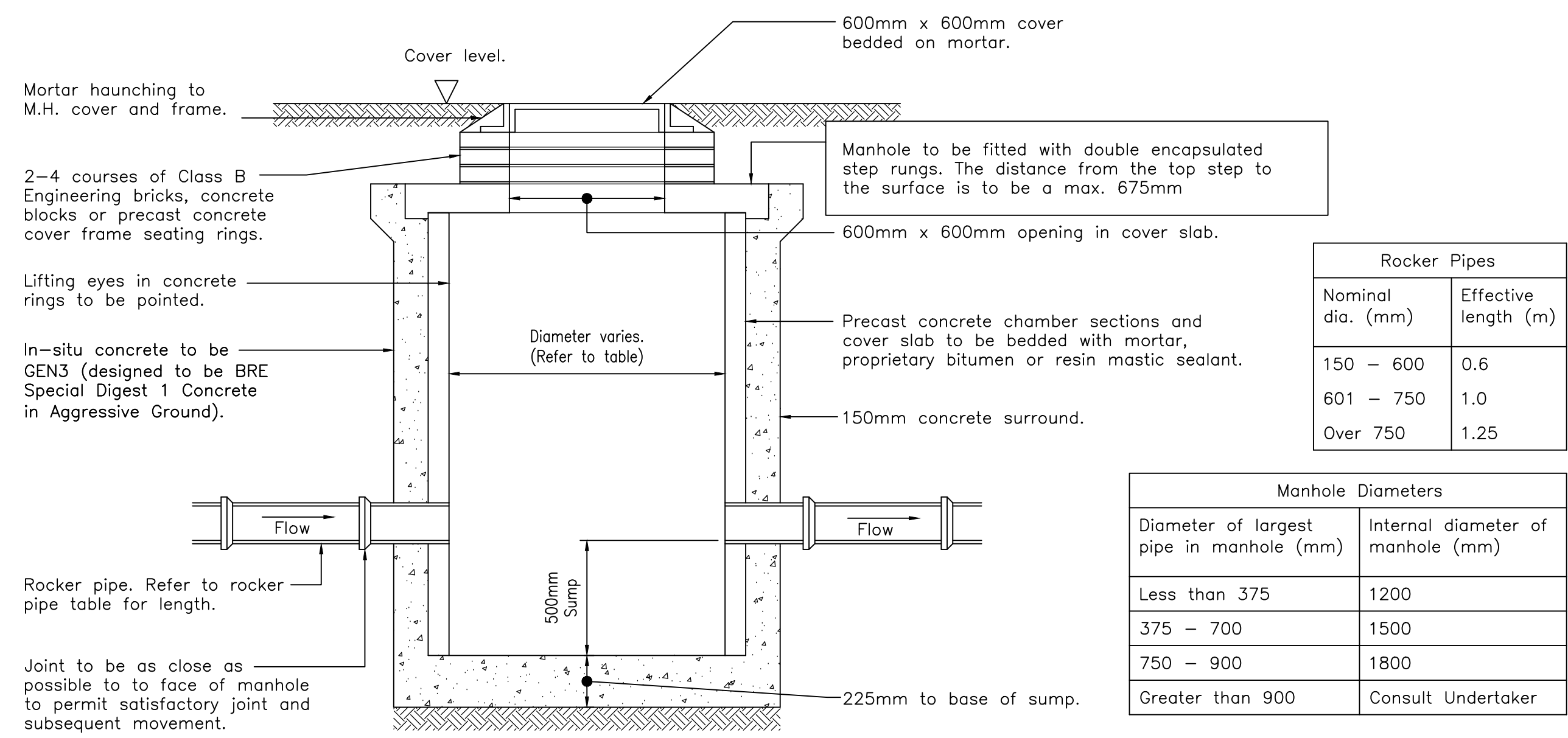
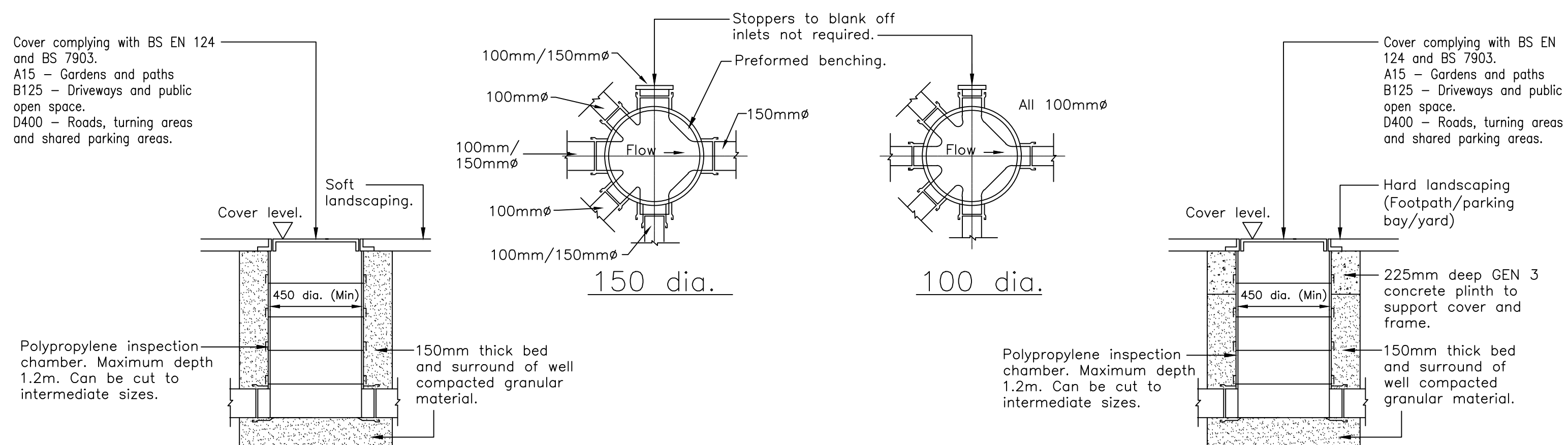


Typical Section and Specification for New Permeable Block Paved Private Driveways with Perforated Collector Pipe



Catchpit Manhole



UIC Sited in Soft Landscaping

UIC Sited in Hard Landscaping

Universal Inspection Chamber (UIC) - Polypropylene  
Max. Depth from cover level to invert of pipe 1.2m

INITIAL ISSUE	FA	30.01.23
REVISION	BY	DATE

DRAWING STATUS

**PRELIMINARY**

DRAWING TITLE

**DRAINAGE DETAILS SHEET 2**

PROJECT

**99-101 RESERVOIR ROAD  
GLOUCESTER  
GL4 6SZ**

**simpson | tws**  
1.08, 80 Grays Inn Road  
London, WC1X 8LU

London, Henley-on-Thames, Gloucester and Exeter

Drawn	Ch'kd	Scales	Date
FA	LJK	1:20 @ A1	JAN 23

Purpose of Issue

**FOR PLANNING**

Project Number	Drawing Number	Revision
<b>P21-599</b>	<b>SK102</b>	<b>A</b>



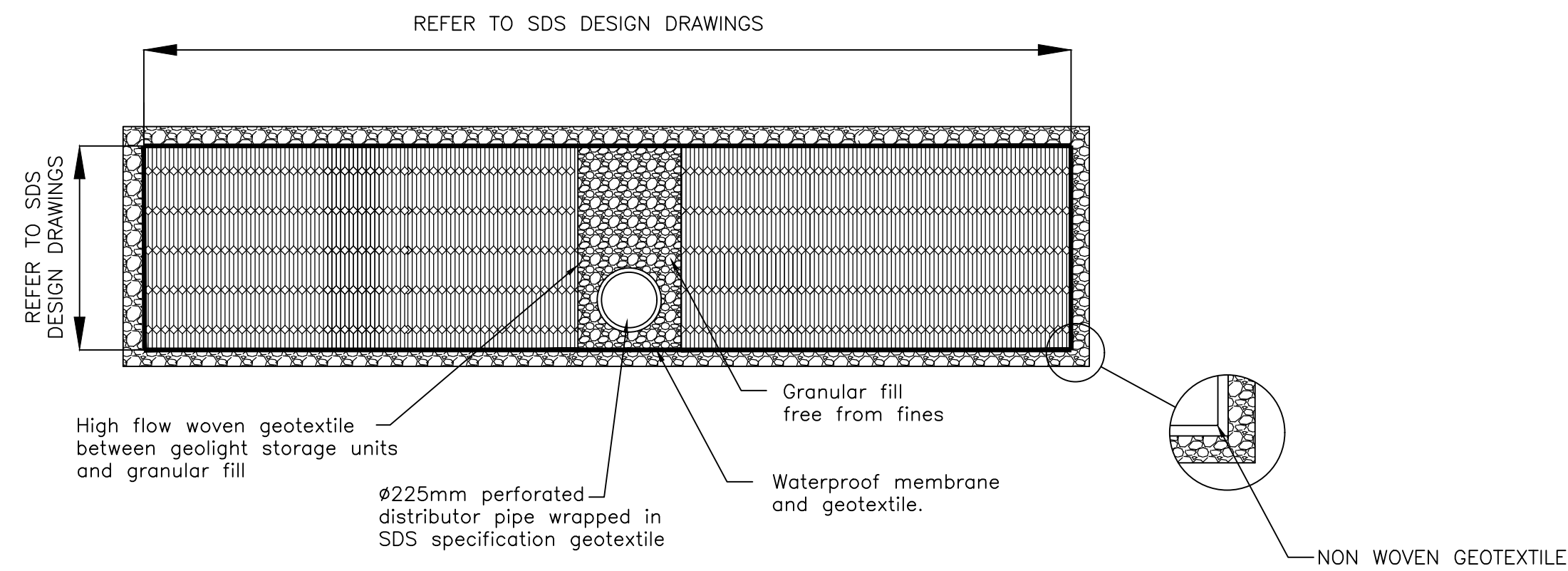
APPROX. CL (REFER TO DRAINAGE STRATEGY DRAWING)

TOT (REFER TO DRAINAGE STRATEGY DRAWING)

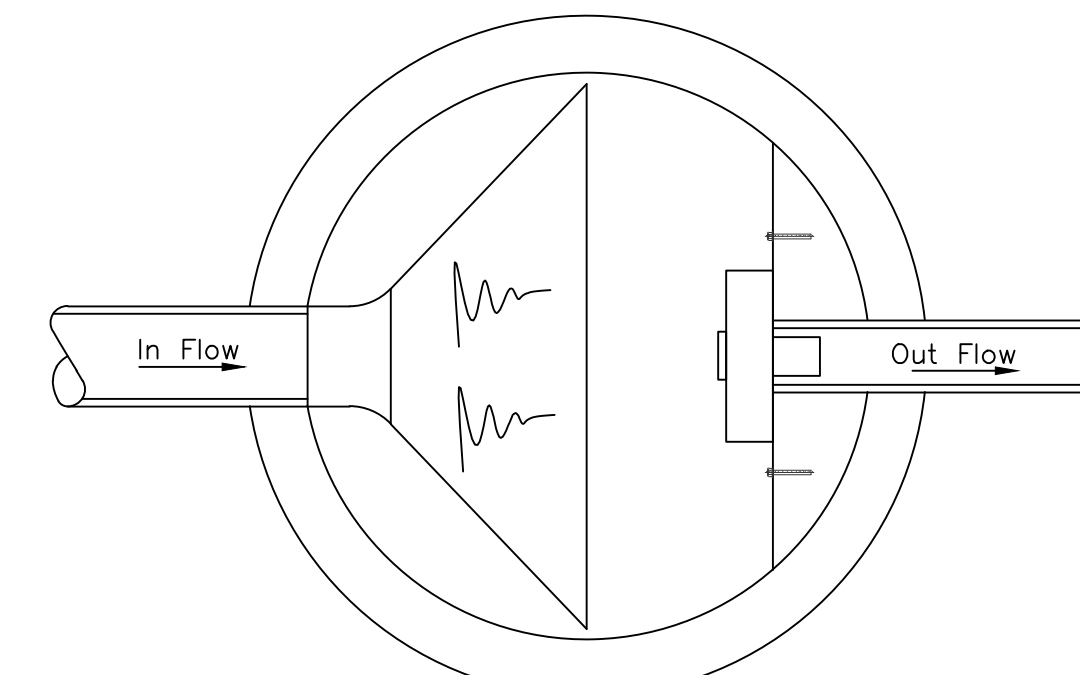
PIPE IL (REFER TO DRAINAGE STRATEGY DRAWING)

IL (REFER TO DRAINAGE STRATEGY DRAWING)

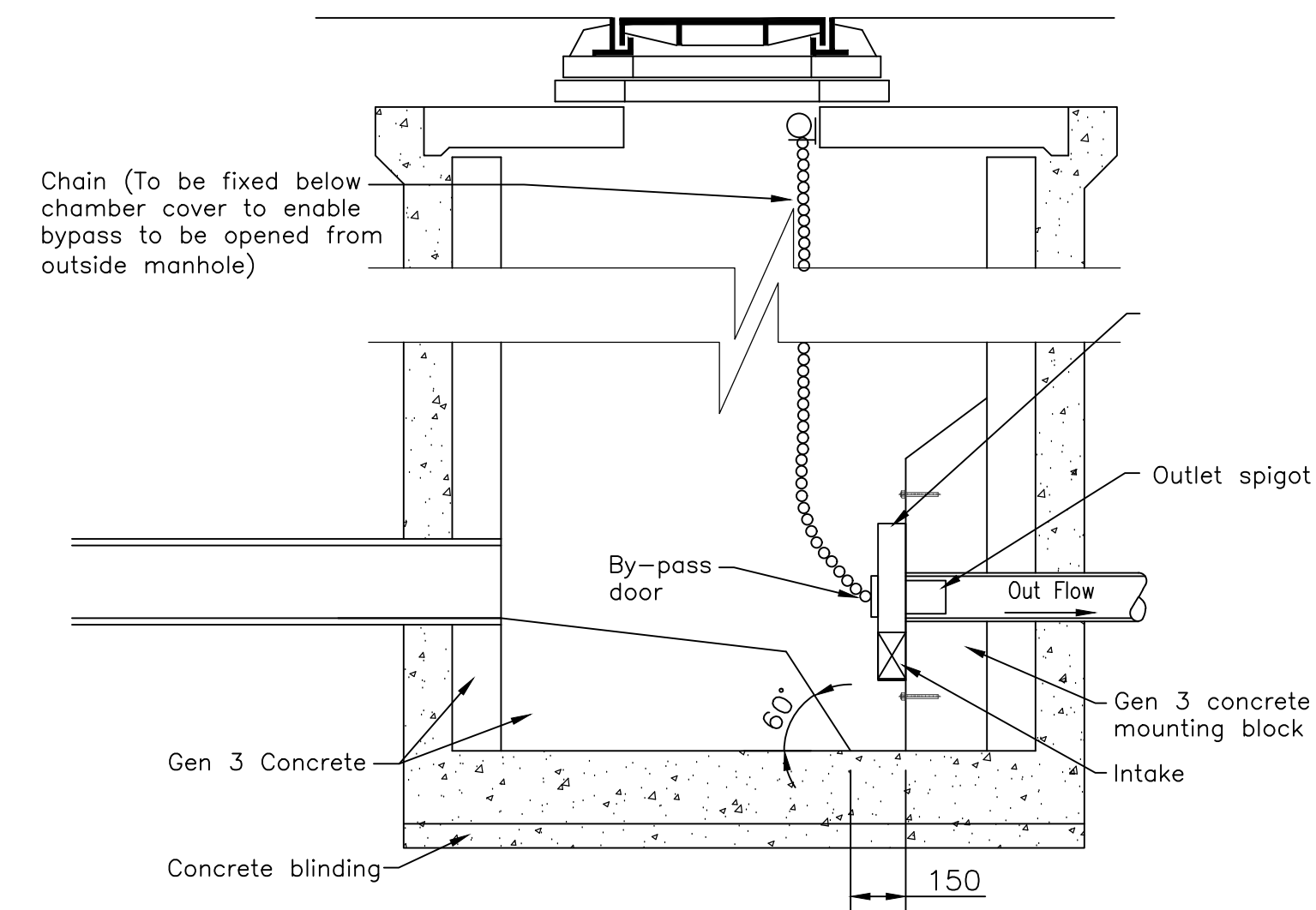
REFER TO SDS DESIGN DRAWINGS FOR FULL SPECIFICATION OF GEOCELLULAR ATTENUATION



Typical SDS Attenuation Section



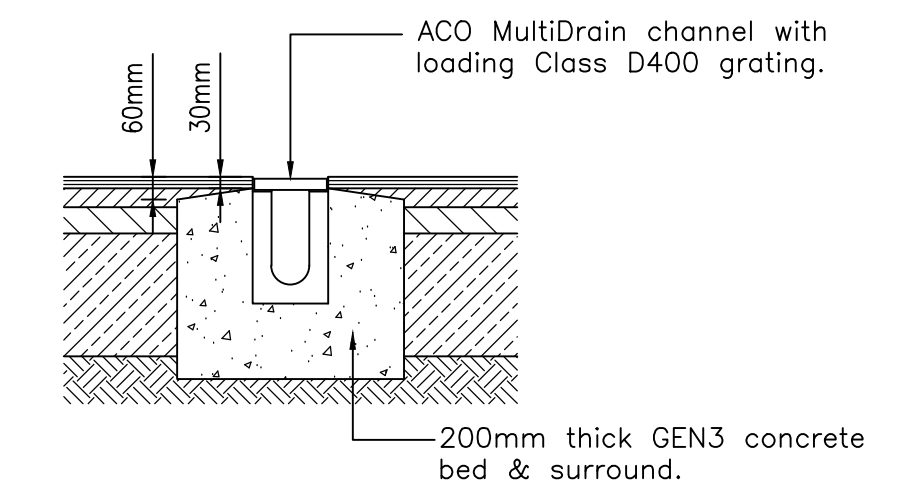
Flow Control Chamber with One Vortex Flow Control (Plan)



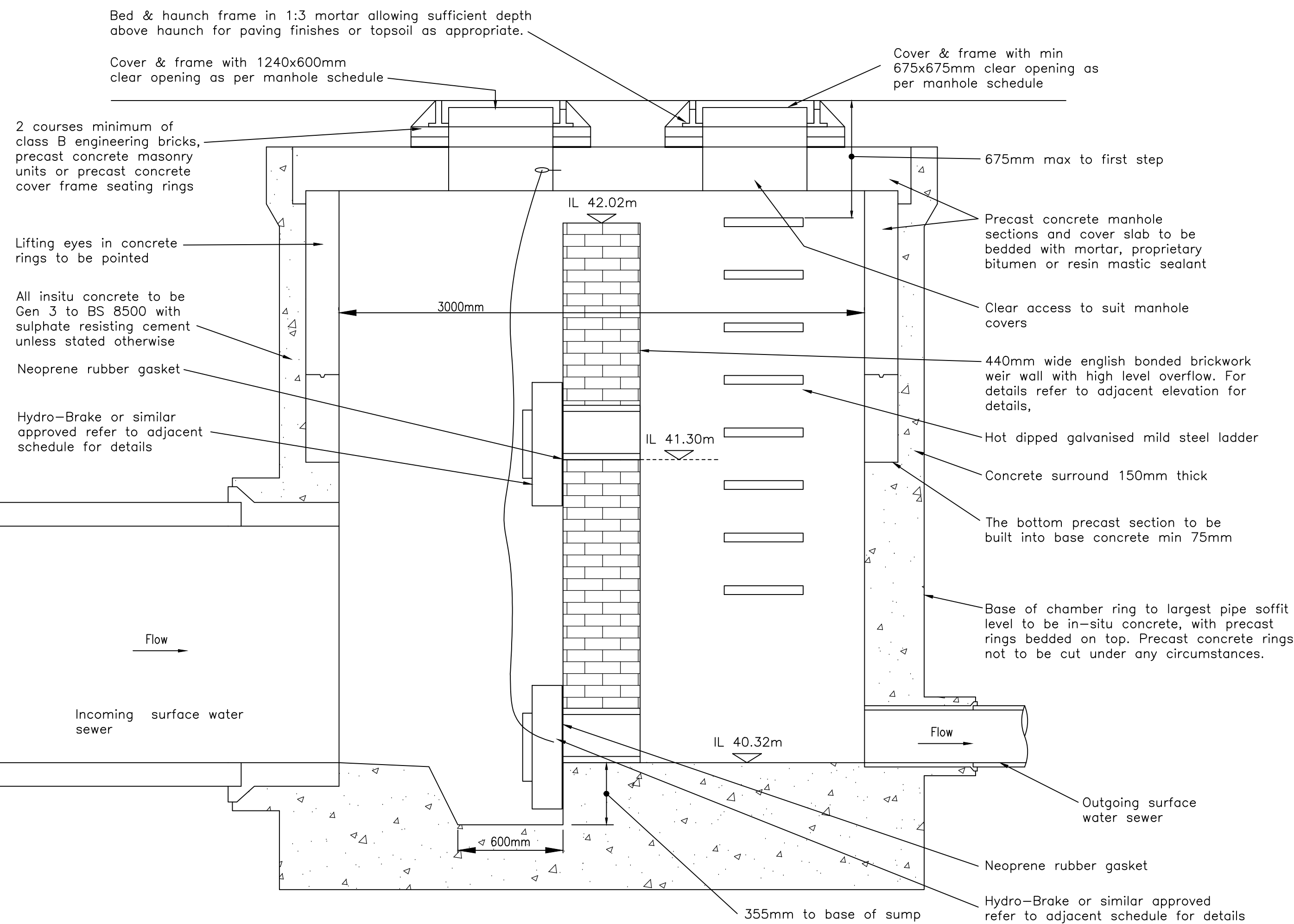
Flow Control Chamber with One Vortex Flow Control (Section)

Notes:

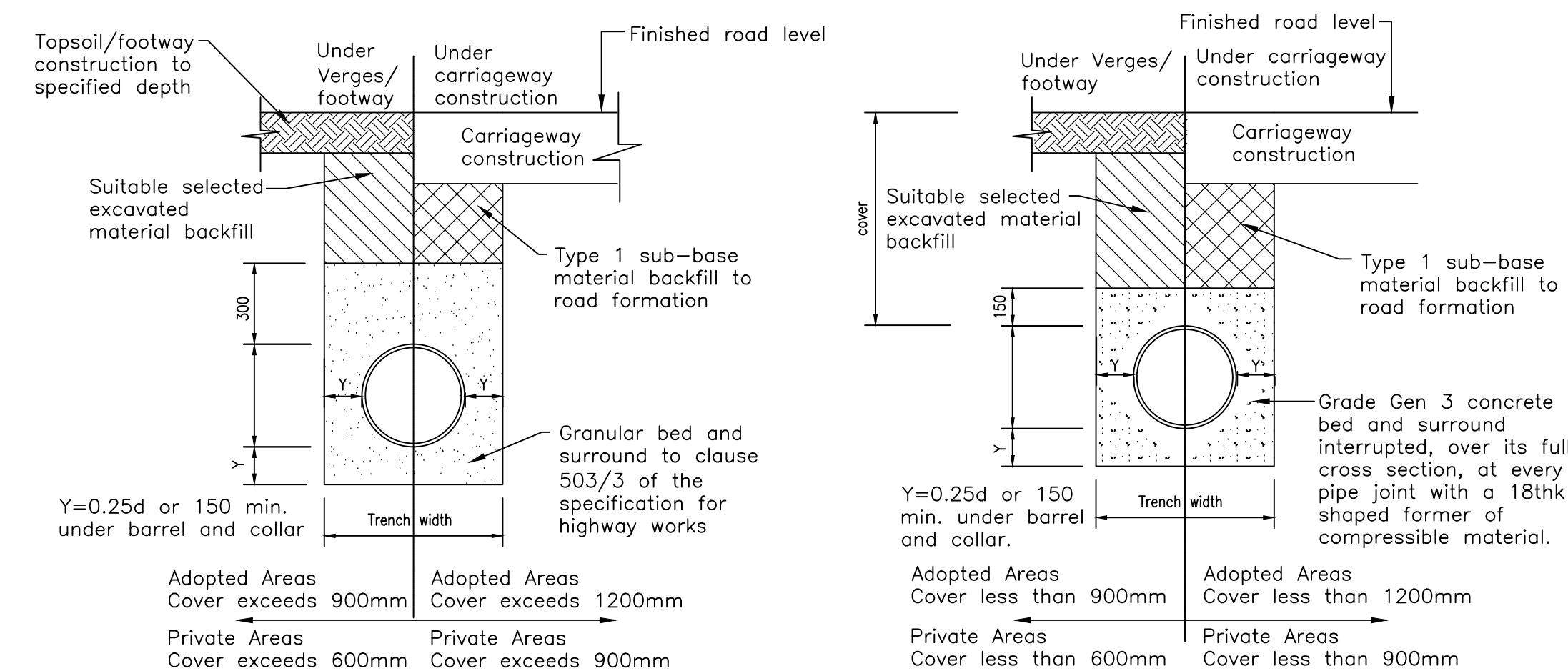
1. Chamber cover to be positioned directly above by-pass door.
2. Dimensions are indicative only and are dependant on type of control device used. Refer to manufacturer's specifications for details.
3. Hydrobrake flow control chamber to limit flows to 0.6 l/s for all storm events up to & including the 1 in 100 year storm plus 40% allowance for climate change.  
hydrobrake type - MD-SHE-0030-6000-1900-6000  
design head - 1.90m  
orifice diameter - 0.30m
4. For chamber construction details refer to surface water catchpit manhole construction details.



Typical ACO Multidrain Channel Section within Tarmac Circulation Areas



Flow Control Chamber with two Flow Controls



Class S Granular Surround

Class Z Concrete surround

Pipe Bedding Details

A	INITIAL ISSUE	FA	30.01.23
MK	REVISION	BY	DATE

DRAWING STATUS  
**PRELIMINARY**

DRAWING TITLE  
**DRAINAGE DETAILS SHEET 1**

PROJECT  
**99-101 RESERVOIR ROAD GLOUCESTER GL4 6SZ**

**simpson | tws**  
1.08, 60 Grays Inn Road London, WC1X 8LU T: 0207 253 2626

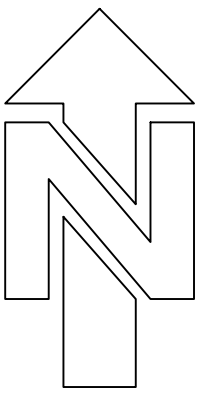
London, Henley-on-Thames, Gloucester and Exeter

Drawn: FA, Chkd: LJK, Scales: 1:20 @ A1, Date: JAN 23

Purpose of Issue  
**FOR PLANNING**

Project Number: P21-599, Drawing Number: SK101, Revision: A



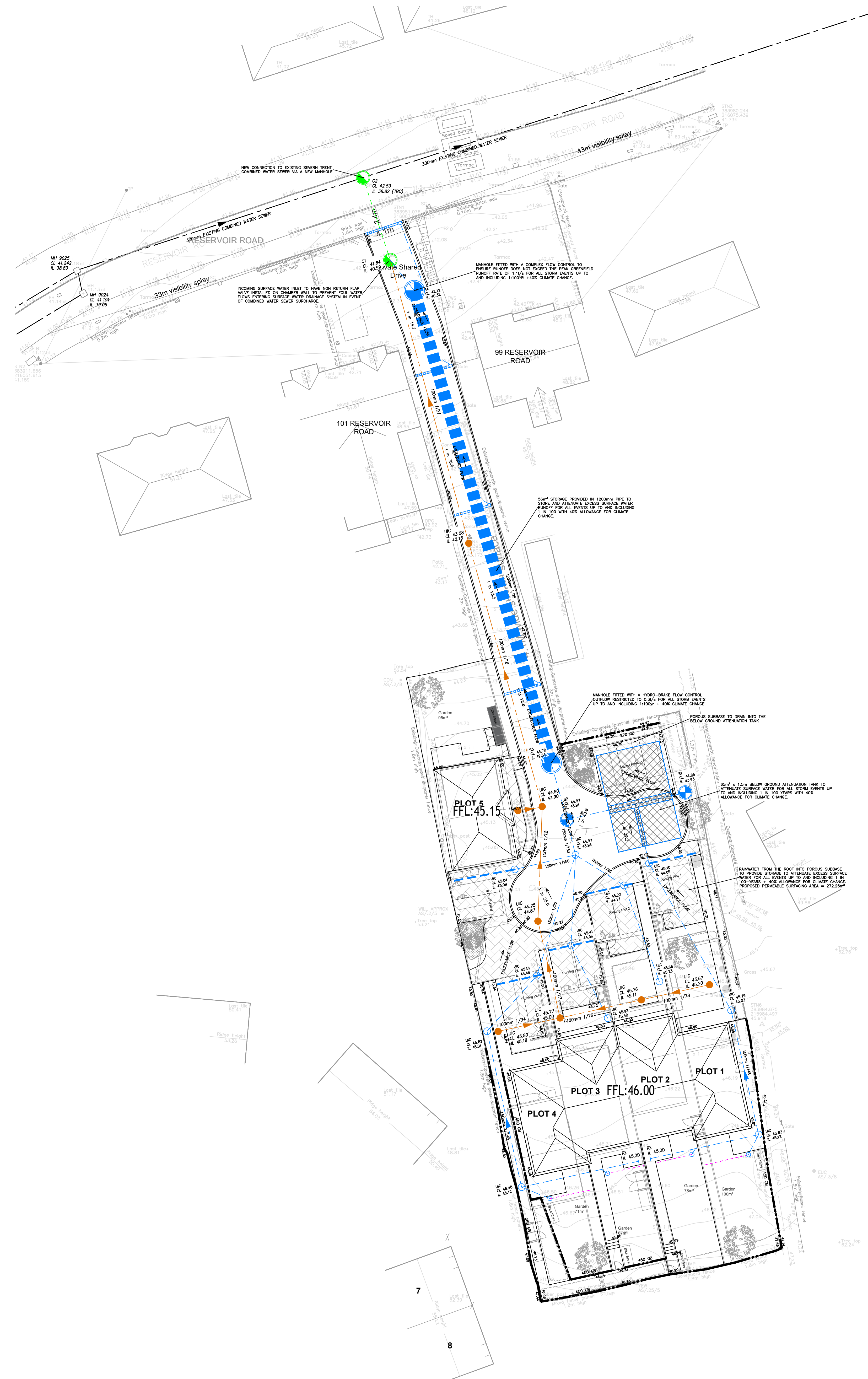


LEGEND

- FFL:45.65** Proposed finished floor level
- 45.31 + Proposed level
- 1:50 Proposed gradient
- Denotes extent of Gravel Board with max. level difference shown.
- CG Channel drain and trapped outfall unit
- RE Surface water rodding eye
- 100mm 1/100 Surface water drain
- 100mm 1/100 Gravel filter strip
- 100mm 1/100 Foul water drain
- 150mm 1/100 Existing foul water pipe
- Combined water drain
- SA SW shallow inspection chamber
- SI Surface water inspection chamber
- FI Foul water inspection chamber
- Surface water catchpit manhole
- Surface water manhole
- Denotes extent of permeable block paving driveway with a porous sub-base.
- Denotes extent of permeable paved driveways
- EXCEEDANCE FLOW Flood exceedance route

DRAINAGE STRATEGY NOTES

- Based on site investigation report 488/RS by Wilson Associates it is understood that infiltration is not feasible hence soakaways are not suitable. It is proposed to drain surface water runoff via a traditional network of underground pipework to an existing combined water sewer.
- Greenfield runoff rates have been estimated based on the ICP SUDS facility of the Microdrainage Software package. The calculations are based on the sites proposed impermeable area of 0.12 ha. The calculated rates for a variety of storm events up to the 1 in 100 year return period are listed below:
  - QBAR = 0.4l/s
  - 1 in 1yr = 0.3l/s
  - 1 in 30yrs = 0.8l/s
  - 1 in 100yrs = 1.1l/s
- The surface water runoff from the roof area will be collected by the proposed permeable surfacing which will drain into the proposed porous sub-base beneath with a fully perforated collector pipe before discharging via a different method.
- The proposed porous sub-base has been designed to serve all storm events up to and including the 1 in 100 year storm event plus a 40% allowance for climate change.
- The surface water runoff from the access road and parking areas will drain to a geocellular tank. Part of the proposed geocellular tank is to be lined with an impermeable membrane whilst the rest is left to allow porous sub-base to drain. The geocellular tank has been designed to serve all storm events up to and including a 1 in 100 year event plus a 40% allowance for climate change.
- The surface water runoff will then discharge to an existing combined water sewer located in Reservoir Road. Before discharging runoff to the sewer, flows will be restricted to a maximum rate of 1.1l/s using a complex flow control device with excess flows stored and attenuated in a geocellular tank and porous sub-base for all storm events up to and including a 1 in 100 year event with 40% allowance for climate change.
- The foul water drainage generated from the proposed development will be conveyed to the combined water sewer via a traditional network of below ground drainage, and connected to a new manhole to be installed on the line of the existing Severn Trent Water sewer on Reservoir Road.



B	DRAWING UPDATED TO SUIT GCC COMMENTS	FA	27.01.23
A	SOAKAWAY / PERMEABLE PAVING DESIGN UPDATED TO SUIT ALFA COMMENTS.	AGC	06.06.22
MK	REVISION	BY	DATE

DRAWING STATUS  
**PRELIMINARY**

DRAWING TITLE  
**DRAINAGE STRATEGY**

PROJECT  
**99-101 RESERVOIR ROAD  
GLOUCESTER  
GL4 6SZ**



Unit B10  
Elmbridge Court Business Park  
Gloucester, GL3 1JZ  
T: 01452 308 222

London, Henley-on-Thames and Gloucester

Drawn	Chkd	Scale	Date
EL	ADC	1:200 @ A1	OCT 2021
Purpose of Issue <b>PRELIMINARY</b>			
Project Number	Drawing Number	Revision	
P21-599	SK100	B	






Cascade Summary of Results for Hydraulic Calcs (1 in 1) TOP.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (1/s)	Max Control (1/s)	Max Σ Outflow (1/s)	Max Volume (m <sup>3</sup> )	Status
8640 min Summer	42.684	0.004	0.0	0.2	0.2	0.3	O K
10080 min Summer	42.681	0.001	0.0	0.2	0.2	0.1	O K
15 min Winter	42.716	0.036	0.0	0.3	0.3	2.9	O K
30 min Winter	42.729	0.049	0.0	0.3	0.3	4.2	O K
60 min Winter	42.740	0.060	0.0	0.3	0.3	5.5	O K
120 min Winter	42.751	0.071	0.0	0.3	0.3	6.8	O K
180 min Winter	42.755	0.075	0.0	0.3	0.3	7.5	O K
240 min Winter	42.758	0.078	0.0	0.3	0.3	7.8	O K
360 min Winter	42.760	0.080	0.0	0.3	0.3	8.0	O K
480 min Winter	42.759	0.079	0.0	0.3	0.3	8.0	O K
600 min Winter	42.758	0.078	0.0	0.3	0.3	7.9	O K
720 min Winter	42.756	0.076	0.0	0.3	0.3	7.6	O K
960 min Winter	42.752	0.072	0.0	0.3	0.3	7.0	O K
1440 min Winter	42.742	0.062	0.0	0.3	0.3	5.7	O K
2160 min Winter	42.727	0.047	0.0	0.3	0.3	4.0	O K
2880 min Winter	42.713	0.033	0.0	0.3	0.3	2.5	O K
4320 min Winter	42.693	0.013	0.0	0.3	0.3	0.9	O K
5760 min Winter	42.683	0.003	0.0	0.2	0.2	0.2	O K
7200 min Winter	42.680	0.000	0.0	0.2	0.2	0.0	O K
8640 min Winter	42.680	0.000	0.0	0.2	0.2	0.0	O K
10080 min Winter	42.680	0.000	0.0	0.2	0.2	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Time-Peak (mins)
8640 min Summer	0.388	0.0	27.3	4416
10080 min Summer	0.349	0.0	28.1	5136
15 min Winter	26.578	0.0	3.1	21
30 min Winter	17.617	0.0	4.5	34
60 min Winter	11.376	0.0	6.2	62
120 min Winter	7.231	0.0	8.3	120
180 min Winter	5.524	0.0	9.6	176
240 min Winter	4.561	0.0	10.7	230
360 min Winter	3.474	0.0	12.4	290
480 min Winter	2.846	0.0	13.6	368
600 min Winter	2.439	0.0	14.7	446
720 min Winter	2.150	0.0	15.5	522
960 min Winter	1.762	0.0	17.0	672
1440 min Winter	1.332	0.0	19.3	954
2160 min Winter	1.008	0.0	21.8	1344
2880 min Winter	0.826	0.0	23.6	1704
4320 min Winter	0.624	0.0	26.4	2340
5760 min Winter	0.512	0.0	28.5	3008
7200 min Winter	0.440	0.0	30.1	0
8640 min Winter	0.388	0.0	31.4	0
10080 min Winter	0.349	0.0	32.4	0

Simpson Associates		Page 3
Unit B10, Elmbridge Court Business Park Gloucester GL3 1JZ		
Date 27/01/2023 16:05 File CASCADE NETWORK 1 in 1 ...	Designed by FizaAli Checked by	
XP Solutions	Source Control 2020.1.3	


Cascade Rainfall Details for Hydraulic Calcs (1 in 1) TOP.SRCX

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.080

Time (mins) Area			Time (mins) Area		
From:	To:	(ha)	From:	To:	(ha)
0	4	0.055	4	8	0.025

Simpson Associates		Page 4
Unit B10, Elmbridge Court Business Park Gloucester GL3 1JZ		
Date 27/01/2023 16:05 File CASCADE NETWORK 1 in 1 ...	Designed by FizaAli Checked by	
XP Solutions	Source Control 2020.1.3	

Cascade Model Details for Hydraulic Calcs (1 in 1) TOP.SRCX

Storage is Online Cover Level (m) 44.680

Complex Structure

Cellular Storage

Invert Level (m) 42.680 Safety Factor 2.0  
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95  
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	65.0	0.0	1.501	0.0	0.0
1.500	65.0	0.0			

Porous Car Park


Infiltration Coefficient Base (m/hr) 0.00000 Width (m) 16.5  
 Membrane Percolation (mm/hr) 1000 Length (m) 16.5  
 Max Percolation (l/s) 75.6 Slope (1:X) 200.0  
 Safety Factor 2.0 Depression Storage (mm) 5  
 Porosity 0.30 Evaporation (mm/day) 3  
 Invert Level (m) 42.680 Membrane Depth (m) 0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0030-6000-1900-6000  
 Design Head (m) 1.900  
 Design Flow (l/s) 0.6  
 Flush-Flo™ Calculated  
 Objective Minimise upstream storage  
 Application Surface  
 Sump Available Yes  
 Diameter (mm) 30  
 Invert Level (m) 42.640  
 Minimum Outlet Pipe Diameter (mm) 75  
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.900	0.6
Flush-Flo™	0.136	0.3
Kick-Flo®	0.273	0.3
Mean Flow over Head Range	-	0.4


The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Simpson Associates		Page 5
Unit B10, Elmbridge Court Business Park Gloucester GL3 1JZ		
Date 27/01/2023 16:05 File CASCADE NETWORK 1 in 1 ...	Designed by FizaAli Checked by	
XP Solutions		Source Control 2020.1.3

Hydro-Brake® Optimum Outflow Control

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.3	1.200	0.5	3.000	0.7	7.000	1.1
0.200	0.3	1.400	0.5	3.500	0.8	7.500	1.1
0.300	0.3	1.600	0.6	4.000	0.8	8.000	1.1
0.400	0.3	1.800	0.6	4.500	0.9	8.500	1.2
0.500	0.3	2.000	0.6	5.000	0.9	9.000	1.2
0.600	0.4	2.200	0.6	5.500	1.0	9.500	1.2
0.800	0.4	2.400	0.7	6.000	1.0		
1.000	0.5	2.600	0.7	6.500	1.0		



Simpson Associates		Page 1
Unit B10, Elmbridge Court Business Park Gloucester GL3 1JZ		
Date 27/01/2023 16:04 File CASCADE NETWORK 1 in 1 ...	Designed by FizaAli Checked by	
XP Solutions		Source Control 2020.1.3

Cascade Summary of Results for Hydraulic Calcs (1 in 1) BOTTOM.SRCX

<b>Upstream Structures</b>	<b>Outflow To</b>	<b>Overflow To</b>
Hydraulic Calcs (1 in 1) TOP.SRCX	(None)	(None)


<b>Storm Event</b>	<b>Max Level (m)</b>	<b>Max Depth (m)</b>	<b>Max Control (l/s)</b>	<b>Max Volume (m³)</b>	<b>Status</b>
15 min Summer	40.808	0.488	0.2	2.3	O K
30 min Summer	40.876	0.556	0.2	3.1	O K
60 min Summer	40.941	0.621	0.2	3.9	O K
120 min Summer	41.003	0.683	0.3	4.8	O K
180 min Summer	41.041	0.721	0.3	5.4	O K
240 min Summer	41.070	0.750	0.3	5.8	O K
360 min Summer	41.114	0.794	0.3	6.6	O K
480 min Summer	41.146	0.826	0.3	7.2	O K
600 min Summer	41.172	0.852	0.3	7.6	O K
720 min Summer	41.192	0.872	0.3	8.0	O K
960 min Summer	41.220	0.900	0.3	8.6	O K
1440 min Summer	41.238	0.918	0.3	9.0	O K
2160 min Summer	41.239	0.919	0.3	9.0	O K
2880 min Summer	41.232	0.912	0.3	8.8	O K
4320 min Summer	41.198	0.878	0.3	8.2	O K
5760 min Summer	41.141	0.821	0.3	7.1	O K
7200 min Summer	41.072	0.752	0.3	5.9	O K
8640 min Summer	41.000	0.680	0.3	4.7	O K

<b>Storm Event</b>	<b>Rain (mm/hr)</b>	<b>Flooded Volume (m³)</b>	<b>Discharge Volume (m³)</b>	<b>Time-Peak (mins)</b>
15 min Summer	26.578	0.0	4.6	160
30 min Summer	17.617	0.0	6.5	224
60 min Summer	11.376	0.0	8.8	306
120 min Summer	7.231	0.0	11.5	414
180 min Summer	5.524	0.0	13.4	492
240 min Summer	4.561	0.0	14.9	558
360 min Summer	3.474	0.0	17.1	646
480 min Summer	2.846	0.0	18.8	712
600 min Summer	2.439	0.0	20.2	774
720 min Summer	2.150	0.0	21.4	832
960 min Summer	1.762	0.0	23.4	968
1440 min Summer	1.332	0.0	26.6	1358
2160 min Summer	1.008	0.0	30.1	1688
2880 min Summer	0.826	0.0	32.7	2024
4320 min Summer	0.624	0.0	36.6	2720
5760 min Summer	0.512	0.0	39.6	3392
7200 min Summer	0.440	0.0	42.0	4040
8640 min Summer	0.388	0.0	44.0	4680

Cascade Summary of Results for Hydraulic Calcs (1 in 1) BOTTOM.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m <sup>3</sup> )	Status
10080 min Summer	40.935	0.615	0.2	3.8	O K
15 min Winter	40.837	0.517	0.2	2.6	O K
30 min Winter	40.908	0.588	0.2	3.5	O K
60 min Winter	40.975	0.655	0.3	4.4	O K
120 min Winter	41.042	0.722	0.3	5.4	O K
180 min Winter	41.081	0.761	0.3	6.0	O K
240 min Winter	41.110	0.790	0.3	6.5	O K
360 min Winter	41.156	0.836	0.3	7.4	O K
480 min Winter	41.189	0.869	0.3	8.0	O K
600 min Winter	41.217	0.897	0.3	8.5	O K
720 min Winter	41.239	0.919	0.3	9.0	O K
960 min Winter	41.274	0.954	0.3	9.7	O K
1440 min Winter	41.305	0.985	0.3	10.4	O K
2160 min Winter	41.302	0.982	0.3	10.3	O K
2880 min Winter	41.282	0.962	0.3	9.9	O K
4320 min Winter	41.188	0.868	0.3	8.0	O K
5760 min Winter	41.065	0.745	0.3	5.8	O K
7200 min Winter	40.953	0.633	0.3	4.1	O K
8640 min Winter	40.856	0.536	0.2	2.9	O K
10080 min Winter	40.770	0.450	0.2	2.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Time-Peak (mins)
10080 min Summer	0.349	0.0	45.7	5440
15 min Winter	26.578	0.0	5.3	180
30 min Winter	17.617	0.0	7.5	252
60 min Winter	11.376	0.0	10.0	344
120 min Winter	7.231	0.0	13.1	460
180 min Winter	5.524	0.0	15.2	540
240 min Winter	4.561	0.0	16.9	596
360 min Winter	3.474	0.0	19.4	684
480 min Winter	2.846	0.0	21.3	748
600 min Winter	2.439	0.0	22.9	802
720 min Winter	2.150	0.0	24.2	850
960 min Winter	1.762	0.0	26.5	964
1440 min Winter	1.332	0.0	30.0	1392
2160 min Winter	1.008	0.0	34.0	1752
2880 min Winter	0.826	0.0	37.0	2092
4320 min Winter	0.624	0.0	41.5	2768
5760 min Winter	0.512	0.0	45.0	3400
7200 min Winter	0.440	0.0	47.8	4104
8640 min Winter	0.388	0.0	50.2	4760
10080 min Winter	0.349	0.0	52.1	5456

Simpson Associates		Page 3
Unit B10, Elmbridge Court Business Park Gloucester GL3 1JZ		
Date 27/01/2023 16:04 File CASCADE NETWORK 1 in 1 ...	Designed by FizaAli Checked by	
XP Solutions	Source Control 2020.1.3	

Cascade Rainfall Details for Hydraulic Calcs (1 in 1) BOTTOM.SRCX


Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.040

<b>Time (mins) Area</b>			<b>Time (mins) Area</b>		
<b>From:</b>	<b>To:</b>	<b>(ha)</b>	<b>From:</b>	<b>To:</b>	<b>(ha)</b>
0	4	0.025	4	8	0.015



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Unit B10, Elmbridge Court Business Park Gloucester GL3 1JZ		
Date 27/01/2023 16:04 File CASCADE NETWORK 1 in 1 ...	Designed by FizaAli Checked by	
XP Solutions		Source Control 2020.1.3

Cascade Model Details for Hydraulic Calcs (1 in 1) BOTTOM.SRCX

Storage is Online Cover Level (m) 42.120

Pipe Structure

Diameter (m) 1.200          Length (m) 49.649  
Slope (1:X) 21.000      Invert Level (m) 40.320

Complex Outflow Control

Hydro-Brake® Optimum

Unit Reference MD-SHE-0025-3000-0950-3000  
Design Head (m) 0.950  
Design Flow (l/s) 0.3  
Flush-Flo™ Calculated  
Objective Minimise upstream storage  
Application Surface  
Sump Available Yes  
Diameter (mm) 25  
Invert Level (m) 40.320  
Minimum Outlet Pipe Diameter (mm) 75  
Suggested Manhole Diameter (mm) 1200


Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.950	0.3
Flush-Flo™	0.109	0.2
Kick-Flo®	0.220	0.2
Mean Flow over Head Range	-	0.2

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.2	1.200	0.3	3.000	0.5	7.000	0.7
0.200	0.2	1.400	0.4	3.500	0.5	7.500	0.7
0.300	0.2	1.600	0.4	4.000	0.6	8.000	0.8
0.400	0.2	1.800	0.4	4.500	0.6	8.500	0.8
0.500	0.2	2.000	0.4	5.000	0.6	9.000	0.8
0.600	0.2	2.200	0.4	5.500	0.6	9.500	0.8
0.800	0.3	2.400	0.4	6.000	0.7		
1.000	0.3	2.600	0.5	6.500	0.7		

Hydro-Brake® Optimum

Unit Reference MD-SHE-0045-8000-0700-8000  
Design Head (m) 0.700

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Hydro-Brake® Optimum

Design Flow (l/s)	0.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	45
Invert Level (m)	41.300
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.700	0.8
Flush-Flo™	0.198	0.8
Kick-Flo®	0.401	0.6
Mean Flow over Head Range	-	0.7

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.7	1.200	1.0	3.000	1.5	7.000	2.3
0.200	0.8	1.400	1.1	3.500	1.6	7.500	2.3
0.300	0.7	1.600	1.2	4.000	1.7	8.000	2.4
0.400	0.6	1.800	1.2	4.500	1.8	8.500	2.5
0.500	0.7	2.000	1.3	5.000	1.9	9.000	2.6
0.600	0.7	2.200	1.3	5.500	2.0	9.500	2.6
0.800	0.8	2.400	1.4	6.000	2.1		
1.000	0.9	2.600	1.4	6.500	2.2		

Cascade Summary of Results for Hydraulic Calcs (1 in 30) TOP.SRCX

**Upstream Structures**                      **Outflow To**                      **Overflow To**

(None) Hydraulic Calcs (1 in 30) BOTTOM.SRCX                      (None)

Half Drain Time : 693 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ (l/s)	Max Outflow Volume (m³)	Status
15 min Summer	42.760	0.080	0.0	0.3	0.3	8.1	O K
30 min Summer	42.781	0.101	0.0	0.3	0.3	11.1	O K
60 min Summer	42.803	0.123	0.0	0.3	0.3	14.3	O K
120 min Summer	42.825	0.145	0.0	0.3	0.3	17.4	O K
180 min Summer	42.836	0.156	0.0	0.3	0.3	19.0	O K
240 min Summer	42.843	0.163	0.0	0.3	0.3	20.0	O K
360 min Summer	42.849	0.169	0.0	0.3	0.3	20.8	O K
480 min Summer	42.851	0.171	0.0	0.3	0.3	21.1	O K
600 min Summer	42.850	0.170	0.0	0.3	0.3	21.0	O K
720 min Summer	42.849	0.169	0.0	0.3	0.3	20.8	O K
960 min Summer	42.845	0.165	0.0	0.3	0.3	20.3	O K
1440 min Summer	42.837	0.157	0.0	0.3	0.3	19.1	O K
2160 min Summer	42.825	0.145	0.0	0.3	0.3	17.4	O K
2880 min Summer	42.813	0.133	0.0	0.3	0.3	15.7	O K
4320 min Summer	42.790	0.110	0.0	0.3	0.3	12.4	O K
5760 min Summer	42.769	0.089	0.0	0.3	0.3	9.4	O K
7200 min Summer	42.752	0.072	0.0	0.3	0.3	7.0	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	65.002	0.0	8.3	22
30 min Summer	43.293	0.0	11.6	36
60 min Summer	27.653	0.0	15.2	66
120 min Summer	17.172	0.0	19.1	124
180 min Summer	12.859	0.0	21.7	184
240 min Summer	10.426	0.0	23.5	242
360 min Summer	7.714	0.0	26.2	362
480 min Summer	6.230	0.0	28.2	480
600 min Summer	5.275	0.0	29.9	572
720 min Summer	4.602	0.0	31.3	620
960 min Summer	3.709	0.0	33.7	744
1440 min Summer	2.733	0.0	37.1	1008
2160 min Summer	2.010	0.0	40.8	1408
2880 min Summer	1.616	0.0	43.5	1820
4320 min Summer	1.186	0.0	47.4	2596
5760 min Summer	0.951	0.0	50.2	3344
7200 min Summer	0.802	0.0	52.2	4040



Cascade Summary of Results for Hydraulic Calcs (1 in 30) TOP.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (1/s)	Max Control (1/s)	Max Σ Outflow (1/s)	Max Volume (m <sup>3</sup> )	Status
8640 min Summer	42.737	0.057	0.0	0.3	0.3	5.1	O K
10080 min Summer	42.724	0.044	0.0	0.3	0.3	3.7	O K
15 min Winter	42.768	0.088	0.0	0.3	0.3	9.3	O K
30 min Winter	42.792	0.112	0.0	0.3	0.3	12.7	O K
60 min Winter	42.817	0.137	0.0	0.3	0.3	16.3	O K
120 min Winter	42.842	0.162	0.0	0.3	0.3	19.9	O K
180 min Winter	42.855	0.175	0.0	0.3	0.3	21.8	O K
240 min Winter	42.864	0.184	0.0	0.3	0.3	23.0	O K
360 min Winter	42.872	0.192	0.0	0.3	0.3	24.2	O K
480 min Winter	42.876	0.196	0.0	0.3	0.3	24.8	O K
600 min Winter	42.877	0.197	0.0	0.3	0.3	24.9	O K
720 min Winter	42.876	0.196	0.0	0.3	0.3	24.8	O K
960 min Winter	42.871	0.191	0.0	0.3	0.3	24.0	O K
1440 min Winter	42.860	0.180	0.0	0.3	0.3	22.4	O K
2160 min Winter	42.841	0.161	0.0	0.3	0.3	19.7	O K
2880 min Winter	42.822	0.142	0.0	0.3	0.3	17.0	O K
4320 min Winter	42.786	0.106	0.0	0.3	0.3	11.8	O K
5760 min Winter	42.756	0.076	0.0	0.3	0.3	7.5	O K
7200 min Winter	42.731	0.051	0.0	0.3	0.3	4.4	O K
8640 min Winter	42.710	0.030	0.0	0.3	0.3	2.3	O K
10080 min Winter	42.696	0.016	0.0	0.3	0.3	1.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Time-Peak (mins)
8640 min Summer	0.697	0.0	53.9	4752
10080 min Summer	0.619	0.0	55.3	5440
15 min Winter	65.002	0.0	9.5	22
30 min Winter	43.293	0.0	13.1	36
60 min Winter	27.653	0.0	17.2	64
120 min Winter	17.172	0.0	21.6	122
180 min Winter	12.859	0.0	24.4	180
240 min Winter	10.426	0.0	26.5	238
360 min Winter	7.714	0.0	29.5	354
480 min Winter	6.230	0.0	31.8	468
600 min Winter	5.275	0.0	33.7	578
720 min Winter	4.602	0.0	35.3	686
960 min Winter	3.709	0.0	37.9	878
1440 min Winter	2.733	0.0	41.9	1096
2160 min Winter	2.010	0.0	46.0	1540
2880 min Winter	1.616	0.0	49.1	1984
4320 min Winter	1.186	0.0	53.6	2768
5760 min Winter	0.951	0.0	56.8	3512
7200 min Winter	0.802	0.0	59.2	4176
8640 min Winter	0.697	0.0	61.2	4760
10080 min Winter	0.619	0.0	62.9	5344

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Cascade Rainfall Details for Hydraulic Calcs (1 in 30) TOP.SRCX

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.080

<b>Time (mins) Area</b>			<b>Time (mins) Area</b>		
<b>From:</b>	<b>To:</b>	<b>(ha)</b>	<b>From:</b>	<b>To:</b>	<b>(ha)</b>
0	4	0.055	4	8	0.025

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Cascade Model Details for Hydraulic Calcs (1 in 30) TOP.SRCX

Storage is Online Cover Level (m) 44.680

Complex Structure

Cellular Storage

Invert Level (m) 42.680 Safety Factor 2.0  
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95  
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	65.0	0.0	1.501	0.0	0.0
1.500	65.0	0.0			

Porous Car Park

Infiltration Coefficient Base (m/hr) 0.00000 Width (m) 16.5  
 Membrane Percolation (mm/hr) 1000 Length (m) 16.5  
 Max Percolation (l/s) 75.6 Slope (1:X) 200.0  
 Safety Factor 2.0 Depression Storage (mm) 5  
 Porosity 0.30 Evaporation (mm/day) 3  
 Invert Level (m) 42.680 Membrane Depth (m) 0


Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0030-6000-1900-6000  
 Design Head (m) 1.900  
 Design Flow (l/s) 0.6  
 Flush-Flo™ Calculated  
 Objective Minimise upstream storage  
 Application Surface  
 Sump Available Yes  
 Diameter (mm) 30  
 Invert Level (m) 42.640  
 Minimum Outlet Pipe Diameter (mm) 75  
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.900	0.6
Flush-Flo™	0.136	0.3
Kick-Flo®	0.273	0.3
Mean Flow over Head Range	-	0.4


The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated



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Hydro-Brake® Optimum Outflow Control

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.3	1.200	0.5	3.000	0.7	7.000	1.1
0.200	0.3	1.400	0.5	3.500	0.8	7.500	1.1
0.300	0.3	1.600	0.6	4.000	0.8	8.000	1.1
0.400	0.3	1.800	0.6	4.500	0.9	8.500	1.2
0.500	0.3	2.000	0.6	5.000	0.9	9.000	1.2
0.600	0.4	2.200	0.6	5.500	1.0	9.500	1.2
0.800	0.4	2.400	0.7	6.000	1.0		
1.000	0.5	2.600	0.7	6.500	1.0		

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Cascade Summary of Results for Hydraulic Calcs (1 in 30) BOTTOM.SRCX

<b>Upstream Structures</b>	<b>Outflow To</b>	<b>Overflow To</b>
Hydraulic Calcs (1 in 30) TOP.SRCX	(None)	(None)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m <sup>3</sup> )	Status
15 min Summer	41.054	0.734	0.3	5.6	O K
30 min Summer	41.143	0.823	0.3	7.1	O K
60 min Summer	41.224	0.904	0.3	8.7	O K
120 min Summer	41.301	0.981	0.3	10.3	O K
180 min Summer	41.332	1.012	0.6	11.0	O K
240 min Summer	41.336	1.016	0.6	11.1	O K
360 min Summer	41.344	1.024	0.7	11.3	O K
480 min Summer	41.352	1.032	0.8	11.4	O K
600 min Summer	41.358	1.038	0.9	11.6	O K
720 min Summer	41.361	1.041	0.9	11.6	O K
960 min Summer	41.362	1.042	0.9	11.7	O K
1440 min Summer	41.357	1.037	0.9	11.5	O K
2160 min Summer	41.347	1.027	0.8	11.3	O K
2880 min Summer	41.341	1.021	0.7	11.2	O K
4320 min Summer	41.334	1.014	0.6	11.0	O K
5760 min Summer	41.330	1.010	0.6	10.9	O K
7200 min Summer	41.327	1.007	0.5	10.9	O K
8640 min Summer	41.324	1.004	0.5	10.8	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Time-Peak (mins)
15 min Summer	65.002	0.0	13.2	427
30 min Summer	43.293	0.0	18.1	555
60 min Summer	27.653	0.0	23.5	672
120 min Summer	17.172	0.0	29.4	698
180 min Summer	12.859	0.0	33.2	180
240 min Summer	10.426	0.0	36.0	208
360 min Summer	7.714	0.0	40.1	254
480 min Summer	6.230	0.0	43.2	314
600 min Summer	5.275	0.0	45.7	376
720 min Summer	4.602	0.0	47.9	438
960 min Summer	3.709	0.0	51.5	562
1440 min Summer	2.733	0.0	55.2	808
2160 min Summer	2.010	0.0	62.5	1172
2880 min Summer	1.616	0.0	66.8	1556
4320 min Summer	1.186	0.0	73.0	2288
5760 min Summer	0.951	0.0	77.6	3048
7200 min Summer	0.802	0.0	81.1	3808
8640 min Summer	0.697	0.0	84.0	4576

Cascade Summary of Results for Hydraulic Calcs (1 in 30) BOTTOM.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m <sup>3</sup> )	Status
10080 min Summer	41.322	1.002	0.5	10.8	O K
15 min Winter	41.089	0.769	0.3	6.2	O K
30 min Winter	41.181	0.861	0.3	7.8	O K
60 min Winter	41.264	0.944	0.3	9.5	O K
120 min Winter	41.338	1.018	0.7	11.1	O K
180 min Winter	41.352	1.032	0.8	11.4	O K
240 min Winter	41.363	1.043	0.9	11.7	O K
360 min Winter	41.375	1.055	1.0	12.0	O K
480 min Winter	41.379	1.059	1.0	12.1	O K
600 min Winter	41.379	1.059	1.0	12.1	O K
720 min Winter	41.377	1.057	1.0	12.0	O K
960 min Winter	41.370	1.050	1.0	11.8	O K
1440 min Winter	41.358	1.038	0.9	11.6	O K
2160 min Winter	41.345	1.025	0.8	11.3	O K
2880 min Winter	41.338	1.018	0.7	11.1	O K
4320 min Winter	41.331	1.011	0.6	11.0	O K
5760 min Winter	41.327	1.007	0.5	10.9	O K
7200 min Winter	41.324	1.004	0.5	10.8	O K
8640 min Winter	41.321	1.001	0.4	10.7	O K
10080 min Winter	41.317	0.997	0.4	10.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Time-Peak (mins)
10080 min Summer	0.619	0.0	86.5	5344
15 min Winter	65.002	0.0	15.0	475
30 min Winter	43.293	0.0	20.4	605
60 min Winter	27.653	0.0	26.4	712
120 min Winter	17.172	0.0	33.2	120
180 min Winter	12.859	0.0	37.4	166
240 min Winter	10.426	0.0	40.5	184
360 min Winter	7.714	0.0	45.1	254
480 min Winter	6.230	0.0	48.6	324
600 min Winter	5.275	0.0	51.4	390
720 min Winter	4.602	0.0	53.9	454
960 min Winter	3.709	0.0	57.1	574
1440 min Winter	2.733	0.0	59.0	808
2160 min Winter	2.010	0.0	70.3	1164
2880 min Winter	1.616	0.0	75.2	1504
4320 min Winter	1.186	0.0	82.2	2244
5760 min Winter	0.951	0.0	87.4	2992
7200 min Winter	0.802	0.0	91.5	3776
8640 min Winter	0.697	0.0	94.9	4560
10080 min Winter	0.619	0.0	97.8	5472



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Cascade Rainfall Details for Hydraulic Calcs (1 in 30) BOTTOM.SRCX

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.040

Time (mins) Area			Time (mins) Area		
From:	To:	(ha)	From:	To:	(ha)
0	4	0.025	4	8	0.015

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Cascade Model Details for Hydraulic Calcs (1 in 30) BOTTOM.SRCX

Storage is Online Cover Level (m) 42.120

Pipe Structure

Diameter (m) 1.200          Length (m) 49.649  
Slope (1:X) 21.000      Invert Level (m) 40.320

Complex Outflow Control

Hydro-Brake® Optimum

Unit Reference MD-SHE-0025-3000-0950-3000  
Design Head (m) 0.950  
Design Flow (l/s) 0.3  
Flush-Flo™ Calculated  
Objective Minimise upstream storage  
Application Surface  
Sump Available Yes  
Diameter (mm) 25  
Invert Level (m) 40.320  
Minimum Outlet Pipe Diameter (mm) 75  
Suggested Manhole Diameter (mm) 1200


Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.950	0.3
Flush-Flo™	0.109	0.2
Kick-Flo®	0.220	0.2
Mean Flow over Head Range	-	0.2

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.2	1.200	0.3	3.000	0.5	7.000	0.7
0.200	0.2	1.400	0.4	3.500	0.5	7.500	0.7
0.300	0.2	1.600	0.4	4.000	0.6	8.000	0.8
0.400	0.2	1.800	0.4	4.500	0.6	8.500	0.8
0.500	0.2	2.000	0.4	5.000	0.6	9.000	0.8
0.600	0.2	2.200	0.4	5.500	0.6	9.500	0.8
0.800	0.3	2.400	0.4	6.000	0.7		
1.000	0.3	2.600	0.5	6.500	0.7		

Hydro-Brake® Optimum

Unit Reference MD-SHE-0045-8000-0700-8000  
Design Head (m) 0.700

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Hydro-Brake® Optimum

Design Flow (l/s)	0.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	45
Invert Level (m)	41.300
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.700	0.8
Flush-Flo™	0.198	0.8
Kick-Flo®	0.401	0.6
Mean Flow over Head Range	-	0.7

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.7	1.200	1.0	3.000	1.5	7.000	2.3
0.200	0.8	1.400	1.1	3.500	1.6	7.500	2.3
0.300	0.7	1.600	1.2	4.000	1.7	8.000	2.4
0.400	0.6	1.800	1.2	4.500	1.8	8.500	2.5
0.500	0.7	2.000	1.3	5.000	1.9	9.000	2.6
0.600	0.7	2.200	1.3	5.500	2.0	9.500	2.6
0.800	0.8	2.400	1.4	6.000	2.1		
1.000	0.9	2.600	1.4	6.500	2.2		




Cascade Summary of Results for Hydraulic Calcs (1 in 100) TOP.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (1/s)	Max Control (1/s)	Max Σ Outflow (1/s)	Max Volume (m <sup>3</sup> )	Status
8640 min Summer	42.772	0.092	0.0	0.3	0.3	9.8	O K
10080 min Summer	42.756	0.076	0.0	0.3	0.3	7.5	O K
15 min Winter	42.790	0.110	0.0	0.3	0.3	12.4	O K
30 min Winter	42.823	0.143	0.0	0.3	0.3	17.1	O K
60 min Winter	42.857	0.177	0.0	0.3	0.3	22.0	O K
120 min Winter	42.892	0.212	0.0	0.3	0.3	27.1	O K
180 min Winter	42.912	0.232	0.0	0.3	0.3	29.9	O K
240 min Winter	42.924	0.244	0.0	0.3	0.3	31.6	O K
360 min Winter	42.937	0.257	0.0	0.3	0.3	33.5	O K
480 min Winter	42.945	0.265	0.0	0.3	0.3	34.6	O K
600 min Winter	42.948	0.268	0.0	0.3	0.3	35.1	O K
720 min Winter	42.950	0.270	0.0	0.3	0.3	35.3	O K
960 min Winter	42.948	0.268	0.0	0.3	0.3	35.0	O K
1440 min Winter	42.934	0.254	0.0	0.3	0.3	33.1	O K
2160 min Winter	42.913	0.233	0.0	0.3	0.3	30.0	O K
2880 min Winter	42.890	0.210	0.0	0.3	0.3	26.7	O K
4320 min Winter	42.846	0.166	0.0	0.3	0.3	20.4	O K
5760 min Winter	42.807	0.127	0.0	0.3	0.3	14.9	O K
7200 min Winter	42.774	0.094	0.0	0.3	0.3	10.2	O K
8640 min Winter	42.748	0.068	0.0	0.3	0.3	6.5	O K
10080 min Winter	42.726	0.046	0.0	0.3	0.3	3.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Time-Peak (mins)
8640 min Summer	0.847	0.0	66.9	4928
10080 min Summer	0.749	0.0	68.5	5552
15 min Winter	83.892	0.0	12.7	22
30 min Winter	56.436	0.0	17.6	36
60 min Winter	36.294	0.0	22.9	66
120 min Winter	22.586	0.0	28.9	124
180 min Winter	16.884	0.0	32.5	182
240 min Winter	13.646	0.0	35.2	240
360 min Winter	10.027	0.0	38.8	356
480 min Winter	8.062	0.0	41.7	472
600 min Winter	6.801	0.0	44.0	586
720 min Winter	5.916	0.0	45.9	700
960 min Winter	4.743	0.0	47.8	922
1440 min Winter	3.467	0.0	46.5	1318
2160 min Winter	2.529	0.0	58.6	1648
2880 min Winter	2.020	0.0	62.1	2080
4320 min Winter	1.468	0.0	67.2	2904
5760 min Winter	1.169	0.0	70.8	3688
7200 min Winter	0.979	0.0	73.5	4400
8640 min Winter	0.847	0.0	75.7	5096
10080 min Winter	0.749	0.0	77.6	5656



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Cascade Rainfall Details for Hydraulic Calcs (1 in 100) TOP.SRCX

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.080

Time (mins) Area			Time (mins) Area		
From:	To:	(ha)	From:	To:	(ha)
0	4	0.055	4	8	0.025

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Cascade Model Details for Hydraulic Calcs (1 in 100) TOP.SRCX

Storage is Online Cover Level (m) 44.680

Complex Structure

Cellular Storage

Invert Level (m) 42.680 Safety Factor 2.0  
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95  
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	65.0	0.0	1.501	0.0	0.0
1.500	65.0	0.0			

Porous Car Park


Infiltration Coefficient Base (m/hr) 0.00000 Width (m) 16.5  
 Membrane Percolation (mm/hr) 1000 Length (m) 16.5  
 Max Percolation (l/s) 75.6 Slope (1:X) 200.0  
 Safety Factor 2.0 Depression Storage (mm) 5  
 Porosity 0.30 Evaporation (mm/day) 3  
 Invert Level (m) 42.680 Membrane Depth (m) 0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0030-6000-1900-6000  
 Design Head (m) 1.900  
 Design Flow (l/s) 0.6  
 Flush-Flo™ Calculated  
 Objective Minimise upstream storage  
 Application Surface  
 Sump Available Yes  
 Diameter (mm) 30  
 Invert Level (m) 42.640  
 Minimum Outlet Pipe Diameter (mm) 75  
 Suggested Manhole Diameter (mm) 1200


Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.900	0.6
Flush-Flo™	0.136	0.3
Kick-Flo®	0.273	0.3
Mean Flow over Head Range	-	0.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

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Hydro-Brake® Optimum Outflow Control

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.3	1.200	0.5	3.000	0.7	7.000	1.1
0.200	0.3	1.400	0.5	3.500	0.8	7.500	1.1
0.300	0.3	1.600	0.6	4.000	0.8	8.000	1.1
0.400	0.3	1.800	0.6	4.500	0.9	8.500	1.2
0.500	0.3	2.000	0.6	5.000	0.9	9.000	1.2
0.600	0.4	2.200	0.6	5.500	1.0	9.500	1.2
0.800	0.4	2.400	0.7	6.000	1.0		
1.000	0.5	2.600	0.7	6.500	1.0		

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Cascade Summary of Results for Hydraulic Calcs (1 in 100) BOTTOM.SRCX

<b>Upstream Structures</b>	<b>Outflow To</b>	<b>Overflow To</b>
Hydraulic Calcs (1 in 100) TOP.SRCX	(None)	(None)

<b>Storm Event</b>	<b>Max Level (m)</b>	<b>Max Depth (m)</b>	<b>Max Control (l/s)</b>	<b>Max Volume (m<sup>3</sup>)</b>	<b>Status</b>
15 min Summer	41.134	0.814	0.3	6.9	O K
30 min Summer	41.232	0.912	0.3	8.8	O K
60 min Summer	41.323	1.003	0.5	10.8	O K
120 min Summer	41.373	1.053	1.0	11.9	O K
180 min Summer	41.395	1.075	1.0	12.4	O K
240 min Summer	41.411	1.091	1.0	12.8	O K
360 min Summer	41.428	1.108	1.1	13.2	O K
480 min Summer	41.437	1.117	1.1	13.4	O K
600 min Summer	41.441	1.121	1.1	13.5	O K
720 min Summer	41.441	1.121	1.1	13.5	O K
960 min Summer	41.435	1.115	1.1	13.4	O K
1440 min Summer	41.412	1.092	1.0	12.8	O K
2160 min Summer	41.379	1.059	1.0	12.1	O K
2880 min Summer	41.362	1.042	0.9	11.7	O K
4320 min Summer	41.347	1.027	0.8	11.3	O K
5760 min Summer	41.339	1.019	0.7	11.1	O K
7200 min Summer	41.334	1.014	0.6	11.0	O K
8640 min Summer	41.331	1.011	0.6	11.0	O K


<b>Storm Event</b>	<b>Rain (mm/hr)</b>	<b>Flooded Volume (m<sup>3</sup>)</b>	<b>Discharge Volume (m<sup>3</sup>)</b>	<b>Time-Peak (mins)</b>
15 min Summer	83.892	0.0	17.5	536
30 min Summer	56.436	0.0	23.5	673
60 min Summer	36.294	0.0	31.2	66
120 min Summer	22.586	0.0	39.2	116
180 min Summer	16.884	0.0	44.1	140
240 min Summer	13.646	0.0	47.6	172
360 min Summer	10.027	0.0	52.5	240
480 min Summer	8.062	0.0	56.4	306
600 min Summer	6.801	0.0	58.4	372
720 min Summer	5.916	0.0	59.5	438
960 min Summer	4.743	0.0	60.9	562
1440 min Summer	3.467	0.0	61.9	798
2160 min Summer	2.529	0.0	79.3	1148
2880 min Summer	2.020	0.0	84.2	1496
4320 min Summer	1.468	0.0	91.3	2208
5760 min Summer	1.169	0.0	96.4	2936
7200 min Summer	0.979	0.0	100.3	3664
8640 min Summer	0.847	0.0	103.5	4408

Cascade Summary of Results for Hydraulic Calcs (1 in 100) BOTTOM.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m <sup>3</sup> )	Status
10080 min Summer	41.328	1.008	0.5	10.9	O K
15 min Winter	41.171	0.851	0.3	7.6	O K
30 min Winter	41.272	0.952	0.3	9.7	O K
60 min Winter	41.363	1.043	0.9	11.7	O K
120 min Winter	41.428	1.108	1.0	13.2	O K
180 min Winter	41.455	1.135	1.1	13.9	O K
240 min Winter	41.471	1.151	1.1	14.2	O K
<b>360 min Winter</b>	<b>41.481</b>	<b>1.161</b>	<b>1.1</b>	<b>14.5</b>	<b>O K</b>
480 min Winter	41.480	1.160	1.1	14.5	O K
600 min Winter	41.473	1.153	1.1	14.3	O K
720 min Winter	41.462	1.142	1.1	14.0	O K
960 min Winter	41.438	1.118	1.1	13.4	O K
1440 min Winter	41.393	1.073	1.0	12.4	O K
2160 min Winter	41.360	1.040	0.9	11.6	O K
2880 min Winter	41.348	1.028	0.8	11.3	O K
4320 min Winter	41.336	1.016	0.6	11.1	O K
5760 min Winter	41.331	1.011	0.6	11.0	O K
7200 min Winter	41.328	1.008	0.5	10.9	O K
8640 min Winter	41.325	1.005	0.5	10.8	O K
10080 min Winter	41.323	1.003	0.5	10.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Time-Peak (mins)
10080 min Summer	0.749	0.0	106.2	5136
15 min Winter	83.892	0.0	19.7	586
30 min Winter	56.436	0.0	24.7	708
60 min Winter	36.294	0.0	35.1	62
120 min Winter	22.586	0.0	44.1	116
180 min Winter	16.884	0.0	49.6	146
240 min Winter	13.646	0.0	53.5	184
<b>360 min Winter</b>	<b>10.027</b>	<b>0.0</b>	<b>58.4</b>	<b>258</b>
480 min Winter	8.062	0.0	60.5	330
600 min Winter	6.801	0.0	61.8	398
720 min Winter	5.916	0.0	62.7	462
960 min Winter	4.743	0.0	63.8	586
1440 min Winter	3.467	0.0	64.7	810
2160 min Winter	2.529	0.0	89.2	1128
2880 min Winter	2.020	0.0	94.7	1472
4320 min Winter	1.468	0.0	102.7	2204
5760 min Winter	1.169	0.0	108.5	2936
7200 min Winter	0.979	0.0	113.0	3664
8640 min Winter	0.847	0.0	116.7	4496
10080 min Winter	0.749	0.0	119.9	5136



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Cascade Rainfall Details for Hydraulic Calcs (1 in 100) BOTTOM.SRCX

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.040

Time (mins) Area			Time (mins) Area		
From:	To:	(ha)	From:	To:	(ha)
0	4	0.025	4	8	0.015

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Cascade Model Details for Hydraulic Calcs (1 in 100) BOTTOM.SRCX

Storage is Online Cover Level (m) 42.120

Pipe Structure

Diameter (m) 1.200          Length (m) 49.649  
Slope (1:X) 21.000      Invert Level (m) 40.320

Complex Outflow Control

Hydro-Brake® Optimum

Unit Reference MD-SHE-0025-3000-0950-3000  
Design Head (m) 0.950  
Design Flow (l/s) 0.3  
Flush-Flo™ Calculated  
Objective Minimise upstream storage  
Application Surface  
Sump Available Yes  
Diameter (mm) 25  
Invert Level (m) 40.320  
Minimum Outlet Pipe Diameter (mm) 75  
Suggested Manhole Diameter (mm) 1200


Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.950	0.3
Flush-Flo™	0.109	0.2
Kick-Flo®	0.220	0.2
Mean Flow over Head Range	-	0.2

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.2	1.200	0.3	3.000	0.5	7.000	0.7
0.200	0.2	1.400	0.4	3.500	0.5	7.500	0.7
0.300	0.2	1.600	0.4	4.000	0.6	8.000	0.8
0.400	0.2	1.800	0.4	4.500	0.6	8.500	0.8
0.500	0.2	2.000	0.4	5.000	0.6	9.000	0.8
0.600	0.2	2.200	0.4	5.500	0.6	9.500	0.8
0.800	0.3	2.400	0.4	6.000	0.7		
1.000	0.3	2.600	0.5	6.500	0.7		

Hydro-Brake® Optimum

Unit Reference MD-SHE-0045-8000-0700-8000  
Design Head (m) 0.700

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Hydro-Brake® Optimum

Design Flow (l/s)	0.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	45
Invert Level (m)	41.300
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.700	0.8
Flush-Flo™	0.198	0.8
Kick-Flo®	0.401	0.6
Mean Flow over Head Range	-	0.7

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.7	1.200	1.0	3.000	1.5	7.000	2.3
0.200	0.8	1.400	1.1	3.500	1.6	7.500	2.3
0.300	0.7	1.600	1.2	4.000	1.7	8.000	2.4
0.400	0.6	1.800	1.2	4.500	1.8	8.500	2.5
0.500	0.7	2.000	1.3	5.000	1.9	9.000	2.6
0.600	0.7	2.200	1.3	5.500	2.0	9.500	2.6
0.800	0.8	2.400	1.4	6.000	2.1		
1.000	0.9	2.600	1.4	6.500	2.2		




Cascade Summary of Results for Hydraulic Calcs (1 in 100 + 40) TOP.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (1/s)	Max Control (1/s)	Max Σ Outflow (1/s)	Max Volume (m <sup>3</sup> )	Status
8640 min Summer	42.874	0.194	0.0	0.3	0.3	24.5	O K
10080 min Summer	42.850	0.170	0.0	0.3	0.3	21.0	O K
15 min Winter	42.829	0.149	0.0	0.3	0.3	18.0	O K
30 min Winter	42.875	0.195	0.0	0.3	0.3	24.6	O K
60 min Winter	42.925	0.245	0.0	0.3	0.3	31.8	O K
120 min Winter	42.977	0.297	0.0	0.3	0.3	39.2	O K
180 min Winter	43.006	0.326	0.0	0.3	0.3	43.4	O K
240 min Winter	43.025	0.345	0.0	0.3	0.3	46.1	O K
360 min Winter	43.047	0.367	0.0	0.3	0.3	49.3	O K
480 min Winter	43.062	0.382	0.0	0.3	0.3	51.4	O K
600 min Winter	43.071	0.391	0.0	0.3	0.3	52.7	O K
720 min Winter	43.076	0.396	0.0	0.3	0.3	53.4	O K
<b>960 min Winter</b>	<b>43.080</b>	<b>0.400</b>	<b>0.0</b>	<b>0.3</b>	<b>0.3</b>	<b>54.0</b>	<b>O K</b>
1440 min Winter	43.074	0.394	0.0	0.3	0.3	53.2	O K
2160 min Winter	43.053	0.373	0.0	0.3	0.3	50.1	O K
2880 min Winter	43.033	0.353	0.0	0.3	0.3	47.3	O K
4320 min Winter	42.994	0.314	0.0	0.3	0.3	41.7	O K
5760 min Winter	42.954	0.274	0.0	0.3	0.3	35.9	O K
7200 min Winter	42.910	0.230	0.0	0.3	0.3	29.7	O K
8640 min Winter	42.865	0.185	0.0	0.3	0.3	23.2	O K
10080 min Winter	42.828	0.148	0.0	0.3	0.3	17.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Time-Peak (mins)
8640 min Summer	1.186	0.0	96.2	5264
10080 min Summer	1.049	0.0	98.7	5952
15 min Winter	117.448	0.0	18.3	22
30 min Winter	79.010	0.0	25.1	37
60 min Winter	50.812	0.0	32.7	66
120 min Winter	31.621	0.0	41.0	124
180 min Winter	23.637	0.0	46.1	182
240 min Winter	19.105	0.0	49.4	240
360 min Winter	14.037	0.0	49.6	358
480 min Winter	11.286	0.0	49.4	474
600 min Winter	9.522	0.0	49.3	590
720 min Winter	8.282	0.0	49.1	706
<b>960 min Winter</b>	<b>6.640</b>	<b>0.0</b>	<b>48.8</b>	<b>932</b>
1440 min Winter	4.854	0.0	48.3	1368
2160 min Winter	3.541	0.0	83.1	1728
2880 min Winter	2.828	0.0	88.2	2192
4320 min Winter	2.055	0.0	87.9	3116
5760 min Winter	1.637	0.0	100.9	4032
7200 min Winter	1.371	0.0	105.0	4904
8640 min Winter	1.186	0.0	108.5	5616
10080 min Winter	1.049	0.0	111.3	6264



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Cascade Rainfall Details for Hydraulic Calcs (1 in 100 + 40) TOP.SRCX

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.080

<b>Time (mins) Area</b>			<b>Time (mins) Area</b>		
<b>From:</b>	<b>To:</b>	<b>(ha)</b>	<b>From:</b>	<b>To:</b>	<b>(ha)</b>
0	4	0.055	4	8	0.025

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Cascade Model Details for Hydraulic Calcs (1 in 100 + 40) TOP.SRCX

Storage is Online Cover Level (m) 44.680

Complex Structure

Cellular Storage

Invert Level (m) 42.680 Safety Factor 2.0  
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95  
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	65.0	0.0	1.501	0.0	0.0
1.500	65.0	0.0			

Porous Car Park


Infiltration Coefficient Base (m/hr) 0.00000 Width (m) 16.5  
 Membrane Percolation (mm/hr) 1000 Length (m) 16.5  
 Max Percolation (l/s) 75.6 Slope (1:X) 200.0  
 Safety Factor 2.0 Depression Storage (mm) 5  
 Porosity 0.30 Evaporation (mm/day) 3  
 Invert Level (m) 42.680 Membrane Depth (m) 0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0030-6000-1900-6000  
 Design Head (m) 1.900  
 Design Flow (l/s) 0.6  
 Flush-Flo™ Calculated  
 Objective Minimise upstream storage  
 Application Surface  
 Sump Available Yes  
 Diameter (mm) 30  
 Invert Level (m) 42.640  
 Minimum Outlet Pipe Diameter (mm) 75  
 Suggested Manhole Diameter (mm) 1200


Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.900	0.6
Flush-Flo™	0.136	0.3
Kick-Flo®	0.273	0.3
Mean Flow over Head Range	-	0.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

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Hydro-Brake® Optimum Outflow Control

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.3	1.200	0.5	3.000	0.7	7.000	1.1
0.200	0.3	1.400	0.5	3.500	0.8	7.500	1.1
0.300	0.3	1.600	0.6	4.000	0.8	8.000	1.1
0.400	0.3	1.800	0.6	4.500	0.9	8.500	1.2
0.500	0.3	2.000	0.6	5.000	0.9	9.000	1.2
0.600	0.4	2.200	0.6	5.500	1.0	9.500	1.2
0.800	0.4	2.400	0.7	6.000	1.0		
1.000	0.5	2.600	0.7	6.500	1.0		

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Cascade Summary of Results for Hydraulic Calcs (1 in 100 + 40) BOTTOM.SRCX

<b>Upstream Structures</b>	<b>Outflow To</b>	<b>Overflow To</b>
Hydraulic Calcs (1 in 100 + 40) TOP.SRCX	(None)	(None)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m <sup>3</sup> )	Status
15 min Summer	41.246	0.926	0.3	9.1	O K
30 min Summer	41.357	1.037	0.9	11.6	O K
60 min Summer	41.462	1.142	1.1	14.0	O K
120 min Summer	41.552	1.232	1.1	16.2	O K
180 min Summer	41.591	1.271	1.1	17.2	O K
240 min Summer	41.616	1.296	1.1	17.8	O K
360 min Summer	41.641	1.321	1.1	18.5	O K
480 min Summer	41.655	1.335	1.1	18.8	O K
600 min Summer	41.658	1.338	1.1	18.9	O K
720 min Summer	41.655	1.335	1.1	18.8	O K
960 min Summer	41.635	1.315	1.1	18.3	O K
1440 min Summer	41.575	1.255	1.1	16.8	O K
2160 min Summer	41.484	1.164	1.1	14.6	O K
2880 min Summer	41.424	1.104	1.0	13.1	O K
4320 min Summer	41.370	1.050	1.0	11.8	O K
5760 min Summer	41.354	1.034	0.8	11.5	O K
7200 min Summer	41.345	1.025	0.8	11.3	O K
8640 min Summer	41.340	1.020	0.7	11.1	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Time-Peak (mins)
15 min Summer	117.448	0.0	24.0	684
30 min Summer	79.010	0.0	27.3	35
60 min Summer	50.812	0.0	44.3	62
120 min Summer	31.621	0.0	55.4	120
180 min Summer	23.637	0.0	60.5	156
240 min Summer	19.105	0.0	62.7	190
360 min Summer	14.037	0.0	65.3	256
480 min Summer	11.286	0.0	67.0	326
600 min Summer	9.522	0.0	68.3	394
720 min Summer	8.282	0.0	69.4	462
960 min Summer	6.640	0.0	71.1	592
1440 min Summer	4.854	0.0	73.2	838
2160 min Summer	3.541	0.0	112.1	1176
2880 min Summer	2.828	0.0	119.1	1524
4320 min Summer	2.055	0.0	118.9	2204
5760 min Summer	1.637	0.0	136.8	2936
7200 min Summer	1.371	0.0	142.6	3632
8640 min Summer	1.186	0.0	147.4	4336

Cascade Summary of Results for Hydraulic Calcs (1 in 100 + 40) BOTTOM.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m <sup>3</sup> )	Status
10080 min Summer	41.336	1.016	0.6	11.1	O K
15 min Winter	41.286	0.966	0.3	10.0	O K
30 min Winter	41.410	1.090	1.0	12.8	O K
60 min Winter	41.534	1.214	1.1	15.8	O K
120 min Winter	41.646	1.326	1.1	18.6	O K
180 min Winter	41.701	1.381	1.1	19.9	O K
240 min Winter	41.724	1.404	1.1	20.5	O K
360 min Winter	41.737	1.417	1.1	20.8	O K
480 min Winter	41.738	1.418	1.1	20.8	O K
600 min Winter	41.729	1.409	1.1	20.6	O K
720 min Winter	41.711	1.391	1.1	20.2	O K
960 min Winter	41.652	1.332	1.1	18.7	O K
1440 min Winter	41.536	1.216	1.1	15.8	O K
2160 min Winter	41.415	1.095	1.0	12.9	O K
2880 min Winter	41.369	1.049	1.0	11.8	O K
4320 min Winter	41.348	1.028	0.8	11.3	O K
5760 min Winter	41.339	1.019	0.7	11.1	O K
7200 min Winter	41.335	1.015	0.6	11.0	O K
8640 min Winter	41.331	1.011	0.6	11.0	O K
10080 min Winter	41.329	1.009	0.6	10.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Time-Peak (mins)
10080 min Summer	1.049	0.0	151.5	5072
15 min Winter	117.448	0.0	25.1	704
30 min Winter	79.010	0.0	28.8	35
60 min Winter	50.812	0.0	49.8	62
120 min Winter	31.621	0.0	60.6	120
180 min Winter	23.637	0.0	64.0	176
240 min Winter	19.105	0.0	66.0	228
360 min Winter	14.037	0.0	68.6	282
480 min Winter	11.286	0.0	70.6	360
600 min Winter	9.522	0.0	72.2	436
720 min Winter	8.282	0.0	73.5	512
960 min Winter	6.640	0.0	75.7	644
1440 min Winter	4.854	0.0	78.4	880
2160 min Winter	3.541	0.0	125.9	1176
2880 min Winter	2.828	0.0	130.8	1472
4320 min Winter	2.055	0.0	128.0	2196
5760 min Winter	1.637	0.0	153.7	2896
7200 min Winter	1.371	0.0	160.3	3608
8640 min Winter	1.186	0.0	165.8	4408
10080 min Winter	1.049	0.0	170.6	5072



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Cascade Rainfall Details for Hydraulic Calcs (1 in 100 + 40) BOTTOM.SRCX

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.040

Time (mins) Area			Time (mins) Area		
From:	To:	(ha)	From:	To:	(ha)
0	4	0.025	4	8	0.015

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Cascade Model Details for Hydraulic Calcs (1 in 100 + 40) BOTTOM.SRCX

Storage is Online Cover Level (m) 42.120

Pipe Structure

Diameter (m) 1.200                      Length (m) 49.649  
Slope (1:X) 21.000      Invert Level (m) 40.320

Complex Outflow Control

Hydro-Brake® Optimum

Unit Reference MD-SHE-0025-3000-0950-3000  
Design Head (m) 0.950  
Design Flow (l/s) 0.3  
Flush-Flo™ Calculated  
Objective Minimise upstream storage  
Application Surface  
Sump Available Yes  
Diameter (mm) 25  
Invert Level (m) 40.320  
Minimum Outlet Pipe Diameter (mm) 75  
Suggested Manhole Diameter (mm) 1200


Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.950	0.3
Flush-Flo™	0.109	0.2
Kick-Flo®	0.220	0.2
Mean Flow over Head Range	-	0.2

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.2	1.200	0.3	3.000	0.5	7.000	0.7
0.200	0.2	1.400	0.4	3.500	0.5	7.500	0.7
0.300	0.2	1.600	0.4	4.000	0.6	8.000	0.8
0.400	0.2	1.800	0.4	4.500	0.6	8.500	0.8
0.500	0.2	2.000	0.4	5.000	0.6	9.000	0.8
0.600	0.2	2.200	0.4	5.500	0.6	9.500	0.8
0.800	0.3	2.400	0.4	6.000	0.7		
1.000	0.3	2.600	0.5	6.500	0.7		

Hydro-Brake® Optimum

Unit Reference MD-SHE-0045-8000-0700-8000  
Design Head (m) 0.700

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Hydro-Brake® Optimum

Design Flow (l/s)	0.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	45
Invert Level (m)	41.300
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.700	0.8
Flush-Flo™	0.198	0.8
Kick-Flo®	0.401	0.6
Mean Flow over Head Range	-	0.7

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.7	1.200	1.0	3.000	1.5	7.000	2.3
0.200	0.8	1.400	1.1	3.500	1.6	7.500	2.3
0.300	0.7	1.600	1.2	4.000	1.7	8.000	2.4
0.400	0.6	1.800	1.2	4.500	1.8	8.500	2.5
0.500	0.7	2.000	1.3	5.000	1.9	9.000	2.6
0.600	0.7	2.200	1.3	5.500	2.0	9.500	2.6
0.800	0.8	2.400	1.4	6.000	2.1		
1.000	0.9	2.600	1.4	6.500	2.2		