DENIS O'SULLIVAN & ASSOCIATES
CONSULTING ENGINEERS

RESIDENTIAL DEVELOPMENT AT GLYNTOWN, GLANMIRE, CORK

INFRASTRUCTURE REPORT

DATE 04/09/2024

REVISION 5

JOB NO. 6291

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DOCUMENT CONTROL

PROJECT NAME: RESIDENTIAL DEVELOPMENT AT GLYNTOWN, GLANMIRE, CORK

PROJECT NUMBER: 6291

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Contents

1 *Introduction*

Denis O'Sullivan & Associates were engaged as Consulting Engineers for the proposed development at Glyntown, Glanmire, Cork.

Planning permission is being sought for the construction of 80 residential units. The site is accessed from the East Cliff Road in Glyntown, Glanmire. The site is located on the outskirts of Cork City and is in close proximity to the town of Glanmire. The overall development shall provide a mixture of duplex units and apartments of varying sizes. There is an existing protected structure on the site, the Coach House, which is to be restored and converted as part of the scheme.

1.1 Objectives

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

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

The foul sewer & water infrastructure associated with the proposed development were discussed with Mr. Dario Alvarez, Design Engineer, Southern Region, Irish Water. The Confirmation of Feasibility as issued by Irish Water is included in Appendix A of this Report.

1.2 Site Location & Historical Aerial Photographs

The site is accessed from the East Cliff Road in Glyntown, Glanmire. The site is located on the outskirts of Cork City and is in close proximity to the town of Glanmire. The following Figures 1–3 show the various aerials view back to the year 2000.

Figure 1 Aerial View 2013-2018

Figure 2 Aerial View 2005

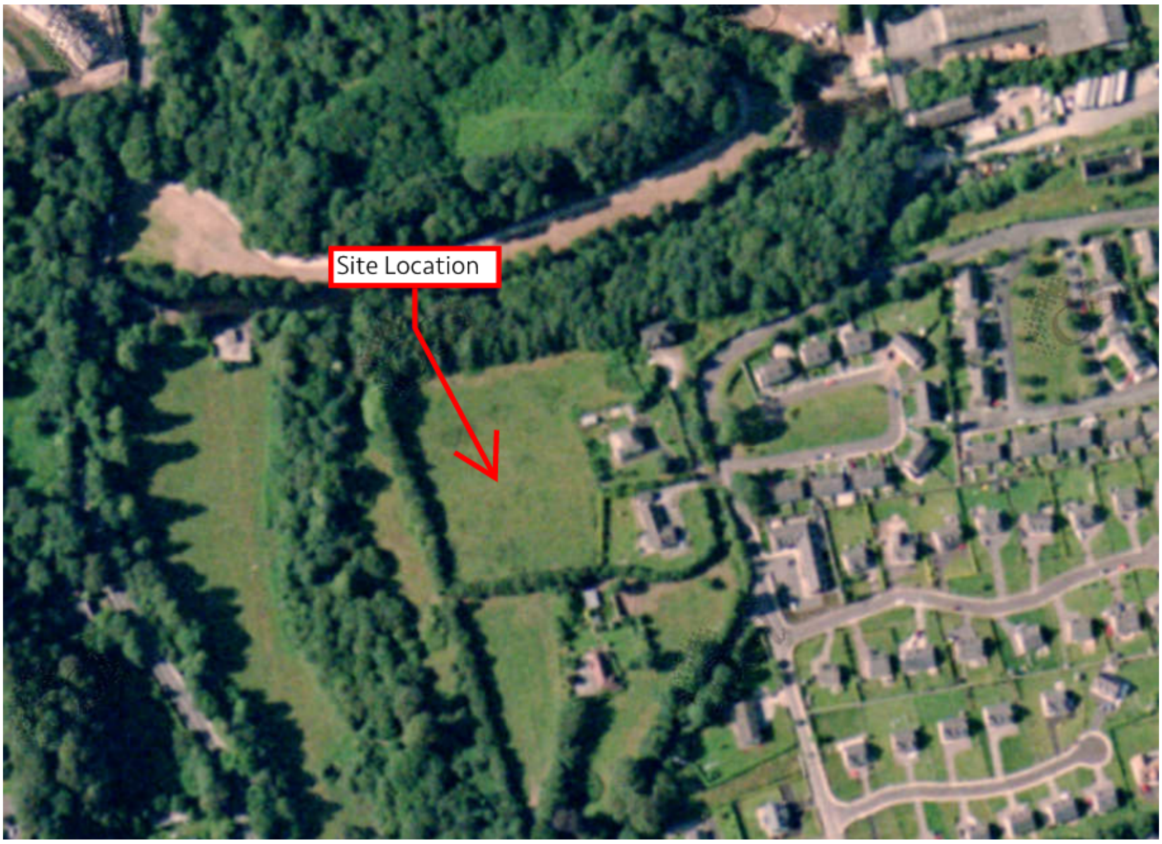


Figure 3 Aerial View 2000

2 *Surface Water Management*

2.1 Surface Water Design

As was agreed with the engineering section of Cork County Council, the storm water system for the development will involve a network of underground pipelines and manholes discharging to the strom sewer at the junction of East Cliff Road and Brookville Estate via an attenuation system, which will be fitted with flow control devices to ensure no increase in peak flows and an oil interceptor to remove any traces of oil washed off road surfaces.

Surface water discharge rates from the proposed surface water drainage network will be controlled by a vortex flow control device (Hydrobrake or equivalent) and associated attenuation tank. Surface water discharge will also pass via a bypass fuel/oil separator (sized in accordance with permitted discharge from the site).

The proposed surface water drainage network will collect surface water runoff from the site via a piped network prior to discharging off site via the attenuation tank, flow control device and separator arrangement as noted above.

2.2 SuDS Appraisal

Stormwater attenuation and treatment measures utilising Sustainable Drainage Systems (SuDS) in addition to attenuation tanks and hydrocarbon interceptors, shall be incorporated into the proposed storm water system.

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

The applicant has considered the use of all appropriate SUDS devices as part of the site SUDS strategy.

- Underground Attenuation -below the open space area
- Flow control device (e.g. hydrobrake) - installed at the outfall manhole of each catchment
- Petrol Interceptor - installed downstream of each flow control device manhole.

The effectiveness of each SUDS / drainage mechanism proposed is outlined below

2.2.1 Tree Pits

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

2.2.2 Underground Attenuation

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

2.2.3 Flow Control Device

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

2.2.4 Petrol Interceptor

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

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

The above measures ensure a suitable management train is provided.

2.2.5 Management Train

The management train commences with the introduction of the hydrocarbon interceptors, site control, which provide a degree of treatment before discharging to the attenuation system.

The second stage of the management train, regional control, is provided by the underground attenuation, by slowing the storm water discharge down, promoting infiltration and removing additional silts which may remain in the storm water.

2.3 Surface Water Drainage Network

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

2.4 Design Criteria

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

- Return period for pipe work design 2 years
- Return period for attenuation design 100 years
- Soil Type 2
- Allowable Outflow 2.1/4.7 l/sec
- Time of entry 5 minutes
- M5 – 60 18.80 mm
- Ratio "r" 0.25
- Pipe Friction (Ks) 0.6 mm
- Minimum Velocity (based on pipe flowing full) 1.0 m/s
- Rainfall Runoff from Roads and Footpaths 100%
- Rainfall Runoff from Roofs 80%
- Rainfall Runoff from Driveways 80%
- Rainfall Runoff from Green Areas 20%
- Rainfall Depth Factored for Climate Change (as per GDSDS) 20%

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

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

Table 6.2 Climate Change Factors to be Applied to Drainage Design

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

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

- M5-60 = 18.80mm
- Ratio R = 0.25

Microdrainage generates design storms using the principles set out in the Flood Studies Report (NERC 1975). A summer rainfall profile was used for the design of the pipework and a winter rainfall profile was used for the design of the storm water attenuation tank to give the critical design. A summer profile gives higher rainfall intensities and results in higher runoff rates and is used to determine the required capacity of the pipework. A winter rainfall profile gives a flatter more sustained profile and results in higher runoff volumes and is used to determine the attenuation/storage requirements.

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

The layout of the proposed storm water network is shown on the Proposed Stormwater & Foul Sewer Layout Plan Drawing No. 6291-5020.

NOTE: The surcharging indicated in the design sheets is directly upstream of the restricted outlet. For design purposes the tank has been replaced with a pipe and as a result surcharging occurs. This design approach is acceptable and in reality, there will be no surcharging.

2.5 Stormwater Attenuation Strategy

2.5.1 Pre-Development Conditions

The catchment area of this proposed development area within the overall estate is 2.3 hectares (ha). For this development, the permissible outflow is calculated using the estimation method contained in the Institute of Hydrology Report No. 124: Flood estimation for small catchments.

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

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

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

SAAR = Standard Annual Average Rainfall

SOIL = Soil index

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

Design summary sheets for the QBAR value are contained in Appendix A. The Mean Annual Peak Flow (permissible outflow) was calculated for the particular design development areas. The allowable runoff estimation method utilises IH 124 and the Soil Index value taken from the Micrcodrainage Design Package mapping system gives a Soil Index of 0.3.

2.5.2 Post-Development Conditions

The stormwater management plan adopted for this particular development area within the estate involves the use of an attenuation tank located in the green area of the development.

Contributing Area	Permissible Outflow (l/sec)
Catchment Area A	2.1 l/sec
Catchment Area B	4.7 l/sec

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

It should be noted that climate change has been accounted for in the design. As per volume 5 of the GDSDS a factor of 10% has been incorporated into the design.

2.6 Attenuation Tank

2.6.1 Volume of Attenuation Tank

The capacity of the attenuation tank is designed to cater for the capacity required for a 1 in 100 year ARI event. This capacity is summarised as follows:

Tank No.	Capacity (m^3)	Restricted Outlet (l/sec)
1	256	2.1 l/sec
2	216	4.7 l/sec

2.7 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.

For the Catchment Area A, the hard-surfaced area that will be draining to the interceptor between SW.012 & SW.011 is approximately 4,060m^2. A Conder CNSB10s/21 interceptor with a catchment capacity of 5,560m^2 will be provided. For the Catchment Area B, the hard-surfaced area that will be draining to the interceptor between SW.005 & SW.004 is approximately 4,200m^2. A Conder CNSB10s/21 interceptor with a catchment capacity of 5,560m^2 will be provided

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

Table 2.4 – Petrol Interceptor Details

Catchment Reference	Petrol Interceptor Make & Model	Oil Storage Capacity (l)
Catchment Area A	1 No. Conder CNSB10s/21	150 litres
Catchment Area B	1 No. Conder CNSB10s/21	150 litres

2.8 Silt Control

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

Table 2.5 – Petrol Interceptor Silt Storage Details

Catchment Reference	Petrol Interceptor Make & Model	Silt Storage Capacity (l)
Catchment Area A	1 No. Conder CNSB10s/21	1000 litres
Catchment Area B	1 No. Conder CNSB10s/21	1000 litres

3 *Foul Sewer System*

3.1 Foul Sewer Design

A Pre-Connection Enquiry was submitted to Irish Water. The Irish Water Reference Number for this enquiry is CDS21004747. The response to this Enquiry issued on the 28th September 2021 confirmed that connection to the network was feasible without any infrastructure upgrade. There are Irish Water pipes within and in close proximity of the site boundaries as indicated in Appendix B.

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

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

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

3.1.1 Development Breakdown

80 No. Units

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 = (80) (450) / (24) (60) (60) = 0.417 litres/second

6DWF = 2.5 litres/second

The layout of the proposed foul sewer network is shown on the Proposed Stormwater & Foul Sewer Layout Plan 6291-5020 & 5021.

The overall quantity of wastewater for the proposed development is estimated at 216m^3 per day.

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

All works will be in accordance with Irish Water specifications and requirements.

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

4 *Water Supply*

As with the drainage network, a Pre-Connection Enquiry was submitted to Irish Water under Reference No. CDS21004747. This confirmed that connection to the network was feasible subject to the requirement to upsize the 100mm watermain to 150mm diameter by approximately 120m in Glyntown Heights.

It is proposed to provide a 100mm internal diameter HDPE connection to tie into the existing public main located on East Cliffe Road with associated valves and metering requirements. Internally within the development it is proposed to have a series of 100mm Ø branches and loops with associated hydrants, valves and metering requirements.

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

The layout of the proposed watermain network is shown on the Proposed Watermain Layout Plan 6291-5030.

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

5 Summary of Results

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

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

Table 5.1 Summary of Surcharge and Flooding

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

The stormwater system is designed to ensure no surcharge occurs during a 1 in 2-year return period event. The surcharging that occurs in the pipes highlighted in the summary of the design sheets are the pipes that have been replaced with tanks and hydrobrakes. For the purposes of design this is acceptable.

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

Table 5.2 Outlet Control Summary

Attenuation Tank Reference	Hydrobrake Reference	Limiting Discharge (l/s)	Design Head (m)	Hydrobrake Diameter (mm)
Attenuation Tank No. 1	MD4	2.1 l/sec	2.0	44
Attenuation Tank No. 2	MD4	4.7 l/s	3.0	60

Table 5.3: Storage Tank Summary

Tank No.	Storage Type	Capacity (m^3)	Invert Level (m)	Maximum Storage Level (m)
Attenuation Tank No. 1	RC Concrete/Proprietary System	256	22.452	24.452
Attenuation Tank No. 2	RC Concrete/Proprietary System	216	19.44	22.44

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

Appendix A – Irish Water COF

Stephen O' Grady

Joyce House
Barrack Square
Ballincollig
Co. Cork
P31KP84

28 September 2021

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

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

www.water.ie

Re: CDS21004747 pre-connection enquiry - Subject to contract | Contract denied

Connection for Housing Development of 81 unit(s) at Glyntown, Glanmire, Cork

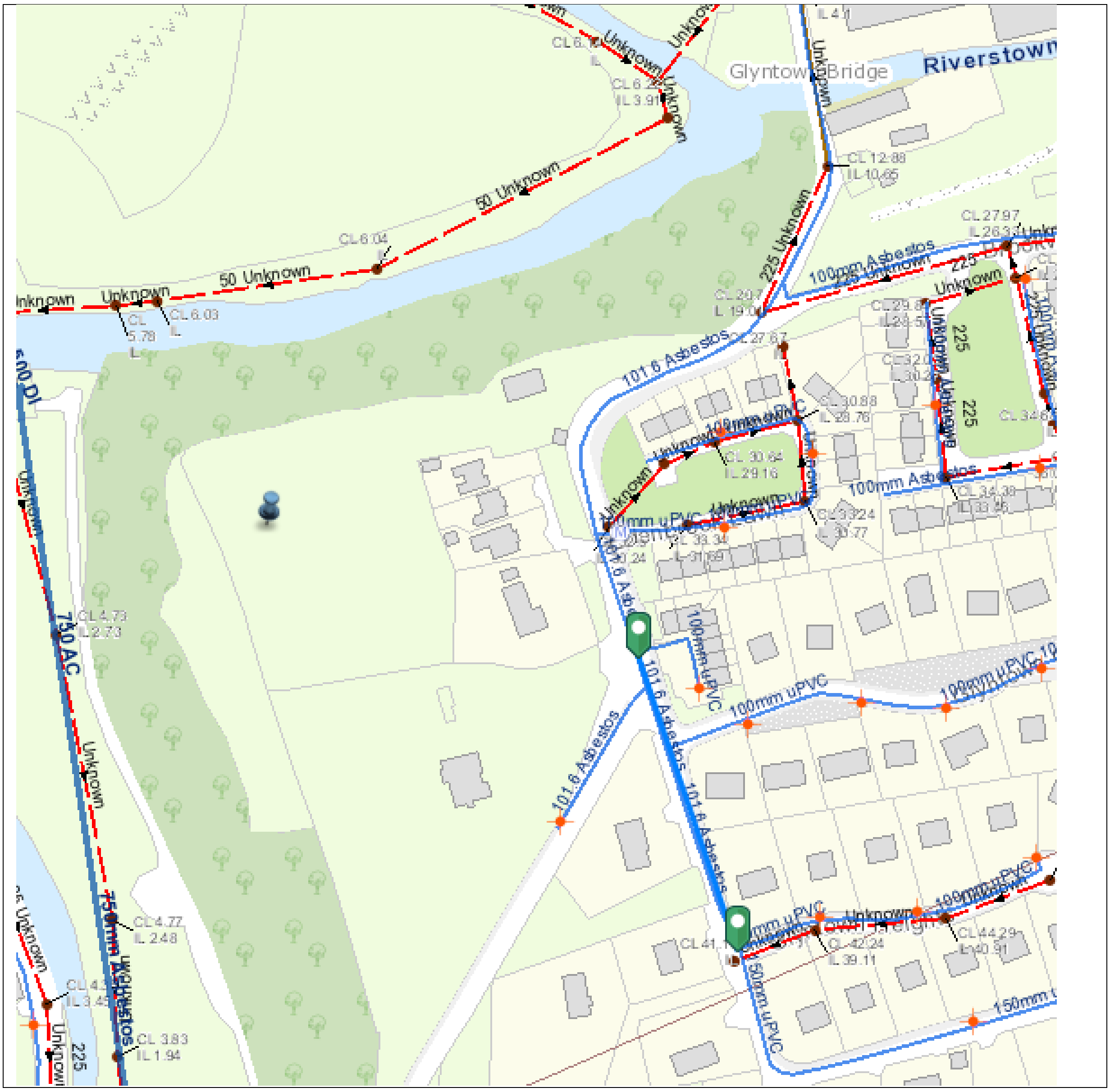
Dear Sir/Madam,

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

SERVICE	**OUTCOME OF PRE-CONNECTION ENQUIRY** **THIS IS NOT A CONNECTION OFFER. YOU MUST APPLY FOR A CONNECTION(S) TO THE IRISH WATER NETWORK(S) IF YOU WISH TO PROCEED.**
Water Connection	Upgrades may be required
Wastewater Connection	Feasible without infrastructure upgrade by Irish Water
SITE SPECIFIC COMMENTS	
Water Connection	In order to accommodate the proposed connection to Irish Water water network at the Premises, upgrade works may be required to upsize the 100mm watermain to 150mm diameter by approximately 120m in Glyntown Heights. This upgrade in the network will be confirmed at connection application stage. Irish Water currently does not have any plans to extend its network in this area. Should you wish to progress with the connection you will be required to fund this network extension.
Wastewater Connection	Connection feasible to the 225mm diameter sewer network in East Cliff Road.

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

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



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

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

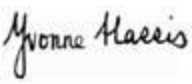
Water underground network. The onus is on the parties carrying out excavations or any other works to ensure the exact location of the Irish Water underground network is identified prior to excavations or any other works being carried out. Service connection pipes are not generally shown but their presence should be anticipated.

General Notes:

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

If you have any further questions, please contact Dario Alvarez from the design team on + 353 2254621 or email dalvarez@water.ie For further information, visit **www.water.ie/connections.**

Yours sincerely,



Yvonne Harris

Head of Customer Operations

Appendix B – Allowable Runoff QBAR Values

IH 124 Mean Annual Flood

Input

Return Period (years)	100	Soil	0.300
Area (ha)	2.400	Urban	0.000
SAAR (mm)	1135	Region Number	Ireland South

Results	**l/s**
QBAR Rural	10.8
QBAR Urban	10.8
Q100 years	19.8
Q1 year	9.1
Q2 years	10.3
Q5 years	12.8
Q10 years	14.5
Q20 years	16.1
Q25 years	16.7
Q30 years	17.1
Q50 years	18.3
Q100 years	19.8
Q200 years	21.4
Q250 years	n/a
Q1000 years	n/a

WARNING: Irish growth curves are not defined above 200 years.

Warning: It is unusual to use the IH124 method with an area < 50ha. The Interim Code of Practice recommends that the IH124 method is applied with 50ha and the resulting discharge is linearly interpolated for the required area. The ICP SUDS tab will do this automatically.

Appendix C – 1 in 2 Year Design Sheets

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	100	Add Flow / Climate Change (%)	10
M5-60 (mm)	18.800	Minimum Backdrop Height (m)	0.200
Ratio R	0.250	Maximum Backdrop Height (m)	1.500
Maximum Rainfall (mm/hr)	50	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.082	4-8	0.628	8-12	0.091

Total Area Contributing (ha) = 0.801

Total Pipe Volume (m³) = 38.407

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S1.000	26.250	1.100	23.9	0.010	5.00	0.0	0.600	o	225
S1.001	14.065	0.850	16.5	0.010	0.00	0.0	0.600	o	225
S1.002	5.825	0.350	16.6	0.005	0.00	0.0	0.600	o	225
S1.003	25.335	0.950	26.7	0.005	0.00	0.0	0.600	o	225
S1.004	4.200	0.200	21.0	0.005	0.00	0.0	0.600	o	225
S1.005	4.000	0.333	12.0	0.000	0.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	5.16	32.950	0.010	0.0	0.0	0.1	2.69	106.9	1.5
S1.001	50.00	5.24	31.850	0.020	0.0	0.0	0.3	3.23	128.5	3.0
S1.002	50.00	5.27	31.000	0.025	0.0	0.0	0.3	3.22	128.2	3.7
S1.003	50.00	5.43	30.650	0.030	0.0	0.0	0.4	2.54	101.1	4.5
S1.004	50.00	5.46	29.700	0.035	0.0	0.0	0.5	2.87	114.0	5.2
S1.005	50.00	5.47	29.383	0.035	0.0	0.0	0.5	3.80	151.0	5.2

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S1.006	11.025	0.550	20.0	0.000	0.00	0.0	0.600	o	225
S1.007	27.785	1.500	18.5	0.105	0.00	0.0	0.600	o	225
S1.008	50.485	2.500	20.2	0.078	0.00	0.0	0.600	o	225
S1.009	26.000	1.250	20.8	0.047	0.00	0.0	0.600	o	225
S1.010	17.600	0.105	167.6	0.017	0.00	0.0	0.600	o	300
S2.000	38.015	1.500	25.3	0.052	5.00	0.0	0.600	o	225
S3.000	19.150	0.115	166.5	0.032	5.00	0.0	0.600	o	225
S2.001	19.265	0.135	142.7	0.019	0.00	0.0	0.600	o	225
S2.002	17.810	0.350	50.9	0.010	0.00	0.0	0.600	o	225
S1.011	9.000	0.054	166.7	0.000	0.00	0.0	0.600	o	300
S1.012	12.000	0.048	250.0	0.000	0.00	0.0	0.600	o	300
S1.013	9.595	0.038	252.5	0.000	0.00	0.0	0.600	o	225
S1.014	51.485	0.206	249.9	0.000	0.00	0.0	0.600	o	225
S1.015	20.545	0.262	78.4	0.000	0.00	0.0	0.600	o	225
S4.000	48.625	0.291	167.1	0.108	5.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.006	50.00	5.54	29.050	0.035	0.0	0.0	0.5	2.94	116.7	5.2
S1.007	50.00	5.69	28.500	0.140	0.0	0.0	1.9	3.05	121.5	20.9
S1.008	50.00	5.98	27.000	0.218	0.0	0.0	3.0	2.93	116.3	32.5
S1.009	50.00	6.13	24.500	0.265	0.0	0.0	3.6	2.88	114.6	39.5
S1.010	50.00	6.37	23.250	0.282	0.0	0.0	3.8	1.21	85.6	42.0
S2.000	50.00	5.24	25.850	0.052	0.0	0.0	0.7	2.61	103.8	7.7
S3.000	50.00	5.32	24.200	0.032	0.0	0.0	0.4	1.01	40.2	4.8
S2.001	50.00	5.61	24.085	0.103	0.0	0.0	1.4	1.09	43.4	15.3
S2.002	50.00	5.77	23.950	0.113	0.0	0.0	1.5	1.84	73.1	16.8
S1.011	50.00	6.49	23.145	0.395	0.0	0.0	5.3	1.22	85.9	58.8
S1.012	50.00	6.69	22.500	0.395	0.0	0.0	5.3	0.99	70.0	58.8
S1.013	50.00	5.20	22.452	0.000	2.1	0.0	0.2	0.82	32.5	2.1
S1.014	50.00	6.24	22.414	0.000	2.1	0.0	0.2	0.82	32.7	2.3
S1.015	50.00	6.47	22.208	0.000	2.1	0.0	0.2	1.48	58.8	2.3
S4.000	50.00	5.80	23.375	0.108	0.0	0.0	1.5	1.01	40.1	16.1

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S4.001	48.485	0.290	167.2	0.093	0.00	0.0	0.600	o	225
S4.002	35.465	0.794	44.7	0.000	0.00	0.0	0.600	o	225
S5.000	22.985	1.000	23.0	0.035	5.00	0.0	0.600	o	225
S4.003	40.700	0.244	166.8	0.085	0.00	0.0	0.600	o	300
S4.004	44.090	0.264	167.0	0.000	0.00	0.0	0.600	o	300
S1.016	25.950	0.155	167.4	0.021	0.00	0.0	0.600	o	300
S1.017	45.295	0.271	167.1	0.064	0.00	0.0	0.600	o	300
S1.018	13.100	0.078	167.9	0.000	0.00	0.0	0.600	o	300
S1.019	12.000	0.060	200.0	0.000	0.00	0.0	0.600	o	300
S1.020	5.745	0.029	198.1	0.000	0.00	0.0	0.600	o	225
S1.021	30.825	2.349	13.1	0.000	0.00	0.0	0.600	o	225
S1.022	12.355	0.062	199.3	0.000	0.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S4.001	50.00	6.60	23.084	0.201	0.0	0.0	2.7	1.01	40.1	29.9
S4.002	50.00	6.91	22.794	0.201	0.0	0.0	2.7	1.96	78.0	29.9
S5.000	50.00	5.14	23.000	0.035	0.0	0.0	0.5	2.74	109.0	5.2
S4.003	50.00	7.46	22.000	0.321	0.0	0.0	4.3	1.21	85.9	47.8
S4.004	50.00	8.07	21.756	0.321	0.0	0.0	4.3	1.21	85.8	47.8
S1.016	50.00	8.43	21.492	0.342	2.1	0.0	4.8	1.21	85.7	53.3
S1.017	50.00	9.05	21.337	0.406	2.1	0.0	5.7	1.21	85.8	62.8
S1.018	50.00	9.23	21.066	0.406	2.1	0.0	5.7	1.21	85.6	62.8
S1.019	50.00	9.41	19.500	0.406	2.1	0.0	5.7	1.11	78.3	62.8
S1.020	50.00	5.10	19.440	0.000	4.7	0.0	0.4	0.93	36.8	4.7
S1.021	50.00	5.24	19.411	0.000	4.7	0.0	0.5	3.63	144.4	5.2
S1.022	50.00	5.47	17.062	0.000	4.7	0.0	0.5	0.92	36.7	5.2

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
SSW.027	34.450	1.500	1050	S1.000	32.950	225				
SSW.028	33.350	1.500	1050	S1.001	31.850	225	S1.000	31.850	225	
SSW.029	32.500	1.500	1050	S1.002	31.000	225	S1.001	31.000	225	
SSW.030	32.150	1.500	1050	S1.003	30.650	225	S1.002	30.650	225	
SSW.031	31.200	1.500	1050	S1.004	29.700	225	S1.003	29.700	225	
SSW.032	31.000	1.617	1050	S1.005	29.383	225	S1.004	29.500	225	117
SSW.033	30.550	1.500	1050	S1.006	29.050	225	S1.005	29.050	225	
SSW.016	30.000	1.500	1050	S1.007	28.500	225	S1.006	28.500	225	
SSW.015	28.500	1.500	1050	S1.008	27.000	225	S1.007	27.000	225	
SSW.014	26.000	1.500	1050	S1.009	24.500	225	S1.008	24.500	225	
SSW.013	24.750	1.500	1050	S1.010	23.250	300	S1.009	23.250	225	
SSW.019	27.350	1.500	1050	S2.000	25.850	225				
SSW.020	25.700	1.500	1050	S3.000	24.200	225				
SSW.018	25.850	1.765	1200	S2.001	24.085	225	S2.000	24.350	225	265
							S3.000	24.085	225	
SSW.017	25.450	1.500	1050	S2.002	23.950	225	S2.001	23.950	225	
SSW.012	25.100	1.955	1200	S1.011	23.145	300	S1.010	23.145	300	
							S2.002	23.600	225	380
SSW.011	25.250	2.750	1200	S1.012	22.500	300	S1.011	23.091	300	591
SSW.010	25.250	2.798	1200	S1.013	22.452	225	S1.012	22.452	300	
SSW.009	25.300	2.886	1200	S1.014	22.414	225	S1.013	22.414	225	
SSW.008	27.350	5.142	1200	S1.015	22.208	225	S1.014	22.208	225	
SSW.025	24.500	1.125	1050	S4.000	23.375	225				
SSW.024	24.500	1.416	1050	S4.001	23.084	225	S4.000	23.084	225	
SSW.023	24.500	1.706	1050	S4.002	22.794	225	S4.001	22.794	225	
SSW.026	24.500	1.500	1050	S5.000	23.000	225				
SSW.022	23.500	1.500	1050	S4.003	22.000	300	S4.002	22.000	225	
							S5.000	22.000	225	
SSW.021	23.500	1.744	1050	S4.004	21.756	300	S4.003	21.756	300	
SSW.007	25.500	4.008	1200	S1.016	21.492	300	S1.015	21.946	225	379
							S4.004	21.492	300	
SSW.006	25.400	4.063	1200	S1.017	21.337	300	S1.016	21.337	300	
SSW.005	23.100	2.034	1200	S1.018	21.066	300	S1.017	21.066	300	
SSW.004	23.100	3.600	1200	S1.019	19.500	300	S1.018	20.988	300	1488
SSW.003	23.100	3.660	1200	S1.020	19.440	225	S1.019	19.440	300	
SSW.002	23.100	3.689	1200	S1.021	19.411	225	S1.020	19.411	225	
SSW.001	18.500	1.438	1050	S1.022	17.062	225	S1.021	17.062	225	
SExis MH	18.500	1.500	0		OUTFALL		S1.022	17.000	225	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.000	o	225	SSW.027	34.450	32.950	1.275	1050
S1.001	o	225	SSW.028	33.350	31.850	1.275	1050
S1.002	o	225	SSW.029	32.500	31.000	1.275	1050
S1.003	o	225	SSW.030	32.150	30.650	1.275	1050
S1.004	o	225	SSW.031	31.200	29.700	1.275	1050
S1.005	o	225	SSW.032	31.000	29.383	1.392	1050
S1.006	o	225	SSW.033	30.550	29.050	1.275	1050
S1.007	o	225	SSW.016	30.000	28.500	1.275	1050
S1.008	o	225	SSW.015	28.500	27.000	1.275	1050
S1.009	o	225	SSW.014	26.000	24.500	1.275	1050
S1.010	o	300	SSW.013	24.750	23.250	1.200	1050
S2.000	o	225	SSW.019	27.350	25.850	1.275	1050
S3.000	o	225	SSW.020	25.700	24.200	1.275	1050
S2.001	o	225	SSW.018	25.850	24.085	1.540	1200
S2.002	o	225	SSW.017	25.450	23.950	1.275	1050

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.000	26.250	23.9	SSW.028	33.350	31.850	1.275	1050
S1.001	14.065	16.5	SSW.029	32.500	31.000	1.275	1050
S1.002	5.825	16.6	SSW.030	32.150	30.650	1.275	1050
S1.003	25.335	26.7	SSW.031	31.200	29.700	1.275	1050
S1.004	4.200	21.0	SSW.032	31.000	29.500	1.275	1050
S1.005	4.000	12.0	SSW.033	30.550	29.050	1.275	1050
S1.006	11.025	20.0	SSW.016	30.000	28.500	1.275	1050
S1.007	27.785	18.5	SSW.015	28.500	27.000	1.275	1050
S1.008	50.485	20.2	SSW.014	26.000	24.500	1.275	1050
S1.009	26.000	20.8	SSW.013	24.750	23.250	1.275	1050
S1.010	17.600	167.6	SSW.012	25.100	23.145	1.655	1200
S2.000	38.015	25.3	SSW.018	25.850	24.350	1.275	1200
S3.000	19.150	166.5	SSW.018	25.850	24.085	1.540	1200
S2.001	19.265	142.7	SSW.017	25.450	23.950	1.275	1050
S2.002	17.810	50.9	SSW.012	25.100	23.600	1.275	1200

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.011	o	300	SSW.012	25.100	23.145	1.655	1200
S1.012	o	300	SSW.011	25.250	22.500	2.450	1200
S1.013	o	225	SSW.010	25.250	22.452	2.573	1200
S1.014	o	225	SSW.009	25.300	22.414	2.661	1200
S1.015	o	225	SSW.008	27.350	22.208	4.917	1200
S4.000	o	225	SSW.025	24.500	23.375	0.900	1050
S4.001	o	225	SSW.024	24.500	23.084	1.191	1050
S4.002	o	225	SSW.023	24.500	22.794	1.481	1050
S5.000	o	225	SSW.026	24.500	23.000	1.275	1050
S4.003	o	300	SSW.022	23.500	22.000	1.200	1050
S4.004	o	300	SSW.021	23.500	21.756	1.444	1050
S1.016	o	300	SSW.007	25.500	21.492	3.708	1200
S1.017	o	300	SSW.006	25.400	21.337	3.763	1200
S1.018	o	300	SSW.005	23.100	21.066	1.734	1200
S1.019	o	300	SSW.004	23.100	19.500	3.300	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.011	9.000	166.7	SSW.011	25.250	23.091	1.859	1200
S1.012	12.000	250.0	SSW.010	25.250	22.452	2.498	1200
S1.013	9.595	252.5	SSW.009	25.300	22.414	2.661	1200
S1.014	51.485	249.9	SSW.008	27.350	22.208	4.917	1200
S1.015	20.545	78.4	SSW.007	25.500	21.946	3.329	1200
S4.000	48.625	167.1	SSW.024	24.500	23.084	1.191	1050
S4.001	48.485	167.2	SSW.023	24.500	22.794	1.481	1050
S4.002	35.465	44.7	SSW.022	23.500	22.000	1.275	1050
S5.000	22.985	23.0	SSW.022	23.500	22.000	1.275	1050
S4.003	40.700	166.8	SSW.021	23.500	21.756	1.444	1050
S4.004	44.090	167.0	SSW.007	25.500	21.492	3.708	1200
S1.016	25.950	167.4	SSW.006	25.400	21.337	3.763	1200
S1.017	45.295	167.1	SSW.005	23.100	21.066	1.734	1200
S1.018	13.100	167.9	SSW.004	23.100	20.988	1.812	1200
S1.019	12.000	200.0	SSW.003	23.100	19.440	3.360	1200

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.020	o	225	SSW.003	23.100	19.440	3.435	1200
S1.021	o	225	SSW.002	23.100	19.411	3.464	1200
S1.022	o	225	SSW.001	18.500	17.062	1.213	1050

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.020	5.745	198.1	SSW.002	23.100	19.411	3.464	1200
S1.021	30.825	13.1	SSW.001	18.500	17.062	1.213	1050
S1.022	12.355	199.3	SExis MH	18.500	17.000	1.275	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.022	SExis MH	18.500	17.000	17.000	0	0

Simulation Criteria for Storm

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

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	18.800	Storm Duration (mins)	30
Ratio R	0.250		

Online Controls for Storm

Hydro-Brake® Manhole: SSW.010, DS/PN: S1.013, Volume (m³): 3.9

Design Head (m) 2.000 Hydro-Brake® Type Md4 Invert Level (m) 22.452
Design Flow (l/s) 2.1 Diameter (mm) 44

Depth (m)	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**
0.100	0.8	1.200	1.7	3.000	2.6	7.000	4.0
0.200	0.7	1.400	1.8	3.500	2.8	7.500	4.1
0.300	0.8	1.600	1.9	4.000	3.0	8.000	4.3
0.400	1.0	1.800	2.0	4.500	3.2	8.500	4.4
0.500	1.1	2.000	2.1	5.000	3.4	9.000	4.5
0.600	1.2	2.200	2.2	5.500	3.5	9.500	4.7
0.800	1.3	2.400	2.3	6.000	3.7		
1.000	1.5	2.600	2.4	6.500	3.8		

Hydro-Brake® Manhole: SSW.003, DS/PN: S1.020, Volume (m³): 4.9

Design Head (m) 3.000 Hydro-Brake® Type Md4 Invert Level (m) 19.440
Design Flow (l/s) 4.7 Diameter (mm) 60

Depth (m)	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**
0.100	1.6	1.200	3.1	3.000	4.9	7.000	7.4
0.200	1.5	1.400	3.3	3.500	5.2	7.500	7.7
0.300	1.6	1.600	3.5	4.000	5.6	8.000	7.9
0.400	1.8	1.800	3.8	4.500	6.0	8.500	8.2
0.500	2.0	2.000	4.0	5.000	6.3	9.000	8.4
0.600	2.2	2.200	4.2	5.500	6.6	9.500	8.6
0.800	2.5	2.400	4.3	6.000	6.9		
1.000	2.8	2.600	4.5	6.500	7.2		

Storage Structures for Storm

Tank or Pond Manhole: SSW.010, DS/PN: S1.013

Invert Level (m) 22.452

Depth (m)	**Area (m²)**	**Depth (m)**	**Area (m²)**
0.000	128.0	2.000	128.0

Tank or Pond Manhole: SSW.003, DS/PN: S1.020

Invert Level (m) 19.440

Depth (m)	**Area (m²)**	**Depth (m)**	**Area (m²)**
0.000	72.0	3.000	72.0

Appendix D – 1 in 100 Year Design Sheets

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	100	Add Flow / Climate Change (%)	10
M5-60 (mm)	18.800	Minimum Backdrop Height (m)	0.200
Ratio R	0.250	Maximum Backdrop Height (m)	1.500
Maximum Rainfall (mm/hr)	50	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.082	4-8	0.628	8-12	0.091

Total Area Contributing (ha) = 0.801

Total Pipe Volume (m³) = 38.407

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S1.000	26.250	1.100	23.9	0.010	5.00	0.0	0.600	o	225
S1.001	14.065	0.850	16.5	0.010	0.00	0.0	0.600	o	225
S1.002	5.825	0.350	16.6	0.005	0.00	0.0	0.600	o	225
S1.003	25.335	0.950	26.7	0.005	0.00	0.0	0.600	o	225
S1.004	4.200	0.200	21.0	0.005	0.00	0.0	0.600	o	225
S1.005	4.000	0.333	12.0	0.000	0.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	5.16	32.950	0.010	0.0	0.0	0.1	2.69	106.9	1.5
S1.001	50.00	5.24	31.850	0.020	0.0	0.0	0.3	3.23	128.5	3.0
S1.002	50.00	5.27	31.000	0.025	0.0	0.0	0.3	3.22	128.2	3.7
S1.003	50.00	5.43	30.650	0.030	0.0	0.0	0.4	2.54	101.1	4.5
S1.004	50.00	5.46	29.700	0.035	0.0	0.0	0.5	2.87	114.0	5.2
S1.005	50.00	5.47	29.383	0.035	0.0	0.0	0.5	3.80	151.0	5.2

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S1.006	11.025	0.550	20.0	0.000	0.00	0.0	0.600	o	225
S1.007	27.785	1.500	18.5	0.105	0.00	0.0	0.600	o	225
S1.008	50.485	2.500	20.2	0.078	0.00	0.0	0.600	o	225
S1.009	26.000	1.250	20.8	0.047	0.00	0.0	0.600	o	225
S1.010	17.600	0.105	167.6	0.017	0.00	0.0	0.600	o	300
S2.000	38.015	1.500	25.3	0.052	5.00	0.0	0.600	o	225
S3.000	19.150	0.115	166.5	0.032	5.00	0.0	0.600	o	225
S2.001	19.265	0.135	142.7	0.019	0.00	0.0	0.600	o	225
S2.002	17.810	0.350	50.9	0.010	0.00	0.0	0.600	o	225
S1.011	9.000	0.054	166.7	0.000	0.00	0.0	0.600	o	300
S1.012	12.000	0.048	250.0	0.000	0.00	0.0	0.600	o	300
S1.013	9.595	0.038	252.5	0.000	0.00	0.0	0.600	o	225
S1.014	51.485	0.206	249.9	0.000	0.00	0.0	0.600	o	225
S1.015	20.545	0.262	78.4	0.000	0.00	0.0	0.600	o	225
S4.000	48.625	0.291	167.1	0.108	5.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.006	50.00	5.54	29.050	0.035	0.0	0.0	0.5	2.94	116.7	5.2
S1.007	50.00	5.69	28.500	0.140	0.0	0.0	1.9	3.05	121.5	20.9
S1.008	50.00	5.98	27.000	0.218	0.0	0.0	3.0	2.93	116.3	32.5
S1.009	50.00	6.13	24.500	0.265	0.0	0.0	3.6	2.88	114.6	39.5
S1.010	50.00	6.37	23.250	0.282	0.0	0.0	3.8	1.21	85.6	42.0
S2.000	50.00	5.24	25.850	0.052	0.0	0.0	0.7	2.61	103.8	7.7
S3.000	50.00	5.32	24.200	0.032	0.0	0.0	0.4	1.01	40.2	4.8
S2.001	50.00	5.61	24.085	0.103	0.0	0.0	1.4	1.09	43.4	15.3
S2.002	50.00	5.77	23.950	0.113	0.0	0.0	1.5	1.84	73.1	16.8
S1.011	50.00	6.49	23.145	0.395	0.0	0.0	5.3	1.22	85.9	58.8
S1.012	50.00	6.69	22.500	0.395	0.0	0.0	5.3	0.99	70.0	58.8
S1.013	50.00	5.20	22.452	0.000	2.1	0.0	0.2	0.82	32.5	2.1
S1.014	50.00	6.24	22.414	0.000	2.1	0.0	0.2	0.82	32.7	2.3
S1.015	50.00	6.47	22.208	0.000	2.1	0.0	0.2	1.48	58.8	2.3
S4.000	50.00	5.80	23.375	0.108	0.0	0.0	1.5	1.01	40.1	16.1

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S4.001	48.485	0.290	167.2	0.093	0.00	0.0	0.600	o	225
S4.002	35.465	0.794	44.7	0.000	0.00	0.0	0.600	o	225
S5.000	22.985	1.000	23.0	0.035	5.00	0.0	0.600	o	225
S4.003	40.700	0.244	166.8	0.085	0.00	0.0	0.600	o	300
S4.004	44.090	0.264	167.0	0.000	0.00	0.0	0.600	o	300
S1.016	25.950	0.155	167.4	0.021	0.00	0.0	0.600	o	300
S1.017	45.295	0.271	167.1	0.064	0.00	0.0	0.600	o	300
S1.018	13.100	0.078	167.9	0.000	0.00	0.0	0.600	o	300
S1.019	12.000	0.060	200.0	0.000	0.00	0.0	0.600	o	300
S1.020	5.745	0.029	198.1	0.000	0.00	0.0	0.600	o	225
S1.021	30.825	2.349	13.1	0.000	0.00	0.0	0.600	o	225
S1.022	12.355	0.062	199.3	0.000	0.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S4.001	50.00	6.60	23.084	0.201	0.0	0.0	2.7	1.01	40.1	29.9
S4.002	50.00	6.91	22.794	0.201	0.0	0.0	2.7	1.96	78.0	29.9
S5.000	50.00	5.14	23.000	0.035	0.0	0.0	0.5	2.74	109.0	5.2
S4.003	50.00	7.46	22.000	0.321	0.0	0.0	4.3	1.21	85.9	47.8
S4.004	50.00	8.07	21.756	0.321	0.0	0.0	4.3	1.21	85.8	47.8
S1.016	50.00	8.43	21.492	0.342	2.1	0.0	4.8	1.21	85.7	53.3
S1.017	50.00	9.05	21.337	0.406	2.1	0.0	5.7	1.21	85.8	62.8
S1.018	50.00	9.23	21.066	0.406	2.1	0.0	5.7	1.21	85.6	62.8
S1.019	50.00	9.41	19.500	0.406	2.1	0.0	5.7	1.11	78.3	62.8
S1.020	50.00	5.10	19.440	0.000	4.7	0.0	0.4	0.93	36.8	4.7
S1.021	50.00	5.24	19.411	0.000	4.7	0.0	0.5	3.63	144.4	5.2
S1.022	50.00	5.47	17.062	0.000	4.7	0.0	0.5	0.92	36.7	5.2

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
SSW.027	34.450	1.500	1050	S1.000	32.950	225				
SSW.028	33.350	1.500	1050	S1.001	31.850	225	S1.000	31.850	225	
SSW.029	32.500	1.500	1050	S1.002	31.000	225	S1.001	31.000	225	
SSW.030	32.150	1.500	1050	S1.003	30.650	225	S1.002	30.650	225	
SSW.031	31.200	1.500	1050	S1.004	29.700	225	S1.003	29.700	225	
SSW.032	31.000	1.617	1050	S1.005	29.383	225	S1.004	29.500	225	117
SSW.033	30.550	1.500	1050	S1.006	29.050	225	S1.005	29.050	225	
SSW.016	30.000	1.500	1050	S1.007	28.500	225	S1.006	28.500	225	
SSW.015	28.500	1.500	1050	S1.008	27.000	225	S1.007	27.000	225	
SSW.014	26.000	1.500	1050	S1.009	24.500	225	S1.008	24.500	225	
SSW.013	24.750	1.500	1050	S1.010	23.250	300	S1.009	23.250	225	
SSW.019	27.350	1.500	1050	S2.000	25.850	225				
SSW.020	25.700	1.500	1050	S3.000	24.200	225				
SSW.018	25.850	1.765	1200	S2.001	24.085	225	S2.000	24.350	225	265
							S3.000	24.085	225	
SSW.017	25.450	1.500	1050	S2.002	23.950	225	S2.001	23.950	225	
SSW.012	25.100	1.955	1200	S1.011	23.145	300	S1.010	23.145	300	
							S2.002	23.600	225	380
SSW.011	25.250	2.750	1200	S1.012	22.500	300	S1.011	23.091	300	591
SSW.010	25.250	2.798	1200	S1.013	22.452	225	S1.012	22.452	300	
SSW.009	25.300	2.886	1200	S1.014	22.414	225	S1.013	22.414	225	
SSW.008	27.350	5.142	1200	S1.015	22.208	225	S1.014	22.208	225	
SSW.025	24.500	1.125	1050	S4.000	23.375	225				
SSW.024	24.500	1.416	1050	S4.001	23.084	225	S4.000	23.084	225	
SSW.023	24.500	1.706	1050	S4.002	22.794	225	S4.001	22.794	225	
SSW.026	24.500	1.500	1050	S5.000	23.000	225				
SSW.022	23.500	1.500	1050	S4.003	22.000	300	S4.002	22.000	225	
							S5.000	22.000	225	
SSW.021	23.500	1.744	1050	S4.004	21.756	300	S4.003	21.756	300	
SSW.007	25.500	4.008	1200	S1.016	21.492	300	S1.015	21.946	225	379
							S4.004	21.492	300	
SSW.006	25.400	4.063	1200	S1.017	21.337	300	S1.016	21.337	300	
SSW.005	23.100	2.034	1200	S1.018	21.066	300	S1.017	21.066	300	
SSW.004	23.100	3.600	1200	S1.019	19.500	300	S1.018	20.988	300	1488
SSW.003	23.100	3.660	1200	S1.020	19.440	225	S1.019	19.440	300	
SSW.002	23.100	3.689	1200	S1.021	19.411	225	S1.020	19.411	225	
SSW.001	18.500	1.438	1050	S1.022	17.062	225	S1.021	17.062	225	
SExis MH	18.500	1.500	0		OUTFALL		S1.022	17.000	225	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.000	o	225	SSW.027	34.450	32.950	1.275	1050
S1.001	o	225	SSW.028	33.350	31.850	1.275	1050
S1.002	o	225	SSW.029	32.500	31.000	1.275	1050
S1.003	o	225	SSW.030	32.150	30.650	1.275	1050
S1.004	o	225	SSW.031	31.200	29.700	1.275	1050
S1.005	o	225	SSW.032	31.000	29.383	1.392	1050
S1.006	o	225	SSW.033	30.550	29.050	1.275	1050
S1.007	o	225	SSW.016	30.000	28.500	1.275	1050
S1.008	o	225	SSW.015	28.500	27.000	1.275	1050
S1.009	o	225	SSW.014	26.000	24.500	1.275	1050
S1.010	o	300	SSW.013	24.750	23.250	1.200	1050
S2.000	o	225	SSW.019	27.350	25.850	1.275	1050
S3.000	o	225	SSW.020	25.700	24.200	1.275	1050
S2.001	o	225	SSW.018	25.850	24.085	1.540	1200
S2.002	o	225	SSW.017	25.450	23.950	1.275	1050

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.000	26.250	23.9	SSW.028	33.350	31.850	1.275	1050
S1.001	14.065	16.5	SSW.029	32.500	31.000	1.275	1050
S1.002	5.825	16.6	SSW.030	32.150	30.650	1.275	1050
S1.003	25.335	26.7	SSW.031	31.200	29.700	1.275	1050
S1.004	4.200	21.0	SSW.032	31.000	29.500	1.275	1050
S1.005	4.000	12.0	SSW.033	30.550	29.050	1.275	1050
S1.006	11.025	20.0	SSW.016	30.000	28.500	1.275	1050
S1.007	27.785	18.5	SSW.015	28.500	27.000	1.275	1050
S1.008	50.485	20.2	SSW.014	26.000	24.500	1.275	1050
S1.009	26.000	20.8	SSW.013	24.750	23.250	1.275	1050
S1.010	17.600	167.6	SSW.012	25.100	23.145	1.655	1200
S2.000	38.015	25.3	SSW.018	25.850	24.350	1.275	1200
S3.000	19.150	166.5	SSW.018	25.850	24.085	1.540	1200
S2.001	19.265	142.7	SSW.017	25.450	23.950	1.275	1050
S2.002	17.810	50.9	SSW.012	25.100	23.600	1.275	1200

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.011	o	300	SSW.012	25.100	23.145	1.655	1200
S1.012	o	300	SSW.011	25.250	22.500	2.450	1200
S1.013	o	225	SSW.010	25.250	22.452	2.573	1200
S1.014	o	225	SSW.009	25.300	22.414	2.661	1200
S1.015	o	225	SSW.008	27.350	22.208	4.917	1200
S4.000	o	225	SSW.025	24.500	23.375	0.900	1050
S4.001	o	225	SSW.024	24.500	23.084	1.191	1050
S4.002	o	225	SSW.023	24.500	22.794	1.481	1050
S5.000	o	225	SSW.026	24.500	23.000	1.275	1050
S4.003	o	300	SSW.022	23.500	22.000	1.200	1050
S4.004	o	300	SSW.021	23.500	21.756	1.444	1050
S1.016	o	300	SSW.007	25.500	21.492	3.708	1200
S1.017	o	300	SSW.006	25.400	21.337	3.763	1200
S1.018	o	300	SSW.005	23.100	21.066	1.734	1200
S1.019	o	300	SSW.004	23.100	19.500	3.300	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.011	9.000	166.7	SSW.011	25.250	23.091	1.859	1200
S1.012	12.000	250.0	SSW.010	25.250	22.452	2.498	1200
S1.013	9.595	252.5	SSW.009	25.300	22.414	2.661	1200
S1.014	51.485	249.9	SSW.008	27.350	22.208	4.917	1200
S1.015	20.545	78.4	SSW.007	25.500	21.946	3.329	1200
S4.000	48.625	167.1	SSW.024	24.500	23.084	1.191	1050
S4.001	48.485	167.2	SSW.023	24.500	22.794	1.481	1050
S4.002	35.465	44.7	SSW.022	23.500	22.000	1.275	1050
S5.000	22.985	23.0	SSW.022	23.500	22.000	1.275	1050
S4.003	40.700	166.8	SSW.021	23.500	21.756	1.444	1050
S4.004	44.090	167.0	SSW.007	25.500	21.492	3.708	1200
S1.016	25.950	167.4	SSW.006	25.400	21.337	3.763	1200
S1.017	45.295	167.1	SSW.005	23.100	21.066	1.734	1200
S1.018	13.100	167.9	SSW.004	23.100	20.988	1.812	1200
S1.019	12.000	200.0	SSW.003	23.100	19.440	3.360	1200

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.020	o	225	SSW.003	23.100	19.440	3.435	1200
S1.021	o	225	SSW.002	23.100	19.411	3.464	1200
S1.022	o	225	SSW.001	18.500	17.062	1.213	1050

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.020	5.745	198.1	SSW.002	23.100	19.411	3.464	1200
S1.021	30.825	13.1	SSW.001	18.500	17.062	1.213	1050
S1.022	12.355	199.3	SExis MH	18.500	17.000	1.275	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.022	SExis MH	18.500	17.000	17.000	0	0

Simulation Criteria for Storm

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

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	18.800	Storm Duration (mins)	30
Ratio R	0.250		

Online Controls for Storm

Hydro-Brake® Manhole: SSW.010, DS/PN: S1.013, Volume (m³): 3.9

Design Head (m) 2.000 Hydro-Brake® Type Md4 Invert Level (m) 22.452
Design Flow (l/s) 2.1 Diameter (mm) 44

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.8	1.200	1.7	3.000	2.6	7.000	4.0
0.200	0.7	1.400	1.8	3.500	2.8	7.500	4.1
0.300	0.8	1.600	1.9	4.000	3.0	8.000	4.3
0.400	1.0	1.800	2.0	4.500	3.2	8.500	4.4
0.500	1.1	2.000	2.1	5.000	3.4	9.000	4.5
0.600	1.2	2.200	2.2	5.500	3.5	9.500	4.7
0.800	1.3	2.400	2.3	6.000	3.7		
1.000	1.5	2.600	2.4	6.500	3.8		

Hydro-Brake® Manhole: SSW.003, DS/PN: S1.020, Volume (m³): 4.9

Design Head (m) 3.000 Hydro-Brake® Type Md4 Invert Level (m) 19.440
Design Flow (l/s) 4.7 Diameter (mm) 60

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.6	1.200	3.1	3.000	4.9	7.000	7.4
0.200	1.5	1.400	3.3	3.500	5.2	7.500	7.7
0.300	1.6	1.600	3.5	4.000	5.6	8.000	7.9
0.400	1.8	1.800	3.8	4.500	6.0	8.500	8.2
0.500	2.0	2.000	4.0	5.000	6.3	9.000	8.4
0.600	2.2	2.200	4.2	5.500	6.6	9.500	8.6
0.800	2.5	2.400	4.3	6.000	6.9		
1.000	2.8	2.600	4.5	6.500	7.2		

Storage Structures for Storm

Tank or Pond Manhole: SSW.010, DS/PN: S1.013

Invert Level (m) 22.452

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	128.0	2.000	128.0

Tank or Pond Manhole: SSW.003, DS/PN: S1.020

Invert Level (m) 19.440

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	72.0	3.000	72.0

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

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

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

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
S1.000	15 Winter	100	0%					
S1.001	15 Winter	100	0%					
S1.002	15 Winter	100	0%					
S1.003	15 Winter	100	0%					
S1.004	15 Winter	100	0%					
S1.005	15 Winter	100	0%					
S1.006	15 Winter	100	0%					
S1.007	15 Winter	100	0%					
S1.008	15 Winter	100	0%					
S1.009	15 Winter	100	0%	100/15 Summer				
S1.010	1440 Winter	100	0%	100/15 Summer				
S2.000	15 Winter	100	0%					
S3.000	1440 Winter	100	0%					
S2.001	1440 Winter	100	0%	100/960 Winter				
S2.002	1440 Winter	100	0%	100/480 Winter				
S1.011	1440 Winter	100	0%	100/15 Summer				
S1.012	1440 Winter	100	0%	100/15 Summer				
S1.013	1440 Winter	100	0%	100/15 Summer				
S1.014	1440 Winter	100	0%					
S1.015	1440 Winter	100	0%	100/1440 Winter				
S4.000	15 Winter	100	0%	100/15 Summer				
S4.001	15 Winter	100	0%	100/15 Summer				
S4.002	15 Winter	100	0%	100/15 Winter				
S5.000	15 Winter	100	0%					
S4.003	15 Winter	100	0%	100/15 Summer				
S4.004	1440 Winter	100	0%	100/15 Summer				
S1.016	1440 Winter	100	0%	100/15 Summer				
S1.017	1440 Winter	100	0%	100/15 Summer				
S1.018	1440 Winter	100	0%	100/15 Summer				
S1.019	1440 Winter	100	0%	100/15 Summer				
S1.020	1440 Winter	100	0%	100/15 Summer				
S1.021	1440 Winter	100	0%					
S1.022	1440 Winter	100	0%					

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

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
S1.000	SSW.027	32.979	-0.196	0.000	0.04	0.0	4.0	OK
S1.001	SSW.028	31.890	-0.185	0.000	0.07	0.0	8.2	OK
S1.002	SSW.029	31.053	-0.172	0.000	0.12	0.0	10.3	OK
S1.003	SSW.030	30.705	-0.170	0.000	0.13	0.0	12.3	OK
S1.004	SSW.031	29.773	-0.152	0.000	0.23	0.0	14.4	OK
S1.005	SSW.032	29.447	-0.161	0.000	0.18	0.0	14.3	OK
S1.006	SSW.033	29.107	-0.168	0.000	0.14	0.0	14.3	OK
S1.007	SSW.016	28.615	-0.109	0.000	0.52	0.0	58.4	OK
S1.008	SSW.015	27.156	-0.069	0.000	0.81	0.0	90.7	OK
S1.009	SSW.014	25.178	0.454	0.000	0.98	0.0	104.1	SURCHARGED
S1.010	SSW.013	24.407	0.857	0.000	0.10	0.0	7.7	SURCHARGED
S2.000	SSW.019	25.920	-0.155	0.000	0.21	0.0	20.6	OK
S3.000	SSW.020	24.408	-0.017	0.000	0.02	0.0	0.9	OK
S2.001	SSW.018	24.408	0.098	0.000	0.07	0.0	2.9	SURCHARGED
S2.002	SSW.017	24.407	0.232	0.000	0.05	0.0	3.1	SURCHARGED
S1.011	SSW.012	24.406	0.961	0.000	0.17	0.0	10.7	SURCHARGED
S1.012	SSW.011	24.404	1.604	0.000	0.19	0.0	10.7	SURCHARGED
S1.013	SSW.010	24.403	1.726	0.000	0.08	0.0	2.1	SURCHARGED
S1.014	SSW.009	22.471	-0.168	0.000	0.07	0.0	2.1	OK
S1.015	SSW.008	22.459	0.026	0.000	0.04	0.0	2.2	SURCHARGED
S4.000	SSW.025	24.116	0.516	0.000	0.95	0.0	36.5	SURCHARGED
S4.001	SSW.024	23.846	0.537	0.000	1.64	0.0	63.1	SURCHARGED
S4.002	SSW.023	23.036	0.017	0.000	0.81	0.0	59.8	SURCHARGED
S5.000	SSW.026	23.056	-0.169	0.000	0.14	0.0	13.9	OK
S4.003	SSW.022	22.524	0.224	0.000	1.17	0.0	93.0	SURCHARGED
S4.004	SSW.021	22.458	0.402	0.000	0.11	0.0	8.9	SURCHARGED
S1.016	SSW.007	22.454	0.662	0.000	0.15	0.0	11.1	SURCHARGED
S1.017	SSW.006	22.449	0.812	0.000	0.16	0.0	12.8	SURCHARGED
S1.018	SSW.005	22.442	1.076	0.000	0.18	0.0	12.3	SURCHARGED
S1.019	SSW.004	22.438	2.638	0.000	0.19	0.0	11.9	SURCHARGED
S1.020	SSW.003	22.434	2.769	0.000	0.18	0.0	4.9	SURCHARGED
S1.021	SSW.002	19.438	-0.198	0.000	0.04	0.0	4.9	OK
S1.022	SSW.001	17.121	-0.166	0.000	0.15	0.0	4.9	OK

Appendix E – Foul Sewer Design Sheets

FOUL SEWERAGE DESIGN

Design Criteria for Foul - Main

Pipe Sizes STANDARD Manhole Sizes STANDARD

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

Designed with Level Inverts

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
F1.000	8.500	0.350	24.3	0.000	0	0.0	1.500	o	150
F1.001	22.550	0.950	23.7	0.000	0	0.0	1.500	o	150
F1.002	4.000	0.200	20.0	0.000	0	0.0	1.500	o	150
F1.003	5.300	0.265	20.0	0.000	0	0.0	1.500	o	150
F1.004	10.750	0.538	20.0	0.000	0	0.0	1.500	o	150
F1.005	35.100	1.500	23.4	0.000	10	0.0	1.500	o	150
F1.006	32.750	1.638	20.0	0.000	0	0.0	1.500	o	150
F1.007	48.850	0.326	149.8	0.000	24	0.0	1.500	o	225
F1.008	48.450	0.323	150.0	0.000	24	0.0	1.500	o	225
F1.009	31.875	1.076	29.6	0.000	0	0.0	1.500	o	225
F1.010	44.165	0.294	150.2	0.000	12	0.0	1.500	o	225
F1.011	44.550	0.297	150.0	0.000	0	0.0	1.500	o	225

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.000	30.650	0.000	0.0	0	0.0	0	0.00	1.78	31.5	0.0
F1.001	30.300	0.000	0.0	0	0.0	0	0.00	1.80	31.9	0.0
F1.002	29.350	0.000	0.0	0	0.0	0	0.00	1.96	34.7	0.0
F1.003	28.965	0.000	0.0	0	0.0	0	0.00	1.96	34.7	0.0
F1.004	28.700	0.000	0.0	0	0.0	0	0.00	1.97	34.7	0.0
F1.005	28.162	0.000	0.0	10	0.0	11	0.55	1.82	32.1	0.3
F1.006	25.013	0.000	0.0	10	0.0	10	0.58	1.97	34.7	0.3
F1.007	23.375	0.000	0.0	34	0.0	26	0.41	0.94	37.2	1.1
F1.008	23.049	0.000	0.0	58	0.0	34	0.48	0.94	37.2	1.8
F1.009	22.726	0.000	0.0	58	0.0	23	0.84	2.11	84.0	1.8
F1.010	21.650	0.000	0.0	70	0.0	37	0.51	0.94	37.2	2.2
F1.011	21.356	0.000	0.0	70	0.0	37	0.51	0.94	37.2	2.2

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
F1.012	22.915	0.153	149.8	0.000	4	0.0	1.500	o	225
F1.013	44.800	0.299	150.0	0.000	8	0.0	1.500	o	225
F1.014	9.450	0.063	150.0	0.000	0	0.0	1.500	o	225
F1.015	17.985	0.899	20.0	0.000	0	0.0	1.500	o	225
F1.016	29.150	1.458	20.0	0.000	0	0.0	1.500	o	225
F1.017	10.670	0.071	150.0	0.000	0	0.0	1.500	o	225

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.012	21.059	0.000	0.0	74	0.0	38	0.52	0.94	37.3	2.3
F1.013	20.906	0.000	0.0	82	0.0	40	0.53	0.94	37.2	2.5
F1.014	20.607	0.000	0.0	82	0.0	40	0.53	0.94	37.2	2.5
F1.015	20.544	0.000	0.0	82	0.0	25	1.08	2.57	102.3	2.5
F1.016	18.833	0.000	0.0	82	0.0	25	1.08	2.57	102.3	2.5
F1.017	17.375	0.000	0.0	82	0.0	40	0.53	0.94	37.2	2.5

Manhole Schedules for Foul - Main

MH Name	MH CL (m)	MH Depth (m)	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
FFS.018	32.500	1.850	1200	F1.000	30.650	150				
FFS.019	32.150	1.850	1200	F1.001	30.300	150	F1.000	30.300	150	
FFS.020	31.200	1.850	1200	F1.002	29.350	150	F1.001	29.350	150	
FFS.021	31.000	2.035	1200	F1.003	28.965	150	F1.002	29.150	150	185
FFS.022	30.550	1.850	1200	F1.004	28.700	150	F1.003	28.700	150	
FFS.001	30.000	1.838	1200	F1.005	28.162	150	F1.004	28.162	150	
FFS.002	28.500	3.487	1200	F1.006	25.013	150	F1.005	26.662	150	1649
FFS.003	24.500	1.125	1050	F1.007	23.375	225	F1.006	23.375	150	
FFS.004	24.500	1.451	1050	F1.008	23.049	225	F1.007	23.049	225	
FFS.005	24.500	1.774	1200	F1.009	22.726	225	F1.008	22.726	225	
FFS.006	23.500	1.850	1200	F1.010	21.650	225	F1.009	21.650	225	
FFS.007	23.500	2.144	1200	F1.011	21.356	225	F1.010	21.356	225	
FFS.008	25.500	4.441	1200	F1.012	21.059	225	F1.011	21.059	225	
FFS.009	25.400	4.494	1200	F1.013	20.906	225	F1.012	20.906	225	
FFS.010	23.100	2.493	1200	F1.014	20.607	225	F1.013	20.607	225	
FFS.011	23.100	2.556	1200	F1.015	20.544	225	F1.014	20.544	225	
FFS.012	23.100	4.267	1200	F1.016	18.833	225	F1.015	19.645	225	812
FFS.013	18.500	1.125	1050	F1.017	17.375	225	F1.016	17.375	225	
FEXis MH	18.500	1.196	0		OUTFALL		F1.017	17.304	225	

PIPELINE SCHEDULES for Foul - Main

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
F1.000	o	150	FFS.018	32.500	30.650	1.700	1200
F1.001	o	150	FFS.019	32.150	30.300	1.700	1200
F1.002	o	150	FFS.020	31.200	29.350	1.700	1200
F1.003	o	150	FFS.021	31.000	28.965	1.885	1200
F1.004	o	150	FFS.022	30.550	28.700	1.700	1200
F1.005	o	150	FFS.001	30.000	28.162	1.688	1200
F1.006	o	150	FFS.002	28.500	25.013	3.337	1200
F1.007	o	225	FFS.003	24.500	23.375	0.900	1050
F1.008	o	225	FFS.004	24.500	23.049	1.226	1050
F1.009	o	225	FFS.005	24.500	22.726	1.549	1200
F1.010	o	225	FFS.006	23.500	21.650	1.625	1200
F1.011	o	225	FFS.007	23.500	21.356	1.919	1200
F1.012	o	225	FFS.008	25.500	21.059	4.216	1200
F1.013	o	225	FFS.009	25.400	20.906	4.269	1200
F1.014	o	225	FFS.010	23.100	20.607	2.268	1200
F1.015	o	225	FFS.011	23.100	20.544	2.331	1200
F1.016	o	225	FFS.012	23.100	18.833	4.042	1200
F1.017	o	225	FFS.013	18.500	17.375	0.900	1050

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
F1.000	8.500	24.3	FFS.019	32.150	30.300	1.700	1200
F1.001	22.550	23.7	FFS.020	31.200	29.350	1.700	1200
F1.002	4.000	20.0	FFS.021	31.000	29.150	1.700	1200
F1.003	5.300	20.0	FFS.022	30.550	28.700	1.700	1200
F1.004	10.750	20.0	FFS.001	30.000	28.162	1.688	1200
F1.005	35.100	23.4	FFS.002	28.500	26.662	1.688	1200
F1.006	32.750	20.0	FFS.003	24.500	23.375	0.975	1050
F1.007	48.850	149.8	FFS.004	24.500	23.049	1.226	1050
F1.008	48.450	150.0	FFS.005	24.500	22.726	1.549	1200
F1.009	31.875	29.6	FFS.006	23.500	21.650	1.625	1200
F1.010	44.165	150.2	FFS.007	23.500	21.356	1.919	1200
F1.011	44.550	150.0	FFS.008	25.500	21.059	4.216	1200
F1.012	22.915	149.8	FFS.009	25.400	20.906	4.269	1200
F1.013	44.800	150.0	FFS.010	23.100	20.607	2.268	1200
F1.014	9.450	150.0	FFS.011	23.100	20.544	2.331	1200
F1.015	17.985	20.0	FFS.012	23.100	19.645	3.230	1200
F1.016	29.150	20.0	FFS.013	18.500	17.375	0.900	1050
F1.017	10.670	150.0	FEXis MH	18.500	17.304	0.971	0

Free Flowing Outfall Details for Foul - Main

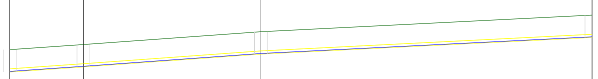
Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
F1.017	FEXis MH	18.500	17.304	17.300	0	0

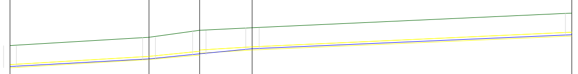
Simulation Criteria for Foul - Main

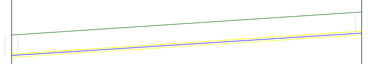
Volumetric Runoff Coeff	0.750	Foul Sewage per hectare (l/s)	0.000
PIMP (% impervious)	100	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Run Time (mins)	60
Manhole Headloss Coeff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

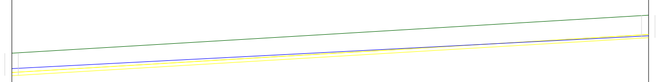
Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

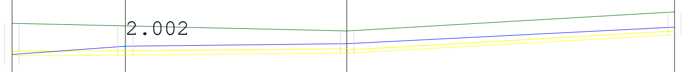
Appendix F – Storm Water Longitudinal Sections

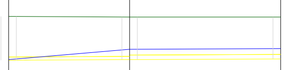
MH Name	SSW.030		SSW.028	SSW.027	
Hor Scale 600 Ver Scale 500 Datum (m)21.000					
PN			S1.001	S1.000	
Dia (mm)			225	225	
Slope (1:X)			16.5	23.9	
Cover Level (m)	32.150	32.500	33.350	34.450	
Invert Level (m)		30.650 31.000	31.000 31.850	31.850 32.950	
Length (m)			14.065	26.250	

MH Name	SSW.016	SSW.033			SSW.030	
Hor Scale 600 Ver Scale 500 Datum (m)19.000						
PN		S1.006			S1.003	
Dia (mm)		225			225	
Slope (1:X)		20.0			26.7	
Cover Level (m)	30.000	30.550	31.000	31.200	32.150	
Invert Level (m)		28.500 29.050	29.383	29.700	29.700 30.650	
Length (m)		11.025			25.335	

MH Name	SSW.015	SSW.016	
Hor Scale 600 Ver Scale 500 Datum (m) 17.000			
PN		S1.007	
Dia (mm)		225	
Slope (1:X)		18.5	
Cover Level (m)	28.500	30.000	
Invert Level (m)	27.000	28.500	
Length (m)		27.785	

MH Name	SSW.014	SSW.015	
Hor Scale 600 Ver Scale 500 Datum (m) 15.000			
PN		S1.008	
Dia (mm)		225	
Slope (1:X)		20.2	
Cover Level (m)	26.000	28.500	
Invert Level (m)	24.500	27.000	
Length (m)		50.485	

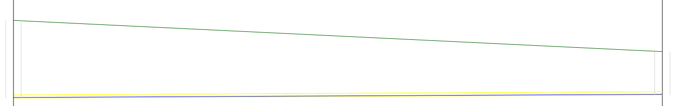
MH Name	SSW.011	SSW.012	SSW.013	SSW.014	
Hor Scale 600 Ver Scale 500 Datum (m)13.000					
PN		S1.011	S1.010	S1.009	
Dia (mm)		300	300	225	
Slope (1:X)		166.7	167.6	20.8	
Cover Level (m)	25.250	25.100	24.750	26.000	
Invert Level (m)		23.091 23.145	23.145 23.250	23.250 24.500	
Length (m)		9.000	17.600	26.000	

MH Name	SSW.009	SSW.010	SSW.011	
Hor Scale 600 Ver Scale 500 Datum (m)12.000				
PN		S1.013	S1.012	
Dia (mm)		225	300	
Slope (1:X)		252.5	250.0	
Cover Level (m)	25.300	25.250	25.250	
Invert Level (m)		22.414 22.452	22.452 22.500	
Length (m)		9.595	12.000	

Hor Scale 600

Ver Scale 500

Datum (m) 13.000

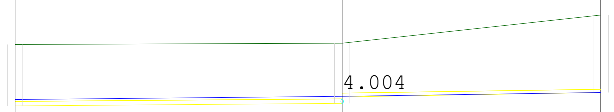


MH Name	SSW.008		SSW.009
PN		S1.014	
Dia (mm)		225	
Slope (1:X)		249.9	
Cover Level (m)	27.350		25.300
Invert Level (m)	22.208		22.414
Length (m)		51.485	

Hor Scale 600

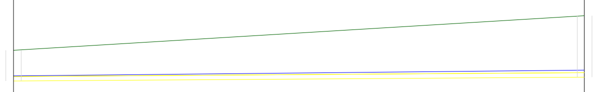
Ver Scale 500

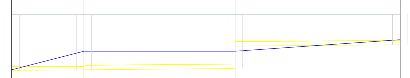
Datum (m) 13.000



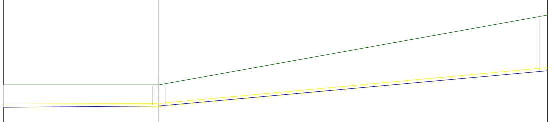
MH Name	SSW.006		SSW.007		SSW.008
PN		S1.016		S1.015	
Dia (mm)		300		225	
Slope (1:X)		167.4		78.4	
Cover Level (m)	25.400		25.500		27.350
Invert Level (m)	21.337		21.492 / 21.946		22.208
Length (m)		25.950		20.545	

Denis O'Sullivan & Associates		Page 5
Unit 5, Joyce House Barrack Square Ballincollig, Co. Cork	Residential Development Glyntown Glanmire, Co. Cork	Micro Drainage
Date 10/01/2022 File Revised SW Model.MDX	Designed By S.O.'Grady Checked By	
Micro Drainage	Network W.12.4	

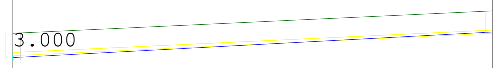
MH Name	SSW.005	SSW.006	
Hor Scale 600 Ver Scale 500 Datum (m) 12.000			
PN		S1.017	
Dia (mm)		300	
Slope (1:X)		167.1	
Cover Level (m)	23.100	25.400	
Invert Level (m)		21.066 21.337	
Length (m)		45.295	

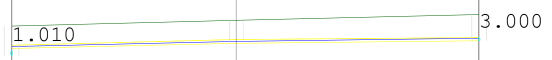
MH Name	SSW.002		SSW.004	SSW.005	
Hor Scale 600 Ver Scale 500 Datum (m) 10.000					
PN			S1.019	S1.018	
Dia (mm)			300	300	
Slope (1:X)			200.0	167.9	
Cover Level (m)	23.100	23.100	23.100	23.100	
Invert Level (m)		19.411 19.440	19.440 19.500	20.988 21.066	
Length (m)			12.000	13.100	

MH Name	SExis MH	SSW.001	SSW.002
Hor Scale 600 Ver Scale 500 Datum (m) 9.000			
PN		S1.022	S1.021
Dia (mm)		225	225
Slope (1:X)		199.3	13.1
Cover Level (m)	18.500	18.500	23.100
Invert Level (m)		17.000 / 17.062	17.062 / 19.411
Length (m)		12.355	30.825



MH Name	SSW.018	SSW.019
Hor Scale 600 Ver Scale 500 Datum (m) 14.000		
PN		S2.000
Dia (mm)		225
Slope (1:X)		25.3
Cover Level (m)	25.850	27.350
Invert Level (m)		24.350 / 25.850
Length (m)		38.015

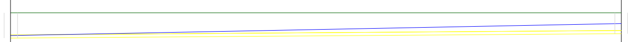


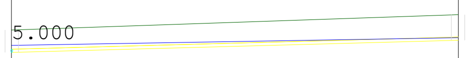


MH Name	SSW.012	SSW.017	SSW.018	
Hor Scale 600 Ver Scale 500 Datum (m)13.000				
PN		S2.002	S2.001	
Dia (mm)		225	225	
Slope (1:X)		50.9	142.7	
Cover Level (m)	25.100	25.450	25.850	
Invert Level (m)		23.600 / 23.950	23.950 / 24.085	
Length (m)		17.810	19.265	

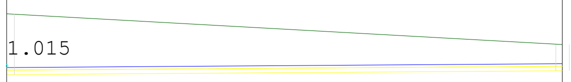
MH Name	SSW.018	SSW.020	
Hor Scale 600 Ver Scale 500 Datum (m)13.000			
PN		S3.000	
Dia (mm)		225	
Slope (1:X)		166.5	
Cover Level (m)	25.850	25.700	
Invert Level (m)		24.085 / 24.200	
Length (m)		19.150	

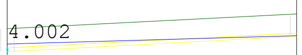
MH Name	SSW.024		SSW.025
Hor Scale 600 Ver Scale 500 Datum (m) 12.000			
PN		S4.000	
Dia (mm)		225	
Slope (1:X)		167.1	
Cover Level (m)	24.500		24.500
Invert Level (m)	23.084		23.375
Length (m)		48.625	

MH Name	SSW.023		SSW.024
Hor Scale 600 Ver Scale 500 Datum (m) 12.000			
PN		S4.001	
Dia (mm)		225	
Slope (1:X)		167.2	
Cover Level (m)	24.500		24.500
Invert Level (m)	22.794		23.084
Length (m)		48.485	

MH Name	SSW.022		SSW.023	
Hor Scale 600 Ver Scale 500 Datum (m) 12.000				
PN		S4.002		
Dia (mm)		225		
Slope (1:X)		44.7		
Cover Level (m)	23.500		24.500	
Invert Level (m)	22.000		22.794	
Length (m)		35.465		

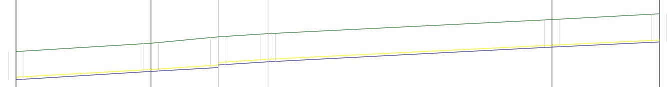
MH Name	SSW.021		SSW.022	
Hor Scale 600 Ver Scale 500 Datum (m) 11.000				
PN		S4.003		
Dia (mm)		300		
Slope (1:X)		166.8		
Cover Level (m)	23.500		23.500	
Invert Level (m)	21.756		22.000	
Length (m)		40.700		

MH Name	SSW.007		SSW.021
Hor Scale 600 Ver Scale 500 Datum (m) 12.000			
PN		S4.004	
Dia (mm)		300	
Slope (1:X)		167.0	
Cover Level (m)	25.500		23.500
Invert Level (m)	21.492		21.756
Length (m)		44.090	

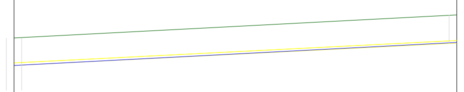
MH Name	SSW.022		SSW.026
Hor Scale 600 Ver Scale 500 Datum (m) 12.000			
PN		S5.000	
Dia (mm)		225	
Slope (1:X)		23.0	
Cover Level (m)	23.500		24.500
Invert Level (m)	22.000		23.000
Length (m)		22.985	

Appendix G – Foul Sewer Longitudinal Sections

Denis O'Sullivan & Associates		Page 1
Unit 5, Joyce House Barrack Square Ballincollig, Co. Cork	Residential Development Glyntown Glanmire, Co. Cork	
Date 24/01/2022 File Revised FS Model.MDX	Designed By S.O.'Grady Checked By	
Micro Drainage	Network W.12.4	

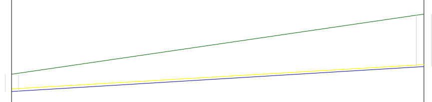


MH Name	FFS.001	FFS.022			FFS.019	FFS.018	
Hor Scale 600 Ver Scale 500 Datum (m)19.000							
PN		F1.004			F1.001	F1.000	
Dia (mm)		150			150	150	
Slope (1:X)		20.0			23.7	24.3	
Cover Level (m)	30.000	30.550	31.000	31.200	32.150	32.500	
Invert Level (m)		28.162 / 28.700	28.700 / 28.965	29.350	29.350 / 30.300	30.300 / 30.650	
Length (m)		10.750			22.550	8.500	



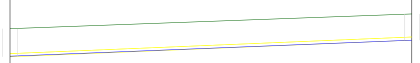
MH Name	FFS.002	FFS.001	
Hor Scale 600 Ver Scale 500 Datum (m)16.000			
PN		F1.005	
Dia (mm)		150	
Slope (1:X)		23.4	
Cover Level (m)	28.500	30.000	
Invert Level (m)		26.662 / 28.162	
Length (m)		35.100	

MH Name	FFS.003		FFS.002
Hor Scale 600 Ver Scale 500 Datum (m) 14.000			
PN		F1.006	
Dia (mm)		150	
Slope (1:X)		20.0	
Cover Level (m)	24.500		28.500
Invert Level (m)	23.375		25.013
Length (m)		32.750	

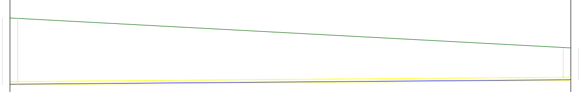


MH Name	FFS.004		FFS.003
Hor Scale 600 Ver Scale 500 Datum (m) 12.000			
PN		F1.007	
Dia (mm)		225	
Slope (1:X)		149.8	
Cover Level (m)	24.500		24.500
Invert Level (m)	23.049		23.375
Length (m)		48.850	

MH Name	FFS.005	FFS.004	
Hor Scale 600 Ver Scale 500 Datum (m) 12.000			
PN		F1.008	
Dia (mm)		225	
Slope (1:X)		150.0	
Cover Level (m)	24.500	24.500	
Invert Level (m)		22.726 / 23.049	
Length (m)		48.450	

MH Name	FFS.006	FFS.005	
Hor Scale 600 Ver Scale 500 Datum (m) 12.000			
PN		F1.009	
Dia (mm)		225	
Slope (1:X)		29.6	
Cover Level (m)	23.500	24.500	
Invert Level (m)		21.650 / 22.726	
Length (m)		31.875	

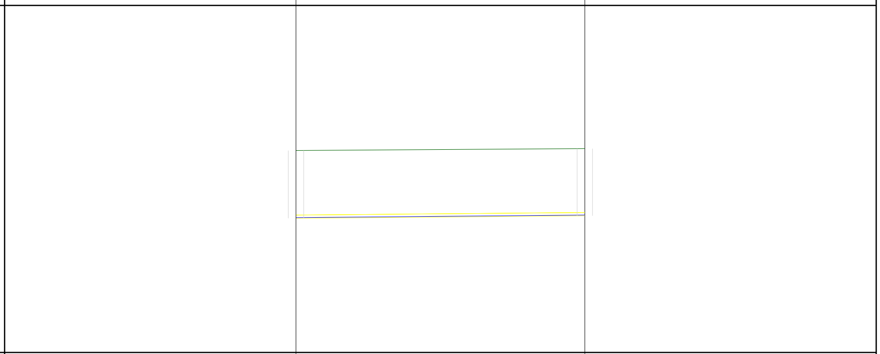
MH Name	FFS.007		FFS.006
Hor Scale 600 Ver Scale 500 Datum (m) 11.000			
PN		F1.010	
Dia (mm)		225	
Slope (1:X)		150.2	
Cover Level (m)	23.500		23.500
Invert Level (m)	21.356		21.650
Length (m)		44.165	

MH Name	FFS.008		FFS.007
Hor Scale 600 Ver Scale 500 Datum (m) 12.000			
PN		F1.011	
Dia (mm)		225	
Slope (1:X)		150.0	
Cover Level (m)	25.500		23.500
Invert Level (m)	21.059		21.356
Length (m)		44.550	

Hor Scale 600

Ver Scale 500

Datum (m) 12.000

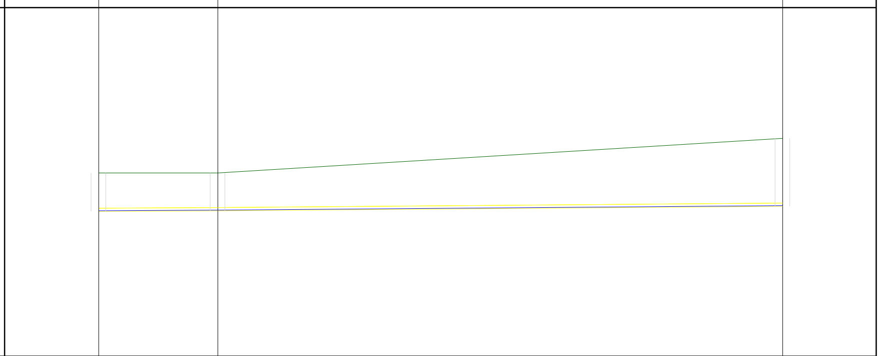


MH Name	FFS.009	FFS.008	
PN		F1.012	
Dia (mm)		225	
Slope (1:X)		149.8	
Cover Level (m)	25.400	25.500	
Invert Level (m)		20.906 / 21.059	
Length (m)		22.915	

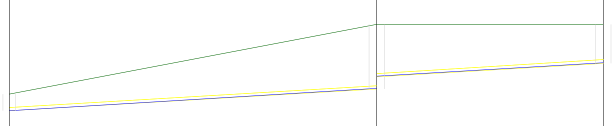
Hor Scale 600

Ver Scale 500

Datum (m) 11.000



MH Name	FFS.011	FFS.010	FFS.009	
PN		F1.014	F1.013	
Dia (mm)		225	225	
Slope (1:X)		150.0	150.0	
Cover Level (m)	23.100	23.100	25.400	
Invert Level (m)		20.544 / 20.607	20.607 / 20.906	
Length (m)		9.450	44.800	



MH Name	FFS.013	FFS.012	FFS.011	
Hor Scale 600 Ver Scale 500 Datum (m) 9.000				
PN		F1.016	F1.015	
Dia (mm)		225	225	
Slope (1:X)		20.0	20.0	
Cover Level (m)	18.500	23.100	23.100	
Invert Level (m)		17.375 / 18.833	19.645 / 20.544	
Length (m)		29.150	17.985	

MH Name	FEXis MH	FFS.013	
Hor Scale 600 Ver Scale 500 Datum (m) 6.000			
PN		F1.017	
Dia (mm)		225	
Slope (1:X)		150.0	
Cover Level (m)	18.500	18.500	
Invert Level (m)		17.304 / 17.375	
Length (m)		10.670	

Appendix H - Petrol Interceptor Details

Conder® OIL/WATER SEPARATORS

THE PARTNER OF CHOICE

PREMIER TECH AQUA

40 years OF PASSION

The Conder Range of Oil Separators are for installation on surface water drainage systems and are designed to prevent hydrocarbons (e.g. diesel, petrol, engine oil) from mixing with surface water and entering our drainage systems.

Pollution prevention is a critical part of sustainable drainage systems and statutory regulations are in force to control the discharge of hydrocarbons, with severe penalties imposed for non-compliance.

Compliance

The Conder Range of Oil Separators fully conform to both the Environment Agency's latest PPG guidelines and European standard BSEN-858-1-2 and are proven to effectively separate oil and water. Under test, the Conder Bypass performed to less than 1 mg/L and in doing so guarantees minimal environmental impact and ensures public safety.

Classes of Separators

There are two classes of separators which are defined by performance.

Class 1	Class 2*
Class 1 Separators are designed to achieve a concentration of less than 5 mg/L of oil under standard test conditions. These conditions are required for discharges to surface water drains and the water environment.	Class 2 Separators are designed to achieve a concentration of less than 100 mg/L oil under standard test conditions and are suitable for dealing with discharges where a lower quality requirement applies, such as discharges to the foul sewer.

*Class 2 available in forecourt separators only.

Selecting the Right Separator

Premier Tech Aqua offers a full range of Separators for varying use and application:

- Bypass Separator
- Full Retention Separator
- Forecourt Separator
- Wash Down and Silt Separators

If you're unsure of what type of Conder Oil Separator you require, please use the chart below to help you identify the most suitable product for your project.

The guidance given is for the use of separators in surface water drainage systems that discharge to rivers and soakways.

Is there a risk of oil contaminating the drainage from the site?

YES	YES	YES	YES	NO
Risk of infrequent light contamination and potential for small spills only e.g. car park.	Risk of regular contamination of surface water run off with oil and/or risk of larger spills e.g. vehicle maintenance area, goods vehicle parking or vehicle manoeuvring.	Risk of regular Drainage will also contain dissolved oils, detergents or degreasers such as vehicle wash water and trade effluents e.g. industrial sites.	Fuel oils are delivered to and dispensed on site e.g. retail fuel forecourts.	Very low risk of oil contamination e.g. roofwater.
YES				YES
Source control SUDS must be considered and incorporated where suitable.				Separator not required.
IF NOT SUITABLE	YES	YES	YES	
By-pass separator with alarm required. Class 1 if discharge to surface water. Class 2 if discharge to foul sewer.	Full retention separator with alarm required. Class 1 if discharge to surface water. Class 2 if discharge to foul sewer.	Trade effluents must be directed to the foul sewer. It may need to pass through a separator before discharge to sewer to remove.	Full retention forecourt separator with alarm required. Class 1 if discharge to surface water. Class 2 if discharge to foul sewer.	Clean water should not be passed through the separator unless the size of the unit is increased accordingly.

The use of SUDS should be considered at all sites and they should be incorporated where suitable. SUDS can be used to polish the effluent from these separators before it enters the environment.

Source control SUDS should be considered where possible.

Separator Alarms

All oil separators are required by legislation to be fitted with an oil level alarm system with recommendations that the alarm is installed, tested, commissioned and regularly serviced by a qualified technician.

The alarm indicates when the separator is in need of immediate maintenance in order for it to continue to work effectively. Premier Tech Aqua can offer a full technical and service package for a variety of alarm options.

The Conder Range of Bypass Separators

The Conder Range of Bypass Separators are used to fully treat all flows generated by rainfall rates of up to 6.5 mm/hr. Bypass Separators are used when it is considered an acceptable risk not to provide full treatment for high flows, for example where only small spillages occur and the risk of spillage is small.

Typical Applications

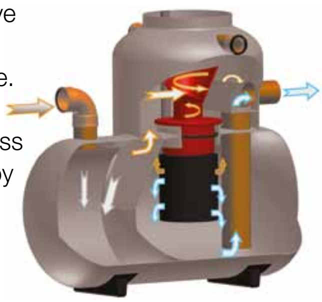
- Car parks
- Roadways and major trunk roads
- Light industrial and goods yards

Features and Benefits

- Innovative design
- Compact and easy to handle/install
- Fully compliant to the Environment Agency's PPG3 guidelines
- Low product and install costs
- Full BSI certification
- Exceeds industry standards
- Easy to service
- Fully tested and verified with a range from CNSB 3 to CNSB 1000 (Class 1)

Performance

Conder Bypass Separators have been designed to treat all flow up to the designed nominal size. Any flow in excess of the nominal size is allowed to bypass the separation chamber, thereby keeping the separated and trapped oil safe.



How it Works

Step 1

During the early part of a rain storm, which is a time of high oil contamination, all of the contaminated water flow passes through the sediment collection chamber and enters the separation chamber through a patented oil skimming and filter device.

Step 2

All of the oil then proceeds to the separation chamber where it is separated to the Class 1 standard of 5 mg/L and safely trapped.

Step 3

As the rainstorm builds up to its maximum and the level of oil contamination reduces significantly, the nominal size flow continues to pass through the separation chamber and any excess flow of virtually clean water is allowed to bypass directly to the outlet.

Specifications

Larger models up to CNSB 1000 are available.

Area Drained (m^2)	Tank Code including Silt	Length including Silt (mm)	Silt Capacity (L)	Oil Storage Capacity (L)	Diameter (mm)	Height (mm)	Base to Inlet Invert (mm)	Base to Outlet Invert (mm)	Access (mm)
1667	CNSB3s/21	1400	300	45	1026	2200	1730	1680	750
2500	CNSB4.5s/21	1785	450	67.5	1026	1875	1270	1220	600
3333	CNSB6s/21	1975	600	90	1026	1875	1270	1220	600
4444	CNSB8s/21	2165	800	120	1026	1875	1270	1220	600
5555	CNSB10s/21	2485	1000	150	1026	1875	1270	1220	600
8333	CNSB15s/21	2670	1500	225	1210	2150	1450	1400	600
11111	CNSB20s/21	3115	2000	300	1210	2150	1450	1400	600
13889	CNSB25s/21	3555	2500	375	1210	2150	1450	1400	600
16667	CNSB30s/21	3470	3000	450	1510	2690	1770	1720	750
22222	CNSB40s/21	4040	4000	600	1510	2690	1770	1720	750
27778	CNSB50s/21	4655	5000	750	1510	2690	1770	1720	750
33333	CNSB60s/21	4415	6000	900	1880	3300	2025	1975	2 x 600
44444	CNSB80s/21	5225	8000	1200	1880	3300	2025	1975	2 x 600
55556	CNSB100s/21	6010	10,000	1500	1880	3300	2025	1975	2 x 600

Note: It is a requirement of PPG3 that you have a silt capacity either in your tank or in an upstream catch pit.

The Conder Range of Full Retention Separators

The Conder Range of Full Retention Separators are designed to treat the full flow that can be delivered by a drainage system, which is normally equivalent to the flow generated by a rainfall intensity of 65 mm/hr. Full Retention Separators are used where there is a risk of regular contamination with oil and a foreseeable risk of significant spillages.

Typical Applications

- Sites with a high-risk of oil contamination
- Fuel storage depots
- Refuelling facilities
- Petrol forecourts
- Vehicle maintenance areas/workshops
- Where discharge is to a sensitive environment

Features and Benefits

- All surface water is treated
- Automatic closure device (ACD) fitted as standard

Performance

All Conder Full Retention Separators have an automatic closure device (ACD) fitted as standard. This is compulsory for all PPG3 compliant Full Retention Separators and prevents accumulated pollutants flowing through the unit when maximum storage level is reached.

How it Works

Step 1

Contaminated water enters the separator where the liquid is retained for a sufficient period to ensure that the lighter than water pollutants (such as oil, petrol) separate and rise to the surface of the water.

Step 2

The decontaminated water then passes through the coalescing filter before it is safely discharged from the separator, with the remaining pollutants being retained in the separator.

Step 3

Retained pollutants must be emptied from the separator once the level of oil is reached, or the oil level alarm is activated. This waste should be removed from the separator under the terms of The Waste Management Code of Practice.

Specifications

Larger models available upon request.

Area Drained (m^2)	Tank code Incl. Silt	Length including Silt (mm)	Slit Capacity (L)	Oil Storage Capacity	Diameter (mm)	Height (mm)	Base to Inlet Invert (mm)	Base to Outlet Invert (mm)
222	CNS4s/11	2319	400	40	1026	1655	1295	1245
333	CNS6s/11	3414	600	60	1026	1655	1295	1245
444	CNS8s/11	3197	800	80	1210	1855	1480	1430
556	CNS10s/11	3957	1000	100	1210	1855	1480	1430
833	CNS15s/11	3870	1500	150	1510	2180	1780	1730
1111	CNS20s/11	5060	2000	200	1510	2180	1780	1730
1667	CNS30s/11	5369	3000	300	1880	2560	2030	1980
2222	CNS40s/11	7059	4000	400	1880	2560	2030	1980
2778	CNS50s/11	4080	5000	500	2600	3315	2730	2680
3333	CNS60s/11	4805	6000	600	2600	3315	2730	2680
3889	CNS70s/11	5529	7000	700	2600	3315	2730	2680
4444	CNS80s/11	6254	8000	800	2600	3315	2730	2680
5556	CNS100s/11	6751	10,000	1,000	2600	3315	2730	2680

Note: It is a requirement of PPG3 that you have a silt capacity either in your tank or in an upstream catch pit.

Conder Range of Forecourt Separators

Conder Forecourt Separators have been designed for specific use in petrol filling stations and other similar applications. The size of this separator has been specifically increased in order to retain the possible loss of the contents from one compartment of a road tanker, which could be up to 7,600 litres.

Forecourt separators are an essential infrastructure requirement for all forecourts so as to ensure compliance with both health and safety and environmental legislation.

Typical Applications

- Petrol forecourts
- Refuelling facilities
- Fuel storage depot

Features and Benefits

- All surface water is treated
- Available in Class 1 and Class 2
- Automatic Closure Device (ACD) fitted as standard
- Includes 2000L silt capacity

Performance

All Conder Forecourt Separators have an automatic closure device (ACD) fitted as standard. This is compulsory for all PPG3 compliant Full Retention Separators and prevents accumulated pollutants flowing through the unit when maximum storage level is reached.

How it Works

Step 1

Contaminated water enters the separator where the liquid is retained for a sufficient period to ensure that the lighter than water pollutants (such as oil, petrol) separate and rise to the surface of the water.

Step 2

The decontaminated water then passes through the coalescing filter before it is safely discharged from the separator, with the remaining pollutants being retained in the separator.

Step 3

Retained pollutants must be emptied from the separator once the level of oil is reached, or the oil level alarm is activated. This waste should be removed from the separator under the terms of The Waste Management Code of Practice.

Specifications

Tank Code	Volume (L)	Length (mm)	Diameter (mm)	Height (mm)	Base to Inlet (mm)	Base to Outlet (mm)	Access (mm)
ANO/11*	10,000	4,250	1,800	2,100	1,600	1,550	750
ANT/12**	10,000	4,250	1,800	2,100	1,600	1,550	750
LNO/11***	10,000	4,250	1,800	2,100	1,600	1,550	750

*Class 1 Forecourt Separator suitable for discharging to surface water drains

**Class 2 Forecourt Separator suitable for discharging to foul drains only

***Class 1 Forecourt Separator suitable for installation in granular materials

Conder Range of Washdown and Silt Separators

Conder Washdown and Silt Separators are for use in areas such as car washes, pressure wash facilities or other cleaning facilities and must be discharged to the foul water drainage system in accordance with PPG13.

Typical Applications

- Car wash facilities
- Tool hire depots
- Pressure washer facilities

Features and Benefits

- Available in 1,2 and 3 stage options
- Efficient silt and hydrocarbon removal

Performance

The Environment Agency's PPG13 requires that discharge from pressure washers must discharge to a foul drainage system. Where there is no foul drainage available, the effluent must be contained within a sealed drainage system or catchpit for disposal by a licenced waste contractor.

Silt build-up is the primary concern with washdown facilities and so the Conder range of washdown and silt separators are used to remove the silt and will allow some separation of hydrocarbons.

Detergents that are used in wash down areas will break down and disperse hydrocarbons (hindering the separation process). Therefore, it is important to remember the main function of wash down separators is to remove silt.

How it Works

Step 1

Contaminated wash down water enters the unit where the heavier solids, silts and settle to the bottom of the tank.

Step 2

The lighter liquids, hydrocarbons, will rise to the surface and be retained within the tank.

Step 3

Treated water will exit the separator via the dipped outlet.

Specifications

Although it is recognised that single stage separators give the most efficient separation, 2 and 3 chamber Conder Washdown and Silt Separators are available on request.

Tank Code	Capacity (L)	Silt Storage	Diameter (mm)	Length (mm)	Access Diameter (mm)	Base to Inlet Invert (mm)	Base to Outlet Invert (mm)
CWS2/12	2,000	1,000	1,000	2,713	600	1,290	1,240
CWS3/12	3,000	1,500	1,200	2,853	600	1,475	1,425
CWS4/12	4,000	2,000	1,200	3,737	600	1,475	1,425
CWS6/12	6,000	3,000	1,500	3,636	600	1,775	1,725
CWS8/12	8,000	4,000	1,800	3,443	600	2,030	1,980
CWS10/12	10,000	5,000	1,800	4,250	600	2,030	1,980

FST Silt Trap

Large quantities of silt can be associated with washdown areas. The Conder FST silt trap is ideal for easy removal of silt either manually or by a waste disposal contractor.

The FST range of silt traps are available with varying grades of covers from B125 up to E600 to allow installation in all types of vehicle or plant washdown facilities.

Conder Range of Alarm Systems

All separators must be fitted with an alarm in order to provide visual and audible warning when the level of oil reaches 90% of its storage volume, as required by The Environment Agency's PPG3.

The alarm system will then be triggered to indicate that the separator is in need of immediate emptying, in order to continue effective operation.

Features and Benefits

- Option for installation at a remote supervisory point
- Audible and visual
- Eliminates unnecessary waste management visits
- Easy installation
- Audible, visual and text message alert alarm systems available

Mains Powered System

Mains powered alarm systems are best suited to new build situations or sites where installation of the necessary cabling and ducting is straight forward and economical. The probe located in the separator will, when surrounded by floating hydrocarbons, activate an alarm condition on the remote panel to advise that the unit requires emptying.

Solar Powered System (Flashing Beacon)

This option requires no mains power supply or any significant cabling or ducting, making it extremely economical for large sites and retro fitting alarms to existing oil separators. A High Intensity Beacon will flash when a problem is detected.

Solar GSM Alarm

The Solar GSM Alarm sends a status report on your separator to a mobile phone number of your choice. The status of the GSM Alarm can also be tested at any time by simply sending a pre-recorded text message via your directed mobile phone, for additional peace of mind.

Peripherals

Coalescing Filters

The Conder Coalescing Filter is designed to separate residual oil in already separated oil/water and ensures a discharge quality of less than 5 mg/L of oil in water.

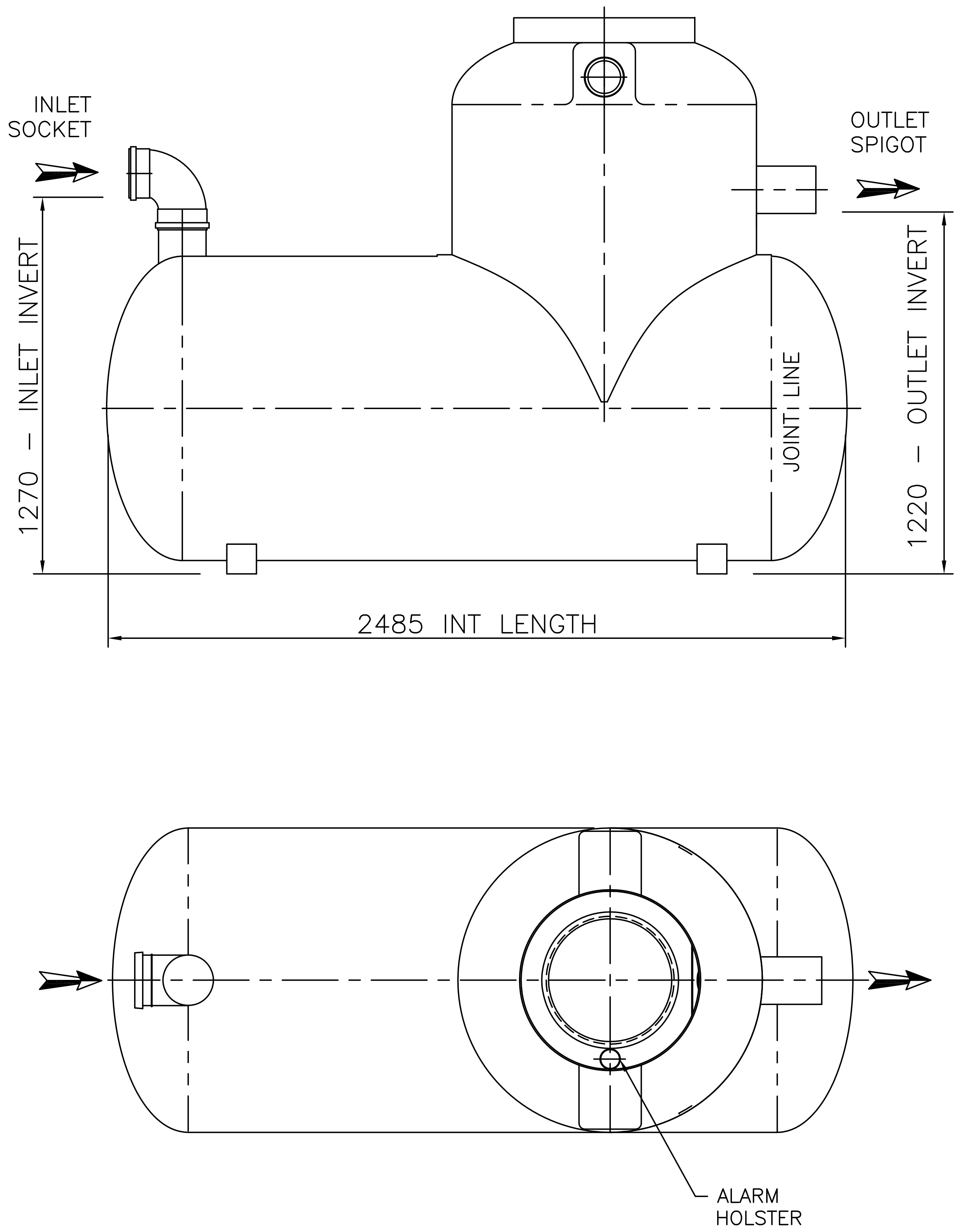
Features and Benefits

- Handle for easy removal and cleaning
- Flashing beacons (with option of siren kit)
- Kiosks
- Probe brackets
- Bas 1000 intrinsically safe junction box
- High level probe
- Silt level probe
- Oil level probe

Servicing

The Environmental Agency's PPG3 guidelines stipulate that every 6 months, and in accordance with manufacturer's instructions, experienced personnel should carry out maintenance to both the separator and alarm.

Premier Tech Aqua and our service partners can offer a full technical and service package including separator and alarm installation, commissioning, oil and silt removal and route service contracts.



NOTES:

1. PRODUCT INFORMATION
The Conder range of light liquid separators is produced from high grade GRP. Inlets are provided as sockets and outlets as spigots, Connections may be made by steel-banded flexible couplings, nitrile seal joints, rope-seal and mortar or any other appropriate jointing method.
Ventilation specifications should be in accordance with Local Authority requirements. Vent pipework from multiple chambers must never be manifolded below ground level.

2. PERFORMANCE CHARACTERISTICS
Separators are based on the requirements stated in European Standard EN858-1 and Environment Agency guideline PPG3, in particular:-
a. The nominal size has been established from performance tests where the residual oil at the outlet is less than 5mg/l for class 1 separators and less than 100mg/l for class 2 separators.

3. MAINTENANCE AND USE
It is important to recognise that light liquid separators require regular maintenance. The period between maintenance operations can vary depending on the location and use of the separator, therefore routine inspections shall be undertaken at least every six months and a log maintained of inspection date, depth of oil, depth of silt and any cleaning that is undertaken.
A Conder Alarm should be fitted to every separator to give automatic warning that the light liquid capacity has been reached.
Access to the separator should be kept clear and not used for storage.

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

IMPORTANT NOTE

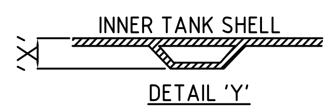
DUE TO THE COMPACT DESIGN AND EASE OF INSTALLATION, CONDER SEPARATORS ARE NOW SUPPLIED AS STANDARD WITH AN IN LINE CONFIGURATION.

PIPE SIZE VARIANTS

100, 150, 225 PVC

300, 375 GRP

IMPORTANT INVERT LEVEL NOTE (RIBBED TANKS ONLY!):
The inlet and outlet Invert Level(IL) shown on this drawing is to internals of the shell unless otherwise stated.
For Invert level to the outside of the shell ribs, see the conversion below:
Ø1.0m, 1.2m, 1.5m, 1.8m, 2.5m IL+50mm ('X')
Ø3.0m, 4.0m IL+75mm ('X')



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

PREMIER TECH AQUA

1ST ANGLE PROJECTION

TITLE: CNSB10S/21/SALES BYPASS SEPARATOR

REV.	DATE	BY	CHKD.	APPD.	DESCRIPTION
6	19.09.11	RU	DG	RU	VENT BOXES AND GROMMETS ADDED

DRAWN BY	CHKD.	APPD.	SCALE	DRAWING No.	REVISION
RU	PB	RP	NTS	CNSB10S/21 SALES	6
DATE 23.03.09	DATE 23.03.09	DATE 23.03.09			

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

GENERAL TOLERANCES (unless noted otherwise)				
GRP	LINEAR	± 5mm	ANGLE	±0.5°
FABRICATED		± 2mm		±0.2°
MACHINED		± 0.5mm		±0.1°

Appendix J – Hydrobrake Details

Hydro-Brake® Flow Control

Modelling Guide

Unit Selection Design Guide

Overview

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

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

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

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

STH Range of Hydro-Brake® Flow Controls

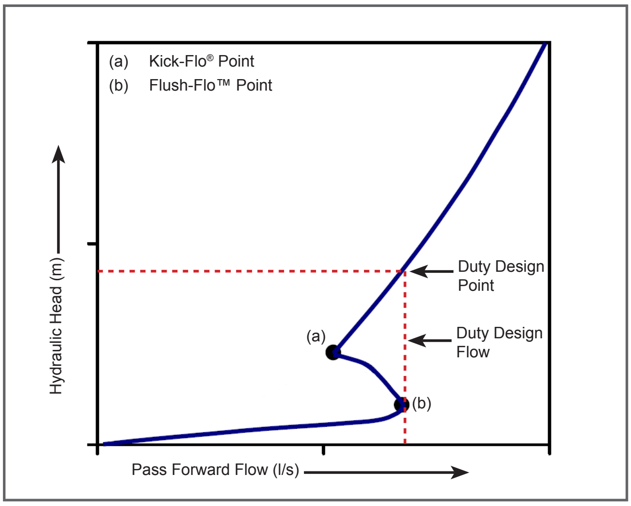
BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE No 08/4599

See back cover for details.

Hydraulic Characteristics and Specification

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

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



Typical Hydro-Brake® Head Versus Flow Characteristics

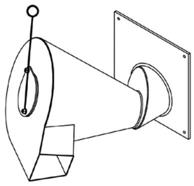
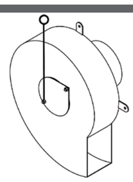
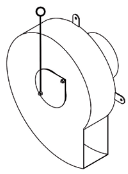
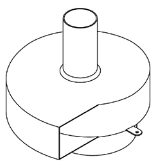
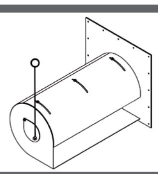
To ensure correct implementation a multiple design-point specification, defining the main hydraulic features of the selected flow control, can be provided by HRD Technologies Ltd. This should include at least the following information:

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

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

Hydro-Brake® Flow Control Models Supported in Micro Drainage

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

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

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

General Advice

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

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

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

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

General Guidance on Unit Selection

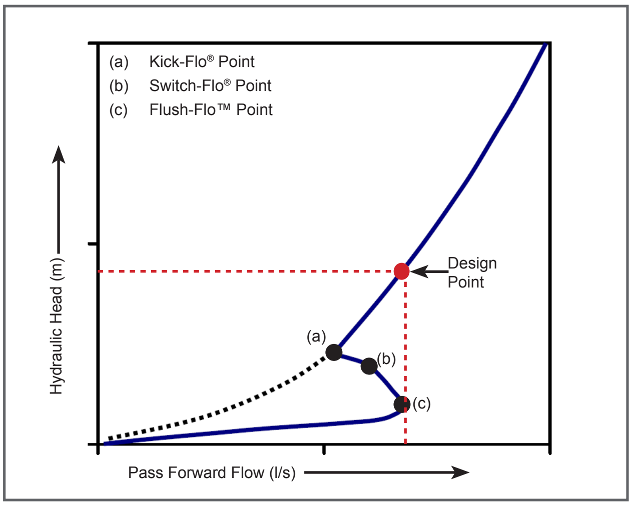
Surface / Storm Water Applications	Foul / Combined Applications
1) Select sump-type Md13 (STH) initially. This is a British Board of Agrément (BBA) approved product that is currently only available in certain sizes – if a size is not available for the specified duty/ design point go to 2) otherwise use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

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

STH Type Hydro-Brake® Flow Control with BBA Approval

Now included in Win*Des*® W.12.6!

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



Typical STH Head Versus Flow Characteristics

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

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

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

BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE No 08/4599
STH Range of Hydro-Brake® Flow Controls

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

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

www.hrdtec.com

Take a Look at Our New Stormwater Web Resource

Engineering Nature's Way™

www.engineeringnaturesway.co.uk

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

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

turning water around ...®

This information is for guidance only and not intended to form part of a contract. HRD Technologies Ltd pursues a policy of continual development and reserves the right to amend specifications without prior notice. Equipment is patented in countries throughout the world.

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