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Civic Centre
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Esher
KT10 9SD

Our Ref: 221584/KL/ml/02

06 April 2023

Dear Sirs,

16-18 OATLANDS DRIVE, WEYBRIDGE, SURREY, KT13 9JL

Further to the recent correspondence from Surrey County Council objecting to the application on the grounds that drainage strategy does not meet the requirement of the NPPF, its accompanying PPG and the Non Statutory Technical Standards.

The first point of objections is in relation to the alternative drainage strategy should infiltration prove inadequate for soakaways. They comment that the suggested discharge rate of 2.3l/s to the watercourse is not considered the practical minimum. The drainage strategy contained the greenfield runoff calculations which showed the greenfield runoff rate from an 1in100 year event for the undeveloped site to be 1.9 l/s. The proposed discharge rate is only 0.4 l/s above the greenfield rate.

Technical Standard S3 states, "*For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event.*"

The proposals meet the above requirements in that the runoff is less than the developed discharge rate and is near the greenfield rate, the LLFA have also questioned the storage requirements for the attenuation tank which they require now and not at the detailed design stage. Therefore, a design of the storage tank has been undertaken with a restricted flow below the undeveloped greenfield rate.

The full calculations for the attenuation tank for the 1 in 1, 30, 100 and 100+40% are enclosed. These show that the proposed discharge rate for the 1 in 100 year event +40% allowance will have a discharge rate of 1.5 l/s, 0.4 l/s lower that the greenfield rate for the 1 in 100 year event and that the soakaway size proposed if convert to a tank is adequate to accommodate the storm event. The same is true for the 1 in 100 year event the proposed discharge will be 0.4 l/s lower than the greenfield rate. For the in 30 year event there will be a slight increase of 0.2 l/s compared to the greenfield rate and slightly more for the 1 in 1 year event.

The LLFA go on to state that *"The development offers the opportunity to utilise a range of sustainable surface water management techniques which not only contribute to a reduction in discharge rates from the site, but provide amenity, biodiversity and water quality improvements and contribute to mitigating climate change by considering both drought and flood conditions. Justification should be provided as to why SuDS features such as; green/blue roofs, permeable paving, downpipe planters, attenuating tree pits, raingardens etc have not been utilised."* but seem have ignored the fact that permeable paving is being used and the building have green roofs.

On the basis that the development incorporates both green roofs and permeable paving we assume that the LLFA are happy that the proposals comply with Technical Standard S3 in this respect.

The LLFA have restated the climate change allowances to be factored in the drainage design which we in the original calculations and also the attached so we assume this was not a point of objection but just clarification.

Finally the LLFA raise the issue of exceedance flows in excess of the 1 in 100 year rainfall event. The proposed drainage strategy will cater for all events up to and including the 1 in 100 year event plus an allowance of 40%, and as stated previously any events that exceed this, the topography of the site means that flood waters will be force to the north away from the site towards the water course. The topographical survey of the site shows the fall in levels to the water course, this will mean any flood routes will be away from the people and property to an area of open land and therefore minimise the risk to people and property in compliance with Technical Standard S9.

I trust the above is sufficient for the LLFA to remove their objection, but they have any other queries please let us know.

Yours sincerely

Kevin Lang

Cascade Summary of Results for Permeable Paving.srcx

Upstream Structures	Outflow To	Overflow To
(None)	Tank.srcx	(None)

Half Drain Time : 48 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	14.063	0.063	0.0	0.9	0.9	3.0	O K
30 min Summer	14.074	0.074	0.0	1.2	1.2	4.1	O K
60 min Summer	14.081	0.081	0.0	1.2	1.2	5.0	O K
120 min Summer	14.086	0.086	0.0	1.3	1.3	5.6	O K
180 min Summer	14.088	0.088	0.0	1.3	1.3	5.8	O K
240 min Summer	14.087	0.087	0.0	1.3	1.3	5.7	O K
360 min Summer	14.084	0.084	0.0	1.3	1.3	5.3	O K
480 min Summer	14.080	0.080	0.0	1.2	1.2	4.8	O K
600 min Summer	14.076	0.076	0.0	1.2	1.2	4.4	O K
720 min Summer	14.073	0.073	0.0	1.1	1.1	4.0	O K
960 min Summer	14.067	0.067	0.0	1.0	1.0	3.4	O K
1440 min Summer	14.059	0.059	0.0	0.9	0.9	2.6	O K
2160 min Summer	14.051	0.051	0.0	0.7	0.7	2.0	O K
2880 min Summer	14.046	0.046	0.0	0.6	0.6	1.6	O K
4320 min Summer	14.039	0.039	0.0	0.4	0.4	1.1	O K
5760 min Summer	14.034	0.034	0.0	0.4	0.4	0.9	O K
7200 min Summer	14.030	0.030	0.0	0.3	0.3	0.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	30.991	0.0	3.4	17
30 min Summer	20.215	0.0	5.1	31
60 min Summer	12.800	0.0	7.0	48
120 min Summer	7.942	0.0	9.2	82
180 min Summer	5.979	0.0	10.7	116
240 min Summer	4.882	0.0	11.8	150
360 min Summer	3.646	0.0	13.4	216
480 min Summer	2.956	0.0	14.6	278
600 min Summer	2.511	0.0	15.5	338
720 min Summer	2.199	0.0	16.3	398
960 min Summer	1.782	0.0	17.7	520
1440 min Summer	1.326	0.0	19.6	762
2160 min Summer	0.988	0.0	21.7	1124
2880 min Summer	0.800	0.0	23.1	1472
4320 min Summer	0.595	0.0	25.0	2204
5760 min Summer	0.483	0.0	26.2	2936
7200 min Summer	0.410	0.0	27.0	3672

Cascade Summary of Results for Permeable Paving.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
8640 min Summer	14.028	0.028	0.0	0.3	0.3	0.6	O K
10080 min Summer	14.027	0.027	0.0	0.2	0.2	0.5	O K
15 min Winter	14.063	0.063	0.0	0.9	0.9	3.0	O K
30 min Winter	14.074	0.074	0.0	1.2	1.2	4.1	O K
60 min Winter	14.081	0.081	0.0	1.2	1.2	5.0	O K
120 min Winter	14.085	0.085	0.0	1.3	1.3	5.4	O K
180 min Winter	14.084	0.084	0.0	1.3	1.3	5.3	O K
240 min Winter	14.082	0.082	0.0	1.2	1.2	5.1	O K
360 min Winter	14.077	0.077	0.0	1.2	1.2	4.4	O K
480 min Winter	14.071	0.071	0.0	1.1	1.1	3.8	O K
600 min Winter	14.067	0.067	0.0	1.0	1.0	3.4	O K
720 min Winter	14.063	0.063	0.0	0.9	0.9	3.0	O K
960 min Winter	14.057	0.057	0.0	0.8	0.8	2.4	O K
1440 min Winter	14.049	0.049	0.0	0.6	0.6	1.8	O K
2160 min Winter	14.041	0.041	0.0	0.5	0.5	1.3	O K
2880 min Winter	14.036	0.036	0.0	0.4	0.4	1.0	O K
4320 min Winter	14.029	0.029	0.0	0.3	0.3	0.6	O K
5760 min Winter	14.026	0.026	0.0	0.2	0.2	0.5	O K
7200 min Winter	14.025	0.025	0.0	0.2	0.2	0.5	O K
8640 min Winter	14.023	0.023	0.0	0.2	0.2	0.4	O K
10080 min Winter	14.022	0.022	0.0	0.2	0.2	0.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	0.359	0.0	27.4	4304
10080 min Summer	0.322	0.0	27.7	5072
15 min Winter	30.991	0.0	3.4	17
30 min Winter	20.215	0.0	5.1	30
60 min Winter	12.800	0.0	7.0	50
120 min Winter	7.942	0.0	9.2	88
180 min Winter	5.979	0.0	10.7	124
240 min Winter	4.882	0.0	11.8	160
360 min Winter	3.646	0.0	13.4	226
480 min Winter	2.956	0.0	14.6	286
600 min Winter	2.511	0.0	15.5	348
720 min Winter	2.199	0.0	16.3	408
960 min Winter	1.782	0.0	17.7	530
1440 min Winter	1.326	0.0	19.6	764
2160 min Winter	0.988	0.0	21.7	1124
2880 min Winter	0.800	0.0	23.1	1476
4320 min Winter	0.595	0.0	25.0	2180
5760 min Winter	0.483	0.0	26.3	2936
7200 min Winter	0.410	0.0	27.1	3704
8640 min Winter	0.359	0.0	27.7	4344
10080 min Winter	0.322	0.0	28.0	5216

Cascade Rainfall Details for Permeable Paving.srcx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	1.000
Region	England and Wales	Cv (Winter)	1.000
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.073

Time (mins) From:	To:	Area (ha)
0	4	0.073

Cascade Model Details for Permeable Paving.srcx

Storage is Online Cover Level (m) 14.500

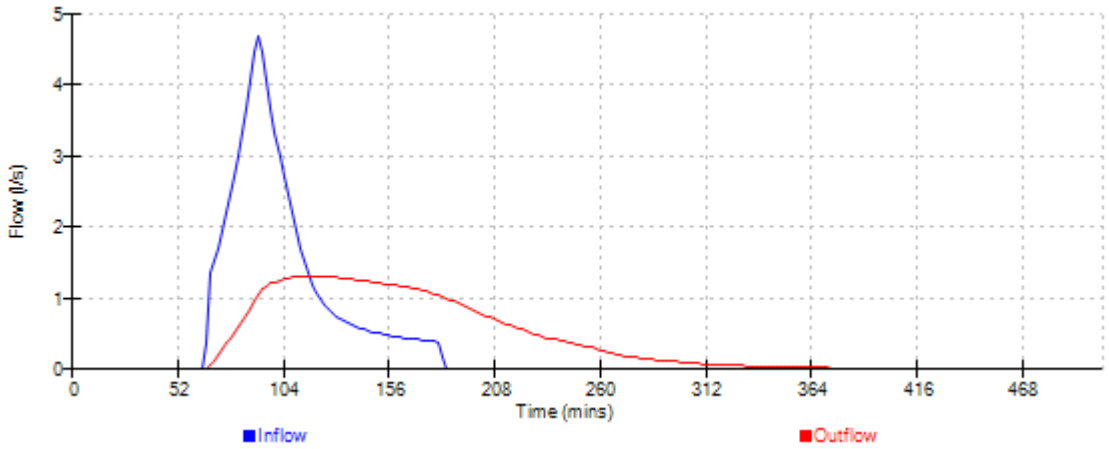
Porous Car Park Structure

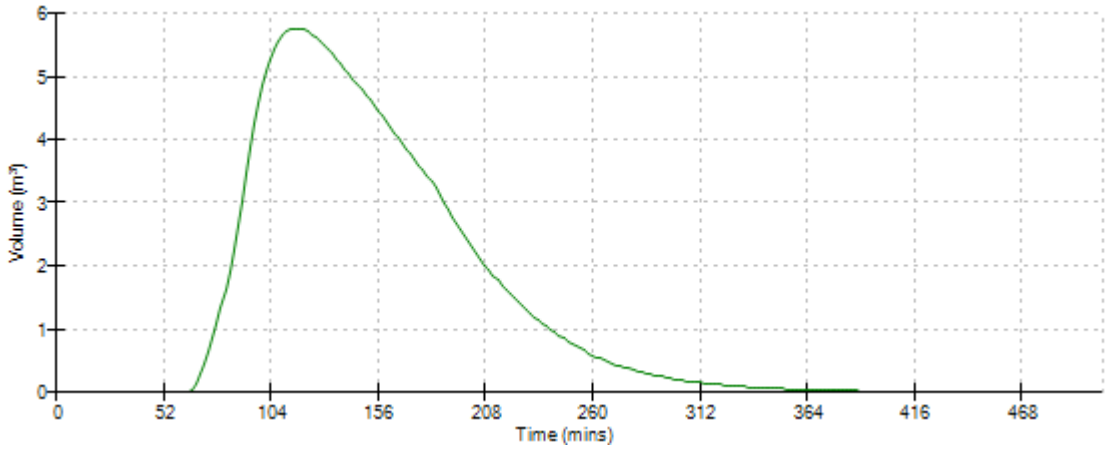
Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	20.0
Membrane Percolation (mm/hr)	1000	Length (m)	22.5
Max Percolation (l/s)	125.0	Slope (1:X)	250.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	14.000	Cap Volume Depth (m)	0.450

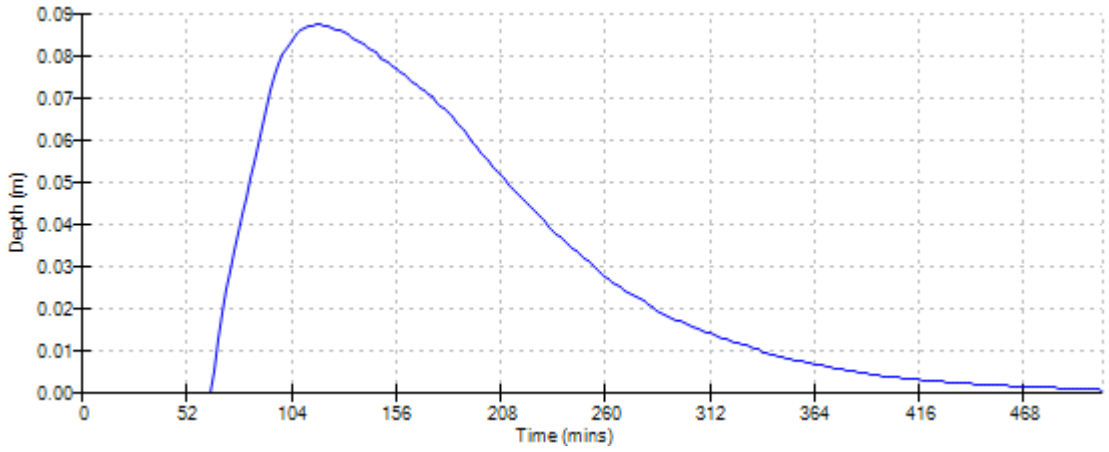
Orifice Outflow Control

Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 14.000

Cascade Event: 180 min Summer for Permeable Paving.srcx







Cascade Summary of Results for Tank.srcx

	Upstream Structures	Outflow To	Overflow To
	Permeable Paving.srcx	(None)	(None)

Half Drain Time : 168 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	12.550	0.050	0.0	0.7	0.7	9.0	O K
30 min Summer	12.565	0.065	0.0	1.0	1.0	11.8	O K
60 min Summer	12.581	0.081	0.0	1.2	1.2	14.8	O K
120 min Summer	12.600	0.100	0.0	1.3	1.3	18.2	O K
180 min Summer	12.610	0.110	0.0	1.3	1.3	20.1	O K
240 min Summer	12.616	0.116	0.0	1.4	1.4	21.1	O K
360 min Summer	12.620	0.120	0.0	1.4	1.4	22.0	O K
480 min Summer	12.622	0.122	0.0	1.4	1.4	22.3	O K
600 min Summer	12.623	0.123	0.0	1.4	1.4	22.4	O K
720 min Summer	12.622	0.122	0.0	1.4	1.4	22.3	O K
960 min Summer	12.618	0.118	0.0	1.4	1.4	21.5	O K
1440 min Summer	12.607	0.107	0.0	1.3	1.3	19.4	O K
2160 min Summer	12.590	0.090	0.0	1.3	1.3	16.4	O K
2880 min Summer	12.579	0.079	0.0	1.2	1.2	14.4	O K
4320 min Summer	12.565	0.065	0.0	1.0	1.0	11.8	O K
5760 min Summer	12.556	0.056	0.0	0.9	0.9	10.2	O K
7200 min Summer	12.550	0.050	0.0	0.8	0.8	9.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	30.991	0.0	11.3	34
30 min Summer	20.215	0.0	15.7	46
60 min Summer	12.800	0.0	21.2	64
120 min Summer	7.942	0.0	26.9	124
180 min Summer	5.979	0.0	30.6	182
240 min Summer	4.882	0.0	33.5	236
360 min Summer	3.646	0.0	37.8	296
480 min Summer	2.956	0.0	41.0	356
600 min Summer	2.511	0.0	43.6	416
720 min Summer	2.199	0.0	45.8	480
960 min Summer	1.782	0.0	49.5	608
1440 min Summer	1.326	0.0	55.1	864
2160 min Summer	0.988	0.0	61.9	1216
2880 min Summer	0.800	0.0	66.5	1584
4320 min Summer	0.595	0.0	73.2	2292
5760 min Summer	0.483	0.0	78.8	3000
7200 min Summer	0.410	0.0	82.8	3744

Cascade Summary of Results for Tank.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
8640 min Summer	12.546	0.046	0.0	0.7	0.7	8.4	O K
10080 min Summer	12.543	0.043	0.0	0.6	0.6	7.9	O K
15 min Winter	12.550	0.050	0.0	0.7	0.7	9.0	O K
30 min Winter	12.565	0.065	0.0	1.0	1.0	11.8	O K
60 min Winter	12.581	0.081	0.0	1.2	1.2	14.8	O K
120 min Winter	12.600	0.100	0.0	1.3	1.3	18.2	O K
180 min Winter	12.610	0.110	0.0	1.3	1.3	20.1	O K
240 min Winter	12.616	0.116	0.0	1.4	1.4	21.2	O K
360 min Winter	12.619	0.119	0.0	1.4	1.4	21.7	O K
480 min Winter	12.619	0.119	0.0	1.4	1.4	21.8	O K
600 min Winter	12.617	0.117	0.0	1.4	1.4	21.4	O K
720 min Winter	12.614	0.114	0.0	1.3	1.3	20.8	O K
960 min Winter	12.605	0.105	0.0	1.3	1.3	19.2	O K
1440 min Winter	12.588	0.088	0.0	1.3	1.3	16.0	O K
2160 min Winter	12.572	0.072	0.0	1.1	1.1	13.0	O K
2880 min Winter	12.561	0.061	0.0	0.9	0.9	11.1	O K
4320 min Winter	12.549	0.049	0.0	0.7	0.7	9.0	O K
5760 min Winter	12.543	0.043	0.0	0.6	0.6	7.8	O K
7200 min Winter	12.539	0.039	0.0	0.5	0.5	7.1	O K
8640 min Winter	12.536	0.036	0.0	0.5	0.5	6.5	O K
10080 min Winter	12.533	0.033	0.0	0.4	0.4	6.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	0.359	0.0	86.1	4416
10080 min Summer	0.322	0.0	88.7	5144
15 min Winter	30.991	0.0	11.3	34
30 min Winter	20.215	0.0	15.7	46
60 min Winter	12.800	0.0	21.2	64
120 min Winter	7.942	0.0	26.9	122
180 min Winter	5.979	0.0	30.6	178
240 min Winter	4.882	0.0	33.5	232
360 min Winter	3.646	0.0	37.8	298
480 min Winter	2.956	0.0	41.0	364
600 min Winter	2.511	0.0	43.6	434
720 min Winter	2.199	0.0	45.8	502
960 min Winter	1.782	0.0	49.5	636
1440 min Winter	1.326	0.0	55.2	880
2160 min Winter	0.988	0.0	61.9	1236
2880 min Winter	0.800	0.0	66.5	1588
4320 min Winter	0.595	0.0	73.2	2292
5760 min Winter	0.483	0.0	78.9	3024
7200 min Winter	0.410	0.0	83.0	3744
8640 min Winter	0.359	0.0	86.3	4416
10080 min Winter	0.322	0.0	89.0	5240

Cascade Rainfall Details for Tank.srcx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	1.000
Region	England and Wales	Cv (Winter)	1.000
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.114

Time (mins) From:	To:	Area (ha)
0	4	0.114

Cascade Model Details for Tank.srcx

Storage is Online Cover Level (m) 14.500

Cellular Storage Structure

Invert Level (m) 12.500 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	192.0	192.0	0.801	0.0	243.2
0.800	192.0	243.2			

Hydro-Brake Optimum® Outflow Control

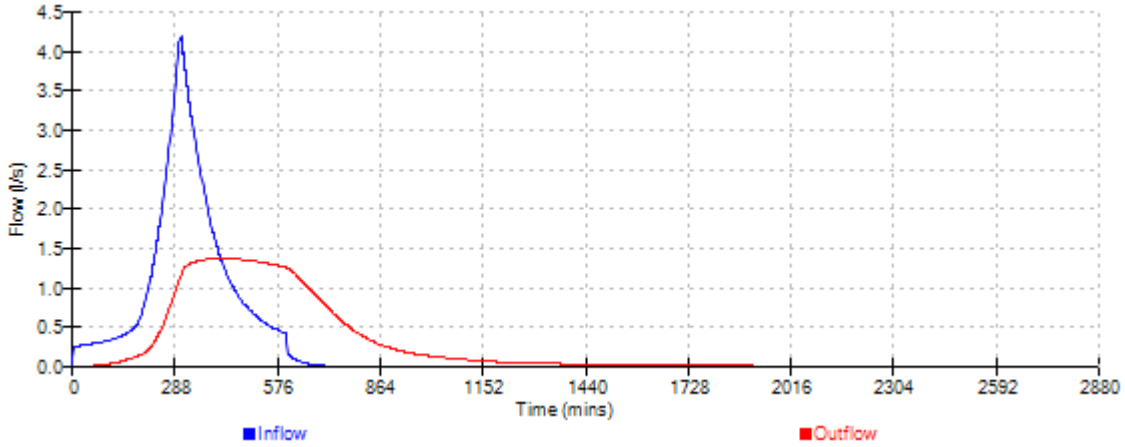
Unit Reference	MD-SHE-0060-1500-0800-1500
Design Head (m)	0.800
Design Flow (l/s)	1.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	60
Invert Level (m)	12.500
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

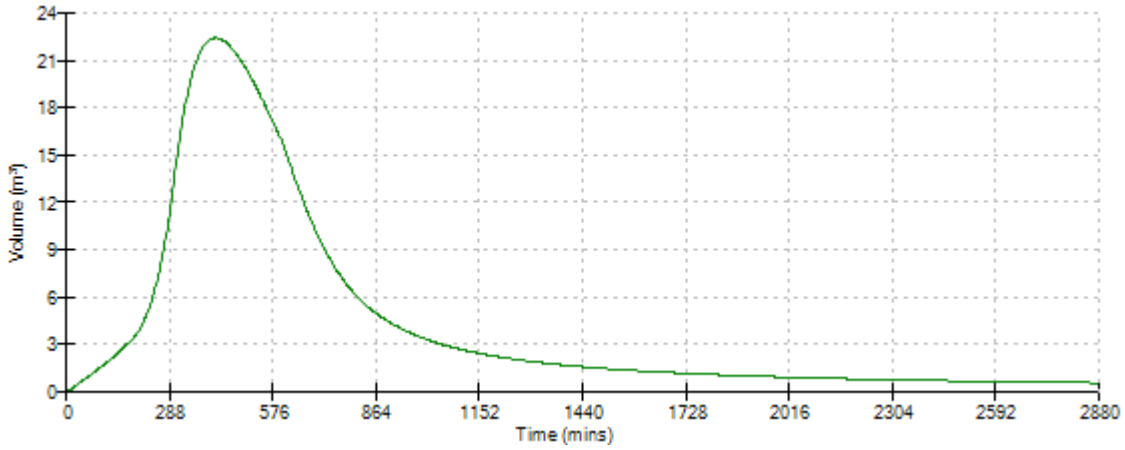
Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	1.5
Flush-Flo™	0.246	1.5
Kick-Flo®	0.505	1.2
Mean Flow over Head Range	-	1.3

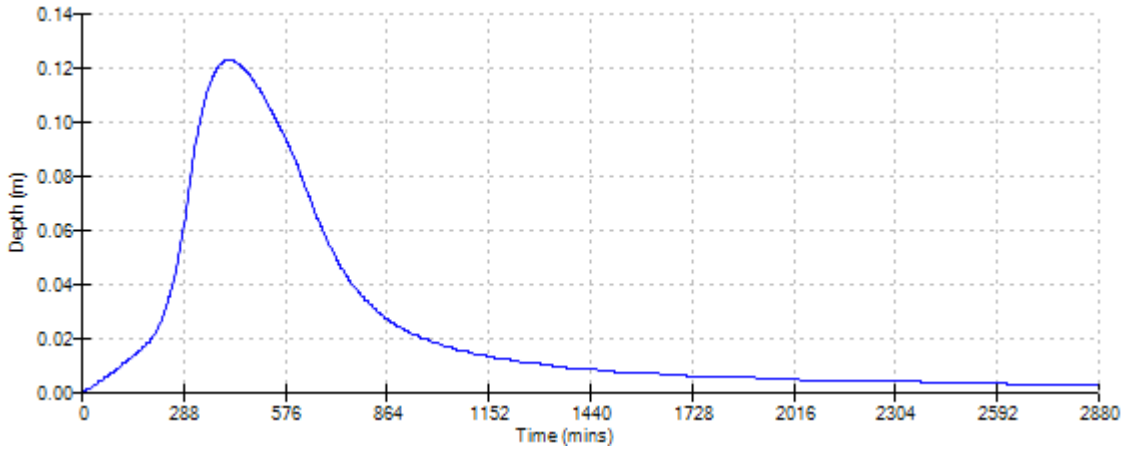
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.3	1.200	1.8	3.000	2.7	7.000	4.0
0.200	1.5	1.400	1.9	3.500	2.9	7.500	4.2
0.300	1.5	1.600	2.0	4.000	3.1	8.000	4.3
0.400	1.4	1.800	2.1	4.500	3.3	8.500	4.4
0.500	1.2	2.000	2.3	5.000	3.4	9.000	4.5
0.600	1.3	2.200	2.4	5.500	3.6	9.500	4.7
0.800	1.5	2.400	2.5	6.000	3.8		
1.000	1.6	2.600	2.5	6.500	3.9		

Cascade Event: 600 min Summer for Tank.srcx







Cascade Summary of Results for Permeable Paving.srcx

Upstream Structures	Outflow To	Overflow To
(None)	Tank.srcx	(None)

Half Drain Time : 87 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	14.124	0.124	0.0	1.6	1.6	10.7	O K
30 min Summer	14.148	0.148	0.0	1.8	1.8	13.9	O K
60 min Summer	14.164	0.164	0.0	1.9	1.9	16.1	O K
120 min Summer	14.172	0.172	0.0	2.0	2.0	17.1	O K
180 min Summer	14.172	0.172	0.0	2.0	2.0	17.2	O K
240 min Summer	14.169	0.169	0.0	2.0	2.0	16.8	O K
360 min Summer	14.161	0.161	0.0	1.9	1.9	15.7	O K
480 min Summer	14.152	0.152	0.0	1.9	1.9	14.5	O K
600 min Summer	14.144	0.144	0.0	1.8	1.8	13.3	O K
720 min Summer	14.136	0.136	0.0	1.7	1.7	12.3	O K
960 min Summer	14.122	0.122	0.0	1.6	1.6	10.4	O K
1440 min Summer	14.102	0.102	0.0	1.4	1.4	7.7	O K
2160 min Summer	14.083	0.083	0.0	1.3	1.3	5.1	O K
2880 min Summer	14.071	0.071	0.0	1.1	1.1	3.8	O K
4320 min Summer	14.059	0.059	0.0	0.8	0.8	2.6	O K
5760 min Summer	14.051	0.051	0.0	0.7	0.7	2.0	O K
7200 min Summer	14.046	0.046	0.0	0.6	0.6	1.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	76.035	0.0	11.6	18
30 min Summer	49.499	0.0	15.8	32
60 min Summer	30.811	0.0	20.2	60
120 min Summer	18.615	0.0	24.8	92
180 min Summer	13.715	0.0	27.6	126
240 min Summer	10.995	0.0	29.6	160
360 min Summer	8.034	0.0	32.6	228
480 min Summer	6.428	0.0	34.8	294
600 min Summer	5.404	0.0	36.6	360
720 min Summer	4.687	0.0	38.1	426
960 min Summer	3.743	0.0	40.6	550
1440 min Summer	2.723	0.0	44.1	794
2160 min Summer	1.979	0.0	47.7	1148
2880 min Summer	1.577	0.0	50.3	1496
4320 min Summer	1.143	0.0	53.8	2204
5760 min Summer	0.910	0.0	56.1	2936
7200 min Summer	0.762	0.0	57.7	3672

Cascade Summary of Results for Permeable Paving.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
8640 min Summer	14.043	0.043	0.0	0.5	0.5	1.4	O K
10080 min Summer	14.039	0.039	0.0	0.4	0.4	1.2	O K
15 min Winter	14.124	0.124	0.0	1.6	1.6	10.7	O K
30 min Winter	14.148	0.148	0.0	1.8	1.8	13.9	O K
60 min Winter	14.165	0.165	0.0	2.0	2.0	16.2	O K
120 min Winter	14.171	0.171	0.0	2.0	2.0	17.0	O K
180 min Winter	14.169	0.169	0.0	2.0	2.0	16.7	O K
240 min Winter	14.164	0.164	0.0	1.9	1.9	16.1	O K
360 min Winter	14.152	0.152	0.0	1.9	1.9	14.4	O K
480 min Winter	14.140	0.140	0.0	1.8	1.8	12.8	O K
600 min Winter	14.128	0.128	0.0	1.7	1.7	11.2	O K
720 min Winter	14.118	0.118	0.0	1.6	1.6	9.9	O K
960 min Winter	14.102	0.102	0.0	1.4	1.4	7.7	O K
1440 min Winter	14.080	0.080	0.0	1.2	1.2	4.8	O K
2160 min Winter	14.064	0.064	0.0	1.0	1.0	3.1	O K
2880 min Winter	14.055	0.055	0.0	0.8	0.8	2.3	O K
4320 min Winter	14.045	0.045	0.0	0.6	0.6	1.5	O K
5760 min Winter	14.040	0.040	0.0	0.4	0.4	1.2	O K
7200 min Winter	14.035	0.035	0.0	0.4	0.4	0.9	O K
8640 min Winter	14.031	0.031	0.0	0.3	0.3	0.7	O K
10080 min Winter	14.029	0.029	0.0	0.3	0.3	0.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	0.659	0.0	58.9	4400
10080 min Summer	0.583	0.0	59.8	5136
15 min Winter	76.035	0.0	11.6	18
30 min Winter	49.499	0.0	15.8	31
60 min Winter	30.811	0.0	20.2	58
120 min Winter	18.615	0.0	24.8	96
180 min Winter	13.715	0.0	27.6	134
240 min Winter	10.995	0.0	29.6	172
360 min Winter	8.034	0.0	32.6	244
480 min Winter	6.428	0.0	34.8	312
600 min Winter	5.404	0.0	36.6	380
720 min Winter	4.687	0.0	38.1	444
960 min Winter	3.743	0.0	40.6	568
1440 min Winter	2.723	0.0	44.1	806
2160 min Winter	1.979	0.0	47.7	1144
2880 min Winter	1.577	0.0	50.3	1500
4320 min Winter	1.143	0.0	53.8	2208
5760 min Winter	0.910	0.0	56.2	2936
7200 min Winter	0.762	0.0	57.8	3672
8640 min Winter	0.659	0.0	59.0	4408
10080 min Winter	0.583	0.0	59.9	5088

Cascade Rainfall Details for Permeable Paving.srcx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	1.000
Region	England and Wales	Cv (Winter)	1.000
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.073

Time (mins) From:	To:	Area (ha)
0	4	0.073

Cascade Model Details for Permeable Paving.srcx

Storage is Online Cover Level (m) 14.500

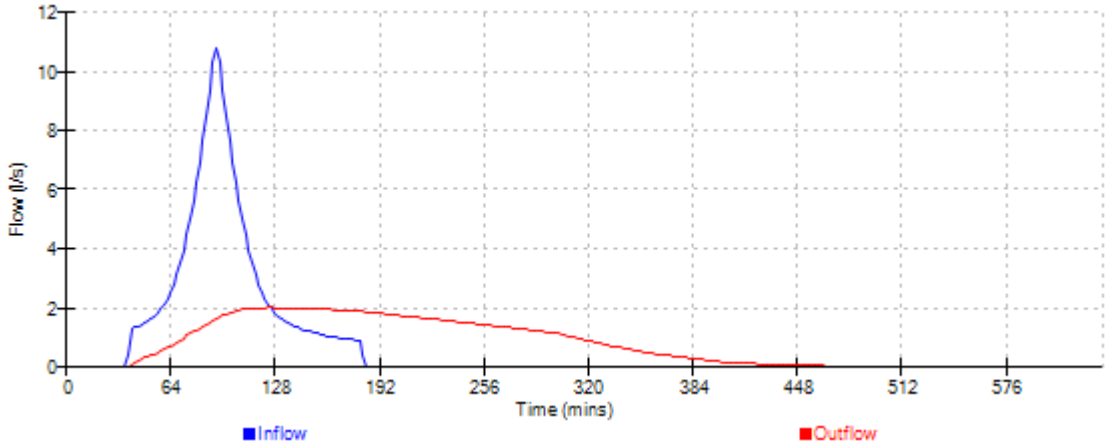
Porous Car Park Structure

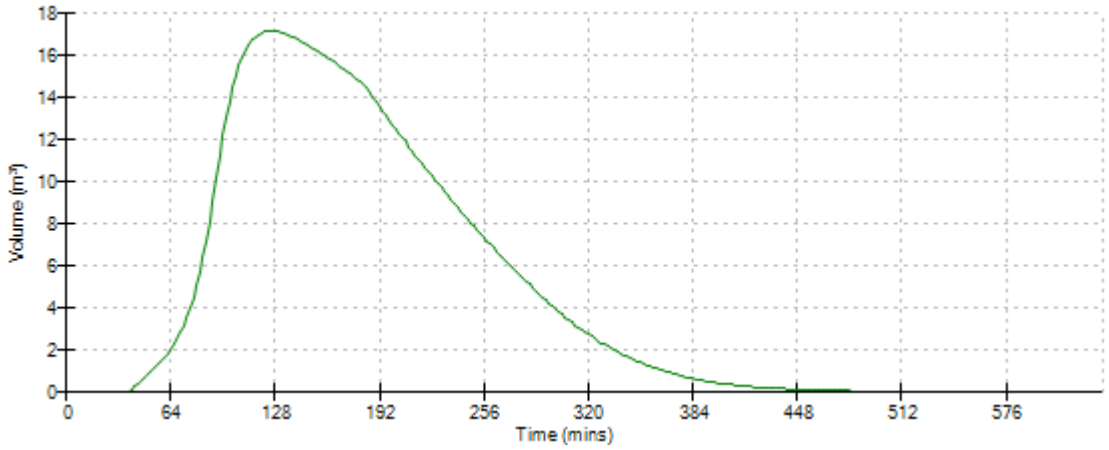
Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	20.0
Membrane Percolation (mm/hr)	1000	Length (m)	22.5
Max Percolation (l/s)	125.0	Slope (1:X)	250.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	14.000	Cap Volume Depth (m)	0.450

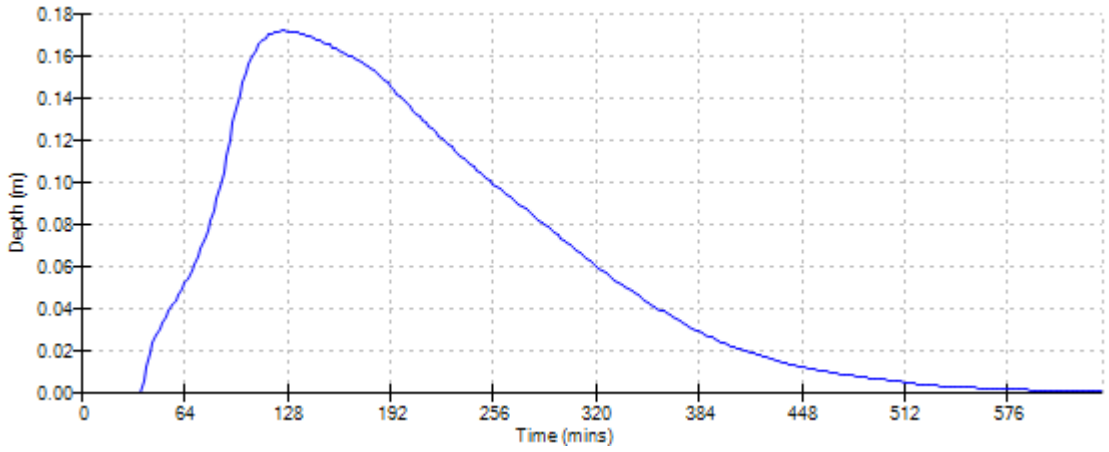
Orifice Outflow Control

Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 14.000

Cascade Event: 180 min Summer for Permeable Paving.srcx







Cascade Summary of Results for Permeable Paving.srcx

Upstream Structures	Outflow To	Overflow To
(None)	Tank.srcx	(None)

Half Drain Time : 87 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	14.124	0.124	0.0	1.6	1.6	10.7	O K
30 min Summer	14.148	0.148	0.0	1.8	1.8	13.9	O K
60 min Summer	14.164	0.164	0.0	1.9	1.9	16.1	O K
120 min Summer	14.172	0.172	0.0	2.0	2.0	17.1	O K
180 min Summer	14.172	0.172	0.0	2.0	2.0	17.2	O K
240 min Summer	14.169	0.169	0.0	2.0	2.0	16.8	O K
360 min Summer	14.161	0.161	0.0	1.9	1.9	15.7	O K
480 min Summer	14.152	0.152	0.0	1.9	1.9	14.5	O K
600 min Summer	14.144	0.144	0.0	1.8	1.8	13.3	O K
720 min Summer	14.136	0.136	0.0	1.7	1.7	12.3	O K
960 min Summer	14.122	0.122	0.0	1.6	1.6	10.4	O K
1440 min Summer	14.102	0.102	0.0	1.4	1.4	7.7	O K
2160 min Summer	14.083	0.083	0.0	1.3	1.3	5.1	O K
2880 min Summer	14.071	0.071	0.0	1.1	1.1	3.8	O K
4320 min Summer	14.059	0.059	0.0	0.8	0.8	2.6	O K
5760 min Summer	14.051	0.051	0.0	0.7	0.7	2.0	O K
7200 min Summer	14.046	0.046	0.0	0.6	0.6	1.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	76.035	0.0	11.6	18
30 min Summer	49.499	0.0	15.8	32
60 min Summer	30.811	0.0	20.2	60
120 min Summer	18.615	0.0	24.8	92
180 min Summer	13.715	0.0	27.6	126
240 min Summer	10.995	0.0	29.6	160
360 min Summer	8.034	0.0	32.6	228
480 min Summer	6.428	0.0	34.8	294
600 min Summer	5.404	0.0	36.6	360
720 min Summer	4.687	0.0	38.1	426
960 min Summer	3.743	0.0	40.6	550
1440 min Summer	2.723	0.0	44.1	794
2160 min Summer	1.979	0.0	47.7	1148
2880 min Summer	1.577	0.0	50.3	1496
4320 min Summer	1.143	0.0	53.8	2204
5760 min Summer	0.910	0.0	56.1	2936
7200 min Summer	0.762	0.0	57.7	3672

Cascade Summary of Results for Permeable Paving.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
8640 min Summer	14.043	0.043	0.0	0.5	0.5	1.4	O K
10080 min Summer	14.039	0.039	0.0	0.4	0.4	1.2	O K
15 min Winter	14.124	0.124	0.0	1.6	1.6	10.7	O K
30 min Winter	14.148	0.148	0.0	1.8	1.8	13.9	O K
60 min Winter	14.165	0.165	0.0	2.0	2.0	16.2	O K
120 min Winter	14.171	0.171	0.0	2.0	2.0	17.0	O K
180 min Winter	14.169	0.169	0.0	2.0	2.0	16.7	O K
240 min Winter	14.164	0.164	0.0	1.9	1.9	16.1	O K
360 min Winter	14.152	0.152	0.0	1.9	1.9	14.4	O K
480 min Winter	14.140	0.140	0.0	1.8	1.8	12.8	O K
600 min Winter	14.128	0.128	0.0	1.7	1.7	11.2	O K
720 min Winter	14.118	0.118	0.0	1.6	1.6	9.9	O K
960 min Winter	14.102	0.102	0.0	1.4	1.4	7.7	O K
1440 min Winter	14.080	0.080	0.0	1.2	1.2	4.8	O K
2160 min Winter	14.064	0.064	0.0	1.0	1.0	3.1	O K
2880 min Winter	14.055	0.055	0.0	0.8	0.8	2.3	O K
4320 min Winter	14.045	0.045	0.0	0.6	0.6	1.5	O K
5760 min Winter	14.040	0.040	0.0	0.4	0.4	1.2	O K
7200 min Winter	14.035	0.035	0.0	0.4	0.4	0.9	O K
8640 min Winter	14.031	0.031	0.0	0.3	0.3	0.7	O K
10080 min Winter	14.029	0.029	0.0	0.3	0.3	0.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	0.659	0.0	58.9	4400
10080 min Summer	0.583	0.0	59.8	5136
15 min Winter	76.035	0.0	11.6	18
30 min Winter	49.499	0.0	15.8	31
60 min Winter	30.811	0.0	20.2	58
120 min Winter	18.615	0.0	24.8	96
180 min Winter	13.715	0.0	27.6	134
240 min Winter	10.995	0.0	29.6	172
360 min Winter	8.034	0.0	32.6	244
480 min Winter	6.428	0.0	34.8	312
600 min Winter	5.404	0.0	36.6	380
720 min Winter	4.687	0.0	38.1	444
960 min Winter	3.743	0.0	40.6	568
1440 min Winter	2.723	0.0	44.1	806
2160 min Winter	1.979	0.0	47.7	1144
2880 min Winter	1.577	0.0	50.3	1500
4320 min Winter	1.143	0.0	53.8	2208
5760 min Winter	0.910	0.0	56.2	2936
7200 min Winter	0.762	0.0	57.8	3672
8640 min Winter	0.659	0.0	59.0	4408
10080 min Winter	0.583	0.0	59.9	5088

Cascade Rainfall Details for Permeable Paving.srcx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	1.000
Region	England and Wales	Cv (Winter)	1.000
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.073

Time (mins) From:	To:	Area (ha)
0	4	0.073

Cascade Model Details for Permeable Paving.srcx

Storage is Online Cover Level (m) 14.500

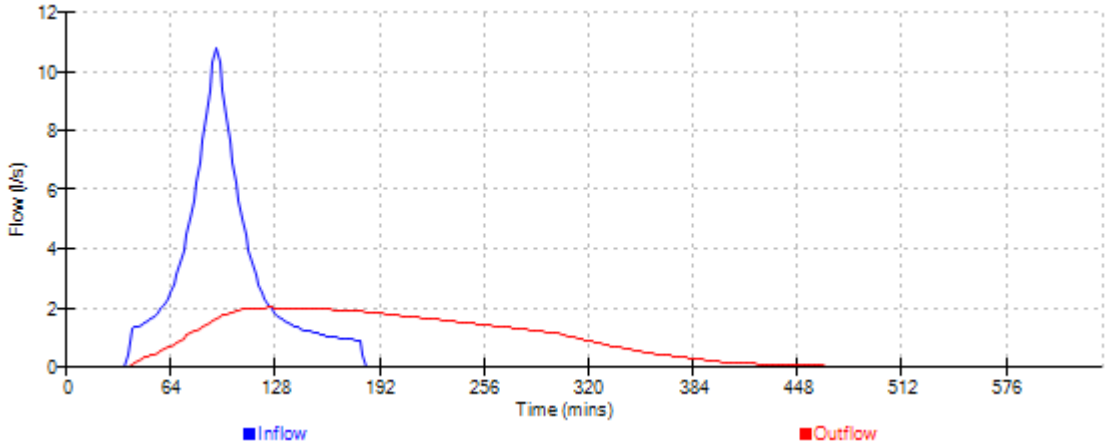
Porous Car Park Structure

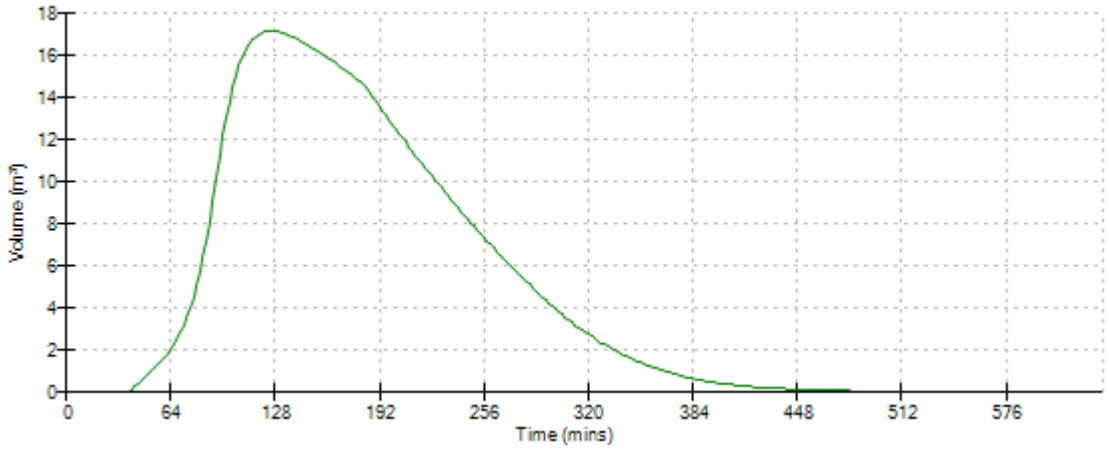
Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	20.0
Membrane Percolation (mm/hr)	1000	Length (m)	22.5
Max Percolation (l/s)	125.0	Slope (1:X)	250.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	14.000	Cap Volume Depth (m)	0.450

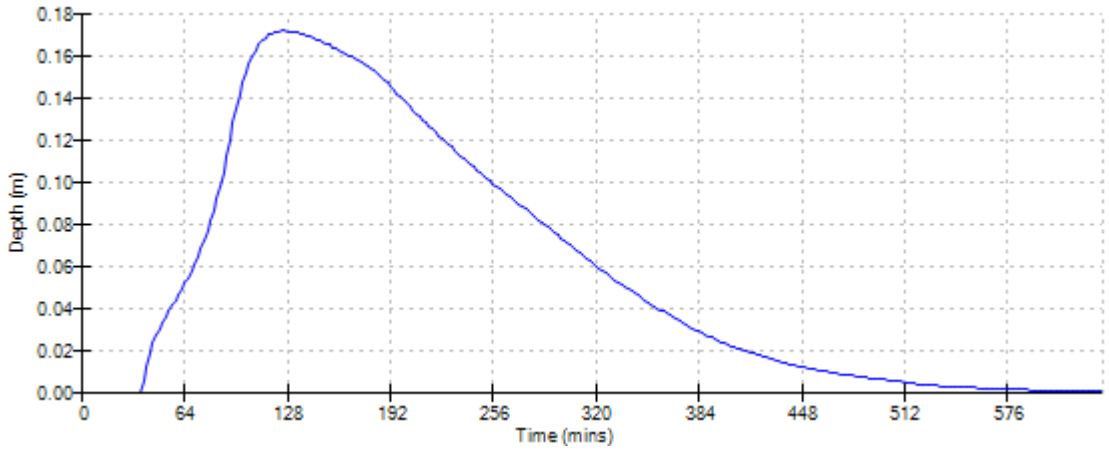
Orifice Outflow Control

Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 14.000

Cascade Event: 180 min Summer for Permeable Paving.srcx







Cascade Summary of Results for Permeable Paving.srcx

Upstream Structures	Outflow To	Overflow To
(None)	Tank.srcx	(None)

Half Drain Time : 103 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	14.153	0.153	0.0	1.9	1.9	14.6	O K
30 min Summer	14.186	0.186	0.0	2.1	2.1	19.1	O K
60 min Summer	14.211	0.211	0.0	2.3	2.3	22.4	Flood Risk
120 min Summer	14.221	0.221	0.0	2.3	2.3	23.8	Flood Risk
180 min Summer	14.221	0.221	0.0	2.3	2.3	23.8	Flood Risk
240 min Summer	14.218	0.218	0.0	2.3	2.3	23.3	Flood Risk
360 min Summer	14.207	0.207	0.0	2.2	2.2	21.9	Flood Risk
480 min Summer	14.196	0.196	0.0	2.2	2.2	20.4	O K
600 min Summer	14.185	0.185	0.0	2.1	2.1	18.9	O K
720 min Summer	14.175	0.175	0.0	2.0	2.0	17.6	O K
960 min Summer	14.157	0.157	0.0	1.9	1.9	15.1	O K
1440 min Summer	14.130	0.130	0.0	1.7	1.7	11.5	O K
2160 min Summer	14.103	0.103	0.0	1.5	1.5	7.8	O K
2880 min Summer	14.086	0.086	0.0	1.3	1.3	5.6	O K
4320 min Summer	14.068	0.068	0.0	1.1	1.1	3.5	O K
5760 min Summer	14.059	0.059	0.0	0.8	0.8	2.6	O K
7200 min Summer	14.053	0.053	0.0	0.7	0.7	2.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	98.681	0.0	15.7	18
30 min Summer	64.789	0.0	21.4	32
60 min Summer	40.510	0.0	27.3	60
120 min Summer	24.461	0.0	33.4	96
180 min Summer	17.964	0.0	36.9	130
240 min Summer	14.342	0.0	39.4	164
360 min Summer	10.418	0.0	43.0	232
480 min Summer	8.302	0.0	45.8	300
600 min Summer	6.956	0.0	48.0	366
720 min Summer	6.017	0.0	49.8	432
960 min Summer	4.784	0.0	52.7	558
1440 min Summer	3.456	0.0	57.0	808
2160 min Summer	2.493	0.0	61.2	1168
2880 min Summer	1.975	0.0	64.3	1524
4320 min Summer	1.421	0.0	68.4	2204
5760 min Summer	1.124	0.0	71.1	2936
7200 min Summer	0.936	0.0	73.0	3672

Cascade Summary of Results for Permeable Paving.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
8640 min Summer	14.048	0.048	0.0	0.6	0.6	1.7	O K
10080 min Summer	14.045	0.045	0.0	0.6	0.6	1.5	O K
15 min Winter	14.153	0.153	0.0	1.9	1.9	14.6	O K
30 min Winter	14.187	0.187	0.0	2.1	2.1	19.1	O K
60 min Winter	14.212	0.212	0.0	2.3	2.3	22.5	Flood Risk
120 min Winter	14.221	0.221	0.0	2.3	2.3	23.7	Flood Risk
180 min Winter	14.219	0.219	0.0	2.3	2.3	23.5	Flood Risk
240 min Winter	14.213	0.213	0.0	2.3	2.3	22.7	Flood Risk
360 min Winter	14.198	0.198	0.0	2.2	2.2	20.6	O K
480 min Winter	14.182	0.182	0.0	2.1	2.1	18.5	O K
600 min Winter	14.168	0.168	0.0	2.0	2.0	16.6	O K
720 min Winter	14.155	0.155	0.0	1.9	1.9	14.8	O K
960 min Winter	14.133	0.133	0.0	1.7	1.7	11.8	O K
1440 min Winter	14.102	0.102	0.0	1.5	1.5	7.7	O K
2160 min Winter	14.076	0.076	0.0	1.2	1.2	4.4	O K
2880 min Winter	14.064	0.064	0.0	1.0	1.0	3.1	O K
4320 min Winter	14.052	0.052	0.0	0.7	0.7	2.0	O K
5760 min Winter	14.045	0.045	0.0	0.6	0.6	1.5	O K
7200 min Winter	14.041	0.041	0.0	0.5	0.5	1.2	O K
8640 min Winter	14.036	0.036	0.0	0.4	0.4	1.0	O K
10080 min Winter	14.033	0.033	0.0	0.4	0.4	0.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	0.806	0.0	74.4	4400
10080 min Summer	0.710	0.0	75.4	5128
15 min Winter	98.681	0.0	15.7	18
30 min Winter	64.789	0.0	21.4	32
60 min Winter	40.510	0.0	27.3	60
120 min Winter	24.461	0.0	33.4	100
180 min Winter	17.964	0.0	36.9	136
240 min Winter	14.342	0.0	39.4	174
360 min Winter	10.418	0.0	43.0	248
480 min Winter	8.302	0.0	45.8	320
600 min Winter	6.956	0.0	48.0	388
720 min Winter	6.017	0.0	49.8	454
960 min Winter	4.784	0.0	52.7	580
1440 min Winter	3.456	0.0	57.0	824
2160 min Winter	2.493	0.0	61.2	1168
2880 min Winter	1.975	0.0	64.3	1500
4320 min Winter	1.421	0.0	68.4	2204
5760 min Winter	1.124	0.0	71.2	2920
7200 min Winter	0.936	0.0	73.1	3680
8640 min Winter	0.806	0.0	74.5	4408
10080 min Winter	0.710	0.0	75.5	5096

Cascade Rainfall Details for Permeable Paving.srcx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
Region	England and Wales	Cv (Winter)	1.000
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.073

Time (mins) From:	To:	Area (ha)
0	4	0.073

Cascade Model Details for Permeable Paving.srcx

Storage is Online Cover Level (m) 14.500

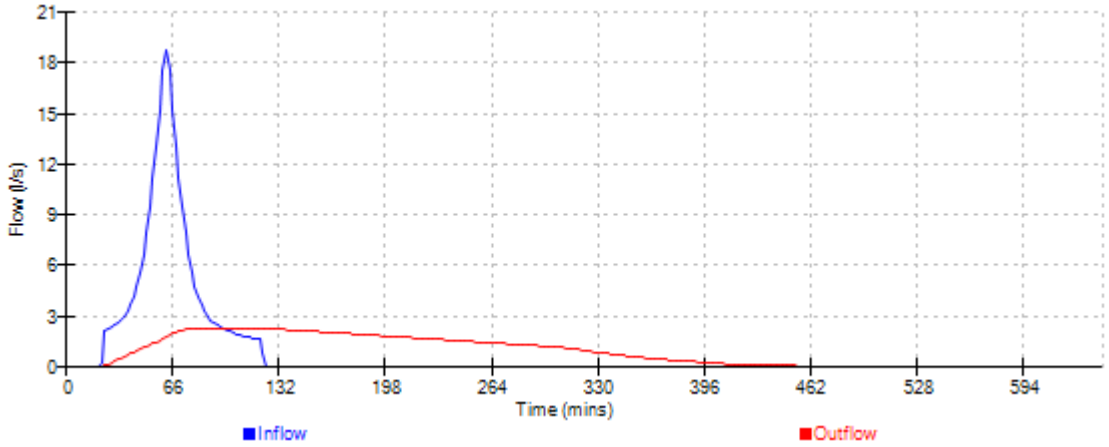
Porous Car Park Structure

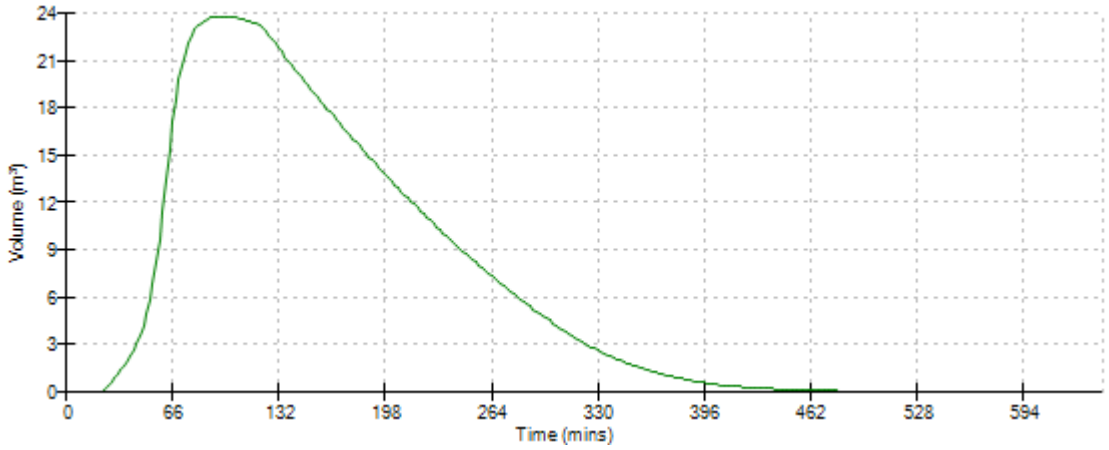
Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	20.0
Membrane Percolation (mm/hr)	1000	Length (m)	22.5
Max Percolation (l/s)	125.0	Slope (1:X)	250.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	14.000	Cap Volume Depth (m)	0.450

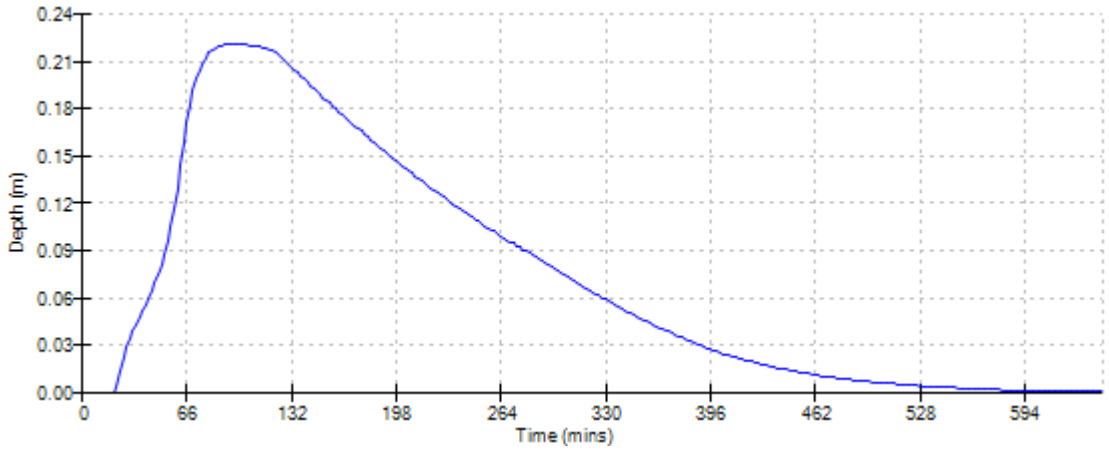
Orifice Outflow Control

Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 14.000

Cascade Event: 120 min Summer for Permeable Paving.srcx







Cascade Summary of Results for Tank.srcx

Upstream Structures	Outflow To	Overflow To
Permeable Paving.srcx	(None)	(None)

Half Drain Time : 488 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	12.661	0.161	0.0	1.4	1.4	29.3	O K
30 min Summer	12.716	0.216	0.0	1.5	1.5	39.4	O K
60 min Summer	12.777	0.277	0.0	1.5	1.5	50.5	O K
120 min Summer	12.841	0.341	0.0	1.5	1.5	62.2	O K
180 min Summer	12.878	0.378	0.0	1.5	1.5	68.9	O K
240 min Summer	12.902	0.402	0.0	1.5	1.5	73.3	O K
360 min Summer	12.934	0.434	0.0	1.5	1.5	79.2	O K
480 min Summer	12.954	0.454	0.0	1.5	1.5	82.8	O K
600 min Summer	12.966	0.466	0.0	1.5	1.5	84.9	O K
720 min Summer	12.967	0.467	0.0	1.5	1.5	85.2	O K
960 min Summer	12.951	0.451	0.0	1.5	1.5	82.2	O K
1440 min Summer	12.917	0.417	0.0	1.5	1.5	76.0	O K
2160 min Summer	12.868	0.368	0.0	1.5	1.5	67.1	O K
2880 min Summer	12.820	0.320	0.0	1.5	1.5	58.4	O K
4320 min Summer	12.737	0.237	0.0	1.5	1.5	43.3	O K
5760 min Summer	12.677	0.177	0.0	1.5	1.5	32.4	O K
7200 min Summer	12.636	0.136	0.0	1.4	1.4	24.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	98.681	0.0	42.7	89
30 min Summer	64.789	0.0	56.9	135
60 min Summer	40.510	0.0	72.9	190
120 min Summer	24.461	0.0	88.5	258
180 min Summer	17.964	0.0	97.7	310
240 min Summer	14.342	0.0	104.1	354
360 min Summer	10.418	0.0	113.5	438
480 min Summer	8.302	0.0	120.6	518
600 min Summer	6.956	0.0	126.3	604
720 min Summer	6.017	0.0	131.1	720
960 min Summer	4.784	0.0	138.8	840
1440 min Summer	3.456	0.0	150.1	1064
2160 min Summer	2.493	0.0	163.2	1424
2880 min Summer	1.975	0.0	171.9	1788
4320 min Summer	1.421	0.0	184.3	2512
5760 min Summer	1.124	0.0	193.9	3224
7200 min Summer	0.936	0.0	200.8	3896

Cascade Summary of Results for Tank.srcx

	Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
8640	min Summer	12.608	0.108	0.0	1.3	1.3	19.8	O K
10080	min Summer	12.590	0.090	0.0	1.3	1.3	16.4	O K
15	min Winter	12.661	0.161	0.0	1.4	1.4	29.3	O K
30	min Winter	12.716	0.216	0.0	1.5	1.5	39.4	O K
60	min Winter	12.777	0.277	0.0	1.5	1.5	50.5	O K
120	min Winter	12.840	0.340	0.0	1.5	1.5	62.1	O K
180	min Winter	12.877	0.377	0.0	1.5	1.5	68.8	O K
240	min Winter	12.901	0.401	0.0	1.5	1.5	73.1	O K
360	min Winter	12.933	0.433	0.0	1.5	1.5	78.9	O K
480	min Winter	12.952	0.452	0.0	1.5	1.5	82.5	O K
600	min Winter	12.963	0.463	0.0	1.5	1.5	84.4	O K
720	min Winter	12.965	0.465	0.0	1.5	1.5	84.8	O K
960	min Winter	12.945	0.445	0.0	1.5	1.5	81.2	O K
1440	min Winter	12.899	0.399	0.0	1.5	1.5	72.9	O K
2160	min Winter	12.825	0.325	0.0	1.5	1.5	59.2	O K
2880	min Winter	12.755	0.255	0.0	1.5	1.5	46.6	O K
4320	min Winter	12.656	0.156	0.0	1.4	1.4	28.5	O K
5760	min Winter	12.602	0.102	0.0	1.3	1.3	18.5	O K
7200	min Winter	12.578	0.078	0.0	1.2	1.2	14.2	O K
8640	min Winter	12.567	0.067	0.0	1.0	1.0	12.1	O K
10080	min Winter	12.559	0.059	0.0	0.9	0.9	10.7	O K

	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640	min Summer	0.806	0.0	206.3	4584
10080	min Summer	0.710	0.0	210.7	5248
15	min Winter	98.681	0.0	42.7	89
30	min Winter	64.789	0.0	56.9	135
60	min Winter	40.510	0.0	72.9	190
120	min Winter	24.461	0.0	88.5	258
180	min Winter	17.964	0.0	97.7	310
240	min Winter	14.342	0.0	104.1	354
360	min Winter	10.418	0.0	113.5	436
480	min Winter	8.302	0.0	120.6	514
600	min Winter	6.956	0.0	126.3	600
720	min Winter	6.017	0.0	131.1	708
960	min Winter	4.784	0.0	138.9	862
1440	min Winter	3.456	0.0	150.1	1084
2160	min Winter	2.493	0.0	163.2	1480
2880	min Winter	1.975	0.0	172.0	1860
4320	min Winter	1.421	0.0	184.3	2552
5760	min Winter	1.124	0.0	193.9	3184
7200	min Winter	0.936	0.0	200.9	3816
8640	min Winter	0.806	0.0	206.5	4496
10080	min Winter	0.710	0.0	210.9	5240

Cascade Rainfall Details for Tank.srcx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
Region	England and Wales	Cv (Winter)	1.000
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.114

Time (mins) From:	To:	Area (ha)
0	4	0.114

Cascade Model Details for Tank.srcx

Storage is Online Cover Level (m) 14.500

Cellular Storage Structure

Invert Level (m) 12.500 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	192.0	192.0	0.801	0.0	243.2
0.800	192.0	243.2			

Hydro-Brake Optimum® Outflow Control

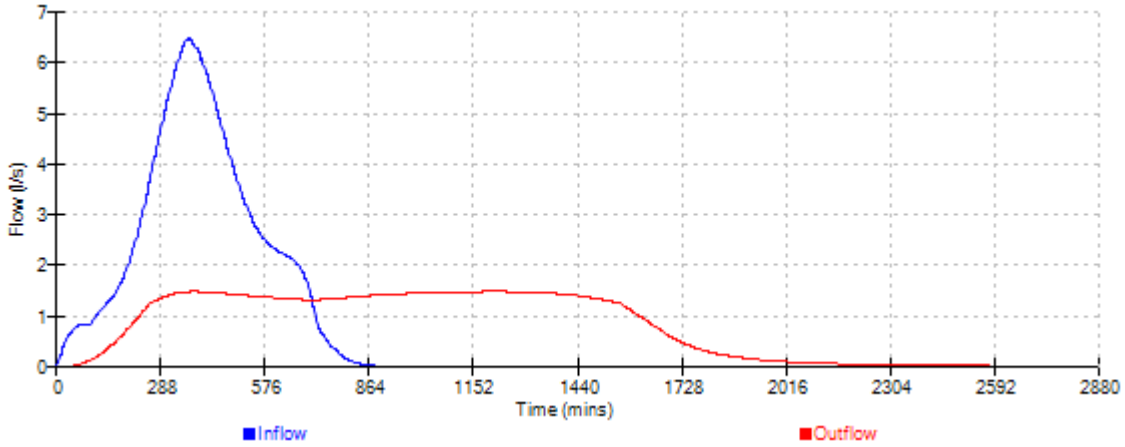
Unit Reference	MD-SHE-0060-1500-0800-1500
Design Head (m)	0.800
Design Flow (l/s)	1.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	60
Invert Level (m)	12.500
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

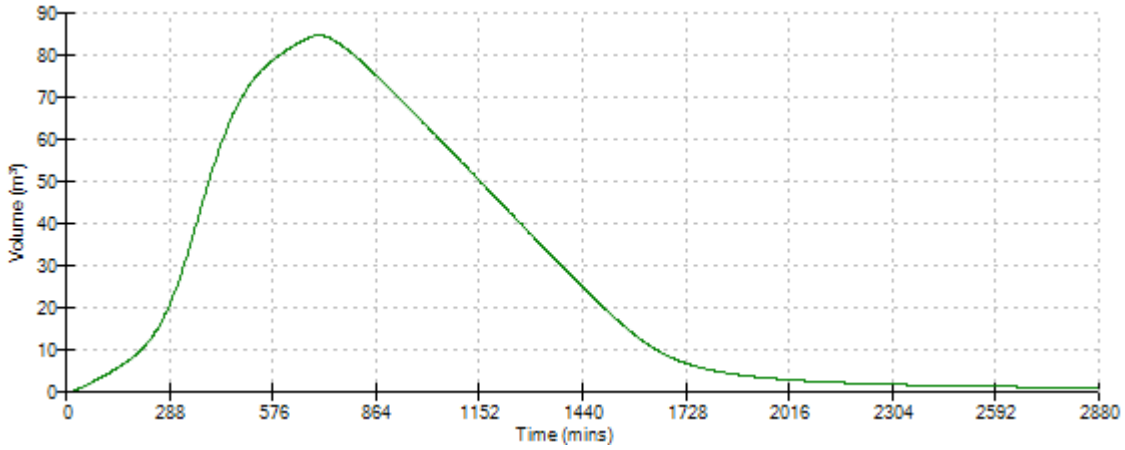
Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	1.5
Flush-Flo™	0.246	1.5
Kick-Flo®	0.505	1.2
Mean Flow over Head Range	-	1.3

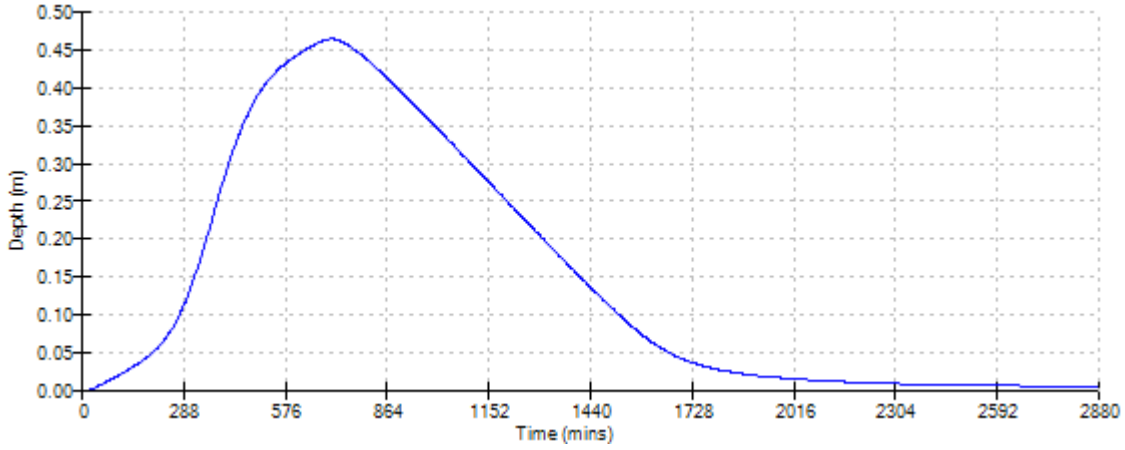
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.3	1.200	1.8	3.000	2.7	7.000	4.0
0.200	1.5	1.400	1.9	3.500	2.9	7.500	4.2
0.300	1.5	1.600	2.0	4.000	3.1	8.000	4.3
0.400	1.4	1.800	2.1	4.500	3.3	8.500	4.4
0.500	1.2	2.000	2.3	5.000	3.4	9.000	4.5
0.600	1.3	2.200	2.4	5.500	3.6	9.500	4.7
0.800	1.5	2.400	2.5	6.000	3.8		
1.000	1.6	2.600	2.5	6.500	3.9		

Cascade Event: 720 min Winter for Tank.srcx







Cascade Summary of Results for Permeable Paving.srcx

Upstream Structures	Outflow To	Overflow To
(None)	Tank.srcx	(None)

Half Drain Time : 132 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	14.205	0.205	0.0	2.2	2.2	21.6	Flood Risk
30 min Summer	14.252	0.252	0.0	2.5	2.5	28.0	Flood Risk
60 min Summer	14.290	0.290	0.0	2.7	2.7	33.1	Flood Risk
120 min Summer	14.307	0.307	0.0	2.8	2.8	35.4	Flood Risk
180 min Summer	14.309	0.309	0.0	2.8	2.8	35.6	Flood Risk
240 min Summer	14.305	0.305	0.0	2.8	2.8	35.1	Flood Risk
360 min Summer	14.293	0.293	0.0	2.7	2.7	33.4	Flood Risk
480 min Summer	14.279	0.279	0.0	2.6	2.6	31.6	Flood Risk
600 min Summer	14.265	0.265	0.0	2.6	2.6	29.7	Flood Risk
720 min Summer	14.252	0.252	0.0	2.5	2.5	27.9	Flood Risk
960 min Summer	14.228	0.228	0.0	2.4	2.4	24.7	Flood Risk
1440 min Summer	14.190	0.190	0.0	2.1	2.1	19.6	O K
2160 min Summer	14.151	0.151	0.0	1.9	1.9	14.3	O K
2880 min Summer	14.124	0.124	0.0	1.6	1.6	10.7	O K
4320 min Summer	14.092	0.092	0.0	1.4	1.4	6.4	O K
5760 min Summer	14.075	0.075	0.0	1.2	1.2	4.2	O K
7200 min Summer	14.066	0.066	0.0	1.0	1.0	3.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.153	0.0	22.9	18
30 min Summer	90.705	0.0	30.8	32
60 min Summer	56.713	0.0	39.1	62
120 min Summer	34.246	0.0	47.6	104
180 min Summer	25.149	0.0	52.7	136
240 min Summer	20.078	0.0	56.2	168
360 min Summer	14.585	0.0	61.3	238
480 min Summer	11.622	0.0	65.2	306
600 min Summer	9.738	0.0	68.3	374
720 min Summer	8.424	0.0	70.9	440
960 min Summer	6.697	0.0	75.1	570
1440 min Summer	4.839	0.0	81.2	822
2160 min Summer	3.490	0.0	87.5	1188
2880 min Summer	2.766	0.0	92.0	1556
4320 min Summer	1.989	0.0	98.3	2248
5760 min Summer	1.573	0.0	102.6	2944
7200 min Summer	1.311	0.0	105.8	3672

Cascade Summary of Results for Permeable Paving.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
8640 min Summer	14.060	0.060	0.0	0.9	0.9	2.7	O K
10080 min Summer	14.055	0.055	0.0	0.8	0.8	2.3	O K
15 min Winter	14.205	0.205	0.0	2.2	2.2	21.6	Flood Risk
30 min Winter	14.253	0.253	0.0	2.5	2.5	28.1	Flood Risk
60 min Winter	14.291	0.291	0.0	2.7	2.7	33.2	Flood Risk
120 min Winter	14.308	0.308	0.0	2.8	2.8	35.6	Flood Risk
180 min Winter	14.307	0.307	0.0	2.8	2.8	35.4	Flood Risk
240 min Winter	14.301	0.301	0.0	2.7	2.7	34.6	Flood Risk
360 min Winter	14.283	0.283	0.0	2.7	2.7	32.2	Flood Risk
480 min Winter	14.264	0.264	0.0	2.5	2.5	29.6	Flood Risk
600 min Winter	14.245	0.245	0.0	2.4	2.4	27.0	Flood Risk
720 min Winter	14.228	0.228	0.0	2.3	2.3	24.7	Flood Risk
960 min Winter	14.198	0.198	0.0	2.2	2.2	20.6	O K
1440 min Winter	14.153	0.153	0.0	1.9	1.9	14.6	O K
2160 min Winter	14.112	0.112	0.0	1.5	1.5	9.0	O K
2880 min Winter	14.087	0.087	0.0	1.3	1.3	5.7	O K
4320 min Winter	14.065	0.065	0.0	1.0	1.0	3.2	O K
5760 min Winter	14.056	0.056	0.0	0.8	0.8	2.3	O K
7200 min Winter	14.050	0.050	0.0	0.7	0.7	1.8	O K
8640 min Winter	14.045	0.045	0.0	0.6	0.6	1.5	O K
10080 min Winter	14.042	0.042	0.0	0.5	0.5	1.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	1.129	0.0	108.3	4408
10080 min Summer	0.994	0.0	110.2	5112
15 min Winter	138.153	0.0	22.9	18
30 min Winter	90.705	0.0	30.8	32
60 min Winter	56.713	0.0	39.1	60
120 min Winter	34.246	0.0	47.6	114
180 min Winter	25.149	0.0	52.7	142
240 min Winter	20.078	0.0	56.2	180
360 min Winter	14.585	0.0	61.3	254
480 min Winter	11.622	0.0	65.2	328
600 min Winter	9.738	0.0	68.3	398
720 min Winter	8.424	0.0	70.9	468
960 min Winter	6.697	0.0	75.1	598
1440 min Winter	4.839	0.0	81.2	852
2160 min Winter	3.490	0.0	87.5	1212
2880 min Winter	2.766	0.0	92.0	1556
4320 min Winter	1.989	0.0	98.3	2208
5760 min Winter	1.573	0.0	102.6	2944
7200 min Winter	1.311	0.0	105.9	3592
8640 min Winter	1.129	0.0	108.4	4288
10080 min Winter	0.994	0.0	110.3	5144

Cascade Rainfall Details for Permeable Paving.srcx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
Region	England and Wales	Cv (Winter)	1.000
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.073

Time (mins) From:	To:	Area (ha)
0	4	0.073

Cascade Model Details for Permeable Paving.srcx

Storage is Online Cover Level (m) 14.500

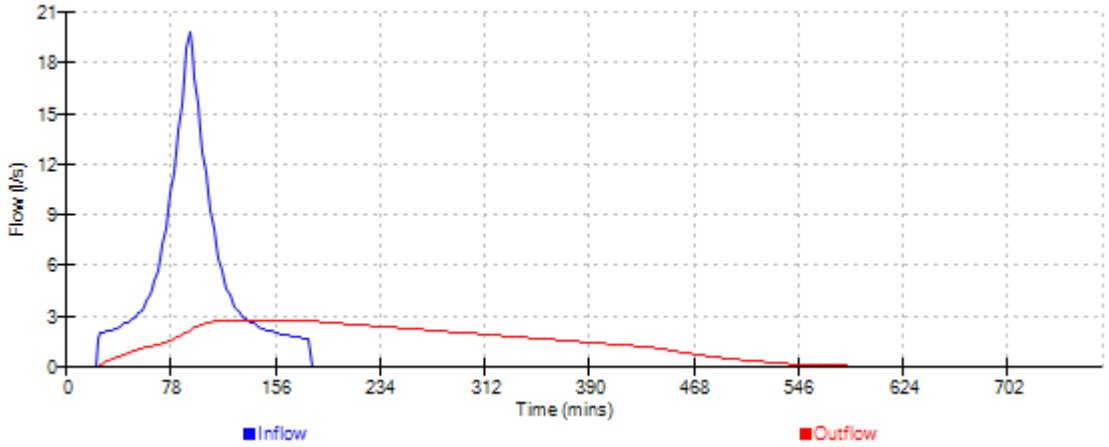
Porous Car Park Structure

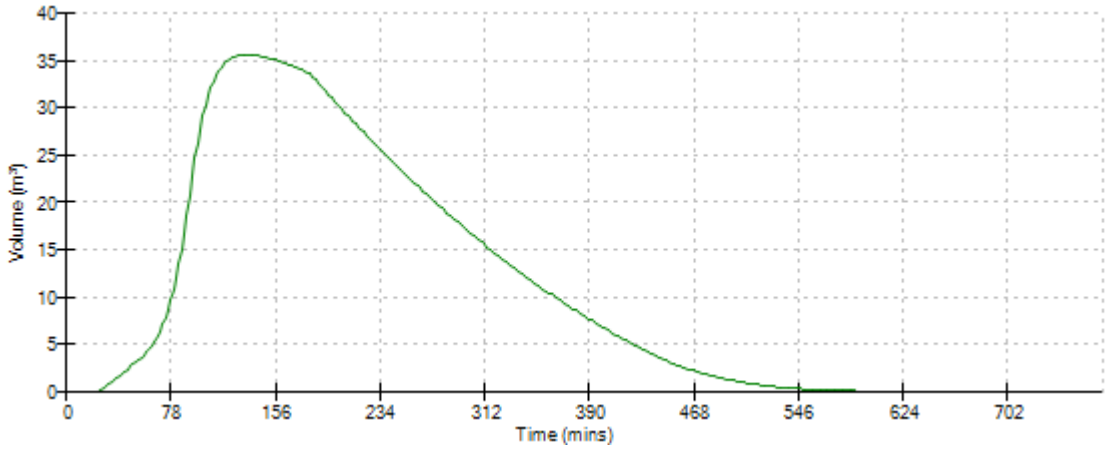
Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	20.0
Membrane Percolation (mm/hr)	1000	Length (m)	22.5
Max Percolation (l/s)	125.0	Slope (1:X)	250.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	14.000	Cap Volume Depth (m)	0.450

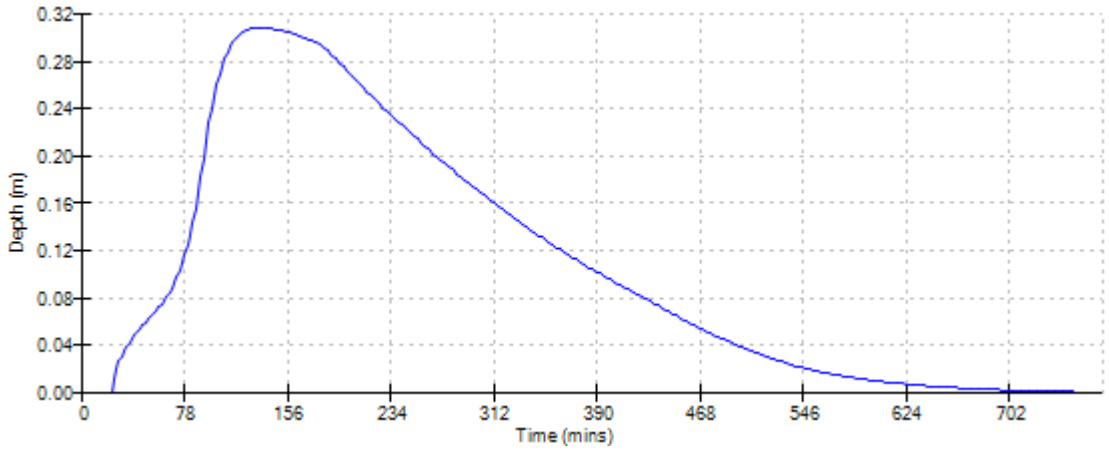
Orifice Outflow Control

Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 14.000

Cascade Event: 180 min Summer for Permeable Paving.srcx







Cascade Summary of Results for Tank.srcx

	Upstream Structures	Outflow To	Overflow To
	Permeable Paving.srcx	(None)	(None)

Half Drain Time : 754 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	12.732	0.232	0.0	1.5	1.5	42.4	O K
30 min Summer	12.817	0.317	0.0	1.5	1.5	57.8	O K
60 min Summer	12.911	0.411	0.0	1.5	1.5	74.9	O K
120 min Summer	13.018	0.518	0.0	1.5	1.5	94.4	O K
180 min Summer	13.071	0.571	0.0	1.5	1.5	104.2	O K
240 min Summer	13.105	0.605	0.0	1.5	1.5	110.4	O K
360 min Summer	13.151	0.651	0.0	1.5	1.5	118.7	O K
480 min Summer	13.181	0.681	0.0	1.5	1.5	124.2	O K
600 min Summer	13.202	0.702	0.0	1.5	1.5	128.0	O K
720 min Summer	13.215	0.715	0.0	1.5	1.5	130.5	O K
960 min Summer	13.222	0.722	0.0	1.5	1.5	131.7	O K
1440 min Summer	13.185	0.685	0.0	1.5	1.5	125.0	O K
2160 min Summer	13.132	0.632	0.0	1.5	1.5	115.3	O K
2880 min Summer	13.081	0.581	0.0	1.5	1.5	105.9	O K
4320 min Summer	12.968	0.468	0.0	1.5	1.5	85.4	O K
5760 min Summer	12.867	0.367	0.0	1.5	1.5	66.9	O K
7200 min Summer	12.788	0.288	0.0	1.5	1.5	52.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.153	0.0	60.9	139
30 min Summer	90.705	0.0	80.5	202
60 min Summer	56.713	0.0	103.0	274
120 min Summer	34.246	0.0	124.9	374
180 min Summer	25.149	0.0	137.7	418
240 min Summer	20.078	0.0	146.6	456
360 min Summer	14.585	0.0	159.8	526
480 min Summer	11.622	0.0	169.7	596
600 min Summer	9.738	0.0	177.6	668
720 min Summer	8.424	0.0	184.1	740
960 min Summer	6.697	0.0	194.5	960
1440 min Summer	4.839	0.0	206.8	1200
2160 min Summer	3.490	0.0	230.2	1560
2880 min Summer	2.766	0.0	242.7	1940
4320 min Summer	1.989	0.0	260.7	2720
5760 min Summer	1.573	0.0	274.6	3424
7200 min Summer	1.311	0.0	284.8	4112

Cascade Summary of Results for Tank.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
8640 min Summer	12.727	0.227	0.0	1.5	1.5	41.3	O K
10080 min Summer	12.681	0.181	0.0	1.5	1.5	33.0	O K
15 min Winter	12.732	0.232	0.0	1.5	1.5	42.4	O K
30 min Winter	12.817	0.317	0.0	1.5	1.5	57.8	O K
60 min Winter	12.910	0.410	0.0	1.5	1.5	74.8	O K
120 min Winter	13.017	0.517	0.0	1.5	1.5	94.3	O K
180 min Winter	13.071	0.571	0.0	1.5	1.5	104.2	O K
240 min Winter	13.104	0.604	0.0	1.5	1.5	110.3	O K
360 min Winter	13.150	0.650	0.0	1.5	1.5	118.5	O K
480 min Winter	13.180	0.680	0.0	1.5	1.5	124.0	O K
600 min Winter	13.200	0.700	0.0	1.5	1.5	127.8	O K
720 min Winter	13.214	0.714	0.0	1.5	1.5	130.2	O K
960 min Winter	13.222	0.722	0.0	1.5	1.5	131.7	O K
1440 min Winter	13.179	0.679	0.0	1.5	1.5	123.8	O K
2160 min Winter	13.107	0.607	0.0	1.5	1.5	110.8	O K
2880 min Winter	13.027	0.527	0.0	1.5	1.5	96.2	O K
4320 min Winter	12.855	0.355	0.0	1.5	1.5	64.7	O K
5760 min Winter	12.735	0.235	0.0	1.5	1.5	42.8	O K
7200 min Winter	12.658	0.158	0.0	1.4	1.4	28.8	O K
8640 min Winter	12.612	0.112	0.0	1.3	1.3	20.4	O K
10080 min Winter	12.586	0.086	0.0	1.3	1.3	15.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	1.129	0.0	293.1	4800
10080 min Summer	0.994	0.0	299.9	5456
15 min Winter	138.153	0.0	60.9	139
30 min Winter	90.705	0.0	80.5	202
60 min Winter	56.713	0.0	103.0	274
120 min Winter	34.246	0.0	124.9	374
180 min Winter	25.149	0.0	137.7	418
240 min Winter	20.078	0.0	146.6	454
360 min Winter	14.585	0.0	159.8	526
480 min Winter	11.622	0.0	169.7	596
600 min Winter	9.738	0.0	177.6	666
720 min Winter	8.424	0.0	184.2	738
960 min Winter	6.697	0.0	194.5	942
1440 min Winter	4.839	0.0	207.2	1220
2160 min Winter	3.490	0.0	230.2	1620
2880 min Winter	2.766	0.0	242.7	2064
4320 min Winter	1.989	0.0	260.8	2808
5760 min Winter	1.573	0.0	274.6	3464
7200 min Winter	1.311	0.0	284.9	4112
8640 min Winter	1.129	0.0	293.2	4752
10080 min Winter	0.994	0.0	300.1	5304

Cascade Rainfall Details for Tank.srcx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
Region	England and Wales	Cv (Winter)	1.000
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.114

Time (mins) From:	To:	Area (ha)
0	4	0.114

Cascade Model Details for Tank.srcx

Storage is Online Cover Level (m) 14.500

Cellular Storage Structure

Invert Level (m) 12.500 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	192.0	192.0	0.801	0.0	243.2
0.800	192.0	243.2			

Hydro-Brake Optimum® Outflow Control

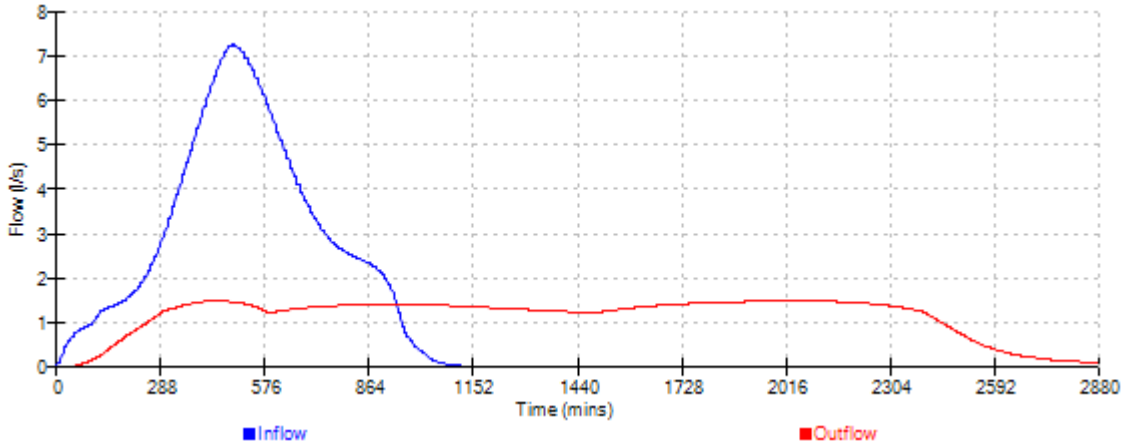
Unit Reference	MD-SHE-0060-1500-0800-1500
Design Head (m)	0.800
Design Flow (l/s)	1.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	60
Invert Level (m)	12.500
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

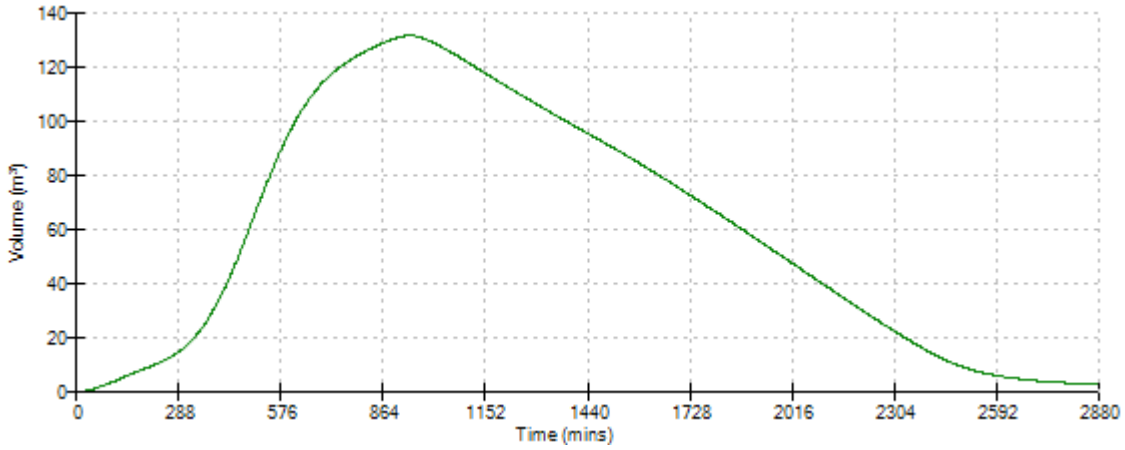
Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	1.5
Flush-Flo™	0.246	1.5
Kick-Flo®	0.505	1.2
Mean Flow over Head Range	-	1.3

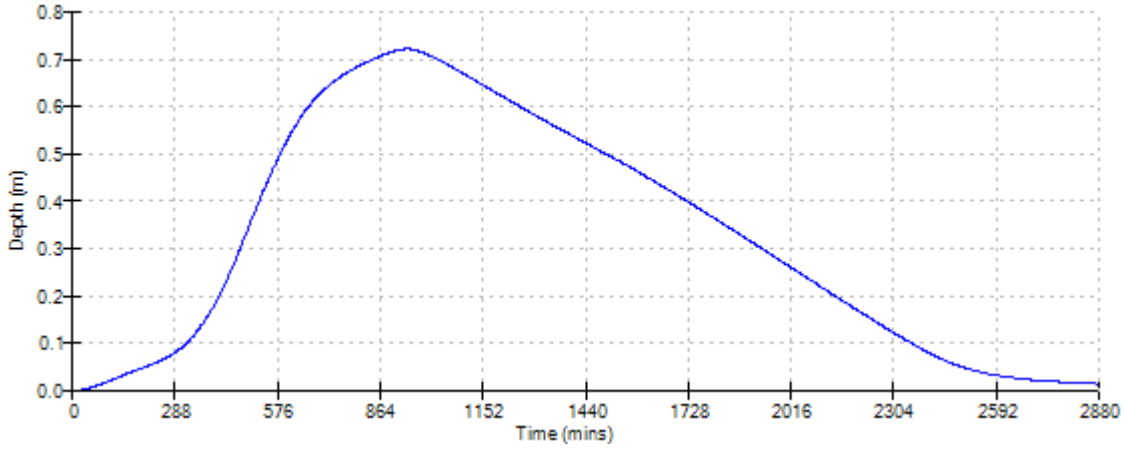
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

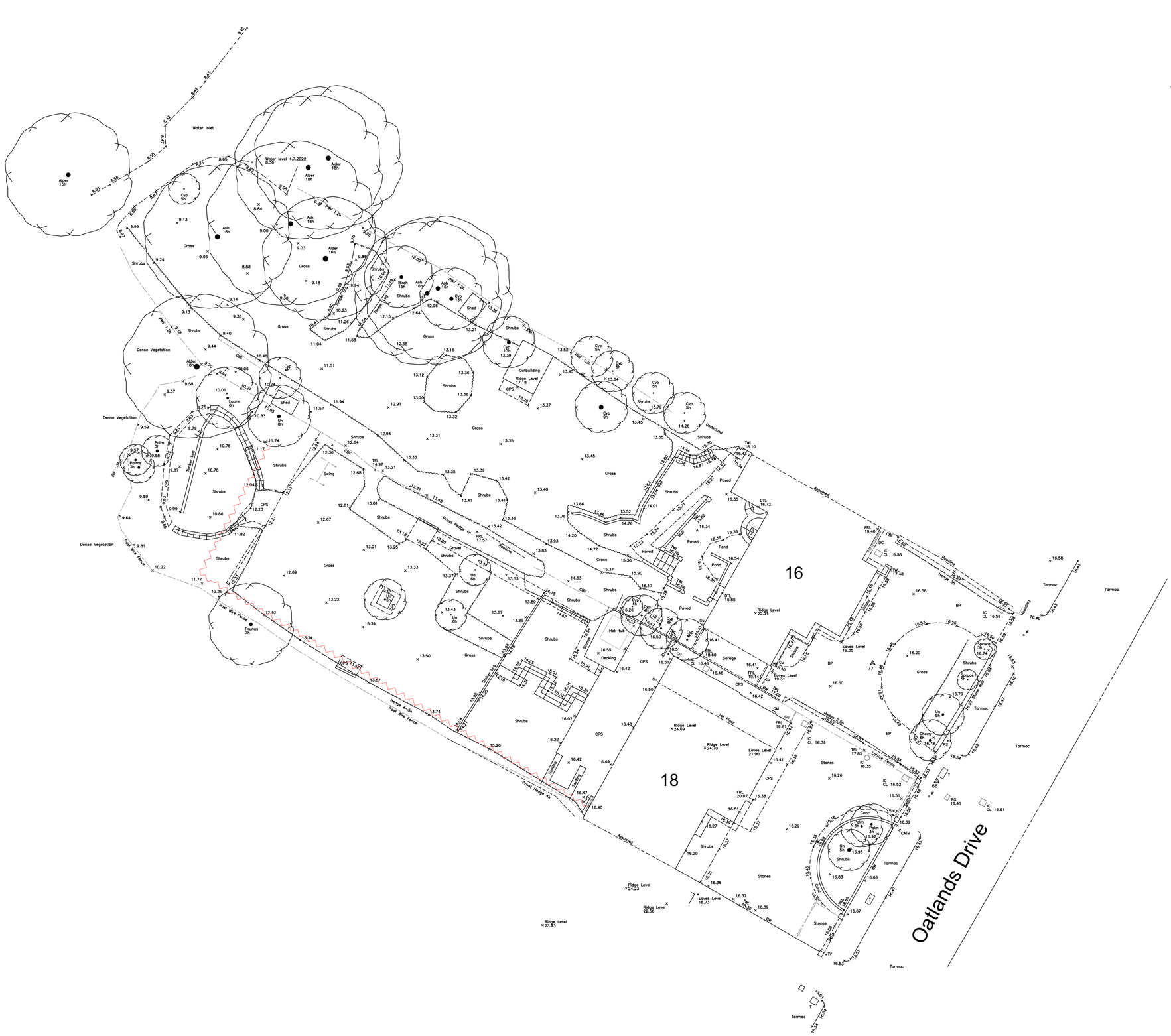
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.3	1.200	1.8	3.000	2.7	7.000	4.0
0.200	1.5	1.400	1.9	3.500	2.9	7.500	4.2
0.300	1.5	1.600	2.0	4.000	3.1	8.000	4.3
0.400	1.4	1.800	2.1	4.500	3.3	8.500	4.4
0.500	1.2	2.000	2.3	5.000	3.4	9.000	4.5
0.600	1.3	2.200	2.4	5.500	3.6	9.500	4.7
0.800	1.5	2.400	2.5	6.000	3.8		
1.000	1.6	2.600	2.5	6.500	3.9		

Cascade Event: 960 min Winter for Tank.srcx









Note:

For safety reasons all underground drainage details are by visual inspection only.

Drainage must be verified on site before the commencement of any works.

All tree information is indicative and if required should be verified by a specialist .

Surveyed boundary features are not necessarily legal boundaries

Oct 22: Position of electrical supply to lamp columns

Abbreviations:

BE	Bare Earth	OBF	Open Board Fence
Bol	Bollard	O/H	Overhead
BP	Brick Paving	OHC	Overhead Cable
BRW	Brick Retaining Wall	P	Post
BS	Bus Stop	PCF	Post & Chain Fence
BW	Brick Wall	PWL	Parapet Wall Level
CATV	Cable TV	PRF	Post & Rail Fence
CBF	Close Board Fence	PWF	Post & Wire Fence
CL	Cover Level	RE	Rodding Eye
Cyp	Cypress	RG	Road Gully
Conc	Concrete	RL	Ridge Level
CPS	Concrete Paving Slabs	RNP	Road Name Plate
DPC	Damp Proof Level	RS	Road Sign
Dk	Drop Kerb	RW	Retaining Wall
DTL	Door Theshold	RWP	Rain Water Pipe
E	Electricity	SB	Silver Birch
EL	Eaves Level	SP	Sign Post
EP	Electricity Pole	SC	Stop Cock
ER	Earthing Rod	SPF	Stock Proof Fence
FH	Fire Hydrant	SRW	Stone Retaining Wall
FRL	Flat Roof Level	St	Stump
G	Gas	SV	Stop Valve
GP	Gate Post	SW	Stone Wall
Gu	Gully	Syc	Sycamore
h	Height (metres)	T	Telephone
IL	Invert Level	TFL	Top of Fence Level
IR	Iron Railing	TWL	Top of Wall Level
IRF	Iron Railing Fence	U	Unidentified
JB	Junction Box	UTL	Unable to Lift
LB	Letter Box	V	Vent
LP	Lamp Post	VP	Vent Pipe
Mkr	Marker	W	Water
IC	Inspection Cover		
MPF	Metal Palisade Fence		

Benchmark Details:

Survey Grid set to Ordnance Survey Grid via RTK network.
All Levels related to Ordnance Survey Datum via RTK network.

Drawing Title:

Topographical Survey

Job Title:

16-18
Oatlands Drive
Weybridge
KT13 9JL

Scale:	Size:	Date:
1/200	A1	Oct 2022

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