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Drainage Design Report

for

Warehouse Development

at

Kingswood Business Park,
Baldonnell,
Dublin 22

Job No:	D1568
Client:	JMC VAN TRANS LTD
Date:	January 2022
Local Authority:	South Dublin County Council
Revision:	Planning Alterations (2021) ADDITIONAL INFORMATION PL7

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Introduction

This report details the site development works design for a development at Kingswood Business Park, Baldonnell, Dublin 22.

The subject site extends to circa 4.0 ha where the vehicular and pedestrian access to the site is provided from the existing estate access road. The site will be serviced primarily through connection to the existing services in the area, i.e. watermain, foul, communications and power supply are located within this Kingswood Business Park Access Road. On the Eastern site boundary there is an existing watercourse channel adjacent to the existing access road, where it is proposed that the attenuated surface water runoff from the subject site will discharge.

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

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.

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 10% 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 includes a specific model of vortex flow control device with discharge of the calculated QBAR and 10% 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, calculated separately for each block, will be installed on the outfall from the last surface water manholes of each network. The discharge from site, i.e. the restricted flow from the flow control device will ultimately discharge to the adjacent open channel to the eastern site's boundary, as shown at the accompanying drawing ref. D1568 – 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 (drg. ref. D1568 – D4) 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

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 Baldonnell Business Park and Greenogue Business Park individual sites have been developed in a similar nature.

The following figures synopsis the surface water attenuation calculations:

SITE AREA	40,000 m^2
CATCHMENT AREA	38,165 m^2
SAAR	756
SOIL VALUE	0.3

STRUCTURE TYPE	RUNOFF COEFFICIENTS	AREA (ha)
Impermeable Areas *(Roofs; Concrete Yard/Road; Pathways)*	1.0	3.422
Green Roof (if any)	0.8	0
Landscaping	0.3	0.195

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 Kingswood Business Park. This proposed network collects the sewage on site from the proposed offices/staff facilities and adjacent existing Baldonnell House. Connection to the existing foul sewer network is proposed at the existing foul sewer manhole located at the south-east corner of the site.

Foul network pipework falls against the yard slope, so foul effluent from the rear of the development and flow from the existing Baldonnell House will be pumped in order to meet the invert level of existing public sewer manhole. The pump sump and duty & standby pump operation cut-in and cut-out design is the subject of more detailed design at construction stage. It should be noted that this pump station is located on the private lands forming the development and will be maintained long term by the Management Company.

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 200mm watermain on site, within Kingswood Business Park Access Road, the exact connection locations shown on accompanying drg ref. D1568 – D3.

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. D1568 - D4 for layout details.

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Surface Water Attenuation Design

- StormTech Cumulative Spreadsheet (SC-740)
- StormTech Cumulative Spreadsheet (MC-3500)

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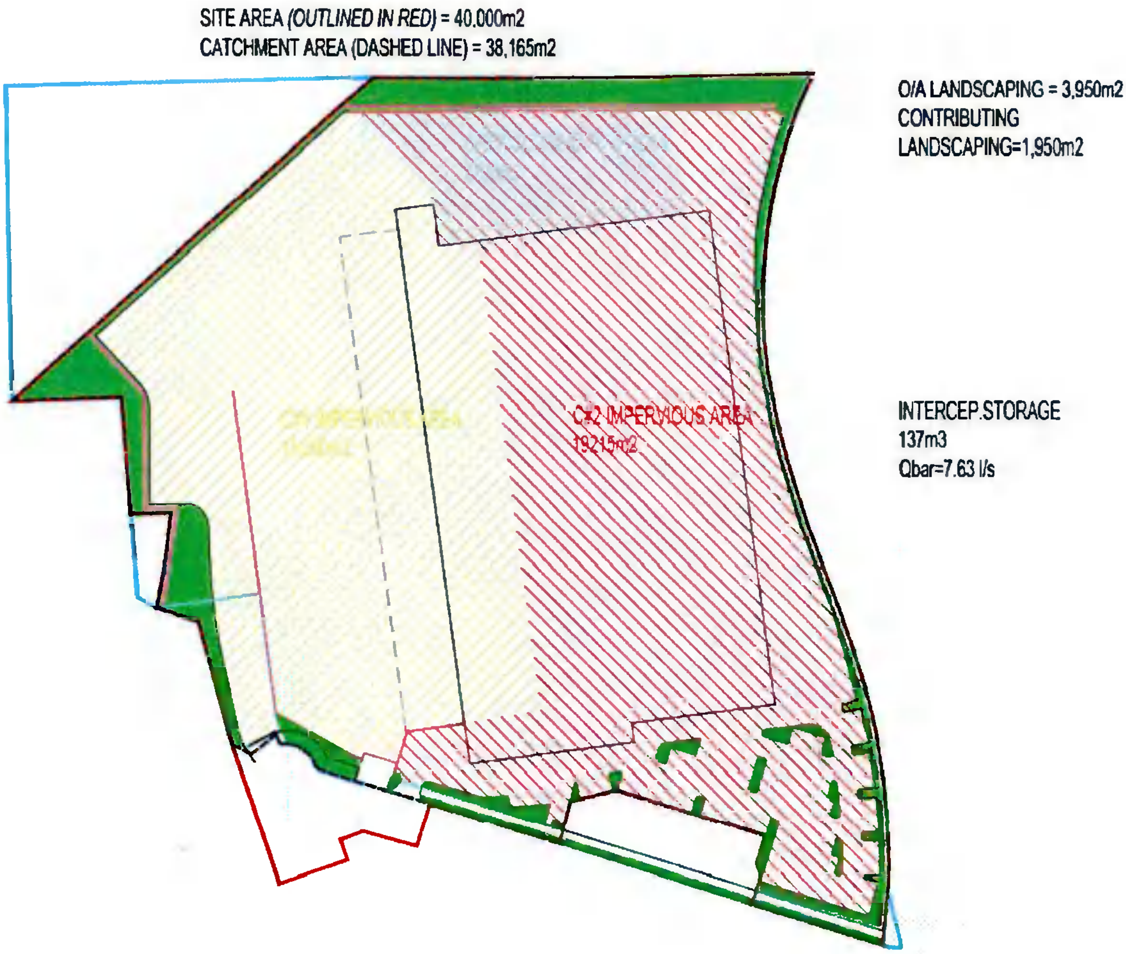
Surface Water Attenuation Calculation

1) Areas for Attenuation Calculation

Site Area of development (red line)	40,000 m^2 (4.0 ha)
Catchment Area	38,165 m^2 (3.82 ha)
O/A Landscaping:	3,950 m^2
Contributing landscaping	1,950 m^2
Impermeable Areas (roof, concrete yard, car parking):	**34,215 m^2**

SKETCH OF AREAS USED FOR ATTENUATION CALCULATION:



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: 34,215 m^2 x 0.80 = 27,372 m^2

Total volume for 5mm rainfall: 5mm x 27,372 m^2 = **136.86 m^3**

Therefore, a minimum Interception Storage volume of 137m^3 should be provided. This will prevent discharge from site during rainfall events of up to 5mm rainfall.

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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 305000, N 229500): 756 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 $(756)^{1.17}$ x $(0.3)^{2.17}$ =
99.71 l/sec =
1.994 l/sec/ha

Q_{BAR} for the subject site area:

1.994 l/sec/ha x 3.8165 ha =
Q_{BAR} = 7.63 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.

Therefore allowable discharge (Q_{BAR}) will be set at **7.63 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

Equivalent Runoff Area: 100% x 34,215 m^2 + 30% x 1,950 m^2 =
34,215 m^2 + 585 m^2 =
34,800 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 2,839m^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}=8.75 l/sec*)**	**(m^3) E - F**
15 min	34800	19.20	21.12	734.98	6.87	728.11
30 min	34800	24.40	26.84	934.03	13.74	920.29
1 hour	34800	30.90	33.99	1182.85	27.48	1155.37
2 hour	34800	39.10	43.01	1496.75	54.96	1441.79
4 hour	34800	49.60	54.56	1898.69	109.92	1788.77
6 hour	34800	56.90	62.59	2178.13	164.87	2013.26
12 hour	34800	72.10	79.31	2759.99	329.75	2430.24
1 day	34800	91.40	100.54	3498.79	659.49	2839.30
2 day	34800	102.40	112.64	3919.87	1318.98	2600.89

Critical Attenuation Volume = 2,840 m^3

Subtract Interception Storage: 2,840 m^3 – 137 m^3 = **2,703 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 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 34,215 m^2 + 30% x 1,950 m^2 =
34,215 m^2 + 585 m^2 =
34,800 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: 79.9 mm
Factor up by 10% for climate change: 87.89 mm

Total Volume of Runoff:	87.89mm x 34,800 m^2	=	3,059 m^3
Deduct discharge at Q_{BAR} for 6hrs:	7.63 l/sec x 6 hrs	=	165 m^3
Storage volume required;	3,059 - 165	=	2,894 m^3
Deduct Interception Storage;	137 m^3		
Deduct Attenuation Storage;	2,703 m^3		
Temporary Flood Storage required:	2,894 – 137 – 2,703	=	54 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:

<u>INTERCEPTION STORAGE</u>: 137m³ to be provided by a lowered base of the northern attenuation system. Attenuation System Area: 1,580m². Therefore, the Interception Storage Depth will equal 200mm. 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: **2,703 m³** to be provided within the attenuation system on site.

TEMPORARY FLOOD STORAGE: **54 m³** to be provided within the attenuation system on site.

ATTENUATION VOLUME REQUIRED: 137 + 2,703 + 54 = 2,894 m³

ATTENUATION VOLUME PROVIDED: 2,022 + 882 = 2,904 m³
(Refer to 2no StormTech Cumulative Storages spreadsheet below)

Project: JMC - Western Attenuation_SC-740

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Chamber Model -	SC-740	
Units -	Metric	Click Here for Imperial
Number of chambers -	339	
Voids in the stone (porosity) -	47	%
Base of Stone Elevation -	78.00	m
Amount of Stone Above Chambers -	160	mm
Amount of Stone Below Chambers -	380	mm
Area of system -	1065	sq.meters

☑ Include Perimeter Stone in Calculations

Min. Area - 1064.633 sq.mete

StormTech SC-740 Cumulative Storage Volumes

Height of System (mm)	Incremental Single Chamber (cubic meters)	Incremental Total Chamber (cubic meters)	Incremental Stone (cubic meters)	Incremental Ch & St (cubic meters)	Cumulative Chamber (cubic meters)	Elevation (meters)
1295	0.00	0.00	12.71	12.71	882.221	79.30
1270	0.00	0.00	12.71	12.71	869.506	79.27
1245	0.00	0.00	12.71	12.71	856.792	79.24
1219	0.00	0.00	12.71	12.71	844.077	79.22
1194	0.00	0.00	12.71	12.71	831.363	79.19
1168	0.00	0.00	12.71	12.71	818.648	79.17
1143	0.00	0.53	12.47	12.99	805.934	79.14
1118	0.00	1.56	11.98	13.54	792.940	79.12
1092	0.01	2.71	11.44	14.15	779.396	79.09
1067	0.02	5.80	9.99	15.79	765.248	79.07
1041	0.02	7.70	9.10	16.79	749.460	79.04
1016	0.03	9.13	8.43	17.55	732.667	79.02
991	0.03	10.31	7.87	18.18	715.116	78.99
965	0.03	11.33	7.39	18.72	696.935	78.97
940	0.04	12.15	7.00	19.15	678.214	78.94
914	0.04	13.01	6.60	19.61	659.060	78.91
889	0.04	13.96	6.15	20.11	639.452	78.89
864	0.04	14.64	5.84	20.47	619.340	78.86
838	0.04	15.19	5.58	20.76	598.868	78.84
813	0.05	15.76	5.30	21.07	578.103	78.81
787	0.05	16.31	5.05	21.36	557.033	78.79
762	0.05	16.83	4.81	21.63	535.672	78.76
737	0.05	17.31	4.58	21.89	514.039	78.74
711	0.05	17.81	4.35	22.15	492.153	78.71
686	0.05	18.17	4.17	22.35	470.001	78.69
660	0.05	18.57	3.99	22.55	447.655	78.66
635	0.06	18.96	3.80	22.76	425.101	78.64
610	0.06	19.29	3.65	22.94	402.338	78.61
584	0.06	19.63	3.49	23.12	379.398	78.58
559	0.06	19.92	3.35	23.27	356.279	78.56
533	0.06	20.21	3.22	23.42	333.008	78.53
508	0.06	20.46	3.10	23.56	309.584	78.51
483	0.06	20.68	3.00	23.67	286.024	78.48
457	0.06	20.90	2.89	23.79	262.351	78.46
432	0.06	21.10	2.80	23.90	238.560	78.43
406	0.06	21.19	2.76	23.94	214.661	78.41
381	0.00	0.00	12.71	12.71	190.717	78.38
356	0.00	0.00	12.71	12.71	178.002	78.36
330	0.00	0.00	12.71	12.71	165.288	78.33
305	0.00	0.00	12.71	12.71	152.573	78.30
279	0.00	0.00	12.71	12.71	139.859	78.28
254	0.00	0.00	12.71	12.71	127.145	78.25
229	0.00	0.00	12.71	12.71	114.430	78.23
203	0.00	0.00	12.71	12.71	101.716	78.20
178	0.00	0.00	12.71	12.71	89.001	78.18

Project: JMC - Northern Attenuation_MC3500

Chamber Model -	MC-3500		
Units -	Metric	Click Here for Imperial	
Number of Chambers -	313		
Number of End Caps -	16		
Voids in the stone (porosity) -	48	%	
Base of Stone Elevation -	77.30	m	☑ Include Perimeter Stone in Calculations
Amount of Stone Above Chambers -	400	mm	
Amount of Stone Below Chambers -	455	mm	
Area of system -	1570	sq.meters	Min. Area - 1518.886 sq.meters

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StormTech MC-3500 Cumulative Storage Volumes

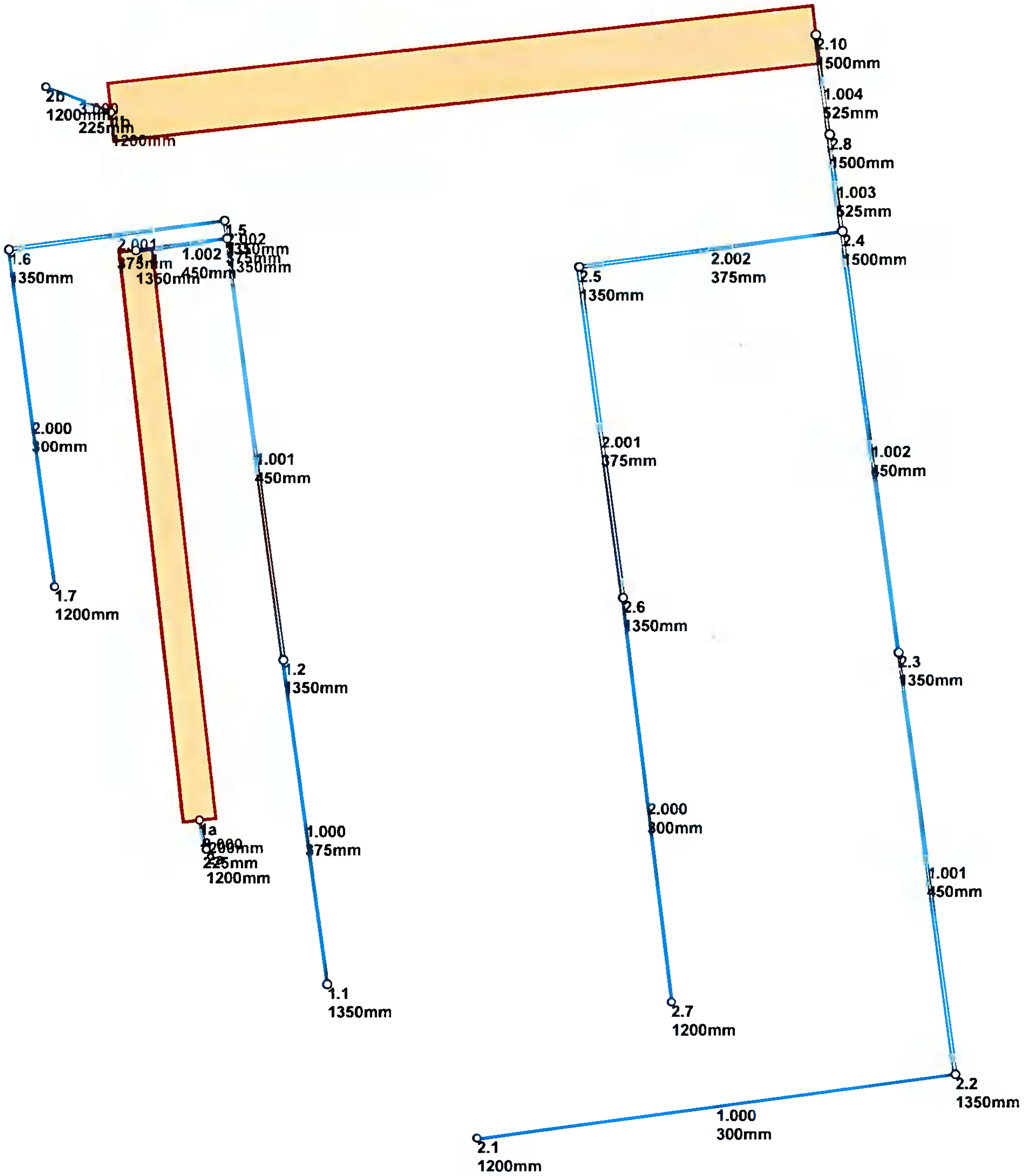
Height of System (mm)	Incremental Single Chamber (cubic meters)	Incremental Single End Cap (cubic meters)	Incremental Chambers (cubic meters)	Incremental End Cap (cubic meters)	Incremental Stone (cubic meters)	Incremental Chamber, End Cap and Stone (cubic meters)	Cumulative System (cubic meters)	Elevation (meters)
2007	0.00	0.00	0.00	0.00	19.132	19.13	2021.83	79.31
1981	0.00	0.00	0.00	0.00	19.132	19.13	2002.70	79.28
1956	0.00	0.00	0.00	0.00	19.132	19.13	1983.57	79.26
1930	0.00	0.00	0.00	0.00	19.132	19.13	1964.44	79.23
1905	0.00	0.00	0.00	0.00	19.132	19.13	1945.31	79.21
1880	0.00	0.00	0.00	0.00	19.132	19.13	1926.17	79.18
1854	0.00	0.00	0.00	0.00	19.132	19.13	1907.04	79.15
1829	0.00	0.00	0.00	0.00	19.132	19.13	1887.91	79.13
1803	0.00	0.00	0.00	0.00	19.132	19.13	1868.78	79.10
1778	0.00	0.00	0.00	0.00	19.132	19.13	1849.65	79.08
1753	0.00	0.00	0.00	0.00	19.132	19.13	1830.51	79.05
1727	0.00	0.00	0.00	0.00	19.132	19.13	1811.38	79.03
1702	0.00	0.00	0.00	0.00	19.132	19.13	1792.25	79.00
1676	0.00	0.00	0.00	0.00	19.132	19.13	1773.12	78.98
1651	0.00	0.00	0.00	0.00	19.132	19.13	1753.99	78.95
1626	0.00	0.00	0.00	0.00	19.132	19.13	1734.86	78.93
1600	0.00	0.00	0.51	0.00	18.885	19.40	1715.72	78.90
1575	0.01	0.00	1.72	0.00	18.304	20.03	1696.32	78.87
1549	0.01	0.00	2.61	0.00	17.879	20.49	1676.30	78.85
1524	0.01	0.00	3.58	0.01	17.410	21.00	1655.81	78.82
1499	0.02	0.00	6.09	0.02	16.200	22.31	1634.81	78.80
1473	0.03	0.00	9.11	0.02	14.746	23.88	1612.50	78.77
1448	0.04	0.00	11.07	0.03	13.801	24.91	1588.62	78.75
1422	0.04	0.00	12.61	0.04	13.062	25.71	1563.71	78.72
1397	0.04	0.00	13.94	0.05	12.417	26.41	1538.00	78.70
1372	0.05	0.00	15.13	0.05	11.843	27.03	1511.60	78.67
1346	0.05	0.00	16.21	0.06	11.322	27.59	1484.57	78.65
1321	0.05	0.00	17.17	0.07	10.853	28.10	1456.98	78.62
1295	0.06	0.01	18.09	0.08	10.410	28.58	1428.88	78.60
1270	0.06	0.01	18.92	0.09	10.007	29.02	1400.30	78.57
1245	0.06	0.01	19.71	0.10	9.624	29.43	1371.28	78.54
1219	0.07	0.01	20.45	0.11	9.266	29.82	1341.85	78.52
1194	0.07	0.01	21.14	0.12	8.930	30.18	1312.03	78.49
1168	0.07	0.01	21.80	0.12	8.611	30.53	1281.84	78.47
1143	0.07	0.01	22.41	0.13	8.313	30.85	1251.31	78.44
1118	0.07	0.01	22.99	0.14	8.027	31.16	1220.46	78.42
1092	0.08	0.01	23.54	0.15	7.760	31.45	1189.30	78.39
1067	0.08	0.01	24.06	0.16	7.505	31.73	1157.85	78.37
1041	0.08	0.01	24.56	0.17	7.261	31.99	1126.12	78.34
1016	0.08	0.01	25.04	0.18	7.030	32.24	1094.13	78.32
991	0.08	0.01	25.49	0.19	6.809	32.48	1061.89	78.29
965	0.08	0.01	25.92	0.19	6.598	32.71	1029.41	78.27
940	0.08	0.01	26.32	0.20	6.399	32.93	996.70	78.24
914	0.09	0.01	26.70	0.21	6.216	33.12	963.77	78.21
889	0.09	0.01	27.06	0.22	6.038	33.32	930.65	78.19
864	0.09	0.01	27.43	0.22	5.861	33.51	897.33	78.16
838	0.09	0.01	27.75	0.23	5.702	33.68	863.82	78.14
813	0.09	0.01	28.06	0.24	5.551	33.84	830.14	78.11
787	0.09	0.02	28.36	0.24	5.403	34.00	796.29	78.09
762	0.09	0.02	28.64	0.24	5.268	34.15	762.29	78.06
737	0.09	0.02	28.91	0.25	5.135	34.30	728.14	78.04
711	0.09	0.02	29.16	0.26	5.010	34.43	693.84	78.01
686	0.09	0.02	29.41	0.26	4.890	34.56	659.41	77.99
660	0.09	0.02	29.64	0.26	4.779	34.68	624.85	77.96
635	0.10	0.02	29.86	0.27	4.670	34.80	590.17	77.94

610	0.10	0.02	30.07	0.27	4.568	34.91	555.37	77.91
584	0.10	0.02	30.26	0.28	4.472	35.01	520.46	77.88
559	0.10	0.02	30.46	0.28	4.377	35.12	485.45	77.86
533	0.10	0.02	30.65	0.28	4.287	35.21	450.33	77.83
508	0.10	0.02	30.83	0.29	4.195	35.31	415.12	77.81
483	0.10	0.02	31.07	0.29	4.083	35.43	379.81	77.78
457	0.00	0.00	0.00	0.00	19.132	19.13	344.37	77.76
432	0.00	0.00	0.00	0.00	19.132	19.13	325.24	77.73
406	0.00	0.00	0.00	0.00	19.132	19.13	306.11	77.71
381	0.00	0.00	0.00	0.00	19.132	19.13	286.98	77.68
356	0.00	0.00	0.00	0.00	19.132	19.13	267.85	77.66
330	0.00	0.00	0.00	0.00	19.132	19.13	248.71	77.63
305	0.00	0.00	0.00	0.00	19.132	19.13	229.58	77.60
279	0.00	0.00	0.00	0.00	19.132	19.13	210.45	77.58
254	0.00	0.00	0.00	0.00	19.132	19.13	191.32	77.55
229	0.00	0.00	0.00	0.00	19.132	19.13	172.19	77.53
203	0.00	0.00	0.00	0.00	19.132	19.13	153.05	77.50
178	0.00	0.00	0.00	0.00	19.132	19.13	133.92	77.48
152	0.00	0.00	0.00	0.00	19.132	19.13	114.79	77.45
127	0.00	0.00	0.00	0.00	19.132	19.13	95.66	77.43
102	0.00	0.00	0.00	0.00	19.132	19.13	76.53	77.40
76	0.00	0.00	0.00	0.00	19.132	19.13	57.40	77.38
51	0.00	0.00	0.00	0.00	19.132	19.13	38.26	77.35
25	0.00	0.00	0.00	0.00	19.132	19.13	19.13	77.33

KAVANAGH BURKE
CONSULTING ENGINEERS

Surface Water Network Design

KAVANAGH BURKE CONSULTING ENGINEERS	Kavanagh Burke Unit F3 Block F, Calmount Park, Ballymount, Dublin 12, D12PX28	File: D1568 - SW Network Design Network: SW #1 Elena Dragoje 10/01/2022	Page 1 SW Network Scheme



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)	17.300	Minimum Backdrop Height (m)	0.200
Ratio-R	0.272	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)
1.1	0.200	5.00	80.030	1350	1.150
1.2	0.290	5.00	80.030	1350	1.530
1.7	0.200	5.00	80.550	1200	1.350
1.6	0.110	5.00	80.250	1350	1.525
1.5			80.030	1350	1.630
1.3			80.030	1350	1.830
1.4			79.950	1350	1.900
1a		5.00	80.500	1200	2.500
2a			80.500	1200	2.550

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)
1.000	1.1	1.2	53.812	0.600	78.880	78.575	0.305	176.4	375	Circular	5.66	49.4	0.200
1.001	1.2	1.3	70.000	0.600	78.500	78.200	0.300	233.3	450	Circular	6.54	46.6	0.200
2.000	1.7	1.6	56.000	0.600	79.200	78.800	0.400	140.0	300	Circular	5.70	49.2	0.150
2.001	1.6	1.5	36.001	0.600	78.725	78.400	0.325	110.8	375	Circular	6.05	48.1	0.150
2.002	1.5	1.3	3.001	0.600	78.400	78.375	0.025	120.0	375	Circular	6.08	48.0	
1.002	1.3	1.4	15.269	0.600	78.200	78.050	0.150	101.8	450	Circular	6.67	46.2	
3.000	1a	2a	4.995	0.600	78.000	77.950	0.050	99.9	225	Circular	5.06	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)
1.000	1.1	1.2	150.3	53.5	0.775	1.080	1.080	0.400	0.0	1.249
1.001	1.2	1.3	210.9	112.4	1.080	1.380	1.380	0.890	0.0	1.348
2.000	1.7	1.6	93.8	46.7	1.050	1.150	1.150	0.350	0.0	1.326
2.001	1.6	1.5	190.0	79.5	1.150	1.255	1.255	0.610	0.0	1.646
2.002	1.5	1.3	182.5	79.3	1.255	1.280	1.280	0.610	0.0	1.596
1.002	1.3	1.4	320.4	188.0	1.380	1.450	1.450	1.500	0.0	2.092
3.000	1a	2a	52.0	0.0	2.275	2.325	2.325	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)	17.300	Analysis Speed	Detailed	Check Discharge Rate(s)	x
Ratio-R	0.272	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	8640

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

Node 1a Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Main Channel Length (m)	50.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	78.000	Main Channel Slope (1:X)	1000.0
Safety Factor	2.0	Time to half empty (mins)	0	Main Channel n	0.015

Inlets
1.4

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	510.0	0.0	1.300	510.0	0.0	1.301	5.0	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	246.748	69.821	100 year +20% CC 15 minute summer	320.329	90.642
30 year +20% CC 15 minute winter	173.156	69.821	100 year +20% CC 15 minute winter	224.793	90.642
30 year +20% CC 30 minute summer	169.734	48.029	100 year +20% CC 30 minute summer	221.691	62.731
30 year +20% CC 30 minute winter	119.112	48.029	100 year +20% CC 30 minute winter	155.573	62.731
30 year +20% CC 60 minute summer	118.537	31.326	100 year +20% CC 60 minute summer	153.817	40.649
30 year +20% CC 60 minute winter	78.753	31.326	100 year +20% CC 60 minute winter	102.193	40.649
30 year +20% CC 120 minute summer	75.572	19.971	100 year +20% CC 120 minute summer	97.197	25.686
30 year +20% CC 120 minute winter	50.208	19.971	100 year +20% CC 120 minute winter	64.575	25.686
30 year +20% CC 180 minute summer	59.232	15.242	100 year +20% CC 180 minute summer	75.700	19.480
30 year +20% CC 180 minute winter	38.502	15.242	100 year +20% CC 180 minute winter	49.207	19.480
30 year +20% CC 240 minute summer	47.520	12.558	100 year +20% CC 240 minute summer	60.440	15.972
30 year +20% CC 240 minute winter	31.571	12.558	100 year +20% CC 240 minute winter	40.155	15.972
30 year +20% CC 360 minute summer	37.066	9.538	100 year +20% CC 360 minute summer	46.809	12.045
30 year +20% CC 360 minute winter	24.094	9.538	100 year +20% CC 360 minute winter	30.427	12.045
30 year +20% CC 480 minute summer	29.663	7.839	100 year +20% CC 480 minute summer	37.262	9.847
30 year +20% CC 480 minute winter	19.707	7.839	100 year +20% CC 480 minute winter	24.756	9.847
30 year +20% CC 600 minute summer	24.602	6.729	100 year +20% CC 600 minute summer	30.776	8.418
30 year +20% CC 600 minute winter	16.810	6.729	100 year +20% CC 600 minute winter	21.028	8.418
30 year +20% CC 720 minute summer	22.159	5.939	100 year +20% CC 720 minute summer	27.624	7.404
30 year +20% CC 720 minute winter	14.892	5.939	100 year +20% CC 720 minute winter	18.565	7.404
30 year +20% CC 960 minute summer	18.513	4.875	100 year +20% CC 960 minute summer	22.954	6.044
30 year +20% CC 960 minute winter	12.264	4.875	100 year +20% CC 960 minute winter	15.205	6.044
30 year +20% CC 1440 minute summer	13.769	3.690	100 year +20% CC 1440 minute summer	16.942	4.541
30 year +20% CC 1440 minute winter	9.254	3.690	100 year +20% CC 1440 minute winter	11.386	4.541
30 year +20% CC 2160 minute summer	10.098	2.791	100 year +20% CC 2160 minute summer	12.326	3.406
30 year +20% CC 2160 minute winter	6.958	2.791	100 year +20% CC 2160 minute winter	8.493	3.406
30 year +20% CC 2880 minute summer	8.534	2.287	100 year +20% CC 2880 minute summer	10.355	2.775
30 year +20% CC 2880 minute winter	5.736	2.287	100 year +20% CC 2880 minute winter	6.959	2.775
30 year +20% CC 4320 minute summer	6.604	1.727	100 year +20% CC 4320 minute summer	7.942	2.076
30 year +20% CC 4320 minute winter	4.349	1.727	100 year +20% CC 4320 minute winter	5.230	2.076
30 year +20% CC 5760 minute summer	5.523	1.414	100 year +20% CC 5760 minute summer	6.598	1.689
30 year +20% CC 5760 minute winter	3.575	1.414	100 year +20% CC 5760 minute winter	4.270	1.689
30 year +20% CC 7200 minute summer	4.745	1.211	100 year +20% CC 7200 minute summer	5.640	1.439
30 year +20% CC 7200 minute winter	3.063	1.211	100 year +20% CC 7200 minute winter	3.640	1.439
30 year +20% CC 8640 minute summer	4.180	1.066	100 year +20% CC 8640 minute summer	4.947	1.262
30 year +20% CC 8640 minute winter	2.698	1.066	100 year +20% CC 8640 minute winter	3.193	1.262

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 99.68%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1.1	12	79.347	0.467	63.5	2.2931	0.0000	SURCHARGED
15 minute winter	1.000:50%	12	79.326	0.598	112.1	6.8696	0.0000	SURCHARGED
15 minute winter	1.2	11	79.234	0.734	182.5	3.8349	0.0000	SURCHARGED
15 minute winter	1.001:50%	11	79.108	0.758	236.0	0.0000	0.0000	SURCHARGED
15 minute winter	1.7	11	79.546	0.346	63.5	1.4147	0.0000	SURCHARGED
15 minute winter	2.000:50%	11	79.468	0.468	102.3	0.0000	0.0000	SURCHARGED
15 minute winter	1.6	11	79.219	0.494	130.1	1.4193	0.0000	SURCHARGED
15 minute winter	2.001:50%	11	79.127	0.565	171.8	5.0529	0.0000	SURCHARGED
15 minute winter	1.5	11	78.968	0.568	172.0	0.8131	0.0000	SURCHARGED
15 minute winter	1.3	10	78.895	0.695	409.5	0.9946	0.0000	SURCHARGED
60 minute winter	1.4	46	78.479	0.429	266.7	0.6138	0.0000	OK
60 minute winter	1a	46	78.479	0.479	169.8	0.5419	0.0000	SURCHARGED
30 minute summer	2a	23	78.163	0.213	81.4	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	1.1	1.000	1.000:50%	52.4	0.890	0.348	2.9677	
15 minute winter	1.1	1.000	1.2	125.8	1.218	0.837	2.9677	
15 minute winter	1.2	1.001	1.001:50%	188.1	1.187	0.892	5.5455	
15 minute winter	1.2	1.001	1.3	236.8	1.495	1.122	5.5455	
15 minute winter	1.7	2.000	2.000:50%	57.4	1.055	0.612	1.9717	
15 minute winter	1.7	2.000	1.6	95.9	1.490	1.023	1.9717	
15 minute winter	1.6	2.001	2.001:50%	126.5	1.295	0.666	1.9853	
15 minute winter	1.6	2.001	1.5	172.0	1.560	0.905	1.9853	
15 minute winter	1.5	2.002	1.3	173.4	1.572	0.950	0.3310	
15 minute winter	1.3	1.002	1.4	411.1	3.323	1.283	1.9829	
60 minute winter	1.4	Flow through pond	1a	169.8	0.206	0.009	231.5671	
60 minute winter	1a	3.000	2a	94.0	2.363	1.807	0.1966	391.6

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.68%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1.1	12	79.702	0.822	82.5	4.0368	0.0000	SURCHARGED
15 minute winter	1.000:50%	12	79.672	0.944	152.0	17.1120	0.0000	SURCHARGED
15 minute winter	1.2	12	79.552	1.052	211.6	5.4953	0.0000	SURCHARGED
15 minute winter	1.001:50%	11	79.373	1.023	279.0	0.0000	0.0000	SURCHARGED
15 minute winter	1.7	11	80.115	0.915	82.5	3.7474	0.0000	SURCHARGED
15 minute winter	2.000:50%	11	79.980	0.980	129.1	0.0000	0.0000	SURCHARGED
15 minute winter	1.6	12	79.569	0.844	170.4	2.4264	0.0000	SURCHARGED
15 minute winter	2.001:50%	12	79.430	0.867	225.2	11.9178	0.0000	SURCHARGED
15 minute winter	1.5	12	79.187	0.787	210.6	1.1258	0.0000	SURCHARGED
15 minute winter	1.3	11	79.065	0.865	486.0	1.2383	0.0000	SURCHARGED
60 minute winter	1.4	47	78.622	0.572	328.5	0.8180	0.0000	OK
60 minute winter	1a	47	78.621	0.621	213.3	0.7027	0.0000	SURCHARGED
15 minute summer	2a	15	78.163	0.213	87.0	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	1.1	1.000	1.000:50%	70.2	0.816	0.467	2.9677	
15 minute winter	1.1	1.000	1.2	154.0	1.396	1.025	2.9677	
15 minute winter	1.2	1.001	1.001:50%	220.1	1.389	1.043	5.5455	
15 minute winter	1.2	1.001	1.3	279.2	1.763	1.324	5.5455	
15 minute winter	1.7	2.000	2.000:50%	72.5	1.068	0.773	1.9717	
15 minute winter	1.7	2.000	1.6	127.8	1.814	1.362	1.9717	
15 minute winter	1.6	2.001	2.001:50%	167.1	1.515	0.879	1.9853	
15 minute winter	1.6	2.001	1.5	210.6	1.910	1.108	1.9853	
15 minute winter	1.5	2.002	1.3	212.2	1.924	1.163	0.3310	
15 minute winter	1.3	1.002	1.4	488.0	3.718	1.523	2.3252	
60 minute winter	1.4	Flow through pond	1a	213.3	0.228	0.011	304.2024	
60 minute winter	1a	3.000	2a	113.2	2.846	2.176	0.1966	508.6

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)	17.300	Minimum Backdrop Height (m)	0.200
Ratio-R	0.272	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)	Add Inflow (l/s)	Cover Level (m)	Diameter (mm)	Depth (m)
2.1	0.415	5.00		82.025	1200	1.425
2.2	0.260	5.00		80.500	1350	1.275
2.3	0.230	5.00		80.030	1350	1.430
2.4	0.065	5.00		80.030	1500	2.030
2.5	0.060	5.00		80.100	1350	1.750
2.6	0.150	5.00		80.100	1350	1.450
2.7	0.150	5.00		80.100	1200	1.050
2.8	0.332	5.00	5.0	79.900	1500	2.000
2.10				79.700	1500	2.350
1b		5.00		79.900	1200	2.600
2b				79.900	1200	2.700

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)
1.000	2.1	2.2	80.000	0.600	80.600	79.375	1.225	65.3	300	Circular	5.68	49.3	
1.001	2.2	2.3	70.048	0.600	79.225	78.600	0.625	112.1	450	Circular	6.29	47.3	
1.002	2.3	2.4	70.000	0.600	78.600	78.075	0.525	133.3	450	Circular	6.96	45.4	
2.000	2.7	2.6	67.000	0.600	79.050	78.725	0.325	206.2	300	Circular	6.02	48.2	0.160
2.001	2.6	2.5	55.000	0.600	78.650	78.350	0.300	183.3	375	Circular	6.71	46.1	0.100
2.002	2.5	2.4	44.001	0.600	78.350	78.150	0.200	220.0	375	Circular	7.31	44.5	
1.003	2.4	2.8	16.000	0.600	78.000	77.900	0.100	160.0	525	Circular	7.46	44.1	
1.004	2.8	2.10	16.472	0.600	77.900	77.750	0.150	109.8	525	Circular	7.59	43.8	
3.000	1b	2b	11.536	0.600	77.300	77.200	0.100	115.4	225	Circular	5.16	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)
1.000	2.1	2.2	137.7	55.4	1.125	0.825	1.125	0.415	0.0	1.845
1.001	2.2	2.3	305.3	86.6	0.825	0.980	0.980	0.675	0.0	1.660
1.002	2.3	2.4	279.7	111.4	0.980	1.505	1.505	0.905	0.0	1.663
2.000	2.7	2.6	77.1	40.5	0.750	1.075	1.075	0.310	0.0	1.104
2.001	2.6	2.5	147.4	70.0	1.075	1.375	1.375	0.560	0.0	1.318
2.002	2.5	2.4	134.4	74.7	1.375	1.505	1.505	0.620	0.0	1.247
1.003	2.4	2.8	382.7	190.0	1.505	1.475	1.505	1.590	0.0	1.764
1.004	2.8	2.10	462.5	233.0	1.475	1.425	1.475	1.922	5.0	2.141
3.000	1b	2b	48.4	0.0	2.375	2.475	2.475	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)	17.300	Analysis Speed	Detailed	Check Discharge Rate(s)	x
Ratio-R	0.272	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	8640

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 1b Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	77.500	Product Number	CTL-SHE-0117-7600-1800-7600
Design Depth (m)	1.800	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	7.6	Min Node Diameter (mm)	1200

Node 1b Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Main Channel Length (m)	50.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	77.300	Main Channel Slope (1:X)	1000.0
Safety Factor	2.0	Time to half empty (mins)		Main Channel n	0.015

Inlets
2.10

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	1120.0	0.0	2.000	1120.0	0.0	2.010	5.0	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	246.748	69.821	100 year +20% CC 15 minute summer	320.329	90.642
30 year +20% CC 15 minute winter	173.156	69.821	100 year +20% CC 15 minute winter	224.793	90.642
30 year +20% CC 30 minute summer	169.734	48.029	100 year +20% CC 30 minute summer	221.691	62.731
30 year +20% CC 30 minute winter	119.112	48.029	100 year +20% CC 30 minute winter	155.573	62.731
30 year +20% CC 60 minute summer	118.537	31.326	100 year +20% CC 60 minute summer	153.817	40.649
30 year +20% CC 60 minute winter	78.753	31.326	100 year +20% CC 60 minute winter	102.193	40.649
30 year +20% CC 120 minute summer	75.572	19.971	100 year +20% CC 120 minute summer	97.197	25.686
30 year +20% CC 120 minute winter	50.208	19.971	100 year +20% CC 120 minute winter	64.575	25.686
30 year +20% CC 180 minute summer	59.232	15.242	100 year +20% CC 180 minute summer	75.700	19.480
30 year +20% CC 180 minute winter	38.502	15.242	100 year +20% CC 180 minute winter	49.207	19.480
30 year +20% CC 240 minute summer	47.520	12.558	100 year +20% CC 240 minute summer	60.440	15.972
30 year +20% CC 240 minute winter	31.571	12.558	100 year +20% CC 240 minute winter	40.155	15.972
30 year +20% CC 360 minute summer	37.066	9.538	100 year +20% CC 360 minute summer	46.809	12.045
30 year +20% CC 360 minute winter	24.094	9.538	100 year +20% CC 360 minute winter	30.427	12.045
30 year +20% CC 480 minute summer	29.663	7.839	100 year +20% CC 480 minute summer	37.262	9.847
30 year +20% CC 480 minute winter	19.707	7.839	100 year +20% CC 480 minute winter	24.756	9.847
30 year +20% CC 600 minute summer	24.602	6.729	100 year +20% CC 600 minute summer	30.776	8.418
30 year +20% CC 600 minute winter	16.810	6.729	100 year +20% CC 600 minute winter	21.028	8.418
30 year +20% CC 720 minute summer	22.159	5.939	100 year +20% CC 720 minute summer	27.624	7.404
30 year +20% CC 720 minute winter	14.892	5.939	100 year +20% CC 720 minute winter	18.565	7.404
30 year +20% CC 960 minute summer	18.513	4.875	100 year +20% CC 960 minute summer	22.954	6.044
30 year +20% CC 960 minute winter	12.264	4.875	100 year +20% CC 960 minute winter	15.205	6.044
30 year +20% CC 1440 minute summer	13.769	3.690	100 year +20% CC 1440 minute summer	16.942	4.541
30 year +20% CC 1440 minute winter	9.254	3.690	100 year +20% CC 1440 minute winter	11.386	4.541
30 year +20% CC 2160 minute summer	10.098	2.791	100 year +20% CC 2160 minute summer	12.326	3.406
30 year +20% CC 2160 minute winter	6.958	2.791	100 year +20% CC 2160 minute winter	8.493	3.406
30 year +20% CC 2880 minute summer	8.534	2.287	100 year +20% CC 2880 minute summer	10.355	2.775
30 year +20% CC 2880 minute winter	5.736	2.287	100 year +20% CC 2880 minute winter	6.959	2.775
30 year +20% CC 4320 minute summer	6.604	1.727	100 year +20% CC 4320 minute summer	7.942	2.076
30 year +20% CC 4320 minute winter	4.349	1.727	100 year +20% CC 4320 minute winter	5.230	2.076
30 year +20% CC 5760 minute summer	5.523	1.414	100 year +20% CC 5760 minute summer	6.598	1.689
30 year +20% CC 5760 minute winter	3.575	1.414	100 year +20% CC 5760 minute winter	4.270	1.689
30 year +20% CC 7200 minute summer	4.745	1.211	100 year +20% CC 7200 minute summer	5.640	1.439
30 year +20% CC 7200 minute winter	3.063	1.211	100 year +20% CC 7200 minute winter	3.640	1.439
30 year +20% CC 8640 minute summer	4.180	1.066	100 year +20% CC 8640 minute summer	4.947	1.262
30 year +20% CC 8640 minute winter	2.698	1.066	100 year +20% CC 8640 minute winter	3.193	1.262

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 99.82%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	2.1	11	80.836	0.236	131.8	1.6393	0.0000	OK
15 minute winter	2.2	10	79.504	0.279	206.8	1.5359	0.0000	OK
15 minute winter	2.3	12	79.256	0.656	275.9	3.0497	0.0000	SURCHARGED
8640 minute winter	2.4	8040	79.022	1.022	13.6	2.4620	0.0000	SURCHARGED
8640 minute winter	2.5	8040	79.022	0.672	3.8	1.4235	0.0000	SURCHARGED
15 minute winter	2.6	12	79.230	0.580	118.8	2.0312	0.0000	SURCHARGED
15 minute winter	2.001:50%	12	79.146	0.646	142.7	0.0000	0.0000	SURCHARGED
15 minute winter	2.7	12	79.389	0.339	47.7	1.3516	0.0000	SURCHARGED
15 minute winter	2.000:50%	12	79.363	0.475	97.1	4.6411	0.0000	SURCHARGED
8640 minute winter	2.8	8040	79.022	1.122	30.3	5.7097	0.0000	SURCHARGED
8640 minute winter	2.10	8040	79.022	1.672	51.2	2.9550	0.0000	OK
8640 minute winter	1b	8040	79.022	1.722	52.7	1.9480	0.0000	SURCHARGED
15 minute summer	2b	1	77.200	0.000	3.3	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	2.1	1.000	2.2	127.3	2.198	0.924	4.6314	
15 minute winter	2.2	1.001	2.3	205.2	1.659	0.672	9.0014	
15 minute winter	2.3	1.002	2.4	254.3	1.605	0.909	11.0910	
8640 minute winter	2.4	1.003	2.8	21.0	0.596	0.055	3.4565	
8640 minute winter	2.5	2.002	2.4	3.8	0.541	0.028	4.8532	
15 minute winter	2.6	2.001	2.001:50%	114.8	1.230	0.779	3.0332	
15 minute winter	2.6	2.001	2.5	135.2	1.307	0.917	3.0332	
15 minute winter	2.7	2.000	2.000:50%	46.3	0.844	0.600	2.3590	
15 minute winter	2.7	2.000	2.6	83.2	1.348	1.079	2.3590	
8640 minute winter	2.8	1.004	2.10	30.2	0.883	0.065	3.5585	
8640 minute winter	2.10	Flow through pond	1b	52.7	0.014	0.001	1901.3933	
8640 minute winter	1b	Hydro-Brake®	2b	7.4				3267.0

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.82%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	2.1	12	81.424	0.824	171.1	5.7329	0.0000	SURCHARGED
15 minute winter	2.2	12	80.091	0.866	247.1	4.7713	0.0000	SURCHARGED
15 minute winter	2.3	12	79.696	1.096	320.9	5.0957	0.0000	SURCHARGED
8640 minute winter	2.4	7080	79.280	1.280	16.9	3.0831	0.0000	SURCHARGED
15 minute winter	2.5	12	79.321	0.971	158.4	2.0549	0.0000	SURCHARGED
15 minute winter	2.6	12	79.575	0.925	121.1	3.2385	0.0000	SURCHARGED
15 minute winter	2.001:50%	12	79.479	0.979	144.8	0.0000	0.0000	SURCHARGED
15 minute winter	2.7	13	79.764	0.714	61.9	2.8457	0.0000	SURCHARGED
15 minute winter	2.000:50%	13	79.728	0.840	112.0	14.5300	0.0000	SURCHARGED
8640 minute winter	2.8	7080	79.280	1.380	29.1	7.0219	0.0000	SURCHARGED
8640 minute winter	2.10	7080	79.280	1.930	48.2	3.4108	0.0000	OK
8640 minute winter	1b	7080	79.280	1.980	84.1	2.2397	0.0000	SURCHARGED
15 minute summer	2b	1	77.200	0.000	5.1	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	2.1	1.000	2.2	140.0	2.112	1.016	5.6335	
15 minute winter	2.2	1.001	2.3	231.6	1.674	0.759	11.0986	
15 minute winter	2.3	1.002	2.4	302.6	1.910	1.082	11.0910	
8640 minute winter	2.4	1.003	2.8	22.1	0.605	0.058	3.4565	
15 minute winter	2.5	2.002	2.4	160.9	1.460	1.197	4.8532	
15 minute winter	2.6	2.001	2.001:50%	126.5	1.242	0.858	3.0332	
15 minute winter	2.6	2.001	2.5	144.5	1.314	0.980	3.0332	
15 minute winter	2.7	2.000	2.000:50%	49.9	0.860	0.648	2.3590	
15 minute winter	2.7	2.000	2.6	105.0	1.491	1.361	2.3590	
8640 minute winter	2.8	1.004	2.10	40.3	0.892	0.087	3.5585	
8640 minute winter	2.10	Flow through pond	1b	84.1	0.014	0.001	2190.2354	
8640 minute winter	1b	Hydro-Brake®	2b	7.6				3405.0

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: 304800, Northing: 229600,

	Interval		Years													
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.4,	3.5,	4.2,	5.1,	5.8,	6.4,	8.2,	10.3,	11.7,	13.8,	15.6,	17.1,	19.4,	21.2,	22.7,	N/A ,
10 mins	3.3,	4.9,	5.8,	7.2,	8.1,	8.9,	11.4,	14.3,	16.3,	19.2,	21.8,	23.8,	27.0,	29.5,	31.6,	N/A ,
15 mins	3.9,	5.8,	6.8,	8.4,	9.5,	10.4,	13.4,	16.9,	19.2,	22.6,	25.6,	28.0,	31.8,	34.7,	37.2,	N/A ,
30 mins	5.1,	7.5,	8.8,	10.9,	12.3,	13.4,	17.1,	21.4,	24.3,	28.5,	32.3,	35.2,	39.8,	43.4,	46.5,	N/A ,
1 hours	6.7,	9.8,	11.4,	14.0,	15.8,	17.2,	21.8,	27.2,	30.8,	36.0,	40.6,	44.2,	49.9,	54.3,	58.0,	N/A ,
2 hours	8.8,	12.7,	14.8,	18.1,	20.4,	22.1,	27.9,	34.6,	39.0,	45.4,	51.1,	55.6,	62.5,	67.9,	72.4,	N/A ,
3 hours	10.3,	14.8,	17.3,	21.0,	23.6,	25.6,	32.2,	39.8,	44.8,	52.0,	58.5,	63.5,	71.3,	77.4,	82.4,	N/A ,
4 hours	11.5,	16.5,	19.3,	23.4,	26.2,	28.4,	35.6,	43.9,	49.5,	57.3,	64.3,	69.8,	78.3,	84.9,	90.4,	N/A ,
6 hours	13.5,	19.3,	22.4,	27.1,	30.4,	32.9,	41.1,	50.6,	56.8,	65.7,	73.6,	79.7,	89.3,	96.7,	102.9,	N/A ,
9 hours	15.9,	22.5,	26.1,	31.5,	35.2,	38.1,	47.5,	58.2,	65.2,	75.3,	84.2,	91.1,	101.9,	110.2,	117.1,	N/A ,
12 hours	17.7,	25.1,	29.1,	35.0,	39.1,	42.2,	52.5,	64.2,	72.0,	82.9,	92.6,	100.2,	111.8,	120.9,	128.4,	N/A ,
18 hours	20.8,	29.3,	33.8,	40.7,	45.3,	48.9,	60.6,	73.9,	82.7,	95.0,	106.0,	114.5,	127.6,	137.8,	146.2,	N/A ,
24 hours	23.3,	32.7,	37.7,	45.2,	50.3,	54.2,	67.1,	81.6,	91.2,	104.6,	116.6,	125.8,	140.1,	151.1,	160.3,	192.3,
2 days	29.3,	39.9,	45.5,	53.8,	59.3,	63.5,	77.1,	92.3,	102.2,	115.9,	127.9,	137.2,	151.4,	162.2,	171.2,	202.3,
3 days	34.2,	45.8,	51.8,	60.6,	66.5,	71.0,	85.3,	101.1,	111.3,	125.4,	137.7,	147.1,	161.5,	172.4,	181.4,	212.5,
4 days	38.4,	50.9,	57.3,	66.6,	72.8,	77.5,	92.5,	108.8,	119.4,	133.8,	146.4,	156.0,	170.5,	181.6,	190.7,	221.9,
6 days	45.9,	59.8,	66.8,	77.0,	83.7,	88.8,	104.9,	122.2,	133.3,	148.4,	161.5,	171.4,	186.4,	197.8,	207.1,	238.8,
8 days	52.5,	67.6,	75.2,	86.1,	93.2,	98.6,	115.6,	133.8,	145.4,	161.1,	174.7,	184.9,	200.3,	212.0,	221.5,	253.8,
10 days	58.6,	74.7,	82.8,	94.4,	101.9,	107.6,	125.3,	144.3,	156.3,	172.6,	186.5,	197.1,	212.9,	224.8,	234.5,	267.4,
12 days	64.3,	81.4,	89.9,	102.0,	109.9,	115.8,	134.3,	154.0,	166.4,	183.1,	197.4,	208.2,	224.4,	236.6,	246.5,	279.9,
16 days	74.8,	93.6,	102.9,	116.1,	124.5,	130.9,	150.7,	171.6,	184.7,	202.3,	217.3,	228.5,	245.3,	258.0,	268.2,	302.6,
20 days	84.6,	104.9,	114.8,	128.9,	137.9,	144.7,	165.6,	187.5,	201.2,	219.6,	235.2,	246.9,	264.2,	277.3,	287.8,	323.2,
25 days	96.1,	118.0,	128.7,	143.8,	153.4,	160.6,	182.7,	205.8,	220.2,	239.4,	255.7,	267.8,	285.8,	299.3,	310.2,	346.6,

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

HR Wallingford
Working with water

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Elena Dragoje
Site name:	JMC
Site location:	Kingswood Business Park, Baldonnell, D22

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.

Site Details

Latitude:	53.30645° N
Longitude:	6.42769° W
Reference:	3851999538
Date:	Jan 10 2022 18:24

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 3.8165

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):	899	756
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):	9.32	7.61
1 in 1 year (l/s):	7.92	6.47
1 in 30 years (l/s):	19.85	16.21
1 in 100 year (l/s):	24.33	19.86
1 in 200 years (l/s):	26.66	21.77

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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.

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

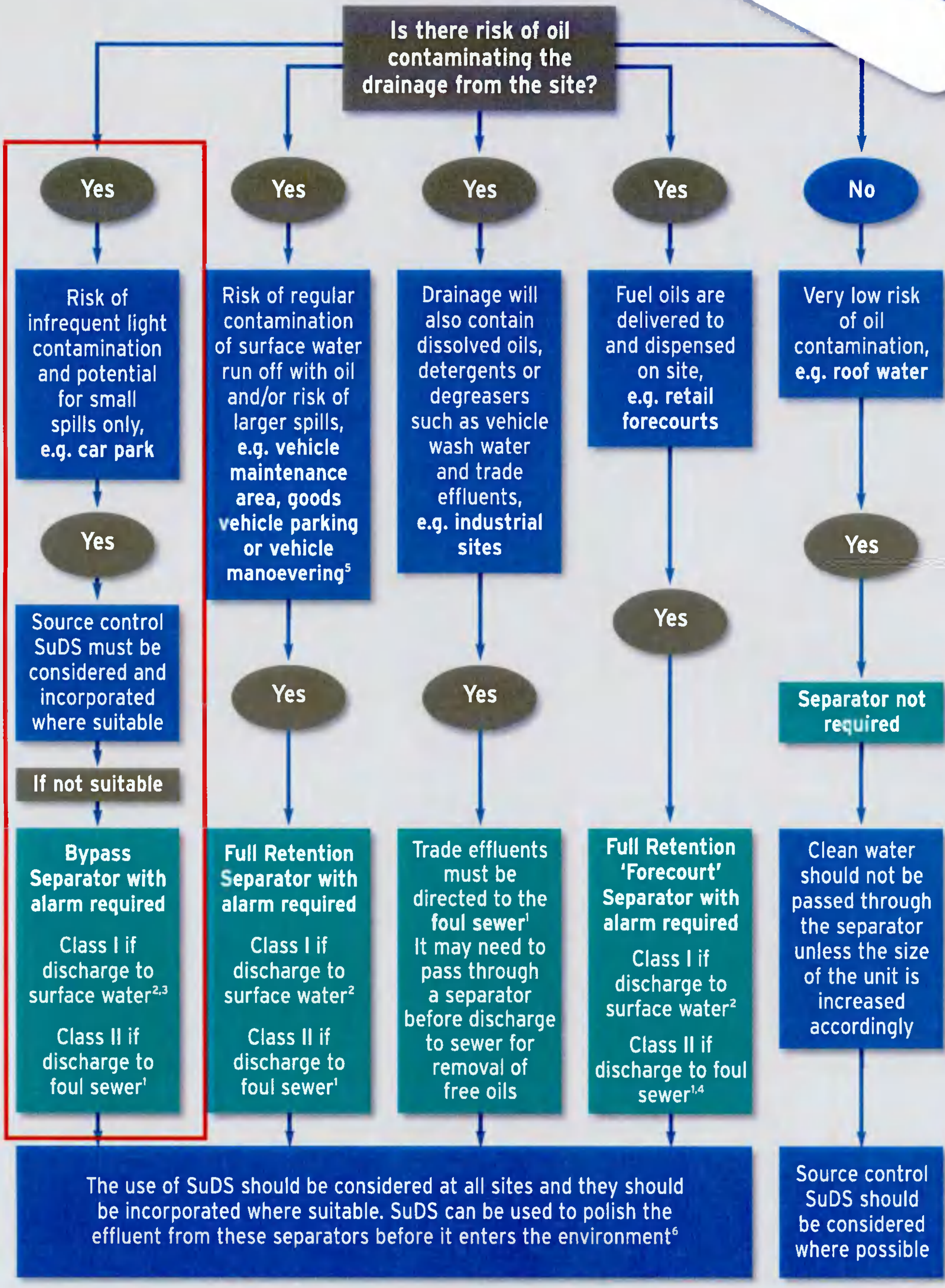
Forecourt separators are full retention separators specified to retain on site the maximum spillage likely to occur on a petrol filling station. They are required for both safety and environmental reasons and will treat spillages occurring during vehicle refuelling and road tanker delivery. The size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

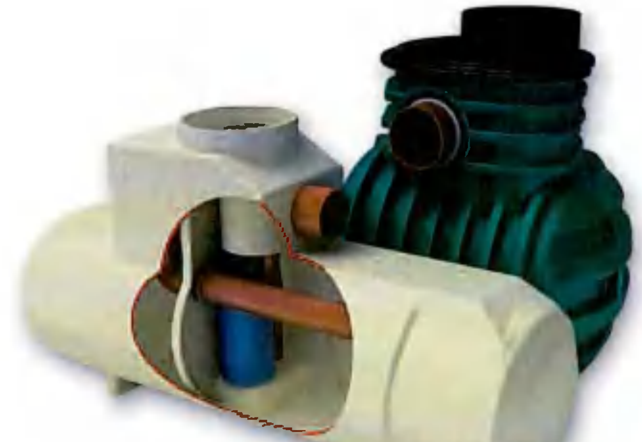
Klargester were one of the first UK manufacturers to have separators tested to EN 858-1. Klargester have now added the NSB bypass range to their portfolio of certified and tested models. The NSB number denotes the maximum flow at which the separator treats liquids. The British Standards Institute (BSI) 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 (m²)	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.
- 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) 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

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

www.klargester.com/installers

Kingspan Klargester Accredited Installer

CARE & MAINTENANCE

Kingspan Environmental Services

Who better to look after your treatment plant than the people who designed and built it?

Kingspan Environmental have a dedicated service division providing maintenance for wastewater products.

Factory trained engineers are available for site visits as part of a planned maintenance contract or on a one-off call out basis.

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0844 846 0500

or visit us online:

www.kingspanenvservice.com

Kingspan Environmental Services

Kingspan Klargester

COMMERCIAL WASTEWATER SOLUTIONS

- **BIODISC®, BIOTEC™ & ENVIROSAFE** HIGH PERFORMANCE SEWAGE TREATMENT SYSTEMS
- **HILLMASTER** PACKAGE PUMP STATIONS
- **PUMPSTOR24** PUMPING SYSTEMS
- STORMWATER ATTENUATION SYSTEMS
- OIL/WATER SEPARATORS
- BELOW GROUND STORAGE TANKS
- GREASE & SILT TRAPS

Kingspan Water

NEW BUILD & RETROFIT SOLUTIONS

- BELOW GROUND RAINWATER HARVESTING SYSTEMS
- ABOVE GROUND RAINWATER HARVESTING SYSTEMS

PROVIDE KLARGESTER CLASS I BYPASS PETROL INTERCEPTOR REF. NSBE040

2NO P.I. TO BE INSTALLED UPSTREAM OF EACH ATTENUATION SYSTEM.

Klargester

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Visit our website **www.klargester.com** or our company website **www.kingspanenv.com**

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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

www.cdstech.com.au

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

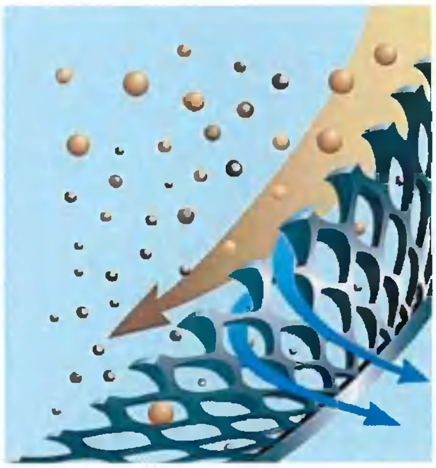
Field evaluations to determine pollutant mobilization have found that the vast majority of pollutants are mobilized in flows that are well below the design capacity' for the conveyance facility - typically known as the 'first flush'.

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.



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 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

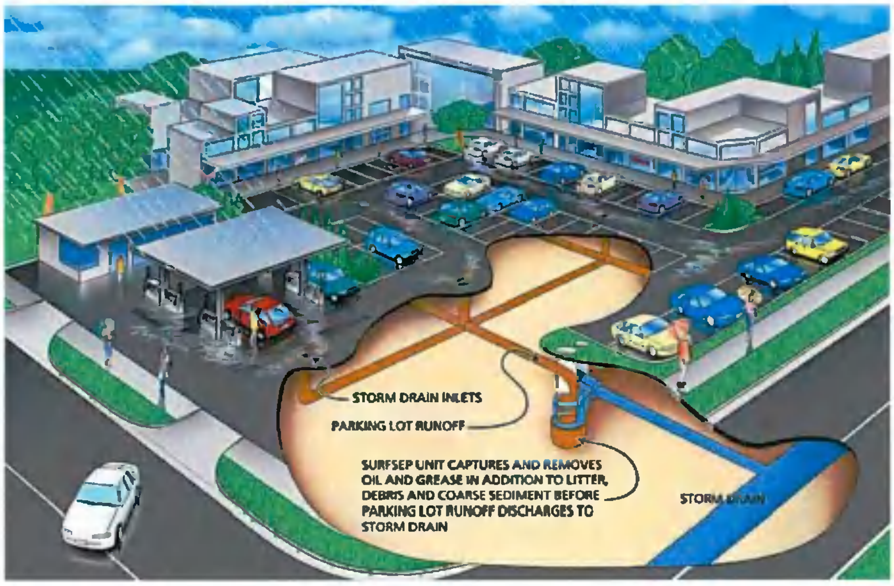
Flow Control

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.



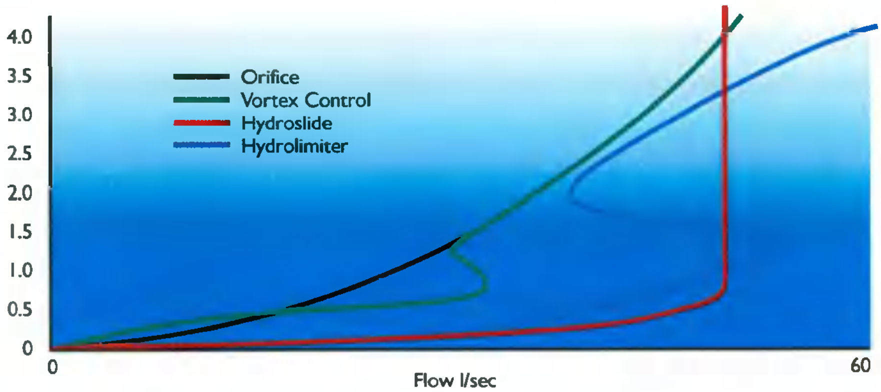
Typical SurfSep installation

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

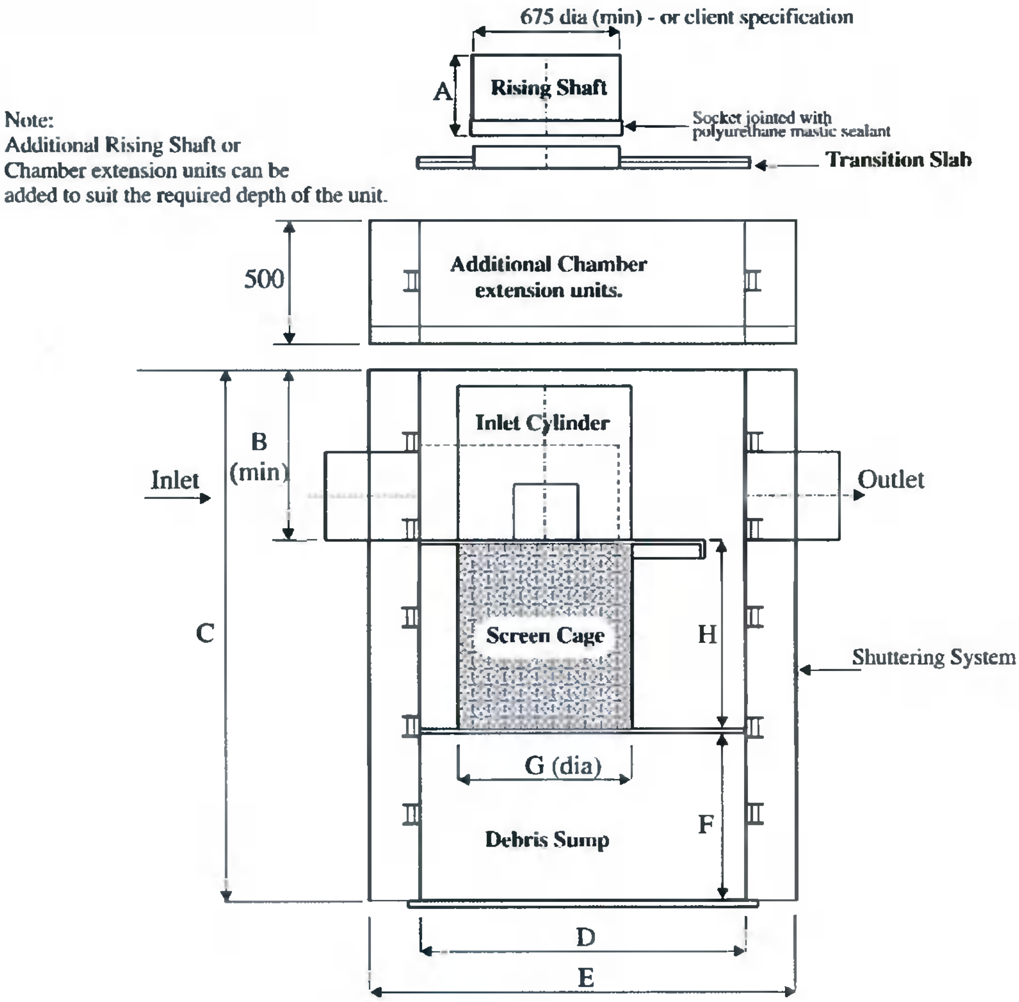
- Eduction (Suction)
- Basket Removal
- Mechanical Grab

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)

	SW10404	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.

CDS TECHNOLOGIES

Surface Water Treatment

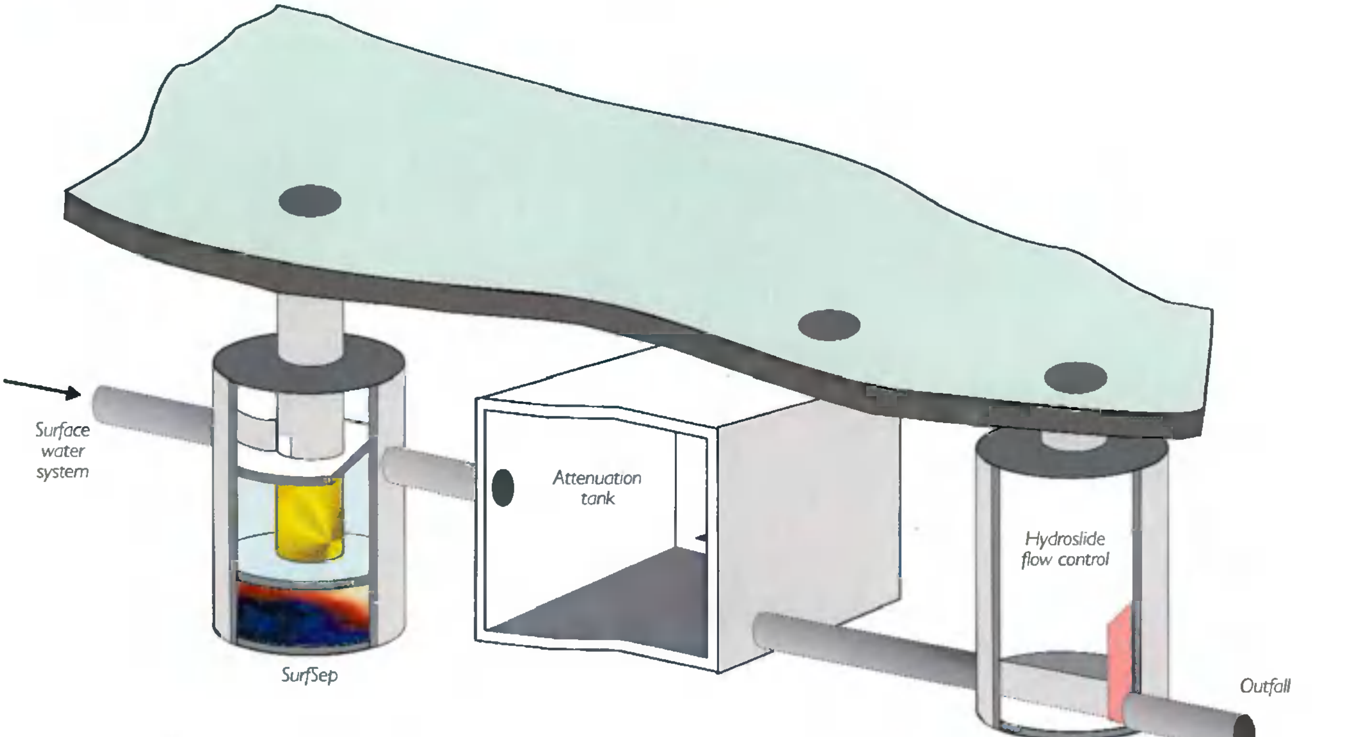


Illustration: Detention & Retention Systems

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 BRITISH BOARD OF AGREMENT

* 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:

PROVIDE SILT TRAP REF. SWI 0804
2NO S.T. TO BE INSTALLED UPSTREAM OF EACH ATTENUATION SYSTEM.

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.

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

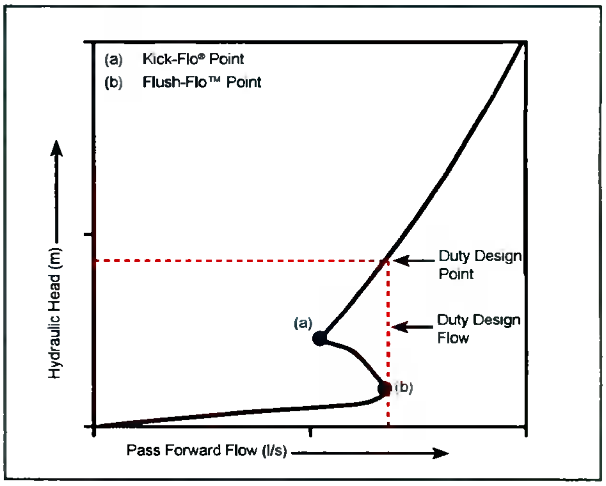
BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE No 08/4599

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:

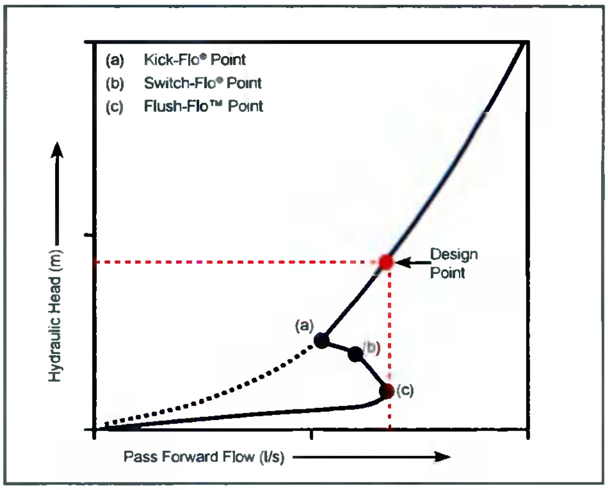
- outlet size and model of Hydro-Brake® Flow Control
- definition of the duty/design point (head and flow)
- definition of the Flush-Flo™ point (head and flow)
- definition of the Kick-Flo® point (head and flow)

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 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.

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 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.

HRD Technologies Ltd

HRD Technologies Ltd • Tootenhill House • Rathcoole • Co. Dublin • Ireland
Tel: +353 (0) 1 4013964 • Fax: +353 (0) 1 4013978 • www.hrdtec.com
HRD Technologies Ltd is a subsidiary of Hydro International plc

Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.800	7.630
Flush-Flo™	0.512	7.418
Kick-Flo®	1.042	5.906
Mean Flow		6.574

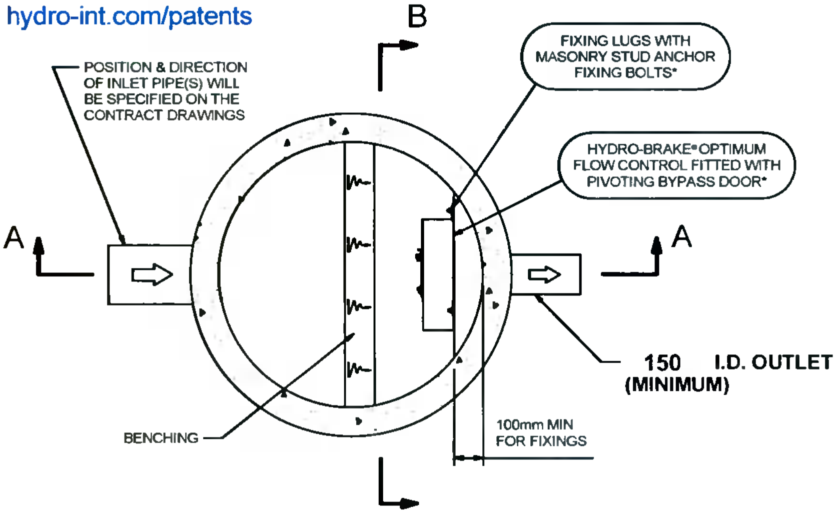
Hydro-Brake® Optimum Flow Control including:

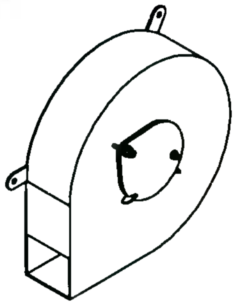
- 3 mm grade 304L stainless steel
- Integral stainless steel pivoting by-pass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Beed blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet

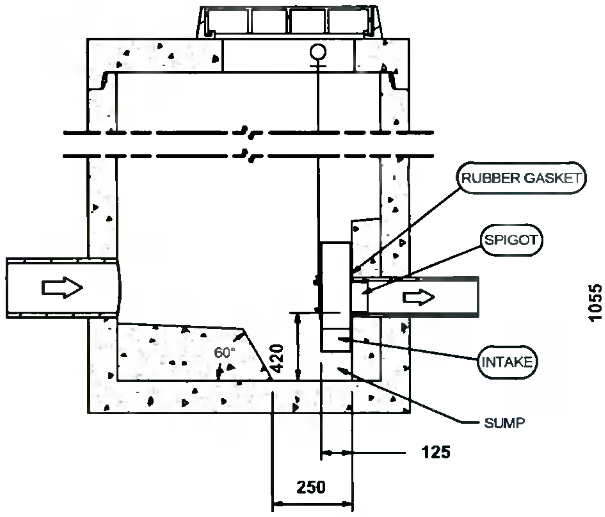
BBA APPROVAL INSPECTION TESTING CERTIFICATION CERTIFICATE 08/4596

WRc Approved PT/329/0412

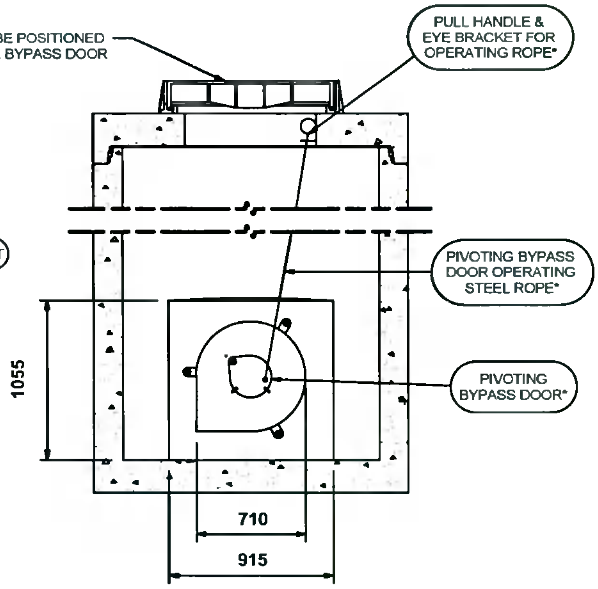
hydro-int.com/patents







SECTION A-A



SECTION B-B

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

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

DESIGN ADVICE !

The head/flow characteristics of this SHE-0117-7630-1800-7630 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.
The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro International®

DATE	1/27/2022 8:11 PM
SITE	JMC Kingswood, Baldonnell, D22
DESIGNER	Elena Dragoje
REF	D1568

SHE-0117-7630-1800-7630

Hydro-Brake® Optimum

edragoje@kavanaghburke.ie

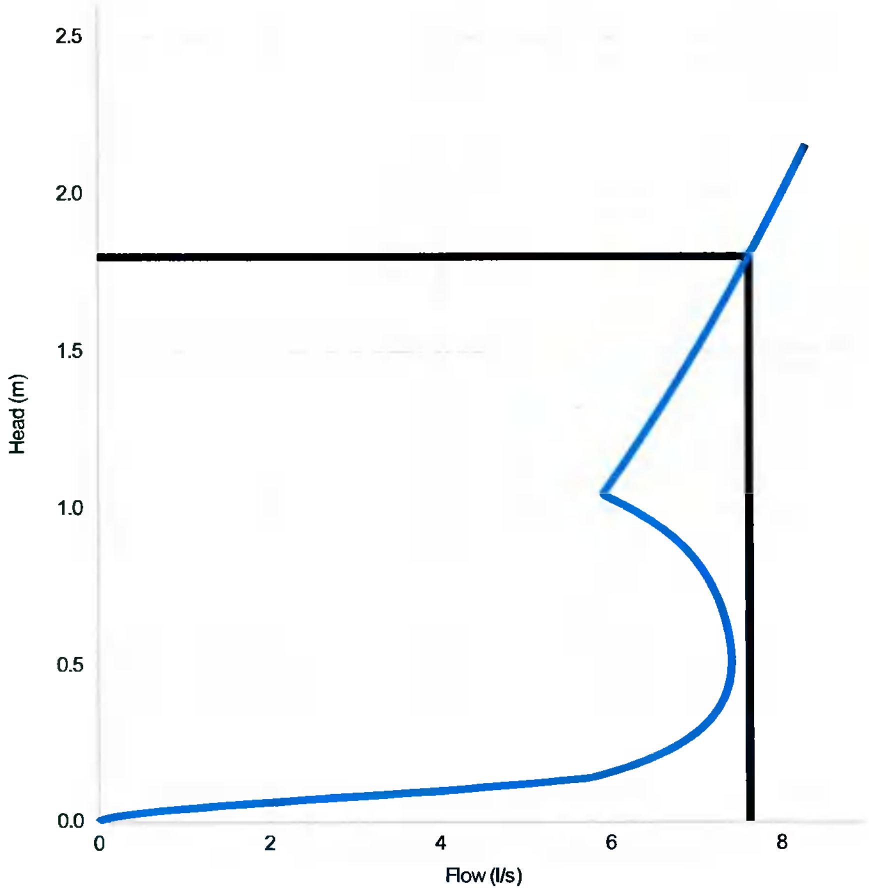
Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.800	7.630
Flush-Flo	0.512	7.418
Kick-Flo®	1.042	5.906
Mean Flow		6.574

hydro-int.com/patents

BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE No 08/4596

WRc APPROVED
PT/329/0412



Head (m)	Flow (l/s)
0.000	0.000
0.062	1.979
0.124	5.183
0.186	6.312
0.248	6.801
0.310	7.107
0.372	7.289
0.434	7.383
0.497	7.417
0.559	7.408
0.621	7.368
0.683	7.300
0.745	7.203
0.807	7.068
0.869	6.880
0.931	6.622
0.993	6.271
1.055	5.941
1.117	6.101
1.179	6.256
1.241	6.408
1.303	6.555
1.366	6.699
1.428	6.840
1.490	6.977
1.552	7.112
1.614	7.243
1.676	7.373
1.738	7.499
1.800	7.624

DESIGN ADVICE

!

The head/flow characteristics of this SHE-0117-7630-1800-7630 Hydro-Brake Optimum® Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.

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

Hydro International®

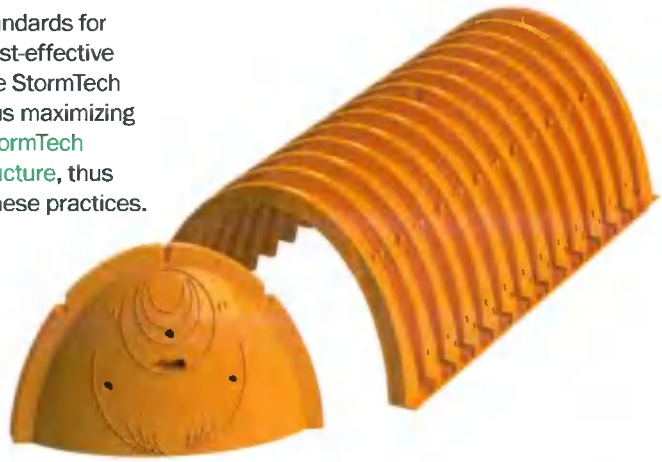
DATE	27/01/2022 20:11
Site	JMC Kingswood, Baldonnell, D22
DESIGNER	Elena Dragoje
Ref	D1568

SHE-0117-7630-1800-7630

Hydro-Brake Optimum®

STORMTECH SC-740 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 SC-740 CHAMBER
(not to scale)

Nominal Chamber Specifications

Size (L x W x H)
85.4" x 51" x 30"
2,170 mm x 1,295 mm x 762 mm

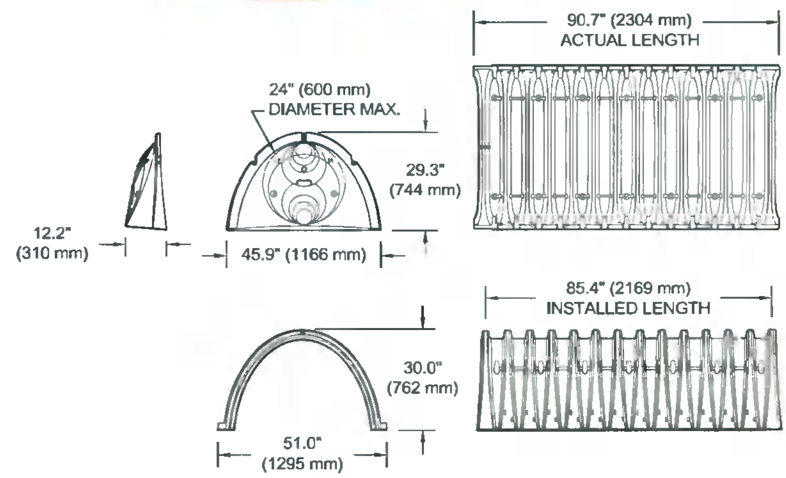
Chamber Storage
45.9 ft^3 (1.30 m^3)

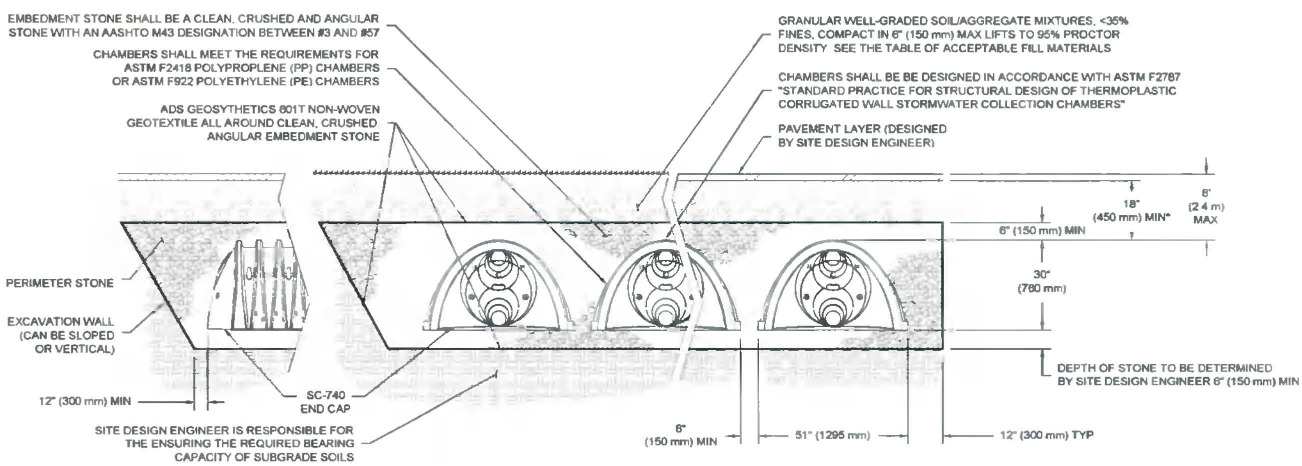
Min. Installed Storage*
74.9 ft^3 (2.12 m^3)

Weight
74.0 lbs (33.6 kg)

Shipping
30 chambers/pallet
60 end caps/pallet
12 pallets/truck

*Assumes 6" (150 mm) stone above, below and between chambers 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

SC-740 CUMULATIVE STORAGE VOLUMES PER CHAMBER

Assumes 40% Stone Porosity. Calculations are Based Upon a 6" (150 mm) Stone Base Under Chambers.

Depth of Water in System Inches (mm)	Cumulative Chamber Storage ft³ (m³)	Total System Cumulative Storage ft³ (m³)
42 (1067)	↑ 45.90 (1.300)	74.90 (2.121)
41 (1041)	45.90 (1.300)	73.77 (2.089)
40 (1016)	Stone 45.90 (1.300)	72.64 (2.057)
39 (991)	Cover 45.90 (1.300)	71.52 (2.025)
38 (965)	45.90 (1.300)	70.39 (1.993)
37 (940)	↓ 45.90 (1.300)	69.26 (1.961)
36 (914)	45.90 (1.300)	68.14 (1.929)
35 (889)	45.85 (1.298)	66.98 (1.897)
34 (864)	45.69 (1.294)	65.75 (1.862)
33 (838)	45.41 (1.286)	64.46 (1.825)
32 (813)	44.81 (1.269)	62.97 (1.783)
31 (787)	44.01 (1.246)	61.36 (1.737)
30 (762)	43.06 (1.219)	59.66 (1.689)
29 (737)	41.98 (1.189)	57.89 (1.639)
28 (711)	40.80 (1.155)	56.05 (1.587)
27 (686)	39.54 (1.120)	54.17 (1.534)
26 (660)	38.18 (1.081)	52.23 (1.479)
25 (635)	36.74 (1.040)	50.23 (1.422)
24 (610)	35.22 (0.977)	48.19 (1.365)
23 (584)	33.64 (0.953)	46.11 (1.306)
22 (559)	31.99 (0.906)	44.00 (1.246)
21 (533)	30.29 (0.858)	1.85 (1.185)
20 (508)	28.54 (0.808)	39.67 (1.123)
19 (483)	26.74 (0.757)	37.47 (1.061)
18 (457)	24.89 (0.705)	35.23 (0.997)
17 (432)	23.00 (0.651)	32.96 (0.939)
16 (406)	21.06 (0.596)	30.68 (0.869)
15 (381)	19.09 (0.541)	28.36 (0.803)
14 (356)	17.08 (0.484)	26.03 (0.737)
13 (330)	15.04 (0.426)	23.68 (0.670)
12 (305)	12.97 (0.367)	21.31 (0.608)
11 (279)	10.87 (0.309)	18.92 (0.535)
10 (254)	8.74 (0.247)	16.51 (0.468)
9 (229)	6.58 (0.186)	14.09 (0.399)
8 (203)	4.41 (0.125)	11.66 (0.330)
7 (178)	2.21 (0.063)	9.21 (0.264)
6 (152)	↑ 0 (0)	6.76 (0.191)
5 (127)	0 (0)	5.63 (0.160)
4 (102)	Stone 0 (0)	4.51 (0.128)
3 (76)	Foundation 0 (0)	3.38 (0.096)
2 (51)	0 (0)	2.25 (0.064)
1 (25)	↓ 0 (0)	1.13 (0.032)

Note: Add 1.13 ft³ (0.032 m³) of storage for each additional inch (25 mm) of stone foundation.

STORAGE VOLUME PER CHAMBER FT³ (M³)

	Bare Chamber Storage ft³ (m³)	Chamber and Stone Foundation Depth in. (mm)		
		6 (150)	12 (300)	18 (450)
SC-740 Chamber	45.9 (1.3)	74.9 (2.1)	81.7 (2.3)	88.4 (2.5)

Note: Assumes 6" (150 mm) stone above chambers, 6" (150 mm) row spacing and 40% stone porosity.

AMOUNT OF STONE PER CHAMBER

ENGLISH TONS (yds³)	Stone Foundation Depth		
	6"	12"	16"
SC-740	3.8 (2.8)	4.6 (3.3)	5.5 (3.9)
METRIC KILOGRAMS (m³)	150 mm	300 mm	450 mm
SC-740	3,450 (2.1)	4,170 (2.5)	4,490 (3.0)

Note: Assumes 6" (150 mm) of stone above and between chambers.

VOLUME EXCAVATION PER CHAMBER YD³ (M³)

	Stone Foundation Depth		
	6 (150)	12 (300)	18 (450)
SC-740	5.5 (4.2)	6.2 (4.7)	6.8 (5.2)

Note: Assumes 6" (150 mm) of row separation and 18" (450 mm) of cover. The volume of excavation will vary as depth of cover increases.

ADS StormTech DESIGN TOOL

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

For more information on the StormTech SC-740 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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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

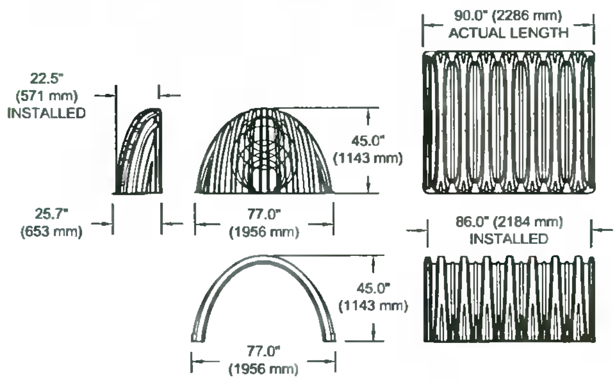
Size (L x W x H)
26.5" x 71" x 45.1"
673 mm x 1,803 mm x 1,145 mm

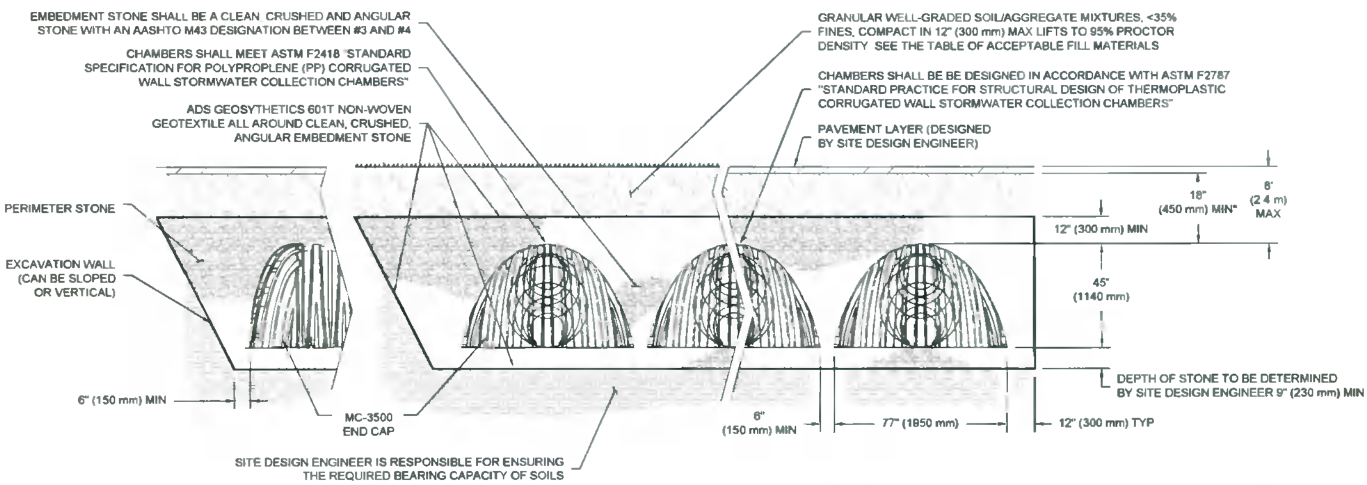
End Cap Storage
14.9 ft^3 (0.42 m^3)

Min. Installed Storage*
45.1ft^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

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MC-3500 CHAMBER SPECIFICATION

STORAGE VOLUME PER CHAMBER FT^3 (M^3)

	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 YD^3 (M^3)

	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.

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KAVANAGH BURKE
CONSULTING ENGINEERS

Discharge Units Calculation

KAVANAGH BURKE
CONSULTING ENGINEERS

INPUT FOR FOUL SEWER NETWORK DESIGN

Client: JMC VAN TRANS LTD

Project: WAREHOUSE DEVELOPMENT AT
KINGSWOOD BUSINESS PARK,
BALDONNELL, DUBLIN 22

Project Ref: **D1568 - PLANNING ALTERATIONS (2021) A.I.**

Floors	Type of Applience	Discharge Unit per Applience	No of Applie.	Discharge Units
OFFICE/STAFF FACILITIES				
GROUND FLOOR PLAN:	WB	0.6	7	4.2
	WC	2.5	8	20.0
	URINAL	0.8	2	1.6
	SINK	1.3	1	1.3
	SHOWER	0.6	3	1.8
	DISHWASHER	0.8	1	0.8
		TOTAL:		***30***
FIRST FLOOR PLAN:	WB	0.6	6	3.6
	WC	2.5	4	10.0
	URINAL	0.8	2	1.6
		TOTAL:		***15***
SECOND FLOOR PLAN:	WB	0.6	7	4.2
	WC	2.5	6	15.0
	URINAL	0.8	2	1.6
	SHOWER	0.6	5	3.0
		TOTAL:		***24***
TOTAL NO OF DICHARGE UNITS FOR OFFICE BLOCK 2:				***69***
			Q (l/sec) =	*5.80*

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

INPUT FOR FOUL SEWER NETWORK DESIGN

Client: JMC VAN TRANS LTD
Project: WAREHOUSE DEVELOPMENT AT KINGSWOOD BUSINESS PARK, BALDONNELL, DUBLIN 22

Project Ref: **D1568 - PLANNING ALTERATIONS (2021) A.I.**

Floors	Type of Applience	Discharge Unit per Applience	No of Applie.	Discharge Units
OFFICE/STAFF FACILITIES				
OFFICE B	WB	0.6	4	2.4
GROUND FLOOR	WC	2.5	4	10.0
	SINK	1.3	1	1.3
	SHOWER	0.6	3	1.8
	URINAL	0.8	2	1.6
	DISHWASHER	0.8	1	0.8
	TOTAL:			***17.9***
TOTAL NO OF DICHARGE UNITS:				***18***
Q (l/sec) =				*2.96*

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

INPUT FOR FOUL SEWER NETWORK DESIGN

Client: JMC VAN TRANS LTD
Project: WAREHOUSE DEVELOPMENT AT KINGSWOOD BUSINESS PARK, BALDONNELL, DUBLIN 22

Project Ref: **D1568 - PLANNING ALTERATIONS (2021) A.I.**

Floors	Type of Applience	Discharge Unit per Applience	No of Applie.	Discharge Units
OFFICE/STAFF FACILITIES				
SECURITY HUT GROUND FLOOR	WB	0.6	1	0.6
	WC	2.5	1	2.5
	SINK	1.3	1	1.3
	TOTAL:			***4.4***
TOTAL NO OF DICHARGE UNITS:				***4***
Q (l/sec) =				*1.47*

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

INPUT FOR FOUL SEWER NETWORK DESIGN

Client: JMC VAN TRANS LTD

Project: WAREHOUSE DEVELOPMENT AT KINGSWOOD BUSINESS PARK, BALDONNELL, DUBLIN 22

Project Ref: **D1568 - PLANNING ALTERATIONS (2021) A.I.**

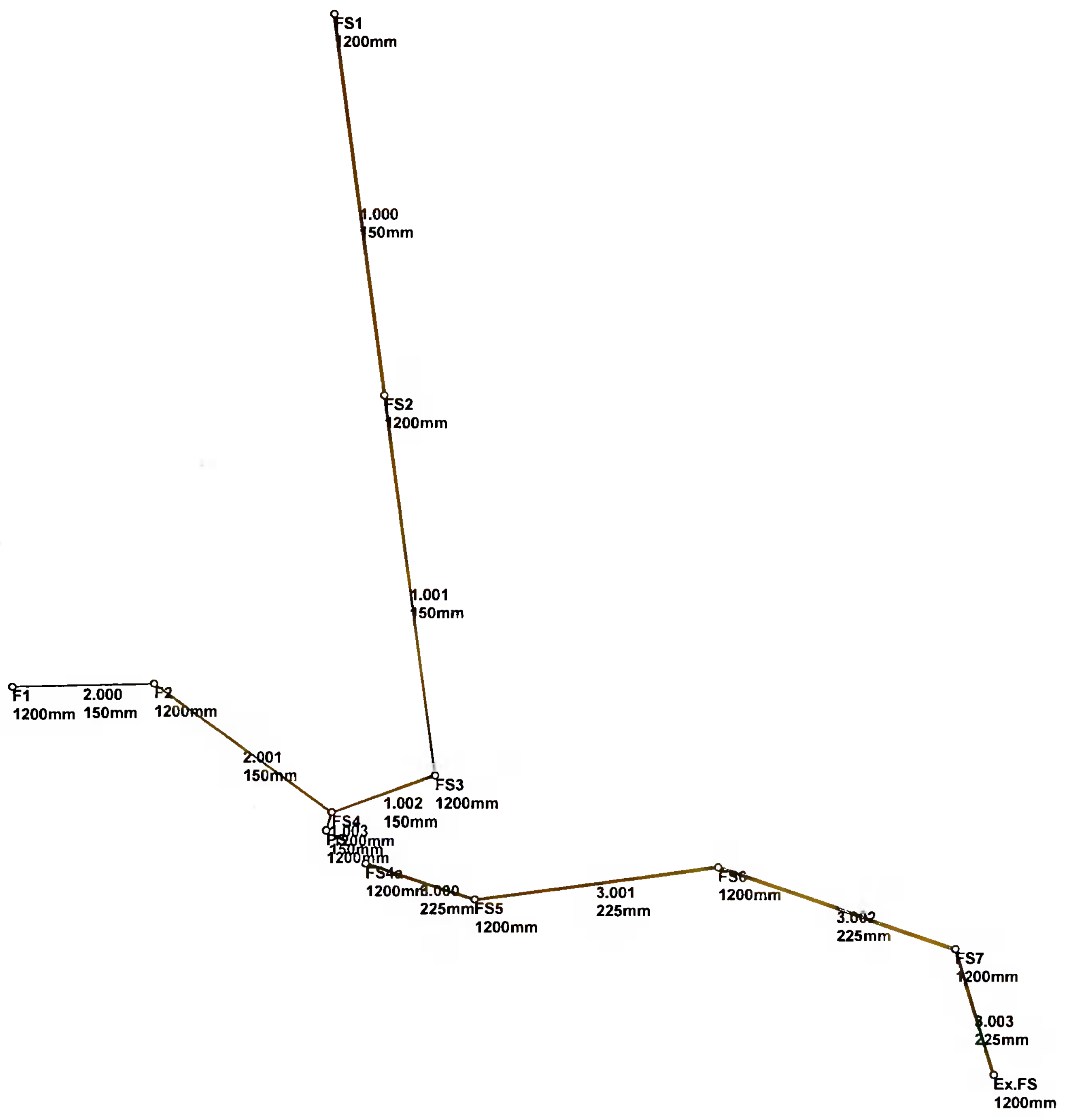
Floors	Type of Applience	Discharge Unit per Applience	No of Applie.	Discharge Units
OFFICE/STAFF FACILITIES				
BALDONNELL HOUSE	WB	0.6	2	1.2
3storey house	WC	2.5	2	5.0
	WASH MACH	0.8	1	0.8
	SINK	1.3	1	1.3
	bath	1.3	1	1.3
	SHOWER	0.6	1	0.6
	DISHWASHER	0.8	1	0.8
	TOTAL:			***11***
TOTAL NO OF DICHARGE UNITS FOR OFFICE BLOCK 2:				***11***
			Q (l/sec) =	*1.66*

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}=0.5)
Design flow rate is given by the equation: $Q = kDU \sqrt{\Sigma DU}$

KAVANAGH BURKE
CONSULTING ENGINEERS

Foul Sewer Network Design

KAVANAGH BURKE CONSULTING ENGINEERS	Kavanagh Burke Unit F3 Block F, Calmount Park, Ballymount, Dublin 12, D12PX28	File: D1568 - SW & FS Networks Desig Network: FOUL NETWORK Elena Dragoje 10/01/2022	Page 1



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)
FS1	18.0	79.950	Adoptable	0.900
FS2		80.050	Adoptable	1.950
FS3		80.050	Adoptable	2.900
FS4		80.050	Adoptable	3.150
Fs A	11.0	82.400	Adoptable	1.400
Fs B	4.0	80.750	Adoptable	1.000
PS		80.300	Adoptable	3.450
FS4a	33.0	82.400	Adoptable	1.350
FS5	69.0	82.320	Adoptable	1.520
FS6		81.900	Adoptable	1.600
FS7		80.920	Adoptable	1.170
Ex.FS		81.000	Adoptable	1.550

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	FS1	FS2	70.000	1.500	79.050	78.100	0.950	73.7	150	Circular
1.001	FS2	FS3	70.000	1.500	78.100	77.150	0.950	73.7	150	Circular
1.002	FS3	FS4	20.110	1.500	77.150	76.900	0.250	80.4	150	Circular
2.000	Fs A	Fs B	26.001	1.500	81.000	79.750	1.250	20.8	150	Circular
2.001	Fs B	FS4	40.040	1.500	79.750	78.750	1.000	40.0	150	Circular
1.003	FS4	PS	3.332	1.500	76.900	76.850	0.050	66.6	150	Circular
3.000	FS4a	FS5	21.000	1.500	81.050	80.800	0.250	84.0	225	Circular
3.001	FS5	FS6	45.000	1.500	80.800	80.300	0.500	90.0	225	Circular
3.002	FS6	FS7	46.000	1.500	80.300	79.750	0.550	83.6	225	Circular
3.003	FS7	Ex.FS	24.001	1.500	79.750	79.450	0.300	80.0	225	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	FS1	FS2	18.0	3.0	0.750	1.800	1.800	0.000	18.0	0.0	0.751
1.001	FS2	FS3	18.0	3.0	1.800	2.750	2.750	0.000	18.0	0.0	0.751
1.002	FS3	FS4	17.3	3.0	2.750	3.000	3.000	0.000	18.0	0.0	0.730
2.000	Fs A	Fs B	34.0	2.3	1.250	0.850	1.250	0.000	11.0	0.0	1.087
2.001	Fs B	FS4	24.5	2.7	0.850	1.150	1.150	0.000	15.0	0.0	0.905
1.003	FS4	PS	19.0	4.0	3.000	3.300	3.300	0.000	33.0	0.0	0.852
3.000	FS4a	FS5	49.8	4.0	1.125	1.295	1.295	0.000	33.0	0.0	0.752
3.001	FS5	FS6	48.1	7.1	1.295	1.375	1.375	0.000	102.0	0.0	0.866
3.002	FS6	FS7	49.9	7.1	1.375	0.945	1.375	0.000	102.0	0.0	0.891
3.003	FS7	Ex.FS	51.0	7.1	0.945	1.325	1.325	0.000	102.0	0.0	0.903

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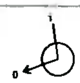
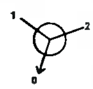
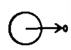
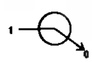
Pipeline Schedule

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	70.000	73.7	150	79.950	79.050	0.750	80.050	78.100	1.800
1.001	70.000	73.7	150	80.050	78.100	1.800	80.050	77.150	2.750
1.002	20.110	80.4	150	80.050	77.150	2.750	80.050	76.900	3.000
2.000	26.001	20.8	150	82.400	81.000	1.250	80.750	79.750	0.850
2.001	40.040	40.0	150	80.750	79.750	0.850	80.050	78.750	1.150
1.003	3.332	66.6	150	80.050	76.900	3.000	80.300	76.850	3.300
3.000	21.000	84.0	225	82.400	81.050	1.125	82.320	80.800	1.295
3.001	45.000	90.0	225	82.320	80.800	1.295	81.900	80.300	1.375
3.002	46.000	83.6	225	81.900	80.300	1.375	80.920	79.750	0.945
3.003	24.001	80.0	225	80.920	79.750	0.945	81.000	79.450	1.325

Link
1.000
1.001
1.002
2.000
2.001
1.003
3.000
3.001
3.002
3.003

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
FS1	704735.822	729669.709	79.950	0.900	1200		0	1.000	79.050	150
FS2	704745.020	729600.316	80.050	1.950	1200		1	1.000	78.100	150
							0	1.001	78.100	150
FS3	704754.217	729530.923	80.050	2.900	1200		1	1.001	77.150	150
							0	1.002	77.150	150
FS4	704735.246	729524.250	80.050	3.150	1200		1	2.001	78.750	150
							2	1.002	76.900	150
							0	1.003	76.900	150
Fs A	704676.742	729547.032	82.400	1.400	1200		0	2.000	81.000	150
Fs B	704702.736	729547.623	80.750	1.000	1200		1	2.000	79.750	150
							0	2.001	79.750	150
PS	704734.219	729521.080	80.300	3.450	1200		1	1.003	76.850	150
FS4a	704741.423	729515.046	82.400	1.350	1200		0	3.000	81.050	225
FS5	704761.385	729508.526	82.320	1.520	1200		1	3.000	80.800	225
							0	3.001	80.800	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
FS6	704805.994	729514.442	81.900	1.600	1200	1	3.001	80.300	225
						0	3.002	80.300	225
FS7	704849.520	729499.559	80.920	1.170	1200	1	3.002	79.750	225
						0	3.003	79.750	225
Ex.FS	704856.517	729476.601	81.000	1.550	1200	1	3.003	79.450	225