



TESS SQUARE, MARNHULL VILLAGE CENTRE

FLOOD RISK ASSESSMENT

P & D CROCKER

PART 3 OF 3

APPENDICES 9 – 10

DOCUMENT REFERENCE: C798-DOC12-FRA (Tess Square) – Issue 1

MAY 2023

PFA Consulting				Page 1	
Stratton Park House Wanborough Road Swindon SN3 4HG		C798: Tess Square, Marnhull Attenuation Pond 1			
Date 26/04/2023		Designed by IS			
File C798 - TESS SQUARE - CAS...		Checked by MWS			
Causeway		Source Control 2020.1.3			
<u>Cascade Summary of Results for C798 - TESS SQUARE - POND 1 V5.srcx</u>					
Upstream Structures		Outflow To		Overflow To	
(None)		C798 - TESS SQUARE - POND 2 V5.srcx		(None)	
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	70.000	0.244	1.5	78.3	O K
30 min Summer	70.067	0.311	1.6	104.6	O K
60 min Summer	70.135	0.379	1.7	133.2	O K
120 min Summer	70.180	0.424	1.7	153.0	O K
180 min Summer	70.206	0.450	1.7	165.1	O K
240 min Summer	70.224	0.468	1.7	173.5	O K
360 min Summer	70.248	0.492	1.8	184.6	O K
480 min Summer	70.261	0.505	1.8	191.0	O K
600 min Summer	70.268	0.512	1.8	194.5	O K
720 min Summer	70.271	0.515	1.8	196.2	O K
960 min Summer	70.271	0.515	1.8	196.0	O K
1440 min Summer	70.264	0.508	1.8	192.7	O K
2160 min Summer	70.255	0.499	1.8	188.3	O K
2880 min Summer	70.245	0.489	1.8	183.6	O K
4320 min Summer	70.221	0.465	1.7	171.9	O K
5760 min Summer	70.194	0.438	1.7	159.5	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	125.725	0.0	79.8	19	
30 min Summer	84.612	0.0	107.4	34	
60 min Summer	54.624	0.0	138.8	64	
120 min Summer	32.295	0.0	164.1	124	
180 min Summer	23.835	0.0	181.6	182	
240 min Summer	19.255	0.0	195.7	242	
360 min Summer	14.305	0.0	218.1	362	
480 min Summer	11.596	0.0	235.7	482	
600 min Summer	9.858	0.0	250.6	600	
720 min Summer	8.636	0.0	263.4	720	
960 min Summer	7.013	0.0	271.6	894	
1440 min Summer	5.238	0.0	272.9	1138	
2160 min Summer	3.926	0.0	359.3	1532	
2880 min Summer	3.202	0.0	390.8	1956	
4320 min Summer	2.396	0.0	438.5	2768	
5760 min Summer	1.953	0.0	476.5	3584	
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PFA Consulting			Page 2		
Stratton Park House Wanborough Road Swindon SN3 4HG		C798: Tess Square, Marnhull Attenuation Pond 1			
Date 26/04/2023		Designed by IS			
File C798 - TESS SQUARE - CAS...		Checked by			
Causeway		Source Control 2020.1.3			
<u>Cascade Summary of Results for C798 - TESS SQUARE - POND 1 V5.srcx</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
7200 min Summer	70.167	0.411	1.7	147.2	O K
8640 min Summer	70.140	0.384	1.7	135.5	O K
10080 min Summer	70.116	0.360	1.6	124.8	O K
15 min Winter	70.025	0.269	1.6	87.9	O K
30 min Winter	70.098	0.342	1.6	117.5	O K
60 min Winter	70.173	0.417	1.7	149.8	O K
120 min Winter	70.223	0.467	1.7	172.8	O K
180 min Winter	70.252	0.496	1.8	186.9	O K
240 min Winter	70.273	0.517	1.8	197.1	O K
360 min Winter	70.301	0.545	1.8	211.0	O K
480 min Winter	70.318	0.562	1.8	219.5	O K
600 min Winter	70.329	0.573	1.8	225.0	O K
720 min Winter	70.335	0.579	1.8	228.4	O K
960 min Winter	70.340	0.584	1.8	231.1	O K
1440 min Winter	70.334	0.578	1.8	228.0	O K
2160 min Winter	70.321	0.565	1.8	220.8	O K
2880 min Winter	70.304	0.548	1.8	212.4	O K
4320 min Winter	70.264	0.508	1.8	192.7	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
7200 min Summer	1.669	0.0	509.2	4400	
8640 min Summer	1.470	0.0	538.0	5192	
10080 min Summer	1.324	0.0	565.2	5952	
15 min Winter	125.725	0.0	89.4	19	
30 min Winter	84.612	0.0	120.4	33	
60 min Winter	54.624	0.0	155.4	62	
120 min Winter	32.295	0.0	183.8	122	
180 min Winter	23.835	0.0	203.4	180	
240 min Winter	19.255	0.0	219.3	238	
360 min Winter	14.305	0.0	244.4	356	
480 min Winter	11.596	0.0	264.0	470	
600 min Winter	9.858	0.0	274.7	584	
720 min Winter	8.636	0.0	277.2	698	
960 min Winter	7.013	0.0	280.0	916	
1440 min Winter	5.238	0.0	280.4	1300	
2160 min Winter	3.926	0.0	402.4	1644	
2880 min Winter	3.202	0.0	437.4	2108	
4320 min Winter	2.396	0.0	491.2	3024	
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Stratton Park House Wanborough Road Swindon SN3 4HG	C798: Tess Square, Marnhull Attenuation Pond 1	
Date 26/04/2023	Designed by IS	
File C798 - TESS SQUARE - CAS...	Checked by	
Causeway	Source Control 2020.1.3	

Cascade Summary of Results for C798 - TESS SQUARE - POND 1 V5.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
5760 min Winter	70.221	0.465	1.7	171.9	O K
7200 min Winter	70.177	0.421	1.7	151.7	O K
8640 min Winter	70.135	0.379	1.7	133.2	O K
10080 min Winter	70.096	0.340	1.6	116.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
5760 min Winter	1.953	0.0	534.0	3872
7200 min Winter	1.669	0.0	569.9	4752
8640 min Winter	1.470	0.0	602.8	5536
10080 min Winter	1.324	0.0	632.9	6352

PFA Consulting		Page 5
Stratton Park House Wanborough Road Swindon SN3 4HG	C798: Tess Square, Marnhull Attenuation Pond 1	
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Causeway	Source Control 2020.1.3	

Cascade Model Details for C798 - TESS SQUARE - POND 1 V5.srcx

Storage is Online Cover Level (m) 70.835

Tank or Pond Structure

Invert Level (m) 69.756

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	224.8	0.300	402.2	0.600	527.5	0.900	666.9
0.100	326.5	0.400	442.4	0.700	572.4	1.000	716.5
0.200	363.6	0.500	484.2	0.800	618.8	1.079	756.7

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0062-1500-0700-1500
Design Head (m)	0.700
Design Flow (l/s)	1.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	62
Invert Level (m)	69.256
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.700	1.5	Kick-Flo®	0.446	1.2
Flush-Flo™	0.211	1.5	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	1.4	1.200	1.9	3.000	2.9	7.000	4.3
0.200	1.5	1.400	2.1	3.500	3.1	7.500	4.5
0.300	1.5	1.600	2.2	4.000	3.3	8.000	4.6
0.400	1.4	1.800	2.3	4.500	3.5	8.500	4.8
0.500	1.3	2.000	2.4	5.000	3.7	9.000	4.9
0.600	1.4	2.200	2.5	5.500	3.9	9.500	5.0
0.800	1.6	2.400	2.6	6.000	4.0		
1.000	1.8	2.600	2.7	6.500	4.2		

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Stratton Park House Wanborough Road Swindon SN3 4HG		C798: Tess Square, Marnhull Attenuation Pond 2			
Date 26/04/2023		Designed by IS			
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Causeway		Source Control 2020.1.3			
<u>Cascade Summary of Results for C798 - TESS SQUARE - POND 2 V5.srcx</u>					
Upstream Structures		Outflow To Overflow To			
C798 - TESS SQUARE - POND 1 V5.srcx		(None)		(None)	
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	69.436	0.180	2.0	28.3	O K
30 min Summer	69.484	0.228	2.0	37.8	O K
60 min Summer	69.536	0.280	2.1	48.3	O K
120 min Summer	69.571	0.315	2.1	55.9	O K
180 min Summer	69.593	0.337	2.1	60.7	O K
240 min Summer	69.609	0.353	2.1	64.2	O K
360 min Summer	69.632	0.376	2.1	69.3	O K
480 min Summer	69.646	0.390	2.2	72.6	O K
600 min Summer	69.656	0.400	2.2	74.8	O K
720 min Summer	69.662	0.406	2.2	76.3	O K
960 min Summer	69.669	0.413	2.2	77.9	O K
1440 min Summer	69.668	0.412	2.2	77.7	O K
2160 min Summer	69.662	0.406	2.2	76.4	O K
2880 min Summer	69.657	0.401	2.2	75.2	O K
4320 min Summer	69.644	0.388	2.2	72.0	O K
5760 min Summer	69.627	0.371	2.1	68.3	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	125.725	0.0	108.5	19	
30 min Summer	84.612	0.0	146.1	34	
60 min Summer	54.624	0.0	188.7	64	
120 min Summer	32.295	0.0	223.1	124	
180 min Summer	23.835	0.0	247.0	184	
240 min Summer	19.255	0.0	266.1	244	
360 min Summer	14.305	0.0	296.7	362	
480 min Summer	11.596	0.0	320.5	482	
600 min Summer	9.858	0.0	340.8	602	
720 min Summer	8.636	0.0	350.3	722	
960 min Summer	7.013	0.0	352.2	962	
1440 min Summer	5.238	0.0	351.6	1440	
2160 min Summer	3.926	0.0	488.5	1812	
2880 min Summer	3.202	0.0	531.5	2188	
4320 min Summer	2.396	0.0	596.4	2984	
5760 min Summer	1.953	0.0	647.8	3808	
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10080 min Summer	1.324	0.0	768.5	6248																																																																																																																			
15 min Winter	125.725	0.0	121.5	19																																																																																																																			
30 min Winter	84.612	0.0	163.7	34																																																																																																																			
60 min Winter	54.624	0.0	211.3	64																																																																																																																			
120 min Winter	32.295	0.0	250.0	122																																																																																																																			
180 min Winter	23.835	0.0	276.7	182																																																																																																																			
240 min Winter	19.255	0.0	298.2	240																																																																																																																			
360 min Winter	14.305	0.0	332.2	358																																																																																																																			
480 min Winter	11.596	0.0	353.4	476																																																																																																																			
600 min Winter	9.858	0.0	356.0	592																																																																																																																			
720 min Winter	8.636	0.0	357.6	708																																																																																																																			
960 min Winter	7.013	0.0	359.0	940																																																																																																																			
1440 min Winter	5.238	0.0	357.3	1388																																																																																																																			
2160 min Winter	3.926	0.0	547.2	2032																																																																																																																			
2880 min Winter	3.202	0.0	594.8	2336																																																																																																																			
4320 min Winter	2.396	0.0	646.0	3240																																																																																																																			
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PFA Consulting		Page 3
Stratton Park House Wanborough Road Swindon SN3 4HG	C798: Tess Square, Marnhull Attenuation Pond 2	
Date 26/04/2023	Designed by IS	
File C798 - TESS SQUARE - CAS...	Checked by	
Causeway	Source Control 2020.1.3	

Cascade Summary of Results for C798 - TESS SQUARE - POND 2 V5.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
5760 min Winter	69.667	0.411	2.2	77.6	O K
7200 min Winter	69.636	0.380	2.1	70.4	O K
8640 min Winter	69.605	0.349	2.1	63.2	O K
10080 min Winter	69.573	0.317	2.1	56.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
5760 min Winter	1.953	0.0	725.9	4144
7200 min Winter	1.669	0.0	774.6	4976
8640 min Winter	1.470	0.0	819.4	5872
10080 min Winter	1.324	0.0	860.6	6656

PFA Consulting		Page 5
Stratton Park House Wanborough Road Swindon SN3 4HG	C798: Tess Square, Marnhull Attenuation Pond 2	
Date 26/04/2023	Designed by IS	
File C798 - TESS SQUARE - CAS...	Checked by	
Causeway	Source Control 2020.1.3	

Cascade Model Details for C798 - TESS SQUARE - POND 2 V5.srcx

Storage is Online Cover Level (m) 70.056

Tank or Pond Structure

Invert Level (m) 69.256

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	101.3	0.300	213.6	0.600	274.7
0.100	175.7	0.400	233.4	0.700	296.2
0.200	194.4	0.500	253.8	0.800	318.3

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0065-1500-0500-1500
Design Head (m)	0.500
Design Flow (l/s)	1.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	65
Invert Level (m)	68.530
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	1.5	Kick-Flo®	0.336	1.3
Flush-Flo™	0.147	1.5	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	1.5	1.200	2.2	3.000	3.4	7.000	5.1
0.200	1.5	1.400	2.4	3.500	3.7	7.500	5.3
0.300	1.4	1.600	2.5	4.000	3.9	8.000	5.4
0.400	1.4	1.800	2.7	4.500	4.1	8.500	5.6
0.500	1.5	2.000	2.8	5.000	4.3	9.000	5.8
0.600	1.6	2.200	2.9	5.500	4.5	9.500	5.9
0.800	1.9	2.400	3.1	6.000	4.7		
1.000	2.0	2.600	3.2	6.500	4.9		

PFA Consulting		Page 1
Stratton Park House Wanborough Road Swindon SN3 4HG	C798: Tess Square, Marnhull Porous Paving 10	
Date 26/04/2023	Designed by IS	
File C798 - TESS SQUARE - PP1...	Checked by	
Causeway		Source Control 2020.1.3

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

Half Drain Time : 1039 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control Σ (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	70.722	0.422	0.0	0.7	0.7	26.7	O K
30 min Summer	70.799	0.499	0.0	0.7	0.7	37.4	O K
60 min Summer	70.869	0.569	0.0	0.7	0.7	48.6	O K
120 min Summer	70.924	0.624	0.0	0.7	0.7	58.3	O K
180 min Summer	70.953	0.653	0.0	0.7	0.7	63.9	O K
240 min Summer	70.971	0.671	0.0	0.7	0.7	67.5	O K
360 min Summer	70.989	0.689	0.0	0.7	0.7	71.2	O K
480 min Summer	70.997	0.697	0.0	0.7	0.7	72.8	O K
600 min Summer	70.998	0.698	0.0	0.7	0.7	73.2	O K
720 min Summer	70.996	0.696	0.0	0.7	0.7	72.7	O K
960 min Summer	70.986	0.686	0.0	0.7	0.7	70.6	O K
1440 min Summer	70.964	0.664	0.0	0.7	0.7	66.2	O K
2160 min Summer	70.931	0.631	0.0	0.7	0.7	59.6	O K
2880 min Summer	70.900	0.600	0.0	0.7	0.7	54.0	O K
4320 min Summer	70.845	0.545	0.0	0.7	0.7	44.5	O K
5760 min Summer	70.795	0.495	0.0	0.7	0.7	36.7	O K
7200 min Summer	70.750	0.450	0.0	0.7	0.7	30.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	147.323	0.0	27.1	19
30 min Summer	98.447	0.0	38.2	34
60 min Summer	62.800	0.0	50.4	64
120 min Summer	37.929	0.0	62.0	124
180 min Summer	28.125	0.0	69.5	182
240 min Summer	22.670	0.0	75.0	242
360 min Summer	16.609	0.0	82.8	362
480 min Summer	13.291	0.0	88.5	482
600 min Summer	11.157	0.0	92.9	600
720 min Summer	9.655	0.0	96.5	720
960 min Summer	7.657	0.0	101.9	830
1440 min Summer	5.502	0.0	100.7	1080
2160 min Summer	3.916	0.0	115.5	1472
2880 min Summer	3.075	0.0	119.7	1876
4320 min Summer	2.195	0.0	125.5	2684
5760 min Summer	1.740	0.0	130.0	3512
7200 min Summer	1.468	0.0	134.6	4256

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Stratton Park House Wanborough Road Swindon SN3 4HG	C798: Tess Square, Marnhull Porous Paving 10	
Date 26/04/2023	Designed by IS	
File C798 - TESS SQUARE - PP1...	Checked by	
Causeway		Source Control 2020.1.3

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 377947 118457 ST 77947 18457
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+45

Time Area Diagram

Total Area (ha) 0.120

Time (mins)	Area
From:	To: (ha)
0	4 0.120

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PFA Consulting		Page 5
Stratton Park House Wanborough Road Swindon SN3 4HG	C798: Tess Square, Marnhull Porous Paving 10	
Date 26/04/2023	Designed by IS	
File C798 - TESS SQUARE - PP1...	Checked by	
Causeway		Source Control 2020.1.3

Model Details

Storage is Online Cover Level (m) 71.500

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	119.8
Max Percolation (l/s)	332.8	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	70.300	Cap Volume Depth (m)	0.900

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0042-1000-1500-1000
Design Head (m)	1.500
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	42
Invert Level (m)	70.300
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	1.0	Kick-Flo®	0.378	0.5
Flush-Flo™	0.186	0.7	Mean Flow over Head Range	-	0.7

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	0.6	1.200	0.9	3.000	1.4	7.000	2.0
0.200	0.7	1.400	1.0	3.500	1.5	7.500	2.1
0.300	0.6	1.600	1.0	4.000	1.6	8.000	2.1
0.400	0.6	1.800	1.1	4.500	1.6	8.500	2.2
0.500	0.6	2.000	1.1	5.000	1.7	9.000	2.3
0.600	0.7	2.200	1.2	5.500	1.8	9.500	2.3
0.800	0.8	2.400	1.2	6.000	1.9		
1.000	0.8	2.600	1.3	6.500	1.9		

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PFA Consulting		Page 4																																	
Stratton Park House Wanborough Road Swindon SN3 4HG	C798: Tess Square, Marnhull Porous Paving 1																																		
Date 26/04/2023	Designed by IS																																		
File PP Cascade.CASX	Checked by																																		
Causeway		Source Control 2020.1.3																																	
<u>Cascade Rainfall Details for C798 - Tess Square - PP1.SRCX</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> </tr> <tr> <td>Site Location</td> <td>GB 377947 118457 ST 77947 18457</td> </tr> <tr> <td>Data Type</td> <td>Point</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> </tr> <tr> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Climate Change %</td> <td>+45</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.050 <table> <thead> <tr> <th align="left" colspan="3">Time (mins) Area</th> </tr> <tr> <th align="left">From:</th> <th align="left">To:</th> <th align="left">(ha)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>4</td> <td>0.050</td> </tr> </tbody> </table>			Rainfall Model	FEH	Return Period (years)	100	FEH Rainfall Version	2013	Site Location	GB 377947 118457 ST 77947 18457	Data Type	Point	Summer Storms	Yes	Winter Storms	Yes	Cv (Summer)	0.750	Cv (Winter)	0.840	Shortest Storm (mins)	15	Longest Storm (mins)	10080	Climate Change %	+45	Time (mins) Area			From:	To:	(ha)	0	4	0.050
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0	4	0.050																																	
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Stratton Park House Wanborough Road Swindon SN3 4HG	C798: Tess Square, Marnhull Porous Paving 1	
Date 26/04/2023	Designed by IS	
File PP Cascade.CASX	Checked by	
Causeway	Source Control 2020.1.3	

Cascade Model Details for C798 - Tess Square - PP1.SRCX

Storage is Online Cover Level (m) 77.500

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	8.0
Membrane Percolation (mm/hr)	1000	Length (m)	62.3
Max Percolation (l/s)	138.4	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	76.000	Cap Volume Depth (m)	1.200

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0042-1000-1500-1000
Design Head (m)	1.500
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	42
Invert Level (m)	76.000
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	1.0	Kick-Flo®	0.378	0.5
Flush-Flo™	0.186	0.7	Mean Flow over Head Range	-	0.7

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	0.6	1.200	0.9	3.000	1.4	7.000	2.0
0.200	0.7	1.400	1.0	3.500	1.5	7.500	2.1
0.300	0.6	1.600	1.0	4.000	1.6	8.000	2.1
0.400	0.6	1.800	1.1	4.500	1.6	8.500	2.2
0.500	0.6	2.000	1.1	5.000	1.7	9.000	2.3
0.600	0.7	2.200	1.2	5.500	1.8	9.500	2.3
0.800	0.8	2.400	1.2	6.000	1.9		
1.000	0.8	2.600	1.3	6.500	1.9		

PFA Consulting		Page 2
Stratton Park House Wanborough Road Swindon SN3 4HG	C798: Tess Square, Marnhull Porous Paving 2	
Date 26/04/2023	Designed by IS	
File PP Cascade.CASX	Checked by	
Causeway		Source Control 2020.1.3

Cascade Summary of Results for C798 - Tess Square - PP2.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
5760 min Summer	75.594	0.504	0.0	0.7	0.7	25.9	O K
7200 min Summer	75.536	0.446	0.0	0.7	0.7	20.3	O K
8640 min Summer	75.477	0.387	0.0	0.7	0.7	15.3	O K
10080 min Summer	75.404	0.314	0.0	0.7	0.7	10.0	O K
15 min Winter	75.482	0.392	0.0	0.7	0.7	15.7	O K
30 min Winter	75.540	0.450	0.0	0.7	0.7	20.7	O K
60 min Winter	75.592	0.502	0.0	0.7	0.7	25.7	O K
120 min Winter	75.645	0.555	0.0	0.7	0.7	31.4	O K
180 min Winter	75.677	0.587	0.0	0.7	0.7	35.1	O K
240 min Winter	75.699	0.609	0.0	0.7	0.7	37.8	O K
360 min Winter	75.727	0.637	0.0	0.7	0.7	41.4	O K
480 min Winter	75.746	0.656	0.0	0.7	0.7	43.9	O K
600 min Winter	75.758	0.668	0.0	0.7	0.7	45.6	O K
720 min Winter	75.767	0.677	0.0	0.7	0.7	46.7	O K
960 min Winter	75.774	0.684	0.0	0.7	0.7	47.8	O K
1440 min Winter	75.776	0.686	0.0	0.7	0.7	48.1	O K
2160 min Winter	75.785	0.695	0.0	0.7	0.7	49.2	O K
2880 min Winter	75.760	0.670	0.0	0.7	0.7	45.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
5760 min Summer	1.740	0.0	112.7	3416
7200 min Summer	1.468	0.0	116.7	4184
8640 min Summer	1.286	0.0	120.6	4944
10080 min Summer	1.156	0.0	124.6	5552
15 min Winter	147.323	0.0	27.0	331
30 min Winter	98.447	0.0	37.8	476
60 min Winter	62.800	0.0	49.6	64
120 min Winter	37.929	0.0	60.8	124
180 min Winter	28.125	0.0	68.1	182
240 min Winter	22.670	0.0	73.5	242
360 min Winter	16.609	0.0	81.1	360
480 min Winter	13.291	0.0	86.7	478
600 min Winter	11.157	0.0	91.0	596
720 min Winter	9.655	0.0	94.5	714
960 min Winter	7.657	0.0	99.8	944
1440 min Winter	5.502	0.0	103.4	1414
2160 min Winter	3.916	0.0	113.3	1924
2880 min Winter	3.075	0.0	117.6	2128

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Stratton Park House Wanborough Road Swindon SN3 4HG	C798: Tess Square, Marnhull Porous Paving 2	
Date 26/04/2023	Designed by IS	
File PP Cascade.CASX	Checked by	
Causeway	Source Control 2020.1.3	

Cascade Summary of Results for C798 - Tess Square - PP2.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m ³)	Status
4320 min Winter	75.662	0.572	0.0	0.7	0.7	33.3	O K
5760 min Winter	75.563	0.473	0.0	0.7	0.7	22.9	O K
7200 min Winter	75.439	0.349	0.0	0.7	0.7	12.4	O K
8640 min Winter	75.311	0.221	0.0	0.7	0.7	5.0	O K
10080 min Winter	75.227	0.137	0.0	0.6	0.6	1.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
4320 min Winter	2.195	0.0	123.7	2848
5760 min Winter	1.740	0.0	128.5	3640
7200 min Winter	1.468	0.0	133.4	4392
8640 min Winter	1.286	0.0	138.2	4840
10080 min Winter	1.156	0.0	143.1	5344

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Stratton Park House Wanborough Road Swindon SN3 4HG	C798: Tess Square, Marnhull Porous Paving 2																																		
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Winter Storms	Yes																																		
Cv (Summer)	0.750																																		
Cv (Winter)	0.840																																		
Shortest Storm (mins)	15																																		
Longest Storm (mins)	10080																																		
Climate Change %	+45																																		
Time (mins)		Area																																	
From:	To:	(ha)																																	
0	4	0.054																																	
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PFA Consulting		Page 5
Stratton Park House Wanborough Road Swindon SN3 4HG	C798: Tess Square, Marnhull Porous Paving 2	
Date 26/04/2023	Designed by IS	
File PP Cascade.CASX	Checked by	
Causeway		Source Control 2020.1.3

Cascade Model Details for C798 - Tess Square - PP2.SRCX

Storage is Online Cover Level (m) 76.590

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	6.8
Membrane Percolation (mm/hr)	1000	Length (m)	79.0
Max Percolation (l/s)	149.2	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	75.090	Cap Volume Depth (m)	1.200

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0042-1000-1500-1000
Design Head (m)	1.500
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	42
Invert Level (m)	75.090
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	1.0	Kick-Flo®	0.378	0.5
Flush-Flo™	0.186	0.7	Mean Flow over Head Range	-	0.7

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	0.6	1.200	0.9	3.000	1.4	7.000	2.0
0.200	0.7	1.400	1.0	3.500	1.5	7.500	2.1
0.300	0.6	1.600	1.0	4.000	1.6	8.000	2.1
0.400	0.6	1.800	1.1	4.500	1.6	8.500	2.2
0.500	0.6	2.000	1.1	5.000	1.7	9.000	2.3
0.600	0.7	2.200	1.2	5.500	1.8	9.500	2.3
0.800	0.8	2.400	1.2	6.000	1.9		
1.000	0.8	2.600	1.3	6.500	1.9		

PFA Consulting		Page 3
Stratton Park House Wanborough Road Swindon SN3 4HG	C798: Tess Square, Marnhull Porous Paving 4	
Date 26/04/2023	Designed by IS	
File PP Cascade.CASX	Checked by	
Causeway		Source Control 2020.1.3

Cascade Summary of Results for C798 - Tess Square - PP4.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m ³)	Status
2880 min Winter	72.372	0.572	0.0	0.7	0.7	63.4	O K
4320 min Winter	72.373	0.573	0.0	0.7	0.7	63.5	O K
5760 min Winter	72.367	0.567	0.0	0.7	0.7	62.5	O K
7200 min Winter	72.356	0.556	0.0	0.7	0.7	60.7	O K
8640 min Winter	72.351	0.551	0.0	0.7	0.7	60.0	O K
10080 min Winter	72.340	0.540	0.0	0.7	0.7	58.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
2880 min Winter	3.075	0.0	201.6	3820
4320 min Winter	2.195	0.0	189.2	4488
5760 min Winter	1.740	0.0	263.1	5536
7200 min Winter	1.468	0.0	273.1	7160
8640 min Winter	1.286	0.0	283.0	7792
10080 min Winter	1.156	0.0	292.9	8384

PFA Consulting		Page 4
Stratton Park House Wanborough Road Swindon SN3 4HG	C798: Tess Square, Marnhull Porous Paving 4	
Date 26/04/2023	Designed by IS	
File PP Cascade.CASX	Checked by	
Causeway		Source Control 2020.1.3

Cascade Rainfall Details for C798 - Tess Square - PP4.SRCX

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 377947 118457 ST 77947 18457
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+45

Time Area Diagram

Total Area (ha) 0.054

Time (mins)	Area
From:	To: (ha)
0	4 0.054

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PFA Consulting		Page 5
Stratton Park House Wanborough Road Swindon SN3 4HG	C798: Tess Square, Marnhull Porous Paving 4	
Date 26/04/2023	Designed by IS	
File PP Cascade.CASX	Checked by	
Causeway		Source Control 2020.1.3

Cascade Model Details for C798 - Tess Square - PP4.SRCX

Storage is Online Cover Level (m) 73.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	15.0
Membrane Percolation (mm/hr)	1000	Length (m)	35.8
Max Percolation (l/s)	149.2	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	71.800	Cap Volume Depth (m)	0.900

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0042-1000-1500-1000
Design Head (m)	1.500
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	42
Invert Level (m)	71.800
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	1.0	Kick-Flo®	0.378	0.5
Flush-Flo™	0.186	0.7	Mean Flow over Head Range	-	0.7

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	0.6	1.200	0.9	3.000	1.4	7.000	2.0
0.200	0.7	1.400	1.0	3.500	1.5	7.500	2.1
0.300	0.6	1.600	1.0	4.000	1.6	8.000	2.1
0.400	0.6	1.800	1.1	4.500	1.6	8.500	2.2
0.500	0.6	2.000	1.1	5.000	1.7	9.000	2.3
0.600	0.7	2.200	1.2	5.500	1.8	9.500	2.3
0.800	0.8	2.400	1.2	6.000	1.9		
1.000	0.8	2.600	1.3	6.500	1.9		

PFA Consulting		Page 3
Stratton Park House Wanborough Road Swindon SN3 4HG	C798: Tess Square, Marnhull Porous Paving 4	
Date 26/04/2023	Designed by IS	
File PP Cascade.CASX	Checked by	
Causeway		Source Control 2020.1.3

Cascade Summary of Results for C798 - Tess Square - PP4.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m ³)	Status
2880 min Winter	72.372	0.572	0.0	0.7	0.7	63.4	O K
4320 min Winter	72.373	0.573	0.0	0.7	0.7	63.5	O K
5760 min Winter	72.367	0.567	0.0	0.7	0.7	62.5	O K
7200 min Winter	72.356	0.556	0.0	0.7	0.7	60.7	O K
8640 min Winter	72.351	0.551	0.0	0.7	0.7	60.0	O K
10080 min Winter	72.340	0.540	0.0	0.7	0.7	58.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
2880 min Winter	3.075	0.0	201.6	3820
4320 min Winter	2.195	0.0	189.2	4488
5760 min Winter	1.740	0.0	263.1	5536
7200 min Winter	1.468	0.0	273.1	7160
8640 min Winter	1.286	0.0	283.0	7792
10080 min Winter	1.156	0.0	292.9	8384

PFA Consulting		Page 4																																	
Stratton Park House Wanborough Road Swindon SN3 4HG	C798: Tess Square, Marnhull Porous Paving 4																																		
Date 26/04/2023	Designed by IS																																		
File PP Cascade.CASX	Checked by																																		
Causeway		Source Control 2020.1.3																																	
<u>Cascade Rainfall Details for C798 - Tess Square - PP4.SRCX</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> </tr> <tr> <td>Site Location</td> <td>GB 377947 118457 ST 77947 18457</td> </tr> <tr> <td>Data Type</td> <td>Point</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> </tr> <tr> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Climate Change %</td> <td>+45</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.054 <table> <tr> <td align="center" colspan="2">Time (mins)</td> <td align="center">Area</td> </tr> <tr> <td align="center">From:</td> <td align="center">To:</td> <td align="center">(ha)</td> </tr> <tr> <td align="center">0</td> <td align="center">4</td> <td align="center">0.054</td> </tr> </table>			Rainfall Model	FEH	Return Period (years)	100	FEH Rainfall Version	2013	Site Location	GB 377947 118457 ST 77947 18457	Data Type	Point	Summer Storms	Yes	Winter Storms	Yes	Cv (Summer)	0.750	Cv (Winter)	0.840	Shortest Storm (mins)	15	Longest Storm (mins)	10080	Climate Change %	+45	Time (mins)		Area	From:	To:	(ha)	0	4	0.054
Rainfall Model	FEH																																		
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PFA Consulting		Page 5
Stratton Park House Wanborough Road Swindon SN3 4HG	C798: Tess Square, Marnhull Porous Paving 4	
Date 26/04/2023	Designed by IS	
File PP Cascade.CASX	Checked by	
Causeway	Source Control 2020.1.3	

Cascade Model Details for C798 - Tess Square - PP4.SRCX

Storage is Online Cover Level (m) 73.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	15.0
Membrane Percolation (mm/hr)	1000	Length (m)	35.8
Max Percolation (l/s)	149.2	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	71.800	Cap Volume Depth (m)	0.900

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0042-1000-1500-1000
Design Head (m)	1.500
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	42
Invert Level (m)	71.800
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	1.0	Kick-Flo®	0.378	0.5
Flush-Flo™	0.186	0.7	Mean Flow over Head Range	-	0.7

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	0.6	1.200	0.9	3.000	1.4	7.000	2.0
0.200	0.7	1.400	1.0	3.500	1.5	7.500	2.1
0.300	0.6	1.600	1.0	4.000	1.6	8.000	2.1
0.400	0.6	1.800	1.1	4.500	1.6	8.500	2.2
0.500	0.6	2.000	1.1	5.000	1.7	9.000	2.3
0.600	0.7	2.200	1.2	5.500	1.8	9.500	2.3
0.800	0.8	2.400	1.2	6.000	1.9		
1.000	0.8	2.600	1.3	6.500	1.9		

PFA Consulting		Page 3
Stratton Park House Wanborough Road Swindon SN3 4HG	C798: Tess Square, Marnhull Porous Paving 5	
Date 26/04/2023	Designed by IS	
File PP Cascade.CASX	Checked by	
Causeway		Source Control 2020.1.3

Cascade Summary of Results for C798 - Tess Square - PP5.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m ³)	Status
2160 min Winter	71.071	0.551	0.0	0.7	0.7	60.0	O K
2880 min Winter	71.079	0.559	0.0	0.7	0.7	61.3	O K
4320 min Winter	71.084	0.564	0.0	0.7	0.7	62.2	O K
5760 min Winter	71.089	0.569	0.0	0.7	0.7	62.9	O K
7200 min Winter	71.093	0.573	0.0	0.7	0.7	63.6	O K
8640 min Winter	71.093	0.573	0.0	0.7	0.7	63.6	O K
10080 min Winter	71.086	0.566	0.0	0.7	0.7	62.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
2160 min Winter	3.916	0.0	206.3	4820
2880 min Winter	3.075	0.0	202.6	4576
4320 min Winter	2.195	0.0	191.4	5116
5760 min Winter	1.740	0.0	329.8	5712
7200 min Winter	1.468	0.0	342.4	7064
8640 min Winter	1.286	0.0	354.7	8168
10080 min Winter	1.156	0.0	346.9	8808

PFA Consulting		Page 4																																	
Stratton Park House Wanborough Road Swindon SN3 4HG	C798: Tess Square, Marnhull Porous Paving 5																																		
Date 26/04/2023	Designed by IS																																		
File PP Cascade.CASX	Checked by																																		
Causeway		Source Control 2020.1.3																																	
<u>Cascade Rainfall Details for C798 - Tess Square - PP5.SRCX</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> </tr> <tr> <td>Site Location</td> <td>GB 377947 118457 ST 77947 18457</td> </tr> <tr> <td>Data Type</td> <td>Point</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> </tr> <tr> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Climate Change %</td> <td>+45</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.054 <table> <tr> <td align="center" colspan="2">Time (mins)</td> <td align="center">Area</td> </tr> <tr> <td align="center">From:</td> <td align="center">To:</td> <td align="center">(ha)</td> </tr> <tr> <td align="center">0</td> <td align="center">4</td> <td align="center">0.054</td> </tr> </table>			Rainfall Model	FEH	Return Period (years)	100	FEH Rainfall Version	2013	Site Location	GB 377947 118457 ST 77947 18457	Data Type	Point	Summer Storms	Yes	Winter Storms	Yes	Cv (Summer)	0.750	Cv (Winter)	0.840	Shortest Storm (mins)	15	Longest Storm (mins)	10080	Climate Change %	+45	Time (mins)		Area	From:	To:	(ha)	0	4	0.054
Rainfall Model	FEH																																		
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PFA Consulting		Page 5
Stratton Park House Wanborough Road Swindon SN3 4HG	C798: Tess Square, Marnhull Porous Paving 5	
Date 26/04/2023	Designed by IS	
File PP Cascade.CASX	Checked by	
Causeway		Source Control 2020.1.3

Cascade Model Details for C798 - Tess Square - PP5.SRCX

Storage is Online Cover Level (m) 71.720

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	15.0
Membrane Percolation (mm/hr)	1000	Length (m)	35.9
Max Percolation (l/s)	149.6	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	70.520	Cap Volume Depth (m)	0.900

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0042-1000-1500-1000
Design Head (m)	1.500
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	42
Invert Level (m)	70.520
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	1.0	Kick-Flo®	0.378	0.5
Flush-Flo™	0.186	0.7	Mean Flow over Head Range	-	0.7

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	0.6	1.200	0.9	3.000	1.4	7.000	2.0
0.200	0.7	1.400	1.0	3.500	1.5	7.500	2.1
0.300	0.6	1.600	1.0	4.000	1.6	8.000	2.1
0.400	0.6	1.800	1.1	4.500	1.6	8.500	2.2
0.500	0.6	2.000	1.1	5.000	1.7	9.000	2.3
0.600	0.7	2.200	1.2	5.500	1.8	9.500	2.3
0.800	0.8	2.400	1.2	6.000	1.9		
1.000	0.8	2.600	1.3	6.500	1.9		

PFA Consulting

Stratton Park House
Wanborough Road
Swindon SN3 4HG

Date 26/04/2023
File PP Cascade.CASX

Causeway

C798: Tess Square, Marnhull
Porous Paving 6

Designed by IS
Checked by

Source Control 2020.1.3

Page 1



Cascade Summary of Results for C798 - Tess Square - PP6.SRCX										
Upstream Structures		Outflow To			Overflow To					
C798 - Tess Square - PP5.SRCX		C798 - Tess Square - PP7.SRCX			(None)					
C798 - Tess Square - PP4.SRCX										
C798 - Tess Square - PP3.SRCX										
C798 - Tess Square - PP2.SRCX										
C798 - Tess Square - PP1.SRCX										
Half Drain Time : 1085 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	70.727	0.427	0.0	0.7	0.7	27.4	O K			
30 min Summer	70.763	0.463	0.0	0.7	0.7	32.2	O K			
60 min Summer	70.799	0.499	0.0	0.7	0.7	37.4	O K			
120 min Summer	70.847	0.547	0.0	0.7	0.7	44.8	O K			
180 min Summer	70.878	0.578	0.0	0.7	0.7	50.1	O K			
240 min Summer	70.899	0.599	0.0	0.7	0.7	53.8	O K			
360 min Summer	70.927	0.627	0.0	0.7	0.7	59.0	O K			
480 min Summer	70.946	0.646	0.0	0.7	0.7	62.7	O K			
600 min Summer	70.961	0.661	0.0	0.7	0.7	65.5	O K			
720 min Summer	70.971	0.671	0.0	0.7	0.7	67.6	O K			
960 min Summer	70.987	0.687	0.0	0.7	0.7	70.7	O K			
1440 min Summer	71.005	0.705	0.0	0.7	0.7	74.5	O K			
2160 min Summer	71.015	0.715	0.0	0.7	0.7	76.8	O K			
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)						
15 min Summer	147.323	0.0	48.4	1440						
30 min Summer	98.447	0.0	50.4	1440						
60 min Summer	62.800	0.0	105.3	2880						
120 min Summer	37.929	0.0	107.3	124						
180 min Summer	28.125	0.0	108.2	184						
240 min Summer	22.670	0.0	109.2	244						
360 min Summer	16.609	0.0	110.8	364						
480 min Summer	13.291	0.0	111.7	484						
600 min Summer	11.157	0.0	112.0	604						
720 min Summer	9.655	0.0	112.0	724						
960 min Summer	7.657	0.0	111.5	962						
1440 min Summer	5.502	0.0	109.1	1442						
2160 min Summer	3.916	0.0	223.8	2160						

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PFA Consulting		Page 4
Stratton Park House Wanborough Road Swindon SN3 4HG	C798: Tess Square, Marnhull Porous Paving 6	
Date 26/04/2023	Designed by IS	
File PP Cascade.CASX	Checked by	
Causeway		Source Control 2020.1.3

Cascade Rainfall Details for C798 - Tess Square - PP6.SRCX

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 377947 118457 ST 77947 18457
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+45

Time Area Diagram

Total Area (ha) 0.087

Time (mins)	Area
From:	To: (ha)
0	4 0.087

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PFA Consulting		Page 5
Stratton Park House Wanborough Road Swindon SN3 4HG	C798: Tess Square, Marnhull Porous Paving 6	
Date 26/04/2023	Designed by IS	
File PP Cascade.CASX	Checked by	
Causeway		Source Control 2020.1.3

Cascade Model Details for C798 - Tess Square - PP6.SRCX

Storage is Online Cover Level (m) 71.500

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	87.0
Max Percolation (l/s)	241.7	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	70.300	Cap Volume Depth (m)	0.900

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0042-1000-1500-1000
Design Head (m)	1.500
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	42
Invert Level (m)	70.300
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	1.0	Kick-Flo®	0.378	0.5
Flush-Flo™	0.186	0.7	Mean Flow over Head Range	-	0.7

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	0.6	1.200	0.9	3.000	1.4	7.000	2.0
0.200	0.7	1.400	1.0	3.500	1.5	7.500	2.1
0.300	0.6	1.600	1.0	4.000	1.6	8.000	2.1
0.400	0.6	1.800	1.1	4.500	1.6	8.500	2.2
0.500	0.6	2.000	1.1	5.000	1.7	9.000	2.3
0.600	0.7	2.200	1.2	5.500	1.8	9.500	2.3
0.800	0.8	2.400	1.2	6.000	1.9		
1.000	0.8	2.600	1.3	6.500	1.9		

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PFA Consulting		Page 1
Stratton Park House Wanborough Road Swindon SN3 4HG	C798: Tess Square, Marnhull Porous Paving 7	
Date 26/04/2023	Designed by IS	
File PP Cascade.CASX	Checked by	
Causeway		Source Control 2020.1.3

Cascade Summary of Results for C798 - Tess Square - PP7.SRCX

Upstream Structures	Outflow To	Overflow To
C798 - Tess Square - PP6.SRCX	C798 - Tess Square - PP8.SRCX	(None)
C798 - Tess Square - PP5.SRCX		
C798 - Tess Square - PP4.SRCX		
C798 - Tess Square - PP3.SRCX		
C798 - Tess Square - PP2.SRCX		
C798 - Tess Square - PP1.SRCX		

Half Drain Time : 1051 minutes.

Outflow is too low. Design is unsatisfactory.

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	69.410	0.310	0.0	0.7	0.7	14.4	O K
30 min Summer	69.493	0.393	0.0	0.7	0.7	23.2	O K
60 min Summer	69.560	0.460	0.0	0.7	0.7	31.7	O K
120 min Summer	69.593	0.493	0.0	0.7	0.7	36.5	O K
180 min Summer	69.614	0.514	0.0	0.7	0.7	39.7	O K
240 min Summer	69.632	0.532	0.0	0.7	0.7	42.5	O K
360 min Summer	69.659	0.559	0.0	0.7	0.7	46.9	O K
480 min Summer	69.678	0.578	0.0	0.7	0.7	50.1	O K
600 min Summer	69.692	0.592	0.0	0.7	0.7	52.6	O K
720 min Summer	69.704	0.604	0.0	0.7	0.7	54.7	O K
960 min Summer	69.720	0.620	0.0	0.7	0.7	57.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	147.323	0.0	55.0	19
30 min Summer	98.447	0.0	47.6	1440
60 min Summer	62.800	0.0	100.5	2880
120 min Summer	37.929	0.0	103.9	2880
180 min Summer	28.125	0.0	105.7	2410
240 min Summer	22.670	0.0	106.9	2224
360 min Summer	16.609	0.0	108.2	2468
480 min Summer	13.291	0.0	108.8	2674
600 min Summer	11.157	0.0	108.9	2864
720 min Summer	9.655	0.0	108.8	2880
960 min Summer	7.657	0.0	108.1	2880

PFA Consulting		Page 5
Stratton Park House Wanborough Road Swindon SN3 4HG	C798: Tess Square, Marnhull Porous Paving 7	
Date 26/04/2023	Designed by IS	
File PP Cascade.CASX	Checked by	
Causeway		Source Control 2020.1.3

Cascade Model Details for C798 - Tess Square - PP7.SRCX

Storage is Online Cover Level (m) 70.300

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	63.9
Max Percolation (l/s)	177.5	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	69.100	Cap Volume Depth (m)	0.900

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0042-1000-1500-1000
Design Head (m)	1.500
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	42
Invert Level (m)	69.100
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	1.0	Kick-Flo®	0.378	0.5
Flush-Flo™	0.186	0.7	Mean Flow over Head Range	-	0.7

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	0.6	1.200	0.9	3.000	1.4	7.000	2.0
0.200	0.7	1.400	1.0	3.500	1.5	7.500	2.1
0.300	0.6	1.600	1.0	4.000	1.6	8.000	2.1
0.400	0.6	1.800	1.1	4.500	1.6	8.500	2.2
0.500	0.6	2.000	1.1	5.000	1.7	9.000	2.3
0.600	0.7	2.200	1.2	5.500	1.8	9.500	2.3
0.800	0.8	2.400	1.2	6.000	1.9		
1.000	0.8	2.600	1.3	6.500	1.9		

PFA Consulting		Page 1
Stratton Park House Wanborough Road Swindon SN3 4HG	C798: Tess Square, Marnhull Porous Paving 8	
Date 26/04/2023	Designed by IS	
File PP Cascade.CASX	Checked by	
Causeway		Source Control 2020.1.3

Cascade Summary of Results for C798 - Tess Square - PP8.SRCX

Upstream Structures Outflow To Overflow To

C798 - Tess Square - PP7.SRCX (None) (None)
 C798 - Tess Square - PP6.SRCX
 C798 - Tess Square - PP5.SRCX
 C798 - Tess Square - PP4.SRCX
 C798 - Tess Square - PP3.SRCX
 C798 - Tess Square - PP2.SRCX
 C798 - Tess Square - PP1.SRCX

Half Drain Time : 35 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max E Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	68.856	0.106	0.0	0.8	0.8	1.5	O K
30 min Summer	68.881	0.131	0.0	0.8	0.8	2.0	O K
60 min Summer	68.902	0.152	0.0	0.8	0.8	2.4	O K
120 min Summer	68.913	0.163	0.0	0.8	0.8	2.7	O K
180 min Summer	68.917	0.167	0.0	0.8	0.8	2.8	O K
240 min Summer	68.917	0.167	0.0	0.8	0.8	2.8	O K
360 min Summer	68.914	0.164	0.0	0.8	0.8	2.7	O K
480 min Summer	68.909	0.159	0.0	0.8	0.8	2.6	O K
600 min Summer	68.903	0.153	0.0	0.8	0.8	2.5	O K
720 min Summer	68.896	0.146	0.0	0.8	0.8	2.3	O K
960 min Summer	68.881	0.131	0.0	0.8	0.8	2.0	O K
1440 min Summer	68.854	0.104	0.0	0.8	0.8	1.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	147.323	0.0	56.6	18
30 min Summer	98.447	0.0	49.8	32
60 min Summer	62.800	0.0	103.4	62
120 min Summer	37.929	0.0	107.5	118
180 min Summer	28.125	0.0	109.7	148
240 min Summer	22.670	0.0	111.2	182
360 min Summer	16.609	0.0	113.0	252
480 min Summer	13.291	0.0	113.9	322
600 min Summer	11.157	0.0	114.4	392
720 min Summer	9.655	0.0	114.5	464
960 min Summer	7.657	0.0	114.0	606
1440 min Summer	5.502	0.0	112.0	880

PFA Consulting		Page 3
Stratton Park House Wanborough Road Swindon SN3 4HG	C798: Tess Square, Marnhull Porous Paving 8	
Date 26/04/2023	Designed by IS	
File PP Cascade.CASX	Checked by	
Causeway	Source Control 2020.1.3	

Cascade Summary of Results for C798 - Tess Square - PP8.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m ³)	Status
1440 min Winter	68.858	0.108	0.0	0.8	0.8	1.5	O K
2160 min Winter	68.822	0.072	0.0	0.7	0.7	0.8	O K
2880 min Winter	68.808	0.058	0.0	0.7	0.7	0.5	O K
4320 min Winter	68.796	0.046	0.0	0.7	0.7	0.3	O K
5760 min Winter	68.800	0.050	0.0	0.7	0.7	0.4	O K
7200 min Winter	68.807	0.057	0.0	0.7	0.7	0.5	O K
8640 min Winter	68.815	0.065	0.0	0.7	0.7	0.6	O K
10080 min Winter	68.823	0.073	0.0	0.7	0.7	0.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
1440 min Winter	5.502	0.0	115.6	996
2160 min Winter	3.916	0.0	234.5	1492
2880 min Winter	3.075	0.0	229.8	1960
4320 min Winter	2.195	0.0	218.3	4192
5760 min Winter	1.740	0.0	455.4	5640
7200 min Winter	1.468	0.0	441.4	7056
8640 min Winter	1.286	0.0	424.9	8472
10080 min Winter	1.156	0.0	407.0	9880

PFA Consulting		Page 4
Stratton Park House Wanborough Road Swindon SN3 4HG	C798: Tess Square, Marnhull Porous Paving 8	
Date 26/04/2023	Designed by IS	
File PP Cascade.CASX	Checked by	
Causeway		Source Control 2020.1.3

Cascade Rainfall Details for C798 - Tess Square - PP8.SRCX

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 377947 118457 ST 77947 18457
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+45

Time Area Diagram

Total Area (ha) 0.007

	Time (mins)	Area	
From:	To:	(ha)	
	0	4	0.007

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PFA Consulting		Page 5
Stratton Park House Wanborough Road Swindon SN3 4HG	C798: Tess Square, Marnhull Porous Paving 8	
Date 26/04/2023	Designed by IS	
File PP Cascade.CASX	Checked by	
Causeway	Source Control 2020.1.3	

Cascade Model Details for C798 - Tess Square - PP8.SRCX

Storage is Online Cover Level (m) 69.250

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	7.0
Max Percolation (l/s)	19.4	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	68.750	Cap Volume Depth (m)	0.900

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0042-1000-1500-1000
Design Head (m)	1.500
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	42
Invert Level (m)	68.050
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	1.0	Kick-Flo®	0.378	0.5
Flush-Flo™	0.186	0.7	Mean Flow over Head Range	-	0.7

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	0.6	1.200	0.9	3.000	1.4	7.000	2.0
0.200	0.7	1.400	1.0	3.500	1.5	7.500	2.1
0.300	0.6	1.600	1.0	4.000	1.6	8.000	2.1
0.400	0.6	1.800	1.1	4.500	1.6	8.500	2.2
0.500	0.6	2.000	1.1	5.000	1.7	9.000	2.3
0.600	0.7	2.200	1.2	5.500	1.8	9.500	2.3
0.800	0.8	2.400	1.2	6.000	1.9		
1.000	0.8	2.600	1.3	6.500	1.9		

PFA Consulting		Page 1
Stratton Park House Wanborough Road Swindon SN3 4HG	C798: Tess Square, Marnhull Porous Paving 9	
Date 26/04/2023	Designed by IS	
File C798 - TESS SQUARE - PP9...	Checked by	
Causeway		Source Control 2020.1.3

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

Half Drain Time : 42 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	67.348	0.148	0.0	0.7	0.7	1.7	O K
30 min Summer	67.368	0.168	0.0	0.7	0.7	2.1	O K
60 min Summer	67.378	0.178	0.0	0.7	0.7	2.4	O K
120 min Summer	67.373	0.173	0.0	0.7	0.7	2.2	O K
180 min Summer	67.363	0.163	0.0	0.7	0.7	2.0	O K
240 min Summer	67.352	0.152	0.0	0.7	0.7	1.7	O K
360 min Summer	67.330	0.130	0.0	0.6	0.6	1.3	O K
480 min Summer	67.310	0.110	0.0	0.6	0.6	0.9	O K
600 min Summer	67.293	0.093	0.0	0.6	0.6	0.6	O K
720 min Summer	67.278	0.078	0.0	0.6	0.6	0.5	O K
960 min Summer	67.261	0.061	0.0	0.5	0.5	0.3	O K
1440 min Summer	67.244	0.044	0.0	0.4	0.4	0.1	O K
2160 min Summer	67.233	0.033	0.0	0.3	0.3	0.1	O K
2880 min Summer	67.228	0.028	0.0	0.2	0.2	0.1	O K
4320 min Summer	67.223	0.023	0.0	0.2	0.2	0.0	O K
5760 min Summer	67.220	0.020	0.0	0.1	0.1	0.0	O K
7200 min Summer	67.218	0.018	0.0	0.1	0.1	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	147.323	0.0	2.0	16
30 min Summer	98.447	0.0	2.9	30
60 min Summer	62.800	0.0	3.8	46
120 min Summer	37.929	0.0	4.7	80
180 min Summer	28.125	0.0	5.2	114
240 min Summer	22.670	0.0	5.6	146
360 min Summer	16.609	0.0	6.2	210
480 min Summer	13.291	0.0	6.7	268
600 min Summer	11.157	0.0	7.0	326
720 min Summer	9.655	0.0	7.3	382
960 min Summer	7.657	0.0	7.7	492
1440 min Summer	5.502	0.0	8.2	734
2160 min Summer	3.916	0.0	8.7	1100
2880 min Summer	3.075	0.0	9.0	1428
4320 min Summer	2.195	0.0	9.4	2192
5760 min Summer	1.740	0.0	9.8	2936
7200 min Summer	1.468	0.0	10.1	3600

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Stratton Park House Wanborough Road Swindon SN3 4HG	C798: Tess Square, Marnhull Porous Paving 9	
Date 26/04/2023	Designed by IS	
File C798 - TESS SQUARE - PP9...	Checked by	
Causeway		Source Control 2020.1.3

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 377947 118457 ST 77947 18457
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+45

Time Area Diagram

Total Area (ha) 0.009

Time (mins)	Area
From: To:	(ha)
0	4 0.009

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Stratton Park House Wanborough Road Swindon SN3 4HG	C798: Tess Square, Marnhull Porous Paving 9	
Date 26/04/2023	Designed by IS	
File C798 - TESS SQUARE - PP9...	Checked by	
Causeway		Source Control 2020.1.3

Model Details

Storage is Online Cover Level (m) 67.700

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	5.0
Membrane Percolation (mm/hr)	1000	Length (m)	17.5
Max Percolation (l/s)	24.3	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	67.200	Cap Volume Depth (m)	0.300

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0042-1000-1500-1000
Design Head (m)	1.500
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	42
Invert Level (m)	67.200
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	1.0	Kick-Flo®	0.378	0.5
Flush-Flo™	0.186	0.7	Mean Flow over Head Range	-	0.7

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	0.6	1.200	0.9	3.000	1.4	7.000	2.0
0.200	0.7	1.400	1.0	3.500	1.5	7.500	2.1
0.300	0.6	1.600	1.0	4.000	1.6	8.000	2.1
0.400	0.6	1.800	1.1	4.500	1.6	8.500	2.2
0.500	0.6	2.000	1.1	5.000	1.7	9.000	2.3
0.600	0.7	2.200	1.2	5.500	1.8	9.500	2.3
0.800	0.8	2.400	1.2	6.000	1.9		
1.000	0.8	2.600	1.3	6.500	1.9		