KAVANAGH BURKE
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Drainage Design Report

for

Warehouse Development

at

Magna Avenue,
Magna Business Park,
Dublin 24

Job No:	**D1720**
Client:	**Rockface Developments Ltd.**
Date:	**17th February 2022**
Local Authority:	**South Dublin County Council**
Revision:	**Planning**
	PL1

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Contents:

Introduction.

Rockface Developments Limited intend to apply for permission for development at this 3.03 Ha site at Magna Avenue and Magna Drive, Citywest, Dublin 24. The lands are bounded to the south by Magna Avenue, to the north and west by Magna Drive, and to the east by development within Manga Business Park. The building will have a maximum height of 15.5 m with a gross floor area of 13,604 sq m including a warehouse area (12,568 sq m), staff facilities (498 sq m) and ancillary office (538 sq m).

The development will also include: a vehicular and pedestrian entrance to the site from Magna Avenue, a separate HGV entrance from Magna Drive; 67 No. ancillary car parking spaces; covered bicycle parking; HGV Parking and yards; level access goods doors; dock levellers; access gates; signage; hard and soft landscaping; lighting; boundary treatments; ESB substation; sprinkler tank and pump house; and all associated site development works above and below ground.

The site will be serviced primarily through 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, and for the same purpose grasscrete surfacing is provided for the fire tender access road.

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" (GDSDS) 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 GDSDS 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 GDSDS). All flows and runoffs for storm water network design and attenuation sizing are calculated incorporating 20% climate change factor for all rainfall intensities as per chapter 6.3.2.4 of GDSDS 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 from the last surface water manhole. The discharge from sites, i.e. the restricted flow from the flow control device will ultimately discharge to an existing surface water manhole located to the northern site's boundary at the foopaths of Magna Drive, as shown at the accompanying drawing reference *D1720 D3 Drainage and Watermain Layout*.

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 *D1720 D3 Drainage and Watermain Layout*) 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:

- Permeable paving.
- Grasscrete.
- Restricted discharge.
- Silt trap and petrol interceptor

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 more recent developments of South Dublin area where many individual sites have been developed in a similar nature.

In summary, the following figures synopsise the surface water attenuation calculations:

SITE AREA	30,340 m^2 (3.03 Ha)
SAAR	839
SOIL VALUE	0.3

STRUCTURE TYPE	RUNOFF COEFFICIENTS	AREA (ha)
Impermeable Areas *(Buildings; Concrete Yard/Road; Pathways; Permeable paving)*	1.0	2.41
Landscaping	0.3	0.62
TOTAL	-	3.03

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 *D1720 D3 Drainage & Watermain Layout*) for review by the Local Authority.

Foul Sewer:

A new foul sewer has been designed to collect discharge from the proposed development and discharge to the existing foul sewer network at Magna Drive. This proposed network collects the sewage on site from the proposed unit and ancillary office/staff facilities. Connection to the existing foul sewer network is proposed to the eastern site boundary at the existing foul sewer manhole at the footpaths of Magna Drive.

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 for 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 150mm watermain on site, at Manga Avenue, the exact connection locations shown on accompanying drawing reference *D1720 D3 Drainage and Watermain Layout*.

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 reference *D1720 D3 Drainage and Watermain Layout*.

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Surface Water Attenuation Design

Surface Water Attenuation Calculation

1) Areas for Attenuation Calculation

Site Area of development:	30,340 m^2 (3.03 Ha)
Overall landscaping:	6,240 m^2
Contributing Landscaping:	6,240 m^2
Impermeable Areas (roof, concrete yard):	23,200 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: 23,962 m^2 x 0.80 = 19,169.6 m^2

Total volume for 5mm rainfall: 5mm x 19,169.6 m^2 = **95.9 m^3**

Therefore, a minimum Interception Storage volume of 96 m^3 should be provided. This will prevent discharge from site during rainfall events of up to 5mm rainfall.

3) Greenfield Runoff Rate – QBAR, (mean annual flood flow):

$Q_{BARrural}$ (m^3/sec) = 0.00108 x $AREA^{0.89}$ x $SAAR^{1.17}$ x $SOIL^{2.17}$

SAAR (E 305630, N 226640): 839 mm (*as per Met Eireann data*)

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

Soil = 0.1($Soil_1$) + 0.3($Soil_2$) + 0.37($Soil_3$) + 0.47($Soil_4$) + 0.53($Soil_5$)
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: $Soil_2$
Runoff Potential: Low
Soil Value: 0.3

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

Q_{BAR} (m^3/sec) = 0.00108 x $AREA^{0.89}$ x $SAAR^{1.17}$ x $SOIL^{2.17}$ =
0.00108 x $(0.5)^{0.89}$ x $(780)^{1.17}$ x $(0.3)^{2.17}$ =
112.63 l/sec =
2.25 l/sec/ha

Q_{BAR} for the subject site area:

2.25 l/sec/ha x 3.03ha =
Q_{BAR} = 6.83 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 l/sec/ha x 3.02 ha = 6.04 l/sec.

Therefore allowable discharge (Q_{BAR}) will be set at **6.83 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.

Equivalent Runoff Area: 100% x 23,962 m^2 = 23,962 m^2

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 2,632 m^3 - (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	23962,00	18,50	20,35	487.63	6.15	481.48
30 min	23962,00	24,30	26,73	640.50	12.30	628.20
1 hour	23962,00	32,00	35,2	843.46	24.60	818.86
2 hour	23962,00	42,20	46,42	1112.32	49.21	1063.11
4 hour	23962,00	55,60	61,16	1465.52	98.42	1367.10
6 hour	23962,00	65,30	71,83	1721.19	147.63	1573.57
12 hour	23962,00	86,20	94,82	2272.08	295.25	1976.83
1 day	23962,00	113,70	125,07	2996.93	590.50	2406.43
2 day	23962,00	127,60	140,36	3363.31	1181.00	2182.30

Critical Attenuation Volume = 2,406.43 m^3

Subtract Interception Storage: 2,406.43 m^3 - 95.85 m^3= **2,310.58 m^3 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 GDSDS 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.

Equivalent Runoff Area:	100% x 23,962 m^2 + 30% x 6,325 m^2 =
	= 23,962 m^2 + 1,897.5 m^2 =
	= **25,859.5 m^2**

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: 91.4 mm
Factor up by 10% for climate change: 100.54 mm

Total Volume of Runoff:	100.54mm x 25,859 m^2	=	2,599.9 m^3
Deduct discharge at Q_{BAR} for 6hrs:	6.83 l/sec x 6 hrs	=	147.6 m^3
Storage volume required:	2,599.9 – 147.6	=	2,452.3 m^3
Deduct Interception Storage:	95.4 m^3		
Deduct Attenuation Storage:	2,299.1 m^3		
Temporary Flood Storage required:	2,441.5 – 95.85 – 2,310.6	=	45.9 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: 96 m³ to be provided by a lowered base to the attenuation system. Attenuation System Area: 2,200m². Therefore, the Interception Storage Depth will equal 100 mm. 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: 2,311 m³ to be provided within the attenuation system on site.

TEMPORARY FLOOD STORAGE: 46 m³ to be provided within the attenuation system on site.

ATTENUATION VOLUME REQUIRED: 2,453 m³

ATTENUATION VOLUME PROVIDED: 2,460 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.

Project: D1720

Chamber Model -	MC-3500	
Units -	Metric	Click Here for Imperial
Number of Chambers -	464	
Number of End Caps -	30	
Voids in the stone (porosity) -	43	%
Base of Stone Elevation -	117.90	m
Amount of Stone Above Chambers -	305	mm
Amount of Stone Below Chambers -	230	mm
Area of system -	2262	sq.meters

Min. Area - 2261.6 sq.meters

StormTech Detention • Retention • Water Quality

A division of ADS

☑ Include Perimeter Stone in Calculations

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	24.693	24.69	2460.75	119.58
1651	0.00	0.00	0.00	0.00	24.693	24.69	2436.06	119.55
1626	0.00	0.00	0.00	0.00	24.693	24.69	2411.36	119.53
1600	0.00	0.00	0.00	0.00	24.693	24.69	2386.67	119.50
1575	0.00	0.00	0.00	0.00	24.693	24.69	2361.98	119.47
1549	0.00	0.00	0.00	0.00	24.693	24.69	2337.28	119.45
1524	0.00	0.00	0.00	0.00	24.693	24.69	2312.59	119.42
1499	0.00	0.00	0.00	0.00	24.693	24.69	2287.90	119.40
1473	0.00	0.00	0.00	0.00	24.693	24.69	2263.20	119.37
1448	0.00	0.00	0.00	0.00	24.693	24.69	2238.51	119.35
1422	0.00	0.00	0.00	0.00	24.693	24.69	2213.82	119.32
1397	0.00	0.00	0.00	0.00	24.693	24.69	2189.12	119.30
1372	0.00	0.00	0.76	0.00	24.365	25.13	2164.43	119.27
1346	0.01	0.00	2.55	0.01	23.593	26.15	2139.30	119.25
1321	0.01	0.00	3.86	0.01	23.029	26.90	2113.15	119.22
1295	0.01	0.00	5.30	0.02	22.405	27.73	2086.25	119.20
1270	0.02	0.00	9.03	0.03	20.796	29.86	2058.53	119.17
1245	0.03	0.00	13.51	0.04	18.865	32.42	2028.67	119.14
1219	0.04	0.00	16.42	0.06	17.608	34.09	1996.25	119.12
1194	0.04	0.00	18.69	0.08	16.625	35.39	1962.16	119.09
1168	0.04	0.00	20.67	0.08	15.769	36.52	1926.77	119.07
1143	0.05	0.00	22.43	0.10	15.004	37.54	1890.25	119.04
1118	0.05	0.00	24.02	0.12	14.311	38.46	1852.71	119.02
1092	0.05	0.00	25.46	0.14	13.687	39.28	1814.26	118.99
1067	0.06	0.01	26.81	0.15	13.097	40.06	1774.98	118.97
1041	0.06	0.01	28.05	0.17	12.559	40.78	1734.91	118.94
1016	0.06	0.01	29.22	0.18	12.050	41.45	1694.13	118.92
991	0.07	0.01	30.31	0.20	11.572	42.09	1652.68	118.89
965	0.07	0.01	31.33	0.22	11.125	42.68	1610.60	118.87
940	0.07	0.01	32.31	0.23	10.701	43.24	1567.92	118.84
914	0.07	0.01	33.22	0.25	10.303	43.77	1524.68	118.81
889	0.07	0.01	34.08	0.27	9.922	44.27	1480.91	118.79
864	0.08	0.01	34.90	0.28	9.566	44.74	1436.63	118.76
838	0.08	0.01	35.67	0.30	9.225	45.20	1391.89	118.74
813	0.08	0.01	36.41	0.31	8.901	45.63	1346.69	118.71
787	0.08	0.01	37.11	0.33	8.592	46.04	1301.07	118.69
762	0.08	0.01	37.78	0.35	8.298	46.43	1255.03	118.66
737	0.08	0.01	38.42	0.37	8.015	46.80	1208.60	118.64
711	0.08	0.01	39.02	0.38	7.749	47.15	1161.80	118.61
686	0.09	0.01	39.58	0.39	7.505	47.48	1114.65	118.59
660	0.09	0.01	40.12	0.41	7.267	47.79	1067.17	118.56
635	0.09	0.01	40.66	0.42	7.032	48.10	1019.38	118.54
610	0.09	0.01	41.13	0.43	6.820	48.39	971.27	118.51
584	0.09	0.01	41.59	0.44	6.618	48.65	922.89	118.48
559	0.09	0.02	42.04	0.46	6.420	48.92	874.23	118.46
533	0.09	0.02	42.45	0.46	6.241	49.15	825.32	118.43
508	0.09	0.02	42.85	0.48	6.062	49.39	776.16	118.41
483	0.09	0.02	43.23	0.48	5.896	49.61	726.77	118.38
457	0.09	0.02	43.60	0.49	5.735	49.82	677.16	118.36

432	0.09	0.02	43.94	0.49	5.588	50.02	627.34	118.33
406	0.10	0.02	44.26	0.51	5.442	50.21	577.32	118.31
381	0.10	0.02	44.57	0.51	5.307	50.39	527.11	118.28
356	0.10	0.02	44.86	0.52	5.179	50.56	476.72	118.26
330	0.10	0.02	45.16	0.52	5.052	50.73	426.16	118.23
305	0.10	0.02	45.43	0.53	4.931	50.89	375.43	118.20
279	0.10	0.02	45.71	0.54	4.809	51.05	324.54	118.18
254	0.10	0.02	46.05	0.54	4.660	51.25	273.49	118.15
229	0.00	0.00	0.00	0.00	24.693	24.69	222.24	118.13
203	0.00	0.00	0.00	0.00	24.693	24.69	197.55	118.10
178	0.00	0.00	0.00	0.00	24.693	24.69	172.85	118.08
152	0.00	0.00	0.00	0.00	24.693	24.69	148.16	118.05
127	0.00	0.00	0.00	0.00	24.693	24.69	123.47	118.03
102	0.00	0.00	0.00	0.00	24.693	24.69	98.77	118.00
76	0.00	0.00	0.00	0.00	24.693	24.69	74.08	117.98
51	0.00	0.00	0.00	0.00	24.693	24.69	49.39	117.95
25	0.00	0.00	0.00	0.00	24.693	24.69	24.69	117.93

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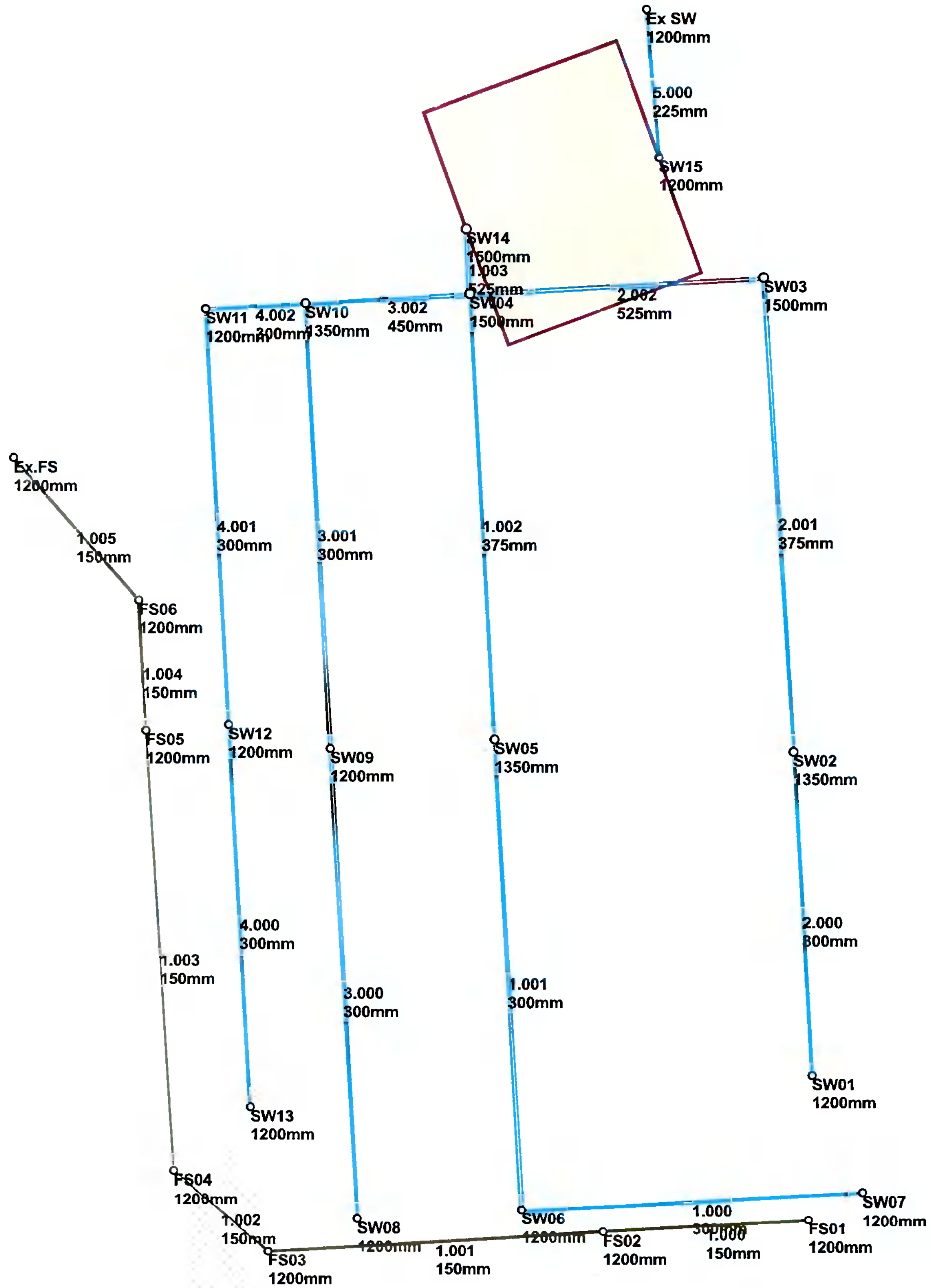
Surface Water Network Design

KAVANAGH BURKE CONSULTING ENGINEERS	Kavanagh Burke Unit F3 Block F, Calmount Park, Ballymount, Dublin 12, D12PX28	File: D1720 - SW & FS Networks Network: SURFACE WATER Elena Dragoje 26/01/2022	Page 1 Surface Water Network Design: PL 1



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)	18.400	Minimum Backdrop Height (m)	1.000
Ratio-R	0.234	Preferred Cover Depth (m)	1.200
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	0.350	5.00	122.720	1200	1.620
SW02	0.326	5.00	122.350	1350	1.700
SW03	0.290	5.00	120.000	1500	1.450
SW04			120.600	1500	2.250
SW05	0.205	5.00	122.800	1350	2.875
SW06	0.255	5.00	122.500	1200	1.500
SW07	0.150	5.00	123.700	1200	1.500
SW08	0.320	5.00	122.500	1200	1.700
SW09	0.205	5.00	122.800	1200	2.600
SW10			121.050	1350	2.000
SW11			121.250	1200	1.850
SW12	0.100	5.00	122.800	1200	2.250
SW13	0.120	5.00	122.800	1200	1.600
SW14			121.625	1500	3.695
SW15		5.00	120.000	1200	2.100
Ex SW			119.260	1200	1.480

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)
1.000	SW07	SW06	58.000	0.600	122.200	121.000	1.200	48.3	300	Circular	5.43	49.5
1.001	SW06	SW05	80.001	0.600	121.000	120.000	1.000	80.0	300	Circular	6.18	47.1
1.002	SW05	SW04	75.048	0.600	119.925	119.000	0.925	81.1	375	Circular	6.81	45.4
2.000	SW01	SW02	54.997	0.600	121.100	120.725	0.375	146.7	300	Circular	5.71	48.6
2.001	SW02	SW03	80.000	0.600	120.650	118.700	1.950	41.0	375	Circular	6.18	47.2
2.002	SW03	SW04	50.000	0.600	118.550	118.350	0.200	250.0	525	Circular	6.77	45.5
3.000	SW08	SW09	80.000	0.600	120.800	120.200	0.600	133.3	300	Circular	5.98	47.7
3.001	SW09	SW10	75.000	0.600	120.200	119.200	1.000	75.0	300	Circular	6.67	45.8
4.000	SW13	SW12	65.000	0.600	121.200	120.550	0.650	100.0	300	Circular	5.69	48.6
4.001	SW12	SW11	70.000	0.600	120.550	119.850	0.700	100.0	300	Circular	6.43	46.5
4.002	SW11	SW10	17.000	0.600	119.400	119.200	0.200	85.0	300	Circular	6.60	46.0
3.002	SW10	SW04	28.000	0.600	119.050	118.600	0.450	62.2	450	Circular	6.85	45.3
1.003	SW04	SW14	10.952	0.600	118.350	118.250	0.100	109.5	525	Circular	6.93	45.1
5.000	SW15	Ex SW	25.000	0.600	117.900	117.780	0.120	208.3	225	Circular	5.46	49.3

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)
1.000	SW07	SW06	160.2	20.1	1.200	1.200	1.200	0.150	0.0	1.563
1.001	SW06	SW05	124.3	51.8	1.200	2.500	2.500	0.405	0.0	1.682
1.002	SW05	SW04	222.3	75.1	2.500	1.225	2.500	0.610	0.0	1.823
2.000	SW01	SW02	91.6	46.1	1.320	1.325	1.325	0.350	0.0	1.297
2.001	SW02	SW03	313.2	86.4	1.325	0.925	1.325	0.676	0.0	2.439
2.002	SW03	SW04	305.6	119.3	0.925	1.725	1.725	0.966	0.0	1.328
3.000	SW08	SW09	96.1	41.4	1.400	2.300	2.300	0.320	0.0	1.310
3.001	SW09	SW10	128.4	65.2	2.300	1.550	2.300	0.525	0.0	1.824
4.000	SW13	SW12	111.1	15.8	1.300	1.950	1.950	0.120	0.0	1.122
4.001	SW12	SW11	111.1	27.7	1.950	1.100	1.950	0.220	0.0	1.312
4.002	SW11	SW10	120.6	27.4	1.550	1.550	1.550	0.220	0.0	1.390
3.002	SW10	SW04	410.4	91.5	1.550	1.550	1.550	0.745	0.0	2.095
1.003	SW04	SW14	463.2	283.8	1.725	2.850	2.850	2.321	0.0	2.242
5.000	SW15	Ex SW	35.9	0.0	1.875	1.255	1.875	0.000	0.0	0.000

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	58.000	48.3	300	123.700	122.200	1.200	122.500	121.000	1.200
1.001	80.001	80.0	300	122.500	121.000	1.200	122.800	120.000	2.500
1.002	75.048	81.1	375	122.800	119.925	2.500	120.600	119.000	1.225
2.000	54.997	146.7	300	122.720	121.100	1.320	122.350	120.725	1.325
2.001	80.000	41.0	375	122.350	120.650	1.325	120.000	118.700	0.925
2.002	50.000	250.0	525	120.000	118.550	0.925	120.600	118.350	1.725
3.000	80.000	133.3	300	122.500	120.800	1.400	122.800	120.200	2.300
3.001	75.000	75.0	300	122.800	120.200	2.300	121.050	119.200	1.550
4.000	65.000	100.0	300	122.800	121.200	1.300	122.800	120.550	1.950
4.001	70.000	100.0	300	122.800	120.550	1.950	121.250	119.850	1.100
4.002	17.000	85.0	300	121.250	119.400	1.550	121.050	119.200	1.550
3.002	28.000	62.2	450	121.050	119.050	1.550	120.600	118.600	1.550
1.003	10.952	109.5	525	120.600	118.350	1.725	121.625	118.250	2.850
5.000	25.000	208.3	225	120.000	117.900	1.875	119.260	117.780	1.255

Link
1.000
1.001
1.002
2.000
2.001
2.002
3.000
3.001
4.000
4.001
4.002
3.002
1.003
5.000

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SW01	705617.416	726607.086	122.720	1.620	1200	0	2.000	121.100	300
SW02	705614.334	726661.997	122.350	1.700	1350	1	2.000	120.725	300
						0	2.001	120.650	375
SW03	705609.340	726741.841	120.000	1.450	1500	1	2.001	118.700	375
						0	2.002	118.550	525
SW04	705559.414	726739.121	120.600	2.250	1500	1	3.002	118.600	450
						2	2.002	118.350	525
						3	1.002	119.000	375
						0	1.003	118.350	525
SW05	705563.570	726664.188	122.800	2.875	1350	1	1.001	120.000	300
						0	1.002	119.925	375
SW06	705568.000	726584.310	122.500	1.500	1200	1	1.000	121.000	300
						0	1.001	121.000	300
SW07	705625.940	726586.958	123.700	1.500	1200	0	1.000	122.200	300

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SW08	705540.040	726582.809	122.500	1.700	1200	0	3.000	120.800	300
SW09	705535.610	726662.686	122.800	2.600	1200	1	3.000	120.200	300
						0	3.001	120.200	300
SW10	705531.457	726737.571	121.050	2.000	1350	1	4.002	119.200	300
						2	3.001	119.200	300
						0	3.002	119.050	450
SW11	705514.483	726736.630	121.250	1.850	1200	1	4.001	119.850	300
						0	4.002	119.400	300
SW12	705518.360	726666.737	122.800	2.250	1200	1	4.000	120.550	300
						0	4.001	120.550	300
SW13	705521.959	726601.837	122.800	1.600	1200	0	4.000	121.200	300
SW14	705558.811	726750.056	121.625	3.695	1500	1	1.003	118.250	525
SW15	705591.529	726762.140	120.000	2.100	1200	0	5.000	117.900	225
Ex SW	705589.394	726787.049	119.260	1.480	1200	1	5.000	117.780	225

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)	18.400	Analysis Speed	Detailed	Check Discharge Rate(s)	x
Ratio-R	0.234	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 SW15 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	118.050	Product Number	CTL-SHE-0114-6800-1530-6800
Design Depth (m)	1.530	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	6.8	Min Node Diameter (mm)	1200

Node SW15 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)	117.900	Main Channel Slope (1:X)	1000.0
Safety Factor	2.0	Time to half empty (mins)		Main Channel n	0.015

Inlets
SW14

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	1450.0	0.0	1.680	1450.0	0.0	1.690	10.0	0.0

<u>Rainfall</u>

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	250.292	70.824	100 year +20% CC 15 minute summer	325.056	91.980
30 year +20% CC 15 minute winter	175.644	70.824	100 year +20% CC 15 minute winter	228.110	91.980
30 year +20% CC 30 minute summer	175.868	49.765	100 year +20% CC 30 minute summer	229.536	64.951
30 year +20% CC 30 minute winter	123.416	49.765	100 year +20% CC 30 minute winter	161.078	64.951
30 year +20% CC 60 minute summer	125.709	33.221	100 year +20% CC 60 minute summer	162.824	43.030
30 year +20% CC 60 minute winter	83.518	33.221	100 year +20% CC 60 minute winter	108.177	43.030
30 year +20% CC 120 minute summer	81.999	21.670	100 year +20% CC 120 minute summer	105.052	27.762
30 year +20% CC 120 minute winter	54.478	21.670	100 year +20% CC 120 minute winter	69.794	27.762
30 year +20% CC 180 minute summer	65.175	16.772	100 year +20% CC 180 minute summer	82.888	21.330
30 year +20% CC 180 minute winter	42.366	16.772	100 year +20% CC 180 minute winter	53.880	21.330
30 year +20% CC 240 minute summer	52.805	13.955	100 year +20% CC 240 minute summer	66.778	17.647
30 year +20% CC 240 minute winter	35.082	13.955	100 year +20% CC 240 minute winter	44.365	17.647
30 year +20% CC 360 minute summer	41.767	10.748	100 year +20% CC 360 minute summer	52.380	13.479
30 year +20% CC 360 minute winter	27.150	10.748	100 year +20% CC 360 minute winter	34.049	13.479
30 year +20% CC 480 minute summer	33.760	8.922	100 year +20% CC 480 minute summer	42.083	11.121
30 year +20% CC 480 minute winter	22.430	8.922	100 year +20% CC 480 minute winter	27.959	11.121
30 year +20% CC 600 minute summer	28.222	7.719	100 year +20% CC 600 minute summer	35.013	9.577
30 year +20% CC 600 minute winter	19.283	7.719	100 year +20% CC 600 minute winter	23.923	9.577
30 year +20% CC 720 minute summer	25.587	6.858	100 year +20% CC 720 minute summer	31.623	8.475
30 year +20% CC 720 minute winter	17.196	6.858	100 year +20% CC 720 minute winter	21.252	8.475
30 year +20% CC 960 minute summer	21.600	5.688	100 year +20% CC 960 minute summer	26.533	6.987
30 year +20% CC 960 minute winter	14.308	5.688	100 year +20% CC 960 minute winter	17.576	6.987
30 year +20% CC 1440 minute summer	16.283	4.364	100 year +20% CC 1440 minute summer	19.821	5.312
30 year +20% CC 1440 minute winter	10.943	4.364	100 year +20% CC 1440 minute winter	13.321	5.312
30 year +20% CC 2160 minute summer	12.100	3.344	100 year +20% CC 2160 minute summer	14.585	4.031
30 year +20% CC 2160 minute winter	8.337	3.344	100 year +20% CC 2160 minute winter	10.049	4.031
30 year +20% CC 2880 minute summer	10.323	2.767	100 year +20% CC 2880 minute summer	12.352	3.311
30 year +20% CC 2880 minute winter	6.937	2.767	100 year +20% CC 2880 minute winter	8.301	3.311
30 year +20% CC 4320 minute summer	8.097	2.117	100 year +20% CC 4320 minute summer	9.588	2.507
30 year +20% CC 4320 minute winter	5.332	2.117	100 year +20% CC 4320 minute winter	6.314	2.507
30 year +20% CC 5760 minute summer	6.840	1.751	100 year +20% CC 5760 minute summer	8.039	2.058
30 year +20% CC 5760 minute winter	4.427	1.751	100 year +20% CC 5760 minute winter	5.203	2.058
30 year +20% CC 7200 minute summer	5.925	1.512	100 year +20% CC 7200 minute summer	6.926	1.767
30 year +20% CC 7200 minute winter	3.824	1.512	100 year +20% CC 7200 minute winter	4.470	1.767

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 99.90%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SW01	11	121.485	0.385	112.8	2.1002	0.0000	SURCHARGED
15 minute winter	SW02	11	120.871	0.221	204.2	1.1616	0.0000	OK
15 minute winter	SW03	11	119.435	0.885	294.6	5.1061	0.0000	SURCHARGED
15 minute winter	SW04	11	119.217	0.867	674.6	1.5318	0.0000	SURCHARGED
15 minute winter	SW05	11	120.198	0.273	186.6	0.7798	0.0000	OK
15 minute winter	SW06	11	121.255	0.255	129.8	1.1547	0.0000	OK
15 minute winter	SW07	10	122.311	0.111	48.3	0.3478	0.0000	OK
15 minute winter	SW08	12	121.319	0.519	103.1	2.5394	0.0000	SURCHARGED
15 minute winter	SW09	12	120.772	0.572	158.1	1.5491	0.0000	SURCHARGED
15 minute winter	SW10	12	119.338	0.288	207.7	0.4119	0.0000	OK
15 minute winter	SW11	11	119.577	0.177	67.7	0.2001	0.0000	OK
15 minute winter	SW12	11	120.723	0.173	70.0	0.3499	0.0000	OK
15 minute winter	SW13	10	121.319	0.119	38.7	0.3141	0.0000	OK
4320 minute winter	SW14	3420	119.205	1.275	45.9	2.2523	0.0000	OK
4320 minute winter	SW15	3420	119.205	1.305	23.7	1.4755	0.0000	SURCHARGED
15 minute summer	Ex SW	1	117.780	0.000	2.7	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	SW02	104.7	1.501	1.143	3.6635	
15 minute winter	SW02	2.001	SW03	203.5	2.661	0.650	7.1070	
15 minute winter	SW03	2.002	SW04	284.9	1.319	0.932	10.8016	
15 minute winter	SW04	1.003	SW14	672.8	3.114	1.453	2.3421	
15 minute winter	SW05	1.002	SW04	185.3	2.239	0.834	6.2333	
15 minute winter	SW06	1.001	SW05	124.4	2.006	1.001	5.2037	
15 minute winter	SW07	1.000	SW06	47.6	1.136	0.297	2.5216	
15 minute winter	SW08	3.000	SW09	92.0	1.435	0.958	5.6335	
15 minute winter	SW09	3.001	SW10	141.5	2.022	1.102	5.1951	
15 minute winter	SW10	3.002	SW04	210.7	2.050	0.513	3.7169	
15 minute winter	SW11	4.002	SW10	67.5	1.667	0.560	0.6886	
15 minute winter	SW12	4.001	SW11	67.7	1.643	0.609	2.8850	
15 minute winter	SW13	4.000	SW12	37.8	1.143	0.340	2.2062	
4320 minute winter	SW14	Flow through pond	SW15	23.7	0.007	0.000	1869.9277	
4320 minute winter	SW15	Hydro-Brake®	Ex SW	6.8				1220.4

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.90%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SW01	11	121.862	0.762	146.5	4.1549	0.0000	SURCHARGED
15 minute winter	SW02	12	121.008	0.358	261.8	1.8849	0.0000	OK
15 minute winter	SW03	11	119.805	1.254	370.7	7.2344	0.0000	FLOOD RISK
4320 minute winter	SW04	3480	119.502	1.152	33.7	2.0359	0.0000	SURCHARGED
15 minute winter	SW05	12	120.301	0.376	221.3	1.0748	0.0000	SURCHARGED
15 minute winter	SW06	12	121.692	0.692	168.7	3.1371	0.0000	SURCHARGED
15 minute winter	SW07	10	122.328	0.128	62.8	0.4018	0.0000	OK
15 minute winter	SW08	12	122.445	1.645	133.9	8.0541	0.0000	FLOOD RISK
15 minute winter	SW09	12	121.674	1.474	177.1	3.9922	0.0000	SURCHARGED
15 minute winter	SW10	11	119.689	0.639	256.5	0.9146	0.0000	SURCHARGED
15 minute winter	SW11	11	119.838	0.438	88.1	0.4958	0.0000	SURCHARGED
15 minute winter	SW12	11	120.758	0.208	91.1	0.4203	0.0000	OK
15 minute winter	SW13	10	121.338	0.138	50.2	0.3636	0.0000	OK
4320 minute winter	SW14	3480	119.502	1.572	43.7	2.7780	0.0000	OK
4320 minute winter	SW15	3480	119.502	1.602	30.3	1.8120	0.0000	SURCHARGED
15 minute summer	Ex SW	1	117.780	0.000	5.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SW01	2.000	SW02	133.5	1.896	1.457	3.8299	
15 minute winter	SW02	2.001	SW03	253.3	2.619	0.809	8.7506	
15 minute winter	SW03	2.002	SW04	360.0	1.667	1.178	10.8016	
4320 minute winter	SW04	1.003	SW14	43.7	1.053	0.094	2.3660	
15 minute winter	SW05	1.002	SW04	216.1	2.196	0.972	8.2750	
15 minute winter	SW06	1.001	SW05	141.6	2.010	1.138	5.6322	
15 minute winter	SW07	1.000	SW06	62.0	1.180	0.387	2.8760	
15 minute winter	SW08	3.000	SW09	104.1	1.479	1.084	5.6335	
15 minute winter	SW09	3.001	SW10	170.9	2.427	1.330	5.2814	
15 minute winter	SW10	3.002	SW04	258.0	2.080	0.629	4.4364	
15 minute winter	SW11	4.002	SW10	87.0	1.640	0.721	1.1971	
15 minute winter	SW12	4.001	SW11	88.1	1.733	0.793	3.5579	
15 minute winter	SW13	4.000	SW12	49.2	1.211	0.443	2.7079	
4320 minute winter	SW14	Flow through pond	SW15	30.3	0.007	0.000	2301.3206	
4320 minute winter	SW15	Hydro-Brake®	Ex SW	6.8				1334.1

KAVANAGH BURKE
CONSULTING ENGINEERS

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: SC-740™ & MC-3500™

Met Eireann

Return Period Rainfall Depths for sliding Durations

Irish Grid: Easting: 305630, Northing: 226640,

	Interval		Years													
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.6,	3.7,	4.3,	5.3,	5.9,	6.4,	8.1,	10.0,	11.3,	13.1,	14.7,	16.0,	18.0,	19.5,	20.8,	N/A ,
10 mins	3.6,	5.1,	6.0,	7.3,	8.2,	8.9,	11.2,	13.9,	15.7,	18.2,	20.5,	22.3,	25.0,	27.2,	29.0,	N/A ,
15 mins	4.2,	6.0,	7.1,	8.6,	9.7,	10.5,	13.2,	16.4,	18.5,	21.4,	24.1,	26.2,	29.4,	32.0,	34.1,	N/A ,
30 mins	5.6,	8.0,	9.4,	11.4,	12.8,	13.9,	17.5,	21.6,	24.3,	28.2,	31.7,	34.4,	38.6,	41.9,	44.6,	N/A ,
1 hours	7.5,	10.7,	12.5,	15.1,	17.0,	18.4,	23.1,	28.4,	32.0,	37.1,	41.6,	45.2,	50.6,	54.9,	58.5,	N/A ,
2 hours	10.0,	14.2,	16.6,	20.1,	22.5,	24.3,	30.5,	37.5,	42.2,	48.8,	54.7,	59.3,	66.4,	72.0,	76.6,	N/A ,
3 hours	11.8,	16.8,	19.6,	23.7,	26.5,	28.7,	35.9,	44.1,	49.6,	57.3,	64.2,	69.6,	77.9,	84.4,	89.8,	N/A ,
4 hours	13.3,	18.9,	22.0,	26.6,	29.8,	32.2,	40.3,	49.5,	55.6,	64.2,	71.9,	77.9,	87.2,	94.4,	100.4,	N/A ,
6 hours	15.7,	22.4,	26.0,	31.4,	35.1,	38.0,	47.4,	58.2,	65.3,	75.4,	84.4,	91.4,	102.3,	110.7,	117.7,	N/A ,
9 hours	18.7,	26.5,	30.7,	37.1,	41.4,	44.8,	55.9,	68.5,	76.8,	88.6,	99.1,	107.3,	119.9,	129.8,	137.9,	N/A ,
12 hours	21.0,	29.8,	34.6,	41.7,	46.6,	50.4,	62.7,	76.8,	86.2,	99.3,	111.1,	120.2,	134.3,	145.3,	154.4,	N/A ,
18 hours	24.9,	35.3,	40.9,	49.3,	55.0,	59.4,	73.9,	90.4,	101.3,	116.7,	130.4,	141.1,	157.5,	170.3,	180.9,	N/A ,
24 hours	28.1,	39.7,	46.0,	55.4,	61.8,	66.8,	83.0,	101.5,	113.7,	130.9,	146.2,	158.1,	176.4,	190.7,	202.5,	244.1,
2 days	35.7,	49.0,	55.9,	66.3,	73.2,	78.5,	95.8,	115.0,	127.6,	145.0,	160.4,	172.3,	190.4,	204.4,	215.9,	255.9,
3 days	41.9,	56.4,	63.9,	75.0,	82.4,	88.1,	106.2,	126.2,	139.1,	157.0,	172.7,	184.7,	202.9,	217.0,	228.5,	268.2,
4 days	47.3,	62.9,	70.9,	82.6,	90.4,	96.3,	115.2,	135.9,	149.2,	167.5,	183.5,	195.7,	214.2,	228.3,	239.9,	279.7,
6 days	56.8,	74.2,	83.0,	95.8,	104.2,	110.6,	130.8,	152.7,	166.7,	185.8,	202.3,	214.9,	233.9,	248.3,	260.1,	300.4,
8 days	65.3,	84.1,	93.7,	107.4,	116.3,	123.1,	144.4,	167.3,	181.9,	201.7,	218.8,	231.7,	251.1,	265.8,	277.9,	318.7,
10 days	73.0,	93.2,	103.3,	117.8,	127.3,	134.4,	156.7,	180.5,	195.6,	216.0,	233.5,	246.8,	266.6,	281.7,	293.9,	335.2,
12 days	80.3,	101.7,	112.4,	127.6,	137.4,	144.8,	168.0,	192.7,	208.2,	229.2,	247.1,	260.7,	280.9,	296.2,	308.6,	350.6,
16 days	93.9,	117.3,	128.9,	145.4,	156.0,	164.0,	188.7,	214.8,	231.1,	253.1,	271.8,	285.9,	306.9,	322.6,	335.4,	378.3,
20 days	106.5,	131.8,	144.2,	161.7,	173.0,	181.4,	207.5,	234.8,	251.8,	274.7,	294.1,	308.6,	330.2,	346.4,	359.5,	403.4,
25 days	121.2,	148.6,	161.9,	180.7,	192.6,	201.6,	229.1,	257.8,	275.6,	299.4,	319.5,	334.6,	356.9,	373.6,	387.0,	431.9,

NOTES:

N/A Data not available

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

For details refer to:

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

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

HR Wallingford
Working with water

Calculated by:	Pablo Martin Bussi
Site name:	Manga development Citywest
Site location:	Dublin

Site Details

Latitude:	53.27956° N
Longitude:	6.4169° W
Reference:	2906314006
Date:	Jan 14 2022 12:24

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 3.02

Methodology

Q_{BAR} estimation method: Calculate from SPR and SAAR

SPR estimation method: Calculate from SOIL type

Soil characteristics	Default	Edited
SOIL type:	2	2
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.3

Hydrological characteristics	Default	Edited
SAAR (mm):	993	993
Hydrological region:	12	12
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.13	2.13
Growth curve factor 100 years:	2.61	2.61
Growth curve factor 200 years:	2.86	2.86

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	8.29	8.29
1 in 1 year (l/s):	7.04	7.04
1 in 30 years (l/s):	17.65	17.65
1 in 100 year (l/s):	21.63	21.63
1 in 200 years (l/s):	23.7	23.7

Kingspan Klargester

SEPARATORS

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Separators

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

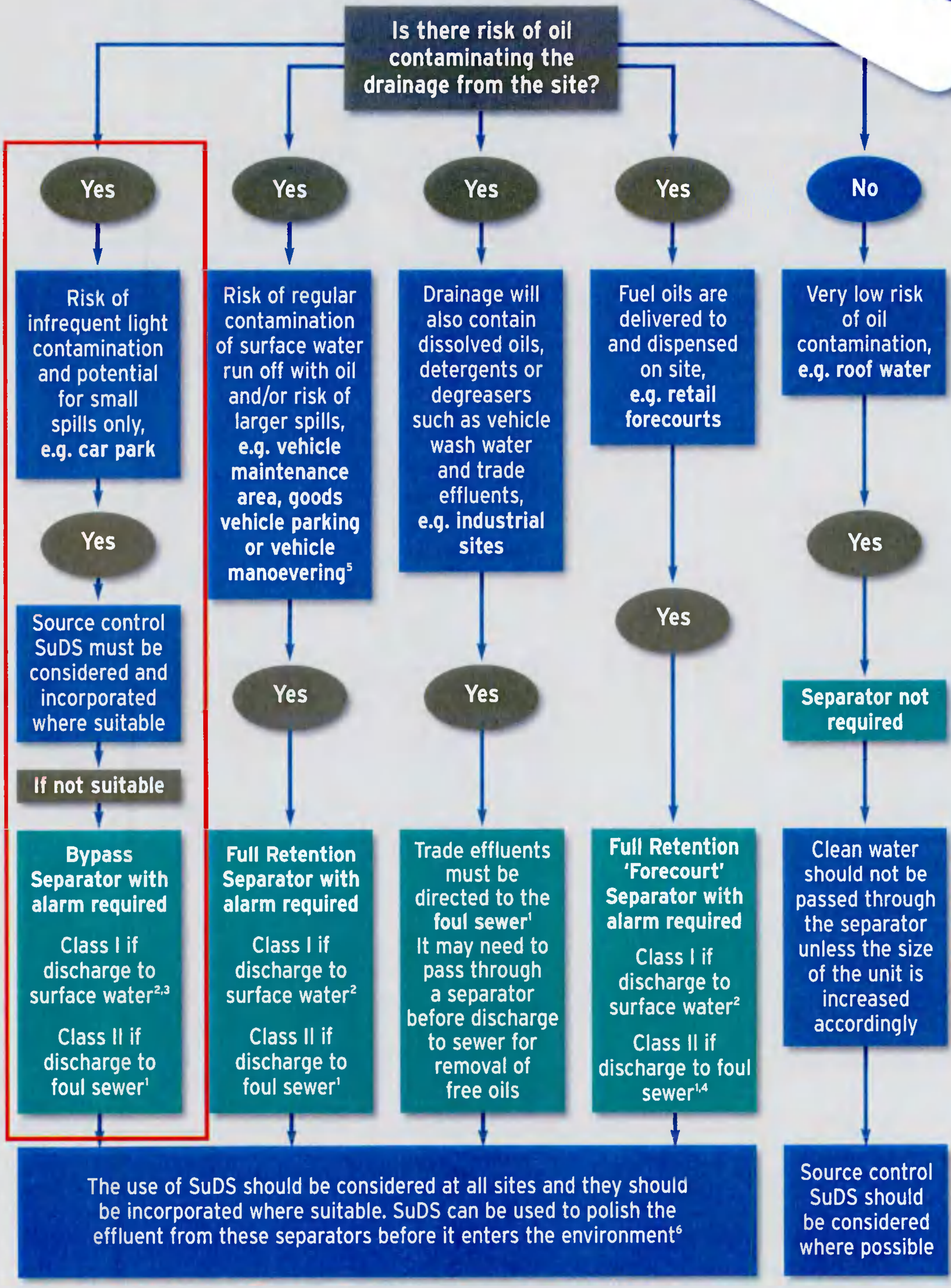
Forecourt separators are full retention separators specified to retain on site the maximum spillage likely to occur on a petrol filling station. They are required for both safety and environmental reasons and will treat spillages occurring during vehicle refuelling and road tanker delivery. The size 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.
- Silt storage capacity.
- Oil storage volume.
- Coalescer.

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

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

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

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) SILT	OIL	UNIT LENGTH (mm)	UNIT DIA. (mm)	ACCESS SHAFT DIA. (mm)	BASE TO INLET INVERT (mm)	BASE TO OUTLET INVERT	STANDARD FALL ACROSS (mm)	MIN. INLET INVERT (mm)	STANDARD PIPEWORK DIA. (mm)
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

Kingspan Klargester

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

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 (m²) PPG-3 (0.018)	STORAGE CAPACITY (litres) SILT	OIL	UNIT LENGTH (mm)	UNIT DIA. (mm)	BASE TO INLET INVERT (mm)	BASE TO OUTLET INVERT	MIN. INLET INLET (mm)	STANDARD PIPEWORK DIA. (mm)
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

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BRITISH WATER

UK GREEN BUILDING COUNCIL

Issue No. 20: August 2014

CDS TECHNOLOGIES

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 it's 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

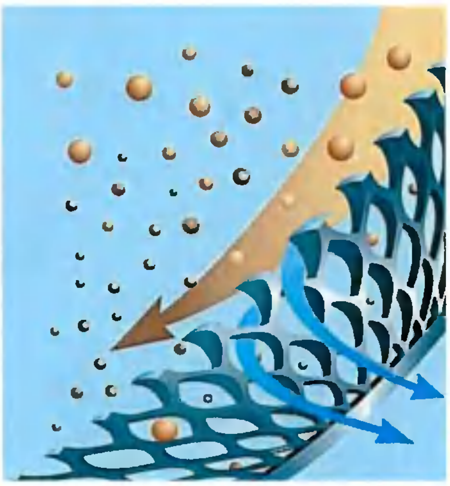
Field evaluations to determine pollutant mobilization have found that the vast majority of pollutants are mobilized in flows that are well below the design capacity' for the conveyance facility - typically known as the 'first flush'.

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 a 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 PolyAramatic 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

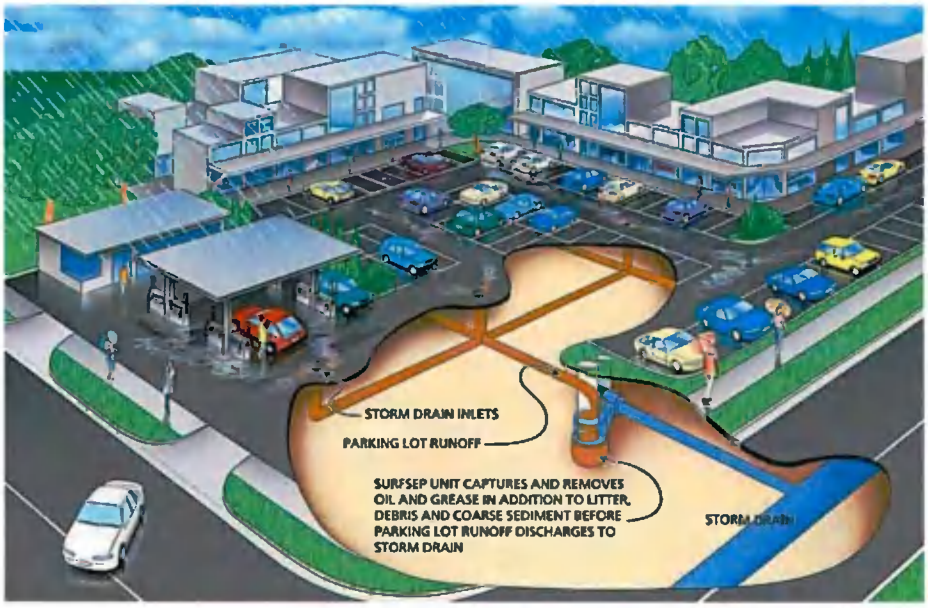
Flow Control

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.



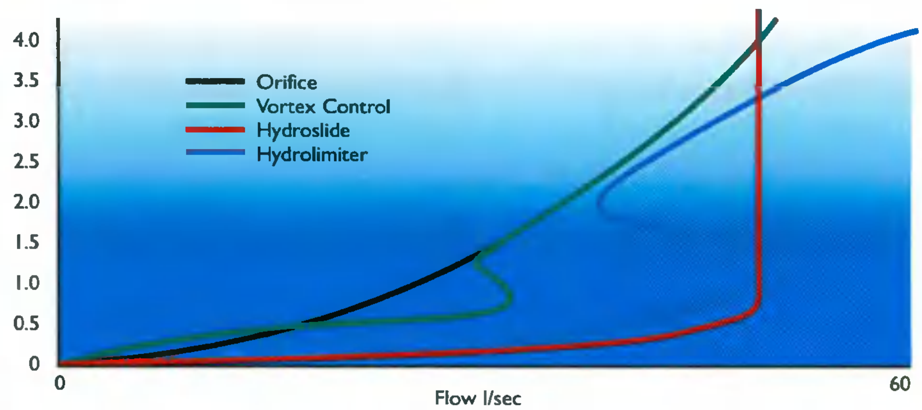
Typical SurfSep installation

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 attentuation/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

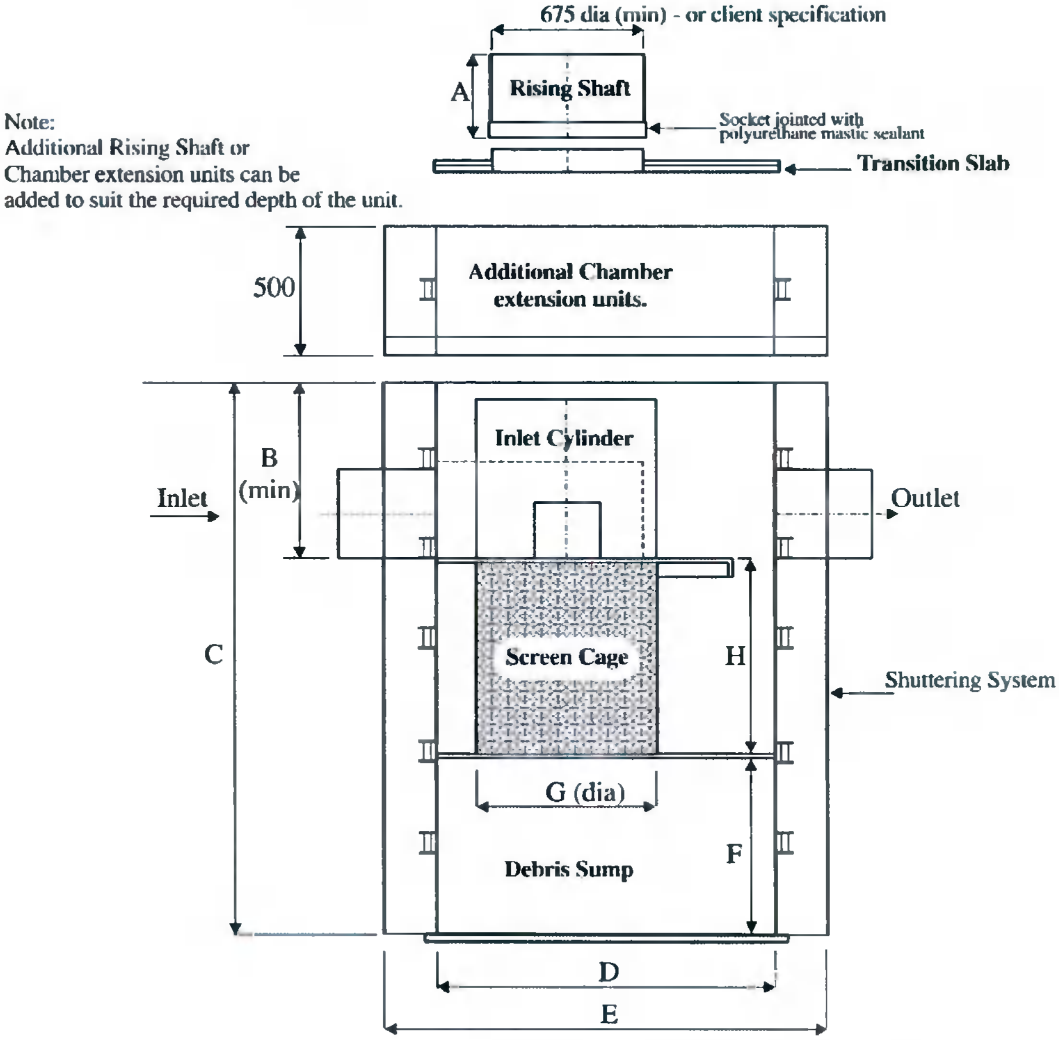
- Eduction (Suction)
- Basket Removal
- Mechanical Grab

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



SurfSep Dimensions (mm)

	SW0404	SW0604	SW0606	SW0804	SW0806	SW0808	SW1010	SW1012	SW1015
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 (**I**nline or **O**ffline).

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 Inline with a separation screen dia 0.8 m and screen height of 0.6m.

Surface Water Treatment

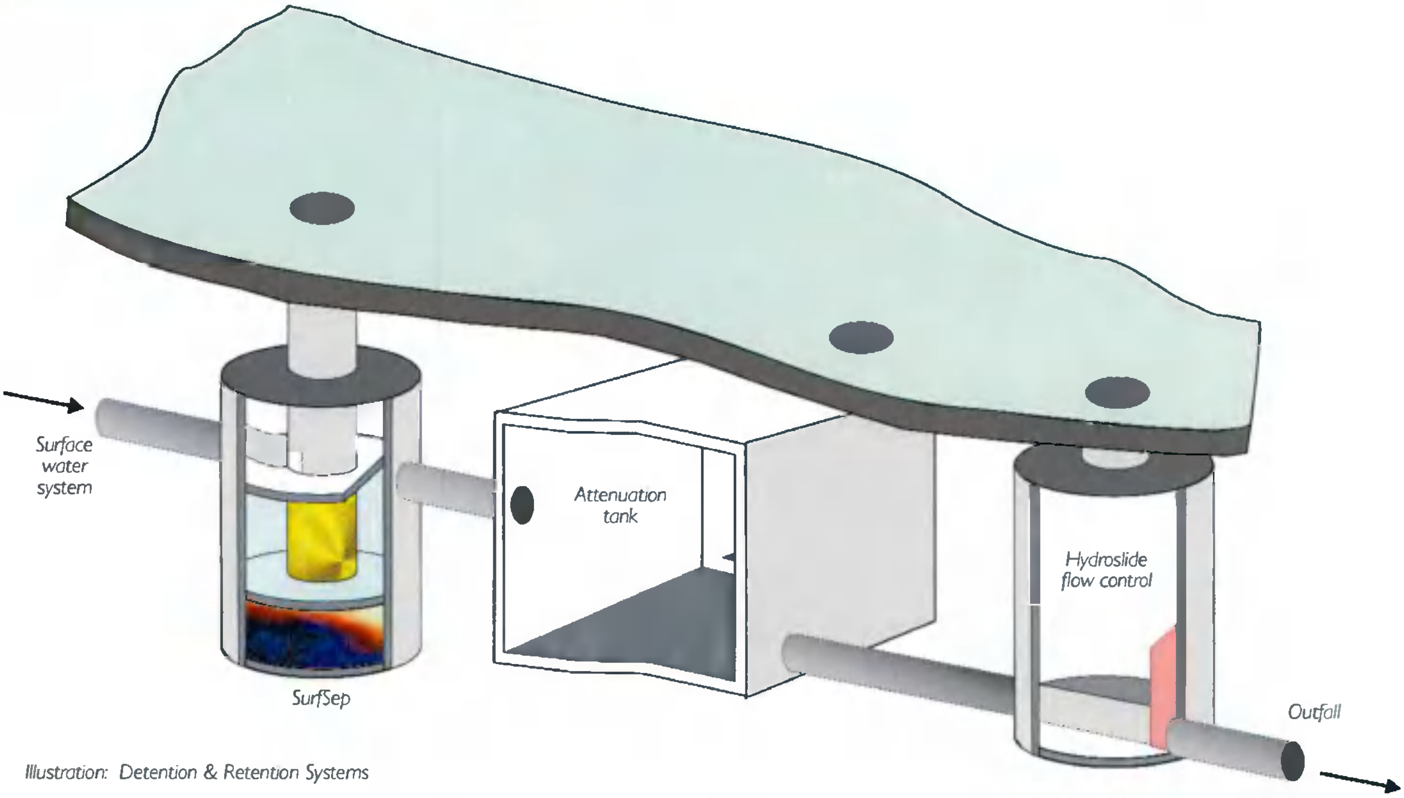


Illustration: Detention & Retention Systems

SurfSeps 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.

STH Range of Hydro-Brake® Flow Controls

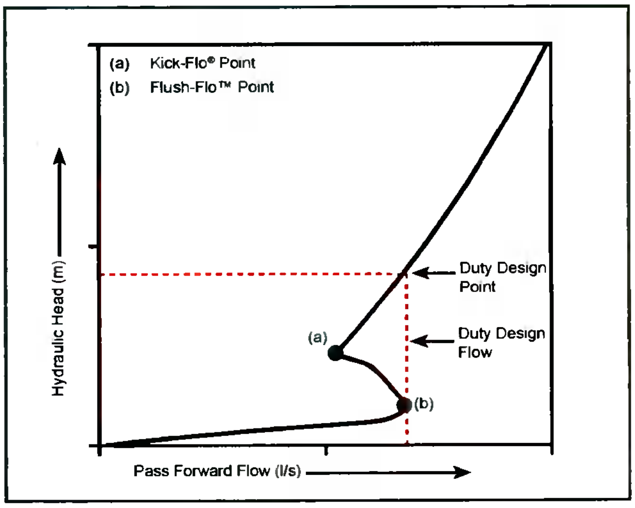
BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE No 08/4599

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:

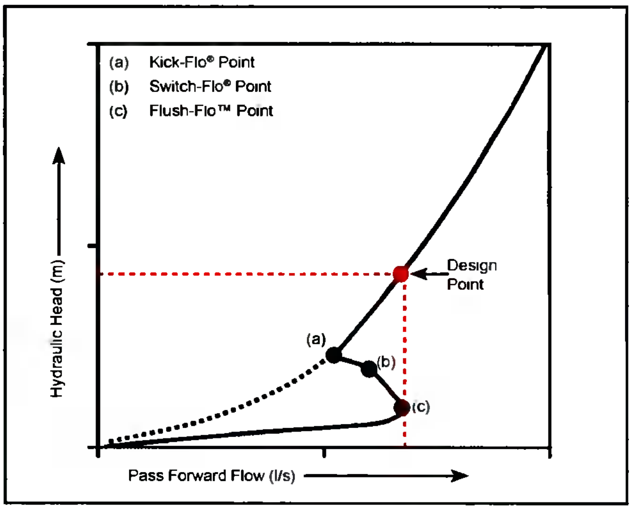
- outlet size and model of Hydro-Brake® Flow Control
- definition of the duty/design point (head and flow)
- definition of the Flush-Flo™ point (head and flow)
- definition of the Kick-Flo® point (head and flow)

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

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 ...®

HRD Technologies Ltd

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HRD Technologies Ltd is a subsidiary of Hydro International plc

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 ft^3 (3.11 m^3)

Min. Installed Storage*
175.0 ft^3 (4.96 m^3)

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

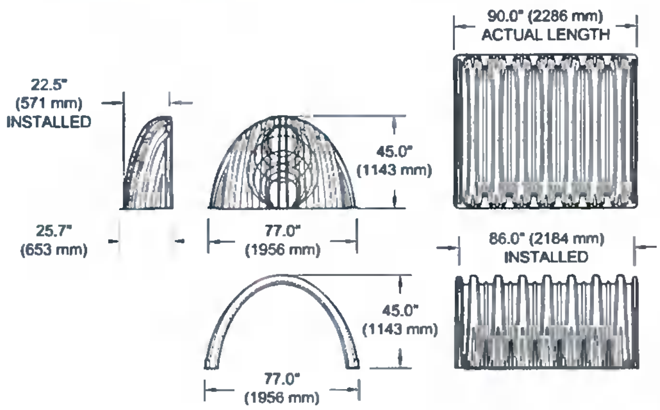
Size (L x W x H)
26.5" x 71" x 45.1"
673 mm x 1,803 mm x 1,145 mm

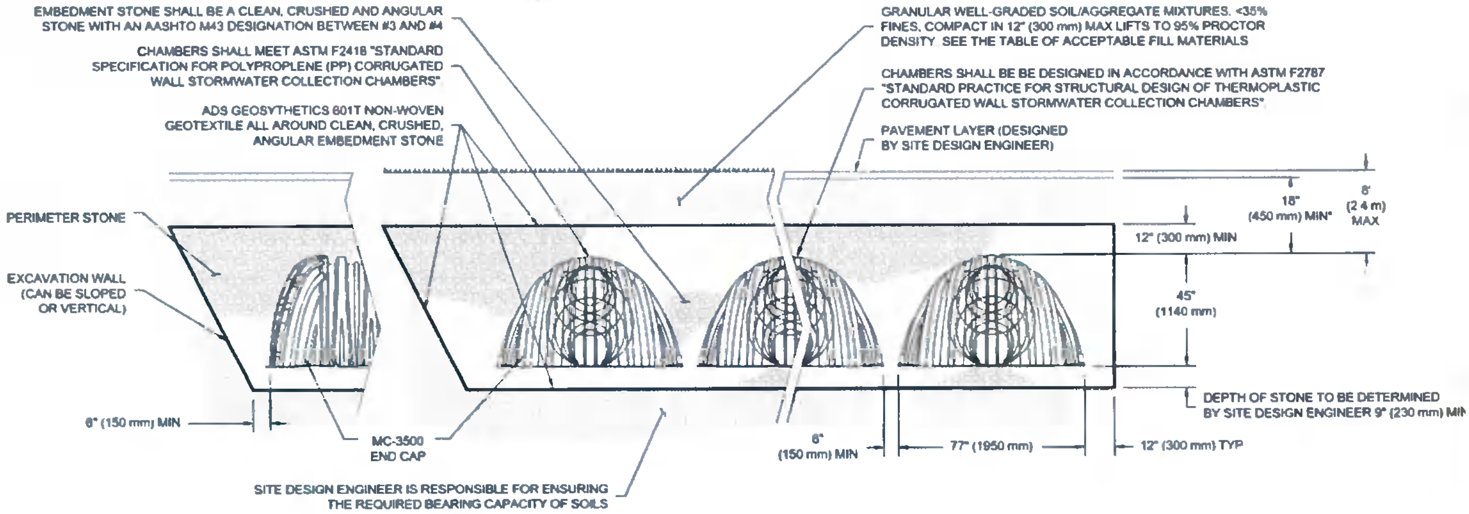
End Cap Storage
14.9 ft^3 (0.42 m^3)

Min. Installed Storage*
45.1 ft^3 (1.28 m^3)

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).

StormTech®

ADS®

MC-3500 CHAMBER SPECIFICATION

STORAGE VOLUME PER CHAMBER FT³ (M³)

	Bare Chamber Storage ft³ (m³)	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 (yds³)	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 (m³)	**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

KAVANAGH BURKE
CONSULTING ENGINEERS

Discharge Units Calculation

KAVANAGH BURKE
CONSULTING ENGINEERS

INPUT FOR FOUL SEWER NETWORK DESIGN

Client: ROCKFACE DEVELOPMENTS LTD

Project: WAREHOUSE DEVELOPMENT AT
MAGNA BUSINESS PARK,
DUBLIN 24

Project Ref: **D1720 PL1 - OFFICE BLOCK & WAREHOUSE TOILET BLOCK**

Floors	Type of Applience	Discharge Unit per Applience	No of Applie.	Discharge Units
OFFICE/STAFF FACILITIES				
GROUND FLOOR PLAN:	WB	0,6	11	6,6
	WC	2,5	8	20,0
	URINAL	0,8	3	2,4
	SINK	1,3	1	1,3
	DISHWASHER	0,8	1	0,8
	SHOWER	0,6	2	1,2
		TOTAL:		***32,3***
FIRST FLOOR PLAN:	WB	0,6	4	2,4
	WC	2,5	4	10,0
	URINAL	0,8	1	0,8
	SINK	1,3	1	1,3
	DISHWASHER	0,8	1	0,8
		TOTAL:		***15,3***
SECOND FLOOR PLAN:	WB	0,6	4	2,4
	WC	2,5	4	10,0
	URINAL	0,8	1	0,8
	SINK	1,3	1	1,3
	DISHWASHER	0,8	1	0,8
		TOTAL:		***15,3***
TOTAL NO OF DICHARGE UNITS FOR OFFICE BLOCK 2:				***63***
Q (l/sec) =				*5,55*
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***
Q (l/sec) =				*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: $Q = kDU \sqrt{\Sigma DU}$

KAVANAGH BURKE
CONSULTING ENGINEERS

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	63.0	123.570	Adoptable	1.170
FS02		122.925	Adoptable	0.900
FS03		122.900	Adoptable	1.300
FS04		122.850	Adoptable	1.400
FS05	25.0	122.850	Adoptable	1.900
FS06		122.850	Adoptable	2.050
Ex.FS		122.520	Adoptable	1.940

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	35.001	1.500	122.400	122.025	0.375	93.3	150	Circular
1.001	FS02	FS03	56.999	1.500	122.025	121.600	0.425	134.1	150	Circular
1.002	FS03	FS04	21.001	1.500	121.600	121.450	0.150	140.0	150	Circular
1.003	FS04	FS05	75.001	1.500	121.450	120.950	0.500	150.0	150	Circular
1.004	FS05	FS06	21.999	1.500	120.950	120.800	0.150	146.7	150	Circular
1.005	FS06	Ex.FS	32.001	1.500	120.800	120.580	0.220	145.5	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	16.0	5.6	1.020	0.750	1.020	0.000	63.0	0.0	0.825
1.001	FS02	FS03	13.4	5.6	0.750	1.150	1.150	0.000	63.0	0.0	0.721
1.002	FS03	FS04	13.1	5.6	1.150	1.250	1.250	0.000	63.0	0.0	0.709
1.003	FS04	FS05	12.6	5.6	1.250	1.750	1.750	0.000	63.0	0.0	0.690
1.004	FS05	FS06	12.8	6.6	1.750	1.900	1.900	0.000	88.0	0.0	0.728
1.005	FS06	Ex.FS	12.8	6.6	1.900	1.790	1.900	0.000	88.0	0.0	0.729

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	35.001	93.3	150	123.570	122.400	1.020	122.925	122.025	0.750
1.001	56.999	134.1	150	122.925	122.025	0.750	122.900	121.600	1.150
1.002	21.001	140.0	150	122.900	121.600	1.150	122.850	121.450	1.250
1.003	75.001	150.0	150	122.850	121.450	1.250	122.850	120.950	1.750
1.004	21.999	146.7	150	122.850	120.950	1.750	122.850	120.800	1.900
1.005	32.001	145.5	150	122.850	120.800	1.900	122.520	120.580	1.790

Link
1.000
1.001
1.002
1.003
1.004
1.005

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
FS01	705616.738	726582.488	123.570	1.170	1200	0	1.000	122.400	150
FS02	705581.794	726580.498	122.925	0.900	1200	1	1.000	122.025	150
						0	1.001	122.025	150
FS03	705524.883	726577.326	122.900	1.300	1200	1	1.001	121.600	150
						0	1.002	121.600	150
FS04	705508.892	726590.939	122.850	1.400	1200	1	1.002	121.450	150
						0	1.003	121.450	150
FS05	705504.301	726665.799	122.850	1.900	1200	1	1.003	120.950	150
						0	1.004	120.950	150
FS06	705503.114	726687.766	122.850	2.050	1200	1	1.004	120.800	150
						0	1.005	120.800	150
Ex.FS	705481.836	726711.668	122.520	1.940	1200	1	1.005	120.580	150