

Drainage Design Report

for

Warehouse Development

at

**Kingswood Road,
Citywest Business Campus,
Dublin 24**

Job No: D1736
Client: ROCKFACE DEVELOPMENTS LTD
Date: 17th June 2022
Local Authority: South Dublin County Council
Revision: PL1

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Introduction

This report details the site development works design for a warehouse development at Kingswood Road, Citywest Business Campus, Dublin 24.

The subject site is located on the undeveloped land at Citywest Business Campus, bound by Kingswood Avenue to the south-east and Kingswood Road to the north-east.

The site will be serviced primarily through the connection to the existing services in the area.

The provision of the new on-site foul sewer, surface water & watermain are described as follows with calculations appended.

Surface Water:

Due to the industrial nature of the proposed development, the yard surfacing for HGV access and marshalling is concrete. An area of porous asphalt is provided to the car park area where traffic loads are light, with addition of permeable paving to the car parking spaces.

Runoff from the hardstanding areas will be collected by trapped road gullies and rainwater goods throughout the development and directed to an on-site surface water attenuation facility. This facility is designed to attenuate 1 in 30-year storm event of any duration, therefore no flooding will occur on site for any duration events up to 30 year return period as per "Greater Dublin Strategic Drainage Study" (GSDSDS) requirements. In addition to providing attenuation volume, temporary flood storage is check and provided where needed (as an integrated part of the attenuation system) for 100-year return events as per GSDSDS requirements. The restricted discharge from site will be limited by a proprietary flow control device. The maximum allowable discharge is limited to calculated flow (see calculations in the succeeding chapters) not exceeding Greenfield runoff rate, QBAR (as per criterion 4.3 "River Flood Protection" chapter 6.3.4 of GSDSDS). All flows and runoffs for storm water network design and attenuation sizing are calculated incorporating 10% climate change factor for all rainfall intensities as per chapter 6.3.2.4 of GSDSDS table 6.2 "Climate Change Factors". In addition, a computer analysis in the storm network modelling software was performed to confirm the sizing of the pipe network and underground attenuation storage for 1 in 100 year storms of all durations. This analysis include a specific model of vortex flow control device with discharge of the calculated QBAR and 20% Climate Change Factor. The analysis indicated no on-site flooding (meaning that both the network and all proposed attenuation storage have sufficient capacities).

The attenuation facility proposed is "StormTech" or equivalent. This proprietary system consists of thermoplastic arches backfilled in specified stone and wrapped in a pervious geotextile. Prior to entering the system, the surface water runoff will pass through a proprietary silt trap and petrol interceptor to ensure debris, silt particles and hydrocarbons are removed. Subsequently the surface runoff enters the attenuation facility through an "isolator row" whereby a row of void forming thermoplastic arches are wrapped in a pervious geotextile which provides a second level of suspended solid removal prior to the water entering the greater attenuation area.

These water quality control measures can be cleaned out by suction hose/tanker if required from standard maintenance inspections. In the case of the isolator row, the chamber is backwashed with a proprietary power jet wash and its water removed by suction hose/tanker.

Water quantity control is provided downstream of the attenuation facilities by providing the above-mentioned flow control device. The proposed vortex style flow control device of discharge rate will be installed on the outfall of the last surface water manhole, shown at accompanying Drainage and Watermain Layout drg. ref. D1736 – D3. The discharge from site, i.e. the restricted flow from the flow control device will discharge to an existing open channel at Kingswood Avenue to the site's western corner and ultimately to Camac River.

The details of the surface water attenuation system including interceptors, flow restrictions, volume and pipe designs are attached in this Drainage Design Report and on the accompanying Drainage details layout (drawing reference D1736 - D3 - Drainage & Watermain Layout PL1) for review by the Local Authority.

In considering the above surface water management solution we considered all SuDS devices and given the industrial nature of the proposed operations on this site, the above solution of underground surface water attenuation was decided on. In summary, a range of measures have been incorporated into the development as follows:

- Tree Pits
- Porous Asphalt
- Trapped Road Gullies
- Restricted discharge
- Silt trap and petrol interceptor
- Water butts
- Permeable paving
- Grasscrete paving

The proposed surface water management solution for the subject site provides both runoff quality and quantity control. Quality control is provided by ensuring all surface water runoff is dealt with on site as described earlier in this document with reference to the specified attenuation system with in-built "isolator row", proprietary silt traps & petrol interceptors. Quantity control is also provided through the surface water attenuation system coupled with the downstream flow control device. This system of surface water management has been put in place throughout the nearby business parks in South Dublin area where many individual sites have been developed in a similar nature.

The following figures synopsis the surface water attenuation calculations:

SITE AREA	25,675 m ²
SAAR	780
SOIL VALUE	0.3

STRUCTURE TYPE	RUNOFF COEFFICIENTS	AREA (ha)
Impermeable Areas <i>(Roofs; Concrete Yard/Road; Pathways; Permeable paving)</i>	0.8	1.
Green Roof (if any)	0.8	0
Grasscrete	0.8	0.03
Contributing Landscaping	0.3	0.35
TOTAL	-	2.19

Details of the surface water attenuation system including interceptors, flow restrictions, volume and pipe designs are included in this Drainage Design Report and on the accompanying Drainage Layout (drawing reference D1736 - D4 - Drainage & Watermain Layout) for review by the Local Authority.

A Flood Impact Assessment compiled by Enviroguide Consulting is enclosed detailing measures proposed for flood mitigation on site.

Foul Sewer:

A new foul sewer has been designed to collect sewage from the proposed development and discharge to the existing foul sewer manhole and network at Kingswood Road, Citywest Business Campus.

The peak foul sewer discharge rate is based on the discharge unit method of drainage design for calculating maximum sewage and wastewater flows. The proposed ancillary offices and warehouse toilet facilities are the source of wastewater discharge for the overall development.

As per the requirements of the Irish Water Code of Practice, minimum velocities of 0.75 m/s are met for the proposed gradients and contributing discharge unit numbers (refer to discharge unit calculation sheet for details). The proposed foul sewer including manholes and service connections will be constructed in compliance with design standards set out by Irish Water in the IW Code of Practice for Wastewater Infrastructure and Wastewater Infrastructure Standard Details.

The method of calculating the total discharge units from the development is carried out in accordance with BS EN 752-4:1998 "Drain and sewer systems outside buildings", refer to insert below for the relative tabulated extract;

Table C.1 — Typical frequency factors (k_{DU})

Type of building	k_{DU}
Dwelling, guesthouse, office (intermittent use)	0.5
Hospital, school, restaurant, hotel (frequent use)	0.7
Toilets and/or shower open to the public (congested use)	1.0
Laboratory buildings (special use)	1.2

Table C.2 — Typical values of discharge units (DU)

Type of appliance	DU
Washbasin, shower	0.3 to 0.6
Urinal	0.3 to 0.8
Bath, kitchen sink	0.8 to 1.3
Dishwasher	0.2 to 0.8
Household washing machine	0.5 to 0.8
Commercial washing machine	1.0 to 1.5
WCs (4.0 l to 9.0 l cistern)	1.2 to 2.5
Floor drains (DN 50 to DN 100)	0.6 to 2.0
The discharge unit will depend on the type of drainage system inside the building and the size of the appliance. Where no specific information is available, the higher value should be used.	

All proposed calculations of discharge units, flows and pipe designs are included further in this Drainage Design Report for the review of the Local Authority.

Watermain:

The watermain proposed to serve the development will form a metered connection from the existing main spur at Kingswood Avenue, exact location shown on accompanying drg ref. D1736 - D4.

A new looped 150mm dia. HDPE watermain within the site will be provided with adequate sluice valves, water meter & fire hydrants to provide water supply and for firefighting purposes. Hydrants will not be placed within 6m of a building or structure and at a maximum 46m from proposed buildings. All associated details including watermain pipe material will be in accordance with the current Irish Water guidelines. Guidelines set out in the Irish Water Publications IW-CDS_5020-1 & IW-CDS-5030-1 have been consulted and adopted within the design of the proposed drainage & watermain networks. Refer to enclosed Drainage & Watermain drawing Ref. D1736 - D4 for layout details.

Surface Water Attenuation Design

- StormTech Cumulative Spreadsheet

Surface Water Attenuation Calculation

1) Areas for Attenuation Calculation

Site Area of development:	25,675 m ² (2.56 ha)
Overall landscaping:	7,310 m ²
Contributing Landscaping:	3,500 m ²
Impermeable Areas (roof, concrete yard):	19,365 m ²

2) Interception Storage

Calculate runoff from 5mm of rainfall on developed area.

For this calculation only hardstanding areas are assumed to provide 80% runoff, and non-hardstanding areas are assumed to provide 0% runoff.

The equivalent volume of Interception Storage should be provided on site as no discharge from site should occur for this initial 5mm depth of rainfall. The Interception Storage on this subject site will be provided through the base of attenuation tank.

Design Impermeable Areas: $19,242 \text{ m}^2 \times 0.80 = 15,393.6 \text{ m}^2$

Total volume for 5mm rainfall: $5\text{mm} \times 15,393.6 \text{ m}^2 = 77 \text{ m}^3$

Therefore, a minimum Interception Storage volume of 77 m³ should be provided. This will prevent discharge from site during rainfall events of up to 5mm rainfall.

3) Greenfield Runoff Rate – Q_{BAR}, (mean annual flood flow):

$$Q_{BAR_{rural}} \text{ (m}^3\text{/sec)} = 0.00108 \times \text{AREA}^{0.89} \times \text{SAAR}^{1.17} \times \text{SOIL}^{2.17}$$

SAAR (E 305400, N 228350): 780 mm (as per Met Eireann data)

Soil Index: S1 (very low runoff)
 S2
 S3 (moderate runoff)
 S4
 S5 (very high runoff)

$$\text{Soil} = 0.1(\text{Soil}_1) + 0.3(\text{Soil}_2) + 0.37(\text{Soil}_3) + 0.47(\text{Soil}_4) + 0.53(\text{Soil}_5)$$

As the site is relatively small in catchment terms the soil class will be 100% Soil₂ as per online Wallingford Procedure Greenfield runoff estimation tool on www.uksuds.com (see Appendix to Surface Water Design for the HR Wallingford Greenfield runoff rate estimation report).

Soil Class: Soil₂
Runoff Potential: Low
Soil Value: 0.3

Q_{BAR}:

As the site area is less than 50 hectares, Q_{BAR} for 50 hectares is firstly calculated:

$$\begin{aligned} Q_{BAR} \text{ (m}^3\text{/sec)} &= 0.00108 \times \text{AREA}^{0.89} \times \text{SAAR}^{1.17} \times \text{SOIL}^{2.17} = \\ &0.00108 \times (0.5)^{0.89} \times (780)^{1.17} \times (0.3)^{2.17} = \\ &103.42 \text{ l/sec} = \\ &2.07 \text{ l/sec/ha} \end{aligned}$$

Q_{BAR} for the subject site area:

$$2.07 \text{ l/sec/ha} \times 2.54 \text{ ha} =$$

Q_{BAR} = 5.25 l/sec

According to GDSDS chapter 6.3.1.4 if the separate long term storage cannot be provided and temporary flood storage forms part of the single attenuation system, all the runoff from the site should be discharged at either a rate of 2.0 l/s/ha or the average annual peak flow rate Q_{BAR}, whichever is greater:

$$2 \text{ l/sec/ha} \times 2.54 \text{ ha} = 5.08 \text{ l/sec.}$$

Therefore allowable discharge (Q_{BAR}) will be set at **5.25 l/sec.**

4) Attenuation Storage Volume

100% of hardstand areas are assumed to contribute.

Permeable paving taken as impervious surfacing for attenuation storage calculations to allow for long term paving infiltration rate reduction.

Soil SPR Value - 0.3, therefore 30% of non-hardstand areas assumed to contribute

$$\begin{aligned} \text{Equivalent Runoff Area:} & \quad 100\% \times 19,242 \text{ m}^2 + 30\% \times 2,500 \text{ m}^2 = \\ & \quad 19,242 \text{ m}^2 + 750 \text{ m}^2 = \\ & \quad 19,992 \text{ m}^2 \end{aligned}$$

Met Eireann's Rainfall depths for the 30 year storm event have been used. The table below identified the 24 hour event as the critical event. The rainfall depth used includes a 10% allowance for climate change giving a volume of 1,646 m³ - (Column G).

A	B	C	D	E	F	G
Duration	Runoff Area	Total Rainfall Depth	Revised Depth for 10% Climate Change	Total Surface Water	Total Permitted Discharge	Storage Volume Required
	(m ²)	(mm)	(mm) C x 1.1	(m ³) B x D	(m ³) Q2 x A (Q _{BAR} =5.25 l/sec)	(m ³) E - F
15 min	19,992.00	20.10	22.11	442.02	4.73	437.30
30 min	19,992.00	25.50	28.05	560.78	9.45	551.32
1 hour	19,992.00	32.30	35.53	710.32	18.91	691.41
2 hour	19,992.00	40.90	44.99	899.44	37.82	861.62
4 hour	19,992.00	51.80	56.98	1139.14	75.63	1063.51
6 hour	19,992.00	59.50	65.45	1308.48	113.45	1195.03
12 hour	19,992.00	75.40	82.94	1658.14	226.89	1431.24
1 day	19,992.00	95.50	105.05	2100.16	453.79	1646.37
2 day	19,992.00	107.20	117.92	2357.46	907.57	1449.88

Critical Attenuation Volume = 1,646 m³

$$\text{Subtract Interception Storage: } 1,646 \text{ m}^3 - 77 \text{ m}^3 = \underline{\underline{1,569 \text{ m}^3 \text{ Required Attenuation Volume}}}$$

The calculated attenuation storage volume was analysed in the storm water network modelling software using the site-specific vortex type flow control device and there was no indication of flood or ponding for any storm duration for 1 in 30-year return period including 20% CCF therefore calculated volume of attenuation tank is sufficient.

The detailed results of this analysis are enclosed in this report at Surface Water Network Design.

5) Temporary Flood Storage

In addition to the previous calculations for interception & attenuation storage, the temporary flood storage must be calculated.

For long term storage the GSDSDS runoff model assumptions:

100% of hardstand areas are assumed to contribute.

Soil SPR Value – 0.3, therefore 30% of non-hardstand areas assumed to contribute.

$$\begin{aligned} \text{Equivalent Runoff Area:} & \quad 100\% \times 19,242 \text{ m}^2 + 30\% \times 2,500 \text{ m}^2 = \\ & \quad = 19,242 \text{ m}^2 + 750 \text{ m}^2 = \\ & \quad = \mathbf{19,992 \text{ m}^2} \end{aligned}$$

The 6 hour duration, 100 year return period must be checked to assess the **temporary flood storage** required for the site.

100 year 6 hour event, rainfall depth: 83.7 mm

Factor up by 10% for climate change: 92.07 mm

Total Volume of Runoff:	92.07mm x 19,992 m ²	=	1,840.7 m ³
Deduct discharge at Q _{BAR} for 6hrs:	5.25 l/sec x 6 hrs	=	113.5 m ³
Storage volume required:	1,840.7 – 113.5	=	1,727.2 m ³
Deduct Interception Storage:	77 m ³		
Deduct Attenuation Storage:	1,569 m ³		
Temporary Flood Storage required:	1,727.2 – 77 – 1,569	=	80.8 m ³

The calculated attenuation volume was analysed in a storm water network modelling software using the site-specific vortex type flow control device and there was no indication of flood or ponding for any storm duration for 1 in 100 year storms with 20% CCF and there is no flooding or ponding during the analysis. The detailed results of this analysis are enclosed in this report at Surface Water Network Design.

In summary:

INTERCEPTION STORAGE: 77m³ to be provided by a lowered base to the attenuation system.

Attenuation System Area: 1,600m². Therefore, the Interception Storage Depth will equal 120mm. A lowered base level to the attenuation facility allowing base infiltration will facilitate on site discharge of this interception volume. This storage volume being lower than the system outlet cannot discharge from site.

ATTENUATION VOLUME: 1,569m³ to be provided within the attenuation system on site.

TEMPORARY FLOOD STORAGE: 80.8 m³ to be provided within the attenuation system on site.

ATTENUATION VOLUME REQUIRED: 1,727.2m³

ATTENUATION VOLUME PROVIDED: 1,735 m³

(Refer to StormTech Cumulative Storages spreadsheet below)

Storm Water Network analysis and Attenuation Tank Size checks were performed using a computer hydraulic analysis software. The analysis did not highlight any ponding for any storm durations up to 1:100y return therefore the network and attenuation capacity calculated above are satisfactory.

The results of the analysis are included in this report.



Chamber Model -
 Units -
 Number of Chambers -
 Number of End Caps -
 Voids in the stone (porosity) -
 Base of Stone Elevation -
 Amount of Stone Above Chambers -
 Amount of Stone Below Chambers -
 Area of system -

MC-3500	
Metric	Click Here for Imperial
324	
32	
43	%
95.65	m
305	mm
230	mm
1600	sq.meters

Include Perimeter Stone in Calculations

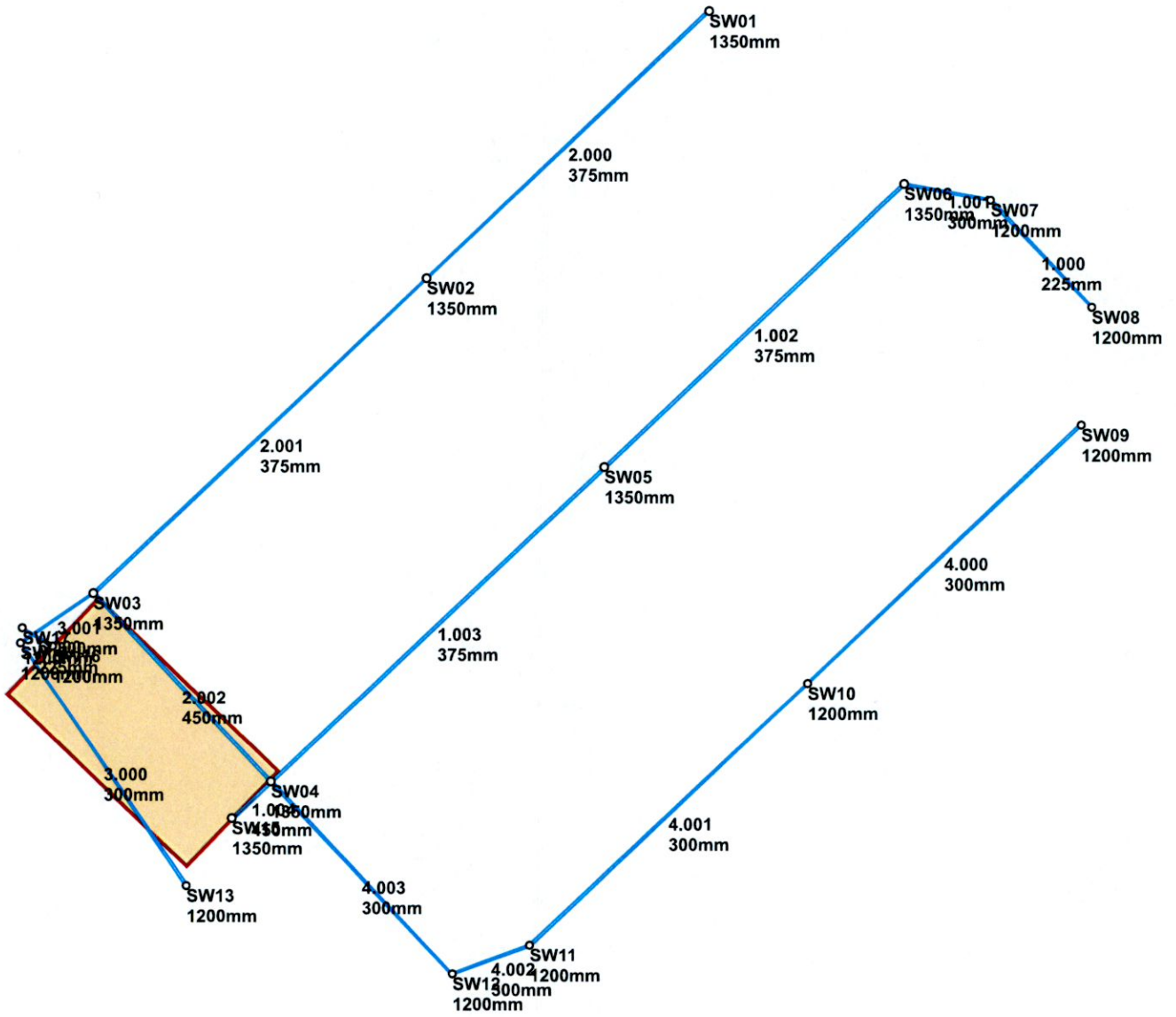
Min. Area - 1596.747 sq.meters

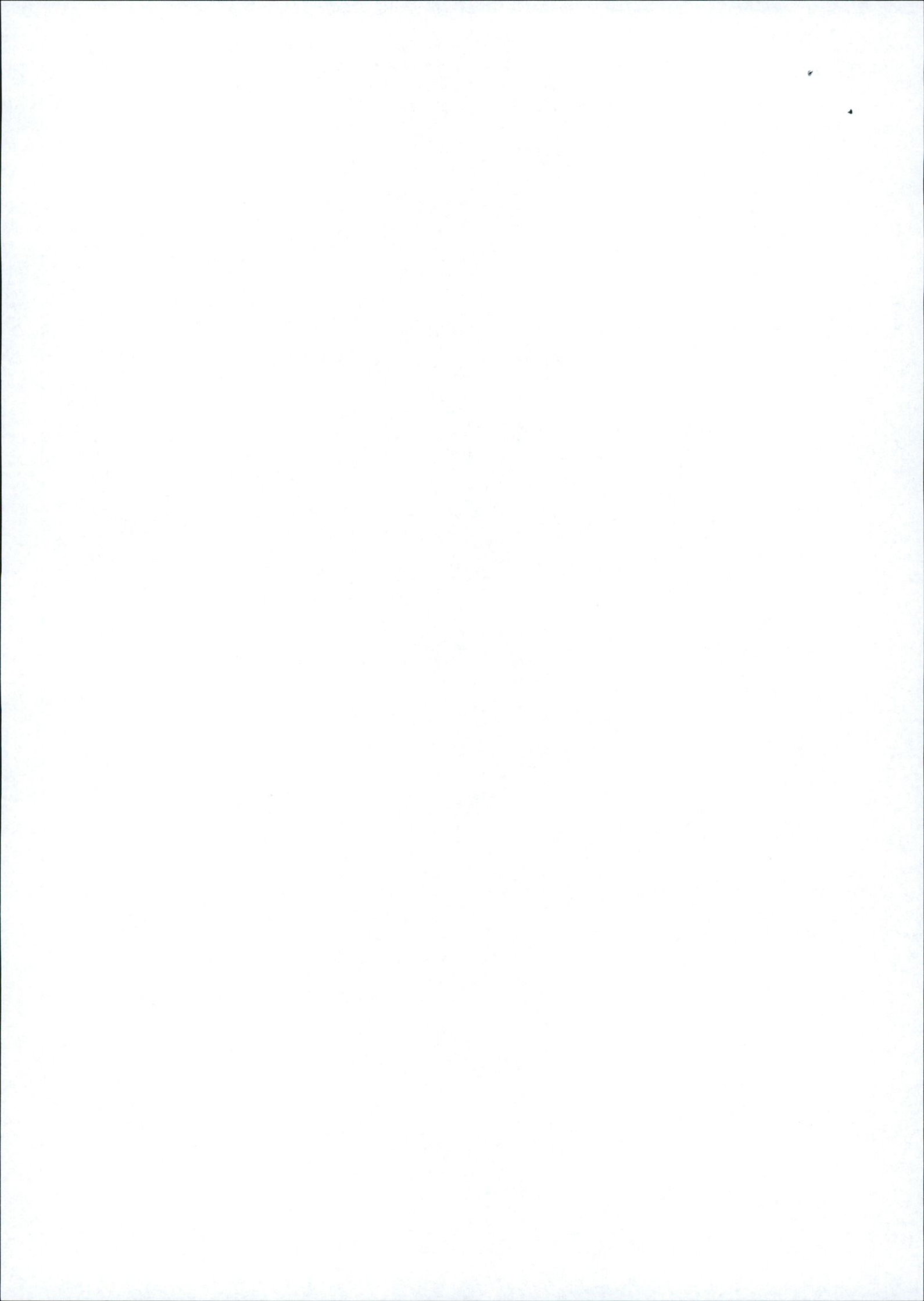
StormTech MC-3500 Cumulative Storage Volumes

Height of System (mm)	Incremental Single Chamber (cubic meters)	Incremental Single End Cap (cubic meters)	Incremental Chambers (cubic meters)	Incremental End Cap (cubic meters)	Incremental Stone (cubic meters)	Incremental Chamber, End Cap and Stone (cubic meters)	Cumulative System (cubic meters)	Elevation (meters)
1676	0.00	0.00	0.00	0.00	17.466	17.47	1735.84	97.33
1651	0.00	0.00	0.00	0.00	17.466	17.47	1718.37	97.30
1626	0.00	0.00	0.00	0.00	17.466	17.47	1700.91	97.28
1600	0.00	0.00	0.00	0.00	17.466	17.47	1683.44	97.25
1575	0.00	0.00	0.00	0.00	17.466	17.47	1665.98	97.22
1549	0.00	0.00	0.00	0.00	17.466	17.47	1648.51	97.20
1524	0.00	0.00	0.00	0.00	17.466	17.47	1631.04	97.17
1499	0.00	0.00	0.00	0.00	17.466	17.47	1613.58	97.15
1473	0.00	0.00	0.00	0.00	17.466	17.47	1596.11	97.12
1448	0.00	0.00	0.00	0.00	17.466	17.47	1578.64	97.10
1422	0.00	0.00	0.00	0.00	17.466	17.47	1561.18	97.07
1397	0.00	0.00	0.00	0.00	17.466	17.47	1543.71	97.05
1372	0.00	0.00	0.53	0.00	17.237	17.77	1526.24	97.02
1346	0.01	0.00	1.78	0.01	16.697	18.49	1508.47	97.00
1321	0.01	0.00	2.70	0.01	16.303	19.01	1489.99	96.97
1295	0.01	0.00	3.70	0.02	15.866	19.59	1470.98	96.95
1270	0.02	0.00	6.30	0.04	14.740	21.08	1451.39	96.92
1245	0.03	0.00	9.43	0.05	13.390	22.87	1430.31	96.89
1219	0.04	0.00	11.46	0.06	12.510	24.04	1407.44	96.87
1194	0.04	0.00	13.05	0.08	11.820	24.95	1383.40	96.84
1168	0.04	0.00	14.43	0.09	11.221	25.74	1358.45	96.82
1143	0.05	0.00	15.66	0.11	10.685	26.46	1332.71	96.79
1118	0.05	0.00	16.78	0.13	10.198	27.10	1306.25	96.77
1092	0.05	0.00	17.78	0.14	9.759	27.68	1279.15	96.74
1067	0.06	0.01	18.72	0.16	9.345	28.23	1251.47	96.72
1041	0.06	0.01	19.59	0.18	8.967	28.73	1223.24	96.69
1016	0.06	0.01	20.41	0.19	8.610	29.21	1194.50	96.67
991	0.07	0.01	21.16	0.22	8.272	29.65	1165.30	96.64
965	0.07	0.01	21.88	0.24	7.957	30.07	1135.64	96.62
940	0.07	0.01	22.56	0.24	7.660	30.47	1105.57	96.59
914	0.07	0.01	23.20	0.26	7.379	30.84	1075.10	96.56
889	0.07	0.01	23.80	0.29	7.109	31.20	1044.27	96.54
864	0.08	0.01	24.37	0.30	6.859	31.53	1013.07	96.51
838	0.08	0.01	24.91	0.32	6.619	31.85	981.54	96.49
813	0.08	0.01	25.43	0.34	6.389	32.15	949.70	96.46
787	0.08	0.01	25.92	0.35	6.171	32.44	917.55	96.44
762	0.08	0.01	26.38	0.37	5.963	32.72	885.11	96.41
737	0.08	0.01	26.83	0.39	5.763	32.98	852.39	96.39
711	0.08	0.01	27.25	0.41	5.574	33.23	819.41	96.36
686	0.09	0.01	27.64	0.42	5.403	33.46	786.18	96.34
660	0.09	0.01	28.01	0.43	5.234	33.68	752.72	96.31
635	0.09	0.01	28.39	0.44	5.068	33.90	719.04	96.29
610	0.09	0.01	28.72	0.46	4.917	34.10	685.14	96.26
584	0.09	0.01	29.04	0.47	4.775	34.29	651.04	96.23
559	0.09	0.02	29.35	0.49	4.634	34.48	616.75	96.21
533	0.09	0.02	29.64	0.49	4.509	34.64	582.27	96.18
508	0.09	0.02	29.92	0.51	4.382	34.81	547.63	96.16
483	0.09	0.02	30.19	0.52	4.264	34.97	512.82	96.13
457	0.09	0.02	30.44	0.53	4.151	35.12	477.85	96.11
432	0.09	0.02	30.68	0.53	4.047	35.25	442.73	96.08
406	0.10	0.02	30.91	0.54	3.943	35.39	407.48	96.06
381	0.10	0.02	31.13	0.54	3.849	35.52	372.08	96.03
356	0.10	0.02	31.33	0.55	3.758	35.64	336.57	96.01
330	0.10	0.02	31.53	0.55	3.669	35.76	300.93	95.98
305	0.10	0.02	31.72	0.56	3.584	35.87	265.17	95.95
279	0.10	0.02	31.92	0.57	3.497	35.98	229.30	95.93

254	0.10	0.02	32.16	0.57	3.393	36.12	193.32	95.90
229	0.00	0.00	0.00	0.00	17.466	17.47	157.20	95.88
203	0.00	0.00	0.00	0.00	17.466	17.47	139.73	95.85
178	0.00	0.00	0.00	0.00	17.466	17.47	122.26	95.83
152	0.00	0.00	0.00	0.00	17.466	17.47	104.80	95.80
127	0.00	0.00	0.00	0.00	17.466	17.47	87.33	95.78
102	0.00	0.00	0.00	0.00	17.466	17.47	69.87	95.75
76	0.00	0.00	0.00	0.00	17.466	17.47	52.40	95.73
51	0.00	0.00	0.00	0.00	17.466	17.47	34.93	95.70
25	0.00	0.00	0.00	0.00	17.466	17.47	17.47	95.68

Surface Water Network Design





Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	Scotland and Ireland	Connection Type	Level Soffits
M5-60 (mm)	18.000	Minimum Backdrop Height (m)	1.000
Ratio-R	0.271	Preferred Cover Depth (m)	0.750
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
SW01	0.200	5.00	98.000	1350	1.200
SW02	0.100	5.00	98.200	1350	1.700
SW03			97.900	1350	1.850
SW04			97.900	1350	2.000
SW05	0.200	5.00	98.500	1350	2.025
SW06	0.150	5.00	98.090	1350	1.315
SW07	0.030	5.00	98.200	1200	1.250
SW08	0.050	5.00	98.300	1200	1.100
SW09	0.180	5.00	98.350	1200	1.200
SW10	0.150	5.00	98.350	1200	1.550
SW11			98.350	1200	1.900
SW12			97.900	1200	1.550
SW13	0.130	5.00	97.500	1200	1.050
SW14	0.120	5.00	97.500	1200	1.225
SW15			97.700	1350	2.020
SW16		5.00	97.600	1200	1.950
SW17			97.550	1200	1.930

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	Link Type	T of C (mins)	Rain (mm/hr)	Lateral Area (ha)
2.000	SW01	SW02	66.000	0.600	96.800	96.500	0.300	220.0	375	Circular	5.90	50.0	0.150
2.001	SW02	SW03	78.000	0.600	96.500	96.125	0.375	208.0	375	Circular	6.94	47.2	0.070
3.000	SW13	SW14	50.000	0.600	96.450	96.275	0.175	285.7	300	Circular	5.90	50.0	0.100
3.001	SW14	SW03	15.000	0.600	96.275	96.200	0.075	200.0	300	Circular	6.13	49.7	
2.002	SW03	SW04	44.001	0.600	96.050	95.900	0.150	293.3	450	Circular	7.56	45.5	
1.000	SW08	SW07	25.001	0.600	97.200	97.025	0.175	142.9	225	Circular	5.38	50.0	0.050
1.001	SW07	SW06	15.000	0.600	96.950	96.850	0.100	150.0	300	Circular	5.58	50.0	
1.002	SW06	SW05	70.000	0.600	96.775	96.475	0.300	233.3	375	Circular	6.56	48.3	0.140
1.003	SW05	SW04	78.001	0.600	96.475	95.975	0.500	156.0	375	Circular	7.46	45.8	0.135
4.000	SW09	SW10	64.000	0.600	97.150	96.800	0.350	182.9	300	Circular	5.92	50.0	
4.001	SW10	SW11	65.000	0.600	96.800	96.450	0.350	185.7	300	Circular	6.86	47.5	
4.002	SW11	SW12	14.000	0.600	96.450	96.350	0.100	140.0	300	Circular	7.04	47.0	
4.003	SW12	SW04	45.000	0.600	96.350	96.050	0.300	150.0	300	Circular	7.62	45.4	

Name	US Node	DS Node	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Maximum Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Velocity (m/s)
2.000	SW01	SW02	134.4	47.4	0.825	1.325	1.325	0.350	0.0	1.115
2.001	SW02	SW03	138.3	66.6	1.325	1.400	1.400	0.520	0.0	1.241
3.000	SW13	SW14	65.4	31.2	0.750	0.925	0.925	0.230	0.0	0.914
3.001	SW14	SW03	78.3	47.1	0.925	1.400	1.400	0.350	0.0	1.157
2.002	SW03	SW04	187.9	107.4	1.400	1.550	1.550	0.870	0.0	1.219
1.000	SW08	SW07	43.4	13.6	0.875	0.950	0.950	0.100	0.0	0.969
1.001	SW07	SW06	90.6	17.6	0.950	0.940	0.950	0.130	0.0	0.999
1.002	SW06	SW05	130.5	55.0	0.940	1.650	1.650	0.420	0.0	1.132
1.003	SW05	SW04	159.9	93.7	1.650	1.550	1.650	0.755	0.0	1.504
4.000	SW09	SW10	81.9	24.4	0.900	1.250	1.250	0.180	0.0	1.014
4.001	SW10	SW11	81.3	42.4	1.250	1.600	1.600	0.330	0.0	1.162
4.002	SW11	SW12	93.8	42.0	1.600	1.250	1.600	0.330	0.0	1.290
4.003	SW12	SW04	90.6	40.6	1.250	1.550	1.550	0.330	0.0	1.248

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	Link Type	T of C (mins)	Rain (mm/hr)	Lateral Area (ha)
1.004	SW04	SW15	9.119	0.600	95.900	95.800	0.100	91.2	450	Circular	7.69	45.2	
5.000	SW16	SW17	6.000	0.600	95.650	95.620	0.030	200.0	225	Circular	5.11	50.0	

Name	US Node	DS Node	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Maximum Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Velocity (m/s)
1.004	SW04	SW15	338.6	239.5	1.550	1.450	1.550	1.955	0.0	2.300
5.000	SW16	SW17	36.6	0.0	1.725	1.705	1.725	0.000	0.0	0.000

Simulation Settings

Rainfall Methodology	FSR	Summer CV	0.750	Drain Down Time (mins)	240
FSR Region	Scotland and Ireland	Winter CV	0.840	Additional Storage (m³/ha)	20.0
M5-60 (mm)	18.000	Analysis Speed	Detailed	Check Discharge Rate(s)	x
Ratio-R	0.271	Skip Steady State	x	Check Discharge Volume	x

Storm Durations

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

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

Node SW16 Online Hydro-Brake® Control

Flap Valve	x	Objective (HE)	Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	95.770	Product Number	CTL-SHE-0100-5300-1560-5300
Design Depth (m)	1.560	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	5.3	Min Node Diameter (mm)	1200

Node SW16 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Main Channel Length (m)	30.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	95.650	Main Channel Slope (1:X)	1000.0
Safety Factor	2.0	Time to half empty (mins)		Main Channel n	0.015

Inlets

SW15

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	950.0	0.0	1.680	950.0	0.0	1.690	10.0	0.0

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year +20% CC 15 minute summer	256.863	72.683	30 year +20% CC 480 minute summer	30.814	8.143
30 year +20% CC 15 minute winter	180.255	72.683	30 year +20% CC 480 minute winter	20.472	8.143
30 year +20% CC 30 minute summer	176.278	49.881	30 year +20% CC 600 minute summer	25.560	6.991
30 year +20% CC 30 minute winter	123.704	49.881	30 year +20% CC 600 minute winter	17.464	6.991
30 year +20% CC 60 minute summer	123.107	32.534	30 year +20% CC 720 minute summer	23.025	6.171
30 year +20% CC 60 minute winter	81.790	32.534	30 year +20% CC 720 minute winter	15.475	6.171
30 year +20% CC 120 minute summer	78.466	20.736	30 year +20% CC 960 minute summer	19.243	5.067
30 year +20% CC 120 minute winter	52.131	20.736	30 year +20% CC 960 minute winter	12.747	5.067
30 year +20% CC 180 minute summer	61.506	15.828	30 year +20% CC 1440 minute summer	14.315	3.837
30 year +20% CC 180 minute winter	39.981	15.828	30 year +20% CC 1440 minute winter	9.621	3.837
30 year +20% CC 240 minute summer	49.349	13.041	30 year +20% CC 2160 minute summer	10.499	2.902
30 year +20% CC 240 minute winter	32.786	13.041	30 year +20% CC 2160 minute winter	7.234	2.902
30 year +20% CC 360 minute summer	38.499	9.907	30 year +20% CC 2880 minute summer	8.874	2.378
30 year +20% CC 360 minute winter	25.025	9.907	30 year +20% CC 2880 minute winter	5.964	2.378

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year +20% CC 4320 minute summer	6.868	1.796	100 year +20% CC 480 minute summer	38.621	10.206
30 year +20% CC 4320 minute winter	4.523	1.796	100 year +20% CC 480 minute winter	25.659	10.206
30 year +20% CC 5760 minute summer	5.744	1.470	100 year +20% CC 600 minute summer	31.901	8.726
30 year +20% CC 5760 minute winter	3.718	1.470	100 year +20% CC 600 minute winter	21.797	8.726
30 year +20% CC 7200 minute summer	4.936	1.259	100 year +20% CC 720 minute summer	28.638	7.675
30 year +20% CC 7200 minute winter	3.186	1.259	100 year +20% CC 720 minute winter	19.246	7.675
100 year +20% CC 15 minute summer	333.817	94.459	100 year +20% CC 960 minute summer	23.803	6.268
100 year +20% CC 15 minute winter	234.257	94.459	100 year +20% CC 960 minute winter	15.767	6.268
100 year +20% CC 30 minute summer	230.059	65.099	100 year +20% CC 1440 minute summer	17.572	4.709
100 year +20% CC 30 minute winter	161.445	65.099	100 year +20% CC 1440 minute winter	11.809	4.709
100 year +20% CC 60 minute summer	159.562	42.167	100 year +20% CC 2160 minute summer	12.782	3.533
100 year +20% CC 60 minute winter	106.009	42.167	100 year +20% CC 2160 minute winter	8.807	3.533
100 year +20% CC 120 minute summer	100.744	26.624	100 year +20% CC 2880 minute summer	10.737	2.878
100 year +20% CC 120 minute winter	66.932	26.624	100 year +20% CC 2880 minute winter	7.216	2.878
100 year +20% CC 180 minute summer	78.458	20.190	100 year +20% CC 4320 minute summer	8.235	2.153
100 year +20% CC 180 minute winter	51.000	20.190	100 year +20% CC 4320 minute winter	5.423	2.153
100 year +20% CC 240 minute summer	62.640	16.554	100 year +20% CC 5760 minute summer	6.842	1.751
100 year +20% CC 240 minute winter	41.616	16.554	100 year +20% CC 5760 minute winter	4.428	1.751
100 year +20% CC 360 minute summer	48.513	12.484	100 year +20% CC 7200 minute summer	5.849	1.492
100 year +20% CC 360 minute winter	31.535	12.484	100 year +20% CC 7200 minute winter	3.775	1.492

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 99.62%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
15 minute winter	SW01	12	97.327	0.527	66.1	2.5110	0.0000	SURCHARGED
15 minute winter	2.000:50%	12	97.303	0.653	116.9	0.0000	0.0000	SURCHARGED
15 minute winter	SW02	12	97.208	0.708	128.9	1.8475	0.0000	SURCHARGED
15 minute winter	2.001:50%	12	97.056	0.744	139.7	0.0000	0.0000	SURCHARGED
2880 minute winter	SW03	2640	96.944	0.894	12.0	1.2797	0.0000	SURCHARGED
2880 minute winter	SW04	2640	96.944	1.044	26.5	1.4943	0.0000	SURCHARGED
15 minute winter	SW05	11	97.271	0.796	173.4	2.7121	0.0000	SURCHARGED
15 minute winter	1.003:50%	11	97.029	0.804	190.3	0.0000	0.0000	SURCHARGED
15 minute winter	SW06	12	97.414	0.639	82.3	2.3737	0.0000	SURCHARGED
15 minute winter	1.002:50%	12	97.385	0.760	120.1	0.0000	0.0000	SURCHARGED
15 minute winter	SW07	12	97.416	0.466	46.3	0.7508	0.0000	SURCHARGED
15 minute winter	SW08	12	97.479	0.279	18.0	0.5683	0.0000	SURCHARGED
15 minute winter	1.000:50%	12	97.454	0.342	32.8	2.5656	0.0000	SURCHARGED
15 minute winter	SW09	12	97.532	0.382	59.5	1.5778	0.0000	SURCHARGED
15 minute winter	SW10	12	97.408	0.608	107.0	1.8652	0.0000	SURCHARGED
15 minute winter	SW11	12	97.018	0.568	80.2	0.6427	0.0000	SURCHARGED
2880 minute winter	SW12	2640	96.944	0.594	4.6	0.6721	0.0000	SURCHARGED
15 minute winter	SW13	13	96.999	0.549	43.0	1.9797	0.0000	SURCHARGED
15 minute winter	3.000:50%	13	96.989	0.626	67.4	8.6131	0.0000	SURCHARGED
2880 minute winter	SW14	2640	96.944	0.669	4.9	2.0680	0.0000	SURCHARGED
2880 minute winter	SW15	2640	96.944	1.264	59.6	1.8090	0.0000	OK
2880 minute winter	SW16	2640	96.944	1.294	64.2	1.4637	0.0000	SURCHARGED
15 minute summer	SW17	1	95.620	0.000	4.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)
15 minute winter	SW01	2.000	2.000:50%	67.3	0.899	0.501	3.6398	
15 minute winter	SW01	2.000	SW02	97.9	1.161	0.728	3.6398	
15 minute winter	SW02	2.001	2.001:50%	117.9	1.271	0.853	4.3016	
15 minute winter	SW02	2.001	SW03	135.4	1.242	0.979	4.3016	
2880 minute winter	SW03	2.002	SW04	11.7	0.513	0.062	6.9717	
2880 minute winter	SW04	1.004	SW15	43.6	0.814	0.129	1.4448	
15 minute winter	SW05	1.003	1.003:50%	149.2	1.380	0.933	4.3016	
15 minute winter	SW05	1.003	SW04	192.5	1.746	1.204	4.3016	
15 minute winter	SW06	1.002	1.002:50%	84.6	0.977	0.649	3.8604	
15 minute winter	SW06	1.002	SW05	111.1	1.111	0.852	3.8604	
15 minute winter	SW07	1.001	SW06	50.7	1.071	0.559	1.0563	
15 minute winter	SW08	1.000	1.000:50%	16.3	0.728	0.376	0.4971	
15 minute winter	SW08	1.000	SW07	42.3	1.220	0.974	0.4971	
15 minute winter	SW09	4.000	SW10	57.5	0.944	0.701	4.5068	
15 minute winter	SW10	4.001	SW11	80.2	1.313	0.987	4.5773	
15 minute winter	SW11	4.002	SW12	79.3	1.364	0.846	0.9859	
2880 minute winter	SW12	4.003	SW04	4.6	0.622	0.051	3.1689	
15 minute winter	SW13	3.000	3.000:50%	36.3	0.705	0.555	1.7605	
15 minute winter	SW13	3.000	SW14	61.9	0.878	0.946	1.7605	
2880 minute winter	SW14	3.001	SW03	4.7	0.596	0.060	1.0563	
2880 minute winter	SW15	Flow through pond	SW16	64.2	0.014	0.001	1215.3962	
2880 minute winter	SW16	Hydro-Brake®	SW17	5.1				662.1

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.62%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SW01	12	97.967	1.167	86.0	5.5586	0.0000	FLOOD RISK
15 minute winter	2.000:50%	12	97.915	1.265	128.7	0.0000	0.0000	SURCHARGED
15 minute winter	SW02	12	97.774	1.274	162.8	3.3217	0.0000	SURCHARGED
15 minute winter	2.001:50%	12	97.500	1.188	183.1	0.0000	0.0000	SURCHARGED
2880 minute winter	SW03	2700	97.257	1.207	13.5	1.7270	0.0000	SURCHARGED
2880 minute winter	SW04	2700	97.257	1.357	30.7	1.9416	0.0000	SURCHARGED
15 minute winter	SW05	12	97.635	1.160	176.0	3.9516	0.0000	SURCHARGED
15 minute winter	1.003:50%	12	97.324	1.099	220.9	0.0000	0.0000	SURCHARGED
15 minute winter	SW06	12	97.773	0.998	87.0	3.7073	0.0000	SURCHARGED
15 minute winter	1.002:50%	12	97.734	1.109	124.6	0.0000	0.0000	SURCHARGED
15 minute winter	SW07	13	97.789	0.839	70.5	1.3513	0.0000	SURCHARGED
15 minute winter	SW08	13	97.842	0.642	21.5	1.3104	0.0000	SURCHARGED
15 minute winter	1.000:50%	13	97.835	0.723	67.1	11.4750	0.0000	SURCHARGED
15 minute winter	SW09	12	98.287	1.137	77.4	4.6977	0.0000	FLOOD RISK
15 minute winter	SW10	12	98.099	1.299	119.7	3.9836	0.0000	FLOOD RISK
15 minute winter	SW11	12	97.456	1.006	103.3	1.1379	0.0000	SURCHARGED
15 minute winter	SW12	12	97.277	0.927	102.3	1.0489	0.0000	SURCHARGED
15 minute winter	SW13	13	97.304	0.854	55.9	3.0793	0.0000	FLOOD RISK
15 minute winter	3.000:50%	13	97.285	0.922	85.3	18.6897	0.0000	SURCHARGED
2880 minute winter	SW14	2700	97.257	0.982	5.4	3.0340	0.0000	FLOOD RISK
2880 minute winter	SW15	2700	97.257	1.577	34.7	2.2564	0.0000	OK
2880 minute winter	SW16	2700	97.257	1.607	49.7	1.8173	0.0000	SURCHARGED
15 minute summer	SW17	1	95.620	0.000	4.9	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SW01	2.000	2.000:50%	71.6	0.903	0.533	3.6398	
15 minute winter	SW01	2.000	SW02	123.2	1.165	0.916	3.6398	
15 minute winter	SW02	2.001	2.001:50%	158.3	1.435	1.144	4.3016	
15 minute winter	SW02	2.001	SW03	181.9	1.649	1.315	4.3016	
2880 minute winter	SW03	2.002	SW04	13.4	0.521	0.071	6.9717	
2880 minute winter	SW04	1.004	SW15	30.6	0.813	0.090	1.4448	
15 minute winter	SW05	1.003	1.003:50%	167.8	1.522	1.049	4.3016	
15 minute winter	SW05	1.003	SW04	219.3	1.989	1.371	4.3016	
15 minute winter	SW06	1.002	1.002:50%	100.4	0.978	0.769	3.8604	
15 minute winter	SW06	1.002	SW05	117.1	1.131	0.897	3.8604	
15 minute winter	SW07	1.001	SW06	75.7	1.251	0.836	1.0563	
15 minute winter	SW08	1.000	1.000:50%	19.6	0.759	0.450	0.4971	
15 minute winter	SW08	1.000	SW07	68.3	1.718	1.574	0.4971	
15 minute winter	SW09	4.000	SW10	59.0	0.970	0.720	4.5068	
15 minute winter	SW10	4.001	SW11	103.3	1.467	1.271	4.5773	
15 minute winter	SW11	4.002	SW12	102.3	1.452	1.091	0.9859	
15 minute winter	SW12	4.003	SW04	103.3	1.468	1.141	3.1689	
15 minute winter	SW13	3.000	3.000:50%	43.7	0.707	0.669	1.7605	
15 minute winter	SW13	3.000	SW14	86.9	1.234	1.329	1.7605	
2880 minute winter	SW14	3.001	SW03	5.2	0.614	0.066	1.0563	
2880 minute winter	SW15	Flow through pond	SW16	49.7	0.014	0.001	1512.4027	
2880 minute winter	SW16	Hydro-Brake®	SW17	5.2				725.7

Appendix to Surface Water Design

- Rainfall table for subject's site
- HR Wallingford Greenfield runoff rate estimation report
- Specification/Product Information for:
 - Separators
 - Silt Trap
 - Flow Control Device
- StormTech Chamber Information Sheets: MC-3500™

Greenfield runoff rates	Runoff	Runoff
1 in 200 years (Rp)	1.17	1.17
1 in 100 years (Rp)	1.00	1.00
1 in 50 years (Rp)	0.83	0.83
1 in 1 year (Rp)	0.17	0.17
0.5 (Rp)	0.50	0.50

Greenfield runoff rates	Runoff	Runoff
Growth curve factor 300 years	0.89	0.89
Growth curve factor 100 years	0.81	0.81
Growth curve factor 50 years	0.73	0.73
Growth curve factor 1 year	0.17	0.17

Hydrological region	Runoff	Runoff
Hydrological region	1.00	1.00
GVAI factor	1.00	1.00

Hydrological characteristics	Runoff	Runoff
Hydrological characteristics	1.00	1.00
SPRINT factor	0.50	0.50
HOBT factor	0.50	0.50
SOIL type	0.50	0.50

SOIL type	Runoff	Runoff
SOIL type	0.50	0.50
SOIL characteristics	0.50	0.50
BFR retention method	0.50	0.50
QBR retention method	0.50	0.50

Pathology	Runoff	Runoff
Pathology	0.50	0.50
Runoff rate (Rp) - 0.50	0.50	0.50
Site characteristics	0.50	0.50
Runoff estimation approach	0.50	0.50

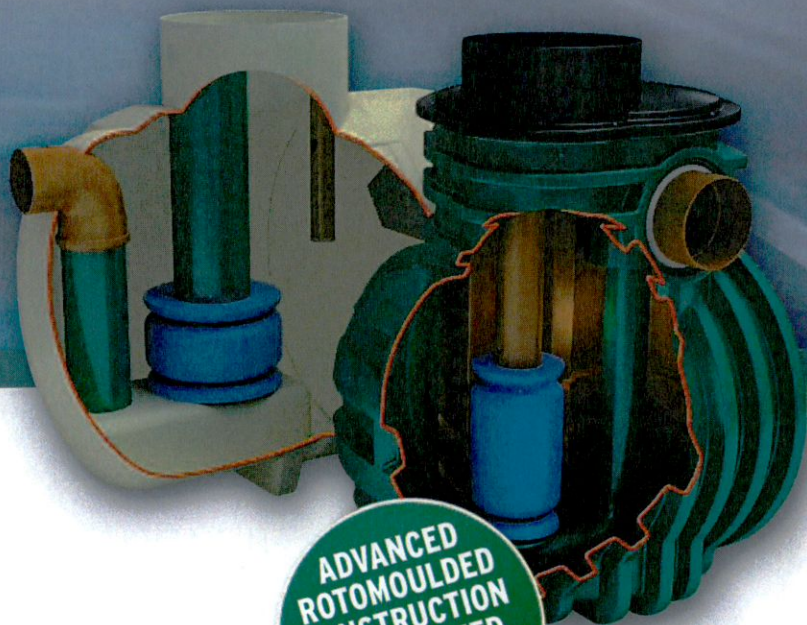
Site Details	Runoff	Runoff
Site Details	0.50	0.50
Latitude	51.50	51.50
Longitude	-1.00	-1.00
Altitude	100	100

The report was prepared using the runoff rates developed by HR Watermark and is intended for use in the design of drainage systems. The runoff rates are based on a range of site characteristics and are intended to provide a general indication of the runoff rates for a given site. The runoff rates are based on a range of site characteristics and are intended to provide a general indication of the runoff rates for a given site. The runoff rates are based on a range of site characteristics and are intended to provide a general indication of the runoff rates for a given site.

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A RANGE OF FUEL/OIL SEPARATORS FOR PEACE OF MIND

Surface water drains normally discharge to a watercourse or indirectly into underground waters (groundwater) via a soakaway. Contamination of surface water by oil, chemicals or suspended solids can cause these discharges to have a serious impact on the receiving water.

The Environment Regulators, Environment Agency, England and Wales, SEPA, Scottish Environmental Protection Agency in Scotland and Department of Environment & Heritage in Northern Ireland, have published guidance on surface water disposal, which offers a range of means of dealing with pollution both at source and at the point of discharge from site (so called 'end of pipe' treatment). These techniques are known as 'Sustainable Drainage Systems' (SuDS).

Where run-off is draining from relatively low risk areas such as car-parks and non-operational areas, a source control approach, such as permeable surfaces or infiltration trenches, may offer a suitable means of treatment, removing the need for a separator.

Oil separators are installed on surface water drainage systems to protect receiving waters from pollution by oil, which may be present due to minor leaks from vehicles and plant, from accidental spillage.

Effluent from industrial processes and vehicle washing should normally be discharged to the foul sewer (subject to the approval of the sewerage undertaker) for further treatment at a municipal treatment works.

SEPARATOR STANDARDS AND TYPES

A British (and European) standard (EN 858-1 and 858-2) for the design and use of prefabricated oil separators has been adopted. New prefabricated separators should comply with the standard.

SEPARATOR CLASSES

The standard refers to two 'classes' of separator, based on performance under standard test conditions.

CLASS I

Designed to achieve a concentration of less than 5mg/l of oil under standard test conditions, should be used when the separator is required to remove very small oil droplets.

CLASS II

Designed to achieve a concentration of less than 100mg/l oil under standard test conditions and are suitable for dealing with discharges where a lower quality requirement applies (for example where the effluent passes to foul sewer).

Both classes can be produced as full retention or bypass separators. The oil concentration limits of 5 mg/l and 100 mg/l are only applicable under standard test conditions. It should not be expected that separators will comply with these limits when operating under field conditions.

FULL RETENTION SEPARATORS

Full retention separators treat the full flow that can be delivered by the drainage system, which is normally equivalent to the flow generated by a rainfall intensity of 65mm/hr.

On large sites, some short term flooding may be an acceptable means of limiting the flow rate and hence the size of full retention systems.

Get in touch for a **FREE** professional site visit and a representative will contact you within 5 working days to arrange a visit.

helpingyou@klargester.com to make the right decision or call **028 302 66799**

BYPASS SEPARATORS

Bypass separators fully treat all flows generated by rainfall rates of up to 6.5mm/hr. This covers over 99% of all rainfall events. Flows above this rate are allowed to bypass the separator. These separators are used when it is considered an acceptable risk not to provide full treatment for high flows, for example where the risk of a large spillage and heavy rainfall occurring at the same time is small.

FORECOURT SEPARATORS

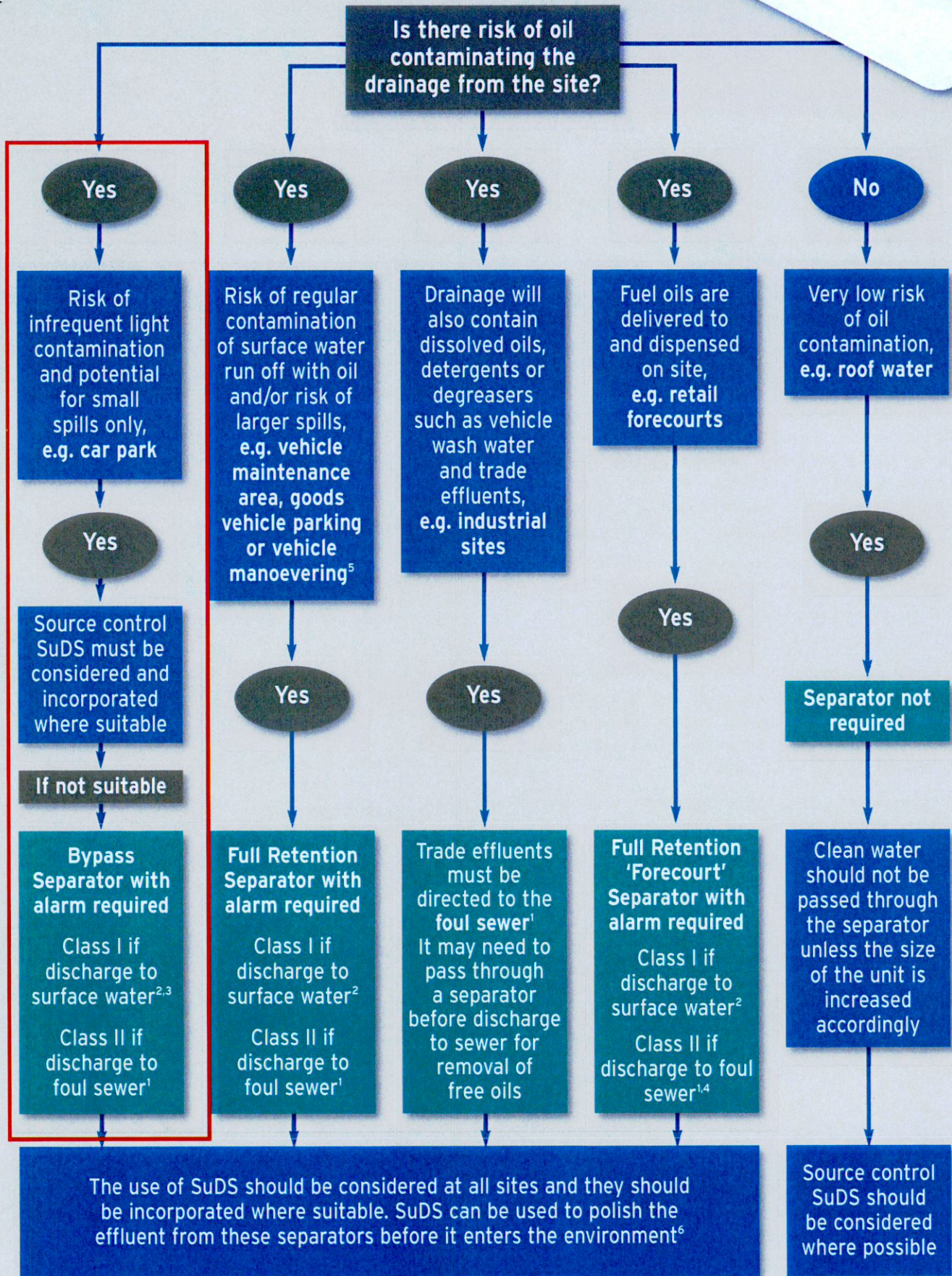
Forecourt separators are full retention separators specified to retain on site the maximum spillage likely to occur on a petrol filling station. They are required for both safety and environmental reasons and will treat spillages occurring during vehicle refuelling and road tanker delivery. The size of the separator is increased in order to retain the possible loss of the contents of one compartment of a road tanker, which may be up to 7,600 litres.

SELECTING THE RIGHT SEPARATOR

The chart on the following page gives guidance to aid selection of the appropriate type of fuel/oil separator for use in surface water drainage systems which discharge into rivers and soakaways.

For further detailed information, please consult the Environment Agency Pollution Prevention Guideline 03 (PPG 3) 'Use and design of oil separators in surface water drainage systems' available from their website.

Klargester has a specialist team who provide technical assistance in selecting the appropriate separator for your application.



1 You must seek prior permission from your local sewer provider before you decide which separator to install and before you make any discharge.
 2 You must seek prior permission from the relevant environmental body before you decide which separator to install.
 3 In this case, if it is considered that there is a low risk of pollution a source control SuDS scheme may be appropriate.
 4 In certain circumstances, the sewer provider may require a Class 1 separator for discharges to sewer to prevent explosive atmospheres from being generated.
 5 Drainage from higher risk areas such as vehicle maintenance yards and goods vehicle parking areas should be connected to foul sewer in preference to surface water.
 6 In certain circumstances, a separator may be one of the devices used in the SuDS scheme. Ask us for advice.

Bypass NSB RANGE

APPLICATION

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

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

PERFORMANCE

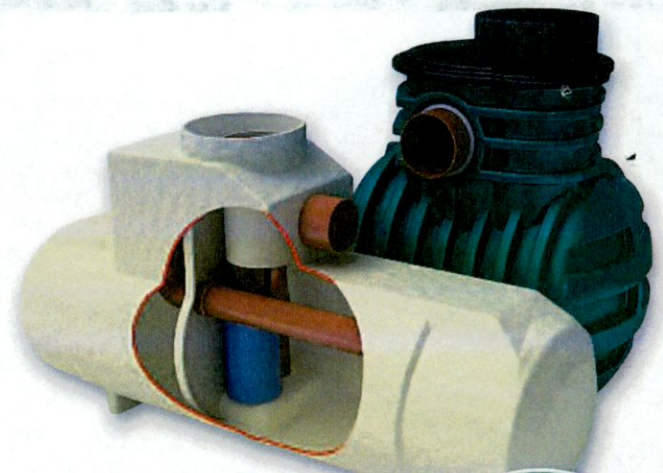
Klargester were one of the first UK manufacturers to have separators tested to EN 858-1. Klargester have now added the NSB bypass range to their portfolio of certified and tested models. The NSB number denotes the maximum flow at which the separator treats liquids. The British Standards Institute (BSI)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

Each bypass separator design includes the necessary volume requirements for:

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

The unit is designed to treat 10% of peak flow. The calculated drainage areas served by each separator are indicated according to the formula given by PPG3 $NSB = 0.0018A(m^2)$. Flows generated by higher rainfall rates will pass through part of the separator and bypass the main separation chamber.

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



Class II separators are designed to achieve a concentration of 100mg/litre of oil under standard test conditions.

Advanced rotomoulded construction on selected models

- Compact and robust
- Require less backfill
- Tough, lightweight and easy to handle

FEATURES

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

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

- The calculated flow rate for the drainage area served. Our designs are based on the assumption that any interconnecting pipework fitted elsewhere on site does not impede flow into or out of the separator and that the flow is not pumped.
- The required discharge standard. This will decide whether a Class I or Class II unit is required.
- The drain invert inlet depth.
- Pipework type, size and orientation.

SIZES AND SPECIFICATIONS

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

■ Rotomoulded chamber construction

■ GRP chamber construction

* Some units have more than one access shaft – diameter of largest shown.

Full Retention NSF RANGE

APPLICATION

Full retention separators are used in high risk spillage areas such as:

- Fuel distribution depots.
- Vehicle workshops.
- Scrap Yards

PERFORMANCE

Klargester were the first UK manufacturer to have the required range (3-30 l/sec) certified to EN 858-1 in the UK. The NSF number denotes the flow at which the separator operates.

The British Standards Institute (BSI) have witnessed the performance tests of the required range of separators and have certified their performance, in relation to their flow and process performance to ensure that they met the effluent quality requirements of EN 858-1. Larger separator designs have been determined using the formulas extrapolated from the test range.

Each full retention separator design includes the necessary volume requirements for:

- Oil separation capacity.
- Oil storage volume.
- Silt storage capacity.
- Coalescer (Class I units only).
- Automatic closure device.

Klargester full retention separators treat the whole of the specified flow.

FEATURES

- Light and easy to install.
- Class I and Class II designs.
- 3-30 l/sec range independently tested and performance sampled, certified by the BSI.
- Inclusive of silt storage volume.
- Fitted inlet/outlet connectors.



- Oil alarm system available.
- Vent points within necks.
- Extension access shafts for deep inverts.
- Maintenance from ground level.
- GRP or rotomoulded construction (subject to model).

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

- The calculated flow rate for the drainage area served. Our designs are based on the assumption that any interconnecting pipework fitted elsewhere on site does not impede flow into or out of the separator and that the influent is not pumped.
- The required discharge standard. This will decide whether a Class I or Class II unit is required.
- The drain invert inlet depth.
- Pipework type, size and orientation.

SIZES AND SPECIFICATIONS

UNIT NOMINAL SIZE	FLOW (l/s)	DRAINAGE AREA (m ² PPG-3 (0.018))	STORAGE CAPACITY (litres)		UNIT LENGTH (mm)	UNIT DIA. (mm)	BASE TO INLET INVERT (mm)	BASE TO OUTLET INVERT	MIN. INLET INLET (mm)	STANDARD PIPEWORK DIA. (mm)
			SILT	OIL						
NSFP003	3	170	300	30	1700	1350	1420	1345	500	160
NSFP006	6	335	600	60	1700	1350	1420	1345	500	160
NSFA010	10	555	1000	100	2610	1225	1050	1000	500	200
NSFA015	15	835	1500	150	3910	1225	1050	1000	500	200
NSFA020	20	1115	2000	200	3200	2010	1810	1760	1000	315
NSFA030	30	1670	3000	300	3915	2010	1810	1760	1000	315
NSFA040	40	2225	4000	400	4640	2010	1810	1760	1000	315
NSFA050	50	2780	5000	500	5425	2010	1810	1760	1000	315
NSFA065	65	3610	6500	650	6850	2010	1810	1760	1000	315
NSFA080	80	4445	8000	800	5744	2820	2500	2450	1000	300
NSFA100	100	5560	10000	1000	6200	2820	2500	2450	1000	400
NSFA125	125	6945	12500	1250	7365	2820	2500	2450	1000	450
NSFA150	150	8335	15000	1500	8675	2820	2550	2450	1000	525
NSFA175	175	9725	17500	1750	9975	2820	2550	2450	1000	525
NSFA200	200	11110	20000	2000	11280	2820	2550	2450	1000	600

■ Rotomoulded chamber construction ■ GRP chamber construction

PROFESSIONAL INSTALLERS

Klargester Accredited Installers

Experience shows that correct installation is a prerequisite for the long-lasting and successful operation of any wastewater treatment product. This is why using an installer with the experience and expertise to install your product is highly recommended.



Services include :

- Site survey to establish ground conditions and soil types
- Advice on system design and product selection
- Assistance on gaining environmental consents and building approvals
- Tank and drainage system installation
- Connection to discharge point and electrical networks
- Waste emptying and disposal

Discover more about the Accredited Installers and locate your local expert online.

www.klargester.com/installers



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In keeping with Company policy of continuing research and development and in order to offer our clients the most advanced products, Kingspan Environmental reserves the right to alter specifications and drawings without prior notice.

Issue No. 20: August 2014



Specialists in Wastewater Treatment & Stormwater Management

Surface Water Treatment SUDs Protector



The CDS Non Blocking screening technology is an innovative method of liquid / solid separation for Surface Water, Combined Sewer Overflows (CSO) and Foul Sewage Systems.

- **SurfSep** for Surface Water applications
- **OverSep** for Combined Sewer Overflow applications.

The technology accomplishes high efficiency separation of settleable particulate matter and capture of floatable material.

A unique feature of the CDS Technology is its compact design. Both the *SurfSep* and *OverSep* are available as packaged systems, which can either be installed inside pre-cast concrete chamber rings, or complete BBA Approved Polyethylene Chambers unit.

Applications

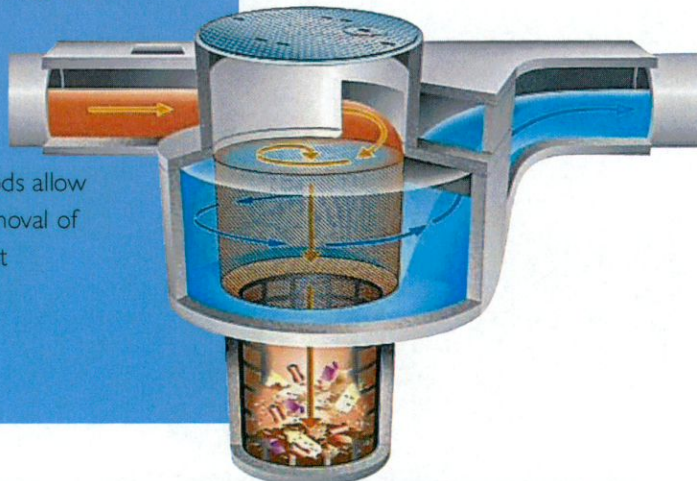
- Storm-water Treatment
- Combined Sewer Overflow Treatment
- Parking Area Run-Off Treatment
- Vehicle Service Yard Areas
- Pre-treatment for Wetlands, Ponds and Swales
- Rainwater Harvesting
- Pre-treatment for Oil Separators
- Pre-treatment for media and Ground In-filtration Systems



Rapid installation

Primary features

- **Effective:** Capturing more than 95% of solid pollutants.
- **Non-Blocking:** Unique design takes advantage of indirect filtration and properly proportioned hydraulic forces that virtually makes the unit unblockable.
- **Non-Mechanical:** The unit has no moving parts and requires no mechanical devices to support the solid separation function.
- **Low Maintenance Costs:** The system has no moving parts and is fabricated of durable materials.
- **Compact & Flexible:** Design and size flexibility enables the use of various configurations.
- **High Flow Effectiveness:** The technology remains highly effective across a broad spectrum of flow ranges.
- **Assured Pollutant Capture:** All materials captured are retained during high flow conditions.
- **Safe & Easy Pollutant Removal:** Extraction methods allow safe and easy removal of pollutants without manual handling.



Surface Water System

Hydraulic Analysis

In storm water applications, an analysis of the catchment in terms of its size, topography and land use will provide information for determining flow to be expected for various return periods.

The *SurfSep* is designed for the flow that mobilizes the gross pollutants within the catchment. Since there are variations in catchment response due to region, land use and topography, it is recommended that the selection of flow to be treated will be for return periods of between 3 months and 1 year.

Balancing the cost to the operator against the benefits to the environment

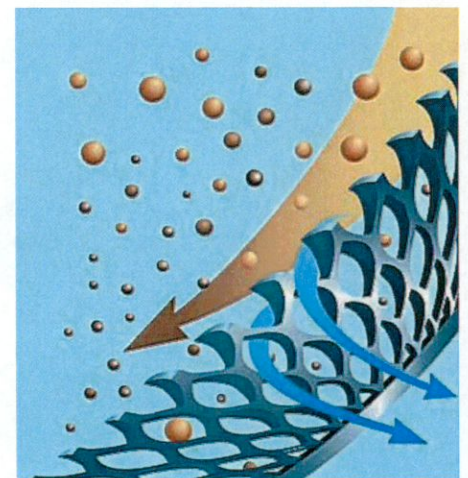
Field evaluations to determine pollutant mobilization have found that the vast majority of pollutants are mobilized in flows that are well below the design capacity for the conveyance facility - typically known as the 'first flush'.

Therefore it is typical not to design the *SurfSep* models to process the conveyance system's maximum flow in order to achieve a very high level of pollutant removal.

The added value benefit to the operator is reduced civil costs without compromising the benefits to the environment.

How it works

Water and pollutants enter the system and are introduced tangentially inside the separation chamber forming a circular flow motion. Floatables and suspended solids are diverted to the slow moving centre of the flow. Negatively buoyant solids settle out to an undisturbed sump chamber below, while the water passes countercurrently through the separation screen. Floatables remain at the water surface and retained within the screen.



Surface Water Treatment Systems

Hydraulic Design

Every application requires a detailed hydraulic analysis to ensure the final installation will perform to effect optimum solids separation without blocking the screen.

After the design flow has been determined, the appropriate standard model can be selected. A selection table is provided on page 7.

The Ultimate SUDs Protector

There are four principal areas of proprietary SUDs technology;

- Infiltration • Flow Control • Storage/attenuation • Treatment

SurfSeps, although a common form of treatment are unique. When installed upstream of any proprietary SUDs technology, the *SurfSep* protects the receiving SUDs from fine solids and debris that would otherwise accumulate over time rendering the SUDs non-operational, as the worst case.

SurfSeps have been successfully installed in front of;

- Soakaways
- Infiltration Trenches
- Filters
- Wetlands
- Ponds and Water Features
- Detention and Retention Systems
- Oil Separators
- Create storage storage systems

to remove fine solids and debris that would otherwise accumulate over time reducing the down stream effectiveness of downstream SUDs assets.

Various independent field trials have shown that the *SurfSep* can remove high levels of Phosphates, Heavy Metals and PolyAromatic Hydrocarbons (PAH's) from the flow.

Infiltration

SurfSeps have been successfully installed in front of ground Infiltration systems to remove grit, fine solids and debris which accumulates in and around the SUDs causing visual degradation in the short term and accumulation of silt and grits leading to reduced volume in the long term.

Studies have also shown that Heavy metals & PAH's accumulate within the SUDs over time before being released back to the environment resulting in elevated concentrations.

Detention & Retention Systems

SurfSeps have been successfully installed in front of collection and attenuation SUDs to remove grit, fine solids and debris which accumulates in the SUDs leading to potential blockage of flow regulators resulting in increased Occupational Health & Safety risk during the treatment of blockages and during the periodic cleaning operations.

Applications

- Rainwater Harvesting
- Road run off
- New Developments
- Motorways
- A / B Roads
- Local Roads
- Residential
- Industrial
- Commercial

Purpose

Removal of plastics, oil, grit, fine solids, organic and inorganic debris, from point source pollution.

Flow Control Systems

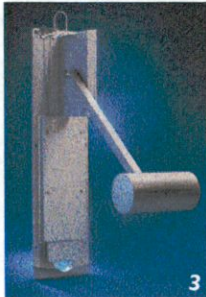
Flow Control

Flow control is often required to reduce flooding of downstream sewer networks or receiving water courses. There are a number of ways to achieve this. The Hydroslide - Float controlled, constant flow regulator, as detailed below is ideally suited to the providing an efficient and reliable means of flow control.

There are four types of standard Hydroslide flow regulators as pictured.

- 1) Mini
- 2) HydroLimiter
- 3) VS - Vertical Standard
- 4) Combi - self flushing, can be mounted on the dry or wet side of the flow chamber.

Most applications can be dealt with using any of the four models to suit the flow. An accuracy of +/-5% is achievable.



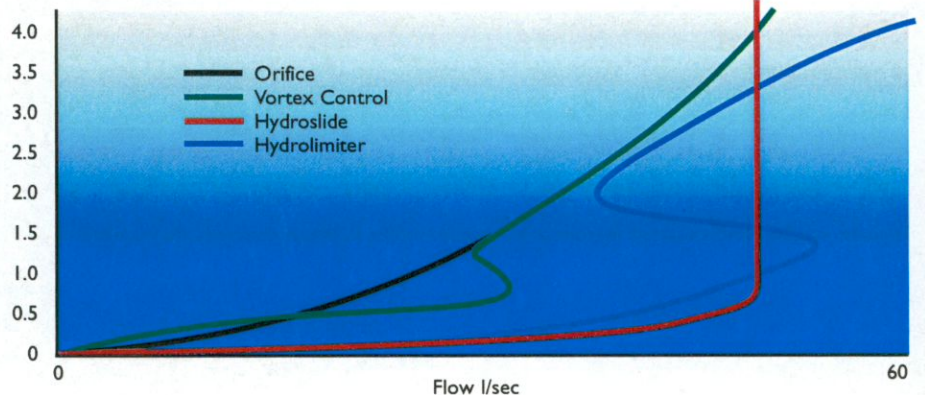
Typical SurfSep installation

Flow Control Technical Design

The Hydroslide regulator does not affect the flow until the flow is approaching the set discharge limit, this allows all flow (the first flush) to be discharged to the sewer. Because the flow to the sewer can be optimised at it's maximum permitted capacity the attenuation/storage capacity can be reduced over other methods of flow control, thus giving cost savings in storage provision. This is best explained by looking at a single storm event and comparing the 3 flow regulation processes as was done independantly by WRc in the report titled 'REDUCING THE COST OF STORMWATER STORAGE', Report No. PT1052, March 1995. The chart below represents 50 l/s control and up to 4m of head. The area difference between the curves being the detention volume saving.

Typically the volume saving when using a Hydroslide regulator is between 7% to 40%

Representation of flow through an orifice



Operation & Performance

Performance Criteria

Note: Screen apertures of 4.8 mm , 2.4 mm and 1.2 mm are available.

The 4.8 and 2.4 mm screens are generally used for Surface Water applications, with foul applications using either 2.4 or 1.2 mm aperture units.

Typical 1.2 mm aperture Performance

- shall remove all solids with a single dimension greater than 1.2 mm and positively contain those solids until the unit is cleaned.
- shall remove and positively contain 100 percent of all neutrally buoyant particles with a single dimension greater than 1.2 mm for all flow conditions to design capacity.
- shall remove and positively contain 100 percent of all floating trash and debris with a single dimension greater than 1.2 mm for all flow conditions to the design capacity.
- shall remove a minimum of 50 percent of oil and grease (as defined as the floating portion of total hexane extractable materials) for all flow conditions to the design capacity, without the addition of absorbents.
- shall provide the following minimum particle removal efficiencies (based on a specific gravity of 2.65):
 - a) 100 percent of all particles greater than 1100 microns.
 - b) 95 percent of all particles greater than 550 microns.
 - c) 90 percent of all particles greater than 367 microns.
 - d) 20 percent of all particles greater than 200 microns.

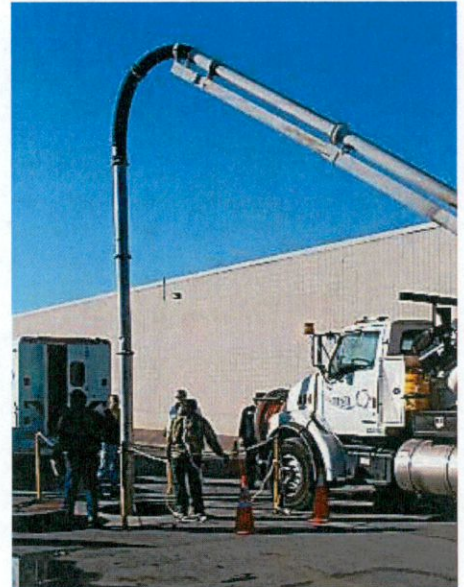
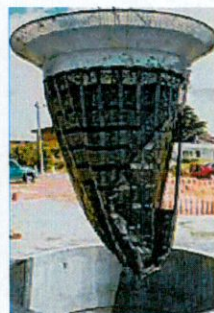
Maintenance

SurfSep maintenance can be site and drainage area specific. The installation should be inspected periodically to assure its condition to handle anticipated runoff. If pollutant loadings are known, then a preventive maintenance schedule can be developed based on runoff volumes processed.

Since this is seldom the case we recommend;

New Installations

Check the condition of the installation after the first few events. This includes a visual inspection to ascertain that the unit is operating correctly and measuring the amount of deposition that has occurred in the unit. This may be achieved using a 'Dip Stick'.



Ongoing Operation

For the first 12 months the installations sump full volume should be inspected monthly and recorded. When the inspection indicates that the sump full volume is approaching the top of the sump (base of screen) a cleanout should be undertaken.

Cleaning Methods

- Eduction (Suction)
- Basket Removal
- Mechanical Grab

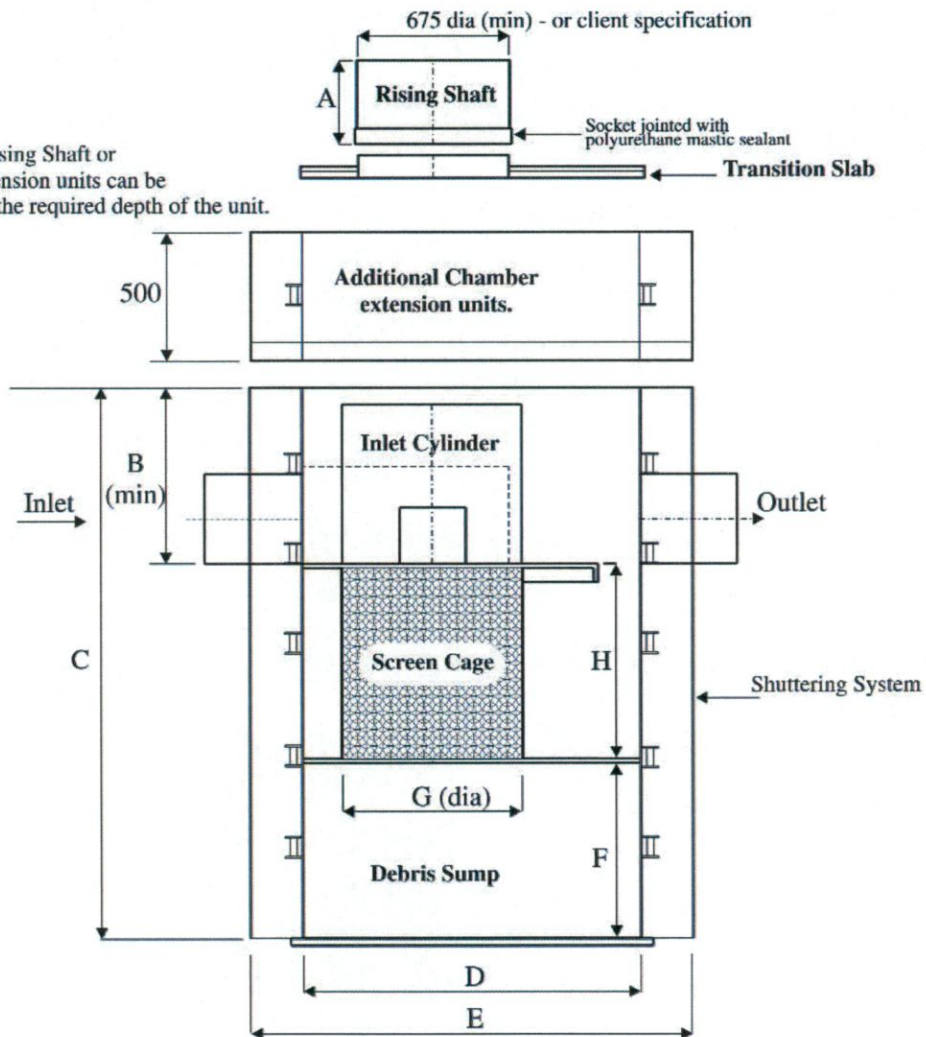
Maintenance Cycle

Minimum once per year. Depending on the pollutant load it may be necessary to maintain the installation more frequently.

The operator shall be able to devise the most efficient maintenance schedule for any particular installation over a 12 month operating cycle.

SurfSep Dimensions

Note:
Additional Rising Shaft or Chamber extension units can be added to suit the required depth of the unit.



SurfSep Dimensions (mm)

	SWI0404	SW0604	SW0606	SW0804	SW0806	SW0808	SWI010	SWI012	SWI015
A	370	370	370	370	370	370	500	500	500
B	444	815	615	810	830	810	800	800	830
C	1250	1985	1985	2080	2300	2480	2800	3000	3330
D	800	1200	1200	1500	1500	1500	2000	2000	2000
E	1112	1665	1665	1966	1966	1966	2475	2475	2475
F	400	700	700	700	700	800	1000	1000	1000
G (dia)	400	600	600	800	800	800	1000	1000	1000
H	400	400	600	400	600	800	1000	1200	1500

Selection Table - SurfSep

Model Reference	Hydraulic Peak Flow Rate l/s	Drainage Area - Impermeable m ²	Chamber Diameter (mm)	Internal Pipe Diameter (mm)
SWI 0404	30	2,000	900	150 / 225
SWI 0604	70	5,000	1200	225
SWI 0606 / 01	140	10,000	1200	225 - 375
SWI 0606 / 02	200	15,000	1200	225 - 375
SWI 0804	275	20,000	1500	300
SWI 0806	350	25,000	1500	450
SWI 0808	400	30,000	1500	450
SWI 1010	480	35,000	2000	450
SWI 1012	550	40,000	2000	450 / 750
SWI 1015	700	50,000	2000	450 / 750

* Proposed Peak Flow Rate for each model calculated using Rational Lloyd Davies with a rainfall intensity of 50mm/hr. For greater flows - special design / construction required.

In-Line SurfSep Units (SWI)

These units are used with in the drainage system in-line and are supplied as BBA Approved complete Polyethylene Chamber units from the selection table above.

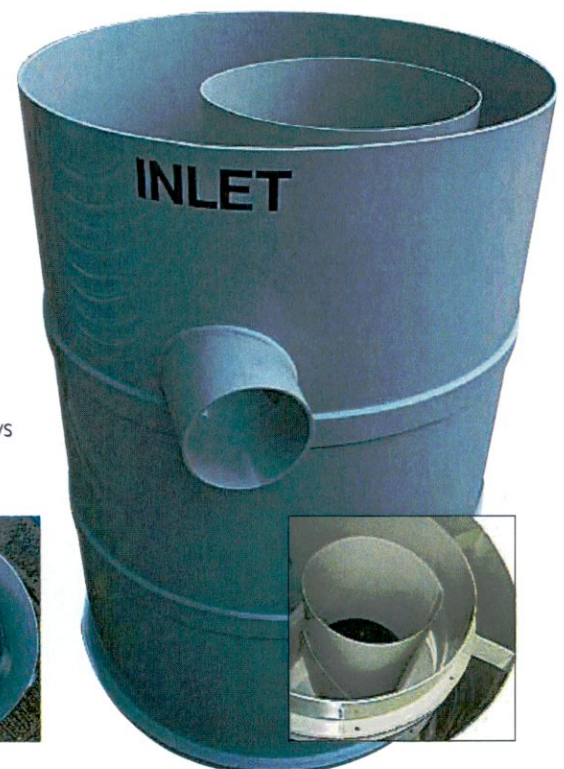
Off-Line SurfSep Units (SWO)

These can be designed either using pre-cast concrete or specially designed Polyethylene chambers.

Model Designation

SurfSep models are firstly identified by the letters SW for Surface Water followed by a letter (I or O) representing the configuration (In-line or Off-line).

A four digit number representing the screen diameter and screen height then follows to give the standard model designation for a SurfSep screen for installation into standard commercially available pre-fabricated manhole chambers i.e SWI 0806. Example: SWI 0806 designates Surface Water In-line with a separation screen dia 0.8 m and screen height of 0.6m.



Surface Water Treatment

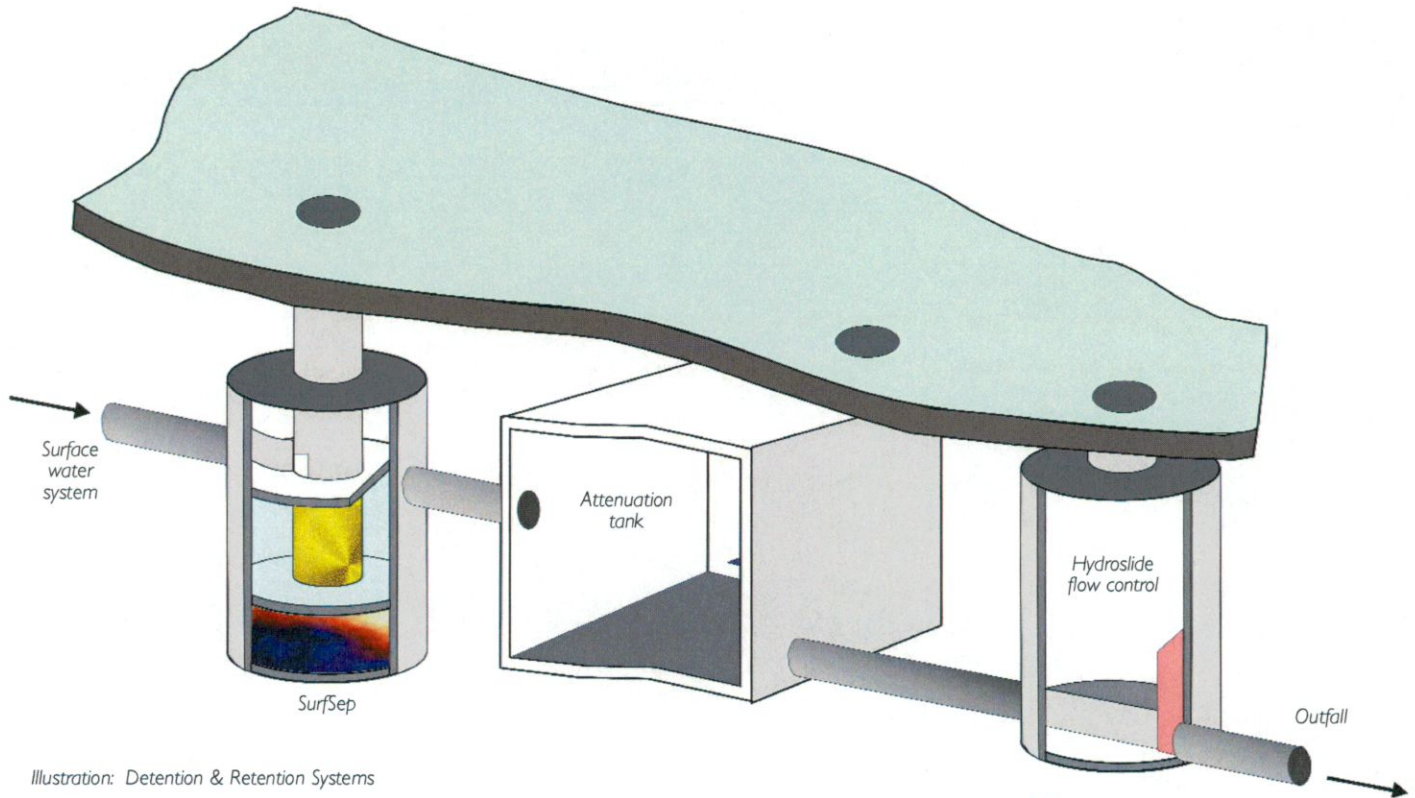


Illustration: Detention & Retention Systems

SurfSep's unit installed in front of attenuation tank / cellular storage system, to remove grit, fine sediments and floating debris which can accumulate within surface water systems. Hydroslide flow control regulating the discharge to the outfall. The Hydroslide can be supplied for installation in an insitu constructed chamber, or as a complete unit housed within a pre-fabricated polyethylene manhole chamber.



* BBA - THIS CERTIFICATE RELATES TO PIPEX UNIVERSAL MANHOLES AND ACCESS CHAMBERS, WHICH ARE MANUFACTURED FROM WELDED POLYPROPYLENE. This Certificate covers the use of the manholes and chambers for drain and sewer applications where they are used for maintenance to depths of 6 mtrs.

Approved Suppliers

If you would like more information please contact:

CDS Technologies is a multi disciplined, international, company offering a comprehensive product range of; wastewater treatment technologies and processes, and stormwater management solutions for attenuation, infiltration, flow control and overflow treatment. CDS have an established network of Distributors and Representatives. Further information can be found on our website www.cdstech.com.au

Alternatively please contact our approved supplier detailed left.

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.

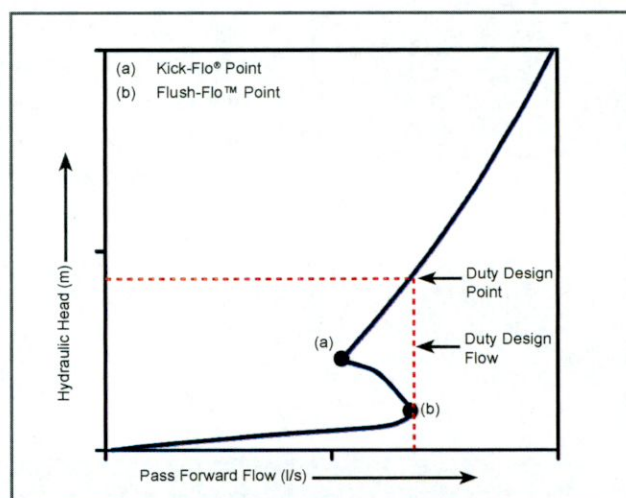
The information provided here is intended for the purposes of general guidance only - individual application requirements may differ. If in doubt, or to enquire about new product additions, please contact HRD Technologies Ltd.



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:

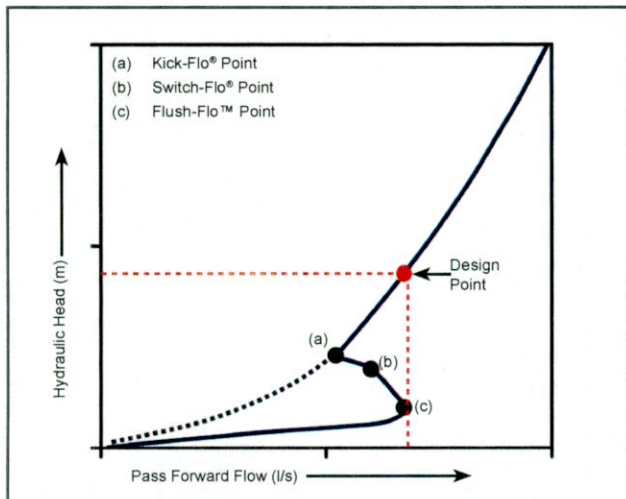
- outlet size and model of Hydro-Brake® Flow Control
- definition of the duty/design point (head and flow)
- definition of the Flush-Flo™ point (head and flow)
- definition of the Kick-Flo® point (head and flow)

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

STH Type Hydro-Brake® Flow Control with BBA Approval

Now included in WinDes® 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.



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 WinDes® 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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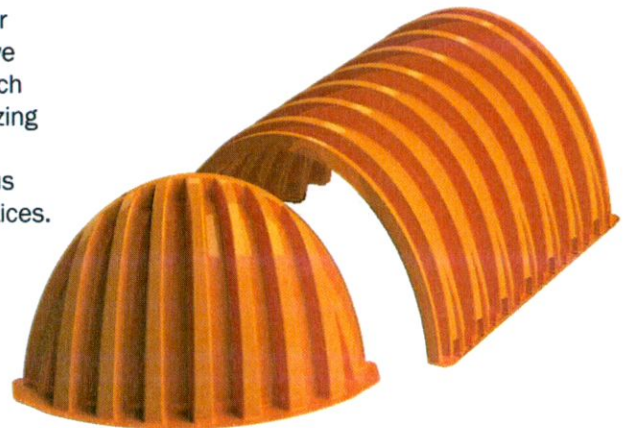
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STORMTECH MC-3500 CHAMBER

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots, thus maximizing land usage for private (commercial) and public applications. StormTech chambers can also be used in conjunction with Green Infrastructure, thus enhancing the performance and extending the service life of these practices.



STORMTECH MC-3500 CHAMBER

(not to scale)

Nominal Chamber Specifications

Size (L x W x H)

90" x 77" x 45"

2,286 mm x 1,956 mm x 1,143 mm

Chamber Storage

109.9 ft³ (3.11 m³)

Min. Installed Storage*

175.0 ft³ (4.96 m³)

Weight

134 lbs (60.8 kg)

Shipping

15 chambers/pallet

7 end caps/pallet

7 pallets/truck

*Assumes a minimum of 12" (300 mm) of stone above, 9" (230 mm) of stone below chambers, 6" (150 mm) of stone between chambers/end caps and 40% stone porosity.

STORMTECH MC-3500 END CAP

(not to scale)

Nominal End Cap Specifications

Size (L x W x H)

26.5" x 71" x 45.1"

673 mm x 1,803 mm x 1,145 mm

End Cap Storage

14.9 ft³ (0.42 m³)

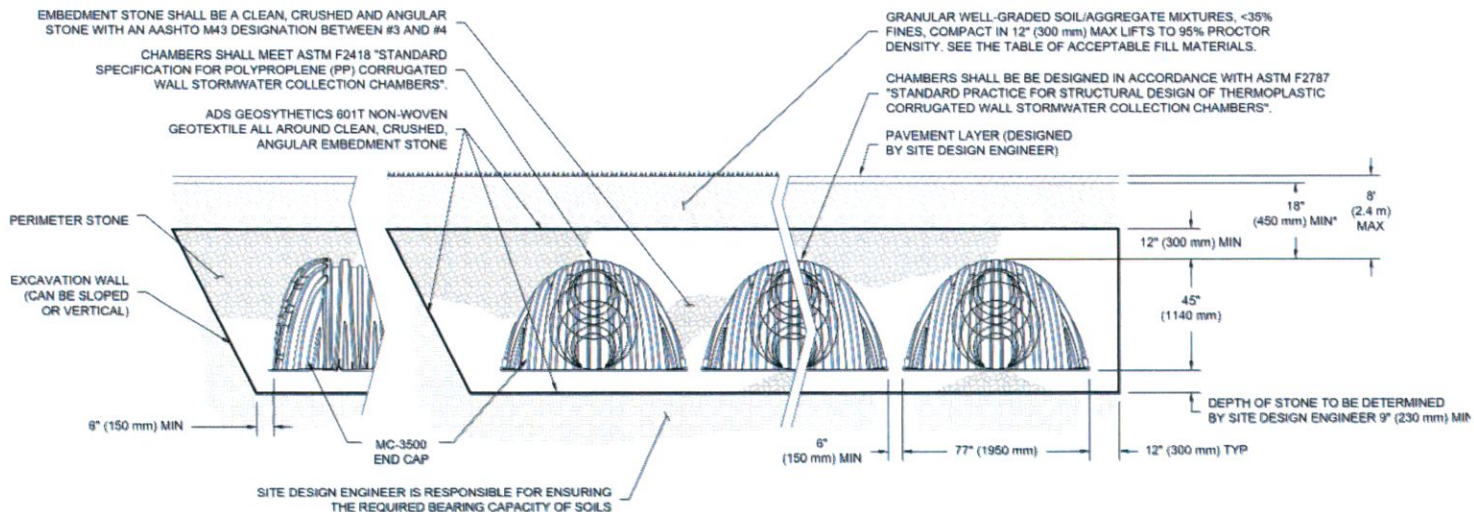
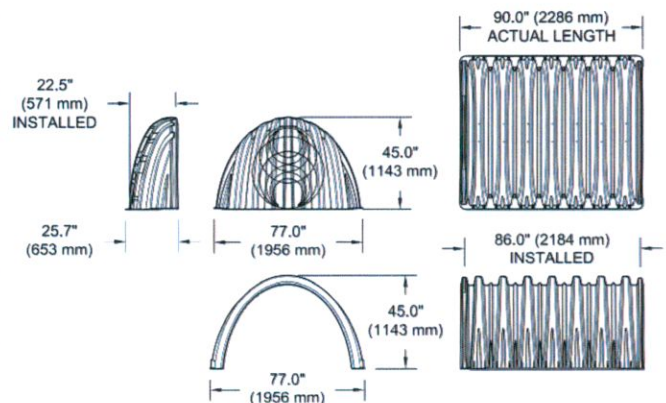
Min. Installed Storage*

45.1 ft³ (1.28 m³)

Weight

49 lbs (22.2 kg)

*Assumes a minimum of 12" (300 mm) of stone above, 9" (230 mm) of stone below, 6" (150 mm) of stone perimeter, 6" (150 mm) of stone between chambers/end caps and 40% stone porosity.



*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 24" (600 mm).

MC-3500 CHAMBER SPECIFICATION

STORAGE VOLUME PER CHAMBER FT³ (M³)

	Bare Chamber Storage ft ³ (m ³)	Chamber and Stone Foundation Depth in. (mm)			
		9" (230 mm)	12" (300 mm)	15" (375 mm)	18" (450 mm)
MC-3500 Chamber	109.9 (3.11)	175.0 (4.96)	179.9 (5.09)	184.9 (5.24)	189.9 (5.38)
MC-3500 End Cap	14.9 (.42)	45.1 (1.28)	46.6 (1.32)	48.3 (1.37)	49.9 (1.41)

Note: Assumes 6" (150 mm) row spacing, 40% stone porosity, 12" (300 mm) stone above and includes the bare chamber/end cap volume.

AMOUNT OF STONE PER CHAMBER

ENGLISH TONS (yds ³)	Stone Foundation Depth			
	9"	12"	15"	18"
MC-3500 Chamber	8.5 (6.0)	9.1 (6.5)	9.7 (6.9)	10.4 (7.4)
MC-3500 End Cap	3.9 (2.8)	4.1 (2.9)	4.3 (3.1)	4.5 (3.2)
METRIC KILOGRAMS (m ³)	230 mm	300 mm	375 mm	450 mm
MC-3500 Chamber	7711 (4.6)	8255 (5.0)	8800 (5.3)	9435 (5.7)
MC-3500 End Cap	3538 (2.1)	3719 (2.2)	3901 (2.4)	4082 (2.5)

Note: Assumes 12" (300 mm) of stone above and 6" (150 mm) row spacing and 6" (150 mm) of perimeter stone in front of end caps.

VOLUME EXCAVATION PER CHAMBER YD³ (M³)

	Stone Foundation Depth			
	9" (230 mm)	12" (300 mm)	15" (375mm)	18" (450 mm)
MC-3500 Chamber	11.9 (9.1)	12.4 (9.5)	12.8(9.8)	13.3 (10.2)
MC-3500 End Cap	4.0 (3.1)	4.1 (3.2)	4.3 (3.3)	4.4 (3.4)

Note: Assumes 6" (150 mm) of separation between chamber rows and 24" (600 mm) of cover. The volume of excavation will vary as depth of cover increases.



Working on a project?
Visit us at www.stormtech.com
and utilize the StormTech Design Tool

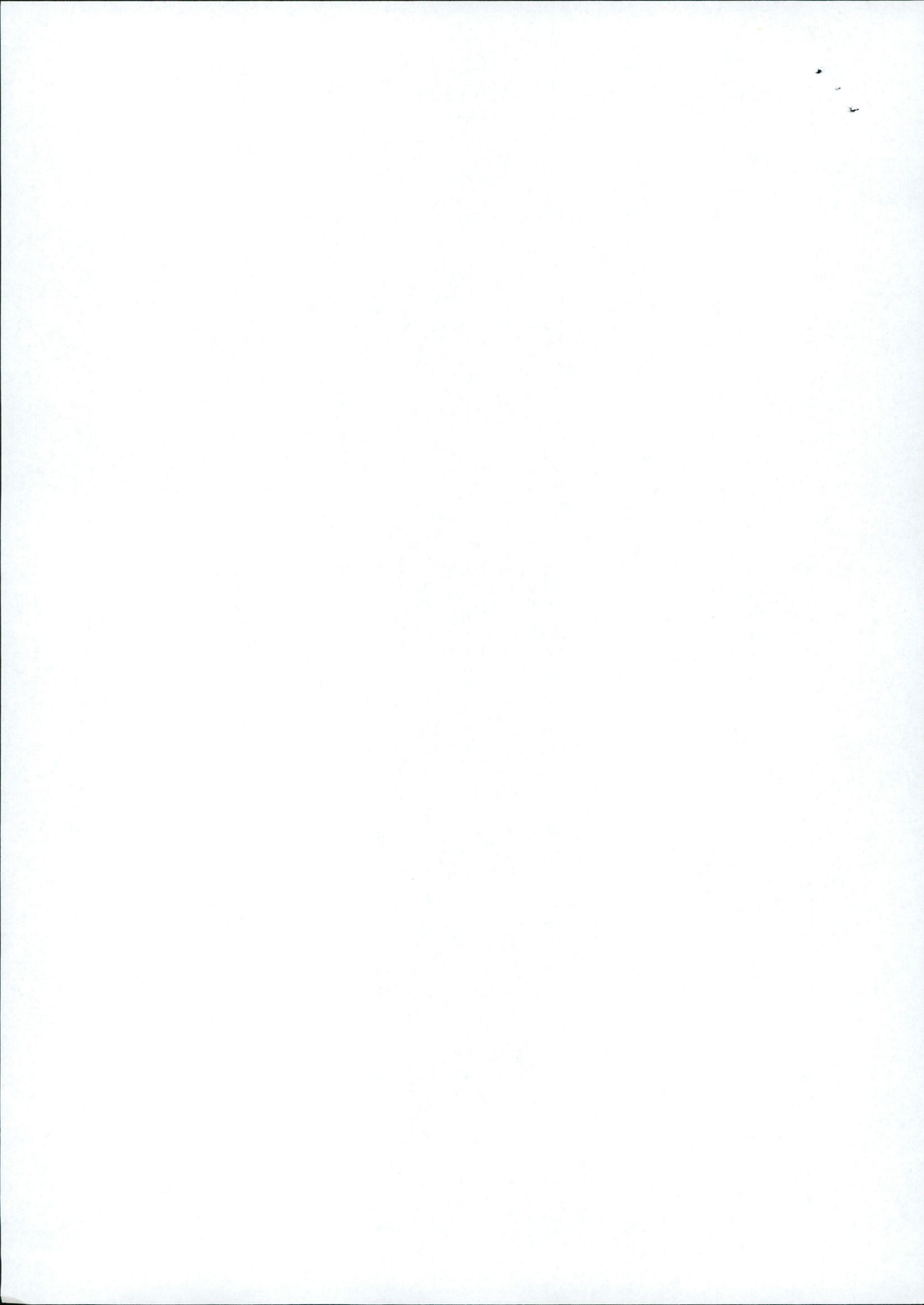
For more information on the StormTech MC-3500 Chamber and other ADS products, please contact our Customer Service Representatives at 1-800-821-6710

THE MOST **ADVANCED** NAME IN WATER MANAGEMENT SOLUTIONS®

Advanced Drainage Systems, Inc.
4640 Trueman Blvd., Hilliard, OH 43026
1-800-821-6710 www.ads-pipe.com

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Discharge Units Calculation



INPUT FOR FOUL SEWER NETWORK DESIGN

Client: ROCKFACE DEVELOPMENTS LTD
Project: WAREHOUSE DEVELOPMENT AT KINGSWOOD ROAD,
CITYWEST BUSINESS CAMPUS,
DUBLIN 24

Project Ref: **D1736 PL1 - OFFICE BLOCK & WAREHOUSE TOILET BLOCK**

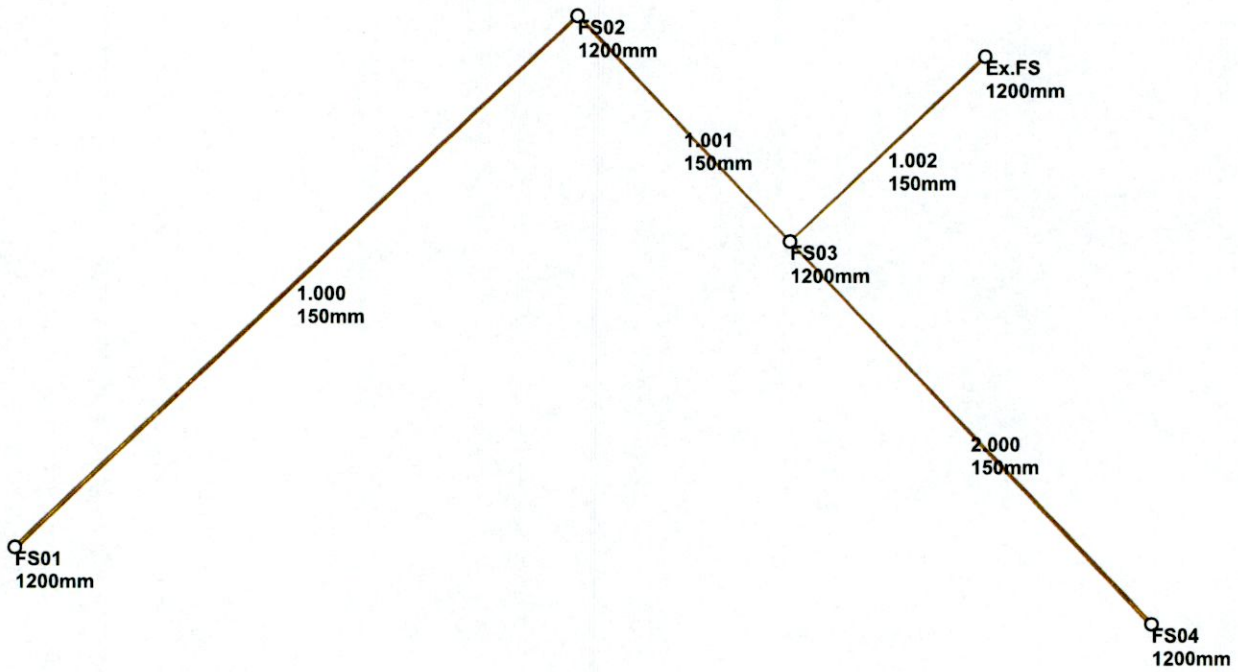
Floors	Type of Appliance	Discharge Unit per Appliance	No of Applie.	Discharge Units
OFFICE/STAFF FACILITIES				
GROUND FLOOR PLAN:	WB	0.6	10	6.0
	WC	2.5	10	25.0
	URINAL	0.8	3	2.4
	SINK	1.3	2	2.6
	DISHWASHER	0.8	2	1.6
	SHOWER	0.6	2	1.2
	TOTAL:			
FIRST FLOOR PLAN:	WB	0.6	7	4.2
	WC	2.5	7	17.5
	URINAL	0.8	3	2.4
	SINK	1.3	1	1.3
	DISHWASHER	0.8	1	0.8
	TOTAL:			
SECOND FLOOR PLAN:	WB	0.6	7	4.2
	WC	2.5	7	17.5
	URINAL	0.8	3	2.4
	SINK	1.3	1	1.3
	DISHWASHER	0.8	1	0.8
	TOTAL:			
TOTAL NO OF DICHARGE UNITS FOR OFFICE BLOCK 2:				91
<i>Q (l/sec) =</i>				6.68
WAREHOUSE TOILET BLOCK				
GROUND FLOOR PLAN:	WB	0.6	10	6.0
	WC	2.5	6	15.0
	URINAL	0.8	5	4.0
TOTAL NO OF DICHARGE UNITS FOR 1 NO WAREHOUSE TOILET BLOCK:				25
<i>Q (l/sec) =</i>				3.50

NOTE:

Discharge units calculated as per Table C.2. Typical values of discharge units of BS EN 752-4.
Typical frequency factors are taken from Table C.1. ($k_{DU}=0.7$)
Design flow rate is given by the equation: $Q = k_{DU} \sqrt{\sum DU}$

3
4
5

Foul Sewer Network Design



Design Settings

Frequency of use (kDU)	0.70	Additional Flow (%)	0	Preferred Cover Depth (m)	1.200
Flow per dwelling per day (l/day)	2700	Minimum Velocity (m/s)	0.75	Include Intermediate Ground	✓
Domestic Flow (l/s/ha)	0.0	Connection Type	Level Soffits		
Industrial Flow (l/s/ha)	0.0	Minimum Backdrop Height (m)	0.200		

Nodes

Name	Units	Cover Level (m)	Manhole Type	Depth (m)
FS01	25.0	98.200	Adoptable	1.000
FS02		97.850	Adoptable	1.550
FS03		97.950	Adoptable	2.050
FS04	91.0	98.350	Adoptable	1.350
Ex.FS		97.700	Adoptable	2.050

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	Link Type
1.000	FS01	FS02	75.000	1.500	97.200	96.300	0.900	83.3	150	Circular
1.001	FS02	FS03	30.000	1.500	96.300	95.900	0.400	75.0	150	Circular
2.000	FS04	FS03	51.000	1.500	97.000	96.400	0.600	85.0	150	Circular
1.002	FS03	Ex.FS	26.028	1.500	95.900	95.650	0.250	104.1	150	Circular




Name	US Node	DS Node	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Maximum Depth (m)	Σ Area (ha)	Σ Units (ha)	Σ Add Inflow (ha)	Pro Velocity (m/s)
1.000	FS01	FS02	17.0	3.5	0.850	1.400	1.400	0.000	25.0	0.0	0.756
1.001	FS02	FS03	17.9	3.5	1.400	1.900	1.900	0.000	25.0	0.0	0.780
2.000	FS04	FS03	16.8	6.7	1.200	1.400	1.400	0.000	91.0	0.0	0.896
1.002	FS03	Ex.FS	15.2	7.5	1.900	1.900	1.900	0.000	116.0	0.0	0.857

Pipeline Schedule



Link	Length (m)	Slope (1:X)	Dia (mm)	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	75.000	83.3	150	98.200	97.200	0.850	97.850	96.300	1.400
1.001	30.000	75.0	150	97.850	96.300	1.400	97.950	95.900	1.900
2.000	51.000	85.0	150	98.350	97.000	1.200	97.950	96.400	1.400
1.002	26.028	104.1	150	97.950	95.900	1.900	97.700	95.650	1.900

Link
1.000
1.001
2.000
1.002

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
FS01	705323.501	728418.062	98.200	1.000	1200				
						0	1.000	97.200	150
FS02	705378.133	728469.446	97.850	1.550	1200		1	1.000	96.300
						0	1.001	96.300	150
FS03	705398.696	728447.602	97.950	2.050	1200		1	2.000	96.400
						2	1.001	95.900	150
						0	1.002	95.900	150

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
FS04	705433.653	728410.467	98.350	1.350	1200					
							0	2.000	97.000	150
Ex.FS	705417.628	728465.463	97.700	2.050	1200		1	1.002	95.650	150