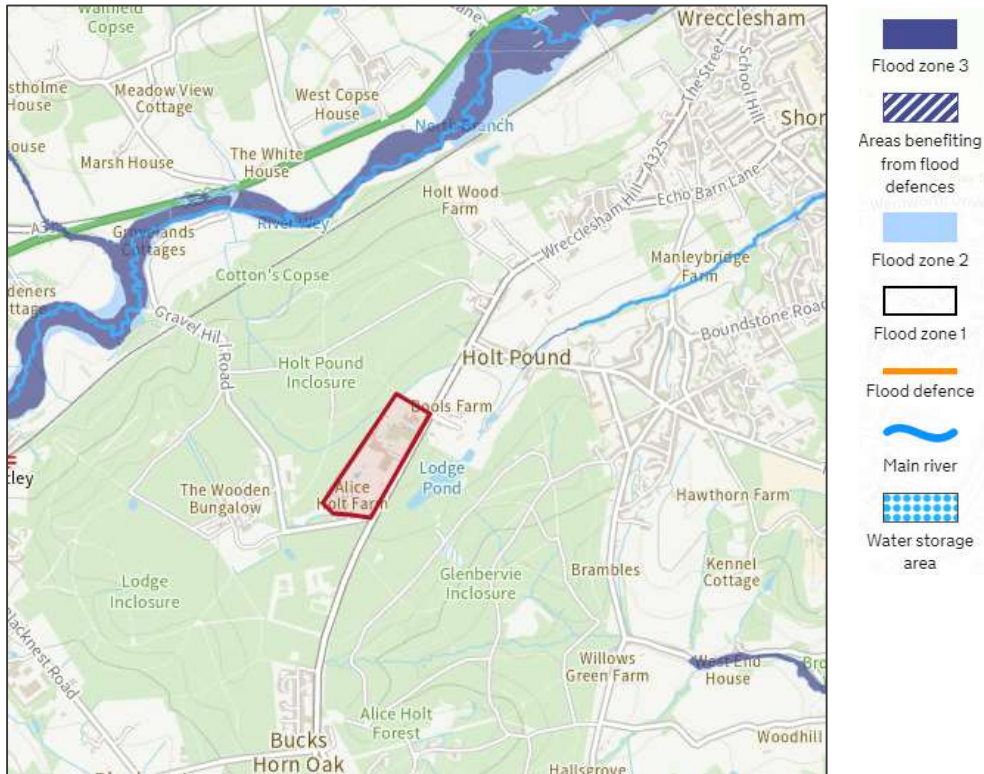


Appendix H Flood Map Extracts

River and Sea Flooding



Flood Map For Planning

Flood risk from rivers or the sea

Low Probability (Flood Zone 1) means that each year this area has a chance of flooding of less than 0.1%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.

Medium Probability (Flood Zone 2) means that each year this area has a chance of flooding of between 0.1% and 1%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.

High Probability (Flood Zone 3) means that each year this area has a chance of flooding of

greater than 1%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.

Surface Water Flooding



Extent of flooding from surface water



Flood Map – Surface Water

Flood risk from surface water

Very low risk means that each year this area has a chance of flooding of less than 0.1%. Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.

Low risk means that each year this area has a chance of flooding of between 0.1% and 1%. Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.

Medium risk means that each year this area has a chance of flooding of between 1% and 3.3%. Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.

High risk means that each year this area has a chance of flooding of greater than 3.3%. Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.



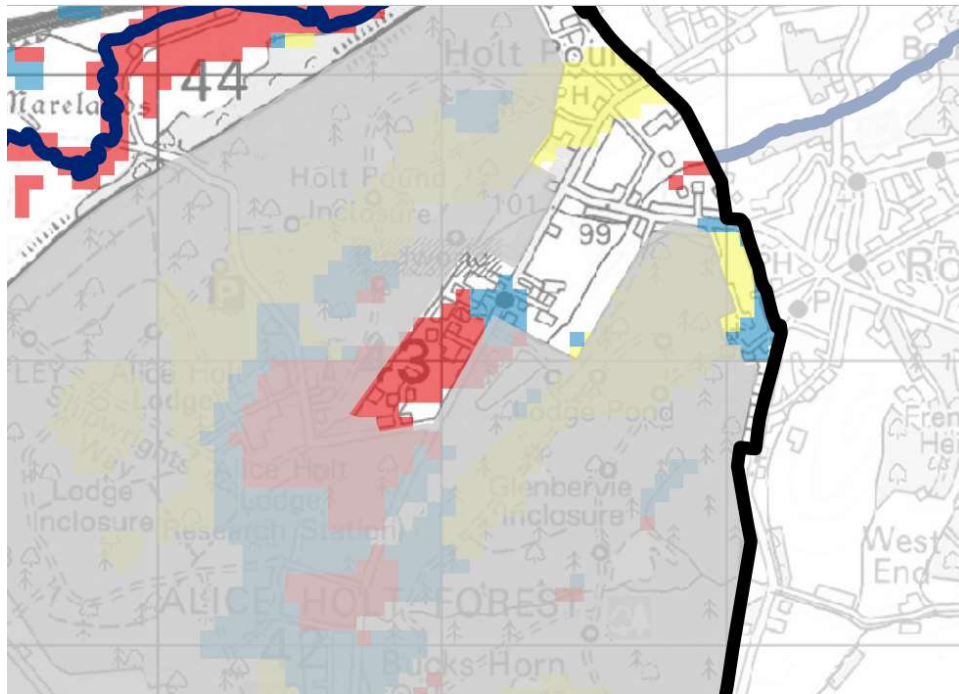
Surface water flood risk: water velocity in a low risk scenario

Flood velocity (metres/second)









- Over 0.25 m/s
- Less than 0.25 m/s
- Direction of water flow

Appendix I
SFRA Flood Map Extracts

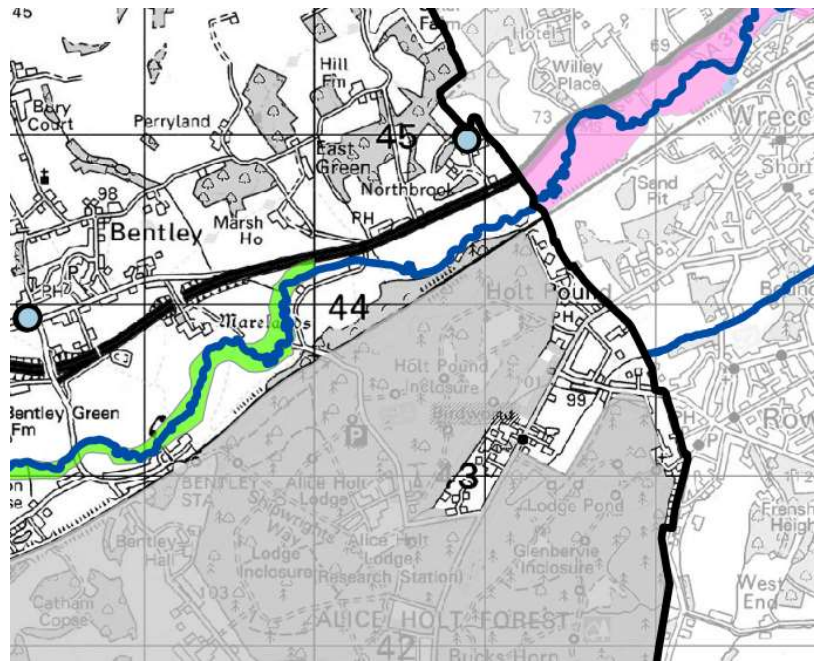
BGS Susceptibility to Groundwater Flooding



LEGEND

-  East Hampshire District Boundary
-  South Downs National Park
-  Town
-  Groundwater Flood Record (EA)
-  Main Rivers
-  Limited potential for groundwater flooding to occur
-  Potential for groundwater flooding of property situated below ground level
-  Potential for groundwater flooding to occur at surface

Recorded Flood Outlines and Flood Incidents



LEGEND

- East Hampshire District Boundary
- Town
- South Downs National Park
- Main Rivers
- Ordinary Watercourse
- Groundwater Flood Record (EA)
- Recorded Floods (EA)
 - < 1960
 - 1960 - 1969
 - 1970 - 1979
 - 1980 - 1989
 - 1990 - 1999
 - > 2000
- Flood Investigations (HCC)
 - Fluvial Flooding
 - Surface Water Flooding
- Flood Incidents (EHDC)
 - Unknown
 - 2001
 - 2006
 - 2007
 - 2008
 - 2008-2009
 - 2009
 - 2010
 - 2011
 - 2012

Appendix J
Greenfield Runoff Rate Calculations

Calculated by:	Michael Hartley
Site name:	Haskins GC and Birdworld
Site location:	Farnham

Site Details

Latitude:	51.18087° N
Longitude:	0.84217° W
Reference:	2897497314
Date:	Jan 11 2024 16:35

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

Runoff estimation approach

FEH Statistical

Site characteristics

Total site area (ha):

Methodology

Q _{MED} estimation method:	Calculate from BFI and SAAR
BFI and SPR method:	Specify BFI manually
HOST class:	N/A
BFI / BFIHOST:	0.276
Q _{MED} (l/s):	
Q _{BAR} / Q _{MED} factor:	1.14

Notes

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

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

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

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

(3) Is $SPR/SPRHOST \leq 0.3$?

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

Hydrological characteristics

	Default	Edited
SAAR (mm):	772	772
Hydrological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Greenfield runoff rates

Default Edited

Q _{BAR} (l/s):		7.31
1 in 1 year (l/s):		6.21
1 in 30 years (l/s):		16.81
1 in 100 year (l/s):		23.32
1 in 200 years (l/s):		27.34

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Appendix K

Drainage Design Calculations

Phase 1

Play Barn Building

Phase 2

Garden Centre and Carriageway Complex

Garden Centre Car Park

Highway

Living Collection Buildings (BoH)

Phase 3

Bird World Car Park

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42 West Street London House Carshalton SM5 2PR	Haskins Garden Centre and Birdworld Farnham	
Date 19/01/2024 15:29 File Play Barn etc, 1 in 100,...	Designed by BC Checked by TK / RH	
Micro Drainage	Source Control 2020.1.3	

Summary of Results for 100 year Return Period (+45%)

Half Drain Time : 1328 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max E Outflow (l/s)	Max Volume (m ³)	Status
15 min Summer	8.320	0.320	0.0	2.7	2.7	133.8	O K
30 min Summer	8.428	0.428	0.0	2.7	2.7	178.7	O K
60 min Summer	8.542	0.542	0.0	2.7	2.7	226.5	O K
120 min Summer	8.658	0.658	0.0	2.7	2.7	274.9	O K
180 min Summer	8.719	0.719	0.0	2.7	2.7	300.7	O K
240 min Summer	8.757	0.757	0.0	2.7	2.7	316.4	O K
360 min Summer	8.807	0.807	0.0	2.7	2.7	337.5	O K
480 min Summer	8.836	0.836	0.0	2.7	2.7	349.4	O K
600 min Summer	8.852	0.852	0.0	2.7	2.7	356.1	O K
720 min Summer	8.860	0.860	0.0	2.7	2.7	359.5	O K
960 min Summer	8.861	0.861	0.0	2.7	2.7	360.0	O K
1440 min Summer	8.841	0.841	0.0	2.7	2.7	351.5	O K
2160 min Summer	8.804	0.804	0.0	2.7	2.7	336.0	O K
2880 min Summer	8.765	0.765	0.0	2.7	2.7	319.6	O K
4320 min Summer	8.686	0.686	0.0	2.7	2.7	286.6	O K
5760 min Summer	8.598	0.598	0.0	2.7	2.7	249.8	O K
7200 min Summer	8.513	0.513	0.0	2.7	2.7	214.2	O K
8640 min Summer	8.441	0.441	0.0	2.7	2.7	184.5	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	135.062	0.0	128.7	19
30 min Summer	90.740	0.0	171.8	34
60 min Summer	58.134	0.0	230.1	64
120 min Summer	35.913	0.0	283.9	124
180 min Summer	26.669	0.0	315.6	184
240 min Summer	21.426	0.0	337.3	242
360 min Summer	15.778	0.0	370.0	362
480 min Summer	12.674	0.0	392.0	482
600 min Summer	10.684	0.0	405.2	602
720 min Summer	9.287	0.0	409.7	720
960 min Summer	7.438	0.0	405.2	960
1440 min Summer	5.429	0.0	387.4	1214
2160 min Summer	3.954	0.0	568.9	1600
2880 min Summer	3.153	0.0	604.0	2016
4320 min Summer	2.288	0.0	651.6	2852
5760 min Summer	1.820	0.0	701.4	3640
7200 min Summer	1.525	0.0	734.3	4392
8640 min Summer	1.320	0.0	762.3	5104

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Micro Drainage	Source Control 2020.1.3	

Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (1/s)	Max Control (1/s)	Max Σ Outflow (1/s)	Max Volume (m³)	Status
10080 min Summer	8.380	0.380	0.0	2.7	2.7	158.7	O K
15 min Winter	8.359	0.359	0.0	2.7	2.7	150.0	O K
30 min Winter	8.480	0.480	0.0	2.7	2.7	200.5	O K
60 min Winter	8.609	0.609	0.0	2.7	2.7	254.6	O K
120 min Winter	8.740	0.740	0.0	2.7	2.7	309.3	O K
180 min Winter	8.810	0.810	0.0	2.7	2.7	338.7	O K
240 min Winter	8.854	0.854	0.0	2.7	2.7	356.8	O K
360 min Winter	8.913	0.913	0.0	2.7	2.7	381.8	O K
480 min Winter	8.949	0.949	0.0	2.7	2.7	396.6	O K
600 min Winter	8.970	0.970	0.0	2.7	2.7	405.6	O K
720 min Winter	8.983	0.983	0.0	2.7	2.7	410.8	O K
960 min Winter	8.991	0.991	0.0	2.7	2.7	414.4	O K
1440 min Winter	8.973	0.973	0.0	2.7	2.7	406.6	O K
2160 min Winter	8.924	0.924	0.0	2.7	2.7	386.2	O K
2880 min Winter	8.871	0.871	0.0	2.7	2.7	364.3	O K
4320 min Winter	8.758	0.758	0.0	2.7	2.7	316.9	O K
5760 min Winter	8.635	0.635	0.0	2.7	2.7	265.4	O K
7200 min Winter	8.495	0.495	0.0	2.7	2.7	207.1	O K
8640 min Winter	8.390	0.390	0.0	2.7	2.7	162.9	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	1.169	0.0	786.1	5848
15 min Winter	135.062	0.0	144.1	19
30 min Winter	90.740	0.0	190.5	33
60 min Winter	58.134	0.0	257.6	64
120 min Winter	35.913	0.0	317.4	122
180 min Winter	26.669	0.0	352.0	180
240 min Winter	21.426	0.0	375.2	240
360 min Winter	15.778	0.0	406.7	356
480 min Winter	12.674	0.0	418.9	472
600 min Winter	10.684	0.0	419.1	588
720 min Winter	9.287	0.0	416.7	700
960 min Winter	7.438	0.0	409.9	924
1440 min Winter	5.429	0.0	395.1	1344
2160 min Winter	3.954	0.0	636.8	1684
2880 min Winter	3.153	0.0	675.5	2160
4320 min Winter	2.288	0.0	715.8	3072
5760 min Winter	1.820	0.0	785.7	3984
7200 min Winter	1.525	0.0	822.5	4680
8640 min Winter	1.320	0.0	854.1	5360

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Micro Drainage	Source Control 2020.1.3	

Summary of Results for 100 year Return Period (+45%)

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	8.305	0.305	0.0	2.7	2.7	127.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Winter	1.169	0.0	881.0	6048

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Micro Drainage	Source Control 2020.1.3	


Rainfall Details

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)	19.800	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+45

Time Area Diagram

Total Area (ha) 0.536

Time (mins)		Area
From:	To:	(ha)
0	4	0.536

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Micro Drainage	Source Control 2020.1.3	

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 8.000 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	440.0	440.0	1.001	0.0	524.0
1.000	440.0	524.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0078-2700-1000-2700
 Design Head (m) 1.000
 Design Flow (l/s) 2.7
 Flush-Flo™ Calculated
 Objective Minimise upstream storage
 Application Surface
 Sump Available Yes
 Diameter (mm) 78
 Invert Level (m) 8.000
 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)	1.000	2.7	Kick-Flo®	0.622	2.2
Flush-Flo™	0.300	2.7	Mean Flow over Head Range	-	2.4

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.2	1.200	2.9	3.000	4.5	7.000	6.7
0.200	2.6	1.400	3.2	3.500	4.8	7.500	6.9
0.300	2.7	1.600	3.4	4.000	5.1	8.000	7.1
0.400	2.7	1.800	3.5	4.500	5.4	8.500	7.3
0.500	2.5	2.000	3.7	5.000	5.7	9.000	7.5
0.600	2.3	2.200	3.9	5.500	6.0	9.500	7.7
0.800	2.4	2.400	4.0	6.000	6.2		
1.000	2.7	2.600	4.2	6.500	6.5		

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42 West Street London House Carshalton SM5 2PR	Haskins Garden Centre and Birdworld Farnham	
Date 19/01/2024 15:32 File GC and carriageway pond ...	Designed by BC Checked by TK / RH	
Micro Drainage		Source Control 2020.1.3

Summary of Results for 100 year Return Period (+10%)

Half Drain Time : 1409 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max E Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	9.385	0.385	0.0	10.6	10.6	554.8	O K
30 min Summer	9.502	0.502	0.0	10.6	10.6	741.5	O K
60 min Summer	9.620	0.620	0.0	10.6	10.6	940.5	O K
120 min Summer	9.734	0.734	0.0	10.6	10.6	1142.1	O K
180 min Summer	9.793	0.793	0.0	10.6	10.6	1249.8	O K
240 min Summer	9.829	0.829	0.0	10.6	10.6	1316.8	O K
360 min Summer	9.876	0.876	0.0	10.6	10.6	1406.9	O K
480 min Summer	9.903	0.903	0.0	10.6	10.6	1459.3	O K
600 min Summer	9.919	0.919	0.0	10.6	10.6	1490.2	O K
720 min Summer	9.928	0.928	0.0	10.6	10.6	1507.1	O K
960 min Summer	9.931	0.931	0.0	10.6	10.6	1514.4	O K
1440 min Summer	9.917	0.917	0.0	10.6	10.6	1485.5	O K
2160 min Summer	9.887	0.887	0.0	10.6	10.6	1428.0	O K
2880 min Summer	9.854	0.854	0.0	10.6	10.6	1365.1	O K
4320 min Summer	9.786	0.786	0.0	10.6	10.6	1235.8	O K
5760 min Summer	9.714	0.714	0.0	10.6	10.6	1105.9	O K
7200 min Summer	9.633	0.633	0.0	10.6	10.6	963.0	O K
8640 min Summer	9.559	0.559	0.0	10.6	10.6	836.6	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	103.029	0.0	516.7	19
30 min Summer	69.212	0.0	688.8	34
60 min Summer	44.331	0.0	942.3	64
120 min Summer	27.374	0.0	1161.1	124
180 min Summer	20.320	0.0	1288.5	184
240 min Summer	16.332	0.0	1375.5	242
360 min Summer	12.021	0.0	1502.5	362
480 min Summer	9.656	0.0	1583.0	482
600 min Summer	8.139	0.0	1624.9	602
720 min Summer	7.075	0.0	1629.5	722
960 min Summer	5.666	0.0	1599.7	960
1440 min Summer	4.135	0.0	1529.8	1226
2160 min Summer	3.011	0.0	2341.7	1600
2880 min Summer	2.402	0.0	2482.9	2016
4320 min Summer	1.742	0.0	2654.2	2852
5760 min Summer	1.386	0.0	2896.3	3688
7200 min Summer	1.161	0.0	3031.9	4464
8640 min Summer	1.005	0.0	3146.8	5184

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42 West Street London House Carshalton SM5 2PR	Haskins Garden Centre and Birdworld Farnham	
Date 19/01/2024 15:32 File GC and carriageway pond ...	Designed by BC Checked by TK / RH	
Micro Drainage	Source Control 2020.1.3	

Summary of Results for 100 year Return Period (+10%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (1/s)	Max Control (1/s)	Max Σ Outflow (1/s)	Max Volume (m³)	Status
10080 min Summer	9.492	0.492	0.0	10.6	10.6	725.5	O K
15 min Winter	9.428	0.428	0.0	10.6	10.6	622.0	O K
30 min Winter	9.556	0.556	0.0	10.6	10.6	831.7	O K
60 min Winter	9.687	0.687	0.0	10.6	10.6	1056.4	O K
120 min Winter	9.811	0.811	0.0	10.6	10.6	1283.8	O K
180 min Winter	9.876	0.876	0.0	10.6	10.6	1406.7	O K
240 min Winter	9.916	0.916	0.0	10.6	10.6	1484.0	O K
360 min Winter	9.970	0.970	0.0	10.6	10.6	1590.1	O K
480 min Winter	10.001	1.001	0.0	10.6	10.6	1654.4	FLOOD
600 min Winter	10.020	1.020	0.0	10.7	10.7	1694.9	FLOOD
720 min Winter	10.031	1.031	0.0	10.7	10.7	1720.0	FLOOD
960 min Winter	10.040	1.040	0.0	10.8	10.8	1740.5	FLOOD
1440 min Winter	10.030	1.030	0.0	10.7	10.7	1717.8	FLOOD
2160 min Winter	9.994	0.994	0.0	10.6	10.6	1639.6	O K
2880 min Winter	9.952	0.952	0.0	10.6	10.6	1555.3	O K
4320 min Winter	9.856	0.856	0.0	10.6	10.6	1368.4	O K
5760 min Winter	9.753	0.753	0.0	10.6	10.6	1175.8	O K
7200 min Winter	9.629	0.629	0.0	10.6	10.6	955.9	O K
8640 min Winter	9.514	0.514	0.0	10.6	10.6	760.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	0.890	0.0	3241.7	5856
15 min Winter	103.029	0.0	578.6	19
30 min Winter	69.212	0.0	762.1	33
60 min Winter	44.331	0.0	1054.8	64
120 min Winter	27.374	0.0	1296.4	122
180 min Winter	20.320	0.0	1434.1	180
240 min Winter	16.332	0.0	1524.5	240
360 min Winter	12.021	0.0	1638.6	356
480 min Winter	9.656	3.0	1670.1	472
600 min Winter	8.139	43.6	1660.6	588
720 min Winter	7.075	68.6	1647.6	702
960 min Winter	5.666	89.1	1620.9	926
1440 min Winter	4.135	66.4	1570.1	1356
2160 min Winter	3.011	0.0	2619.1	1688
2880 min Winter	2.402	0.0	2772.4	2160
4320 min Winter	1.742	0.0	2877.8	3072
5760 min Winter	1.386	0.0	3244.2	3984
7200 min Winter	1.161	0.0	3396.6	4760
8640 min Winter	1.005	0.0	3526.2	5456

42 West Street London House Carshalton SM5 2PR	Haskins Garden Centre and Birdworld Farnham	
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Date 19/01/2024 15:32 File GC and carriageway pond ...	Designed by BC Checked by TK / RH
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Micro Drainage	Source Control 2020.1.3
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Summary of Results for 100 year Return Period (+10%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m ³)	Status	
10080 min Winter	9.414	0.414		0.0	10.6	10.6	599.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
10080 min Winter	0.890	0.0	3634.5	6152

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Date 19/01/2024 15:32 File GC and carriageway pond ...	Designed by BC Checked by TK / RH	
Micro Drainage	Source Control 2020.1.3	

Rainfall Details

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)	19.900	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+10

Time Area Diagram

Total Area (ha) 2.910

Time (mins)		Area
From:	To:	(ha)
0	4	2.910

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Micro Drainage	Source Control 2020.1.3	

Model Details

Storage is Online Cover Level (m) 10.000

Complex Structure

Tank or Pond

Invert Level (m) 9.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	500.0	1.000	1200.0

Cellular Storage

Invert Level (m) 9.000 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	870.0	870.0	1.001	0.0	997.0
1.000	870.0	997.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0150-1060-1000-1060
 Design Head (m) 1.000
 Design Flow (l/s) 10.6
 Flush-Flo™ Calculated
 Objective Minimise upstream storage
 Application Surface
 Sump Available Yes
 Diameter (mm) 150
 Invert Level (m) 9.000
 Minimum Outlet Pipe Diameter (mm) 225
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	10.6	Kick-Flo®	0.682	8.8
Flush-Flo™	0.309	10.6	Mean Flow over Head Range	-	9.1

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	5.4	1.200	11.5	3.000	17.8	7.000	26.7
0.200	10.2	1.400	12.4	3.500	19.2	7.500	27.6
0.300	10.6	1.600	13.2	4.000	20.4	8.000	28.5
0.400	10.5	1.800	14.0	4.500	21.6	8.500	29.4
0.500	10.2	2.000	14.7	5.000	22.7	9.000	30.2
0.600	9.8	2.200	15.4	5.500	23.8	9.500	31.0
0.800	9.5	2.400	16.0	6.000	24.8		
1.000	10.6	2.600	16.6	6.500	25.8		

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Micro Drainage	Source Control 2020.1.3	

Summary of Results for 100 year Return Period (+45%)

Half Drain Time : 1310 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max E Outflow (l/s)	Max Volume (m ³)	Status
15 min Summer	9.368	0.368	0.0	10.6	10.6	527.2	O K
30 min Summer	9.478	0.478	0.0	10.6	10.6	702.8	O K
60 min Summer	9.590	0.590	0.0	10.6	10.6	889.1	O K
120 min Summer	9.698	0.698	0.0	10.6	10.6	1077.2	O K
180 min Summer	9.754	0.754	0.0	10.6	10.6	1178.2	O K
240 min Summer	9.788	0.788	0.0	10.6	10.6	1240.0	O K
360 min Summer	9.831	0.831	0.0	10.6	10.6	1321.4	O K
480 min Summer	9.856	0.856	0.0	10.6	10.6	1367.9	O K
600 min Summer	9.870	0.870	0.0	10.6	10.6	1394.3	O K
720 min Summer	9.877	0.877	0.0	10.6	10.6	1407.7	O K
960 min Summer	9.878	0.878	0.0	10.6	10.6	1409.9	O K
1440 min Summer	9.861	0.861	0.0	10.6	10.6	1378.7	O K
2160 min Summer	9.831	0.831	0.0	10.6	10.6	1319.9	O K
2880 min Summer	9.796	0.796	0.0	10.6	10.6	1256.1	O K
4320 min Summer	9.724	0.724	0.0	10.6	10.6	1123.4	O K
5760 min Summer	9.642	0.642	0.0	10.6	10.6	977.5	O K
7200 min Summer	9.563	0.563	0.0	10.6	10.6	842.1	O K
8640 min Summer	9.493	0.493	0.0	10.6	10.6	726.5	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	134.982	0.0	491.0	19
30 min Summer	90.475	0.0	655.6	34
60 min Summer	57.831	0.0	892.0	64
120 min Summer	35.658	0.0	1098.8	124
180 min Summer	26.462	0.0	1220.1	184
240 min Summer	21.255	0.0	1303.0	242
360 min Summer	15.624	0.0	1426.3	362
480 min Summer	12.540	0.0	1511.0	482
600 min Summer	10.565	0.0	1568.1	602
720 min Summer	9.180	0.0	1599.6	720
960 min Summer	7.347	0.0	1590.9	960
1440 min Summer	5.357	0.0	1516.0	1210
2160 min Summer	3.898	0.0	2201.0	1580
2880 min Summer	3.107	0.0	2333.8	1992
4320 min Summer	2.253	0.0	2511.6	2812
5760 min Summer	1.791	0.0	2716.4	3632
7200 min Summer	1.499	0.0	2839.6	4392
8640 min Summer	1.297	0.0	2945.4	5104

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Micro Drainage	Source Control 2020.1.3	

Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (1/s)	Max Control (1/s)	Max Σ Outflow (1/s)	Max Volume (m³)	Status
10080 min Summer	9.429	0.429	0.0	10.6	10.6	624.2	O K
15 min Winter	9.409	0.409	0.0	10.6	10.6	591.1	O K
30 min Winter	9.530	0.530	0.0	10.6	10.6	788.5	O K
60 min Winter	9.654	0.654	0.0	10.6	10.6	998.5	O K
120 min Winter	9.772	0.772	0.0	10.6	10.6	1211.6	O K
180 min Winter	9.834	0.834	0.0	10.6	10.6	1326.5	O K
240 min Winter	9.871	0.871	0.0	10.6	10.6	1397.6	O K
360 min Winter	9.921	0.921	0.0	10.6	10.6	1493.7	O K
480 min Winter	9.950	0.950	0.0	10.6	10.6	1551.1	O K
600 min Winter	9.968	0.968	0.0	10.6	10.6	1586.2	O K
720 min Winter	9.978	0.978	0.0	10.6	10.6	1607.0	O K
960 min Winter	9.985	0.985	0.0	10.6	10.6	1621.1	O K
1440 min Winter	9.970	0.970	0.0	10.6	10.6	1591.0	O K
2160 min Winter	9.930	0.930	0.0	10.6	10.6	1512.0	O K
2880 min Winter	9.886	0.886	0.0	10.6	10.6	1425.4	O K
4320 min Winter	9.785	0.785	0.0	10.6	10.6	1234.8	O K
5760 min Winter	9.667	0.667	0.0	10.6	10.6	1022.1	O K
7200 min Winter	9.541	0.541	0.0	10.6	10.6	806.5	O K
8640 min Winter	9.435	0.435	0.0	10.6	10.6	633.0	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	1.147	0.0	3032.4	5840
15 min Winter	134.982	0.0	550.4	19
30 min Winter	90.475	0.0	728.0	33
60 min Winter	57.831	0.0	999.1	64
120 min Winter	35.658	0.0	1227.9	122
180 min Winter	26.462	0.0	1360.5	180
240 min Winter	21.255	0.0	1449.2	240
360 min Winter	15.624	0.0	1572.6	356
480 min Winter	12.540	0.0	1637.9	472
600 min Winter	10.565	0.0	1650.8	588
720 min Winter	9.180	0.0	1638.9	700
960 min Winter	7.347	0.0	1608.6	924
1440 min Winter	5.357	0.0	1547.2	1344
2160 min Winter	3.898	0.0	2462.9	1684
2880 min Winter	3.107	0.0	2609.0	2136
4320 min Winter	2.253	0.0	2773.5	3068
5760 min Winter	1.791	0.0	3042.8	3968
7200 min Winter	1.499	0.0	3181.5	4680
8640 min Winter	1.297	0.0	3300.7	5360

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Summary of Results for 100 year Return Period (+45%)

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	9.344	0.344	0.0	10.6	10.6	490.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Winter	1.147	0.0	3400.1	6048

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Micro Drainage	Source Control 2020.1.3	

Rainfall Details

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)	19.700	Shortest Storm (mins)	15
Ratio R	0.355	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+45

Time Area Diagram

Total Area (ha) 2.112

Time (mins)		Area
From:	To:	(ha)
0	4	2.112

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Micro Drainage	Source Control 2020.1.3	

Model Details

Storage is Online Cover Level (m) 10.000

Complex Structure

Tank or Pond

Invert Level (m) 9.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	500.0	1.000	1200.0

Cellular Storage

Invert Level (m) 9.000 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	870.0	870.0	1.001	0.0	1064.0
1.000	870.0	1064.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0150-1060-1000-1060
 Design Head (m) 1.000
 Design Flow (l/s) 10.6
 Flush-Flo™ Calculated
 Objective Minimise upstream storage
 Application Surface
 Sump Available Yes
 Diameter (mm) 150
 Invert Level (m) 9.000
 Minimum Outlet Pipe Diameter (mm) 225
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	10.6	Kick-Flo®	0.682	8.8
Flush-Flo™	0.309	10.6	Mean Flow over Head Range	-	9.1

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	5.4	1.200	11.5	3.000	17.8	7.000	26.7
0.200	10.2	1.400	12.4	3.500	19.2	7.500	27.6
0.300	10.6	1.600	13.2	4.000	20.4	8.000	28.5
0.400	10.5	1.800	14.0	4.500	21.6	8.500	29.4
0.500	10.2	2.000	14.7	5.000	22.7	9.000	30.2
0.600	9.8	2.200	15.4	5.500	23.8	9.500	31.0
0.800	9.5	2.400	16.0	6.000	24.8		
1.000	10.6	2.600	16.6	6.500	25.8		

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Micro Drainage	Source Control 2020.1.3	

Summary of Results for 100 year Return Period (+45%)

Half Drain Time : 1177 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max E Outflow (l/s)	Max Volume (m ³)	Status
15 min Summer	8.275	0.275	0.0	2.0	2.0	90.9	O K
30 min Summer	8.318	0.318	0.0	2.0	2.0	121.2	O K
60 min Summer	8.357	0.357	0.0	2.0	2.0	153.1	O K
120 min Summer	8.392	0.392	0.0	2.0	2.0	184.0	O K
180 min Summer	8.408	0.408	0.0	2.0	2.0	199.8	O K
240 min Summer	8.417	0.417	0.0	2.0	2.0	209.0	O K
360 min Summer	8.428	0.428	0.0	2.0	2.0	220.2	O K
480 min Summer	8.433	0.433	0.0	2.0	2.0	225.4	O K
600 min Summer	8.435	0.435	0.0	2.0	2.0	227.2	O K
720 min Summer	8.435	0.435	0.0	2.0	2.0	226.9	O K
960 min Summer	8.431	0.431	0.0	2.0	2.0	222.6	O K
1440 min Summer	8.421	0.421	0.0	2.0	2.0	212.4	O K
2160 min Summer	8.407	0.407	0.0	2.0	2.0	199.1	O K
2880 min Summer	8.394	0.394	0.0	2.0	2.0	186.6	O K
4320 min Summer	8.368	0.368	0.0	2.0	2.0	162.4	O K
5760 min Summer	8.340	0.340	0.0	2.0	2.0	138.7	O K
7200 min Summer	8.308	0.308	0.0	2.0	2.0	113.9	O K
8640 min Summer	8.276	0.276	0.0	2.0	2.0	91.3	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	135.811	0.0	92.7	19
30 min Summer	91.234	0.0	124.5	34
60 min Summer	58.437	0.0	159.5	64
120 min Summer	36.084	0.0	197.0	124
180 min Summer	26.785	0.0	219.4	182
240 min Summer	21.529	0.0	235.1	242
360 min Summer	15.846	0.0	259.6	362
480 min Summer	12.728	0.0	278.0	482
600 min Summer	10.729	0.0	292.9	602
720 min Summer	9.326	0.0	305.4	720
960 min Summer	7.469	0.0	318.9	914
1440 min Summer	5.451	0.0	309.6	1140
2160 min Summer	3.970	0.0	390.1	1536
2880 min Summer	3.166	0.0	414.8	1956
4320 min Summer	2.297	0.0	451.5	2768
5760 min Summer	1.827	0.0	478.8	3576
7200 min Summer	1.531	0.0	501.4	4328
8640 min Summer	1.325	0.0	520.9	5096

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Micro Drainage	Source Control 2020.1.3	

Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (1/s)	Max Control (1/s)	Max Σ Outflow (1/s)	Max Volume (m³)	Status
10080 min Summer	8.246	0.246	0.0	2.0	2.0	72.4	O K
15 min Winter	8.292	0.292	0.0	2.0	2.0	102.0	O K
30 min Winter	8.337	0.337	0.0	2.0	2.0	136.2	O K
60 min Winter	8.379	0.379	0.0	2.0	2.0	172.2	O K
120 min Winter	8.416	0.416	0.0	2.0	2.0	207.8	O K
180 min Winter	8.434	0.434	0.0	2.0	2.0	226.4	O K
240 min Winter	8.445	0.445	0.0	2.0	2.0	237.5	O K
360 min Winter	8.458	0.458	0.0	2.0	2.0	251.9	O K
480 min Winter	8.465	0.465	0.0	2.0	2.0	259.5	O K
600 min Winter	8.469	0.469	0.0	2.0	2.0	263.2	O K
720 min Winter	8.470	0.470	0.0	2.0	2.0	264.6	O K
960 min Winter	8.468	0.468	0.0	2.0	2.0	262.6	O K
1440 min Winter	8.457	0.457	0.0	2.0	2.0	250.1	O K
2160 min Winter	8.440	0.440	0.0	2.0	2.0	232.1	O K
2880 min Winter	8.422	0.422	0.0	2.0	2.0	214.1	O K
4320 min Winter	8.385	0.385	0.0	2.0	2.0	177.5	O K
5760 min Winter	8.343	0.343	0.0	2.0	2.0	141.1	O K
7200 min Winter	8.291	0.291	0.0	2.0	2.0	101.5	O K
8640 min Winter	8.239	0.239	0.0	2.0	2.0	68.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	1.173	0.0	538.0	5752
15 min Winter	135.811	0.0	103.8	19
30 min Winter	91.234	0.0	139.5	33
60 min Winter	58.437	0.0	178.7	62
120 min Winter	36.084	0.0	220.7	122
180 min Winter	26.785	0.0	245.7	180
240 min Winter	21.529	0.0	263.3	238
360 min Winter	15.846	0.0	290.7	356
480 min Winter	12.728	0.0	311.1	472
600 min Winter	10.729	0.0	322.9	586
720 min Winter	9.326	0.0	322.8	700
960 min Winter	7.469	0.0	320.2	922
1440 min Winter	5.451	0.0	314.2	1314
2160 min Winter	3.970	0.0	436.9	1644
2880 min Winter	3.166	0.0	464.6	2104
4320 min Winter	2.297	0.0	505.6	3024
5760 min Winter	1.827	0.0	536.3	3872
7200 min Winter	1.531	0.0	561.6	4616
8640 min Winter	1.325	0.0	583.4	5280

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Date 19/01/2024 15:40 File GC Car park, 1 in 100, 4...	Designed by BC Checked by TK / RH	
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Micro Drainage	Source Control 2020.1.3
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Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m ³)	Status	
10080 min Winter	8.188	0.188		0.0	2.0	2.0	42.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
10080 min Winter	1.173	0.0	602.6	5856

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Date 19/01/2024 15:40 File GC Car park, 1 in 100, 4...	Designed by BC Checked by TK / RH	
Micro Drainage	Source Control 2020.1.3	

Rainfall Details

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)	19.900	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+45

Time Area Diagram

Total Area (ha) 0.364

Time (mins)		Area
From:	To:	(ha)
0	4	0.364

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Date 19/01/2024 15:40 File GC Car park, 1 in 100, 4...	Designed by BC Checked by TK / RH	
Micro Drainage	Source Control 2020.1.3	

Model Details

Storage is Online Cover Level (m) 10.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	100.0
Membrane Percolation (mm/hr)	1000	Length (m)	36.4
Max Percolation (l/s)	1011.1	Slope (1:X)	80.0
Safety Factor	2.0	Depression Storage (mm)	0
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	8.000	Membrane Depth (m)	0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0075-2000-0460-2000
Design Head (m)	0.460
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	75
Invert Level (m)	8.000
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)	0.460	2.0	Kick-Flo®	0.322	1.7
Flush-Flo™	0.139	2.0	Mean Flow over Head Range	-	1.7

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	2.0	1.200	3.1	3.000	4.7	7.000	7.1
0.200	2.0	1.400	3.3	3.500	5.1	7.500	7.4
0.300	1.8	1.600	3.5	4.000	5.4	8.000	7.6
0.400	1.9	1.800	3.7	4.500	5.7	8.500	7.9
0.500	2.1	2.000	3.9	5.000	6.0	9.000	8.1
0.600	2.3	2.200	4.1	5.500	6.3	9.500	8.3
0.800	2.6	2.400	4.3	6.000	6.6		
1.000	2.8	2.600	4.4	6.500	6.9		

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Micro Drainage		Source Control 2020.1.3

Summary of Results for 100 year Return Period (+45%)

Half Drain Time : 1245 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max E Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	8.266	0.266	0.2	5.0	5.1	249.5	O K
30 min Summer	8.307	0.307	0.2	5.0	5.1	332.8	O K
60 min Summer	8.345	0.345	0.2	5.0	5.1	420.8	O K
120 min Summer	8.380	0.380	0.3	5.0	5.1	507.9	O K
180 min Summer	8.397	0.397	0.3	5.0	5.1	553.2	O K
240 min Summer	8.408	0.408	0.3	5.0	5.1	580.3	O K
360 min Summer	8.421	0.421	0.3	5.0	5.1	614.9	O K
480 min Summer	8.428	0.428	0.3	5.0	5.1	633.0	O K
600 min Summer	8.432	0.432	0.3	5.0	5.1	641.7	O K
720 min Summer	8.433	0.433	0.3	5.0	5.1	644.3	O K
960 min Summer	8.430	0.430	0.3	5.0	5.1	638.5	O K
1440 min Summer	8.421	0.421	0.3	5.0	5.1	614.5	O K
2160 min Summer	8.407	0.407	0.3	5.0	5.1	578.8	O K
2880 min Summer	8.394	0.394	0.3	5.0	5.1	544.6	O K
4320 min Summer	8.367	0.367	0.3	5.0	5.1	475.8	O K
5760 min Summer	8.340	0.340	0.2	5.0	5.1	407.8	O K
7200 min Summer	8.313	0.313	0.2	5.0	5.1	346.5	O K
8640 min Summer	8.288	0.288	0.2	5.0	5.1	291.7	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	135.811	0.0	253.8	19
30 min Summer	91.234	0.0	340.4	34
60 min Summer	58.437	0.0	437.0	64
120 min Summer	36.084	0.0	539.6	124
180 min Summer	26.785	0.0	600.9	182
240 min Summer	21.529	0.0	643.9	242
360 min Summer	15.846	0.0	710.8	362
480 min Summer	12.728	0.0	760.2	482
600 min Summer	10.729	0.0	796.9	602
720 min Summer	9.326	0.0	819.6	720
960 min Summer	7.469	0.0	822.7	960
1440 min Summer	5.451	0.0	796.6	1186
2160 min Summer	3.970	0.0	1068.6	1560
2880 min Summer	3.166	0.0	1136.2	1964
4320 min Summer	2.297	0.0	1236.6	2808
5760 min Summer	1.827	0.0	1311.5	3576
7200 min Summer	1.531	0.0	1373.3	4328
8640 min Summer	1.325	0.0	1426.8	5096

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Micro Drainage	Source Control 2020.1.3	

Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (1/s)	Max Control (1/s)	Max Σ Outflow (1/s)	Max Volume (m³)	Status
10080 min Summer	8.262	0.262	0.2	5.0	5.1	242.8	O K
15 min Winter	8.282	0.282	0.2	5.0	5.1	279.9	O K
30 min Winter	8.325	0.325	0.2	5.0	5.1	373.8	O K
60 min Winter	8.366	0.366	0.3	5.0	5.1	473.3	O K
120 min Winter	8.405	0.405	0.3	5.0	5.1	572.9	O K
180 min Winter	8.425	0.425	0.3	5.0	5.1	625.5	O K
240 min Winter	8.438	0.438	0.3	5.0	5.1	657.6	O K
360 min Winter	8.454	0.454	0.3	5.0	5.1	700.2	O K
480 min Winter	8.464	0.464	0.3	5.0	5.1	724.3	O K
600 min Winter	8.469	0.469	0.3	5.0	5.1	737.9	O K
720 min Winter	8.471	0.471	0.3	5.0	5.1	744.7	O K
960 min Winter	8.472	0.472	0.3	5.0	5.1	745.5	O K
1440 min Winter	8.462	0.462	0.3	5.0	5.1	720.8	O K
2160 min Winter	8.444	0.444	0.3	5.0	5.1	673.4	O K
2880 min Winter	8.425	0.425	0.3	5.0	5.1	625.9	O K
4320 min Winter	8.387	0.387	0.3	5.0	5.1	526.9	O K
5760 min Winter	8.345	0.345	0.2	5.0	5.1	420.9	O K
7200 min Winter	8.304	0.304	0.2	5.0	5.1	325.8	O K
8640 min Winter	8.263	0.263	0.2	5.0	5.1	244.0	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	1.173	0.0	1473.7	5760
15 min Winter	135.811	0.0	284.2	19
30 min Winter	91.234	0.0	379.1	33
60 min Winter	58.437	0.0	489.4	62
120 min Winter	36.084	0.0	604.4	122
180 min Winter	26.785	0.0	672.9	180
240 min Winter	21.529	0.0	721.0	240
360 min Winter	15.846	0.0	792.9	356
480 min Winter	12.728	0.0	832.4	472
600 min Winter	10.729	0.0	839.0	588
720 min Winter	9.326	0.0	835.3	700
960 min Winter	7.469	0.0	826.5	924
1440 min Winter	5.451	0.0	806.2	1342
2160 min Winter	3.970	0.0	1196.8	1668
2880 min Winter	3.166	0.0	1272.5	2136
4320 min Winter	2.297	0.0	1384.0	3064
5760 min Winter	1.827	0.0	1468.9	3864
7200 min Winter	1.531	0.0	1538.1	4616
8640 min Winter	1.325	0.0	1598.0	5360

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Summary of Results for 100 year Return Period (+45%)

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	8.223	0.223		0.2	5.0	5.1 175.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Winter	1.173	0.0	1650.5	6048

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Rainfall Details

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)	19.900	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+45

Time Area Diagram

Total Area (ha) 0.997

Time (mins)		Area
From:	To:	(ha)
0	4	0.997

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Model Details

Storage is Online Cover Level (m) 10.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00022	Width (m)	336.0
Membrane Percolation (mm/hr)	1000	Length (m)	25.6
Max Percolation (l/s)	2389.3	Slope (1:X)	70.0
Safety Factor	2.0	Depression Storage (mm)	0
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	8.000	Membrane Depth (m)	0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0113-5000-0500-5000
Design Head (m)	0.500
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	113
Invert Level (m)	8.000
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)	0.500	5.0	Kick-Flo®	0.372	4.4
Flush-Flo™	0.179	5.0	Mean Flow over Head Range	-	4.1

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	3.9	1.200	7.5	3.000	11.6	7.000	17.4
0.200	5.0	1.400	8.1	3.500	12.5	7.500	18.1
0.300	4.8	1.600	8.6	4.000	13.3	8.000	18.7
0.400	4.5	1.800	9.1	4.500	14.1	8.500	19.2
0.500	5.0	2.000	9.6	5.000	14.8	9.000	19.8
0.600	5.4	2.200	10.0	5.500	15.4	9.500	20.3
0.800	6.2	2.400	10.4	6.000	16.1		
1.000	6.9	2.600	10.8	6.500	16.8		

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Micro Drainage	Source Control 2020.1.3	

Summary of Results for 100 year Return Period (+45%)

Half Drain Time : 1334 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max E Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	8.317	0.317	0.0	2.3	2.3	117.5	O K
30 min Summer	8.424	0.424	0.0	2.3	2.3	156.9	O K
60 min Summer	8.537	0.537	0.0	2.3	2.3	198.8	O K
120 min Summer	8.651	0.651	0.0	2.3	2.3	241.3	O K
180 min Summer	8.712	0.712	0.0	2.3	2.3	263.9	O K
240 min Summer	8.750	0.750	0.0	2.3	2.3	277.8	O K
360 min Summer	8.800	0.800	0.0	2.3	2.3	296.3	O K
480 min Summer	8.828	0.828	0.0	2.3	2.3	306.9	O K
600 min Summer	8.845	0.845	0.0	2.3	2.3	312.9	O K
720 min Summer	8.853	0.853	0.0	2.3	2.3	316.0	O K
960 min Summer	8.855	0.855	0.0	2.3	2.3	316.7	O K
1440 min Summer	8.835	0.835	0.0	2.3	2.3	309.3	O K
2160 min Summer	8.798	0.798	0.0	2.3	2.3	295.7	O K
2880 min Summer	8.760	0.760	0.0	2.3	2.3	281.5	O K
4320 min Summer	8.682	0.682	0.0	2.3	2.3	252.7	O K
5760 min Summer	8.595	0.595	0.0	2.3	2.3	220.5	O K
7200 min Summer	8.512	0.512	0.0	2.3	2.3	189.8	O K
8640 min Summer	8.442	0.442	0.0	2.3	2.3	163.9	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	135.811	0.0	113.2	19
30 min Summer	91.234	0.0	150.9	34
60 min Summer	58.437	0.0	202.1	64
120 min Summer	36.084	0.0	249.3	124
180 min Summer	26.785	0.0	276.9	184
240 min Summer	21.529	0.0	296.0	242
360 min Summer	15.846	0.0	324.4	362
480 min Summer	12.728	0.0	343.0	482
600 min Summer	10.729	0.0	353.2	602
720 min Summer	9.326	0.0	355.4	722
960 min Summer	7.469	0.0	351.0	960
1440 min Summer	5.451	0.0	335.6	1226
2160 min Summer	3.970	0.0	498.8	1604
2880 min Summer	3.166	0.0	529.6	2016
4320 min Summer	2.297	0.0	570.7	2852
5760 min Summer	1.827	0.0	614.8	3640
7200 min Summer	1.531	0.0	643.6	4392
8640 min Summer	1.325	0.0	668.3	5104

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Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (1/s)	Max Control (1/s)	Max Σ Outflow (1/s)	Max Volume (m³)	Status
10080 min Summer	8.382	0.382	0.0	2.3	2.3	141.5	O K
15 min Winter	8.356	0.356	0.0	2.3	2.3	131.7	O K
30 min Winter	8.475	0.475	0.0	2.3	2.3	176.1	O K
60 min Winter	8.603	0.603	0.0	2.3	2.3	223.5	O K
120 min Winter	8.733	0.733	0.0	2.3	2.3	271.5	O K
180 min Winter	8.802	0.802	0.0	2.3	2.3	297.2	O K
240 min Winter	8.846	0.846	0.0	2.3	2.3	313.3	O K
360 min Winter	8.905	0.905	0.0	2.3	2.3	335.2	O K
480 min Winter	8.940	0.940	0.0	2.3	2.3	348.3	O K
600 min Winter	8.962	0.962	0.0	2.3	2.3	356.3	O K
720 min Winter	8.975	0.975	0.0	2.3	2.3	361.1	O K
960 min Winter	8.984	0.984	0.0	2.3	2.3	364.5	O K
1440 min Winter	8.966	0.966	0.0	2.3	2.3	358.1	O K
2160 min Winter	8.918	0.918	0.0	2.3	2.3	340.2	O K
2880 min Winter	8.867	0.867	0.0	2.3	2.3	321.2	O K
4320 min Winter	8.756	0.756	0.0	2.3	2.3	280.0	O K
5760 min Winter	8.635	0.635	0.0	2.3	2.3	235.4	O K
7200 min Winter	8.499	0.499	0.0	2.3	2.3	184.8	O K
8640 min Winter	8.394	0.394	0.0	2.3	2.3	146.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	1.173	0.0	689.1	5848
15 min Winter	135.811	0.0	126.7	19
30 min Winter	91.234	0.0	167.2	33
60 min Winter	58.437	0.0	226.3	64
120 min Winter	36.084	0.0	278.6	122
180 min Winter	26.785	0.0	308.8	180
240 min Winter	21.529	0.0	329.0	240
360 min Winter	15.846	0.0	355.2	356
480 min Winter	12.728	0.0	363.3	472
600 min Winter	10.729	0.0	363.0	588
720 min Winter	9.326	0.0	360.7	702
960 min Winter	7.469	0.0	354.7	924
1440 min Winter	5.451	0.0	342.1	1354
2160 min Winter	3.970	0.0	558.2	1688
2880 min Winter	3.166	0.0	592.1	2160
4320 min Winter	2.297	0.0	623.6	3072
5760 min Winter	1.827	0.0	688.6	3984
7200 min Winter	1.531	0.0	721.0	4688
8640 min Winter	1.325	0.0	748.7	5368

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Micro Drainage	Source Control 2020.1.3
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Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m ³)	Status
10080 min Winter	8.311	0.311	0.0	2.3	2.3	115.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
10080 min Winter	1.173	0.0	772.3	6056

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Micro Drainage	Source Control 2020.1.3	

Rainfall Details

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)	19.900	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+45

Time Area Diagram

Total Area (ha) 0.468

Time (mins)		Area
From:	To:	(ha)
0	4	0.468

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Micro Drainage	Source Control 2020.1.3	

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 8.000 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	390.0	390.0	1.001	0.0	469.0
1.000	390.0	469.0			


Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0073-2340-1000-2340
 Design Head (m) 1.000
 Design Flow (l/s) 2.3
 Flush-Flo™ Calculated
 Objective Minimise upstream storage
 Application Surface
 Sump Available Yes
 Diameter (mm) 73
 Invert Level (m) 8.000
 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)	1.000	2.3	Kick-Flo®	0.622	1.9
Flush-Flo™	0.303	2.3	Mean Flow over Head Range	-	2.1

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	1.9	1.200	2.5	3.000	3.9	7.000	5.8
0.200	2.3	1.400	2.7	3.500	4.2	7.500	6.0
0.300	2.3	1.600	2.9	4.000	4.4	8.000	6.1
0.400	2.3	1.800	3.1	4.500	4.7	8.500	6.3
0.500	2.2	2.000	3.2	5.000	4.9	9.000	6.5
0.600	2.0	2.200	3.4	5.500	5.2	9.500	6.7
0.800	2.1	2.400	3.5	6.000	5.4		
1.000	2.3	2.600	3.6	6.500	5.6		

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42 West Street London House Carshalton SM5 2PR	Haskins Garden Centre and Birdworld Farnham	
Date 19/01/2024 14:39 File BoH, 1 in 100, 45cc, 0....	Designed by BC Checked by TK/RH	
Micro Drainage		Source Control 2020.1.3

Summary of Results for 100 year Return Period (+45%)

Half Drain Time : 256 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	8.445	0.445	0.0	1.9	1.9	26.6	O K
30 min Summer	8.586	0.586	0.0	1.9	1.9	35.1	O K
60 min Summer	8.721	0.721	0.0	1.9	1.9	43.1	O K
120 min Summer	8.819	0.819	0.0	1.9	1.9	49.0	O K
180 min Summer	8.840	0.840	0.0	1.9	1.9	50.3	O K
240 min Summer	8.832	0.832	0.0	1.9	1.9	49.8	O K
360 min Summer	8.813	0.813	0.0	1.9	1.9	48.6	O K
480 min Summer	8.787	0.787	0.0	1.9	1.9	47.1	O K
600 min Summer	8.759	0.759	0.0	1.9	1.9	45.4	O K
720 min Summer	8.730	0.730	0.0	1.9	1.9	43.7	O K
960 min Summer	8.671	0.671	0.0	1.9	1.9	40.2	O K
1440 min Summer	8.535	0.535	0.0	1.9	1.9	32.0	O K
2160 min Summer	8.369	0.369	0.0	1.9	1.9	22.1	O K
2880 min Summer	8.257	0.257	0.0	1.9	1.9	15.4	O K
4320 min Summer	8.140	0.140	0.0	1.8	1.8	8.4	O K
5760 min Summer	8.093	0.093	0.0	1.6	1.6	5.5	O K
7200 min Summer	8.077	0.077	0.0	1.4	1.4	4.6	O K
8640 min Summer	8.066	0.066	0.0	1.2	1.2	4.0	O K
10080 min Summer	8.059	0.059	0.0	1.1	1.1	3.6	O K
15 min Winter	8.501	0.501	0.0	1.9	1.9	30.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	135.062	0.0	28.0	18
30 min Summer	90.740	0.0	37.7	33
60 min Summer	58.134	0.0	48.3	62
120 min Summer	35.913	0.0	59.7	122
180 min Summer	26.669	0.0	66.6	180
240 min Summer	21.426	0.0	71.3	218
360 min Summer	15.778	0.0	78.8	280
480 min Summer	12.674	0.0	84.4	346
600 min Summer	10.684	0.0	88.9	414
720 min Summer	9.287	0.0	92.7	484
960 min Summer	7.438	0.0	99.0	626
1440 min Summer	5.429	0.0	108.4	882
2160 min Summer	3.954	0.0	118.5	1236
2880 min Summer	3.153	0.0	126.0	1584
4320 min Summer	2.288	0.0	137.1	2252
5760 min Summer	1.820	0.0	145.4	2944
7200 min Summer	1.525	0.0	152.3	3672
8640 min Summer	1.320	0.0	158.2	4400
10080 min Summer	1.169	0.0	163.4	5136
15 min Winter	135.062	0.0	31.4	18

Summary of Results for 100 year Return Period (+45%)

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	8.662	0.662	0.0	1.9	1.9	39.6	O K
60 min Winter	8.815	0.815	0.0	1.9	1.9	48.8	O K
120 min Winter	8.934	0.934	0.0	1.9	1.9	55.9	O K
180 min Winter	8.967	0.967	0.0	2.0	2.0	57.9	O K
240 min Winter	8.965	0.965	0.0	2.0	2.0	57.7	O K
360 min Winter	8.936	0.936	0.0	1.9	1.9	56.0	O K
480 min Winter	8.903	0.903	0.0	1.9	1.9	54.1	O K
600 min Winter	8.864	0.864	0.0	1.9	1.9	51.7	O K
720 min Winter	8.821	0.821	0.0	1.9	1.9	49.1	O K
960 min Winter	8.733	0.733	0.0	1.9	1.9	43.9	O K
1440 min Winter	8.523	0.523	0.0	1.9	1.9	31.3	O K
2160 min Winter	8.287	0.287	0.0	1.9	1.9	17.2	O K
2880 min Winter	8.165	0.165	0.0	1.8	1.8	9.8	O K
4320 min Winter	8.084	0.084	0.0	1.5	1.5	5.0	O K
5760 min Winter	8.066	0.066	0.0	1.2	1.2	4.0	O K
7200 min Winter	8.057	0.057	0.0	1.0	1.0	3.4	O K
8640 min Winter	8.051	0.051	0.0	0.9	0.9	3.1	O K
10080 min Winter	8.047	0.047	0.0	0.8	0.8	2.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	90.740	0.0	42.2	33
60 min Winter	58.134	0.0	54.2	62
120 min Winter	35.913	0.0	66.9	118
180 min Winter	26.669	0.0	74.5	176
240 min Winter	21.426	0.0	79.9	230
360 min Winter	15.778	0.0	88.2	292
480 min Winter	12.674	0.0	94.5	368
600 min Winter	10.684	0.0	99.6	446
720 min Winter	9.287	0.0	103.8	522
960 min Winter	7.438	0.0	110.9	674
1440 min Winter	5.429	0.0	121.4	952
2160 min Winter	3.954	0.0	132.7	1280
2880 min Winter	3.153	0.0	141.1	1588
4320 min Winter	2.288	0.0	153.5	2208
5760 min Winter	1.820	0.0	162.9	2936
7200 min Winter	1.525	0.0	170.6	3640
8640 min Winter	1.320	0.0	177.2	4384
10080 min Winter	1.169	0.0	183.0	5088

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42 West Street London House Carshalton SM5 2PR	Haskins Garden Centre and Birdworld Farnham	
Date 19/01/2024 14:39 File BoH, 1 in 100, 45cc, 0....	Designed by BC Checked by TK/RH	
Micro Drainage	Source Control 2020.1.3	


Rainfall Details

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)	19.800	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+45

Time Area Diagram

Total Area (ha) 0.111

Time (mins)		Area
From:	To:	(ha)
0	4	0.111

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Micro Drainage	Source Control 2020.1.3	

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 8.000 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	63.0	63.0	1.100	0.0	95.0
1.000	63.0	95.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0067-2000-1000-2000
 Design Head (m) 1.000
 Design Flow (l/s) 2.0
 Flush-Flo™ Calculated
 Objective Minimise upstream storage
 Application Surface
 Sump Available Yes
 Diameter (mm) 67
 Invert Level (m) 8.000
 Minimum Outlet Pipe Diameter (mm) 100
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.0
Flush-Flo™	0.296	1.9
Kick-Flo®	0.599	1.6
Mean Flow over Head Range	-	1.7

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	1.6	1.200	2.2	3.000	3.3	7.000	4.9
0.200	1.9	1.400	2.3	3.500	3.5	7.500	5.1
0.300	1.9	1.600	2.5	4.000	3.8	8.000	5.2
0.400	1.9	1.800	2.6	4.500	4.0	8.500	5.4
0.500	1.8	2.000	2.7	5.000	4.2	9.000	5.5
0.600	1.6	2.200	2.9	5.500	4.4	9.500	5.7
0.800	1.8	2.400	3.0	6.000	4.6		
1.000	2.0	2.600	3.1	6.500	4.7		

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Date 19/01/2024 15:13 File Birdworld Car park, 1 in...	Designed by BC Checked by TK/RH	
Micro Drainage	Source Control 2020.1.3	

Summary of Results for 100 year Return Period (+45%)

Half Drain Time : 865 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max E Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	8.220	0.220	0.0	4.4	4.4	160.5	O K
30 min Summer	8.253	0.253	0.0	4.4	4.4	213.3	O K
60 min Summer	8.284	0.284	0.0	4.4	4.4	268.3	O K
120 min Summer	8.311	0.311	0.0	4.4	4.4	321.0	O K
180 min Summer	8.325	0.325	0.0	4.4	4.4	347.4	O K
240 min Summer	8.332	0.332	0.0	4.4	4.4	362.0	O K
360 min Summer	8.341	0.341	0.0	4.4	4.4	379.4	O K
480 min Summer	8.345	0.345	0.0	4.4	4.4	386.1	O K
600 min Summer	8.345	0.345	0.0	4.4	4.4	386.9	O K
720 min Summer	8.344	0.344	0.0	4.4	4.4	384.2	O K
960 min Summer	8.339	0.339	0.0	4.4	4.4	374.4	O K
1440 min Summer	8.328	0.328	0.0	4.4	4.4	353.2	O K
2160 min Summer	8.312	0.312	0.0	4.4	4.4	322.6	O K
2880 min Summer	8.297	0.297	0.0	4.4	4.4	293.2	O K
4320 min Summer	8.267	0.267	0.0	4.4	4.4	238.0	O K
5760 min Summer	8.238	0.238	0.0	4.4	4.4	188.8	O K
7200 min Summer	8.210	0.210	0.0	4.4	4.4	147.0	O K
8640 min Summer	8.184	0.184	0.0	4.4	4.4	113.2	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	135.466	0.0	164.1	19
30 min Summer	90.879	0.0	220.1	34
60 min Summer	58.134	0.0	281.7	64
120 min Summer	35.863	0.0	347.5	122
180 min Summer	26.614	0.0	386.8	182
240 min Summer	21.375	0.0	414.2	242
360 min Summer	15.726	0.0	457.2	362
480 min Summer	12.626	0.0	489.4	482
600 min Summer	10.639	0.0	515.5	600
720 min Summer	9.246	0.0	537.5	720
960 min Summer	7.401	0.0	573.6	836
1440 min Summer	5.399	0.0	624.7	1070
2160 min Summer	3.930	0.0	685.4	1468
2880 min Summer	3.133	0.0	728.6	1872
4320 min Summer	2.272	0.0	792.6	2640
5760 min Summer	1.807	0.0	840.3	3408
7200 min Summer	1.512	0.0	879.3	4112
8640 min Summer	1.309	0.0	913.3	4832

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Date 19/01/2024 15:13 File Birdworld Car park, 1 in...	Designed by BC Checked by TK/RH	
Micro Drainage	Source Control 2020.1.3	

Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (1/s)	Max Control (1/s)	Max Σ Outflow (1/s)	Max Volume (m ³)	Status
10080 min Summer	8.162	0.162	0.0	4.4	4.4	87.2	O K
15 min Winter	8.233	0.233	0.0	4.4	4.4	180.1	O K
30 min Winter	8.268	0.268	0.0	4.4	4.4	239.8	O K
60 min Winter	8.301	0.301	0.0	4.4	4.4	302.1	O K
120 min Winter	8.333	0.333	0.0	4.4	4.4	363.2	O K
180 min Winter	8.349	0.349	0.0	4.4	4.4	394.5	O K
240 min Winter	8.358	0.358	0.0	4.4	4.4	412.3	O K
360 min Winter	8.370	0.370	0.0	4.4	4.4	434.4	O K
480 min Winter	8.375	0.375	0.0	4.4	4.4	444.6	O K
600 min Winter	8.377	0.377	0.0	4.4	4.4	448.4	O K
720 min Winter	8.377	0.377	0.0	4.4	4.4	448.0	O K
960 min Winter	8.372	0.372	0.0	4.4	4.4	439.8	O K
1440 min Winter	8.359	0.359	0.0	4.4	4.4	413.1	O K
2160 min Winter	8.337	0.337	0.0	4.4	4.4	371.8	O K
2880 min Winter	8.314	0.314	0.0	4.4	4.4	325.9	O K
4320 min Winter	8.268	0.268	0.0	4.4	4.4	239.4	O K
5760 min Winter	8.222	0.222	0.0	4.4	4.4	164.5	O K
7200 min Winter	8.178	0.178	0.0	4.4	4.4	105.7	O K
8640 min Winter	8.141	0.141	0.0	4.4	4.4	65.8	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
10080 min Summer	1.159	0.0	943.0	5448
15 min Winter	135.466	0.0	183.8	19
30 min Winter	90.879	0.0	246.5	33
60 min Winter	58.134	0.0	315.5	62
120 min Winter	35.863	0.0	389.2	122
180 min Winter	26.614	0.0	433.3	180
240 min Winter	21.375	0.0	464.0	238
360 min Winter	15.726	0.0	512.0	354
480 min Winter	12.626	0.0	548.1	470
600 min Winter	10.639	0.0	577.3	584
720 min Winter	9.246	0.0	601.8	694
960 min Winter	7.401	0.0	640.5	912
1440 min Winter	5.399	0.0	668.0	1152
2160 min Winter	3.930	0.0	767.7	1604
2880 min Winter	3.133	0.0	816.0	2044
4320 min Winter	2.272	0.0	887.7	2856
5760 min Winter	1.807	0.0	941.2	3584
7200 min Winter	1.512	0.0	984.8	4248
8640 min Winter	1.309	0.0	1022.8	4840

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Date 19/01/2024 15:13 File Birdworld Car park, 1 in...	Designed by BC Checked by TK/RH	
Micro Drainage	Source Control 2020.1.3	

Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m ³)	Status
10080 min Winter	8.117	0.117	0.0	4.2	4.2	45.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
10080 min Winter	1.159	0.0	1056.1	5344

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42 West Street London House Carshalton SM5 2PR	Haskins Garden Centre and Birdworld Farnham	
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Micro Drainage	Source Control 2020.1.3	

Rainfall Details

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)	19.800	Shortest Storm (mins)	15
Ratio R	0.353	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+45

Time Area Diagram

Total Area (ha) 0.646

Time (mins)		Area
From:	To:	(ha)
0	4	0.646

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Micro Drainage	Source Control 2020.1.3	

Model Details

Storage is Online Cover Level (m) 10.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	222.0
Membrane Percolation (mm/hr)	1000	Length (m)	29.1
Max Percolation (l/s)	1794.5	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	0
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	8.000	Membrane Depth (m)	0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0107-4400-0450-4400
Design Head (m)	0.450
Design Flow (l/s)	4.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	107
Invert Level (m)	8.000
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)	0.450	4.4	Kick-Flo®	0.337	3.9
Flush-Flo™	0.166	4.4	Mean Flow over Head Range	-	3.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.6	1.200	6.9	3.000	10.7	7.000	16.1
0.200	4.4	1.400	7.5	3.500	11.5	7.500	16.7
0.300	4.1	1.600	7.9	4.000	12.3	8.000	17.3
0.400	4.2	1.800	8.4	4.500	13.0	8.500	17.8
0.500	4.6	2.000	8.8	5.000	13.6	9.000	18.3
0.600	5.0	2.200	9.2	5.500	14.3	9.500	18.8
0.800	5.7	2.400	9.6	6.000	14.9		
1.000	6.4	2.600	10.0	6.500	15.5		

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Date 19/01/2024 15:37 File Birdworld CP, 1 in 100, ...	Designed by BC Checked by TK / RH	
Micro Drainage	Source Control 2020.1.3	

Summary of Results for 100 year Return Period (+45%)

Half Drain Time : 1289 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max E Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	8.214	0.214	0.0	4.1	4.1	206.8	O K
30 min Summer	8.248	0.248	0.0	4.1	4.1	275.7	O K
60 min Summer	8.283	0.283	0.0	4.1	4.1	348.3	O K
120 min Summer	8.317	0.317	0.0	4.1	4.1	420.5	O K
180 min Summer	8.335	0.335	0.0	4.1	4.1	458.3	O K
240 min Summer	8.346	0.346	0.0	4.1	4.1	481.0	O K
360 min Summer	8.360	0.360	0.0	4.1	4.1	510.5	O K
480 min Summer	8.368	0.368	0.0	4.1	4.1	526.4	O K
600 min Summer	8.371	0.371	0.0	4.1	4.1	534.6	O K
720 min Summer	8.373	0.373	0.0	4.1	4.1	537.8	O K
960 min Summer	8.372	0.372	0.0	4.1	4.1	534.9	O K
1440 min Summer	8.363	0.363	0.0	4.1	4.1	517.3	O K
2160 min Summer	8.350	0.350	0.0	4.1	4.1	489.6	O K
2880 min Summer	8.337	0.337	0.0	4.1	4.1	462.6	O K
4320 min Summer	8.312	0.312	0.0	4.1	4.1	409.2	O K
5760 min Summer	8.285	0.285	0.0	4.1	4.1	353.7	O K
7200 min Summer	8.261	0.261	0.0	4.1	4.1	303.4	O K
8640 min Summer	8.240	0.240	0.0	4.1	4.1	258.5	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	136.217	0.0	209.9	19
30 min Summer	91.374	0.0	279.5	34
60 min Summer	58.437	0.0	360.7	64
120 min Summer	36.033	0.0	444.8	124
180 min Summer	26.730	0.0	494.9	182
240 min Summer	21.473	0.0	530.0	242
360 min Summer	15.794	0.0	583.5	362
480 min Summer	12.680	0.0	620.5	482
600 min Summer	10.684	0.0	643.7	602
720 min Summer	9.284	0.0	653.4	720
960 min Summer	7.432	0.0	648.1	960
1440 min Summer	5.421	0.0	625.9	1198
2160 min Summer	3.945	0.0	876.7	1580
2880 min Summer	3.145	0.0	931.8	1988
4320 min Summer	2.281	0.0	1013.0	2812
5760 min Summer	1.813	0.0	1074.6	3624
7200 min Summer	1.518	0.0	1124.5	4392
8640 min Summer	1.314	0.0	1168.0	5104

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Micro Drainage	Source Control 2020.1.3	

Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (1/s)	Max Control (1/s)	Max Σ Outflow (1/s)	Max Volume (m ³)	Status
10080 min Summer	8.220	0.220	0.0	4.1	4.1	218.3	O K
15 min Winter	8.227	0.227	0.0	4.1	4.1	232.0	O K
30 min Winter	8.264	0.264	0.0	4.1	4.1	309.5	O K
60 min Winter	8.303	0.303	0.0	4.1	4.1	391.6	O K
120 min Winter	8.342	0.342	0.0	4.1	4.1	473.9	O K
180 min Winter	8.363	0.363	0.0	4.1	4.1	517.5	O K
240 min Winter	8.376	0.376	0.0	4.1	4.1	544.3	O K
360 min Winter	8.393	0.393	0.0	4.1	4.1	580.1	O K
480 min Winter	8.403	0.403	0.0	4.1	4.1	600.8	O K
600 min Winter	8.409	0.409	0.0	4.1	4.1	612.7	O K
720 min Winter	8.412	0.412	0.0	4.2	4.2	619.2	O K
960 min Winter	8.413	0.413	0.0	4.2	4.2	621.5	O K
1440 min Winter	8.405	0.405	0.0	4.1	4.1	604.3	O K
2160 min Winter	8.387	0.387	0.0	4.1	4.1	567.9	O K
2880 min Winter	8.370	0.370	0.0	4.1	4.1	530.9	O K
4320 min Winter	8.333	0.333	0.0	4.1	4.1	453.7	O K
5760 min Winter	8.293	0.293	0.0	4.1	4.1	370.8	O K
7200 min Winter	8.256	0.256	0.0	4.1	4.1	291.6	O K
8640 min Winter	8.223	0.223	0.0	4.1	4.1	223.3	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
10080 min Summer	1.163	0.0	1206.0	5848
15 min Winter	136.217	0.0	234.9	19
30 min Winter	91.374	0.0	308.7	33
60 min Winter	58.437	0.0	404.0	64
120 min Winter	36.033	0.0	498.1	122
180 min Winter	26.730	0.0	553.9	180
240 min Winter	21.473	0.0	592.1	240
360 min Winter	15.794	0.0	644.0	356
480 min Winter	12.680	0.0	664.3	472
600 min Winter	10.684	0.0	664.2	588
720 min Winter	9.284	0.0	660.8	700
960 min Winter	7.432	0.0	653.3	924
1440 min Winter	5.421	0.0	636.8	1342
2160 min Winter	3.945	0.0	981.9	1684
2880 min Winter	3.145	0.0	1043.6	2136
4320 min Winter	2.281	0.0	1126.8	3068
5760 min Winter	1.813	0.0	1203.5	3920
7200 min Winter	1.518	0.0	1259.5	4680
8640 min Winter	1.314	0.0	1308.1	5368

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Summary of Results for 100 year Return Period (+45%)

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	8.192	0.192		0.0	4.1	4.1 165.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Winter	1.163	0.0	1350.7	6056

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Micro Drainage	Source Control 2020.1.3	

Rainfall Details

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)	19.900	Shortest Storm (mins)	15
Ratio R	0.353	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+45

Time Area Diagram

Total Area (ha) 0.823

Time (mins)		Area
From:	To:	(ha)
0	4	0.823

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Model Details

Storage is Online Cover Level (m) 10.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	300.0
Membrane Percolation (mm/hr)	1000	Length (m)	23.3
Max Percolation (l/s)	1941.7	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	0
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	8.000	Membrane Depth (m)	0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0104-4100-0400-4100
Design Head (m)	0.400
Design Flow (l/s)	4.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	104
Invert Level (m)	8.000
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)	0.400	4.1	Kick-Flo®	0.306	3.6
Flush-Flo™	0.157	4.1	Mean Flow over Head Range	-	3.3

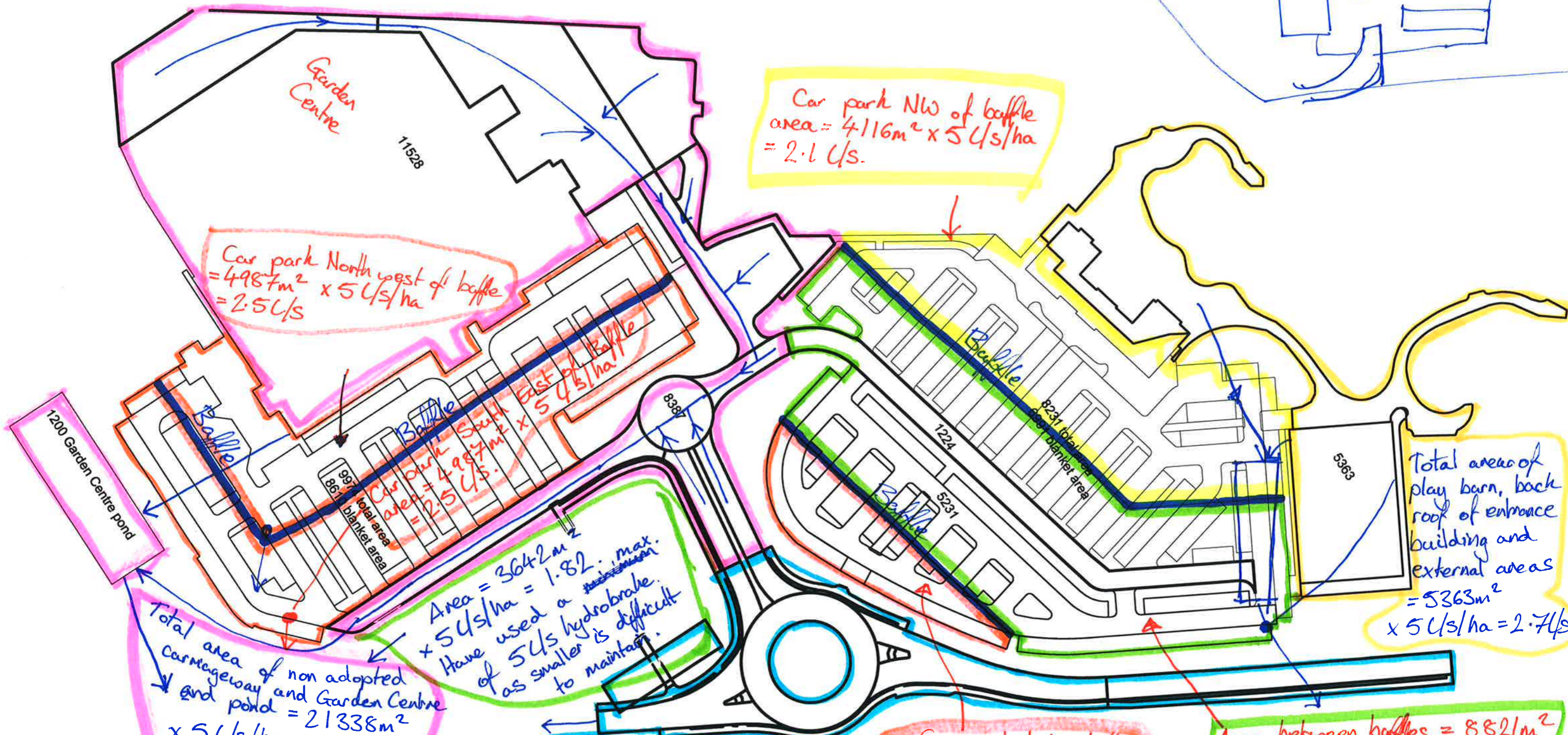
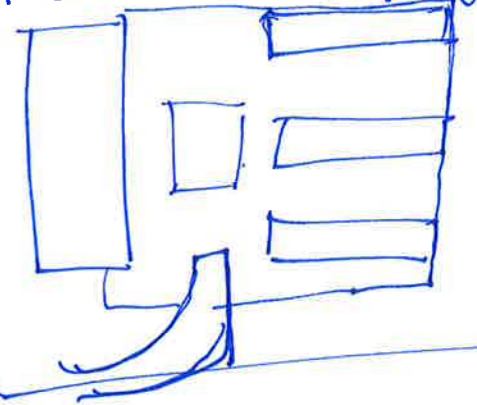
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.5	1.200	6.8	3.000	10.5	7.000	15.9
0.200	4.1	1.400	7.3	3.500	11.3	7.500	16.5
0.300	3.7	1.600	7.8	4.000	12.1	8.000	17.0
0.400	4.1	1.800	8.3	4.500	12.7	8.500	17.6
0.500	4.5	2.000	8.7	5.000	13.4	9.000	18.1
0.600	4.9	2.200	9.1	5.500	14.1	9.500	18.6
0.800	5.7	2.400	9.5	6.000	14.7		
1.000	6.3	2.600	9.8	6.500	15.3		

Appendix L
Proposed Drainage Drawings



BoH area = 1100m². x 5 U/s/ha
 = 0.55 U/s. Too small a flow
 to maintain so have used 2 U/s hydrobrake



Car park NW of baffle
 area = 4116m² x 5 U/s/ha
 = 2.1 U/s.

Car park North west of baffle
 = 4987m² x 5 U/s/ha
 = 2.5 U/s

Area = 3642m²
 x 5 U/s/ha = 1.82 max.
 Have used a hydrobrake.
 of 5 U/s as smaller is difficult
 to maintain.

Total area of
 play barn, back
 roof of entrance
 building and
 external areas
 = 5363m²
 x 5 U/s/ha = 2.7 U/s.

Total area of non adopted
 carmageway and Garden Centre
 and pond = 21338m²
 x 5 U/s/ha = 10.6 U/s

Total area from new
 highway + paving + swales
 = 4675 x 5 U/s/ha
 = 2.3

Car park below baffle
 area = 1750m² x 5 U/s/ha
 = 0.9 U/s. Too small to
 maintain so have used 2.0 U/s.

Area between baffles = 8821m²
 x 5 U/s/ha = 4.4 U/s.

1200 Garden Centre pond

Garden Centre

11528

8387

997 total area
 886 blanket area

Car park South of baffle
 area = 4987m² x 5 U/s/ha
 = 2.5 U/s

1224

8231 total area
 8231 blanket area

5231

5363

