DOSA

DENIS O'SULLIVAN & ASSOCIATES

CONSULTING ENGINEERS

RESIDENTIAL DEVELOPMENT, AT CARRIGALINE ROAD & CHURCHYARD LANE, DOUGLAS, CORK

INFRASTRUCTURE REPORT

DATE 16/01/2025

REVISION 2

JOB NO. 7114

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DOCUMENT CONTROL

PROJECT NAME: Residential Development, at Carrigaline Road & Churchyard Lane, Douglas, Cork

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1 Introduction

Denis O'Sullivan & Associates (DOSA) were engaged as Consulting Engineers for the proposed development at Carrigaline Road & Churchyard Lane, Douglas, Cork. Following the opinion received from Cork City Council from the Section 32(B) meeting, the report has been amended to address concerns raised by the Council.

1.1 Objectives

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

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

1.2 Site Location

The subject site is located to the south-east of Douglas Village shopping centre and just off East Douglas Street on the Carrigaline Road. The subject site presents a greenfield landscape characterised by its level terrain. Bordered by the Carrigaline Roads to the east, Churchyard Lane to the west, the Telephone Exchange to the south, and a residential dwelling alongside a restaurant and bar to the north. The land is currently zoned mixed use development in the Current Development Plan

A snapshot of the site is outlined in Figure 1-1 below.

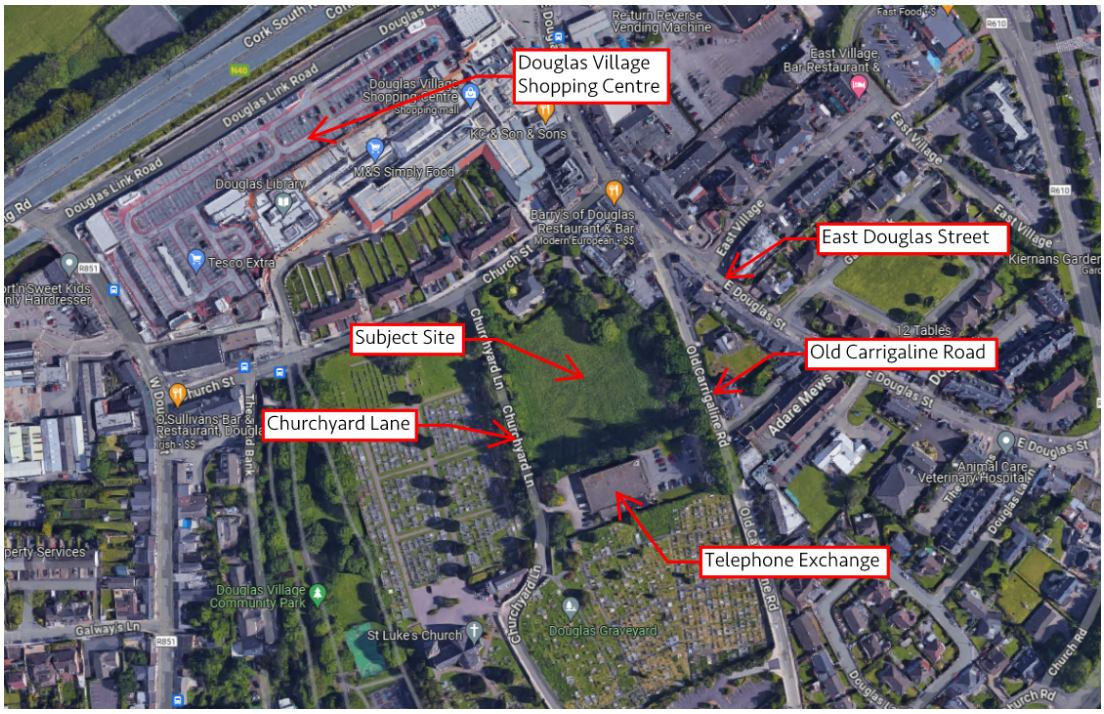


Figure 1-1 Site Location (Google Maps)

1.3 Site Topography

The subject site presents a greenfield landscape characterised by its level terrain. There is a very gentle incline from South to Northerly direction to a low point on the Northern boundary which is approximately 5.00m OD.

1.4 Site History

There are two previous planning applications on the site for a mixed use development dated 2016 & 2018. Both planning application had been granted by Cork County Council but were appealed to An Bord Pleanála and refused.

1.5 Proposed Development

The proposed development on the site entails the construction of 124 no. residential apartments (consisting of a mix of 1, 2 and 3 bed units), 1 no. cafe unit and 2 no. office units, in a development ranging in height from 1 to 5 storeys and all associated site development works including footpaths, car and bicycle parking, drainage, bicycle and bin stores, lighting, fencing, landscaping/amenity areas, ESB substation/switchroom and plant room. Site development works include 2 no. new uncontrolled pedestrian crossings and footpath improvements on Churchyard Lane which requires the removal of 6 no. existing on-street car parking spaces. The proposed development works include a connection and construction of a new storm water and foul sewer along Carrigaline Road. Access to the site will be via a new vehicle access point and a new pedestrian connection from Carrigaline Road and 2 new pedestrian connections onto Churchyard Lane. The new vehicular access requires the removal of 4 no. existing car parking spaces. This comprehensive proposal outlines a significant residential development that aims to contribute to the local area while providing a range of housing options for potential residents.



Figure 1-2 Proposed Site Layout (O'Mahony Pike Architecture/Urban Design)

2 *Surface Water Management*

2.1 Surface Water Design

The proposed storm water drainage system has been designed to cater for all surface water runoff from all hard surfaces within the proposed development including roadways, roofs, parking areas etc. The completed development site is a mix of soft landscaping and hard paving or roofing. The existing topography is a single catchment. There will be one no. surface water discharge points to service the developed site and it will discharge to the stormwater network at the junction between East Douglas Street and Church Street.

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

Surface water discharge rates from the proposed surface water drainage network will be controlled by SUDs features, a vortex flow control devices (Hydrobrakes or equivalent) and associated attenuation tanks. A series of above ground infiltration/detention systems shall also be provided. Surface water discharge will also pass via a full retention fuel / oil separators (sized in accordance with permitted discharge from the site).

The proposed surface water drainage network will collect surface water runoff from the site via a piped network prior to discharging off site via the attenuation tanks, infiltration/detention systems, flow control devices and separator arrangement as noted above.

Surface water runoff from the site's road network will be directed to the proposed pipe network and infiltration/detentions systems via conventional road gullies with additional surface water runoff from roofs also routed to the proposed surface water network.

2.2 Surface Water Drainage Network

The surface water drainage network for the proposed development was modelled using the Autodesk InfoDrainage software application. The surface water pipe lengths, slopes, contributing impermeable areas, upstream invert levels, upstream cover levels and pipe diameters were entered into the model using the drawings supplied.

2.3 Design Criteria:

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

- Return period for pipe work design 2 years
- Return period for attenuation design 100 years

- Soil Type 3
- Allowable Outflow Varies
- Time of entry 5 minutes
- M5 – 60 18.8 mm
- Ratio "r" 0.25
- Pipe Friction (Ks) 0.009 mm
- Minimum Velocity (based on pipe flowing full) 1.0 m/s
- Rainfall Runoff from Roads and Footpaths 100%
- Rainfall Runoff from Roofs 80%
- Rainfall Runoff from Driveways 80%
- Rainfall Runoff from Green Areas 20%
- Rainfall Depth Factored for Climate Change (as per GDSDS) 20%

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

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

Table 6.2 Climate Change Factors to be Applied to Drainage Design

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

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

- M5-60 = 18.8mm
- Ratio R = 0.25

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

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

The surface water drainage network was assessed for compliance with maximum and minimum velocities, pipe length etc. The network was designed to ensure velocities in the network and pipe gradients did not exceed the maximum velocity of 3.0m/s. The minimum velocity allowed was 0.75m/s.

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

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

2.3.1 Pre-Development Conditions

The catchment area for the runoff of this proposed development is 0.84 hectares (ha). This is based on a developable area. For this development, the permissible outflow is calculated using the estimation method contained in the Institute of Hydrology Report No. 124: Flood estimation for small catchments.

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

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

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

SAAR = Standard Annual Average Rainfall

SOIL = Soil index

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

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

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

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

2.3.2 Post-Development Conditions

The stormwater management plan adopted for the particular development involves using an attenuation tank/basin located in the green areas within the courtyard and underneath the internal road. All surface water runoff arising from the paved development will be drained away from the site. The attenuation tanks will be designed for a 100-year storm event. The maximum discharge from the tanks will be limited to calculated permissible runoff (QBAR) for the catchment area and is shown in Table 2-1 below;

Tank Ref	Restricted Outlet
Tank No. 1	1.5 l/s
Tank No. 2	1.2 l/s

Table 2-1

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

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

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

2.4 Attenuation Tank

2.4.1 Volume of Attenuation

The proposed attenuation system shall be used as a last resort to restrict the outflow to the equivalent of the existing greenfield runoff. This ensures the development will not give rise to any impact downstream of the site. The system will be a mixture of impermeable (tanked) with no infiltration of the runoff to the ground and permeable with infiltration of the runoff to the ground. The design and location of the tanks has been carefully considered and will be located under the open space area within the courtyard and under the internal road.

The introduction of bioretention systems and filter drains has resulted in a reduction of the overall volumetric attenuation requirement.

The capacity of the attenuation tanks is designed to cater for the capacity required for a 1 in 100-year ARI event.

2.5 Hydrocarbon Treatment

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

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

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

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

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

In this project there is a single catchment areas that eventually discharge to the public network and adjoining watercourse. The hydrocarbon specifications are summarized in Table 2.5 below.

Tank Reference	Petrol Interceptor Make & Model	Impermeable Treatment Area (m^2)	Oil Storage (ltrs)	Silt Storage (Ltrs)
Tank No. 2	Kingspan NSBE010	5560	150	1000

Table 2-2 Hydrocarbon Specifications

2.6 Silt Control

The proposed petrol interceptor from Kingsapn also includes a silt storage capacity, see table 2-2 in addition to the oil storage capacity that allow silt to be collected in the interceptor prior to discharge to the proposed attenuation tanks. This silt build-up can then be removed from the tanks. The interceptors will be specified at detailed design stage.

2.7 Construction & Operational Stage Run-Off

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

The attenuation facilities will be in the form of a series of interlinked attenuation tanks.

3 *Foul Sewer System*

3.1 Foul Sewer Design

A Pre-Connection Enquiry was submitted to Uisce Éireann. The Uisce Éireann Reference Number for this enquiry is CDS24009261. The response to this Enquiry was issued by Uisce Éireann on 20th November 2024. This confirmed that, subject to a valid connection agreement being put in place, the proposed connection to the Uisce Éireann network could be facilitated.

Following, consultation with Cork City Council & Uisce Eireann the discharge location was agreed on the Carrigaline Road, see figure 3-1 below.



Figure 3-1 Existing Services Layout (Cork City Council)

In order to facilitate the proposed connection at the Development, the Uisce Éireann sewer network will have to be extended by approximately 80m by the main contractor.

The foul sewer has been designed using the InfoDrainage package. The foul network design addresses present day design issues and can view velocities at Full Bore, Proportional Depth and 1/3 flow. The model was analysed and amended until the results met with the design criteria specified.

The network has been designed to achieve self-cleansing velocities at 1/3 flow whilst maintaining minimum gradients.

3.1.1 Development Breakdown

124 No. Dwellings

Section 3.6 of The Irish Water Code of Practice Wastewater Infrastructure states that for the gravity sewers shall be designed to carry a minimum wastewater volume of 6 times the dry weather flow (6DWF) which is to be taken as 450 litres per dwelling

Loading = (124) (450) / (24) (60) (60) = 0.65 litres/second

6DWF = 3.9 litres/second

Cafe

No. of People = 147/1 = 147

From the EPA Code of Practice for Small Communities, Business, Leisure Centres and Hotels Loading = 10 L/Person/day

Loading = (147) (10) / (24) (60) (60) = 0.02 litres/second

6DWF = 0.12 litres/second

Office

No. of People = 202.1/5 = 40

From the EPA Code of Practice for Small Communities, Business, Leisure Centres and Hotels Loading = 60 L/Person/day

Loading = (40) (60) / (24) (60) (60) = 0.03 litres/second

6DWF = 0.18 litres/second

This is based on the unit schedule submitted by the architect. The foul waste within the development will be collected via an internal gravity network and will discharge to the public foul sewer on the Carrigaline Road.

All works will be in accordance with Uisce Éireann specifications and requirements.

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

4 Water Supply

As with the drainage network, a Pre-Connection Enquiry was submitted to Uisce Éireann under Reference No. CDS24009261. This confirmed that, subject to a valid connection agreement being put in place, the proposed connection to the Uisce Éireann network could be facilitated.

Following, consultation with Uisce Eireann a revised connection location was agreed at the junction of Carrigaline Road and East Douglas Street, see figure 4-1 below.

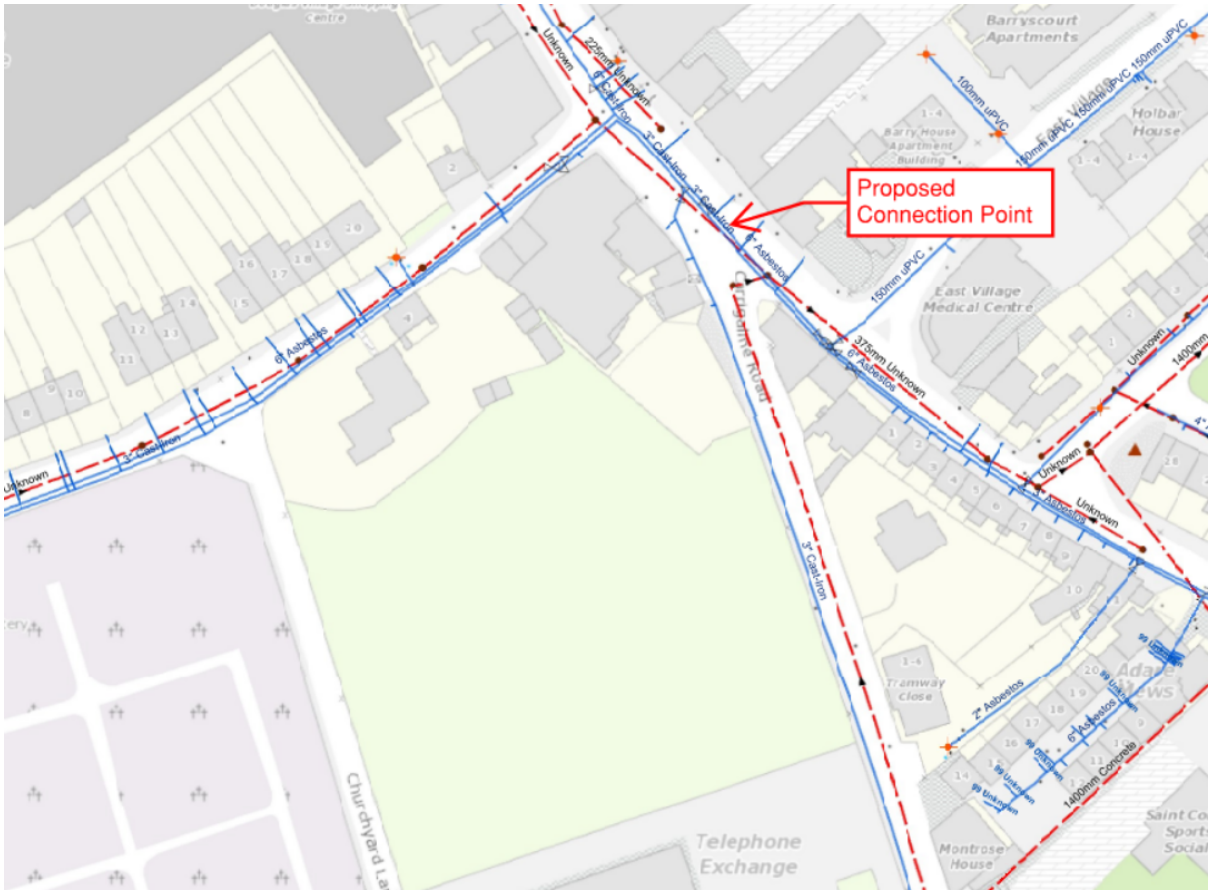


Figure 4-1 Uisce Éireann Utility Network

In order to facilitate the proposed connection at the Development, the Uisce Éireann sewer network will have to be extended by approximately 60m by the main contractor.

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

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

The layout of the proposed watermain network is shown on the Proposed Watermain Layout Plan DOSA Drawing No. 7114-0030.

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

5 Summary of Results

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

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

Attenuation Area Reference	Storm Event	Results
Attenuation Tank	1 in 2 year	No surcharge of the stormwater network
	1 in 100 year	Surcharge

Table 5-1 Summary of Surcharge and Flooding

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

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

Tank Ref	Restricted Outlet	Storage Type	Capacity (m^3)
Tank No. 1	1.5 l/s	Proprietary (with infiltration)	278
Tank No. 2	1.2 l/s	Proprietary (with infiltration)	188

Table 5-2 Outlet Control, Storage Type & Capacity Summary

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

Appendix A –Uisce Éireann Confirmation of Feasibility

CONFIRMATION OF FEASIBILITY

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

Uisce Éireann
PO Box 448
South City
Delivery Office
Cork City

www.water.ie

Brian O' Sullivan

Dennis O'Sullivan and Associates
Joyce House
Barrack Square
Ballincollig
Co. Cork
P31 KP84

20 November 2024

Our Ref: CDS24009261 Pre-Connection Enquiry
Barrys Field, Old Carrigaline Road, Douglas, Cork, Co. Cork

Dear Applicant/Agent,

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

Uisce Éireann has reviewed the pre-connection enquiry in relation to a Water & Wastewater connection for a Multi/Mixed Use Development of 127 unit(s) at Barrys Field, Old Carrigaline Road, Douglas, Cork, Co. Cork **(the Development)**.

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

- **Water Connection** - Feasible Subject to Upgrade:

  In order to facilitate the proposed connection at the Development, the Uisce Éireann watermain network will have to be extended by approximately 50m from the existing 150mm dia watermain network at the junction of Old Carrigaline Road and East Douglas Street. Uisce Éireann currently does not have any plans to extend its network in this area. These works will be carried out by Uisce Éireann and the costs for this will be included in your connection fee. Please see www.water.ie/connections/ for information on connection charges.

- **Wastewater Connection** - Feasible Subject to Upgrade:

  In order to facilitate the proposed connection at the Development, the Uisce Éireann wastewater network will have to be extended by approximately 50m from the existing 1400mm dia wastewater network on Old Carrigaline Road. Uisce Éireann currently does not have any plans to extend its network in this area. These works will be carried out by Uisce Éireann and the costs for this will be included in your connection fee. Please see www.water.ie/connections/ for information on connection charges.

Stiúrthóirí / Directors: Tony Keohane (Cathaoirleach / Chairman), Niall Gleeson (POF / CEO), Christopher Banks, Fred Barry, Gerard Britchfield, Liz Joyce, Patricia King, Eileen Maher, Cathy Mannion, Michael Walsh.
Oifig Chláraithe / Registered Office: Teach Colvill, 24-26 Sráid Thalbóid, Baile Átha Cliath 1, D01 NP86 / Colvill House, 24-26 Talbot Street, Dublin, Ireland D01NP86
Is cuideachta ghníomhaíochta ainmnithe atá faoi theorainn scaireanna é Uisce Éireann / Uisce Éireann is a design activity company, limited by shares. Cláraithe in Éirinn Uimh.: 530363 / Registered in Ireland No.: 530363.

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

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

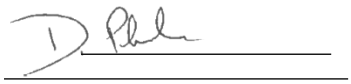
Where can you find more information?

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

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

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

Yours sincerely,



Dermot Phelan
Connections Delivery Manager

Section A - What is important to know?

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

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

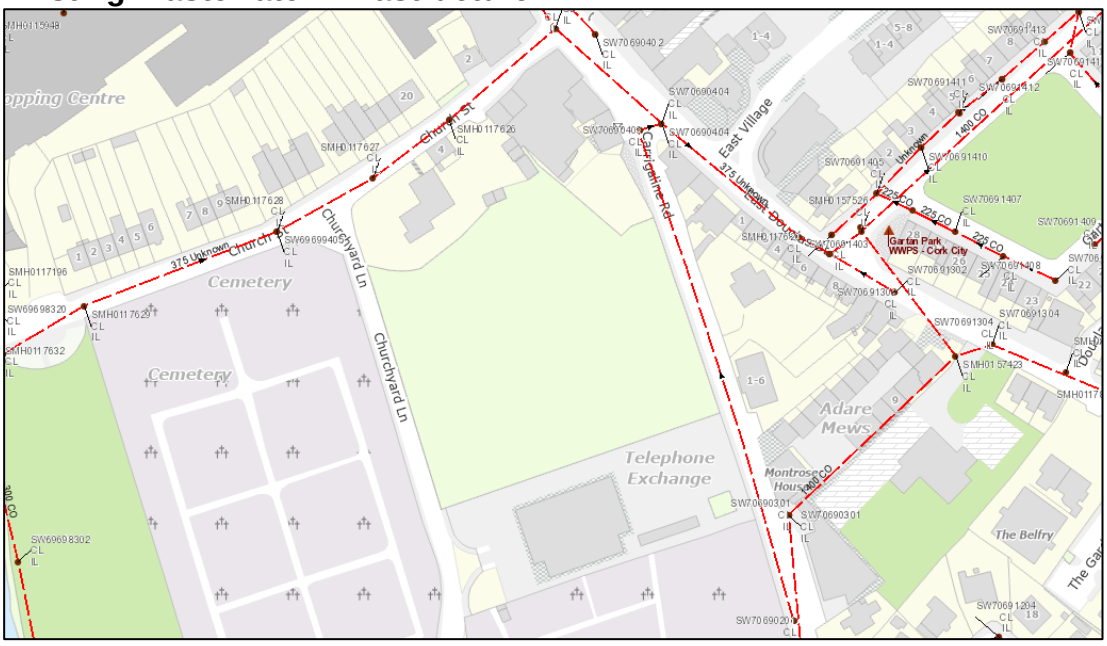
Section B – Details of Uisce Éireann's Network(s)

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

Existing Water Infrastructure:



Existing Wastewater Infrastructure:



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

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

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

Appendix B – Storm Water Report

Project:	Date:		
Barry's Field, Douglas Cork	01/10/2024		
	Designed by:	Checked by:	Approved By:
	BOSullivan		
Report Details: Type: Inflows Storm Phase: Bio-Retention x2	Company Address: Joyce House, Barrack Square, Ballincollig, Cork		

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Catchment Area

Type : Catchment Area

Area (m²)	575.239

Dynamic Sizing

Runoff Method	Time of Concentration
Summer Volumetric Runoff	0.750
Winter Volumetric Runoff	0.840
Time of Concentration (mins)	5
Percentage Impervious (%)	100



Catchment Area (1)

Type : Catchment Area

Area (m²)	913.942

Dynamic Sizing

Runoff Method	Time of Concentration
Summer Volumetric Runoff	0.750
Winter Volumetric Runoff	0.840
Time of Concentration (mins)	5
Percentage Impervious (%)	68



Catchment Area (2)

Type : Catchment Area

Area (m²)	184.993

Dynamic Sizing

Runoff Method	Time of Concentration
Summer Volumetric Runoff	0.750
Winter Volumetric Runoff	0.840
Time of Concentration (mins)	5
Percentage Impervious (%)	100

Catchment Area (3)

Type : Catchment Area

Area (m²)	677.513

Dynamic Sizing

Runoff Method	Time of Concentration
Summer Volumetric Runoff	0.750
Winter Volumetric Runoff	0.840
Time of Concentration (mins)	5
Percentage Impervious (%)	80

Catchment Area (4)

Type : Catchment Area

Area (m²)	798.365

Dynamic Sizing

Runoff Method	Time of Concentration
Summer Volumetric Runoff	0.750
Winter Volumetric Runoff	0.840
Time of Concentration (mins)	5
Percentage Impervious (%)	80

Catchment Area (5)

Type : Catchment Area

Area (m²)	1836.702

Dynamic Sizing

Runoff Method	Time of Concentration
Summer Volumetric Runoff	0.750
Winter Volumetric Runoff	0.840
Time of Concentration (mins)	5
Percentage Impervious (%)	60

Catchment Area (6)

Type : Catchment Area

Area (m²)	1118.691

Dynamic Sizing

Runoff Method	Time of Concentration
Summer Volumetric Runoff	0.750
Winter Volumetric Runoff	0.840
Time of Concentration (mins)	5
Percentage Impervious (%)	70

Catchment Area (7)

Type : Catchment Area

Area (m²)	1104.244

Dynamic Sizing

Runoff Method	Time of Concentration
Summer Volumetric Runoff	0.750
Winter Volumetric Runoff	0.840
Time of Concentration (mins)	5
Percentage Impervious (%)	86

Catchment Area (8)

Type : Catchment Area

Area (m²)	716.954

Dynamic Sizing

Runoff Method	Time of Concentration
Summer Volumetric Runoff	0.750
Winter Volumetric Runoff	0.840
Time of Concentration (mins)	5
Percentage Impervious (%)	50



Catchment Area (9)

Type : Catchment Area

Area (m²)	546.762

Dynamic Sizing

Runoff Method	Time of Concentration
Summer Volumetric Runoff	0.750
Winter Volumetric Runoff	0.840
Time of Concentration (mins)	5
Percentage Impervious (%)	65

Project:	Date:		
Barry's Field, Douglas Cork	01/10/2024		
	Designed by:	Checked by:	Approved By:
	BOSullivan		
Report Details: Type: Junctions Storm Phase: Bio-Retention x2	Company Address: Joyce House, Barrack Square, Ballincollig, Cork		

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Name	Junction Type	Easting (m)	Northing (m)	Cover Elevation (m)	Depth (m)	Invert Elevation (m)	Chamber Shape	Diameter (m)
SW102	Manhole	569927.257	569393.432	5.250	0.650	4.600	Circular	1.200
SW101	Manhole	569921.986	569410.944	5.250	0.930	4.320	Circular	1.200
SW100	Manhole	569909.945	569450.942	5.250	0.650	4.600	Circular	1.200
SW104	Manhole	569940.662	569440.676	5.250	0.650	4.600	Circular	1.200
SW103	Manhole	569947.316	569418.567	5.250	1.110	4.140	Circular	1.200
SW105	Manhole	569952.104	569420.008	5.250	2.210	3.040	Circular	1.200
SW106	Manhole	569925.957	569461.541	5.250	1.150	4.100	Circular	1.200
SW107	Manhole	569953.075	569469.696	5.250	1.350	3.900	Circular	1.200
SW108	Manhole	569965.266	569429.191	5.250	2.220	3.030	Circular	1.200
SW109	Manhole	569961.919	569422.962	5.250	2.270	2.980	Circular	1.200
SW115	Manhole	569986.718	569448.649	5.000	2.070	2.930	Circular	1.200
SW117	Manhole	569997.315	569413.440	5.250	0.650	4.600	Circular	1.200
SW113	Manhole	569996.709	569451.110	4.800	1.850	2.950	Circular	1.200
SW114	Manhole	570001.588	569434.901	4.800	1.970	2.830	Circular	1.200
SW112	Manhole	570000.201	569422.161	4.720	1.980	2.740	Circular	1.200
SW118	Manhole	570023.159	569429.071	5.000	2.380	2.620	Circular	1.200
SW119	Manhole	570019.048	569441.947	4.800	2.250	2.550	Circular	1.200
SW120	Manhole	570012.072	569463.032	4.450	2.010	2.440	Circular	1.200
SW121	Manhole	570000.071	569499.245	3.800	1.550	2.250	Circular	1.200
SW122	Manhole	569989.482	569523.558	3.350	1.230	2.120	Circular	1.200
SW123	Manhole	569970.860	569548.714	3.000	1.000	2.000	Circular	1.200
SW116	Manhole	569991.028	569434.334	5.250	2.420	2.830	Circular	1.200
SW110	Manhole	569992.945	569432.300	5.250	2.430	2.820	Circular	1.200
SW111	Manhole	569996.345	569421.000	4.850	2.090	2.760	Circular	1.200

Name	Lock
SW102	None
SW101	None
SW100	None
SW104	None
SW103	None
SW105	None
SW106	None
SW107	None
SW108	None
SW109	None
SW115	None
SW117	None
SW113	None
SW114	None
SW112	None
SW118	None
SW119	None
SW120	None
SW121	None
SW122	None
SW123	None
SW116	None
SW110	None
SW111	None



Bioretention

Type : Bioretention

Ponding Area

Exceedance Elevation (m)	5.250
Depth (m)	0.150
Base Elevation (m)	5.100
Top Area (m²)	90.00
Side Slope (1:x)	4.53
Base Area (m²)	65.00
Freeboard (mm)	0
Porosity (%)	100
Length (m)	18.407
Long. Slope (1:x)	200.00
Filtration Rate (m/s)	0.0000772
Friction Scheme	Manning's n
n	0.3
Total Volume (m³)	41.387

Filter Area

Base Elevation (m)	3.600

Under Drain

Height Above Base (m)	0.000
Diameter (mm)	225
No. of Barrels	1
Friction Scheme	Manning's n
n	0.009
Release Height (m)	0.000

Filtration Layers

Use	Name	Filtration Layer Depth (mm)	Porosity (%)	Conductivity (m/s)	Soil Type
☐	Soil	0	0	0.0	Soil Type
	Storage	1500	30	0.083	

Inlets

Inlet

Inlet Type	Point Inflow
Incoming Item(s)	5.001
Bypass Destination	(None)
Inlet Destination	Subsurface Area
Capacity Type	No Restriction

Outlets

Outlet

Outgoing Connection	5.002
Outlet Type	Free Discharge

Advanced

Ponding Area

Base Perimeter (m)	43.877
Top Perimeter (m)	46.593



Bioretention (1)

Type : Bioretention

Ponding Area

Exceedance Elevation (m)	5.250
Depth (m)	0.150
Base Elevation (m)	5.100
Top Area (m²)	61.82
Side Slope (1:x)	2.47
Base Area (m²)	50.00
Freeboard (mm)	0
Porosity (%)	100
Length (m)	15.924
Long. Slope (1:x)	0.00
Filtration Rate (m/s)	0.0000772
Friction Scheme	Manning's n
n	0.3
Total Volume (m³)	31.330

Filter Area

Base Elevation (m)	3.600

Under Drain

Height Above Base (m)	0.000
Diameter (mm)	225
No. of Barrels	1
Friction Scheme	Manning's n
n	0.009
Release Height (m)	0.000

Filtration Layers

Use	Name	Filtration Layer Depth (mm)	Porosity (%)	Conductivity (m/s)	Soil Type
☐	Soil	0	0	0.0	Soil Type
	Storage	1500	30	0.083	

Inlets

Inlet

Inlet Type	Point Inflow
Incoming Item(s)	Catchment Area (1)
Bypass Destination	(None)
Inlet Destination	Subsurface Area
Capacity Type	No Restriction

Project:	Date:		
Barry's Field, Douglas Cork	01/10/2024		
	Designed by:	Checked by:	Approved By:
	BOSullivan		
Report Details: Type: Stormwater Controls Storm Phase: Bio-Retention x2	Company Address: Joyce House, Barrack Square, Ballincollig, Cork		

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Outlets

Outlet

Outgoing Connection	4.000
Outlet Type	Free Discharge

Advanced

Ponding Area

Base Perimeter (m)	38.127
Top Perimeter (m)	39.612



Cellular Storage

Type : Cellular Storage

Dimensions

Exceedance Elevation (m)	5.250
Depth (m)	1.500
Base Elevation (m)	3.000
Number of Crates Long	13
Number of Crates Wide	30
Number of Crates High	3
Porosity (%)	95
Crate Length (m)	1
Crate Width (m)	0.5
Crate Height (m)	0.5
Total Volume (m^3)	278.625

Inlets

Inlet

Inlet Type	Point Inflow
Incoming Item(s)	1.003
Bypass Destination	(None)
Capacity Type	No Restriction

Inlet (1)

Inlet Type	Point Inflow
Incoming Item(s)	5.003
Bypass Destination	(None)
Capacity Type	No Restriction

Project:	Date:		
Barry's Field, Douglas Cork	01/10/2024		
	Designed by:	Checked by:	Approved By:
	BOSullivan		
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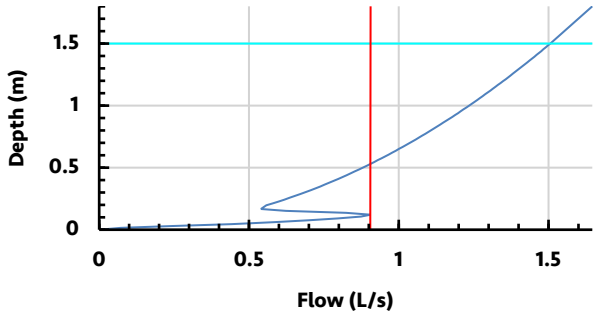
Outlets

Outlet

Outgoing Connection	1.004
Outlet Type	Hydro-Brake®

Invert Elevation (m)	3.000
Design Depth (m)	1.500
Design Flow (L/s)	1.5
Objective	Minimize Upstream Storage Requirements
Application	Surface Water Only
Sump Available	☐

Unit Reference	CHE-0050-1500-1500-1500



Cellular Storage (1)

Type : Cellular Storage

Dimensions

Exceedance Elevation (m)	5.000
Depth (m)	1.500
Base Elevation (m)	2.800
Number of Crates Long	22
Number of Crates Wide	12
Number of Crates High	3
Porosity (%)	95
Crate Length (m)	1
Crate Width (m)	0.5
Crate Height (m)	0.5
Total Volume (m³)	188.800

Project:	Date:		
Barry's Field, Douglas Cork	01/10/2024		
	Designed by:	Checked by:	Approved By:
	BOSullivan		
Report Details: Type: Stormwater Controls Storm Phase: Bio-Retention x2	Company Address: Joyce House, Barrack Square, Ballincollig, Cork		

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Inlets

Inlet (1)

Inlet Type	Point Inflow
Incoming Item(s)	6.001
Bypass Destination	(None)
Capacity Type	No Restriction

Inlet (2)

Inlet Type	Point Inflow
Incoming Item(s)	7.001
Bypass Destination	(None)
Capacity Type	No Restriction

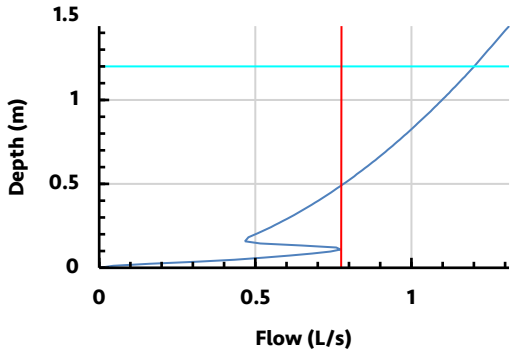
Outlets

Outlet

Outgoing Connection	6.002
Outlet Type	Hydro-Brake®

Invert Elevation (m)	2.800
Design Depth (m)	1.200
Design Flow (L/s)	1.2
Objective	Minimize Upstream Storage Requirements
Application	Surface Water Only
Sump Available	☐

Unit Reference	CHE-0048-1200-1200-1200



Project:	Date:		
Barry's Field, Douglas Cork	01/10/2024		
	Designed by:	Checked by:	Approved By:
	BOSullivan		
Report Details: Type: Connections Storm Phase: Bio-Retention x2	Company Address: Joyce House, Barrack Square, Ballincollig, Cork		

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Name	Length (m)	Connection Type	Slope (1:x)	Manning's n	Diameter / Base Width (mm)	Upstream Cover Elevation (m)	Upstream Invert Elevation (m)	Downstream Cover Elevation (m)
2.000	18.287	Pipe	65.312	0.009	150	5.250	4.600	5.250
1.000	41.772	Pipe	149.185	0.009	225	5.250	4.600	5.250
1.001	26.452	Pipe	146.954	0.009	225	5.250	4.320	5.250
3.000	23.089	Pipe	153.926	0.009	150	5.250	4.600	5.250
1.002	5.000	Pipe	166.667	0.009	225	5.250	4.140	5.250
5.000	28.317	Pipe	141.586	0.009	150	5.250	4.100	5.250
6.000	16.927	Pipe	141.055	0.009	150	4.800	2.950	4.800
1.008	23.976	Pipe	199.801	0.009	225	4.720	2.740	5.000
1.009	13.517	Pipe	193.103	0.009	225	5.000	2.620	4.800
1.010	22.209	Pipe	201.897	0.009	225	4.800	2.550	4.450
1.011	38.150	Pipe	200.788	0.009	225	4.450	2.440	3.800
1.012	26.519	Pipe	203.993	0.009	225	3.800	2.250	3.350
1.013	31.298	Pipe	260.817	0.009	225	3.350	2.120	3.000
1.003	5.070	Pipe	126.749	0.009	225	5.250	3.040	5.250
5.003	4.651	Pipe	155.044	0.009	225	5.250	3.030	5.250
1.004	3.839	Pipe	191.939	0.009	225	5.250	3.000	5.250
6.001	3.623	Pipe	120.765	0.009	225	4.800	2.830	5.000
6.002	10.936	Pipe	182.273	0.009	225	5.000	2.800	4.720
1.005	32.402	Pipe	202.510	0.009	225	5.250	2.980	5.250
1.006	11.800	Pipe	196.668	0.009	225	5.250	2.820	4.850
1.007	4.027	Pipe	201.332	0.009	225	4.850	2.760	4.720
7.000	14.950	Pipe	149.499	0.009	150	5.000	2.930	5.250
8.000	21.819	Pipe	18.649	0.009	150	5.250	4.600	5.250
7.001	3.912	Pipe	130.388	0.009	225	5.250	2.830	5.000
5.001	7.987	Pipe	159.741	0.013	225	5.250	3.900	5.342
5.002	21.355	Pipe	37.465	0.013	225	5.342	3.600	5.250
4.000	4.291	Pipe	85.814	0.013	225	5.250	3.600	5.250

Project:	Date:		
Barry's Field, Douglas Cork	01/10/2024		
	Designed by:	Checked by:	Approved By:
	BOSullivan		
Report Details: Type: Connections Storm Phase: Bio-Retention x2	Company Address: Joyce House, Barrack Square, Ballincollig, Cork		

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Name	Downstream Invert Elevation (m)	Lock	Flow Restriction (L/s)
2.000	4.320	All	
1.000	4.320	All	
1.001	4.140	All	
3.000	4.450	All	
1.002	4.110	All	
5.000	3.900	All	
6.000	2.830	All	
1.008	2.620	All	
1.009	2.550	All	
1.010	2.440	All	
1.011	2.250	All	
1.012	2.120	All	
1.013	2.000	All	
1.003	3.000	All	
5.003	3.000	All	
1.004	2.980	All	1.6
6.001	2.800	All	
6.002	2.740	All	1.3
1.005	2.820	All	
1.006	2.760	All	
1.007	2.740	All	
7.000	2.830	All	
8.000	3.430	All	
7.001	2.800	All	
5.001	3.850	All	
5.002	3.030	All	
4.000	3.550	All	

Project:	Date:		
Barry's Field, Douglas Cork	01/10/2024		
	Designed by:	Checked by:	Approved By:
	BOSullivan		
Report Details: Type: Network Design Criteria Storm Phase: Bio-Retention x2	Company Address: Joyce House, Barrack Square, Ballincollig, Cork		

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Flow Options

Peak Flow Calculation	Rational Method
Min. Time of Entry (mins)	5
Max. Travel Time (mins)	30

FSR

Type: FSR

Return Period (years)	2.0
Region	Scotland and Ireland
M5-60 (mm)	18.8
Ratio R	0.250

Pipe Options

Lock Slope Options	None
Design Options	Minimize Excavation
Design Level	Level Crowns
Min. Cover Depth (m)	1.200
Min. Slope (1:x)	1000.00
Max. Slope (1:x)	10.00
Min. Velocity (m/s)	1.0
Max. Velocity (m/s)	3.0
Use Flow Restriction	☑
Reduce Channel Depths	☑

Pipe Size Library

Default

Add. Increment (mm)	75
Max. Diameter (mm)	0

Diameter (mm)	Min. Slope (1:x)	Max. Slope (1:x)
100	0.00	0.00
150	0.00	0.00

Project:	Date:		
Barry's Field, Douglas Cork	01/10/2024		
	Designed by:	Checked by:	Approved By:
	BOSullivan		
Report Details: Type: Network Design Criteria Storm Phase: Bio-Retention x2	Company Address: Joyce House, Barrack Square, Ballincollig, Cork		

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Manhole Options

Apply Offset	☐

Manhole Size Library

Default

Diameter / Width

Connection (mm)	Diameter / Length (m)	Width (m)
0	1.200	0.000
375	1.350	0.000
500	1.500	0.000
750	1.800	0.000

Additional Sizing

Connection (mm)	900
Diameter / Length (m)	0.900
Width (m)	0.000

Depth

Depth (m)	Diameter / Length (m)	Width (m)
0.000	1.050	0.000
1.500	1.200	0.000

Access

Depth (m)	Ladder Protrusion (mm)
0.000	130
3.000	230

Benching Requirements

Landing Width (mm)	500
Benching Width (mm)	225

Project:	Date:		
Barry's Field, Douglas Cork	01/10/2024		
	Designed by:	Checked by:	Approved By:
	BOSullivan		
Report Details: Type: Outfall Details Storm Phase: Bio-Retention x2	Company Address: Joyce House, Barrack Square, Ballincollig, Cork		

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Outfalls

Outfall	Outfall Type	Fixed Surcharged Elevation (m)	Elevation Curve
SW123	Free Discharge		

Project:	Date:		
Barry's Field, Douglas Cork	01/10/2024		
	Designed by:	Checked by:	Approved By:
	BOSullivan		
Report Title:	Company Address:		
Rainfall Analysis Criteria	Joyce House, Barrack Square, Ballincollig, Cork		

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Runoff Type	Dynamic
Output Interval (mins)	5
Time Step	Reduced
Urban Creep	Apply Global Value
Urban Creep Global Value (%)	0
Junction Flood Risk Margin (mm)	300
Perform First Flush Analysis	☐

Project:	Date:		
Barry's Field, Douglas Cork	01/10/2024		
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Report Details: Type: Inflows Summary Storm Phase: Bio-Retention x2	Company Address: Joyce House, Barrack Square, Ballincollig, Cork		

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Critical Storm Per Item: Rank By: Max. Inflow

Inflow	Storm Event	Inflow Area (m^2)	Max. Inflow (L/s)	Total Inflow Volume (m^3)
Catchment Area	FSR: 100 years: +20 %: 15 mins: Winter	575.24	25.1	11.631
Catchment Area (1)	FSR: 100 years: +20 %: 15 mins: Winter	913.94	27.1	12.567
Catchment Area (2)	FSR: 100 years: +20 %: 15 mins: Winter	184.99	8.1	3.739
Catchment Area (3)	FSR: 100 years: +20 %: 15 mins: Winter	677.51	23.7	10.959
Catchment Area (4)	FSR: 100 years: +20 %: 15 mins: Winter	798.36	27.9	12.916
Catchment Area (5)	FSR: 100 years: +20 %: 15 mins: Winter	1836.70	48.1	22.287
Catchment Area (6)	FSR: 100 years: +20 %: 15 mins: Winter	1118.69	34.2	15.832
Catchment Area (7)	FSR: 100 years: +20 %: 15 mins: Winter	1104.24	41.5	19.205
Catchment Area (8)	FSR: 100 years: +20 %: 15 mins: Winter	716.95	15.7	7.250
Catchment Area (9)	FSR: 100 years: +20 %: 15 mins: Winter	546.76	15.5	7.187

Project:	Date:		
Barry's Field, Douglas Cork	01/10/2024		
	Designed by:	Checked by:	Approved By:
	BOSullivan		
Report Details: Type: Junctions Summary Storm Phase: Bio-Retention x2	Company Address: Joyce House, Barrack Square, Ballincollig, Cork		

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Critical Storm Per Item: Rank By: Max. Depth

Junction	Storm Event	Cover Elevation (m)	Invert Elevation (m)	Max. Elevation (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m^3)	Max. Flooded Volume (m^3)	Max. Outflow (L/s)	Total Discharge Volume (m^3)	Status
SW102	FSR: 100 years: +20 %: 15 mins: Winter	5.250	4.600	4.701	0.101	15.5	0.115	0.000	12.1	7.180	OK
SW101	FSR: 100 years: +20 %: 15 mins: Winter	5.250	4.320	4.645	0.325	47.6	0.368	0.000	48.2	26.370	Surcharged
SW100	FSR: 100 years: +20 %: 15 mins: Winter	5.250	4.600	4.760	0.160	41.5	0.181	0.000	35.6	19.173	OK
SW104	FSR: 100 years: +20 %: 15 mins: Winter	5.250	4.600	4.883	0.283	25.1	0.320	0.000	22.9	11.625	Surcharged
SW103	FSR: 100 years: +20 %: 15 mins: Winter	5.250	4.140	4.470	0.330	71.2	0.373	0.000	70.5	37.977	Surcharged
SW105	FSR: 100 years: +20 %: 1440 mins: Winter	5.250	3.040	4.387	1.347	7.0	1.524	0.000	6.9	255.036	Surcharged
SW106	FSR: 100 years: +20 %: 1440 mins: Winter	5.250	4.100	4.387	0.287	1.1	0.325	0.000	1.1	37.359	Surcharged
SW107	FSR: 100 years: +20 %: 1440 mins: Winter	5.250	3.900	4.387	0.487	1.6	0.551	0.000	1.6	56.648	Surcharged
SW108	FSR: 100 years: +20 %: 1440 mins: Winter	5.250	3.030	4.387	1.357	3.0	1.535	0.000	2.9	106.644	Surcharged
SW109	FSR: 100 years: +20 %: 1440 mins: Winter	5.250	2.980	3.008	0.028	1.4	0.031	0.000	1.4	196.905	OK
SW115	FSR: 100 years: +20 %: 1440 mins: Winter	5.000	2.930	4.245	1.315	3.4	1.487	0.000	3.3	114.008	Surcharged
SW117	FSR: 100 years: +20 %: 15 mins: Winter	5.250	4.600	4.684	0.084	27.9	0.095	0.000	27.3	12.913	OK
SW113	FSR: 100 years: +20 %: 1440 mins: Winter	4.800	2.950	4.245	1.295	2.4	1.465	0.000	2.3	80.836	Surcharged
SW114	FSR: 100 years: +20 %: 1440 mins: Winter	4.800	2.830	4.245	1.415	2.3	1.600	0.000	2.3	79.803	Surcharged
SW112	FSR: 100 years: +20 %: 1440 mins: Winter	4.720	2.740	2.778	0.038	2.7	0.043	0.000	2.7	368.960	OK
SW118	FSR: 100 years: +20 %: 1440 mins: Winter	5.000	2.620	2.658	0.038	2.7	0.043	0.000	2.7	368.855	OK
SW119	FSR: 100 years: +20 %: 1440 mins: Winter	4.800	2.550	2.588	0.038	2.7	0.043	0.000	2.7	368.753	OK
SW120	FSR: 100 years: +20 %: 1440 mins: Winter	4.450	2.440	2.478	0.038	2.7	0.043	0.000	2.7	368.609	OK
SW121	FSR: 100 years: +20 %: 1440 mins: Winter	3.800	2.250	2.288	0.038	2.7	0.043	0.000	2.7	368.457	OK
SW122	FSR: 100 years: +20 %: 1440 mins: Winter	3.350	2.120	2.161	0.041	2.7	0.046	0.000	2.7	368.303	OK

SW123	FSR: 100 years: +20 %: 1440 mins: Winter	3.000	2.000	2.040	0.040	2.7	0.000	0.000	2.7	368.303	OK
SW116	FSR: 100 years: +20 %: 1440 mins: Winter	5.250	2.830	4.245	1.415	5.3	1.600	0.000	5.2	179.454	Surcharged
SW110	FSR: 100 years: +20 %: 1440 mins: Winter	5.250	2.820	2.848	0.028	1.4	0.031	0.000	1.4	196.824	OK
SW111	FSR: 100 years: +20 %: 1440 mins: Winter	4.850	2.760	2.790	0.030	1.4	0.034	0.000	1.4	196.773	OK

Project:	Date:		
Barry's Field, Douglas Cork	01/10/2024		
	Designed by:	Checked by:	Approved By:
	BOSullivan		
Report Details: Type: Stormwater Controls Summary Storm Phase: Bio-Retention x2	Company Address: Joyce House, Barrack Square, Ballincollig, Cork		

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Critical Storm Per Item: Rank By: Max. Avg. Depth

Stormwater Control	Storm Event	Max. US Elevation (m)	Max. DS Elevation (m)	Max. US Depth (m)	Max. DS	Max. Inflow (L/s)	Max. Resident	Max. Flooded Volume (m^3)	Total Lost Volume (m^3)	Max. Outflow (L/s)	Total Discharge Volume (m^3)	Percentage Available (%)	Status
Cellular Storage	FSR: 100 years: +20 %: 1440 mins: Winter	4.387	4.387	1.387	1.387	9.7	256.970	0.000	0.000	1.4	197.006	7.772	OK
Cellular Storage (1)	FSR: 100 years: +20 %: 1440 mins: Winter	4.245	4.245	1.445	1.445	7.4	181.208	0.000	0.000	1.3	172.318	4.021	OK
Bioretention	FSR: 100 years: +20 %: 1440 mins: Winter	4.387	4.387	0.695	0.787	1.7	14.454	0.000	0.000	1.5	51.911	65.076	OK
Bioretention (1)	FSR: 100 years: +20 %: 1440 mins: Winter	4.387	4.387	0.787	0.787	1.9	11.809	0.000	0.000	1.7	60.334	62.306	OK

Project:	Date:		
Barry's Field, Douglas Cork	01/10/2024		
	Designed by:	Checked by:	Approved By:
	BOSullivan		
Report Details: Type: Connections Summary Storm Phase: Bio-Retention x2	Company Address: Joyce House, Barrack Square, Ballincollig, Cork		

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Critical Storm Per Item: Rank By: Max. Flow

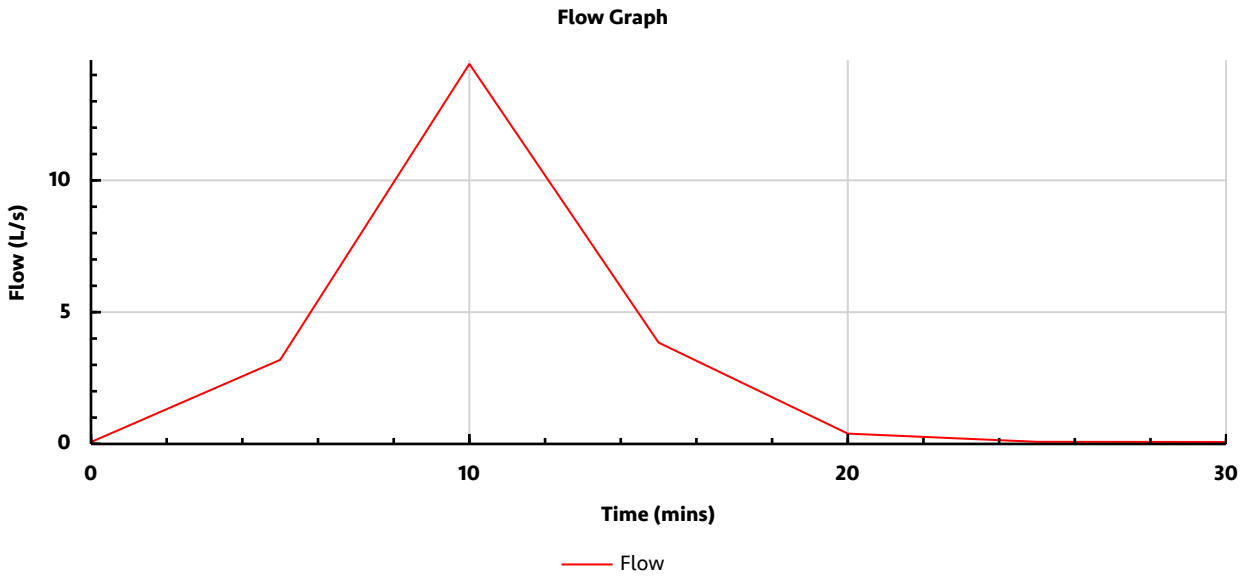
Connection	Storm Event	Connection Type	From	To	Upstream Cover Elevation (m)	Max. US Water Elevation (m)	Max. Flow	Discharge Volume (m^3)	Max.	Flow / Capacity	Max. Flow (L/s)	Status
2.000	FSR: 100 years: +20 %: 15 mins: Summer	Pipe	SW102	SW101	5.250	4.678	0.150	6.412	0.8	0.53	14.4	OK
1.000	FSR: 100 years: +20 %: 15 mins: Summer	Pipe	SW100	SW101	5.250	4.743	0.216	17.112	1.0	0.73	38.8	OK
1.001	FSR: 100 years: +20 %: 15 mins: Winter	Pipe	SW101	SW103	5.250	4.645	0.225	26.370	1.2	0.9	48.2	Surcharged
3.000	FSR: 100 years: +20 %: 15 mins: Winter	Pipe	SW104	SW103	5.250	4.883	0.150	11.625	1.3	1.29	22.9	Surcharged
1.002	FSR: 100 years: +20 %: 15 mins: Winter	Pipe	SW103	SW105	5.250	4.470	0.225	37.977	1.8	1.4	70.5	Surcharged
5.000	FSR: 100 years: +20 %: 15 mins: Winter	Pipe	SW106	SW107	5.250	4.209	0.124	7.247	1.0	0.81	15.0	OK
6.000	FSR: 100 years: +20 %: 15 mins: Winter	Pipe	SW113	SW114	4.800	3.423	0.150	15.391	1.8	1.69	31.3	Surcharged
1.008	FSR: 100 years: +20 %: 1440 mins: Winter	Pipe	SW112	SW118	4.720	2.778	0.038	368.960	0.6	0.06	2.7	OK
1.009	FSR: 100 years: +20 %: 1440 mins: Winter	Pipe	SW118	SW119	5.000	2.658	0.038	368.855	0.6	0.06	2.7	OK
1.010	FSR: 100 years: +20 %: 1440 mins: Winter	Pipe	SW119	SW120	4.800	2.588	0.038	368.753	0.6	0.06	2.7	OK
1.011	FSR: 100 years: +20 %: 1440 mins: Winter	Pipe	SW120	SW121	4.450	2.478	0.038	368.609	0.6	0.06	2.7	OK
1.012	FSR: 100 years: +20 %: 1440 mins: Winter	Pipe	SW121	SW122	3.800	2.288	0.039	368.457	0.6	0.06	2.7	OK
1.013	FSR: 100 years: +20 %: 1440 mins: Winter	Pipe	SW122	SW123	3.350	2.161	0.040	368.303	0.6	0.07	2.7	OK
1.003	FSR: 100 years: +20 %: 15 mins: Summer	Pipe	SW105	Cellular Storage	5.250	3.335	0.225	44.424	2.6	1.44	82.7	Surcharged
5.003	FSR: 100 years: +20 %: 15 mins: Winter	Pipe	SW108	Cellular Storage	5.250	3.376	0.225	20.707	1.7	0.78	40.4	Surcharged
1.004	FSR: 100 years: +20 %: 1440 mins: Winter	Pipe	Cellular Storage	SW109	5.250	4.387	0.028	196.975	0.5	0.03	1.4	Surcharged
6.001	FSR: 100 years: +20 %: 15 mins: Winter	Pipe	SW114	Cellular Storage (1)	4.800	3.186	0.225	14.775	1.5	0.51	30.4	Surcharged

6.002	FSR: 100 years: +20 %: 1440 mins: Winter	Pipe	Cellular Storage (1)	SW112	5.000	4.245	0.032	172.293	0.4	0.03	1.3	Surcharged
1.005	FSR: 100 years: +20 %: 1440 mins: Winter	Pipe	SW109	SW110	5.250	3.008	0.028	196.905	0.5	0.03	1.4	OK
1.006	FSR: 100 years: +20 %: 1440 mins: Winter	Pipe	SW110	SW111	5.250	2.848	0.029	196.824	0.5	0.03	1.4	OK
1.007	FSR: 100 years: +20 %: 1440 mins: Winter	Pipe	SW111	SW112	4.850	2.790	0.034	196.773	0.4	0.03	1.4	OK
7.000	FSR: 100 years: +20 %: 15 mins: Winter	Pipe	SW115	SW116	5.000	3.786	0.150	21.850	2.4	2.36	42.5	Surcharged
8.000	FSR: 100 years: +20 %: 15 mins: Winter	Pipe	SW117	SW116	5.250	4.684	0.081	12.913	2.8	0.54	27.3	OK
7.001	FSR: 100 years: +20 %: 15 mins: Summer	Pipe	SW116	Cellular Storage (1)	5.250	3.144	0.225	30.466	2.2	1.16	65.7	Surcharged
5.001	FSR: 100 years: +20 %: 15 mins: Winter	Pipe	SW107	Bioretention	5.250	4.039	0.131	10.974	0.9	0.62	22.1	OK
5.002	FSR: 100 years: +20 %: 15 mins: Winter	Pipe	Bioretention	SW108	5.342	3.696	0.186	10.802	0.8	0.26	18.9	OK
4.000	FSR: 100 years: +20 %: 15 mins: Winter	Pipe	Bioretention (1)	SW105	5.250	3.750	0.117	12.319	1.1	0.48	23.4	OK

2.000 Type : Pipe

Critical Storm: FSR: 100 years: Increase Rainfall (%): +20: 15 mins: Summer

Graphs

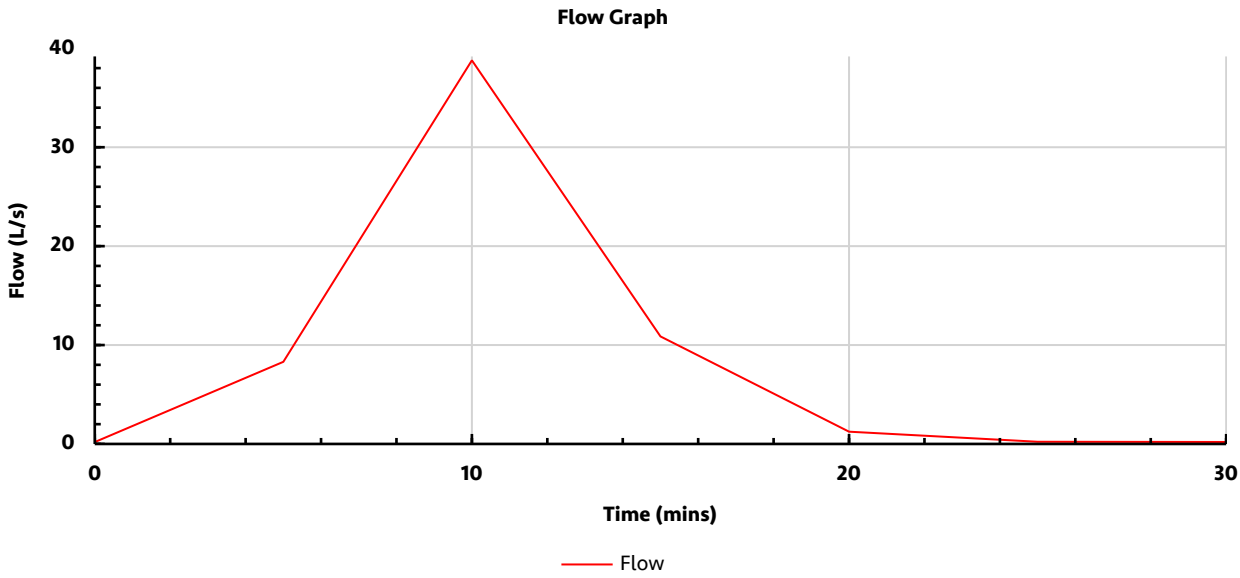


Project:	Date:		
Barry's Field, Douglas Cork	01/10/2024		
	Designed by:	Checked by:	Approved By:
	BOSullivan		
Report Details: Type: Connection Results Storm Phase: Bio-Retention x2	Company Address: Joyce House, Barrack Square, Ballincollig, Cork		

1.000 Type : Pipe

Critical Storm: FSR: 100 years: Increase Rainfall (%): +20: 15 mins: Summer

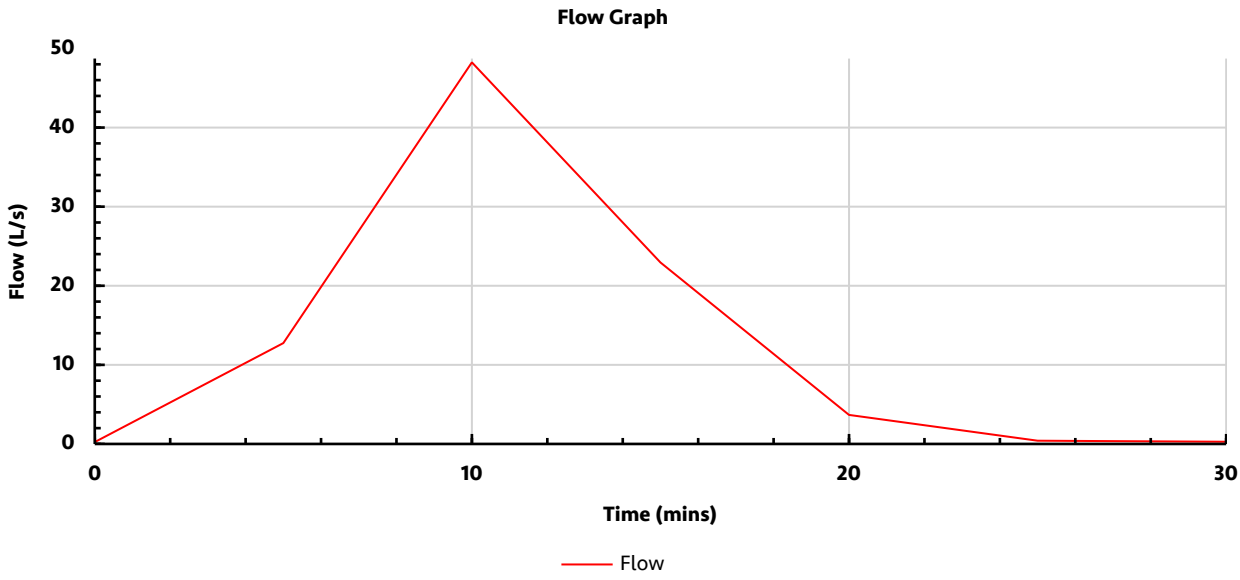
Graphs



1.001 Type : Pipe

Critical Storm: FSR: 100 years: Increase Rainfall (%): +20: 15 mins: Winter

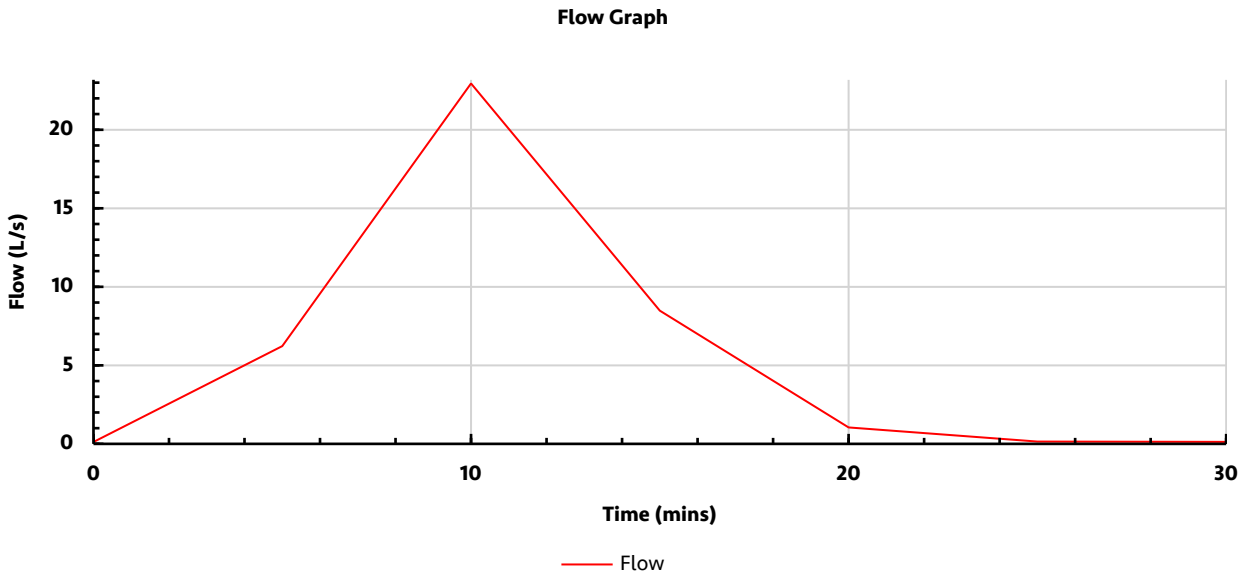
Graphs



3.000 Type : Pipe

Critical Storm: FSR: 100 years: Increase Rainfall (%): +20: 15 mins: Winter

Graphs



Project:	Date:		
Barry's Field, Douglas Cork	01/10/2024		
	Designed by:	Checked by:	Approved By:
	BOSullivan		
Report Details: Type: Connection Results Storm Phase: Bio-Retention x2	Company Address: Joyce House, Barrack Square, Ballincollig, Cork		

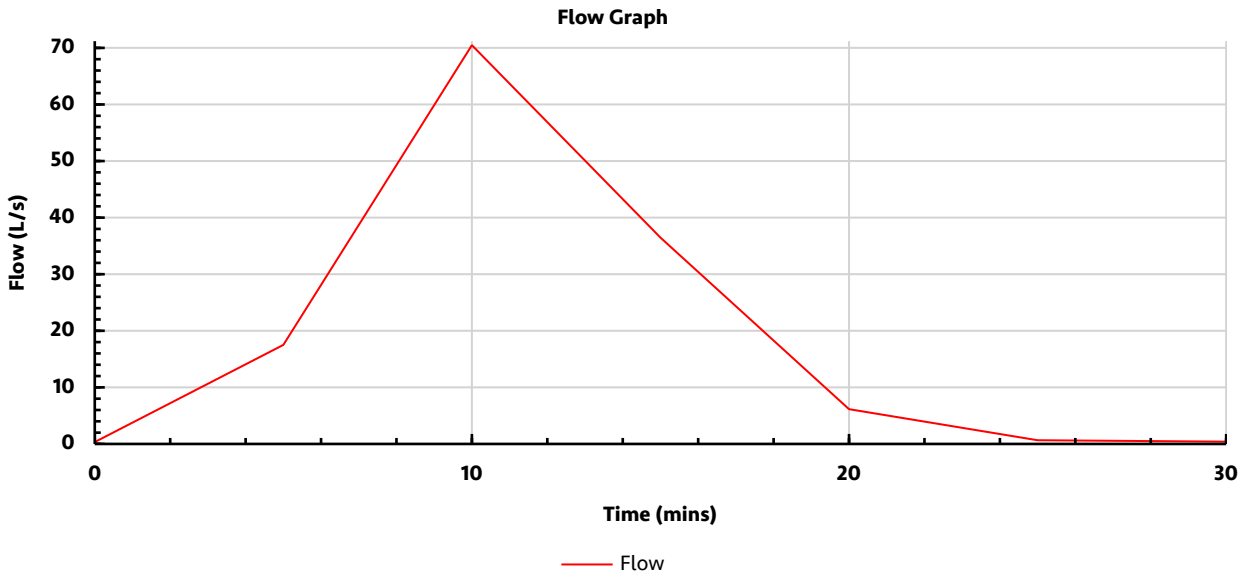
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1.002
Critical Storm: FSR: 100 years: Increase Rainfall (%): +20: 15 mins: Winter

Type : Pipe

Graphs

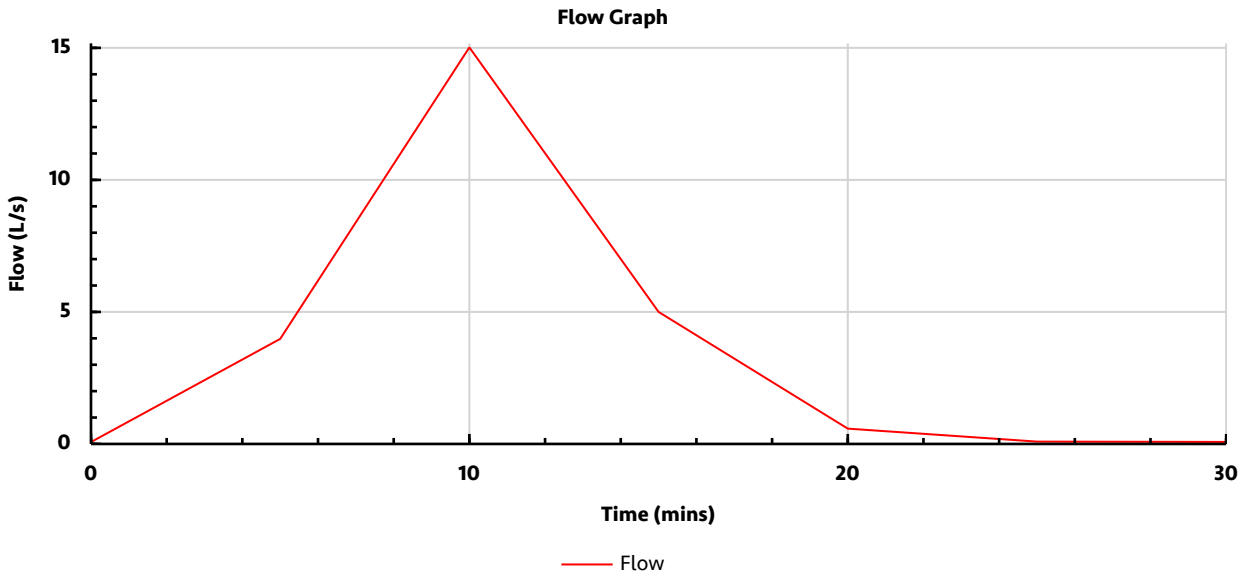


Project:	Date:		
Barry's Field, Douglas Cork	01/10/2024		
	Designed by:	Checked by:	Approved By:
	BOSullivan		
Report Details: Type: Connection Results Storm Phase: Bio-Retention x2	Company Address: Joyce House, Barrack Square, Ballincollig, Cork		

5.000 Type : Pipe

Critical Storm: FSR: 100 years: Increase Rainfall (%): +20: 15 mins: Winter

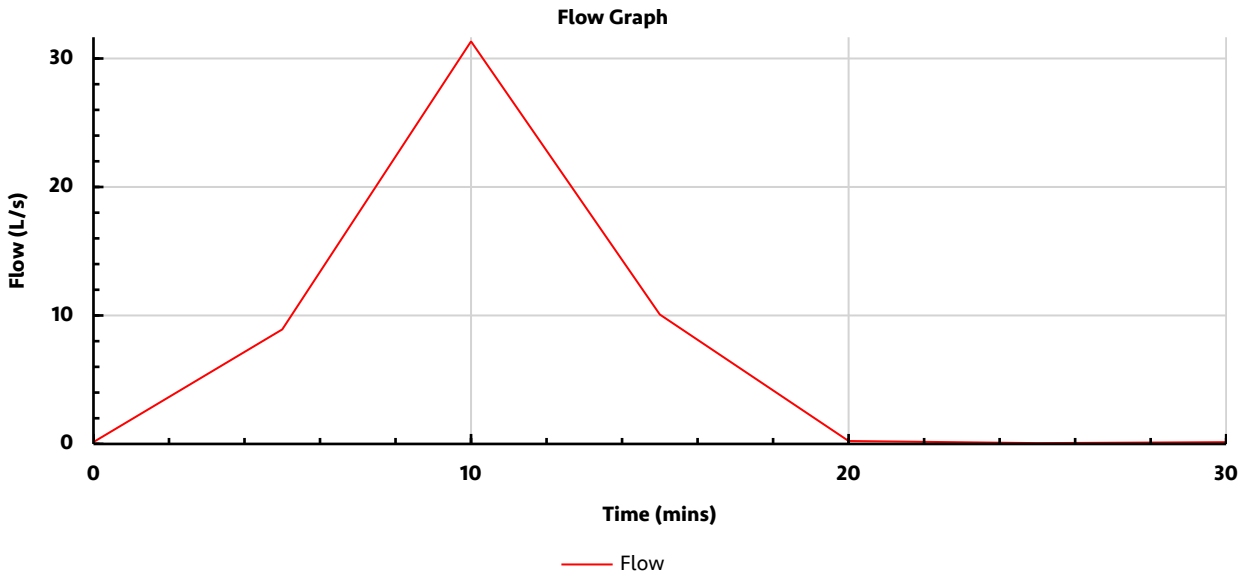
Graphs



6.000 Type : Pipe

Critical Storm: FSR: 100 years: Increase Rainfall (%): +20: 15 mins: Winter

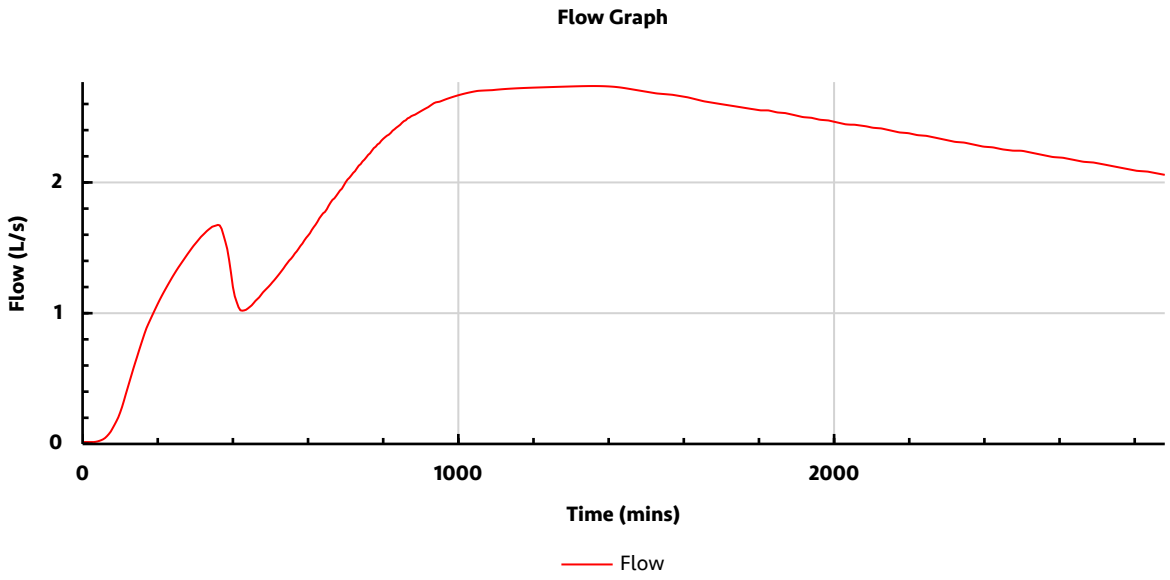
Graphs



1.008 Type : Pipe

Critical Storm: FSR: 100 years: Increase Rainfall (%): +20: 1440 mins: Winter

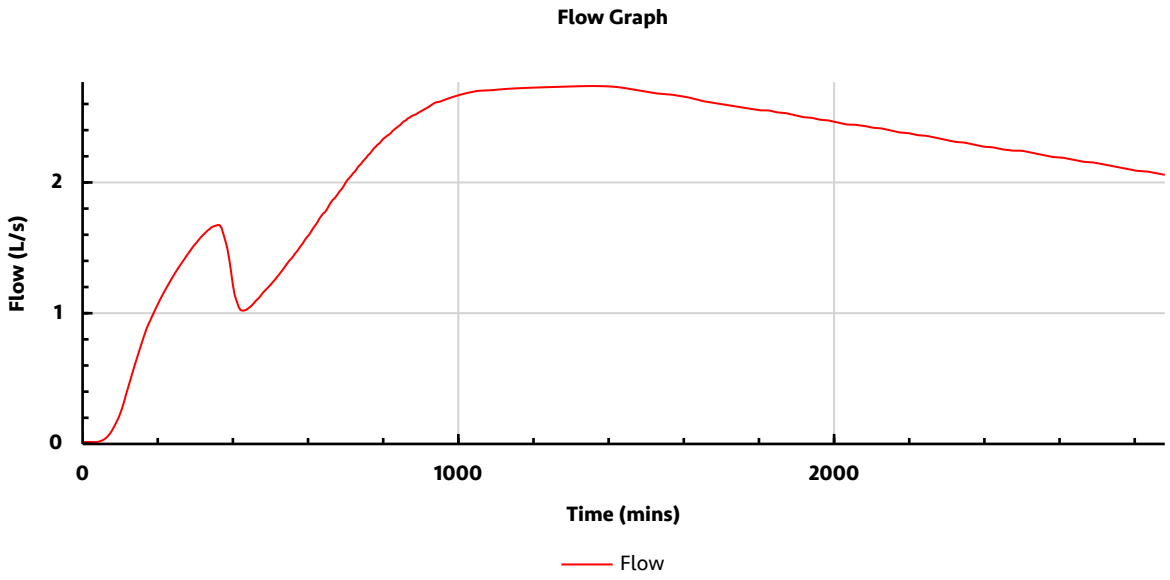
Graphs



1.009 Type : Pipe

Critical Storm: FSR: 100 years: Increase Rainfall (%): +20: 1440 mins: Winter

Graphs



Project:	Date:		
Barry's Field, Douglas Cork	01/10/2024		
	Designed by:	Checked by:	Approved By:
	BOSullivan		
Report Details: Type: Connection Results Storm Phase: Bio-Retention x2	Company Address: Joyce House, Barrack Square, Ballincollig, Cork		

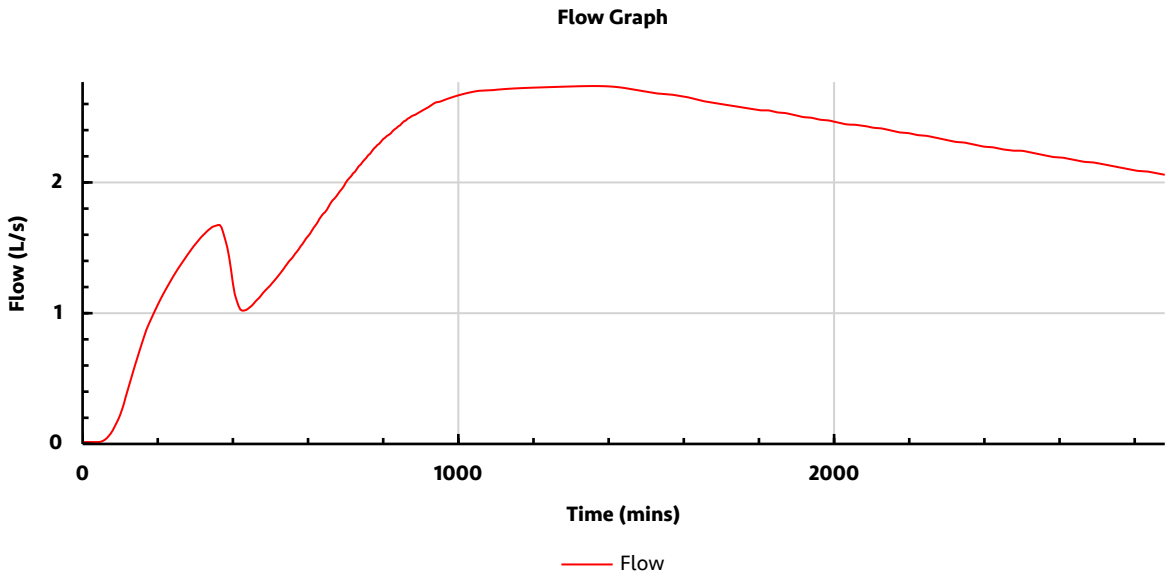
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1.010 Type : Pipe

Critical Storm: FSR: 100 years: Increase Rainfall (%): +20: 1440 mins: Winter

Graphs



Project:	Date:		
Barry's Field, Douglas Cork	01/10/2024		
	Designed by:	Checked by:	Approved By:
	BOSullivan		
Report Details: Type: Connection Results Storm Phase: Bio-Retention x2	Company Address: Joyce House, Barrack Square, Ballincollig, Cork		

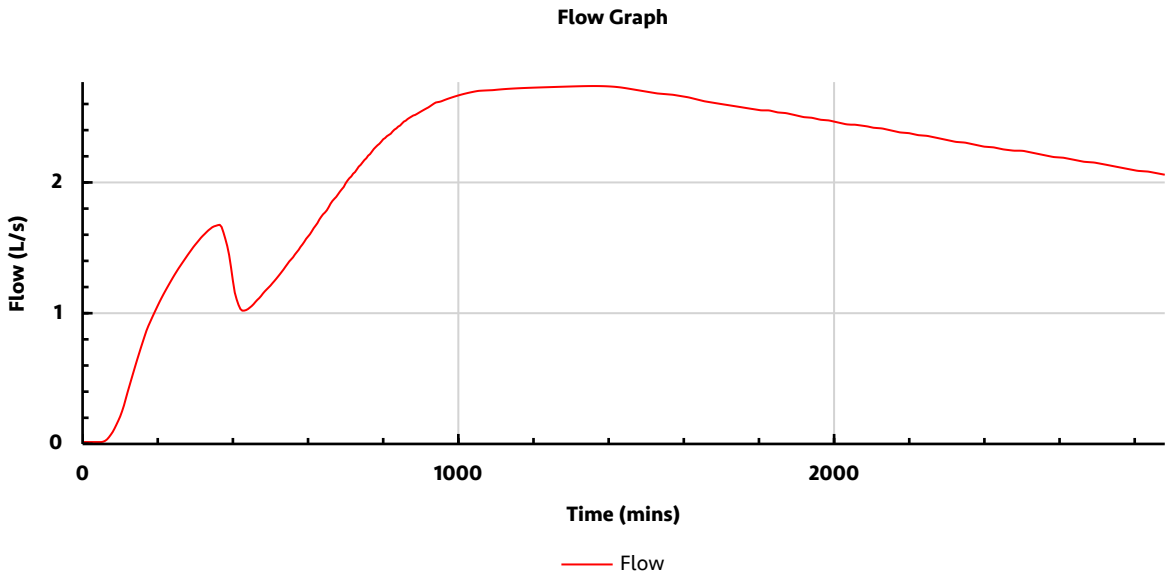
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1.011 Type : Pipe

Critical Storm: FSR: 100 years: Increase Rainfall (%): +20: 1440 mins: Winter

Graphs

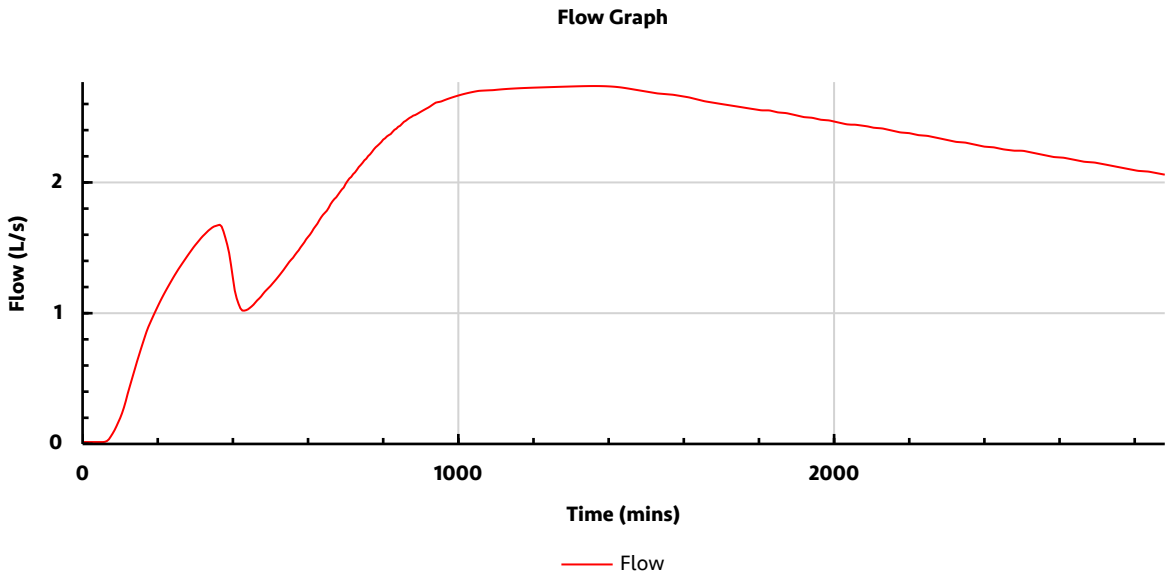




1.012 Type : Pipe

Critical Storm: FSR: 100 years: Increase Rainfall (%): +20: 1440 mins: Winter

Graphs

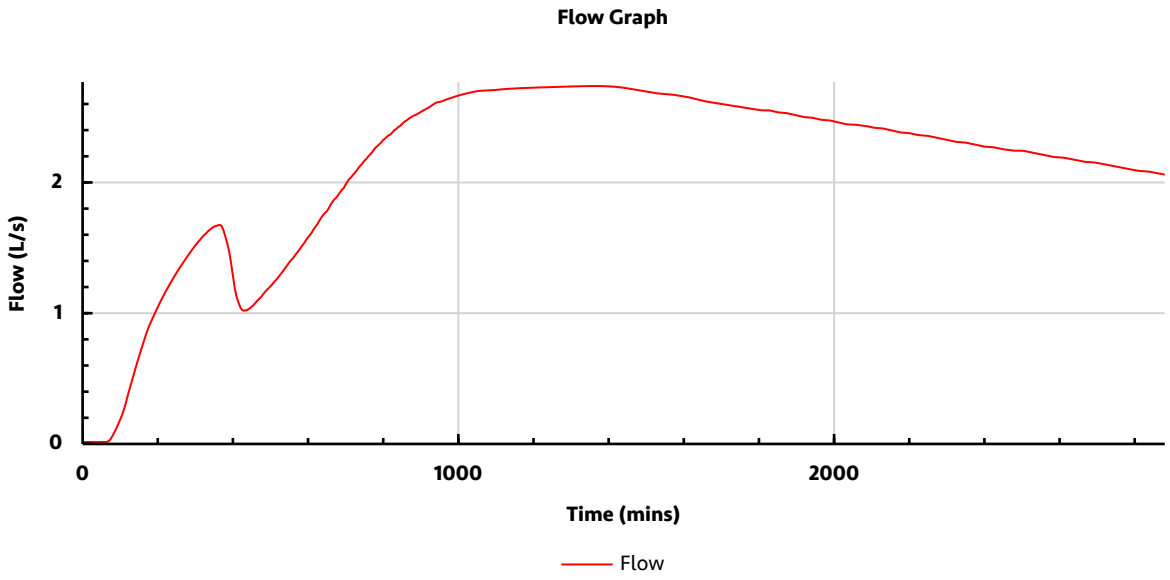




1.013 Type : Pipe

Critical Storm: FSR: 100 years: Increase Rainfall (%): +20: 1440 mins: Winter

Graphs



Project:	Date:		
Barry's Field, Douglas Cork	01/10/2024		
	Designed by:	Checked by:	Approved By:
	BOSullivan		
Report Details: Type: Connection Results Storm Phase: Bio-Retention x2	Company Address: Joyce House, Barrack Square, Ballincollig, Cork		

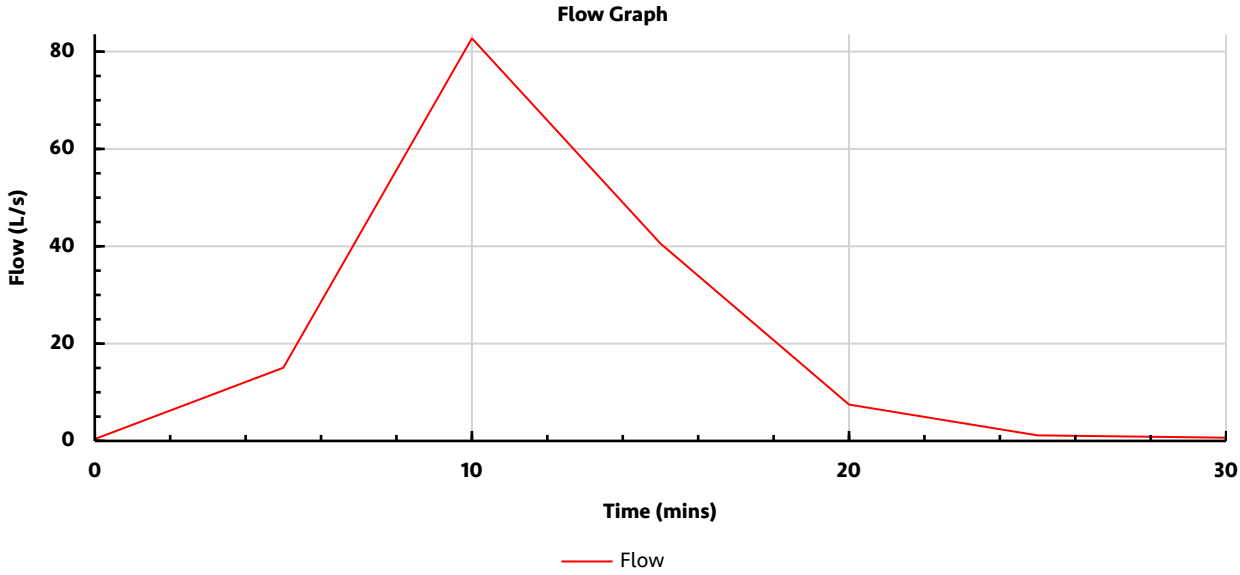
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1.003 Type : Pipe

Critical Storm: FSR: 100 years: Increase Rainfall (%): +20: 15 mins: Summer

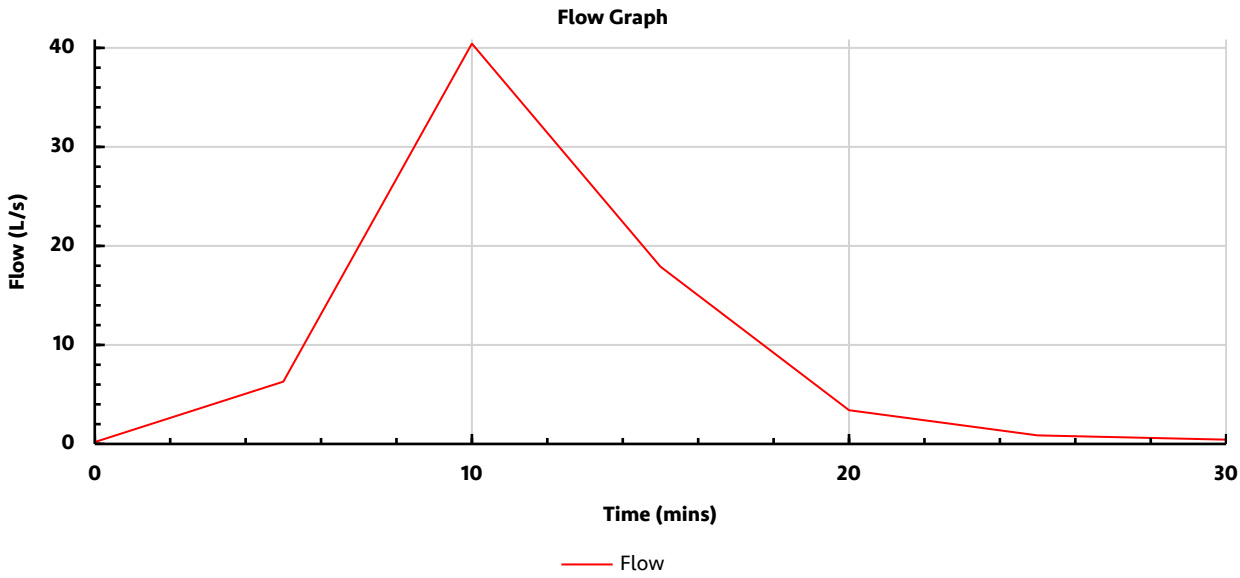
Graphs



5.003 Type : Pipe

Critical Storm: FSR: 100 years: Increase Rainfall (%): +20: 15 mins: Winter

Graphs



Project:	Date:		
Barry's Field, Douglas Cork	01/10/2024		
	Designed by:	Checked by:	Approved By:
	BOSullivan		
Report Details: Type: Connection Results Storm Phase: Bio-Retention x2	Company Address: Joyce House, Barrack Square, Ballincollig, Cork		

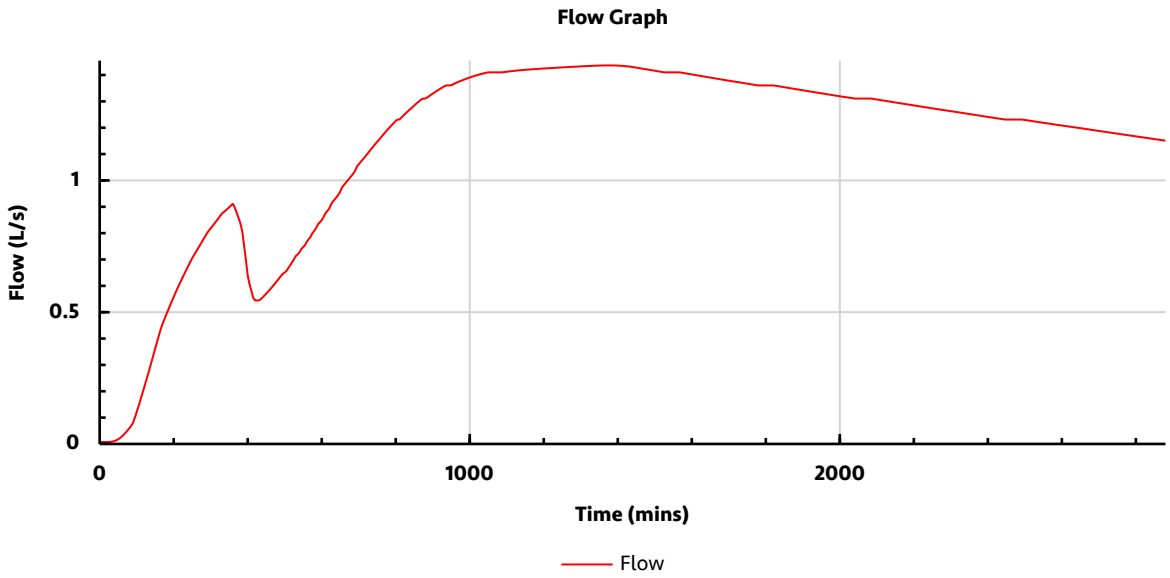
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1.004 Type : Pipe

Critical Storm: FSR: 100 years: Increase Rainfall (%): +20: 1440 mins: Winter

Graphs

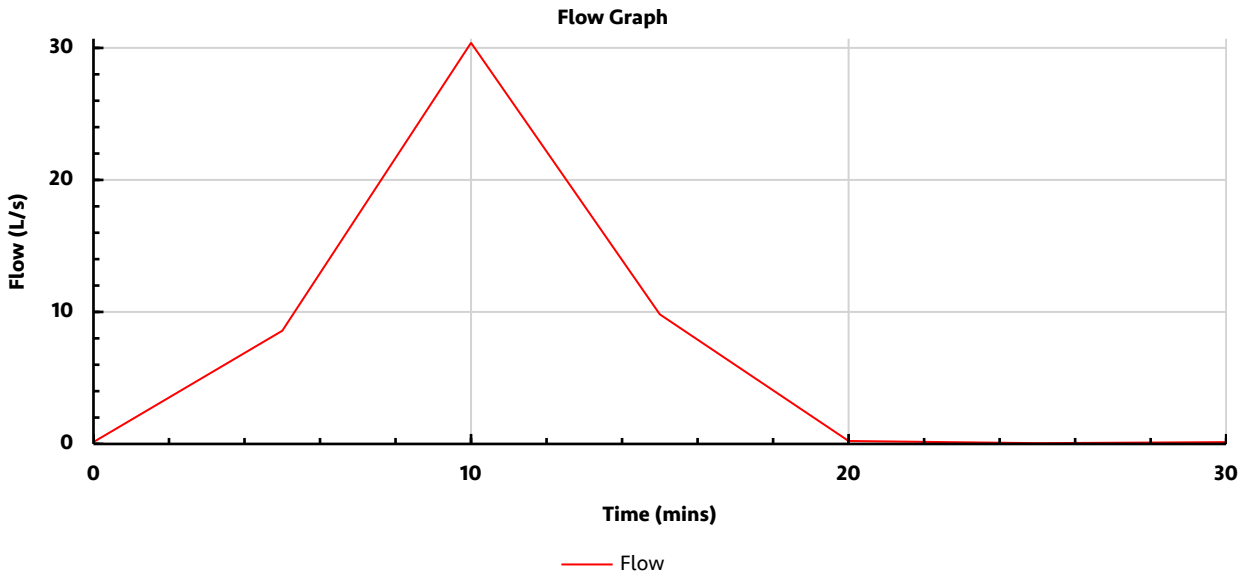




6.001 Type : Pipe

Critical Storm: FSR: 100 years: Increase Rainfall (%): +20: 15 mins: Winter

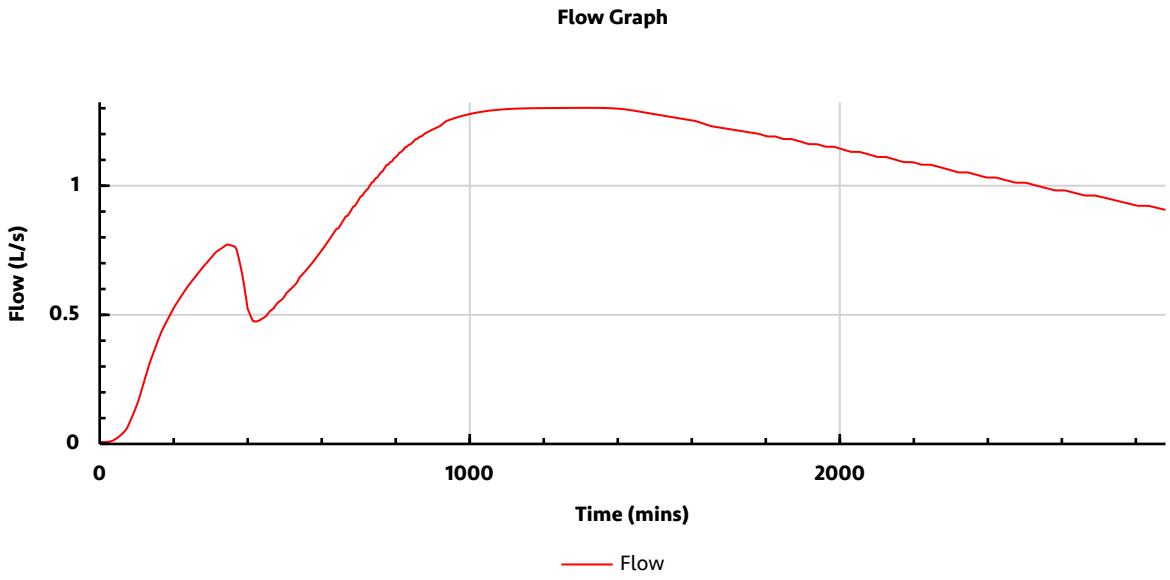
Graphs



6.002 Type : Pipe

Critical Storm: FSR: 100 years: Increase Rainfall (%): +20: 1440 mins: Winter

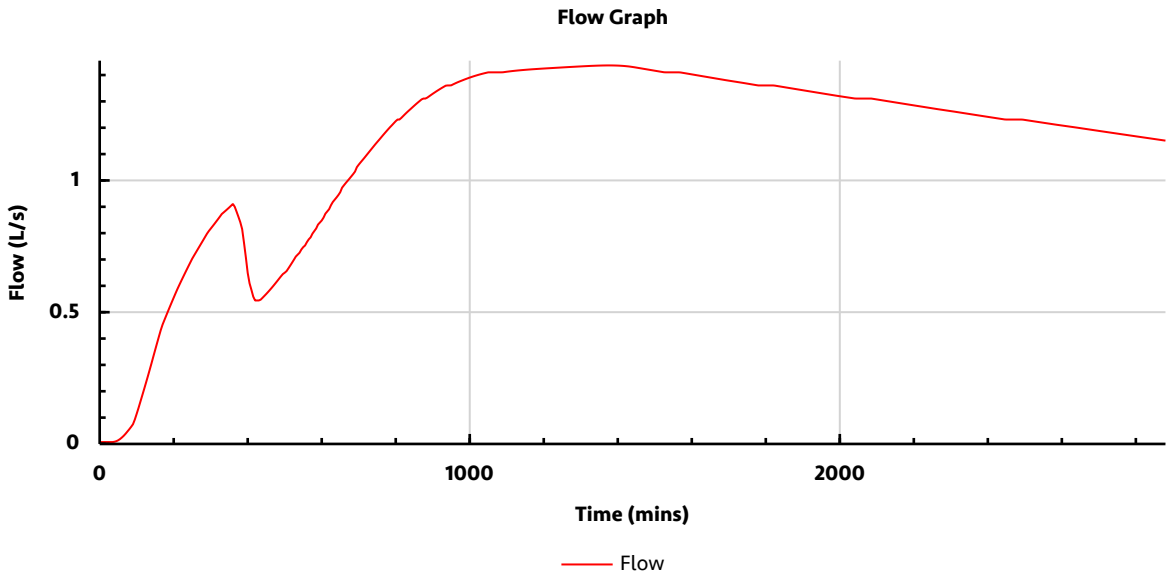
Graphs



1.005 Type : Pipe

Critical Storm: FSR: 100 years: Increase Rainfall (%): +20: 1440 mins: Winter

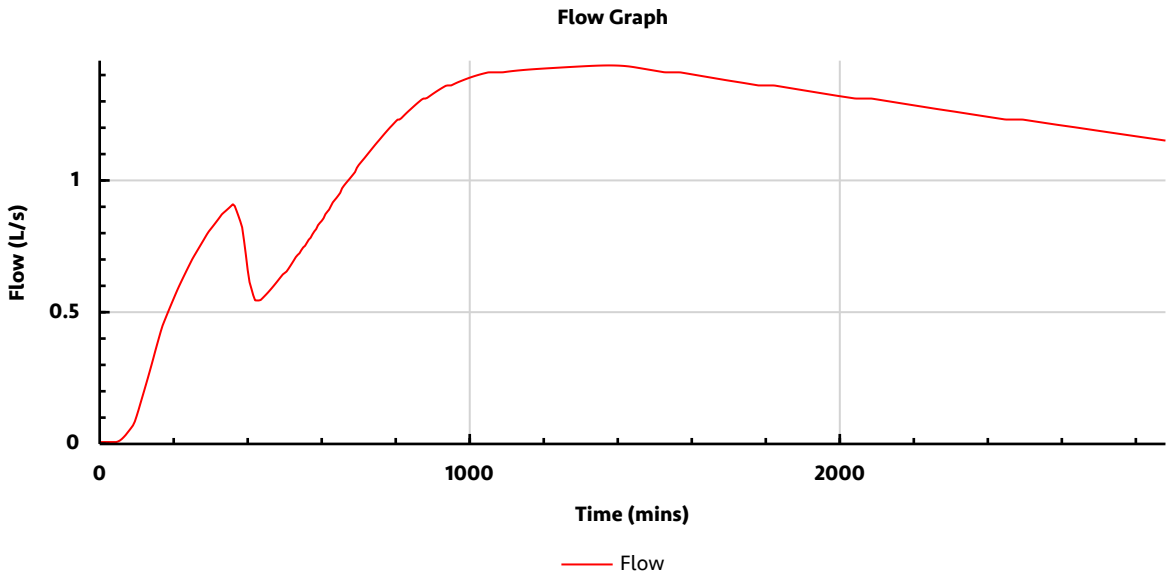
Graphs



1.006 Type : Pipe

Critical Storm: FSR: 100 years: Increase Rainfall (%): +20: 1440 mins: Winter

Graphs



Project:	Date:		
Barry's Field, Douglas Cork	01/10/2024		
	Designed by:	Checked by:	Approved By:
	BOSullivan		
Report Details: Type: Connection Results Storm Phase: Bio-Retention x2	Company Address: Joyce House, Barrack Square, Ballincollig, Cork		

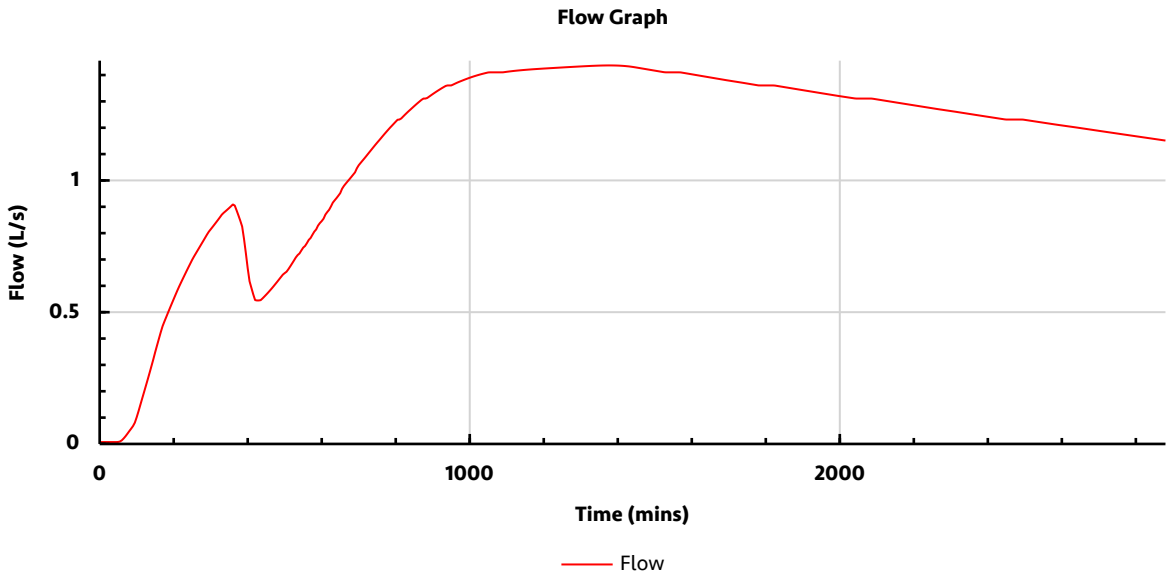
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1.007
Critical Storm: FSR: 100 years: Increase Rainfall (%): +20: 1440 mins: Winter

Type : Pipe

Graphs



Project:	Date:		
Barry's Field, Douglas Cork	01/10/2024		
	Designed by:	Checked by:	Approved By:
	BOSullivan		
Report Details: Type: Connection Results Storm Phase: Bio-Retention x2	Company Address: Joyce House, Barrack Square, Ballincollig, Cork		

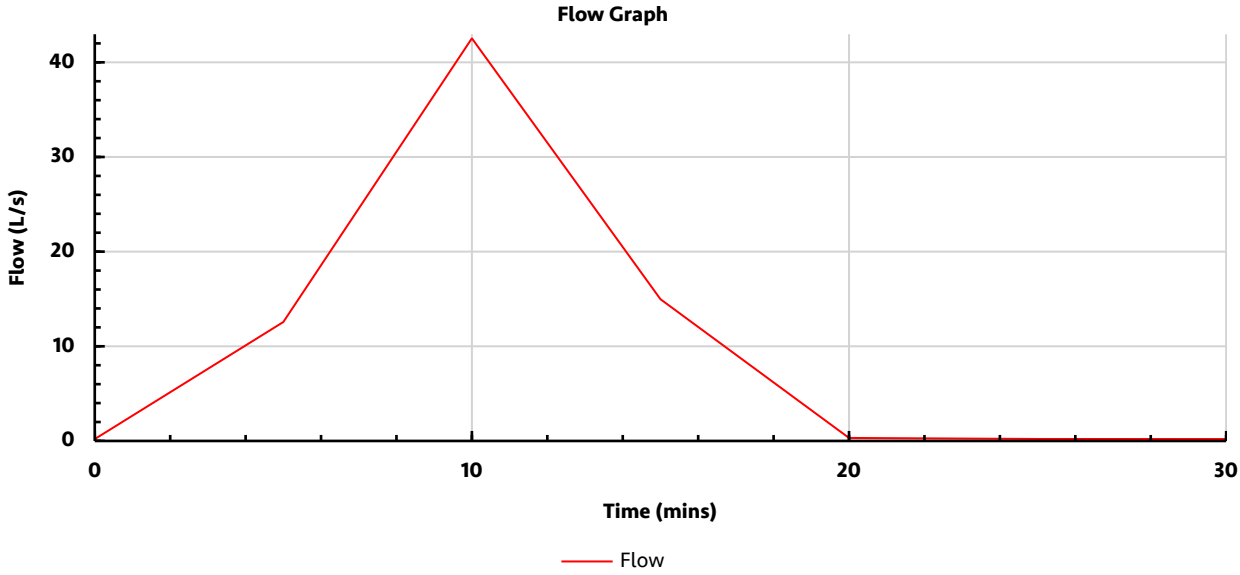
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7.000 Type : Pipe

Critical Storm: FSR: 100 years: Increase Rainfall (%): +20: 15 mins: Winter

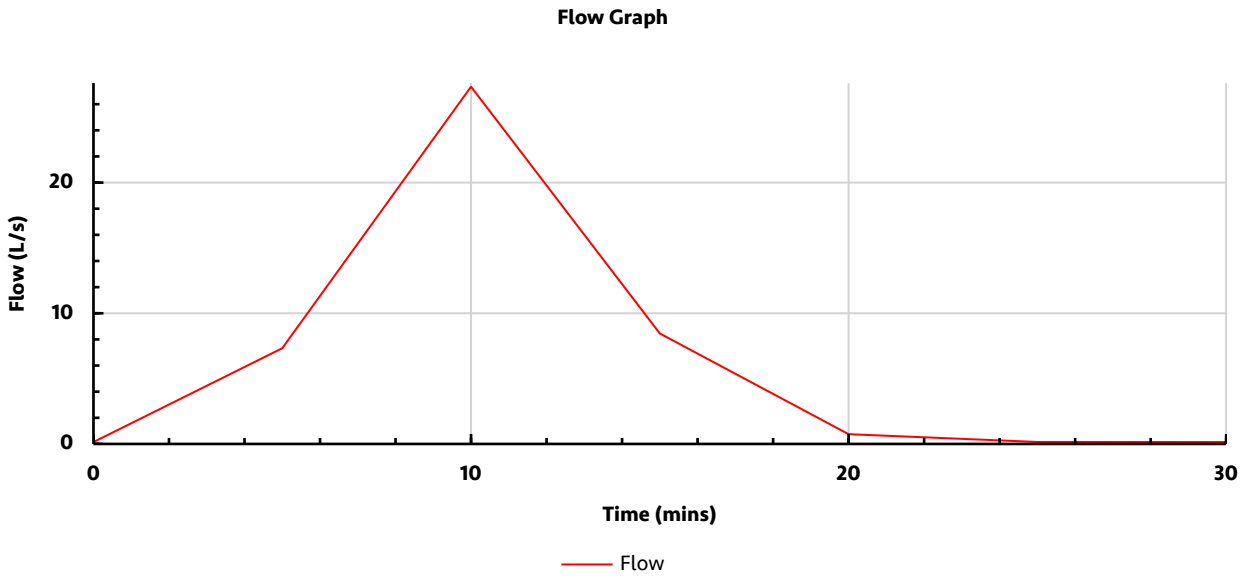
Graphs



8.000 Type : Pipe

Critical Storm: FSR: 100 years: Increase Rainfall (%): +20: 15 mins: Winter

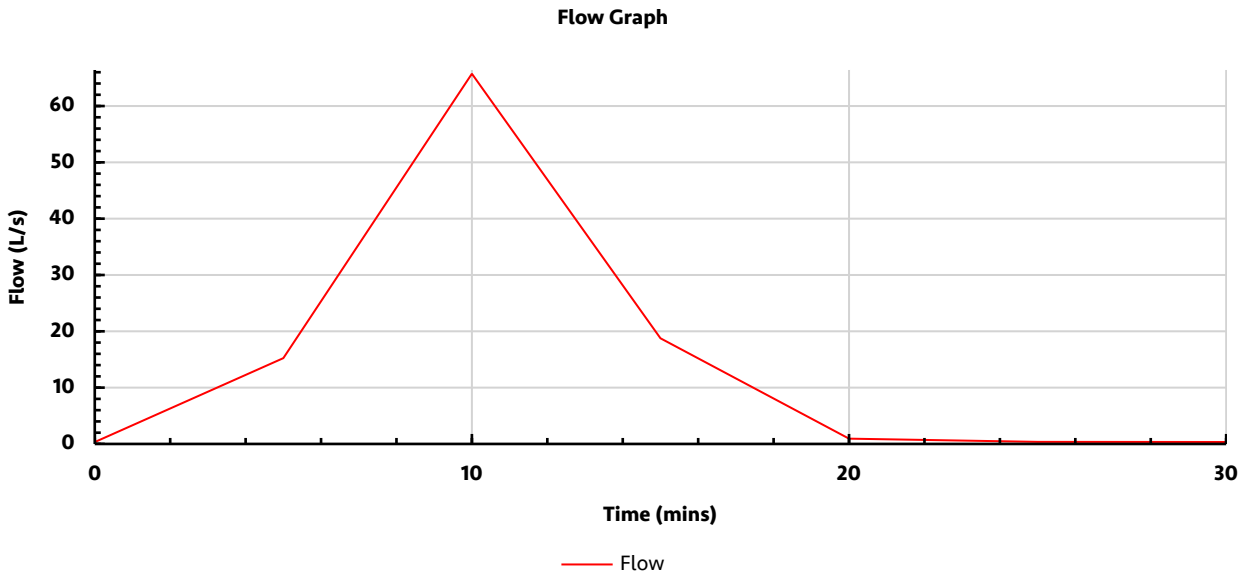
Graphs



7.001 Type : Pipe

Critical Storm: FSR: 100 years: Increase Rainfall (%): +20: 15 mins: Summer

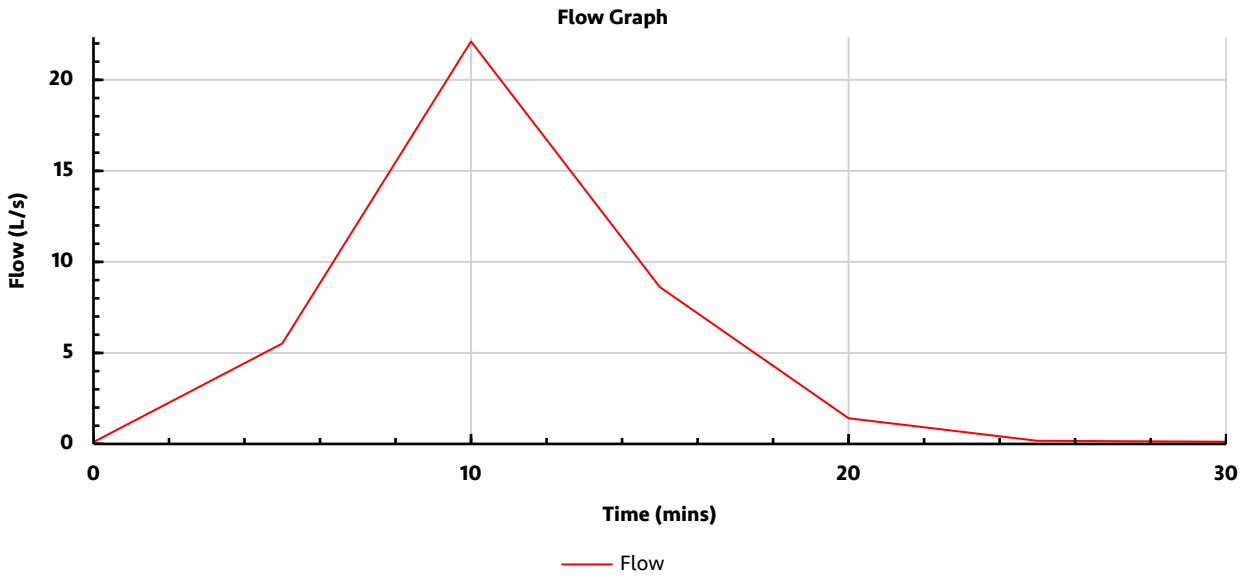
Graphs



5.001 Type : Pipe

Critical Storm: FSR: 100 years: Increase Rainfall (%): +20: 15 mins: Winter

Graphs

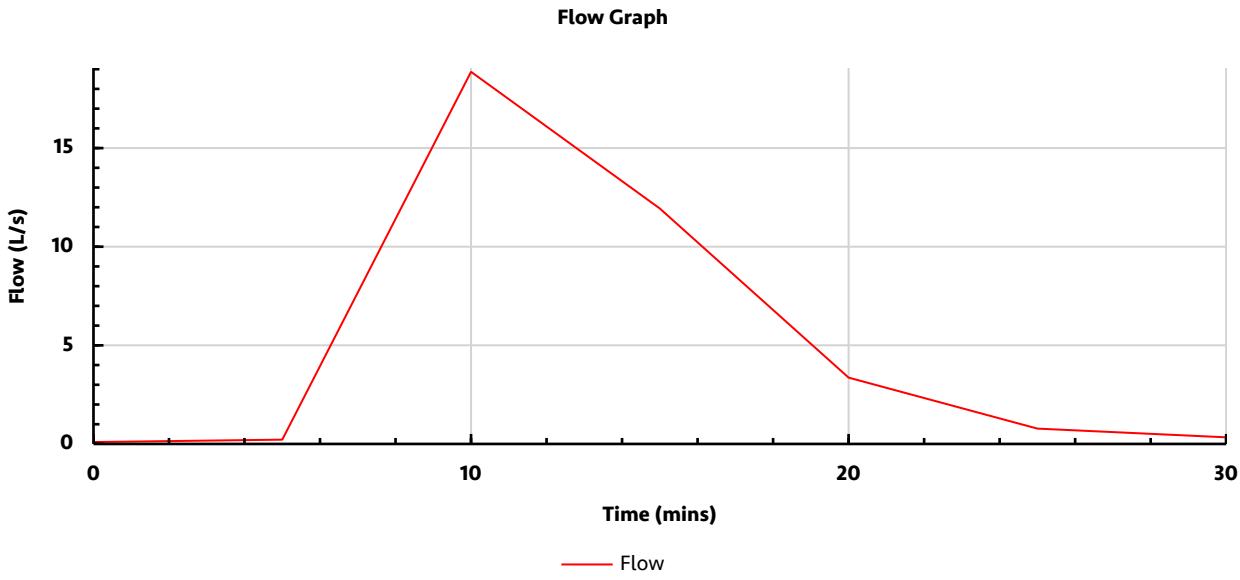


Project:	Date:		
Barry's Field, Douglas Cork	01/10/2024		
	Designed by:	Checked by:	Approved By:
	BOSullivan		
Report Details: Type: Connection Results Storm Phase: Bio-Retention x2	Company Address: Joyce House, Barrack Square, Ballincollig, Cork		

5.002 Type : Pipe

Critical Storm: FSR: 100 years: Increase Rainfall (%): +20: 15 mins: Winter

Graphs



Project:	Date:		
Barry's Field, Douglas Cork	01/10/2024		
	Designed by:	Checked by:	Approved By:
	BOSullivan		
Report Details: Type: Connection Results Storm Phase: Bio-Retention x2	Company Address: Joyce House, Barrack Square, Ballincollig, Cork		

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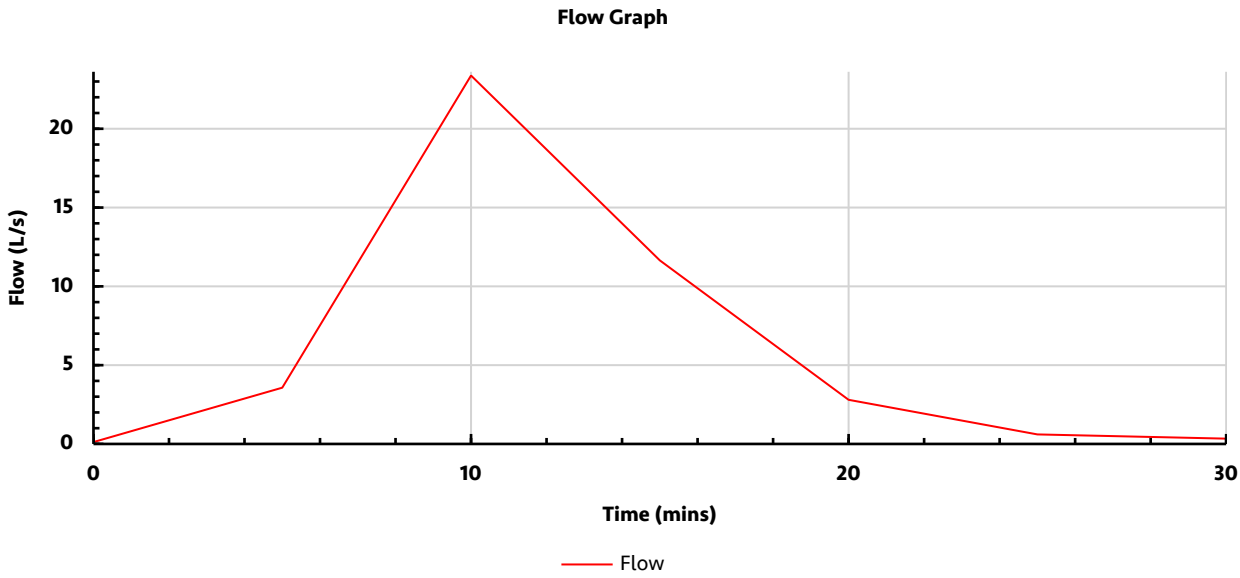


4.000

Type : Pipe

Critical Storm: FSR: 100 years: Increase Rainfall (%): +20: 15 mins: Winter

Graphs



Appendix C – Foul Sewer Report

Project:	Date:		
Barry's Field, Douglas, Cork	04/10/2024		
	Designed by:	Checked by:	Approved By:
	BOSullivan		
Report Details: Type: Junctions Sanitary Phase: Phase	Company Address: Joyce House, Barrack Square, Ballincollig, Cork		

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Name	Junction Type	Easting (m)	Northing (m)	Cover Elevation (m)	Depth (m)	Invert Elevation (m)	Chamber Shape	Diameter (m)
FS100	Manhole	569911.939	569450.282	5.250	0.825	4.425	Circular	1.200
FS101	Manhole	569923.974	569410.289	5.250	1.520	3.730	Circular	1.200
FS102	Manhole	569929.248	569392.765	5.250	0.825	4.425	Circular	1.200
FS103	Manhole	569946.011	569416.921	5.250	1.670	3.580	Circular	1.200
FS104	Manhole	569938.666	569441.329	5.250	0.825	4.425	Circular	1.200
FS106	Manhole	569927.951	569460.882	5.250	0.825	4.425	Circular	1.200
FS107	Manhole	569951.770	569468.050	5.250	1.240	4.010	Circular	1.200
FS108	Manhole	569957.462	569449.138	5.250	1.570	3.680	Circular	1.200
FS109	Manhole	569961.877	569446.962	5.250	1.600	3.650	Circular	1.200
FS105	Manhole	569968.849	569423.795	5.250	1.830	3.420	Circular	1.200
FS111	Manhole	569984.722	569449.301	5.250	0.825	4.425	Circular	1.200
FS110	Manhole	569990.443	569430.294	5.250	1.980	3.270	Circular	1.200
FS114	Manhole	569997.362	569453.106	4.800	1.050	3.750	Circular	1.200
FS112	Manhole	569993.843	569418.994	5.250	2.060	3.190	Circular	1.200
FS113	Manhole	570006.483	569422.798	4.720	1.620	3.100	Circular	1.200
FS115	Manhole	570025.155	569428.418	5.000	2.030	2.970	Circular	1.200
FS116	Manhole	570040.322	569382.029	5.650	3.010	2.640	Circular	1.200

Name	Lock
FS100	None
FS101	None
FS102	None
FS103	None
FS104	None
FS106	None
FS107	None
FS108	None
FS109	None
FS105	None
FS111	None
FS110	None
FS114	None
FS112	None
FS113	None
FS115	None
FS116	None

Project:	Date:		
Barry's Field, Douglas, Cork	04/10/2024		
	Designed by:	Checked by:	Approved By:
	BOSullivan		
Report Details: Type: Connections Sanitary Phase: Phase	Company Address: Joyce House, Barrack Square, Ballincollig, Cork		

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Name	Length (m)	Connection Type	Slope (1:x)	Manning's n	Colebrook-White Roughness (mm)	Diameter / Base Width (mm)	Upstream Cover Elevation (m)	Upstream Invert Elevation (m)
1.000	41.765	Pipe	60.094		1.5	150	5.250	4.425
2.000	18.300	Pipe	60.000		1.5	150	5.250	4.425
1.001	23.014	Pipe	153.426		1.5	225	5.250	3.730
3.000	25.489	Pipe	59.974		1.5	150	5.250	4.425
1.002	23.850	Pipe	149.063		1.5	225	5.250	3.580
4.000	24.875	Pipe	59.940		1.5	150	5.250	4.425
4.001	19.750	Pipe	59.848		1.5	150	5.250	4.010
4.002	4.922	Pipe	164.072		1.5	225	5.250	3.680
4.003	24.193	Pipe	151.208		1.5	225	5.250	3.650
1.003	22.550	Pipe	150.333		1.5	225	5.250	3.420
5.000	19.850	Pipe	59.254		1.5	150	5.250	4.425
1.004	11.800	Pipe	147.500		1.5	225	5.250	3.270
1.005	13.200	Pipe	146.667		1.5	225	5.250	3.190
6.000	31.650	Pipe	59.717		1.5	150	4.800	3.750
1.006	19.499	Pipe	149.996		1.5	225	4.720	3.100
1.007	48.806	Pipe	147.895		1.5	225	5.000	2.970

Name	Downstream Cover Elevation (m)	Downstream Invert Elevation (m)	Lock
1.000	5.250	3.730	All
2.000	5.250	4.120	All
1.001	5.250	3.580	All
3.000	5.250	4.000	All
1.002	5.250	3.420	All
4.000	5.250	4.010	All
4.001	5.250	3.680	All
4.002	5.250	3.650	All
4.003	5.250	3.490	All
1.003	5.250	3.270	All
5.000	5.250	4.090	All
1.004	5.250	3.190	All
1.005	4.720	3.100	All
6.000	4.720	3.220	All
1.006	5.000	2.970	All
1.007	5.650	2.640	All

Project:	Date:			
Barry's Field, Douglas, Cork	04/10/2024			
	Designed by:	Checked by:	Approved By:	
	BOSullivan			
Report Details: Type: Manhole Schedule Sanitary Phase: Phase	Company Address: Joyce House, Barrack Square, Ballincollig, Cork			

Name	Cover Elevation (m) Invert Elevation (m)	Manhole Size (m)	Connection Details				Type
Coordinates (m)	Depth (m)		Incoming Connections	Connection Type	Connection Invert (m)	Connection Size (mm)	Junction Type
			Outgoing Connections				Cover
FS100	5.250 4.425	Diameter / Length: 1.200					Manhole
E:569911.939 N:569450.282	0.825		{a} 1.000	Pipe	4.425	Diam/Width:150	Not Applicable
FS101	5.250 3.730	Diameter / Length: 1.200	{1} 1.000 {2} 2.000	Pipe Pipe	3.730 4.120	Diam/Width:150 Diam/Width:150	Manhole
E:569923.974 N:569410.289	1.520		{a} 1.001	Pipe	3.730	Diam/Width:225	Not Applicable
FS102	5.250 4.425	Diameter / Length: 1.200					Manhole
E:569929.248 N:569392.765	0.825		{a} 2.000	Pipe	4.425	Diam/Width:150	Not Applicable
FS103	5.250 3.580	Diameter / Length: 1.200	{1} 1.001 {2} 3.000	Pipe Pipe	3.580 4.000	Diam/Width:225 Diam/Width:150	Manhole
E:569946.011 N:569416.921	1.670		{a} 1.002	Pipe	3.580	Diam/Width:225	Not Applicable

Project:	Date:			
Barry's Field, Douglas, Cork	04/10/2024			
	Designed by:	Checked by:	Approved By:	
	BOSullivan			
Report Details: Type: Manhole Schedule Sanitary Phase: Phase	Company Address: Joyce House, Barrack Square, Ballincollig, Cork			

Name	Cover Elevation (m) Invert Elevation (m)	Manhole Size (m)	Connection Details				Type
Coordinates (m)	Depth (m)		Incoming Connections	Connection Type	Connection Invert (m)	Connection Size (mm)	Junction Type
			Outgoing Connections				Cover
FS104	5.250 4.425	Diameter / Length: 1.200					Manhole
E:569938.666 N:569441.329	0.825		{a} 3.000	Pipe	4.425	Diam/Width:150	Not Applicable
FS106	5.250 4.425	Diameter / Length: 1.200					Manhole
E:569927.951 N:569460.882	0.825		{a} 4.000	Pipe	4.425	Diam/Width:150	Not Applicable
FS107	5.250 4.010	Diameter / Length: 1.200	{1} 4.000	Pipe	4.010	Diam/Width:150	Manhole
E:569951.770 N:569468.050	1.240		{a} 4.001	Pipe	4.010	Diam/Width:150	Not Applicable
FS108	5.250 3.680	Diameter / Length: 1.200	{1} 4.001	Pipe	3.680	Diam/Width:150	Manhole
E:569957.462 N:569449.138	1.570		{a} 4.002	Pipe	3.680	Diam/Width:225	Not Applicable

Project:	Date:			
Barry's Field, Douglas, Cork	04/10/2024			
	Designed by:	Checked by:	Approved By:	
	BOSullivan			
Report Details: Type: Manhole Schedule Sanitary Phase: Phase	Company Address: Joyce House, Barrack Square, Ballincollig, Cork			

Name	Cover Elevation (m) Invert Elevation (m)	Manhole Size (m)	Connection Details				Type
Coordinates (m)	Depth (m)		Incoming Connections	Connection Type	Connection Invert (m)	Connection Size (mm)	Junction Type
			Outgoing Connections				Cover
FS109	5.250 3.650	Diameter / Length: 1.200	{1} 4.002	Pipe	3.650	Diam/Width:225	Manhole
E:569961.877 N:569446.962	1.600		{a} 4.003	Pipe	3.650	Diam/Width:225	Not Applicable
FS105	5.250 3.420	Diameter / Length: 1.200	{1} 1.002 {2} 4.003	Pipe Pipe	3.420 3.490	Diam/Width:225 Diam/Width:225	Manhole
E:569968.849 N:569423.795	1.830		{a} 1.003	Pipe	3.420	Diam/Width:225	Not Applicable
FS111	5.250 4.425	Diameter / Length: 1.200					Manhole
E:569984.722 N:569449.301	0.825		{a} 5.000	Pipe	4.425	Diam/Width:150	Not Applicable
FS110	5.250 3.270	Diameter / Length: 1.200	{1} 1.003 {2} 5.000	Pipe Pipe	3.270 4.090	Diam/Width:225 Diam/Width:150	Manhole
E:569990.443 N:569430.294	1.980		{a} 1.004	Pipe	3.270	Diam/Width:225	Not Applicable

Project:	Date:			
Barry's Field, Douglas, Cork	04/10/2024			
	Designed by:	Checked by:	Approved By:	
	BOSullivan			
Report Details: Type: Manhole Schedule Sanitary Phase: Phase	Company Address: Joyce House, Barrack Square, Ballincollig, Cork			

Name	Cover Elevation (m) Invert Elevation (m)	Manhole Size (m)	Connection Details				Type
Coordinates (m)	Depth (m)		Incoming Connections	Connection Type	Connection Invert (m)	Connection Size (mm)	Junction Type
			Outgoing Connections				Cover
FS114	4.800 3.750	Diameter / Length: 1.200					Manhole
E:569997.362 N:569453.106	1.050		{a} 6.000	Pipe	3.750	Diam/Width:150	Not Applicable
FS112	5.250 3.190	Diameter / Length: 1.200	{1} 1.004	Pipe	3.190	Diam/Width:225	Manhole
E:569993.843 N:569418.994	2.060		{a} 1.005	Pipe	3.190	Diam/Width:225	Not Applicable
FS113	4.720 3.100	Diameter / Length: 1.200	{1} 1.005 {2} 6.000	Pipe Pipe	3.100 3.220	Diam/Width:225 Diam/Width:150	Manhole
E:570006.483 N:569422.798	1.620		{a} 1.006	Pipe	3.100	Diam/Width:225	Not Applicable
FS115	5.000 2.970	Diameter / Length: 1.200	{1} 1.006	Pipe	2.970	Diam/Width:225	Manhole
E:570025.155 N:569428.418	2.030		{a} 1.007	Pipe	2.970	Diam/Width:225	Not Applicable

Project:	Date:		
Barry's Field, Douglas, Cork	04/10/2024		
	Designed by:	Checked by:	Approved By:
	BOSullivan		
Report Details: Type: Manhole Schedule Sanitary Phase: Phase	Company Address: Joyce House, Barrack Square, Ballincollig, Cork		

Name	Cover Elevation (m) Invert Elevation (m)	Manhole Size (m)	Connection Details				Type
Coordinates (m)	Depth (m)		Incoming Connections	Connection Type	Connection Invert (m)	Connection Size (mm)	Junction Type
			Outgoing Connections				Cover
FS116	5.650 2.640	Diameter / Length: 1.200	{1} 1.007	Pipe	2.640	Diam/Width:225	Manhole
E:570040.322 N:569382.029	3.010						
							Not Applicable

Project:	Date:		
Barry's Field, Douglas, Cork	04/10/2024		
	Designed by:	Checked by:	Approved By:
	BOSullivan		
Report Details: Type: Network Design Report Sanitary Phase: Phase Flow Path: Flow Path	Company Address: Joyce House, Barrack Square, Ballincollig, Cork		

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Name	Total Area (km^2)	Proportional Depth (mm)	Proportional Velocity (m/s)	Full Bore Velocity (m/s)	Capacity (L/s)	Flow (L/s)
1.000	0.00110	18	0.485	1.131	19.993	0.563
Branch: 2.000						
2.000	0.00055	13	0.400	1.132	20.009	0.313
1.001	0.00165	24	0.381	0.926	36.807	0.875
Branch: 3.000						
3.000	0.00058	18	0.486	1.133	20.013	0.563
1.002	0.00314	37	0.507	0.939	37.345	2.156
Branch: 4.000						
4.000	0.00072	11	0.343	1.133	20.019	0.188
4.001	0.00072	11	0.343	1.134	20.034	0.188
4.002	0.00090	18	0.300	0.895	35.587	0.438
4.003	0.00158	26	0.403	0.933	37.078	1.031
1.003	0.00472	45	0.569	0.935	37.186	3.188
Branch: 5.000						
5.000	0.00184	18	0.488	1.139	20.135	0.563
1.004	0.00735	50	0.614	0.944	37.544	4.000
1.005	0.00735	50	0.615	0.947	37.651	4.000
Branch: 6.000						
6.000	0.00112	15	0.438	1.135	20.056	0.406
1.006	0.00847	52	0.628	0.936	37.228	4.406
1.007	0.00847	52	0.631	0.943	37.493	4.406

Project:	Date:		
Barry's Field, Douglas, Cork	04/10/2024		
	Designed by:	Checked by:	Approved By:
	BOSullivan		
Report Details: Type: Network Design Criteria Sanitary Phase: Phase	Company Address: Joyce House, Barrack Square, Ballincollig, Cork		

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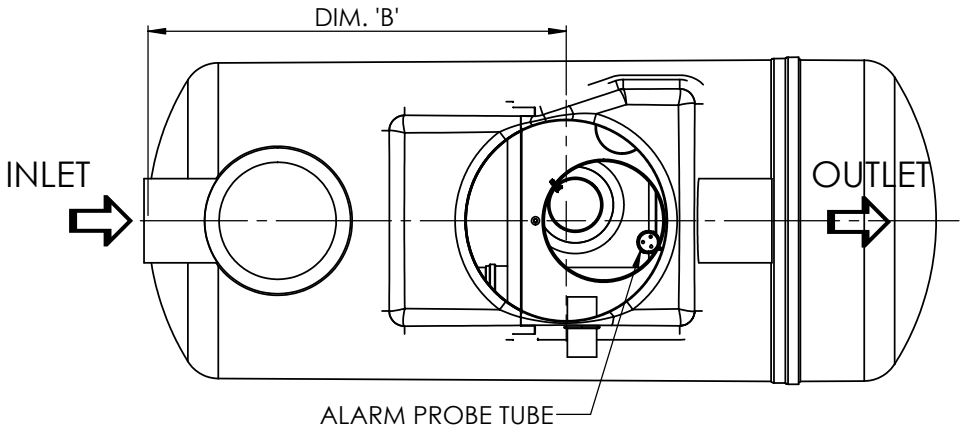
Pipe Options

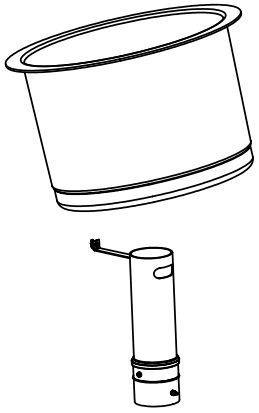
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Design Options	Minimize Excavation
Design Level	Level Inverts
Min. Slope (1:x)	200.00
Max. Slope (1:x)	22.00
Min. Backdrop (m)	0.450
Max. Backdrop (m)	10.000
Velocity Criteria	1/3 Proportional Velocity
Min. Velocity (m/s)	0.5
Max. Velocity (m/s)	3.0
Limit Pipe Full Conditions (%)	75
Use Flow Restriction	☐
Reduce Channel Depths	☐

Manhole Options

Apply Offset	☐

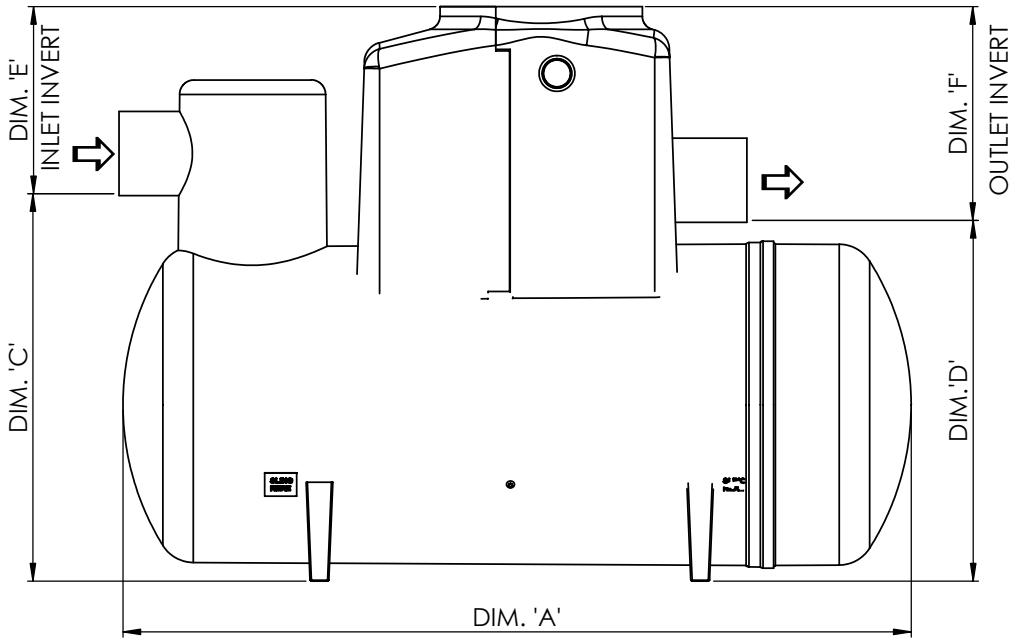
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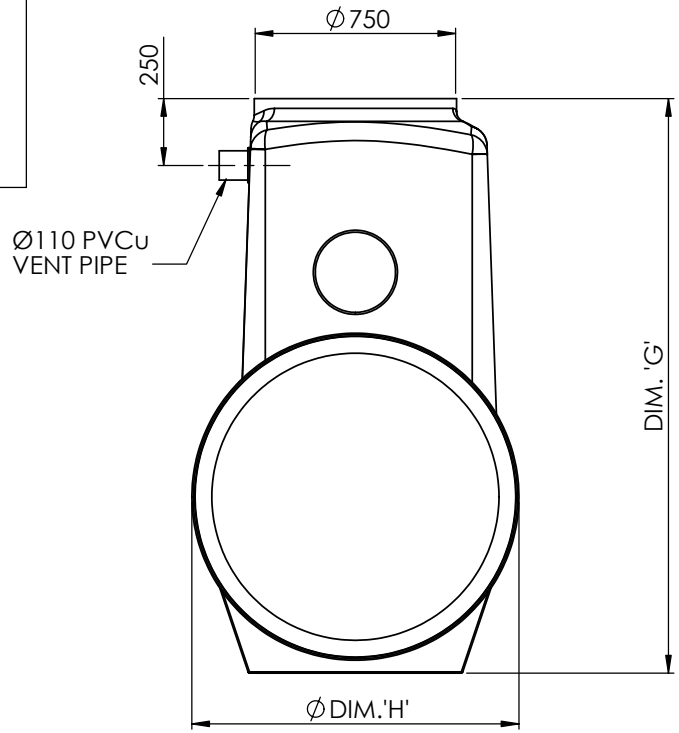




EXTENSION PARTS (IF REQUIRED) INCLUDED IN PRODUCT CODE

NOTES
1. UNITS ARE SUPPLIED WITH THE STANDARD (MINIMUM) PIPEWORK SIZE, AND ORIENTATION SHOWN ON THE DRAWING. THE STANDARD EN858-1 STATES MINIMUM CONNECTION SIZES, UNITS ORDERED WITH DIFFERENT SIZE CONNECTIONS MAY NOT BE FULLY COMPLIANT WITH THE STANDARD. PLEASE CONSULT OUR SALES DEPARTMENT FOR DETAILS OF AVAILABLE OPTIONS, BUT PLEASE NOTE WE DO NOT ALTER INTERNAL PIPEWORK.
2. ALL UNITS SUPPLIED ARE CLASS 1 AND INCLUDE A COALESCER.
3. EXTENSION PARTS FOR DEEPER INVERTS CAN BE PROVIDED FOR ON SITE ASSEMBLY.
4. ALL UNITS REQUIRE APPROPRIATE CONCRETE BASE, COVER AND FRAME TO SUIT APPLIED LOADINGS.
5. THIS DRAWING SHOULD BE USED FOR DIMENSIONAL INFORMATION ONLY.
6. A Ø76mm TUBE IS SUPPLIED TO HOUSE AN OIL ALARM PROBE.





UNIT	NOMINAL FLOW (l/sec.)	DIM.'A'	DIM.'B'	DIM.'C'	DIM.'D'	DIM.'E'	DIM.'F'	DIM.'G'	DIM.'H'	STD. PIPE Ø	APPROX. EMPTY WEIGHT (kg)	FALL ACROSS UNIT
NSBE010	10.0	2070	1095	1450	1350	700	800	2150	1220	315	160	100
NSBE015	15.0	2950	1560	1450	1350	700	800	2150	1220	315	200	100
NSBE020	20.0	3893	2016	1450	1350	700	800	2150	1220	375	220	100
NSBE025	25.0	3575	1900	1680	1580	700	800	2380	1420	375	300	100
NSBE030	30.0	4265	2263	1680	1580	700	800	2380	1420	450	325	100

Please check with Kingspan Environmental that this drawing is the latest issue

Issue	Date	Drawn by	Approved by	Description
05	24.06.13	T.Kelly		CC1131 - Case Feet Changed
04	13.02.13	T.Kelly		CC981 Phase 2 - NSBE025 & 030 Added

Material : Various	Tolerance :
Finish :	Thickness : n/a
Weight :	Surface Area :

Drawing : DS1155

NSBE010 - NSBE030 Bypass Separators

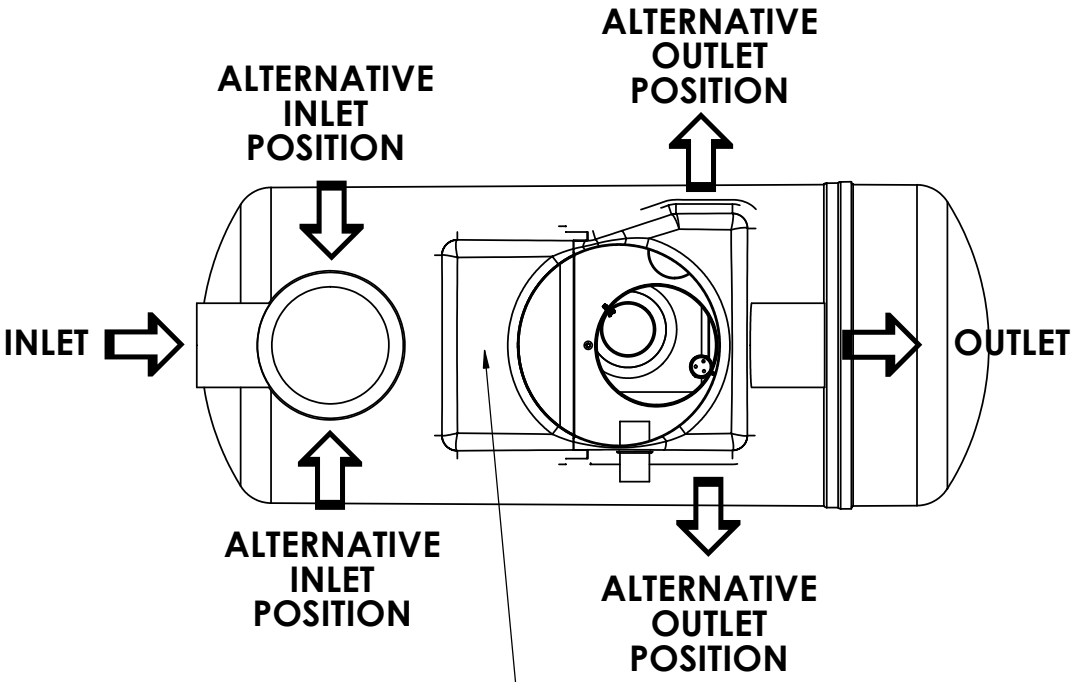
All dimensions in mm

Scale: Not to scale

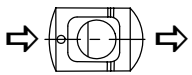
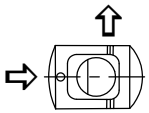
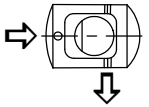
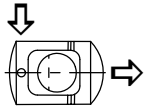
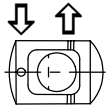
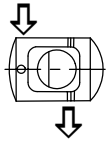
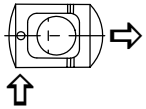
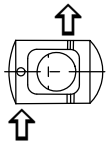
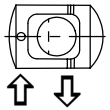
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Please Note:-
Due to the physically small size of the NSBE010, the inlet pipe, all orientation options, is fitted directly into this turret.

Pipe Orientation Options		
OPTION A 	OPTION B 	OPTION C 
OPTION D 	OPTION E 	OPTION F 
OPTION G 	OPTION H 	OPTION K 

Material : Various	Tolerance (unless stated) :	**Drawing : DS1155**	Page 2 of 2
Finish :	Thickness : n/a		
Weight : 229.91 Kg	Surface Area : m²	NSBE010 - 030 BYPASS SEPARATORS	
Modelled By :			

All Dimensions In mm | Scale: Do Not Scale | Third Angle Projection

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Appendix E – Hydrobrake Details

Hydro International Ltd
Shearwater House
Clevedon Hall Estate
Victoria Road
Clevedon
Somerset BS21 7RD

Tel: 01275 878371 (general enquiries)
Tel: 01275 337937 (Hydro-Brake sales/support)
Fax: 01275 874979

e-mail: enquiries@hydro-int.com
website: www.hydro-int.com

Agrément Certificate

08/4596

Product Sheet 1

HYDRO INTERNATIONAL HYDRO-BRAKE FLOW CONTROLS

S-RANGE HYDRO-BRAKE OPTIMUM FLOW CONTROLS

This Agrément Certificate Product Sheet(1) relates to S-Range Hydro-Brake Optimum Flow Controls(2), a range of units to control the discharge outlet flow in surface/storm water management systems.

(1) Hereinafter referred to as 'Certificate'.
(2) Hydro-Brake, Hydro-Brake Optimum, Flush-Flo and Kick-Flo are trademarks of Hydro International Ltd.



CERTIFICATION INCLUDES:

- factors relating to compliance with Building Regulations where applicable
- factors relating to additional non-regulatory information where applicable
- independently verified technical specification
- assessment criteria and technical investigations
- design considerations
- installation guidance
- regular surveillance of production
- formal three-yearly review.

KEY FACTORS ASSESSED

Flow characteristics — the performance characteristics of the flow controls have been assessed (see section 6).

Strength — the ability of the flow controls to withstand characteristic loads has been assessed (see section 8).

Durability — under normal service conditions, the flow controls will have a service life in excess of 60 years (see section 10).

The BBA has awarded this Certificate to the company named above for the products described herein. These products have been assessed by the BBA as being fit for their intended use provided they are installed, used and maintained as set out in this Certificate.

On behalf of the British Board of Agrément

Date of Fifth issue: 25 May 2021

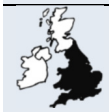
Originally certificated on 18 October 2008

Hardy Giesler
Chief Executive Officer

The BBA is a UKAS accredited certification body – Number 113.
The schedule of the current scope of accreditation for product certification is available in pdf format via the UKAS link on the BBA website at www.bbacerts.co.uk
Readers MUST check the validity and latest issue number of this Agrément Certificate by either referring to the BBA website or contacting the BBA directly.
Any photographs are for illustrative purposes only, do not constitute advice and should not be relied upon.

Regulations

In the opinion of the BBA, S-Range Hydro-Brake Optimum Flow Controls, if installed, used and maintained in accordance with this Certificate, can satisfy or contribute to satisfying the relevant requirements of the following Building Regulations (the presence of a UK map indicates that the subject is related to the Building Regulations in the region or regions of the UK depicted):



The Building Regulations 2010 (England and Wales) (as amended)

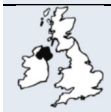
Requirement:	**H3(3)**	**Rainwater drainage**
Comment:		The products can be used in a construction to satisfy this Requirement. See section 6 of this Certificate.
Requirement:	**7(1)**	**Materials and workmanship**
Comment:		The products are acceptable. See section 10 and the *Installation* part of this Certificate.



The Building (Scotland) Regulations 2004 (as amended)

Regulation:	**8(1)(2)**	**Durability, workmanship and fitness of materials**
Comment:		The products are acceptable. See sections 9 and 10 and the *Installation* part of this Certificate.
Regulation:	**9**	**Building standards applicable to construction**
Standard:	3.6(a)(b)	Surface water drainage
Comment:		The products can be used in a construction to satisfy this Standard, with reference to clauses 3.6.1(1)(2) to 3.6.5(1)(2). See section 6 of this Certificate.
Standard:	7.1(a)(b)	Statement of sustainability
Comment:		The products can contribute to satisfying the relevant requirements of Regulation 9, Standards 1 to 6, and therefore will contribute to a construction meeting a bronze level of sustainability as defined in this Standard.
Regulation:	**12**	**Building standards applicable to conversions**
Comment:		All comments given for the products under Regulation 9, Standards 1 to 6, also apply to this Regulation, with reference to clause 0.12.1(1)(2) and Schedule 6(1)(2).

(1) Technical Handbook (Domestic).
(2) Technical Handbook (Non-Domestic).



The Building Regulations (Northern Ireland) 2012 (as amended)

Regulation:	**23(a)(i)(iii)(b)**	**Fitness of materials and workmanship**
Comment:		The products are acceptable. See section 10 and the *Installation* part of this Certificate.
Regulation:	**82**	**Rain-water drainage**
Comment:		The products can be used in a construction to satisfy this Regulation. See section 6 of this Certificate.

Construction (Design and Management) Regulations 2015
Construction (Design and Management) Regulations (Northern Ireland) 2016

Information in this Certificate may assist the client, designer (including Principal Designer) and contractor (including Principal Contractor) to address their obligations under these Regulations.

See sections: 3 *Delivery and site handling* (3.3) and 12 *General* (12.1) of this Certificate.

1 Description

1.1 S-Range Hydro-Brake Optimum Flow Controls are vortex flow controls manufactured from 3, 5 or 8 mm thick grade 1.4301/1.4307 stainless steel to BS EN 10088-4 : 2009. Alternative material thicknesses and grades are available depending on the application, but are outside the scope of this Certificate. The Certificate holder should be contacted for further details.

1.2 Each unit is designed and manufactured to meet specific hydraulic requirements (see section 7). The configuration of the inlet, volute and outlet is varied to achieve the required discharge control characteristics. The units may be fitted with a fixed inlet or an adjustable inlet gate to allow for post-installation adjustment of the discharge flow rate by up to 20% (see Figure 1).

Figure 1 Fixed and adjustable inlet arrangements



1.3 The units are available in a range of sizes to give design flow rates from 0.7 to 250 $l \cdot s^{-1}$, suitable for use in surface/stormwater management applications. A summary of technical information is given in Table 1.

Table 1 Summary of technical information

Characteristic (unit)	Typical range of values
Design flow rate ($l \cdot s^{-1}$)	0.7 to 250
Design head (m)	0.4 to 4
Maximum lateral dimension (mm)	
Lug mounted units	180 to 2000
Backplate mounted units	Dependent on discharge pipe size
Push-fit units	180 to 2000
Mass (kg) excluding packaging	
Lug mounted units	6 to 680
Backplate mounted units	Dependent on discharge pipe size
Push-fit units	6 to 680

1.4 Each unit is supplied fully assembled including:

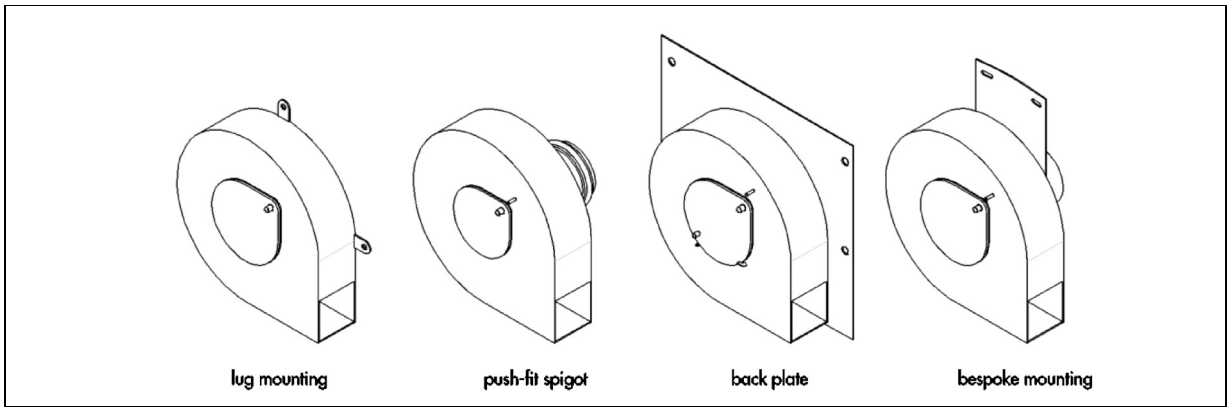
- an S-Range Hydro-Brake Optimum Flow Control with integral bypass door on the front face of the unit, outlet pipe location spigot and mounting face gasket or push-fit sealing rings

- wire rope to allow remote operation of the pivoting bypass door (3 mm diameter rope consisting of 7 x 7 strand elements of 0.018 mm diameter) and stainless steel wire rope attachment brackets
- mounting anchor bolts (A4 316 stainless steel). The performance and suitability of the mounting bolts is outside the scope of this Certificate; the Certificate holder should be contacted for advice on the most appropriate fixings for individual projects.

1.5 The flow controls are available with various types of mounting arrangement (see Figure 2):

- lug mounting — lugs are provided at points around the perimeter of the flow control mounting face. This is appropriate for the majority of applications where the outlet diameter of the installation structure is approximately 0.5 times the flow control body diameter or less
- push-fit spigot — a push-fit spigot with rubber sealing rings is provided. A single lug may also be provided on the outside perimeter of the mounting face to prevent rotation of the flow control in service. Precise specification of the outlet pipe is essential for push-fit mounting, in order to ensure a watertight seal
- backplate mounting — a rectangular mounting plate is provided to allow fixing to the outlet of the installation structure where lug mounting is not appropriate. If a flat surface is not available, the mounting plate may also be provided curved to the same radius as the chamber in which it is to be fitted.

Figure 2 Standard mounting arrangements



1.6 The units may be supplied for installation in purpose-built or existing structural housings on site. These must have adequate strength to resist the loads imposed by the unit. The design of these structures is outside the scope of this Certificate but the performance and durability of the flow control will be unaffected, provided it is installed in accordance with the recommendations of this Certificate.

1.7 The units may also be supplied ready-fitted to purpose-built reinforced concrete or plastic manhole chambers ready for installation into the ground. The performance of these chambers is outside the scope of this Certificate.

2 Manufacture

2.1 The products are manufactured from austenitic stainless steel sheet which is cut, rolled and welded to the required dimensions.

2.2 As part of the assessment and ongoing surveillance of product quality, the BBA has:

- agreed with the manufacturer the quality control procedures and product testing to be undertaken
- assessed and agreed the quality control operated over batches of incoming materials
- monitored the production process and verified that it is in accordance with the documented process
- evaluated the process for management of nonconformities
- checked that equipment has been properly tested and calibrated
- 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.

2.3 The management system of Hydro International Ltd has been assessed and registered as meeting the requirements of BS EN ISO 9001 : 2015 by Lloyd's Register Quality Assurance Limited (Certificate LRQ 4002211).

3 Delivery and site handling

3.1 S-Range Hydro-Brake Optimum Flow Controls are supplied wrapped in polythene and plywood packaging for small units and on a pallet for large units. They should be handled and stored appropriately to avoid being dropped or receiving impacts, eg from construction plant.

3.2 Each unit is stamped with the Certificate holder's unique project reference number and carries a label bearing the Certificate holder's contact information and advice on orientation. The packaging also bears details of the package weight and client details.

3.3 Care should be taken handling the units and when lowering into position for installation. Where appropriate, larger units should be lifted via the fitted lugs using mechanical lifting/lowering equipment.

Assessment and Technical Investigations

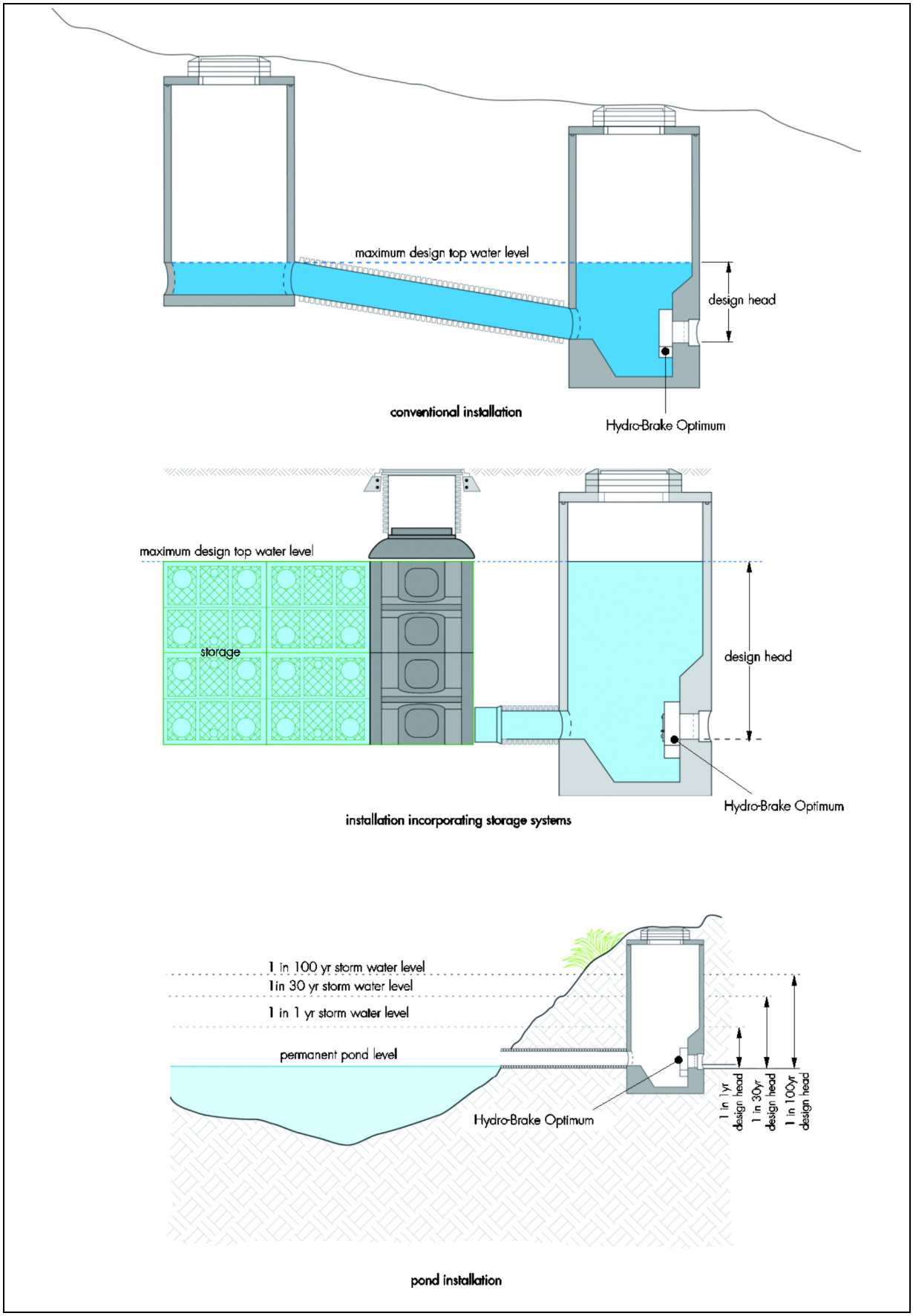
The following is a summary of the assessment and technical investigations carried out on S-Range Hydro-Brake Optimum Flow Controls.

Design Considerations

4 Use

4.1 S-Range Hydro-Brake Optimum Flow Controls are intended to restrict the outlet flow from a surface/storm water management system by increasing back pressure, achieved by inducing a vortex flow pattern in the water passing through the device. In these applications, the units are often used in conjunction with storage facilities, including geocellular storage systems, concrete tanks, oversized pipes and ponds. The performance of these items is outside the scope of this Certificate. Guidance on design of sustainable drainage systems is given in Flood risk and coastal change Guidance and CIRIA C753 : 2015. Typical installation details are shown in Figure 3.

Figure 3 Typical applications and design head



4.2 The units are self-activating without any moving parts and do not, therefore, require external power.

4.3 As a matter of good design practice, measures should be taken to remove silt sediment and debris from the surface water at an early stage to prevent problems further downstream.

4.4 It is recommended to maintain a minimum clear opening of 75 mm in a surface water drainage system. In some cases, it may be necessary to use a flow control with a smaller minimum opening. In which case, the installation of screens or debris removal systems upstream of the device is recommended.

5 Practicability of installation

The products are designed to be installed by a competent contractor, experienced with these types of products.

6 Flow characteristics



6.1 Owing to the 'S'-shaped head-flow characteristic, the units are able to pass greater volume flow rates at lower heads, whilst still limiting the flow at the duty/design point to an acceptable level. A typical head versus flow characteristic for the units is given in Figures 4, 5 and 6.

6.2 The units have a hydraulic characteristic, comprising three distinct stages corresponding to different phases of operation (see Figures 4, 5 and 6):

- pre-initiation phase — at low heads, the flow control provides similar performance to an orifice plate with equivalent size to its outlet(1). Flow rate accuracy of ±5% of the ultimate duty/design flow is typically achievable in this region
- vortex initiation phase — as the head increases, vortex motion will start to develop inside the unit, starting to restrict the flow(1). Flow rate accuracy of –5% of flow to +5% of phase peak is typically achievable in this region
- post-initiation/design phase — following vortex initiation, the flow control characteristic stabilises, providing hydraulic performance equivalent to a substantially smaller orifice plate than the unit's outlet. The units can be specified to give a duty/design point in any part of this region, though in most practical cases specification will be at flow rates above the initiation phase peak (corresponding to the Flush-Flo point). Flow rate accuracy of ±5% of flow is typically achievable in this region.

As the water level subsides and water in the device drains, the energy within the flow reduces and the vortex collapses. Air is drawn into the volute and the unit returns to operating in a similar manner to an orifice of the same cross sectional area. This drains the system quickly so that the upstream network is ready for the next event.

(1) Although a flow control would not usually be selected with the duty/design point in this region, this part of the characteristic will have implications to overall drainage system operation.

Figure 4 Pre-initiation phase

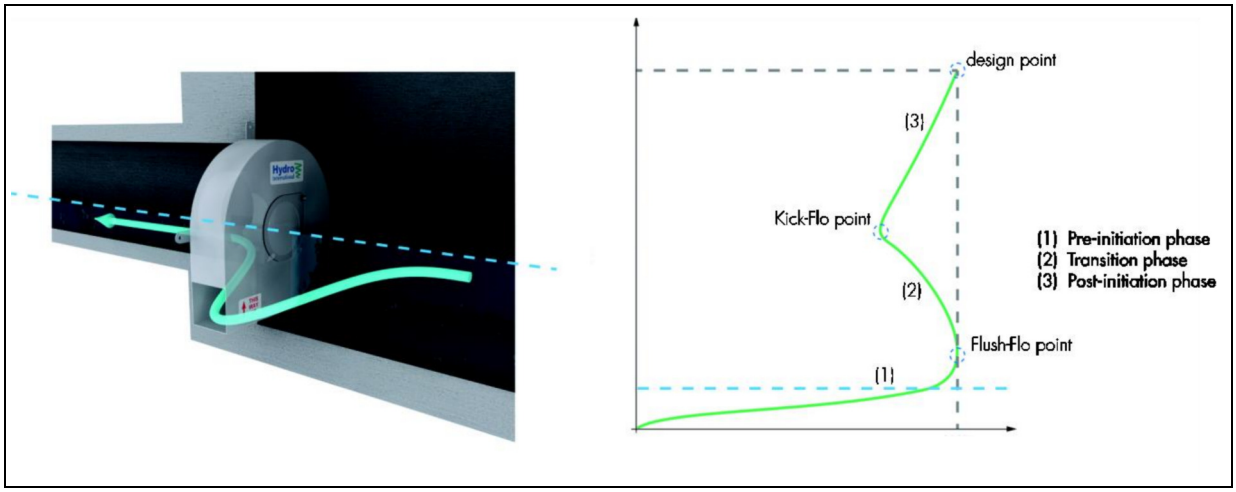


Figure 5 Vortex initiation phase

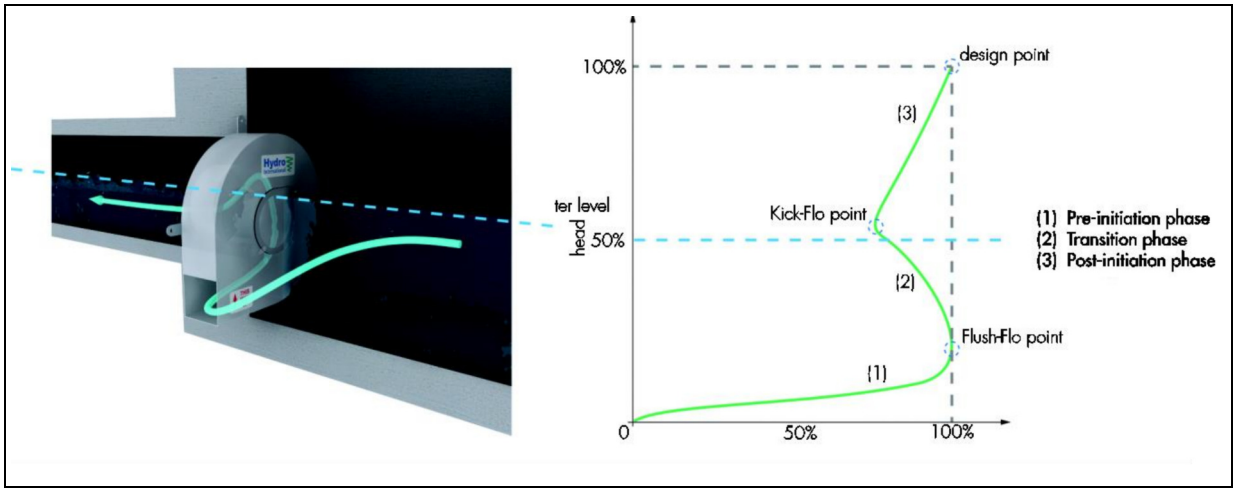
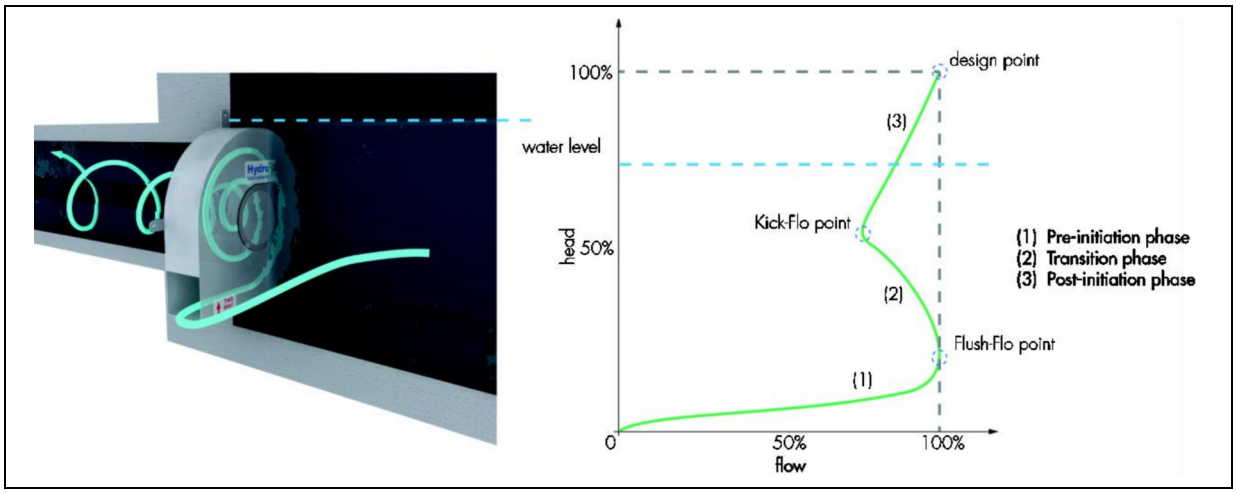


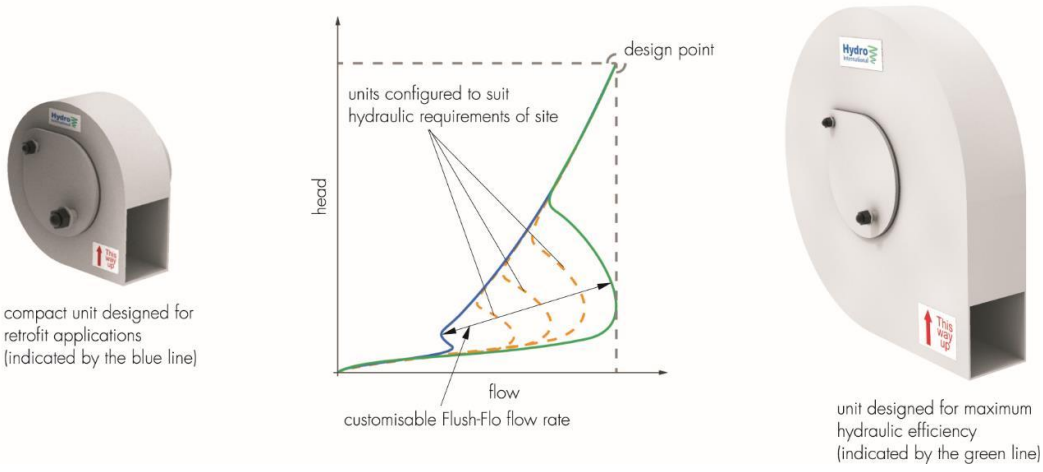
Figure 6 Post-initiation phase



6.3 S-Range Hydro-Brake Optimum Flow Controls allow the inlet, volute and outlet to be individually configured to suit the application, enabling the system to be designed to provide the appropriate hydraulic performance or to suit constant discharge, multi-stage discharge or risk-based network designs (see Figure 7). Individual configuration of the inlet, volute and outlet also allows the system designer to adjust the physical dimensions of the unit in order to:

- maximise the internal clearances
- comply with minimum outlet guidelines
- retrofit to existing infrastructure.

Figure 7 Application-based design



6.4 The units are specified and supplied to meet individual application requirements. Though the characteristics are incorporated into a number of commercially available hydraulic modelling packages, the Certificate holder should be contacted directly for advice on correct selection. The following information should be provided:

- operating head — depth from the unit's outlet invert to the design water level(s) (see Figure 3)
- flow — required discharge at the given head(s)
- manhole details or control chamber proposals, including outlet size
- information on any 'special' conditions, for example if the unit is expected to be subjected to downstream surcharging or possible siphoning effects.

6.5 In most cases the downstream drainage system will be designed to allow the unit a free discharge. However, this is not always possible and in certain cases it will be necessary to design the flow control to surcharge conditions. Surcharge of the flow control will affect the hydraulic performance, and advice should be sought from the Certificate holder. Installations where the outlet is surcharged are outside the scope of this Certificate.

6.6 Where a drainage system has been designed and hydraulically modelled based on the use of a S-Range Hydro-Brake Optimum Flow Control, it is essential to ensure that the same flow control, or a flow control that has been confirmed to provide an equivalent hydraulic performance across the whole design head range, is used in the final installation.

7 Hydraulic design

7.1 The units are typically used to control flows across a site or to limit the rate of discharge from a site. Where used to limit the rate of discharge from a site, the allowable discharge rate to an appropriate outfall will generally be set by the Environmental Regulator, local Planning Authorities or the Sewer Undertaker.

7.2 The allowable discharge rate will often be calculated in respect of the greenfield equivalent run-off rate for the undeveloped site. Advice on calculating the greenfield equivalent run-off rate can be found in the *Interim Code of Practice for Sustainable Drainage Systems*. Where a site is being redeveloped, the allowable discharge rate may be determined based on the discharge rate prior to the redevelopment. The design head acting on the upstream side of the S-Range Hydro-Brake Optimum Flow Control will generally be determined by the maximum design top water level within the storage volume. The design head is illustrated in Figure 3.

8 Strength

8.1 The units are manufactured from stainless steel of a sufficient strength and thickness to ensure that the products remain fit for purpose throughout their design life.

8.2 Under normal operation, the units will deflect by no more than the thickness of the material used for manufacture. This ensures that the volume of the unit available for water flow is not compromised during operation and therefore the hydraulic operation of the unit is not adversely affected by deformation of the unit.

9 Maintenance



9.1 Access should be allowed for clearing debris from the chamber housing the flow control. In the event that the inlet to the unit becomes blocked, the pivoting bypass door may be operated by pulling the wire rope attached upwards to drain down the chamber and provide access for maintenance. The pivoting bypass door must be returned to the closed position following drain down of the chamber and clearance of the blockage.

9.2 Regular inspections should be carried out to ensure that debris that may obstruct the inlet to the flow control is not present in the chamber. The frequency of inspection will depend on the location of the unit but must be at least once per year.

9.3 The units can be jetted from downstream, in accordance with standard sewer jetting procedures without affecting the hydraulic performance of the system.

10 Durability



The units are made from materials that will not be adversely affected by contaminants likely to be found in surface water systems in the UK. In the opinion of the BBA, the units will have a service life in excess of 60 years when installed in surface water systems.

11 Reuse and recyclability

The units consist of stainless steel which is readily recyclable.

Installation

12 General

12.1 S-Range Hydro-Brake Optimum Flow Controls must be installed in accordance with the Certificate holder's instructions. In many cases the installation will be in a confined space and all appropriate measures must be taken to ensure the safety of operatives working in such areas.

12.2 Dimensioned drawings for each installation are provided by the Certificate holder. It is important that the flow control chamber is constructed to the drawing. Other than where a curved backplate is supplied, this should incorporate a flat mounting surface on the inside face of the chamber wall at the outlet pipe. Ensure that the sump has sufficient width and depth below the invert of the outlet pipe to accommodate the unit.

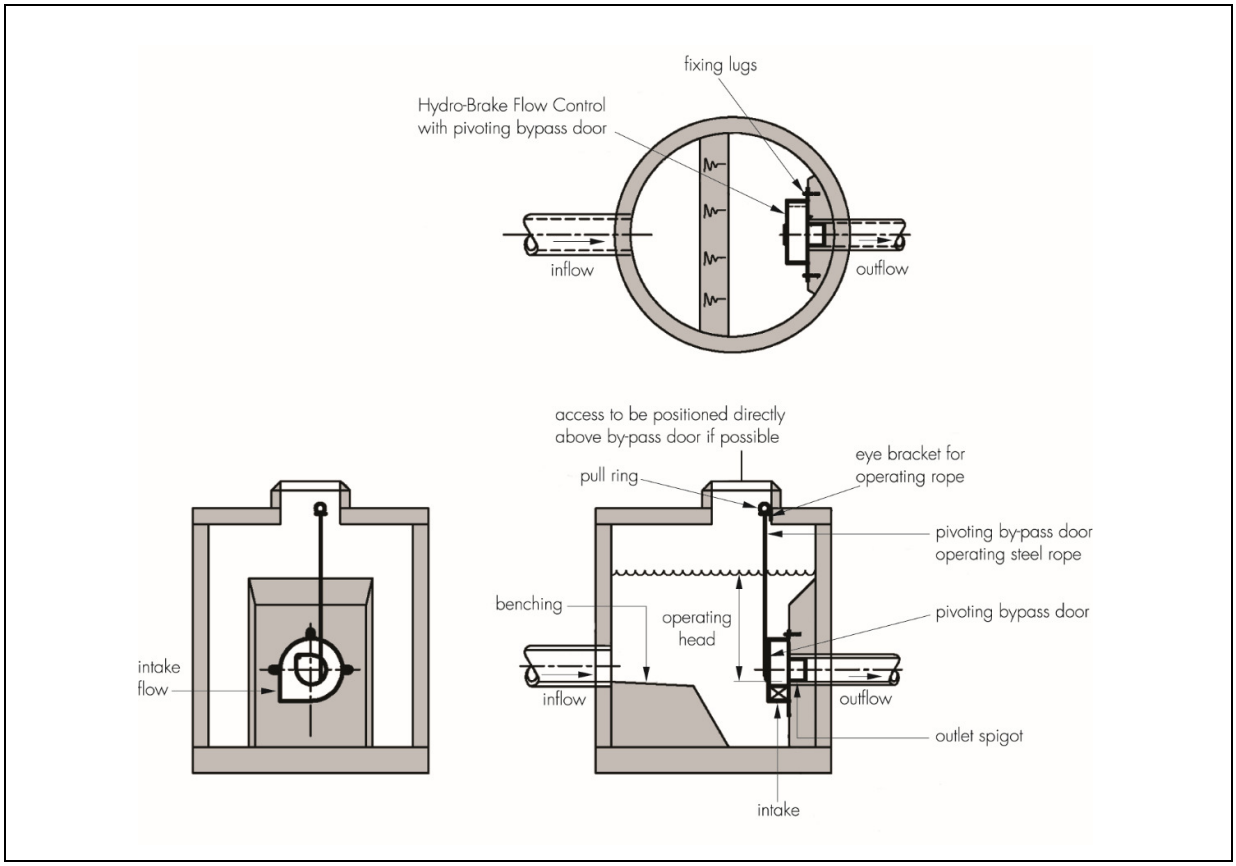
12.3 The benching must be formed as indicated on the installation drawing.

12.4 Where an adjustable inlet gate is provided, the factory set position must not be adjusted without prior consultation with the Certificate holder.

13 Procedure

13.1 The unit is offered up to the chamber outlet wall until the spigot projects into the outlet pipe with its invert seated to the outlet pipe invert and with the unit in the correct orientation (see Figure 8).

Figure 8 Typical installation details



13.2 With the unit in position, the position of the required number of bolt holes is marked and drilled through the fixing lugs or plate mount (depending on specification).

13.3 Ensuring that the supplied rubber gasket is suitably positioned over the outlet spigot of the flow control, the fixings are inserted and tightened until moderate compression of the gasket is achieved.

13.4 The supplied eye brackets on the pivoting bypass door operating rope are fixed to the soffit of the roof slab using masonry bolts, to achieve a direct vertical line of pull from over the chamber access cover to the pivoting bypass door. It should be arranged that the rope is taut when held in the upper eye bracket. Where it is not possible to attain a direct vertical line of pull, additional eye brackets can be used to account for the change of direction.

13.5 The rope stop should be positioned to ensure that, when the pivoting bypass door is open, the rope stop can be clipped to the uppermost bracket. Once positioned, the stop attachment grub screws should be tightened.

Technical Investigations

14 Tests

Tests were carried out and the results assessed to determine:

- dimensional accuracy of the units
- the hydraulic performance of the units.

15 Investigations

15.1 The manufacturing process was evaluated, including the methods adopted for quality control, and details were obtained of the quality and composition of the materials used.

15.2 A site visit was made to assess the practicability and ease of installation.

15.3 An assessment of computational fluid dynamic (CFD) modelling used to predict the hydraulic performance of the units was made.

15.4 An assessment of the Certificate holder's predicted characteristics was made against the results of hydraulic performance tests.

15.5 An assessment was made of the structural adequacy of the units under loads that they are expected to resist.

15.6 An evaluation of existing data was made to assess durability.

Bibliography

BS EN 10088-4 : 2009 *Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for construction purposes*

BS EN ISO 9001 : 2015 *Quality management systems — Requirements*

CIRIA C753 : 2015 *The SUDS manual*

Flood risk and coastal change Guidance - National Planning Policy Framework

16 Conditions

16.1 This Certificate:

- relates only to the product/system that is named and described on the front page
- is issued only to the company, firm, organisation or person named on the front page – no other company, firm, organisation or person may hold or claim that this Certificate has been issued to them
- is valid only within the UK
- has to be read, considered and used as a whole document – it may be misleading and will be incomplete to be selective
- is copyright of the BBA
- is subject to English Law.

16.2 Publications, documents, specifications, legislation, regulations, standards and the like referenced in this Certificate are those that were current and/or deemed relevant by the BBA at the date of issue or reissue of this Certificate.

16.3 This Certificate will remain valid for an unlimited period provided that the product/system and its manufacture and/or fabrication, including all related and relevant parts and processes thereof:

- are maintained at or above the levels which have been assessed and found to be satisfactory by the BBA
- continue to be checked as and when deemed appropriate by the BBA under arrangements that it will determine
- are reviewed by the BBA as and when it considers appropriate.

16.4 The BBA has used due skill, care and diligence in preparing this Certificate, but no warranty is provided.

16.5 In issuing this Certificate the BBA is not responsible and is excluded from any liability to any company, firm, organisation or person, for any matters arising directly or indirectly from:

- the presence or absence of any patent, intellectual property or similar rights subsisting in the product/system or any other product/system
- the right of the Certificate holder to manufacture, supply, install, maintain or market the product/system
- actual installations of the product/system, including their nature, design, methods, performance, workmanship and maintenance
- any works and constructions in which the product/system is installed, including their nature, design, methods, performance, workmanship and maintenance
- any loss or damage, including personal injury, howsoever caused by the product/system, including its manufacture, supply, installation, use, maintenance and removal
- any claims by the manufacturer relating to CE marking.

16.6 Any information relating to the manufacture, supply, installation, use, maintenance and removal of this product/system which is contained or referred to in this Certificate is the minimum required to be met when the product/system is manufactured, supplied, installed, used, maintained and removed. It does not purport in any way to restate the requirements of the Health and Safety at Work etc. Act 1974, or of any other statutory, common law or other duty which may exist at the date of issue or reissue of this Certificate; nor is conformity with such information to be taken as satisfying the requirements of the 1974 Act or of any statutory, common law or other duty of care.