PUNCH consulting engineers

Proposed SHD at Lands at Former Greenpark Racecourse, Limerick City

Engineering Planning Report

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Table of Contents

1 Introduction

Punch Consulting Engineers are providing civil and structural engineering consultancy services for a proposed residential development at Greenpark, Dock Road, Limerick. Please refer to Figure 1-1 below for site location. This report was prepared to accompany a planning application and addresses foul water drainage, surface water drainage, watermain design and roads/access for the proposed development.

1.1 Site Location

The site is located in Greenpark and is approximately 2 km to the southwest of Limerick City. The site is a greenfield site with a total site area of 10.5 hectares with a developable area of 7.9ha.

Figure 1-1: Location of the proposed development

1.2 Proposed Development

The proposed development is residential in nature and comprises of 371 no. residential units consisting of 157 no. semi-detached and terraced houses; 76 no. duplex units and 138 no. apartments and a creche. The development will also include all relevant infrastructure including parking areas, access roads, drainage, internal roads, pedestrian and cycle routes, services provisions, landscaping and boundary treatment and all associated site development and excavation works.

The proposed works are outlined in a series of architectural drawings prepared by Reddy Architecture & Urbanism, engineering drawings by PUNCH Consulting Engineers and Woods PS, landscape architect drawings by Murray & Associates and supplementary information by Tom Philips & Associates.

In preparation for this report and design of the development, PUNCH Consulting Engineers have liaised with the following parties:

a) Irish Water New Connections and Diversions team

b) Limerick City & County Council

2 Surveys

2.1 Topographical Survey

A topographical survey of the entire site was commissioned for the project and completed by NCW and Murphys Surveys. The survey includes contours, spot levels on the site (all to Malin Head datum), the site boundary, road and kerb lines bounding the site as well as existing drainage, chambers and additional services within the site.

2.2 Ground Penetrating Radar Survey

A Ground Penetrating Radar (GPR) survey of part of the site was commissioned for the project and completed by Precision Surveys. The GPR survey focused on areas where services were previously constructed and includes service locations, routes and sizes.

3 Foul Water Drainage Design

3.1 Existing Foul Water Drainage

Based on existing record drawings, surveys and site visits it was established that the following foul water drainage infrastructure is located within Greenpark lands:

a) Limerick Main Drainage 1500mm diameter pipe flowing south east to north west through the site. Refer to figure 3.1.

b) 225mm/300mm diameter pipe flowing north east to south west for approximately 315m before flowing south east to north west through the site and discharging to the Limerick Main Drainage network upstream of Greenpark Roundabout.

Please refer to Appendix A for existing foul water drainage record drawings received from Irish Water and Figure 3-1 for details of the existing drainage network.

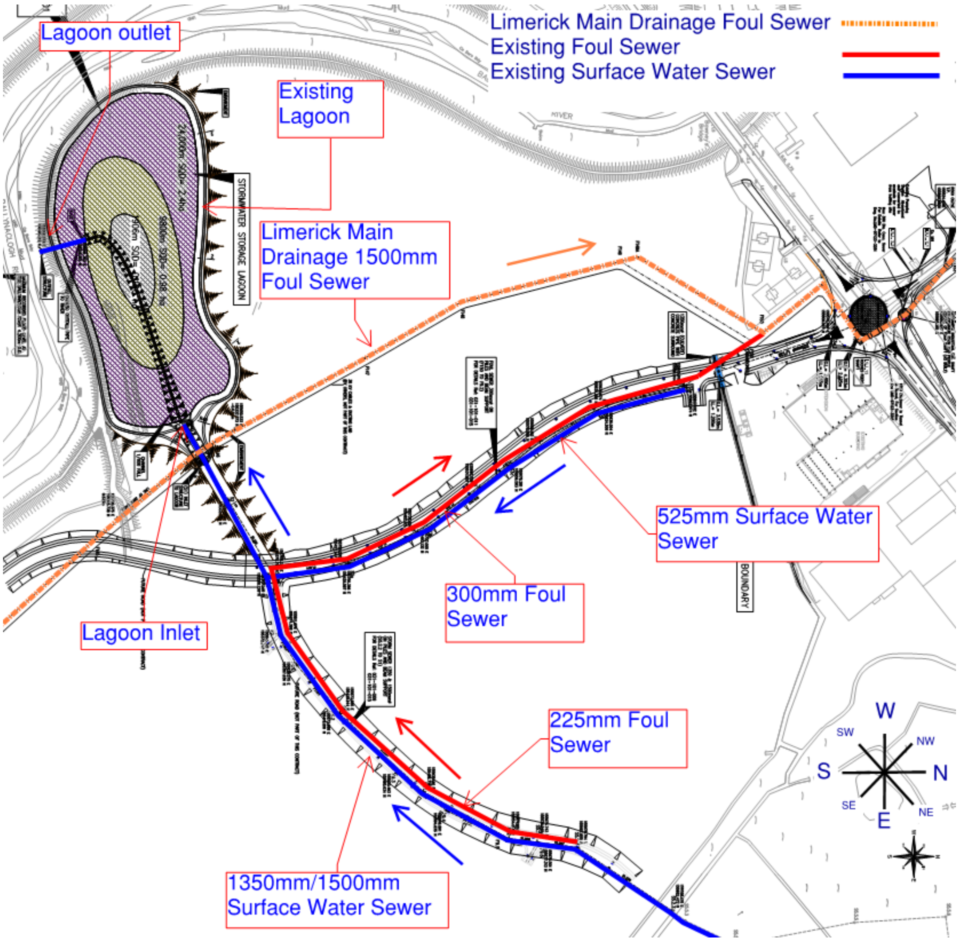


Figure 3-1: Existing foul water infrastructure surrounding the site

Please refer to PUNCH Drawings 191325-PUNCH-XX-XX-DR-C-0100, 101, 102 & 103 for details of the existing foul water drainage network in relation to the proposed development.

3.2 Proposed Foul Water Drainage

3.2.1 Design Criteria

The foul water drainage has been designed using Causeway Flow software in accordance with the *"Recommendations for site development works for Housing Areas"* design guide and Irish Water *"Code of Practice for Wastewater Infrastructure"*, please refer to Appendix B for detailed calculations.

3.2.2 Proposed Foul Water Flows

In accordance with the Code of Practice for Wastewater Infrastructure published by Irish Water, the design foul flow generated for the proposed development is designed on the basis of 165 litres/person/day for Residential usage and 2.7 residents per unit. This includes a 10% allowance for infiltration.

Table 3-1 summarises the predicted foul flows for the proposed development. The daily foul loading for the proposed development has been calculated as 173.2m^3. The dry weather flow has been calculated as 2.005 l/s. The sewers are designed for a peak flow of 6 times dry weather flow (6DWF) for residential and 4.5 times dry weather flow (4.5DWF) for the creche – 11.894 l/s.

Table 3-1: Calculation of Peak Daily Flows and Diversion Flows from proposed development

	Quantity	Flow (l/person/day)	Daily Flow (l/day)	DWF (l/s)	Peaking Factor	Design Flow (6DWF) (l/s)
Proposed Residential	371 units totalling 1002 persons	165	165,330	1.914	6	11.484
Proposed Creche	14 staff 65 children	99	7,821	0.091	4.5	0.410
Totals			**173,151**	**2.005**		**11.894**

3.2.3 Proposed Foul Water Drainage System

It is proposed that foul water from the proposed development shall discharge by gravity to the existing 225mm/300mm diameter foul sewer prior to discharging to the Limerick Main Drainage Network. It is noted that a self-cleansing velocity of 0.75 m/s will be achieved within the foul network design when flowing full as per Irish Water requirements.

A proposed residential development for 31 units was granted planning on Greenpark Avenue, planning number 17/1190 (ABP-302015-18). The development allowed for the foul network to discharge to the Limerick Main Drainage network within Greenpark. As part of the Greenpark housing development, it is proposed to provide a manhole at the site boundary to accommodate foul water flows from the Greenpark Avenue development.

The proposed foul water drainage network has also been designed to allow for future residential and nursing home development projects within Greenpark.

Please refer to PUNCH Drawings 191325-PUNCH-XX-XX-DR-C-0100, 101, 102 & 103 for details of the proposed foul water drainage network.

3.3 Irish Water Consultation

A pre-connection application enquiry (Customer Reference No. CDS20006611) was issued to Irish Water in October 2020 and a response was received in December 2020 stating that "subject to a valid connection agreement being put in place, your proposed connection to Irish Water network(s) can be facilitated."

Following submitting a design submission to Irish Water, a statement of design acceptance was received from Irish Water in September 2021.

Please refer to Appendix C for details.

4 Surface Water Drainage Design

4.1 Existing Surface Water Drainage

As part of the proposed redevelopment of the old racecourse lands at Greenpark in 2006, Limerick Race Company plc was required to provide stormwater drainage infrastructure with sufficient capacity to serve both Greenpark lands and other adjoining developments. This requirement was based on the recommendations of a White Young Green (WYG) report 'Ballinacurra-Courtbrack Drainage Study' prepared for Limerick Corporation (dated September 1999) and subsequent revision (dated December 2001).

Regional SUDS attenuation (Lagoon) and strategic conveyance systems (pipework) were constructed within Greenpark lands.

Based on the WYG Drainage Study, the Lagoon was designed to take into account future developments. The total allowable contributing areas into the Lagoon from Greenpark and adjoining lands totals 39.19 ha. The extent of the contributing areas into the Lagoon is summarised in Table 4.1.

Table 4-4-1: Regional SuDS (Lagoon) Contributing Areas

Regional SuDS (Lagoon) Contributing Areas	
Greenpark	14.561ha
Mary Immaculate College	2.91 ha
Oil Storage Depot	2.38 ha
Fitzhaven	3.7 ha
Convent	2.42 ha
Alandale	9.81 ha
Other	3.404 ha
Total Impermeable Area	**39.19 ha**

The WYG Drainage Study (September 1999) recommended that the Lagoon required a design capacity of 16,700m^3 for the above contributing areas. The Study further states that the Lagoon attenuates flows to Greenfield discharge rate and discharges to the Ballynaclogh River. This is achieved through the use of a penstock structure.

The design capacity for the Lagoon of 16,700m^3 was based on a 50 year return period design criteria. Current guidelines require attenuation to be provided for a 30 year design return period with no flooding to occur for a 100 year return period with a 10% allowance for climate change. Based on a total contributing catchment area of 39.19ha, the Lagoon would require a design capacity of 21,000m^3 for a 100 year Return Period with a 10% allowance for climate change.

The as built capacity of the existing lagoon is approximately 23,000m^3 based on the topographical survey. Therefore, the existing lagoon has sufficient capacity to attenuate flows from Greenpark and adjoining lands for the contributing areas noted in table 4.1.

Based on existing record drawings, surveys and site visits it was established that the following surface water drainage infrastructure is located within Greenpark lands:

a) 1350mm/1500mm diameter pipe flowing north east to south west from the boundary of the Alandale Development to the existing lagoon. This pipe was designed to receive surface water from Greenpark, Mary immaculate College, Oil Storage Depot, Fitzhaven, Convent and Alandale lands.

b) 525mm diameter pipe flowing north west to south east from the Limerick Greyhound Stadium roundabout to the existing lagoon. This pipe was designed to receive surface water from Greenpark lands.

c) 300mm diameter pipe from Log na gCapall which discharges to an existing surface water drain within Greenpark

d) An existing lagoon which was designed to receive surface water from the lands noted in table 4-1 and attenuates flows to greenfield runoff rate. The existing lagoon consists of:

- Inlet structure to the lagoon
- Penstock structure - the penstock structure controls the flow of the water from the lagoon to the outfall structure in the Ballynaclogh River.
- Outfall structure - the outfall structure is constructed of reinforced concrete and contains a 1050mm diameter Tideflex valve with thimble plate which allows discharge of water to the river at low tide but prevents backflow into the lagoon in times of high tide.

Please refer to Appendix A for existing surface water drainage record drawings received from Limerick City and County Council and Figure 3-1 for details of the existing drainage network.

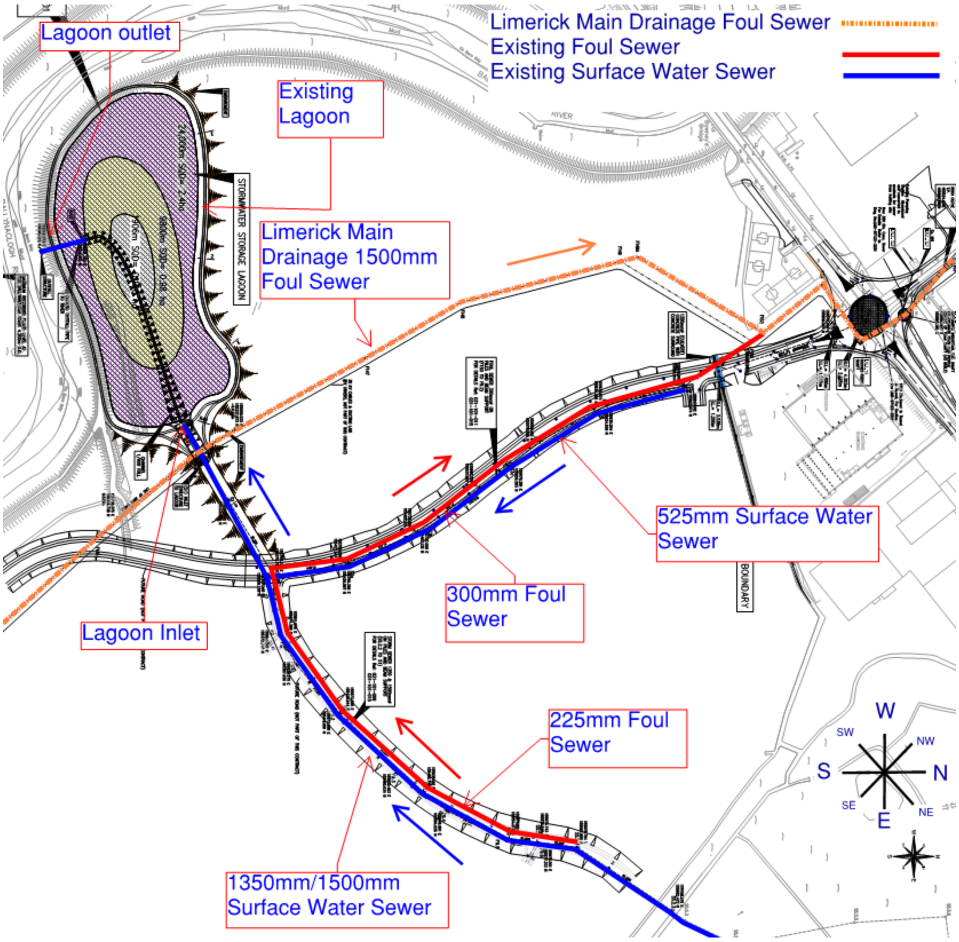


Figure 4-4-1: Existing surface water infrastructure surrounding the site

Please refer to PUNCH Drawings 191325-PUNCH-XX-XX-DR-C-0100, 101, 102 & 103 for details of the existing surface water drainage network in relation to the proposed development.

4.2 Proposed Surface Water Drainage Design

4.2.1 Design Criteria

The proposed surface water sewers have been designed in accordance with the "*Recommendations for Site Development Works for Housing Areas*" design guide, "*Greater Dublin Strategic Drainage Study"* (GDSDS) and Limerick City & County Council Development Plan. Please refer to Appendix D for detailed calculations.

Table 4-2 describes the stormwater drainage design parameters used. Please refer to Appendix E for Met Eireann rainfall data.

Table 4-2: Stormwater Drainage Design Parameters

Description	Value
Return period target	Pipe Design 1 in 5 year Network Design 1 in 30 year + CC Check 1 in 100 year + CC for flooding
Climate Change	20%
Urban Creep	10%
Freeboard to FFL	500mm
M5-60	17.3 (as per Met Eireann Records)
Ratio R	0.325
SOIL type	4 (clayey/poorly drained)
Soil value	0.45
Rainfall Intensity	50 mm/hr
SAAR	1031 mm
Flow reduction parameter	4l/s/ha
Controlled Outflow from Development	4l/s/ha
Flow restriction method	Hydrobrake

4.2.2 Proposed Surface Water Drainage System

A new surface water sewer network shall be provided for the proposed development which will be entirely separate from the foul water sewer network. Surface water run-off from roof areas and hardstanding areas are designed to be collected by a gravity pipe network. Surface water will be collected and discharged via a mixture of traditional and Sustainable urban Drainage System (SuDS) to the existing 1350mm/1500mm diameter surface water sewer. Each unit will have its own independent connection to the surface water sewer network.

The minimum diameter of the mainline surface water sewers is 225mm and minimum horizontal and vertical separation distances between the proposed drainage and other services are as per the Irish Water Code of Practice.

It is proposed that surface water will discharge via attenuation tanks, a class 1 bypass separator and flow control device prior to discharging to the existing surface water network.

The surface water drainage network has been analysed for the risk of flooding for a 1 in 5-year flood event, 1 in 30- year rainfall event and a 1 in 100-year rainfall event by means of simulating such events in the drainage model with no flooding occurring. An increase of 20% in rainfall has been included to account for climate change and 10% for urban creep. Please refer to Appendix D for detailed calculations.

A proposed residential development for 31 units was granted planning on Greenpark Avenue, planning number 17/1190 (ABP-302015-18) . The development allowed for the attenuated surface water network to discharge to the existing surface water network within Greenpark with a restricted discharge rate of 9l/s. As part of the Greenpark housing development, it is proposed to provide an attenuation tank to accommodate surface water flows from the Greenpark Avenue development. The attenuation tank has been designed for a 1 in 30- year rainfall event and a 1 in 100-year rainfall event with a 20% allowance for climate change.

It is proposed that the surface water sewer from Log na gCapall will be accommodated via a separate surface water sewer which will discharge to the existing 1350mm/1500mm diameter surface water sewer.

The proposed surface water drainage network has also been designed to allow for future residential and nursing home development projects within Greenpark.

All surface water manholes will be in line with the Irish Water Cope of Practice.

It was agreed with Tony Carmody of LCC that upon receipt of a planning grant, a CCTV survey and detailed condition report shall be carried out of the existing surface water network and submitted to LCCC prior to works commencing on site.

Please refer to Appendix H for details of the bypass separator and Appendix I for details of the flow control device.

Please refer to PUNCH Drawings 191325-PUNCH-XX-XX-DR-C-0100, 101, 102 & 103 for details of the proposed surface water drainage network.

Please refer to PUNCH drawing 191325-PUNCH-XX-XX-DR-C-110 for the proposed drainage phasing plan.

4.3 Sustainable Urban Drainage Systems (SuDS)

The proposed development has been assessed in relation to Sustainable Urban Drainage Systems (SuDS) and a variety of SuDS measures have been adopted. All SuDS measures are to be implemented with reference to the UK Suds Manual and Limerick City & County Council water services department requirements.

The SuDS processes decrease the impact of the development on the receiving environment and also provide amenity and biodiversity in many cases. Regular maintenance of the SuDS proposals is required to ensure they are operating to their optimal level throughout their design life.

The following sections indicate how each of the SuDS proposals contribute to reducing and restricting the discharge rate from the site.

Please refer to PUNCH drawing 191325-PUNCH-XX-XX-DR-C-0150, 0151, 0152, 0500, 0501 & 0502 for details.

4.3.1 Green Roof

It is proposed to provide extensive green roofs for the proposed creche and apartments buildings. The green roofs have been designed taking guidance from CIRIA Publications C644 – "Building Greener" and C697 – "The SUDS Manual".

Green roofs are widely recognised as an effective SuDS solution and an important tool in mitigating the adverse effects of development on rainfall run-off and for managing urban flood risk. Research in the UK by Kellagher and Lauchlan (2005) and CIRIA C753 (The SuDS Manual) indicates that green roofs are effective in providing both attenuation and volume reduction in runoff for minor rainfall events.

Extensive Green Roofs areas typically contain vegetation such as sedums and small grasses, which require less maintenance than other green roof types, and no permanent irrigation system.

The green roofs will improve water quality, reduce water quantity being discharged from the site, offers an amenity to residents and offers a biodiversity element to the site also (addressing the four pillars of SuDS design for the site).

Assuming 5% of the substrate depth is available for water storage, the green roofs shall provide interception storage for the first 10mm of rainfall, as required by the GDSDS criteria for River Water Quality Protection.

Please refer to Appendix D for supporting calculations.

4.3.2 Tree Pit Systems

Proposed surface water along the development's landscaped paved areas where possible will discharge to a SuDS element such as tree root systems for interception and treatment prior to entering the drainage network. The tree root systems will incorporate drainage stone/subsoil and will provide a level of additional attenuation within the tree root system. A high-level overflow pipe to the drainage network within the build-up will accommodate removal of water.

CIRIA C753 (The SuDS Manual) Table 24.6 notes that regarding interception design of tree root system (bio retention areas), pavements drained by tree root systems can be considered to provide Interception, i.e. it can be assumed that there will be zero runoff from the first 5 mm rainfall for 80% of events during the summer and 50% in winter.

Please refer to Appendix D for supporting calculations.

4.3.3 Permeable Paving

It is proposed that house driveways and the visitor parking will be constructed of a pervious pavement system, as per CIRIA C753 (The SuDS Manual). The base of the pervious pavement build-up will be lined and a drainage network within the build-up will accommodate removal of water.

CIRIA C753 (The SuDS Manual) notes that regarding interception design of pervious pavements, studies have shown that runoff typically does not occur from pervious pavements for rainfall events up to 5 mm. Please refer to Table 24.6 of CIRIA C753.

The subbase layer of the pervious pavements will also provide a level of attenuation within the paving build up.

Please refer to Appendix D for supporting calculations.

4.3.4 Infiltration Trenches

The proposed infiltration trenches will provide a level of attenuation storage within the voids in the stone within the trench.

CIRIA C753 (The SuDS Manual) Table 24.6 notes that regarding interception design of infiltration trenches, pavements drained by infiltration trenches can be considered to provide Interception, i.e. it can be assumed that there will be zero runoff from the first 5 mm rainfall for 80% of events during the summer and 50% in winter.

Please refer to Appendix D for supporting calculations.

4.3.5 Swales

Proposed surface water along the development's landscaped paved areas where possible will discharge to a SuDS element for interception and treatment prior to entering the drainage network. The swales will incorporate an infiltration trench and will provide a level of attenuation within the swale. A high level overflow to the drainage network within the build-up will accommodate removal of water.

CIRIA C753 (The SuDS Manual) Table 24.6 notes that regarding interception design of swales, pavements drained by swales can be considered to provide Interception, i.e. it can be assumed that there will be zero runoff from the first 5 mm rainfall for 80% of events during the summer and 50% in winter.

Please refer to Appendix D for supporting calculations.

4.3.6 Rain Gardens

It is proposed that dwelling roofs can discharge to rain gardens where they will provide treatment to roof runoff through evapotranspiration within the filter media of the rain garden structure. The rain gardens will comprise of a landscape area with high permeability soil and a perforated surface water drain is to be provided at a low level to drain any excess surface water to the drainage network.

CIRIA C753 (The SuDS Manual) Table 24.6 notes that regarding interception design of rain gardens (bio retention areas), pavements drained by rain gardens can be considered to provide Interception, i.e. it can be assumed that there will be zero runoff from the first 5 mm rainfall for 80% of events during the summer and 50% in winter.

Please refer to Appendix D for supporting calculations.

4.3.7 Bypass Separator

It is proposed that surface water from the proposed development will flow through a Class 1 Klargester NSBE125 bypass separator or approved equivalent prior to discharging to the existing surface water network. It is also proposed to provide a Class 1 Klargester NSBE050 bypass separator or approved equivalent on the existing 525mm diameter surface water sewer.

Bypass separators fully treat all flows generated by rainfall rates of up to 6.5mm/hr. This covers over 99% of all rainfall events. Flows above this rate are allowed to bypass the separator. These separators are used when it is considered an acceptable risk not to provide full treatment for high flows, for example where the risk of a large spillage and heavy rainfall occurring at the same time is small. Class 1 devices are designed to achieve a concentration of less than 5mg/l of oil under standard test conditions.

Please refer to Appendix H for details of the bypass separator and Appendix F for the Maintenance Plan.

4.3.8 Attenuation Tanks

It is proposed to attenuate surface water from the proposed development with six attenuation tanks located in open spaces throughout the development. The proposed attenuation tanks have been designed to reduce the peak runoff from the site. The attenuation tank has been sized to cater for a 1:100 storm event with a 20% allowance for climate change and 10% for urban creep. Please refer to Appendix D for supporting calculations.

It is proposed that the attenuation tanks will be an Ecocell Pluvial Cube attenuation tank (or approved equivalent) which is Irish Agrement Board certified is proposed. Please refer to Appendix G for further details. The attenuation tank will be designed for site specific conditions, installed, tested and certified by the approved supplier.

Please refer to Appendix G for details of the attenuation tanks and Appendix F for the Maintenance Plan.

4.4 Pollution Hazard Indices Based on the Simple Index Approach

The method used is guided by the land use and SuDS performance evidence. The design criteria for the Simple Index approach are for the Total SuDS mitigation index (for each contaminant type) ≥ pollution hazard index (for each contaminant type). As shown below, in all cases the mitigation index is greater than the pollution index for each contaminant type.

4.4.1 Step 1: Define Pollution Hazard Indices

Pollution hazard indices are presented in Table 26.2 of the CIRIA SuDS manual (reproduced in Figure 4-2 below). These specify the hazard index for each contaminant type for different types of land use.

TABLE 26.2 Pollution hazard indices for different land use classifications

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways[1]	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways[1]	High	0.8[2]	0.8[2]	0.9[2]

Notes

1 Motorways and trunk roads should follow the guidance and risk assessment process set out in Highways Agency (2009).

2 These should only be used if considered appropriate as part of a detailed risk assessment – required for all these land use types (Table 4.3). When dealing with high hazard sites, the environmental regulator should first be consulted for pre-permitting advice. This will help determine the most appropriate approach to the development of a design solution.

Where a site land use falls outside the defined categories, the indices should be adapted (and agreed with the drainage approving body) or else the more detailed risk assessment method should be adopted.

Where nutrient or bacteria and pathogen removal is important for a particular receiving water, equivalent indices should be developed for these pollutants (if acceptable to the drainage approving body) or the risk assessment method adopted.

Figure 4-2: CIRIA SuDS Manual - Pollution hazard indices for different land use classifications

The proposed site consists of the following land uses:

- Residential roofs
- Other roofs
- Individual property driveways, residential car parks and low traffic roads.
- All roads except low traffic roads

4.4.2 Step 2: Determine SuDS pollution mitigation indices

Indicative SuDS mitigation indices are presented in Table 26.3 of the CIRIA SuDS manual (reproduced in Figure 4-3 below). These specify the mitigation index for each contaminant type for different types of SuDS measures.

TABLE 26.3 Indicative SuDS mitigation indices for discharges to surface waters

	Mitigation indices[1]		
Type of SuDS component	**TSS**	**Metals**	**Hydrocarbons**
Filter strip	0.4	0.4	0.5
Filter drain	0.4[2]	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond[4]	0.7[3]	0.7	0.5
Wetland	0.8[3]	0.8	0.8
Proprietary treatment systems[5,6]	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		

Figure 4-3: Indicative SuDS mitigation indices for discharges to surface waters

The proposed SuDS measures for the development consist of permeable paving, tree pits, rain gardens, infiltration trenches, green roofs and swales. Both tree pits, rain gardens and green roofs are considered bioretention systems and the infiltration trenches are classed as filter drains. Table 4-2 below summarises the risk indices for the development and

Table 4-3 summarises the mitigation indices provided by the proposed SuDS measures.

Table 4-2: Summary of Hazard indices for subject site

		Total Suspended Solids (TSS)	Metals	Hydrocarbons
Hazard Indices	Residential Roofs	0.2	0.2	0.05
	Other roofs	0.3	0.2	0.05
	Driveways/ Parking/ Roads	0.5	0.4	0.4
	All roads except low traffic roads	0.7	0.6	0.7

Table 4-3: Summary of Mitigation Indices for subject site

		Total Suspended Solids (TSS)	Metals	Hydrocarbons
Mitigation indices	Permeable Paving	0.7	0.6	0.7
	Tree Pits	0.8	0.8	0.8
	Rain Gardens	0.8	0.8	0.8
	Filter Drains	0.4	0.4	0.4
	Swales	0.5	0.6	0.6

The following Sections summarise the specific SuDS measures proposed for each land use type.

4.4.3 Residential Roofs

The proposed development is an SHD development therefore the majority of the roofs within the development will be classed as residential roofs. The residential roofs within the development will be drained via rain gardens where feasible. As shown in Table 4-4 below the rain gardens provide greater mitigation indices than the hazard indices and as such the proposed SuDS are deemed appropriate.

The apartment roofs will be drained via green roof systems. As shown in Table 4-4 below the green roofs provide greater mitigation indices than the hazard indices and as such the proposed SuDS are deemed appropriate.

Table 4-4: Comparison of Hazard and Mitigation indices for Residential Roofs

		TSS	Metals	Hydrocarbons
Hazard Indices	Residential roofs	0.2	0.2	0.05
Mitigation Indices	Rain Gardens	0.8	0.8	0.8
Hazard Indices	Apartment roofs	0.2	0.2	0.05
Mitigation Indices	Green Roofs	0.8	0.8	0.8

4.4.4 Other Roofs

The proposed development includes a creche which will be classed as other roofs. These roofs within the development will be drained via green roof systems. As shown in Table 4-5 below the green roofs provide greater mitigation indices than the hazard indices and as such the proposed SuDS are deemed appropriate.

Table 4-5: Comparison of Hazard and Mitigation indices for Other Roofs

		TSS	Metals	Hydrocarbons
Hazard Indices	Other roofs	0.3	0.2	0.05
Mitigation Indices	Green Roofs	0.8	0.8	0.8

4.4.5 Driveways/ Parking/ Roads

The proposed development is residential in nature. The development includes parking areas and private driveways for the individual properties and the majority of the roads within the development are classified as low traffic roads. These areas within the development will be drained via permeable paving, tree pits, swales and infiltration trenches. As shown in Table 4-6 below the proposed measures each provide greater or equal mitigation indices than the hazard indices and as such the proposed SuDS are deemed appropriate.

Table 4-6: Comparison of Hazard and Mitigation indices Driveways/Parking/Roads

		TSS	Metals	Hydrocarbons
Hazard Indices	Driveways/ Parking/ Roads	0.5	0.4	0.4
Mitigation Indices	Permeable Paving	0.7	0.6	0.7
	Tree Pits	0.8	0.8	0.8
	Filter Drain	0.4	0.4	0.4
	Swales	0.5	0.6	0.6

4.4.6 All roads except low traffic roads

The proposed development will be accessed via a new road which will link to the existing road network to the north-west. This road will be classified as all roads except low traffic roads and will be drained via infiltration trenches and tree pits. As shown in Table 4-7 below the tree pits provide greater mitigation indices than the hazard indices and as such the proposed SuDS are deemed appropriate.

Table 4-7: Comparison of Hazard and Mitigation indices for All roads except low traffic roads

		TSS	Metals	Hydrocarbons
Hazard Indices	All Roads except low traffic roads	0.7	0.6	0.7
Mitigation Indices	Tree Pits	0.8	0.8	0.8
	Infiltration Trenches	0.4	0.4	0.4

The proposed infiltration trenches have mitigation indices less than the hazard indices. As such the SuDS proposals for these areas will be for the road gullys from the roads to drain via rain gardens first which will then discharge to the infiltration trenches. This gives an increased proposed mitigation indices for these areas of a combination of the tree pits and the infiltration trench which will be in excess of the hazard indices for the land use and therefore the SuDS measures proposed are acceptable.

The design criteria for the Simple Index approach are for the Total SuDS mitigation index (for each contaminant type) ≥ pollution hazard index (for each contaminant type). As shown above in all cases the mitigation index is greater than the pollution index for each contaminant type. As such the range of SuDS measures proposed satisfies the Simple index Approach and provides adequate mitigation for the site.

5 Watermain Design

5.1 Existing Watermain Infrastructure

Based on existing record drawings, surveys and site visits it was established that the following watermain infrastructure is located within Greenpark lands:

a) 1000mm diameter pipe flowing south east to north west through the site. Through correspondence with Irish Water they have noted that this is actually a 600mm dia. watermain.

b) 300mm diameter pipe flowing south east to north west from the dock road roundabout for approximately 220m.

Please refer to Appendix A for existing watermain record drawings received from Irish Water and Figure 5-1 and 5.2 for details of the existing watermain network.

Figure 5-1: Existing Watermains infrastructure surrounding the site

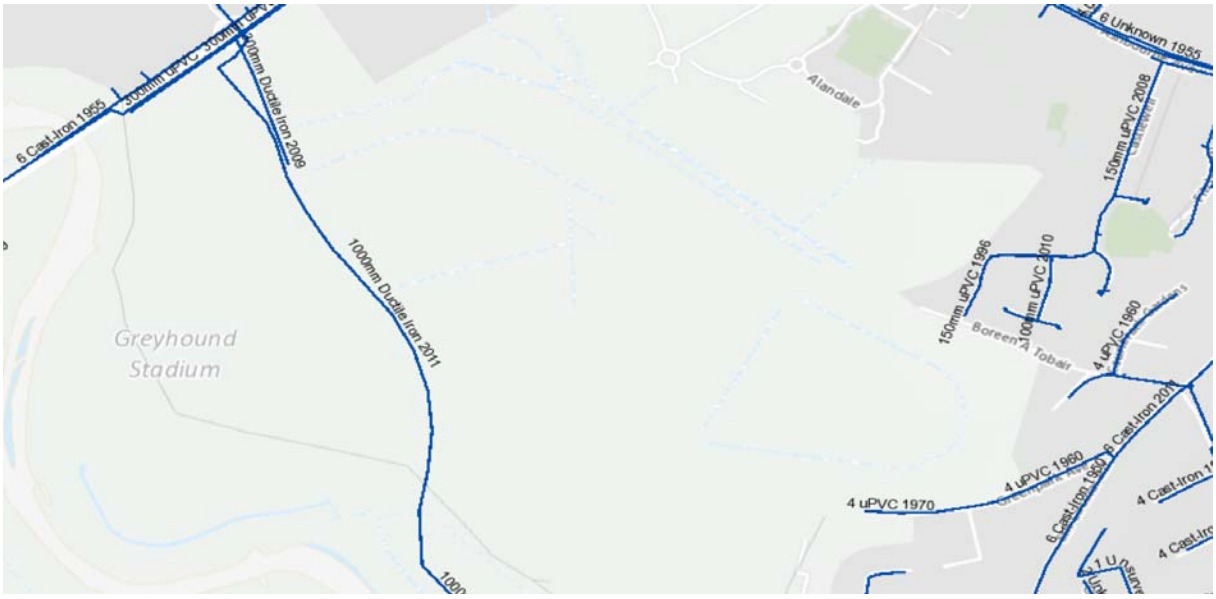


Figure 5-2: Existing Watermains infrastructure surrounding the site

Please refer to PUNCH Drawings 191325-PUNCH-XX-XX-DR-C-0200 & 0201 for details of the existing watermain network.

5.2 Proposed Watermain

It is generally accepted that the design loading for foul drainage can be used to evaluate an approximation of the water demand on the site. With reference to Irish Water's Code of Practice for Water Infrastructure, the average daily flow is calculated as the number of persons multiplied by the flow rate per person.

The demand generated for the proposed development is designed on the basis of 150 litres/person/day for Residential usage and 2.7 residents per unit.

The average day peak week flow is taken to be 1.25 x the average flow, and the peak demand is taken to be the average day peak week flow multiplied by a peaking factor of 5. **Table 5-1** summarises the predicted water demand for the proposed development. The estimated peak demand from the development is 11.385 l/s with the average daily demand being 157.4m3/day.

Table 5-1: Calculation of Peak Daily Flow

	Quantity	Flow (l/person/day)	Daily Flow (l/day)	Average (l/s)	Peak week (l/s)	Peak Demand (l/s)
Proposed Residential	371 units totalling 1002 persons	150	150,300	1.739	2.174	10.870
Proposed Creche	14 staff 65 children	90	7,110	0.082	0.103	0.515
Totals			**157,410**	**1.821**	**2.277**	**11.385**

It is proposed to provide a 250mm diameter and 180mm diameter watermain for the proposed development with 125mm diameter watermain branch lines within the development. A connection will be made to the existing 600mm diameter watermain.

The proposed watermain will provide potable and firefighting water to the proposed development. A bulk water meter and individual boundary box's will be provided for each unit.

The watermain layout has been designed in accordance with "*Irish Water Code of Practice for Water Infrastructure*". All watermains are to be constructed in accordance with Irish Water Code of Practice and the Local Authority's requirements.

To reduce the water demand on Irish Water water supplies and to reduce the foul discharge from the development, water conservation measures will be incorporated in the sanitary facilities throughout the development, e.g. dual flush toilets and monobloc low volume push taps.

The proposed watermain network has also been designed to allow for future residential and nursing home development projects within Greenpark.

Please refer to PUNCH Drawings 191325-PUNCH-XX-XX-DR-C-0200 & 0201 for details of the proposed watermain network.

5.3 Irish Water Consultation

A pre-connection application enquiry (Customer Reference No. CDS20006611) was issued to Irish Water in October 2020 and a response was received in December 2020 stating that “subject to a valid connection agreement being put in place, your proposed connection to Irish Water network(s) can be facilitated.”

Following submitting a design submission to Irish Water, a statement of design acceptance was received from Irish Water in September 2021.

A build over application (Customer Reference No. DIV21203) was issued to Irish Water with regards to existing infrastructure that Link Street 1 will be built over. A confirmation of feasibility letter was received from Irish Water in September 2021. Irish Water have noted that they would not support raising the road levels of Link Street 1 as it would result in the watermain infrastructure having additional cover over it.

Please refer to Appendix C for details.

6 Roads and Access

6.1 Proposed Roads & Access

The proposed development will be accessed from the Greenpark Roundabout on the N69 Dock Road.

Internal cycle lanes and footways forms part of the proposed development and have been located adjacent to proposed Link streets to encourage pedestrian movement and cycling in line with the requirements of the Limerick City and County Development Plan 2010-2016 (as extended) and in accordance with the Draft Limerick/ Shannon Transport Strategy 2040. The proposed residential development includes cycle lane/footpath connectivity through the site to facilitate connecting the Dock Road and the South Circular Road. Additional pedestrian/ cycle access points have been provided to the boundary of Log na gCapall and Greenpark Avenue.

The proposed development has been assessed for compliance with the "Design Manual for Urban Roads and Streets" (DMURS) published by the Department of Transport, Tourism and Sport & the Department of Environment, Community and Local Government.

DMURS sets out design guidance and standards for constructing new and reconfigured existing urban roads and streets. It also sets out practical design measures to encourage more sustainable travel patterns in urban areas.

The primary objectives of DMURS are as follows:

a) Prioritise pedestrians and cyclists in urban settings without unduly compromising vehicular movement.

b) Provide good pedestrian permeability and connectivity in urban environments in order to encourage walking.

c) Implement speed reduction measures to provide safe interaction between pedestrians, cyclists and motorists.

d) Create attractive streetscapes through the design of roads and footpaths with careful consideration given to landscaping and selection of surface finishes.

Access to all buildings by a fire appliance can be provided. Delivery vehicles will be able to access and leave the site by provision of appropriate turning heads.

Due to the road layouts and nature of the proposed development, it is envisaged that traffic will be moving at a slow speed. Traffic management by means of road markings and signage will be supplied within the proposed development where necessary.

Sight lines at all junctions are designed in accordance with DMURS based on proposed speed limits. Please refer to PUNCH Drawings 191325-PUNCH-XX-XX-DR-C-0750.

Autotrack analysis was carried out on the proposed street network and demonstrates that a fire tender and refuse lorry can safely negotiate the proposed street network and turning heads. Please refer to PUNCH Drawings 191325-PUNCH-XX-XX-DR-C-0700, 0701, 0702, 0703, 0704 & 0705.

Please also refer to PUNCH Drawings 191325-PUNCH-XX-XX-M2-C- 0401, 0402, 0403, 0450, 0451, 0452, 0453, 0475, 0476 & 0477 for details of the proposed street network and road markings/signage.

6.1.1 Link Street 1 – Proposed Road Levels

Limerick County Council requested that the proposed road levels of link street one be revised to be raised above the flood level.

A build over application (Customer Reference No. DIV21203) was issued to Irish Water with regards to existing watermain infrastructure that Link Street 1 will be built over. Irish Water have noted that they would not support raising the road levels of Link Street 1 as it would result in the watermain infrastructure having additional cover over it. Please refer to Appendix C for correspondence with Irish Water.

6.2 Condition Survey

Limerick City and Council tripartite report noted that a "Condition Survey" of the existing carriageway must be carried out from the N69 inwards.

PUNCH undertook the condition survey with Tony Carmody of Limerick City and County Council on the 15th of August 2021. It was agreed the following upgrade works would be undertaken:

i. Existing road surface from Roches Feeds entrance to Greenpark Roundabout to be re-laid
ii. The western footpath/cycle path to be re-laid from Roches Feeds entrance to Greenpark Roundabout
iii. Remaining footpaths/cycle paths to be cleaned by power washing
iv. New road gully to be provided at Roches Feeds entrance
v. Tactile and Corduroy paving to be provided
vi. Existing line marking to be relined

The Applicant is happy to carry out the above works to the existing road outside the red line planning application boundary on lands under its control, if considered necessary by LCCC and the Board. Full details can be agreed with the Planning Authority by way of an appropriately worded planning condition.

6.3 Traffic and Transport Assessment

A traffic and transport assessment has been prepared and forms part of the planning application.

6.4 DMURS Statement

A DMURS statement has been prepared and forms part of the planning application.

6.5 Road Safety Audit

A road safety audit was undertaken by an independent consultant, Burton Consulting Engineers and forms part of the planning application.

6.6 Outline Mobility Management Plan

An outline mobility management plan has been prepared and forms part of the planning application.

7 Conclusion

Foul water from the proposed development shall discharge by gravity to the existing 225mm/300mm diameter foul sewer prior to discharging to the Limerick Main Drainage Network. The water drainage network has been designed in accordance with the "*Irish Water Code of Practice for Wastewater Infrastructure*".

It is proposed to provide a 250mm diameter and 180mm diameter watermain for the proposed development with 125mm diameter watermain branch lines within the development. Connection will be made to the existing 600mm diameter watermain.

The foul water networks has been designed to accommodate foul water flows from a proposed residential development for 31 units that was granted planning on Greenpark Avenue, planning number 17/1190 (ABP-302015-18).

The proposed watermain will provide potable and firefighting water to the proposed development. A bulk water meter and individual boundary box's will be provided for each unit.

The watermain network has been designed in accordance with the "*Irish Water Code of Practice for Water Infrastructure*".

A pre-connection application enquiry (Customer Reference No. CDS20006611) was issued to Irish Water in October 2020 and a response was received in December 2020 stating that "subject to a valid connection agreement being put in place, your proposed connection to Irish Water network(s) can be facilitated."

Following submitting a design submission to Irish Water, a statement of design acceptance was received from Irish Water in September 2021.

A build over application (Customer Reference No. DIV21203) was issued to Irish Water with regards to existing infrastructure that Link Street 1 will be built over. A confirmation of feasibility letter was received from Irish Water in September 2021.

Irish Water have noted that they would not support raising the road levels of Link Street 1 as it would result in the watermain infrastructure having additional cover over it.

A new surface water sewer network shall be provided for the proposed development which will be entirely separate from the foul water sewer network. Surface water will be collected and discharged via a mixture of traditional and Sustainable urban Drainage System (SuDS) to the existing 1350mm/1500mm diameter surface water sewer. Each unit will have its own independent connection to the surface water sewer network.

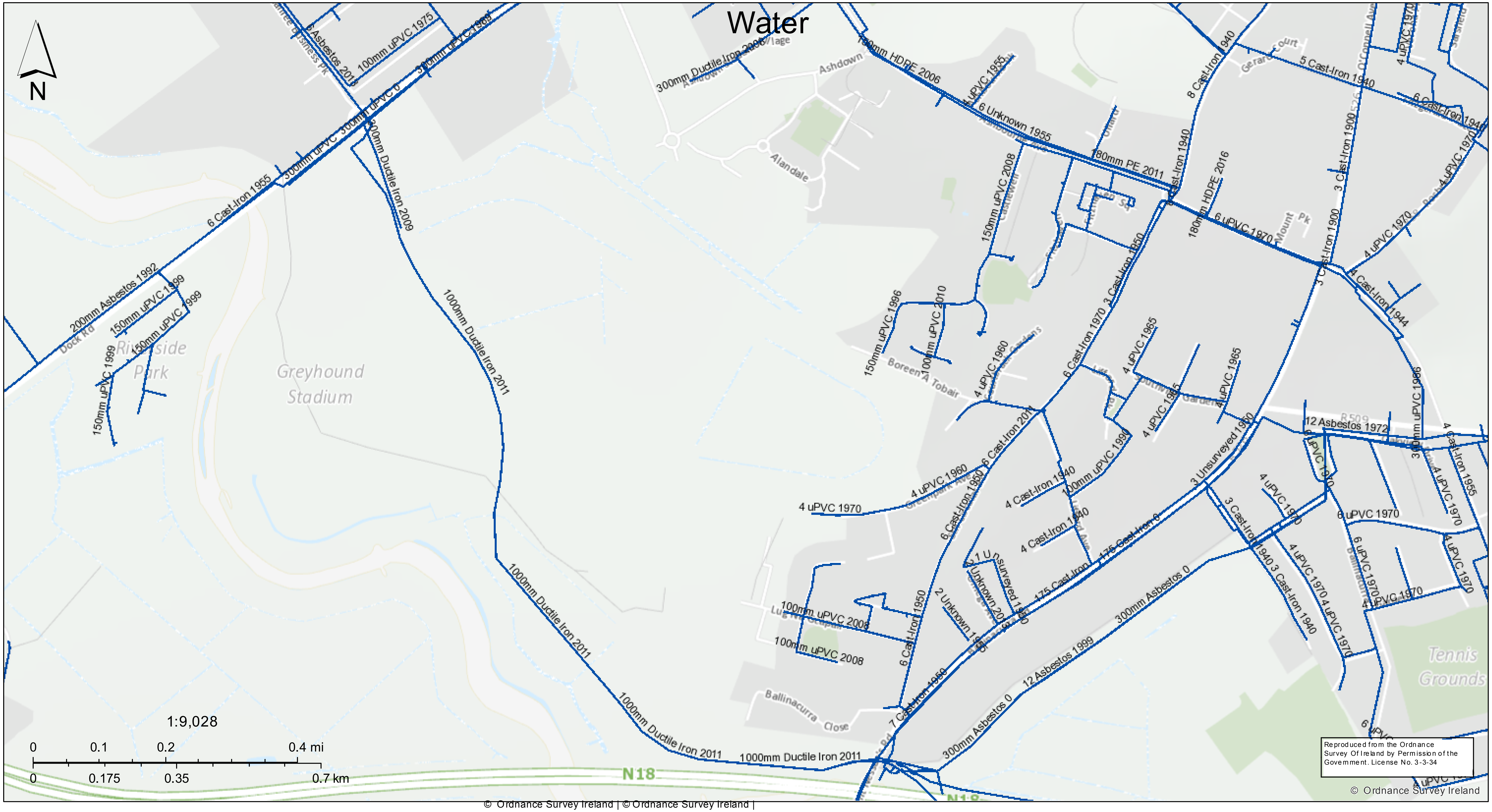
It is proposed that surface water will discharge via attenuation tanks, a class 1 bypass separator and flow control device prior to discharging to the existing surface water network.

The surface water drainage network has been analysed for the risk of flooding for a 1 in 5-year flood event, 1 in 30- year rainfall event and a 1 in 100-year rainfall event by means of simulating such events in the drainage model with no flooding occurring. An increase of 20% in rainfall has been included to account for climate change and 10% for urban creep.

The surface water drainage network has been designed to accommodate surface water flows from a proposed residential development for 31 units that was granted planning on Greenpark Avenue, planning number 17/1190 (ABP-302015-18). The surface water drainage network has also been designed to accommodate existing surface water flows from Log na gCapall.

A Traffic and Transportation Assessment, DMURS statement, Stage 1 Road Safety Audit and Outline Mobility Management Plan been undertaken and forms part of the planning application.

Appendix A Existing Service Record Drawings



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Legend

- Treatment Plant
- Potable Water
- Water Abandoned Lines

Reservoir

- Potable
- Raw Water
- Pump Stations

Water Mains(Non Irish Water Owned)

- Untreated
- Potable Water

Water Lateral Lines

- Irish Water
- Non IW

Water Mains(Irish Water Owned)

- Untreated

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

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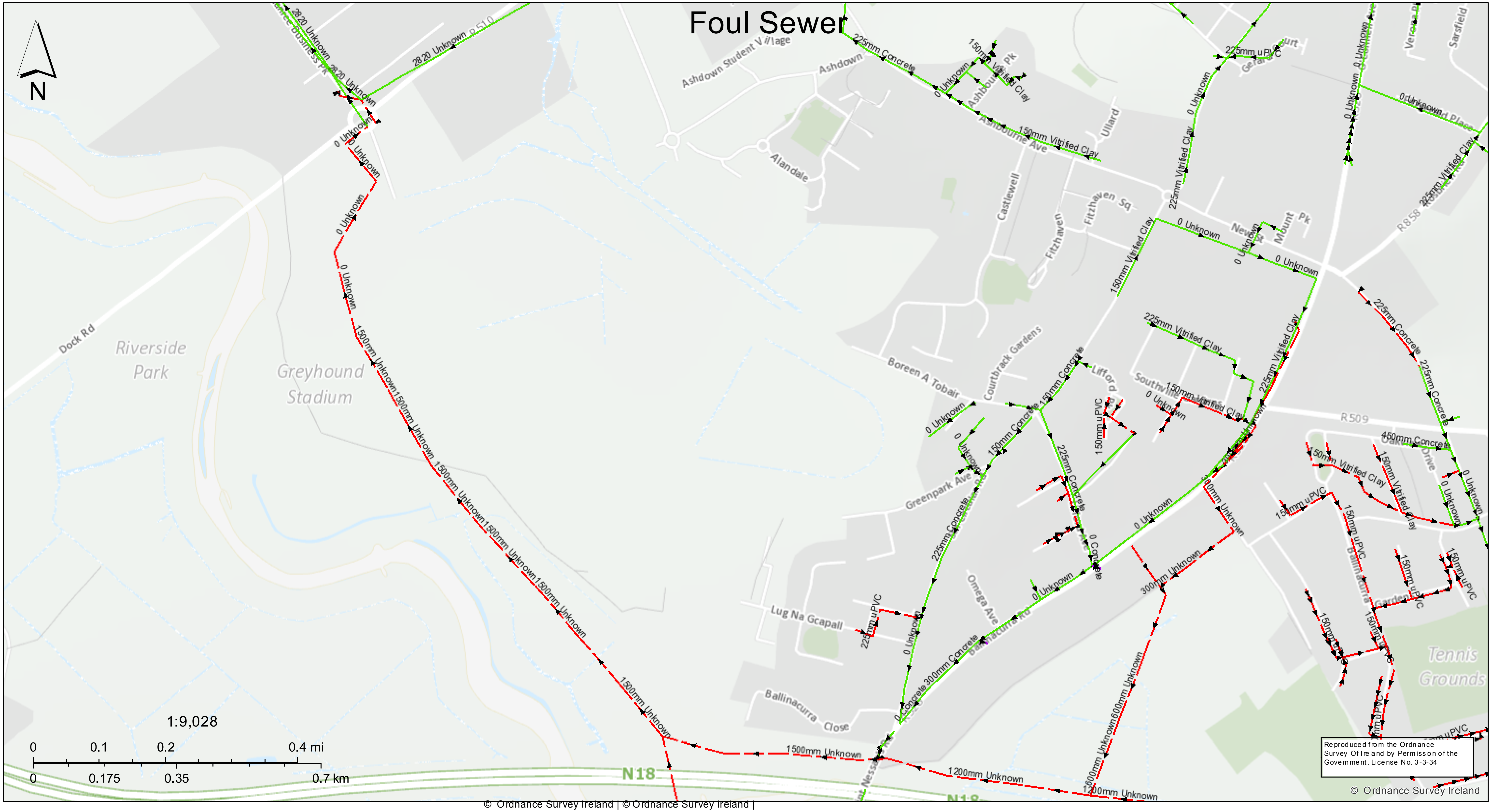

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Legend

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

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

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

Sewer Pressurized Mains (Non-Irish Water owned)
- Combined
- Foul
- Overflow
- Unknown
- Treatment plant

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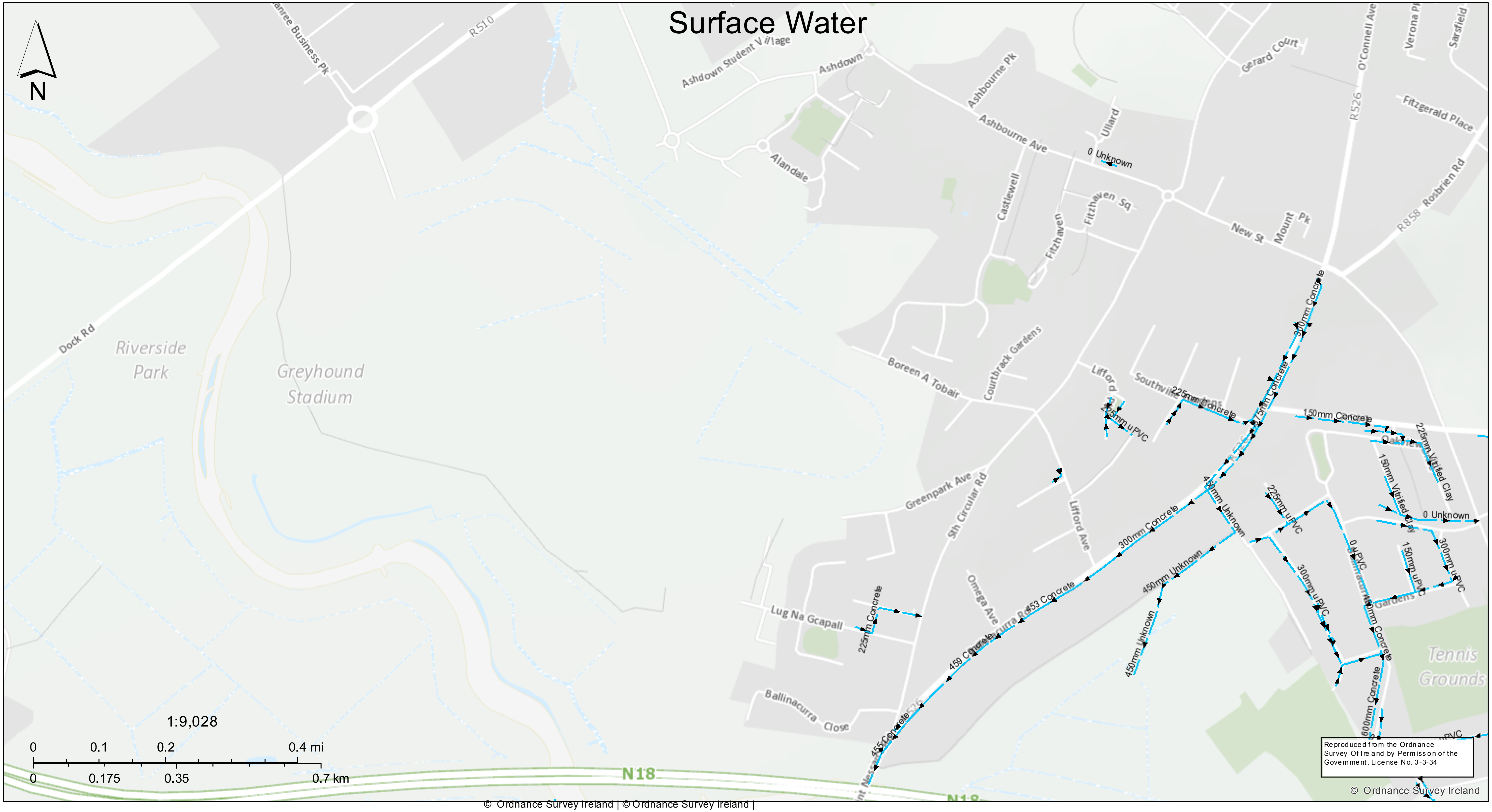
Surface Water



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Legend

Stormwater Gravity Mains (Irish Water Owned)

- Surface

Stormwater Gravity Mains (Non-Irish Water Owned)

- Surface

Appendix B Foul Water Drainage Calculations

Design Settings

Frequency of use (kDU)	0.00	Minimum Velocity (m/s)	0.75
Flow per dwelling per day (l/day)	2673	Connection Type	Level Inverts
Domestic Flow (l/s/ha)	0.0	Minimum Backdrop Height (m)	0.000
Industrial Flow (l/s/ha)	0.0	Preferred Cover Depth (m)	1.200
Additional Flow (%)	0	Include Intermediate Ground	✓

Nodes

Name	Add Inflow (l/s)	Cover Level (m)	Manhole Type	Easting (m)	Northing (m)	Depth (m)
F1-0		6.926	Adoptable	556224.502	655296.927	1.350
F1-1		6.926	Adoptable	556158.897	655314.339	2.481
F2-1		6.970	Adoptable	556231.667	655290.103	1.425
F2-2		6.970	Adoptable	556188.139	655280.871	1.755
F2-3		6.970	Adoptable	556168.919	655283.780	1.899
F1-2		6.781	Adoptable	556151.709	655288.263	2.536
F3-0		6.171	Adoptable	556124.441	655350.217	1.425
F1-3		6.171	Adoptable	556111.045	655298.677	2.313
F4-0		5.443	Adoptable	556102.070	655356.898	1.425
F1-4		5.443	Adoptable	556088.117	655304.709	2.505
F5-0		6.368	Adoptable	556047.634	655206.897	1.350
F5-1		6.127	Adoptable	556061.773	655260.838	2.038
F1-5		5.247	Adoptable	556074.080	655307.994	2.453
F6-0		5.332	Adoptable	555883.564	655163.211	1.425
F6-1		5.282	Adoptable	555913.615	655193.519	2.086
F6-1A		5.382	Adoptable	555926.174	655180.801	2.318
F7-0		5.382	Adoptable	555971.565	655159.262	1.425
F7-1		5.382	Adoptable	555940.166	655169.286	1.974
F6-2		5.382	Adoptable	555931.080	655178.662	2.358
F8-0	0.6	5.288	Adoptable	556024.377	655179.211	1.425
F8-1		5.288	Adoptable	555977.750	655192.426	1.910
F6-3		5.288	Adoptable	555957.560	655206.366	2.456
F6-4		5.407	Adoptable	555977.542	655226.734	2.718
F6-5		5.312	Adoptable	555991.226	655250.974	2.762
F1-6		5.319	Adoptable	556010.933	655324.955	3.152
F9-0		5.248	Adoptable	555981.777	655343.309	1.425
F1-7		5.248	Adoptable	555979.213	655333.459	3.245
F10-0		5.284	Adoptable	555930.634	655287.618	1.350
F1-8		5.308	Adoptable	555945.154	655342.432	3.481
F1-9		5.423	Adoptable	555921.390	655349.546	3.720
F1-10		5.348	Adoptable	555902.695	655358.245	3.748
F1-11		5.248	Adoptable	555887.339	655368.415	3.740
F13-0		5.266	Adoptable	555863.082	655206.925	1.350
F13-1		5.241	Adoptable	555839.954	655228.963	1.857
F13-2		5.241	Adoptable	555839.884	655235.085	1.902
F11-0		5.266	Adoptable	555872.674	655210.971	1.350
F12-0		5.370	Adoptable	555934.408	655227.329	1.350
F11-1		5.340	Adoptable	555911.246	655249.932	1.972
F11-2		5.288	Adoptable	555881.530	655278.686	2.396
F11-3		5.360	Adoptable	555857.331	655302.896	2.639
F14-0		5.314	Adoptable	555776.328	655291.441	1.350
F14-0A		5.407	Adoptable	555789.339	655278.980	1.743
F14-1		5.407	Adoptable	555794.155	655279.864	1.825
F15-0		5.278	Adoptable	555781.411	655302.634	1.350

Nodes

Name	Add Inflow (l/s)	Cover Level (m)	Manhole Type	Easting (m)	Northing (m)	Depth (m)
F15-1		5.367	Adoptable	555808.606	655327.165	2.049
F15-2		5.367	Adoptable	555814.814	655327.480	2.095
F14-2		5.204	Adoptable	555829.372	655315.130	2.073
F11-4		5.314	Adoptable	555837.753	655322.628	2.732
F11-5		5.364	Adoptable	555843.389	655329.479	2.826
F1-12		5.248	Adoptable	555868.002	655380.799	4.705
F1-13		5.348	Adoptable	555854.233	655387.896	4.882
F1-14		5.398	Adoptable	555840.526	655393.824	5.007
F1-15		5.375	Adoptable	555826.057	655397.189	5.058
F1-16		4.992	Adoptable	555800.945	655402.954	4.804
F1-17		4.300	Adoptable	555782.621	655417.154	4.228
EXFMH-F9		3.963	Adoptable	555772.337	655414.838	3.944

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
F1.000	F1-0	F1-1	67.876	1.500	5.576	4.445	1.131	60.0	150
F1.001	F1-1	F1-2	27.049	1.500	4.445	4.245	0.200	135.0	150
F2.001	F2-1	F2-2	44.498	1.500	5.545	5.215	0.330	135.0	225
F2.002	F2-2	F2-3	19.439	1.500	5.215	5.071	0.144	135.0	225
F2.003	F2-3	F1-2	17.784	1.500	5.071	4.939	0.132	135.0	225
F1.002	F1-2	F1-3	41.976	1.500	4.245	3.934	0.311	135.0	225
F3.000	F3-0	F1-3	53.252	1.500	4.746	3.858	0.888	60.0	225
F1.003	F1-3	F1-4	23.708	1.500	3.858	3.682	0.176	135.0	225
F4.000	F4-0	F1-4	54.022	1.500	4.018	2.938	1.080	50.0	225
F1.004	F1-4	F1-5	14.416	1.500	2.938	2.794	0.144	100.0	225
F5.000	F5-0	F5-1	55.763	1.500	5.018	4.089	0.929	60.0	150
F5.001	F5-1	F1-5	48.736	1.500	4.089	3.728	0.361	135.0	150
F1.005	F1-5	F1-6	65.385	1.500	2.794	2.467	0.327	200.0	225
F6.000	F6-0	F6-1	42.681	1.500	3.907	3.196	0.711	60.0	225
F6.001	F6-1	F6-1A	17.874	1.500	3.196	3.064	0.132	135.0	225

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Dwellings (ha)	Σ Units (ha)	Σ Add Inflow (ha)	Pro Depth (mm)
F1.000	1.132	20.0	0.0	1.200	2.331	0.000	0	0.0	0.0	0
F1.001	0.753	13.3	0.0	2.331	2.386	0.000	0	0.0	0.0	0
F2.001	0.987	39.2	0.0	1.200	1.530	0.000	0	0.0	0.0	0
F2.002	0.987	39.2	0.0	1.530	1.674	0.000	0	0.0	0.0	0
F2.003	0.987	39.2	0.0	1.674	1.617	0.000	0	0.0	0.0	0
F1.002	0.987	39.2	0.0	2.311	2.012	0.000	0	0.0	0.0	0
F3.000	1.483	59.0	0.0	1.200	2.088	0.000	0	0.0	0.0	0
F1.003	0.987	39.2	0.0	2.088	1.536	0.000	0	0.0	0.0	0
F4.000	1.625	64.6	0.0	1.200	2.280	0.000	0	0.0	0.0	0
F1.004	1.148	45.6	0.0	2.280	2.228	0.000	0	0.0	0.0	0
F5.000	1.132	20.0	0.0	1.200	1.888	0.000	0	0.0	0.0	0
F5.001	0.753	13.3	0.0	1.888	1.369	0.000	0	0.0	0.0	0
F1.005	0.810	32.2	0.0	2.228	2.627	0.000	0	0.0	0.0	0
F6.000	1.483	59.0	0.0	1.200	1.861	0.000	0	0.0	0.0	0
F6.001	0.987	39.2	0.0	1.861	2.093	0.000	0	0.0	0.0	0

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
F6.001A	F6-1A	F6-2	5.352	1.500	3.064	3.024	0.040	135.0	225
F7.000	F7-0	F7-1	32.960	1.500	3.957	3.408	0.549	60.0	225
F7.001	F7-1	F6-2	13.056	1.500	3.408	3.311	0.097	135.0	225
F6.002	F6-2	F6-3	38.324	1.500	3.024	2.832	0.192	200.0	225
F8.000	F8-0	F8-1	48.464	1.500	3.863	3.378	0.485	100.0	225
F8.001	F8-1	F6-3	24.535	1.500	3.378	3.255	0.123	200.0	225
F6.003	F6-3	F6-4	28.533	1.500	2.832	2.689	0.143	200.0	225
F6.004	F6-4	F6-5	27.836	1.500	2.689	2.550	0.139	200.0	225
F6.005	F6-5	F1-6	76.561	1.500	2.550	2.167	0.383	200.0	225
F1.006	F1-6	F1-7	32.840	1.500	2.167	2.003	0.164	200.0	225
F9.000	F9-0	F1-7	10.178	1.500	3.823	3.653	0.170	60.0	225
F1.007	F1-7	F1-8	35.221	1.500	2.003	1.827	0.176	200.0	225
F10.000	F10-0	F1-8	56.705	1.500	3.934	2.989	0.945	60.0	150
F1.008	F1-8	F1-9	24.806	1.500	1.827	1.703	0.124	200.0	225
F1.009	F1-9	F1-10	20.620	1.500	1.703	1.600	0.103	200.0	225
F1.010	F1-10	F1-11	18.418	1.500	1.600	1.508	0.092	200.0	225
F1.011	F1-11	F1-12	22.963	1.500	1.508	1.393	0.115	200.0	225
F13.000	F13-0	F13-1	31.946	1.500	3.916	3.384	0.532	60.0	150
F13.001	F13-1	F13-2	6.122	1.500	3.384	3.339	0.045	135.0	150
F13.002	F13-2	F11-2	60.295	1.500	3.339	2.892	0.447	135.0	150
F11.000	F11-0	F11-1	54.825	1.500	3.916	3.368	0.548	100.0	150
F12.000	F12-0	F11-1	32.363	1.500	4.020	3.481	0.539	60.0	150
F11.001	F11-1	F11-2	41.350	1.500	3.368	3.161	0.207	200.0	225
F11.002	F11-2	F11-3	34.230	1.500	2.892	2.721	0.171	200.0	225

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Dwellings (ha)	Σ Units (ha)	Σ Add Inflow (ha)	Pro Depth (mm)
F6.001A	0.987	39.2	0.0	2.093	2.133	0.000	0	0.0	0.0	0
F7.000	1.483	59.0	0.0	1.200	1.749	0.000	0	0.0	0.0	0
F7.001	0.987	39.2	0.0	1.749	1.846	0.000	0	0.0	0.0	0
F6.002	0.810	32.2	0.0	2.133	2.231	0.000	0	0.0	0.0	0
F8.000	1.148	45.6	0.6	1.200	1.685	0.000	0	0.0	0.6	18
F8.001	0.810	32.2	0.6	1.685	1.808	0.000	0	0.0	0.6	22
F6.003	0.810	32.2	0.6	2.231	2.493	0.000	0	0.0	0.6	22
F6.004	0.810	32.2	0.6	2.493	2.537	0.000	0	0.0	0.6	22
F6.005	0.810	32.2	0.6	2.537	2.927	0.000	0	0.0	0.6	22
F1.006	0.810	32.2	0.6	2.927	3.020	0.000	0	0.0	0.6	22
F9.000	1.483	59.0	0.0	1.200	1.370	0.000	0	0.0	0.0	0
F1.007	0.810	32.2	0.6	3.020	3.256	0.000	0	0.0	0.6	22
F10.000	1.132	20.0	0.0	1.200	2.169	0.000	0	0.0	0.0	0
F1.008	0.810	32.2	0.6	3.256	3.495	0.000	0	0.0	0.6	22
F1.009	0.810	32.2	0.6	3.495	3.523	0.000	0	0.0	0.6	22
F1.010	0.810	32.2	0.6	3.523	3.515	0.000	0	0.0	0.6	22
F1.011	0.810	32.2	0.6	3.515	3.630	0.000	0	0.0	0.6	22
F13.000	1.132	20.0	0.0	1.200	1.707	0.000	0	0.0	0.0	0
F13.001	0.753	13.3	0.0	1.707	1.752	0.000	0	0.0	0.0	0
F13.002	0.753	13.3	0.0	1.752	2.246	0.000	0	0.0	0.0	0
F11.000	0.876	15.5	0.0	1.200	1.822	0.000	0	0.0	0.0	0
F12.000	1.132	20.0	0.0	1.200	1.709	0.000	0	0.0	0.0	0
F11.001	0.810	32.2	0.0	1.747	1.902	0.000	0	0.0	0.0	0
F11.002	0.810	32.2	0.0	2.171	2.414	0.000	0	0.0	0.0	0

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
F11.003	F11-3	F11-4	27.797	1.500	2.721	2.582	0.139	200.0	225
F14.000	F14-0	F14-0A	18.016	1.500	3.964	3.664	0.300	60.0	150
F14.000A	F14-0A	F14-1	4.896	1.500	3.664	3.582	0.082	60.0	150
F14.001	F14-1	F14-2	49.839	1.500	3.582	3.213	0.369	135.0	150
F15.000	F15-0	F15-1	36.624	1.500	3.928	3.318	0.610	60.0	150
F15.001	F15-1	F15-2	6.216	1.500	3.318	3.272	0.046	135.0	150
F15.002	F15-2	F14-2	19.091	1.500	3.272	3.131	0.141	135.0	150
F14.002	F14-2	F11-4	11.245	1.500	3.131	3.048	0.083	135.0	225
F11.004	F11-4	F11-5	8.871	1.500	2.582	2.538	0.044	200.0	225
F11.005	F11-5	F1-12	56.917	1.500	2.538	2.253	0.285	200.0	225
F1.012	F1-12	F1-13	15.490	1.500	0.543	0.466	0.077	200.0	225
F1.013	F1-13	F1-14	14.934	1.500	0.466	0.391	0.075	200.0	225
F1.014	F1-14	F1-15	14.855	1.500	0.391	0.317	0.074	200.0	225
F1.015	F1-15	F1-16	25.765	1.500	0.317	0.188	0.129	200.0	225
F1.016	F1-16	F1-17	23.182	1.500	0.188	0.072	0.116	200.0	225
F1.017	F1-17	EXFMH-F9	10.542	1.500	0.072	0.019	0.053	200.0	225

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Dwellings (ha)	Σ Units (ha)	Σ Add Inflow (ha)	Pro Depth (mm)
F11.003	0.810	32.2	0.0	2.414	2.507	0.000	0	0.0	0.0	0
F14.000	1.132	20.0	0.0	1.200	1.593	0.000	0	0.0	0.0	0
F14.000A	1.132	20.0	0.0	1.593	1.675	0.000	0	0.0	0.0	0
F14.001	0.753	13.3	0.0	1.675	1.841	0.000	0	0.0	0.0	0
F15.000	1.132	20.0	0.0	1.200	1.899	0.000	0	0.0	0.0	0
F15.001	0.753	13.3	0.0	1.899	1.945	0.000	0	0.0	0.0	0
F15.002	0.753	13.3	0.0	1.945	1.923	0.000	0	0.0	0.0	0
F14.002	0.987	39.2	0.0	1.848	2.041	0.000	0	0.0	0.0	0
F11.004	0.810	32.2	0.0	2.507	2.601	0.000	0	0.0	0.0	0
F11.005	0.810	32.2	0.0	2.601	2.770	0.000	0	0.0	0.0	0
F1.012	0.810	32.2	0.6	4.480	4.657	0.000	0	0.0	0.6	22
F1.013	0.810	32.2	0.6	4.657	4.782	0.000	0	0.0	0.6	22
F1.014	0.810	32.2	0.6	4.782	4.833	0.000	0	0.0	0.6	22
F1.015	0.810	32.2	0.6	4.833	4.579	0.000	0	0.0	0.6	22
F1.016	0.810	32.2	0.6	4.579	4.003	0.000	0	0.0	0.6	22
F1.017	0.810	32.2	0.6	4.003	3.719	0.000	0	0.0	0.6	22

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
F1.000	67.876	60.0	150	Circular	6.926	5.576	1.200	6.926	4.445	2.331
F1.001	27.049	135.0	150	Circular	6.926	4.445	2.331	6.781	4.245	2.386
F2.001	44.498	135.0	225	Circular	6.970	5.545	1.200	6.970	5.215	1.530
F2.002	19.439	135.0	225	Circular	6.970	5.215	1.530	6.970	5.071	1.674

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
F1.000	F1-0	1200	Manhole	Adoptable	F1-1	1200	Manhole	Adoptable
F1.001	F1-1	1200	Manhole	Adoptable	F1-2	1200	Manhole	Adoptable
F2.001	F2-1	1200	Manhole	Adoptable	F2-2	1200	Manhole	Adoptable
F2.002	F2-2	1200	Manhole	Adoptable	F2-3	1200	Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
F2.003	17.784	135.0	225	Circular	6.970	5.071	1.674	6.781	4.939	1.617
F1.002	41.976	135.0	225	Circular	6.781	4.245	2.311	6.171	3.934	2.012
F3.000	53.252	60.0	225	Circular	6.171	4.746	1.200	6.171	3.858	2.088
F1.003	23.708	135.0	225	Circular	6.171	3.858	2.088	5.443	3.682	1.536
F4.000	54.022	50.0	225	Circular	5.443	4.018	1.200	5.443	2.938	2.280
F1.004	14.416	100.0	225	Circular	5.443	2.938	2.280	5.247	2.794	2.228
F5.000	55.763	60.0	150	Circular	6.368	5.018	1.200	6.127	4.089	1.888
F5.001	48.736	135.0	150	Circular	6.127	4.089	1.888	5.247	3.728	1.369
F1.005	65.385	200.0	225	Circular	5.247	2.794	2.228	5.319	2.467	2.627
F6.000	42.681	60.0	225	Circular	5.332	3.907	1.200	5.282	3.196	1.861
F6.001	17.874	135.0	225	Circular	5.282	3.196	1.861	5.382	3.064	2.093
F6.001A	5.352	135.0	225	Circular	5.382	3.064	2.093	5.382	3.024	2.133
F7.000	32.960	60.0	225	Circular	5.382	3.957	1.200	5.382	3.408	1.749
F7.001	13.056	135.0	225	Circular	5.382	3.408	1.749	5.382	3.311	1.846
F6.002	38.324	200.0	225	Circular	5.382	3.024	2.133	5.288	2.832	2.231
F8.000	48.464	100.0	225	Circular	5.288	3.863	1.200	5.288	3.378	1.685
F8.001	24.535	200.0	225	Circular	5.288	3.378	1.685	5.288	3.255	1.808
F6.003	28.533	200.0	225	Circular	5.288	2.832	2.231	5.407	2.689	2.493
F6.004	27.836	200.0	225	Circular	5.407	2.689	2.493	5.312	2.550	2.537
F6.005	76.561	200.0	225	Circular	5.312	2.550	2.537	5.319	2.167	2.927
F1.006	32.840	200.0	225	Circular	5.319	2.167	2.927	5.248	2.003	3.020
F9.000	10.178	60.0	225	Circular	5.248	3.823	1.200	5.248	3.653	1.370
F1.007	35.221	200.0	225	Circular	5.248	2.003	3.020	5.308	1.827	3.256
F10.000	56.705	60.0	150	Circular	5.284	3.934	1.200	5.308	2.989	2.169
F1.008	24.806	200.0	225	Circular	5.308	1.827	3.256	5.423	1.703	3.495

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
F2.003	F2-3	1200	Manhole	Adoptable	F1-2	1200	Manhole	Adoptable
F1.002	F1-2	1200	Manhole	Adoptable	F1-3	1200	Manhole	Adoptable
F3.000	F3-0	1200	Manhole	Adoptable	F1-3	1200	Manhole	Adoptable
F1.003	F1-3	1200	Manhole	Adoptable	F1-4	1200	Manhole	Adoptable
F4.000	F4-0	1200	Manhole	Adoptable	F1-4	1200	Manhole	Adoptable
F1.004	F1-4	1200	Manhole	Adoptable	F1-5	1200	Manhole	Adoptable
F5.000	F5-0	1200	Manhole	Adoptable	F5-1	1200	Manhole	Adoptable
F5.001	F5-1	1200	Manhole	Adoptable	F1-5	1200	Manhole	Adoptable
F1.005	F1-5	1200	Manhole	Adoptable	F1-6	1200	Manhole	Adoptable
F6.000	F6-0	1200	Manhole	Adoptable	F6-1	1200	Manhole	Adoptable
F6.001	F6-1	1200	Manhole	Adoptable	F6-1A	1200	Manhole	Adoptable
F6.001A	F6-1A	1200	Manhole	Adoptable	F6-2	1200	Manhole	Adoptable
F7.000	F7-0	1200	Manhole	Adoptable	F7-1	1200	Manhole	Adoptable
F7.001	F7-1	1200	Manhole	Adoptable	F6-2	1200	Manhole	Adoptable
F6.002	F6-2	1200	Manhole	Adoptable	F6-3	1200	Manhole	Adoptable
F8.000	F8-0	1200	Manhole	Adoptable	F8-1	1200	Manhole	Adoptable
F8.001	F8-1	1200	Manhole	Adoptable	F6-3	1200	Manhole	Adoptable
F6.003	F6-3	1200	Manhole	Adoptable	F6-4	1200	Manhole	Adoptable
F6.004	F6-4	1200	Manhole	Adoptable	F6-5	1200	Manhole	Adoptable
F6.005	F6-5	1200	Manhole	Adoptable	F1-6	1200	Manhole	Adoptable
F1.006	F1-6	1200	Manhole	Adoptable	F1-7	1200	Manhole	Adoptable
F9.000	F9-0	1200	Manhole	Adoptable	F1-7	1200	Manhole	Adoptable
F1.007	F1-7	1200	Manhole	Adoptable	F1-8	1200	Manhole	Adoptable
F10.000	F10-0	1200	Manhole	Adoptable	F1-8	1200	Manhole	Adoptable
F1.008	F1-8	1200	Manhole	Adoptable	F1-9	1200	Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
F1.009	20.620	200.0	225	Circular	5.423	1.703	3.495	5.348	1.600	3.523
F1.010	18.418	200.0	225	Circular	5.348	1.600	3.523	5.248	1.508	3.515
F1.011	22.963	200.0	225	Circular	5.248	1.508	3.515	5.248	1.393	3.630
F13.000	31.946	60.0	150	Circular	5.266	3.916	1.200	5.241	3.384	1.707
F13.001	6.122	135.0	150	Circular	5.241	3.384	1.707	5.241	3.339	1.752
F13.002	60.295	135.0	150	Circular	5.241	3.339	1.752	5.288	2.892	2.246
F11.000	54.825	100.0	150	Circular	5.266	3.916	1.200	5.340	3.368	1.822
F12.000	32.363	60.0	150	Circular	5.370	4.020	1.200	5.340	3.481	1.709
F11.001	41.350	200.0	225	Circular	5.340	3.368	1.747	5.288	3.161	1.902
F11.002	34.230	200.0	225	Circular	5.288	2.892	2.171	5.360	2.721	2.414
F11.003	27.797	200.0	225	Circular	5.360	2.721	2.414	5.314	2.582	2.507
F14.000	18.016	60.0	150	Circular	5.314	3.964	1.200	5.407	3.664	1.593
F14.000A	4.896	60.0	150	Circular	5.407	3.664	1.593	5.407	3.582	1.675
F14.001	49.839	135.0	150	Circular	5.407	3.582	1.675	5.204	3.213	1.841
F15.000	36.624	60.0	150	Circular	5.278	3.928	1.200	5.367	3.318	1.899
F15.001	6.216	135.0	150	Circular	5.367	3.318	1.899	5.367	3.272	1.945
F15.002	19.091	135.0	150	Circular	5.367	3.272	1.945	5.204	3.131	1.923
F14.002	11.245	135.0	225	Circular	5.204	3.131	1.848	5.314	3.048	2.041
F11.004	8.871	200.0	225	Circular	5.314	2.582	2.507	5.364	2.538	2.601
F11.005	56.917	200.0	225	Circular	5.364	2.538	2.601	5.248	2.253	2.770
F1.012	15.490	200.0	225	Circular	5.248	0.543	4.480	5.348	0.466	4.657
F1.013	14.934	200.0	225	Circular	5.348	0.466	4.657	5.398	0.391	4.782
F1.014	14.855	200.0	225	Circular	5.398	0.391	4.782	5.375	0.317	4.833
F1.015	25.765	200.0	225	Circular	5.375	0.317	4.833	4.992	0.188	4.579
F1.016	23.182	200.0	225	Circular	4.992	0.188	4.579	4.300	0.072	4.003

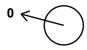
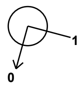
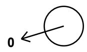
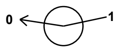
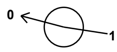
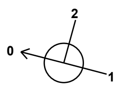
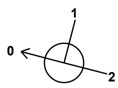
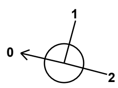
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
F1.009	F1-9	1200	Manhole	Adoptable	F1-10	1200	Manhole	Adoptable
F1.010	F1-10	1200	Manhole	Adoptable	F1-11	1200	Manhole	Adoptable
F1.011	F1-11	1200	Manhole	Adoptable	F1-12	1200	Manhole	Adoptable
F13.000	F13-0	1200	Manhole	Adoptable	F13-1	1200	Manhole	Adoptable
F13.001	F13-1	1200	Manhole	Adoptable	F13-2	1200	Manhole	Adoptable
F13.002	F13-2	1200	Manhole	Adoptable	F11-2	1200	Manhole	Adoptable
F11.000	F11-0	1200	Manhole	Adoptable	F11-1	1200	Manhole	Adoptable
F12.000	F12-0	1200	Manhole	Adoptable	F11-1	1200	Manhole	Adoptable
F11.001	F11-1	1200	Manhole	Adoptable	F11-2	1200	Manhole	Adoptable
F11.002	F11-2	1200	Manhole	Adoptable	F11-3	1200	Manhole	Adoptable
F11.003	F11-3	1200	Manhole	Adoptable	F11-4	1200	Manhole	Adoptable
F14.000	F14-0	1200	Manhole	Adoptable	F14-0A	1200	Manhole	Adoptable
F14.000A	F14-0A	1200	Manhole	Adoptable	F14-1	1200	Manhole	Adoptable
F14.001	F14-1	1200	Manhole	Adoptable	F14-2	1200	Manhole	Adoptable
F15.000	F15-0	1200	Manhole	Adoptable	F15-1	1200	Manhole	Adoptable
F15.001	F15-1	1200	Manhole	Adoptable	F15-2	1200	Manhole	Adoptable
F15.002	F15-2	1200	Manhole	Adoptable	F14-2	1200	Manhole	Adoptable
F14.002	F14-2	1200	Manhole	Adoptable	F11-4	1200	Manhole	Adoptable
F11.004	F11-4	1200	Manhole	Adoptable	F11-5	1200	Manhole	Adoptable
F11.005	F11-5	1200	Manhole	Adoptable	F1-12	1200	Manhole	Adoptable
F1.012	F1-12	1200	Manhole	Adoptable	F1-13	1200	Manhole	Adoptable
F1.013	F1-13	1200	Manhole	Adoptable	F1-14	1200	Manhole	Adoptable
F1.014	F1-14	1200	Manhole	Adoptable	F1-15	1200	Manhole	Adoptable
F1.015	F1-15	1200	Manhole	Adoptable	F1-16	1200	Manhole	Adoptable
F1.016	F1-16	1200	Manhole	Adoptable	F1-17	1200	Manhole	Adoptable

Pipeline Schedule

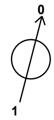
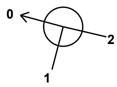
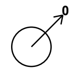
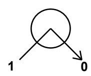
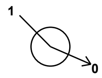
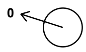
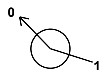
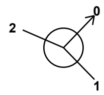
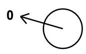
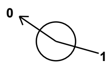
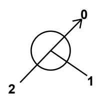
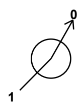
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
F1.017	10.542	200.0	225	Circular	4.300	0.072	4.003	3.963	0.019	3.719

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
F1.017	F1-17	1200	Manhole	Adoptable	EXFMH-F9	1200	Manhole	Adoptable

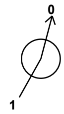
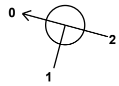
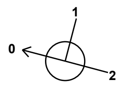
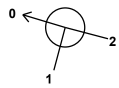
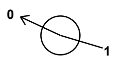
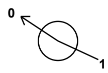
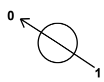
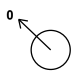
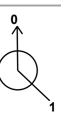
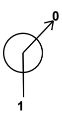
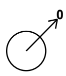
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
F1-0	556224.502	655296.927	6.926	1.350	1200		0	F1.000	5.576	150
F1-1	556158.897	655314.339	6.926	2.481	1200		1	F1.000	4.445	150
							0	F1.001	4.445	150
F2-1	556231.667	655290.103	6.970	1.425	1200		0	F2.001	5.545	225
F2-2	556188.139	655280.871	6.970	1.755	1200		1	F2.001	5.215	225
							0	F2.002	5.215	225
F2-3	556168.919	655283.780	6.970	1.899	1200		1	F2.002	5.071	225
							0	F2.003	5.071	225
F1-2	556151.709	655288.263	6.781	2.536	1200		1	F2.003	4.939	225
							2	F1.001	4.245	150
							0	F1.002	4.245	225
F3-0	556124.441	655350.217	6.171	1.425	1200		0	F3.000	4.746	225
F1-3	556111.045	655298.677	6.171	2.313	1200		1	F3.000	3.858	225
							2	F1.002	3.934	225
							0	F1.003	3.858	225
F4-0	556102.070	655356.898	5.443	1.425	1200		0	F4.000	4.018	225
F1-4	556088.117	655304.709	5.443	2.505	1200		1	F4.000	2.938	225
							2	F1.003	3.682	225
							0	F1.004	2.938	225

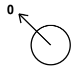
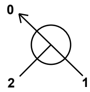
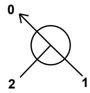
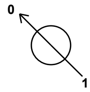
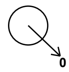
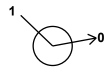
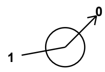
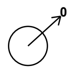
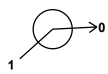
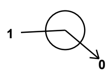
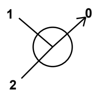
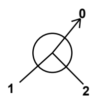
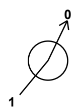
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
F5-0	556047.634	655206.897	6.368	1.350	1200		0	F5.000	5.018	150
F5-1	556061.773	655260.838	6.127	2.038	1200		1	F5.000	4.089	150
							0	F5.001	4.089	150
F1-5	556074.080	655307.994	5.247	2.453	1200		1	F5.001	3.728	150
							2	F1.004	2.794	225
							0	F1.005	2.794	225
F6-0	555883.564	655163.211	5.332	1.425	1200		0	F6.000	3.907	225
F6-1	555913.615	655193.519	5.282	2.086	1200		1	F6.000	3.196	225
							0	F6.001	3.196	225
F6-1A	555926.174	655180.801	5.382	2.318	1200		1	F6.001	3.064	225
							0	F6.001A	3.064	225
F7-0	555971.565	655159.262	5.382	1.425	1200		0	F7.000	3.957	225
F7-1	555940.166	655169.286	5.382	1.974	1200		1	F7.000	3.408	225
							0	F7.001	3.408	225
F6-2	555931.080	655178.662	5.382	2.358	1200		1	F7.001	3.311	225
							2	F6.001A	3.024	225
							0	F6.002	3.024	225
F8-0	556024.377	655179.211	5.288	1.425	1200		0	F8.000	3.863	225
F8-1	555977.750	655192.426	5.288	1.910	1200		1	F8.000	3.378	225
							0	F8.001	3.378	225
F6-3	555957.560	655206.366	5.288	2.456	1200		1	F8.001	3.255	225
							2	F6.002	2.832	225
							0	F6.003	2.832	225
F6-4	555977.542	655226.734	5.407	2.718	1200		1	F6.003	2.689	225
							0	F6.004	2.689	225

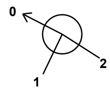
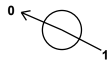
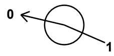
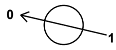
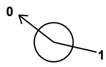
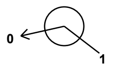
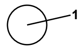
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
F6-5	555991.226	655250.974	5.312	2.762	1200		1	F6.004	2.550	225
							0	F6.005	2.550	225
F1-6	556010.933	655324.955	5.319	3.152	1200		1	F6.005	2.167	225
							2	F1.005	2.467	225
							0	F1.006	2.167	225
F9-0	555981.777	655343.309	5.248	1.425	1200		0	F9.000	3.823	225
F1-7	555979.213	655333.459	5.248	3.245	1200		1	F9.000	3.653	225
							2	F1.006	2.003	225
							0	F1.007	2.003	225
F10-0	555930.634	655287.618	5.284	1.350	1200		0	F10.000	3.934	150
F1-8	555945.154	655342.432	5.308	3.481	1200		1	F10.000	2.989	150
							2	F1.007	1.827	225
							0	F1.008	1.827	225
F1-9	555921.390	655349.546	5.423	3.720	1200		1	F1.008	1.703	225
							0	F1.009	1.703	225
F1-10	555902.695	655358.245	5.348	3.748	1200		1	F1.009	1.600	225
							0	F1.010	1.600	225
F1-11	555887.339	655368.415	5.248	3.740	1200		1	F1.010	1.508	225
							0	F1.011	1.508	225
F13-0	555863.082	655206.925	5.266	1.350	1200		0	F13.000	3.916	150
F13-1	555839.954	655228.963	5.241	1.857	1200		1	F13.000	3.384	150
							0	F13.001	3.384	150
F13-2	555839.884	655235.085	5.241	1.902	1200		1	F13.001	3.339	150
							0	F13.002	3.339	150
F11-0	555872.674	655210.971	5.266	1.350	1200		0	F11.000	3.916	150

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
F12-0	555934.408	655227.329	5.370	1.350	1200		0	F12.000	4.020	150
F11-1	555911.246	655249.932	5.340	1.972	1200		1	F12.000	3.481	150
							2	F11.000	3.368	150
							0	F11.001	3.368	225
F11-2	555881.530	655278.686	5.288	2.396	1200		1	F11.001	3.161	225
							2	F13.002	2.892	150
							0	F11.002	2.892	225
F11-3	555857.331	655302.896	5.360	2.639	1200		1	F11.002	2.721	225
							0	F11.003	2.721	225
F14-0	555776.328	655291.441	5.314	1.350	1200		0	F14.000	3.964	150
F14-0A	555789.339	655278.980	5.407	1.743	1200		1	F14.000	3.664	150
							0	F14.000A	3.664	150
F14-1	555794.155	655279.864	5.407	1.825	1200		1	F14.000A	3.582	150
							0	F14.001	3.582	150
F15-0	555781.411	655302.634	5.278	1.350	1200		0	F15.000	3.928	150
F15-1	555808.606	655327.165	5.367	2.049	1200		1	F15.000	3.318	150
							0	F15.001	3.318	150
F15-2	555814.814	655327.480	5.367	2.095	1200		1	F15.001	3.272	150
							0	F15.002	3.272	150
F14-2	555829.372	655315.130	5.204	2.073	1200		1	F15.002	3.131	150
							2	F14.001	3.213	150
							0	F14.002	3.131	225
F11-4	555837.753	655322.628	5.314	2.732	1200		1	F14.002	3.048	225
							2	F11.003	2.582	225
							0	F11.004	2.582	225
F11-5	555843.389	655329.479	5.364	2.826	1200		1	F11.004	2.538	225
							0	F11.005	2.538	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
F1-12	555868.002	655380.799	5.248	4.705	1200		1	F11.005	2.253	225
							2	F1.011	1.393	225
							0	F1.012	0.543	225
F1-13	555854.233	655387.896	5.348	4.882	1200		1	F1.012	0.466	225
							0	F1.013	0.466	225
F1-14	555840.526	655393.824	5.398	5.007	1200		1	F1.013	0.391	225
							0	F1.014	0.391	225
F1-15	555826.057	655397.189	5.375	5.058	1200		1	F1.014	0.317	225
							0	F1.015	0.317	225
F1-16	555800.945	655402.954	4.992	4.804	1200		1	F1.015	0.188	225
							0	F1.016	0.188	225
F1-17	555782.621	655417.154	4.300	4.228	1200		1	F1.016	0.072	225
							0	F1.017	0.072	225
EXFMH-F9	555772.337	655414.838	3.963	3.944	1200		1	F1.017	0.019	225

Appendix C Irish Water Consultation

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

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

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97 Henry Street
V94YC2H
Co.Limerick
Ireland

30 September 2021

Re: Design Submission for Greenpark Development, Limerick, Limerick (the "Development")
(the "Design Submission") / Connection Reference No: CDS20006611

Dear Damien Egan,

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

Appendix A

Document Title & Revision

- [191325-PUNCH-XX-XX-DR-C-0200 Watermain Layout (Sheet 1 of 2)]
- [191325-PUNCH-XX-XX-DR-C-0201 Watermain Layout (Sheet 2 of 2)]
- [191325-PUNCH-XX-XX-DR-C-0102 Drainage Layout (Sheet 3 of 4)]
- [191325-PUNCH-XX-XX-DR-C-0103 Drainage Layout (Sheet 4 of 4)]
- [191325-PUNCH-XX-XX-DR-C-0175 Foul Sewer Sections (Sheet 1 of 2)]
- [191325-PUNCH-XX-XX-DR-C-0176 Foul Sewer Sections (Sheet 2 of 2)]

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

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

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

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

www.water.ie

Mr. Donal Gallery,
Punch Consulting Engineers,
97 Henry Street,
Limerick

21 September 2021

Re: DIV21203 Build Near Application - Greenpark Development, Limerick
Subject to contract | Contract denied

Dear Mr. Gallery,

Irish Water has reviewed your enquiry on behalf of Voyage Property Limited in relation to a proposed build near of Irish Water's 600mm trunk watermain at Greenpark Development, Limerick (site located at Irish Grid co-ordinates: 155804, 155428).

Based upon the details you have provided in drawings 191325-PUNCH-XX-XX-DR-C-0300, 191325-PUNCH-XX-XX-DR-C-0301 and 191325-PUNCH-XX-XX-DR-C-0190 and as assessed by Irish Water, we wish to advise you that, subject to valid agreements being put in place, the proposed build near can be facilitated.

You are advised that this correspondence does not constitute an agreement in whole or in part to build near any Irish Water infrastructure and is provided subject to a Deed of Easement being provided by Voyage Property Limited to Irish Water for the route of the 600mm trunk watermain through the site, prior to any construction works taking place on the ground.

If you have any further questions, please contact Brendan Kearney from the Diversions team on 0871016233 or email brkearney@water.ie. For further information, visit https://www.water.ie/connections/developer-services/diversion-and-build-over/.

Yours sincerely,

Yvonne Harris

Yvonne Harris
Head of Customer Operations

Damien Egan

Punch Consulting Engineers
97 Henry Street
Co.Limerick
V94YC2H
Ireland

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

1 December 2020

Re: CDS20006611 pre-connection enquiry - Subject to contract | Contract denied

Connection for Multi/Mixed Use Development of 361 unit(s) at Greenpark Development, Limerick, Limerick

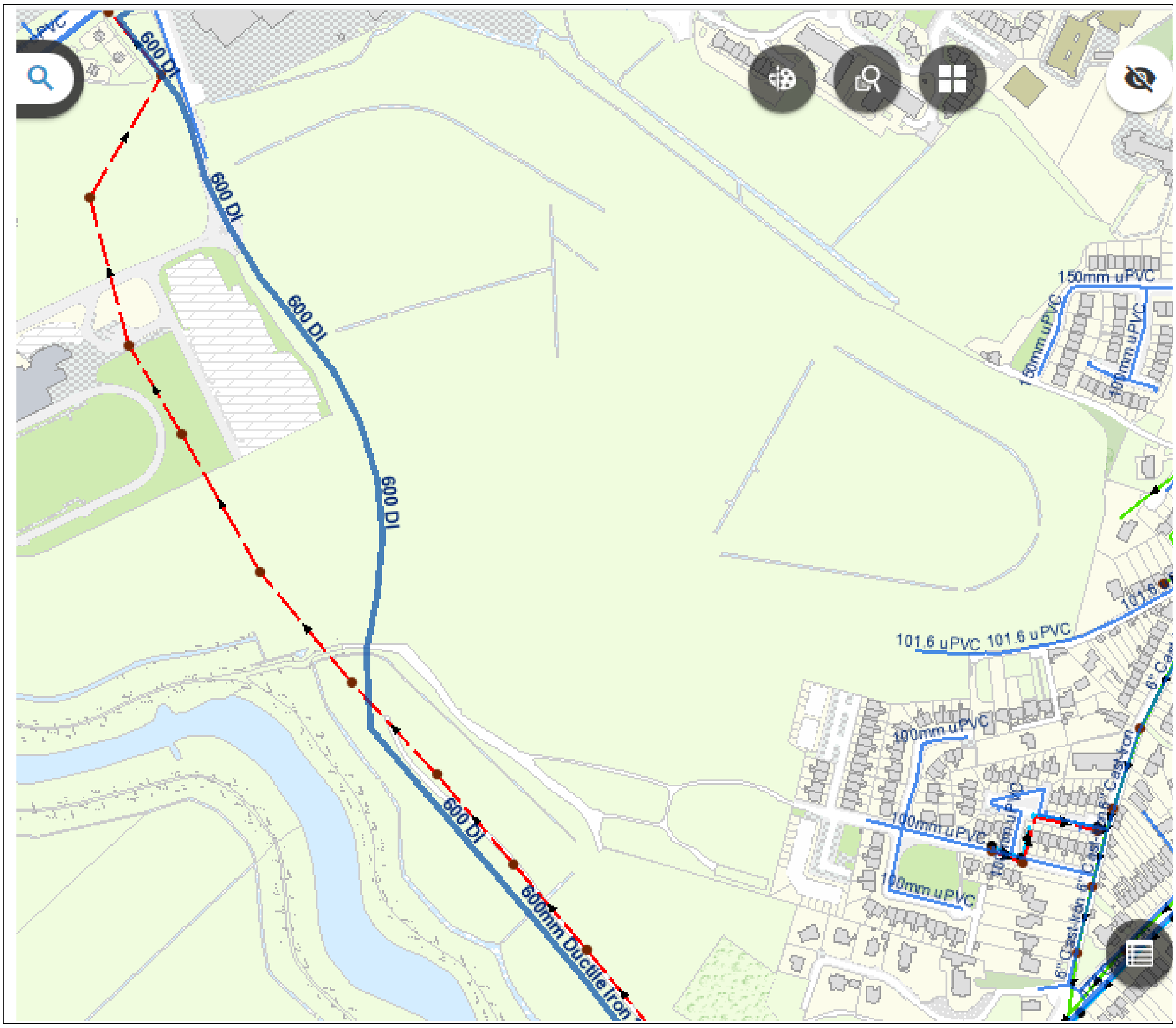
Dear Sir/Madam,

Irish Water has reviewed your pre-connection enquiry in relation to a Water & Wastewater connection at Greenpark Development, Limerick, Limerick (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.

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 infrastructure upgrade by Irish Water
Wastewater Connection	Feasible without infrastructure upgrade by Irish Water
SITE SPECIFIC COMMENTS	
Water Connection	This Confirmation of Feasibility to connect to the Irish Water infrastructure also does not extend to your fire flow requirements. In order to determine the potential flow that could be delivered during normal operational conditions, an on site assessment of the existing network is required. Please note that Irish Water cannot guarantee a flow rate to meet fire flow requirements and in order to guarantee a flow to meet the Fire Authority requirements, you should provide adequate fire storage capacity within your development.
Wastewater Connection	It is noted that the proposed wastewater network and associated connection to the public network will be carried out at a significant depth

	and in excess of 6m. The applicant shall provide further details at detailed design stage in respect of such infrastructure exhibiting adherence with the IW Codes of Practice and Standard Details.
Strategic Housing Development	Strategic Housing Development Irish Water notes that the scale of this development dictates that it is subject to the Strategic Housing Development planning process. Therefore: A. In advance of submitting your full application to An Bord Pleanala for assessment, you must have reviewed this development with Irish Water and received a Statement of Design Acceptance in relation to the layout of water and wastewater services. B. You are advised that this correspondence does not constitute an offer in whole or in part to provide a connection to any Irish Water infrastructure and is provided subject to a connection agreement being signed and appropriate connection fee paid at a later date.
Significant infrastructure traversing the site	There is significant existing water and wastewater infrastructure traversing through the site. IW records indicate existing 300mm and 600mm diameter trunk watermains as well as a 1500mm foul sewer line traverse through the proposed site for development. Due to the size and significance of these IW assets, diversions will not be feasible.
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.

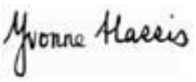
General Notes:

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 John Hennessy from the design team on 022 52256 or email jhennessy@water.ie For further information, visit **www.water.ie/connections.**

Yours sincerely,



Yvonne Harris

Head of Customer Operations

Donal Gallery | PUNCH

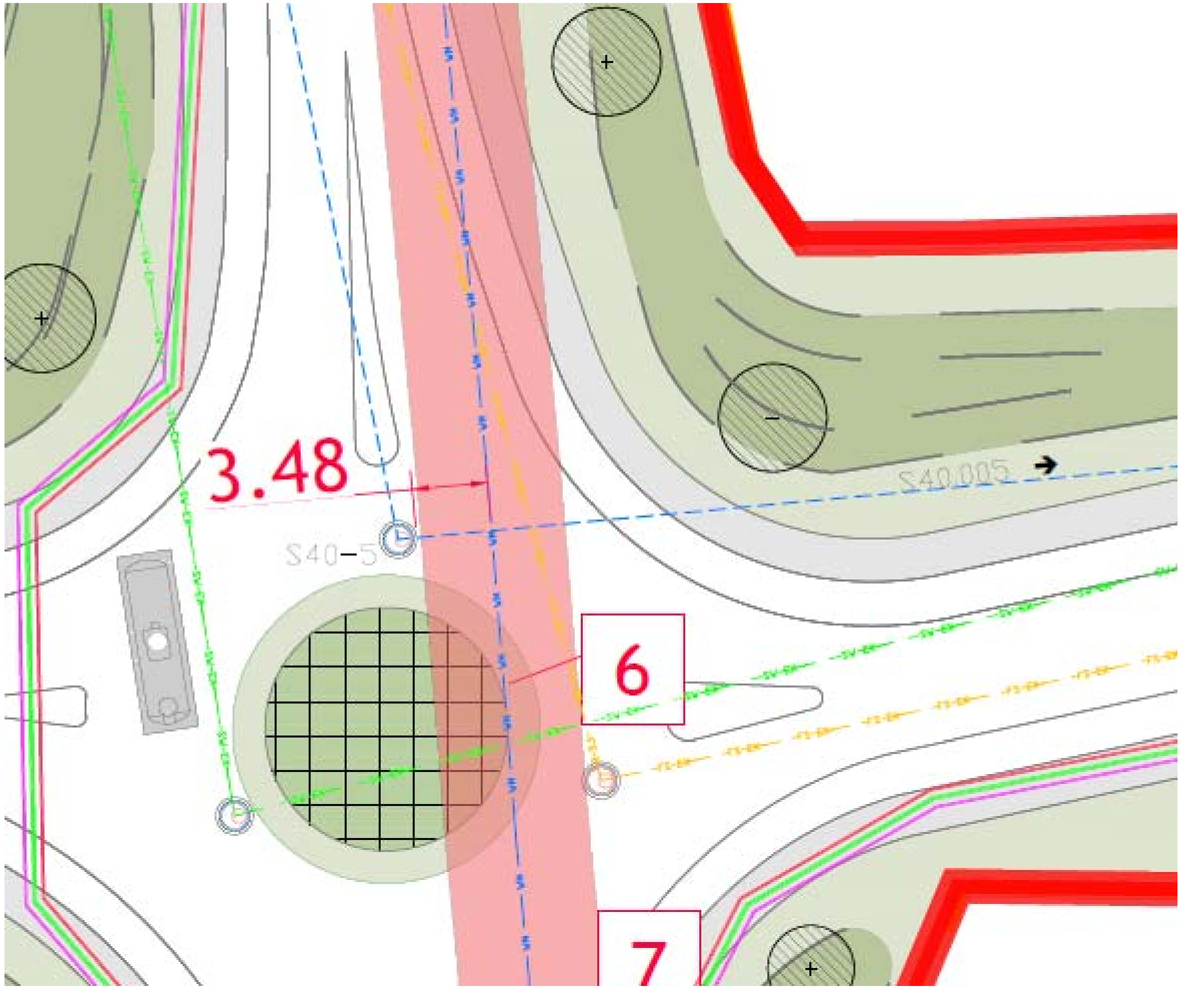
From: Brendan Kearney <brkearney@water.ie>
Sent: Wednesday 15 September 2021 17:07
To: Donal Gallery | PUNCH
Cc: Maurice Feehan; Damien Egan | PUNCH; Cian Nolan | PUNCH
Subject: RE: DIV21203 Greenpark Development, Limerick

Hi Donal,

As discussed on the phone this afternoon, I think we are a lot closer to an agreeable proposal now. However there are still two things IW need clarified:

1. The Long Section drawing shows 3 different scenarios: "EXISTING GROUND LEVELS", "PREFERRED OPTION" & "OPTION 2 LIMERICK COUNCIL PREFERRED FINISHED GROUND LEVELS". Please clarify that the "PREFERRED OPTION" is what is being proposed (Irish Water would not support Option 2 which would lead to the critical 600mm trunk watermain having a lot more cover)?

2. Note that the IW Code of Practice for Water outlines "A storm water sewer or a wastewater sewer should generally not be installed to cross over a Water Main". Whilst in some other cases, where there are no other available alternatives, there can be justification for introducing such crossings –such justification does not appear to be present here. Given the criticality of this 600mm trunk watermain and the vast population it serves, we need to avoid introducing additional risk wherever possible. There is already an existing storm water sewer crossing the trunk watermain in the vicinity of the roundabout (green in the screenshot below). The design should be updated so that existing pipe is used as the route for the additional storm water, and the unnecessary new pipe crossing should be removed.



If you can provide clarity on the above I will then be able to provide you with the Confirmation of Feasibility letter.

Best regards,

Brendan Kearney
Diversions, Connections and Developer Services
Uisce Éireann
Teach Colvill, 24-26 Sráid Thalbóid, Baile Átha Cliath 1, Éire
Irish Water
Colvill House, 24-26 Talbot Street, Dublin 1, Ireland

Appendix D Surface Water Drainage Calculations

Surface Water Drainage Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	5	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	10	Minimum Velocity (m/s)	1.00
FSR Region	Scotland and Ireland	Connection Type	Level Inverts
M5-60 (mm)	17.300	Minimum Backdrop Height (m)	0.000
Ratio-R	0.325	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S1-0	0.087	5.00		5.332	1200	555880.569	655162.902	1.500
S1-1	0.198	5.00		5.282	1350	555913.163	655196.060	1.682
S1-1A				5.407	1350	555928.589	655181.283	1.914
S2-0	0.031	5.00		5.407	1200	555974.085	655160.632	1.425
S2-1	0.118	5.00		5.407	1200	555942.486	655170.547	1.977
S1-2	0.118	5.00		5.407	1350	555933.769	655179.338	2.039
S3-0	0.086	5.00	1.8	5.288	1200	556022.190	655178.066	1.425
S3-1	0.008	5.00		5.288	1200	555978.318	655190.411	2.185
S4-0	0.043	5.00		5.320	1200	555937.834	655223.373	1.425
S1-3	0.082	5.00		5.288	1350	555957.356	655203.700	2.599
S5-0		5.00		5.332	1200	555987.035	655204.366	2.332
S5-1				5.332	1200	555975.569	655212.524	2.567
S1-4	0.194	5.00		5.407	1350	555980.022	655227.504	2.902
S1-5	0.239	5.00		5.286	1350	555993.480	655251.810	2.920
S8-0	0.023	5.00		6.900	1200	556221.616	655296.283	1.425
S8-1	0.156	5.00		6.900	1200	556160.222	655312.666	2.484
S6-1	1.085	9.00		6.950	1350	556229.921	655292.411	3.250
S6-2	0.008	5.00		6.950	1500	556190.962	655288.713	3.902
S6-3	0.025	5.00		6.950	1500	556175.759	655292.357	3.980
S7-0	0.005	5.00		6.950	1200	556221.959	655289.422	1.425
S7-1	0.086	5.00		6.950	1200	556188.075	655282.837	2.000
S7-2	0.060	5.00		6.950	1350	556167.932	655285.553	4.041
S6-5	0.018	5.00		6.795	1350	556153.795	655288.968	3.959
S10-0	0.062	5.00		6.000	1200	556123.943	655353.761	1.425
S10-1	0.110	5.00		6.000	1200	556116.446	655325.470	1.718
S9-0	0.056	5.00		5.300	1200	556103.850	655358.354	1.425
S9-1	0.095	5.00		5.300	1200	556096.425	655330.909	1.592
S9-2	0.018	5.00		5.700		556105.491	655328.448	3.347
S6-6	0.228	5.00		5.600	1500	556099.015	655303.759	3.375
S11-0	0.064	5.00		6.368	1200	556048.280	655204.810	1.425
S11-1	0.167	5.00		6.127	1200	556062.328	655258.490	3.109
S6-7	0.081	5.00		5.247	1500	556075.964	655310.689	3.142
S12-0	0.024	5.00		6.500	1200	556159.504	655366.383	1.425
S12-1	0.200	5.00		5.200	1200	556073.814	655389.348	1.604
S7-8	0.176	5.00		5.100	1500	556054.260	655315.981	3.107
S1-6	0.112	5.00		5.298	1800	556013.425	655327.228	3.517
S13-0	0.020	5.00		5.248	1200	555982.671	655341.239	1.425
S1-7	0.088	5.00		5.248	1800	555981.246	655335.791	3.633
S14-0	0.136	5.00		5.284	1200	555932.519	655289.040	1.425
S1-8	0.127	5.00		5.306	1800	555946.905	655344.284	3.868
S1-9	0.128	5.00		5.423	1800	555920.327	655352.825	4.125

Nodes

Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S1-10	0.164	5.00		5.348	1800	555903.148	655361.136	4.145
S1-11	0.034	5.00		5.248	1800	555886.996	655371.857	4.142
S17-0	0.122	5.00		5.266	1200	555865.466	655206.888	1.425
S17-1	0.080	5.00		5.241	1200	555841.157	655230.708	1.967
S17-2	0.080	5.00		5.241	1200	555841.980	655235.500	2.048
S15-0	0.114	5.00		5.266	1200	555872.054	655212.698	1.425
S16-0	0.137	5.00		5.370	1200	555934.313	655229.466	1.425
S15-1	0.185	5.00		5.320	1200	555911.018	655252.643	2.409
S18-0		5.00		5.260	1200	555861.899	655238.411	2.960
S18-1				5.260	1200	555887.849	655264.915	3.331
S15-2	0.217	5.00		5.288	1350	555883.945	655278.694	3.443
S15-3	0.062	5.00		5.387	1350	555859.630	655302.857	3.713
S19-0	0.033	5.00		5.320	1200	555775.719	655293.851	1.425
S19-0A				5.407	1200	555788.861	655281.137	1.817
S19-1	0.138	5.00		5.407	1200	555794.687	655282.132	1.916
S20-0	0.128	5.00		5.275	1200	555780.757	655299.930	1.425
S20-1	0.221	5.00		5.367	1200	555809.363	655325.016	2.151
S20-2	0.210	5.00		5.367	1200	555815.669	655324.975	2.256
S21-0		5.00		5.324	1200	555789.336	655290.215	2.924
S21-1				5.324	1200	555815.478	655316.307	3.540
S19-2	0.101	5.00		5.324	1350	555826.853	655314.928	3.731
S15-4	0.034	5.00		5.314	1500	555837.767	655325.270	3.797
S15-5	0.031	5.00		5.364	1500	555843.282	655331.894	3.890
S1-12	0.227	5.00		5.248	1800	555868.100	655383.917	4.254
S1-13	0.061	5.00		5.298	1800	555857.985	655389.107	4.361
S1-14	0.026	5.00		5.348	1800	555861.682	655405.800	4.496
S1-15	0.026	5.00		5.382	1800	555828.359	655414.202	4.702
S30-0	1.400	10.00		6.304	1350	556070.775	655161.389	1.575
S30-1				6.304	1350	556039.233	655170.314	2.121
S30-2				6.304	1350	556053.249	655218.928	2.374
S30-3				6.127	1350	556064.152	655260.993	2.414
S30-4				5.305	1350	556076.824	655308.605	1.838
S30-5				5.298	1350	556015.841	655325.098	2.463
S30-6				5.328	1350	555943.360	655344.117	3.117
S30-7				5.410	1500	555917.690	655352.537	3.334
S30-8				5.328	1500	555900.686	655361.017	3.347
S30-9				5.223	1500	555881.434	655373.985	3.358
S30-10				5.298	1500	555864.876	655383.950	3.530
S30-11				5.348	1500	555850.088	655391.594	3.746
S30-12				5.398	1500	555838.535	655396.615	3.922
S1-16				5.382	1800	555824.137	655398.946	4.781
S1-17				4.992	1200	555799.455	655405.900	4.542
S40-0	0.054	5.00		3.963	1200	555767.383	655420.630	1.350
S40-1	0.114	5.00		4.063	1200	555781.784	655429.196	1.618
S41-0		5.00		4.063	1200	555822.438	655417.134	2.563
S40-2				4.063	1200	555796.494	655424.670	2.766
S1-18				4.300	1200	555787.423	655420.123	3.960
EXSMH				3.963	1200	555771.951	655417.836	3.715
S42-0	0.054	5.00		4.124	1200	555604.608	655634.859	1.425
S42-1	0.133	5.00		3.913	1200	555611.827	655622.429	1.435
S42-2	0.070	5.00		3.703	1350	555646.541	655577.899	1.557
S42-3	0.099	5.00		3.397	1350	555686.891	655521.544	1.598

Nodes

Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S42-4	0.071	5.00		3.617	1350	555707.655	655473.577	1.967
S42-5				3.700	1350	555714.358	655448.126	2.116
S42-6	0.185	5.00		3.763	1350	555719.439	655416.117	2.260
S42-7				3.763	1350	555719.480	655386.888	2.333
S43-0		5.00		3.763	1200	555699.951	655383.923	1.425
S42-8				3.763	1350	555715.775	655386.536	2.342
EXSMH2				3.763	1200	555711.035	655404.266	2.450

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
S1.000	S1-0	S1-1	46.495	0.600	3.832	3.600	0.232	200.0	300	5.70	50.0
S1.001	S1-1	S1-1A	21.362	0.600	3.600	3.493	0.107	200.0	375	5.98	50.0
S1.001A	S1-1A	S1-2	5.533	0.600	3.493	3.465	0.028	200.0	375	6.05	50.0
S2.000	S2-0	S2-1	33.118	0.600	3.982	3.430	0.552	60.0	225	5.33	50.0
S2.001	S2-1	S1-2	12.380	0.600	3.430	3.368	0.062	200.0	300	5.51	50.0
S1.002	S1-2	S1-3	33.909	0.600	3.368	3.198	0.170	200.0	375	6.49	50.0
S3.000	S3-0	S3-1	45.576	0.600	3.863	3.103	0.760	60.0	225	5.45	50.0
S3.001	S3-1	S1-3	24.819	0.600	3.103	2.689	0.414	60.0	300	5.65	50.0
S4.000	S4-0	S1-3	27.715	0.600	3.895	3.433	0.462	60.0	225	5.27	50.0
S1.003	S1-3	S1-4	32.869	0.600	2.689	2.525	0.164	200.0	375	6.92	50.0
S5.000	S5-0	S5-1	14.072	0.600	3.000	2.765	0.235	60.0	300	5.12	50.0
S5.001	S5-1	S1-4	15.628	0.600	2.765	2.505	0.260	60.0	300	5.24	50.0
S1.004	S1-4	S1-5	27.783	0.600	2.505	2.366	0.139	200.0	400	7.27	50.0
S1.005	S1-5	S1-6	78.011	0.600	2.366	1.846	0.520	150.0	400	8.11	50.0
S8.000	S8-0	S8-1	63.542	0.600	5.475	4.416	1.059	60.0	225	5.63	50.0
S8.001	S8-1	S6-5	24.554	0.600	4.416	4.272	0.144	170.0	225	6.04	50.0
S6.001	S6-1	S6-2	39.134	0.600	3.700	3.048	0.652	60.0	375	9.28	50.0
S6.002	S6-2	S6-3	15.634	0.600	3.048	2.970	0.078	200.0	400	9.47	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)
S1.000	1.108	78.3	13.0	1.200	1.382	0.087	0.0	82
S1.001	1.277	141.1	42.5	1.307	1.539	0.285	0.0	141
S1.001A	1.277	141.1	42.5	1.539	1.567	0.285	0.0	141
S2.000	1.691	67.2	4.6	1.200	1.752	0.031	0.0	40
S2.001	1.108	78.3	22.2	1.677	1.739	0.149	0.0	109
S1.002	1.277	141.1	82.3	1.664	1.715	0.552	0.0	206
S3.000	1.691	67.2	14.8	1.200	1.960	0.086	1.8	72
S3.001	2.033	143.7	16.0	1.885	2.299	0.094	1.8	67
S4.000	1.691	67.2	6.4	1.200	1.630	0.043	0.0	47
S1.003	1.277	141.1	116.9	2.224	2.507	0.771	1.8	262
S5.000	2.033	143.7	0.0	2.032	2.267	0.000	0.0	0
S5.001	2.033	143.7	0.0	2.267	2.602	0.000	0.0	0
S1.004	1.331	167.2	145.8	2.502	2.520	0.965	1.8	290
S1.005	1.538	193.3	181.5	2.520	3.052	1.204	1.8	310
S8.000	1.691	67.2	3.4	1.200	2.259	0.023	0.0	35
S8.001	1.000	39.7	26.7	2.259	2.298	0.179	0.0	135
S6.001	2.342	258.7	161.7	2.875	3.527	1.085	0.0	215
S6.002	1.331	167.2	162.9	3.502	3.580	1.093	0.0	321

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
S6.003	S6-3	S7-2	10.371	0.600	2.970	2.909	0.061	170.0	225	9.65	50.0
S7.000	S7-0	S7-1	34.518	0.600	5.525	4.950	0.575	60.0	225	5.34	50.0
S7.001	S7-1	S7-2	20.325	0.600	4.950	4.611	0.339	60.0	225	5.54	50.0
S7.002	S7-2	S6-5	14.544	0.600	2.909	2.836	0.073	200.0	450	9.82	50.0
S6.005	S6-5	S6-6	56.742	0.600	2.836	2.552	0.284	200.0	450	10.48	50.0
S10.000	S10-0	S10-1	29.267	0.600	4.575	4.282	0.293	100.0	225	5.37	50.0
S10.001	S10-1	S9-2	11.353	0.600	4.282	4.215	0.067	170.0	225	5.56	50.0
S9.000	S9-0	S9-1	28.432	0.600	3.875	3.708	0.167	170.0	225	5.47	50.0
S9.001	S9-1	S9-2	9.394	0.600	3.708	3.653	0.055	170.0	225	5.63	50.0
S9.002	S9-2	S6-6	25.524	0.600	2.353	2.225	0.128	200.0	300	6.01	50.0
S6.006	S6-6	S6-7	24.070	0.600	2.225	2.105	0.120	200.0	600	10.71	50.0
S11.000	S11-0	S11-1	55.488	0.600	4.943	4.018	0.925	60.0	225	5.55	50.0
S11.001	S11-1	S6-7	53.951	0.600	3.018	2.119	0.899	60.0	225	6.08	50.0
S6.007	S6-7	S7-8	22.340	0.600	2.105	1.993	0.112	200.0	600	10.93	49.7
S12.000	S12-0	S12-1	88.714	0.600	5.075	3.596	1.479	60.0	225	5.87	50.0
S12.001	S12-1	S7-8	75.928	0.600	3.596	3.090	0.506	150.0	225	7.06	50.0
S7.008	S7-8	S1-6	42.356	0.600	1.993	1.781	0.212	200.0	600	11.34	48.8
S1.006	S1-6	S1-7	33.299	0.600	1.781	1.615	0.166	200.0	750	11.62	48.2
S13.000	S13-0	S1-7	5.631	0.600	3.823	3.729	0.094	60.0	225	5.06	50.0
S1.007	S1-7	S1-8	35.376	0.600	1.615	1.438	0.177	200.0	750	11.92	47.5
S14.000	S14-0	S1-8	57.086	0.600	3.859	2.908	0.951	60.0	225	5.56	50.0
S1.008	S1-8	S1-9	27.917	0.600	1.438	1.298	0.140	200.0	750	12.15	47.0
S1.009	S1-9	S1-10	19.084	0.600	1.298	1.203	0.095	200.0	750	12.31	46.7
S1.010	S1-10	S1-11	19.386	0.600	1.203	1.106	0.097	200.0	750	12.48	46.4

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)
S6.003	1.000	39.7	166.7	3.755	3.816	1.118	0.0	225
S7.000	1.691	67.2	0.7	1.200	1.775	0.005	0.0	16
S7.001	1.691	67.2	13.6	1.775	2.114	0.091	0.0	68
S7.002	1.434	228.0	189.2	3.591	3.509	1.269	0.0	314
S6.005	1.434	228.0	218.5	3.509	2.598	1.466	0.0	356
S10.000	1.307	52.0	9.2	1.200	1.493	0.062	0.0	64
S10.001	1.000	39.7	25.6	1.493	1.260	0.172	0.0	131
S9.000	1.000	39.7	8.3	1.200	1.367	0.056	0.0	70
S9.001	1.000	39.7	22.5	1.367	1.822	0.151	0.0	122
S9.002	1.108	78.3	50.8	3.047	3.075	0.341	0.0	176
S6.006	1.718	485.8	303.4	2.775	2.542	2.035	0.0	344
S11.000	1.691	67.2	9.5	1.200	1.884	0.064	0.0	57
S11.001	1.691	67.2	34.4	2.884	2.903	0.231	0.0	114
S6.007	1.718	485.8	347.8	2.542	2.507	2.347	0.0	377
S12.000	1.691	67.2	3.6	1.200	1.379	0.024	0.0	35
S12.001	1.065	42.3	33.4	1.379	1.785	0.224	0.0	151
S7.008	1.718	485.8	399.4	2.507	2.917	2.747	0.0	416
S1.006	1.975	872.5	585.3	2.767	2.883	4.063	1.8	451
S13.000	1.691	67.2	3.0	1.200	1.294	0.020	0.0	32
S1.007	1.975	872.5	593.0	2.883	3.118	4.171	1.8	455
S14.000	1.691	67.2	20.3	1.200	2.173	0.136	0.0	85
S1.008	1.975	872.5	623.9	3.118	3.375	4.434	1.8	471
S1.009	1.975	872.5	637.5	3.375	3.395	4.562	1.8	478
S1.010	1.975	872.5	655.7	3.395	3.392	4.726	1.8	487

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
S1.011	S1-11	S1-12	22.417	0.600	1.106	0.994	0.112	200.0	750	12.67	46.0
S17.000	S17-0	S17-1	34.034	0.600	3.841	3.274	0.567	60.0	225	5.34	50.0
S17.001	S17-1	S17-2	4.862	0.600	3.274	3.193	0.081	60.0	300	5.38	50.0
S17.002	S17-2	S15-2	60.223	0.600	3.193	2.189	1.004	60.0	300	5.87	50.0
S15.000	S15-0	S15-1	55.801	0.600	3.841	2.911	0.930	60.0	225	5.55	50.0
S16.000	S16-0	S15-1	32.861	0.600	3.945	3.397	0.548	60.0	225	5.32	50.0
S15.001	S15-1	S15-2	37.571	0.600	2.911	2.285	0.626	60.0	300	5.86	50.0
S18.000	S18-0	S18-1	37.093	0.600	2.300	1.929	0.371	100.0	225	5.47	50.0
S18.001	S18-1	S15-2	14.321	0.600	1.929	1.845	0.084	170.0	225	5.71	50.0
S15.002	S15-2	S15-3	34.279	0.600	1.845	1.674	0.171	200.0	375	6.32	50.0
S15.003	S15-3	S15-4	31.310	0.600	1.674	1.517	0.157	200.0	400	6.71	50.0
S19.000	S19-0	S19-0A	18.285	0.600	3.895	3.590	0.305	60.0	225	5.18	50.0
S19.000A	S19-0A	S19-1	5.910	0.600	3.590	3.491	0.099	60.0	225	5.24	50.0
S19.001	S19-1	S19-2	45.937	0.600	3.491	2.725	0.766	60.0	225	5.69	50.0
S20.000	S20-0	S20-1	38.047	0.600	3.850	3.216	0.634	60.0	225	5.37	50.0
S20.001	S20-1	S20-2	6.306	0.600	3.216	3.111	0.105	60.0	225	5.44	50.0
S20.002	S20-2	S19-2	15.034	0.600	3.111	2.860	0.251	60.0	300	5.56	50.0
S21.000	S21-0	S21-1	36.935	0.600	2.400	1.784	0.616	60.0	225	5.36	50.0
S21.001	S21-1	S19-2	11.458	0.600	1.784	1.593	0.191	60.0	225	5.48	50.0
S19.002	S19-2	S15-4	15.036	0.600	1.593	1.518	0.075	200.0	375	5.89	50.0
S15.004	S15-4	S15-5	8.619	0.600	1.517	1.474	0.043	200.0	500	6.80	50.0
S15.005	S15-5	S1-12	57.640	0.600	1.474	1.031	0.443	130.0	500	7.31	50.0
S1.012	S1-12	S1-13	11.369	0.600	0.994	0.937	0.057	200.0	750	12.76	45.8
S1.013	S1-13	S1-14	17.097	0.600	0.937	0.852	0.085	200.0	750	12.91	45.6

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)
S1.011	1.975	872.5	655.2	3.392	3.504	4.760	1.8	487
S17.000	1.691	67.2	18.2	1.200	1.742	0.122	0.0	80
S17.001	2.033	143.7	30.1	1.667	1.748	0.202	0.0	93
S17.002	2.033	143.7	42.0	1.748	2.799	0.282	0.0	111
S15.000	1.691	67.2	17.0	1.200	2.184	0.114	0.0	77
S16.000	1.691	67.2	20.4	1.200	1.698	0.137	0.0	85
S15.001	2.033	143.7	65.0	2.109	2.703	0.436	0.0	142
S18.000	1.307	52.0	0.0	2.735	3.106	0.000	0.0	0
S18.001	1.000	39.7	0.0	3.106	3.218	0.000	0.0	0
S15.002	1.277	141.1	139.4	3.068	3.338	0.935	0.0	306
S15.003	1.331	167.2	148.6	3.313	3.397	0.997	0.0	295
S19.000	1.691	67.2	4.9	1.200	1.592	0.033	0.0	41
S19.000A	1.691	67.2	4.9	1.592	1.691	0.033	0.0	41
S19.001	1.691	67.2	25.5	1.691	2.374	0.171	0.0	96
S20.000	1.691	67.2	19.1	1.200	1.926	0.128	0.0	82
S20.001	1.691	67.2	52.0	1.926	2.031	0.349	0.0	149
S20.002	2.033	143.7	83.3	1.956	2.164	0.559	0.0	164
S21.000	1.691	67.2	0.0	2.699	3.315	0.000	0.0	0
S21.001	1.691	67.2	0.0	3.315	3.506	0.000	0.0	0
S19.002	1.277	141.1	123.9	3.356	3.421	0.831	0.0	274
S15.004	1.532	300.8	277.6	3.297	3.390	1.862	0.0	381
S15.005	1.903	373.7	282.2	3.390	3.717	1.893	0.0	326
S1.012	1.975	872.5	942.4	3.504	3.611	6.880	1.8	750
S1.013	1.975	872.5	945.1	3.611	3.746	6.941	1.8	750

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
S1.014	S1-14	S1-15	34.366	0.600	0.852	0.680	0.172	200.0	750	13.20	45.0
S1.015	S1-15	S1-16	15.829	0.600	0.680	0.601	0.079	200.0	750	13.33	44.8
S30.000	S30-0	S30-1	32.780	0.600	4.729	4.183	0.546	60.0	375	10.23	50.0
S30.001	S30-1	S30-2	50.594	0.600	4.183	3.930	0.253	200.0	450	10.82	49.9
S30.002	S30-2	S30-3	43.455	0.600	3.930	3.713	0.217	200.0	450	11.33	48.8
S30.003	S30-3	S30-4	49.269	0.600	3.713	3.467	0.246	200.0	450	11.90	47.6
S30.004	S30-4	S30-5	63.174	0.600	3.467	2.835	0.632	100.0	450	12.42	46.5
S30.005	S30-5	S30-6	74.935	0.600	2.835	2.211	0.624	120.0	450	13.09	45.2
S30.006	S30-6	S30-7	27.016	0.600	2.211	2.076	0.135	200.0	450	13.40	44.7
S30.007	S30-7	S30-8	19.001	0.600	2.076	1.981	0.095	200.0	500	13.61	44.3
S30.008	S30-8	S30-9	23.212	0.600	1.981	1.865	0.116	200.0	500	13.86	43.9
S30.009	S30-9	S30-10	19.325	0.600	1.865	1.768	0.097	200.0	500	14.07	43.5
S30.010	S30-10	S30-11	16.647	0.600	1.768	1.602	0.166	100.0	500	14.20	43.3
S30.011	S30-11	S30-12	12.597	0.600	1.602	1.476	0.126	100.0	500	14.30	43.1
S30.012	S30-12	S1-16	14.585	0.600	1.476	1.330	0.146	100.0	500	14.41	43.0
S1.016	S1-16	S1-17	25.643	0.600	0.601	0.450	0.151	170.0	500	14.84	42.3
S1.017	S1-17	S1-18	18.630	0.600	0.450	0.340	0.110	170.0	500	15.15	41.8
S40.006	S40-0	S40-1	16.756	0.600	2.613	2.445	0.168	100.0	150	5.28	50.0
S40.007	S40-1	S40-2	15.391	0.600	2.445	2.354	0.091	170.0	225	5.53	50.0
S41.000	S41-0	S40-2	27.016	0.600	1.500	1.297	0.203	133.1	225	5.40	50.0
S40.008	S40-2	S1-18	10.147	0.600	1.297	1.237	0.060	170.0	225	5.70	50.0
S1.018	S1-18	EXSMH	15.640	0.600	0.340	0.248	0.092	170.0	500	15.41	41.4
S40.000	S42-0	S42-1	14.374	0.600	2.699	2.478	0.221	65.0	225	5.15	50.0
S40.001	S42-1	S42-2	56.462	0.600	2.478	2.146	0.332	170.0	300	5.93	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)
S1.014	1.975	872.5	937.6	3.746	3.952	6.967	1.8	750
S1.015	1.975	872.5	936.0	3.952	4.031	6.993	1.8	750
S30.000	2.342	258.7	208.7	1.200	1.746	1.400	0.0	257
S30.001	1.434	228.0	208.5	1.671	1.924	1.400	0.0	341
S30.002	1.434	228.0	203.7	1.924	1.964	1.400	0.0	334
S30.003	1.434	228.0	198.5	1.964	1.388	1.400	0.0	327
S30.004	2.033	323.3	194.2	1.388	2.013	1.400	0.0	252
S30.005	1.855	294.9	188.8	2.013	2.667	1.400	0.0	262
S30.006	1.434	228.0	186.4	2.667	2.884	1.400	0.0	311
S30.007	1.532	300.8	184.9	2.834	2.847	1.400	0.0	284
S30.008	1.532	300.8	183.1	2.847	2.858	1.400	0.0	282
S30.009	1.532	300.8	181.6	2.858	3.030	1.400	0.0	281
S30.010	2.172	426.5	180.7	3.030	3.246	1.400	0.0	227
S30.011	2.172	426.5	180.1	3.246	3.422	1.400	0.0	226
S30.012	2.172	426.5	179.3	3.422	3.552	1.400	0.0	226
S1.016	2.172	426.5	1059.5	4.556	4.317	8.393	1.8	225
S1.017	2.172	426.5	1047.4	4.317	3.735	8.393	1.8	225
S40.006	1.005	17.8	8.1	1.200	1.468	0.054	0.0	71
S40.007	1.000	39.7	25.0	1.393	1.484	0.168	0.0	130
S41.000	1.131	45.0	0.0	2.338	2.541	0.000	0.0	0
S40.008	1.000	39.7	25.0	2.541	2.838	0.168	0.0	130
S1.018	2.172	426.5	1058.2	3.735	3.490	8.561	1.8	225
S40.000	1.624	64.6	8.1	1.200	1.210	0.054	0.0	53
S40.001	1.203	85.0	27.9	1.135	1.257	0.187	0.0	118

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
S40.002	S42-2	S42-3	69.311	0.600	2.146	1.799	0.347	200.0	375	6.83	50.0
S40.003	S42-3	S42-4	52.268	0.600	1.799	1.650	0.149	350.0	400	7.70	50.0
S40.004	S42-4	S42-5	26.319	0.600	1.650	1.584	0.066	400.0	450	8.14	50.0
S40.004A	S42-5	S42-6	32.410	0.600	1.584	1.503	0.081	400.0	450	8.67	50.0
S40.005	S42-6	S42-7	29.229	0.600	1.503	1.430	0.073	400.0	450	9.15	50.0
S40.005A	S42-7	S42-8	3.722	0.600	1.430	1.421	0.009	400.0	450	9.22	50.0
S42.000	S43-0	S42-8	16.038	0.600	2.338	2.086	0.252	63.6	225	5.16	50.0
S40.005B	S42-8	EXSMH2	18.353	0.600	1.421	1.313	0.108	170.0	225	9.52	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)
S40.002	1.277	141.1	38.3	1.182	1.223	0.257	0.0	133
S40.003	1.003	126.0	53.1	1.198	1.567	0.356	0.0	181
S40.004	1.010	160.7	63.7	1.517	1.666	0.427	0.0	196
S40.004A	1.010	160.7	63.7	1.666	1.810	0.427	0.0	196
S40.005	1.010	160.7	91.2	1.810	1.883	0.612	0.0	243
S40.005A	1.010	160.7	91.2	1.883	1.892	0.612	0.0	243
S42.000	1.642	65.3	0.0	1.200	1.452	0.000	0.0	0
S40.005B	1.000	39.7	91.2	2.117	2.225	0.612	0.0	225

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
S1.000	46.495	200.0	300	Circular	5.332	3.832	1.200	5.282	3.600	1.382
S1.001	21.362	200.0	375	Circular	5.282	3.600	1.307	5.407	3.493	1.539
S1.001A	5.533	200.0	375	Circular	5.407	3.493	1.539	5.407	3.465	1.567
S2.000	33.118	60.0	225	Circular	5.407	3.982	1.200	5.407	3.430	1.752
S2.001	12.380	200.0	300	Circular	5.407	3.430	1.677	5.407	3.368	1.739
S1.002	33.909	200.0	375	Circular	5.407	3.368	1.664	5.288	3.198	1.715
S3.000	45.576	60.0	225	Circular	5.288	3.863	1.200	5.288	3.103	1.960
S3.001	24.819	60.0	300	Circular	5.288	3.103	1.885	5.288	2.689	2.299
S4.000	27.715	60.0	225	Circular	5.320	3.895	1.200	5.288	3.433	1.630
S1.003	32.869	200.0	375	Circular	5.288	2.689	2.224	5.407	2.525	2.507
S5.000	14.072	60.0	300	Circular	5.332	3.000	2.032	5.332	2.765	2.267
S5.001	15.628	60.0	300	Circular	5.332	2.765	2.267	5.407	2.505	2.602

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
S1.000	S1-0	1200	Manhole	Adoptable	S1-1	1350	Manhole	Adoptable
S1.001	S1-1	1350	Manhole	Adoptable	S1-1A	1350	Manhole	Adoptable
S1.001A	S1-1A	1350	Manhole	Adoptable	S1-2	1350	Manhole	Adoptable
S2.000	S2-0	1200	Manhole	Adoptable	S2-1	1200	Manhole	Adoptable
S2.001	S2-1	1200	Manhole	Adoptable	S1-2	1350	Manhole	Adoptable
S1.002	S1-2	1350	Manhole	Adoptable	S1-3	1350	Manhole	Adoptable
S3.000	S3-0	1200	Manhole	Adoptable	S3-1	1200	Manhole	Adoptable
S3.001	S3-1	1200	Manhole	Adoptable	S1-3	1350	Manhole	Adoptable
S4.000	S4-0	1200	Manhole	Adoptable	S1-3	1350	Manhole	Adoptable
S1.003	S1-3	1350	Manhole	Adoptable	S1-4	1350	Manhole	Adoptable
S5.000	S5-0	1200	Manhole	Adoptable	S5-1	1200	Manhole	Adoptable
S5.001	S5-1	1200	Manhole	Adoptable	S1-4	1350	Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
S1.004	27.783	200.0	400	Circular	5.407	2.505	2.502	5.286	2.366	2.520
S1.005	78.011	150.0	400	Circular	5.286	2.366	2.520	5.298	1.846	3.052
S8.000	63.542	60.0	225	Circular	6.900	5.475	1.200	6.900	4.416	2.259
S8.001	24.554	170.0	225	Circular	6.900	4.416	2.259	6.795	4.272	2.298
S6.001	39.134	60.0	375	Circular	6.950	3.700	2.875	6.950	3.048	3.527
S6.002	15.634	200.0	400	Circular	6.950	3.048	3.502	6.950	2.970	3.580
S6.003	10.371	170.0	225	Circular	6.950	2.970	3.755	6.950	2.909	3.816
S7.000	34.518	60.0	225	Circular	6.950	5.525	1.200	6.950	4.950	1.775
S7.001	20.325	60.0	225	Circular	6.950	4.950	1.775	6.950	4.611	2.114
S7.002	14.544	200.0	450	Circular	6.950	2.909	3.591	6.795	2.836	3.509
S6.005	56.742	200.0	450	Circular	6.795	2.836	3.509	5.600	2.552	2.598
S10.000	29.267	100.0	225	Circular	6.000	4.575	1.200	6.000	4.282	1.493
S10.001	11.353	170.0	225	Circular	6.000	4.282	1.493	5.700	4.215	1.260
S9.000	28.432	170.0	225	Circular	5.300	3.875	1.200	5.300	3.708	1.367
S9.001	9.394	170.0	225	Circular	5.300	3.708	1.367	5.700	3.653	1.822
S9.002	25.524	200.0	300	Circular	5.700	2.353	3.047	5.600	2.225	3.075
S6.006	24.070	200.0	600	Circular	5.600	2.225	2.775	5.247	2.105	2.542
S11.000	55.488	60.0	225	Circular	6.368	4.943	1.200	6.127	4.018	1.884
S11.001	53.951	60.0	225	Circular	6.127	3.018	2.884	5.247	2.119	2.903
S6.007	22.340	200.0	600	Circular	5.247	2.105	2.542	5.100	1.993	2.507
S12.000	88.714	60.0	225	Circular	6.500	5.075	1.200	5.200	3.596	1.379
S12.001	75.928	150.0	225	Circular	5.200	3.596	1.379	5.100	3.090	1.785
S7.008	42.356	200.0	600	Circular	5.100	1.993	2.507	5.298	1.781	2.917
S1.006	33.299	200.0	750	Circular	5.298	1.781	2.767	5.248	1.615	2.883
S13.000	5.631	60.0	225	Circular	5.248	3.823	1.200	5.248	3.729	1.294

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
S1.004	S1-4	1350	Manhole	Adoptable	S1-5	1350	Manhole	Adoptable
S1.005	S1-5	1350	Manhole	Adoptable	S1-6	1800	Manhole	Adoptable
S8.000	S8-0	1200	Manhole	Adoptable	S8-1	1200	Manhole	Adoptable
S8.001	S8-1	1200	Manhole	Adoptable	S6-5	1350	Manhole	Adoptable
S6.001	S6-1	1350	Manhole	Adoptable	S6-2	1500	Manhole	Adoptable
S6.002	S6-2	1500	Manhole	Adoptable	S6-3	1500	Manhole	Adoptable
S6.003	S6-3	1500	Manhole	Adoptable	S7-2	1350	Manhole	Adoptable
S7.000	S7-0	1200	Manhole	Adoptable	S7-1	1200	Manhole	Adoptable
S7.001	S7-1	1200	Manhole	Adoptable	S7-2	1350	Manhole	Adoptable
S7.002	S7-2	1350	Manhole	Adoptable	S6-5	1350	Manhole	Adoptable
S6.005	S6-5	1350	Manhole	Adoptable	S6-6	1500	Manhole	Adoptable
S10.000	S10-0	1200	Manhole	Adoptable	S10-1	1200	Manhole	Adoptable
S10.001	S10-1	1200	Manhole	Adoptable	S9-2		Junction	
S9.000	S9-0	1200	Manhole	Adoptable	S9-1	1200	Manhole	Adoptable
S9.001	S9-1	1200	Manhole	Adoptable	S9-2		Junction	
S9.002	S9-2		Junction		S6-6	1500	Manhole	Adoptable
S6.006	S6-6	1500	Manhole	Adoptable	S6-7	1500	Manhole	Adoptable
S11.000	S11-0	1200	Manhole	Adoptable	S11-1	1200	Manhole	Adoptable
S11.001	S11-1	1200	Manhole	Adoptable	S6-7	1500	Manhole	Adoptable
S6.007	S6-7	1500	Manhole	Adoptable	S7-8	1500	Manhole	Adoptable
S12.000	S12-0	1200	Manhole	Adoptable	S12-1	1200	Manhole	Adoptable
S12.001	S12-1	1200	Manhole	Adoptable	S7-8	1500	Manhole	Adoptable
S7.008	S7-8	1500	Manhole	Adoptable	S1-6	1800	Manhole	Adoptable
S1.006	S1-6	1800	Manhole	Adoptable	S1-7	1800	Manhole	Adoptable
S13.000	S13-0	1200	Manhole	Adoptable	S1-7	1800	Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
S1.007	35.376	200.0	750	Circular	5.248	1.615	2.883	5.306	1.438	3.118
S14.000	57.086	60.0	225	Circular	5.284	3.859	1.200	5.306	2.908	2.173
S1.008	27.917	200.0	750	Circular	5.306	1.438	3.118	5.423	1.298	3.375
S1.009	19.084	200.0	750	Circular	5.423	1.298	3.375	5.348	1.203	3.395
S1.010	19.386	200.0	750	Circular	5.348	1.203	3.395	5.248	1.106	3.392
S1.011	22.417	200.0	750	Circular	5.248	1.106	3.392	5.248	0.994	3.504
S17.000	34.034	60.0	225	Circular	5.266	3.841	1.200	5.241	3.274	1.742
S17.001	4.862	60.0	300	Circular	5.241	3.274	1.667	5.241	3.193	1.748
S17.002	60.223	60.0	300	Circular	5.241	3.193	1.748	5.288	2.189	2.799
S15.000	55.801	60.0	225	Circular	5.266	3.841	1.200	5.320	2.911	2.184
S16.000	32.861	60.0	225	Circular	5.370	3.945	1.200	5.320	3.397	1.698
S15.001	37.571	60.0	300	Circular	5.320	2.911	2.109	5.288	2.285	2.703
S18.000	37.093	100.0	225	Circular	5.260	2.300	2.735	5.260	1.929	3.106
S18.001	14.321	170.0	225	Circular	5.260	1.929	3.106	5.288	1.845	3.218
S15.002	34.279	200.0	375	Circular	5.288	1.845	3.068	5.387	1.674	3.338
S15.003	31.310	200.0	400	Circular	5.387	1.674	3.313	5.314	1.517	3.397
S19.000	18.285	60.0	225	Circular	5.320	3.895	1.200	5.407	3.590	1.592
S19.000A	5.910	60.0	225	Circular	5.407	3.590	1.592	5.407	3.491	1.691
S19.001	45.937	60.0	225	Circular	5.407	3.491	1.691	5.324	2.725	2.374
S20.000	38.047	60.0	225	Circular	5.275	3.850	1.200	5.367	3.216	1.926
S20.001	6.306	60.0	225	Circular	5.367	3.216	1.926	5.367	3.111	2.031
S20.002	15.034	60.0	300	Circular	5.367	3.111	1.956	5.324	2.860	2.164
S21.000	36.935	60.0	225	Circular	5.324	2.400	2.699	5.324	1.784	3.315
S21.001	11.458	60.0	225	Circular	5.324	1.784	3.315	5.324	1.593	3.506
S19.002	15.036	200.0	375	Circular	5.324	1.593	3.356	5.314	1.518	3.421

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
S1.007	S1-7	1800	Manhole	Adoptable	S1-8	1800	Manhole	Adoptable
S14.000	S14-0	1200	Manhole	Adoptable	S1-8	1800	Manhole	Adoptable
S1.008	S1-8	1800	Manhole	Adoptable	S1-9	1800	Manhole	Adoptable
S1.009	S1-9	1800	Manhole	Adoptable	S1-10	1800	Manhole	Adoptable
S1.010	S1-10	1800	Manhole	Adoptable	S1-11	1800	Manhole	Adoptable
S1.011	S1-11	1800	Manhole	Adoptable	S1-12	1800	Manhole	Adoptable
S17.000	S17-0	1200	Manhole	Adoptable	S17-1	1200	Manhole	Adoptable
S17.001	S17-1	1200	Manhole	Adoptable	S17-2	1200	Manhole	Adoptable
S17.002	S17-2	1200	Manhole	Adoptable	S15-2	1350	Manhole	Adoptable
S15.000	S15-0	1200	Manhole	Adoptable	S15-1	1200	Manhole	Adoptable
S16.000	S16-0	1200	Manhole	Adoptable	S15-1	1200	Manhole	Adoptable
S15.001	S15-1	1200	Manhole	Adoptable	S15-2	1350	Manhole	Adoptable
S18.000	S18-0	1200	Manhole	Adoptable	S18-1	1200	Manhole	Adoptable
S18.001	S18-1	1200	Manhole	Adoptable	S15-2	1350	Manhole	Adoptable
S15.002	S15-2	1350	Manhole	Adoptable	S15-3	1350	Manhole	Adoptable
S15.003	S15-3	1350	Manhole	Adoptable	S15-4	1500	Manhole	Adoptable
S19.000	S19-0	1200	Manhole	Adoptable	S19-0A	1200	Manhole	Adoptable
S19.000A	S19-0A	1200	Manhole	Adoptable	S19-1	1200	Manhole	Adoptable
S19.001	S19-1	1200	Manhole	Adoptable	S19-2	1350	Manhole	Adoptable
S20.000	S20-0	1200	Manhole	Adoptable	S20-1	1200	Manhole	Adoptable
S20.001	S20-1	1200	Manhole	Adoptable	S20-2	1200	Manhole	Adoptable
S20.002	S20-2	1200	Manhole	Adoptable	S19-2	1350	Manhole	Adoptable
S21.000	S21-0	1200	Manhole	Adoptable	S21-1	1200	Manhole	Adoptable
S21.001	S21-1	1200	Manhole	Adoptable	S19-2	1350	Manhole	Adoptable
S19.002	S19-2	1350	Manhole	Adoptable	S15-4	1500	Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
S15.004	8.619	200.0	500	Circular	5.314	1.517	3.297	5.364	1.474	3.390
S15.005	57.640	130.0	500	Circular	5.364	1.474	3.390	5.248	1.031	3.717
S1.012	11.369	200.0	750	Circular	5.248	0.994	3.504	5.298	0.937	3.611
S1.013	17.097	200.0	750	Circular	5.298	0.937	3.611	5.348	0.852	3.746
S1.014	34.366	200.0	750	Circular	5.348	0.852	3.746	5.382	0.680	3.952
S1.015	15.829	200.0	750	Circular	5.382	0.680	3.952	5.382	0.601	4.031
S30.000	32.780	60.0	375	Circular	6.304	4.729	1.200	6.304	4.183	1.746
S30.001	50.594	200.0	450	Circular	6.304	4.183	1.671	6.304	3.930	1.924
S30.002	43.455	200.0	450	Circular	6.304	3.930	1.924	6.127	3.713	1.964
S30.003	49.269	200.0	450	Circular	6.127	3.713	1.964	5.305	3.467	1.388
S30.004	63.174	100.0	450	Circular	5.305	3.467	1.388	5.298	2.835	2.013
S30.005	74.935	120.0	450	Circular	5.298	2.835	2.013	5.328	2.211	2.667
S30.006	27.016	200.0	450	Circular	5.328	2.211	2.667	5.410	2.076	2.884
S30.007	19.001	200.0	500	Circular	5.410	2.076	2.834	5.328	1.981	2.847
S30.008	23.212	200.0	500	Circular	5.328	1.981	2.847	5.223	1.865	2.858
S30.009	19.325	200.0	500	Circular	5.223	1.865	2.858	5.298	1.768	3.030
S30.010	16.647	100.0	500	Circular	5.298	1.768	3.030	5.348	1.602	3.246
S30.011	12.597	100.0	500	Circular	5.348	1.602	3.246	5.398	1.476	3.422
S30.012	14.585	100.0	500	Circular	5.398	1.476	3.422	5.382	1.330	3.552
S1.016	25.643	170.0	225	Circular	5.382	0.601	4.556	4.992	0.450	4.317
S1.017	18.630	170.0	225	Circular	4.992	0.450	4.317	4.300	0.340	3.735
S40.006	16.756	100.0	150	Circular	3.963	2.613	1.200	4.063	2.445	1.468
S40.007	15.391	170.0	225	Circular	4.063	2.445	1.393	4.063	2.354	1.484
S41.000	27.016	133.1	225	Circular	4.063	1.500	2.338	4.063	1.297	2.541
S40.008	10.147	170.0	225	Circular	4.063	1.297	2.541	4.300	1.237	2.838

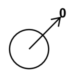
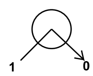
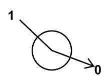
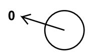
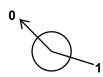
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
S15.004	S15-4	1500	Manhole	Adoptable	S15-5	1500	Manhole	Adoptable
S15.005	S15-5	1500	Manhole	Adoptable	S1-12	1800	Manhole	Adoptable
S1.012	S1-12	1800	Manhole	Adoptable	S1-13	1800	Manhole	Adoptable
S1.013	S1-13	1800	Manhole	Adoptable	S1-14	1800	Manhole	Adoptable
S1.014	S1-14	1800	Manhole	Adoptable	S1-15	1800	Manhole	Adoptable
S1.015	S1-15	1800	Manhole	Adoptable	S1-16	1800	Manhole	Adoptable
S30.000	S30-0	1350	Manhole	Adoptable	S30-1	1350	Manhole	Adoptable
S30.001	S30-1	1350	Manhole	Adoptable	S30-2	1350	Manhole	Adoptable
S30.002	S30-2	1350	Manhole	Adoptable	S30-3	1350	Manhole	Adoptable
S30.003	S30-3	1350	Manhole	Adoptable	S30-4	1350	Manhole	Adoptable
S30.004	S30-4	1350	Manhole	Adoptable	S30-5	1350	Manhole	Adoptable
S30.005	S30-5	1350	Manhole	Adoptable	S30-6	1350	Manhole	Adoptable
S30.006	S30-6	1350	Manhole	Adoptable	S30-7	1500	Manhole	Adoptable
S30.007	S30-7	1500	Manhole	Adoptable	S30-8	1500	Manhole	Adoptable
S30.008	S30-8	1500	Manhole	Adoptable	S30-9	1500	Manhole	Adoptable
S30.009	S30-9	1500	Manhole	Adoptable	S30-10	1500	Manhole	Adoptable
S30.010	S30-10	1500	Manhole	Adoptable	S30-11	1500	Manhole	Adoptable
S30.011	S30-11	1500	Manhole	Adoptable	S30-12	1500	Manhole	Adoptable
S30.012	S30-12	1500	Manhole	Adoptable	S1-16	1800	Manhole	Adoptable
S1.016	S1-16	1800	Manhole	Adoptable	S1-17	1200	Manhole	Adoptable
S1.017	S1-17	1200	Manhole	Adoptable	S1-18	1200	Manhole	Adoptable
S40.006	S40-0	1200	Manhole	Adoptable	S40-1	1200	Manhole	Adoptable
S40.007	S40-1	1200	Manhole	Adoptable	S40-2	1200	Manhole	Adoptable
S41.000	S41-0	1200	Manhole	Adoptable	S40-2	1200	Manhole	Adoptable
S40.008	S40-2	1200	Manhole	Adoptable	S1-18	1200	Manhole	Adoptable

Pipeline Schedule

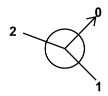
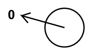
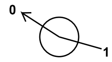
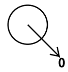
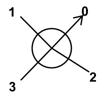
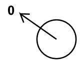
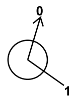
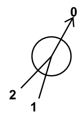
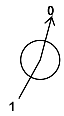
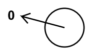
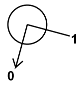
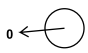
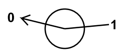
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
S1.018	15.640	170.0	225	Circular	4.300	0.340	3.735	3.963	0.248	3.490
S40.000	14.374	65.0	225	Circular	4.124	2.699	1.200	3.913	2.478	1.210
S40.001	56.462	170.0	300	Circular	3.913	2.478	1.135	3.703	2.146	1.257
S40.002	69.311	200.0	375	Circular	3.703	2.146	1.182	3.397	1.799	1.223
S40.003	52.268	350.0	400	Circular	3.397	1.799	1.198	3.617	1.650	1.567
S40.004	26.319	400.0	450	Circular	3.617	1.650	1.517	3.700	1.584	1.666
S40.004A	32.410	400.0	450	Circular	3.700	1.584	1.666	3.763	1.503	1.810
S40.005	29.229	400.0	450	Circular	3.763	1.503	1.810	3.763	1.430	1.883
S40.005A	3.722	400.0	450	Circular	3.763	1.430	1.883	3.763	1.421	1.892
S42.000	16.038	63.6	225	Circular	3.763	2.338	1.200	3.763	2.086	1.452
S40.005B	18.353	170.0	225	Circular	3.763	1.421	2.117	3.763	1.313	2.225

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
S1.018	S1-18	1200	Manhole	Adoptable	EXSMH	1200	Manhole	Adoptable
S40.000	S42-0	1200	Manhole	Adoptable	S42-1	1200	Manhole	Adoptable
S40.001	S42-1	1200	Manhole	Adoptable	S42-2	1350	Manhole	Adoptable
S40.002	S42-2	1350	Manhole	Adoptable	S42-3	1350	Manhole	Adoptable
S40.003	S42-3	1350	Manhole	Adoptable	S42-4	1350	Manhole	Adoptable
S40.004	S42-4	1350	Manhole	Adoptable	S42-5	1350	Manhole	Adoptable
S40.004A	S42-5	1350	Manhole	Adoptable	S42-6	1350	Manhole	Adoptable
S40.005	S42-6	1350	Manhole	Adoptable	S42-7	1350	Manhole	Adoptable
S40.005A	S42-7	1350	Manhole	Adoptable	S42-8	1350	Manhole	Adoptable
S42.000	S43-0	1200	Manhole	Adoptable	S42-8	1350	Manhole	Adoptable
S40.005B	S42-8	1350	Manhole	Adoptable	EXSMH2	1200	Manhole	Adoptable

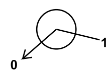
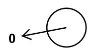
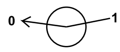
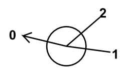
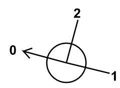
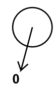
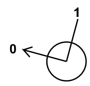
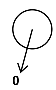
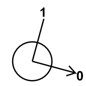
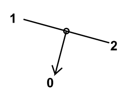
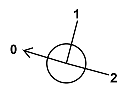
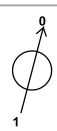
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
S1-0	555880.569	655162.902	5.332	1.500	1200		0	S1.000	3.832	300
S1-1	555913.163	655196.060	5.282	1.682	1350		1	S1.000	3.600	300
							0	S1.001	3.600	375
S1-1A	555928.589	655181.283	5.407	1.914	1350		1	S1.001	3.493	375
							0	S1.001A	3.493	375
S2-0	555974.085	655160.632	5.407	1.425	1200		0	S2.000	3.982	225
S2-1	555942.486	655170.547	5.407	1.977	1200		1	S2.000	3.430	225
							0	S2.001	3.430	300

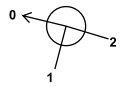
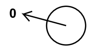
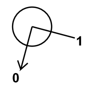
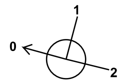
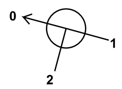
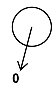
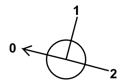
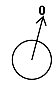
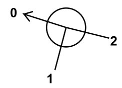
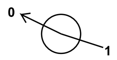
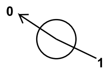
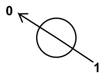
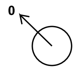
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
S1-2	555933.769	655179.338	5.407	2.039	1350		1	S2.001	3.368	300
							2	S1.001A	3.465	375
							0	S1.002	3.368	375
S3-0	556022.190	655178.066	5.288	1.425	1200		0	S3.000	3.863	225
S3-1	555978.318	655190.411	5.288	2.185	1200		1	S3.000	3.103	225
							0	S3.001	3.103	300
S4-0	555937.834	655223.373	5.320	1.425	1200		0	S4.000	3.895	225
S1-3	555957.356	655203.700	5.288	2.599	1350		1	S4.000	3.433	225
							2	S3.001	2.689	300
							3	S1.002	3.198	375
							0	S1.003	2.689	375
S5-0	555987.035	655204.366	5.332	2.332	1200		0	S5.000	3.000	300
S5-1	555975.569	655212.524	5.332	2.567	1200		1	S5.000	2.765	300
							0	S5.001	2.765	300
S1-4	555980.022	655227.504	5.407	2.902	1350		1	S5.001	2.505	300
							2	S1.003	2.525	375
							0	S1.004	2.505	400
S1-5	555993.480	655251.810	5.286	2.920	1350		1	S1.004	2.366	400
							0	S1.005	2.366	400
S8-0	556221.616	655296.283	6.900	1.425	1200		0	S8.000	5.475	225
S8-1	556160.222	655312.666	6.900	2.484	1200		1	S8.000	4.416	225
							0	S8.001	4.416	225
S6-1	556229.921	655292.411	6.950	3.250	1350		0	S6.001	3.700	375
S6-2	556190.962	655288.713	6.950	3.902	1500		1	S6.001	3.048	375
							0	S6.002	3.048	400

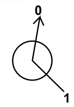
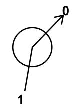
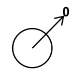
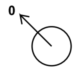
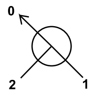
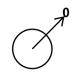
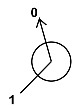
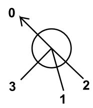
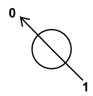
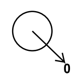
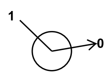
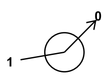
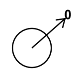
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
S6-3	556175.759	655292.357	6.950	3.980	1500		1	S6.002	2.970	400
							0	S6.003	2.970	225
S7-0	556221.959	655289.422	6.950	1.425	1200		0	S7.000	5.525	225
S7-1	556188.075	655282.837	6.950	2.000	1200		1	S7.000	4.950	225
							0	S7.001	4.950	225
S7-2	556167.932	655285.553	6.950	4.041	1350		1	S7.001	4.611	225
							2	S6.003	2.909	225
							0	S7.002	2.909	450
S6-5	556153.795	655288.968	6.795	3.959	1350		1	S7.002	2.836	450
							2	S8.001	4.272	225
							0	S6.005	2.836	450
S10-0	556123.943	655353.761	6.000	1.425	1200		0	S10.000	4.575	225
S10-1	556116.446	655325.470	6.000	1.718	1200		1	S10.000	4.282	225
							0	S10.001	4.282	225
S9-0	556103.850	655358.354	5.300	1.425	1200		0	S9.000	3.875	225
S9-1	556096.425	655330.909	5.300	1.592	1200		1	S9.000	3.708	225
							0	S9.001	3.708	225
S9-2	556105.491	655328.448	5.700	3.347			1	S9.001	3.653	225
							2	S10.001	4.215	225
							0	S9.002	2.353	300
S6-6	556099.015	655303.759	5.600	3.375	1500		1	S9.002	2.225	300
							2	S6.005	2.552	450
							0	S6.006	2.225	600
S11-0	556048.280	655204.810	6.368	1.425	1200		0	S11.000	4.943	225
S11-1	556062.328	655258.490	6.127	3.109	1200		1	S11.000	4.018	225
							0	S11.001	3.018	225

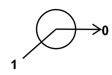
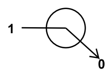
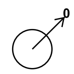
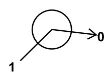
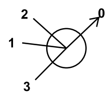
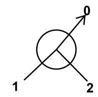
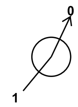
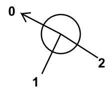
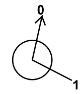
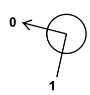
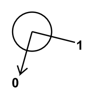
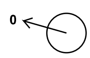
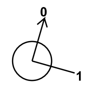
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
S6-7	556075.964	655310.689	5.247	3.142	1500		1	S11.001	2.119	225
							2	S6.006	2.105	600
							0	S6.007	2.105	600
S12-0	556159.504	655366.383	6.500	1.425	1200		0	S12.000	5.075	225
S12-1	556073.814	655389.348	5.200	1.604	1200		1	S12.000	3.596	225
							0	S12.001	3.596	225
S7-8	556054.260	655315.981	5.100	3.107	1500		1	S12.001	3.090	225
							2	S6.007	1.993	600
							0	S7.008	1.993	600
S1-6	556013.425	655327.228	5.298	3.517	1800		1	S7.008	1.781	600
							2	S1.005	1.846	400
							0	S1.006	1.781	750
S13-0	555982.671	655341.239	5.248	1.425	1200		0	S13.000	3.823	225
S1-7	555981.246	655335.791	5.248	3.633	1800		1	S13.000	3.729	225
							2	S1.006	1.615	750
							0	S1.007	1.615	750
S14-0	555932.519	655289.040	5.284	1.425	1200		0	S14.000	3.859	225
S1-8	555946.905	655344.284	5.306	3.868	1800		1	S14.000	2.908	225
							2	S1.007	1.438	750
							0	S1.008	1.438	750
S1-9	555920.327	655352.825	5.423	4.125	1800		1	S1.008	1.298	750
							0	S1.009	1.298	750
S1-10	555903.148	655361.136	5.348	4.145	1800		1	S1.009	1.203	750
							0	S1.010	1.203	750
S1-11	555886.996	655371.857	5.248	4.142	1800		1	S1.010	1.106	750
							0	S1.011	1.106	750
S17-0	555865.466	655206.888	5.266	1.425	1200		0	S17.000	3.841	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
S17-1	555841.157	655230.708	5.241	1.967	1200		1	S17.000	3.274	225
							0	S17.001	3.274	300
S17-2	555841.980	655235.500	5.241	2.048	1200		1	S17.001	3.193	300
							0	S17.002	3.193	300
S15-0	555872.054	655212.698	5.266	1.425	1200		0	S15.000	3.841	225
S16-0	555934.313	655229.466	5.370	1.425	1200		0	S16.000	3.945	225
S15-1	555911.018	655252.643	5.320	2.409	1200		1	S16.000	3.397	225
							2	S15.000	2.911	225
							0	S15.001	2.911	300
S18-0	555861.899	655238.411	5.260	2.960	1200		0	S18.000	2.300	225
S18-1	555887.849	655264.915	5.260	3.331	1200		1	S18.000	1.929	225
							0	S18.001	1.929	225
S15-2	555883.945	655278.694	5.288	3.443	1350		1	S18.001	1.845	225
							2	S15.001	2.285	300
							3	S17.002	2.189	300
							0	S15.002	1.845	375
S15-3	555859.630	655302.857	5.387	3.713	1350		1	S15.002	1.674	375
							0	S15.003	1.674	400
S19-0	555775.719	655293.851	5.320	1.425	1200		0	S19.000	3.895	225
S19-0A	555788.861	655281.137	5.407	1.817	1200		1	S19.000	3.590	225
							0	S19.000A	3.590	225
S19-1	555794.687	655282.132	5.407	1.916	1200		1	S19.000A	3.491	225
							0	S19.001	3.491	225
S20-0	555780.757	655299.930	5.275	1.425	1200		0	S20.000	3.850	225

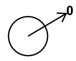
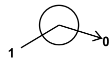
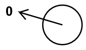
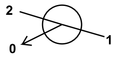
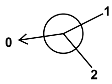
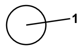
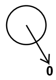
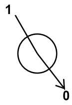
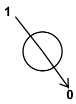
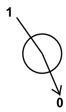
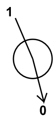
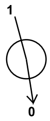
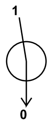
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
S20-1	555809.363	655325.016	5.367	2.151	1200		1	S20.000	3.216	225
							0	S20.001	3.216	225
S20-2	555815.669	655324.975	5.367	2.256	1200		1	S20.001	3.111	225
							0	S20.002	3.111	300
S21-0	555789.336	655290.215	5.324	2.924	1200					
							0	S21.000	2.400	225
S21-1	555815.478	655316.307	5.324	3.540	1200		1	S21.000	1.784	225
							0	S21.001	1.784	225
S19-2	555826.853	655314.928	5.324	3.731	1350		1	S21.001	1.593	225
							2	S20.002	2.860	300
							3	S19.001	2.725	225
							0	S19.002	1.593	375
S15-4	555837.767	655325.270	5.314	3.797	1500		1	S19.002	1.518	375
							2	S15.003	1.517	400
							0	S15.004	1.517	500
S15-5	555843.282	655331.894	5.364	3.890	1500		1	S15.004	1.474	500
							0	S15.005	1.474	500
S1-12	555868.100	655383.917	5.248	4.254	1800		1	S15.005	1.031	500
							2	S1.011	0.994	750
							0	S1.012	0.994	750
S1-13	555857.985	655389.107	5.298	4.361	1800		1	S1.012	0.937	750
							0	S1.013	0.937	750
S1-14	555861.682	655405.800	5.348	4.496	1800		1	S1.013	0.852	750
							0	S1.014	0.852	750
S1-15	555828.359	655414.202	5.382	4.702	1800		1	S1.014	0.680	750
							0	S1.015	0.680	750
S30-0	556070.775	655161.389	6.304	1.575	1350					
							0	S30.000	4.729	375
S30-1	556039.233	655170.314	6.304	2.121	1350		1	S30.000	4.183	375
							0	S30.001	4.183	450

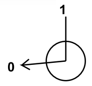
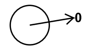
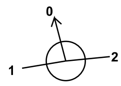
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S30-2	556053.249	655218.928	6.304	2.374	1350	1	S30.001	3.930	450
						0	S30.002	3.930	450
S30-3	556064.152	655260.993	6.127	2.414	1350	1	S30.002	3.713	450
						0	S30.003	3.713	450
S30-4	556076.824	655308.605	5.305	1.838	1350	1	S30.003	3.467	450
						0	S30.004	3.467	450
S30-5	556015.841	655325.098	5.298	2.463	1350	1	S30.004	2.835	450
						0	S30.005	2.835	450
S30-6	555943.360	655344.117	5.328	3.117	1350	1	S30.005	2.211	450
						0	S30.006	2.211	450
S30-7	555917.690	655352.537	5.410	3.334	1500	1	S30.006	2.076	450
						0	S30.007	2.076	500
S30-8	555900.686	655361.017	5.328	3.347	1500	1	S30.007	1.981	500
						0	S30.008	1.981	500
S30-9	555881.434	655373.985	5.223	3.358	1500	1	S30.008	1.865	500
						0	S30.009	1.865	500
S30-10	555864.876	655383.950	5.298	3.530	1500	1	S30.009	1.768	500
						0	S30.010	1.768	500
S30-11	555850.088	655391.594	5.348	3.746	1500	1	S30.010	1.602	500
						0	S30.011	1.602	500
S30-12	555838.535	655396.615	5.398	3.922	1500	1	S30.011	1.476	500
						0	S30.012	1.476	500
S1-16	555824.137	655398.946	5.382	4.781	1800	1	S30.012	1.330	500
						2	S1.015	0.601	750
						0	S1.016	0.601	225
S1-17	555799.455	655405.900	4.992	4.542	1200	1	S1.016	0.450	225
						0	S1.017	0.450	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
S40-0	555767.383	655420.630	3.963	1.350	1200		0	S40.006	2.613	150
S40-1	555781.784	655429.196	4.063	1.618	1200		1	S40.006	2.445	150
							0	S40.007	2.445	225
S41-0	555822.438	655417.134	4.063	2.563	1200		0	S41.000	1.500	225
S40-2	555796.494	655424.670	4.063	2.766	1200		1	S41.000	1.297	225
							2	S40.007	2.354	225
							0	S40.008	1.297	225
S1-18	555787.423	655420.123	4.300	3.960	1200		1	S40.008	1.237	225
							2	S1.017	0.340	225
							0	S1.018	0.340	225
EXSMH	555771.951	655417.836	3.963	3.715	1200		1	S1.018	0.248	225
S42-0	555604.608	655634.859	4.124	1.425	1200		0	S40.000	2.699	225
S42-1	555611.827	655622.429	3.913	1.435	1200		1	S40.000	2.478	225
							0	S40.001	2.478	300
S42-2	555646.541	655577.899	3.703	1.557	1350		1	S40.001	2.146	300
							0	S40.002	2.146	375
S42-3	555686.891	655521.544	3.397	1.598	1350		1	S40.002	1.799	375
							0	S40.003	1.799	400
S42-4	555707.655	655473.577	3.617	1.967	1350		1	S40.003	1.650	400
							0	S40.004	1.650	450
S42-5	555714.358	655448.126	3.700	2.116	1350		1	S40.004	1.584	450
							0	S40.004A	1.584	450
S42-6	555719.439	655416.117	3.763	2.260	1350		1	S40.004A	1.503	450
							0	S40.005	1.503	450

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
S42-7	555719.480	655386.888	3.763	2.333	1350		1	S40.005	1.430	450
							0	S40.005A	1.430	450
S43-0	555699.951	655383.923	3.763	1.425	1200		0	S42.000	2.338	225
S42-8	555715.775	655386.536	3.763	2.342	1350		1	S42.000	2.086	225
							2	S40.005A	1.421	450
							0	S40.005B	1.421	225
EXSMH2	555711.035	655404.266	3.763	2.450	1200		1	S40.005B	1.313	225

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	Scotland and Ireland	Skip Steady State	x
M5-60 (mm)	17.300	Drain Down Time (mins)	240
Ratio-R	0.325	Additional Storage (m³/ha)	50.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

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

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
5	0	0	0
30	20	0	0
100	20	0	0

Node S1-16 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	0.601	Product Number	CTL-SHE-0172-1670-1800-1670
Design Depth (m)	1.800	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	16.7	Min Node Diameter (mm)	1500

Node S40-1 Online Orifice Control

Flap Valve	✓	Invert Level (m)	2.445	Discharge Coefficient	1.000
Replaces Downstream Link	✓	Diameter (m)	0.375		

Node S30-12 Online Orifice Control

Flap Valve	✓	Invert Level (m)	1.476	Discharge Coefficient	1.000
Replaces Downstream Link	✓	Diameter (m)	0.450		

Node S6-3 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	2.970	Product Number	CTL-SHE-0127-9000-1800-9000
Design Depth (m)	1.800	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	9.0	Min Node Diameter (mm)	1500

Node S40-2 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	1.297	Product Number	CTL-SHE-0027-4000-1350-4000
Design Depth (m)	1.350	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	0.4	Min Node Diameter (mm)	1200

Node S42-8 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	1.421	Product Number	CTL-SHE-0064-2400-1800-2400
Design Depth (m)	1.800	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.4	Min Node Diameter (mm)	1200

Node S6-3 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	1.0	Invert Level (m)	2.970
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	265.0	0.0	1.800	265.0	0.0	1.801	0.0	0.0

Node S1-15 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	1.0	Invert Level (m)	0.680
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	750.0	0.0	1.800	750.0	0.0	1.801	0.0	0.0

Node S21-1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	1.0	Invert Level (m)	1.784
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	470.0	0.0	1.800	470.0	0.0	1.801	0.0	0.0

Node S18-1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	1.0	Invert Level (m)	1.929
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	615.0	0.0	1.800	615.0	0.0	1.801	0.0	0.0

Node S9-2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	1.0	Invert Level (m)	2.353
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	545.0	0.0	1.800	545.0	0.0	1.801	0.0	0.0

Node S5-1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	1.0	Invert Level (m)	2.765
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	80.0	0.0	1.800	80.0	0.0	1.801	0.0	0.0

Node S41-0 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	1.0	Invert Level (m)	1.500
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	60.0	0.0	1.800	60.0	0.0	1.801	0.0	0.0

Node S42-8 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	1.0	Invert Level (m)	1.421
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	155.0	0.0	1.800	155.0	0.0	1.801	0.0	0.0

Results for 5 year Critical Storm Duration. Lowest mass balance: 99.36%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1-0	11	3.923	0.091	16.6	0.3670	0.0000	OK
15 minute winter	S1-1	11	3.771	0.171	53.8	1.2520	0.0000	OK
15 minute winter	S1-1A	11	3.669	0.176	52.5	0.2525	0.0000	OK
15 minute winter	S2-0	10	4.026	0.044	5.9	0.0986	0.0000	OK
15 minute winter	S2-1	11	3.623	0.193	28.4	0.7922	0.0000	OK
15 minute winter	S1-2	11	3.614	0.246	100.1	1.0643	0.0000	OK
15 minute winter	S3-0	10	3.945	0.082	18.2	0.3392	0.0000	OK
15 minute winter	S3-1	11	3.177	0.074	19.4	0.0967	0.0000	OK
15 minute winter	S4-0	10	3.948	0.053	8.2	0.1405	0.0000	OK
15 minute winter	S1-3	11	3.042	0.353	141.0	1.0616	0.0000	OK
15 minute summer	S5-0	1	3.000	0.000	0.0	0.0000	0.0000	OK
15 minute winter	S5-1	14	2.801	0.036	16.1	2.7467	0.0000	OK
15 minute winter	S1-4	11	2.872	0.367	172.1	1.7522	0.0000	OK
15 minute winter	S1-5	12	2.728	0.362	201.9	2.0009	0.0000	OK
15 minute winter	S8-0	11	5.513	0.038	4.4	0.0736	0.0000	OK
15 minute winter	S8-1	11	4.579	0.163	34.0	0.6982	0.0000	OK
15 minute winter	S6-1	12	3.912	0.212	150.7	3.8468	0.0000	OK
240 minute winter	S6-2	196	3.619	0.571	43.6	1.0680	0.0000	SURCHARGED
240 minute winter	S6-3	196	3.619	0.649	43.2	164.6869	0.0000	SURCHARGED
15 minute winter	S7-0	11	5.544	0.019	1.0	0.0243	0.0000	OK
15 minute winter	S7-1	10	5.030	0.080	17.3	0.2616	0.0000	OK
15 minute winter	S7-2	11	3.029	0.120	30.0	0.2614	0.0000	OK
15 minute winter	S6-5	12	3.003	0.167	65.3	0.2763	0.0000	OK
15 minute winter	S10-0	10	4.647	0.072	11.9	0.2376	0.0000	OK
15 minute winter	S10-1	11	4.440	0.158	32.6	0.6840	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S1-0	S1.000	S1-1	16.0	0.545	0.204	1.3842	
15 minute winter	S1-1	S1.001	S1-1A	52.5	1.052	0.372	1.0669	
15 minute winter	S1-1A	S1.001A	S1-2	52.6	1.119	0.373	0.2603	
15 minute winter	S2-0	S2.000	S2-1	5.8	0.351	0.086	0.6897	
15 minute winter	S2-1	S2.001	S1-2	26.2	0.532	0.335	0.6785	
15 minute winter	S1-2	S1.002	S1-3	99.0	1.360	0.702	2.4800	
15 minute winter	S3-0	S3.000	S3-1	17.9	1.481	0.266	0.5506	
15 minute winter	S3-1	S3.001	S1-3	19.3	0.739	0.134	1.0398	
15 minute winter	S4-0	S4.000	S1-3	7.9	1.130	0.118	0.1951	
15 minute winter	S1-3	S1.003	S1-4	138.3	1.299	0.980	3.5197	
15 minute summer	S5-0	S5.000	S5-1	0.0	0.000	0.000	0.0186	
15 minute winter	S5-1	S5.001	S1-4	-16.1	-0.382	-0.112	0.5775	
15 minute winter	S1-4	S1.004	S1-5	158.9	1.343	0.950	3.3140	
15 minute winter	S1-5	S1.005	S1-6	195.3	1.640	1.010	9.5348	
15 minute winter	S8-0	S8.000	S8-1	4.2	0.252	0.062	1.1222	
15 minute winter	S8-1	S8.001	S6-5	32.3	1.091	0.812	0.7260	
15 minute winter	S6-1	S6.001	S6-2	150.1	1.931	0.580	3.0423	
240 minute winter	S6-2	S6.002	S6-3	42.2	1.120	0.252	1.9572	
240 minute winter	S6-3	Hydro-Brake®	S7-2	9.0				
15 minute winter	S7-0	S7.000	S7-1	0.9	0.147	0.014	0.2435	
15 minute winter	S7-1	S7.001	S7-2	16.8	1.380	0.250	0.2476	
15 minute winter	S7-2	S7.002	S6-5	29.8	0.699	0.131	0.6336	
15 minute winter	S6-5	S6.005	S6-6	64.5	1.240	0.283	2.9529	
15 minute winter	S10-0	S10.000	S10-1	11.6	0.576	0.224	0.5930	
15 minute winter	S10-1	S10.001	S9-2	31.8	1.102	0.801	0.3280	

Results for 5 year Critical Storm Duration. Lowest mass balance: 99.36%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S9-0	10	3.953	0.078	10.7	0.2414	0.0000	OK
15 minute winter	S9-1	11	3.853	0.145	28.6	0.5961	0.0000	OK
1440 minute winter	S9-2	1380	2.464	0.111	4.5	57.3689	0.0000	OK
1440 minute winter	S6-6	1350	2.464	0.239	18.7	1.2282	0.0000	OK
15 minute winter	S11-0	11	5.007	0.064	12.2	0.2166	0.0000	OK
15 minute winter	S11-1	10	3.147	0.129	43.4	0.4911	0.0000	OK
1440 minute winter	S6-7	1350	2.464	0.359	22.2	1.0964	0.0000	OK
15 minute winter	S12-0	11	5.114	0.039	4.6	0.0764	0.0000	OK
15 minute winter	S12-1	12	3.762	0.166	42.4	1.2206	0.0000	OK
1440 minute winter	S7-8	1350	2.464	0.471	26.8	2.1639	0.0000	OK
1440 minute winter	S1-6	1380	2.464	0.683	43.6	2.8249	0.0000	OK
15 minute winter	S13-0	10	3.861	0.038	3.8	0.0699	0.0000	OK
1440 minute winter	S1-7	1380	2.464	0.849	44.2	3.1886	0.0000	SURCHARGED
15 minute winter	S14-0	11	3.956	0.097	26.0	0.5697	0.0000	OK
1440 minute winter	S1-8	1380	2.465	1.027	45.2	4.2988	0.0000	SURCHARGED
1440 minute winter	S1-9	1320	2.464	1.166	44.7	4.7755	0.0000	SURCHARGED
1440 minute winter	S1-10	1380	2.465	1.262	46.3	5.7086	0.0000	SURCHARGED
1440 minute winter	S1-11	1350	2.465	1.359	46.5	4.0149	0.0000	SURCHARGED
15 minute winter	S17-0	10	3.931	0.090	23.3	0.4858	0.0000	OK
15 minute winter	S17-1	10	3.401	0.127	38.1	0.4032	0.0000	OK
15 minute winter	S17-2	10	3.318	0.125	52.6	0.3869	0.0000	OK
15 minute winter	S15-0	10	3.927	0.086	21.8	0.4423	0.0000	OK
15 minute winter	S16-0	10	4.044	0.099	26.2	0.5874	0.0000	OK
15 minute winter	S15-1	10	3.078	0.167	81.9	0.8302	0.0000	OK
1440 minute winter	S18-0	1350	2.465	0.165	0.1	0.1868	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S9-0	S9.000	S9-1	10.4	0.535	0.262	0.5561	
15 minute winter	S9-1	S9.001	S9-2	27.9	1.065	0.703	0.2464	
1440 minute winter	S9-2	S9.002	S6-6	4.2	0.347	0.054	1.0684	
1440 minute winter	S6-6	S6.006	S6-7	18.7	0.785	0.038	3.3726	
15 minute winter	S11-0	S11.000	S11-1	11.8	1.274	0.175	0.5120	
15 minute winter	S11-1	S11.001	S6-7	42.4	1.215	0.631	1.7056	
1440 minute winter	S6-7	S6.007	S7-8	22.2	0.820	0.046	4.6119	
15 minute winter	S12-0	S12.000	S12-1	4.4	0.268	0.065	1.5912	
15 minute winter	S12-1	S12.001	S7-8	37.1	1.202	0.877	2.3447	
1440 minute winter	S7-8	S7.008	S1-6	26.8	0.825	0.055	10.9863	
1440 minute winter	S1-6	S1.006	S1-7	43.0	1.015	0.049	14.3341	
15 minute winter	S13-0	S13.000	S1-7	3.8	0.881	0.056	0.0240	
1440 minute winter	S1-7	S1.007	S1-8	42.3	0.954	0.048	15.5697	
15 minute winter	S14-0	S14.000	S1-8	25.1	1.564	0.373	0.9156	
1440 minute winter	S1-8	S1.008	S1-9	43.3	0.926	0.050	12.2868	
1440 minute winter	S1-9	S1.009	S1-10	44.5	0.908	0.051	8.3993	
1440 minute winter	S1-10	S1.010	S1-11	46.1	0.956	0.053	8.5322	
1440 minute winter	S1-11	S1.011	S1-12	46.4	0.731	0.053	9.8662	
15 minute winter	S17-0	S17.000	S17-1	22.8	1.203	0.339	0.6455	
15 minute winter	S17-1	S17.001	S17-2	37.3	1.340	0.260	0.1371	
15 minute winter	S17-2	S17.002	S15-2	53.1	1.751	0.369	2.9464	
15 minute winter	S15-0	S15.000	S15-1	21.2	0.935	0.315	1.2719	
15 minute winter	S16-0	S16.000	S15-1	25.3	1.553	0.376	0.5374	
15 minute winter	S15-1	S15.001	S15-2	83.3	2.025	0.580	2.0520	
1440 minute winter	S18-0	S18.000	S18-1	-0.1	-0.003	-0.002	1.3171	

Results for 5 year Critical Storm Duration. Lowest mass balance: 99.36%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	S18-1	1350	2.465	0.536	30.0	313.8429	0.0000	SURCHARGED
15 minute winter	S15-2	12	2.715	0.870	174.6	3.9850	0.0000	SURCHARGED
15 minute winter	S15-3	12	2.485	0.811	153.2	1.8368	0.0000	SURCHARGED
15 minute winter	S19-0	10	3.942	0.047	6.3	0.1084	0.0000	OK
15 minute winter	S19-0A	10	3.636	0.046	6.2	0.0516	0.0000	OK
15 minute winter	S19-1	11	3.602	0.111	32.5	0.5250	0.0000	OK
15 minute winter	S20-0	10	3.942	0.092	24.5	0.5183	0.0000	OK
15 minute winter	S20-1	11	3.487	0.271	66.1	1.6997	0.0000	SURCHARGED
15 minute winter	S20-2	11	3.324	0.213	101.2	1.2303	0.0000	OK
1440 minute winter	S21-0	1380	2.465	0.065	0.1	0.0738	0.0000	OK
1440 minute winter	S21-1	1380	2.465	0.681	32.8	304.9388	0.0000	SURCHARGED
1440 minute winter	S19-2	1380	2.466	0.873	32.9	2.4305	0.0000	SURCHARGED
1440 minute winter	S15-4	1350	2.464	0.947	25.8	2.0972	0.0000	SURCHARGED
1440 minute winter	S15-5	1350	2.466	0.992	25.4	2.1484	0.0000	SURCHARGED
1440 minute winter	S1-12	1380	2.465	1.471	61.8	7.6669	0.0000	SURCHARGED
1440 minute winter	S1-13	1350	2.467	1.530	61.2	4.9647	0.0000	SURCHARGED
1440 minute winter	S1-14	1380	2.465	1.613	61.3	4.5722	0.0000	SURCHARGED
1440 minute winter	S1-15	1350	2.464	1.784	61.3	1275.9590	0.0000	SURCHARGED
15 minute winter	S30-0	14	4.979	0.250	181.2	11.4611	0.0000	OK
15 minute winter	S30-1	14	4.506	0.323	180.1	0.4620	0.0000	OK
15 minute winter	S30-2	14	4.254	0.324	180.2	0.4639	0.0000	OK
15 minute winter	S30-3	15	4.023	0.310	179.7	0.4443	0.0000	OK
15 minute winter	S30-4	15	3.714	0.247	180.0	0.3542	0.0000	OK
15 minute winter	S30-5	16	3.094	0.259	179.9	0.3701	0.0000	OK
15 minute winter	S30-6	16	2.551	0.340	179.9	0.4862	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
1440 minute winter	S18-1	S18.001	S15-2	-30.0	-0.819	-0.755	0.5696	
15 minute winter	S15-2	S15.002	S15-3	143.9	1.315	1.020	3.7809	
15 minute winter	S15-3	S15.003	S15-4	156.2	1.248	0.934	3.9197	
15 minute winter	S19-0	S19.000	S19-0A	6.2	1.051	0.092	0.1079	
15 minute winter	S19-0A	S19.000A	S19-1	6.1	0.500	0.091	0.0745	
15 minute winter	S19-1	S19.001	S19-2	31.6	1.653	0.470	0.8787	
15 minute winter	S20-0	S20.000	S20-1	24.0	0.792	0.356	1.0476	
15 minute winter	S20-1	S20.001	S20-2	63.4	1.595	0.943	0.2480	
15 minute winter	S20-2	S20.002	S19-2	101.5	2.055	0.706	0.7412	
1440 minute winter	S21-0	S21.000	S21-1	-0.1	0.002	-0.001	0.9105	
1440 minute winter	S21-1	S21.001	S19-2	-32.8	-1.029	-0.488	0.4557	
1440 minute winter	S19-2	S19.002	S15-4	-23.8	0.530	-0.169	1.6584	
1440 minute winter	S15-4	S15.004	S15-5	-25.4	0.884	-0.084	1.6860	
1440 minute winter	S15-5	S15.005	S1-12	-25.1	0.688	-0.067	11.2749	
1440 minute winter	S1-12	S1.012	S1-13	60.5	0.917	0.069	5.0037	
1440 minute winter	S1-13	S1.013	S1-14	61.0	0.904	0.070	7.5247	
1440 minute winter	S1-14	S1.014	S1-15	61.0	1.001	0.070	15.1252	
1440 minute winter	S1-15	S1.015	S1-16	31.6	0.310	0.036	6.9667	
15 minute winter	S30-0	S30.000	S30-1	180.1	1.996	0.696	2.9325	
15 minute winter	S30-1	S30.001	S30-2	180.2	1.478	0.790	6.1722	
15 minute winter	S30-2	S30.002	S30-3	179.7	1.506	0.788	5.1866	
15 minute winter	S30-3	S30.003	S30-4	180.0	1.744	0.789	5.0740	
15 minute winter	S30-4	S30.004	S30-5	179.9	1.961	0.556	5.7947	
15 minute winter	S30-5	S30.005	S30-6	179.9	1.621	0.610	8.3433	
15 minute winter	S30-6	S30.006	S30-7	179.3	1.431	0.786	3.3846	

Results for 5 year Critical Storm Duration. Lowest mass balance: 99.36%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	S30-7	1290	2.455	0.379	16.0	0.6689	0.0000	OK
1440 minute winter	S30-8	1320	2.455	0.474	16.0	0.8372	0.0000	OK
1440 minute winter	S30-9	1290	2.456	0.591	16.7	1.0437	0.0000	SURCHARGED
1440 minute winter	S30-10	1410	2.458	0.690	16.7	1.2201	0.0000	SURCHARGED
1440 minute winter	S30-11	1410	2.458	0.856	18.0	1.5127	0.0000	SURCHARGED
1440 minute winter	S30-12	1380	2.463	0.987	16.6	1.7439	0.0000	SURCHARGED
1440 minute winter	S1-16	1350	2.464	1.863	36.4	4.7405	0.0000	SURCHARGED
1440 minute winter	S1-17	1380	0.558	0.108	17.0	0.1221	0.0000	OK
15 minute winter	S40-0	10	2.696	0.083	10.3	0.2596	0.0000	OK
15 minute winter	S40-1	10	2.556	0.111	31.9	0.5151	0.0000	OK
1440 minute winter	S41-0	1170	2.224	0.724	1.6	42.0660	0.0000	SURCHARGED
1440 minute winter	S40-2	1170	2.224	0.927	1.9	1.0480	0.0000	SURCHARGED
1440 minute winter	S1-18	1350	0.449	0.109	17.3	0.1238	0.0000	OK
1440 minute winter	EXSMH	1350	0.351	0.103	17.3	0.0000	0.0000	OK
15 minute winter	S42-0	10	2.759	0.060	10.3	0.1817	0.0000	OK
15 minute winter	S42-1	10	2.613	0.135	35.6	0.7785	0.0000	OK
15 minute winter	S42-2	11	2.292	0.146	47.5	0.5374	0.0000	OK
960 minute winter	S42-3	870	2.148	0.349	5.8	1.5793	0.0000	OK
960 minute winter	S42-4	870	2.148	0.498	6.5	1.6107	0.0000	SURCHARGED
960 minute winter	S42-5	870	2.148	0.564	5.8	0.8074	0.0000	SURCHARGED
960 minute winter	S42-6	870	2.147	0.644	8.1	3.5568	0.0000	SURCHARGED
720 minute winter	S42-7	720	2.168	0.738	8.9	1.0559	0.0000	SURCHARGED
15 minute summer	S43-0	1	2.338	0.000	0.0	0.0000	0.0000	OK
720 minute winter	S42-8	705	2.141	0.720	8.6	107.0822	0.0000	SURCHARGED
15 minute summer	EXSMH2	1	1.313	0.000	1.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
1440 minute winter	S30-7	S30.007	S30-8	16.0	0.813	0.053	3.3320	
1440 minute winter	S30-8	S30.008	S30-9	16.7	0.802	0.055	4.4977	
1440 minute winter	S30-9	S30.009	S30-10	16.7	0.896	0.055	3.7801	
1440 minute winter	S30-10	S30.010	S30-11	18.0	0.998	0.042	3.2563	
1440 minute winter	S30-11	S30.011	S30-12	16.6	1.037	0.039	2.4641	
1440 minute winter	S30-12	Orifice	S1-16	23.8				
1440 minute winter	S1-16	Hydro-Brake®	S1-17	17.0				
1440 minute winter	S1-17	S1.017	S1-18	17.0	0.894	0.427	0.3538	
15 minute winter	S40-0	S40.006	S40-1	10.1	0.839	0.567	0.2003	
15 minute winter	S40-1	Orifice	S40-2	31.4				
1440 minute winter	S41-0	S41.000	S40-2	-1.6	-0.040	-0.036	1.0745	
1440 minute winter	S40-2	Hydro-Brake®	S1-18	0.3				
1440 minute winter	S1-18	S1.018	EXSMH	17.3	0.940	0.436	0.2880	1514.8
15 minute winter	S42-0	S40.000	S42-1	10.2	0.617	0.157	0.2398	
15 minute winter	S42-1	S40.001	S42-2	34.8	1.082	0.409	1.8258	
15 minute winter	S42-2	S40.002	S42-3	46.7	0.939	0.331	3.4651	
960 minute winter	S42-3	S40.003	S42-4	5.4	0.457	0.043	6.2995	
960 minute winter	S42-4	S40.004	S42-5	5.8	0.452	0.036	4.1701	
960 minute winter	S42-5	S40.004A	S42-6	5.3	0.343	0.033	5.1352	
960 minute winter	S42-6	S40.005	S42-7	7.9	0.329	0.049	4.6311	
720 minute winter	S42-7	S40.005A	S42-8	8.6	0.622	0.054	0.5897	
15 minute summer	S43-0	S42.000	S42-8	0.0	0.000	0.000	0.0000	
720 minute winter	S42-8	Hydro-Brake®	EXSMH2	1.8				78.5

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 99.36%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1-0	12	4.053	0.221	29.3	0.8927	0.0000	OK
15 minute winter	S1-1	13	4.019	0.419	95.1	3.0659	0.0000	SURCHARGED
15 minute winter	S1-1A	12	3.997	0.504	89.4	0.7206	0.0000	SURCHARGED
15 minute winter	S2-0	10	4.041	0.059	10.4	0.1310	0.0000	OK
15 minute winter	S2-1	12	4.018	0.588	50.0	2.4202	0.0000	SURCHARGED
15 minute winter	S1-2	12	3.986	0.618	147.5	2.6710	0.0000	SURCHARGED
15 minute winter	S3-0	11	3.968	0.105	30.8	0.4368	0.0000	OK
15 minute winter	S3-1	12	3.819	0.716	42.1	0.9413	0.0000	SURCHARGED
15 minute winter	S4-0	10	3.966	0.071	14.5	0.1861	0.0000	OK
15 minute winter	S1-3	12	3.792	1.103	197.0	3.3201	0.0000	SURCHARGED
2160 minute winter	S5-0	2040	3.473	0.473	0.1	0.5347	0.0000	SURCHARGED
2160 minute winter	S5-1	2040	3.473	0.708	3.9	54.5898	0.0000	SURCHARGED
2160 minute winter	S1-4	2040	3.472	0.967	15.1	4.6182	0.0000	SURCHARGED
2160 minute winter	S1-5	2040	3.473	1.107	18.4	6.1132	0.0000	SURCHARGED
15 minute winter	S8-0	10	5.526	0.051	7.8	0.0980	0.0000	OK
15 minute winter	S8-1	11	4.768	0.352	60.1	1.5033	0.0000	SURCHARGED
15 minute winter	S6-1	14	4.345	0.645	265.7	11.6892	0.0000	SURCHARGED
360 minute winter	S6-2	352	4.301	1.253	56.2	2.3439	0.0000	SURCHARGED
360 minute winter	S6-3	352	4.301	1.331	56.5	337.9160	0.0000	SURCHARGED
15 minute winter	S7-0	11	5.549	0.024	1.7	0.0316	0.0000	OK
15 minute winter	S7-1	10	5.061	0.111	30.6	0.3648	0.0000	OK
2160 minute winter	S7-2	1980	3.476	0.567	11.1	1.2332	0.0000	SURCHARGED
2160 minute winter	S6-5	1980	3.476	0.640	13.9	1.0618	0.0000	SURCHARGED
15 minute winter	S10-0	10	4.673	0.098	20.9	0.3224	0.0000	OK
15 minute winter	S10-1	11	4.566	0.284	57.6	1.2309	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S1-0	S1.000	S1-1	29.0	0.612	0.371	2.9333	
15 minute winter	S1-1	S1.001	S1-1A	89.4	1.095	0.634	2.3562	
15 minute winter	S1-1A	S1.001A	S1-2	83.3	1.124	0.590	0.6103	
15 minute winter	S2-0	S2.000	S2-1	10.2	0.361	0.152	0.7958	
15 minute winter	S2-1	S2.001	S1-2	43.5	0.618	0.556	0.8718	
15 minute winter	S1-2	S1.002	S1-3	139.9	1.422	0.992	3.7401	
15 minute winter	S3-0	S3.000	S3-1	30.3	1.580	0.451	1.3214	
15 minute winter	S3-1	S3.001	S1-3	30.1	0.695	0.209	1.7477	
15 minute winter	S4-0	S4.000	S1-3	14.5	1.280	0.215	0.6983	
15 minute winter	S1-3	S1.003	S1-4	198.6	1.801	1.408	3.6254	
2160 minute winter	S5-0	S5.000	S5-1	-0.1	-0.003	-0.001	0.9909	
2160 minute winter	S5-1	S5.001	S1-4	-3.9	-0.068	-0.027	1.1005	
2160 minute winter	S1-4	S1.004	S1-5	15.1	0.813	0.090	3.4782	
2160 minute winter	S1-5	S1.005	S1-6	18.3	0.913	0.095	9.7662	
15 minute winter	S8-0	S8.000	S8-1	7.5	0.269	0.112	1.4750	
15 minute winter	S8-1	S8.001	S6-5	54.3	1.372	1.365	0.9325	
15 minute winter	S6-1	S6.001	S6-2	244.5	2.217	0.945	4.3164	
360 minute winter	S6-2	S6.002	S6-3	55.2	1.112	0.330	1.9572	
360 minute winter	S6-3	Hydro-Brake®	S7-2	9.0				
15 minute winter	S7-0	S7.000	S7-1	1.6	0.165	0.024	0.3766	
15 minute winter	S7-1	S7.001	S7-2	29.7	1.593	0.442	0.3808	
2160 minute winter	S7-2	S7.002	S6-5	11.1	0.683	0.049	2.3044	
2160 minute winter	S6-5	S6.005	S6-6	13.9	0.806	0.061	8.9904	
15 minute winter	S10-0	S10.000	S10-1	20.5	0.628	0.395	0.8232	
15 minute winter	S10-1	S10.001	S9-2	55.9	1.412	1.407	0.4332	

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 99.36%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S9-0	10	3.982	0.107	18.9	0.3308	0.0000	OK
15 minute winter	S9-1	11	3.945	0.237	50.5	0.9746	0.0000	SURCHARGED
2160 minute winter	S9-2	2040	3.472	1.119	32.6	579.6705	0.0000	SURCHARGED
2160 minute winter	S6-6	1980	3.474	1.249	29.8	6.4240	0.0000	SURCHARGED
15 minute winter	S11-0	11	5.030	0.087	21.6	0.2938	0.0000	OK
15 minute winter	S11-1	12	3.843	0.825	76.9	3.1483	0.0000	SURCHARGED
2160 minute winter	S6-7	1980	3.473	1.368	25.0	4.1798	0.0000	SURCHARGED
15 minute winter	S12-0	11	5.126	0.051	8.1	0.1014	0.0000	OK
15 minute winter	S12-1	12	4.049	0.453	75.0	3.3369	0.0000	SURCHARGED
2160 minute winter	S7-8	2040	3.472	1.479	29.7	6.8032	0.0000	SURCHARGED
2160 minute winter	S1-6	2040	3.472	1.691	48.7	6.9966	0.0000	SURCHARGED
15 minute winter	S13-0	10	3.874	0.051	6.7	0.0943	0.0000	OK
2160 minute winter	S1-7	1980	3.473	1.858	48.9	6.9773	0.0000	SURCHARGED
15 minute winter	S14-0	11	3.995	0.136	45.8	0.8043	0.0000	OK
2160 minute winter	S1-8	1980	3.473	2.035	52.3	8.5196	0.0000	SURCHARGED
2160 minute winter	S1-9	1980	3.474	2.176	53.9	8.9116	0.0000	SURCHARGED
2160 minute winter	S1-10	1980	3.474	2.271	56.0	10.2705	0.0000	SURCHARGED
2160 minute winter	S1-11	1980	3.474	2.368	56.3	6.9967	0.0000	SURCHARGED
15 minute winter	S17-0	13	4.062	0.221	41.1	1.1940	0.0000	OK
15 minute winter	S17-1	12	3.978	0.704	67.4	2.2290	0.0000	SURCHARGED
15 minute winter	S17-2	12	3.961	0.768	86.3	2.3699	0.0000	SURCHARGED
15 minute winter	S15-0	13	4.202	0.361	38.4	1.8527	0.0000	SURCHARGED
15 minute winter	S16-0	13	4.183	0.238	46.2	1.4137	0.0000	SURCHARGED
15 minute winter	S15-1	12	4.058	1.147	146.2	5.7038	0.0000	SURCHARGED
2160 minute winter	S18-0	2040	3.473	1.173	0.2	1.3264	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S9-0	S9.000	S9-1	18.5	0.593	0.465	0.8293	
15 minute winter	S9-1	S9.001	S9-2	49.0	1.268	1.233	0.3504	
2160 minute winter	S9-2	S9.002	S6-6	-27.8	-0.466	-0.355	1.7974	
2160 minute winter	S6-6	S6.006	S6-7	20.7	0.757	0.043	6.7800	
15 minute winter	S11-0	S11.000	S11-1	20.8	1.490	0.310	0.7759	
15 minute winter	S11-1	S11.001	S6-7	64.4	1.635	0.957	2.1457	
2160 minute winter	S6-7	S6.007	S7-8	24.1	0.821	0.050	6.2927	
15 minute winter	S12-0	S12.000	S12-1	7.8	0.288	0.115	2.0661	
15 minute winter	S12-1	S12.001	S7-8	53.2	1.348	1.257	2.8744	
2160 minute winter	S7-8	S7.008	S1-6	28.7	0.800	0.059	11.9307	
2160 minute winter	S1-6	S1.006	S1-7	47.4	0.965	0.054	14.6556	
15 minute winter	S13-0	S13.000	S1-7	6.6	1.028	0.098	0.0363	
2160 minute winter	S1-7	S1.007	S1-8	48.6	0.898	0.056	15.5697	
15 minute winter	S14-0	S14.000	S1-8	44.3	1.793	0.658	1.4090	
2160 minute winter	S1-8	S1.008	S1-9	52.1	0.855	0.060	12.2868	
2160 minute winter	S1-9	S1.009	S1-10	53.7	0.882	0.062	8.3993	
2160 minute winter	S1-10	S1.010	S1-11	55.8	0.852	0.064	8.5322	
2160 minute winter	S1-11	S1.011	S1-12	56.1	0.679	0.064	9.8662	
15 minute winter	S17-0	S17.000	S17-1	40.4	1.355	0.601	1.3499	
15 minute winter	S17-1	S17.001	S17-2	59.4	1.481	0.413	0.3424	
15 minute winter	S17-2	S17.002	S15-2	79.2	1.712	0.551	4.2409	
15 minute winter	S15-0	S15.000	S15-1	35.6	1.024	0.530	2.2193	
15 minute winter	S16-0	S16.000	S15-1	48.2	1.716	0.717	1.3069	
15 minute winter	S15-1	S15.001	S15-2	114.3	2.072	0.795	2.6457	
2160 minute winter	S18-0	S18.000	S18-1	-0.2	-0.004	-0.003	1.4752	

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 99.36%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2160 minute winter	S18-1	2040	3.473	1.544	35.2	903.7661	0.0000	SURCHARGED
15 minute winter	S15-2	12	3.730	1.885	242.0	8.6404	0.0000	SURCHARGED
2160 minute winter	S15-3	1980	3.473	1.799	23.5	4.0756	0.0000	SURCHARGED
15 minute winter	S19-0	10	3.959	0.064	11.1	0.1458	0.0000	OK
15 minute winter	S19-0A	11	3.683	0.093	11.0	0.1054	0.0000	OK
15 minute winter	S19-1	12	3.691	0.200	57.4	0.9451	0.0000	OK
15 minute winter	S20-0	12	4.205	0.355	43.1	1.9982	0.0000	SURCHARGED
15 minute winter	S20-1	12	4.038	0.822	108.9	5.1513	0.0000	SURCHARGED
15 minute winter	S20-2	12	3.701	0.590	159.8	3.4118	0.0000	SURCHARGED
2160 minute winter	S21-0	2040	3.473	1.073	0.3	1.2130	0.0000	SURCHARGED
2160 minute winter	S21-1	2040	3.473	1.689	31.8	755.8623	0.0000	SURCHARGED
2160 minute winter	S19-2	1980	3.472	1.879	32.0	5.2330	0.0000	SURCHARGED
2160 minute winter	S15-4	1980	3.474	1.957	30.6	4.3340	0.0000	SURCHARGED
2160 minute winter	S15-5	1980	3.472	1.998	30.3	4.3283	0.0000	SURCHARGED
2160 minute winter	S1-12	1980	3.476	2.482	59.3	12.9399	0.0000	SURCHARGED
2160 minute winter	S1-13	2040	3.473	2.536	51.0	8.2265	0.0000	SURCHARGED
2160 minute winter	S1-14	1980	3.475	2.623	51.1	7.4328	0.0000	SURCHARGED
2160 minute winter	S1-15	1980	3.475	2.795	51.2	1290.7410	0.0000	SURCHARGED
15 minute winter	S30-0	16	5.587	0.858	319.5	39.3437	0.0000	SURCHARGED
15 minute winter	S30-1	16	4.903	0.720	256.1	1.0308	0.0000	SURCHARGED
15 minute winter	S30-2	16	4.518	0.588	255.2	0.8410	0.0000	SURCHARGED
15 minute winter	S30-3	17	4.185	0.472	254.5	0.6756	0.0000	SURCHARGED
15 minute winter	S30-4	17	3.784	0.317	254.6	0.4535	0.0000	OK
2160 minute winter	S30-5	1980	3.474	0.639	19.6	0.9149	0.0000	SURCHARGED
2160 minute winter	S30-6	1980	3.478	1.267	19.6	1.8129	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
2160 minute winter	S18-1	S18.001	S15-2	-35.2	-0.905	-0.886	0.5696	
15 minute winter	S15-2	S15.002	S15-3	185.9	1.685	1.318	3.7809	
2160 minute winter	S15-3	S15.003	S15-4	-22.7	0.548	-0.135	3.9197	
15 minute winter	S19-0	S19.000	S19-0A	11.0	1.229	0.163	0.2201	
15 minute winter	S19-0A	S19.000A	S19-1	16.2	0.599	0.242	0.1546	
15 minute winter	S19-1	S19.001	S19-2	52.1	1.798	0.775	1.7696	
15 minute winter	S20-0	S20.000	S20-1	41.2	1.096	0.613	1.5132	
15 minute winter	S20-1	S20.001	S20-2	94.5	2.375	1.405	0.2508	
15 minute winter	S20-2	S20.002	S19-2	152.8	2.170	1.063	1.0587	
2160 minute winter	S21-0	S21.000	S21-1	-0.3	-0.008	-0.004	1.4689	
2160 minute winter	S21-1	S21.001	S19-2	-31.8	-0.801	-0.474	0.4557	
2160 minute winter	S19-2	S19.002	S15-4	-22.2	0.485	-0.157	1.6584	
2160 minute winter	S15-4	S15.004	S15-5	-30.2	0.818	-0.100	1.6860	
2160 minute winter	S15-5	S15.005	S1-12	-29.9	0.663	-0.080	11.2749	
2160 minute winter	S1-12	S1.012	S1-13	50.4	0.828	0.058	5.0037	
2160 minute winter	S1-13	S1.013	S1-14	50.8	0.825	0.058	7.5247	
2160 minute winter	S1-14	S1.014	S1-15	50.9	0.916	0.058	15.1252	
2160 minute winter	S1-15	S1.015	S1-16	36.3	0.286	0.042	6.9667	
15 minute winter	S30-0	S30.000	S30-1	256.1	2.322	0.990	3.6155	
15 minute winter	S30-1	S30.001	S30-2	255.2	1.611	1.119	8.0163	
15 minute winter	S30-2	S30.002	S30-3	254.5	1.606	1.116	6.8852	
15 minute winter	S30-3	S30.003	S30-4	254.6	1.826	1.116	6.8427	
15 minute winter	S30-4	S30.004	S30-5	254.9	2.124	0.788	7.6875	
2160 minute winter	S30-5	S30.005	S30-6	19.6	0.965	0.066	11.8730	
2160 minute winter	S30-6	S30.006	S30-7	20.9	0.828	0.092	4.2805	

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 99.36%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2160 minute winter	S30-7	1980	3.477	1.401	20.9	2.4763	0.0000	SURCHARGED
2160 minute winter	S30-8	1980	3.478	1.497	19.4	2.6455	0.0000	SURCHARGED
2160 minute winter	S30-9	1980	3.475	1.610	20.3	2.8454	0.0000	SURCHARGED
2160 minute winter	S30-10	1980	3.473	1.705	20.4	3.0128	0.0000	SURCHARGED
2160 minute winter	S30-11	1980	3.472	1.870	20.6	3.3037	0.0000	SURCHARGED
2160 minute winter	S30-12	2100	3.466	1.990	20.7	3.5167	0.0000	SURCHARGED
2160 minute winter	S1-16	1980	3.480	2.879	39.9	7.3260	0.0000	SURCHARGED
2160 minute winter	S1-17	1980	0.573	0.123	20.9	0.1389	0.0000	OK
2160 minute winter	S40-0	1740	2.822	0.209	0.8	0.6545	0.0000	SURCHARGED
2160 minute winter	S40-1	1740	2.826	0.381	2.4	1.7721	0.0000	SURCHARGED
2160 minute winter	S41-0	1800	2.839	1.339	3.7	77.8491	0.0000	SURCHARGED
2160 minute winter	S40-2	1920	2.843	1.546	2.4	1.7485	0.0000	SURCHARGED
2160 minute winter	S1-18	1980	0.464	0.124	21.3	0.1406	0.0000	OK
2160 minute winter	EXSMH	1980	0.364	0.116	21.3	0.0000	0.0000	OK
960 minute winter	S42-0	945	2.803	0.104	1.4	0.3143	0.0000	OK
960 minute winter	S42-1	945	2.799	0.321	4.8	1.8519	0.0000	SURCHARGED
960 minute winter	S42-2	930	2.799	0.653	6.6	2.4007	0.0000	SURCHARGED
960 minute winter	S42-3	930	2.796	0.997	9.1	4.5171	0.0000	SURCHARGED
960 minute winter	S42-4	930	2.799	1.149	9.8	3.7197	0.0000	SURCHARGED
960 minute winter	S42-5	930	2.801	1.217	9.5	1.7409	0.0000	SURCHARGED
960 minute winter	S42-6	930	2.801	1.298	14.1	7.1698	0.0000	SURCHARGED
960 minute winter	S42-7	990	2.796	1.366	13.7	1.9549	0.0000	SURCHARGED
960 minute winter	S43-0	915	2.791	0.453	0.2	0.5127	0.0000	SURCHARGED
960 minute winter	S42-8	915	2.791	1.370	13.6	203.7226	0.0000	SURCHARGED
15 minute summer	EXSMH2	1	1.313	0.000	1.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
2160 minute winter	S30-7	S30.007	S30-8	19.4	0.818	0.064	3.7168	
2160 minute winter	S30-8	S30.008	S30-9	20.3	0.793	0.067	4.5405	
2160 minute winter	S30-9	S30.009	S30-10	20.4	0.820	0.068	3.7801	
2160 minute winter	S30-10	S30.010	S30-11	20.6	0.955	0.048	3.2563	
2160 minute winter	S30-11	S30.011	S30-12	20.7	0.993	0.049	2.4641	
2160 minute winter	S30-12	Orifice	S1-16	21.7				
2160 minute winter	S1-16	Hydro-Brake®	S1-17	20.9				
2160 minute winter	S1-17	S1.017	S1-18	20.9	0.935	0.525	0.4158	
2160 minute winter	S40-0	S40.006	S40-1	1.4	0.547	0.079	0.2950	
2160 minute winter	S40-1	Orifice	S40-2	2.4				
2160 minute winter	S41-0	S41.000	S40-2	-3.7	-0.093	-0.083	1.0745	
2160 minute winter	S40-2	Hydro-Brake®	S1-18	0.4				
2160 minute winter	S1-18	S1.018	EXSMH	21.3	0.988	0.536	0.3370	2503.1
960 minute winter	S42-0	S40.000	S42-1	1.6	0.351	0.024	0.4145	
960 minute winter	S42-1	S40.001	S42-2	4.8	0.602	0.056	3.9760	
960 minute winter	S42-2	S40.002	S42-3	6.6	0.498	0.047	7.6448	
960 minute winter	S42-3	S40.003	S42-4	8.0	0.464	0.063	6.5434	
960 minute winter	S42-4	S40.004	S42-5	9.5	0.452	0.059	4.1701	
960 minute winter	S42-5	S40.004A	S42-6	9.4	0.327	0.059	5.1352	
960 minute winter	S42-6	S40.005	S42-7	13.7	0.385	0.085	4.6311	
960 minute winter	S42-7	S40.005A	S42-8	13.6	0.649	0.084	0.5897	
960 minute winter	S43-0	S42.000	S42-8	-0.2	-0.006	-0.002	0.6378	
960 minute winter	S42-8	Hydro-Brake®	EXSMH2	2.1				123.8

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.36%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1-0	13	4.594	0.762	43.2	3.0702	0.0000	SURCHARGED
15 minute winter	S1-1	13	4.573	0.973	121.5	7.1159	0.0000	SURCHARGED
2160 minute winter	S1-1A	2040	4.554	1.061	4.9	1.5183	0.0000	SURCHARGED
2160 minute winter	S2-0	2040	4.554	0.572	0.5	1.2689	0.0000	SURCHARGED
2160 minute winter	S2-1	2040	4.555	1.125	2.5	4.6290	0.0000	SURCHARGED
2160 minute winter	S1-2	2040	4.555	1.187	9.4	5.1325	0.0000	SURCHARGED
2160 minute winter	S3-0	2040	4.556	0.693	3.3	2.8741	0.0000	SURCHARGED
2160 minute winter	S3-1	2040	4.555	1.452	3.4	1.9074	0.0000	SURCHARGED
2160 minute winter	S4-0	2040	4.552	0.657	0.7	1.7356	0.0000	SURCHARGED
2160 minute winter	S1-3	2040	4.554	1.865	14.9	5.6128	0.0000	SURCHARGED
2160 minute winter	S5-0	2040	4.554	1.554	0.2	1.7577	0.0000	SURCHARGED
2160 minute winter	S5-1	2040	4.554	1.789	7.9	137.9992	0.0000	SURCHARGED
2160 minute winter	S1-4	2040	4.554	2.049	18.2	9.7834	0.0000	SURCHARGED
2160 minute winter	S1-5	2040	4.554	2.188	21.5	12.0881	0.0000	SURCHARGED
15 minute winter	S8-0	10	5.533	0.058	10.1	0.1120	0.0000	OK
15 minute winter	S8-1	11	4.978	0.562	78.2	2.3994	0.0000	SURCHARGED
15 minute winter	S6-1	15	5.035	1.335	345.5	24.1868	0.0000	SURCHARGED
480 minute winter	S6-2	464	4.907	1.859	55.3	3.4759	0.0000	SURCHARGED
480 minute winter	S6-3	464	4.907	1.937	55.7	457.3058	0.0000	SURCHARGED
15 minute winter	S7-0	10	5.552	0.027	2.2	0.0359	0.0000	OK
15 minute winter	S7-1	10	5.082	0.132	39.8	0.4315	0.0000	OK
2160 minute winter	S7-2	2040	4.553	1.644	11.6	3.5736	0.0000	SURCHARGED
2160 minute winter	S6-5	2040	4.553	1.717	15.0	2.8479	0.0000	SURCHARGED
15 minute winter	S10-0	11	4.734	0.159	27.2	0.5255	0.0000	OK
15 minute winter	S10-1	11	4.675	0.393	71.0	1.7024	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S1-0	S1.000	S1-1	39.8	0.639	0.508	3.2741	
15 minute winter	S1-1	S1.001	S1-1A	100.0	1.112	0.709	2.3562	
2160 minute winter	S1-1A	S1.001A	S1-2	4.9	0.587	0.035	0.6103	
2160 minute winter	S2-0	S2.000	S2-1	0.5	0.220	0.007	1.3171	
2160 minute winter	S2-1	S2.001	S1-2	2.5	0.313	0.032	0.8718	
2160 minute winter	S1-2	S1.002	S1-3	9.4	0.732	0.067	3.7401	
2160 minute winter	S3-0	S3.000	S3-1	3.3	0.913	0.049	1.8126	
2160 minute winter	S3-1	S3.001	S1-3	3.4	0.589	0.024	1.7477	
2160 minute winter	S4-0	S4.000	S1-3	0.7	0.550	0.010	1.1023	
2160 minute winter	S1-3	S1.003	S1-4	14.9	0.821	0.105	3.6254	
2160 minute winter	S5-0	S5.000	S5-1	-0.2	-0.003	-0.001	0.9909	
2160 minute winter	S5-1	S5.001	S1-4	-7.9	-0.112	-0.055	1.1005	
2160 minute winter	S1-4	S1.004	S1-5	17.4	0.824	0.104	3.4782	
2160 minute winter	S1-5	S1.005	S1-6	20.7	0.885	0.107	9.7662	
15 minute winter	S8-0	S8.000	S8-1	9.8	0.341	0.146	1.5191	
15 minute winter	S8-1	S8.001	S6-5	68.1	1.713	1.714	0.9596	
15 minute winter	S6-1	S6.001	S6-2	306.2	2.776	1.183	4.3164	
480 minute winter	S6-2	S6.002	S6-3	54.4	1.086	0.325	1.9572	
480 minute winter	S6-3	Hydro-Brake®	S7-2	9.0				
15 minute winter	S7-0	S7.000	S7-1	2.1	0.173	0.032	0.4633	
15 minute winter	S7-1	S7.001	S7-2	38.7	1.691	0.576	0.4669	
2160 minute winter	S7-2	S7.002	S6-5	11.6	0.679	0.051	2.3044	
2160 minute winter	S6-5	S6.005	S6-6	15.0	0.818	0.066	8.9904	
15 minute winter	S10-0	S10.000	S10-1	25.7	0.725	0.495	1.0208	
15 minute winter	S10-1	S10.001	S9-2	70.0	1.760	1.761	0.4444	

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.36%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2160 minute winter	S9-0	2040	4.551	0.676	1.0	2.0923	0.0000	SURCHARGED
2160 minute winter	S9-1	2040	4.552	0.844	3.4	3.4726	0.0000	SURCHARGED
2160 minute winter	S9-2	2040	4.552	2.199	38.2	932.8005	0.0000	SURCHARGED
2160 minute winter	S6-6	2040	4.552	2.327	34.0	11.9725	0.0000	SURCHARGED
15 minute winter	S11-0	10	5.044	0.101	28.0	0.3411	0.0000	OK
2160 minute winter	S11-1	2040	4.552	1.534	4.0	5.8542	0.0000	SURCHARGED
2160 minute winter	S6-7	2040	4.552	2.447	26.2	7.4787	0.0000	SURCHARGED
15 minute winter	S12-0	11	5.134	0.059	10.5	0.1157	0.0000	OK
2160 minute winter	S12-1	2040	4.552	0.956	3.8	7.0404	0.0000	SURCHARGED
2160 minute winter	S7-8	2040	4.553	2.560	31.0	11.7714	0.0000	SURCHARGED
2160 minute winter	S1-6	2040	4.553	2.772	50.4	11.4683	0.0000	SURCHARGED
2160 minute winter	S13-0	2040	4.553	0.730	0.4	1.3382	0.0000	SURCHARGED
2160 minute winter	S1-7	2040	4.553	2.938	50.1	11.0348	0.0000	SURCHARGED
2160 minute winter	S14-0	2040	4.552	0.693	2.3	4.0933	0.0000	SURCHARGED
2160 minute winter	S1-8	2040	4.552	3.114	53.0	13.0346	0.0000	SURCHARGED
2160 minute winter	S1-9	2040	4.552	3.254	54.6	13.3304	0.0000	SURCHARGED
2160 minute winter	S1-10	2040	4.552	3.349	56.8	15.1454	0.0000	SURCHARGED
2160 minute winter	S1-11	2040	4.553	3.447	57.1	10.1859	0.0000	SURCHARGED
15 minute winter	S17-0	13	4.784	0.943	53.5	5.1055	0.0000	FLOOD RISK
15 minute winter	S17-1	13	4.615	1.341	82.2	4.2443	0.0000	SURCHARGED
15 minute winter	S17-2	13	4.584	1.391	88.7	4.2895	0.0000	SURCHARGED
15 minute winter	S15-0	13	4.955	1.114	50.0	5.7171	0.0000	FLOOD RISK
15 minute winter	S16-0	13	4.938	0.993	60.0	5.8992	0.0000	FLOOD RISK
15 minute winter	S15-1	13	4.737	1.826	168.7	9.0752	0.0000	SURCHARGED
2160 minute winter	S18-0	2040	4.555	2.255	0.3	2.5501	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
2160 minute winter	S9-0	S9.000	S9-1	1.0	0.290	0.025	1.1308	
2160 minute winter	S9-1	S9.001	S9-2	-2.8	0.564	-0.072	0.3736	
2160 minute winter	S9-2	S9.002	S6-6	-32.9	-0.467	-0.419	1.7974	
2160 minute winter	S6-6	S6.006	S6-7	21.7	0.791	0.045	6.7800	
15 minute winter	S11-0	S11.000	S11-1	26.9	1.586	0.400	1.5654	
2160 minute winter	S11-1	S11.001	S6-7	4.0	0.455	0.059	2.1457	
2160 minute winter	S6-7	S6.007	S7-8	25.1	0.803	0.052	6.2927	
15 minute winter	S12-0	S12.000	S12-1	10.1	0.351	0.150	2.1283	
2160 minute winter	S12-1	S12.001	S7-8	3.8	0.666	0.090	3.0197	
2160 minute winter	S7-8	S7.008	S1-6	29.5	0.759	0.061	11.9307	
2160 minute winter	S1-6	S1.006	S1-7	48.5	0.969	0.056	14.6556	
2160 minute winter	S13-0	S13.000	S1-7	0.8	0.423	0.012	0.2240	
2160 minute winter	S1-7	S1.007	S1-8	49.1	0.918	0.056	15.5697	
2160 minute winter	S14-0	S14.000	S1-8	2.3	0.791	0.034	2.2704	
2160 minute winter	S1-8	S1.008	S1-9	52.7	0.854	0.060	12.2868	
2160 minute winter	S1-9	S1.009	S1-10	54.4	0.806	0.062	8.3993	
2160 minute winter	S1-10	S1.010	S1-11	56.6	0.833	0.065	8.5322	
2160 minute winter	S1-11	S1.011	S1-12	56.9	0.670	0.065	9.8662	
15 minute winter	S17-0	S17.000	S17-1	49.2	1.367	0.731	1.3536	
15 minute winter	S17-1	S17.001	S17-2	66.6	1.504	0.464	0.3424	
15 minute winter	S17-2	S17.002	S15-2	92.0	1.835	0.640	4.2409	
15 minute winter	S15-0	S15.000	S15-1	41.6	1.118	0.619	2.2193	
15 minute winter	S16-0	S16.000	S15-1	54.3	1.718	0.807	1.3069	
15 minute winter	S15-1	S15.001	S15-2	130.3	2.031	0.907	2.6457	
2160 minute winter	S18-0	S18.000	S18-1	-0.3	-0.010	-0.006	1.4752	

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.36%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2160 minute winter	S18-1	2040	4.555	2.626	37.9	1054.9120	0.0000	SURCHARGED
2160 minute winter	S15-2	2040	4.555	2.710	38.8	12.4188	0.0000	SURCHARGED
2160 minute winter	S15-3	2040	4.554	2.880	22.5	6.5265	0.0000	SURCHARGED
2160 minute winter	S19-0	2040	4.554	0.659	0.6	1.5082	0.0000	SURCHARGED
2160 minute winter	S19-0A	2040	4.554	0.964	0.6	1.0901	0.0000	SURCHARGED
2160 minute winter	S19-1	2040	4.554	1.063	3.0	5.0293	0.0000	SURCHARGED
15 minute winter	S20-0	13	4.904	1.054	56.1	5.9274	0.0000	FLOOD RISK
15 minute winter	S20-1	12	4.695	1.479	121.5	9.2677	0.0000	SURCHARGED
2160 minute winter	S20-2	2040	4.553	1.442	9.6	8.3399	0.0000	SURCHARGED
2160 minute winter	S21-0	2040	4.552	2.152	0.3	2.4338	0.0000	SURCHARGED
2160 minute winter	S21-1	2040	4.552	2.768	29.5	807.0541	0.0000	SURCHARGED
2160 minute winter	S19-2	2040	4.553	2.960	29.9	8.2446	0.0000	SURCHARGED
2160 minute winter	S15-4	2040	4.550	3.033	37.2	6.7177	0.0000	SURCHARGED
2160 minute winter	S15-5	2040	4.555	3.081	36.8	6.6744	0.0000	SURCHARGED
2160 minute winter	S1-12	2040	4.551	3.557	60.2	18.5403	0.0000	SURCHARGED
2160 minute winter	S1-13	2040	4.554	3.617	51.9	11.7331	0.0000	SURCHARGED
2160 minute winter	S1-14	2040	4.551	3.699	51.8	10.4830	0.0000	SURCHARGED
2160 minute winter	S1-15	2040	4.551	3.871	54.6	1293.7760	0.0000	SURCHARGED
30 minute winter	S30-0	25	6.296	1.567	410.9	71.8988	0.0000	FLOOD RISK
30 minute winter	S30-1	26	5.472	1.289	297.2	1.8441	0.0000	SURCHARGED
30 minute winter	S30-2	26	5.023	1.093	295.9	1.5644	0.0000	SURCHARGED
30 minute winter	S30-3	27	4.644	0.931	295.1	1.3321	0.0000	SURCHARGED
2160 minute winter	S30-4	1980	4.539	1.072	24.1	1.5335	0.0000	SURCHARGED
2160 minute winter	S30-5	2040	4.539	1.704	24.1	2.4383	0.0000	SURCHARGED
2160 minute winter	S30-6	2040	4.544	2.333	24.0	3.3383	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
2160 minute winter	S18-1	S18.001	S15-2	-37.9	-0.953	-0.953	0.5696	
2160 minute winter	S15-2	S15.002	S15-3	-22.6	0.700	-0.160	3.7809	
2160 minute winter	S15-3	S15.003	S15-4	-21.4	0.546	-0.128	3.9197	
2160 minute winter	S19-0	S19.000	S19-0A	0.6	0.525	0.009	0.7272	
2160 minute winter	S19-0A	S19.000A	S19-1	0.6	0.271	0.009	0.2350	
2160 minute winter	S19-1	S19.001	S19-2	3.0	0.856	0.045	1.8270	
15 minute winter	S20-0	S20.000	S20-1	46.5	1.170	0.692	1.5132	
15 minute winter	S20-1	S20.001	S20-2	111.5	2.803	1.658	0.2508	
2160 minute winter	S20-2	S20.002	S19-2	9.6	1.142	0.067	1.0587	
2160 minute winter	S21-0	S21.000	S21-1	0.4	-0.011	0.006	1.4689	
2160 minute winter	S21-1	S21.001	S19-2	-29.5	-0.750	-0.439	0.4557	
2160 minute winter	S19-2	S19.002	S15-4	-15.8	0.489	-0.112	1.6584	
2160 minute winter	S15-4	S15.004	S15-5	-36.6	0.819	-0.122	1.6860	
2160 minute winter	S15-5	S15.005	S1-12	-36.3	0.690	-0.097	11.2749	
2160 minute winter	S1-12	S1.012	S1-13	51.3	0.832	0.059	5.0037	
2160 minute winter	S1-13	S1.013	S1-14	51.6	0.848	0.059	7.5247	
2160 minute winter	S1-14	S1.014	S1-15	51.6	0.960	0.059	15.1252	
2160 minute winter	S1-15	S1.015	S1-16	25.1	0.204	0.029	6.9667	
30 minute winter	S30-0	S30.000	S30-1	297.2	2.695	1.149	3.6155	
30 minute winter	S30-1	S30.001	S30-2	295.9	1.868	1.298	8.0163	
30 minute winter	S30-2	S30.002	S30-3	295.1	1.863	1.294	6.8852	
30 minute winter	S30-3	S30.003	S30-4	294.3	1.889	1.291	7.8064	
2160 minute winter	S30-4	S30.004	S30-5	24.1	1.176	0.075	10.0095	
2160 minute winter	S30-5	S30.005	S30-6	24.0	0.995	0.081	11.8730	
2160 minute winter	S30-6	S30.006	S30-7	25.9	0.873	0.113	4.2805	

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.36%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2160 minute winter	S30-7	2040	4.544	2.468	25.9	4.3617	0.0000	SURCHARGED
2160 minute winter	S30-8	2040	4.545	2.564	22.7	4.5309	0.0000	SURCHARGED
2160 minute winter	S30-9	2040	4.545	2.680	21.6	4.7347	0.0000	SURCHARGED
2160 minute winter	S30-10	2040	4.544	2.776	21.6	4.9059	0.0000	SURCHARGED
2160 minute winter	S30-11	2040	4.544	2.942	21.1	5.1987	0.0000	SURCHARGED
2160 minute winter	S30-12	2040	4.544	3.068	20.7	5.4205	0.0000	SURCHARGED
2160 minute winter	S1-16	2040	4.552	3.951	37.1	10.0554	0.0000	SURCHARGED
2160 minute winter	S1-17	2040	0.586	0.136	24.3	0.1537	0.0000	OK
2160 minute winter	S40-0	2100	3.183	0.570	1.4	1.7843	0.0000	SURCHARGED
2160 minute winter	S40-1	1920	3.184	0.739	2.9	3.4402	0.0000	SURCHARGED
2160 minute winter	S41-0	1980	3.199	1.699	2.5	98.7901	0.0000	SURCHARGED
2160 minute winter	S40-2	1980	3.200	1.903	7.5	2.1526	0.0000	SURCHARGED
2160 minute winter	S1-18	2040	0.477	0.137	24.8	0.1551	0.0000	OK
2160 minute winter	EXSMH	2040	0.375	0.127	24.8	0.0000	0.0000	OK
1440 minute winter	S42-0	1320	3.236	0.537	1.3	1.6249	0.0000	SURCHARGED
1440 minute winter	S42-1	1320	3.236	0.758	4.4	4.3712	0.0000	SURCHARGED
1440 minute winter	S42-2	1320	3.234	1.088	6.0	4.0040	0.0000	FLOOD RISK
960 minute winter	S42-3	885	3.235	1.436	10.6	6.5044	0.0000	FLOOD RISK
1440 minute winter	S42-4	1320	3.231	1.581	8.4	5.1166	0.0000	FLOOD RISK
1440 minute winter	S42-5	1320	3.232	1.648	8.2	2.3577	0.0000	FLOOD RISK
1440 minute winter	S42-6	1320	3.231	1.728	12.4	9.5475	0.0000	SURCHARGED
1440 minute winter	S42-7	1320	3.251	1.821	12.0	2.6058	0.0000	SURCHARGED
960 minute winter	S43-0	885	3.234	0.896	0.3	1.0137	0.0000	SURCHARGED
960 minute winter	S42-8	885	3.231	1.810	16.3	267.7135	0.0000	SURCHARGED
15 minute summer	EXSMH2	1	1.313	0.000	1.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
2160 minute winter	S30-7	S30.007	S30-8	22.7	0.779	0.075	3.7168	
2160 minute winter	S30-8	S30.008	S30-9	21.6	0.803	0.072	4.5405	
2160 minute winter	S30-9	S30.009	S30-10	21.6	0.844	0.072	3.7801	
2160 minute winter	S30-10	S30.010	S30-11	21.1	0.871	0.050	3.2563	
2160 minute winter	S30-11	S30.011	S30-12	20.7	0.988	0.048	2.4641	
2160 minute winter	S30-12	Orifice	S1-16	37.1				
2160 minute winter	S1-16	Hydro-Brake®	S1-17	16.7				
2160 minute winter	S1-17	S1.017	S1-18	24.3	0.964	0.611	0.4696	
2160 minute winter	S40-0	S40.006	S40-1	1.9	0.558	0.109	0.2950	
2160 minute winter	S40-1	Orifice	S40-2	7.5				
2160 minute winter	S41-0	S41.000	S40-2	-2.5	-0.062	-0.055	1.0745	
2160 minute winter	S40-2	Hydro-Brake®	S1-18	0.4				
2160 minute winter	S1-18	S1.018	EXSMH	24.8	1.022	0.623	0.3791	2748.2
1440 minute winter	S42-0	S40.000	S42-1	1.5	0.345	0.023	0.5717	
1440 minute winter	S42-1	S40.001	S42-2	4.4	0.564	0.052	3.9760	
1440 minute winter	S42-2	S40.002	S42-3	5.4	0.467	0.038	7.6448	
960 minute winter	S42-3	S40.003	S42-4	9.6	0.459	0.076	6.5434	
1440 minute winter	S42-4	S40.004	S42-5	8.2	0.398	0.051	4.1701	
1440 minute winter	S42-5	S40.004A	S42-6	8.1	0.301	0.050	5.1352	
1440 minute winter	S42-6	S40.005	S42-7	12.0	0.349	0.075	4.6311	
1440 minute winter	S42-7	S40.005A	S42-8	11.9	0.613	0.074	0.5897	
960 minute winter	S43-0	S42.000	S42-8	0.6	0.015	0.009	0.6378	
960 minute winter	S42-8	Hydro-Brake®	EXSMH2	2.4				137.5

Green Roof Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	5	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	10	Minimum Velocity (m/s)	1.00
FSR Region	Scotland and Ireland	Connection Type	Level Inverts
M5-60 (mm)	17.300	Minimum Backdrop Height (m)	0.000
Ratio-R	0.325	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)
Green Roof	0.166	30.000	33.801	63.261	0.150

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	Scotland and Ireland	Skip Steady State	x
M5-60 (mm)	17.300	Drain Down Time (mins)	240
Ratio-R	0.325	Additional Storage (m³/ha)	0.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

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

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

Node Green Roof Online Orifice Control

Flap Valve	x	Invert Level (m)	29.850	Discharge Coefficient	1.000
Replaces Downstream Link	✓	Diameter (m)	0.100		

Node Green Roof Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	29.850	Slope (1:X)	5000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.150
Safety Factor	2.0	Width (m)	80.000	Inf Depth (m)	
Porosity	0.30	Length (m)	20.700		

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.63%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
120 minute winter	Green Roof	90	29.949	0.099	24.1	47.1244	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m^3)
120 minute winter	Green Roof	Orifice	7.7	60.8

Infiltration Trench Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	5	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	10	Minimum Velocity (m/s)	1.00
FSR Region	Scotland and Ireland	Connection Type	Level Inverts
M5-60 (mm)	17.300	Minimum Backdrop Height (m)	0.000
Ratio-R	0.325	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)
Trench	0.172	24.000	33.801	63.261	1.000

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	Scotland and Ireland	Skip Steady State	x
M5-60 (mm)	17.300	Drain Down Time (mins)	240
Ratio-R	0.325	Additional Storage (m³/ha)	0.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

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

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

Node Trench Online Orifice Control

Flap Valve	x	Invert Level (m)	23.000	Discharge Coefficient	1.000
Replaces Downstream Link	✓	Diameter (m)	0.100		

Node Trench Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	1.0	Invert Level (m)	23.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	0

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	164.0	0.0	1.000	164.0	0.0	1.001	0.0	0.0

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

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	Trench	45	23.217	0.217	40.0	35.5677	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
60 minute winter	Trench	Orifice	14.2	57.7

Permeable Paving Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	5	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	10	Minimum Velocity (m/s)	1.00
FSR Region	Scotland and Ireland	Connection Type	Level Inverts
M5-60 (mm)	17.300	Minimum Backdrop Height (m)	0.000
Ratio-R	0.325	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)
Perm Pave	0.044	24.000	33.801	63.261	0.430

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	Scotland and Ireland	Skip Steady State	x
M5-60 (mm)	17.300	Drain Down Time (mins)	240
Ratio-R	0.325	Additional Storage (m³/ha)	0.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

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

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

Node Perm Pave Online Orifice Control

Flap Valve	x	Invert Level (m)	23.570	Discharge Coefficient	1.000
Replaces Downstream Link	✓	Diameter (m)	0.100		

Node Perm Pave Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	23.570	Slope (1:X)	5000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	9	Depth (m)	0.300
Safety Factor	2.0	Width (m)	21.200	Inf Depth (m)	
Porosity	0.33	Length (m)	5.100		

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

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	Perm Pave	13	23.705	0.135	19.3	4.7290	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
15 minute winter	Perm Pave	Orifice	10.1	8.9

Rain Garden Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	5	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	10	Minimum Velocity (m/s)	1.00
FSR Region	Scotland and Ireland	Connection Type	Level Inverts
M5-60 (mm)	17.300	Minimum Backdrop Height (m)	0.000
Ratio-R	0.325	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)
Rain garden	0.019	24.000	33.801	63.261	0.750

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	Scotland and Ireland	Skip Steady State	x
M5-60 (mm)	17.300	Drain Down Time (mins)	240
Ratio-R	0.325	Additional Storage (m³/ha)	0.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

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

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

Node Rain garden Online Orifice Control

Flap Valve	x	Invert Level (m)	23.250	Discharge Coefficient	1.000
Replaces Downstream Link	✓	Diameter (m)	0.100		

Node Rain garden Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	23.250
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.33	Time to half empty (mins)	0

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	10.0	0.0	0.750	10.0	0.0	0.751	0.0	0.0

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

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	Rain garden	11	23.353	0.103	8.3	0.3389	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
15 minute winter	Rain garden	Orifice	8.0	3.8

Swale Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	5	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	10	Minimum Velocity (m/s)	1.00
FSR Region	Scotland and Ireland	Connection Type	Level Inverts
M5-60 (mm)	17.300	Minimum Backdrop Height (m)	0.000
Ratio-R	0.325	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)
Swale	0.113	24.000	33.801	63.261	0.150

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	Scotland and Ireland	Skip Steady State	x
M5-60 (mm)	17.300	Drain Down Time (mins)	240
Ratio-R	0.325	Additional Storage (m³/ha)	0.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

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

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

Node Swale Online Orifice Control

Flap Valve	x	Invert Level (m)	23.850	Discharge Coefficient	1.000
Replaces Downstream Link	✓	Diameter (m)	0.150		

Node Swale Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	1.0	Invert Level (m)	23.850
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	157.0	0.0	0.150	211.0	0.0	0.151	0.0	0.0

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

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	Swale	24	23.963	0.113	39.2	20.0709	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)
30 minute winter	Swale	Orifice	14.0	30.2

Appendix E Met Eireann Rainfall Data

Met Eireann

Return Period Rainfall Depths for sliding Durations

Irish Grid: Easting: 155729, Northing: 155376,

	Interval		Years													
DURATION	6months	1year	2	3	4	5	10	20	30	50	75	100	150	200	250	500
5 mins	2.6	3.9	4.6	5.7	6.4	7.0	8.9	11.2	12.8	15.0	17.0	18.5	21.0	22.9	24.5	N/A
10 mins	3.7	5.4	6.4	7.9	8.9	9.7	12.5	15.6	17.8	20.8	23.6	25.8	29.2	31.9	34.1	N/A
15 mins	4.3	6.4	7.5	9.3	10.5	11.5	14.7	18.4	20.9	24.5	27.8	30.4	34.4	37.5	40.2	N/A
30 mins	5.6	8.1	9.5	11.5	13.0	14.1	17.8	22.1	24.9	29.0	32.6	35.5	39.9	43.4	46.2	N/A
1 hours	7.2	10.3	11.9	14.4	16.0	17.3	21.6	26.5	29.7	34.2	38.3	41.4	46.3	50.1	53.2	N/A
2 hours	9.4	13.0	14.9	17.8	19.8	21.3	26.2	31.7	35.4	40.4	44.9	48.4	53.7	57.9	61.3	N/A
3 hours	10.9	14.9	17.1	20.3	22.4	24.0	29.4	35.3	39.2	44.6	49.3	53.0	58.6	63.0	66.5	N/A
4 hours	12.1	16.5	18.8	22.2	24.4	26.2	31.8	38.1	42.1	47.8	52.7	56.5	62.4	66.9	70.5	N/A
6 hours	14.1	18.9	21.5	25.2	27.7	29.6	35.6	42.3	46.7	52.7	57.9	61.9	68.1	72.7	76.6	N/A
9 hours	16.4	21.8	24.6	28.6	31.3	33.4	39.9	47.1	51.7	58.1	63.6	67.8	74.2	79.2	83.2	N/A
12 hours	18.2	24.0	27.0	31.3	34.2	36.3	43.3	50.8	55.6	62.2	68.0	72.4	79.0	84.0	88.2	N/A
18 hours	21.2	27.6	30.9	35.6	38.7	41.0	48.4	56.5	61.6	68.6	74.6	79.2	86.2	91.4	95.8	N/A
24 hours	23.6	30.5	33.9	38.9	42.2	44.7	52.5	60.9	66.2	73.5	79.8	84.5	91.7	97.1	101.5	116.5
2 days	30.1	37.8	41.7	47.1	50.6	53.2	61.4	70.1	75.5	82.9	89.1	93.8	100.9	106.2	110.5	124.9
3 days	35.8	44.3	48.4	54.2	58.0	60.8	69.4	78.4	84.1	91.6	98.0	102.8	110.0	115.3	119.6	134.1
4 days	41.1	50.2	54.6	60.8	64.7	67.6	76.7	86.1	91.9	99.7	106.3	111.2	118.5	123.9	128.3	142.9
6 days	50.8	61.0	65.9	72.7	77.0	80.2	90.0	100.1	106.3	114.5	121.5	126.6	134.2	139.8	144.3	159.3
8 days	59.8	71.0	76.3	83.7	88.3	91.8	102.2	112.9	119.5	128.1	135.3	140.7	148.5	154.4	159.0	174.4
10 days	68.4	80.5	86.2	94.1	99.0	102.7	113.7	124.9	131.8	140.8	148.3	153.8	162.0	168.0	172.8	188.6
12 days	76.8	89.6	95.7	104.0	109.2	113.1	124.7	136.4	143.5	152.9	160.6	166.3	174.7	180.9	185.9	202.1
16 days	92.9	107.2	113.9	123.1	128.7	132.9	145.5	158.1	165.7	175.6	183.9	189.9	198.7	205.2	210.4	227.3
20 days	108.6	124.2	131.4	141.3	147.4	151.8	165.2	178.6	186.6	197.1	205.8	212.1	221.3	228.1	233.5	251.0
25 days	127.7	144.8	152.6	163.3	169.8	174.6	188.9	203.2	211.7	222.8	231.9	238.5	248.2	255.2	260.9	279.1

NOTES:

N/A Data not available

These values are derived from a Depth Duration Frequency (DDF) Model

For details refer to:

'Fitzgerald D. L. (2007), Estimates of Point Rainfall Frequencies, Technical Note No. 61, Met Eireann, Dublin',
Available for download at www.met.ie/climate/dataproducts/Estimation-of-Point-Rainfall-Frequencies_TN61.pdf

M5-60 = 17.3 Ratio R = 0.325

Appendix F Maintenance Plan

Maintenance Plan and Maintenance Schedule:

Item	Inspection Frequency	Inspection Type	Cleaning Mechanism	Cleaning Frequency
Road Gullies	Quarterly or after major storm event	Visual	Remove silt and solids by hand	Minimum every 2 years
Storm Water Manholes	Quarterly or after major storm event	Visual	Open manhole cover. Remove any debris.	Minimum every 2 years
Bypass Interceptor	Every 6 months or in the event of a spill	Visual	Petrol Interceptor to be emptied.	Yearly
Hydrobrake	The aperture is to be checked for obstructions quarterly or after major storm events.	Visual	Remove silt and solids by hand	Yearly
Foul Water Manholes	Bi-monthly	Visual	Open manhole cover. Remove any debris.	Minimum every 2 years
Green Roof	Every 6 months	Visual	Inspect all components including soil substrate, vegetation, drains, irrigation systems (if applicable), membranes, and roof structure for proper operation, integrity of waterproofing and structural stability.	Yearly
Tree Pit System	Every 6 months	Visual	Pruning and trimming trees/litter/debris removal	As required
Permeable Paving	Every 3 months	Visual	Brushing and vacuuming	Yearly
Infiltration Trenches	Every 6 months	Visual	Grass cutting	Monthly during growing season
Swales	Every 6 months	Visual	Grass cutting	Monthly during growing season
Rain Gardens	Every 3 months	Visual	Remove sediment, debris and weeds	Quarterly
Attenuation tanks	To be checked for debris or silt quarterly or after major storm event	Visual	Open inlet and outlet manhole cover. Remove any debris	Yearly

Appendix G Attenuation Tank Details

CI/SfB | (29) | |

IRISH AGRÉMENT BOARD
CERTIFICATE NO. 18/0401

Alderburgh Ltd,
Solution House, Dane Street
Rochdale, OL11 4EZ
Tel: +44(0)1706 374416 Fax: 01706376785
Email: info@alderburgh.com

Pluvial Cube Attenuation and Infiltration Systems

Stürmen Sie Wasser Leitung System

NSAI Agrément (Irish Agrément Board) is designated by Government to carry out European Technical Approvals.

NSAI Agrément Certificates establish proof that the certified products are **'proper materials'** suitable for their intended use under Irish site conditions and in accordance with the **Building Regulations 1997 to 2017.**

PRODUCT DESCRIPTION:
This Certificate relates to the Pluvial Cube attenuation and infiltration system which comprises of modular polypropylene units which, in conjunction with a satisfactory civil engineering design, will act as either an attenuation or infiltration vessel as part of a sustainable drainage system.

The Pluvial Cube system consists of modular polypropylene units, low flow maintenance and self-cleaning channels.

USE:
The product is used as a subsurface stormwater management system, used for sub-surface water storage or as a soakaway to manage rain water run-off from impermeable surfaces. Subject to site conditions and restraints, the Pluvial Cube system modules can be built up to create the volumetric capacity required for

- Attenuation system
- Infiltration system.
- Or a combined attenuation/infiltration system.

MANUFACTURE AND MARKETING:
The product is manufactured and marketed by:

Alderburgh Ltd.
Solution House,
Dane Street,
Rochdale,
OL11 4EZ.
Tel: +44(0)1706 374416 Fax: 01706376785
Email:info@alderburgh.com

1.1 ASSESSMENT
In the opinion of NSAI Agrément, the Pluvial Cube system, if used in accordance with this Certificate, meets the requirements of the Building Regulations 1997 - 2017 as indicated in Section 1.2 of this Certificate.

1.2 BUILDING REGULATIONS 1997 to 2017

REQUIREMENT:

Part A – Structure
A1 - The Pluvial Cube system, as certified in this Certificate, can be designed to ensure that the combined dead and imposed loads are sustained and transmitted to the ground in compliance with CIRIA C737 *Structural and geotechnical design of modular geocellular drainage systems*.

Part D - Materials & Workmanship
D3 – The Pluvial Cube system, as certified in this Certificate, is comprised of proper materials fit for their intended use (See Part 4 of this Certificate).

D1 – The Pluvial Cube system, as certified in this Certificate, meets the requirements of the building regulations for workmanship.

Part H – Drainage and waste water disposal.
H1 - The Pluvial Cube system, as certified in this Certificate, meets the requirements of the building regulations for the adequate disposal of surface water from the building.

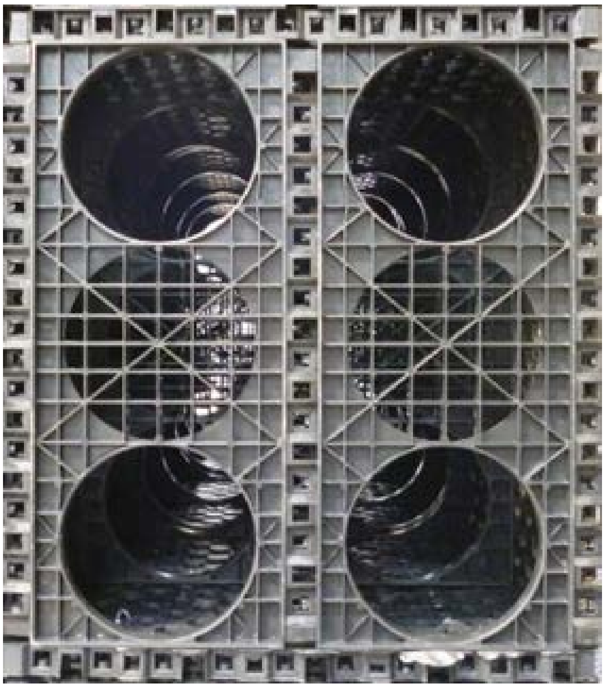
Part Two / Technical Specification and Control Data

2

2.1 Production Description

This Certificate relates to the Pluvial Cube system a subsurface Stormwater Management System. The modular units are manufactured from black polypropylene. The units are assembled on either a permeable geotextile when used for infiltration or on an impermeable geomembrane when used for attenuation.

The units, which have a high void ratio, are assembled to form an underground structure which can be used for storage of surface water or as a soakaway to form part of a sub-surface water management system.



500(L) x 500(W) x 550(D)
Figure 1 - Pluvial Module

The Pluvial Cube module incorporates six 160mm diameter opes in one orientation, four of which are open, and these extend through the module. These opes can accommodate semi-circular distribution pipes or linear access channels. These channels can assist the passage of silt through the system during period of low flow.

Larger diameter distribution pipes up to 360 mm can be accommodate in the perpendicular orientation by forming openings through the side and central walls of the Pluvial Cube module. Larger opening are not suitable for semi-circular pipes but can accommodate perforated circular pipes which can fully support the modified Pluvial Cube module. When it is necessary to accommodate a larger opening than the preformed 160mm diameter opening, guidance from the certificate holder must be followed.

160mm Ø Open Channel
Figure 2 - Pluvial Cube Module

This certificate does not cover collection or disposal of the surface water. Information relating to this matter can be obtained from the Certificate holder. The Pluvial Cube system is suitable for use as an integral part of an overall surface water drainage scheme and can perform the function of either an attenuation tank or and infiltration/soakaway or a combination of both.

2.1.1 Ancillary Items

The Pluvial Cube units are installed with the aid of several ancillary items as outlined hereunder [(§)]

- Geotextiles
- Geomembranes - Impermeable Membrane
- Pipe distribution network
- Inlet manhole
- Outlet Manhole
- Hydrobrake flow control device
- Vent pipes
- Fittings/adaptors
- Petrol/oil interceptor

2.2 Manufacture

The units are manufactured from recycled polypropylene by an injection moulding process.

[§] Outside the scope of this Certificate.

Pluvial Cube Module Dimensions (mm) (l x w x h)	Module Configuration	Units per m³	Module Volume (m³)
500 x 500 x 550	Single	7.27	0.1375
500 x 500 x 1075	Double	3.72	0.2688
500 x 500 x 1600	Triple	2.5	0.4

Table 1 - Physical properties

Product Data	Pluvial Cube Module		Units
	Vertical	Lateral	
Compressive Strength	400	225	kN/m^2
Creep Rupture Test	317	201	kN/m^2
Design strength	176	110	kN/m^2
Average Weight - single module	8		kg
Void Ratio	96		%
Surface Void Ratio	Greater than 90		%
Minimum Backfill Cover#	450		mm
Maximum Backfill Cover	7500		mm
#Any cover less than 450 mm - contact ESS design department			

Table 2 - Product Data

Certified raw materials are supplied to the manufacturer to an agreed specification. The manufacturer carries out quality control checks on incoming raw materials, before manufacture of the Pluvial Cube modules commence.

As part of the assessment process an audit of the manufacturing process was carried out by NSAI. The manufactures quality control procedures and product testing was assessed along with product traceability and satisfactory controls were in place at the time of the audit to meet these requirements.

The manufacturer demonstrated that satisfactory processes were in place to manage nonconformities and complains should they arise.

The manufacturers testing laboratory was inspected and the equipment used to carry out quality control checks on the manufactured product were found to be properly tested, calibrated and operated by trained personnel.

The manufacture has undertaken to carry out the above measures on a regular basis through a surveillance process, to verify that the specifications and quality control operated by the manufacturer are being maintained.

The management system of Alderburgh has been assessed and registered as meeting the requirements of EN ISO 9001 and ISO 14001.

2.3 Delivery, Storage and Marking

The system is supplied to site on pallets, secured with shrink wrap and banding to enable placing and movement by a forklift truck. Each pallet contains a label bearing the Pluvial Cube type, date of manufacture, operator's name, pallet no., and quality control check.

Labels are attached to pallets which display the NSAI Agrément Logo and Certificate number.

The polypropylene chambers are sensitive to UV radiation and as a result exposure to sunlight for prolonged periods must be avoided.

Individual chambers may be carried by one person; normal manual handling precautions should be taken. The mass of one unit/module is given in Table 2.

2.4 Installation

2.4.1 General

Prior to commencing site installation, a full site investigation and design as outlined in section 3.0 of this certificate must be completed by a Chartered Engineer or suitable qualified person.

Once a location has been specified and invert levels checked, the entire area should be checked for buried cables and utilities. Designers and/or project managers' design stage (PMDS), as part of their assessment of Health and Safety, must consider all aspects of the site installation.

Designers should consider the following non-exhaustive Health and Safety issues

- access for plant such as excavators
- embankment angle of excavations
- installation of temporary works if necessary for deep excavations.
- reducing local water table levels if necessary
- floatation concerns both during and post installation

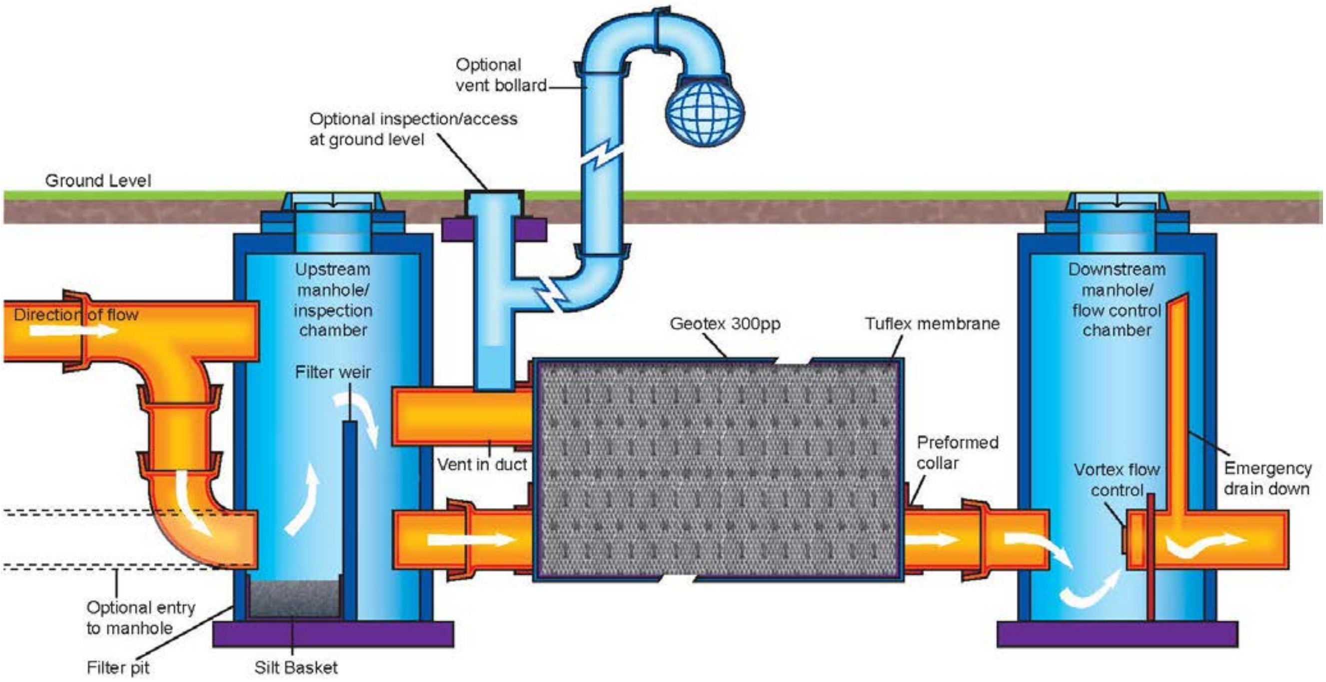


Figure 3 - Typical layout

2.4.2 Installation Procedure

A trench is excavated to the required depth, dimensions and formation levels. The plan area should be sufficient to allow compaction plant access around the sides of the excavation to place and compact backfill material. The base must be smooth and level without sharp drops or humps. Slopes must be cut to a safe angle or adequately supported and safe access must be provided to allow personnel to enter the excavation.

The formation level must be inspected for soft spots and if present, soft spots are excavated out and replaced with compacted granular fill material.

In general, a California bearing ratio (CBR) of 5% is required at formation level for trafficked areas and 3% for green areas.

A 100mm thick, blinding layer of graded stone, sand or quarry dust is laid on the compacted base of the excavation.

The geotextile (and geomembrane, if an attenuation system) is laid over the blinding layer and up the sides of the excavation. When using a geomembrane, it must always be protected by a layer of geotextile. The geomembrane is inspected for damage and all welds are tested as required. Joints between adjacent sheets of impermeable membranes should be sealed correctly using proprietary welding techniques with a minimum lap of 120mm. Outer protective geotextiles must have a minimum overlap of 150mm.

The Pluvial Cube units are installed in the orientation outline on the site-specific design drawings.

Drainage connections are made to the installation using proprietary adaptors. It is recommended by the certificate holder that all connections and air vent installations, in attenuation applications, are made with a flange adaptor, using thermal welding, adhesive cement or double-sided tape to form a seal.

Once the modular units are placed they are then wrapped with the geotextile filter fabric or geomembrane, which is brought up around the sides and lapped over the top of the structure.

The Main Contractor is to indicate outside pipe diameters and the position of all inlet and outlet pipes. Generally, pipes need to be no larger than 450 mm while using a 550 mm deep modular unit (contact manufacturer for information while using other types of modular units). Also, pipes should be positioned at 90° to the structure.

The installation is backfilled with 100mm of Type B material (Gas permeable unbound granular fill) as defined in SR21 Guidance on the use of I.S. EN 13242:2007+A1:2007, or similarly approved specification. The backfill is compacted in 150mm layers and should be free from partials exceeding 40mm in diameter.

3.1 Design General
The Pluvial Cube Stormwater Management System must be designed in accordance with the Certificate holder's instructions. Guidance on the application of sustainable drainage systems (SUDS) for new developments can be found in the TII publication DN-DNG03072 *Design of Soakaways* and the 2015 SUDS Manual C753 published by the Construction Industry Research and Information Association (CIRIA).

3.2 Design options
The system can be used for the control of run-off from impermeable surfaces in three main ways:

- **Infiltration** — water is collected in the units during rainfall and allowed to drain away by soaking into the surrounding ground over a period of time

- **Attenuation** — water is collected in the units during rainfall and released at a reduced flow rate through a flow control device into an appropriate outfall. This reduces peak flows in the watercourse, thereby minimising the risk of flooding

- **Combined** — a combination of the above two systems.

3.3 Site Investigation
Design of the appropriate system for a specific project must always be preceded by a detailed audit of the proposed site to establish:

- Existing factors and considerations applicable to the site

- Predicted factors relating to the site's use following the planned development, and the parameters within which the installation will be required to function

- The type of function of application suggested by this audit.

3.4 Drainage system selection
The following non- exhaustive list of factors must to be considered in any systems design and these factors will influence the final design solution.

- The area to be drained
- The area available to accommodate the Pluvial Cube Stormwater Management System
- Proximity of adjoining buildings must be > 5m
- Site levels
- Elevation of downstream drainage systems
- The rainfall intensity
- Provision of upstream silt traps
- Site topography and stability
- Existing water table
- Seasonal groundwater levels
- Soil properties, e.g. CBR value, stiffness, infiltration potential, etc.
- Future upstream developments from drainage basin if required.

3.5 Drainage system design.
Once the project criteria have been established from the site audit, there are two main parts to the design procedure: hydraulic design (Clause 3.6) and structural design (Clause 3.12).

The design selection flow chart in Figure 4 can be followed to establish the optimum stormwater management design solution.

3.6 Hydraulic Design
3.6.1 Infiltration
There are two approaches, either of which may be adopted:
- the Construction Industry Research and Information Association (CIRIA) Report 156 *Infiltration Drainage — Manual of Good Practice*
- BRE Digest 365, Soakaway design

Further information on the design of Sustainable Drainage Systems (SuDS) may be obtained from CIRIA Report C753 which is the SuDS Manual 2015.

3.6.2 Simplified Infiltration Design
A simplified approximate approach can be used on a small site (i.e. a single-house development), where detailed site infiltration rate information may not be required nor available (see Table 3). A storage volume equal to the area to be drained multiplied by 10 mm, for areas up to 25 m^2 is allowed.

Beyond this size, design should be carried out in accordance with I.S. EN 752:2017 or BRE Digest 365. It is suggested in I.S. EN 752:2017 that a storage volume equal to 20 mm multiplied by the area to be drained may be used.

The method shown above for areas up to 25 m^2 has been used to calculate the Soakaway storage volumes below in Table 3.

Simplified soakaway design for single-house development [(1)]		
Number of units	Storage volume (m^3)	Maximum area to be drained (m^2)
1	0.132	13.2[(2)]
2	0.258	25.0[(2)]
4	0.547	28.5[(3)]
6	0.768	40.0[(3)]

(1) When doubt exists over suitability of ground for infiltration permeability, figures should be derived by test (see BRE Digest 365).
(2) In accordance with TGD Part H.
(3) In accordance with I.S. EN 752:2017

Table 3

Data for use in hydraulic design - one-unit wide trench configuration			
Number of units high	System volume (m^3)	Vertical surface area around sides and ends of tank (m^2)	Surface area beneath base of tank (m^2)
1	0.132	1.1	0.25
2	0.258	2.15	0.25

Table 4

Data for use in hydraulic design - Three-dimensional system, two units high									
System length (Two units long) (1 m side)	2 units long x 2 units wide x 2 units high (1m x 1m x 1.075m)			4 units long x 2 units wide x 2 units high (2m x 1m x 1.075m)			8 units long & 2 units wide x 2 units high (4m x 1m x 1.075)		
	Volume (m^3)	Side area (m^2)	Base area (m^2)	Volume (m^3)	Side (m^2)	Base (m^2)	Volume (m^3)	Side (m^2)	Base (m^2)
1	1.075	1.075	1.0	2.15	6.45	2.0	4.30	10.75	4.0
2	2.15	6.45	2.0	4.30	8.6	4.0	8.60	12.90	8.0
4	4.30	10.75	4.0	8.60	12.9	8.0	17.2	17.20	16.0
8	8.6	19.35	8.0	17.2	21.5	16.0	34.4	25.80	32.0
10	10.75	23.65	10.0	21.5	25.8	20.0	43.0	30.10	40.0
100	107.5	217.15	100.0	215.0	219.3	200.0	430.0	223.6	400.0

Table 5

3.6.3 Detailed Infiltration Design
When the BRE 365 or CIRIA 156 approach is used, the design volumes and areas for trench or cuboid type installations can be found in Table 4 and Table 5 of this certificate.

For calculations, the size and volume of the units are given in Table 1. The total areas of the base and sides are required as water is absorbed through the geotextile soil interface. Storage volume is 96% of the total volume.

As an example, using Table 5, for a typical system 1 m wide (two units) linear trench 10 m long and two units high, the volume is 1.075m x 1m x 10m = 10.75 m^3 and the side area 1.075m x (10m x 2 + 1m x 2) = 23.65 m^2.

3.6.4 Attenuation Calculation principles
The anticipated total run-off volume from the site is estimated. The most commonly-used method for evaluating storm rainfall events is the Wallingford Procedure by which the total rainfall level of storms over defined time periods ranging from five minutes up to 48 hours is assessed. The allowable discharge rate from the site to an appropriate outfall is established, which will normally be set by the Environment Agency or Planning Authorities. The volume to be stored underground in the system is then determined and the number of units needed to contain this volume is calculated on the basis that the storage volume is equal to 96% of the total volume of the system.

In some situations when looking at a 1 in 100-year return period designers can be asked to increase storage capacity by 20% to allow for climate change.

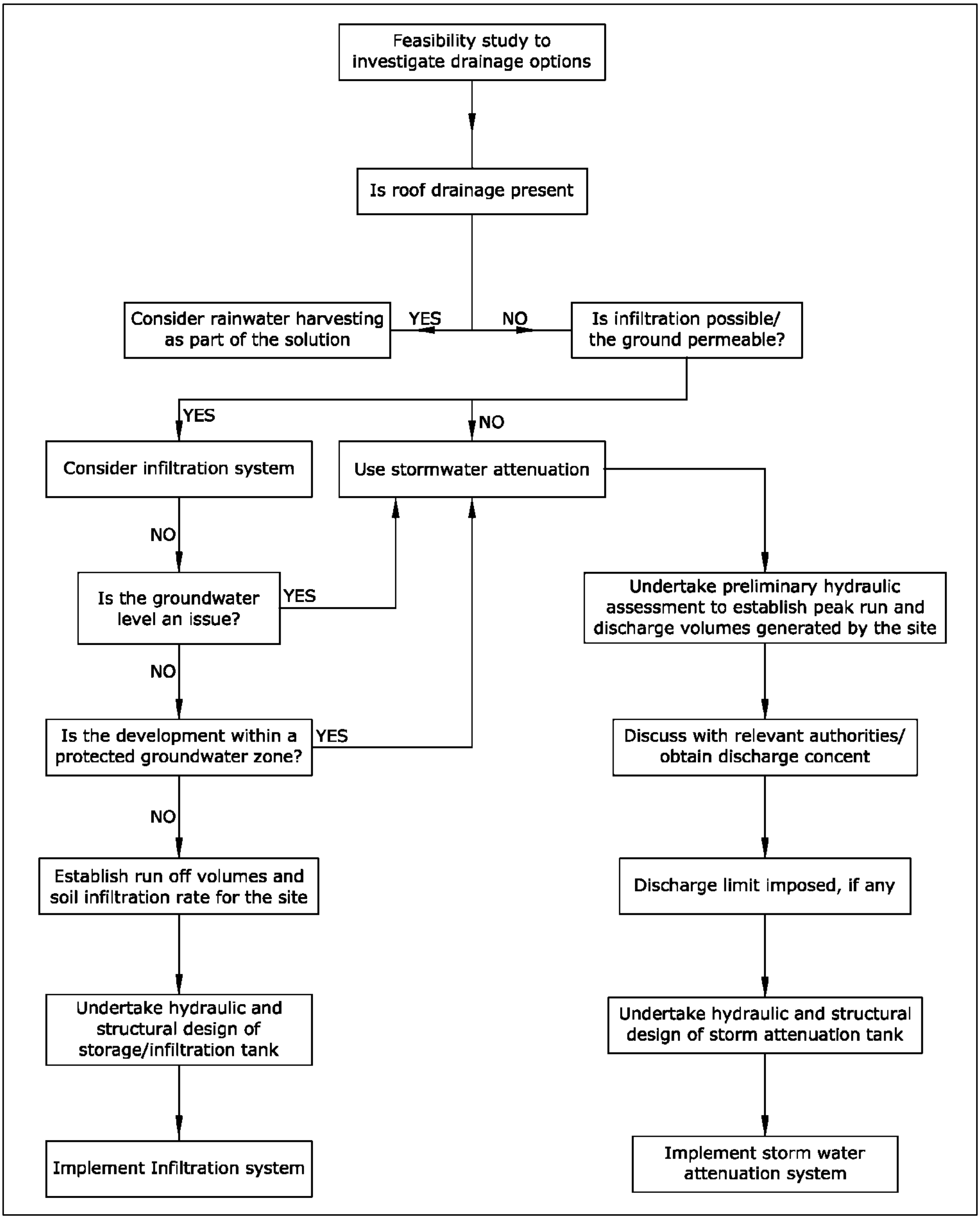


Figure 4 - Design flow chart

Maximum installation depths (m) (to base of system)					
Typical soil type	Soil weight (kN/m³)	Angle of internal friction	Maximum installation depth (from base) (m)		
			Small Domestic gardens/Landscaped areas (adjacent to drives or roads)	Car Park Without barriers Traffic (LM3)	HGV Parks Traffic (LM1)
Over consolidated stiff clay	20	24°	5.5	5.25	5.00
Silty sandy clay	19	26°	6.0	5.75	5.50
Loose sand and gravel	18	30°	6.5	6.25	6.00
Medium-dense sand and gravel	19	35°	7.0	6.75	6.50
Dense sand and gravel	20	38°	7.5	7.25	7.00

(1) Trafficked areas vehicles up to gross vehicle weight (GVW), defined in CIRIA C737, Load models LS, LM3 and LM1.
(2) Non-trafficked areas taken as small gardens or landscaped areas where no vehicles are used, defined in CIRIA C737, Table 5.6.
(3) Depth to invert with high groundwater is depending on the groundwater level
(4) Soil Unit weights Table 5.4/ Angle of Friction Table 5.5 CIRIA C737

Table 6

Minimum cover depths over Pluvial Cube				
Live load conditions	Landscaped area(1)	Trafficked		
		Small domestic gardens/Landscaped areas (adjacent to drives or roads)	Car Park Without barriers Traffic (LM3)	HGV Parks Traffic (LM1)
Minimum cover depth 450 over system to prevent accidental damage (mm)	450	600	600	900

(1) Landscaped areas taken as small gardens or landscaped areas where no vehicles are used, defined in CIRIA C737, Table 5.6.
(2) Trafficked (Car Parks) Loading Model LM3 defined in CIRIA C737, Table 5.6.
(3) Trafficked (HGV Parks and Loading Bays) Loading Model LM1 defined in CIRIA C737, Table 5.6.
Notes:
- Assumes angle of friction of the surrounding soil of 35° and a soil weight of 20 kN/m³.
- The load spread through asphaltic surfaces (for trafficked areas) is assumed to be 26.5°.
- The load spread through landscaped areas is assumed to be 26.5°.
- Ground surface is horizontal.
- Shear planes or other weaknesses are not present within the structure of the soil.
- Calculations based on there being no groundwater present.
- Accidental loading is not considered.
- Partial load and material factors shall be as defined in Table 5.9.

Table 7

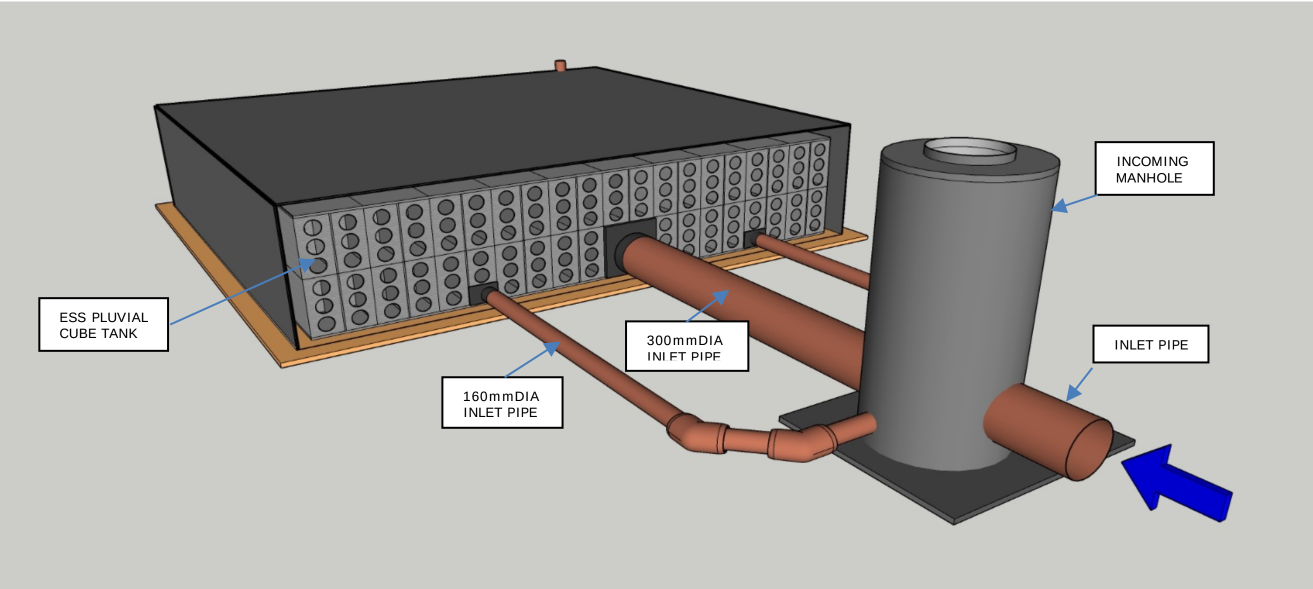


Figure 5 - Typical manifold design

3.7 Outlet Connections

The outlet of detention systems should incorporate a flow control device. The flow control device and the connecting pipe work are not covered by the scope of this Certificate. It is recommended that all connections out of storage applications (using a geomembrane) are made using a flange adaptor. Adhesive cement or double-sided tape should be used between the geomembrane and flange adaptor to ensure a watertight seal.

3.8 Inlet Connections

Any inlets, etc., should be installed flush (i.e. 'butted up') to the tank and are to be surrounded in concrete to the specification of the engineer. The geotextile filter fabric shall be cut to enable hydraulic continuity at the inlet and outlets and secured around the pipe using a suitable coupling prior to the application or the concrete surround to ensure a secure seal. A similar procedure shall occur in respect to the venting pipes.

Tank requires ventilation units to ensure proper hydraulic performance. Number of vent pipes depends on the size of the tank (contact manufacturer for details). Vents are often installed using a 90° elbow etc. with PVC pipe into soft landscape area with 'u' bend or venting bollard to inhibit the ingress of debris, etc., and secure using suitable solvent bonded or mechanical couplings. Alternatively, a ground level ventilated concrete/steel cover can be fixed to suit.

3.9 Manifold design and silt control system

The units are manufactured to allow a connection to be formed by insertion of 160 to 360 mm diameter pipes into the knock-out section incorporated in each cell. The capacity of a 160mm pipe is limited and may be insufficient for the anticipated design flow. The flow may be split amongst a number of 160 to 360 mm pipes connected to a manifold to provide increased hydraulic capacity. To control the build-up of sediment, the Pluvial Cube system incorporates self-cleaning low flow channels. These are usually located at inlet/outlet pipes locations that receive sediments in storm water and are configured with an upstream manhole and pipe access for inspection and removal of sediments, it is also possible to enclose the inlet/outlet channel in a filter fabric (Geotex 225 FF which removes the passage of TSS to 40 micron) to catch sediments in this channel only allowing clean water to enter the rest of the tank. The system designer should ensure the pipework connecting the Pluvial Cube units to the drainage system has sufficient capacity to cope with the design flow.

3.10 Flow control

The outflow from the system must be controlled to comply with the discharge rate consent of the site. The main methods to achieve outflow control are: orifice plate, vortex control or small pipe. Comparative features and benefits of these various control flow devices should be considered prior to selection.

3.11 Outflow and head calculations

The invert level of the outflow pipe should be flush with the bottom of the lowest unit to allow the system to drain. As the system fills, a depth of water develops on the upstream side of the outflow control. For a system with two layers of units, this depth is 1.075 m when the units are full, creating a driving head to push the flow through the control device. For design purposes, the head used in calculations is taken as that at the invert line of the outflow device.

3.12 Structural Performance

3.12.1 General

The system may be placed under a wide variety of landscaped or trafficked areas and must be designed to carry all loads that will be applied, including dead and imposed loads.

The certificate holder provides a site specific structural design for each project which follows the design methodology outlined in CIRIA C737 *Structural and geotechnical design of modular geocellular drainage systems.* As part of that design, a site investigation report will form an integral part of the structural design.

When used for infiltration below trafficked areas and close to structures. It is important to ensure that the infiltrating water will not soften the soils or cause loss of fines and settlement.

In addition to dead and live loads, designers must consider flotation due to high surrounding water tables in times when the tank is empty. When flotation is likely to occur, sufficient overburden should be provided.

3.12.2 Structural Design Inputs

The certificate holder will carry out a structural design to comply with CIRIA C737. Prior to commencing the structural design, a geotechnical site investigation will be carried out to acquire information on the site history, the site geology and the ground and groundwater conditions likely to be encountered at the site.

As part of the design process, the certificate holder uses the "*Design and construction classification and check proforma*" from Annex A1 of CIRIA C737. The principle aim of the scoring system is to identify projects with high intrinsic complexity and/or where the consequences of failure are severe.

3.12.3 Design strength of units

The design strength of the Pluvial Cube is the characteristic strength modified by the appropriate material partial factor.

$$P_d = {}^{P_{ck}}/_{\gamma_m}$$

Where:
P_d = design strength
P_{ck} = characteristic strength (at design life)
γ_m = material partial factor

The characteristic strength is derived from load test data. The material partial factor needs to take account of a wide range of factors including:

1. Manufacturing process, and geocellular unit variability.
2. Extrapolation of test data, between test durations and design life and other selected key design periods.
3. Differences between strengths mobilised under different loading scenarios (e.g. laboratory compared with buried units).
4. Susceptibility to damage during construction, in particular how the units are backfilled, including compaction pressures.
5. The global behaviour of the units, especially when multiple units are stacked together.
6. Environmental effects, exposure to chemicals, UV light, extreme temperatures etc.

The characteristic strength of the Pluvial Cube units has been derived from a combination of compressive load tests and creep rupture tests as described in CIRIA C737. The derivation of unit strength given in CIRIA C737 allows the designer to extrapolate a characteristic design strength for a specified design life (50 years) based on a series of creep rupture test data results.

The design strength and calculated characteristic strength for the 50-year design life are given in Table 8.

Design Strength of Pluvial Cube		
	Vertical loading kN/m^2	Lateral loading kN/m^2
Characteristic strength (P_{ck})	317	201
Design strength (P_d)	176	110
§ A material partial factor (γ_m) of 1.8 has been applied based on - Factory production: with independent audited - Extrapolation of 5000 hr creep rupture test data to 50-year value - Only laboratory test data - Only laboratory data on single units - Allowance for Damage during construction		

Table 8

Load factors for ultimate and serviceability limit state checks (γ_{LF})				
Persistent and transient design situations	Permanent actions		Variable action (unfavourable)[1]	Accidental action
	Unfavourable	Favourable		
ULS				
Vertical loads	1.35	1.0	1.5	1.0
Lateral loads – Combination 1 in EC7[2]	1.35	1.0	1.5	1.0
Lateral loads – Combination 2 in EC7[2]	1.0	1.0	1.3	1.0
Uplift	1.0	0.95	1.5	1.0
SLS				
All loads	1.0	1.0	1.0	N/A

Notes
Any variable favourable loads should be taken as zero, i.e. partial factor applied = 0.
Combination 2 in EC7 is an assessment of overall stability in the ground and should only be considered when assessing overall slope stability or overall stability of the units (i.e. overturning). Combination 1 in EC7 should be used to check the ability of the units to withstand the applied lateral loads.

- Persistent design situations = permanent works.
- Transient design situations = temporary works.
- Permanent actions = dead loads, such as earth pressure, weight of overburden above unit.
- Variable action = live loads, such as car or HGV loads.
- Unfavourable = destabilising. Favourable = stabilising.
- ULS = stability or collapse checks.
- SLS = checks against excessive deformation, settlement etc.
- Partial factors on loads are multipliers.

Table 9

Cover to geocellular unit (m)	Dynamic load factor
0.5	1.25
1.0	1.2
1.5	1.1
2.0	1.0

Table 10

3.12.4 Derivation of design loads

The characteristic loads are an estimate of the load to be placed on a structure during its design life. The characteristic loads derived for the permanent and temporary works need to be factored to allow for possible variations, in order to calculate the design loads, (Q_d), in accordance with CIRIA C737 Equation 5.12:

Design Loads, $Q_d = \sum(Q_{ck} \times \gamma_{LF} \times \gamma_{df} \times \gamma_{sf})$

Where:
Q_{ck} = characteristic loads
γ_{LF} = load factor
γ_{df} = dynamic factor
γ_{sf} = site factor

The partial load factors given in Eurocode 0 (EC0) and EC7 are summarised in table 5.9 of CIRIA C737 and Table 9 above.

Dynamic factors are outlined in table 5.10 of CIRIA C737 and Table 10 above, and Table 5.11 of CIRIA C737 summarises the site importance factors.

The load and site importance factors are applied to characteristic permanent and variable loads (actions).

The dynamic factors are applied to variable loads (actions) generated by road traffic, for any situation (including accidental load cases) where the geocellular units are within the zone of influence outlined in Clause 3.4 of CIRIA C737.

3.12.5 Zone of influence

The zone of influence is defined in Clause 3.4 of CIRIA C737 and takes account for proximity of adjacent structures and slopes, embankments or soil heaps/stockpiles and retaining walls. It should be noted that an installation does not have to be directly beneath a particular loaded surface or area such as a road or railway for the imposed loading to affect the design.

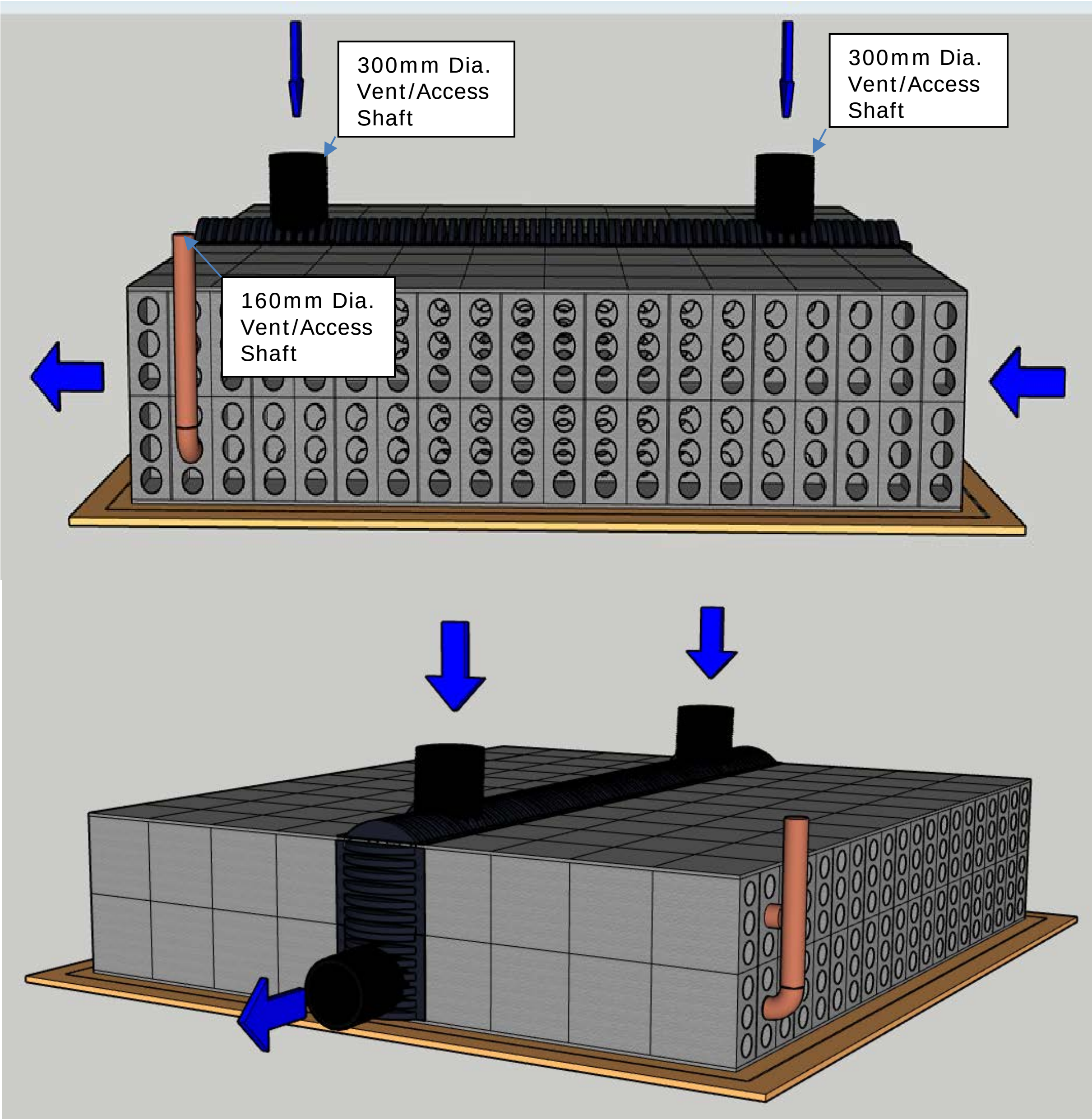


Figure 6 - Typical venting details

3.13 Venting

Adequate venting must be provided to the structure using an air vent. One 160 mm diameter air vent is required per 7500m^2 of impermeable catchment area to be drained or for each 200m^3 of storage volume. At the location where the vent pipe penetrates the impermeable membrane, it is recommended that integrity of the membrane is restored after installation of the vent pipe. This can be achieved using a welded flange adaptor, double-sided adhesive tape or adhesive cement/solvent welding.

3.14 Resistance to Chemicals

An assessment indicates that the components of the system are suitable for use in contact with the chemicals likely to be found in rainwater.

An assessment of the suitability for use of Pluvial Cube units on brownfield sites should be made only after a suitable site investigation to determine the possibility for chemical attack. Care must be taken where acids and organic solvents are present at high concentrations. Further information can be obtained from the Certificate holder.

3.15 Maintenance

The customer is responsible for maintenance. Recommendations for maintenance of SUDS systems are given in CIRIA C697.

3.15.1 For soakaways to individual houses, the only necessary maintenance is to keep gullies clear of debris such as leaves.

3.15.2 For large installations or where the receiving waters are environmentally sensitive, a system of regular inspections should be established to prevent the accumulation of silt in the system which, if allowed to develop, would reduce effectiveness. They should also be inspected after every major storm event.

3.15.3 It is recommended that a silt trap is incorporated into the pipework at the inlet to the tank. There must be a maintenance plan that ensures regular cleaning of the trap to ensure correct performance. Silt traps for use with this system are outside the scope of this Certificate.

3.15.4 For all flow control devices, it is sensible to incorporate access (via a manhole or similar) to the location of the pipe entry, orifice or vortex control. This will enable easy removal of any blockage. The orifice itself may be protected by a debris screen.

3.15.5 Paved surface areas above an installation should be inspected at the same time to ensure the units continue to provide the required structural support.

3.15.6 The open design of the Pluvial Cube module allows inspection of the inside of the structure provided adequate access is available. Each module has a preformed socket from 160 mm up to 360 mm to provide an inspection channel. One inspection channel for each Inlet/outlet row is recommended.

3.16 Durability

The polypropylene used to manufacture the module units will not deteriorate significantly over the life of the structure and will remain chemically stable under exposure to contaminants normally found in a storm-water environment and will not be susceptible to environmental stress cracking.

In common with all thermoplastic structures, the module units will creep with time. This is taken into account in long-term design by the use of a 50-year modulus for the material to allow for accumulated strain under a dead load. The system when used and installed in accordance with this Certificate will have a life in excess of 50 years.

3.17 Installation

The Subsurface Stormwater Management System should be installed in accordance with the Certificate holder's installation instructions.

Installations are generally carried out by the certificate holders approved contractors under their supervision.

Part Four / Technical Investigations 4

4.1 Tests

Tests were carried out on the system to determine:

- short-term resistance to vertical and horizontal loading
- long-term resistance to vertical and horizontal loading
- Volumetric capacity.

4.2 Investigations

The manufacturing process was examined including the method adopted for quality control, and details obtained on the quality and composition of the material used.

An assessment of the system was made in relation to:

- Material properties
- Design procedures.

Site visit was made to assess the practicability and ease of installation and connection.

4.3 Bibliography

- CIRIA Report C737 Structural design of modular geocellular drainage tanks
- BRE Digest 365 Soakaway Design.
- BS 6031:2009 Code of practice for earthworks
- I.S. EN 752:2017 Drain and sewer systems outside buildings - Sewer system management
- I.S. EN 1401-1:2009 Plastics piping systems for non-pressure underground drainage and sewerage. Unplasticized poly(vinylchloride) (PVC-U) — Specifications for pipes, fittings and the system
- I.S. EN ISO 9001:2000 Quality management systems — Requirements

- CIRIA Report 156 Infiltration drainage — Manual of good practice
- CIRIA Report C753 The SuDS Manual 2015
- CIRIA Report SP124:1996 Barriers, liners and cover systems for containment and control of land contamination
- Manual of Contract Documents for Highway Works, Volume 1 Specification for Highway Works
- Manual of Contract Documents for Highway Works, Volume 2 Notes for Guidance on the Specification for Highway Works
- TII publication DN-DNG03072 Design of Soakaways
- PPS25, Development and Flood Risk.

Part Five / Conditions of Certification 5

5.1 National Standards Authority of Ireland ("NSAI") following consultation with NSAI Agrément has assessed the performance and method of installation of the product/process and the quality of the materials used in its manufacture and certifies the product/process to be fit for the use for which it is certified provided that it is manufactured, installed, used and maintained in accordance with the descriptions and specifications set out in this Certificate and in accordance with the manufacturer's instructions and usual trade practice. This Certificate shall remain valid for five years from date of issue so long as:

(a) the specification of the product is unchanged.

(b) the Building Regulations 1997 to 2017 and any other regulation or standard applicable to the product/process, its use or installation remains unchanged.

(c) the product continues to be assessed for the quality of its manufacture and marking by NSAI.

(d) no new information becomes available which in the opinion of the NSAI, would preclude the granting of the Certificate.

(e) the product or process continues to be manufactured, installed, used and maintained in accordance with the description, specifications and safety recommendations set out in this certificate.

(f) the registration and/or surveillance fees due to NSAI Agrément are paid.

5.2 The NSAI Agrément mark and certification number may only be used on or in relation to product/processes in respect of which a valid Certificate exists. If the Certificate becomes invalid the Certificate holder must not use the NSAI Agrément mark and certification number and must remove them from the products already marked.

5.3 In granting Certification, the NSAI makes no representation as to;

(a) the absence or presence of patent rights subsisting in the product/process; or

(b) the legal right of the Certificate holder to market, install or maintain the product/process; or
(c) whether individual products have been manufactured or installed by the Certificate holder in accordance with the descriptions and specifications set out in this Certificate.

5.4 This Certificate does not comprise installation instructions and does not replace the manufacturer's directions or any professional or trade advice relating to use and installation which may be appropriate.

5.5 Any recommendations contained in this Certificate relating to the safe use of the certified product/process are preconditions to the validity of the Certificate. However, the NSAI does not certify that the manufacture or installation of the certified product or process in accordance with the descriptions and specifications set out in this Certificate will satisfy the requirements of the Safety, Health and Welfare at Work Act 2005, or of any other current or future common law duty of care owed by the manufacturer or by the Certificate holder.

5.6 The NSAI is not responsible to any person or body for loss or damage including personal injury arising as a direct or indirect result of the use of this product or process.

5.7 Where reference is made in this Certificate to any Act of the Oireachtas, Regulation made thereunder, Statutory Instrument, Code of Practice, National Standards, manufacturer's instructions, or similar publication, it shall be construed as reference to such publication in the form in which it is in force at the date of this Certification.

NSAI Agrément

NSAI Agrément

This Certificate No. **18/0401** is accordingly granted by the NSAI to Alderburgh Ltd. on behalf of NSAI Agrément.

Date of Issue: **16th July 2018**

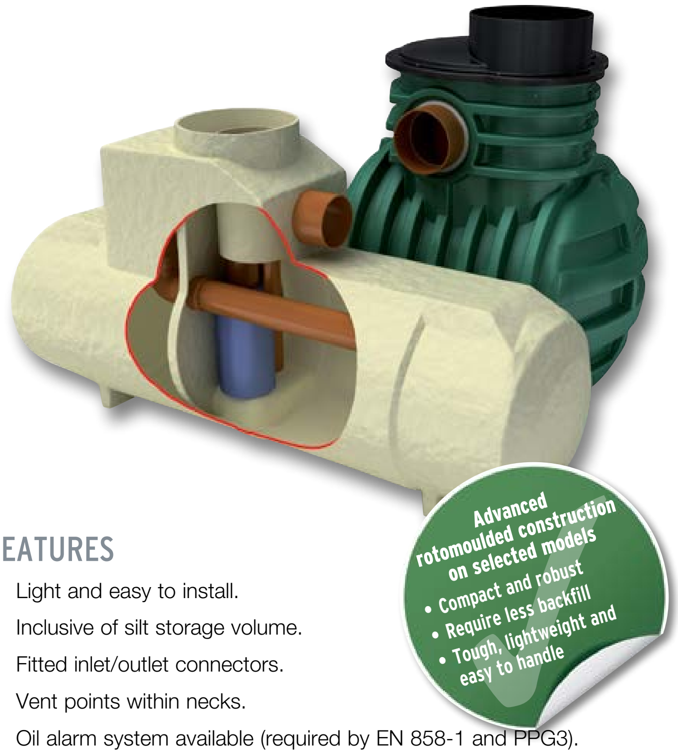
Signed

Seán Balfe
Director of NSAI Agrément

Readers may check that the status of this Certificate has not changed by contacting NSAI Agrément, NSAI, 1 Swift Square, Northwood, Santry, Dublin 9, Ireland.
Telephone: (01) 807 3800. Fax: (01) 807 3842. www.nsai.ie

Appendix H Bypass Separator Details

Bypass NSB RANGE



APPLICATION

Bypass separators are used when it is considered an acceptable risk not to provide full treatment, for very high flows, and are used, for example, where the risk of a large spillage and heavy rainfall occurring at the same time is small, e.g.

- Surface car parks.
- Roadways.
- Lightly contaminated commercial areas.

PERFORMANCE

Klargester were one of the first UK manufacturers to have separators tested to EN 858-1. Klargester have now added the NSB bypass range to their portfolio of certified and tested models. The NSB number denotes the maximum flow at which the separator treats liquids.
The British Standards Institute (BSI) tested the required range of Kingspan Klargester Bypass separators and certified their performance in relation to their flow and process performance assessing the effluent qualities to the requirements of EN 858-1. Klargester bypass separator designs follow the parameters determined during the testing of the required range of bypass separators.

Each bypass separator design includes the necessary volume requirements for:

- Oil separation capacity.
- Oil storage volume.
- Silt storage capacity.
- Coalescer.

The unit is designed to treat 10% of peak flow. The calculated drainage areas served by each separator are indicated according to the formula given by PPG3 NSB = 0.0018A(m2). Flows generated by higher rainfall rates will pass through part of the separator and bypass the main separation chamber.

Class I separators are designed to achieve a concentration of 5mg/litre of oil under standard test conditions.

FEATURES

- Light and easy to install.
- Inclusive of silt storage volume.
- Fitted inlet/outlet connectors.
- Vent points within necks.
- Oil alarm system available (required by EN 858-1 and PPG3).
- Extension access shafts for deep inverts.
- Maintenance from ground level.
- GRP or rotomoulded construction (subject to model).

To specify a nominal size bypass separator, the following information is needed:-

- The calculated flow rate for the drainage area served. Our designs are based on the assumption that any interconnecting pipework fitted elsewhere on site does not impede flow into or out of the separator and that the flow is not pumped.
- The drain invert inlet depth.
- Pipework type, size and orientation.

SIZES AND SPECIFICATIONS

UNIT NOMINAL SIZE	FLOW (l/s)	PEAK FLOW RATE (l/s)	DRAINAGE AREA (m^2)	STORAGE CAPACITY (litres) SILT	OIL	UNIT LENGTH (mm)	UNIT DIA. (mm)	ACCESS SHAFT DIA. (mm)	BASE TO INLET INVERT (mm)	BASE TO OUTLET INVERT	STANDARD FALL ACROSS (mm)	MIN. INLET INVERT (mm)	STANDARD PIPEWORK DIA.
NSBP003	3	30	1670	300	45	1700	1350	600	1420	1320	100	500	160
NSBP004	4.5	45	2500	450	60	1700	1350	600	1420	1320	100	500	160
NSBP006	6	60	3335	600	90	1700	1350	600	1420	1320	100	500	160
NSBE010	10	100	5560	1000	150	2069	1220	750	1450	1350	100	700	315
NSBE015	15	150	8335	1500	225	2947	1220	750	1450	1350	100	700	315
NSBE020	20	200	11111	2000	300	3893	1220	750	1450	1350	100	700	375
NSBE025	25	250	13890	2500	375	3575	1420	750	1680	1580	100	700	375
NSBE030	30	300	16670	3000	450	4265	1420	750	1680	1580	100	700	450
NSBE040	40	400	22222	4000	600	3230	1920	600	2185	2035	150	1000	500
NSBE050	50	500	27778	5000	750	3960	1920	600	2185	2035	150	1000	600
NSBE075	75	750	41667	7500	1125	5841	1920	600	2235	2035	200	950	675
NSBE100	100	1000	55556	10000	1500	7661	1920	600	2235	2035	200	950	750
NSBE125	125	1250	69444	12500	1875	9548	1920	600	2235	2035	200	950	750

Rotomoulded chamber construction   GRP chamber construction   * Some units have more than one access shaft – diameter of largest shown.

Appendix I Flow Control Device Details

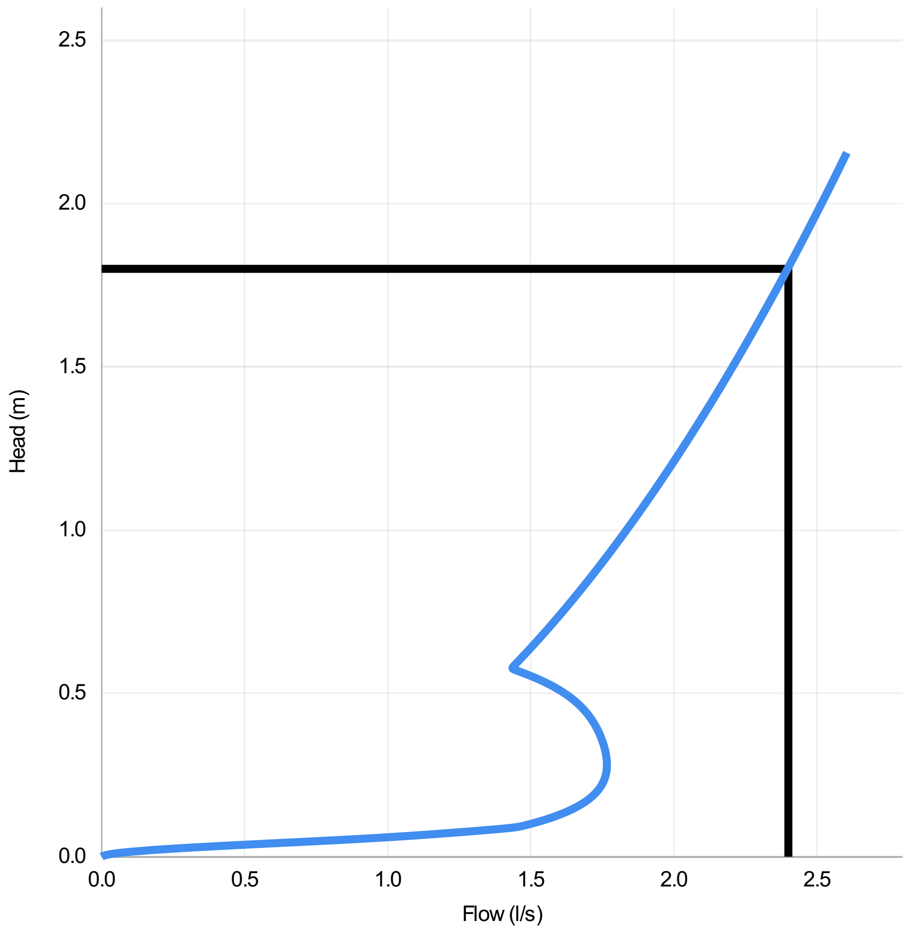
Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.800	2.400
Flush-Flo	0.281	1.766
Kick-Flo®	0.575	1.430
Mean Flow		1.822

hydro-int.com/patents

BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE No 08/4596

WRc APPROVED
PT/329/0412



Head (m)	Flow (l/s)
0.000	0.000
0.062	1.042
0.124	1.586
0.186	1.716
0.248	1.761
0.310	1.763
0.372	1.742
0.434	1.700
0.497	1.624
0.559	1.485
0.621	1.480
0.683	1.544
0.745	1.606
0.807	1.665
0.869	1.721
0.931	1.776
0.993	1.828
1.055	1.879
1.117	1.928
1.179	1.976
1.241	2.023
1.303	2.068
1.366	2.113
1.428	2.156
1.490	2.198
1.552	2.240
1.614	2.280
1.676	2.320
1.738	2.359
1.800	2.397

DESIGN ADVICE

!

The head/flow characteristics of this SHE-0064-2400-1800-2400 Hydro-Brake Optimum® Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.

The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro International®

DATE	01/10/2021 10:06
Site	Greenpark
DESIGNER	Damien Egan
Ref	191325 MH S42-8 / 21_21_5773

SHE-0064-2400-1800-2400

Hydro-Brake Optimum®

Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.800	2.400
Flush-Flo™	0.281	1.766
Kick-Flo®	0.575	1.430
Mean Flow		1.822

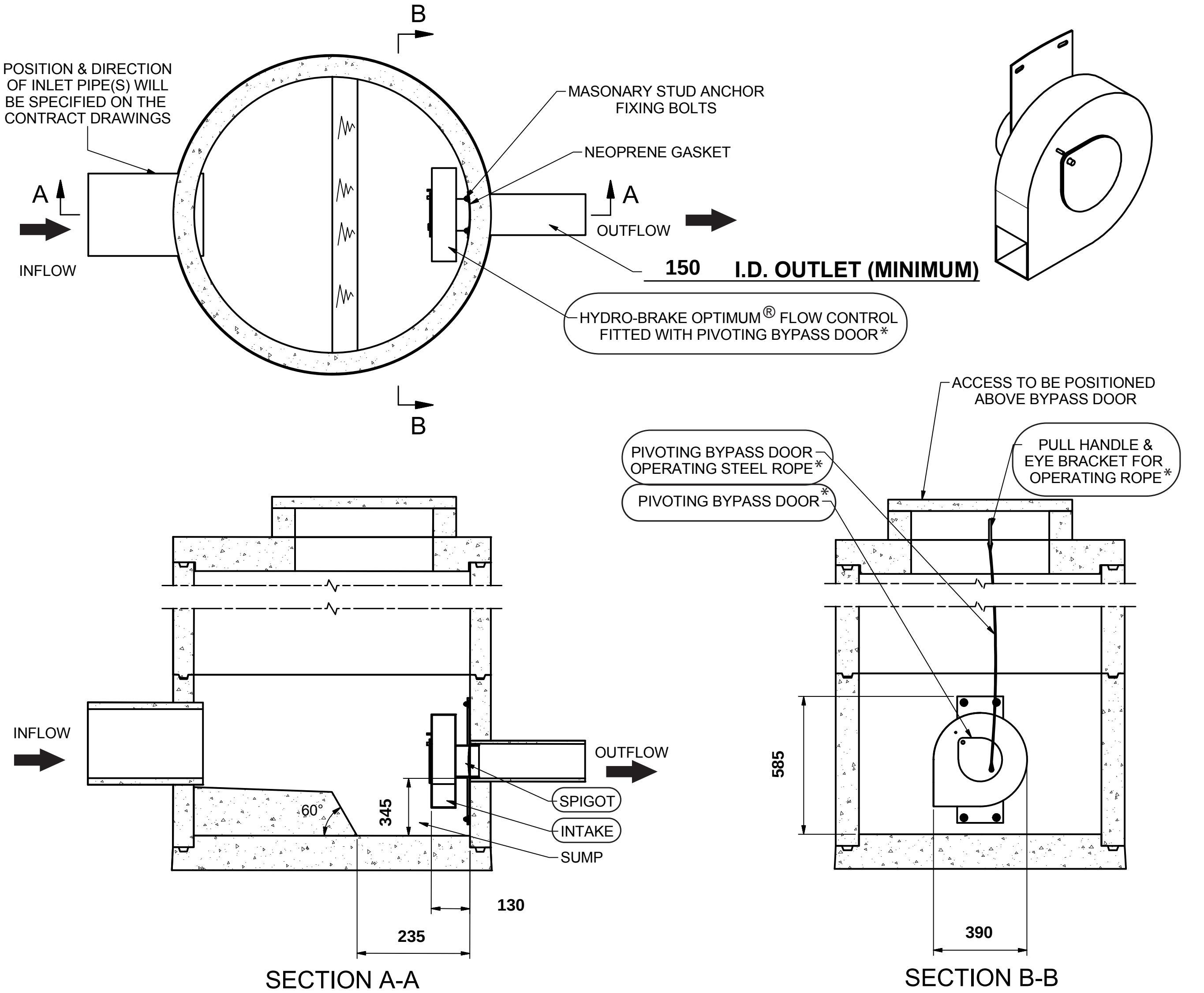
hydro-int.com/patents

Hydro-Brake Optimum® Flow Control including:

- **3 mm** grade 304L stainless steel
- Integral stainless steel pivoting bypass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Bead blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Neoprene gasket to seal outlet

BBA APPROVAL INSPECTION TESTING CERTIFICATION CERTIFICATE No 08/4596

WRc APPROVED PT/329/0412



IMPORTANT: ⬭ LIMIT OF HYDRO INTERNATIONAL SUPPLY
THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS
FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL
ALL CIVIL AND INSTALLATION WORK BY OTHERS
* WHERE SUPPLIED
HYDRO-BRAKE® FLOW CONTROL & HYDRO-BRAKE OPTIMUM® FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO INTERNATIONAL

THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

DESIGN ADVICE !

The head/flow characteristics of this SHE-0064-2400-1800-2400 Hydro-Brake Optimum® Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.

The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro International

DATE	10/1/2021 10:06 AM
SITE	Greenpark
DESIGNER	Damien Egan
REF	191325 MH S42-8 / 21_21_5773

SHE-0064-2400-1800-2400

Hydro-Brake Optimum®

 Hydro International, Shearwater House, Clevedon Hall Estate, Victoria Road, Clevedon, BS21 7RD. Tel 01275 878371 Fax 01275 874979 Web www.hydro-int.com Email enquiries@hydro-int.com

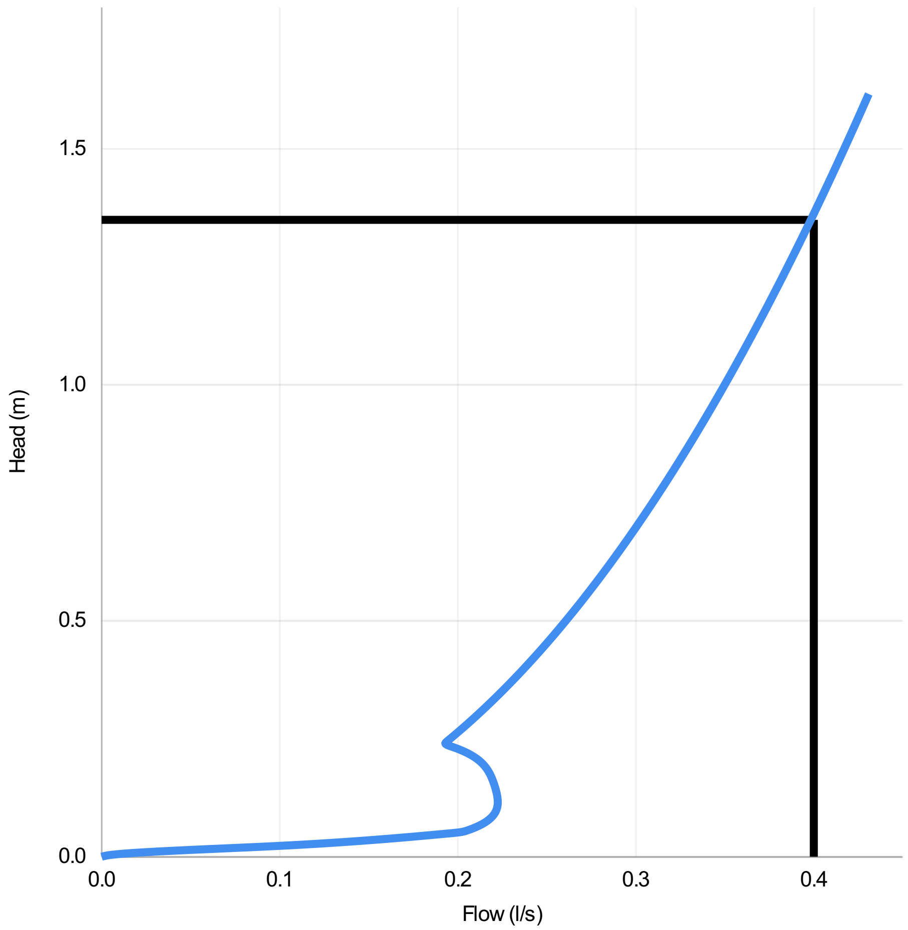
Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.350	0.400
Flush-Flo	0.116	0.222
Kick-Flo®	0.239	0.192
Mean Flow		0.290

hydro-int.com/patents

BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE No 08/4596

WRc APPROVED
PT/329/0412



Head (m)	Flow (l/s)
0.000	0.000
0.047	0.187
0.093	0.221
0.140	0.222
0.186	0.216
0.233	0.197
0.279	0.205
0.326	0.218
0.372	0.231
0.419	0.242
0.466	0.253
0.512	0.263
0.559	0.273
0.605	0.282
0.652	0.291
0.698	0.300
0.745	0.308
0.791	0.317
0.838	0.324
0.884	0.332
0.931	0.339
0.978	0.346
1.024	0.353
1.071	0.360
1.117	0.367
1.164	0.374
1.210	0.380
1.257	0.386
1.303	0.392
1.350	0.398

DESIGN ADVICE

!

The head/flow characteristics of this SHE-0027-4000-1350-4000 Hydro-Brake Optimum® Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.

The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro International®

DATE	01/10/2021 10:04
Site	Greenpark
DESIGNER	Damien Egan
Ref	191325 MH S40-2 / 21_21_5773

SHE-0027-4000-1350-4000

Hydro-Brake Optimum®

Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.350	0.400
Flush-Flo™	0.116	0.222
Kick-Flo®	0.239	0.192
Mean Flow		0.290

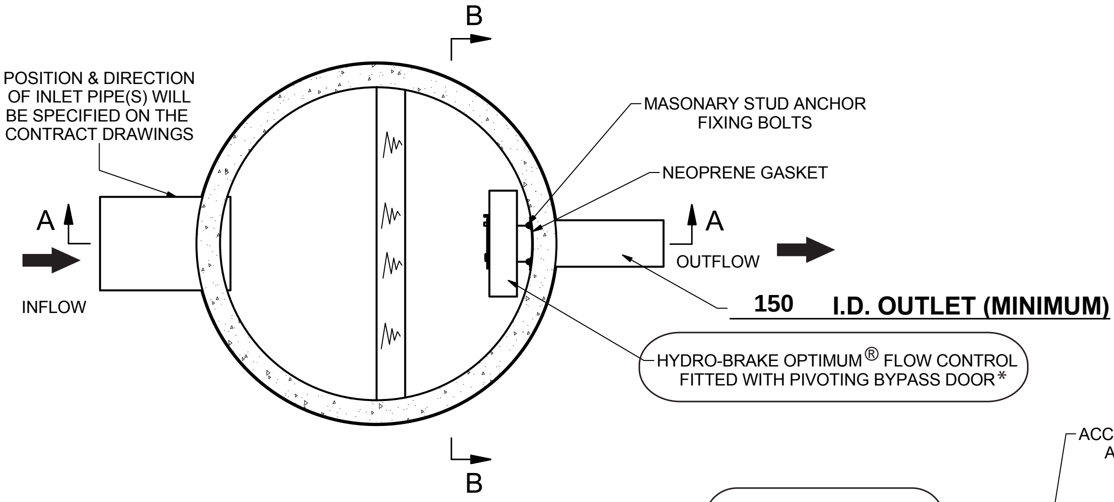
hydro-int.com/patents

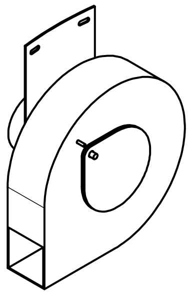
Hydro-Brake Optimum® Flow Control including:

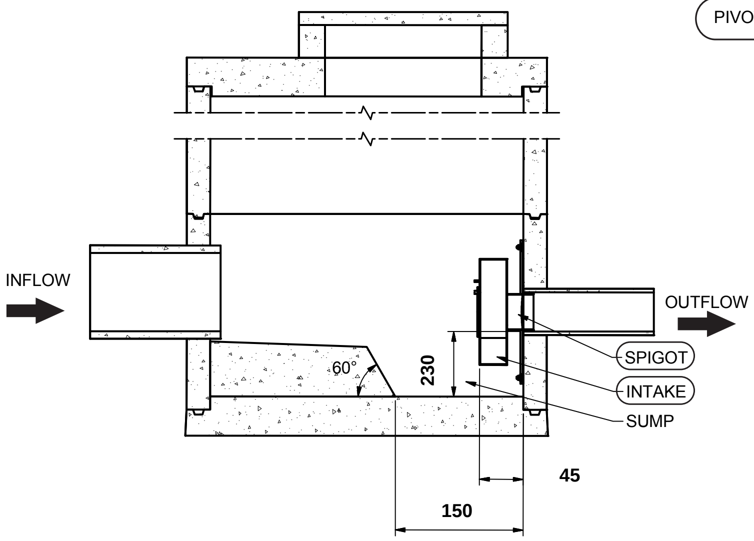
- **3 mm** grade 304L stainless steel
- Integral stainless steel pivoting bypass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Bead blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Neoprene gasket to seal outlet

BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE No 08/4596

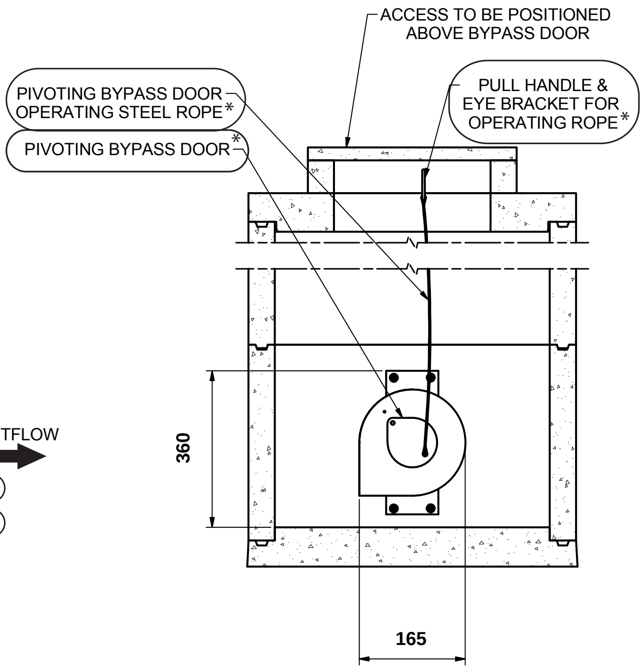
WRc APPROVED
PT/329/0412







SECTION A-A



SECTION B-B

IMPORTANT: ⬭ LIMIT OF HYDRO INTERNATIONAL SUPPLY
THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS
FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL
ALL CIVIL AND INSTALLATION WORK BY OTHERS
* WHERE SUPPLIED
HYDRO-BRAKE® FLOW CONTROL & HYDRO-BRAKE OPTIMUM® FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO INTERNATIONAL

THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

DESIGN ADVICE !

The head/flow characteristics of this SHE-0027-4000-1350-4000 Hydro-Brake Optimum® Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.
The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro International

DATE	10/1/2021 10:04 AM
SITE	Greenpark
DESIGNER	Damien Egan
REF	191325 MH S40-2 / 21_21_5773

SHE-0027-4000-1350-4000
Hydro-Brake Optimum®

 Hydro International, Shearwater House, Clevedon Hall Estate, Victoria Road, Clevedon, BS21 7RD. Tel 01275 878371 Fax 01275 874979 Web www.hydro-int.com Email enquiries@hydro-int.com

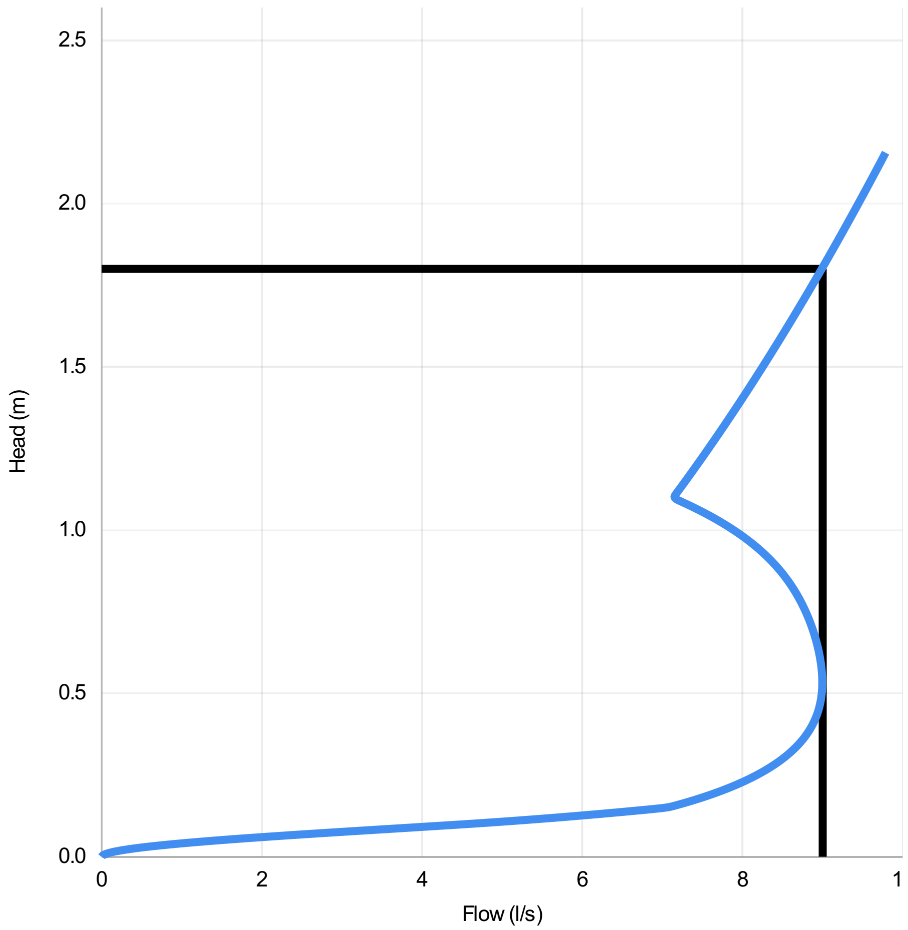
Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.800	9.000
Flush-Flo	0.534	8.995
Kick-Flo®	1.097	7.128
Mean Flow		7.887

hydro-int.com/patents

BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE No 08/4596

WRc APPROVED
PT/329/0412



Head (m)	Flow (l/s)
0.000	0.000
0.062	2.113
0.124	5.887
0.186	7.555
0.248	8.163
0.310	8.553
0.372	8.793
0.434	8.928
0.497	8.986
0.559	8.992
0.621	8.958
0.683	8.892
0.745	8.798
0.807	8.668
0.869	8.492
0.931	8.254
0.993	7.932
1.055	7.505
1.117	7.188
1.179	7.372
1.241	7.551
1.303	7.725
1.366	7.895
1.428	8.061
1.490	8.224
1.552	8.383
1.614	8.539
1.676	8.691
1.738	8.841
1.800	8.988

DESIGN ADVICE

!

The head/flow characteristics of this SHE-0127-9000-1800-9000 Hydro-Brake Optimum® Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.

The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro International®

DATE	01/10/2021 10:03
Site	Greenpark
DESIGNER	Damien Egan
Ref	191325 MH S6-3 / 21_21_5773

SHE-0127-9000-1800-9000

Hydro-Brake Optimum®

Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.800	9.000
Flush-Flo™	0.534	8.995
Kick-Flo®	1.097	7.128
Mean Flow		7.887

Hydro-Brake Optimum® Flow Control including:

- 3 mm grade 304L stainless steel
- Integral stainless steel pivoting bypass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Bead blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Neoprene gasket to seal outlet

BBA APPROVAL INSPECTION TESTING CERTIFICATION CERTIFICATE No 08/4596

WRc APPROVED PT/329/0412

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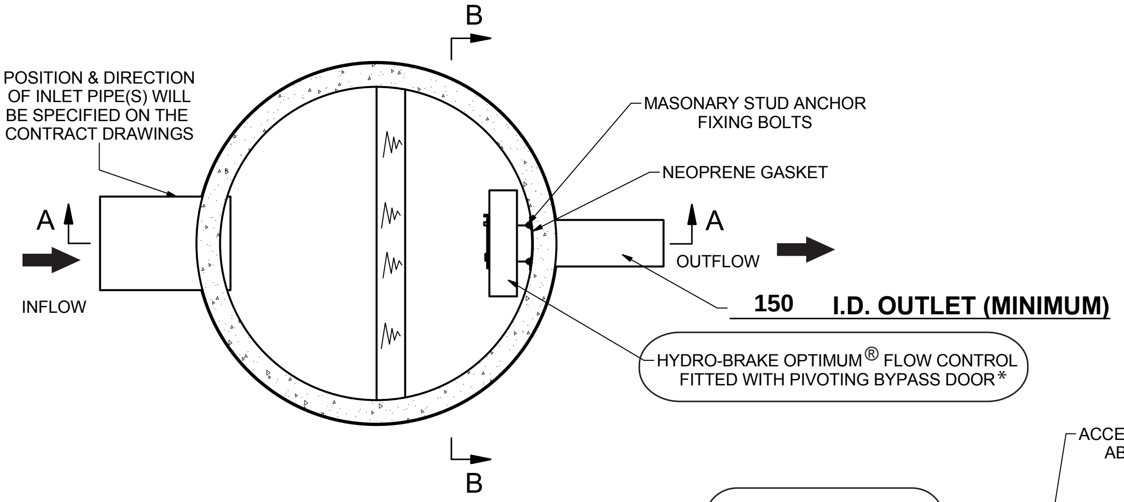
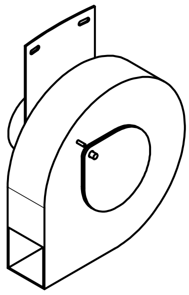
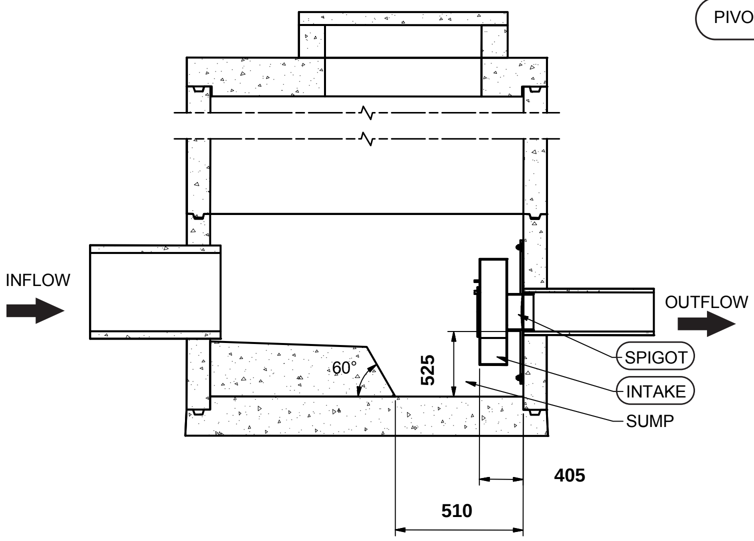
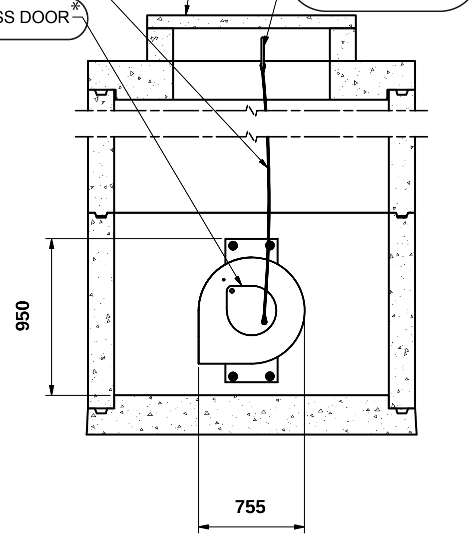






SECTION A-A



SECTION B-B

IMPORTANT: LIMIT OF HYDRO INTERNATIONAL SUPPLY
THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS
FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL
ALL CIVIL AND INSTALLATION WORK BY OTHERS
* WHERE SUPPLIED
HYDRO-BRAKE® FLOW CONTROL & HYDRO-BRAKE OPTIMUM® FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO INTERNATIONAL

THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

DESIGN ADVICE !

The head/flow characteristics of this SHE-0127-9000-1800-9000 Hydro-Brake Optimum® Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.

The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro International

DATE	10/1/2021 10:03 AM
SITE	Greenpark
DESIGNER	Damien Egan
REF	191325 MH S6-3 / 21_21_5773

SHE-0127-9000-1800-9000

Hydro-Brake Optimum®

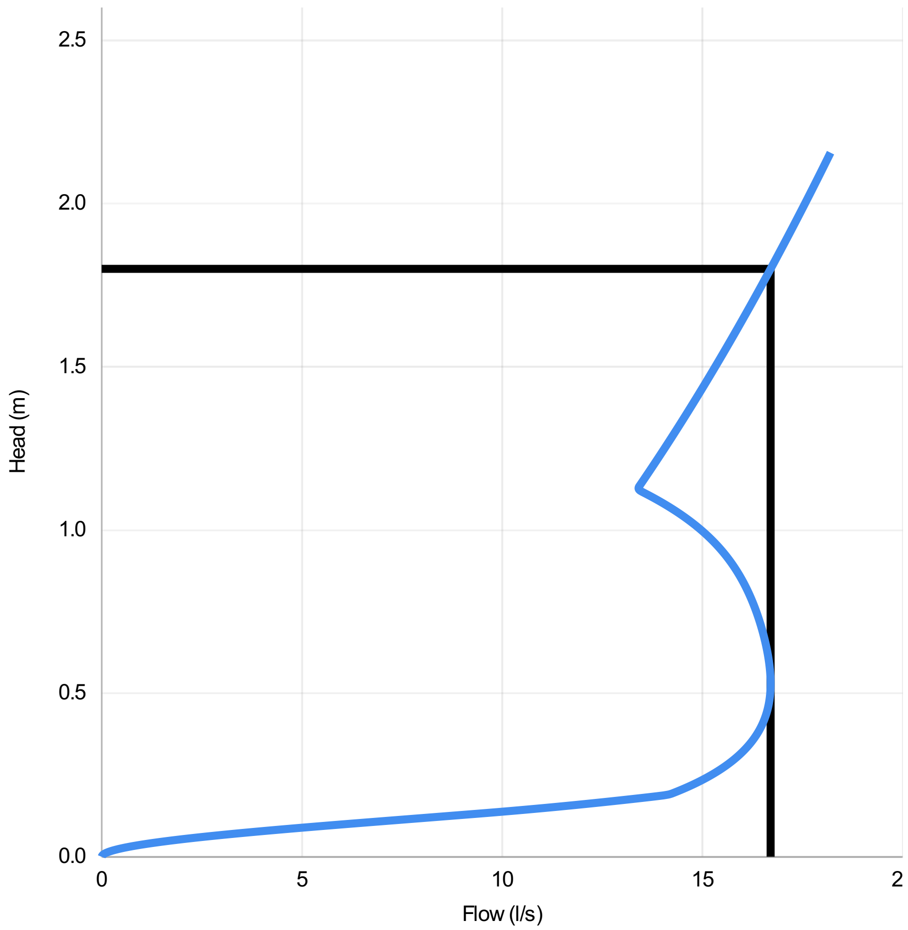
Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.800	16.700
Flush-Flo	0.530	16.700
Kick-Flo®	1.124	13.360
Mean Flow		14.554

hydro-int.com/patents

BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE No 08/4596

WRc APPROVED
PT/329/0412



Head (m)	Flow (l/s)
0.000	0.000
0.062	2.622
0.124	8.590
0.186	13.939
0.248	15.191
0.310	15.905
0.372	16.343
0.434	16.585
0.497	16.687
0.559	16.692
0.621	16.628
0.683	16.515
0.745	16.359
0.807	16.154
0.869	15.885
0.931	15.524
0.993	15.033
1.055	14.371
1.117	13.493
1.179	13.669
1.241	14.004
1.303	14.331
1.366	14.650
1.428	14.961
1.490	15.266
1.552	15.564
1.614	15.856
1.676	16.143
1.738	16.424
1.800	16.700

DESIGN ADVICE

!

The head/flow characteristics of this SHE-0172-1670-1800-1670 Hydro-Brake Optimum® Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.

The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro International®

DATE	01/10/2021 10:00
Site	Greenpark
DESIGNER	Damien Egan
Ref	191325 MH S1-16

SHE-0172-1670-1800-1670

Hydro-Brake Optimum®

Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.800	16.700
Flush-Flo™	0.530	16.700
Kick-Flo®	1.124	13.360
Mean Flow		14.554

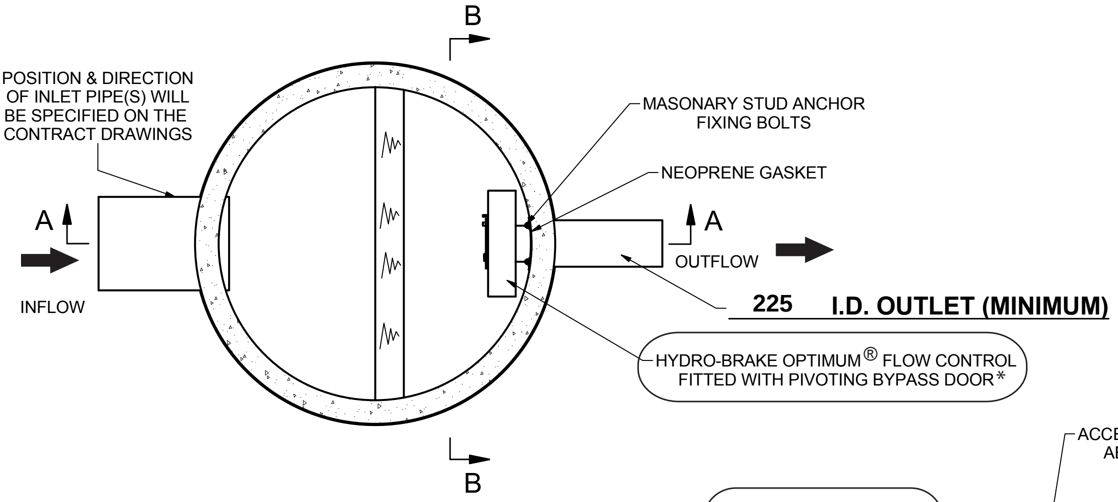
hydro-int.com/patents

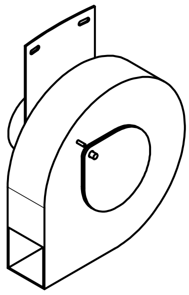
Hydro-Brake Optimum® Flow Control including:

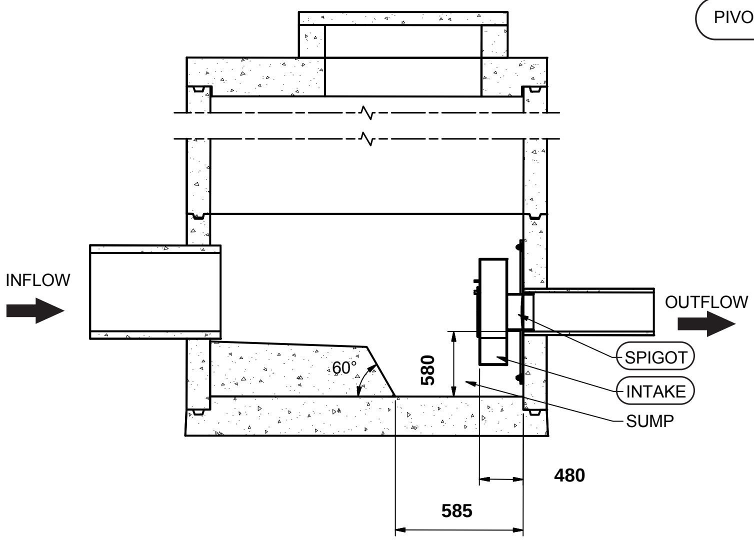
- **5 mm** grade 304L stainless steel
- Integral stainless steel pivoting bypass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Bead blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Neoprene gasket to seal outlet

BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE No 08/4596

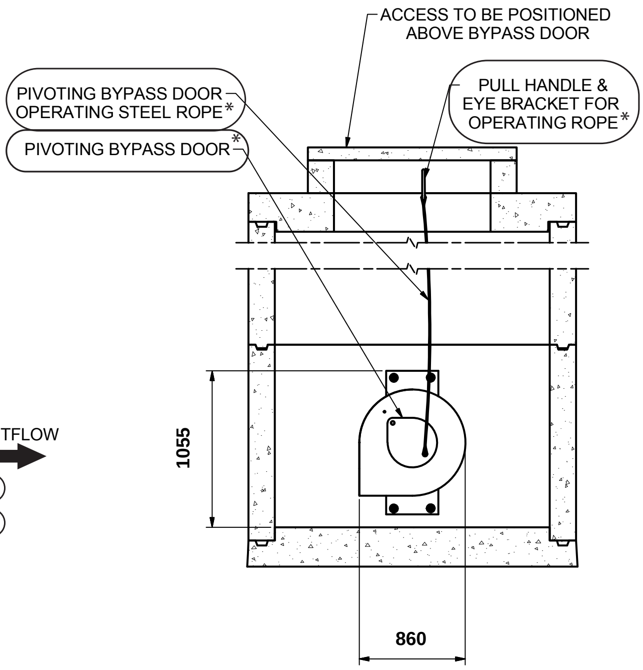
WRc APPROVED
PT/329/0412







SECTION A-A



SECTION B-B

IMPORTANT: (symbol) LIMIT OF HYDRO INTERNATIONAL SUPPLY
THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS
FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL
ALL CIVIL AND INSTALLATION WORK BY OTHERS
* WHERE SUPPLIED
HYDRO-BRAKE® FLOW CONTROL & HYDRO-BRAKE OPTIMUM® FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO INTERNATIONAL

THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

DESIGN ADVICE !

The head/flow characteristics of this SHE-0172-1670-1800-1670 Hydro-Brake Optimum® Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.
The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro International

DATE	10/1/2021 10:00 AM
SITE	Greenpark
DESIGNER	Damien Egan
REF	191325 MH S1-16

SHE-0172-1670-1800-1670
Hydro-Brake Optimum®

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