Key

+ 42.50	Proposed finished levels
+ (42.50)	Interpolated existing spot levels
FFL 42.500	Proposed finished floor level
+ 42.50	Existing (pre-demolition) levels
→	Falls to drives & parking areas

Contouring

- Primary (every 250mm)
- Secondary (every 50mm)

Scale Bar. 1:200

0 2 5 10 25

Existing Road Levels

Sheet piling required were insufficient space exists for reinforced bank

Existing Road Levels

Existing Road Levels

Existing Road Levels

Plots 1-6

FFL 43.850

Plots 7-25

FFL 43.875

FFL 44.400

FFL 43.350

43.200

Remove existing R/W to here

Limit of Adopted Highway Works

Sheet piling required with railing

Cranbrook Road

BUS STOP

1 in 15 max

Double kerb here

double kerb

SW

CONTRACT DOCUMENT

Notes

1. All adoptable highway works to be carried out under the supervision of, and to the satisfaction of Cambridgeshire County Council.
2. For longitudinal sections, refer to IDL-775-04** series drawings
3. All levels in metres unless noted otherwise.
4. All paving and garden areas to be graded evenly between spot levels given.
5. Prior to erecting plot boundary fencing, and before laying topsoil, subsoil to rear gardens to be thoroughly reworked to a depth of min 450mm to reintroduce free-draining properties.
6. Any discrepancies to be referred to the Project Engineer immediately.

Rev	Description	Date
P01	For Planning	06.09.22

Status: For Planning

Scale :	1:200@A1		
Date :	Aug 2022	Checked:	Approved:
Drawn :	IDL	DC	PT

Title : Levels Strategy Layout

Project : Brook House, Hawkhurst

Drg. No:	Rev:	File Ref:	775-05.dwg
IDL/775/05/01	P01	Plot Ref:	775-05-01.pdf

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CONTRACT DOCUMENT

Key

- Private foul water drainage
- Private surface water drainage
- Private combined drainage
- Perforated pipework laid within subbase of permeable paved drives and parking bays. Refer to IDL/1022/07 series construction details
- Polypropylene universal inspection chambers 1200 deep max, 450 dia, 100 inlet / outlet connections (6 no. max) or 150 inlet/outlet connections (4 no max) as detailed on private drainage construction details.
- nme / nme — Polypropylene 'non-entry' inspection chambers 3000 deep max, 450 dia (with 300 dia. or square cover) 100 inlet / outlet connections (6 no. max), or 150 inlet/outlet connections (4 no max) as detailed on private drainage construction details.
- Denotes 250 dia ppic, 600mm deep with 4 no. max 100 dia inlets / outlets, as detailed on IDL/1022/07/ construction details.IMPORTANT NOTE: Should the depth to invert exceed 600mm, a 450mm dia IC **MUST** be used.
- R500 / R600 — Denotes 500/600 dia ppic, 3000mm deep max with 4 no. max inlets / outlets up to 150mm dia, as detailed on private drainage construction details. Where >1200mm deep, use reduced size access cover. Wavin Range 500/600 or similar.
- ST — Denotes 450 dia polypropylene silt trap with 300mm nominal sump, as messrs Polypipe Basic Silt Trap or similar.
- re — Rodding eye same dia. as downstream drain
- HB — Hydrobrake flow control chamber with orifice plate at higher level within the chamber as detailed on private drainage construction details
- CP — PCC surface water catchpit as detailed on private drainage construction details
- Denotes cellular attenuation, as Messrs Wavin Aquacell or similar and approved. As detailed on private drainage construction details

Scale Bar. 1:200
0 2 5 10 25

Plots 1-6
FFL 43.850
43.850
IL 42.90 150Ø IL 42.70
IL 43.00 150Ø
100Ø IL 42.55
IL 42.85 150Ø
IL 42.75
IL 42.50 100Ø
IL 42.45
IL 42.65 150Ø IL 42.00 150Ø
CP
150Ø
100Ø

Cellular storage.
Min ground level 43.00
Top of crates 41.80
IL (in) 47.60
Base 40.60
Total volume 96m3

Gravity flow control achieving the following flow rates;
1 in 2 year 1.3 l/sec
1 in 30 year 3.4 l/sec
1 in 100 year (+40%cc) 4.8l/sec

IL 41.85 CP 225Ø 150Ø HB IL 40.55
IL 42.15
IL 41.65
225Ø
IL 41.75
IL 41.83
IL 41.90

Existing level of FW sewer at this location to be verified prior to commencing any onsite drainage works.

Plots 7-25
FFL 43.875
FFL 44.400
FFL 43.350
43.200
IL 42.30 150Ø IL 42.10
IL 43.50 IL 42.70 150Ø
IL 43.20 100Ø
150Ø
IL 42.90 150Ø IL 41.95
IL 41.90
IL 43.70 150Ø
IL 41.70 150Ø IL 41.80 150Ø 150Ø
IL 41.65 150Ø
IL 43.50 150Ø IL 43.35 100Ø
IL 43.20
150Ø
IL 43.25 150Ø IL 42.50 150Ø IL 42.25

Ex. FWMH Ref 8901 CL 43.08 approx IL unknown. TBC. (Given upstream IL, the invert level here should be no higher than 41.60m AOD)

IL 43.95
150Ø perforated pipe in subbase

Parking bays on this side of the access road to be of permeable (System A) no-dig construction

Turning head to be of permeable (System A) no-dig construction

Existing 150mm dia adopted FW sewer

Parking bays on this side of the access road to be of permeable (System A) no-dig construction

Limit of Adopted Highway Works

IL 42.45

150Ø perforated pipe in subbase

Existing 150mm dia adopted FW sewer

IL 40.70

New headwall outfall to watercourse serving private development. This structure will require Land Drainage Consent pursuant to Section 23 of the Land Drainage Act 1991.

Ex. FWMH Ref 9004 CL 39.926 IL 37.826 (Taken from Records)

New headwall outfall to watercourse serving extent of new adoptable highway. This structure will require Land Drainage Consent pursuant to Section 23 of the Land Drainage Act 1991.

Ex. FWMH Ref 9905 CL 41.211 IL 39.811 (Taken from Records)

Cranbrook Road

BUS STOP

Notes

1. This drawing is to be read in conjunction with the private drainage construction details all other relevant contract documents.
2. All private drainage works to be carried out in accordance with the provisions laid down in BS EN 752 & The Building Regulations, Part H.
3. Levels shown in buildings are Finished Floor Level.
4. Drainage under adopted roads to be either:-
   a) Vitrified Clayware to BSEN295.
   b) Concrete to BS 5911, Class M. Laterals to be formed of either vitrified clay or "Extra Strength", concrete "Class M",
5. Before commencing any Sewer or drainage works, the Developer's Groundworker must satisfy themselves, the developer and the Local Authority of actual levels and conditions of existing sewers.
6. Buried concrete to satisfy the requirements of BRE Special Digest 1 as predetermined by the site's Geotechnical Report
7. All abandoned, buried obstructions encountered during the construction of Highway & Drainage Works are to be broken out to bed level of drains and sewers, and to the formation of carparks and drives etc., and to sufficient depth to allow for laying service company's mains and services.
8. Depth and Location of existing services to be traced prior to any excavation.
9. All private drainage to be laid to levels shown using flexibly jointed pipes, either uPVC to BS 4660 and BS 5481 or vitrified clayware to BS EN 295.
10. Generally pipes to have granular Bed & Surround in accordance with manufacturers recommendations, ensuring adequate protection with respect to depth and location. Where bedding material is placed at depths susceptible to ground water ingress, it is to be wrapped in a geotextile (Terram 700 or better).
11. Private precast concrete manholes and catchpits to be constructed using conc. box sections or circular rings to BS 5911-200, with 150mm conc. surround, size and construction to comply with Table 12 of Approved Document, Part H.
12. Rodding eyes, etc are to be laid to manufacturers minimum cover and depth to allow adequate fall from adjoining unit.
13. Access panels are to be provided to all rainwater pipes, a max. 600 above finished ground level.
14. All manholes / inspection chambers in hard surfaced areas, to have recessed covers. These are to be orientated such as to minimise cut blocks.
15. All pipework to be 100mmØ unless otherwise stated, 150mm dia from road gullies.
16. All levels in metres (m) unless specified otherwise.
17. All drain runs from SVP's, stub stacks or FW gullies to be laid at min. 1:40 gradient unless otherwise stated.
18. Svp's, stub stacks & RWP's are shown indicative only. Refer to Architectural dimensioned GA's for accurate locations
19. House/Flat drainage to be laid prior to erection of scaffold.
20. All cover and invert levels shown are in metres. All pipe diameters are in millimetres U.N.O.
21. All chambers located in trafficked areas to have concrete surround.
22. IMPORTANT NOTE:
    At depths where groundwater ingress is encountered, consider the use of a sump / pump arrangement.
    Where excavations are >1m deep, consider the use of full perimeter trench support.
23. IMPORTANT NOTE:
    The new sewer connections are be successfully made prior to commencing any upstream drainage works.

Rev	Description	Date
P01	For Planning	06.09.22

Status: For Planning

Scale : 1:200@A1
Date : Aug 2022
Drawn : IDL
Checked: DC
Approved: PT

Title : Drainage Strategy Layout

Project : Brook House, Hawkhurst

Drg. No:	Rev:	File Ref:
IDL/775/07/01	P01	775-07.dwg
		Plot Ref: 775-07-01.pdf

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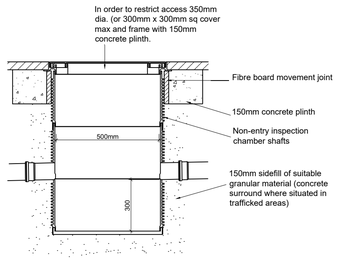
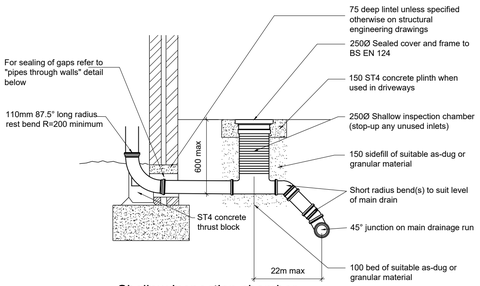
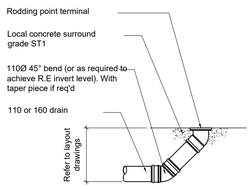


Silt Trap



Shallow inspection chamber

For use in soft areas and driveways only



Rodding eye

TABLE 11 MIN. DIMENSIONS FOR ACCESS FITTINGS AND INSPECTION CHAMBERS

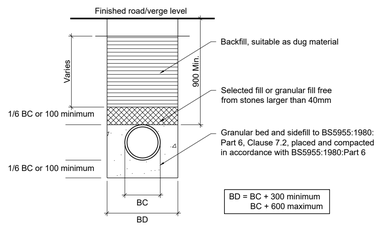
TYPE	DEPTH TO INVERT FROM COVER LEVEL (m)	INTERNAL SIZES		COVER SIZES	
		RECTANGULAR LENGTH AND WIDTH	CIRCULAR DIAMETER	RECTANGULAR LENGTH AND WIDTH	CIRCULAR DIAMETER
Rodding Eye		As drain but min 100			Same size as pipework (1)
Access Fittings small 150 dia 150x100 large 225x100	0.6 or less, except where situated in a chamber	150x100 225x100	150 225	150x100 (1) 225x100 (1)	Same size as access fitting
Inspection Chamber Shallow	0.6 or less	225x100	190 (2)	-	190 (1)
	1.2 or less	450x450	450	Min 430x430	430
Deep	>1.2 but <3.0	450x450	450	max 300x300 (3)	Access restricted to max 350 (3)

Notes:
(1) The clear opening may be reduced by 20mm in order to provide proper support for the cover and frame.
(2) Drains upto 150mm.
(3) A larger clear opening may be used in conjunction with a restricted access. The size is restricted for health and safety reasons to deter entry.

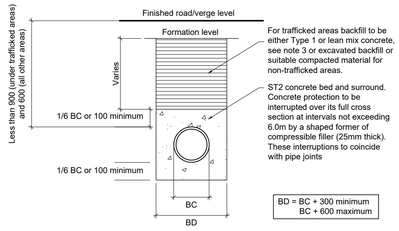
TABLE 12 MINIMUM DIMENSIONS FOR MANHOLES

TYPE	SIZE OF LARGEST PIPE (DN)	MIN. INTERNAL DIMENSIONS (1)		MIN. CLEAR OPENING SIZE (1)	
		RECTANGULAR LENGTH AND WIDTH	CIRCULAR DIAMETER	RECTANGULAR LENGTH AND WIDTH	CIRCULAR DIAMETER
MANHOLE <1.5m deep to soffit	<= 150 225 300 >300	750 x 675 (7) 1200 x 675 1200 x 750 1800 x (DN+450)	1000 (7) 1200 1200 The larger of 1800 or (DN+450)	750 x 675 (2) 1200 x 675 (2)	na (3)
>1.5m deep to soffit	<= 225 300 375-450 >450	1200 x 1000 1200 x 1075 1350 x 1225 1800 x (DN+775)	1200 1200 1200 The larger of 1800 or (DN+775)	600 x 600	600
MANHOLE SHAFT (4) >3.0m deep to soffit of pipe	Steps (5)	1050 x 800	1050	600 x 600	600
	Ladder (5)	1200 x 800	1200		
	Winch (6)	900 x 800	900	600 x 600	600

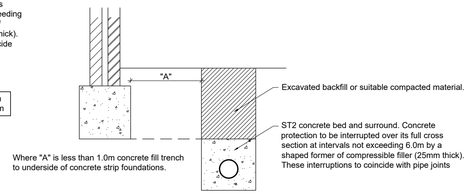
Notes:
(1) Larger sizes may be required for manholes on bends or where there are junctions.
(2) May be reduced to 600 by 600 where required by highway loading considerations, subject to a safe system of work being specified.
(3) Not applicable due to working space needed.
(4) Minimum height of chamber in shafted manhole 2m from benching to underside of reducing slab.
(5) Min clear space between ladder or steps and the opposite face of the shaft should be approximately 900mm.
(6) Winch only - no steps of ladders, permanent or removable.
(7) The minimum size of any manhole serving a sewer (i.e. any drain serving more than one property) should be 1200mm x 675mm rectangular or 1200mm diameter.

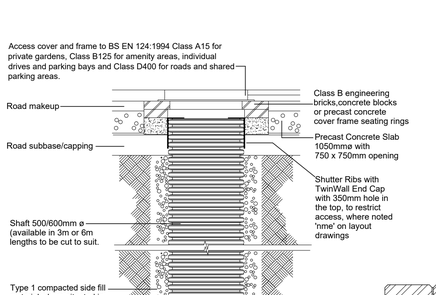


Typical trench detail



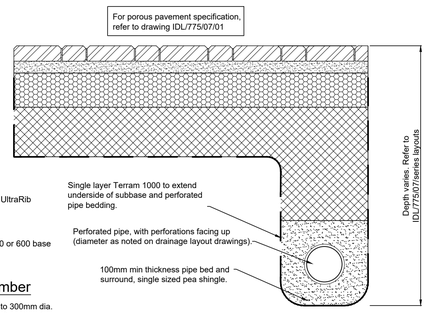
Shallow trench detail

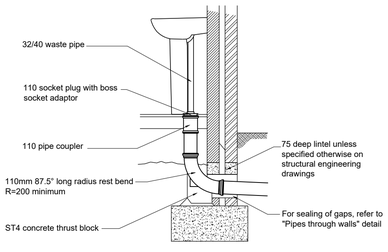




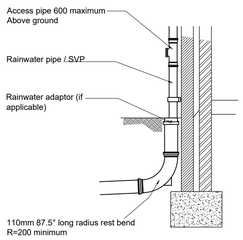
Messrs Wavin 'Range500 or Range600' Inspection chamber

For use in any trafficked areas (up to D400 rating) and / or where pipe diameters >150 and up to 300mm dia. Range500 suitable for 100 and 150mm dia pipes. Range600 suitable also for 225 and 300mm diameter pipes. Where noted 'R500' or 'R600' on layouts

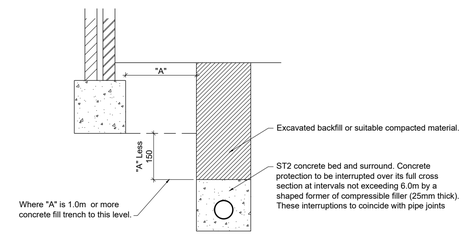




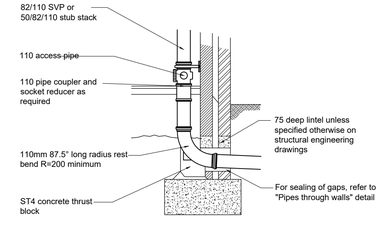
Internal waste pipe connection



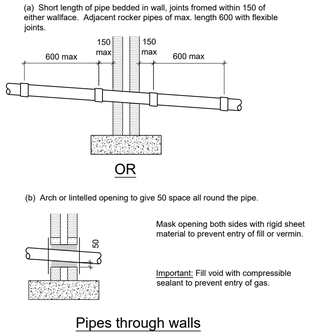
External R.W.P or SVP to drain



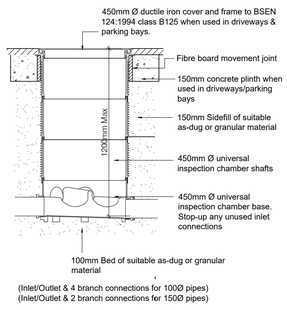
Pipe runs near buildings



Soil and vent pipe connection and stub stack connection

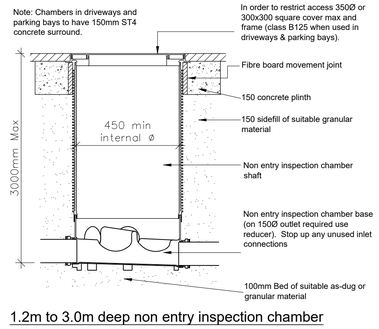


Pipes through walls



1.2m Max. Polypropylene inspection chamber

For use in soft areas, driveways and parking bays only



1.2m to 3.0m deep non entry inspection chamber

For use in soft areas, driveways and parking bays only, where noted 'nme' on layouts

Scale: 1 in 12.5

0 200 500 1000 2500mm

CONTRACT DOCUMENT

Notes

1. This drawing is to be read in conjunction with the Drainage Layout, IDL/1022/07/01
2. All private drainage works to be constructed in accordance with the latest edition of the Building Regulations part H (Drainage & Waste Disposal) and to BSEN752.
3. This drawing is to be read in conjunction with the structural and architectural drawings and specification. Bespoke detailing of lintels / pipe sleeving, etc shown on the structural engineers drawings take precedence over the standard details shown on this drawing.
4. All manholes within block paved areas to have recessed covers and frames.

Rev	Description	Date
P01	For Planning	06.09.22

Status: For Planning

Scale :	1:20@A1		
Date :	Aug 2022	Checked:	Approved:
Drawn :	IDL	DC	PT

Title : Drainage Details Sheet 1 of 2

Project : Brook House, Hawkhurst

Drg. No:	Rev:	File Ref:	775-07.dwg
IDL/775/07/05	P01	Plot Ref:	775-07-05.pdf

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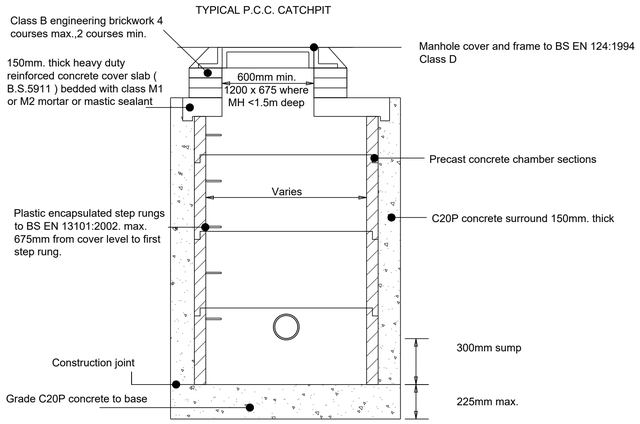
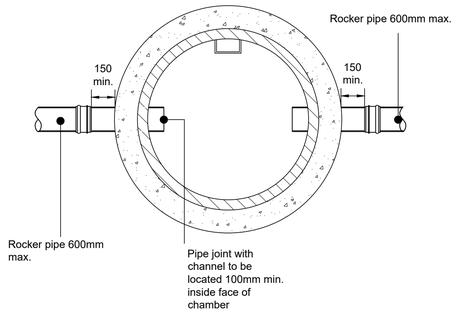
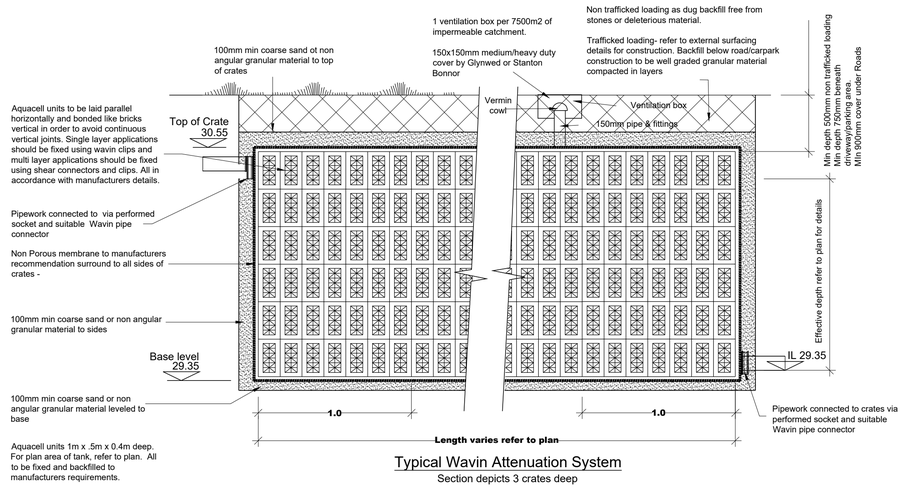
TYPICAL P.C.C. CATCHPIT







Typical Wavin Attenuation System

Section depicts 3 crates deep

Scale 1:12.5

0 200 500 1000 2500mm

CONTRACT DOCUMENT

Notes

1. This drawing is to be read in conjunction with the Drainage Layout, IDL/1022/07/01
2. All private drainage works to be constructed in accordance with the latest edition of the Building Regulations part H (Drainage & Waste Disposal) and to BSEN752.
3. This drawing is to be read in conjunction with the structural and architectural drawings and specification. Bespoke detailing of lintels / pipe sleeving, etc shown on the structural engineers drawings take precedence over the standard details shown on this drawing.
4. All manholes within block paved areas to have recessed covers and frames.

Rev	Description	Date
P01	For Planning	06.09.22

Status: For Planning

Scale : 1:20@A1		
Date : Aug 2022	Checked:	Approved:
Drawn : IDL	DC	PT

Title : Drainage Details Sheet 2 of 2

Project : Brook House, Hawkhurst

Drg. No:	Rev:	File Ref:	775-07.dwg
IDL/775/07/06	P01	Plot Ref:	775-07-06.pdf

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ICP SUDS Mean Annual Flood

Input

Return Period (years) 100 SAAR (mm) 800 Urban 0.000
Area (ha) 0.296 Soil 0.450 Region Number Region 7

Results l/s

QBAR Rural 1.5
QBAR Urban 1.5

Q100 years 4.8

Q1 year 1.3
Q30 years 3.4
Q100 years 4.8

Summary of Results for 2 year Return Period

Half Drain Time : 255 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	40.758	0.158	0.0	1.0	1.0	12.0	O K
30 min Summer	40.800	0.200	0.0	1.0	1.0	15.2	O K
60 min Summer	40.838	0.238	0.0	1.0	1.0	18.1	O K
120 min Summer	40.904	0.304	0.0	1.0	1.0	23.1	O K
180 min Summer	40.931	0.331	0.0	1.0	1.0	25.1	O K
240 min Summer	40.940	0.340	0.0	1.0	1.0	25.8	O K
360 min Summer	40.940	0.340	0.0	1.0	1.0	25.8	O K
480 min Summer	40.930	0.330	0.0	1.0	1.0	25.1	O K
600 min Summer	40.919	0.319	0.0	1.0	1.0	24.2	O K
720 min Summer	40.907	0.307	0.0	1.0	1.0	23.3	O K
960 min Summer	40.882	0.282	0.0	1.0	1.0	21.4	O K
1440 min Summer	40.835	0.235	0.0	1.0	1.0	17.8	O K
2160 min Summer	40.778	0.178	0.0	1.0	1.0	13.5	O K
2880 min Summer	40.736	0.136	0.0	1.0	1.0	10.3	O K
4320 min Summer	40.683	0.083	0.0	1.0	1.0	6.3	O K
5760 min Summer	40.654	0.054	0.0	0.9	0.9	4.1	O K
7200 min Summer	40.637	0.037	0.0	0.9	0.9	2.8	O K
8640 min Summer	40.626	0.026	0.0	0.9	0.9	2.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	36.705	0.0	13.1	21
30 min Summer	23.945	0.0	17.1	35
60 min Summer	15.080	0.0	21.6	64
120 min Summer	10.398	0.0	29.8	122
180 min Summer	8.125	0.0	34.9	180
240 min Summer	6.742	0.0	38.6	226
360 min Summer	5.100	0.0	43.8	288
480 min Summer	4.139	0.0	47.4	350
600 min Summer	3.507	0.0	50.2	418
720 min Summer	3.057	0.0	52.5	486
960 min Summer	2.458	0.0	56.3	620
1440 min Summer	1.809	0.0	62.1	884
2160 min Summer	1.346	0.0	69.4	1260
2880 min Summer	1.103	0.0	75.7	1620
4320 min Summer	0.850	0.0	87.6	2336
5760 min Summer	0.718	0.0	98.7	3048
7200 min Summer	0.637	0.0	109.5	3744
8640 min Summer	0.582	0.0	120.0	4408

Summary of Results for 2 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Summer	40.621	0.021	0.0	0.8	0.8	1.6	O K
15 min Winter	40.779	0.179	0.0	1.0	1.0	13.6	O K
30 min Winter	40.828	0.228	0.0	1.0	1.0	17.3	O K
60 min Winter	40.873	0.273	0.0	1.0	1.0	20.7	O K
120 min Winter	40.953	0.353	0.0	1.0	1.0	26.8	O K
180 min Winter	40.990	0.390	0.0	1.0	1.0	29.6	O K
240 min Winter	41.007	0.407	0.0	1.0	1.0	30.9	O K
360 min Winter	41.010	0.410	0.0	1.0	1.0	31.2	O K
480 min Winter	40.993	0.393	0.0	1.0	1.0	29.9	O K
600 min Winter	40.975	0.375	0.0	1.0	1.0	28.5	O K
720 min Winter	40.954	0.354	0.0	1.0	1.0	26.9	O K
960 min Winter	40.914	0.314	0.0	1.0	1.0	23.9	O K
1440 min Winter	40.839	0.239	0.0	1.0	1.0	18.1	O K
2160 min Winter	40.752	0.152	0.0	1.0	1.0	11.5	O K
2880 min Winter	40.695	0.095	0.0	1.0	1.0	7.2	O K
4320 min Winter	40.637	0.037	0.0	0.9	0.9	2.8	O K
5760 min Winter	40.618	0.018	0.0	0.8	0.8	1.4	O K
7200 min Winter	40.610	0.010	0.0	0.7	0.7	0.8	O K
8640 min Winter	40.605	0.005	0.0	0.7	0.7	0.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	0.542	0.0	130.5	5144
15 min Winter	36.705	0.0	14.7	21
30 min Winter	23.945	0.0	19.2	35
60 min Winter	15.080	0.0	24.1	64
120 min Winter	10.398	0.0	33.3	120
180 min Winter	8.125	0.0	39.0	178
240 min Winter	6.742	0.0	43.2	234
360 min Winter	5.100	0.0	49.1	342
480 min Winter	4.139	0.0	53.1	388
600 min Winter	3.507	0.0	56.2	460
720 min Winter	3.057	0.0	58.9	534
960 min Winter	2.458	0.0	63.0	678
1440 min Winter	1.809	0.0	69.6	952
2160 min Winter	1.346	0.0	77.8	1324
2880 min Winter	1.103	0.0	84.9	1672
4320 min Winter	0.850	0.0	98.1	2336
5760 min Winter	0.718	0.0	110.5	3000
7200 min Winter	0.637	0.0	122.6	3744
8640 min Winter	0.582	0.0	134.4	4408

Summary of Results for 2 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Winter	40.601	0.001	0.0	0.6	0.6	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Winter	0.542	0.0	146.2	5112

Rainfall Details

Rainfall Model	FEH
Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 575948 130360 TQ 75948 30360
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.191

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.101	4	8	0.090

Model Details

Storage is Online Cover Level (m) 43.000

Cellular Storage Structure

Invert Level (m) 40.600 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	80.0	80.0	2.600	0.0	126.5
0.200	80.0	87.2	2.800	0.0	126.5
0.400	80.0	94.3	3.000	0.0	126.5
0.600	80.0	101.5	3.200	0.0	126.5
0.800	80.0	108.6	3.400	0.0	126.5
1.000	80.0	115.8	3.600	0.0	126.5
1.200	80.0	122.9	3.800	0.0	126.5
1.400	0.0	126.5	4.000	0.0	126.5
1.600	0.0	126.5	4.200	0.0	126.5
1.800	0.0	126.5	4.400	0.0	126.5
2.000	0.0	126.5	4.600	0.0	126.5
2.200	0.0	126.5	4.800	0.0	126.5
2.400	0.0	126.5	5.000	0.0	126.5

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0051-1300-1200-1300
Design Head (m)	1.200
Design Flow (l/s)	1.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	51
Invert Level (m)	40.550
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	1.3	Kick-Flo®	0.459	0.8
Flush-Flo™	0.227	1.0	Mean Flow over Head Range	-	1.0

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

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	0.9	1.200	1.3	3.000	2.0	7.000	2.9
0.200	1.0	1.400	1.4	3.500	2.1	7.500	3.0
0.300	1.0	1.600	1.5	4.000	2.2	8.000	3.1
0.400	1.0	1.800	1.6	4.500	2.4	8.500	3.2
0.500	0.9	2.000	1.6	5.000	2.5	9.000	3.3
0.600	1.0	2.200	1.7	5.500	2.6	9.500	3.4
0.800	1.1	2.400	1.8	6.000	2.7		
1.000	1.2	2.600	1.8	6.500	2.8		

Summary of Results for 30 year Return Period

Half Drain Time : 123 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	40.941	0.341	0.0	3.4	3.4	25.9	O K
30 min Summer	41.034	0.434	0.0	3.4	3.4	33.0	O K
60 min Summer	41.106	0.506	0.0	3.4	3.4	38.5	O K
120 min Summer	41.133	0.533	0.0	3.4	3.4	40.5	O K
180 min Summer	41.126	0.526	0.0	3.4	3.4	40.0	O K
240 min Summer	41.110	0.510	0.0	3.4	3.4	38.7	O K
360 min Summer	41.067	0.467	0.0	3.4	3.4	35.5	O K
480 min Summer	41.022	0.422	0.0	3.4	3.4	32.1	O K
600 min Summer	40.978	0.378	0.0	3.4	3.4	28.7	O K
720 min Summer	40.937	0.337	0.0	3.4	3.4	25.6	O K
960 min Summer	40.866	0.266	0.0	3.4	3.4	20.2	O K
1440 min Summer	40.766	0.166	0.0	3.2	3.2	12.6	O K
2160 min Summer	40.687	0.087	0.0	2.9	2.9	6.6	O K
2880 min Summer	40.654	0.054	0.0	2.6	2.6	4.1	O K
4320 min Summer	40.630	0.030	0.0	2.0	2.0	2.3	O K
5760 min Summer	40.618	0.018	0.0	1.7	1.7	1.4	O K
7200 min Summer	40.612	0.012	0.0	1.5	1.5	0.9	O K
8640 min Summer	40.608	0.008	0.0	1.3	1.3	0.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	81.965	0.0	29.3	21
30 min Summer	54.156	0.0	38.7	34
60 min Summer	34.251	0.0	49.1	62
120 min Summer	21.091	0.0	60.4	108
180 min Summer	15.725	0.0	67.6	140
240 min Summer	12.703	0.0	72.7	172
360 min Summer	9.323	0.0	80.1	240
480 min Summer	7.447	0.0	85.3	308
600 min Summer	6.242	0.0	89.4	372
720 min Summer	5.398	0.0	92.7	438
960 min Summer	4.286	0.0	98.2	560
1440 min Summer	3.091	0.0	106.3	796
2160 min Summer	2.240	0.0	115.5	1132
2880 min Summer	1.793	0.0	123.3	1476
4320 min Summer	1.331	0.0	137.2	2204
5760 min Summer	1.090	0.0	149.9	2936
7200 min Summer	0.943	0.0	162.1	3672
8640 min Summer	0.844	0.0	174.1	4368

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Summer	40.604	0.004	0.0	1.2	1.2	0.3	O K
15 min Winter	40.987	0.387	0.0	3.4	3.4	29.4	O K
30 min Winter	41.096	0.496	0.0	3.4	3.4	37.7	O K
60 min Winter	41.186	0.586	0.0	3.4	3.4	44.5	O K
120 min Winter	41.232	0.632	0.0	3.4	3.4	48.0	O K
180 min Winter	41.220	0.620	0.0	3.4	3.4	47.1	O K
240 min Winter	41.195	0.595	0.0	3.4	3.4	45.2	O K
360 min Winter	41.130	0.530	0.0	3.4	3.4	40.3	O K
480 min Winter	41.059	0.459	0.0	3.4	3.4	34.9	O K
600 min Winter	40.992	0.392	0.0	3.4	3.4	29.8	O K
720 min Winter	40.930	0.330	0.0	3.4	3.4	25.1	O K
960 min Winter	40.830	0.230	0.0	3.4	3.4	17.5	O K
1440 min Winter	40.708	0.108	0.0	3.0	3.0	8.2	O K
2160 min Winter	40.647	0.047	0.0	2.5	2.5	3.6	O K
2880 min Winter	40.628	0.028	0.0	2.0	2.0	2.2	O K
4320 min Winter	40.613	0.013	0.0	1.5	1.5	1.0	O K
5760 min Winter	40.605	0.005	0.0	1.2	1.2	0.4	O K
7200 min Winter	40.600	0.000	0.0	1.1	1.1	0.0	O K
8640 min Winter	40.600	0.000	0.0	1.0	1.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	0.772	0.0	185.8	5136
15 min Winter	81.965	0.0	32.8	21
30 min Winter	54.156	0.0	43.4	34
60 min Winter	34.251	0.0	54.9	62
120 min Winter	21.091	0.0	67.6	118
180 min Winter	15.725	0.0	75.7	168
240 min Winter	12.703	0.0	81.5	190
360 min Winter	9.323	0.0	89.7	264
480 min Winter	7.447	0.0	95.5	334
600 min Winter	6.242	0.0	100.1	402
720 min Winter	5.398	0.0	103.9	466
960 min Winter	4.286	0.0	110.0	588
1440 min Winter	3.091	0.0	119.0	810
2160 min Winter	2.240	0.0	129.3	1128
2880 min Winter	1.793	0.0	138.1	1476
4320 min Winter	1.331	0.0	153.7	2180
5760 min Winter	1.090	0.0	167.9	2928
7200 min Winter	0.943	0.0	181.6	3672
8640 min Winter	0.844	0.0	195.0	0

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Winter	40.600	0.000	0.0	0.9	0.9	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Winter	0.772	0.0	208.1	0

Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	2013
Site Location	GB 575948 130360 TQ 75948 30360
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.191

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.101	4	8	0.090

Model Details

Storage is Online Cover Level (m) 43.000

Cellular Storage Structure

Invert Level (m) 40.600 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	80.0	80.0	2.600	0.0	126.5
0.200	80.0	87.2	2.800	0.0	126.5
0.400	80.0	94.3	3.000	0.0	126.5
0.600	80.0	101.5	3.200	0.0	126.5
0.800	80.0	108.6	3.400	0.0	126.5
1.000	80.0	115.8	3.600	0.0	126.5
1.200	80.0	122.9	3.800	0.0	126.5
1.400	0.0	126.5	4.000	0.0	126.5
1.600	0.0	126.5	4.200	0.0	126.5
1.800	0.0	126.5	4.400	0.0	126.5
2.000	0.0	126.5	4.600	0.0	126.5
2.200	0.0	126.5	4.800	0.0	126.5
2.400	0.0	126.5	5.000	0.0	126.5

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0085-3400-1200-3400
Design Head (m)	1.200
Design Flow (l/s)	3.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	85
Invert Level (m)	40.550
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	3.4	Kick-Flo®	0.743	2.7
Flush-Flo™	0.363	3.4	Mean Flow over Head Range	-	3.0

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

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	2.5	1.200	3.4	3.000	5.2	7.000	7.7
0.200	3.2	1.400	3.6	3.500	5.6	7.500	8.0
0.300	3.4	1.600	3.9	4.000	5.9	8.000	8.3
0.400	3.4	1.800	4.1	4.500	6.3	8.500	8.5
0.500	3.3	2.000	4.3	5.000	6.6	9.000	8.7
0.600	3.2	2.200	4.5	5.500	6.9	9.500	9.0
0.800	2.8	2.400	4.7	6.000	7.2		
1.000	3.1	2.600	4.9	6.500	7.5		

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 170 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	41.221	0.621	0.0	4.8	4.8	47.2	O K
30 min Summer	41.410	0.810	0.0	4.8	4.8	61.6	O K
60 min Summer	41.565	0.965	0.0	4.8	4.8	73.3	O K
120 min Summer	41.624	1.024	0.0	4.8	4.8	77.8	O K
180 min Summer	41.616	1.016	0.0	4.8	4.8	77.2	O K
240 min Summer	41.596	0.996	0.0	4.8	4.8	75.7	O K
360 min Summer	41.546	0.946	0.0	4.8	4.8	71.9	O K
480 min Summer	41.491	0.891	0.0	4.8	4.8	67.7	O K
600 min Summer	41.435	0.835	0.0	4.8	4.8	63.4	O K
720 min Summer	41.376	0.776	0.0	4.8	4.8	59.0	O K
960 min Summer	41.239	0.639	0.0	4.8	4.8	48.6	O K
1440 min Summer	41.012	0.412	0.0	4.8	4.8	31.3	O K
2160 min Summer	40.812	0.212	0.0	4.7	4.7	16.1	O K
2880 min Summer	40.718	0.118	0.0	4.4	4.4	8.9	O K
4320 min Summer	40.657	0.057	0.0	3.6	3.6	4.4	O K
5760 min Summer	40.638	0.038	0.0	2.9	2.9	2.9	O K
7200 min Summer	40.628	0.028	0.0	2.5	2.5	2.1	O K
8640 min Summer	40.622	0.022	0.0	2.2	2.2	1.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	145.372	0.0	52.0	21
30 min Summer	97.086	0.0	69.5	35
60 min Summer	61.730	0.0	88.3	64
120 min Summer	37.355	0.0	106.9	120
180 min Summer	27.755	0.0	119.2	156
240 min Summer	22.423	0.0	128.4	188
360 min Summer	16.508	0.0	141.9	254
480 min Summer	13.245	0.0	151.7	326
600 min Summer	11.146	0.0	159.6	394
720 min Summer	9.671	0.0	166.2	464
960 min Summer	7.716	0.0	176.8	594
1440 min Summer	5.580	0.0	191.8	826
2160 min Summer	4.021	0.0	207.3	1168
2880 min Summer	3.193	0.0	219.5	1500
4320 min Summer	2.322	0.0	239.4	2204
5760 min Summer	1.867	0.0	256.8	2936
7200 min Summer	1.592	0.0	273.7	3664
8640 min Summer	1.406	0.0	290.1	4400

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Summer	40.617	0.017	0.0	2.0	2.0	1.3	O K
15 min Winter	41.305	0.705	0.0	4.8	4.8	53.5	O K
30 min Winter	41.519	0.919	0.0	4.8	4.8	69.8	O K
60 min Winter	41.702	1.102	0.0	4.8	4.8	83.8	O K
120 min Winter	41.787	1.187	0.0	4.9	4.9	90.2	O K
180 min Winter	41.785	1.185	0.0	4.9	4.9	90.0	O K
240 min Winter	41.757	1.157	0.0	4.8	4.8	87.9	O K
360 min Winter	41.689	1.089	0.0	4.8	4.8	82.7	O K
480 min Winter	41.608	1.008	0.0	4.8	4.8	76.6	O K
600 min Winter	41.522	0.922	0.0	4.8	4.8	70.1	O K
720 min Winter	41.434	0.834	0.0	4.8	4.8	63.4	O K
960 min Winter	41.221	0.621	0.0	4.8	4.8	47.2	O K
1440 min Winter	40.902	0.302	0.0	4.8	4.8	22.9	O K
2160 min Winter	40.704	0.104	0.0	4.3	4.3	7.9	O K
2880 min Winter	40.657	0.057	0.0	3.6	3.6	4.4	O K
4320 min Winter	40.631	0.031	0.0	2.6	2.6	2.4	O K
5760 min Winter	40.620	0.020	0.0	2.1	2.1	1.5	O K
7200 min Winter	40.613	0.013	0.0	1.8	1.8	1.0	O K
8640 min Winter	40.609	0.009	0.0	1.6	1.6	0.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	1.273	0.0	306.2	5136
15 min Winter	145.372	0.0	58.2	21
30 min Winter	97.086	0.0	77.9	35
60 min Winter	61.730	0.0	99.1	62
120 min Winter	37.355	0.0	119.9	118
180 min Winter	27.755	0.0	133.6	172
240 min Winter	22.423	0.0	143.9	196
360 min Winter	16.508	0.0	158.9	274
480 min Winter	13.245	0.0	169.9	350
600 min Winter	11.146	0.0	178.8	428
720 min Winter	9.671	0.0	186.1	504
960 min Winter	7.716	0.0	198.0	638
1440 min Winter	5.580	0.0	214.9	854
2160 min Winter	4.021	0.0	232.2	1164
2880 min Winter	3.193	0.0	245.8	1476
4320 min Winter	2.322	0.0	268.2	2180
5760 min Winter	1.867	0.0	287.5	2936
7200 min Winter	1.592	0.0	306.5	3624
8640 min Winter	1.406	0.0	324.9	4360

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Winter	40.605	0.005	0.0	1.4	1.4	0.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Winter	1.273	0.0	343.0	4992

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 575948 130360 TQ 75948 30360
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.191

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.101	4	8	0.090

Model Details

Storage is Online Cover Level (m) 43.000

Cellular Storage Structure

Invert Level (m) 40.600 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	80.0	80.0	2.600	0.0	126.5
0.200	80.0	87.2	2.800	0.0	126.5
0.400	80.0	94.3	3.000	0.0	126.5
0.600	80.0	101.5	3.200	0.0	126.5
0.800	80.0	108.6	3.400	0.0	126.5
1.000	80.0	115.8	3.600	0.0	126.5
1.200	80.0	122.9	3.800	0.0	126.5
1.400	0.0	126.5	4.000	0.0	126.5
1.600	0.0	126.5	4.200	0.0	126.5
1.800	0.0	126.5	4.400	0.0	126.5
2.000	0.0	126.5	4.600	0.0	126.5
2.200	0.0	126.5	4.800	0.0	126.5
2.400	0.0	126.5	5.000	0.0	126.5

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0101-4800-1200-4800
Design Head (m)	1.200
Design Flow (l/s)	4.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	101
Invert Level (m)	40.550
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	4.8	Kick-Flo®	0.748	3.9
Flush-Flo™	0.359	4.8	Mean Flow over Head Range	-	4.2

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

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	3.3	1.200	4.8	3.000	7.4	7.000	11.0
0.200	4.5	1.400	5.2	3.500	7.9	7.500	11.4
0.300	4.8	1.600	5.5	4.000	8.4	8.000	11.7
0.400	4.8	1.800	5.8	4.500	8.9	8.500	12.1
0.500	4.7	2.000	6.1	5.000	9.4	9.000	12.4
0.600	4.5	2.200	6.4	5.500	9.8	9.500	12.7
0.800	4.0	2.400	6.6	6.000	10.2		
1.000	4.4	2.600	6.9	6.500	10.6		