



**Horndean Road,
Emsworth**

Drainage Strategy Report

Prepared by:

Escher Silverman

Roughton
Unit 2A Omega Park
Electron Way
Chandlers Ford
Hampshire
SO53 4SE

Tel: 01794 521213

Fax: 01794 522195

Prepared for:

Bellway Homes

Ref: ES1711/DR/B

Prepared by Kevin Mitchell
I Eng FIHIE

Signed:



Date: 31st March 2017

Reviewed by Kazys Narbutas

BSc (Hons) CEng
MICE MIHT

Signed



Date: 31st March 2017

Revision	Description	Date	Initials
A	Initial issue	March 2017	KAM
B	Amended in accordance with revised planning layout	July 2017	KAM

Contents

	Page
1.0 INTRODUCTION	4
2.0 SURFACE WATER DRAINAGE	5
3.0 FOUL DRAINAGE	7
4.0 FLOOD MITIGATION	8

Appendices

Appendix A: Road 1A - Drainage Calculations
Appendix B: Road 1B-Road 1C - Drainage Calculations
Appendix C: Road 1D - Drainage Calculations

1.0 INTRODUCTION

1.1 The development site has the benefit of an outline planning consent reference APP/14/00547, dated 29th April 2015, granted by Havant Borough Council.

1.2 A Flood Risk Assessment (FRA) reference 13-016 dated April 2014, prepared by C&A Consulting Engineers Ltd., was submitted and subsequently approved as part of the outline planning consent.

1.3 The development proposals involve the construction of a flood storage area, diversion of a designated main river and flood mitigation works. The flood mitigation works are required to replace lost Flood Zone 3.

1.4 Further to the FRA an Environmental Permit reference EPPRIGB3598JL-L01, dated 3rd May 2016, was granted by the Environment Agency, consenting the works associated with constructing the Wetland Area and diverting a designated Main River (West Brook).

1.5 This report and associated drawings and calculations detail how the drainage for the development will be delivered.

2.0 SURFACE WATER DRAINAGE

2.1 The surface water drainage strategy for the development has been based on the requirements of SUDS techniques with the discharge rate restricted to the Greenfield runoff rate, all as outlined in the approved FRA.

2.2 The approved greenfield runoff rate quoted in the FRA is 17.4 l/s.

2.3 The drainage strategy utilises tanked porous paving roads draining the adjacent buildings, roads and hard standings. The roads then discharge via flow control devices into the Wetland Area at 3 separate locations at the greenfield runoff rate in aggregate.

2.4 The drainage strategy is indicated on drawing numbers ES1711-500-05-01 to 03 and is as follows;

Northern Area of Site

- Road 4A drains into Road 4 via a flow control manhole at a rate of 5 l/s.
- Road 4 drains into Road 1A via a flow control manhole at a rate of 5 l/s.
- Roads 2, 4D and 4E drain into Road 1A via flow control manholes at a rate of 5 l/s.
- Road 1A drains into the wetland area via a flow control manhole at a rate of 11.1 l/s.

- Road 1A overflows into a dry pond adjacent to plots 44 to 47 in extreme events.
- Road 1C drains into Road 1B via a flow control manhole at a rate of 5 l/s.
- Road 1B flows into the wetland area via a flow control manhole at a rate of 3.3 l/s.
- Road 1D flows into the wetland area via a flow control manhole at a rate of 3 l/s.

2.5 There is an existing 600 diameter Southern Water surface water sewer crossing the site which discharges into the existing main river. The sewer will remain unaltered as a result of the proposals.

2.6 There is an existing pond feature on the site into which an existing highway drain from Horndean Road discharges to. The pond then in turn discharges into the West Brook via a 300 diameter pipe. It is proposed to relay the 300 diameter pipe and connect into West Brook.

2.7 Exceedance events and local network failures have been considered and flood flow routes designed into the development proposals. These have been indicated on the drainage strategy drawings ES1711-500-05-01 to 03.

3.0 Foul Drainage

3.1 There is an existing Southern Water foul sewer crossing the site will remain unaltered as a result of proposals.

3.2 It is proposed to connect the northern part of the development to this sewer via gravity.

3.3 Due to level issues it is not possible to drain the southern part of the development via gravity. It is proposed therefore to install a pump station and pump up to the existing sewer.

4.0 Flood Mitigation Measures

4.1 The approved FRA indicates that part of the development is to be constructed on Flood Zone 2 and 3. In order to mitigate for this the area of the site affected will be raised to a minimum level of 9.75m and compensatory flood plain provided opposite the site adjacent to the Wetland Area.

4.2 It has been determined from the EA information contained within the FRA that the maximum flood level based on depth is 9.25m. This equates to a flood volume of 5,765m³. This volume has been provided in the flood mitigation area adjacent the Wetland Area. The above is indicated on drawing numbers ES1711-07 to 09.

4.3 Following consultation with the EA an allowance for climate change has been incorporated based on a value of 105%.

Appendix A

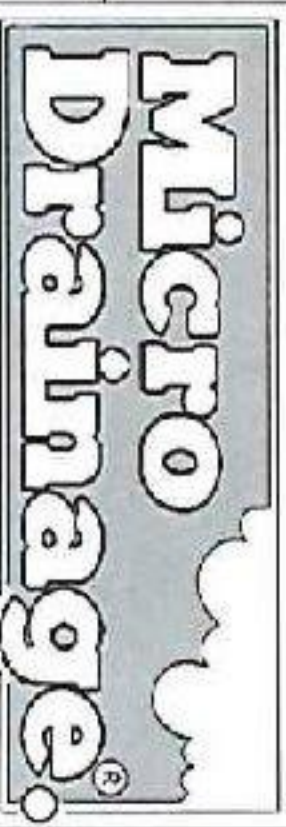
Road 1A - Drainage Calculations

Lone Barn Studios
Stanbridge Lane
Romsey SO51 0HF

Horndean Road
Emsworth
Road 1A Porous Paving

Date March 2017
File Road 1A Cascade....

Designed by KAM
Checked by



Micro Drainage

Source Control 2013.1.1

Cascade Summary of Results for Road 1A.srxx

Upstream Outflow To Overflow To
Structures

Road 4E.srxx (None) (None)
Road 4D.srxx
Road 2.srxx
Road 4.srxx
Road 4A.srxx

Half Drain Time : 184 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	9.415	1.195	0.0	11.1	0.0	11.1	156.5	OK
30 min Summer	9.647	1.427	0.0	11.1	14.8	25.9	188.0	Flood Risk
60 min Summer	9.790	1.570	0.0	11.1	38.0	49.1	207.4	Flood Risk
120 min Summer	9.853	1.633	0.0	11.1	47.8	58.9	219.5	FLOOD
180 min Summer	9.857	1.637	0.0	11.1	48.3	59.4	223.7	FLOOD
240 min Summer	9.857	1.637	0.0	11.1	48.3	59.4	223.0	FLOOD
360 min Summer	9.852	1.632	0.0	11.1	47.6	58.7	218.0	FLOOD
480 min Summer	9.836	1.616	0.0	11.1	45.3	56.4	213.5	Flood Risk
600 min Summer	9.809	1.589	0.0	11.1	41.2	52.3	210.0	Flood Risk
720 min Summer	9.789	1.569	0.0	11.1	37.7	48.8	207.2	Flood Risk
960 min Summer	9.756	1.536	0.0	11.1	31.3	42.4	202.8	Flood Risk
1440 min Summer	9.699	1.479	0.0	11.1	23.2	34.3	195.0	Flood Risk
2160 min Summer	9.652	1.432	0.0	11.1	15.5	26.6	188.7	Flood Risk
2880 min Summer	9.622	1.402	0.0	11.1	10.6	21.7	184.6	Flood Risk
4320 min Summer	9.529	1.309	0.0	11.1	0.7	11.8	171.9	OK
5760 min Summer	8.967	0.747	0.0	11.1	0.0	11.1	95.7	OK
7200 min Summer	8.602	0.382	0.0	11.1	0.0	11.1	46.3	OK

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	118.408	0.0	258.6	0.0	89
30 min Summer	79.579	0.0	351.3	43.4	43
60 min Summer	51.031	0.0	453.5	108.0	60
120 min Summer	31.581	3.5	563.7	174.0	88
180 min Summer	23.488	7.2	629.9	210.4	122
240 min Summer	18.897	6.6	676.3	232.5	154
360 min Summer	13.902	2.2	747.0	256.5	216
480 min Summer	11.169	0.0	800.5	263.6	278
600 min Summer	9.417	0.0	843.8	261.4	338
720 min Summer	8.187	0.0	880.4	254.7	402
960 min Summer	6.558	0.0	940.2	238.7	526
1440 min Summer	4.789	0.0	1029.1	208.9	774
2160 min Summer	3.489	0.0	1123.0	162.6	1156
2880 min Summer	2.783	0.0	1192.5	108.1	1560
4320 min Summer	2.020	0.0	1294.1	3.1	2476
5760 min Summer	1.607	0.0	1368.2	0.0	3176
7200 min Summer	1.346	0.0	1427.2	0.0	3824

Lone Barn Studios

Horndean Road

Stanbridge Lane

Emsworth

Romsey SO51 0HE

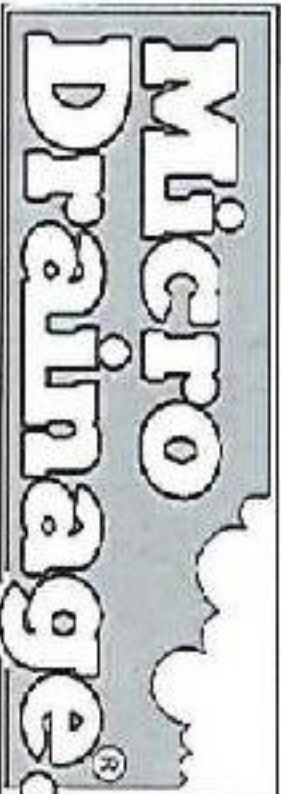
Road 1A Porous Paving

Dale March 2017

Designed by KAM

File Road 1A Cascade....

Checked by



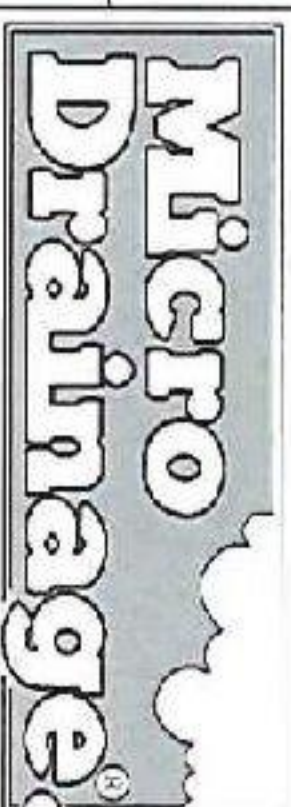
Micro Drainage

Source Control 2013.1.1

Cascade Summary of Results for Road 1A.stcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max E Outflow (l/s)	Max Volume (m³)	Status
8640 min Summer	8.430	0.210	0.0	11.1	0.0	11.1	22.9	O K
10080 min Summer	8.402	0.182	0.0	10.1	0.0	10.1	19.0	O K
15 min Winter	9.552	1.332	0.0	11.1	1.9	13.0	175.0	Flood Risk
30 min Winter	9.747	1.527	0.0	11.1	29.3	40.4	201.5	Flood Risk
60 min Winter	9.857	1.637	0.0	11.1	48.3	59.4	223.8	FLOOD
120 min Winter	9.872	1.652	0.0	11.1	50.4	61.5	240.4	FLOOD
180 min Winter	9.873	1.653	0.0	11.1	50.4	61.5	240.7	FLOOD
240 min Winter	9.867	1.647	0.0	11.1	49.7	60.8	235.0	FLOOD
360 min Winter	9.855	1.635	0.0	11.1	48.1	59.2	221.5	FLOOD
480 min Winter	9.832	1.612	0.0	11.1	44.7	55.8	213.0	Flood Risk
600 min Winter	9.797	1.577	0.0	11.1	39.2	50.3	208.4	Flood Risk
720 min Winter	9.771	1.551	0.0	11.1	34.5	45.6	204.8	Flood Risk
960 min Winter	9.738	1.518	0.0	11.1	27.2	38.3	200.3	Flood Risk
1440 min Winter	9.676	1.456	0.0	11.1	18.9	30.0	191.9	Flood Risk
2160 min Winter	9.631	1.411	0.0	11.1	12.3	23.4	185.7	Flood Risk
2880 min Winter	9.602	1.382	0.0	11.1	7.0	18.1	181.8	Flood Risk
4320 min Winter	9.062	0.842	0.0	11.1	0.0	11.1	108.6	O K
5760 min Winter	8.439	0.219	0.0	11.1	0.0	11.1	24.2	O K
7200 min Winter	8.392	0.172	0.0	9.5	0.0	9.5	17.7	O K
8640 min Winter	8.369	0.149	0.0	8.3	0.0	8.3	14.6	O K
10080 min Winter	8.352	0.132	0.0	7.3	0.0	7.3	12.3	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)			
8640 min Summer	1.165	0.0	1477.9	0.0	4416			
10080 min Summer	1.032	0.0	1521.6	0.0	5136			
15 min Winter	118.408	0.0	290.9	5.5	81			
30 min Winter	79.579	0.0	394.8	72.6	40			
60 min Winter	51.031	7.4	509.3	145.9	58			
120 min Winter	31.581	22.3	632.7	221.9	94			
180 min Winter	23.488	22.5	706.9	264.7	130			
240 min Winter	18.897	17.4	758.9	292.1	162			
360 min Winter	13.902	5.3	838.1	325.4	222			
480 min Winter	11.169	0.0	898.2	338.6	278			
600 min Winter	9.417	0.0	946.7	340.4	340			
720 min Winter	8.187	0.0	987.7	335.8	400			
960 min Winter	6.558	0.0	1054.9	317.0	526			
1440 min Winter	4.789	0.0	1154.6	273.0	774			
2160 min Winter	3.489	0.0	1260.2	190.1	1156			
2880 min Winter	2.783	0.0	1338.5	93.7	1612			
4320 min Winter	2.020	0.0	1453.0	0.0	2572			
5760 min Winter	1.607	0.0	1536.9	0.0	3056			
7200 min Winter	1.346	0.0	1603.7	0.0	3680			
8640 min Winter	1.165	0.0	1661.3	0.0	4416			
10080 min Winter	1.032	0.0	1711.0	0.0	5136			

Lone Barn Studios	Horndean Road
Stanbridge Lane	Emsworth
Romsey SO51 0HE	Road 1A Porous Paving
Date March 2017	Designed by KAM
File Road 1A Cascade....	Checked by



Micro Drainage

Source Control 2013.1.1

Cascade Rainfall Details for Road 1A.srcx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.400	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.631

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
From: To:		From: To:		From: To:	
0 5	0.000	5 10	0.315	10 15	0.316

Lone Barn Studios

Horndean Road

Stanbridge Lane

Emsworth

Romsey SO51 0HE

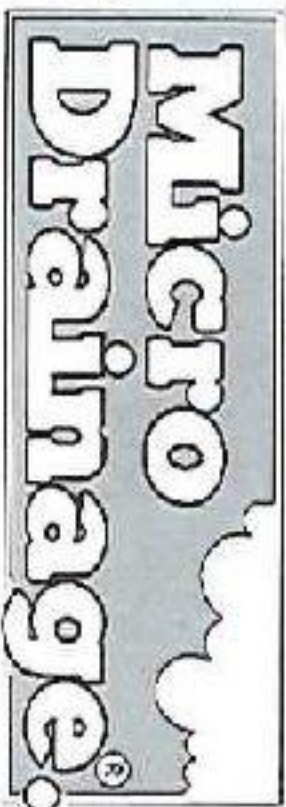
Road 1A Porous Paving

Date March 2017

Designed by KAM

File Road 1A Cascade....

Checked by



Micro Drainage

Source Control 2013.1.1

Cascade Model Details for Road 1A.srck

Storage is Online Cover Level (m) 9.850

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	5.5
Membrane Percolation (mm/hr)	1000	Length (m)	82.2
Max Percolation (l/s)	125.6	Slope (1:X)	1000.0
Safety Factor	5.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	8.220	Cap Volume Depth (m)	0.000

Depth/Flow Relationship Outflow Control

Invert Level (m) 8.220

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.200	11.1000	1.800	11.1000	3.400	11.1000	5.000	11.1000
0.400	11.1000	2.000	11.1000	3.600	11.1000	5.200	11.1000
0.600	11.1000	2.200	11.1000	3.800	11.1000	5.400	11.1000
0.800	11.1000	2.400	11.1000	4.000	11.1000	5.600	11.1000
1.000	11.1000	2.600	11.1000	4.200	11.1000	5.800	11.1000
1.200	11.1000	2.800	11.1000	4.400	11.1000	6.000	11.1000
1.400	11.1000	3.000	11.1000	4.600	11.1000		
1.600	11.1000	3.200	11.1000	4.800	11.1000		

Pipe Overflow Control

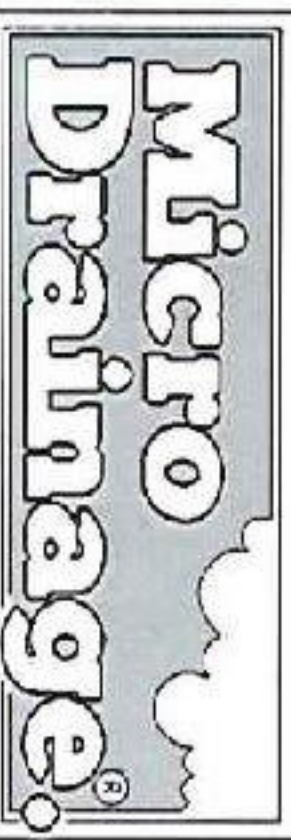
Diameter (m) 0.225 Entry Loss Coefficient 0.500
 Slope (1:X) 167.0 Coefficient of Contraction 0.600
 Length (m) 7.200 Upstream Invert Level (m) 9.500
 Roughness k (mm) 0.600

Lone Barn Studios
Stanbridge Lane
Romsey SO51 0HE

Horndean Road
Emsworth
Road 4E Porous Paving

Date March 2017
File Road 1A Cascade....

Designed by KAM
Checked by



Micro Drainage

Source Control 2013.1.1

Cascade Summary of Results for Road 4E.srcx

Upstream Outflow To Overflow To
Structures

(None) Road 1A.srcx

(None)

Half Drain Time : 53 minutes.

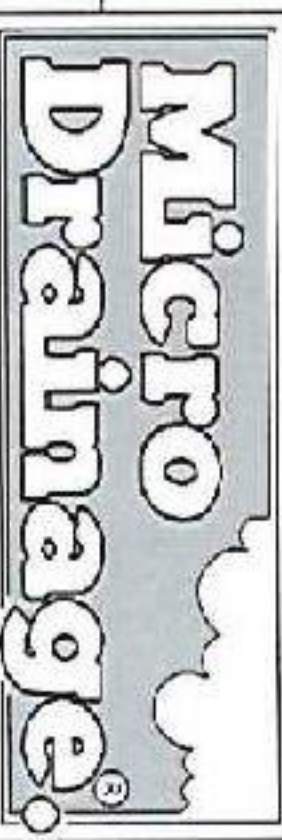
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max E Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	10.284	0.284	0.0	5.0	5.0	17.9	Flood Risk
30 min Summer	10.358	0.358	0.0	5.0	5.0	23.1	Flood Risk
60 min Summer	10.405	0.405	0.0	5.0	5.0	26.4	Flood Risk
120 min Summer	10.416	0.416	0.0	5.0	5.0	27.2	Flood Risk
180 min Summer	10.399	0.399	0.0	5.0	5.0	26.0	Flood Risk
240 min Summer	10.372	0.372	0.0	5.0	5.0	24.1	Flood Risk
360 min Summer	10.319	0.319	0.0	5.0	5.0	20.4	Flood Risk
480 min Summer	10.273	0.273	0.0	5.0	5.0	17.2	Flood Risk
600 min Summer	10.236	0.236	0.0	5.0	5.0	14.5	Flood Risk
720 min Summer	10.208	0.208	0.0	5.0	5.0	12.6	Flood Risk
960 min Summer	10.177	0.177	0.0	4.4	4.4	10.4	O K
1440 min Summer	10.140	0.140	0.0	3.5	3.5	7.8	O K
2160 min Summer	10.108	0.108	0.0	2.7	2.7	5.5	O K
2880 min Summer	10.088	0.088	0.0	2.2	2.2	4.2	O K
4320 min Summer	10.066	0.066	0.0	1.7	1.7	2.6	O K
5760 min Summer	10.053	0.053	0.0	1.3	1.3	1.7	O K
7200 min Summer	10.045	0.045	0.0	1.1	1.1	1.2	O K
8640 min Summer	10.039	0.039	0.0	1.0	1.0	0.9	O K
10080 min Summer	10.035	0.035	0.0	0.9	0.9	0.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
----------------	-----------------	---------------------------	-----------------------------	---------------------

15 min Summer	118.408	0.0	21.7	26
30 min Summer	79.579	0.0	29.5	38
60 min Summer	51.031	0.0	38.2	58
120 min Summer	31.581	0.0	47.6	92
180 min Summer	23.488	0.0	53.2	126
240 min Summer	18.897	0.0	57.1	160
360 min Summer	13.902	0.0	63.1	224
480 min Summer	11.169	0.0	67.6	286
600 min Summer	9.417	0.0	71.3	344
720 min Summer	8.187	0.0	74.4	400
960 min Summer	6.558	0.0	79.4	518
1440 min Summer	4.789	0.0	86.9	760
2160 min Summer	3.489	0.0	94.8	1116
2880 min Summer	2.783	0.0	100.6	1480
4320 min Summer	2.020	0.0	109.1	2212
5760 min Summer	1.607	0.0	115.2	2936
7200 min Summer	1.346	0.0	120.1	3672
8640 min Summer	1.165	0.0	124.2	4408
10080 min Summer	1.032	0.0	127.8	5112

Lone Barn Studios
 Stanbridge Lane
 Romsey SO51 0HE

Horndean Road
 Emsworth
 Road 4E Porous Paving



Date March 2017

Designed by KAM

File Road 1A Cascade...

Checked by

Micro Drainage

Source Control 2013.1.1

Cascade Summary of Results for Road 4E.srccx

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 Winter	10.320	0.320	0.0	5.0	5.0	20.5	Flood Risk
30 min Winter	10.407	0.407	0.0	5.0	5.0	26.5	Flood Risk
60 min Winter	10.463	0.463	0.0	5.0	5.0	30.5	Flood Risk
120 min Winter	10.468	0.468	0.0	5.0	5.0	30.8	Flood Risk
180 min Winter	10.436	0.436	0.0	5.0	5.0	28.6	Flood Risk
240 min Winter	10.394	0.394	0.0	5.0	5.0	25.6	Flood Risk
360 min Winter	10.311	0.311	0.0	5.0	5.0	19.8	Flood Risk
480 min Winter	10.244	0.244	0.0	5.0	5.0	15.1	Flood Risk
600 min Winter	10.200	0.200	0.0	5.0	5.0	12.0	O K
720 min Winter	10.179	0.179	0.0	4.5	4.5	10.5	O K
960 min Winter	10.148	0.148	0.0	3.7	3.7	8.4	O K
1440 min Winter	10.112	0.112	0.0	2.8	2.8	5.8	O K
2160 min Winter	10.083	0.083	0.0	2.1	2.1	3.8	O K
2880 min Winter	10.067	0.067	0.0	1.7	1.7	2.6	O K
4320 min Winter	10.049	0.049	0.0	1.2	1.2	1.4	O K
5760 min Winter	10.039	0.039	0.0	1.0	1.0	0.9	O K
7200 min Winter	10.033	0.033	0.0	0.8	0.8	0.6	O K
8640 min Winter	10.028	0.028	0.0	0.7	0.7	0.5	O K
10080 min Winter	10.025	0.025	0.0	0.6	0.6	0.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	118.408	0.0	24.4	26
30 min Winter	79.579	0.0	33.2	38
60 min Winter	51.031	0.0	42.9	64
120 min Winter	31.581	0.0	53.4	100
180 min Winter	23.488	0.0	59.7	138
240 min Winter	18.897	0.0	64.1	172
360 min Winter	13.902	0.0	70.8	238
480 min Winter	11.169	0.0	75.9	296
600 min Winter	9.417	0.0	80.0	346
720 min Winter	8.187	0.0	83.5	406
960 min Winter	6.558	0.0	89.1	528
1440 min Winter	4.789	0.0	97.6	770
2160 min Winter	3.489	0.0	106.4	1132
2880 min Winter	2.783	0.0	113.0	1480
4320 min Winter	2.020	0.0	122.6	2208
5760 min Winter	1.607	0.0	129.5	2936
7200 min Winter	1.346	0.0	135.0	3672
8640 min Winter	1.165	0.0	139.8	4400
10080 min Winter	1.032	0.0	143.8	5136

Lone Barn Studios
 Stanbridge Lane
 Romsey SO51 0HE

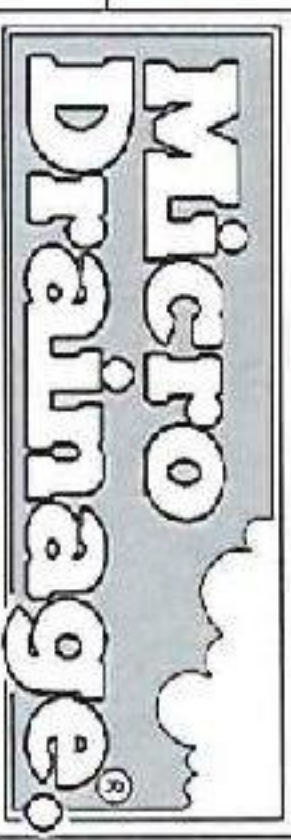
Horndean Road
 Emsworth
 Road 4E Porous Paving

Date March 2017

Designed by KAM

File Road 1A Cascade....

Checked by



Micro Drainage

Source Control 2013.1.1

Cascade Rainfall Details for Road 4F.srpx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.400	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.103

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
From:	To:	From:	To:	From:	To:
0	5	0.000	5	10	0.051
				10	15
					0.052

Lone Barn Studios

Horndean Road

Stanbridge Lane

Emsworth

Romsey SO51 0HE

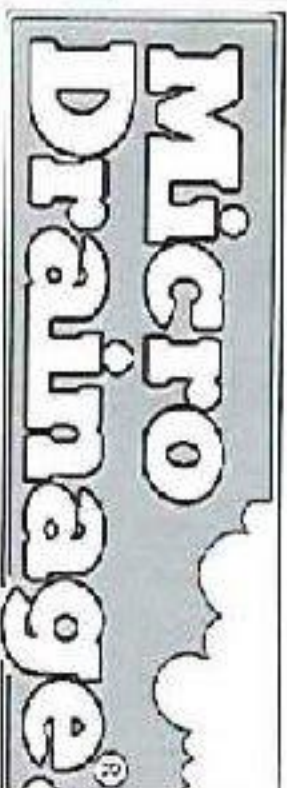
Road 4E Porous Paving

Date March 2017

Designed by KAM

File Road 1A Cascade....

Checked by



Micro Drainage

Source Control 2013.1.1

Cascade Model Details for Road 4E.srxx

Storage is Online Cover Level (m) 10.500

Porous Car Park Structure

Infiltration Coefficient Base (m/hr) 0.00000

Width (m) 4.0

Membrane Percolation (mm/hr)

Length (m) 58.6

Max Percolation (l/s)

Slope (1:X) 1000.0

Safety Factor

5.0 Depression Storage (mm) 5

Porosity

0.30 Evaporation (mm/day) 3

Invert Level (m)

10.000 Cap Volume Depth (m) 0.000

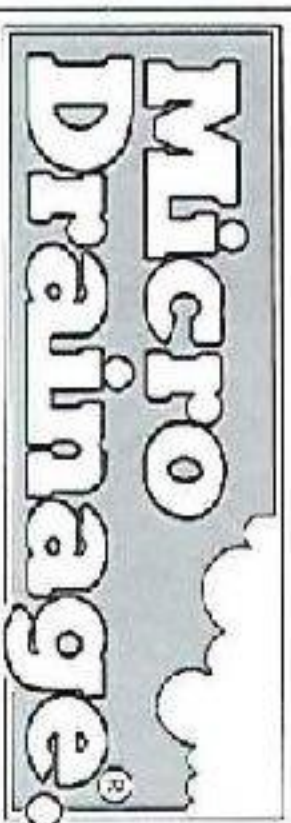
Depth/Flow Relationship Outflow Control

Invert Level (m) 10.000

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.200	5.0000	1.800	5.0000	3.400	5.0000	5.000	5.0000
0.400	5.0000	2.000	5.0000	3.600	5.0000	5.200	5.0000
0.600	5.0000	2.200	5.0000	3.800	5.0000	5.400	5.0000
0.800	5.0000	2.400	5.0000	4.000	5.0000	5.600	5.0000
1.000	5.0000	2.600	5.0000	4.200	5.0000	5.800	5.0000
1.200	5.0000	2.800	5.0000	4.400	5.0000	6.000	5.0000
1.400	5.0000	3.000	5.0000	4.600	5.0000		
1.600	5.0000	3.200	5.0000	4.800	5.0000		

Lone Barn Studios
Stanbridge Lane
Romsey SO51 0HT

Horndean Road
Emsworth
Road 4D Porous Paving



Date March 2017
File Road 1A Cascade...

Designed by KAM
Checked by

Micro Drainage

Source Control 2013.1.1

Cascade Summary of Results for Road 4D.srcc

Upstream Outflow To Overflow To
Structures

(None) Road 1A.srcc

(None)

Half Drain Time : 48 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Z Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	9.918	0.218	0.0	5.0	5.0	15.0	Flood Risk
30 min Summer	9.971	0.271	0.0	5.0	5.0	19.3	Flood Risk
60 min Summer	10.003	0.303	0.0	5.0	5.0	21.9	Flood Risk
120 min Summer	10.010	0.310	0.0	5.0	5.0	22.5	Flood Risk
180 min Summer	9.995	0.295	0.0	5.0	5.0	21.3	Flood Risk
240 min Summer	9.974	0.274	0.0	5.0	5.0	19.6	Flood Risk
360 min Summer	9.936	0.236	0.0	5.0	5.0	16.5	Flood Risk
480 min Summer	9.905	0.205	0.0	5.0	5.0	14.0	Flood Risk
600 min Summer	9.887	0.187	0.0	4.7	4.7	12.4	Flood Risk
720 min Summer	9.872	0.172	0.0	4.3	4.3	11.2	Flood Risk
960 min Summer	9.848	0.148	0.0	3.7	3.7	9.3	Flood Risk
1440 min Summer	9.818	0.118	0.0	3.0	3.0	6.9	Flood Risk
2160 min Summer	9.791	0.091	0.0	2.3	2.3	4.7	Flood Risk
2880 min Summer	9.776	0.076	0.0	1.9	1.9	3.4	Flood Risk
4320 min Summer	9.757	0.057	0.0	1.4	1.4	2.0	Flood Risk
5760 min Summer	9.746	0.046	0.0	1.2	1.2	1.3	Flood Risk
7200 min Summer	9.739	0.039	0.0	1.0	1.0	0.9	Flood Risk
8640 min Summer	9.734	0.034	0.0	0.8	0.8	0.7	Flood Risk
10080 min Summer	9.730	0.030	0.0	0.7	0.7	0.5	Flood Risk

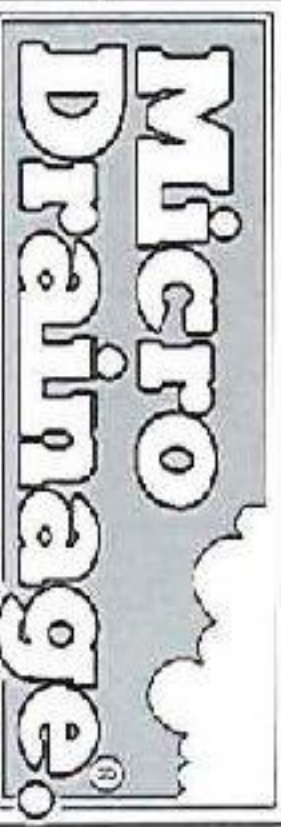
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	118.408	0.0	18.4	25
30 min Summer	79.579	0.0	25.2	37
60 min Summer	51.031	0.0	32.7	56
120 min Summer	31.581	0.0	40.7	90
180 min Summer	23.488	0.0	45.6	124
240 min Summer	18.897	0.0	49.0	156
360 min Summer	13.902	0.0	54.1	220
480 min Summer	11.169	0.0	58.0	278
600 min Summer	9.417	0.0	61.2	338
720 min Summer	8.187	0.0	63.8	400
960 min Summer	6.558	0.0	68.1	522
1440 min Summer	4.789	0.0	74.5	762
2160 min Summer	3.489	0.0	81.3	1128
2880 min Summer	2.783	0.0	86.2	1480
4320 min Summer	2.020	0.0	93.3	2208
5760 min Summer	1.607	0.0	98.4	2936
7200 min Summer	1.346	0.0	102.4	3672
8640 min Summer	1.165	0.0	105.7	4344
10080 min Summer	1.032	0.0	108.6	5096

Lone Barn Studios
 Stanbridge Lane
 Romsey SO51 0HE

Ilfordean Road
 Emsworth
 Road 4D Porous Paving

Date March 2017
 File Road 1A Cascade....

Designed by KAM
 Checked by



Micro Drainage

Source Control 2013.1.1

Cascade Summary of Results for Road 4D.srxx

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 Winter	9.944	0.244	0.0	5.0	5.0	17.1	Flood Risk
30 min Winter	10.006	0.306	0.0	5.0	5.0	22.2	Flood Risk
60 min Winter	10.043	0.343	0.0	5.0	5.0	25.2	Flood Risk
120 min Winter	10.043	0.343	0.0	5.0	5.0	25.2	Flood Risk
180 min Winter	10.017	0.317	0.0	5.0	5.0	23.1	Flood Risk
240 min Winter	9.984	0.284	0.0	5.0	5.0	20.4	Flood Risk
360 min Winter	9.925	0.225	0.0	5.0	5.0	15.6	Flood Risk
480 min Winter	9.890	0.190	0.0	4.7	4.7	12.7	Flood Risk
600 min Winter	9.868	0.168	0.0	4.2	4.2	10.9	Flood Risk
720 min Winter	9.851	0.151	0.0	3.8	3.8	9.6	Flood Risk
960 min Winter	9.826	0.126	0.0	3.2	3.2	7.5	Flood Risk
1440 min Winter	9.796	0.096	0.0	2.4	2.4	5.0	Flood Risk
2160 min Winter	9.771	0.071	0.0	1.8	1.8	3.0	Flood Risk
2880 min Winter	9.758	0.058	0.0	1.4	1.4	2.0	Flood Risk
4320 min Winter	9.742	0.042	0.0	1.1	1.1	1.1	OK
5760 min Winter	9.734	0.034	0.0	0.8	0.8	0.7	OK
7200 min Winter	9.728	0.028	0.0	0.7	0.7	0.5	OK
8640 min Winter	9.724	0.024	0.0	0.6	0.6	0.3	OK
10080 min Winter	9.721	0.021	0.0	0.5	0.5	0.3	OK

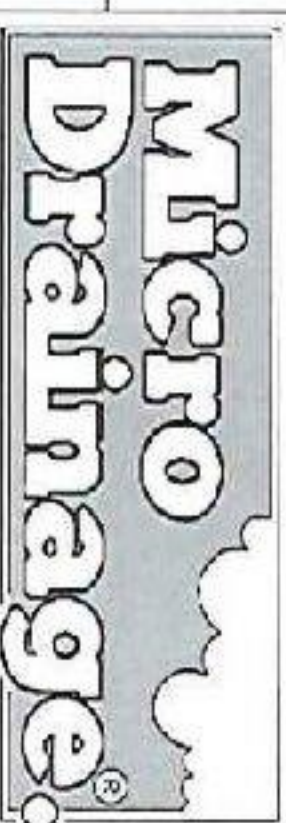
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	118.408	0.0	20.8	26
30 min Winter	79.579	0.0	28.4	38
60 min Winter	51.031	0.0	36.8	60
120 min Winter	31.581	0.0	45.8	98
180 min Winter	23.488	0.0	51.2	134
240 min Winter	18.897	0.0	55.0	168
360 min Winter	13.902	0.0	60.8	230
480 min Winter	11.169	0.0	65.2	286
600 min Winter	9.417	0.0	68.7	350
720 min Winter	8.187	0.0	71.7	410
960 min Winter	6.558	0.0	76.5	532
1440 min Winter	4.789	0.0	83.7	774
2160 min Winter	3.489	0.0	91.3	1132
2880 min Winter	2.783	0.0	96.9	1480
4320 min Winter	2.020	0.0	104.9	2212
5760 min Winter	1.607	0.0	110.7	2936
7200 min Winter	1.346	0.0	115.3	3624
8640 min Winter	1.165	0.0	119.2	4376
10080 min Winter	1.032	0.0	122.5	5144

Lone Barn Studios
 Stanbridge Lane
 Romsey SO51 0HE

Horndean Road
 Emsworth
 Road 4D Porous Paving

Date March 2017
 File Road 1A Cascade....

Designed by KAM
 Checked by



Micro Drainage

Source Control 2013.1.1

Cascade Rainfall Details for Road 4D.srck

Rainfall Model		FSR	Winter Storms	
Return Period (years)		100	Cv (Summer)	Yes
	Region England and Wales		Cv (Winter)	0.840
	M5-60 (mm)	19.400	Shortest Storm (mins)	15
	Ratio R	0.350	Longest Storm (mins)	10080
	Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

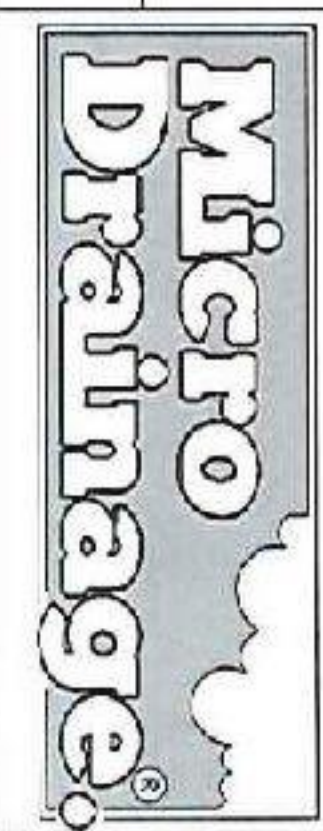
Total Area (ha) 0.089

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
From:	To:	From:	To:	From:	To:
0	5	0.000	5	10	0.045
				10	15
					0.044

Lone Barn Studios
 Stanbridge Lane
 Romsey SO51 0HF

Horndean Road
 Emsworth
 Road 4D Porous Paving

Date March 2017
 File Road 1A Cascade....



Designed by KAM

Checked by

Micro Drainage

Source Control 2013.1.1

Cascade Model Details for Road 4D.sicx

Storage is Online Cover Level (m) 10.050

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	4.0
Membrane Percolation (mm/hr)	1000	Length (m)	68.0
Max Percolation (l/s)	75.6	Slope (1:X)	1000.0
Safety Factor	5.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	9.700	Cap Volume Depth (m)	0.000

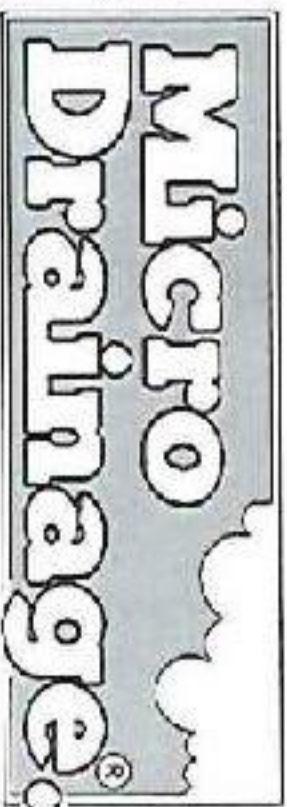
Depth/Flow Relationship Outflow Control

Invert Level (m) 9.700

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.200	5.0000	1.800	5.0000	3.400	5.0000	5.000	5.0000
0.400	5.0000	2.000	5.0000	3.600	5.0000	5.200	5.0000
0.600	5.0000	2.200	5.0000	3.800	5.0000	5.400	5.0000
0.800	5.0000	2.400	5.0000	4.000	5.0000	5.600	5.0000
1.000	5.0000	2.600	5.0000	4.200	5.0000	5.800	5.0000
1.200	5.0000	2.800	5.0000	4.400	5.0000	6.000	5.0000
1.400	5.0000	3.000	5.0000	4.600	5.0000		
1.600	5.0000	3.200	5.0000	4.800	5.0000		

Lone Barn Studios
 Stanbridge Lane
 Romsey SO51 0HE

Horndean Road
 Fmsworth
 Road 2 Porous Paving



Date March 2017
 File Road 1A Cascade....

Designed by KAM
 Checked by

Micro Drainage

Source Control 2013.1.1

Cascade Summary of Results for Road 2.srcx

Upstream Outflow To Overflow To
 Structures

(None) Road 1A.srcx

(None)

Half Drain Time : 69 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	10.361	0.171	0.0	4.3	4.3	19.7	Flood Risk
30 min Summer	10.401	0.211	0.0	5.0	5.0	25.7	Flood Risk
60 min Summer	10.431	0.241	0.0	5.0	5.0	30.0	Flood Risk
120 min Summer	10.445	0.255	0.0	5.0	5.0	32.2	Flood Risk
180 min Summer	10.443	0.253	0.0	5.0	5.0	31.8	Flood Risk
240 min Summer	10.434	0.244	0.0	5.0	5.0	30.5	Flood Risk
360 min Summer	10.414	0.224	0.0	5.0	5.0	27.5	Flood Risk
480 min Summer	10.395	0.205	0.0	5.0	5.0	24.7	Flood Risk
600 min Summer	10.381	0.191	0.0	4.8	4.8	22.6	Flood Risk
720 min Summer	10.369	0.179	0.0	4.5	4.5	20.8	Flood Risk
960 min Summer	10.349	0.159	0.0	4.0	4.0	18.0	Flood Risk
1440 min Summer	10.322	0.132	0.0	3.3	3.3	13.9	Flood Risk
2160 min Summer	10.296	0.106	0.0	2.6	2.6	10.0	Flood Risk
2880 min Summer	10.279	0.089	0.0	2.2	2.2	7.6	Flood Risk
4320 min Summer	10.259	0.069	0.0	1.7	1.7	4.7	Flood Risk
5760 min Summer	10.247	0.057	0.0	1.4	1.4	3.2	Flood Risk
7200 min Summer	10.238	0.048	0.0	1.2	1.2	2.3	Flood Risk
8640 min Summer	10.232	0.042	0.0	1.1	1.1	1.7	Flood Risk
10080 min Summer	10.227	0.037	0.0	0.9	0.9	1.4	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	118.408	0.0	22.6	26
30 min Summer	79.579	0.0	31.2	38
60 min Summer	51.031	0.0	40.7	60
120 min Summer	31.581	0.0	50.9	94
180 min Summer	23.488	0.0	57.1	128
240 min Summer	18.897	0.0	61.3	162
360 min Summer	13.902	0.0	67.8	228
480 min Summer	11.169	0.0	72.8	290
600 min Summer	9.417	0.0	76.7	352
720 min Summer	8.187	0.0	80.0	416
960 min Summer	6.558	0.0	85.5	540
1440 min Summer	4.789	0.0	93.4	786
2160 min Summer	3.489	0.0	101.7	1152
2880 min Summer	2.783	0.0	107.8	1508
4320 min Summer	2.020	0.0	116.4	2216
5760 min Summer	1.607	0.0	122.4	2944
7200 min Summer	1.346	0.0	127.0	3680
8640 min Summer	1.165	0.0	130.8	4400
10080 min Summer	1.032	0.0	134.0	5136

Lone Barn Studios
 Stanbridge Lane
 Romsey SO51 0HE

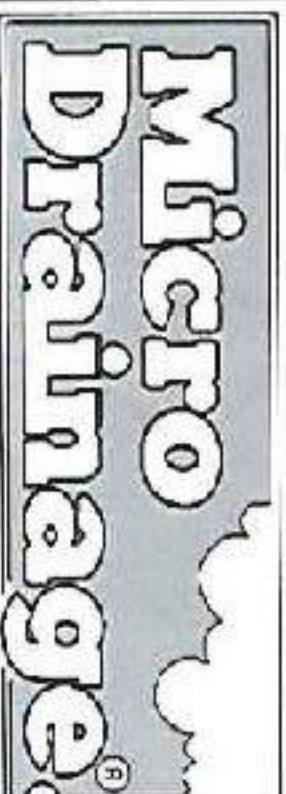
Horndean Road
 Emsworth
 Road 2 Porous Paving

Date March 2017

Designed by KAM

File Road 1A Cascade....

Checked by



Micro Drainage

Source Control 2013.1.1

Cascade Summary of Results for Road 2.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max E (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
15 min Winter	10.379	0.189	0.0	4.7	4.7	4.7	22.4	Flood Risk
30 min Winter	10.426	0.236	0.0	5.0	5.0	5.0	29.4	Flood Risk
60 min Winter	10.462	0.272	0.0	5.0	5.0	5.0	34.7	Flood Risk
120 min Winter	10.475	0.285	0.0	5.0	5.0	5.0	36.6	Flood Risk
180 min Winter	10.467	0.277	0.0	5.0	5.0	5.0	35.5	Flood Risk
240 min Winter	10.452	0.262	0.0	5.0	5.0	5.0	33.2	Flood Risk
360 min Winter	10.420	0.230	0.0	5.0	5.0	5.0	28.4	Flood Risk
480 min Winter	10.392	0.202	0.0	5.0	5.0	5.0	24.3	Flood Risk
600 min Winter	10.374	0.184	0.0	4.6	4.6	4.6	21.6	Flood Risk
720 min Winter	10.359	0.169	0.0	4.2	4.2	4.2	19.4	Flood Risk
960 min Winter	10.335	0.145	0.0	3.6	3.6	3.6	15.9	Flood Risk
1440 min Winter	10.304	0.114	0.0	2.9	2.9	2.9	11.3	Flood Risk
2160 min Winter	10.277	0.087	0.0	2.2	2.2	2.2	7.3	Flood Risk
2880 min Winter	10.261	0.071	0.0	1.8	1.8	1.8	4.9	Flood Risk
4320 min Winter	10.243	0.053	0.0	1.3	1.3	1.3	2.7	Flood Risk
5760 min Winter	10.232	0.042	0.0	1.1	1.1	1.1	1.7	Flood Risk
7200 min Winter	10.225	0.035	0.0	0.9	0.9	0.9	1.2	Flood Risk
8640 min Winter	10.221	0.031	0.0	0.8	0.8	0.8	0.9	Flood Risk
10080 min Winter	10.217	0.027	0.0	0.7	0.7	0.7	0.7	Flood Risk
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)				
15 min Winter	118.408	0.0	25.6	26				
30 min Winter	79.579	0.0	35.3	39				
60 min Winter	51.031	0.0	45.9	64				
120 min Winter	31.581	0.0	57.4	102				
180 min Winter	23.488	0.0	64.2	140				
240 min Winter	18.897	0.0	69.0	176				
360 min Winter	13.902	0.0	76.3	242				
480 min Winter	11.169	0.0	81.8	304				
600 min Winter	9.417	0.0	86.3	368				
720 min Winter	8.187	0.0	90.0	432				
960 min Winter	6.558	0.0	96.1	558				
1440 min Winter	4.789	0.0	105.1	802				
2160 min Winter	3.489	0.0	114.5	1160				
2880 min Winter	2.783	0.0	121.4	1512				
4320 min Winter	2.020	0.0	131.2	2216				
5760 min Winter	1.607	0.0	138.1	2936				
7200 min Winter	1.346	0.0	143.5	3640				
8640 min Winter	1.165	0.0	148.0	4400				
10080 min Winter	1.032	0.0	151.7	5144				

Lone Barn Studios
 Stanbridge Lane
 Romsey SO51 0HE

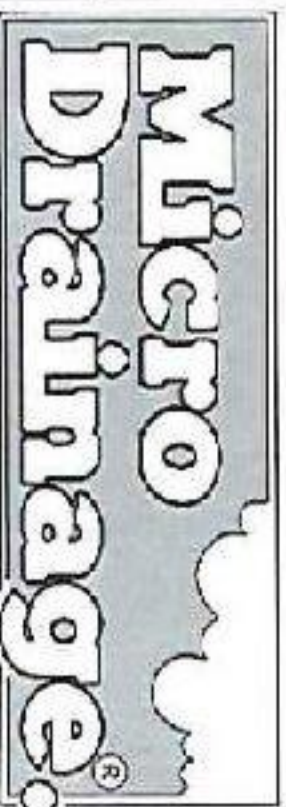
Horndean Road
 Fmsworth
 Road 2 Porous Paving

Date March 2017

Designed by KAM

File Road 1A Cascade....

Checked by



Micro Drainage

Source Control 2013.1.1

Cascade Rainfall Details for Road 2.srccx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region England and Wales		Cv (Winter)	0.840
M5-60 (mm)	19.400	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.113

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
From:	To:	From:	To:	From:	To:
0	5	0.000	5	10	0.056
				10	15
					0.057

Lone Barn Studios

Hordean Road

Stanbridge Lane

Fmsworth

Romsey SO51 0HE

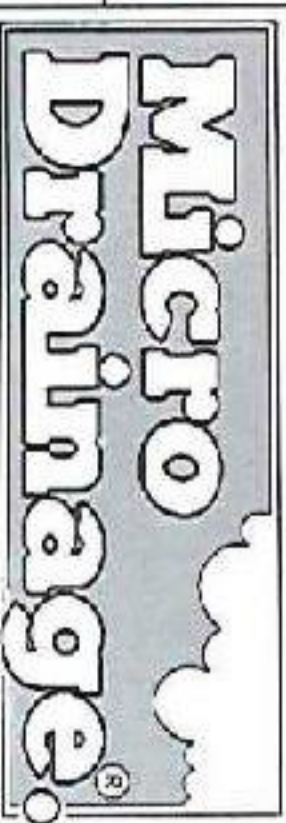
Road 2 Porous Paving

Date March 2017

Designed by KM

File Road 1A Cascade....

Checked by



Micro Drainage

Source Control 2013.1.1

Cascade Model Details for Road 2.srxx

Storage is Online Cover Level (m) 10.490

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	6.5
Membrane Percolation (mm/hr)	1000	Length (m)	76.0
Max Percolation (l/s)	137.2	Slope (1:X)	1000.0
Safety Factor	5.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	10.190	Cap Volume Depth (m)	0.000

Depth/Flow Relationship Outflow Control

Invert level (m) 10.190

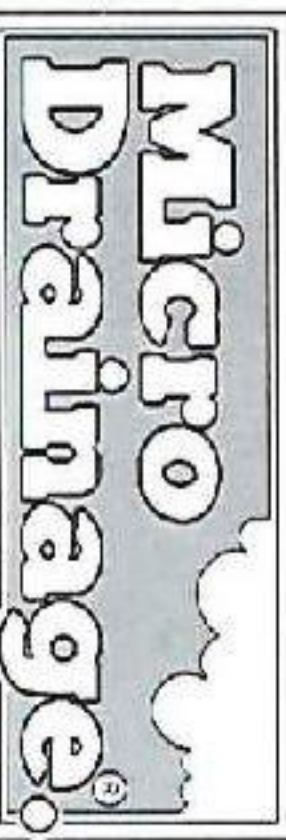
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.200	5.0000	1.800	5.0000	3.400	5.0000	5.000	5.0000
0.400	5.0000	2.000	5.0000	3.600	5.0000	5.200	5.0000
0.600	5.0000	2.200	5.0000	3.800	5.0000	5.400	5.0000
0.800	5.0000	2.400	5.0000	4.000	5.0000	5.600	5.0000
1.000	5.0000	2.600	5.0000	4.200	5.0000	5.800	5.0000
1.200	5.0000	2.800	5.0000	4.400	5.0000	6.000	5.0000
1.400	5.0000	3.000	5.0000	4.600	5.0000		
1.600	5.0000	3.200	5.0000	4.800	5.0000		

Lone Barn Studios
Stanbridge Lane
Romsey SO51 0HE

Horndean Road
Emsworth
Road 4A Porous Paving

Date March 2017
File Road 1A Cascade....

Designed by KAM
Checked by



Micro Drainage

Source Control 2013.1.1

Cascade Summary of Results for Road 4A.srpx

Upstream Outflow To Overflow To Structures

(None) Road 4.srpx

(None)

Half Drain Time : 50 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	11.172	0.222	0.0	5.0	5.0	5.0	17.0 Flood Risk
30 min Summer	11.226	0.276	0.0	5.0	5.0	5.0	21.9 Flood Risk
60 min Summer	11.261	0.311	0.0	5.0	5.0	5.0	25.2 Flood Risk
120 min Summer	11.271	0.321	0.0	5.0	5.0	5.0	26.1 Flood Risk
180 min Summer	11.259	0.309	0.0	5.0	5.0	5.0	25.0 Flood Risk
240 min Summer	11.241	0.291	0.0	5.0	5.0	5.0	23.3 Flood Risk
360 min Summer	11.204	0.254	0.0	5.0	5.0	5.0	20.0 Flood Risk
480 min Summer	11.173	0.223	0.0	5.0	5.0	5.0	17.1 Flood Risk
600 min Summer	11.150	0.200	0.0	5.0	5.0	5.0	14.9 Flood Risk
720 min Summer	11.134	0.184	0.0	4.6	4.6	4.6	13.5 Flood Risk
960 min Summer	11.110	0.160	0.0	4.0	4.0	4.0	11.3 Flood Risk
1440 min Summer	11.078	0.128	0.0	3.2	3.2	3.2	8.4 Flood Risk
2160 min Summer	11.050	0.100	0.0	2.5	2.5	2.5	5.8 Flood Risk
2880 min Summer	11.033	0.083	0.0	2.1	2.1	2.1	4.2 Flood Risk
4320 min Summer	11.013	0.063	0.0	1.6	1.6	1.6	2.5 Flood Risk
5760 min Summer	11.001	0.051	0.0	1.3	1.3	1.3	1.6 O K
7200 min Summer	10.993	0.043	0.0	1.1	1.1	1.1	1.1 O K
8640 min Summer	10.987	0.037	0.0	0.9	0.9	0.9	0.8 O K
10080 min Summer	10.983	0.033	0.0	0.8	0.8	0.7	0.7 O K

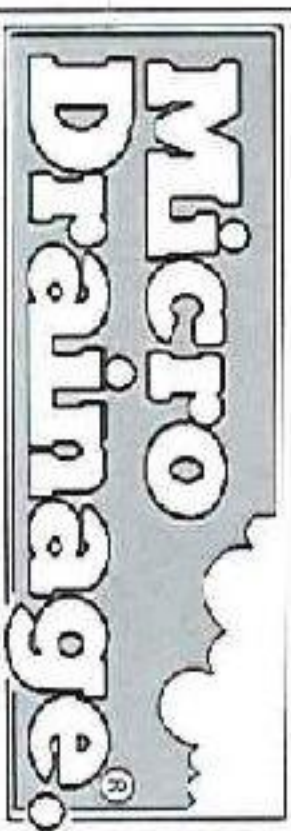
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	118.408	0.0	20.4	25
30 min Summer	79.579	0.0	28.0	37
60 min Summer	51.031	0.0	36.3	58
120 min Summer	31.581	0.0	45.3	92
180 min Summer	23.488	0.0	50.7	126
240 min Summer	18.897	0.0	54.4	160
360 min Summer	13.902	0.0	60.2	224
480 min Summer	11.169	0.0	64.5	284
600 min Summer	9.417	0.0	68.0	342
720 min Summer	8.187	0.0	70.9	402
960 min Summer	6.558	0.0	75.8	524
1440 min Summer	4.789	0.0	82.9	768
2160 min Summer	3.489	0.0	90.3	1132
2880 min Summer	2.783	0.0	95.8	1484
4320 min Summer	2.020	0.0	103.7	2212
5760 min Summer	1.607	0.0	109.4	2936
7200 min Summer	1.346	0.0	113.8	3656
8640 min Summer	1.165	0.0	117.5	4400
10080 min Summer	1.032	0.0	120.7	5104

Lone Barn Studios
 Stanbridge Lane
 Romsey SO51 0HF

Horndean Road
 Emsworth
 Road 4A Porous Paving

Date March 2017

Designed by KAM



File Road 1A Cascade....

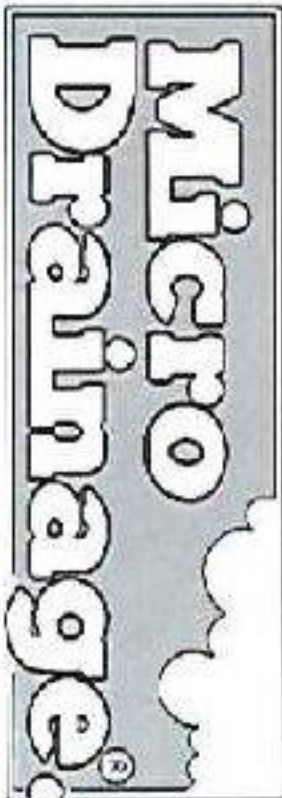
Checked by

Micro Drainage

Source Control 2013.1.1

Cascade Summary of Results for Road 4A.srcx

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 Winter	11.198	0.248	0.0	5.0	5.0	19.4	Flood Risk
30 min Winter	11.261	0.311	0.0	5.0	5.0	25.2	Flood Risk
60 min Winter	11.302	0.352	0.0	5.0	5.0	29.0	Flood Risk
120 min Winter	11.308	0.358	0.0	5.0	5.0	29.5	Flood Risk
180 min Winter	11.286	0.336	0.0	5.0	5.0	27.5	Flood Risk
240 min Winter	11.256	0.306	0.0	5.0	5.0	24.8	Flood Risk
360 min Winter	11.199	0.249	0.0	5.0	5.0	19.5	Flood Risk
480 min Winter	11.156	0.206	0.0	5.0	5.0	15.5	Flood Risk
600 min Winter	11.133	0.183	0.0	4.6	4.6	13.4	Flood Risk
720 min Winter	11.115	0.165	0.0	4.1	4.1	11.7	Flood Risk
960 min Winter	11.088	0.138	0.0	3.5	3.5	9.3	Flood Risk
1440 min Winter	11.055	0.105	0.0	2.6	2.6	6.3	Flood Risk
2160 min Winter	11.029	0.079	0.0	2.0	2.0	3.8	Flood Risk
2880 min Winter	11.014	0.064	0.0	1.6	1.6	2.5	Flood Risk
4320 min Winter	10.997	0.047	0.0	1.2	1.2	1.3	O K
5760 min Winter	10.987	0.037	0.0	0.9	0.9	0.8	O K
7200 min Winter	10.981	0.031	0.0	0.8	0.8	0.6	O K
8640 min Winter	10.977	0.027	0.0	0.7	0.7	0.4	O K
10080 min Winter	10.974	0.024	0.0	0.6	0.6	0.3	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)			
15 min Winter	118.408	0.0	23.1	26			
30 min Winter	79.579	0.0	31.5	38			
60 min Winter	51.031	0.0	40.9	62			
120 min Winter	31.581	0.0	50.9	98			
180 min Winter	23.488	0.0	56.9	136			
240 min Winter	18.897	0.0	61.2	172			
360 min Winter	13.902	0.0	67.6	236			
480 min Winter	11.169	0.0	72.5	292			
600 min Winter	9.417	0.0	76.4	352			
720 min Winter	8.187	0.0	79.7	414			
960 min Winter	6.558	0.0	85.1	538			
1440 min Winter	4.789	0.0	93.1	780			
2160 min Winter	3.489	0.0	101.5	1136			
2880 min Winter	2.783	0.0	107.7	1484			
4320 min Winter	2.020	0.0	116.7	2208			
5760 min Winter	1.607	0.0	123.1	2920			
7200 min Winter	1.346	0.0	128.2	3648			
8640 min Winter	1.165	0.0	132.5	4408			
10080 min Winter	1.032	0.0	136.2	5088			

Lone Barn Studios Stanbridge Lane Romsey SO51 0HE	Horndean Road Emsworth Road 4A Porous Paving	
Date March 2017	Designed by KAM	
File Road 1A Cascade....	Checked by	

Micro Drainage

Source Control 2013.1.1

Cascade Rainfall Details for Road 4A.srxx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region England and Wales		Cv (Winter)	0.840
M5-60 (mm)	19.400	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.099

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
From: To:		From: To:		From: To:	
0 5	0.000	5 10	0.049	10 15	0.050

Lone Barn Studios

Horndean Road

Stanbridge Lane

Emsworth

Romsey SO51 0HE

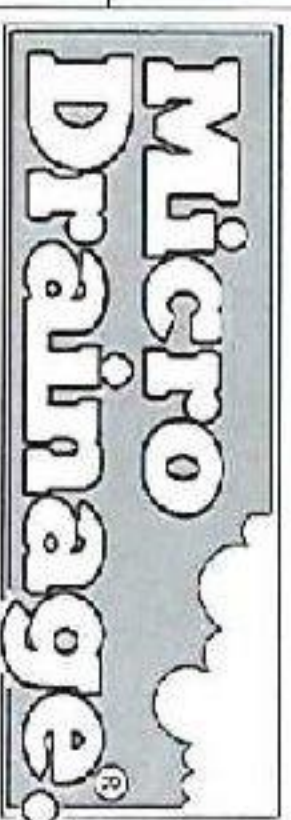
Road 4A Porous Paving

Date March 2017

Designed by KAM

File Road 1A Cascade....

Checked by



Micro Drainage

Source Control 2013.1.1

Cascade Model Details for Road 4A.srcx

Storage is Online Cover Level (m) 11.310

Porous Car Park Structure

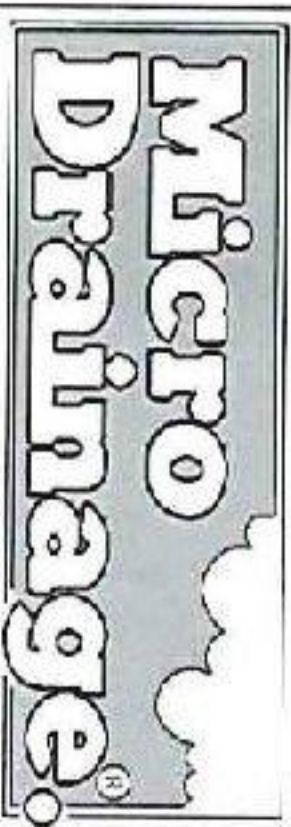
Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	4.1
Membrane Percolation (mm/hr)	1000	Length (m)	74.9
Max Percolation (l/s)	85.3	Slope (1:X)	1000.0
Safety Factor	5.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	10.950	Cap Volume Depth (m)	0.000

Depth/Flow Relationship Outflow Control

Invert Level (m) 10.950

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.200	5.0000	1.800	5.0000	3.400	5.0000	5.000	5.0000
0.400	5.0000	2.000	5.0000	3.600	5.0000	5.200	5.0000
0.600	5.0000	2.200	5.0000	3.800	5.0000	5.400	5.0000
0.800	5.0000	2.400	5.0000	4.000	5.0000	5.600	5.0000
1.000	5.0000	2.600	5.0000	4.200	5.0000	5.800	5.0000
1.200	5.0000	2.800	5.0000	4.400	5.0000	6.000	5.0000
1.400	5.0000	3.000	5.0000	4.600	5.0000		
1.600	5.0000	3.200	5.0000	4.800	5.0000		

Lone Barn Studios	Horndean Road
Slanbridge Lane	Emsworth
Romsey SO51 0HE	Road 4 Porous Paving
Date March 2017	Designed by KAM
File Road 1A Cascade....	Checked by
Micro Drainage	Source Control 2013.1.1



Cascade Summary of Results for Road 4.srcc

Upstream Outflow To Overflow To
Structures

Road 4A.srcc Road 1A.srcc (None)

Half Drain Time : 180 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	10.293	0.343	0.0	5.0	5.0	37.2	O K
30 min Summer	10.404	0.454	0.0	5.0	5.0	50.8	O K
60 min Summer	10.523	0.573	0.0	5.0	5.0	65.3	O K
120 min Summer	10.644	0.694	0.0	5.0	5.0	80.1	O K
180 min Summer	10.709	0.759	0.0	5.0	5.0	87.9	Flood Risk
240 min Summer	10.732	0.782	0.0	5.0	5.0	90.7	Flood Risk
360 min Summer	10.718	0.768	0.0	5.0	5.0	89.0	Flood Risk
480 min Summer	10.693	0.743	0.0	5.0	5.0	86.0	Flood Risk
600 min Summer	10.664	0.714	0.0	5.0	5.0	82.4	Flood Risk
720 min Summer	10.630	0.680	0.0	5.0	5.0	78.3	O K
960 min Summer	10.563	0.613	0.0	5.0	5.0	70.2	O K
1440 min Summer	10.436	0.486	0.0	5.0	5.0	54.7	O K
2160 min Summer	10.282	0.332	0.0	5.0	5.0	35.9	O K
2880 min Summer	10.182	0.232	0.0	5.0	5.0	23.8	O K
4320 min Summer	10.118	0.168	0.0	4.2	4.2	16.0	O K
5760 min Summer	10.088	0.138	0.0	3.4	3.4	12.3	O K
7200 min Summer	10.068	0.118	0.0	2.9	2.9	9.8	O K
8640 min Summer	10.053	0.103	0.0	2.6	2.6	8.0	O K
10080 min Summer	10.041	0.091	0.0	2.3	2.3	6.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	118.408	0.0	58.1	30
30 min Summer	79.579	0.0	79.3	45
60 min Summer	51.031	0.0	102.7	76
120 min Summer	31.581	0.0	127.9	136
180 min Summer	23.488	0.0	143.1	194
240 min Summer	18.897	0.0	153.7	248
360 min Summer	13.902	0.0	169.8	316
480 min Summer	11.169	0.0	182.0	374
600 min Summer	9.417	0.0	191.9	434
720 min Summer	8.187	0.0	200.2	498
960 min Summer	6.558	0.0	213.8	626
1440 min Summer	4.789	0.0	233.9	878
2160 min Summer	3.489	0.0	255.1	1228
2880 min Summer	2.783	0.0	270.7	1560
4320 min Summer	2.020	0.0	293.3	2248
5760 min Summer	1.607	0.0	309.6	2952
7200 min Summer	1.346	0.0	322.5	3680
8640 min Summer	1.165	0.0	333.4	4416
10080 min Summer	1.032	0.0	342.8	5144

Lone Barn Studios

Horndean Road

Stanbridge Lane

Emsworth

Romsey SO51 0HE

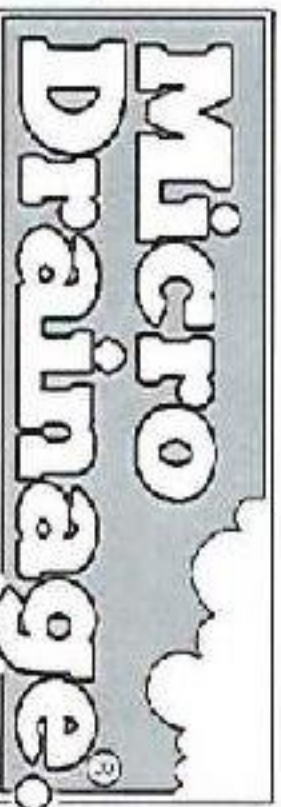
Road 4 Porous Paving

Dale March 2017

Designed by KAM

File Road 1A Cascade....

Checked by



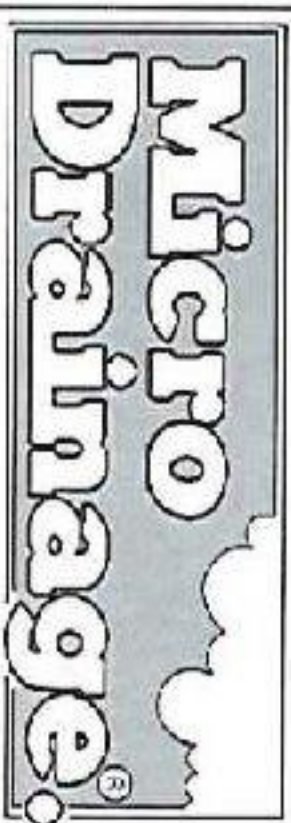
Micro Drainage

Source Control 2013.1.1

Cascade Summary of Results for Road 4.srcx

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 Winter	10.332	0.382	0.0	5.0	5.0	42.1	O K
30 min Winter	10.457	0.507	0.0	5.0	5.0	57.2	O K
60 min Winter	10.591	0.641	0.0	5.0	5.0	73.6	O K
120 min Winter	10.729	0.779	0.0	5.0	5.0	90.4	Flood Risk
180 min Winter	10.805	0.855	0.0	5.0	5.0	99.6	Flood Risk
240 min Winter	10.848	0.898	0.0	5.0	5.0	104.9	Flood Risk
360 min Winter	10.848	0.898	0.0	5.0	5.0	104.9	Flood Risk
480 min Winter	10.808	0.858	0.0	5.0	5.0	100.0	Flood Risk
600 min Winter	10.760	0.810	0.0	5.0	5.0	94.1	Flood Risk
720 min Winter	10.706	0.756	0.0	5.0	5.0	87.6	Flood Risk
960 min Winter	10.597	0.647	0.0	5.0	5.0	74.2	O K
1440 min Winter	10.394	0.444	0.0	5.0	5.0	49.5	O K
2160 min Winter	10.182	0.232	0.0	5.0	5.0	23.8	O K
2880 min Winter	10.125	0.175	0.0	4.4	4.4	16.8	O K
4320 min Winter	10.079	0.129	0.0	3.2	3.2	11.2	O K
5760 min Winter	10.053	0.103	0.0	2.6	2.6	8.1	O K
7200 min Winter	10.037	0.087	0.0	2.2	2.2	6.1	O K
8640 min Winter	10.025	0.075	0.0	1.9	1.9	4.7	O K
10080 min Winter	10.017	0.067	0.0	1.7	1.7	3.7	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)			
15 min Winter	118.408	0.0	65.5	30			
30 min Winter	79.579	0.0	89.3	45			
60 min Winter	51.031	0.0	115.5	76			
120 min Winter	31.581	0.0	143.7	136			
180 min Winter	23.488	0.0	160.7	196			
240 min Winter	18.397	0.0	172.6	248			
360 min Winter	13.902	0.0	190.7	346			
480 min Winter	11.169	0.0	204.4	394			
600 min Winter	9.417	0.0	215.4	464			
720 min Winter	8.187	0.0	224.8	534			
960 min Winter	6.558	0.0	240.0	672			
1440 min Winter	4.789	0.0	262.7	924			
2160 min Winter	3.489	0.0	286.5	1228			
2880 min Winter	2.783	0.0	304.1	1536			
4320 min Winter	2.020	0.0	329.7	2256			
5760 min Winter	1.607	0.0	348.2	2960			
7200 min Winter	1.346	0.0	362.9	3680			
8640 min Winter	1.165	0.0	375.4	4416			
10080 min Winter	1.032	0.0	386.2	5128			

Lone Barn Studios	Horndean Road
Stanbridge Lane	Emsworth
Romsey SO51 0HF	Road 4 Porous Paving
Date March 2017	Designed by KAM
File Road 1A Cascade....	Checked by



Micro Drainage

Source Control 2013.1.1

Cascade Rainfall Details for Road 4.srck

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
	Region England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.400	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.179

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
From: To:		From: To:		From: To:	
0	5	0.000	5	10	0.090
				10	15
					0.089

Lone Barn Studios

Horndean Road

Stanbridge Lane

Emsworth

Romsey SO51 0HE

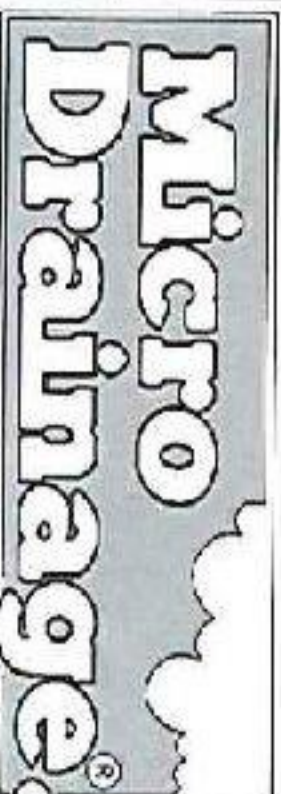
Road 4 Porous Paving

Date March 2017

Designed by KAM

File Road 1A Cascade....

Checked by



Micro Drainage

Source Control 2013.1.1

Cascade Model Details for Road 4.srnx

Storage is Online Cover Level (m) 10.950

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	5.5
Membrane Percolation (mm/hr)	1000	Length (m)	73.8
Max Percolation (l/s)	112.8	Slope (1:X)	1000.0
Safety Factor	5.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert level (m)	9.950	Cap Volume Depth (m)	0.000

Depth/Flow Relationship Outflow Control

Invert level (m) 9.950

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.200	5.00000	1.800	5.00000	3.400	5.00000	5.000	5.00000		
0.400	5.00000	2.000	5.00000	3.600	5.00000	5.200	5.00000		
0.600	5.00000	2.200	5.00000	3.800	5.00000	5.400	5.00000		
0.800	5.00000	2.400	5.00000	4.000	5.00000	5.600	5.00000		
1.000	5.00000	2.600	5.00000	4.200	5.00000	5.800	5.00000		
1.200	5.00000	2.800	5.00000	4.400	5.00000	6.000	5.00000		
1.400	5.00000	3.000	5.00000	4.600	5.00000				
1.600	5.00000	3.200	5.00000	4.800	5.00000				

Appendix B

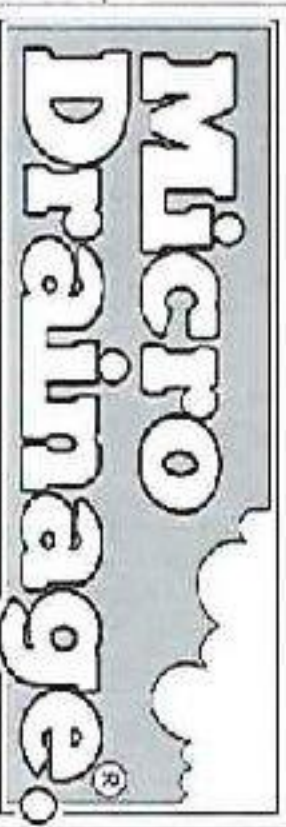
Road 1B-Road 1C – Drainage Calculations

Lone Barn Studios
 Stanbridge Lane
 Romsey SO51 0HE

Horndean Road
 Emsworth
 Road 1C Porous Paving

Date March 2017
 File Road 1C to Road ...

Designed by KAM
 Checked by



Micro Drainage

Source Control 2013.1.1

Cascade Summary of Results for Road 1C.srcx

Upstream Outflow To Overflow To
 Structures

(None) Road 1B.srcx (None)

Half Drain Time : 418 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max E Outflow (l/s)	Max Volume (m ³)	Status
15 min Summer	8.788	0.558	0.0	5.0	5.0	98.7	O K
30 min Summer	8.954	0.724	0.0	5.0	5.0	132.2	O K
60 min Summer	9.119	0.889	0.0	5.0	5.0	165.5	O K
120 min Summer	9.263	1.033	0.0	5.0	5.0	194.4	O K
180 min Summer	9.319	1.089	0.0	5.0	5.0	205.7	O K
240 min Summer	9.336	1.106	0.0	5.0	5.0	209.2	Flood Risk
360 min Summer	9.331	1.101	0.0	5.0	5.0	208.2	Flood Risk
480 min Summer	9.313	1.083	0.0	5.0	5.0	204.5	O K
600 min Summer	9.290	1.060	0.0	5.0	5.0	199.9	O K
720 min Summer	9.266	1.036	0.0	5.0	5.0	195.0	O K
960 min Summer	9.215	0.985	0.0	5.0	5.0	184.8	O K
1440 min Summer	9.112	0.882	0.0	5.0	5.0	164.1	O K
2160 min Summer	8.966	0.736	0.0	5.0	5.0	134.6	O K
2880 min Summer	8.834	0.604	0.0	5.0	5.0	108.1	O K
4320 min Summer	8.626	0.396	0.0	5.0	5.0	66.1	O K
5760 min Summer	8.492	0.262	0.0	5.0	5.0	39.3	O K
7200 min Summer	8.428	0.198	0.0	4.9	4.9	26.3	O K
8640 min Summer	8.404	0.174	0.0	4.4	4.4	21.6	O K
10080 min Summer	8.386	0.156	0.0	3.9	3.9	18.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	118.408	0.0	103.8	29
30 min Summer	79.579	0.0	140.7	43
60 min Summer	51.031	0.0	181.4	72
120 min Summer	31.581	0.0	225.3	130
180 min Summer	23.488	0.0	251.6	188
240 min Summer	18.897	0.0	270.1	246
360 min Summer	13.902	0.0	298.3	342
480 min Summer	11.169	0.0	319.6	398
600 min Summer	9.417	0.0	336.9	460
720 min Summer	8.187	0.0	351.5	524
960 min Summer	6.558	0.0	375.4	660
1440 min Summer	4.789	0.0	410.9	932
2160 min Summer	3.489	0.0	448.6	1328
2880 min Summer	2.783	0.0	476.5	1708
4320 min Summer	2.020	0.0	517.5	2424
5760 min Summer	1.607	0.0	547.6	3064
7200 min Summer	1.346	0.0	571.6	3688
8640 min Summer	1.165	0.0	592.4	4416
10080 min Summer	1.032	0.0	610.3	5152

Lone Barn Studios

Morndean Road

Stanbridge Lane

Emsworth

Romsey SO51 0HE

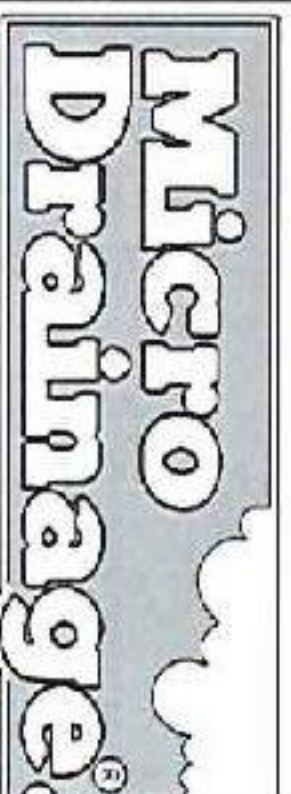
Road 1C Porous Paving

Date March 2017

Designed by KAM

File Road 1C to Road ...

Checked by



Micro Drainage

Source Control 2013.1.1

Cascade Summary of Results for Road 1C.srcc

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 Winter	8.851	0.621	0.0	5.0	5.0	111.5	O K
30 min Winter	9.040	0.810	0.0	5.0	5.0	149.5	O K
60 min Winter	9.229	0.999	0.0	5.0	5.0	187.6	O K
120 min Winter	9.400	1.170	0.0	5.0	5.0	222.0	Flood Risk
180 min Winter	9.472	1.242	0.0	5.0	5.0	236.5	Flood Risk
240 min Winter	9.501	1.271	0.0	5.0	5.0	242.3	Flood Risk
360 min Winter	9.511	1.281	0.0	5.0	5.0	244.4	Flood Risk
480 min Winter	9.489	1.259	0.0	5.0	5.0	239.9	Flood Risk
600 min Winter	9.456	1.226	0.0	5.0	5.0	233.2	Flood Risk
720 min Winter	9.424	1.194	0.0	5.0	5.0	226.8	Flood Risk
960 min Winter	9.351	1.121	0.0	5.0	5.0	212.2	Flood Risk
1440 min Winter	9.194	0.964	0.0	5.0	5.0	180.6	O K
2160 min Winter	8.968	0.738	0.0	5.0	5.0	135.0	O K
2880 min Winter	8.769	0.539	0.0	5.0	5.0	94.9	O K
4320 min Winter	8.487	0.257	0.0	5.0	5.0	38.2	O K
5760 min Winter	8.408	0.178	0.0	4.5	4.5	22.4	O K
7200 min Winter	8.380	0.150	0.0	3.8	3.8	16.7	O K
8640 min Winter	8.361	0.131	0.0	3.3	3.3	12.8	O K
10080 min Winter	8.346	0.116	0.0	2.9	2.9	10.1	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)			
15 min Winter	118.408	0.0	116.7	29			
30 min Winter	79.579	0.0	158.0	43			
60 min Winter	51.031	0.0	203.6	72			
120 min Winter	31.581	0.0	252.7	128			
180 min Winter	23.488	0.0	282.3	186			
240 min Winter	18.897	0.0	303.0	242			
360 min Winter	13.902	0.0	334.5	354			
480 min Winter	11.169	0.0	358.5	458			
600 min Winter	9.417	0.0	377.9	492			
720 min Winter	8.187	0.0	394.2	566			
960 min Winter	6.558	0.0	421.0	720			
1440 min Winter	4.789	0.0	460.9	1016			
2160 min Winter	3.489	0.0	503.2	1432			
2880 min Winter	2.783	0.0	534.6	1800			
4320 min Winter	2.020	0.0	580.8	2428			
5760 min Winter	1.607	0.0	614.7	3008			
7200 min Winter	1.346	0.0	641.8	3744			
8640 min Winter	1.165	0.0	665.3	4416			
10080 min Winter	1.032	0.0	685.6	5144			

Lone Barn Studios

Horndean Road

Stanbridge Lane

Emsworth

Romsey SO51 0HE

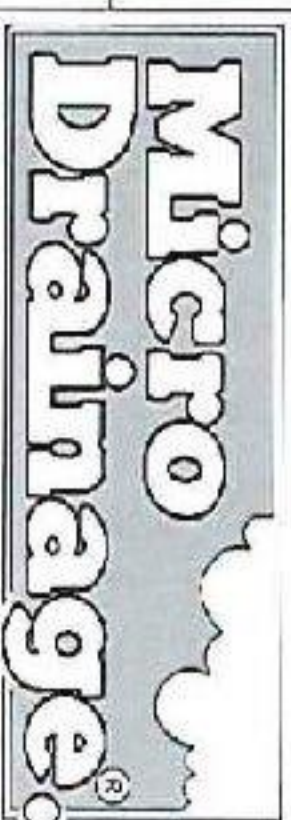
Road 1C Porous Paving

Date March 2017

Designed by KAM

File Road 1C to Road ...

Checked by



Micro Drainage

Source Control 2013.1.1

Cascade Rainfall Details for Road 1C.srccx

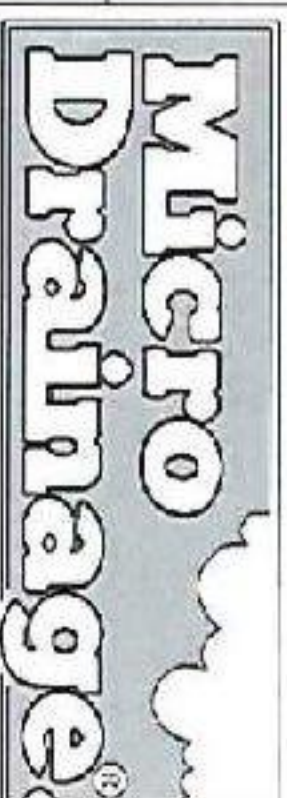
Rainfall Model		FSR	Winter Storms	Yes
Return Period (years)		100	Cv (Summer)	0.750
	Region England and Wales		Cv (Winter)	0.840
	M5-60 (mm)	19.400	Shortest Storm (mins)	15
	Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes		Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.483

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)	From: To:	(ha)
0 5	0.000	5 10	0.242	10 15	0.241

Lone Barn Studios	Horndean Road
Stanbridge Lane	Emsworth
Romsey SO51 0HE	Road 1C Porous Paving
Date March 2017	Designed by KAM
File Road 1C to Road ...	Checked by



Micro Drainage

Source Control 2013.1.1

Cascade Model Details for Road 1C.srcx

Storage is Online Cover Level (m) 9.630

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	5.0
Membrane Percolation (mm/hr)	1000	Length (m)	134.2
Max Percolation (l/s)	186.4	Slope (1:X)	1000.0
Safety Factor	5.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	8.230	Cap Volume Depth (m)	0.000

Depth/Flow Relationship Outflow Control

Invert Level (m) 8.230

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.200	5.0000	1.800	5.0000	3.400	5.0000	5.000	5.0000
0.400	5.0000	2.000	5.0000	3.600	5.0000	5.200	5.0000
0.600	5.0000	2.200	5.0000	3.800	5.0000	5.400	5.0000
0.800	5.0000	2.400	5.0000	4.000	5.0000	5.600	5.0000
1.000	5.0000	2.600	5.0000	4.200	5.0000	5.800	5.0000
1.200	5.0000	2.800	5.0000	4.400	5.0000	6.000	5.0000
1.400	5.0000	3.000	5.0000	4.600	5.0000		
1.600	5.0000	3.200	5.0000	4.800	5.0000		

Lone Barn Studios

Horndean Road

Stanbridge Lane

Emsworth

Romsey SO51 0HE

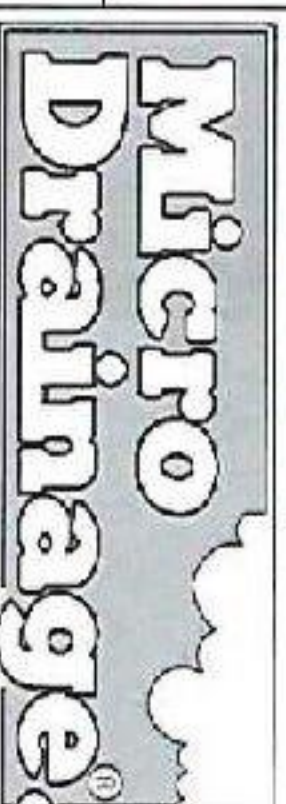
Road 1B Porous Paving

Date March 2017

Designed by KAM

File Road 1C to Road ...

Checked by



Micro Drainage

Source Control 2013.1.1

Cascade Summary of Results for Road 1B.srcc

Upstream Outflow To Overflow To
Structures

Road 1C.srcc (None) (None)

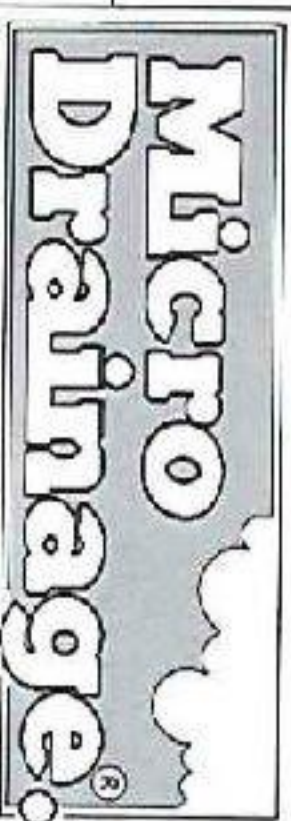
Half Drain Time : 689 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max E Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	8.430	0.330	0.0	3.3	3.3	55.2	O K
30 min Summer	8.536	0.436	0.0	3.3	3.3	77.9	O K
60 min Summer	8.655	0.555	0.0	3.3	3.3	103.4	O K
120 min Summer	8.786	0.686	0.0	3.3	3.3	131.2	O K
180 min Summer	8.864	0.764	0.0	3.3	3.3	147.9	O K
240 min Summer	8.918	0.818	0.0	3.3	3.3	159.5	O K
360 min Summer	8.997	0.897	0.0	3.3	3.3	176.5	O K
480 min Summer	9.054	0.954	0.0	3.3	3.3	188.6	O K
600 min Summer	9.096	0.996	0.0	3.3	3.3	197.6	O K
720 min Summer	9.129	1.029	0.0	3.3	3.3	204.5	O K
960 min Summer	9.174	1.074	0.0	3.3	3.3	214.3	O K
1440 min Summer	9.227	1.127	0.0	3.3	3.3	225.4	Flood Risk
2160 min Summer	9.240	1.140	0.0	3.3	3.3	228.4	Flood Risk
2880 min Summer	9.192	1.092	0.0	3.3	3.3	218.1	O K
4320 min Summer	9.093	0.993	0.0	3.3	3.3	196.9	O K
5760 min Summer	8.958	0.858	0.0	3.3	3.3	168.2	O K
7200 min Summer	8.806	0.706	0.0	3.3	3.3	135.6	O K
8640 min Summer	8.672	0.572	0.0	3.3	3.3	107.1	O K
10080 min Summer	8.560	0.460	0.0	3.3	3.3	83.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	118.408	0.0	129.3	325
30 min Summer	79.579	0.0	176.2	451
60 min Summer	51.031	0.0	227.9	592
120 min Summer	31.581	0.0	283.6	748
180 min Summer	23.468	0.0	317.0	844
240 min Summer	18.897	0.0	340.5	914
360 min Summer	13.902	0.0	376.1	1028
480 min Summer	11.169	0.0	403.1	1122
600 min Summer	9.417	0.0	425.0	1206
720 min Summer	8.187	0.0	443.4	1282
960 min Summer	6.558	0.0	473.5	1426
1440 min Summer	4.789	0.0	509.4	1690
2160 min Summer	3.489	0.0	565.2	2060
2880 min Summer	2.783	0.0	600.0	2340
4320 min Summer	2.020	0.0	650.5	2932
5760 min Summer	1.607	0.0	687.1	3584
7200 min Summer	1.346	0.0	716.1	4296
8640 min Summer	1.165	0.0	740.9	5008
10080 min Summer	1.032	0.0	762.1	5680

Tone Barn Studios
Stanbridge Lane
Romsey SO51 0HE

Horndean Road
Emsworth
Road 1B Porous Paving



Date March 2017

File Road 1C to Road ...

Designed by KAM

Checked by

Micro Drainage

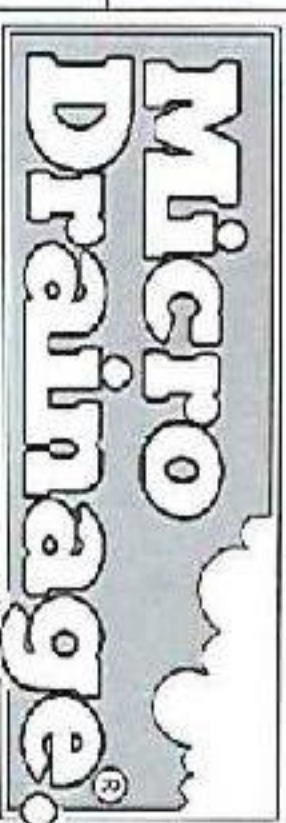
Source Control 2013.1.1

Cascade Summary of Results for Road 1B.srcx

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 Winter	0.466	0.366	0.0	3.3	3.3	63.0	O K
30 min Winter	8.585	0.485	0.0	3.3	3.3	88.5	O K
60 min Winter	8.719	0.619	0.0	3.3	3.3	116.9	O K
120 min Winter	8.863	0.763	0.0	3.3	3.3	147.8	O K
180 min Winter	8.951	0.851	0.0	3.3	3.3	166.5	O K
240 min Winter	9.011	0.911	0.0	3.3	3.3	179.5	O K
360 min Winter	9.102	1.002	0.0	3.3	3.3	198.9	O K
480 min Winter	9.169	1.069	0.0	3.3	3.3	213.1	O K
600 min Winter	9.220	1.120	0.0	3.3	3.3	224.0	Flood Risk
720 min Winter	9.261	1.161	0.0	3.3	3.3	232.7	Flood Risk
960 min Winter	9.320	1.220	0.0	3.3	3.3	245.5	Flood Risk
1440 min Winter	9.391	1.291	0.0	3.3	3.3	260.5	Flood Risk
2160 min Winter	9.443	1.343	0.0	3.3	3.3	271.6	Flood Risk
2880 min Winter	9.377	1.277	0.0	3.3	3.3	257.6	Flood Risk
4320 min Winter	9.182	1.082	0.0	3.3	3.3	216.0	O K
5760 min Winter	8.914	0.814	0.0	3.3	3.3	158.6	O K
7200 min Winter	8.680	0.580	0.0	3.3	3.3	108.7	O K
8640 min Winter	8.494	0.394	0.0	3.3	3.3	68.9	O K
10080 min Winter	8.360	0.260	0.0	3.3	3.3	40.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	118.408	0.0	145.7	360
30 min Winter	79.579	0.0	198.2	508
60 min Winter	51.031	0.0	256.1	666
120 min Winter	31.581	0.0	318.5	838
180 min Winter	23.488	0.0	356.0	944
240 min Winter	18.897	0.0	382.2	1022
360 min Winter	13.902	0.0	422.2	1144
480 min Winter	11.169	0.0	452.5	1244
600 min Winter	9.417	0.0	477.0	1328
720 min Winter	8.187	0.0	497.7	1406
960 min Winter	6.558	0.0	526.6	1548
1440 min Winter	4.789	0.0	521.6	1802
2160 min Winter	3.489	0.0	634.6	2160
2880 min Winter	2.783	0.0	673.8	2432
4320 min Winter	2.020	0.0	730.9	3024
5760 min Winter	1.607	0.0	772.5	3776
7200 min Winter	1.346	0.0	805.4	4480
8640 min Winter	1.165	0.0	833.7	5112
10080 min Winter	1.032	0.0	858.0	5656

Lone Barn Studios	Horndean Road
Stanbridge Lane	Emsworth
Romsey SO51 0HE	Road 1B Porous Paving
Date March 2017	Designed by KM
File Road 1C to Road ...	Checked by



Micro Drainage

Source Control 2013.1.1

Cascade Rainfall Details for Road 1B.srcx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region England and Wales		Cv (Winter)	0.840
M5-60 (mm)	19.400	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.131

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
From: To:		From: To:		From: To:	
0 5	0.000	5 10	0.066	10 15	0.065

Lone Barn Studios

Horndean Road

Stanbridge Lane

Emsworth

Romsey SO51 0HE

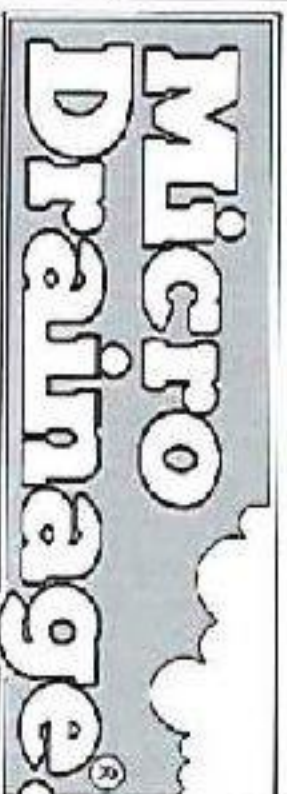
Road 1B Porous Paving

Date March 2017

Designed by KAM

File Road 1C to Road ...

Checked by



Micro Drainage

Source Control 2013.1.1

Cascade Model Details for Road 1B.srpx

Storage is Online Cover Level (m) 9.500

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	5.0
Membrane Percolation (mm/hr)	1000	Length (m)	142.4
Max Percolation (l/s)	197.8	Slope (1:X)	1000.0
Safety Factor	5.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	8.100	Cap Volume Depth (m)	0.000

Depth/Flow Relationship Outflow Control

Invert Level (m) 8.100

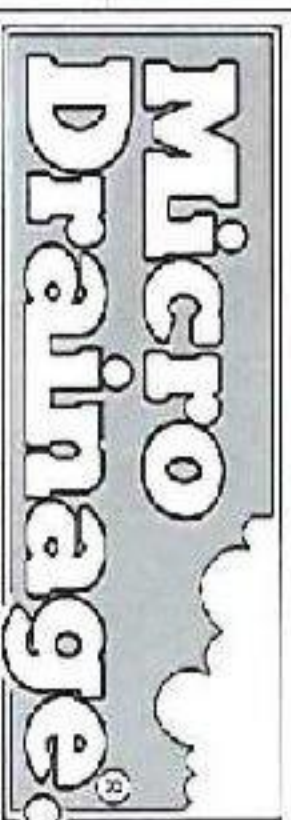
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.200	3.3000	1.800	3.3000	3.400	3.3000	5.000	3.3000
0.400	3.3000	2.000	3.3000	3.600	3.3000	5.200	3.3000
0.600	3.3000	2.200	3.3000	3.800	3.3000	5.400	3.3000
0.800	3.3000	2.400	3.3000	4.000	3.3000	5.600	3.3000
1.000	3.3000	2.600	3.3000	4.200	3.3000	5.800	3.3000
1.200	3.3000	2.800	3.3000	4.400	3.3000	6.000	3.3000
1.400	3.3000	3.000	3.3000	4.600	3.3000		
1.600	3.3000	3.200	3.3000	4.800	3.3000		

Appendix C

Road 1D - Drainage Calculations

Lone Barn Studios
 Slanbridge Lane
 Romsey SO51 0HE

Horndean Road
 Emsworth
 Road ID Porous Paving



Date March 2017

Designed by KAM

File Road ID.srcx

Checked by

Micro Drainage

Source Control 2013.1.1

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 765 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max E Outflow (l/s)	Max Volume (m ³)	Status
15 min Summer	8.846	0.456	0.0	3.0	3.0	96.3	O K
30 min Summer	8.976	0.586	0.0	3.0	3.0	129.9	O K
60 min Summer	9.109	0.719	0.0	3.0	3.0	164.7	O K
120 min Summer	9.238	0.848	0.0	3.0	3.0	198.2	O K
180 min Summer	9.300	0.910	0.0	3.0	3.0	214.5	Flood Risk
240 min Summer	9.334	0.944	0.0	3.0	3.0	223.2	Flood Risk
360 min Summer	9.368	0.978	0.0	3.0	3.0	232.2	Flood Risk
480 min Summer	9.378	0.986	0.0	3.0	3.0	234.7	Flood Risk
600 min Summer	9.373	0.983	0.0	3.0	3.0	233.5	Flood Risk
720 min Summer	9.364	0.974	0.0	3.0	3.0	230.9	Flood Risk
960 min Summer	9.342	0.952	0.0	3.0	3.0	225.2	Flood Risk
1440 min Summer	9.292	0.902	0.0	3.0	3.0	212.4	Flood Risk
2160 min Summer	9.216	0.826	0.0	3.0	3.0	192.5	O K
2880 min Summer	9.142	0.752	0.0	3.0	3.0	173.3	O K
4320 min Summer	9.006	0.616	0.0	3.0	3.0	137.7	O K
5760 min Summer	8.886	0.496	0.0	3.0	3.0	106.6	O K
7200 min Summer	8.787	0.397	0.0	3.0	3.0	80.8	O K
8640 min Summer	8.710	0.320	0.0	3.0	3.0	60.6	O K
10080 min Summer	8.651	0.261	0.0	3.0	3.0	45.2	O K
15 min Winter	8.894	0.504	0.0	3.0	3.0	108.6	O K
30 min Winter	9.040	0.650	0.0	3.0	3.0	146.6	O K
60 min Winter	9.192	0.802	0.0	3.0	3.0	186.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	118.408	0.0	99.3	29
30 min Summer	79.579	0.0	135.0	44
60 min Summer	51.031	0.0	174.3	74
120 min Summer	31.581	0.0	216.7	132
180 min Summer	23.488	0.0	242.1	190
240 min Summer	18.897	0.0	260.0	250
360 min Summer	13.902	0.0	287.1	368
480 min Summer	11.169	0.0	307.7	486
600 min Summer	9.417	0.0	324.4	596
720 min Summer	8.187	0.0	338.4	642
960 min Summer	6.558	0.0	361.4	766
1440 min Summer	4.789	0.0	395.6	1020
2160 min Summer	3.489	0.0	431.7	1432
2880 min Summer	2.783	0.0	458.3	1828
4320 min Summer	2.020	0.0	497.3	2608
5760 min Summer	1.607	0.0	525.7	3352
7200 min Summer	1.346	0.0	548.3	4048
8640 min Summer	1.165	0.0	567.7	4760
10080 min Summer	1.032	0.0	584.4	5360
15 min Winter	118.408	0.0	111.7	29
30 min Winter	79.579	0.0	151.7	43
60 min Winter	51.031	0.0	195.7	72

Lone Barn Studios

Horndean Road

Stanbridge Lane

Emsworth

Romsey SO51 0HF

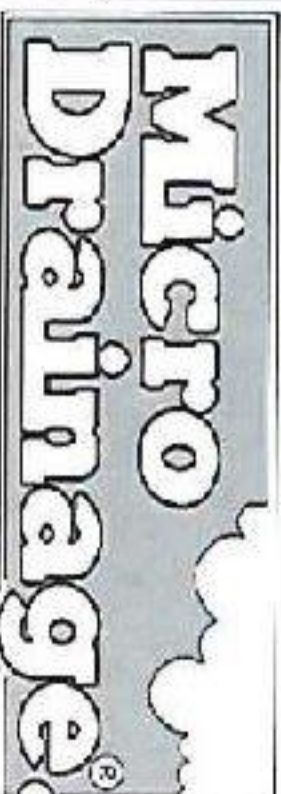
Road 1D Porous Paving

Date March 2017

Designed by KAM

File Road 1D.srcx

Checked by



Micro Drainage

Source Control 2013.1.1

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max E Outflow (l/s)	Max Volume (m ³)	Status
120 min Winter	9.340	0.950	0.0	3.0	3.0	224.7	Flood Risk
180 min Winter	9.415	1.025	0.0	3.0	3.0	244.3	Flood Risk
240 min Winter	9.457	1.067	0.0	3.0	3.0	255.2	Flood Risk
360 min Winter	9.504	1.114	0.0	3.0	3.0	267.5	Flood Risk
480 min Winter	9.524	1.134	0.0	3.0	3.0	272.6	Flood Risk
600 min Winter	9.527	1.137	0.0	3.0	3.0	273.5	Flood Risk
720 min Winter	9.520	1.130	0.0	3.0	3.0	271.8	Flood Risk
960 min Winter	9.490	1.100	0.0	3.0	3.0	263.8	Flood Risk
1440 min Winter	9.424	1.034	0.0	3.0	3.0	246.5	Flood Risk
2160 min Winter	9.312	0.922	0.0	3.0	3.0	217.5	Flood Risk
2880 min Winter	9.199	0.809	0.0	3.0	3.0	188.1	O K
4320 min Winter	8.989	0.599	0.0	3.0	3.0	133.3	O K
5760 min Winter	8.812	0.422	0.0	3.0	3.0	87.2	O K
7200 min Winter	8.677	0.287	0.0	3.0	3.0	52.2	O K
8640 min Winter	8.596	0.206	0.0	3.0	3.0	31.1	O K
10080 min Winter	8.572	0.162	0.0	2.7	2.7	24.8	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)			
120 min Winter	31.581	0.0	243.2	130			
180 min Winter	23.488	0.0	271.7	188			
240 min Winter	18.897	0.0	291.7	246			
360 min Winter	13.902	0.0	322.2	362			
480 min Winter	11.169	0.0	345.3	474			
600 min Winter	9.417	0.0	364.0	586			
720 min Winter	8.187	0.0	379.7	694			
960 min Winter	6.558	0.0	405.5	892			
1440 min Winter	4.789	0.0	443.9	1106			
2160 min Winter	3.489	0.0	484.4	1564			
2880 min Winter	2.783	0.0	514.5	1996			
4320 min Winter	2.020	0.0	558.4	2812			
5760 min Winter	1.607	0.0	590.6	3520			
7200 min Winter	1.346	0.0	616.2	4176			
8640 min Winter	1.165	0.0	638.2	4664			
10080 min Winter	1.032	0.0	657.2	5256			

Lone Barn Studios

Horndean Road

Stanbridge Lane

Emsworth

Romsey SO51 0HE

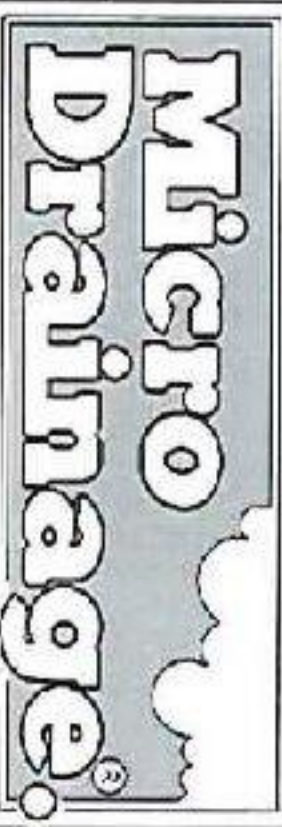
Road 1D Porous Paving

Date March 2017

Designed by KAM

File Road 1D.srxx

Checked by



Micro Drainage

Source Control 2013.1.1

Rainfall Details

Rainfall Model	ESR	Winter Storms
Return Period (years)	100	Cv (Summer) 0.750
Region England and Wales		Cv (Winter) 0.840
M5-60 (mm)	19.400	Shortest Storm (mins) 15
Ratio R	0.350	Longest Storm (mins) 10080
Summer Storms	Yes	Climate Change % +30

Time Area Diagram

Total Area (ha) 0.467

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
From: To:	From: To:	From: To:	From: To:	From: To:	From: To:
0	5	0.000	5	10	0.233
				10	15
					0.234

Lone Barn Studios

Horndean Road

Stanbridge Lane

Emsworth

Romsey SO51 0HE

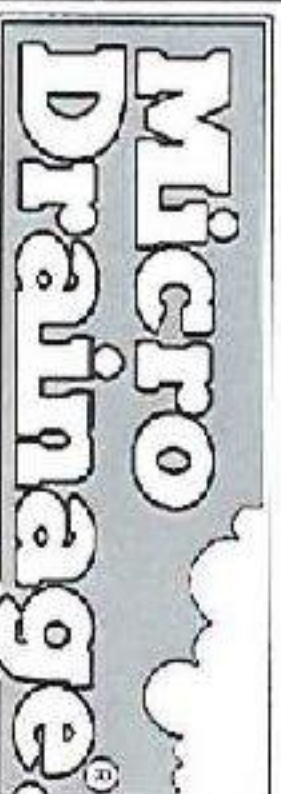
Road 1D Porous Paving

Date March 2017

Designed by KAM

File Road 1D.srcx

Checked by



Micro Drainage

Source Control 2013.1.1

Model Details

Storage is Online Cover Level (m) 9.590

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	5.0
Membrane Percolation (mm/hr)	1000	Length (m)	173.6
Max Percolation (l/s)	241.1	Slope (1:X)	1000.0
Safety Factor	5.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	8.390	Cap Volume Depth (m)	0.000

Depth/Flow Relationship Outflow Control

Invert Level (m) 8.390

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.200	3.0000	1.800	3.0000	3.400	3.0000	5.000	3.0000
0.400	3.0000	2.000	3.0000	3.600	3.0000	5.200	3.0000
0.600	3.0000	2.200	3.0000	3.800	3.0000	5.400	3.0000
0.800	3.0000	2.400	3.0000	4.000	3.0000	5.600	3.0000
1.000	3.0000	2.600	3.0000	4.200	3.0000	5.800	3.0000
1.200	3.0000	2.800	3.0000	4.400	3.0000	6.000	3.0000
1.400	3.0000	3.000	3.0000	4.600	3.0000		
1.600	3.0000	3.200	3.0000	4.800	3.0000		