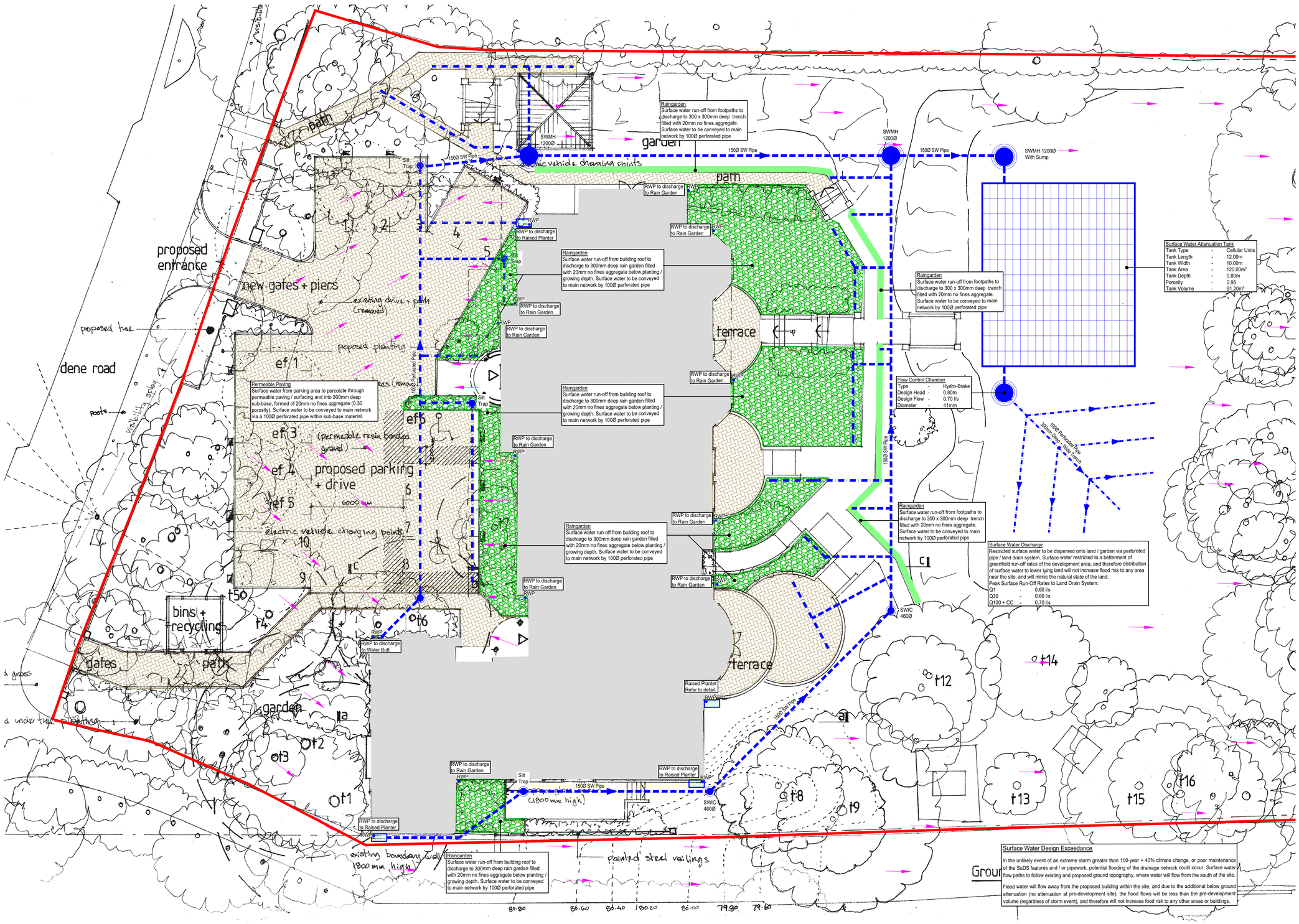


Surface Water Drainage
Perforated Pipe
Permeable Paving
Raingarden
Raised Planter
Filter Drain
Exceedance Flow Routes
Development Boundary

Rev	Description	Drn	Chk	Date
P2	Site Plan Amended	MDS	NC	20.06.22
P1	Issued for Planning	MDS	NC	06.10.21

Client
HGH Consulting

Project
Tormead
27 Dene Road

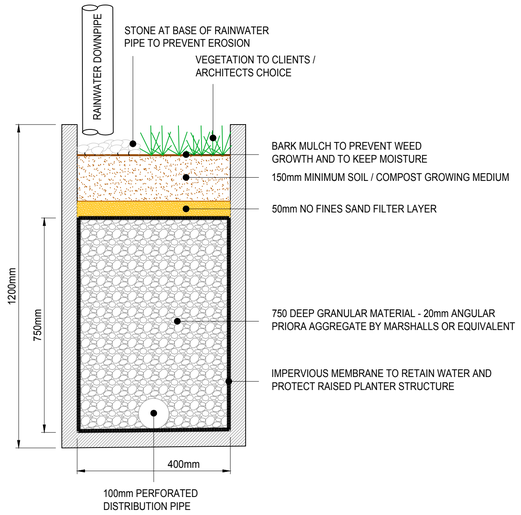
Drawing
Surface Water Management Layout

Scale	Date	Drawn by	Checked
1:125@A1	Jan '22	MDS	NC

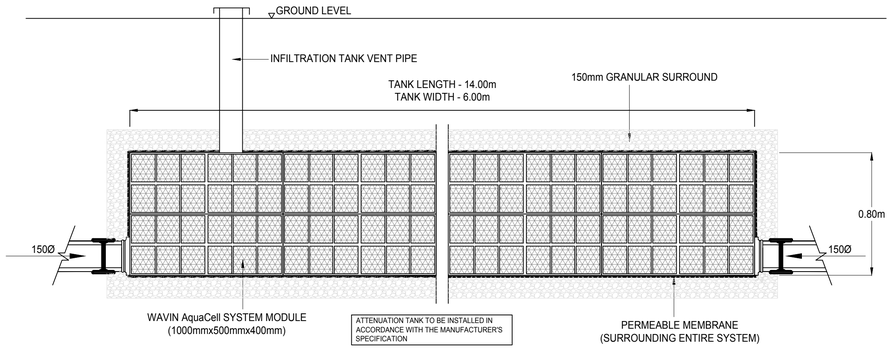
Status
PLANNING

Flo
Chiltern View Studio
Buslins Lane, Chesham
Buckinghamshire, HP5 2XD
m.07772 033 937
e.mark@flo-consult.co.uk

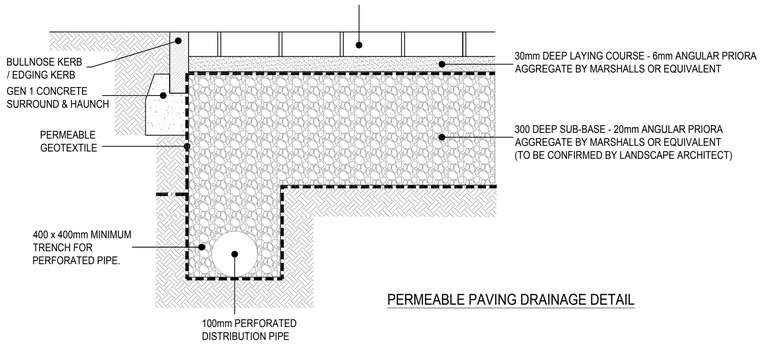
Job No.	Drg. No.	Rev
797	DR-100	P2



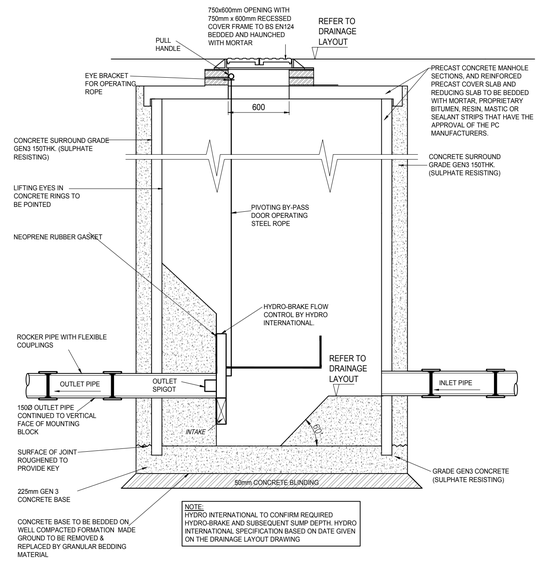
RAISED PLANTER DETAIL



INFILTRATION TANK DETAIL



PERMEABLE PAVING DRAINAGE DETAIL



FLOW CONTROL MANHOLE DETAIL

CONTROL MANHOLE NOTES

ALL DIMENSION ARE IN MILLIMETERS

PRECAST CONCRETE UNITS TO BE BS5911 PART 200 AND TO BE CONSTRUCTED WITH A MINIMUM CLASS 3 SULPHATE RISISTING CEMENT.

ALL INSITU CONCRETE TO BE CLASS STANDARD MIX ST4 (GRADE C20) IN ACCORDANCE WITH SECTION 4 OF BS5328 PART 2.

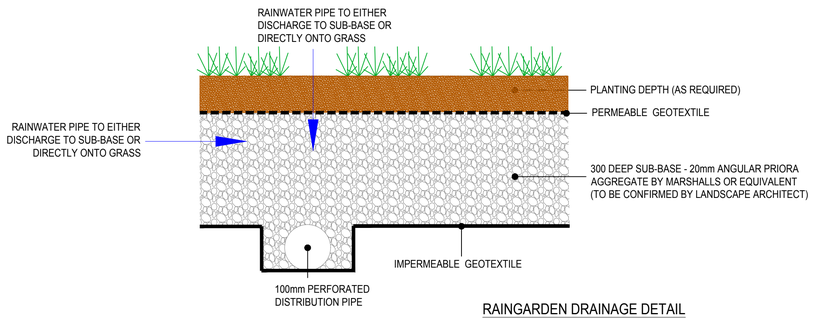
MATERIALS FOR JOINTING MANHOLE RINGS TO BE A RUBBER BITUMEN COMPOUND OF APPROVED MANUFACTURER 'TOKSTRIP' OR SIMILAR.

ALL BRICKWORK TO BE CLASS B ENGINEERING -2 COURSES MIN.4 COURSES MAX; 225mm THICK - BS5628 PART 3.

20mm THICK GRANOLITHIC CONCRETE BENCHING TO BE BROUGHT UP TO A DENSE SMOOTH FACE NEATLY SHAPED AND FINISHED TO ALL BRANCH CONNECTIONS. WHERE BENCHING IS LESS THAN 450mm WIDE, SLOPE TO BE 1:10, MORE THAN 450mm, 1:30

PIPES ENTERING MANHOLES TO HAVE A FLEXIBLE JOINT AS CLOSE AS FEASIBLE TO OUTSIDE FACE OF ANY STRUCTURE INTO WHICH THE PIPE IS BUILT IN ORDER TO FACILITATE MOVEMENT OF THE JOINT.

THE LENGTH OF THE NEXT PIPE (ROCKER PIPELINES, BEDDING, LAYING AND JONTING OF PIPES AND BACKFILLING OF TRENCHES SHALL BE IN ACCORDANCE WITH THE W.S.A.SPEC 'SEWERS FOR ADOPTION' - 6TH EDITION TOGETHER WITH ANY LOCAL AUTHORITY REQUIREMENTS.



RAINGARDEN DRAINAGE DETAIL

Rev	Description	Drn	Chk	Date
P1	Issued for Planning	MDS	NC	06.10.21

Client
HGH Consulting

Project
Tormead
27 Dene Road

Drawing
Surface Water
Management Details

Scale	Date	Drawn by	Checked
1:125@A1	Jan '22	MDS	NC

Status
PLANNING

Flo
m.07772 033 937
e.mark@flo-consult.co.uk
www.flo-consult.co.uk

Job No.	Drg. No.	Rev
797	DR-101	P1

Appendix J

Surface Water Management Calculations

Summary of Results for 1 year Return Period

Half Drain Time : 226 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	77.059	0.059	0.0	0.5	0.5	6.8	O K
30 min Summer	77.072	0.072	0.0	0.5	0.5	8.2	O K
60 min Summer	77.085	0.085	0.0	0.5	0.5	9.7	O K
120 min Summer	77.098	0.098	0.0	0.6	0.6	11.2	O K
180 min Summer	77.104	0.104	0.0	0.6	0.6	11.8	O K
240 min Summer	77.107	0.107	0.0	0.6	0.6	12.2	O K
360 min Summer	77.111	0.111	0.0	0.6	0.6	12.7	O K
480 min Summer	77.113	0.113	0.0	0.6	0.6	12.8	O K
600 min Summer	77.113	0.113	0.0	0.6	0.6	12.8	O K
720 min Summer	77.112	0.112	0.0	0.6	0.6	12.7	O K
960 min Summer	77.109	0.109	0.0	0.6	0.6	12.5	O K
1440 min Summer	77.102	0.102	0.0	0.6	0.6	11.6	O K
2160 min Summer	77.090	0.090	0.0	0.6	0.6	10.2	O K
2880 min Summer	77.079	0.079	0.0	0.5	0.5	9.0	O K
4320 min Summer	77.062	0.062	0.0	0.5	0.5	7.0	O K
5760 min Summer	77.052	0.052	0.0	0.4	0.4	5.9	O K
7200 min Summer	77.045	0.045	0.0	0.4	0.4	5.2	O K
8640 min Summer	77.041	0.041	0.0	0.3	0.3	4.6	O K
10080 min Summer	77.037	0.037	0.0	0.3	0.3	4.3	O K
15 min Winter	77.066	0.066	0.0	0.5	0.5	7.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	31.827	0.0	6.7	28
30 min Summer	19.701	0.0	8.4	41
60 min Summer	12.195	0.0	10.8	68
120 min Summer	7.548	0.0	13.4	122
180 min Summer	5.702	0.0	15.2	164
240 min Summer	4.672	0.0	16.6	194
360 min Summer	3.529	0.0	18.8	262
480 min Summer	2.892	0.0	20.6	332
600 min Summer	2.478	0.0	22.0	400
720 min Summer	2.185	0.0	23.3	468
960 min Summer	1.806	0.0	25.7	606
1440 min Summer	1.382	0.0	29.5	870
2160 min Summer	1.057	0.0	34.1	1248
2880 min Summer	0.874	0.0	37.6	1616
4320 min Summer	0.643	0.0	41.3	2304
5760 min Summer	0.517	0.0	44.6	3016
7200 min Summer	0.437	0.0	47.0	3752
8640 min Summer	0.380	0.0	49.1	4424
10080 min Summer	0.338	0.0	50.9	5152
15 min Winter	31.827	0.0	7.6	28

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Summary of Results for 1 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
30 min Winter	77.081	0.081	0.0	0.5	0.5	9.2	O K
60 min Winter	77.097	0.097	0.0	0.6	0.6	11.0	O K
120 min Winter	77.112	0.112	0.0	0.6	0.6	12.7	O K
180 min Winter	77.118	0.118	0.0	0.6	0.6	13.5	O K
240 min Winter	77.121	0.121	0.0	0.6	0.6	13.8	O K
360 min Winter	77.125	0.125	0.0	0.6	0.6	14.2	O K
480 min Winter	77.125	0.125	0.0	0.6	0.6	14.2	O K
600 min Winter	77.123	0.123	0.0	0.6	0.6	14.1	O K
720 min Winter	77.121	0.121	0.0	0.6	0.6	13.8	O K
960 min Winter	77.115	0.115	0.0	0.6	0.6	13.1	O K
1440 min Winter	77.102	0.102	0.0	0.6	0.6	11.6	O K
2160 min Winter	77.082	0.082	0.0	0.5	0.5	9.4	O K
2880 min Winter	77.068	0.068	0.0	0.5	0.5	7.8	O K
4320 min Winter	77.051	0.051	0.0	0.4	0.4	5.8	O K
5760 min Winter	77.042	0.042	0.0	0.4	0.4	4.8	O K
7200 min Winter	77.036	0.036	0.0	0.3	0.3	4.1	O K
8640 min Winter	77.033	0.033	0.0	0.3	0.3	3.7	O K
10080 min Winter	77.030	0.030	0.0	0.2	0.2	3.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	19.701	0.0	9.5	42
60 min Winter	12.195	0.0	12.1	68
120 min Winter	7.548	0.0	15.0	122
180 min Winter	5.702	0.0	17.0	176
240 min Winter	4.672	0.0	18.6	220
360 min Winter	3.529	0.0	21.1	282
480 min Winter	2.892	0.0	23.0	360
600 min Winter	2.478	0.0	24.7	436
720 min Winter	2.185	0.0	26.1	510
960 min Winter	1.806	0.0	28.8	654
1440 min Winter	1.382	0.0	33.0	926
2160 min Winter	1.057	0.0	38.2	1304
2880 min Winter	0.874	0.0	42.1	1652
4320 min Winter	0.643	0.0	46.3	2348
5760 min Winter	0.517	0.0	49.9	3064
7200 min Winter	0.437	0.0	52.7	3752
8640 min Winter	0.380	0.0	55.0	4424
10080 min Winter	0.338	0.0	57.0	5152

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	1
FEH Rainfall Version	1999
Site Location	GB 508550 191300 TQ 08550 91300
C (1km)	-0.026
D1 (1km)	0.308
D2 (1km)	0.339
D3 (1km)	0.243
E (1km)	0.311
F (1km)	2.501
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) 0.120

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.030	4	8	0.030	8	12	0.030	12	16	0.030

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Model Details

Storage is Online Cover Level (m) 78.700

Cellular Storage Structure

Invert Level (m) 77.000 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	120.0	0.0	2.600	0.0	0.0
0.200	120.0	0.0	2.800	0.0	0.0
0.400	120.0	0.0	3.000	0.0	0.0
0.600	120.0	0.0	3.200	0.0	0.0
0.800	120.0	0.0	3.400	0.0	0.0
1.000	0.0	0.0	3.600	0.0	0.0
1.200	0.0	0.0	3.800	0.0	0.0
1.400	0.0	0.0	4.000	0.0	0.0
1.600	0.0	0.0	4.200	0.0	0.0
1.800	0.0	0.0	4.400	0.0	0.0
2.000	0.0	0.0	4.600	0.0	0.0
2.200	0.0	0.0	4.800	0.0	0.0
2.400	0.0	0.0	5.000	0.0	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0041-7000-0800-7000
Design Head (m)	0.800
Design Flow (l/s)	0.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	41
Invert Level (m)	77.000
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	0.7
Flush-Flo™	0.180	0.6
Kick-Flo®	0.363	0.5
Mean Flow over Head Range	-	0.6

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	0.6	1.200	0.8	3.000	1.3	7.000	1.9
0.200	0.6	1.400	0.9	3.500	1.4	7.500	1.9
0.300	0.6	1.600	1.0	4.000	1.4	8.000	2.0
0.400	0.5	1.800	1.0	4.500	1.5	8.500	2.0
0.500	0.6	2.000	1.1	5.000	1.6	9.000	2.1
0.600	0.6	2.200	1.1	5.500	1.7	9.500	2.2
0.800	0.7	2.400	1.1	6.000	1.7		
1.000	0.8	2.600	1.2	6.500	1.8		

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Summary of Results for 30 year Return Period

Half Drain Time : 617 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	77.197	0.197	0.0	0.6	0.6	22.5	O K
30 min Summer	77.228	0.228	0.0	0.6	0.6	26.0	O K
60 min Summer	77.260	0.260	0.0	0.6	0.6	29.7	O K
120 min Summer	77.293	0.293	0.0	0.6	0.6	33.4	O K
180 min Summer	77.309	0.309	0.0	0.6	0.6	35.3	O K
240 min Summer	77.319	0.319	0.0	0.6	0.6	36.4	O K
360 min Summer	77.327	0.327	0.0	0.6	0.6	37.3	O K
480 min Summer	77.328	0.328	0.0	0.6	0.6	37.3	O K
600 min Summer	77.324	0.324	0.0	0.6	0.6	36.9	O K
720 min Summer	77.320	0.320	0.0	0.6	0.6	36.5	O K
960 min Summer	77.314	0.314	0.0	0.6	0.6	35.9	O K
1440 min Summer	77.299	0.299	0.0	0.6	0.6	34.1	O K
2160 min Summer	77.273	0.273	0.0	0.6	0.6	31.1	O K
2880 min Summer	77.246	0.246	0.0	0.6	0.6	28.1	O K
4320 min Summer	77.184	0.184	0.0	0.6	0.6	21.0	O K
5760 min Summer	77.139	0.139	0.0	0.6	0.6	15.8	O K
7200 min Summer	77.107	0.107	0.0	0.6	0.6	12.2	O K
8640 min Summer	77.086	0.086	0.0	0.5	0.5	9.8	O K
10080 min Summer	77.071	0.071	0.0	0.5	0.5	8.1	O K
15 min Winter	77.221	0.221	0.0	0.6	0.6	25.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	103.009	0.0	22.5	30
30 min Summer	59.989	0.0	26.2	44
60 min Summer	34.936	0.0	31.2	72
120 min Summer	20.346	0.0	36.3	130
180 min Summer	14.829	0.0	39.7	188
240 min Summer	11.849	0.0	42.3	246
360 min Summer	8.636	0.0	46.2	364
480 min Summer	6.900	0.0	49.3	480
600 min Summer	5.798	0.0	51.7	538
720 min Summer	5.029	0.0	53.8	596
960 min Summer	4.055	0.0	57.8	720
1440 min Summer	2.993	0.0	63.9	986
2160 min Summer	2.209	0.0	71.4	1392
2880 min Summer	1.781	0.0	76.7	1792
4320 min Summer	1.264	0.0	81.6	2548
5760 min Summer	0.991	0.0	85.6	3232
7200 min Summer	0.821	0.0	88.5	3904
8640 min Summer	0.704	0.0	91.0	4592
10080 min Summer	0.618	0.0	93.1	5256
15 min Winter	103.009	0.0	25.2	30

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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
30 min Winter	77.256	0.256	0.0	0.6	0.6	29.2	O K
60 min Winter	77.293	0.293	0.0	0.6	0.6	33.4	O K
120 min Winter	77.331	0.331	0.0	0.6	0.6	37.8	O K
180 min Winter	77.352	0.352	0.0	0.6	0.6	40.1	O K
240 min Winter	77.365	0.365	0.0	0.6	0.6	41.6	O K
360 min Winter	77.378	0.378	0.0	0.6	0.6	43.1	O K
480 min Winter	77.382	0.382	0.0	0.6	0.6	43.5	O K
600 min Winter	77.381	0.381	0.0	0.6	0.6	43.4	O K
720 min Winter	77.376	0.376	0.0	0.6	0.6	42.9	O K
960 min Winter	77.366	0.366	0.0	0.6	0.6	41.7	O K
1440 min Winter	77.342	0.342	0.0	0.6	0.6	39.0	O K
2160 min Winter	77.299	0.299	0.0	0.6	0.6	34.1	O K
2880 min Winter	77.256	0.256	0.0	0.6	0.6	29.2	O K
4320 min Winter	77.166	0.166	0.0	0.6	0.6	18.9	O K
5760 min Winter	77.108	0.108	0.0	0.6	0.6	12.3	O K
7200 min Winter	77.075	0.075	0.0	0.5	0.5	8.6	O K
8640 min Winter	77.060	0.060	0.0	0.5	0.5	6.9	O K
10080 min Winter	77.052	0.052	0.0	0.4	0.4	5.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	59.989	0.0	29.4	44
60 min Winter	34.936	0.0	34.9	72
120 min Winter	20.346	0.0	40.7	130
180 min Winter	14.829	0.0	44.5	186
240 min Winter	11.849	0.0	47.4	244
360 min Winter	8.636	0.0	51.8	358
480 min Winter	6.900	0.0	55.2	472
600 min Winter	5.798	0.0	57.9	582
720 min Winter	5.029	0.0	60.3	688
960 min Winter	4.055	0.0	64.7	874
1440 min Winter	2.993	0.0	71.4	1086
2160 min Winter	2.209	0.0	80.0	1520
2880 min Winter	1.781	0.0	85.9	1936
4320 min Winter	1.264	0.0	91.4	2676
5760 min Winter	0.991	0.0	95.8	3344
7200 min Winter	0.821	0.0	99.2	3968
8640 min Winter	0.704	0.0	102.0	4584
10080 min Winter	0.618	0.0	104.3	5256

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	1999
Site Location	GB 508550 191300 TQ 08550 91300
C (1km)	-0.026
D1 (1km)	0.308
D2 (1km)	0.339
D3 (1km)	0.243
E (1km)	0.311
F (1km)	2.501
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) 0.120

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.030	4	8	0.030	8	12	0.030	12	16	0.030

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Model Details

Storage is Online Cover Level (m) 78.700

Cellular Storage Structure

Invert Level (m) 77.000 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	120.0	0.0	2.600	0.0	0.0
0.200	120.0	0.0	2.800	0.0	0.0
0.400	120.0	0.0	3.000	0.0	0.0
0.600	120.0	0.0	3.200	0.0	0.0
0.800	120.0	0.0	3.400	0.0	0.0
1.000	0.0	0.0	3.600	0.0	0.0
1.200	0.0	0.0	3.800	0.0	0.0
1.400	0.0	0.0	4.000	0.0	0.0
1.600	0.0	0.0	4.200	0.0	0.0
1.800	0.0	0.0	4.400	0.0	0.0
2.000	0.0	0.0	4.600	0.0	0.0
2.200	0.0	0.0	4.800	0.0	0.0
2.400	0.0	0.0	5.000	0.0	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0041-7000-0800-7000
Design Head (m)	0.800
Design Flow (l/s)	0.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	41
Invert Level (m)	77.000
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	0.7
Flush-Flo™	0.180	0.6
Kick-Flo®	0.363	0.5
Mean Flow over Head Range	-	0.6

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	0.6	1.200	0.8	3.000	1.3	7.000	1.9
0.200	0.6	1.400	0.9	3.500	1.4	7.500	1.9
0.300	0.6	1.600	1.0	4.000	1.4	8.000	2.0
0.400	0.5	1.800	1.0	4.500	1.5	8.500	2.0
0.500	0.6	2.000	1.1	5.000	1.6	9.000	2.1
0.600	0.6	2.200	1.1	5.500	1.7	9.500	2.2
0.800	0.7	2.400	1.1	6.000	1.7		
1.000	0.8	2.600	1.2	6.500	1.8		

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

Half Drain Time : 1271 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	77.427	0.427	0.0	0.6	0.6	48.7	O K
30 min Summer	77.485	0.485	0.0	0.6	0.6	55.3	O K
60 min Summer	77.546	0.546	0.0	0.6	0.6	62.3	O K
120 min Summer	77.609	0.609	0.0	0.6	0.6	69.4	O K
180 min Summer	77.644	0.644	0.0	0.6	0.6	73.4	O K
240 min Summer	77.666	0.666	0.0	0.6	0.6	75.9	O K
360 min Summer	77.691	0.691	0.0	0.7	0.7	78.8	O K
480 min Summer	77.702	0.702	0.0	0.7	0.7	80.0	O K
600 min Summer	77.704	0.704	0.0	0.7	0.7	80.3	O K
720 min Summer	77.702	0.702	0.0	0.7	0.7	80.0	O K
960 min Summer	77.696	0.696	0.0	0.7	0.7	79.3	O K
1440 min Summer	77.676	0.676	0.0	0.7	0.7	77.1	O K
2160 min Summer	77.645	0.645	0.0	0.6	0.6	73.5	O K
2880 min Summer	77.614	0.614	0.0	0.6	0.6	70.0	O K
4320 min Summer	77.525	0.525	0.0	0.6	0.6	59.9	O K
5760 min Summer	77.450	0.450	0.0	0.6	0.6	51.2	O K
7200 min Summer	77.378	0.378	0.0	0.6	0.6	43.1	O K
8640 min Summer	77.300	0.300	0.0	0.6	0.6	34.2	O K
10080 min Summer	77.242	0.242	0.0	0.6	0.6	27.6	O K
15 min Winter	77.479	0.479	0.0	0.6	0.6	54.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	219.915	0.0	46.0	31
30 min Summer	125.296	0.0	47.8	45
60 min Summer	71.387	0.0	63.7	74
120 min Summer	40.673	0.0	72.5	134
180 min Summer	29.268	0.0	78.1	192
240 min Summer	23.173	0.0	82.4	250
360 min Summer	16.675	0.0	88.5	368
480 min Summer	13.203	0.0	92.7	486
600 min Summer	11.016	0.0	95.4	604
720 min Summer	9.501	0.0	96.5	722
960 min Summer	7.590	0.0	96.2	916
1440 min Summer	5.531	0.0	93.3	1146
2160 min Summer	4.030	0.0	130.2	1536
2880 min Summer	3.219	0.0	138.6	1960
4320 min Summer	2.256	0.0	145.2	2776
5760 min Summer	1.753	0.0	151.4	3592
7200 min Summer	1.442	0.0	155.6	4400
8640 min Summer	1.229	0.0	159.1	5104
10080 min Summer	1.074	0.0	162.0	5752
15 min Winter	219.915	0.0	47.9	30

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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
30 min Winter	77.544	0.544	0.0	0.6	0.6	62.0	O K
60 min Winter	77.614	0.614	0.0	0.6	0.6	69.9	O K
120 min Winter	77.686	0.686	0.0	0.7	0.7	78.2	O K
180 min Winter	77.726	0.726	0.0	0.7	0.7	82.8	O K
240 min Winter	77.753	0.753	0.0	0.7	0.7	85.8	O K
360 min Winter	77.784	0.784	0.0	0.7	0.7	89.4	O K
480 min Winter	77.800	0.800	0.0	0.7	0.7	91.2	O K
600 min Winter	77.806	0.806	0.0	0.7	0.7	91.9	O K
720 min Winter	77.807	0.807	0.0	0.7	0.7	92.0	O K
960 min Winter	77.807	0.807	0.0	0.7	0.7	91.9	O K
1440 min Winter	77.781	0.781	0.0	0.7	0.7	89.1	O K
2160 min Winter	77.743	0.743	0.0	0.7	0.7	84.7	O K
2880 min Winter	77.699	0.699	0.0	0.7	0.7	79.7	O K
4320 min Winter	77.575	0.575	0.0	0.6	0.6	65.6	O K
5760 min Winter	77.467	0.467	0.0	0.6	0.6	53.3	O K
7200 min Winter	77.356	0.356	0.0	0.6	0.6	40.5	O K
8640 min Winter	77.248	0.248	0.0	0.6	0.6	28.3	O K
10080 min Winter	77.176	0.176	0.0	0.6	0.6	20.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	125.296	0.0	48.0	45
60 min Winter	71.387	0.0	71.3	74
120 min Winter	40.673	0.0	81.0	130
180 min Winter	29.268	0.0	87.2	188
240 min Winter	23.173	0.0	91.7	246
360 min Winter	16.675	0.0	97.4	362
480 min Winter	13.203	0.0	99.6	476
600 min Winter	11.016	0.0	99.8	590
720 min Winter	9.501	0.0	99.6	704
960 min Winter	7.590	0.0	99.0	924
1440 min Winter	5.531	0.0	97.1	1210
2160 min Winter	4.030	0.0	145.8	1644
2880 min Winter	3.219	0.0	155.2	2108
4320 min Winter	2.256	0.0	161.8	2996
5760 min Winter	1.753	0.0	169.6	3872
7200 min Winter	1.442	0.0	174.3	4760
8640 min Winter	1.229	0.0	178.2	5288
10080 min Winter	1.074	0.0	181.5	5864

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 508550 191300 TQ 08550 91300
C (1km)	-0.026
D1 (1km)	0.308
D2 (1km)	0.339
D3 (1km)	0.243
E (1km)	0.311
F (1km)	2.501
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) 0.120

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.030	4	8	0.030	8	12	0.030	12	16	0.030

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Model Details

Storage is Online Cover Level (m) 78.700

Cellular Storage Structure

Invert Level (m) 77.000 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	120.0	0.0	2.600	0.0	0.0
0.200	120.0	0.0	2.800	0.0	0.0
0.400	120.0	0.0	3.000	0.0	0.0
0.600	120.0	0.0	3.200	0.0	0.0
0.800	120.0	0.0	3.400	0.0	0.0
1.000	0.0	0.0	3.600	0.0	0.0
1.200	0.0	0.0	3.800	0.0	0.0
1.400	0.0	0.0	4.000	0.0	0.0
1.600	0.0	0.0	4.200	0.0	0.0
1.800	0.0	0.0	4.400	0.0	0.0
2.000	0.0	0.0	4.600	0.0	0.0
2.200	0.0	0.0	4.800	0.0	0.0
2.400	0.0	0.0	5.000	0.0	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0041-7000-0800-7000
Design Head (m)	0.800
Design Flow (l/s)	0.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	41
Invert Level (m)	77.000
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	0.7
Flush-Flo™	0.180	0.6
Kick-Flo®	0.363	0.5
Mean Flow over Head Range	-	0.6

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	0.6	1.200	0.8	3.000	1.3	7.000	1.9
0.200	0.6	1.400	0.9	3.500	1.4	7.500	1.9
0.300	0.6	1.600	1.0	4.000	1.4	8.000	2.0
0.400	0.5	1.800	1.0	4.500	1.5	8.500	2.0
0.500	0.6	2.000	1.1	5.000	1.6	9.000	2.1
0.600	0.6	2.200	1.1	5.500	1.7	9.500	2.2
0.800	0.7	2.400	1.1	6.000	1.7		
1.000	0.8	2.600	1.2	6.500	1.8		

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