

## I. Tide Locking Calculations

### **Appendices**

The Former Stag Brewery, Mortlake

Project Number: WIE18671

Document Reference: WIE18671-104-R-11-7-1-DS




# CALCULATIONS

Company: WIE                      Office: London  
 Sheet No: 1 of 1                  Project No: WIE10667  
 By: N Balboni                      Date: 27.09.2017  
 Checked: D O'Donovan          Date: 27.09.2017

Project Title:            **Former Stag Brewery, Mortlake**  
 Calculations Title:    **Tide Locking Calculation**

CALCULATIONS						
The 'rule of twelfths' is a rule of thumb that allows the tide level to be estimated based on the high and low water levels. The rule is an approximation assuming six hours between high and low water, and does not take account of geographical location.						
Source: Port of London Authority, 2017. <i>Tide Tables and Port Information</i>						
Closest tidal stations: Barnes and Chiswick.						
Barnes MHWS (m AOD)	4.13					
Chiswick MHWS (m AOD)	4.08					
<b>Inputs</b>			<b>Rule of Twelfths</b>			
Mean High Water Spring	=	5.23 m AOD	Hour	Change	Water Level	
Mean Low Water Spring	=	-1.02 m AOD	0	-	-1.02	
			1	1/12	-0.50	
Invert Level of Outfall	=	2.60 m AOD	2	1/6	0.54	
			3	1/4	2.11	
			4	1/4	3.67	
			5	1/6	4.71	
			6	1/12	5.23	
			7	1/12	4.71	
			8	1/6	3.67	
			9	1/4	2.11	
			10	1/4	0.54	
			11	1/6	-0.50	
			12	1/12	-1.02	
<b>Output</b>						
Time that outfall becomes submerged (hrs)	=	3.3				
Time that outfall becomes unsubmerged (hrs)	=	8.6				
<b>Total time that outfall is submerged (hrs)</b>	<b>=</b>	<b>5.3</b>				

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm





Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	100
FEH Rainfall Version	1999
Site Location GB 520450 176000 TQ 20450 76000	
C (1km)	-0.024
D1 (1km)	0.322
D2 (1km)	0.262
D3 (1km)	0.219
E (1km)	0.306
F (1km)	2.539
Maximum Rainfall (mm/hr)	0
Maximum Time of Concentration (mins)	5
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	40
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	124.000	0.012	10333.3	0.300	5.00	0.0	0.600	[]	-1	Pipe/Conduit	
1.001	2.949	0.590	5.0	0.000	0.00	0.0	0.600	o	675	Pipe/Conduit	
1.002	7.594	0.051	150.0	0.000	0.00	0.0	0.600	o	675	Pipe/Conduit	
1.003	25.890	1.295	20.0	0.000	0.00	0.0	0.600	o	675	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	0.00	5.00	5.480	0.300	0.0	0.0	0.0	0.14	67.5	0.0
1.001	0.00	5.00	4.945	0.300	0.0	0.0	0.0	11.77	4211.0	0.0
1.002	0.00	5.00	4.355	0.300	0.0	0.0	0.0	2.14	765.0	0.0
1.003	0.00	5.00	4.305	0.300	0.0	0.0	0.0	5.88	2103.1	0.0

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	[ ]	-1	1	6.030	5.480	0.400	Open Manhole	3000
1.001	o	675	2	6.030	4.945	0.410	Open Manhole	3000
1.002	o	675	3	6.030	4.355	1.000	Open Manhole	1500
1.003	o	675	3	6.030	4.305	1.050	Open Manhole	2100

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	124.000	10333.3	2	6.030	5.468	0.412	Open Manhole	3000
1.001	2.949	5.0	3	6.030	4.355	1.000	Open Manhole	1500
1.002	7.594	150.0	3	6.030	4.305	1.050	Open Manhole	2100
1.003	25.890	20.0		4.500	3.010	0.815	Open Manhole	675

Surcharged Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.003		4.500	3.010	2.625	675	0

Datum (m) 0.000 Offset (mins) 0

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
30	5.230	90	5.230	150	5.230	210	5.230	270	5.230	330	5.230
60	5.230	120	5.230	180	5.230	240	5.230	300	5.230	360	5.230

Simulation Criteria for Storm

Volumetric Runoff Coeff 0.750      Additional Flow - % of Total Flow 0.000  
 Areal Reduction Factor 1.000      MADD Factor \* 10m<sup>3</sup>/ha Storage 2.000  
 Hot Start (mins) 0      Inlet Coefficient 0.800  
 Hot Start Level (mm) 0      Flow per Person per Day (l/per/day) 0.000  
 Manhole Headloss Coeff (Global) 0.500      Run Time (mins) 60  
 Foul Sewage per hectare (l/s) 0.000      Output Interval (mins) 1

Number of Input Hydrographs 0      Number of Storage Structures 0  
 Number of Online Controls 0      Number of Time/Area Diagrams 0  
 Number of Offline Controls 0      Number of Real Time Controls 0

Synthetic Rainfall Details

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Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 520450 176000 TQ 20450 76000
C (1km)	-0.024
D1 (1km)	0.322
D2 (1km)	0.262
D3 (1km)	0.219
E (1km)	0.306
F (1km)	2.539
Summer Storms	Yes
Winter Storms	No
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000    Additional Flow - % of Total Flow 0.000  
 Hot Start (mins) 0    MADD Factor \* 10m<sup>3</sup>/ha Storage 2.000  
 Hot Start Level (mm) 0    Inlet Coefficient 0.800  
 Manhole Headloss Coeff (Global) 0.500    Flow per Person per Day (l/per/day) 0.000  
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0    Number of Storage Structures 0  
 Number of Online Controls 0    Number of Time/Area Diagrams 0  
 Number of Offline Controls 0    Number of Real Time Controls 0

Synthetic Rainfall Details


Rainfall Model FEH  
 FEH Rainfall Version 1999  
 Site Location GB 520450 176000 TQ 20450 76000  
 C (1km) -0.024  
 D1 (1km) 0.322  
 D2 (1km) 0.262  
 D3 (1km) 0.219  
 E (1km) 0.306  
 F (1km) 2.539  
 Cv (Summer) 0.750  
 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0    DVD Status OFF  
 Analysis Timestep Fine Inertia Status OFF  
 DTS Status ON

Profile(s) Summer and Winter  
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600,  
 720, 960, 1440  
 Return Period(s) (years) 100  
 Climate Change (%) 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	100	+40%	100/15	Summer			5.824
1.001	2	60 Summer	100	+40%					5.274
1.002	3	60 Summer	100	+40%	100/30	Summer			5.267
1.003	3	60 Summer	100	+40%	100/30	Summer			5.254

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m <sup>3</sup> )	Flow / Cap. (l/s)	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	0.194	0.000	1.29		285.9	FLOOD RISK	
1.001	2	-0.346	0.000	0.15		147.8	OK	
1.002	3	0.237	0.000	0.35		148.7	SURCHARGED	

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Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Flooded		Flow / Overflow		Pipe	Status	Level Exceeded
		Depth (m)	Volume (m <sup>3</sup> )	Cap.	(l/s)	Flow (l/s)		
1.003	3	0.274	0.000	0.10		149.6	SURCHARGED	

## CHART DATUMS & STANDARD LEVELS IN THE PORT OF LONDON

1. **Chart Datum** is set to approximately the level of Lowest Astronomical Tide (L.A.T.)
2. **Low Water levels** in the upper reaches of the tidal Thames are greatly affected by the land water flow at Teddington Weir. **They frequently fall below chart datum** when this flow is significantly reduced, typically during the summer months.
3. **Maintained level** and chart datum above Richmond half tide weir are both 1.72 metres above Ordnance Datum (Newlyn).
4. **Trinity High Water (T.H.W.)** is deemed, by the Port of London Act, 1968, to be a level having a value of 11.4 feet (**i.e. 3.475 metres**) above Ordnance Datum (Newlyn).

Tidal Station	Level of Chart Datum below Ordnance Datum (Newlyn) m	Standard levels above local C.D.				
		Mean Low Water Springs MLWS	Mean Low Water Neaps MLWN	Mean High Water Neaps MHWN	Mean High Water Springs MHWS	Highest Astronomical Tide (HAT)
WALTON	2.16	0.5	1.1	3.5	4.3	4.7
MARGATE	2.50	0.6	1.3	4.0	4.8	5.1
SHIVERING SAND	-	0.6	1.4	4.4	5.4	5.7
SOUTHEND	2.90	0.6	1.4	4.8	5.9	6.3
CANVEY	2.97	0.6	1.4	5.0	6.1	6.6
CORYTON	3.05	0.6	1.5	5.1	6.2	6.7
TILBURY	3.12	0.6	1.5	5.4	6.6	7.0
GREENHITHE	3.20	0.6	1.6	5.6	6.7	7.2
DAGENHAM	3.28	0.6	1.6	5.8	7.0	7.5
NORTH WOOLWICH	3.35	0.6	1.6	5.9	7.2	7.7
TOWER	3.20	0.5	1.5	5.9	7.1	7.6
BLACKFRIARS	3.05	0.5	1.4	5.8	7.0	7.5
WESTMINSTER	2.90	0.5	1.3	5.7	6.9	7.4
VAUXHALL	2.59	0.3	1.0	5.4	6.6	7.1
VICTORIA RAIL	2.44	0.3	0.9	5.3	6.5	6.9
ALBERT BRIDGE	2.29	0.3	0.9	5.1	6.3	6.8
WANDSWORTH	2.13	0.3	0.9	5.0	6.2	6.7
PUTNEY	1.98	0.3	0.8	4.9	6.1	6.6
HAMMERSMITH	1.68	0.3	0.7	4.7	5.8	6.4
BARNES	1.37	0.2	0.6	4.4	5.5	6.1
CHISWICK	1.22	0.2	0.5	4.3	5.3	6.0
KEW	1.07	0.2	0.5	4.2	5.2	5.9
BRENTFORD	0.91	0.1	0.4	4.0	5.0	5.7
RICHMOND	0.61	0.1	0.2	3.8	4.8	5.5
TWICKENHAM	Note 3	-		1.5	2.5	3.2



## **J. Surface Water Calculations**

### **Appendices**

The Former Stag Brewery, Mortlake

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Summary of Results for 1 year Return Period

Half Drain Time : 175 minutes.


Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m <sup>3</sup> )	Status
15 min Summer	0.064	0.064	0.0	1.3	0.0	1.3	17.6	O K
30 min Summer	0.078	0.078	0.0	1.6	0.0	1.6	21.3	O K
60 min Summer	0.091	0.091	0.0	1.9	0.0	1.9	25.1	O K
120 min Summer	0.103	0.103	0.0	2.0	0.0	2.0	28.2	O K
180 min Summer	0.109	0.109	0.0	2.0	0.0	2.0	29.9	O K
240 min Summer	0.113	0.113	0.0	2.1	0.0	2.1	31.1	O K
360 min Summer	0.117	0.117	0.0	2.1	0.0	2.1	32.2	O K
480 min Summer	0.118	0.118	0.0	2.1	0.0	2.1	32.5	O K
600 min Summer	0.118	0.118	0.0	2.1	0.0	2.1	32.4	O K
720 min Summer	0.116	0.116	0.0	2.1	0.0	2.1	32.0	O K
960 min Summer	0.110	0.110	0.0	2.0	0.0	2.0	30.2	O K
1440 min Summer	0.098	0.098	0.0	2.0	0.0	2.0	26.8	O K
2160 min Summer	0.085	0.085	0.0	1.7	0.0	1.7	23.2	O K
2880 min Summer	0.075	0.075	0.0	1.6	0.0	1.6	20.7	O K
4320 min Summer	0.063	0.063	0.0	1.3	0.0	1.3	17.2	O K
5760 min Summer	0.055	0.055	0.0	1.1	0.0	1.1	15.1	O K
7200 min Summer	0.050	0.050	0.0	0.9	0.0	0.9	13.7	O K
8640 min Summer	0.046	0.046	0.0	0.8	0.0	0.8	12.7	O K
10080 min Summer	0.043	0.043	0.0	0.7	0.0	0.7	11.9	O K
15 min Winter	0.072	0.072	0.0	1.5	0.0	1.5	19.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Overflow Volume (m <sup>3</sup> )	Time-Peak (mins)
15 min Summer	32.424	0.0	16.5	0.0	18
30 min Summer	20.266	0.0	21.0	0.0	32
60 min Summer	12.667	0.0	27.6	0.0	62
120 min Summer	7.917	0.0	34.7	0.0	104
180 min Summer	6.014	0.0	39.6	0.0	136
240 min Summer	4.949	0.0	43.5	0.0	170
360 min Summer	3.759	0.0	49.7	0.0	240
480 min Summer	3.093	0.0	54.6	0.0	308
600 min Summer	2.659	0.0	58.7	0.0	376
720 min Summer	2.350	0.0	62.3	0.0	442
960 min Summer	1.900	0.0	67.2	0.0	570
1440 min Summer	1.409	0.0	74.6	0.0	822
2160 min Summer	1.044	0.0	84.0	0.0	1188
2880 min Summer	0.845	0.0	90.4	0.0	1556
4320 min Summer	0.615	0.0	98.4	0.0	2252
5760 min Summer	0.492	0.0	105.8	0.0	2992
7200 min Summer	0.413	0.0	111.0	0.0	3744
8640 min Summer	0.358	0.0	115.3	0.0	4416
10080 min Summer	0.318	0.0	118.9	0.0	5144
15 min Winter	32.424	0.0	18.7	0.0	18

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 Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m <sup>3</sup> )	Status
30 min Winter	0.087	0.087	0.0	1.8	0.0	1.8	23.9	O K
60 min Winter	0.103	0.103	0.0	2.0	0.0	2.0	28.3	O K
120 min Winter	0.117	0.117	0.0	2.1	0.0	2.1	32.0	O K
180 min Winter	0.123	0.123	0.0	2.1	0.0	2.1	33.7	O K
240 min Winter	0.126	0.126	0.0	2.1	0.0	2.1	34.7	O K
<b>360 min Winter</b>	<b>0.129</b>	<b>0.129</b>	<b>0.0</b>	<b>2.1</b>	<b>0.0</b>	<b>2.1</b>	<b>35.3</b>	<b>O K</b>
480 min Winter	0.127	0.127	0.0	2.1	0.0	2.1	35.0	O K
600 min Winter	0.125	0.125	0.0	2.1	0.0	2.1	34.2	O K
720 min Winter	0.121	0.121	0.0	2.1	0.0	2.1	33.2	O K
960 min Winter	0.110	0.110	0.0	2.0	0.0	2.0	30.2	O K
1440 min Winter	0.093	0.093	0.0	1.9	0.0	1.9	25.4	O K
2160 min Winter	0.076	0.076	0.0	1.6	0.0	1.6	20.9	O K
2880 min Winter	0.066	0.066	0.0	1.4	0.0	1.4	18.1	O K
4320 min Winter	0.054	0.054	0.0	1.0	0.0	1.0	14.8	O K
5760 min Winter	0.047	0.047	0.0	0.8	0.0	0.8	12.9	O K
7200 min Winter	0.043	0.043	0.0	0.7	0.0	0.7	11.7	O K
8640 min Winter	0.039	0.039	0.0	0.6	0.0	0.6	10.8	O K
10080 min Winter	0.037	0.037	0.0	0.6	0.0	0.6	10.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Overflow Volume (m <sup>3</sup> )	Time-Peak (mins)
30 min Winter	20.266	0.0	23.7	0.0	32
60 min Winter	12.667	0.0	31.0	0.0	60
120 min Winter	7.917	0.0	39.0	0.0	114
180 min Winter	6.014	0.0	44.5	0.0	144
240 min Winter	4.949	0.0	48.9	0.0	182
<b>360 min Winter</b>	<b>3.759</b>	<b>0.0</b>	<b>55.8</b>	<b>0.0</b>	<b>260</b>
480 min Winter	3.093	0.0	61.3	0.0	334
600 min Winter	2.659	0.0	65.9	0.0	406
720 min Winter	2.350	0.0	69.9	0.0	476
960 min Winter	1.900	0.0	75.4	0.0	606
1440 min Winter	1.409	0.0	83.7	0.0	852
2160 min Winter	1.044	0.0	94.1	0.0	1216
2880 min Winter	0.845	0.0	101.4	0.0	1584
4320 min Winter	0.615	0.0	110.4	0.0	2292
5760 min Winter	0.492	0.0	118.5	0.0	3000
7200 min Winter	0.413	0.0	124.4	0.0	3744
8640 min Winter	0.358	0.0	129.3	0.0	4496
10080 min Winter	0.318	0.0	133.3	0.0	5152

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Innovyze	Source Control 2019.1	


Rainfall Details

Rainfall Model	FEH
Return Period (years)	1
FEH Rainfall Version	1999
Site Location	GB 520450 176000 TQ 20450 76000
C (1km)	-0.024
D1 (1km)	0.322
D2 (1km)	0.262
D3 (1km)	0.219
E (1km)	0.306
F (1km)	2.539
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) 0.300

Time (mins)	Area
From:	To: (ha)
0	4 0.300

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Model Details

Storage is Online Cover Level (m) 0.935

Cellular Storage Structure

Invert Level (m) 0.000 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 <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	289.0	0.0	0.935	289.0	0.0


Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0074-2400-1000-2400  
 Design Head (m) 1.000  
 Design Flow (l/s) 2.4  
 Flush-Flo™ Calculated  
 Objective Minimise upstream storage  
 Application Surface  
 Sump Available Yes  
 Diameter (mm) 74  
 Invert Level (m) 0.000  
 Minimum Outlet Pipe Diameter (mm) 100  
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.4
Flush-Flo™	0.309	2.4
Kick-Flo®	0.630	1.9
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	2.0	1.200	2.6	3.000	4.0	7.000	5.9
0.200	2.3	1.400	2.8	3.500	4.3	7.500	6.1
0.300	2.4	1.600	3.0	4.000	4.6	8.000	6.3
0.400	2.4	1.800	3.1	4.500	4.8	8.500	6.5
0.500	2.3	2.000	3.3	5.000	5.1	9.000	6.7
0.600	2.1	2.200	3.4	5.500	5.3	9.500	6.8
0.800	2.2	2.400	3.6	6.000	5.5		
1.000	2.4	2.600	3.7	6.500	5.7		

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Weir Overflow Control

Discharge Coef 0.544 Width (m) 2.000 Invert Level (m) 0.935

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Summary of Results for 100 year Return Period

Half Drain Time : 547 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m <sup>3</sup> )	Status
15 min Summer	0.310	0.310	0.0	2.4	0.0	2.4	85.1	O K
30 min Summer	0.355	0.355	0.0	2.4	0.0	2.4	97.4	O K
60 min Summer	0.401	0.401	0.0	2.4	0.0	2.4	110.2	O K
120 min Summer	0.446	0.446	0.0	2.4	0.0	2.4	122.5	O K
180 min Summer	0.468	0.468	0.0	2.4	0.0	2.4	128.4	O K
240 min Summer	0.479	0.479	0.0	2.4	0.0	2.4	131.4	O K
360 min Summer	0.484	0.484	0.0	2.4	0.0	2.4	132.9	O K
480 min Summer	0.479	0.479	0.0	2.4	0.0	2.4	131.4	O K
600 min Summer	0.472	0.472	0.0	2.4	0.0	2.4	129.7	O K
720 min Summer	0.465	0.465	0.0	2.4	0.0	2.4	127.7	O K
960 min Summer	0.439	0.439	0.0	2.4	0.0	2.4	120.5	O K
1440 min Summer	0.390	0.390	0.0	2.4	0.0	2.4	107.1	O K
2160 min Summer	0.327	0.327	0.0	2.4	0.0	2.4	89.7	O K
2880 min Summer	0.274	0.274	0.0	2.4	0.0	2.4	75.3	O K
4320 min Summer	0.191	0.191	0.0	2.3	0.0	2.3	52.4	O K
5760 min Summer	0.140	0.140	0.0	2.2	0.0	2.2	38.3	O K
7200 min Summer	0.108	0.108	0.0	2.0	0.0	2.0	29.7	O K
8640 min Summer	0.091	0.091	0.0	1.9	0.0	1.9	25.0	O K
10080 min Summer	0.081	0.081	0.0	1.7	0.0	1.7	22.1	O K
15 min Winter	0.348	0.348	0.0	2.4	0.0	2.4	95.5	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Overflow Volume (m <sup>3</sup> )	Time-Peak (mins)
15 min Summer	154.409	0.0	84.2	0.0	19
30 min Summer	89.400	0.0	97.6	0.0	33
60 min Summer	51.761	0.0	115.3	0.0	64
120 min Summer	29.969	0.0	133.6	0.0	122
180 min Summer	21.769	0.0	145.6	0.0	182
240 min Summer	17.352	0.0	154.8	0.0	242
360 min Summer	12.604	0.0	168.7	0.0	360
480 min Summer	10.046	0.0	179.2	0.0	438
600 min Summer	8.426	0.0	187.9	0.0	492
720 min Summer	7.298	0.0	195.3	0.0	554
960 min Summer	5.717	0.0	203.9	0.0	674
1440 min Summer	4.053	0.0	216.5	0.0	938
2160 min Summer	2.873	0.0	232.0	0.0	1340
2880 min Summer	2.251	0.0	242.3	0.0	1704
4320 min Summer	1.568	0.0	252.6	0.0	2424
5760 min Summer	1.214	0.0	261.7	0.0	3112
7200 min Summer	0.995	0.0	268.0	0.0	3816
8640 min Summer	0.845	0.0	273.2	0.0	4488
10080 min Summer	0.737	0.0	277.2	0.0	5152
15 min Winter	154.409	0.0	94.4	0.0	19

Summary of Results for 100 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m <sup>3</sup> )	Status
30 min Winter	0.399	0.399	0.0	2.4	0.0	2.4	109.4	O K
60 min Winter	0.452	0.452	0.0	2.4	0.0	2.4	124.1	O K
120 min Winter	0.505	0.505	0.0	2.4	0.0	2.4	138.6	O K
180 min Winter	0.531	0.531	0.0	2.4	0.0	2.4	145.9	O K
240 min Winter	0.547	0.547	0.0	2.4	0.0	2.4	150.1	O K
<b>360 min Winter</b>	<b>0.559</b>	<b>0.559</b>	<b>0.0</b>	<b>2.4</b>	<b>0.0</b>	<b>2.4</b>	<b>153.4</b>	<b>O K</b>
480 min Winter	0.558	0.558	0.0	2.4	0.0	2.4	153.2	O K
600 min Winter	0.550	0.550	0.0	2.4	0.0	2.4	150.9	O K
720 min Winter	0.537	0.537	0.0	2.4	0.0	2.4	147.4	O K
960 min Winter	0.502	0.502	0.0	2.4	0.0	2.4	137.7	O K
1440 min Winter	0.433	0.433	0.0	2.4	0.0	2.4	118.9	O K
2160 min Winter	0.340	0.340	0.0	2.4	0.0	2.4	93.3	O K
2880 min Winter	0.264	0.264	0.0	2.4	0.0	2.4	72.4	O K
4320 min Winter	0.156	0.156	0.0	2.2	0.0	2.2	42.8	O K
5760 min Winter	0.102	0.102	0.0	2.0	0.0	2.0	28.0	O K
7200 min Winter	0.082	0.082	0.0	1.7	0.0	1.7	22.6	O K
8640 min Winter	0.071	0.071	0.0	1.5	0.0	1.5	19.4	O K
10080 min Winter	0.063	0.063	0.0	1.3	0.0	1.3	17.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Overflow Volume (m <sup>3</sup> )	Time-Peak (mins)
30 min Winter	89.400	0.0	109.4	0.0	33
60 min Winter	51.761	0.0	129.2	0.0	62
120 min Winter	29.969	0.0	149.7	0.0	120
180 min Winter	21.769	0.0	163.2	0.0	178
240 min Winter	17.352	0.0	173.4	0.0	236
<b>360 min Winter</b>	<b>12.604</b>	<b>0.0</b>	<b>188.9</b>	<b>0.0</b>	<b>350</b>
480 min Winter	10.046	0.0	200.8	0.0	462
600 min Winter	8.426	0.0	210.4	0.0	566
720 min Winter	7.298	0.0	218.7	0.0	656
960 min Winter	5.717	0.0	228.3	0.0	734
1440 min Winter	4.053	0.0	242.4	0.0	1026
2160 min Winter	2.873	0.0	259.9	0.0	1448
2880 min Winter	2.251	0.0	271.5	0.0	1816
4320 min Winter	1.568	0.0	283.1	0.0	2508
5760 min Winter	1.214	0.0	293.2	0.0	3120
7200 min Winter	0.995	0.0	300.3	0.0	3816
8640 min Winter	0.845	0.0	306.0	0.0	4496
10080 min Winter	0.737	0.0	310.7	0.0	5152



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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 520450 176000 TQ 20450 76000
C (1km)	-0.024
D1 (1km)	0.322
D2 (1km)	0.262
D3 (1km)	0.219
E (1km)	0.306
F (1km)	2.539
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) 0.300

Time (mins)	Area
From:	To: (ha)
0	4 0.300

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Model Details

Storage is Online Cover Level (m) 0.935

Cellular Storage Structure

Invert Level (m) 0.000 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 <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	289.0	0.0	0.935	289.0	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0074-2400-1000-2400  
 Design Head (m) 1.000  
 Design Flow (l/s) 2.4  
 Flush-Flo™ Calculated  
 Objective Minimise upstream storage  
 Application Surface  
 Sump Available Yes  
 Diameter (mm) 74  
 Invert Level (m) 0.000  
 Minimum Outlet Pipe Diameter (mm) 100  
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.4
Flush-Flo™	0.309	2.4
Kick-Flo®	0.630	1.9
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	2.0	1.200	2.6	3.000	4.0	7.000	5.9
0.200	2.3	1.400	2.8	3.500	4.3	7.500	6.1
0.300	2.4	1.600	3.0	4.000	4.6	8.000	6.3
0.400	2.4	1.800	3.1	4.500	4.8	8.500	6.5
0.500	2.3	2.000	3.3	5.000	5.1	9.000	6.7
0.600	2.1	2.200	3.4	5.500	5.3	9.500	6.8
0.800	2.2	2.400	3.6	6.000	5.5		
1.000	2.4	2.600	3.7	6.500	5.7		

Pickfords Wharf  
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Weir Overflow Control

Discharge Coef 0.544 Width (m) 2.000 Invert Level (m) 0.935

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

Half Drain Time : 824 minutes.


Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	0.436	0.436	0.0	2.4	0.0	2.4	119.8	O K
30 min Summer	0.501	0.501	0.0	2.4	0.0	2.4	137.4	O K
60 min Summer	0.570	0.570	0.0	2.4	0.0	2.4	156.6	O K
120 min Summer	0.642	0.642	0.0	2.4	0.0	2.4	176.4	Flood Risk
180 min Summer	0.682	0.682	0.0	2.4	0.0	2.4	187.2	Flood Risk
240 min Summer	0.706	0.706	0.0	2.4	0.0	2.4	193.9	Flood Risk
360 min Summer	0.732	0.732	0.0	2.4	0.0	2.4	200.9	Flood Risk
480 min Summer	0.740	0.740	0.0	2.4	0.0	2.4	203.2	Flood Risk
600 min Summer	0.739	0.739	0.0	2.4	0.0	2.4	202.9	Flood Risk
720 min Summer	0.732	0.732	0.0	2.4	0.0	2.4	201.0	Flood Risk
960 min Summer	0.699	0.699	0.0	2.4	0.0	2.4	191.9	Flood Risk
1440 min Summer	0.639	0.639	0.0	2.4	0.0	2.4	175.4	Flood Risk
2160 min Summer	0.552	0.552	0.0	2.4	0.0	2.4	151.6	O K
2880 min Summer	0.481	0.481	0.0	2.4	0.0	2.4	132.0	O K
4320 min Summer	0.353	0.353	0.0	2.4	0.0	2.4	97.0	O K
5760 min Summer	0.262	0.262	0.0	2.4	0.0	2.4	71.9	O K
7200 min Summer	0.198	0.198	0.0	2.3	0.0	2.3	54.5	O K
8640 min Summer	0.155	0.155	0.0	2.2	0.0	2.2	42.5	O K
10080 min Summer	0.125	0.125	0.0	2.1	0.0	2.1	34.3	O K
15 min Winter	0.489	0.489	0.0	2.4	0.0	2.4	134.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	216.173	0.0	118.1	0.0	19
30 min Summer	125.161	0.0	136.5	0.0	34
60 min Summer	72.466	0.0	161.7	0.0	64
120 min Summer	41.957	0.0	187.2	0.0	124
180 min Summer	30.477	0.0	204.0	0.0	182
240 min Summer	24.292	0.0	216.7	0.0	242
360 min Summer	17.646	0.0	236.0	0.0	362
480 min Summer	14.065	0.0	250.7	0.0	482
600 min Summer	11.796	0.0	262.7	0.0	600
720 min Summer	10.217	0.0	272.8	0.0	714
960 min Summer	8.004	0.0	284.4	0.0	818
1440 min Summer	5.674	0.0	300.6	0.0	1068
2160 min Summer	4.023	0.0	325.0	0.0	1428
2880 min Summer	3.151	0.0	339.4	0.0	1816
4320 min Summer	2.196	0.0	354.1	0.0	2552
5760 min Summer	1.699	0.0	366.6	0.0	3280
7200 min Summer	1.392	0.0	375.4	0.0	3960
8640 min Summer	1.184	0.0	382.7	0.0	4592
10080 min Summer	1.032	0.0	388.6	0.0	5336
15 min Winter	216.173	0.0	132.1	0.0	19

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 Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	0.562	0.562	0.0	2.4	0.0	2.4	154.3	O K
60 min Winter	0.642	0.642	0.0	2.4	0.0	2.4	176.2	Flood Risk
120 min Winter	0.725	0.725	0.0	2.4	0.0	2.4	198.9	Flood Risk
180 min Winter	0.770	0.770	0.0	2.4	0.0	2.4	211.5	Flood Risk
240 min Winter	0.799	0.799	0.0	2.4	0.0	2.4	219.5	Flood Risk
360 min Winter	0.832	0.832	0.0	2.4	0.0	2.4	228.3	Flood Risk
480 min Winter	0.845	0.845	0.0	2.4	0.0	2.4	232.1	Flood Risk
600 min Winter	0.848	0.848	0.0	2.4	0.0	2.4	232.9	Flood Risk
720 min Winter	0.845	0.845	0.0	2.4	0.0	2.4	231.9	Flood Risk
960 min Winter	0.808	0.808	0.0	2.4	0.0	2.4	221.9	Flood Risk
1440 min Winter	0.735	0.735	0.0	2.4	0.0	2.4	201.7	Flood Risk
2160 min Winter	0.627	0.627	0.0	2.4	0.0	2.4	172.2	O K
2880 min Winter	0.514	0.514	0.0	2.4	0.0	2.4	141.2	O K
4320 min Winter	0.329	0.329	0.0	2.4	0.0	2.4	90.2	O K
5760 min Winter	0.210	0.210	0.0	2.3	0.0	2.3	57.7	O K
7200 min Winter	0.141	0.141	0.0	2.2	0.0	2.2	38.7	O K
8640 min Winter	0.103	0.103	0.0	2.0	0.0	2.0	28.2	O K
10080 min Winter	0.087	0.087	0.0	1.8	0.0	1.8	23.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
30 min Winter	125.161	0.0	152.3	0.0	33
60 min Winter	72.466	0.0	181.1	0.0	62
120 min Winter	41.957	0.0	209.7	0.0	122
180 min Winter	30.477	0.0	228.4	0.0	180
240 min Winter	24.292	0.0	242.7	0.0	238
360 min Winter	17.646	0.0	264.2	0.0	354
480 min Winter	14.065	0.0	280.5	0.0	468
600 min Winter	11.796	0.0	293.7	0.0	582
720 min Winter	10.217	0.0	304.8	0.0	692
960 min Winter	8.004	0.0	317.2	0.0	902
1440 min Winter	5.674	0.0	332.2	0.0	1124
2160 min Winter	4.023	0.0	364.0	0.0	1596
2880 min Winter	3.151	0.0	380.2	0.0	1984
4320 min Winter	2.196	0.0	396.9	0.0	2720
5760 min Winter	1.699	0.0	410.6	0.0	3392
7200 min Winter	1.392	0.0	420.6	0.0	4032
8640 min Winter	1.184	0.0	428.7	0.0	4584
10080 min Winter	1.032	0.0	435.5	0.0	5248

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 520450 176000 TQ 20450 76000
C (1km)	-0.024
D1 (1km)	0.322
D2 (1km)	0.262
D3 (1km)	0.219
E (1km)	0.306
F (1km)	2.539
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) 0.300

Time (mins)	Area
From:	To: (ha)
0	4 0.300

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Model Details

Storage is Online Cover Level (m) 0.935

Cellular Storage Structure

Invert Level (m) 0.000 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 <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	289.0	0.0	0.935	289.0	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0074-2400-1000-2400  
 Design Head (m) 1.000  
 Design Flow (l/s) 2.4  
 Flush-Flo™ Calculated  
 Objective Minimise upstream storage  
 Application Surface  
 Sump Available Yes  
 Diameter (mm) 74  
 Invert Level (m) 0.000  
 Minimum Outlet Pipe Diameter (mm) 100  
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.4
Flush-Flo™	0.309	2.4
Kick-Flo®	0.630	1.9
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	2.0	1.200	2.6	3.000	4.0	7.000	5.9
0.200	2.3	1.400	2.8	3.500	4.3	7.500	6.1
0.300	2.4	1.600	3.0	4.000	4.6	8.000	6.3
0.400	2.4	1.800	3.1	4.500	4.8	8.500	6.5
0.500	2.3	2.000	3.3	5.000	5.1	9.000	6.7
0.600	2.1	2.200	3.4	5.500	5.3	9.500	6.8
0.800	2.2	2.400	3.6	6.000	5.5		
1.000	2.4	2.600	3.7	6.500	5.7		

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London, SE1 9DG



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File 220803\_SrcCtrl\_Cat1\_Q10...


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Innovyze Source Control 2019.1

Weir Overflow Control

Discharge Coef 0.544 Width (m) 2.000 Invert Level (m) 0.935



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Pickfords Wharf Clink Street London, SE1 9DG		
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Summary of Results for 30 year Return Period

Half Drain Time : 376 minutes.


Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m <sup>3</sup> )	Status
15 min Summer	0.204	0.204	0.0	2.3	0.0	2.3	56.0	O K
30 min Summer	0.237	0.237	0.0	2.4	0.0	2.4	65.1	O K
60 min Summer	0.272	0.272	0.0	2.4	0.0	2.4	74.6	O K
120 min Summer	0.304	0.304	0.0	2.4	0.0	2.4	83.4	O K
180 min Summer	0.318	0.318	0.0	2.4	0.0	2.4	87.3	O K
240 min Summer	0.324	0.324	0.0	2.4	0.0	2.4	88.8	O K
360 min Summer	0.326	0.326	0.0	2.4	0.0	2.4	89.4	O K
480 min Summer	0.325	0.325	0.0	2.4	0.0	2.4	89.2	O K
600 min Summer	0.322	0.322	0.0	2.4	0.0	2.4	88.4	O K
720 min Summer	0.317	0.317	0.0	2.4	0.0	2.4	87.2	O K
960 min Summer	0.299	0.299	0.0	2.4	0.0	2.4	82.1	O K
1440 min Summer	0.264	0.264	0.0	2.4	0.0	2.4	72.4	O K
2160 min Summer	0.217	0.217	0.0	2.3	0.0	2.3	59.7	O K
2880 min Summer	0.181	0.181	0.0	2.3	0.0	2.3	49.6	O K
4320 min Summer	0.127	0.127	0.0	2.1	0.0	2.1	34.9	O K
5760 min Summer	0.097	0.097	0.0	2.0	0.0	2.0	26.7	O K
7200 min Summer	0.083	0.083	0.0	1.7	0.0	1.7	22.8	O K
8640 min Summer	0.073	0.073	0.0	1.5	0.0	1.5	20.0	O K
10080 min Summer	0.066	0.066	0.0	1.4	0.0	1.4	18.1	O K
15 min Winter	0.229	0.229	0.0	2.4	0.0	2.4	62.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Overflow Volume (m <sup>3</sup> )	Time-Peak (mins)
15 min Summer	102.217	0.0	55.3	0.0	19
30 min Summer	60.391	0.0	65.6	0.0	33
60 min Summer	35.680	0.0	79.2	0.0	62
120 min Summer	21.080	0.0	93.8	0.0	122
180 min Summer	15.495	0.0	103.4	0.0	180
240 min Summer	12.455	0.0	110.9	0.0	240
360 min Summer	9.155	0.0	122.3	0.0	302
480 min Summer	7.358	0.0	131.1	0.0	364
600 min Summer	6.212	0.0	138.4	0.0	428
720 min Summer	5.409	0.0	144.6	0.0	498
960 min Summer	4.273	0.0	152.3	0.0	634
1440 min Summer	3.065	0.0	163.7	0.0	896
2160 min Summer	2.199	0.0	177.4	0.0	1280
2880 min Summer	1.737	0.0	186.8	0.0	1648
4320 min Summer	1.225	0.0	197.0	0.0	2336
5760 min Summer	0.956	0.0	206.0	0.0	3008
7200 min Summer	0.788	0.0	212.3	0.0	3744
8640 min Summer	0.674	0.0	217.5	0.0	4416
10080 min Summer	0.590	0.0	221.7	0.0	5144
15 min Winter	102.217	0.0	62.1	0.0	18

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 Overflow (l/s)	Max Outflow (l/s)	Max Volume (m <sup>3</sup> )	Status
30 min Winter	0.266	0.266	0.0	2.4	0.0	2.4	73.1	O K
60 min Winter	0.306	0.306	0.0	2.4	0.0	2.4	84.1	O K
120 min Winter	0.344	0.344	0.0	2.4	0.0	2.4	94.5	O K
180 min Winter	0.362	0.362	0.0	2.4	0.0	2.4	99.4	O K
240 min Winter	0.371	0.371	0.0	2.4	0.0	2.4	101.8	O K
<b>360 min Winter</b>	<b>0.375</b>	<b>0.375</b>	<b>0.0</b>	<b>2.4</b>	<b>0.0</b>	<b>2.4</b>	<b>102.9</b>	<b>O K</b>
480 min Winter	0.370	0.370	0.0	2.4	0.0	2.4	101.6	O K
600 min Winter	0.365	0.365	0.0	2.4	0.0	2.4	100.3	O K
720 min Winter	0.358	0.358	0.0	2.4	0.0	2.4	98.3	O K
960 min Winter	0.332	0.332	0.0	2.4	0.0	2.4	91.1	O K
1440 min Winter	0.279	0.279	0.0	2.4	0.0	2.4	76.5	O K
2160 min Winter	0.211	0.211	0.0	2.3	0.0	2.3	58.0	O K
2880 min Winter	0.161	0.161	0.0	2.2	0.0	2.2	44.2	O K
4320 min Winter	0.099	0.099	0.0	2.0	0.0	2.0	27.3	O K
5760 min Winter	0.078	0.078	0.0	1.6	0.0	1.6	21.4	O K
7200 min Winter	0.066	0.066	0.0	1.4	0.0	1.4	18.1	O K
8640 min Winter	0.059	0.059	0.0	1.2	0.0	1.2	16.1	O K
10080 min Winter	0.054	0.054	0.0	1.0	0.0	1.0	14.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Overflow Volume (m <sup>3</sup> )	Time-Peak (mins)
30 min Winter	60.391	0.0	73.6	0.0	33
60 min Winter	35.680	0.0	88.8	0.0	62
120 min Winter	21.080	0.0	105.1	0.0	120
180 min Winter	15.495	0.0	115.9	0.0	178
240 min Winter	12.455	0.0	124.3	0.0	234
<b>360 min Winter</b>	<b>9.155</b>	<b>0.0</b>	<b>137.1</b>	<b>0.0</b>	<b>342</b>
480 min Winter	7.358	0.0	147.0	0.0	392
600 min Winter	6.212	0.0	155.1	0.0	464
720 min Winter	5.409	0.0	162.0	0.0	542
960 min Winter	4.273	0.0	170.6	0.0	692
1440 min Winter	3.065	0.0	183.4	0.0	970
2160 min Winter	2.199	0.0	198.8	0.0	1364
2880 min Winter	1.737	0.0	209.3	0.0	1728
4320 min Winter	1.225	0.0	220.8	0.0	2376
5760 min Winter	0.956	0.0	230.8	0.0	3056
7200 min Winter	0.788	0.0	237.9	0.0	3744
8640 min Winter	0.674	0.0	243.8	0.0	4488
10080 min Winter	0.590	0.0	248.5	0.0	5152

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	1999
Site Location	GB 520450 176000 TQ 20450 76000
C (1km)	-0.024
D1 (1km)	0.322
D2 (1km)	0.262
D3 (1km)	0.219
E (1km)	0.306
F (1km)	2.539
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) 0.300

Time (mins)	Area
From:	To: (ha)
0	4 0.300

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Model Details

Storage is Online Cover Level (m) 0.935

Cellular Storage Structure

Invert Level (m) 0.000 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 <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	289.0	0.0	0.935	289.0	0.0


Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0074-2400-1000-2400  
 Design Head (m) 1.000  
 Design Flow (l/s) 2.4  
 Flush-Flo™ Calculated  
 Objective Minimise upstream storage  
 Application Surface  
 Sump Available Yes  
 Diameter (mm) 74  
 Invert Level (m) 0.000  
 Minimum Outlet Pipe Diameter (mm) 100  
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.4
Flush-Flo™	0.309	2.4
Kick-Flo®	0.630	1.9
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	2.0	1.200	2.6	3.000	4.0	7.000	5.9
0.200	2.3	1.400	2.8	3.500	4.3	7.500	6.1
0.300	2.4	1.600	3.0	4.000	4.6	8.000	6.3
0.400	2.4	1.800	3.1	4.500	4.8	8.500	6.5
0.500	2.3	2.000	3.3	5.000	5.1	9.000	6.7
0.600	2.1	2.200	3.4	5.500	5.3	9.500	6.8
0.800	2.2	2.400	3.6	6.000	5.5		
1.000	2.4	2.600	3.7	6.500	5.7		

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Weir Overflow Control

Discharge Coef 0.544 Width (m) 2.000 Invert Level (m) 0.935

Summary of Results for 1 year Return Period

Half Drain Time : 186 minutes.


Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m <sup>3</sup> )	Status
15 min Summer	0.108	0.108	0.0	1.3	0.0	1.3	14.5	O K
30 min Summer	0.131	0.131	0.0	1.3	0.0	1.3	17.6	O K
60 min Summer	0.155	0.155	0.0	1.3	0.0	1.3	20.8	O K
120 min Summer	0.176	0.176	0.0	1.4	0.0	1.4	23.6	O K
180 min Summer	0.186	0.186	0.0	1.4	0.0	1.4	24.9	O K
240 min Summer	0.192	0.192	0.0	1.4	0.0	1.4	25.7	O K
360 min Summer	0.197	0.197	0.0	1.4	0.0	1.4	26.4	O K
480 min Summer	0.198	0.198	0.0	1.4	0.0	1.4	26.5	O K
600 min Summer	0.196	0.196	0.0	1.4	0.0	1.4	26.2	O K
720 min Summer	0.192	0.192	0.0	1.4	0.0	1.4	25.8	O K
960 min Summer	0.179	0.179	0.0	1.4	0.0	1.4	24.0	O K
1440 min Summer	0.154	0.154	0.0	1.3	0.0	1.3	20.6	O K
2160 min Summer	0.123	0.123	0.0	1.3	0.0	1.3	16.5	O K
2880 min Summer	0.101	0.101	0.0	1.2	0.0	1.2	13.6	O K
4320 min Summer	0.075	0.075	0.0	1.1	0.0	1.1	10.1	O K
5760 min Summer	0.063	0.063	0.0	0.9	0.0	0.9	8.4	O K
7200 min Summer	0.055	0.055	0.0	0.8	0.0	0.8	7.3	O K
8640 min Summer	0.049	0.049	0.0	0.7	0.0	0.7	6.6	O K
10080 min Summer	0.046	0.046	0.0	0.6	0.0	0.6	6.1	O K
15 min Winter	0.121	0.121	0.0	1.3	0.0	1.3	16.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Overflow Volume (m <sup>3</sup> )	Time-Peak (mins)
15 min Summer	32.424	0.0	14.7	0.0	18
30 min Summer	20.266	0.0	18.5	0.0	33
60 min Summer	12.667	0.0	23.5	0.0	62
120 min Summer	7.917	0.0	29.4	0.0	118
180 min Summer	6.014	0.0	33.6	0.0	148
240 min Summer	4.949	0.0	36.8	0.0	182
360 min Summer	3.759	0.0	42.0	0.0	250
480 min Summer	3.093	0.0	46.1	0.0	320
600 min Summer	2.659	0.0	49.5	0.0	388
720 min Summer	2.350	0.0	52.5	0.0	456
960 min Summer	1.900	0.0	56.7	0.0	590
1440 min Summer	1.409	0.0	63.0	0.0	850
2160 min Summer	1.044	0.0	70.3	0.0	1212
2880 min Summer	0.845	0.0	75.8	0.0	1560
4320 min Summer	0.615	0.0	82.7	0.0	2252
5760 min Summer	0.492	0.0	88.4	0.0	2992
7200 min Summer	0.413	0.0	92.8	0.0	3680
8640 min Summer	0.358	0.0	96.5	0.0	4408
10080 min Summer	0.318	0.0	99.7	0.0	5136
15 min Winter	32.424	0.0	16.5	0.0	18

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 Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	0.148	0.148	0.0	1.3	0.0	1.3	19.8	O K
60 min Winter	0.176	0.176	0.0	1.4	0.0	1.4	23.6	O K
120 min Winter	0.201	0.201	0.0	1.4	0.0	1.4	27.0	O K
180 min Winter	0.212	0.212	0.0	1.4	0.0	1.4	28.4	O K
240 min Winter	0.217	0.217	0.0	1.4	0.0	1.4	29.0	O K
<b>360 min Winter</b>	<b>0.221</b>	<b>0.221</b>	<b>0.0</b>	<b>1.4</b>	<b>0.0</b>	<b>1.4</b>	<b>29.6</b>	<b>O K</b>
480 min Winter	0.219	0.219	0.0	1.4	0.0	1.4	29.3	O K
600 min Winter	0.214	0.214	0.0	1.4	0.0	1.4	28.6	O K
720 min Winter	0.207	0.207	0.0	1.4	0.0	1.4	27.7	O K
960 min Winter	0.185	0.185	0.0	1.4	0.0	1.4	24.8	O K
1440 min Winter	0.147	0.147	0.0	1.3	0.0	1.3	19.6	O K
2160 min Winter	0.105	0.105	0.0	1.2	0.0	1.2	14.0	O K
2880 min Winter	0.081	0.081	0.0	1.1	0.0	1.1	10.9	O K
4320 min Winter	0.060	0.060	0.0	0.9	0.0	0.9	8.0	O K
5760 min Winter	0.050	0.050	0.0	0.7	0.0	0.7	6.7	O K
7200 min Winter	0.044	0.044	0.0	0.6	0.0	0.6	5.9	O K
8640 min Winter	0.040	0.040	0.0	0.5	0.0	0.5	5.4	O K
10080 min Winter	0.037	0.037	0.0	0.5	0.0	0.5	5.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
30 min Winter	20.266	0.0	20.7	0.0	32
60 min Winter	12.667	0.0	26.3	0.0	60
120 min Winter	7.917	0.0	33.0	0.0	116
180 min Winter	6.014	0.0	37.6	0.0	170
240 min Winter	4.949	0.0	41.3	0.0	194
<b>360 min Winter</b>	<b>3.759</b>	<b>0.0</b>	<b>47.1</b>	<b>0.0</b>	<b>272</b>
480 min Winter	3.093	0.0	51.7	0.0	348
600 min Winter	2.659	0.0	55.5	0.0	422
720 min Winter	2.350	0.0	58.9	0.0	498
960 min Winter	1.900	0.0	63.5	0.0	636
1440 min Winter	1.409	0.0	70.6	0.0	896
2160 min Winter	1.044	0.0	78.8	0.0	1252
2880 min Winter	0.845	0.0	84.9	0.0	1584
4320 min Winter	0.615	0.0	92.7	0.0	2288
5760 min Winter	0.492	0.0	99.0	0.0	2992
7200 min Winter	0.413	0.0	103.9	0.0	3680
8640 min Winter	0.358	0.0	108.1	0.0	4400
10080 min Winter	0.318	0.0	111.7	0.0	5136

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Rainfall Details


Rainfall Model	FEH
Return Period (years)	1
FEH Rainfall Version	1999
Site Location	GB 520450 176000 TQ 20450 76000
C (1km)	-0.024
D1 (1km)	0.322
D2 (1km)	0.262
D3 (1km)	0.219
E (1km)	0.306
F (1km)	2.539
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) 0.250

Time (mins)	Area
From:	To: (ha)
0	4 0.250



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Model Details

Storage is Online Cover Level (m) 1.600

Cellular Storage Structure

Invert Level (m) 0.000 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 <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	141.0	0.0	1.600	141.0	0.0


Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0058-1900-1600-1900  
 Design Head (m) 1.600  
 Design Flow (l/s) 1.9  
 Flush-Flo™ Calculated  
 Objective Minimise upstream storage  
 Application Surface  
 Sump Available Yes  
 Diameter (mm) 58  
 Invert Level (m) 0.000  
 Minimum Outlet Pipe Diameter (mm) 75  
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.600	1.9
Flush-Flo™	0.255	1.4
Kick-Flo®	0.520	1.1
Mean Flow over Head Range	-	1.4


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	1.2	1.200	1.7	3.000	2.5	7.000	3.7
0.200	1.4	1.400	1.8	3.500	2.7	7.500	3.9
0.300	1.4	1.600	1.9	4.000	2.9	8.000	4.0
0.400	1.3	1.800	2.0	4.500	3.1	8.500	4.1
0.500	1.2	2.000	2.1	5.000	3.2	9.000	4.2
0.600	1.2	2.200	2.2	5.500	3.3	9.500	4.3
0.800	1.4	2.400	2.3	6.000	3.5		
1.000	1.5	2.600	2.4	6.500	3.6		

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Weir Overflow Control

Discharge Coef 0.544 Width (m) 2.000 Invert Level (m) 1.600


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Summary of Results for 100 year Return Period

Half Drain Time : 823 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	0.532	0.532	0.0	1.4	0.0	1.4	71.3	O K
30 min Summer	0.611	0.611	0.0	1.4	0.0	1.4	81.8	O K
60 min Summer	0.695	0.695	0.0	1.4	0.0	1.4	93.1	O K
120 min Summer	0.779	0.779	0.0	1.4	0.0	1.4	104.3	O K
180 min Summer	0.823	0.823	0.0	1.4	0.0	1.4	110.2	O K
240 min Summer	0.849	0.849	0.0	1.4	0.0	1.4	113.7	O K
360 min Summer	0.872	0.872	0.0	1.4	0.0	1.4	116.8	O K
480 min Summer	0.875	0.875	0.0	1.4	0.0	1.4	117.3	O K
600 min Summer	0.868	0.868	0.0	1.4	0.0	1.4	116.2	O K
720 min Summer	0.857	0.857	0.0	1.4	0.0	1.4	114.8	O K
960 min Summer	0.817	0.817	0.0	1.4	0.0	1.4	109.5	O K
1440 min Summer	0.749	0.749	0.0	1.4	0.0	1.4	100.4	O K
2160 min Summer	0.663	0.663	0.0	1.4	0.0	1.4	88.8	O K
2880 min Summer	0.586	0.586	0.0	1.4	0.0	1.4	78.5	O K
4320 min Summer	0.411	0.411	0.0	1.4	0.0	1.4	55.1	O K
5760 min Summer	0.289	0.289	0.0	1.4	0.0	1.4	38.7	O K
7200 min Summer	0.207	0.207	0.0	1.4	0.0	1.4	27.7	O K
8640 min Summer	0.154	0.154	0.0	1.3	0.0	1.3	20.6	O K
10080 min Summer	0.119	0.119	0.0	1.3	0.0	1.3	15.9	O K
15 min Winter	0.597	0.597	0.0	1.4	0.0	1.4	80.0	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	154.409	0.0	71.3	0.0	19
30 min Summer	89.400	0.0	82.4	0.0	34
60 min Summer	51.761	0.0	96.7	0.0	64
120 min Summer	29.969	0.0	111.9	0.0	122
180 min Summer	21.769	0.0	122.0	0.0	182
240 min Summer	17.352	0.0	129.6	0.0	242
360 min Summer	12.604	0.0	141.2	0.0	362
480 min Summer	10.046	0.0	150.0	0.0	480
600 min Summer	8.426	0.0	157.2	0.0	596
720 min Summer	7.298	0.0	163.4	0.0	642
960 min Summer	5.717	0.0	170.5	0.0	760
1440 min Summer	4.053	0.0	180.7	0.0	1022
2160 min Summer	2.873	0.0	193.7	0.0	1432
2880 min Summer	2.251	0.0	202.3	0.0	1848
4320 min Summer	1.568	0.0	211.3	0.0	2592
5760 min Summer	1.214	0.0	218.4	0.0	3288
7200 min Summer	0.995	0.0	223.7	0.0	3960
8640 min Summer	0.845	0.0	228.1	0.0	4584
10080 min Summer	0.737	0.0	231.7	0.0	5248
15 min Winter	154.409	0.0	79.7	0.0	19

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Summary of Results for 100 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	0.686	0.686	0.0	1.4	0.0	1.4	91.8	O K
60 min Winter	0.781	0.781	0.0	1.4	0.0	1.4	104.6	O K
120 min Winter	0.878	0.878	0.0	1.4	0.0	1.4	117.6	O K
180 min Winter	0.930	0.930	0.0	1.5	0.0	1.5	124.6	O K
240 min Winter	0.962	0.962	0.0	1.5	0.0	1.5	128.9	O K
360 min Winter	0.995	0.995	0.0	1.5	0.0	1.5	133.3	O K
480 min Winter	1.006	1.006	0.0	1.5	0.0	1.5	134.7	O K
600 min Winter	1.004	1.004	0.0	1.5	0.0	1.5	134.4	O K
720 min Winter	0.994	0.994	0.0	1.5	0.0	1.5	133.2	O K
960 min Winter	0.943	0.943	0.0	1.5	0.0	1.5	126.3	O K
1440 min Winter	0.860	0.860	0.0	1.4	0.0	1.4	115.2	O K
2160 min Winter	0.742	0.742	0.0	1.4	0.0	1.4	99.4	O K
2880 min Winter	0.632	0.632	0.0	1.4	0.0	1.4	84.7	O K
4320 min Winter	0.378	0.378	0.0	1.4	0.0	1.4	50.6	O K
5760 min Winter	0.219	0.219	0.0	1.4	0.0	1.4	29.3	O K
7200 min Winter	0.135	0.135	0.0	1.3	0.0	1.3	18.0	O K
8640 min Winter	0.092	0.092	0.0	1.2	0.0	1.2	12.3	O K
10080 min Winter	0.075	0.075	0.0	1.1	0.0	1.1	10.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
30 min Winter	89.400	0.0	91.9	0.0	33
60 min Winter	51.761	0.0	108.3	0.0	62
120 min Winter	29.969	0.0	125.4	0.0	122
180 min Winter	21.769	0.0	136.6	0.0	180
240 min Winter	17.352	0.0	145.1	0.0	238
360 min Winter	12.604	0.0	158.1	0.0	352
480 min Winter	10.046	0.0	168.0	0.0	466
600 min Winter	8.426	0.0	176.0	0.0	576
720 min Winter	7.298	0.0	182.8	0.0	684
960 min Winter	5.717	0.0	190.7	0.0	802
1440 min Winter	4.053	0.0	201.2	0.0	1084
2160 min Winter	2.873	0.0	217.0	0.0	1556
2880 min Winter	2.251	0.0	226.6	0.0	2016
4320 min Winter	1.568	0.0	236.7	0.0	2728
5760 min Winter	1.214	0.0	244.6	0.0	3352
7200 min Winter	0.995	0.0	250.5	0.0	3968
8640 min Winter	0.845	0.0	255.5	0.0	4584
10080 min Winter	0.737	0.0	259.6	0.0	5240

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 520450 176000 TQ 20450 76000
C (1km)	-0.024
D1 (1km)	0.322
D2 (1km)	0.262
D3 (1km)	0.219
E (1km)	0.306
F (1km)	2.539
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) 0.250

Time (mins)	Area
From:	To: (ha)
0	4 0.250

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Model Details

Storage is Online Cover Level (m) 1.600

Cellular Storage Structure

Invert Level (m) 0.000 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 <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	141.0	0.0	1.600	141.0	0.0


Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0058-1900-1600-1900  
 Design Head (m) 1.600  
 Design Flow (l/s) 1.9  
 Flush-Flo™ Calculated  
 Objective Minimise upstream storage  
 Application Surface  
 Sump Available Yes  
 Diameter (mm) 58  
 Invert Level (m) 0.000  
 Minimum Outlet Pipe Diameter (mm) 75  
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.600	1.9
Flush-Flo™	0.255	1.4
Kick-Flo®	0.520	1.1
Mean Flow over Head Range	-	1.4

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	1.2	1.200	1.7	3.000	2.5	7.000	3.7
0.200	1.4	1.400	1.8	3.500	2.7	7.500	3.9
0.300	1.4	1.600	1.9	4.000	2.9	8.000	4.0
0.400	1.3	1.800	2.0	4.500	3.1	8.500	4.1
0.500	1.2	2.000	2.1	5.000	3.2	9.000	4.2
0.600	1.2	2.200	2.2	5.500	3.3	9.500	4.3
0.800	1.4	2.400	2.3	6.000	3.5		
1.000	1.5	2.600	2.4	6.500	3.6		

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Weir Overflow Control

Discharge Coef 0.544 Width (m) 2.000 Invert Level (m) 1.600

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

Half Drain Time : 1047 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m <sup>3</sup> )	Status
15 min Summer	0.748	0.748	0.0	1.4	0.0	1.4	100.2	O K
30 min Summer	0.859	0.859	0.0	1.4	0.0	1.4	115.1	O K
60 min Summer	0.981	0.981	0.0	1.5	0.0	1.5	131.4	O K
120 min Summer	1.106	1.106	0.0	1.6	0.0	1.6	148.1	O K
180 min Summer	1.175	1.175	0.0	1.6	0.0	1.6	157.4	O K
240 min Summer	1.219	1.219	0.0	1.7	0.0	1.7	163.3	O K
360 min Summer	1.267	1.267	0.0	1.7	0.0	1.7	169.8	O K
480 min Summer	1.287	1.287	0.0	1.7	0.0	1.7	172.3	O K
600 min Summer	1.290	1.290	0.0	1.7	0.0	1.7	172.8	O K
720 min Summer	1.282	1.282	0.0	1.7	0.0	1.7	171.8	O K
960 min Summer	1.233	1.233	0.0	1.7	0.0	1.7	165.2	O K
1440 min Summer	1.150	1.150	0.0	1.6	0.0	1.6	154.0	O K
2160 min Summer	1.046	1.046	0.0	1.6	0.0	1.6	140.2	O K
2880 min Summer	0.959	0.959	0.0	1.5	0.0	1.5	128.5	O K
4320 min Summer	0.791	0.791	0.0	1.4	0.0	1.4	105.9	O K
5760 min Summer	0.650	0.650	0.0	1.4	0.0	1.4	87.0	O K
7200 min Summer	0.505	0.505	0.0	1.4	0.0	1.4	67.6	O K
8640 min Summer	0.370	0.370	0.0	1.4	0.0	1.4	49.6	O K
10080 min Summer	0.280	0.280	0.0	1.4	0.0	1.4	37.5	O K
15 min Winter	0.838	0.838	0.0	1.4	0.0	1.4	112.3	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Overflow Volume (m <sup>3</sup> )	Time-Peak (mins)
15 min Summer	216.173	0.0	98.8	0.0	19
30 min Summer	125.161	0.0	110.9	0.0	34
60 min Summer	72.466	0.0	135.3	0.0	64
120 min Summer	41.957	0.0	156.7	0.0	124
180 min Summer	30.477	0.0	170.7	0.0	182
240 min Summer	24.292	0.0	181.3	0.0	242
360 min Summer	17.646	0.0	197.3	0.0	362
480 min Summer	14.065	0.0	209.4	0.0	482
600 min Summer	11.796	0.0	219.1	0.0	600
720 min Summer	10.217	0.0	226.9	0.0	716
960 min Summer	8.004	0.0	233.4	0.0	818
1440 min Summer	5.674	0.0	227.8	0.0	1068
2160 min Summer	4.023	0.0	271.2	0.0	1472
2880 min Summer	3.151	0.0	283.3	0.0	1876
4320 min Summer	2.196	0.0	295.8	0.0	2720
5760 min Summer	1.699	0.0	305.7	0.0	3520
7200 min Summer	1.392	0.0	313.2	0.0	4320
8640 min Summer	1.184	0.0	319.4	0.0	4928
10080 min Summer	1.032	0.0	324.6	0.0	5552
15 min Winter	216.173	0.0	108.7	0.0	19



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 Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	0.964	0.964	0.0	1.5	0.0	1.5	129.1	O K
60 min Winter	1.102	1.102	0.0	1.6	0.0	1.6	147.6	O K
120 min Winter	1.246	1.246	0.0	1.7	0.0	1.7	166.9	O K
180 min Winter	1.327	1.327	0.0	1.7	0.0	1.7	177.8	Flood Risk
240 min Winter	1.380	1.380	0.0	1.8	0.0	1.8	184.9	Flood Risk
360 min Winter	1.442	1.442	0.0	1.8	0.0	1.8	193.2	Flood Risk
480 min Winter	1.472	1.472	0.0	1.8	0.0	1.8	197.2	Flood Risk
<b>600 min Winter</b>	<b>1.484</b>	<b>1.484</b>	<b>0.0</b>	<b>1.8</b>	<b>0.0</b>	<b>1.8</b>	<b>198.7</b>	<b>Flood Risk</b>
720 min Winter	1.484	1.484	0.0	1.8	0.0	1.8	198.8	Flood Risk
960 min Winter	1.433	1.433	0.0	1.8	0.0	1.8	192.0	Flood Risk
1440 min Winter	1.331	1.331	0.0	1.7	0.0	1.7	178.3	Flood Risk
2160 min Winter	1.198	1.198	0.0	1.7	0.0	1.7	160.4	O K
2880 min Winter	1.077	1.077	0.0	1.6	0.0	1.6	144.3	O K
4320 min Winter	0.841	0.841	0.0	1.4	0.0	1.4	112.7	O K
5760 min Winter	0.638	0.638	0.0	1.4	0.0	1.4	85.5	O K
7200 min Winter	0.402	0.402	0.0	1.4	0.0	1.4	53.8	O K
8640 min Winter	0.252	0.252	0.0	1.4	0.0	1.4	33.8	O K
10080 min Winter	0.166	0.166	0.0	1.4	0.0	1.4	22.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
30 min Winter	125.161	0.0	114.9	0.0	33
60 min Winter	72.466	0.0	151.6	0.0	62
120 min Winter	41.957	0.0	175.4	0.0	122
180 min Winter	30.477	0.0	191.0	0.0	180
240 min Winter	24.292	0.0	202.8	0.0	238
360 min Winter	17.646	0.0	220.5	0.0	354
480 min Winter	14.065	0.0	233.4	0.0	468
<b>600 min Winter</b>	<b>11.796</b>	<b>0.0</b>	<b>242.3</b>	<b>0.0</b>	<b>582</b>
720 min Winter	10.217	0.0	246.1	0.0	692
960 min Winter	8.004	0.0	244.7	0.0	904
1440 min Winter	5.674	0.0	237.2	0.0	1124
2160 min Winter	4.023	0.0	303.8	0.0	1580
2880 min Winter	3.151	0.0	317.2	0.0	2044
4320 min Winter	2.196	0.0	331.1	0.0	2936
5760 min Winter	1.699	0.0	342.4	0.0	3800
7200 min Winter	1.392	0.0	350.8	0.0	4464
8640 min Winter	1.184	0.0	357.7	0.0	5016
10080 min Winter	1.032	0.0	363.6	0.0	5552

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 520450 176000 TQ 20450 76000
C (1km)	-0.024
D1 (1km)	0.322
D2 (1km)	0.262
D3 (1km)	0.219
E (1km)	0.306
F (1km)	2.539
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) 0.250

Time (mins)	Area
From:	To: (ha)
0	4 0.250

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Model Details

Storage is Online Cover Level (m) 1.600

Cellular Storage Structure

Invert Level (m) 0.000 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 <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	141.0	0.0	1.600	141.0	0.0


Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0058-1900-1600-1900  
 Design Head (m) 1.600  
 Design Flow (l/s) 1.9  
 Flush-Flo™ Calculated  
 Objective Minimise upstream storage  
 Application Surface  
 Sump Available Yes  
 Diameter (mm) 58  
 Invert Level (m) 0.000  
 Minimum Outlet Pipe Diameter (mm) 75  
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.600	1.9
Flush-Flo™	0.255	1.4
Kick-Flo®	0.520	1.1
Mean Flow over Head Range	-	1.4

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	1.2	1.200	1.7	3.000	2.5	7.000	3.7
0.200	1.4	1.400	1.8	3.500	2.7	7.500	3.9
0.300	1.4	1.600	1.9	4.000	2.9	8.000	4.0
0.400	1.3	1.800	2.0	4.500	3.1	8.500	4.1
0.500	1.2	2.000	2.1	5.000	3.2	9.000	4.2
0.600	1.2	2.200	2.2	5.500	3.3	9.500	4.3
0.800	1.4	2.400	2.3	6.000	3.5		
1.000	1.5	2.600	2.4	6.500	3.6		

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Weir Overflow Control

Discharge Coef 0.544 Width (m) 2.000 Invert Level (m) 1.600

Summary of Results for 30 year Return Period

Half Drain Time : 569 minutes.


Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m <sup>3</sup> )	Status
15 min Summer	0.350	0.350	0.0	1.4	0.0	1.4	46.9	O K
30 min Summer	0.408	0.408	0.0	1.4	0.0	1.4	54.7	O K
60 min Summer	0.471	0.471	0.0	1.4	0.0	1.4	63.1	O K
120 min Summer	0.536	0.536	0.0	1.4	0.0	1.4	71.8	O K
180 min Summer	0.570	0.570	0.0	1.4	0.0	1.4	76.3	O K
240 min Summer	0.589	0.589	0.0	1.4	0.0	1.4	78.9	O K
360 min Summer	0.605	0.605	0.0	1.4	0.0	1.4	81.1	O K
480 min Summer	0.605	0.605	0.0	1.4	0.0	1.4	81.1	O K
600 min Summer	0.600	0.600	0.0	1.4	0.0	1.4	80.3	O K
720 min Summer	0.593	0.593	0.0	1.4	0.0	1.4	79.4	O K
960 min Summer	0.564	0.564	0.0	1.4	0.0	1.4	75.6	O K
1440 min Summer	0.506	0.506	0.0	1.4	0.0	1.4	67.7	O K
2160 min Summer	0.424	0.424	0.0	1.4	0.0	1.4	56.8	O K
2880 min Summer	0.356	0.356	0.0	1.4	0.0	1.4	47.7	O K
4320 min Summer	0.242	0.242	0.0	1.4	0.0	1.4	32.4	O K
5760 min Summer	0.168	0.168	0.0	1.4	0.0	1.4	22.6	O K
7200 min Summer	0.124	0.124	0.0	1.3	0.0	1.3	16.6	O K
8640 min Summer	0.096	0.096	0.0	1.2	0.0	1.2	12.9	O K
10080 min Summer	0.081	0.081	0.0	1.1	0.0	1.1	10.8	O K
15 min Winter	0.392	0.392	0.0	1.4	0.0	1.4	52.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Overflow Volume (m <sup>3</sup> )	Time-Peak (mins)
15 min Summer	102.217	0.0	47.2	0.0	19
30 min Summer	60.391	0.0	55.8	0.0	33
60 min Summer	35.680	0.0	66.6	0.0	64
120 min Summer	21.080	0.0	78.7	0.0	122
180 min Summer	15.495	0.0	86.8	0.0	182
240 min Summer	12.455	0.0	93.0	0.0	242
360 min Summer	9.155	0.0	102.6	0.0	360
480 min Summer	7.358	0.0	109.9	0.0	480
600 min Summer	6.212	0.0	116.0	0.0	536
720 min Summer	5.409	0.0	121.2	0.0	596
960 min Summer	4.273	0.0	127.6	0.0	722
1440 min Summer	3.065	0.0	137.2	0.0	982
2160 min Summer	2.199	0.0	148.2	0.0	1364
2880 min Summer	1.737	0.0	156.1	0.0	1732
4320 min Summer	1.225	0.0	164.9	0.0	2464
5760 min Summer	0.956	0.0	172.0	0.0	3120
7200 min Summer	0.788	0.0	177.3	0.0	3816
8640 min Summer	0.674	0.0	181.7	0.0	4496
10080 min Summer	0.590	0.0	185.4	0.0	5144
15 min Winter	102.217	0.0	52.9	0.0	19

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 Overflow (l/s)	Max Outflow (l/s)	Max Volume (m <sup>3</sup> )	Status
30 min Winter	0.459	0.459	0.0	1.4	0.0	1.4	61.5	O K
60 min Winter	0.532	0.532	0.0	1.4	0.0	1.4	71.2	O K
120 min Winter	0.606	0.606	0.0	1.4	0.0	1.4	81.2	O K
180 min Winter	0.646	0.646	0.0	1.4	0.0	1.4	86.5	O K
240 min Winter	0.669	0.669	0.0	1.4	0.0	1.4	89.7	O K
360 min Winter	0.693	0.693	0.0	1.4	0.0	1.4	92.8	O K
<b>480 min Winter</b>	<b>0.698</b>	<b>0.698</b>	<b>0.0</b>	<b>1.4</b>	<b>0.0</b>	<b>1.4</b>	<b>93.5</b>	<b>O K</b>
600 min Winter	0.694	0.694	0.0	1.4	0.0	1.4	93.0	O K
720 min Winter	0.685	0.685	0.0	1.4	0.0	1.4	91.7	O K
960 min Winter	0.648	0.648	0.0	1.4	0.0	1.4	86.8	O K
1440 min Winter	0.577	0.577	0.0	1.4	0.0	1.4	77.3	O K
2160 min Winter	0.454	0.454	0.0	1.4	0.0	1.4	60.9	O K
2880 min Winter	0.350	0.350	0.0	1.4	0.0	1.4	46.8	O K
4320 min Winter	0.194	0.194	0.0	1.4	0.0	1.4	25.9	O K
5760 min Winter	0.115	0.115	0.0	1.3	0.0	1.3	15.4	O K
7200 min Winter	0.081	0.081	0.0	1.1	0.0	1.1	10.8	O K
8640 min Winter	0.068	0.068	0.0	1.0	0.0	1.0	9.1	O K
10080 min Winter	0.059	0.059	0.0	0.9	0.0	0.9	7.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Overflow Volume (m <sup>3</sup> )	Time-Peak (mins)
30 min Winter	60.391	0.0	62.5	0.0	33
60 min Winter	35.680	0.0	74.6	0.0	62
120 min Winter	21.080	0.0	88.2	0.0	120
180 min Winter	15.495	0.0	97.2	0.0	180
240 min Winter	12.455	0.0	104.2	0.0	236
360 min Winter	9.155	0.0	114.9	0.0	350
<b>480 min Winter</b>	<b>7.358</b>	<b>0.0</b>	<b>123.1</b>	<b>0.0</b>	<b>462</b>
600 min Winter	6.212	0.0	129.9	0.0	570
720 min Winter	5.409	0.0	135.7	0.0	670
960 min Winter	4.273	0.0	142.9	0.0	758
1440 min Winter	3.065	0.0	153.5	0.0	1068
2160 min Winter	2.199	0.0	166.0	0.0	1492
2880 min Winter	1.737	0.0	174.9	0.0	1872
4320 min Winter	1.225	0.0	184.8	0.0	2548
5760 min Winter	0.956	0.0	192.6	0.0	3176
7200 min Winter	0.788	0.0	198.6	0.0	3752
8640 min Winter	0.674	0.0	203.5	0.0	4488
10080 min Winter	0.590	0.0	207.7	0.0	5144

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	1999
Site Location	GB 520450 176000 TQ 20450 76000
C (1km)	-0.024
D1 (1km)	0.322
D2 (1km)	0.262
D3 (1km)	0.219
E (1km)	0.306
F (1km)	2.539
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) 0.250

Time (mins)	Area
From:	To: (ha)
0	4 0.250

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Model Details

Storage is Online Cover Level (m) 1.600

Cellular Storage Structure

Invert Level (m) 0.000 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 <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	141.0	0.0	1.600	141.0	0.0

Hydro-Brake® Optimum Outflow Control


Unit Reference MD-SHE-0058-1900-1600-1900  
 Design Head (m) 1.600  
 Design Flow (l/s) 1.9  
 Flush-Flo™ Calculated  
 Objective Minimise upstream storage  
 Application Surface  
 Sump Available Yes  
 Diameter (mm) 58  
 Invert Level (m) 0.000  
 Minimum Outlet Pipe Diameter (mm) 75  
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.600	1.9
Flush-Flo™	0.255	1.4
Kick-Flo®	0.520	1.1
Mean Flow over Head Range	-	1.4

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	1.2	1.200	1.7	3.000	2.5	7.000	3.7
0.200	1.4	1.400	1.8	3.500	2.7	7.500	3.9
0.300	1.4	1.600	1.9	4.000	2.9	8.000	4.0
0.400	1.3	1.800	2.0	4.500	3.1	8.500	4.1
0.500	1.2	2.000	2.1	5.000	3.2	9.000	4.2
0.600	1.2	2.200	2.2	5.500	3.3	9.500	4.3
0.800	1.4	2.400	2.3	6.000	3.5		
1.000	1.5	2.600	2.4	6.500	3.6		



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<u>Weir Overflow Control</u>		
Discharge Coef 0.544 Width (m) 2.000 Invert Level (m) 1.600		
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Summary of Results for 1 year Return Period

Half Drain Time : 171 minutes.


Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	0.082	0.082	0.0	1.0	0.0	1.0	10.4	O K
30 min Summer	0.100	0.100	0.0	1.0	0.0	1.0	12.6	O K
60 min Summer	0.118	0.118	0.0	1.0	0.0	1.0	14.9	O K
120 min Summer	0.133	0.133	0.0	1.1	0.0	1.1	16.8	O K
180 min Summer	0.141	0.141	0.0	1.1	0.0	1.1	17.8	O K
240 min Summer	0.145	0.145	0.0	1.1	0.0	1.1	18.4	O K
360 min Summer	0.149	0.149	0.0	1.1	0.0	1.1	18.9	O K
480 min Summer	0.150	0.150	0.0	1.1	0.0	1.1	18.9	O K
600 min Summer	0.148	0.148	0.0	1.1	0.0	1.1	18.7	O K
720 min Summer	0.146	0.146	0.0	1.1	0.0	1.1	18.4	O K
960 min Summer	0.135	0.135	0.0	1.1	0.0	1.1	17.1	O K
1440 min Summer	0.116	0.116	0.0	1.0	0.0	1.0	14.7	O K
2160 min Summer	0.094	0.094	0.0	1.0	0.0	1.0	11.9	O K
2880 min Summer	0.079	0.079	0.0	0.9	0.0	0.9	9.9	O K
4320 min Summer	0.062	0.062	0.0	0.8	0.0	0.8	7.8	O K
5760 min Summer	0.052	0.052	0.0	0.7	0.0	0.7	6.5	O K
7200 min Summer	0.046	0.046	0.0	0.6	0.0	0.6	5.8	O K
8640 min Summer	0.042	0.042	0.0	0.5	0.0	0.5	5.3	O K
10080 min Summer	0.039	0.039	0.0	0.5	0.0	0.5	4.9	O K
15 min Winter	0.093	0.093	0.0	1.0	0.0	1.0	11.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	32.424	0.0	10.5	0.0	18
30 min Summer	20.266	0.0	13.2	0.0	32
60 min Summer	12.667	0.0	16.9	0.0	62
120 min Summer	7.917	0.0	21.1	0.0	112
180 min Summer	6.014	0.0	24.1	0.0	144
240 min Summer	4.949	0.0	26.5	0.0	176
360 min Summer	3.759	0.0	30.2	0.0	246
480 min Summer	3.093	0.0	33.1	0.0	314
600 min Summer	2.659	0.0	35.6	0.0	384
720 min Summer	2.350	0.0	37.8	0.0	452
960 min Summer	1.900	0.0	40.7	0.0	586
1440 min Summer	1.409	0.0	45.2	0.0	838
2160 min Summer	1.044	0.0	50.6	0.0	1192
2880 min Summer	0.845	0.0	54.5	0.0	1556
4320 min Summer	0.615	0.0	59.5	0.0	2252
5760 min Summer	0.492	0.0	63.6	0.0	2992
7200 min Summer	0.413	0.0	66.8	0.0	3680
8640 min Summer	0.358	0.0	69.4	0.0	4408
10080 min Summer	0.318	0.0	71.7	0.0	5144
15 min Winter	32.424	0.0	11.8	0.0	18

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 Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m <sup>3</sup> )	Status
30 min Winter	0.113	0.113	0.0	1.0	0.0	1.0	14.2	O K
60 min Winter	0.134	0.134	0.0	1.1	0.0	1.1	16.9	O K
120 min Winter	0.152	0.152	0.0	1.1	0.0	1.1	19.2	O K
180 min Winter	0.159	0.159	0.0	1.1	0.0	1.1	20.1	O K
240 min Winter	0.164	0.164	0.0	1.1	0.0	1.1	20.7	O K
<b>360 min Winter</b>	<b>0.166</b>	<b>0.166</b>	<b>0.0</b>	<b>1.1</b>	<b>0.0</b>	<b>1.1</b>	<b>21.0</b>	<b>O K</b>
480 min Winter	0.164	0.164	0.0	1.1	0.0	1.1	20.7	O K
600 min Winter	0.160	0.160	0.0	1.1	0.0	1.1	20.2	O K
720 min Winter	0.154	0.154	0.0	1.1	0.0	1.1	19.5	O K
960 min Winter	0.138	0.138	0.0	1.1	0.0	1.1	17.4	O K
1440 min Winter	0.109	0.109	0.0	1.0	0.0	1.0	13.8	O K
2160 min Winter	0.080	0.080	0.0	0.9	0.0	0.9	10.1	O K
2880 min Winter	0.066	0.066	0.0	0.8	0.0	0.8	8.3	O K
4320 min Winter	0.050	0.050	0.0	0.6	0.0	0.6	6.3	O K
5760 min Winter	0.042	0.042	0.0	0.5	0.0	0.5	5.3	O K
7200 min Winter	0.038	0.038	0.0	0.4	0.0	0.4	4.7	O K
8640 min Winter	0.034	0.034	0.0	0.4	0.0	0.4	4.3	O K
10080 min Winter	0.032	0.032	0.0	0.3	0.0	0.3	4.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Overflow Volume (m <sup>3</sup> )	Time-Peak (mins)
30 min Winter	20.266	0.0	14.8	0.0	32
60 min Winter	12.667	0.0	18.9	0.0	60
120 min Winter	7.917	0.0	23.7	0.0	116
180 min Winter	6.014	0.0	27.0	0.0	166
240 min Winter	4.949	0.0	29.7	0.0	188
<b>360 min Winter</b>	<b>3.759</b>	<b>0.0</b>	<b>33.8</b>	<b>0.0</b>	<b>266</b>
480 min Winter	3.093	0.0	37.1	0.0	342
600 min Winter	2.659	0.0	39.9	0.0	416
720 min Winter	2.350	0.0	42.3	0.0	490
960 min Winter	1.900	0.0	45.6	0.0	626
1440 min Winter	1.409	0.0	50.7	0.0	880
2160 min Winter	1.044	0.0	56.7	0.0	1232
2880 min Winter	0.845	0.0	61.1	0.0	1584
4320 min Winter	0.615	0.0	66.6	0.0	2292
5760 min Winter	0.492	0.0	71.3	0.0	2992
7200 min Winter	0.413	0.0	74.8	0.0	3672
8640 min Winter	0.358	0.0	77.8	0.0	4416
10080 min Winter	0.318	0.0	80.3	0.0	5176

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	1
FEH Rainfall Version	1999
Site Location	GB 520450 176000 TQ 20450 76000
C (1km)	-0.024
D1 (1km)	0.322
D2 (1km)	0.262
D3 (1km)	0.219
E (1km)	0.306
F (1km)	2.539
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) 0.180

Time (mins)	Area
From:	To: (ha)
0	4 0.180

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Model Details

Storage is Online Cover Level (m) 1.200

Cellular Storage Structure

Invert Level (m) 0.000 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 <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	133.0	0.0	1.200	133.0	0.0


Hydro-Brake® Optimum Outflow Control


Unit Reference MD-SHE-0053-1400-1200-1400  
 Design Head (m) 1.200  
 Design Flow (l/s) 1.4  
 Flush-Flo™ Calculated  
 Objective Minimise upstream storage  
 Application Surface  
 Sump Available Yes  
 Diameter (mm) 53  
 Invert Level (m) 0.000  
 Minimum Outlet Pipe Diameter (mm) 75  
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	1.4
Flush-Flo™	0.235	1.1
Kick-Flo®	0.474	0.9
Mean Flow over Head Range	-	1.1

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	1.0	1.200	1.4	3.000	2.1	7.000	3.1
0.200	1.1	1.400	1.5	3.500	2.3	7.500	3.2
0.300	1.1	1.600	1.6	4.000	2.4	8.000	3.3
0.400	1.1	1.800	1.7	4.500	2.6	8.500	3.4
0.500	0.9	2.000	1.8	5.000	2.7	9.000	3.5
0.600	1.0	2.200	1.8	5.500	2.8	9.500	3.6
0.800	1.2	2.400	1.9	6.000	2.9		
1.000	1.3	2.600	2.0	6.500	3.0		

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Innovyze	Source Control 2019.1	
<p><u>Weir Overflow Control</u></p> <p>Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 1.200</p>		
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Innovyze		Source Control 2019.1

Summary of Results for 100 year Return Period

Half Drain Time : 724 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m <sup>3</sup> )	Status
15 min Summer	0.406	0.406	0.0	1.1	0.0	1.1	51.2	O K
30 min Summer	0.465	0.465	0.0	1.1	0.0	1.1	58.8	O K
60 min Summer	0.529	0.529	0.0	1.1	0.0	1.1	66.9	O K
120 min Summer	0.592	0.592	0.0	1.1	0.0	1.1	74.9	O K
180 min Summer	0.625	0.625	0.0	1.1	0.0	1.1	79.0	O K
240 min Summer	0.644	0.644	0.0	1.1	0.0	1.1	81.3	O K
360 min Summer	0.660	0.660	0.0	1.1	0.0	1.1	83.4	O K
480 min Summer	0.661	0.661	0.0	1.1	0.0	1.1	83.5	O K
600 min Summer	0.653	0.653	0.0	1.1	0.0	1.1	82.6	O K
720 min Summer	0.644	0.644	0.0	1.1	0.0	1.1	81.4	O K
960 min Summer	0.613	0.613	0.0	1.1	0.0	1.1	77.5	O K
1440 min Summer	0.558	0.558	0.0	1.1	0.0	1.1	70.5	O K
2160 min Summer	0.483	0.483	0.0	1.1	0.0	1.1	61.0	O K
2880 min Summer	0.407	0.407	0.0	1.1	0.0	1.1	51.4	O K
4320 min Summer	0.282	0.282	0.0	1.1	0.0	1.1	35.7	O K
5760 min Summer	0.198	0.198	0.0	1.1	0.0	1.1	25.0	O K
7200 min Summer	0.144	0.144	0.0	1.1	0.0	1.1	18.2	O K
8640 min Summer	0.109	0.109	0.0	1.0	0.0	1.0	13.8	O K
10080 min Summer	0.087	0.087	0.0	1.0	0.0	1.0	11.0	O K
15 min Winter	0.455	0.455	0.0	1.1	0.0	1.1	57.5	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Overflow Volume (m <sup>3</sup> )	Time-Peak (mins)
15 min Summer	154.409	0.0	51.3	0.0	19
30 min Summer	89.400	0.0	59.3	0.0	34
60 min Summer	51.761	0.0	69.5	0.0	64
120 min Summer	29.969	0.0	80.5	0.0	122
180 min Summer	21.769	0.0	87.8	0.0	182
240 min Summer	17.352	0.0	93.3	0.0	242
360 min Summer	12.604	0.0	101.6	0.0	362
480 min Summer	10.046	0.0	108.0	0.0	480
600 min Summer	8.426	0.0	113.1	0.0	584
720 min Summer	7.298	0.0	117.6	0.0	628
960 min Summer	5.717	0.0	122.7	0.0	752
1440 min Summer	4.053	0.0	130.2	0.0	1010
2160 min Summer	2.873	0.0	139.4	0.0	1428
2880 min Summer	2.251	0.0	145.6	0.0	1792
4320 min Summer	1.568	0.0	152.0	0.0	2512
5760 min Summer	1.214	0.0	157.2	0.0	3224
7200 min Summer	0.995	0.0	161.0	0.0	3888
8640 min Summer	0.845	0.0	164.2	0.0	4576
10080 min Summer	0.737	0.0	166.8	0.0	5240
15 min Winter	154.409	0.0	57.4	0.0	19

Summary of Results for 100 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m <sup>3</sup> )	Status
30 min Winter	0.523	0.523	0.0	1.1	0.0	1.1	66.0	O K
60 min Winter	0.595	0.595	0.0	1.1	0.0	1.1	75.2	O K
120 min Winter	0.668	0.668	0.0	1.1	0.0	1.1	84.4	O K
180 min Winter	0.707	0.707	0.0	1.1	0.0	1.1	89.3	O K
240 min Winter	0.730	0.730	0.0	1.1	0.0	1.1	92.2	O K
360 min Winter	0.753	0.753	0.0	1.1	0.0	1.1	95.1	O K
<b>480 min Winter</b>	<b>0.759</b>	<b>0.759</b>	<b>0.0</b>	<b>1.1</b>	<b>0.0</b>	<b>1.1</b>	<b>95.9</b>	<b>O K</b>
600 min Winter	0.755	0.755	0.0	1.1	0.0	1.1	95.5	O K
720 min Winter	0.747	0.747	0.0	1.1	0.0	1.1	94.3	O K
960 min Winter	0.706	0.706	0.0	1.1	0.0	1.1	89.1	O K
1440 min Winter	0.637	0.637	0.0	1.1	0.0	1.1	80.5	O K
2160 min Winter	0.536	0.536	0.0	1.1	0.0	1.1	67.8	O K
2880 min Winter	0.426	0.426	0.0	1.1	0.0	1.1	53.8	O K
4320 min Winter	0.246	0.246	0.0	1.1	0.0	1.1	31.1	O K
5760 min Winter	0.144	0.144	0.0	1.1	0.0	1.1	18.3	O K
7200 min Winter	0.093	0.093	0.0	1.0	0.0	1.0	11.7	O K
8640 min Winter	0.072	0.072	0.0	0.9	0.0	0.9	9.0	O K
10080 min Winter	0.061	0.061	0.0	0.8	0.0	0.8	7.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Overflow Volume (m <sup>3</sup> )	Time-Peak (mins)
30 min Winter	89.400	0.0	66.3	0.0	33
60 min Winter	51.761	0.0	77.9	0.0	62
120 min Winter	29.969	0.0	90.2	0.0	122
180 min Winter	21.769	0.0	98.3	0.0	180
240 min Winter	17.352	0.0	104.4	0.0	238
360 min Winter	12.604	0.0	113.8	0.0	352
<b>480 min Winter</b>	<b>10.046</b>	<b>0.0</b>	<b>120.9</b>	<b>0.0</b>	<b>466</b>
600 min Winter	8.426	0.0	126.7	0.0	576
720 min Winter	7.298	0.0	131.6	0.0	680
960 min Winter	5.717	0.0	137.3	0.0	788
1440 min Winter	4.053	0.0	145.5	0.0	1082
2160 min Winter	2.873	0.0	156.2	0.0	1552
2880 min Winter	2.251	0.0	163.1	0.0	1960
4320 min Winter	1.568	0.0	170.3	0.0	2640
5760 min Winter	1.214	0.0	176.1	0.0	3288
7200 min Winter	0.995	0.0	180.3	0.0	3896
8640 min Winter	0.845	0.0	183.9	0.0	4496
10080 min Winter	0.737	0.0	186.8	0.0	5240



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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 520450 176000 TQ 20450 76000
C (1km)	-0.024
D1 (1km)	0.322
D2 (1km)	0.262
D3 (1km)	0.219
E (1km)	0.306
F (1km)	2.539
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) 0.180

Time (mins)	Area
From:	To: (ha)
0	4 0.180

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Model Details

Storage is Online Cover Level (m) 1.200

Cellular Storage Structure

Invert Level (m) 0.000 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 <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	133.0	0.0	1.200	133.0	0.0


Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0053-1400-1200-1400  
 Design Head (m) 1.200  
 Design Flow (l/s) 1.4  
 Flush-Flo™ Calculated  
 Objective Minimise upstream storage  
 Application Surface  
 Sump Available Yes  
 Diameter (mm) 53  
 Invert Level (m) 0.000  
 Minimum Outlet Pipe Diameter (mm) 75  
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	1.4
Flush-Flo™	0.235	1.1
Kick-Flo®	0.474	0.9
Mean Flow over Head Range	-	1.1

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	1.0	1.200	1.4	3.000	2.1	7.000	3.1
0.200	1.1	1.400	1.5	3.500	2.3	7.500	3.2
0.300	1.1	1.600	1.6	4.000	2.4	8.000	3.3
0.400	1.1	1.800	1.7	4.500	2.6	8.500	3.4
0.500	0.9	2.000	1.8	5.000	2.7	9.000	3.5
0.600	1.0	2.200	1.8	5.500	2.8	9.500	3.6
0.800	1.2	2.400	1.9	6.000	2.9		
1.000	1.3	2.600	2.0	6.500	3.0		

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<p><u>Weir Overflow Control</u></p> <p>Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 1.200</p>		
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Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 1009 minutes.


Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m <sup>3</sup> )	Status
15 min Summer	0.571	0.571	0.0	1.1	0.0	1.1	72.1	O K
30 min Summer	0.655	0.655	0.0	1.1	0.0	1.1	82.8	O K
60 min Summer	0.748	0.748	0.0	1.1	0.0	1.1	94.5	O K
120 min Summer	0.842	0.842	0.0	1.2	0.0	1.2	106.4	O K
180 min Summer	0.894	0.894	0.0	1.2	0.0	1.2	112.9	O K
240 min Summer	0.926	0.926	0.0	1.2	0.0	1.2	117.0	Flood Risk
360 min Summer	0.961	0.961	0.0	1.3	0.0	1.3	121.4	Flood Risk
480 min Summer	0.973	0.973	0.0	1.3	0.0	1.3	123.0	Flood Risk
600 min Summer	0.973	0.973	0.0	1.3	0.0	1.3	123.0	Flood Risk
720 min Summer	0.966	0.966	0.0	1.3	0.0	1.3	122.1	Flood Risk
960 min Summer	0.927	0.927	0.0	1.2	0.0	1.2	117.2	Flood Risk
1440 min Summer	0.862	0.862	0.0	1.2	0.0	1.2	108.9	O K
2160 min Summer	0.780	0.780	0.0	1.2	0.0	1.2	98.5	O K
2880 min Summer	0.710	0.710	0.0	1.1	0.0	1.1	89.7	O K
4320 min Summer	0.572	0.572	0.0	1.1	0.0	1.1	72.3	O K
5760 min Summer	0.434	0.434	0.0	1.1	0.0	1.1	54.8	O K
7200 min Summer	0.320	0.320	0.0	1.1	0.0	1.1	40.5	O K
8640 min Summer	0.241	0.241	0.0	1.1	0.0	1.1	30.4	O K
10080 min Summer	0.184	0.184	0.0	1.1	0.0	1.1	23.3	O K
15 min Winter	0.640	0.640	0.0	1.1	0.0	1.1	80.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Overflow Volume (m <sup>3</sup> )	Time-Peak (mins)
15 min Summer	216.173	0.0	71.4	0.0	19
30 min Summer	125.161	0.0	81.7	0.0	34
60 min Summer	72.466	0.0	97.4	0.0	64
120 min Summer	41.957	0.0	112.7	0.0	124
180 min Summer	30.477	0.0	122.8	0.0	182
240 min Summer	24.292	0.0	130.5	0.0	242
360 min Summer	17.646	0.0	142.1	0.0	362
480 min Summer	14.065	0.0	150.9	0.0	480
600 min Summer	11.796	0.0	158.0	0.0	600
720 min Summer	10.217	0.0	163.9	0.0	702
960 min Summer	8.004	0.0	170.4	0.0	808
1440 min Summer	5.674	0.0	173.7	0.0	1054
2160 min Summer	4.023	0.0	195.2	0.0	1468
2880 min Summer	3.151	0.0	203.9	0.0	1876
4320 min Summer	2.196	0.0	212.9	0.0	2720
5760 min Summer	1.699	0.0	220.1	0.0	3464
7200 min Summer	1.392	0.0	225.5	0.0	4112
8640 min Summer	1.184	0.0	229.9	0.0	4760
10080 min Summer	1.032	0.0	233.6	0.0	5448
15 min Winter	216.173	0.0	79.4	0.0	19

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 Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	0.735	0.735	0.0	1.1	0.0	1.1	92.9	O K
60 min Winter	0.840	0.840	0.0	1.2	0.0	1.2	106.1	O K
120 min Winter	0.949	0.949	0.0	1.3	0.0	1.3	119.8	Flood Risk
180 min Winter	1.010	1.010	0.0	1.3	0.0	1.3	127.6	Flood Risk
240 min Winter	1.049	1.049	0.0	1.3	0.0	1.3	132.5	Flood Risk
360 min Winter	1.094	1.094	0.0	1.3	0.0	1.3	138.2	Flood Risk
480 min Winter	1.114	1.114	0.0	1.4	0.0	1.4	140.7	Flood Risk
<b>600 min Winter</b>	<b>1.121</b>	<b>1.121</b>	<b>0.0</b>	<b>1.4</b>	<b>0.0</b>	<b>1.4</b>	<b>141.6</b>	<b>Flood Risk</b>
720 min Winter	1.119	1.119	0.0	1.4	0.0	1.4	141.3	Flood Risk
960 min Winter	1.076	1.076	0.0	1.3	0.0	1.3	136.0	Flood Risk
1440 min Winter	0.995	0.995	0.0	1.3	0.0	1.3	125.8	Flood Risk
2160 min Winter	0.888	0.888	0.0	1.2	0.0	1.2	112.2	O K
2880 min Winter	0.790	0.790	0.0	1.2	0.0	1.2	99.8	O K
4320 min Winter	0.595	0.595	0.0	1.1	0.0	1.1	75.2	O K
5760 min Winter	0.386	0.386	0.0	1.1	0.0	1.1	48.8	O K
7200 min Winter	0.242	0.242	0.0	1.1	0.0	1.1	30.5	O K
8640 min Winter	0.156	0.156	0.0	1.1	0.0	1.1	19.7	O K
10080 min Winter	0.108	0.108	0.0	1.0	0.0	1.0	13.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
30 min Winter	125.161	0.0	88.8	0.0	33
60 min Winter	72.466	0.0	109.1	0.0	62
120 min Winter	41.957	0.0	126.2	0.0	122
180 min Winter	30.477	0.0	137.5	0.0	180
240 min Winter	24.292	0.0	146.1	0.0	238
360 min Winter	17.646	0.0	158.9	0.0	354
480 min Winter	14.065	0.0	168.6	0.0	468
<b>600 min Winter</b>	<b>11.796</b>	<b>0.0</b>	<b>176.2</b>	<b>0.0</b>	<b>580</b>
720 min Winter	10.217	0.0	182.1	0.0	692
960 min Winter	8.004	0.0	185.8	0.0	896
1440 min Winter	5.674	0.0	180.4	0.0	1112
2160 min Winter	4.023	0.0	218.7	0.0	1580
2880 min Winter	3.151	0.0	228.4	0.0	2044
4320 min Winter	2.196	0.0	238.4	0.0	2936
5760 min Winter	1.699	0.0	246.5	0.0	3640
7200 min Winter	1.392	0.0	252.5	0.0	4256
8640 min Winter	1.184	0.0	257.5	0.0	4840
10080 min Winter	1.032	0.0	261.7	0.0	5448

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 520450 176000 TQ 20450 76000
C (1km)	-0.024
D1 (1km)	0.322
D2 (1km)	0.262
D3 (1km)	0.219
E (1km)	0.306
F (1km)	2.539
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) 0.180

Time (mins)	Area
From:	To: (ha)
0	4 0.180

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Model Details

Storage is Online Cover Level (m) 1.200

Cellular Storage Structure

Invert Level (m) 0.000 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 <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	133.0	0.0	1.200	133.0	0.0


Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0053-1400-1200-1400  
 Design Head (m) 1.200  
 Design Flow (l/s) 1.4  
 Flush-Flo™ Calculated  
 Objective Minimise upstream storage  
 Application Surface  
 Sump Available Yes  
 Diameter (mm) 53  
 Invert Level (m) 0.000  
 Minimum Outlet Pipe Diameter (mm) 75  
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	1.4
Flush-Flo™	0.235	1.1
Kick-Flo®	0.474	0.9
Mean Flow over Head Range	-	1.1

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	1.0	1.200	1.4	3.000	2.1	7.000	3.1
0.200	1.1	1.400	1.5	3.500	2.3	7.500	3.2
0.300	1.1	1.600	1.6	4.000	2.4	8.000	3.3
0.400	1.1	1.800	1.7	4.500	2.6	8.500	3.4
0.500	0.9	2.000	1.8	5.000	2.7	9.000	3.5
0.600	1.0	2.200	1.8	5.500	2.8	9.500	3.6
0.800	1.2	2.400	1.9	6.000	2.9		
1.000	1.3	2.600	2.0	6.500	3.0		

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Weir Overflow Control

Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 1.200



Summary of Results for 30 year Return Period

Half Drain Time : 494 minutes.


Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m <sup>3</sup> )	Status
15 min Summer	0.266	0.266	0.0	1.1	0.0	1.1	33.7	O K
30 min Summer	0.311	0.311	0.0	1.1	0.0	1.1	39.2	O K
60 min Summer	0.358	0.358	0.0	1.1	0.0	1.1	45.2	O K
120 min Summer	0.404	0.404	0.0	1.1	0.0	1.1	51.0	O K
180 min Summer	0.427	0.427	0.0	1.1	0.0	1.1	54.0	O K
240 min Summer	0.440	0.440	0.0	1.1	0.0	1.1	55.6	O K
360 min Summer	0.449	0.449	0.0	1.1	0.0	1.1	56.7	O K
480 min Summer	0.447	0.447	0.0	1.1	0.0	1.1	56.4	O K
600 min Summer	0.442	0.442	0.0	1.1	0.0	1.1	55.8	O K
720 min Summer	0.435	0.435	0.0	1.1	0.0	1.1	55.0	O K
960 min Summer	0.410	0.410	0.0	1.1	0.0	1.1	51.9	O K
1440 min Summer	0.364	0.364	0.0	1.1	0.0	1.1	46.0	O K
2160 min Summer	0.304	0.304	0.0	1.1	0.0	1.1	38.4	O K
2880 min Summer	0.253	0.253	0.0	1.1	0.0	1.1	32.0	O K
4320 min Summer	0.171	0.171	0.0	1.1	0.0	1.1	21.6	O K
5760 min Summer	0.121	0.121	0.0	1.0	0.0	1.0	15.3	O K
7200 min Summer	0.091	0.091	0.0	1.0	0.0	1.0	11.5	O K
8640 min Summer	0.075	0.075	0.0	0.9	0.0	0.9	9.4	O K
10080 min Summer	0.066	0.066	0.0	0.8	0.0	0.8	8.3	O K
15 min Winter	0.299	0.299	0.0	1.1	0.0	1.1	37.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Overflow Volume (m <sup>3</sup> )	Time-Peak (mins)
15 min Summer	102.217	0.0	33.9	0.0	19
30 min Summer	60.391	0.0	40.1	0.0	33
60 min Summer	35.680	0.0	47.9	0.0	64
120 min Summer	21.080	0.0	56.6	0.0	122
180 min Summer	15.495	0.0	62.4	0.0	182
240 min Summer	12.455	0.0	66.9	0.0	242
360 min Summer	9.155	0.0	73.8	0.0	360
480 min Summer	7.358	0.0	79.1	0.0	448
600 min Summer	6.212	0.0	83.4	0.0	500
720 min Summer	5.409	0.0	87.2	0.0	558
960 min Summer	4.273	0.0	91.8	0.0	676
1440 min Summer	3.065	0.0	98.7	0.0	938
2160 min Summer	2.199	0.0	106.7	0.0	1336
2880 min Summer	1.737	0.0	112.4	0.0	1704
4320 min Summer	1.225	0.0	118.7	0.0	2420
5760 min Summer	0.956	0.0	123.8	0.0	3112
7200 min Summer	0.788	0.0	127.6	0.0	3752
8640 min Summer	0.674	0.0	130.8	0.0	4416
10080 min Summer	0.590	0.0	133.4	0.0	5144
15 min Winter	102.217	0.0	38.0	0.0	19

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 Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	0.349	0.349	0.0	1.1	0.0	1.1	44.1	O K
60 min Winter	0.403	0.403	0.0	1.1	0.0	1.1	50.9	O K
120 min Winter	0.458	0.458	0.0	1.1	0.0	1.1	57.9	O K
180 min Winter	0.488	0.488	0.0	1.1	0.0	1.1	61.7	O K
240 min Winter	0.505	0.505	0.0	1.1	0.0	1.1	63.8	O K
360 min Winter	0.521	0.521	0.0	1.1	0.0	1.1	65.8	O K
<b>480 min Winter</b>	<b>0.523</b>	<b>0.523</b>	<b>0.0</b>	<b>1.1</b>	<b>0.0</b>	<b>1.1</b>	<b>66.1</b>	<b>O K</b>
600 min Winter	0.518	0.518	0.0	1.1	0.0	1.1	65.4	O K
720 min Winter	0.509	0.509	0.0	1.1	0.0	1.1	64.3	O K
960 min Winter	0.476	0.476	0.0	1.1	0.0	1.1	60.1	O K
1440 min Winter	0.406	0.406	0.0	1.1	0.0	1.1	51.3	O K
2160 min Winter	0.314	0.314	0.0	1.1	0.0	1.1	39.7	O K
2880 min Winter	0.238	0.238	0.0	1.1	0.0	1.1	30.1	O K
4320 min Winter	0.132	0.132	0.0	1.1	0.0	1.1	16.7	O K
5760 min Winter	0.083	0.083	0.0	1.0	0.0	1.0	10.4	O K
7200 min Winter	0.065	0.065	0.0	0.8	0.0	0.8	8.3	O K
8640 min Winter	0.056	0.056	0.0	0.7	0.0	0.7	7.0	O K
10080 min Winter	0.049	0.049	0.0	0.6	0.0	0.6	6.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
30 min Winter	60.391	0.0	44.9	0.0	33
60 min Winter	35.680	0.0	53.7	0.0	62
120 min Winter	21.080	0.0	63.4	0.0	120
180 min Winter	15.495	0.0	69.9	0.0	178
240 min Winter	12.455	0.0	75.0	0.0	236
360 min Winter	9.155	0.0	82.6	0.0	350
<b>480 min Winter</b>	<b>7.358</b>	<b>0.0</b>	<b>88.6</b>	<b>0.0</b>	<b>462</b>
600 min Winter	6.212	0.0	93.5	0.0	568
720 min Winter	5.409	0.0	97.6	0.0	664
960 min Winter	4.273	0.0	102.8	0.0	752
1440 min Winter	3.065	0.0	110.6	0.0	1036
2160 min Winter	2.199	0.0	119.5	0.0	1444
2880 min Winter	1.737	0.0	125.9	0.0	1816
4320 min Winter	1.225	0.0	133.0	0.0	2468
5760 min Winter	0.956	0.0	138.6	0.0	3112
7200 min Winter	0.788	0.0	142.9	0.0	3752
8640 min Winter	0.674	0.0	146.5	0.0	4488
10080 min Winter	0.590	0.0	149.5	0.0	5144

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	1999
Site Location	GB 520450 176000 TQ 20450 76000
C (1km)	-0.024
D1 (1km)	0.322
D2 (1km)	0.262
D3 (1km)	0.219
E (1km)	0.306
F (1km)	2.539
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) 0.180

Time (mins)	Area
From:	To: (ha)
0	4 0.180

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Model Details

Storage is Online Cover Level (m) 1.200

Cellular Storage Structure

Invert Level (m) 0.000 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 <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	133.0	0.0	1.200	133.0	0.0


Hydro-Brake® Optimum Outflow Control


Unit Reference MD-SHE-0053-1400-1200-1400  
 Design Head (m) 1.200  
 Design Flow (l/s) 1.4  
 Flush-Flo™ Calculated  
 Objective Minimise upstream storage  
 Application Surface  
 Sump Available Yes  
 Diameter (mm) 53  
 Invert Level (m) 0.000  
 Minimum Outlet Pipe Diameter (mm) 75  
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	1.4
Flush-Flo™	0.235	1.1
Kick-Flo®	0.474	0.9
Mean Flow over Head Range	-	1.1

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	1.0	1.200	1.4	3.000	2.1	7.000	3.1
0.200	1.1	1.400	1.5	3.500	2.3	7.500	3.2
0.300	1.1	1.600	1.6	4.000	2.4	8.000	3.3
0.400	1.1	1.800	1.7	4.500	2.6	8.500	3.4
0.500	0.9	2.000	1.8	5.000	2.7	9.000	3.5
0.600	1.0	2.200	1.8	5.500	2.8	9.500	3.6
0.800	1.2	2.400	1.9	6.000	2.9		
1.000	1.3	2.600	2.0	6.500	3.0		

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<p><u>Weir Overflow Control</u></p> <p>Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 1.200</p>		
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Summary of Results for 1 year Return Period

Half Drain Time : 172 minutes.


Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m <sup>3</sup> )	Status
15 min Summer	0.175	0.175	0.0	5.6	0.0	5.6	61.8	O K
30 min Summer	0.212	0.212	0.0	5.9	0.0	5.9	74.9	O K
60 min Summer	0.250	0.250	0.0	6.2	0.0	6.2	88.5	O K
120 min Summer	0.282	0.282	0.0	6.3	0.0	6.3	99.8	O K
180 min Summer	0.297	0.297	0.0	6.4	0.0	6.4	105.2	O K
240 min Summer	0.306	0.306	0.0	6.4	0.0	6.4	108.4	O K
360 min Summer	0.314	0.314	0.0	6.4	0.0	6.4	111.2	O K
480 min Summer	0.314	0.314	0.0	6.4	0.0	6.4	111.3	O K
600 min Summer	0.310	0.310	0.0	6.4	0.0	6.4	109.9	O K
720 min Summer	0.304	0.304	0.0	6.4	0.0	6.4	107.7	O K
960 min Summer	0.282	0.282	0.0	6.3	0.0	6.3	99.9	O K
1440 min Summer	0.241	0.241	0.0	6.1	0.0	6.1	85.3	O K
2160 min Summer	0.192	0.192	0.0	5.8	0.0	5.8	68.1	O K
2880 min Summer	0.159	0.159	0.0	5.5	0.0	5.5	56.2	O K
4320 min Summer	0.121	0.121	0.0	4.7	0.0	4.7	42.8	O K
5760 min Summer	0.102	0.102	0.0	4.0	0.0	4.0	36.1	O K
7200 min Summer	0.091	0.091	0.0	3.4	0.0	3.4	32.2	O K
8640 min Summer	0.083	0.083	0.0	3.0	0.0	3.0	29.4	O K
10080 min Summer	0.077	0.077	0.0	2.7	0.0	2.7	27.3	O K
15 min Winter	0.196	0.196	0.0	5.8	0.0	5.8	69.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Overflow Volume (m <sup>3</sup> )	Time-Peak (mins)
15 min Summer	32.424	0.0	62.6	0.0	18
30 min Summer	20.266	0.0	78.7	0.0	32
60 min Summer	12.667	0.0	100.4	0.0	62
120 min Summer	7.917	0.0	125.8	0.0	112
180 min Summer	6.014	0.0	143.5	0.0	144
240 min Summer	4.949	0.0	157.5	0.0	176
360 min Summer	3.759	0.0	179.6	0.0	246
480 min Summer	3.093	0.0	197.1	0.0	314
600 min Summer	2.659	0.0	211.8	0.0	384
720 min Summer	2.350	0.0	224.7	0.0	452
960 min Summer	1.900	0.0	242.3	0.0	586
1440 min Summer	1.409	0.0	269.2	0.0	838
2160 min Summer	1.044	0.0	300.9	0.0	1208
2880 min Summer	0.845	0.0	324.3	0.0	1556
4320 min Summer	0.615	0.0	353.6	0.0	2248
5760 min Summer	0.492	0.0	378.3	0.0	2952
7200 min Summer	0.413	0.0	397.0	0.0	3680
8640 min Summer	0.358	0.0	412.9	0.0	4408
10080 min Summer	0.318	0.0	426.3	0.0	5144
15 min Winter	32.424	0.0	70.3	0.0	18

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 Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m <sup>3</sup> )	Status
30 min Winter	0.238	0.238	0.0	6.1	0.0	6.1	84.5	O K
60 min Winter	0.283	0.283	0.0	6.3	0.0	6.3	100.2	O K
120 min Winter	0.322	0.322	0.0	6.5	0.0	6.5	114.0	O K
180 min Winter	0.336	0.336	0.0	6.5	0.0	6.5	119.1	O K
240 min Winter	0.345	0.345	0.0	6.5	0.0	6.5	122.1	O K
<b>360 min Winter</b>	<b>0.349</b>	<b>0.349</b>	<b>0.0</b>	<b>6.5</b>	<b>0.0</b>	<b>6.5</b>	<b>123.8</b>	<b>O K</b>
480 min Winter	0.344	0.344	0.0	6.5	0.0	6.5	122.0	O K
600 min Winter	0.334	0.334	0.0	6.5	0.0	6.5	118.5	O K
720 min Winter	0.322	0.322	0.0	6.5	0.0	6.5	114.1	O K
960 min Winter	0.287	0.287	0.0	6.3	0.0	6.3	101.6	O K
1440 min Winter	0.225	0.225	0.0	6.0	0.0	6.0	79.7	O K
2160 min Winter	0.161	0.161	0.0	5.5	0.0	5.5	57.0	O K
2880 min Winter	0.128	0.128	0.0	5.0	0.0	5.0	45.3	O K
4320 min Winter	0.098	0.098	0.0	3.8	0.0	3.8	34.6	O K
5760 min Winter	0.084	0.084	0.0	3.1	0.0	3.1	29.6	O K
7200 min Winter	0.075	0.075	0.0	2.6	0.0	2.6	26.4	O K
8640 min Winter	0.068	0.068	0.0	2.2	0.0	2.2	24.3	O K
10080 min Winter	0.064	0.064	0.0	2.0	0.0	2.0	22.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Overflow Volume (m <sup>3</sup> )	Time-Peak (mins)
30 min Winter	20.266	0.0	88.4	0.0	32
60 min Winter	12.667	0.0	112.6	0.0	60
120 min Winter	7.917	0.0	141.0	0.0	116
180 min Winter	6.014	0.0	160.8	0.0	166
240 min Winter	4.949	0.0	176.5	0.0	188
<b>360 min Winter</b>	<b>3.759</b>	<b>0.0</b>	<b>201.3</b>	<b>0.0</b>	<b>266</b>
480 min Winter	3.093	0.0	220.9	0.0	342
600 min Winter	2.659	0.0	237.4	0.0	416
720 min Winter	2.350	0.0	251.8	0.0	490
960 min Winter	1.900	0.0	271.5	0.0	626
1440 min Winter	1.409	0.0	301.7	0.0	880
2160 min Winter	1.044	0.0	337.1	0.0	1232
2880 min Winter	0.845	0.0	363.4	0.0	1556
4320 min Winter	0.615	0.0	396.4	0.0	2252
5760 min Winter	0.492	0.0	423.7	0.0	2984
7200 min Winter	0.413	0.0	444.8	0.0	3680
8640 min Winter	0.358	0.0	462.6	0.0	4416
10080 min Winter	0.318	0.0	477.8	0.0	5144

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Rainfall Details


Rainfall Model	FEH
Return Period (years)	1
FEH Rainfall Version	1999
Site Location	GB 520450 176000 TQ 20450 76000
C (1km)	-0.024
D1 (1km)	0.322
D2 (1km)	0.262
D3 (1km)	0.219
E (1km)	0.306
F (1km)	2.539
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) 1.070

Time (mins)	Area
From:	To: (ha)
0	4 1.070



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Model Details

Storage is Online Cover Level (m) 2.600

Cellular Storage Structure

Invert Level (m) 0.000 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 <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	373.0	0.0	2.600	373.0	0.0


Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0112-8300-2600-8300  
 Design Head (m) 2.600  
 Design Flow (l/s) 8.3  
 Flush-Flo™ Calculated  
 Objective Minimise upstream storage  
 Application Surface  
 Sump Available Yes  
 Diameter (mm) 112  
 Invert Level (m) 0.000  
 Minimum Outlet Pipe Diameter (mm) 150  
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.600	8.3
Flush-Flo™	0.487	6.7
Kick-Flo®	0.995	5.3
Mean Flow over Head Range	-	6.5


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	5.8	3.000	8.9	7.000	13.3
0.200	5.9	1.400	6.2	3.500	9.5	7.500	13.7
0.300	6.4	1.600	6.6	4.000	10.2	8.000	14.1
0.400	6.6	1.800	7.0	4.500	10.8	8.500	14.6
0.500	6.7	2.000	7.3	5.000	11.3	9.000	15.0
0.600	6.6	2.200	7.7	5.500	11.8	9.500	15.4
0.800	6.3	2.400	8.0	6.000	12.3		
1.000	5.3	2.600	8.3	6.500	12.8		

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Weir Overflow Control

Discharge Coef 0.544 Width (m) 2.000 Invert Level (m) 2.600


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Summary of Results for 100 year Return Period

Half Drain Time : 741 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	0.860	0.860	0.0	6.7	0.0	6.7	304.6	O K
30 min Summer	0.986	0.986	0.0	6.7	0.0	6.7	349.5	O K
60 min Summer	1.122	1.122	0.0	6.7	0.0	6.7	397.6	O K
120 min Summer	1.256	1.256	0.0	6.7	0.0	6.7	445.2	O K
180 min Summer	1.326	1.326	0.0	6.7	0.0	6.7	469.8	O K
240 min Summer	1.366	1.366	0.0	6.7	0.0	6.7	484.0	O K
360 min Summer	1.400	1.400	0.0	6.7	0.0	6.7	496.3	O K
480 min Summer	1.403	1.403	0.0	6.7	0.0	6.7	497.2	O K
600 min Summer	1.388	1.388	0.0	6.7	0.0	6.7	491.8	O K
720 min Summer	1.368	1.368	0.0	6.7	0.0	6.7	484.8	O K
960 min Summer	1.300	1.300	0.0	6.7	0.0	6.7	460.8	O K
1440 min Summer	1.182	1.182	0.0	6.7	0.0	6.7	418.9	O K
2160 min Summer	1.024	1.024	0.0	6.7	0.0	6.7	362.8	O K
2880 min Summer	0.860	0.860	0.0	6.7	0.0	6.7	304.7	O K
4320 min Summer	0.592	0.592	0.0	6.7	0.0	6.7	209.7	O K
5760 min Summer	0.413	0.413	0.0	6.6	0.0	6.6	146.5	O K
7200 min Summer	0.299	0.299	0.0	6.4	0.0	6.4	105.8	O K
8640 min Summer	0.225	0.225	0.0	6.0	0.0	6.0	79.6	O K
10080 min Summer	0.177	0.177	0.0	5.7	0.0	5.7	62.6	O K
15 min Winter	0.965	0.965	0.0	6.7	0.0	6.7	341.9	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	154.409	0.0	305.2	0.0	19
30 min Summer	89.400	0.0	353.0	0.0	34
60 min Summer	51.761	0.0	413.6	0.0	64
120 min Summer	29.969	0.0	478.9	0.0	122
180 min Summer	21.769	0.0	521.9	0.0	182
240 min Summer	17.352	0.0	554.6	0.0	242
360 min Summer	12.604	0.0	604.2	0.0	362
480 min Summer	10.046	0.0	642.0	0.0	480
600 min Summer	8.426	0.0	672.9	0.0	594
720 min Summer	7.298	0.0	699.2	0.0	642
960 min Summer	5.717	0.0	729.9	0.0	760
1440 min Summer	4.053	0.0	774.5	0.0	1022
2160 min Summer	2.873	0.0	829.0	0.0	1444
2880 min Summer	2.251	0.0	865.9	0.0	1812
4320 min Summer	1.568	0.0	904.0	0.0	2512
5760 min Summer	1.214	0.0	934.5	0.0	3224
7200 min Summer	0.995	0.0	957.2	0.0	3888
8640 min Summer	0.845	0.0	975.9	0.0	4576
10080 min Summer	0.737	0.0	991.5	0.0	5248
15 min Winter	154.409	0.0	341.6	0.0	19

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Summary of Results for 100 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	1.108	1.108	0.0	6.7	0.0	6.7	392.6	O K
60 min Winter	1.261	1.261	0.0	6.7	0.0	6.7	447.0	O K
120 min Winter	1.416	1.416	0.0	6.7	0.0	6.7	501.9	O K
180 min Winter	1.499	1.499	0.0	6.7	0.0	6.7	531.2	O K
240 min Winter	1.549	1.549	0.0	6.7	0.0	6.7	548.8	O K
360 min Winter	1.598	1.598	0.0	6.7	0.0	6.7	566.3	O K
480 min Winter	1.611	1.611	0.0	6.7	0.0	6.7	570.9	O K
600 min Winter	1.605	1.605	0.0	6.7	0.0	6.7	568.6	O K
720 min Winter	1.586	1.586	0.0	6.7	0.0	6.7	562.1	O K
960 min Winter	1.498	1.498	0.0	6.7	0.0	6.7	530.9	O K
1440 min Winter	1.353	1.353	0.0	6.7	0.0	6.7	479.3	O K
2160 min Winter	1.141	1.141	0.0	6.7	0.0	6.7	404.5	O K
2880 min Winter	0.905	0.905	0.0	6.7	0.0	6.7	320.8	O K
4320 min Winter	0.516	0.516	0.0	6.7	0.0	6.7	182.8	O K
5760 min Winter	0.301	0.301	0.0	6.4	0.0	6.4	106.8	O K
7200 min Winter	0.192	0.192	0.0	5.8	0.0	5.8	67.9	O K
8640 min Winter	0.137	0.137	0.0	5.2	0.0	5.2	48.5	O K
10080 min Winter	0.118	0.118	0.0	4.6	0.0	4.6	41.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
30 min Winter	89.400	0.0	394.5	0.0	33
60 min Winter	51.761	0.0	463.2	0.0	62
120 min Winter	29.969	0.0	536.5	0.0	122
180 min Winter	21.769	0.0	584.5	0.0	180
240 min Winter	17.352	0.0	621.1	0.0	238
360 min Winter	12.604	0.0	676.6	0.0	352
480 min Winter	10.046	0.0	718.9	0.0	466
600 min Winter	8.426	0.0	753.3	0.0	576
720 min Winter	7.298	0.0	782.6	0.0	684
960 min Winter	5.717	0.0	816.7	0.0	800
1440 min Winter	4.053	0.0	865.1	0.0	1094
2160 min Winter	2.873	0.0	928.6	0.0	1556
2880 min Winter	2.251	0.0	969.9	0.0	1964
4320 min Winter	1.568	0.0	1012.8	0.0	2640
5760 min Winter	1.214	0.0	1046.7	0.0	3288
7200 min Winter	0.995	0.0	1072.1	0.0	3896
8640 min Winter	0.845	0.0	1093.2	0.0	4496
10080 min Winter	0.737	0.0	1110.9	0.0	5152

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 520450 176000 TQ 20450 76000
C (1km)	-0.024
D1 (1km)	0.322
D2 (1km)	0.262
D3 (1km)	0.219
E (1km)	0.306
F (1km)	2.539
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) 1.070

Time (mins)	Area
From:	To: (ha)
0	4 1.070

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Model Details

Storage is Online Cover Level (m) 2.600

Cellular Storage Structure

Invert Level (m) 0.000 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 <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	373.0	0.0	2.600	373.0	0.0


Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0112-8300-2600-8300  
 Design Head (m) 2.600  
 Design Flow (l/s) 8.3  
 Flush-Flo™ Calculated  
 Objective Minimise upstream storage  
 Application Surface  
 Sump Available Yes  
 Diameter (mm) 112  
 Invert Level (m) 0.000  
 Minimum Outlet Pipe Diameter (mm) 150  
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.600	8.3
Flush-Flo™	0.487	6.7
Kick-Flo®	0.995	5.3
Mean Flow over Head Range	-	6.5

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	5.8	3.000	8.9	7.000	13.3
0.200	5.9	1.400	6.2	3.500	9.5	7.500	13.7
0.300	6.4	1.600	6.6	4.000	10.2	8.000	14.1
0.400	6.6	1.800	7.0	4.500	10.8	8.500	14.6
0.500	6.7	2.000	7.3	5.000	11.3	9.000	15.0
0.600	6.6	2.200	7.7	5.500	11.8	9.500	15.4
0.800	6.3	2.400	8.0	6.000	12.3		
1.000	5.3	2.600	8.3	6.500	12.8		

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Weir Overflow Control

Discharge Coef 0.544 Width (m) 2.000 Invert Level (m) 2.600

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

Half Drain Time : 1033 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	1.209	1.209	0.0	6.7	0.0	6.7	428.6	O K
30 min Summer	1.389	1.389	0.0	6.7	0.0	6.7	492.4	O K
60 min Summer	1.585	1.585	0.0	6.7	0.0	6.7	561.7	O K
120 min Summer	1.785	1.785	0.0	7.0	0.0	7.0	632.6	O K
180 min Summer	1.895	1.895	0.0	7.2	0.0	7.2	671.6	O K
240 min Summer	1.964	1.964	0.0	7.3	0.0	7.3	696.1	O K
360 min Summer	2.038	2.038	0.0	7.4	0.0	7.4	722.3	O K
480 min Summer	2.066	2.066	0.0	7.4	0.0	7.4	731.9	O K
600 min Summer	2.067	2.067	0.0	7.4	0.0	7.4	732.4	O K
720 min Summer	2.052	2.052	0.0	7.4	0.0	7.4	727.0	O K
960 min Summer	1.969	1.969	0.0	7.3	0.0	7.3	697.7	O K
1440 min Summer	1.828	1.828	0.0	7.0	0.0	7.0	647.8	O K
2160 min Summer	1.656	1.656	0.0	6.7	0.0	6.7	586.6	O K
2880 min Summer	1.509	1.509	0.0	6.7	0.0	6.7	534.7	O K
4320 min Summer	1.219	1.219	0.0	6.7	0.0	6.7	432.0	O K
5760 min Summer	0.924	0.924	0.0	6.7	0.0	6.7	327.4	O K
7200 min Summer	0.675	0.675	0.0	6.7	0.0	6.7	239.1	O K
8640 min Summer	0.504	0.504	0.0	6.7	0.0	6.7	178.6	O K
10080 min Summer	0.385	0.385	0.0	6.6	0.0	6.6	136.3	O K
15 min Winter	1.356	1.356	0.0	6.7	0.0	6.7	480.4	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	216.173	0.0	424.8	0.0	19
30 min Summer	125.161	0.0	485.8	0.0	34
60 min Summer	72.466	0.0	579.1	0.0	64
120 min Summer	41.957	0.0	670.5	0.0	124
180 min Summer	30.477	0.0	730.4	0.0	182
240 min Summer	24.292	0.0	776.0	0.0	242
360 min Summer	17.646	0.0	844.9	0.0	362
480 min Summer	14.065	0.0	897.1	0.0	482
600 min Summer	11.796	0.0	939.4	0.0	600
720 min Summer	10.217	0.0	974.6	0.0	714
960 min Summer	8.004	0.0	1012.6	0.0	816
1440 min Summer	5.674	0.0	1020.8	0.0	1066
2160 min Summer	4.023	0.0	1160.8	0.0	1472
2880 min Summer	3.151	0.0	1212.3	0.0	1876
4320 min Summer	2.196	0.0	1266.0	0.0	2724
5760 min Summer	1.699	0.0	1308.4	0.0	3464
7200 min Summer	1.392	0.0	1340.3	0.0	4112
8640 min Summer	1.184	0.0	1366.7	0.0	4760
10080 min Summer	1.032	0.0	1388.8	0.0	5448
15 min Winter	216.173	0.0	472.0	0.0	19



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 Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	1.559	1.559	0.0	6.7	0.0	6.7	552.3	O K
60 min Winter	1.780	1.780	0.0	6.9	0.0	6.9	630.8	O K
120 min Winter	2.011	2.011	0.0	7.4	0.0	7.4	712.7	O K
180 min Winter	2.141	2.141	0.0	7.6	0.0	7.6	758.7	O K
240 min Winter	2.224	2.224	0.0	7.7	0.0	7.7	788.2	O K
360 min Winter	2.320	2.320	0.0	7.9	0.0	7.9	822.2	Flood Risk
480 min Winter	2.364	2.364	0.0	7.9	0.0	7.9	837.8	Flood Risk
<b>600 min Winter</b>	<b>2.379</b>	<b>2.379</b>	<b>0.0</b>	<b>8.0</b>	<b>0.0</b>	<b>8.0</b>	<b>843.1</b>	<b>Flood Risk</b>
720 min Winter	2.376	2.376	0.0	8.0	0.0	8.0	841.8	Flood Risk
960 min Winter	2.287	2.287	0.0	7.8	0.0	7.8	810.5	O K
1440 min Winter	2.114	2.114	0.0	7.5	0.0	7.5	749.2	O K
2160 min Winter	1.889	1.889	0.0	7.1	0.0	7.1	669.4	O K
2880 min Winter	1.684	1.684	0.0	6.8	0.0	6.8	596.8	O K
4320 min Winter	1.274	1.274	0.0	6.7	0.0	6.7	451.3	O K
5760 min Winter	0.822	0.822	0.0	6.7	0.0	6.7	291.4	O K
7200 min Winter	0.508	0.508	0.0	6.7	0.0	6.7	180.1	O K
8640 min Winter	0.328	0.328	0.0	6.5	0.0	6.5	116.1	O K
10080 min Winter	0.226	0.226	0.0	6.0	0.0	6.0	80.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
30 min Winter	125.161	0.0	523.4	0.0	33
60 min Winter	72.466	0.0	648.6	0.0	62
120 min Winter	41.957	0.0	750.7	0.0	122
180 min Winter	30.477	0.0	817.6	0.0	180
240 min Winter	24.292	0.0	868.5	0.0	238
360 min Winter	17.646	0.0	945.0	0.0	354
480 min Winter	14.065	0.0	1002.2	0.0	468
<b>600 min Winter</b>	<b>11.796</b>	<b>0.0</b>	<b>1046.9</b>	<b>0.0</b>	<b>582</b>
720 min Winter	10.217	0.0	1080.5	0.0	692
960 min Winter	8.004	0.0	1092.9	0.0	902
1440 min Winter	5.674	0.0	1057.2	0.0	1124
2160 min Winter	4.023	0.0	1300.0	0.0	1580
2880 min Winter	3.151	0.0	1357.7	0.0	2044
4320 min Winter	2.196	0.0	1417.6	0.0	2940
5760 min Winter	1.699	0.0	1465.5	0.0	3688
7200 min Winter	1.392	0.0	1501.2	0.0	4256
8640 min Winter	1.184	0.0	1530.9	0.0	4840
10080 min Winter	1.032	0.0	1555.9	0.0	5448

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 520450 176000 TQ 20450 76000
C (1km)	-0.024
D1 (1km)	0.322
D2 (1km)	0.262
D3 (1km)	0.219
E (1km)	0.306
F (1km)	2.539
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) 1.070

Time (mins)	Area
From:	To: (ha)
0	4 1.070

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Model Details

Storage is Online Cover Level (m) 2.600

Cellular Storage Structure

Invert Level (m) 0.000 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 <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	373.0	0.0	2.600	373.0	0.0


Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0112-8300-2600-8300  
 Design Head (m) 2.600  
 Design Flow (l/s) 8.3  
 Flush-Flo™ Calculated  
 Objective Minimise upstream storage  
 Application Surface  
 Sump Available Yes  
 Diameter (mm) 112  
 Invert Level (m) 0.000  
 Minimum Outlet Pipe Diameter (mm) 150  
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.600	8.3
Flush-Flo™	0.487	6.7
Kick-Flo®	0.995	5.3
Mean Flow over Head Range	-	6.5


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	5.8	3.000	8.9	7.000	13.3
0.200	5.9	1.400	6.2	3.500	9.5	7.500	13.7
0.300	6.4	1.600	6.6	4.000	10.2	8.000	14.1
0.400	6.6	1.800	7.0	4.500	10.8	8.500	14.6
0.500	6.7	2.000	7.3	5.000	11.3	9.000	15.0
0.600	6.6	2.200	7.7	5.500	11.8	9.500	15.4
0.800	6.3	2.400	8.0	6.000	12.3		
1.000	5.3	2.600	8.3	6.500	12.8		

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Weir Overflow Control

Discharge Coef 0.544 Width (m) 2.000 Invert Level (m) 2.600

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Summary of Results for 30 year Return Period

Half Drain Time : 500 minutes.


Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	0.565	0.565	0.0	6.7	0.0	6.7	200.1	O K
30 min Summer	0.658	0.658	0.0	6.7	0.0	6.7	233.2	O K
60 min Summer	0.757	0.757	0.0	6.7	0.0	6.7	268.4	O K
120 min Summer	0.856	0.856	0.0	6.7	0.0	6.7	303.2	O K
180 min Summer	0.905	0.905	0.0	6.7	0.0	6.7	320.8	O K
240 min Summer	0.933	0.933	0.0	6.7	0.0	6.7	330.6	O K
360 min Summer	0.954	0.954	0.0	6.7	0.0	6.7	337.9	O K
480 min Summer	0.948	0.948	0.0	6.7	0.0	6.7	336.0	O K
600 min Summer	0.936	0.936	0.0	6.7	0.0	6.7	331.6	O K
720 min Summer	0.921	0.921	0.0	6.7	0.0	6.7	326.5	O K
960 min Summer	0.866	0.866	0.0	6.7	0.0	6.7	307.0	O K
1440 min Summer	0.767	0.767	0.0	6.7	0.0	6.7	271.8	O K
2160 min Summer	0.638	0.638	0.0	6.7	0.0	6.7	226.2	O K
2880 min Summer	0.530	0.530	0.0	6.7	0.0	6.7	187.7	O K
4320 min Summer	0.355	0.355	0.0	6.5	0.0	6.5	125.9	O K
5760 min Summer	0.249	0.249	0.0	6.2	0.0	6.2	88.4	O K
7200 min Summer	0.185	0.185	0.0	5.7	0.0	5.7	65.5	O K
8640 min Summer	0.146	0.146	0.0	5.3	0.0	5.3	51.8	O K
10080 min Summer	0.127	0.127	0.0	4.9	0.0	4.9	45.0	O K
15 min Winter	0.634	0.634	0.0	6.7	0.0	6.7	224.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	102.217	0.0	201.7	0.0	19
30 min Summer	60.391	0.0	238.6	0.0	33
60 min Summer	35.680	0.0	284.8	0.0	64
120 min Summer	21.080	0.0	336.7	0.0	122
180 min Summer	15.495	0.0	371.3	0.0	182
240 min Summer	12.455	0.0	398.0	0.0	242
360 min Summer	9.155	0.0	438.8	0.0	360
480 min Summer	7.358	0.0	470.3	0.0	458
600 min Summer	6.212	0.0	496.3	0.0	508
720 min Summer	5.409	0.0	518.5	0.0	568
960 min Summer	4.273	0.0	546.1	0.0	682
1440 min Summer	3.065	0.0	587.2	0.0	940
2160 min Summer	2.199	0.0	634.4	0.0	1340
2880 min Summer	1.737	0.0	668.1	0.0	1704
4320 min Summer	1.225	0.0	705.6	0.0	2420
5760 min Summer	0.956	0.0	735.8	0.0	3112
7200 min Summer	0.788	0.0	758.6	0.0	3816
8640 min Summer	0.674	0.0	777.5	0.0	4488
10080 min Summer	0.590	0.0	793.3	0.0	5144
15 min Winter	102.217	0.0	226.1	0.0	19

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 Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m <sup>3</sup> )	Status
30 min Winter	0.740	0.740	0.0	6.7	0.0	6.7	262.2	O K
60 min Winter	0.855	0.855	0.0	6.7	0.0	6.7	302.8	O K
120 min Winter	0.972	0.972	0.0	6.7	0.0	6.7	344.3	O K
180 min Winter	1.035	1.035	0.0	6.7	0.0	6.7	366.8	O K
240 min Winter	1.072	1.072	0.0	6.7	0.0	6.7	379.9	O K
360 min Winter	1.106	1.106	0.0	6.7	0.0	6.7	391.8	O K
<b>480 min Winter</b>	<b>1.111</b>	<b>1.111</b>	<b>0.0</b>	<b>6.7</b>	<b>0.0</b>	<b>6.7</b>	<b>393.7</b>	<b>O K</b>
600 min Winter	1.101	1.101	0.0	6.7	0.0	6.7	390.0	O K
720 min Winter	1.081	1.081	0.0	6.7	0.0	6.7	383.1	O K
960 min Winter	1.010	1.010	0.0	6.7	0.0	6.7	357.9	O K
1440 min Winter	0.859	0.859	0.0	6.7	0.0	6.7	304.4	O K
2160 min Winter	0.660	0.660	0.0	6.7	0.0	6.7	233.9	O K
2880 min Winter	0.499	0.499	0.0	6.7	0.0	6.7	176.9	O K
4320 min Winter	0.275	0.275	0.0	6.3	0.0	6.3	97.6	O K
5760 min Winter	0.168	0.168	0.0	5.6	0.0	5.6	59.5	O K
7200 min Winter	0.126	0.126	0.0	4.9	0.0	4.9	44.6	O K
8640 min Winter	0.108	0.108	0.0	4.2	0.0	4.2	38.2	O K
10080 min Winter	0.096	0.096	0.0	3.7	0.0	3.7	34.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Overflow Volume (m <sup>3</sup> )	Time-Peak (mins)
30 min Winter	60.391	0.0	267.3	0.0	33
60 min Winter	35.680	0.0	319.1	0.0	62
120 min Winter	21.080	0.0	377.2	0.0	120
180 min Winter	15.495	0.0	415.9	0.0	178
240 min Winter	12.455	0.0	445.8	0.0	236
360 min Winter	9.155	0.0	491.5	0.0	350
<b>480 min Winter</b>	<b>7.358</b>	<b>0.0</b>	<b>526.8</b>	<b>0.0</b>	<b>462</b>
600 min Winter	6.212	0.0	555.8	0.0	570
720 min Winter	5.409	0.0	580.6	0.0	670
960 min Winter	4.273	0.0	611.5	0.0	760
1440 min Winter	3.065	0.0	657.6	0.0	1038
2160 min Winter	2.199	0.0	710.6	0.0	1448
2880 min Winter	1.737	0.0	748.4	0.0	1816
4320 min Winter	1.225	0.0	790.6	0.0	2504
5760 min Winter	0.956	0.0	824.2	0.0	3120
7200 min Winter	0.788	0.0	849.7	0.0	3744
8640 min Winter	0.674	0.0	871.0	0.0	4416
10080 min Winter	0.590	0.0	888.9	0.0	5144

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	1999
Site Location	GB 520450 176000 TQ 20450 76000
C (1km)	-0.024
D1 (1km)	0.322
D2 (1km)	0.262
D3 (1km)	0.219
E (1km)	0.306
F (1km)	2.539
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) 1.070

Time (mins)	Area
From:	To: (ha)
0	4 1.070

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Model Details

Storage is Online Cover Level (m) 2.600

Cellular Storage Structure

Invert Level (m) 0.000 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 <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	373.0	0.0	2.600	373.0	0.0

Hydro-Brake® Optimum Outflow Control


Unit Reference MD-SHE-0112-8300-2600-8300  
 Design Head (m) 2.600  
 Design Flow (l/s) 8.3  
 Flush-Flo™ Calculated  
 Objective Minimise upstream storage  
 Application Surface  
 Sump Available Yes  
 Diameter (mm) 112  
 Invert Level (m) 0.000  
 Minimum Outlet Pipe Diameter (mm) 150  
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.600	8.3
Flush-Flo™	0.487	6.7
Kick-Flo®	0.995	5.3
Mean Flow over Head Range	-	6.5

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	5.8	3.000	8.9	7.000	13.3
0.200	5.9	1.400	6.2	3.500	9.5	7.500	13.7
0.300	6.4	1.600	6.6	4.000	10.2	8.000	14.1
0.400	6.6	1.800	7.0	4.500	10.8	8.500	14.6
0.500	6.7	2.000	7.3	5.000	11.3	9.000	15.0
0.600	6.6	2.200	7.7	5.500	11.8	9.500	15.4
0.800	6.3	2.400	8.0	6.000	12.3		
1.000	5.3	2.600	8.3	6.500	12.8		



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Weir Overflow Control

Discharge Coef 0.544 Width (m) 2.000 Invert Level (m) 2.600


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Summary of Results for 1 year Return Period

Half Drain Time : 377 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	0.040	0.040	0.0	1.0	0.0	1.0	55.5	O K
30 min Summer	0.050	0.050	0.0	1.4	0.0	1.4	68.7	O K
60 min Summer	0.061	0.061	0.0	2.1	0.0	2.1	84.0	O K
120 min Summer	0.073	0.073	0.0	2.8	0.0	2.8	100.1	O K
180 min Summer	0.079	0.079	0.0	3.2	0.0	3.2	108.3	O K
240 min Summer	0.082	0.082	0.0	3.5	0.0	3.5	112.9	O K
360 min Summer	0.087	0.087	0.0	3.8	0.0	3.8	119.7	O K
480 min Summer	0.090	0.090	0.0	4.0	0.0	4.0	124.4	O K
600 min Summer	0.093	0.093	0.0	4.2	0.0	4.2	127.7	O K
720 min Summer	0.094	0.094	0.0	4.3	0.0	4.3	129.9	O K
960 min Summer	0.095	0.095	0.0	4.3	0.0	4.3	130.3	O K
1440 min Summer	0.093	0.093	0.0	4.2	0.0	4.2	128.2	O K
2160 min Summer	0.089	0.089	0.0	3.9	0.0	3.9	122.6	O K
2880 min Summer	0.085	0.085	0.0	3.6	0.0	3.6	116.9	O K
4320 min Summer	0.077	0.077	0.0	3.1	0.0	3.1	105.8	O K
5760 min Summer	0.071	0.071	0.0	2.7	0.0	2.7	97.4	O K
7200 min Summer	0.066	0.066	0.0	2.4	0.0	2.4	90.9	O K
8640 min Summer	0.062	0.062	0.0	2.2	0.0	2.2	85.7	O K
10080 min Summer	0.059	0.059	0.0	2.0	0.0	2.0	81.2	O K
15 min Winter	0.045	0.045	0.0	1.2	0.0	1.2	62.1	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	32.424	0.0	34.4	0.0	19
30 min Summer	20.266	0.0	46.3	0.0	34
60 min Summer	12.667	0.0	72.8	0.0	62
120 min Summer	7.917	0.0	93.8	0.0	122
180 min Summer	6.014	0.0	108.5	0.0	180
240 min Summer	4.949	0.0	120.2	0.0	220
360 min Summer	3.759	0.0	138.5	0.0	272
480 min Summer	3.093	0.0	152.9	0.0	336
600 min Summer	2.659	0.0	164.9	0.0	404
720 min Summer	2.350	0.0	175.3	0.0	470
960 min Summer	1.900	0.0	189.0	0.0	606
1440 min Summer	1.409	0.0	208.9	0.0	868
2160 min Summer	1.044	0.0	248.2	0.0	1256
2880 min Summer	0.845	0.0	266.8	0.0	1640
4320 min Summer	0.615	0.0	287.0	0.0	2376
5760 min Summer	0.492	0.0	318.8	0.0	3112
7200 min Summer	0.413	0.0	333.7	0.0	3824
8640 min Summer	0.358	0.0	345.3	0.0	4584
10080 min Summer	0.318	0.0	353.2	0.0	5336
15 min Winter	32.424	0.0	40.1	0.0	19

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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 Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	0.056	0.056	0.0	1.8	0.0	1.8	76.9	O K
60 min Winter	0.068	0.068	0.0	2.5	0.0	2.5	93.9	O K
120 min Winter	0.081	0.081	0.0	3.4	0.0	3.4	111.8	O K
180 min Winter	0.088	0.088	0.0	3.8	0.0	3.8	121.1	O K
240 min Winter	0.092	0.092	0.0	4.1	0.0	4.1	126.3	O K
360 min Winter	0.097	0.097	0.0	4.4	0.0	4.4	132.9	O K
480 min Winter	0.100	0.100	0.0	4.7	0.0	4.7	137.1	O K
600 min Winter	0.101	0.101	0.0	4.8	0.0	4.8	139.4	O K
720 min Winter	0.102	0.102	0.0	4.8	0.0	4.8	140.4	O K
960 min Winter	0.101	0.101	0.0	4.7	0.0	4.7	138.3	O K
1440 min Winter	0.096	0.096	0.0	4.4	0.0	4.4	131.9	O K
2160 min Winter	0.089	0.089	0.0	3.9	0.0	3.9	122.2	O K
2880 min Winter	0.083	0.083	0.0	3.5	0.0	3.5	113.8	O K
4320 min Winter	0.073	0.073	0.0	2.8	0.0	2.8	99.8	O K
5760 min Winter	0.066	0.066	0.0	2.4	0.0	2.4	90.1	O K
7200 min Winter	0.060	0.060	0.0	2.0	0.0	2.0	83.0	O K
8640 min Winter	0.056	0.056	0.0	1.8	0.0	1.8	77.4	O K
10080 min Winter	0.053	0.053	0.0	1.6	0.0	1.6	72.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
30 min Winter	20.266	0.0	53.7	0.0	33
60 min Winter	12.667	0.0	82.9	0.0	62
120 min Winter	7.917	0.0	106.7	0.0	118
180 min Winter	6.014	0.0	123.2	0.0	174
240 min Winter	4.949	0.0	136.3	0.0	226
360 min Winter	3.759	0.0	156.8	0.0	280
480 min Winter	3.093	0.0	173.0	0.0	354
600 min Winter	2.659	0.0	186.5	0.0	428
720 min Winter	2.350	0.0	198.2	0.0	502
960 min Winter	1.900	0.0	213.8	0.0	646
1440 min Winter	1.409	0.0	236.3	0.0	922
2160 min Winter	1.044	0.0	279.2	0.0	1320
2880 min Winter	0.845	0.0	300.3	0.0	1700
4320 min Winter	0.615	0.0	323.3	0.0	2460
5760 min Winter	0.492	0.0	357.9	0.0	3176
7200 min Winter	0.413	0.0	374.7	0.0	3960
8640 min Winter	0.358	0.0	387.9	0.0	4672
10080 min Winter	0.318	0.0	397.4	0.0	5432

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	1
FEH Rainfall Version	1999
Site Location	GB 520450 176000 TQ 20450 76000
C (1km)	-0.024
D1 (1km)	0.322
D2 (1km)	0.262
D3 (1km)	0.219
E (1km)	0.306
F (1km)	2.539
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) 0.920

Time (mins)	Area
From:	To: (ha)
0	4 0.920

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Model Details

Storage is Online Cover Level (m) 0.600

Cellular Storage Structure

Invert Level (m) 0.000 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 <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	1448.0	0.0	0.600	1448.0	0.0


Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0130-7100-0600-7100  
 Design Head (m) 0.600  
 Design Flow (l/s) 7.1  
 Flush-Flo™ Calculated  
 Objective Minimise upstream storage  
 Application Surface  
 Sump Available Yes  
 Diameter (mm) 130  
 Invert Level (m) 0.000  
 Minimum Outlet Pipe Diameter (mm) 150  
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.600	7.1
Flush-Flo™	0.211	7.1
Kick-Flo®	0.440	6.1
Mean Flow over Head Range	-	5.9


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	4.7	1.200	9.8	3.000	15.2	7.000	22.8
0.200	7.1	1.400	10.6	3.500	16.3	7.500	23.6
0.300	6.9	1.600	11.3	4.000	17.4	8.000	24.3
0.400	6.6	1.800	11.9	4.500	18.4	8.500	25.1
0.500	6.5	2.000	12.5	5.000	19.4	9.000	25.8
0.600	7.1	2.200	13.1	5.500	20.3	9.500	26.5
0.800	8.1	2.400	13.6	6.000	21.2		
1.000	9.0	2.600	14.2	6.500	21.9		

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Weir Overflow Control

Discharge Coef 0.544 Width (m) 2.000 Invert Level (m) 0.600

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Summary of Results for 100 year Return Period

Half Drain Time : 589 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	0.191	0.191	0.0	7.1	0.0	7.1	262.1	O K
30 min Summer	0.218	0.218	0.0	7.1	0.0	7.1	300.4	O K
60 min Summer	0.248	0.248	0.0	7.1	0.0	7.1	341.6	O K
120 min Summer	0.278	0.278	0.0	7.1	0.0	7.1	382.7	O K
180 min Summer	0.294	0.294	0.0	7.1	0.0	7.1	404.0	O K
240 min Summer	0.303	0.303	0.0	7.1	0.0	7.1	416.4	Flood Risk
360 min Summer	0.311	0.311	0.0	7.1	0.0	7.1	427.2	Flood Risk
480 min Summer	0.311	0.311	0.0	7.1	0.0	7.1	428.2	Flood Risk
600 min Summer	0.311	0.311	0.0	7.1	0.0	7.1	427.7	Flood Risk
720 min Summer	0.310	0.310	0.0	7.1	0.0	7.1	426.0	Flood Risk
960 min Summer	0.299	0.299	0.0	7.1	0.0	7.1	411.5	O K
1440 min Summer	0.277	0.277	0.0	7.1	0.0	7.1	381.6	O K
2160 min Summer	0.245	0.245	0.0	7.1	0.0	7.1	337.2	O K
2880 min Summer	0.216	0.216	0.0	7.1	0.0	7.1	297.1	O K
4320 min Summer	0.166	0.166	0.0	7.0	0.0	7.0	228.9	O K
5760 min Summer	0.137	0.137	0.0	6.7	0.0	6.7	189.1	O K
7200 min Summer	0.122	0.122	0.0	6.0	0.0	6.0	167.2	O K
8640 min Summer	0.110	0.110	0.0	5.3	0.0	5.3	151.3	O K
10080 min Summer	0.102	0.102	0.0	4.8	0.0	4.8	140.0	O K
15 min Winter	0.214	0.214	0.0	7.1	0.0	7.1	293.9	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	154.409	0.0	230.0	0.0	19
30 min Summer	89.400	0.0	269.1	0.0	33
60 min Summer	51.761	0.0	337.9	0.0	64
120 min Summer	29.969	0.0	393.1	0.0	122
180 min Summer	21.769	0.0	429.1	0.0	182
240 min Summer	17.352	0.0	456.5	0.0	242
360 min Summer	12.604	0.0	497.9	0.0	360
480 min Summer	10.046	0.0	529.1	0.0	446
600 min Summer	8.426	0.0	554.5	0.0	498
720 min Summer	7.298	0.0	575.8	0.0	558
960 min Summer	5.717	0.0	600.2	0.0	682
1440 min Summer	4.053	0.0	634.1	0.0	950
2160 min Summer	2.873	0.0	700.9	0.0	1344
2880 min Summer	2.251	0.0	730.9	0.0	1728
4320 min Summer	1.568	0.0	756.6	0.0	2424
5760 min Summer	1.214	0.0	796.6	0.0	3112
7200 min Summer	0.995	0.0	814.5	0.0	3824
8640 min Summer	0.845	0.0	827.9	0.0	4544
10080 min Summer	0.737	0.0	835.9	0.0	5248
15 min Winter	154.409	0.0	259.9	0.0	19

Summary of Results for 100 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	0.245	0.245	0.0	7.1	0.0	7.1	337.3	O K
60 min Winter	0.279	0.279	0.0	7.1	0.0	7.1	384.0	O K
120 min Winter	0.314	0.314	0.0	7.1	0.0	7.1	431.4	Flood Risk
180 min Winter	0.332	0.332	0.0	7.1	0.0	7.1	456.7	Flood Risk
240 min Winter	0.343	0.343	0.0	7.1	0.0	7.1	472.1	Flood Risk
360 min Winter	0.354	0.354	0.0	7.1	0.0	7.1	487.6	Flood Risk
<b>480 min Winter</b>	<b>0.358</b>	<b>0.358</b>	<b>0.0</b>	<b>7.1</b>	<b>0.0</b>	<b>7.1</b>	<b>491.8</b>	<b>Flood Risk</b>
600 min Winter	0.356	0.356	0.0	7.1	0.0	7.1	489.7	Flood Risk
720 min Winter	0.352	0.352	0.0	7.1	0.0	7.1	483.9	Flood Risk
960 min Winter	0.337	0.337	0.0	7.1	0.0	7.1	463.0	Flood Risk
1440 min Winter	0.304	0.304	0.0	7.1	0.0	7.1	418.7	Flood Risk
2160 min Winter	0.256	0.256	0.0	7.1	0.0	7.1	351.5	O K
2880 min Winter	0.212	0.212	0.0	7.1	0.0	7.1	292.0	O K
4320 min Winter	0.147	0.147	0.0	6.9	0.0	6.9	202.6	O K
5760 min Winter	0.121	0.121	0.0	5.9	0.0	5.9	166.5	O K
7200 min Winter	0.106	0.106	0.0	5.0	0.0	5.0	145.4	O K
8640 min Winter	0.095	0.095	0.0	4.3	0.0	4.3	131.3	O K
10080 min Winter	0.088	0.088	0.0	3.8	0.0	3.8	120.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
30 min Winter	89.400	0.0	303.3	0.0	33
60 min Winter	51.761	0.0	380.0	0.0	62
120 min Winter	29.969	0.0	441.7	0.0	120
180 min Winter	21.769	0.0	482.0	0.0	178
240 min Winter	17.352	0.0	512.6	0.0	236
360 min Winter	12.604	0.0	558.7	0.0	350
<b>480 min Winter</b>	<b>10.046</b>	<b>0.0</b>	<b>593.6</b>	<b>0.0</b>	<b>462</b>
600 min Winter	8.426	0.0	621.8	0.0	566
720 min Winter	7.298	0.0	645.6	0.0	658
960 min Winter	5.717	0.0	672.7	0.0	740
1440 min Winter	4.053	0.0	710.3	0.0	1038
2160 min Winter	2.873	0.0	786.2	0.0	1452
2880 min Winter	2.251	0.0	820.2	0.0	1844
4320 min Winter	1.568	0.0	850.0	0.0	2504
5760 min Winter	1.214	0.0	893.0	0.0	3176
7200 min Winter	0.995	0.0	913.3	0.0	3888
8640 min Winter	0.845	0.0	928.8	0.0	4592
10080 min Winter	0.737	0.0	938.9	0.0	5344



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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 520450 176000 TQ 20450 76000
C (1km)	-0.024
D1 (1km)	0.322
D2 (1km)	0.262
D3 (1km)	0.219
E (1km)	0.306
F (1km)	2.539
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) 0.920

Time (mins)	Area
From:	To: (ha)
0	4 0.920

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Model Details

Storage is Online Cover Level (m) 0.600

Cellular Storage Structure

Invert Level (m) 0.000 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 <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	1448.0	0.0	0.600	1448.0	0.0


Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0130-7100-0600-7100  
 Design Head (m) 0.600  
 Design Flow (l/s) 7.1  
 Flush-Flo™ Calculated  
 Objective Minimise upstream storage  
 Application Surface  
 Sump Available Yes  
 Diameter (mm) 130  
 Invert Level (m) 0.000  
 Minimum Outlet Pipe Diameter (mm) 150  
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.600	7.1
Flush-Flo™	0.211	7.1
Kick-Flo®	0.440	6.1
Mean Flow over Head Range	-	5.9


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	4.7	1.200	9.8	3.000	15.2	7.000	22.8
0.200	7.1	1.400	10.6	3.500	16.3	7.500	23.6
0.300	6.9	1.600	11.3	4.000	17.4	8.000	24.3
0.400	6.6	1.800	11.9	4.500	18.4	8.500	25.1
0.500	6.5	2.000	12.5	5.000	19.4	9.000	25.8
0.600	7.1	2.200	13.1	5.500	20.3	9.500	26.5
0.800	8.1	2.400	13.6	6.000	21.2		
1.000	9.0	2.600	14.2	6.500	21.9		

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Weir Overflow Control

Discharge Coef 0.544 Width (m) 2.000 Invert Level (m) 0.600

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

Half Drain Time : 878 minutes.


Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m <sup>3</sup> )	Status
15 min Summer	0.268	0.268	0.0	7.1	0.0	7.1	368.2	O K
30 min Summer	0.308	0.308	0.0	7.1	0.0	7.1	423.3	Flood Risk
60 min Summer	0.351	0.351	0.0	7.1	0.0	7.1	483.5	Flood Risk
120 min Summer	0.397	0.397	0.0	7.1	0.0	7.1	546.3	Flood Risk
180 min Summer	0.423	0.423	0.0	7.1	0.0	7.1	582.2	Flood Risk
240 min Summer	0.440	0.440	0.0	7.1	0.0	7.1	605.9	Flood Risk
360 min Summer	0.461	0.461	0.0	7.1	0.0	7.1	633.7	Flood Risk
480 min Summer	0.470	0.470	0.0	7.1	0.0	7.1	646.3	Flood Risk
600 min Summer	0.473	0.473	0.0	7.1	0.0	7.1	650.4	Flood Risk
720 min Summer	0.472	0.472	0.0	7.1	0.0	7.1	649.0	Flood Risk
960 min Summer	0.457	0.457	0.0	7.1	0.0	7.1	628.5	Flood Risk
1440 min Summer	0.428	0.428	0.0	7.1	0.0	7.1	588.3	Flood Risk
2160 min Summer	0.386	0.386	0.0	7.1	0.0	7.1	530.9	Flood Risk
2880 min Summer	0.347	0.347	0.0	7.1	0.0	7.1	477.7	Flood Risk
4320 min Summer	0.272	0.272	0.0	7.1	0.0	7.1	374.4	O K
5760 min Summer	0.216	0.216	0.0	7.1	0.0	7.1	296.5	O K
7200 min Summer	0.175	0.175	0.0	7.0	0.0	7.0	241.2	O K
8640 min Summer	0.148	0.148	0.0	6.9	0.0	6.9	203.9	O K
10080 min Summer	0.133	0.133	0.0	6.5	0.0	6.5	182.6	O K
15 min Winter	0.300	0.300	0.0	7.1	0.0	7.1	412.8	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Overflow Volume (m <sup>3</sup> )	Time-Peak (mins)
15 min Summer	216.173	0.0	328.6	0.0	19
30 min Summer	125.161	0.0	381.1	0.0	34
60 min Summer	72.466	0.0	477.8	0.0	64
120 min Summer	41.957	0.0	554.4	0.0	122
180 min Summer	30.477	0.0	604.2	0.0	182
240 min Summer	24.292	0.0	641.9	0.0	242
360 min Summer	17.646	0.0	698.4	0.0	362
480 min Summer	14.065	0.0	740.8	0.0	482
600 min Summer	11.796	0.0	774.7	0.0	600
720 min Summer	10.217	0.0	802.8	0.0	716
960 min Summer	8.004	0.0	833.5	0.0	816
1440 min Summer	5.674	0.0	872.0	0.0	1050
2160 min Summer	4.023	0.0	984.0	0.0	1428
2880 min Summer	3.151	0.0	1026.7	0.0	1820
4320 min Summer	2.196	0.0	1066.1	0.0	2592
5760 min Summer	1.699	0.0	1117.9	0.0	3288
7200 min Summer	1.392	0.0	1143.6	0.0	3960
8640 min Summer	1.184	0.0	1163.3	0.0	4592
10080 min Summer	1.032	0.0	1176.2	0.0	5256
15 min Winter	216.173	0.0	368.9	0.0	19

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 Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	0.345	0.345	0.0	7.1	0.0	7.1	474.9	Flood Risk
60 min Winter	0.395	0.395	0.0	7.1	0.0	7.1	543.0	Flood Risk
120 min Winter	0.447	0.447	0.0	7.1	0.0	7.1	615.4	Flood Risk
180 min Winter	0.478	0.478	0.0	7.1	0.0	7.1	657.0	Flood Risk
240 min Winter	0.497	0.497	0.0	7.1	0.0	7.1	684.2	Flood Risk
360 min Winter	0.521	0.521	0.0	7.1	0.0	7.1	716.6	Flood Risk
480 min Winter	0.533	0.533	0.0	7.1	0.0	7.1	732.9	Flood Risk
600 min Winter	0.538	0.538	0.0	7.1	0.0	7.1	740.0	Flood Risk
720 min Winter	0.539	0.539	0.0	7.1	0.0	7.1	741.2	Flood Risk
960 min Winter	0.522	0.522	0.0	7.1	0.0	7.1	717.7	Flood Risk
1440 min Winter	0.486	0.486	0.0	7.1	0.0	7.1	667.9	Flood Risk
2160 min Winter	0.429	0.429	0.0	7.1	0.0	7.1	590.6	Flood Risk
2880 min Winter	0.370	0.370	0.0	7.1	0.0	7.1	509.5	Flood Risk
4320 min Winter	0.261	0.261	0.0	7.1	0.0	7.1	358.4	O K
5760 min Winter	0.184	0.184	0.0	7.0	0.0	7.0	253.2	O K
7200 min Winter	0.141	0.141	0.0	6.9	0.0	6.9	193.5	O K
8640 min Winter	0.123	0.123	0.0	6.0	0.0	6.0	169.4	O K
10080 min Winter	0.111	0.111	0.0	5.3	0.0	5.3	152.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
30 min Winter	125.161	0.0	425.9	0.0	33
60 min Winter	72.466	0.0	536.2	0.0	62
120 min Winter	41.957	0.0	621.4	0.0	122
180 min Winter	30.477	0.0	676.8	0.0	180
240 min Winter	24.292	0.0	718.6	0.0	238
360 min Winter	17.646	0.0	781.1	0.0	354
480 min Winter	14.065	0.0	827.6	0.0	468
600 min Winter	11.796	0.0	864.5	0.0	582
720 min Winter	10.217	0.0	894.6	0.0	692
960 min Winter	8.004	0.0	925.9	0.0	902
1440 min Winter	5.674	0.0	956.1	0.0	1124
2160 min Winter	4.023	0.0	1102.7	0.0	1580
2880 min Winter	3.151	0.0	1150.7	0.0	1988
4320 min Winter	2.196	0.0	1196.6	0.0	2728
5760 min Winter	1.699	0.0	1253.0	0.0	3400
7200 min Winter	1.392	0.0	1282.0	0.0	3960
8640 min Winter	1.184	0.0	1304.6	0.0	4664
10080 min Winter	1.032	0.0	1320.3	0.0	5344

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 520450 176000 TQ 20450 76000
C (1km)	-0.024
D1 (1km)	0.322
D2 (1km)	0.262
D3 (1km)	0.219
E (1km)	0.306
F (1km)	2.539
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) 0.920

Time (mins)	Area
From:	To: (ha)
0	4 0.920

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Model Details

Storage is Online Cover Level (m) 0.600

Cellular Storage Structure

Invert Level (m) 0.000 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 <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	1448.0	0.0	0.600	1448.0	0.0


Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0130-7100-0600-7100  
 Design Head (m) 0.600  
 Design Flow (l/s) 7.1  
 Flush-Flo™ Calculated  
 Objective Minimise upstream storage  
 Application Surface  
 Sump Available Yes  
 Diameter (mm) 130  
 Invert Level (m) 0.000  
 Minimum Outlet Pipe Diameter (mm) 150  
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.600	7.1
Flush-Flo™	0.211	7.1
Kick-Flo®	0.440	6.1
Mean Flow over Head Range	-	5.9

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	4.7	1.200	9.8	3.000	15.2	7.000	22.8
0.200	7.1	1.400	10.6	3.500	16.3	7.500	23.6
0.300	6.9	1.600	11.3	4.000	17.4	8.000	24.3
0.400	6.6	1.800	11.9	4.500	18.4	8.500	25.1
0.500	6.5	2.000	12.5	5.000	19.4	9.000	25.8
0.600	7.1	2.200	13.1	5.500	20.3	9.500	26.5
0.800	8.1	2.400	13.6	6.000	21.2		
1.000	9.0	2.600	14.2	6.500	21.9		

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Weir Overflow Control

Discharge Coef 0.544 Width (m) 2.000 Invert Level (m) 0.600




Summary of Results for 30 year Return Period

Half Drain Time : 433 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	0.126	0.126	0.0	6.2	0.0	6.2	173.1	O K
30 min Summer	0.147	0.147	0.0	6.9	0.0	6.9	201.7	O K
60 min Summer	0.169	0.169	0.0	7.0	0.0	7.0	232.4	O K
120 min Summer	0.191	0.191	0.0	7.1	0.0	7.1	262.7	O K
180 min Summer	0.202	0.202	0.0	7.1	0.0	7.1	277.7	O K
240 min Summer	0.208	0.208	0.0	7.1	0.0	7.1	285.7	O K
360 min Summer	0.213	0.213	0.0	7.1	0.0	7.1	292.8	O K
480 min Summer	0.216	0.216	0.0	7.1	0.0	7.1	296.9	O K
600 min Summer	0.217	0.217	0.0	7.1	0.0	7.1	298.9	O K
720 min Summer	0.218	0.218	0.0	7.1	0.0	7.1	299.3	O K
960 min Summer	0.211	0.211	0.0	7.1	0.0	7.1	290.9	O K
1440 min Summer	0.197	0.197	0.0	7.1	0.0	7.1	270.9	O K
2160 min Summer	0.175	0.175	0.0	7.0	0.0	7.0	240.3	O K
2880 min Summer	0.155	0.155	0.0	7.0	0.0	7.0	213.6	O K
4320 min Summer	0.128	0.128	0.0	6.3	0.0	6.3	176.7	O K
5760 min Summer	0.113	0.113	0.0	5.5	0.0	5.5	154.8	O K
7200 min Summer	0.102	0.102	0.0	4.8	0.0	4.8	139.9	O K
8640 min Summer	0.094	0.094	0.0	4.2	0.0	4.2	128.7	O K
10080 min Summer	0.087	0.087	0.0	3.8	0.0	3.8	120.3	O K
15 min Winter	0.141	0.141	0.0	6.9	0.0	6.9	193.9	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	102.217	0.0	144.9	0.0	19
30 min Summer	60.391	0.0	175.1	0.0	33
60 min Summer	35.680	0.0	228.8	0.0	62
120 min Summer	21.080	0.0	272.6	0.0	122
180 min Summer	15.495	0.0	301.8	0.0	182
240 min Summer	12.455	0.0	324.2	0.0	240
360 min Summer	9.155	0.0	358.3	0.0	308
480 min Summer	7.358	0.0	384.5	0.0	372
600 min Summer	6.212	0.0	405.9	0.0	434
720 min Summer	5.409	0.0	424.2	0.0	502
960 min Summer	4.273	0.0	446.2	0.0	636
1440 min Summer	3.065	0.0	477.7	0.0	908
2160 min Summer	2.199	0.0	534.2	0.0	1296
2880 min Summer	1.737	0.0	561.4	0.0	1648
4320 min Summer	1.225	0.0	587.0	0.0	2376
5760 min Summer	0.956	0.0	625.9	0.0	3104
7200 min Summer	0.788	0.0	643.9	0.0	3816
8640 min Summer	0.674	0.0	657.7	0.0	4504
10080 min Summer	0.590	0.0	666.5	0.0	5248
15 min Winter	102.217	0.0	165.0	0.0	18

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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 Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	0.165	0.165	0.0	7.0	0.0	7.0	226.4	O K
60 min Winter	0.190	0.190	0.0	7.1	0.0	7.1	261.6	O K
120 min Winter	0.216	0.216	0.0	7.1	0.0	7.1	296.9	O K
180 min Winter	0.229	0.229	0.0	7.1	0.0	7.1	315.1	O K
240 min Winter	0.237	0.237	0.0	7.1	0.0	7.1	325.6	O K
360 min Winter	0.243	0.243	0.0	7.1	0.0	7.1	334.6	O K
480 min Winter	0.244	0.244	0.0	7.1	0.0	7.1	335.4	O K
600 min Winter	0.244	0.244	0.0	7.1	0.0	7.1	335.9	O K
720 min Winter	0.243	0.243	0.0	7.1	0.0	7.1	334.3	O K
960 min Winter	0.232	0.232	0.0	7.1	0.0	7.1	319.7	O K
1440 min Winter	0.208	0.208	0.0	7.1	0.0	7.1	286.5	O K
2160 min Winter	0.174	0.174	0.0	7.0	0.0	7.0	239.2	O K
2880 min Winter	0.147	0.147	0.0	6.9	0.0	6.9	202.1	O K
4320 min Winter	0.117	0.117	0.0	5.7	0.0	5.7	161.2	O K
5760 min Winter	0.101	0.101	0.0	4.7	0.0	4.7	138.6	O K
7200 min Winter	0.090	0.090	0.0	4.0	0.0	4.0	123.9	O K
8640 min Winter	0.082	0.082	0.0	3.5	0.0	3.5	113.2	O K
10080 min Winter	0.076	0.076	0.0	3.1	0.0	3.1	105.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
30 min Winter	60.391	0.0	198.8	0.0	33
60 min Winter	35.680	0.0	257.9	0.0	62
120 min Winter	21.080	0.0	307.0	0.0	120
180 min Winter	15.495	0.0	339.6	0.0	178
240 min Winter	12.455	0.0	364.7	0.0	234
360 min Winter	9.155	0.0	402.9	0.0	342
480 min Winter	7.358	0.0	432.2	0.0	404
600 min Winter	6.212	0.0	456.2	0.0	470
720 min Winter	5.409	0.0	476.7	0.0	544
960 min Winter	4.273	0.0	501.4	0.0	694
1440 min Winter	3.065	0.0	536.9	0.0	982
2160 min Winter	2.199	0.0	599.6	0.0	1368
2880 min Winter	1.737	0.0	630.3	0.0	1728
4320 min Winter	1.225	0.0	659.9	0.0	2424
5760 min Winter	0.956	0.0	701.9	0.0	3168
7200 min Winter	0.788	0.0	722.3	0.0	3888
8640 min Winter	0.674	0.0	738.1	0.0	4592
10080 min Winter	0.590	0.0	748.8	0.0	5344

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	1999
Site Location	GB 520450 176000 TQ 20450 76000
C (1km)	-0.024
D1 (1km)	0.322
D2 (1km)	0.262
D3 (1km)	0.219
E (1km)	0.306
F (1km)	2.539
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) 0.920

Time (mins)	Area
From:	To: (ha)
0	4 0.920

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Model Details

Storage is Online Cover Level (m) 0.600

Cellular Storage Structure

Invert Level (m) 0.000 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 <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	1448.0	0.0	0.600	1448.0	0.0


Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0130-7100-0600-7100  
 Design Head (m) 0.600  
 Design Flow (l/s) 7.1  
 Flush-Flo™ Calculated  
 Objective Minimise upstream storage  
 Application Surface  
 Sump Available Yes  
 Diameter (mm) 130  
 Invert Level (m) 0.000  
 Minimum Outlet Pipe Diameter (mm) 150  
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.600	7.1
Flush-Flo™	0.211	7.1
Kick-Flo®	0.440	6.1
Mean Flow over Head Range	-	5.9


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	4.7	1.200	9.8	3.000	15.2	7.000	22.8
0.200	7.1	1.400	10.6	3.500	16.3	7.500	23.6
0.300	6.9	1.600	11.3	4.000	17.4	8.000	24.3
0.400	6.6	1.800	11.9	4.500	18.4	8.500	25.1
0.500	6.5	2.000	12.5	5.000	19.4	9.000	25.8
0.600	7.1	2.200	13.1	5.500	20.3	9.500	26.5
0.800	8.1	2.400	13.6	6.000	21.2		
1.000	9.0	2.600	14.2	6.500	21.9		

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Weir Overflow Control

Discharge Coef 0.544 Width (m) 2.000 Invert Level (m) 0.600

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Summary of Results for 1 year Return Period

Half Drain Time : 257 minutes.


Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	0.050	0.050	0.0	1.6	0.0	1.6	59.0	O K
30 min Summer	0.065	0.065	0.0	2.6	0.0	2.6	77.4	O K
60 min Summer	0.083	0.083	0.0	3.9	0.0	3.9	98.2	O K
120 min Summer	0.099	0.099	0.0	5.2	0.0	5.2	118.2	O K
180 min Summer	0.107	0.107	0.0	5.8	0.0	5.8	127.2	O K
240 min Summer	0.112	0.112	0.0	6.3	0.0	6.3	133.4	O K
360 min Summer	0.120	0.120	0.0	6.9	0.0	6.9	142.3	O K
480 min Summer	0.124	0.124	0.0	7.2	0.0	7.2	147.9	O K
600 min Summer	0.127	0.127	0.0	7.4	0.0	7.4	151.3	O K
720 min Summer	0.129	0.129	0.0	7.5	0.0	7.5	153.2	O K
960 min Summer	0.128	0.128	0.0	7.4	0.0	7.4	151.9	O K
1440 min Summer	0.123	0.123	0.0	7.1	0.0	7.1	146.0	O K
2160 min Summer	0.114	0.114	0.0	6.4	0.0	6.4	136.1	O K
2880 min Summer	0.107	0.107	0.0	5.9	0.0	5.9	127.5	O K
4320 min Summer	0.094	0.094	0.0	4.8	0.0	4.8	112.4	O K
5760 min Summer	0.086	0.086	0.0	4.1	0.0	4.1	101.8	O K
7200 min Summer	0.079	0.079	0.0	3.6	0.0	3.6	93.8	O K
8640 min Summer	0.074	0.074	0.0	3.2	0.0	3.2	87.7	O K
10080 min Summer	0.069	0.069	0.0	2.9	0.0	2.9	82.6	O K
15 min Winter	0.057	0.057	0.0	2.0	0.0	2.0	68.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	32.424	0.0	42.3	0.0	19
30 min Summer	20.266	0.0	60.4	0.0	33
60 min Summer	12.667	0.0	93.1	0.0	62
120 min Summer	7.917	0.0	123.2	0.0	120
180 min Summer	6.014	0.0	144.1	0.0	166
240 min Summer	4.949	0.0	160.5	0.0	190
360 min Summer	3.759	0.0	186.1	0.0	252
480 min Summer	3.093	0.0	206.1	0.0	320
600 min Summer	2.659	0.0	222.7	0.0	386
720 min Summer	2.350	0.0	237.0	0.0	454
960 min Summer	1.900	0.0	255.6	0.0	588
1440 min Summer	1.409	0.0	282.2	0.0	848
2160 min Summer	1.044	0.0	323.6	0.0	1216
2880 min Summer	0.845	0.0	345.3	0.0	1588
4320 min Summer	0.615	0.0	365.6	0.0	2332
5760 min Summer	0.492	0.0	391.4	0.0	3056
7200 min Summer	0.413	0.0	401.6	0.0	3752
8640 min Summer	0.358	0.0	407.8	0.0	4496
10080 min Summer	0.318	0.0	410.3	0.0	5248
15 min Winter	32.424	0.0	51.0	0.0	19

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 Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m <sup>3</sup> )	Status
30 min Winter	0.075	0.075	0.0	3.3	0.0	3.3	88.9	O K
60 min Winter	0.094	0.094	0.0	4.8	0.0	4.8	112.0	O K
120 min Winter	0.113	0.113	0.0	6.3	0.0	6.3	134.4	O K
180 min Winter	0.121	0.121	0.0	7.0	0.0	7.0	144.5	O K
240 min Winter	0.126	0.126	0.0	7.3	0.0	7.3	150.6	O K
360 min Winter	0.134	0.134	0.0	7.8	0.0	7.8	159.1	O K
480 min Winter	0.137	0.137	0.0	8.0	0.0	8.0	162.9	O K
600 min Winter	0.138	0.138	0.0	8.1	0.0	8.1	164.1	O K
720 min Winter	0.138	0.138	0.0	8.1	0.0	8.1	163.8	O K
960 min Winter	0.133	0.133	0.0	7.8	0.0	7.8	158.4	O K
1440 min Winter	0.123	0.123	0.0	7.1	0.0	7.1	146.5	O K
2160 min Winter	0.110	0.110	0.0	6.1	0.0	6.1	131.5	O K
2880 min Winter	0.101	0.101	0.0	5.3	0.0	5.3	119.9	O K
4320 min Winter	0.086	0.086	0.0	4.2	0.0	4.2	102.5	O K
5760 min Winter	0.077	0.077	0.0	3.4	0.0	3.4	91.1	O K
7200 min Winter	0.070	0.070	0.0	2.9	0.0	2.9	83.0	O K
8640 min Winter	0.065	0.065	0.0	2.5	0.0	2.5	76.8	O K
10080 min Winter	0.060	0.060	0.0	2.2	0.0	2.2	71.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Overflow Volume (m <sup>3</sup> )	Time-Peak (mins)
30 min Winter	20.266	0.0	71.6	0.0	33
60 min Winter	12.667	0.0	107.8	0.0	62
120 min Winter	7.917	0.0	141.7	0.0	118
180 min Winter	6.014	0.0	165.2	0.0	170
240 min Winter	4.949	0.0	183.7	0.0	192
360 min Winter	3.759	0.0	212.5	0.0	266
480 min Winter	3.093	0.0	235.1	0.0	342
600 min Winter	2.659	0.0	253.9	0.0	414
720 min Winter	2.350	0.0	270.0	0.0	484
960 min Winter	1.900	0.0	291.2	0.0	624
1440 min Winter	1.409	0.0	321.7	0.0	884
2160 min Winter	1.044	0.0	368.0	0.0	1272
2880 min Winter	0.845	0.0	393.2	0.0	1644
4320 min Winter	0.615	0.0	418.1	0.0	2376
5760 min Winter	0.492	0.0	447.6	0.0	3112
7200 min Winter	0.413	0.0	460.8	0.0	3824
8640 min Winter	0.358	0.0	469.7	0.0	4576
10080 min Winter	0.318	0.0	474.6	0.0	5344

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Rainfall Details


Rainfall Model	FEH
Return Period (years)	1
FEH Rainfall Version	1999
Site Location	GB 520450 176000 TQ 20450 76000
C (1km)	-0.024
D1 (1km)	0.322
D2 (1km)	0.262
D3 (1km)	0.219
E (1km)	0.306
F (1km)	2.539
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) 1.310

Time (mins)	Area
From:	To: (ha)
0	4 1.310



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Model Details

Storage is Online Cover Level (m) 1.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	63.0
Membrane Percolation (mm/hr)	1000	Length (m)	63.0
Max Percolation (l/s)	1102.5	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	0.000	Cap Volume Depth (m)	1.000

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0146-1010-1000-1010
Design Head (m)	1.000
Design Flow (l/s)	10.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	146
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	10.1
Flush-Flo™	0.305	10.1
Kick-Flo®	0.676	8.4
Mean Flow over Head Range	-	8.7

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	5.3	1.200	11.0	3.000	17.0	7.000	25.5
0.200	9.8	1.400	11.8	3.500	18.3	7.500	26.4
0.300	10.1	1.600	12.6	4.000	19.5	8.000	27.2
0.400	10.0	1.800	13.3	4.500	20.6	8.500	28.0
0.500	9.7	2.000	14.0	5.000	21.7	9.000	28.8
0.600	9.2	2.200	14.7	5.500	22.7	9.500	29.6
0.800	9.1	2.400	15.3	6.000	23.7		
1.000	10.1	2.600	15.9	6.500	24.6		

Weir Overflow Control

Discharge Coef 0.544 Width (m) 2.000 Invert Level (m) 1.000

Summary of Results for 100 year Return Period

Half Drain Time : 560 minutes.


Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m <sup>3</sup> )	Status
15 min Summer	0.296	0.296	0.0	10.1	0.0	10.1	352.9	O K
30 min Summer	0.342	0.342	0.0	10.1	0.0	10.1	407.3	O K
60 min Summer	0.391	0.391	0.0	10.1	0.0	10.1	465.4	O K
120 min Summer	0.439	0.439	0.0	10.1	0.0	10.1	523.0	O K
180 min Summer	0.464	0.464	0.0	10.1	0.0	10.1	552.3	O K
240 min Summer	0.478	0.478	0.0	10.1	0.0	10.1	568.9	O K
360 min Summer	0.489	0.489	0.0	10.1	0.0	10.1	582.1	O K
480 min Summer	0.489	0.489	0.0	10.1	0.0	10.1	581.7	O K
600 min Summer	0.486	0.486	0.0	10.1	0.0	10.1	579.1	O K
720 min Summer	0.483	0.483	0.0	10.1	0.0	10.1	574.9	O K
960 min Summer	0.463	0.463	0.0	10.1	0.0	10.1	551.1	O K
1440 min Summer	0.422	0.422	0.0	10.1	0.0	10.1	502.9	O K
2160 min Summer	0.364	0.364	0.0	10.1	0.0	10.1	433.6	O K
2880 min Summer	0.313	0.313	0.0	10.1	0.0	10.1	372.2	O K
4320 min Summer	0.228	0.228	0.0	9.9	0.0	9.9	271.2	O K
5760 min Summer	0.176	0.176	0.0	9.6	0.0	9.6	209.7	O K
7200 min Summer	0.149	0.149	0.0	8.8	0.0	8.8	177.9	O K
8640 min Summer	0.133	0.133	0.0	7.8	0.0	7.8	158.9	O K
10080 min Summer	0.122	0.122	0.0	7.0	0.0	7.0	144.7	O K
15 min Winter	0.334	0.334	0.0	10.1	0.0	10.1	398.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Overflow Volume (m <sup>3</sup> )	Time-Peak (mins)
15 min Summer	154.409	0.0	330.7	0.0	19
30 min Summer	89.400	0.0	387.8	0.0	33
60 min Summer	51.761	0.0	474.0	0.0	64
120 min Summer	29.969	0.0	552.8	0.0	122
180 min Summer	21.769	0.0	604.3	0.0	182
240 min Summer	17.352	0.0	643.4	0.0	242
360 min Summer	12.604	0.0	702.2	0.0	360
480 min Summer	10.046	0.0	746.7	0.0	442
600 min Summer	8.426	0.0	782.7	0.0	496
720 min Summer	7.298	0.0	813.1	0.0	556
960 min Summer	5.717	0.0	847.4	0.0	680
1440 min Summer	4.053	0.0	895.6	0.0	950
2160 min Summer	2.873	0.0	969.5	0.0	1340
2880 min Summer	2.251	0.0	1007.4	0.0	1728
4320 min Summer	1.568	0.0	1036.8	0.0	2424
5760 min Summer	1.214	0.0	1071.9	0.0	3112
7200 min Summer	0.995	0.0	1086.7	0.0	3752
8640 min Summer	0.845	0.0	1095.9	0.0	4496
10080 min Summer	0.737	0.0	1099.1	0.0	5240
15 min Winter	154.409	0.0	374.3	0.0	19

Summary of Results for 100 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m <sup>3</sup> )	Status
30 min Winter	0.386	0.386	0.0	10.1	0.0	10.1	459.8	O K
60 min Winter	0.442	0.442	0.0	10.1	0.0	10.1	525.8	O K
120 min Winter	0.497	0.497	0.0	10.1	0.0	10.1	592.1	O K
180 min Winter	0.527	0.527	0.0	10.1	0.0	10.1	627.2	O K
240 min Winter	0.544	0.544	0.0	10.1	0.0	10.1	648.2	O K
360 min Winter	0.561	0.561	0.0	10.1	0.0	10.1	668.3	O K
<b>480 min Winter</b>	<b>0.565</b>	<b>0.565</b>	<b>0.0</b>	<b>10.1</b>	<b>0.0</b>	<b>10.1</b>	<b>672.5</b>	<b>O K</b>
600 min Winter	0.561	0.561	0.0	10.1	0.0	10.1	667.6	O K
720 min Winter	0.552	0.552	0.0	10.1	0.0	10.1	657.4	O K
960 min Winter	0.524	0.524	0.0	10.1	0.0	10.1	623.8	O K
1440 min Winter	0.465	0.465	0.0	10.1	0.0	10.1	554.0	O K
2160 min Winter	0.378	0.378	0.0	10.1	0.0	10.1	450.5	O K
2880 min Winter	0.303	0.303	0.0	10.1	0.0	10.1	360.2	O K
4320 min Winter	0.191	0.191	0.0	9.7	0.0	9.7	227.5	O K
5760 min Winter	0.146	0.146	0.0	8.6	0.0	8.6	173.4	O K
7200 min Winter	0.125	0.125	0.0	7.2	0.0	7.2	148.5	O K
8640 min Winter	0.111	0.111	0.0	6.2	0.0	6.2	132.6	O K
10080 min Winter	0.102	0.102	0.0	5.4	0.0	5.4	121.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Overflow Volume (m <sup>3</sup> )	Time-Peak (mins)
30 min Winter	89.400	0.0	437.8	0.0	33
60 min Winter	51.761	0.0	534.4	0.0	62
120 min Winter	29.969	0.0	622.6	0.0	120
180 min Winter	21.769	0.0	680.3	0.0	178
240 min Winter	17.352	0.0	724.0	0.0	236
360 min Winter	12.604	0.0	789.9	0.0	350
<b>480 min Winter</b>	<b>10.046</b>	<b>0.0</b>	<b>839.7</b>	<b>0.0</b>	<b>462</b>
600 min Winter	8.426	0.0	880.0	0.0	566
720 min Winter	7.298	0.0	914.0	0.0	658
960 min Winter	5.717	0.0	952.5	0.0	740
1440 min Winter	4.053	0.0	1006.6	0.0	1038
2160 min Winter	2.873	0.0	1091.1	0.0	1448
2880 min Winter	2.251	0.0	1134.7	0.0	1820
4320 min Winter	1.568	0.0	1170.1	0.0	2504
5760 min Winter	1.214	0.0	1209.4	0.0	3112
7200 min Winter	0.995	0.0	1227.9	0.0	3816
8640 min Winter	0.845	0.0	1240.1	0.0	4504
10080 min Winter	0.737	0.0	1246.4	0.0	5248

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 520450 176000 TQ 20450 76000
C (1km)	-0.024
D1 (1km)	0.322
D2 (1km)	0.262
D3 (1km)	0.219
E (1km)	0.306
F (1km)	2.539
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) 1.310

Time (mins)	Area
From:	To: (ha)
0	4 1.310

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Model Details

Storage is Online Cover Level (m) 1.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	63.0
Membrane Percolation (mm/hr)	1000	Length (m)	63.0
Max Percolation (l/s)	1102.5	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	0.000	Cap Volume Depth (m)	1.000

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0146-1010-1000-1010
Design Head (m)	1.000
Design Flow (l/s)	10.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	146
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	10.1
Flush-Flo™	0.305	10.1
Kick-Flo®	0.676	8.4
Mean Flow over Head Range	-	8.7

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	5.3	1.200	11.0	3.000	17.0	7.000	25.5
0.200	9.8	1.400	11.8	3.500	18.3	7.500	26.4
0.300	10.1	1.600	12.6	4.000	19.5	8.000	27.2
0.400	10.0	1.800	13.3	4.500	20.6	8.500	28.0
0.500	9.7	2.000	14.0	5.000	21.7	9.000	28.8
0.600	9.2	2.200	14.7	5.500	22.7	9.500	29.6
0.800	9.1	2.400	15.3	6.000	23.7		
1.000	10.1	2.600	15.9	6.500	24.6		

Weir Overflow Control

Discharge Coef 0.544 Width (m) 2.000 Invert Level (m) 1.000

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

Half Drain Time : 856 minutes.


Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m <sup>3</sup> )	Status
15 min Summer	0.423	0.423	0.0	10.1	0.0	10.1	504.2	O K
30 min Summer	0.489	0.489	0.0	10.1	0.0	10.1	582.3	O K
60 min Summer	0.561	0.561	0.0	10.1	0.0	10.1	667.6	O K
120 min Summer	0.635	0.635	0.0	10.1	0.0	10.1	756.4	O K
180 min Summer	0.678	0.678	0.0	10.1	0.0	10.1	807.3	O K
240 min Summer	0.706	0.706	0.0	10.1	0.0	10.1	840.4	Flood Risk
360 min Summer	0.737	0.737	0.0	10.1	0.0	10.1	877.7	Flood Risk
480 min Summer	0.751	0.751	0.0	10.1	0.0	10.1	893.7	Flood Risk
600 min Summer	0.754	0.754	0.0	10.1	0.0	10.1	897.8	Flood Risk
720 min Summer	0.751	0.751	0.0	10.1	0.0	10.1	894.1	Flood Risk
960 min Summer	0.724	0.724	0.0	10.1	0.0	10.1	861.5	Flood Risk
1440 min Summer	0.671	0.671	0.0	10.1	0.0	10.1	799.2	O K
2160 min Summer	0.594	0.594	0.0	10.1	0.0	10.1	707.6	O K
2880 min Summer	0.526	0.526	0.0	10.1	0.0	10.1	626.7	O K
4320 min Summer	0.398	0.398	0.0	10.1	0.0	10.1	474.2	O K
5760 min Summer	0.303	0.303	0.0	10.1	0.0	10.1	361.2	O K
7200 min Summer	0.237	0.237	0.0	10.0	0.0	10.0	282.0	O K
8640 min Summer	0.192	0.192	0.0	9.7	0.0	9.7	228.2	O K
10080 min Summer	0.163	0.163	0.0	9.5	0.0	9.5	194.4	O K
15 min Winter	0.477	0.477	0.0	10.1	0.0	10.1	567.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Overflow Volume (m <sup>3</sup> )	Time-Peak (mins)
15 min Summer	216.173	0.0	475.0	0.0	19
30 min Summer	125.161	0.0	552.5	0.0	34
60 min Summer	72.466	0.0	675.0	0.0	64
120 min Summer	41.957	0.0	784.9	0.0	124
180 min Summer	30.477	0.0	856.6	0.0	182
240 min Summer	24.292	0.0	910.8	0.0	242
360 min Summer	17.646	0.0	992.3	0.0	362
480 min Summer	14.065	0.0	1053.5	0.0	482
600 min Summer	11.796	0.0	1102.8	0.0	600
720 min Summer	10.217	0.0	1143.9	0.0	716
960 min Summer	8.004	0.0	1189.0	0.0	818
1440 min Summer	5.674	0.0	1247.1	0.0	1066
2160 min Summer	4.023	0.0	1374.2	0.0	1428
2880 min Summer	3.151	0.0	1430.4	0.0	1820
4320 min Summer	2.196	0.0	1479.3	0.0	2592
5760 min Summer	1.699	0.0	1529.7	0.0	3288
7200 min Summer	1.392	0.0	1555.6	0.0	3960
8640 min Summer	1.184	0.0	1573.9	0.0	4592
10080 min Summer	1.032	0.0	1584.4	0.0	5248
15 min Winter	216.173	0.0	534.3	0.0	19

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 Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	0.551	0.551	0.0	10.1	0.0	10.1	655.8	O K
60 min Winter	0.632	0.632	0.0	10.1	0.0	10.1	752.4	O K
120 min Winter	0.718	0.718	0.0	10.1	0.0	10.1	855.1	Flood Risk
180 min Winter	0.767	0.767	0.0	10.1	0.0	10.1	913.3	Flood Risk
240 min Winter	0.799	0.799	0.0	10.1	0.0	10.1	951.1	Flood Risk
360 min Winter	0.836	0.836	0.0	10.1	0.0	10.1	995.5	Flood Risk
480 min Winter	0.854	0.854	0.0	10.1	0.0	10.1	1017.0	Flood Risk
600 min Winter	0.861	0.861	0.0	10.1	0.0	10.1	1025.5	Flood Risk
720 min Winter	0.861	0.861	0.0	10.1	0.0	10.1	1025.7	Flood Risk
960 min Winter	0.831	0.831	0.0	10.1	0.0	10.1	989.5	Flood Risk
1440 min Winter	0.766	0.766	0.0	10.1	0.0	10.1	912.5	Flood Risk
2160 min Winter	0.667	0.667	0.0	10.1	0.0	10.1	794.8	O K
2880 min Winter	0.562	0.562	0.0	10.1	0.0	10.1	669.3	O K
4320 min Winter	0.375	0.375	0.0	10.1	0.0	10.1	446.3	O K
5760 min Winter	0.248	0.248	0.0	10.0	0.0	10.0	295.3	O K
7200 min Winter	0.175	0.175	0.0	9.6	0.0	9.6	208.6	O K
8640 min Winter	0.147	0.147	0.0	8.6	0.0	8.6	174.6	O K
10080 min Winter	0.130	0.130	0.0	7.6	0.0	7.6	155.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
30 min Winter	125.161	0.0	618.9	0.0	33
60 min Winter	72.466	0.0	759.1	0.0	62
120 min Winter	41.957	0.0	881.7	0.0	122
180 min Winter	30.477	0.0	961.6	0.0	180
240 min Winter	24.292	0.0	1022.0	0.0	238
360 min Winter	17.646	0.0	1112.5	0.0	354
480 min Winter	14.065	0.0	1180.2	0.0	468
600 min Winter	11.796	0.0	1234.1	0.0	582
720 min Winter	10.217	0.0	1278.5	0.0	692
960 min Winter	8.004	0.0	1325.4	0.0	904
1440 min Winter	5.674	0.0	1372.1	0.0	1126
2160 min Winter	4.023	0.0	1543.9	0.0	1580
2880 min Winter	3.151	0.0	1607.8	0.0	1988
4320 min Winter	2.196	0.0	1665.7	0.0	2724
5760 min Winter	1.699	0.0	1722.0	0.0	3400
7200 min Winter	1.392	0.0	1752.7	0.0	3960
8640 min Winter	1.184	0.0	1775.3	0.0	4584
10080 min Winter	1.032	0.0	1790.0	0.0	5248

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Rainfall Details


Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 520450 176000 TQ 20450 76000
C (1km)	-0.024
D1 (1km)	0.322
D2 (1km)	0.262
D3 (1km)	0.219
E (1km)	0.306
F (1km)	2.539
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) 1.310

Time (mins)	Area
From:	To: (ha)
0	4 1.310



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Model Details

Storage is Online Cover Level (m) 1.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	63.0
Membrane Percolation (mm/hr)	1000	Length (m)	63.0
Max Percolation (l/s)	1102.5	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	0.000	Cap Volume Depth (m)	1.000

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0146-1010-1000-1010
Design Head (m)	1.000
Design Flow (l/s)	10.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	146
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200


Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	10.1
Flush-Flo™	0.305	10.1
Kick-Flo®	0.676	8.4
Mean Flow over Head Range	-	8.7

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	5.3	1.200	11.0	3.000	17.0	7.000	25.5
0.200	9.8	1.400	11.8	3.500	18.3	7.500	26.4
0.300	10.1	1.600	12.6	4.000	19.5	8.000	27.2
0.400	10.0	1.800	13.3	4.500	20.6	8.500	28.0
0.500	9.7	2.000	14.0	5.000	21.7	9.000	28.8
0.600	9.2	2.200	14.7	5.500	22.7	9.500	29.6
0.800	9.1	2.400	15.3	6.000	23.7		
1.000	10.1	2.600	15.9	6.500	24.6		

Weir Overflow Control

Discharge Coef 0.544 Width (m) 2.000 Invert Level (m) 1.000

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Summary of Results for 30 year Return Period

Half Drain Time : 382 minutes.


Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	0.190	0.190	0.0	9.7	0.0	9.7	225.7	O K
30 min Summer	0.224	0.224	0.0	9.9	0.0	9.9	266.3	O K
60 min Summer	0.260	0.260	0.0	10.0	0.0	10.0	309.7	O K
120 min Summer	0.296	0.296	0.0	10.1	0.0	10.1	351.9	O K
180 min Summer	0.313	0.313	0.0	10.1	0.0	10.1	372.2	O K
240 min Summer	0.321	0.321	0.0	10.1	0.0	10.1	382.6	O K
360 min Summer	0.328	0.328	0.0	10.1	0.0	10.1	391.1	O K
480 min Summer	0.332	0.332	0.0	10.1	0.0	10.1	395.2	O K
600 min Summer	0.333	0.333	0.0	10.1	0.0	10.1	396.4	O K
720 min Summer	0.332	0.332	0.0	10.1	0.0	10.1	395.4	O K
960 min Summer	0.320	0.320	0.0	10.1	0.0	10.1	380.5	O K
1440 min Summer	0.291	0.291	0.0	10.1	0.0	10.1	346.8	O K
2160 min Summer	0.250	0.250	0.0	10.0	0.0	10.0	297.6	O K
2880 min Summer	0.215	0.215	0.0	9.9	0.0	9.9	255.8	O K
4320 min Summer	0.163	0.163	0.0	9.5	0.0	9.5	194.5	O K
5760 min Summer	0.139	0.139	0.0	8.2	0.0	8.2	165.6	O K
7200 min Summer	0.123	0.123	0.0	7.1	0.0	7.1	146.7	O K
8640 min Summer	0.112	0.112	0.0	6.3	0.0	6.3	133.6	O K
10080 min Summer	0.104	0.104	0.0	5.6	0.0	5.6	123.4	O K
15 min Winter	0.215	0.215	0.0	9.9	0.0	9.9	255.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	102.217	0.0	206.7	0.0	19
30 min Summer	60.391	0.0	250.7	0.0	33
60 min Summer	35.680	0.0	317.4	0.0	62
120 min Summer	21.080	0.0	379.9	0.0	122
180 min Summer	15.495	0.0	421.3	0.0	182
240 min Summer	12.455	0.0	453.1	0.0	240
360 min Summer	9.155	0.0	501.5	0.0	306
480 min Summer	7.358	0.0	538.4	0.0	370
600 min Summer	6.212	0.0	568.6	0.0	434
720 min Summer	5.409	0.0	594.2	0.0	500
960 min Summer	4.273	0.0	624.9	0.0	636
1440 min Summer	3.065	0.0	668.6	0.0	906
2160 min Summer	2.199	0.0	731.4	0.0	1296
2880 min Summer	1.737	0.0	765.5	0.0	1648
4320 min Summer	1.225	0.0	794.5	0.0	2336
5760 min Summer	0.956	0.0	828.8	0.0	3056
7200 min Summer	0.788	0.0	843.7	0.0	3752
8640 min Summer	0.674	0.0	853.2	0.0	4496
10080 min Summer	0.590	0.0	857.2	0.0	5240
15 min Winter	102.217	0.0	236.0	0.0	18

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 Overflow (l/s)	Max Outflow (l/s)	Max Volume (m <sup>3</sup> )	Status
30 min Winter	0.253	0.253	0.0	10.0	0.0	10.0	301.6	O K
60 min Winter	0.295	0.295	0.0	10.1	0.0	10.1	351.1	O K
120 min Winter	0.336	0.336	0.0	10.1	0.0	10.1	400.2	O K
180 min Winter	0.357	0.357	0.0	10.1	0.0	10.1	425.0	O K
240 min Winter	0.369	0.369	0.0	10.1	0.0	10.1	438.8	O K
<b>360 min Winter</b>	<b>0.378</b>	<b>0.378</b>	<b>0.0</b>	<b>10.1</b>	<b>0.0</b>	<b>10.1</b>	<b>449.5</b>	<b>O K</b>
480 min Winter	0.377	0.377	0.0	10.1	0.0	10.1	448.9	O K
600 min Winter	0.376	0.376	0.0	10.1	0.0	10.1	447.8	O K
720 min Winter	0.373	0.373	0.0	10.1	0.0	10.1	443.6	O K
960 min Winter	0.352	0.352	0.0	10.1	0.0	10.1	419.2	O K
1440 min Winter	0.307	0.307	0.0	10.1	0.0	10.1	365.6	O K
2160 min Winter	0.244	0.244	0.0	10.0	0.0	10.0	291.0	O K
2880 min Winter	0.195	0.195	0.0	9.7	0.0	9.7	232.6	O K
4320 min Winter	0.142	0.142	0.0	8.4	0.0	8.4	169.7	O K
5760 min Winter	0.119	0.119	0.0	6.8	0.0	6.8	142.0	O K
7200 min Winter	0.105	0.105	0.0	5.7	0.0	5.7	125.4	O K
8640 min Winter	0.096	0.096	0.0	4.9	0.0	4.9	113.7	O K
10080 min Winter	0.088	0.088	0.0	4.3	0.0	4.3	104.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Overflow Volume (m <sup>3</sup> )	Time-Peak (mins)
30 min Winter	60.391	0.0	285.1	0.0	33
60 min Winter	35.680	0.0	359.1	0.0	62
120 min Winter	21.080	0.0	429.1	0.0	120
180 min Winter	15.495	0.0	475.6	0.0	178
240 min Winter	12.455	0.0	511.3	0.0	234
<b>360 min Winter</b>	<b>9.155</b>	<b>0.0</b>	<b>565.6</b>	<b>0.0</b>	<b>342</b>
480 min Winter	7.358	0.0	607.1	0.0	398
600 min Winter	6.212	0.0	641.0	0.0	468
720 min Winter	5.409	0.0	669.8	0.0	544
960 min Winter	4.273	0.0	704.4	0.0	694
1440 min Winter	3.065	0.0	754.0	0.0	980
2160 min Winter	2.199	0.0	824.7	0.0	1364
2880 min Winter	1.737	0.0	863.8	0.0	1728
4320 min Winter	1.225	0.0	898.6	0.0	2380
5760 min Winter	0.956	0.0	937.3	0.0	3104
7200 min Winter	0.788	0.0	955.9	0.0	3816
8640 min Winter	0.674	0.0	968.5	0.0	4552
10080 min Winter	0.590	0.0	975.5	0.0	5248

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	1999
Site Location	GB 520450 176000 TQ 20450 76000
C (1km)	-0.024
D1 (1km)	0.322
D2 (1km)	0.262
D3 (1km)	0.219
E (1km)	0.306
F (1km)	2.539
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) 1.310

Time (mins)	Area
From:	To: (ha)
0	4 1.310

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Model Details

Storage is Online Cover Level (m) 1.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	63.0
Membrane Percolation (mm/hr)	1000	Length (m)	63.0
Max Percolation (l/s)	1102.5	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	0.000	Cap Volume Depth (m)	1.000

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0146-1010-1000-1010
Design Head (m)	1.000
Design Flow (l/s)	10.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	146
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	10.1
Flush-Flo™	0.305	10.1
Kick-Flo®	0.676	8.4
Mean Flow over Head Range	-	8.7

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	5.3	1.200	11.0	3.000	17.0	7.000	25.5
0.200	9.8	1.400	11.8	3.500	18.3	7.500	26.4
0.300	10.1	1.600	12.6	4.000	19.5	8.000	27.2
0.400	10.0	1.800	13.3	4.500	20.6	8.500	28.0
0.500	9.7	2.000	14.0	5.000	21.7	9.000	28.8
0.600	9.2	2.200	14.7	5.500	22.7	9.500	29.6
0.800	9.1	2.400	15.3	6.000	23.7		
1.000	10.1	2.600	15.9	6.500	24.6		

Weir Overflow Control


Discharge Coef 0.544 Width (m) 2.000 Invert Level (m) 1.000

Summary of Results for 1 year Return Period

Half Drain Time : 175 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m <sup>3</sup> )	Status
15 min Summer	0.219	0.219	0.0	4.1	0.0	4.1	43.3	O K
30 min Summer	0.268	0.268	0.0	4.3	0.0	4.3	52.9	O K
60 min Summer	0.319	0.319	0.0	4.4	0.0	4.4	63.0	O K
120 min Summer	0.361	0.361	0.0	4.4	0.0	4.4	71.4	O K
180 min Summer	0.380	0.380	0.0	4.4	0.0	4.4	75.1	O K
240 min Summer	0.391	0.391	0.0	4.4	0.0	4.4	77.2	O K
360 min Summer	0.399	0.399	0.0	4.4	0.0	4.4	78.9	O K
480 min Summer	0.398	0.398	0.0	4.4	0.0	4.4	78.6	O K
600 min Summer	0.391	0.391	0.0	4.4	0.0	4.4	77.3	O K
720 min Summer	0.382	0.382	0.0	4.4	0.0	4.4	75.5	O K
960 min Summer	0.351	0.351	0.0	4.4	0.0	4.4	69.3	O K
1440 min Summer	0.292	0.292	0.0	4.3	0.0	4.3	57.8	O K
2160 min Summer	0.225	0.225	0.0	4.2	0.0	4.2	44.4	O K
2880 min Summer	0.177	0.177	0.0	3.9	0.0	3.9	35.1	O K
4320 min Summer	0.121	0.121	0.0	3.5	0.0	3.5	23.9	O K
5760 min Summer	0.099	0.099	0.0	3.0	0.0	3.0	19.5	O K
7200 min Summer	0.086	0.086	0.0	2.6	0.0	2.6	17.0	O K
8640 min Summer	0.077	0.077	0.0	2.3	0.0	2.3	15.3	O K
10080 min Summer	0.071	0.071	0.0	2.0	0.0	2.0	14.0	O K
15 min Winter	0.248	0.248	0.0	4.2	0.0	4.2	48.9	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Overflow Volume (m <sup>3</sup> )	Time-Peak (mins)
15 min Summer	32.424	0.0	44.9	0.0	18
30 min Summer	20.266	0.0	56.8	0.0	32
60 min Summer	12.667	0.0	72.3	0.0	62
120 min Summer	7.917	0.0	91.0	0.0	118
180 min Summer	6.014	0.0	104.0	0.0	148
240 min Summer	4.949	0.0	114.3	0.0	180
360 min Summer	3.759	0.0	130.6	0.0	250
480 min Summer	3.093	0.0	143.4	0.0	320
600 min Summer	2.659	0.0	154.2	0.0	388
720 min Summer	2.350	0.0	163.6	0.0	456
960 min Summer	1.900	0.0	176.4	0.0	588
1440 min Summer	1.409	0.0	196.0	0.0	848
2160 min Summer	1.044	0.0	218.2	0.0	1212
2880 min Summer	0.845	0.0	234.9	0.0	1556
4320 min Summer	0.615	0.0	255.5	0.0	2248
5760 min Summer	0.492	0.0	271.8	0.0	2944
7200 min Summer	0.413	0.0	284.4	0.0	3672
8640 min Summer	0.358	0.0	294.8	0.0	4408
10080 min Summer	0.318	0.0	303.6	0.0	5136
15 min Winter	32.424	0.0	50.6	0.0	18

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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 Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m <sup>3</sup> )	Status
30 min Winter	0.304	0.304	0.0	4.4	0.0	4.4	60.0	O K
60 min Winter	0.363	0.363	0.0	4.4	0.0	4.4	71.6	O K
120 min Winter	0.415	0.415	0.0	4.4	0.0	4.4	82.1	O K
180 min Winter	0.436	0.436	0.0	4.4	0.0	4.4	86.1	O K
240 min Winter	0.445	0.445	0.0	4.4	0.0	4.4	87.9	O K
<b>360 min Winter</b>	<b>0.450</b>	<b>0.450</b>	<b>0.0</b>	<b>4.4</b>	<b>0.0</b>	<b>4.4</b>	<b>88.9</b>	<b>O K</b>
480 min Winter	0.442	0.442	0.0	4.4	0.0	4.4	87.4	O K
600 min Winter	0.428	0.428	0.0	4.4	0.0	4.4	84.6	O K
720 min Winter	0.411	0.411	0.0	4.4	0.0	4.4	81.1	O K
960 min Winter	0.360	0.360	0.0	4.4	0.0	4.4	71.2	O K
1440 min Winter	0.272	0.272	0.0	4.3	0.0	4.3	53.8	O K
2160 min Winter	0.181	0.181	0.0	4.0	0.0	4.0	35.9	O K
2880 min Winter	0.130	0.130	0.0	3.6	0.0	3.6	25.6	O K
4320 min Winter	0.093	0.093	0.0	2.8	0.0	2.8	18.4	O K
5760 min Winter	0.077	0.077	0.0	2.3	0.0	2.3	15.2	O K
7200 min Winter	0.068	0.068	0.0	1.9	0.0	1.9	13.5	O K
8640 min Winter	0.062	0.062	0.0	1.6	0.0	1.6	12.3	O K
10080 min Winter	0.058	0.058	0.0	1.5	0.0	1.5	11.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Overflow Volume (m <sup>3</sup> )	Time-Peak (mins)
30 min Winter	20.266	0.0	64.0	0.0	32
60 min Winter	12.667	0.0	81.3	0.0	60
120 min Winter	7.917	0.0	102.3	0.0	116
180 min Winter	6.014	0.0	116.8	0.0	170
240 min Winter	4.949	0.0	128.4	0.0	194
<b>360 min Winter</b>	<b>3.759</b>	<b>0.0</b>	<b>146.6</b>	<b>0.0</b>	<b>272</b>
480 min Winter	3.093	0.0	161.0	0.0	348
600 min Winter	2.659	0.0	173.1	0.0	422
720 min Winter	2.350	0.0	183.6	0.0	496
960 min Winter	1.900	0.0	198.0	0.0	634
1440 min Winter	1.409	0.0	220.0	0.0	894
2160 min Winter	1.044	0.0	245.0	0.0	1236
2880 min Winter	0.845	0.0	263.7	0.0	1560
4320 min Winter	0.615	0.0	287.0	0.0	2248
5760 min Winter	0.492	0.0	305.3	0.0	2944
7200 min Winter	0.413	0.0	319.6	0.0	3680
8640 min Winter	0.358	0.0	331.5	0.0	4408
10080 min Winter	0.318	0.0	341.6	0.0	5144

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Rainfall Details


Rainfall Model	FEH
Return Period (years)	1
FEH Rainfall Version	1999
Site Location	GB 520450 176000 TQ 20450 76000
C (1km)	-0.024
D1 (1km)	0.322
D2 (1km)	0.262
D3 (1km)	0.219
E (1km)	0.306
F (1km)	2.539
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) 0.790

Time (mins)	Area
From:	To: (ha)
0	4 0.790



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Model Details

Storage is Online Cover Level (m) 2.750

Complex Structure

Cellular Storage

Invert Level (m) 0.000 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 <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	77.0	0.0	2.001	0.0	0.0
2.000	77.0	0.0			

Cellular Storage

Invert Level (m) 0.000 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 <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	131.0	0.0	2.001	0.0	0.0
2.000	131.0	0.0			

Porous Car Park


Infiltration Coefficient Base (m/hr) 0.00000 Width (m) 3.4  
 Membrane Percolation (mm/hr) 1000 Length (m) 89.0  
 Max Percolation (l/s) 84.1 Slope (1:X) 0.0  
 Safety Factor 2.0 Depression Storage (mm) 5  
 Porosity 0.30 Evaporation (mm/day) 3  
 Invert Level (m) 0.750 Cap Volume Depth (m) 2.750

Porous Car Park

Infiltration Coefficient Base (m/hr) 0.00000 Width (m) 3.4  
 Membrane Percolation (mm/hr) 1000 Length (m) 45.0  
 Max Percolation (l/s) 42.5 Slope (1:X) 0.0  
 Safety Factor 2.0 Depression Storage (mm) 5  
 Porosity 0.30 Evaporation (mm/day) 3  
 Invert Level (m) 1.550 Cap Volume Depth (m) 2.750

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0094-6100-2750-6100  
 Design Head (m) 2.750  
 Design Flow (l/s) 6.1

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Hydro-Brake® Optimum Outflow Control

Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	94
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200


Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.750	6.1
Flush-Flo™	0.407	4.4
Kick-Flo®	0.840	3.5
Mean Flow over Head Range	-	4.6

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	3.0	1.200	4.1	3.000	6.3	7.000	9.5
0.200	4.1	1.400	4.4	3.500	6.8	7.500	9.8
0.300	4.3	1.600	4.7	4.000	7.3	8.000	10.1
0.400	4.4	1.800	5.0	4.500	7.7	8.500	10.4
0.500	4.4	2.000	5.2	5.000	8.1	9.000	10.7
0.600	4.3	2.200	5.5	5.500	8.4	9.500	11.0
0.800	3.7	2.400	5.7	6.000	8.8		
1.000	3.8	2.600	5.9	6.500	9.1		

Weir Overflow Control

Discharge Coef 0.544 Width (m) 2.000 Invert Level (m) 2.750


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Summary of Results for 100 year Return Period

Half Drain Time : 826 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m <sup>3</sup> )	Status
15 min Summer	1.010	1.010	0.0	4.4	0.0	4.4	223.1	O K
30 min Summer	1.124	1.124	0.0	4.4	0.0	4.4	256.1	O K
60 min Summer	1.247	1.247	0.0	4.4	0.0	4.4	291.5	O K
120 min Summer	1.368	1.368	0.0	4.4	0.0	4.4	326.5	O K
180 min Summer	1.431	1.431	0.0	4.5	0.0	4.5	344.7	O K
240 min Summer	1.468	1.468	0.0	4.5	0.0	4.5	355.2	O K
360 min Summer	1.499	1.499	0.0	4.6	0.0	4.6	364.3	O K
480 min Summer	1.502	1.502	0.0	4.6	0.0	4.6	365.1	O K
600 min Summer	1.488	1.488	0.0	4.6	0.0	4.6	361.2	O K
720 min Summer	1.471	1.471	0.0	4.6	0.0	4.6	356.1	O K
960 min Summer	1.410	1.410	0.0	4.5	0.0	4.5	338.5	O K
1440 min Summer	1.308	1.308	0.0	4.4	0.0	4.4	309.0	O K
2160 min Summer	1.182	1.182	0.0	4.4	0.0	4.4	272.8	O K
2880 min Summer	1.073	1.073	0.0	4.4	0.0	4.4	241.5	O K
4320 min Summer	0.847	0.847	0.0	4.4	0.0	4.4	176.0	O K
5760 min Summer	0.576	0.576	0.0	4.4	0.0	4.4	113.9	O K
7200 min Summer	0.390	0.390	0.0	4.4	0.0	4.4	77.1	O K
8640 min Summer	0.276	0.276	0.0	4.3	0.0	4.3	54.6	O K
10080 min Summer	0.205	0.205	0.0	4.1	0.0	4.1	40.5	O K
15 min Winter	1.104	1.104	0.0	4.4	0.0	4.4	250.4	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Overflow Volume (m <sup>3</sup> )	Time-Peak (mins)
15 min Summer	154.409	0.0	224.4	0.0	19
30 min Summer	89.400	0.0	259.8	0.0	34
60 min Summer	51.761	0.0	303.7	0.0	64
120 min Summer	29.969	0.0	352.0	0.0	122
180 min Summer	21.769	0.0	383.7	0.0	182
240 min Summer	17.352	0.0	407.8	0.0	242
360 min Summer	12.604	0.0	444.4	0.0	362
480 min Summer	10.046	0.0	472.3	0.0	480
600 min Summer	8.426	0.0	495.1	0.0	586
720 min Summer	7.298	0.0	514.4	0.0	632
960 min Summer	5.717	0.0	537.0	0.0	760
1440 min Summer	4.053	0.0	569.7	0.0	1012
2160 min Summer	2.873	0.0	608.2	0.0	1428
2880 min Summer	2.251	0.0	634.8	0.0	1844
4320 min Summer	1.568	0.0	661.9	0.0	2640
5760 min Summer	1.214	0.0	682.4	0.0	3288
7200 min Summer	0.995	0.0	697.9	0.0	3960
8640 min Summer	0.845	0.0	710.5	0.0	4584
10080 min Summer	0.737	0.0	721.0	0.0	5248
15 min Winter	154.409	0.0	251.4	0.0	19

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Summary of Results for 100 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	1.234	1.234	0.0	4.4	0.0	4.4	287.8	O K
60 min Winter	1.373	1.373	0.0	4.4	0.0	4.4	328.0	O K
120 min Winter	1.515	1.515	0.0	4.6	0.0	4.6	368.7	O K
180 min Winter	1.585	1.585	0.0	4.7	0.0	4.7	390.6	O K
240 min Winter	1.625	1.625	0.0	4.8	0.0	4.8	403.9	O K
360 min Winter	1.665	1.665	0.0	4.8	0.0	4.8	417.3	O K
<b>480 min Winter</b>	<b>1.677</b>	<b>1.677</b>	<b>0.0</b>	<b>4.8</b>	<b>0.0</b>	<b>4.8</b>	<b>421.3</b>	<b>O K</b>
600 min Winter	1.673	1.673	0.0	4.8	0.0	4.8	420.0	O K
720 min Winter	1.660	1.660	0.0	4.8	0.0	4.8	415.5	O K
960 min Winter	1.592	1.592	0.0	4.7	0.0	4.7	392.9	O K
1440 min Winter	1.472	1.472	0.0	4.6	0.0	4.6	356.5	O K
2160 min Winter	1.299	1.299	0.0	4.4	0.0	4.4	306.5	O K
2880 min Winter	1.142	1.142	0.0	4.4	0.0	4.4	261.2	O K
4320 min Winter	0.790	0.790	0.0	4.4	0.0	4.4	159.6	O K
5760 min Winter	0.411	0.411	0.0	4.4	0.0	4.4	81.2	O K
7200 min Winter	0.233	0.233	0.0	4.2	0.0	4.2	46.0	O K
8640 min Winter	0.150	0.150	0.0	3.8	0.0	3.8	29.6	O K
10080 min Winter	0.115	0.115	0.0	3.4	0.0	3.4	22.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
30 min Winter	89.400	0.0	290.5	0.0	33
60 min Winter	51.761	0.0	340.4	0.0	62
120 min Winter	29.969	0.0	394.5	0.0	122
180 min Winter	21.769	0.0	430.0	0.0	180
240 min Winter	17.352	0.0	457.0	0.0	238
360 min Winter	12.604	0.0	498.0	0.0	352
<b>480 min Winter</b>	<b>10.046</b>	<b>0.0</b>	<b>529.2</b>	<b>0.0</b>	<b>466</b>
600 min Winter	8.426	0.0	554.6	0.0	576
720 min Winter	7.298	0.0	576.2	0.0	684
960 min Winter	5.717	0.0	601.2	0.0	798
1440 min Winter	4.053	0.0	636.0	0.0	1084
2160 min Winter	2.873	0.0	681.7	0.0	1552
2880 min Winter	2.251	0.0	711.5	0.0	1992
4320 min Winter	1.568	0.0	742.2	0.0	2812
5760 min Winter	1.214	0.0	765.3	0.0	3352
7200 min Winter	0.995	0.0	782.8	0.0	3960
8640 min Winter	0.845	0.0	797.1	0.0	4576
10080 min Winter	0.737	0.0	809.1	0.0	5144

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 520450 176000 TQ 20450 76000
C (1km)	-0.024
D1 (1km)	0.322
D2 (1km)	0.262
D3 (1km)	0.219
E (1km)	0.306
F (1km)	2.539
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) 0.790

Time (mins)	Area
From:	To: (ha)
0	4 0.790

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Model Details

Storage is Online Cover Level (m) 2.750

Complex Structure

Cellular Storage

Invert Level (m) 0.000 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 <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	77.0	0.0	2.001	0.0	0.0
2.000	77.0	0.0			

Cellular Storage

Invert Level (m) 0.000 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 <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	131.0	0.0	2.001	0.0	0.0
2.000	131.0	0.0			

Porous Car Park


Infiltration Coefficient Base (m/hr) 0.00000 Width (m) 3.4  
 Membrane Percolation (mm/hr) 1000 Length (m) 89.0  
 Max Percolation (l/s) 84.1 Slope (1:X) 0.0  
 Safety Factor 2.0 Depression Storage (mm) 5  
 Porosity 0.30 Evaporation (mm/day) 3  
 Invert Level (m) 0.750 Cap Volume Depth (m) 2.750

Porous Car Park

Infiltration Coefficient Base (m/hr) 0.00000 Width (m) 3.4  
 Membrane Percolation (mm/hr) 1000 Length (m) 45.0  
 Max Percolation (l/s) 42.5 Slope (1:X) 0.0  
 Safety Factor 2.0 Depression Storage (mm) 5  
 Porosity 0.30 Evaporation (mm/day) 3  
 Invert Level (m) 1.550 Cap Volume Depth (m) 2.750

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0094-6100-2750-6100  
 Design Head (m) 2.750  
 Design Flow (l/s) 6.1

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Hydro-Brake® Optimum Outflow Control

Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	94
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.750	6.1
Flush-Flo™	0.407	4.4
Kick-Flo®	0.840	3.5
Mean Flow over Head Range	-	4.6

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	3.0	1.200	4.1	3.000	6.3	7.000	9.5
0.200	4.1	1.400	4.4	3.500	6.8	7.500	9.8
0.300	4.3	1.600	4.7	4.000	7.3	8.000	10.1
0.400	4.4	1.800	5.0	4.500	7.7	8.500	10.4
0.500	4.4	2.000	5.2	5.000	8.1	9.000	10.7
0.600	4.3	2.200	5.5	5.500	8.4	9.500	11.0
0.800	3.7	2.400	5.7	6.000	8.8		
1.000	3.8	2.600	5.9	6.500	9.1		

Weir Overflow Control

Discharge Coef 0.544 Width (m) 2.000 Invert Level (m) 2.750


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

Half Drain Time : 1009 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	1.326	1.326	0.0	4.4	0.0	4.4	314.2	O K
30 min Summer	1.489	1.489	0.0	4.6	0.0	4.6	361.3	O K
60 min Summer	1.651	1.651	0.0	4.8	0.0	4.8	412.6	O K
120 min Summer	1.808	1.808	0.0	5.0	0.0	5.0	465.3	O K
180 min Summer	1.896	1.896	0.0	5.1	0.0	5.1	494.5	O K
240 min Summer	1.951	1.951	0.0	5.2	0.0	5.2	513.1	O K
360 min Summer	2.029	2.029	0.0	5.3	0.0	5.3	533.4	O K
480 min Summer	2.087	2.087	0.0	5.4	0.0	5.4	541.3	O K
600 min Summer	2.095	2.095	0.0	5.4	0.0	5.4	542.4	O K
720 min Summer	2.071	2.071	0.0	5.3	0.0	5.3	539.1	O K
960 min Summer	1.964	1.964	0.0	5.2	0.0	5.2	517.3	O K
1440 min Summer	1.852	1.852	0.0	5.1	0.0	5.1	479.9	O K
2160 min Summer	1.718	1.718	0.0	4.9	0.0	4.9	435.1	O K
2880 min Summer	1.607	1.607	0.0	4.7	0.0	4.7	397.9	O K
4320 min Summer	1.367	1.367	0.0	4.4	0.0	4.4	326.1	O K
5760 min Summer	1.163	1.163	0.0	4.4	0.0	4.4	267.2	O K
7200 min Summer	0.982	0.982	0.0	4.4	0.0	4.4	215.2	O K
8640 min Summer	0.777	0.777	0.0	4.4	0.0	4.4	156.1	O K
10080 min Summer	0.551	0.551	0.0	4.4	0.0	4.4	109.0	O K
15 min Winter	1.458	1.458	0.0	4.5	0.0	4.5	352.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	216.173	0.0	312.6	0.0	19
30 min Summer	125.161	0.0	350.2	0.0	34
60 min Summer	72.466	0.0	426.1	0.0	64
120 min Summer	41.957	0.0	493.6	0.0	124
180 min Summer	30.477	0.0	537.9	0.0	182
240 min Summer	24.292	0.0	571.6	0.0	242
360 min Summer	17.646	0.0	622.6	0.0	362
480 min Summer	14.065	0.0	661.1	0.0	482
600 min Summer	11.796	0.0	692.0	0.0	600
720 min Summer	10.217	0.0	717.2	0.0	720
960 min Summer	8.004	0.0	736.5	0.0	828
1440 min Summer	5.674	0.0	715.6	0.0	1068
2160 min Summer	4.023	0.0	853.2	0.0	1472
2880 min Summer	3.151	0.0	890.7	0.0	1876
4320 min Summer	2.196	0.0	929.2	0.0	2720
5760 min Summer	1.699	0.0	958.5	0.0	3512
7200 min Summer	1.392	0.0	980.8	0.0	4320
8640 min Summer	1.184	0.0	999.1	0.0	5016
10080 min Summer	1.032	0.0	1014.4	0.0	5552
15 min Winter	216.173	0.0	344.2	0.0	19




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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 Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	1.630	1.630	0.0	4.8	0.0	4.8	405.6	O K
60 min Winter	1.804	1.804	0.0	5.0	0.0	5.0	463.8	O K
120 min Winter	1.987	1.987	0.0	5.2	0.0	5.2	524.8	O K
180 min Winter	2.218	2.218	0.0	5.5	0.0	5.5	559.2	O K
240 min Winter	2.380	2.380	0.0	5.7	0.0	5.7	581.3	O K
360 min Winter	2.565	2.565	0.0	5.9	0.0	5.9	606.6	Flood Risk
480 min Winter	2.651	2.651	0.0	6.0	0.0	6.0	618.3	Flood Risk
600 min Winter	2.680	2.680	0.0	6.0	0.0	6.0	622.4	Flood Risk
720 min Winter	2.675	2.675	0.0	6.0	0.0	6.0	621.7	Flood Risk
960 min Winter	2.516	2.516	0.0	5.8	0.0	5.8	599.9	Flood Risk
1440 min Winter	2.207	2.207	0.0	5.5	0.0	5.5	557.7	O K
2160 min Winter	1.914	1.914	0.0	5.1	0.0	5.1	500.7	O K
2880 min Winter	1.759	1.759	0.0	4.9	0.0	4.9	448.9	O K
4320 min Winter	1.443	1.443	0.0	4.5	0.0	4.5	348.0	O K
5760 min Winter	1.151	1.151	0.0	4.4	0.0	4.4	264.0	O K
7200 min Winter	0.864	0.864	0.0	4.4	0.0	4.4	181.1	O K
8640 min Winter	0.481	0.481	0.0	4.4	0.0	4.4	95.1	O K
10080 min Winter	0.293	0.293	0.0	4.3	0.0	4.3	57.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
30 min Winter	125.161	0.0	358.3	0.0	33
60 min Winter	72.466	0.0	477.5	0.0	62
120 min Winter	41.957	0.0	553.0	0.0	122
180 min Winter	30.477	0.0	602.5	0.0	180
240 min Winter	24.292	0.0	640.1	0.0	238
360 min Winter	17.646	0.0	696.5	0.0	354
480 min Winter	14.065	0.0	738.0	0.0	468
600 min Winter	11.796	0.0	766.9	0.0	580
720 min Winter	10.217	0.0	776.4	0.0	690
960 min Winter	8.004	0.0	769.6	0.0	896
1440 min Winter	5.674	0.0	746.7	0.0	1124
2160 min Winter	4.023	0.0	956.1	0.0	1596
2880 min Winter	3.151	0.0	998.1	0.0	2048
4320 min Winter	2.196	0.0	1041.2	0.0	2900
5760 min Winter	1.699	0.0	1074.5	0.0	3752
7200 min Winter	1.392	0.0	1099.6	0.0	4616
8640 min Winter	1.184	0.0	1120.3	0.0	5016
10080 min Winter	1.032	0.0	1137.6	0.0	5544

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 520450 176000 TQ 20450 76000
C (1km)	-0.024
D1 (1km)	0.322
D2 (1km)	0.262
D3 (1km)	0.219
E (1km)	0.306
F (1km)	2.539
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) 0.790

Time (mins)	Area
From:	To: (ha)
0	4 0.790

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Model Details

Storage is Online Cover Level (m) 2.750

Complex Structure

Cellular Storage

Invert Level (m) 0.000 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 <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	131.0	0.0	2.001	0.0	0.0
2.000	131.0	0.0			

Cellular Storage

Invert Level (m) 0.000 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 <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	77.0	0.0	2.001	0.0	0.0
2.000	77.0	0.0			

Porous Car Park


Infiltration Coefficient Base (m/hr) 0.00000 Width (m) 3.4  
 Membrane Percolation (mm/hr) 1000 Length (m) 89.0  
 Max Percolation (l/s) 84.1 Slope (1:X) 0.0  
 Safety Factor 2.0 Depression Storage (mm) 5  
 Porosity 0.30 Evaporation (mm/day) 3  
 Invert Level (m) 0.750 Cap Volume Depth (m) 2.750

Porous Car Park

Infiltration Coefficient Base (m/hr) 0.00000 Width (m) 3.4  
 Membrane Percolation (mm/hr) 1000 Length (m) 45.0  
 Max Percolation (l/s) 42.5 Slope (1:X) 0.0  
 Safety Factor 2.0 Depression Storage (mm) 5  
 Porosity 0.30 Evaporation (mm/day) 3  
 Invert Level (m) 1.550 Cap Volume Depth (m) 2.750

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0094-6100-2750-6100  
 Design Head (m) 2.750  
 Design Flow (l/s) 6.1

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Hydro-Brake® Optimum Outflow Control

Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	94
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200


Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.750	6.1
Flush-Flo™	0.407	4.4
Kick-Flo®	0.840	3.5
Mean Flow over Head Range	-	4.6

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	3.0	1.200	4.1	3.000	6.3	7.000	9.5
0.200	4.1	1.400	4.4	3.500	6.8	7.500	9.8
0.300	4.3	1.600	4.7	4.000	7.3	8.000	10.1
0.400	4.4	1.800	5.0	4.500	7.7	8.500	10.4
0.500	4.4	2.000	5.2	5.000	8.1	9.000	10.7
0.600	4.3	2.200	5.5	5.500	8.4	9.500	11.0
0.800	3.7	2.400	5.7	6.000	8.8		
1.000	3.8	2.600	5.9	6.500	9.1		

Weir Overflow Control

Discharge Coef 0.544 Width (m) 2.000 Invert Level (m) 2.750

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Summary of Results for 30 year Return Period

Half Drain Time : 579 minutes.


Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m <sup>3</sup> )	Status
15 min Summer	0.738	0.738	0.0	4.4	0.0	4.4	145.8	O K
30 min Summer	0.828	0.828	0.0	4.4	0.0	4.4	170.6	O K
60 min Summer	0.921	0.921	0.0	4.4	0.0	4.4	197.6	O K
120 min Summer	1.014	1.014	0.0	4.4	0.0	4.4	224.2	O K
180 min Summer	1.061	1.061	0.0	4.4	0.0	4.4	237.8	O K
240 min Summer	1.087	1.087	0.0	4.4	0.0	4.4	245.3	O K
360 min Summer	1.107	1.107	0.0	4.4	0.0	4.4	251.1	O K
480 min Summer	1.104	1.104	0.0	4.4	0.0	4.4	250.4	O K
600 min Summer	1.095	1.095	0.0	4.4	0.0	4.4	247.7	O K
720 min Summer	1.084	1.084	0.0	4.4	0.0	4.4	244.6	O K
960 min Summer	1.042	1.042	0.0	4.4	0.0	4.4	232.4	O K
1440 min Summer	0.966	0.966	0.0	4.4	0.0	4.4	210.3	O K
2160 min Summer	0.858	0.858	0.0	4.4	0.0	4.4	179.3	O K
2880 min Summer	0.740	0.740	0.0	4.4	0.0	4.4	146.2	O K
4320 min Summer	0.472	0.472	0.0	4.4	0.0	4.4	93.2	O K
5760 min Summer	0.310	0.310	0.0	4.4	0.0	4.4	61.2	O K
7200 min Summer	0.216	0.216	0.0	4.1	0.0	4.1	42.7	O K
8640 min Summer	0.160	0.160	0.0	3.8	0.0	3.8	31.7	O K
10080 min Summer	0.127	0.127	0.0	3.6	0.0	3.6	25.2	O K
15 min Winter	0.805	0.805	0.0	4.4	0.0	4.4	164.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Overflow Volume (m <sup>3</sup> )	Time-Peak (mins)
15 min Summer	102.217	0.0	147.9	0.0	19
30 min Summer	60.391	0.0	175.2	0.0	34
60 min Summer	35.680	0.0	208.5	0.0	64
120 min Summer	21.080	0.0	246.8	0.0	122
180 min Summer	15.495	0.0	272.3	0.0	182
240 min Summer	12.455	0.0	292.0	0.0	242
360 min Summer	9.155	0.0	322.1	0.0	360
480 min Summer	7.358	0.0	345.3	0.0	470
600 min Summer	6.212	0.0	364.3	0.0	522
720 min Summer	5.409	0.0	380.7	0.0	584
960 min Summer	4.273	0.0	400.8	0.0	712
1440 min Summer	3.065	0.0	430.9	0.0	982
2160 min Summer	2.199	0.0	464.5	0.0	1404
2880 min Summer	1.737	0.0	488.7	0.0	1760
4320 min Summer	1.225	0.0	515.4	0.0	2464
5760 min Summer	0.956	0.0	535.8	0.0	3120
7200 min Summer	0.788	0.0	551.3	0.0	3816
8640 min Summer	0.674	0.0	564.0	0.0	4496
10080 min Summer	0.590	0.0	574.7	0.0	5144
15 min Winter	102.217	0.0	165.9	0.0	19

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 Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m <sup>3</sup> )	Status
30 min Winter	0.902	0.902	0.0	4.4	0.0	4.4	192.2	O K
60 min Winter	1.008	1.008	0.0	4.4	0.0	4.4	222.7	O K
120 min Winter	1.116	1.116	0.0	4.4	0.0	4.4	253.6	O K
180 min Winter	1.172	1.172	0.0	4.4	0.0	4.4	270.0	O K
240 min Winter	1.206	1.206	0.0	4.4	0.0	4.4	279.6	O K
360 min Winter	1.237	1.237	0.0	4.4	0.0	4.4	288.7	O K
<b>480 min Winter</b>	<b>1.243</b>	<b>1.243</b>	<b>0.0</b>	<b>4.4</b>	<b>0.0</b>	<b>4.4</b>	<b>290.4</b>	<b>O K</b>
600 min Winter	1.235	1.235	0.0	4.4	0.0	4.4	288.1	O K
720 min Winter	1.220	1.220	0.0	4.4	0.0	4.4	283.6	O K
960 min Winter	1.166	1.166	0.0	4.4	0.0	4.4	268.2	O K
1440 min Winter	1.063	1.063	0.0	4.4	0.0	4.4	238.6	O K
2160 min Winter	0.909	0.909	0.0	4.4	0.0	4.4	194.1	O K
2880 min Winter	0.724	0.724	0.0	4.4	0.0	4.4	143.1	O K
4320 min Winter	0.359	0.359	0.0	4.4	0.0	4.4	71.0	O K
5760 min Winter	0.195	0.195	0.0	4.0	0.0	4.0	38.6	O K
7200 min Winter	0.125	0.125	0.0	3.6	0.0	3.6	24.7	O K
8640 min Winter	0.104	0.104	0.0	3.1	0.0	3.1	20.5	O K
10080 min Winter	0.091	0.091	0.0	2.7	0.0	2.7	17.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m <sup>3</sup> )	Discharge Volume (m <sup>3</sup> )	Overflow Volume (m <sup>3</sup> )	Time-Peak (mins)
30 min Winter	60.391	0.0	196.4	0.0	33
60 min Winter	35.680	0.0	233.9	0.0	62
120 min Winter	21.080	0.0	276.8	0.0	120
180 min Winter	15.495	0.0	305.3	0.0	178
240 min Winter	12.455	0.0	327.4	0.0	236
360 min Winter	9.155	0.0	361.1	0.0	350
<b>480 min Winter</b>	<b>7.358</b>	<b>0.0</b>	<b>387.0</b>	<b>0.0</b>	<b>462</b>
600 min Winter	6.212	0.0	408.4	0.0	568
720 min Winter	5.409	0.0	426.7	0.0	664
960 min Winter	4.273	0.0	449.3	0.0	752
1440 min Winter	3.065	0.0	482.8	0.0	1064
2160 min Winter	2.199	0.0	520.7	0.0	1516
2880 min Winter	1.737	0.0	548.0	0.0	1900
4320 min Winter	1.225	0.0	578.1	0.0	2548
5760 min Winter	0.956	0.0	601.0	0.0	3168
7200 min Winter	0.788	0.0	618.6	0.0	3752
8640 min Winter	0.674	0.0	633.0	0.0	4408
10080 min Winter	0.590	0.0	645.2	0.0	5144

Waterman Group		Page 3
Pickfords Wharf Clink Street London, SE1 9DG		
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Innovyze	Source Control 2019.1	


Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	1999
Site Location	GB 520450 176000 TQ 20450 76000
C (1km)	-0.024
D1 (1km)	0.322
D2 (1km)	0.262
D3 (1km)	0.219
E (1km)	0.306
F (1km)	2.539
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) 0.790

Time (mins)	Area
From:	To: (ha)
0	4 0.790

Waterman Group		Page 4
Pickfords Wharf Clink Street London, SE1 9DG		
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Innovyze	Source Control 2019.1	

Model Details

Storage is Online Cover Level (m) 2.750

Complex Structure

Cellular Storage

Invert Level (m) 0.000 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 <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	131.0	0.0	2.001	0.0	0.0
2.000	131.0	0.0			

Cellular Storage

Invert Level (m) 0.000 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 <sup>2</sup> )	Inf. Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf. Area (m <sup>2</sup> )
0.000	77.0	0.0	2.001	0.0	0.0
2.000	77.0	0.0			

Porous Car Park

Infiltration Coefficient Base (m/hr) 0.00000 Width (m) 3.4  
 Membrane Percolation (mm/hr) 1000 Length (m) 89.0  
 Max Percolation (l/s) 84.1 Slope (1:X) 0.0  
 Safety Factor 2.0 Depression Storage (mm) 5  
 Porosity 0.30 Evaporation (mm/day) 3  
 Invert Level (m) 0.750 Cap Volume Depth (m) 2.750


Porous Car Park

Infiltration Coefficient Base (m/hr) 0.00000 Width (m) 3.4  
 Membrane Percolation (mm/hr) 1000 Length (m) 45.0  
 Max Percolation (l/s) 42.5 Slope (1:X) 0.0  
 Safety Factor 2.0 Depression Storage (mm) 5  
 Porosity 0.30 Evaporation (mm/day) 3  
 Invert Level (m) 1.550 Cap Volume Depth (m) 2.750

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0094-6100-2750-6100  
 Design Head (m) 2.750  
 Design Flow (l/s) 6.1



Waterman Group		Page 5
Pickfords Wharf Clink Street London, SE1 9DG		
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Innovyze		Source Control 2019.1

Hydro-Brake® Optimum Outflow Control

Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	94
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.750	6.1
Flush-Flo™	0.407	4.4
Kick-Flo®	0.840	3.5
Mean Flow over Head Range	-	4.6

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	3.0	1.200	4.1	3.000	6.3	7.000	9.5
0.200	4.1	1.400	4.4	3.500	6.8	7.500	9.8
0.300	4.3	1.600	4.7	4.000	7.3	8.000	10.1
0.400	4.4	1.800	5.0	4.500	7.7	8.500	10.4
0.500	4.4	2.000	5.2	5.000	8.1	9.000	10.7
0.600	4.3	2.200	5.5	5.500	8.4	9.500	11.0
0.800	3.7	2.400	5.7	6.000	8.8		
1.000	3.8	2.600	5.9	6.500	9.1		

Weir Overflow Control

Discharge Coef 0.544 Width (m) 2.000 Invert Level (m) 2.750

Calculated by:

Site name:

Site location:

### Site Details

Latitude:

Longitude:

Reference:

Date:

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

### Site characteristics

Total site area (ha):

### Methodology

$Q_{BAR}$  estimation method:

SPR estimation method:

### Soil characteristics

Default Edited

SOIL type:

HOST class:

SPR/SPRHOST:

### Hydrological characteristics

Default Edited

SAAR (mm):

Hydrological region:

Growth curve factor 1 year:

Growth curve factor 30 years:

Growth curve factor 100 years:

Growth curve factor 200 years:

### 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.

### Greenfield runoff rates

Default Edited

$Q_{BAR}$  (l/s):

1 in 1 year (l/s):

1 in 30 years (l/s):

1 in 100 year (l/s):

1 in 200 years (l/s):

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at [www.uksuds.com](http://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](http://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.

## CALCULATIONS

Company: WIE

Office: London

Sheet No: 1 of 2

Project No: WIE18671

By: S Whelan

Date: 05/04/2023

Checked: S Henry

Date: 05/04/2023

Project Title **Former Stag Brewery, Mortlake**

Calculations Title **Existing Discharge Rate - Modified Rational Method**

LOCATION	CALCULATIONS	OPTIONS
	Calculations based on: Design and Analysis of urban storm drainage. The Wallingford Procedure, Volume 1 Principles methods and practice.	
	<b>User Input Data</b>	
	Total site area	5.69 ha
	SAAR (From FEH)	605
	Rainfall Intensity (From FEH)	51.80
	PIMP (% impervious)	100 %
	Soil Type	0.40
	Very Low Runoff (well drained sandy, loamy or earthy peat soils)	0.15
	Low Runoff (Very permeable soils (e.g. gravel, sand)	0.30
	Moderate (Very fine sands, silts and sedimentary clays)	0.40
	High Runoff (Clayey or loamy soils)	0.45
	Very High Runoff (Soils of the wet uplands)	0.50
Fig. 9.7	UCWI (From Figure 9.7 of Wallingford Method)	52
Eqn. 13	$Q_p$ (peak discharge) = 2.78 $C_v$ CR $i$ A	
	Where: $Q_p$ (Peak Discharge) $i$ = rainfall intensity $A$ = Total Area	
From FEH	Average rainfall Intensity ( $i$ )	
	M100_60 is:      51.80 mm	
Eqn 7.20	$C_v = PR/100$	
Eqn 7.3	$PR = (0.829 PIMP) + (25.0 SOIL) + (0.078 UCWI) - 20.7$	
	PIMP (Percentage of catchment which is impervious)	100 %
Page 52	Note: PIMP can not be less than 40%	40 %
	Thus value of PIMP to be used	100 %
	Soil:      0.40      UCWI:      52	
	PR =	76.26
	Thus $C_v$ =	0.76
Sec 7.10	CR (Recommended for simulation and design)	1.3
	<b><math>Q_p</math> for 1 in 100 year 60 minute duration =</b>	<b>812.3 l/s</b> or <b>142.8 l/s/ha</b>
	50% of the existing runoff rate=	405.0 l/s      71.3 l/s/ha



**CALCULATIONS**

Company: WIE Office: London  
 Sheet No: 2 of 2 Project No: WIE18671  
 By: S Whelan Date: 05/04/2023  
 Checked: S Henry Date: 05/04/2023

Project Title **Former Stag Brewery, Mortlake**  
 Calculations Title **Surface water attenuation volume, IH124 Greenfield Runoff Rate**

LOCATION	CALCULATIONS								OPTIONS	
	In order to calculate the volume of surface water attenuation required for the Site, Windes Microdrainage version 2016.1, Source Control module, Quick Storage Estimate has been used. The input and output data for which are shown below;									
	IH124 Greenfield Runoff Rate - Q100									
	7.7	l/s/ha								
Summary	<b>Attenuation volumes required by Drainage Catchment</b>									
	Catchment	Area (ha)	Design runoff Rate (l/s)	Design storage volume (m <sup>3</sup> )	Peak outflow rate (l/s) - 1 in 1	Peak outflow rate (l/s) - 1 in 30	Peak outflow rate (l/s) - 1 in 100	Peak outflow rate (l/s) - 1 in 100+40CC		
	East - 1	0.30	2.4	233	2.1	2.4	2.4	2.4		
	East - 2	0.25	1.9	199	1.4	1.4	1.5	1.8		
	East - 3	0.18	1.4	142	1.1	1.1	1.1	1.4		
	West - school	1.31	10.1	1026	8.1	10.1	10.1	10.1		
	West - 4	1.07	8.3	844	6.5	6.7	6.7	8.0		
	West - 5	0.92	7.1	742	4.8	7.1	7.1	7.1		
	West - 6	0.79	6.1	623	4.4	4.4	4.8	6.0		
	<b>Total</b>	<b>4.84</b>	<b>37.4</b>	<b>3809</b>						
		Greenfield runoff rate (l/s/ha)	Greenfield runoff rate (l/s)	Existing (l/s/ha)	Existing (l/s)	Design discharge rate* (l/s)	Percentage Reduction			
	Qbar	2.4	11.7	43.3	209.3		100%			
	1 in 1	2.1	10.0	35.0	169.3	28.4	83%			
	1 in 30	5.6	26.9	98.4	476.0	33.2	93%			
	1 in 100	7.7	37.4	142.8	690.6	33.7	95%			
	1 in 100+40CC**	10.8	52.4	199.8	966.6	36.8	96%			
	* calculated based on peak outflow rates from each catchment, modelled within the Source Control module of MicroDrainage.									
	** existing and greenfield runoff rates have been multiplied by 1.4 to allow for 40% climate change uplift in the 1 in 100 event									

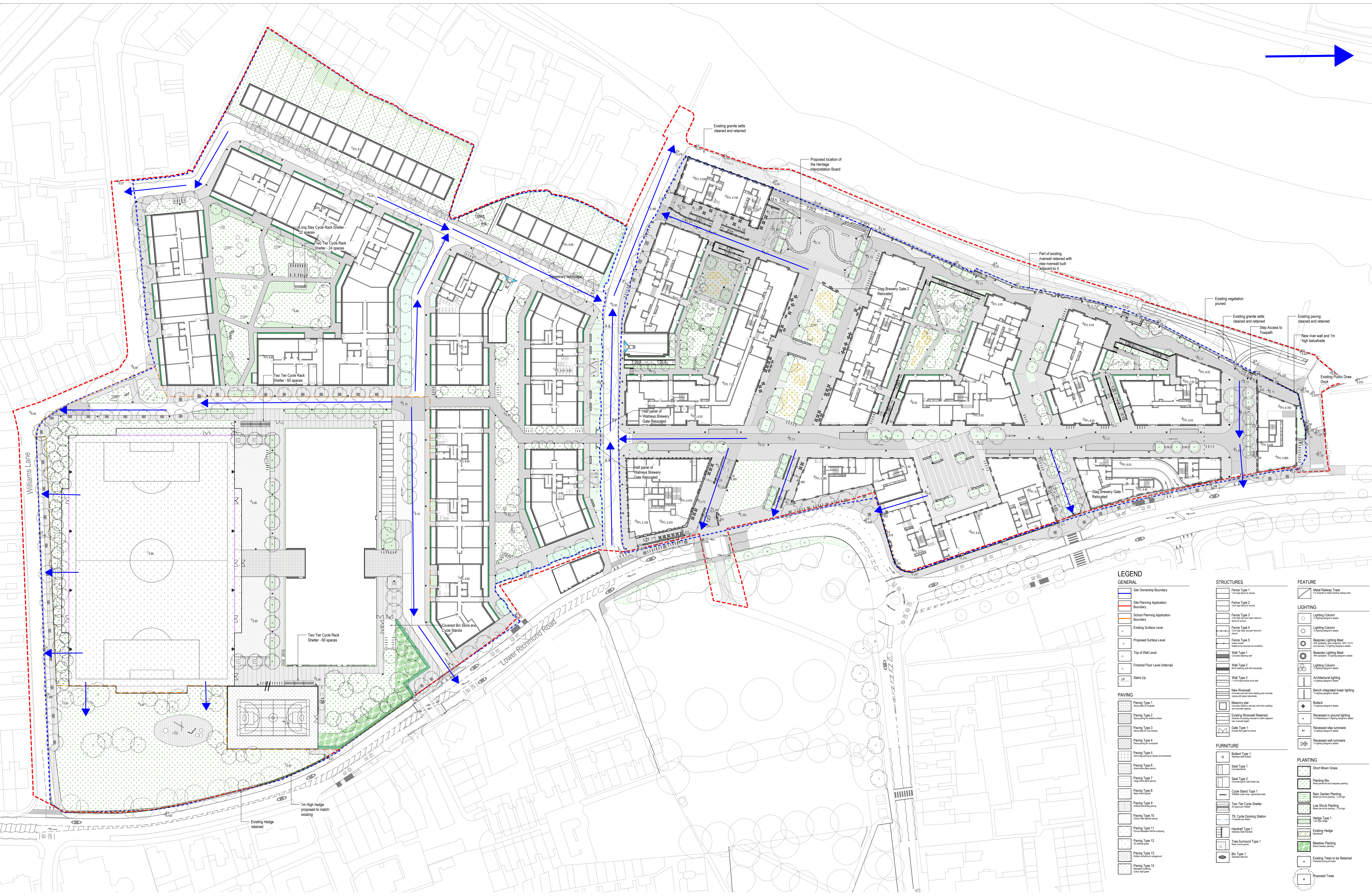
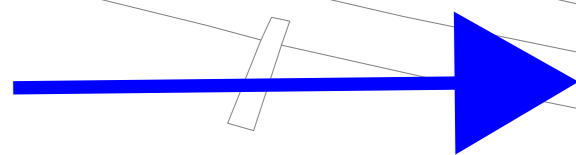
## **K. Exceedance mapping**

### **Appendices**

The Former Stag Brewery, Mortlake

Project Number: WIE18671

Document Reference: WIE18671-104-R-11-7-1-DS



LEGEND

GENERAL

- Site Ownership Boundary
- Site Planning Application Boundary
- School Planning Application Boundary
- Existing Surface Level
- Proposed Surface Level
- Top of Wall Level
- Finished Floor Level (Internal)
- Stairs Up

PAVING

- Paving Type 1
- Paving Type 2
- Paving Type 3
- Paving Type 4
- Paving Type 5
- Paving Type 6
- Paving Type 7
- Paving Type 8
- Paving Type 9
- Paving Type 10
- Paving Type 11
- Paving Type 12
- Paving Type 13
- Paving Type 14

STRUCTURES

- Fence Type 1
- Fence Type 2
- Fence Type 3
- Fence Type 4
- Fence Type 5
- Wall Type 1
- Wall Type 2
- Wall Type 3
- New Riverwall
- Masonry pier
- Existing Riverwall Retained
- Gate Type 1

FURNITURE

- Ballast Type 1
- Seat Type 1
- Seat Type 2
- Cycle Stand Type 1
- Two Tier Cycle Shelter
- TK Cycle Booking Station
- Handrail Type 1
- Tree Surround Type 1
- Bin Type 1

FEATURE

LIGHTING

- Lighting Column
- Lighting Column
- Beespole Lighting Mast
- Beespole Lighting Mast
- Lighting Column
- Architectural lighting
- Bench integrated linear lighting
- Ballast
- Recessed in ground lighting
- Recessed step luminaire
- Recessed wall luminaire

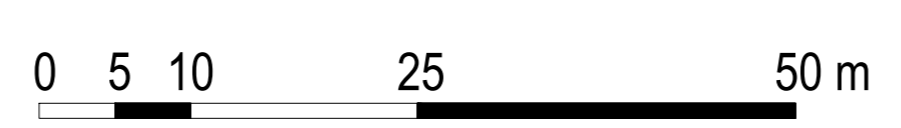
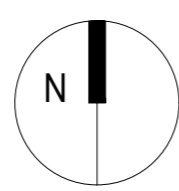
PLANTING

- Short Mown Grass
- Planting Mix
- Rain Garden Planting
- Low Shrub Planting
- Hedge Type 1
- Existing Hedge
- Meadow Planting
- Existing Trees to be Retained
- Proposed Trees

rev	details	by	date	rev	details	by	date
P01	Issue for Planning Submission	AS	11.03.2022				
P01	Issue for Planning Addendum	AS	22.07.2022				

Notes

- 1.0 Do not scale from drawing, use figured dimensions only
- 1.1 All dimensions to be checked onsite
- 1.2 This drawing to be read in conjunction with all other Gillespies drawings and specifications



Site plan

Project title  
**STAG BREWERY**

Drawing title  
**Proposed Site Wide Landscape GA Plan**

Drawing number  
**P10736-00-004-GIL-0101**

Drawing Status  
**PLANNING**

Date  
11.03.2022

Scale  
1:500 @ AD

Revision  
**P01**

Drawn  
AS

Checked  
JG

Client  
**DARTMOUTH CAPITAL**

Address  
100, 102, 104, 106, 108, 110, 112, 114, 116, 118, 120, 122, 124, 126, 128, 130, 132, 134, 136, 138, 140, 142, 144, 146, 148, 150, 152, 154, 156, 158, 160, 162, 164, 166, 168, 170, 172, 174, 176, 178, 180, 182, 184, 186, 188, 190, 192, 194, 196, 198, 200, 202, 204, 206, 208, 210, 212, 214, 216, 218, 220, 222, 224, 226, 228, 230, 232, 234, 236, 238, 240, 242, 244, 246, 248, 250, 252, 254, 256, 258, 260, 262, 264, 266, 268, 270, 272, 274, 276, 278, 280, 282, 284, 286, 288, 290, 292, 294, 296, 298, 300, 302, 304, 306, 308, 310, 312, 314, 316, 318, 320, 322, 324, 326, 328, 330, 332, 334, 336, 338, 340, 342, 344, 346, 348, 350, 352, 354, 356, 358, 360, 362, 364, 366, 368, 370, 372, 374, 376, 378, 380, 382, 384, 386, 388, 390, 392, 394, 396, 398, 400, 402, 404, 406, 408, 410, 412, 414, 416, 418, 420, 422, 424, 426, 428, 430, 432, 434, 436, 438, 440, 442, 444, 446, 448, 450, 452, 454, 456, 458, 460, 462, 464, 466, 468, 470, 472, 474, 476, 478, 480, 482, 484, 486, 488, 490, 492, 494, 496, 498, 500, 502, 504, 506, 508, 510, 512, 514, 516, 518, 520, 522, 524, 526, 528, 530, 532, 534, 536, 538, 540, 542, 544, 546, 548, 550, 552, 554, 556, 558, 560, 562, 564, 566, 568, 570, 572, 574, 576, 578, 580, 582, 584, 586, 588, 590, 592, 594, 596, 598, 600, 602, 604, 606, 608, 610, 612, 614, 616, 618, 620, 622, 624, 626, 628, 630, 632, 634, 636, 638, 640, 642, 644, 646, 648, 650, 652, 654, 656, 658, 660, 662, 664, 666, 668, 670, 672, 674, 676, 678, 680, 682, 684, 686, 688, 690, 692, 694, 696, 698, 700, 702, 704, 706, 708, 710, 712, 714, 716, 718, 720, 722, 724, 726, 728, 730, 732, 734, 736, 738, 740, 742, 744, 746, 748, 750, 752, 754, 756, 758, 760, 762, 764, 766, 768, 770, 772, 774, 776, 778, 780, 782, 784, 786, 788, 790, 792, 794, 796, 798, 800, 802, 804, 806, 808, 810, 812, 814, 816, 818, 820, 822, 824, 826, 828, 830, 832, 834, 836, 838, 840, 842, 844, 846, 848, 850, 852, 854, 856, 858, 860, 862, 864, 866, 868, 870, 872, 874, 876, 878, 880, 882, 884, 886, 888, 890, 892, 894, 896, 898, 900, 902, 904, 906, 908, 910, 912, 914, 916, 918, 920, 922, 924, 926, 928, 930, 932, 934, 936, 938, 940, 942, 944, 946, 948, 950, 952, 954, 956, 958, 960, 962, 964, 966, 968, 970, 972, 974, 976, 978, 980, 982, 984, 986, 988, 990, 992, 994, 996, 998, 1000

**GILLESPIES**

100, 102, 104, 106, 108, 110, 112, 114, 116, 118, 120, 122, 124, 126, 128, 130, 132, 134, 136, 138, 140, 142, 144, 146, 148, 150, 152, 154, 156, 158, 160, 162, 164, 166, 168, 170, 172, 174, 176, 178, 180, 182, 184, 186, 188, 190, 192, 194, 196, 198, 200, 202, 204, 206, 208, 210, 212, 214, 216, 218, 220, 222, 224, 226, 228, 230, 232, 234, 236, 238, 240, 242, 244, 246, 248, 250, 252, 254, 256, 258, 260, 262, 264, 266, 268, 270, 272, 274, 276, 278, 280, 282, 284, 286, 288, 290, 292, 294, 296, 298, 300, 302, 304, 306, 308, 310, 312, 314, 316, 318, 320, 322, 324, 326, 328, 330, 332, 334, 336, 338, 340, 342, 344, 346, 348, 350, 352, 354, 356, 358, 360, 362, 364, 366, 368, 370, 372, 374, 376, 378, 380, 382, 384, 386, 388, 390, 392, 394, 396, 398, 400, 402, 404, 406, 408, 410, 412, 414, 416, 418, 420, 422, 424, 426, 428, 430, 432, 434, 436, 438, 440, 442, 444, 446, 448, 450, 452, 454, 456, 458, 460, 462, 464, 466, 468, 470, 472, 474, 476, 478, 480, 482, 484, 486, 488, 490, 492, 494, 496, 498, 500, 502, 504, 506, 508, 510, 512, 514, 516, 518, 520, 522, 524, 526, 528, 530, 532, 534, 536, 538, 540, 542, 544, 546, 548, 550, 552, 554, 556, 558, 560, 562, 564, 566, 568, 570, 572, 574, 576, 578, 580, 582, 584, 586, 588, 590, 592, 594, 596, 598, 600, 602, 604, 606, 608, 610, 612, 614, 616, 618, 620, 622, 624, 626, 628, 630, 632, 634, 636, 638, 640, 642, 644, 646, 648, 650, 652, 654, 656, 658, 660, 662, 664, 666, 668, 670, 672, 674, 676, 678, 680, 682, 684, 686, 688, 690, 692, 694, 696, 698, 700, 702, 704, 706, 708, 710, 712, 714, 716, 718, 720, 722, 724, 726, 728, 730, 732, 734, 736, 738, 740, 742, 744, 746, 748, 750, 752, 754, 756, 758, 760, 762, 764, 766, 768, 770, 772, 774, 776, 778, 780, 782, 784, 786, 788, 790, 792, 794, 796, 798, 800, 802, 804, 806, 808, 810, 812, 814, 816, 818, 820, 822, 824, 826, 828, 830, 832, 834, 836, 838, 840, 842, 844, 846, 848, 850, 852, 854, 856, 858, 860, 862, 864, 866, 868, 870, 872, 874, 876, 878, 880, 882, 884, 886, 888, 890, 892, 894, 896, 898, 900, 902, 904, 906, 908, 910, 912, 914, 916, 918, 920, 922, 924, 926, 928, 930, 932, 934, 936, 938, 940, 942, 944, 946, 948, 950, 952, 954, 956, 958, 960, 962, 964, 966, 968, 970, 972, 974, 976, 978, 980, 982, 984, 986, 988, 990, 992, 994, 996, 998, 1000