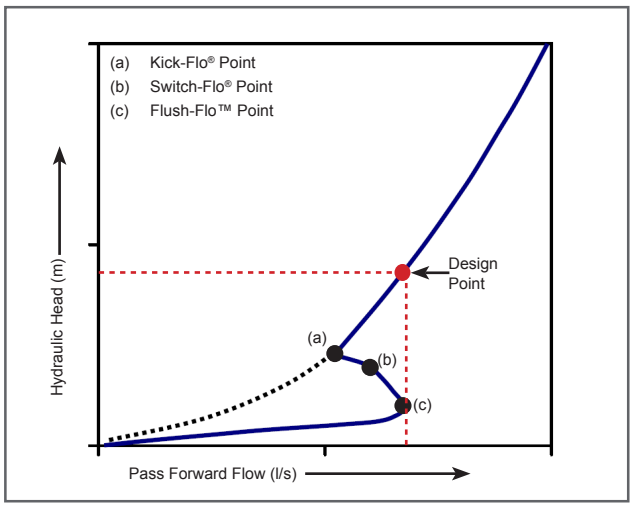
STH Type Hydro-Brake® Flow Control with BBA Approval

Now included in Win*Des*® W.12.6!

The new STH type Hydro-Brake® Flow Control range has a unique head / discharge performance curve which introduces a very important feature - the Switch-Flo® Point. This point illustrates the unique performance feature of the STH range which can lead to further savings in upstream storage, whilst also enabling increased inlet / outlet size to further reduce the risk of blockage.



Typical STH Head Versus Flow Characteristics

Kick-Flo® (a) - the point at which the vortex has initiated and at which the curve begins to return back to follow the orifice curve and reach the same design point or desired head / flow condition.

NEW Switch-Flo® (b) - marks the transition between the Kick-Flo® and Flush-Flo™, from vortex initiation to stabilisation. This point adds a new layer of resolution to the Hydro-Brake® curve that has implications to upstream storage savings.

Flush-Flo™ (c) - the point at which the vortex begins to initiate and have a throttling effect. This point on the Hydro-Brake® curve is usually much nearer to the maximum design flow (Design Point), than other vortex flow controls leading to more water passing through the unit during the earlier stages of a storm, thus reducing the amount of water that needs to be stored upstream.

BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE No 08/4599

STH Range of
Hydro-Brake® Flow Controls

The STH Hydro-Brake® Flow Control is the only vortex flow control available today that has been given the prestigious BBA Approval Certificate. The BBA assessment procedure entails rigorous assessment of production and manufacturing standards, and confirms that the hydraulic performance of the Hydro-Brake® Flow Control matches the data given to designers by HRD Technologies with their head / discharge curves.

A worked example showing the steps to model a Hydro-Brake® Flow Control and associated Stormcell® Storage System within Micro Drainage Win*Des*® is available on our website:

www.hrdtec.com

Take a Look at Our New Stormwater Web Resource

Engineering Nature's Way™

www.engineeringnaturesway.co.uk

Engineering Nature's Way is a brand new resource for people working with Sustainable Drainage and flood management in the UK.

The site provides an opportunity to share news, opinion, information and best practice for people working in local and central Government; developers, consulting engineers and contractors. Do you have something to share? We would be delighted to receive your contributions.

turning water around ...®

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