



Mr Malcolm Daines-Smith
MDS Design Associates
1 Swan Grove
Exning
Suffolk
CB8 7HX

Our Ref: 341/2021/02/DSH - Please quote in all correspondence.

14 June 2022,

Dear Mr Daines-Smith,

Re: Proposed 5no Dwellings and Associated Works at 165 The Street Kirtling, Cambridgeshire.
Planning Appeal Reference No. APP/V0510/W/20/3261587.
Planning Condition Ref No.9 (Foul and Surface Water Drainage).

Thank you for your request to prepare a report and design drawings to address Planning Condition 9 of the aforementioned Allowed Planning Appeal which overturned original Planning Application No. 19/01386/FUL. Please find attached to this report enclosures supporting the design for the planning condition which is addressed below and wording reproduced in italics:

Planning Condition 9 – Foul and Surface Water Drainage.

Development shall not progress above slab level until details of a scheme for the disposal of foul water and a scheme for the disposal of surface water shall have been submitted to and approved in writing by the Local Planning Authority. The approved schemes shall be implemented in accordance with the approved details prior to the occupation of any part of the development.

Please find attached GHB Drawing No. 341-2021-02-P2 (Appendix A), which provides the design details of the proposed foul and surface water drainage at the above site in accordance with PC9. Furthermore, please find below a summary of all the important points in this regard.

Foul Drainage:

Appendix A provides the design details of the proposed foul water drainage at the above site. The proposal is to drain the flows from the new dwellings by gravity to the nearest available public sewer via an existing manhole located within the site, which will be rebuilt.

All new pipework will be constructed in accordance with the Building Regulations. A Section 106 foul drainage connection application to Anglian Water (drainage authority) will be required prior to the connection being made.

Cont.....

Surface Water Drainage:

The site has been proven, by initial soakage testing, to be underlain with soils which are not free draining. As a result, it can be concluded that infiltration solutions, namely trench soakaways and permeable pavings are not viable across the site.

A local piped watercourse is present along the north-west highway boundary of the site and the Developer has riparian rights to connect their surface water to this watercourse. Likewise, a ditch is present along the north-east boundary and within their land ownership and thus, riparian rights also exist. Therefore, it is proposed to spit the sites outfalls, attenuating the site's impermeable roof and hardstanding areas a controlled rate of discharge, set at 1.0 l/s or 2.0 l/s, depending upon catchment size (see below summary), all for the worst-case AEP 1% +40% storm event. There will be 4No. zone outfalls in total with a total combined outfall rate of 5.0l/s not being exceeded.

It is proposed that attenuation will be provided in the form of either cellular storage crates beneath the private driveway areas or porous pavings with open sub base, or both where site levels permit. The four zones are split apart as shown in Appendix A. The attenuation will be tanked using an impermeable membrane, apart from on the main access road which will be formed with a conventional porous asphalt. Orifice 'Contraflow' flow control chambers with various diameters are proposed to control flows to 1.0 and 2.0 l/s as below. Calculations are attached in Appendix B to show that all attenuation storage provided is adequate for the various flow controls for each zone.

A summary of the attenuations for each zone are as follows:

- Zone 1 – Plots 3-5 and Drives
 - **Max discharge rate – 2.0l/s**
 - 40m² at 0.42m deep 'Rainbloc' cellular system, and
 - 480m² of min. 400mm deep Sub Base Porous Paving
 - CL: 99.40m, IL: 98.38m, Orifice Diameter 33mm.
- Zone 2 – Plot 2 and Drive
 - **Max discharge rate – 1.0l/s**
 - 160m² of min. 650mm deep Sub Base Porous Paving
 - CL: 98.70m, IL: 97.90m, Orifice Diameter 24mm.
- Zone 3 – Plot 1 and Drives
 - **Max discharge rate – 1.0l/s**
 - 34m² at 0.42m deep 'Rainbloc' cellular system
 - CL: 97.92m, IL: 96.90m, Orifice Diameter 28mm.
- Zone 4 – Main Access Road
 - **Max discharge rate – 1.0l/s**
 - 300m² of min. 600mm deep Sub Base Porous Paving
 - CL: 98.20m, IL: 97.40m, Orifice Diameter 23mm.

- Combined Max discharge rate – 5.0l/s

The attached calculations show that no flooding or surcharge will occur for the aforementioned worst-case storm event. Impermeable areas are also shown in Appendix A and a 10% allowance for creep is applied to the residential plot roof areas.

Cont.....

I trust the information provided above is adequate to satisfy the requirements of the Local Planning Authority and their consultees in regards to Planning Condition 9. I have no objection to any queries being directed back to me as necessary.

Kind regards

Yours sincerely



Dan Henning
For and on behalf of G H Bullard & Associates LLP

Enc.

List of Appendices

- Appendix A -** Proposed Foul & SW Drainage Plan Layout Drawing
- Appendix B -** Micro-Drainage Design Calculations

APPENDIX A

Proposed Foul & SW Drainage Plan Drawing

APPENDIX B

Micro-Drainage Design Calculations

27 Barton Road Thurston
 Bury St Edmunds
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Micro Drainage Source Control 2018.1.1

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

Half Drain Time : 256 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	98.985	0.605	0.0	1.7	1.7	28.6	O K
30 min Summer	99.044	0.664	0.0	1.8	1.8	37.0	O K
60 min Summer	99.095	0.715	0.0	1.9	1.9	44.4	O K
120 min Summer	99.130	0.750	0.0	1.9	1.9	49.4	O K
180 min Summer	99.136	0.756	0.0	2.0	2.0	50.3	O K
240 min Summer	99.133	0.753	0.0	2.0	2.0	49.9	O K
360 min Summer	99.125	0.745	0.0	1.9	1.9	48.7	O K
480 min Summer	99.115	0.735	0.0	1.9	1.9	47.3	O K
600 min Summer	99.103	0.723	0.0	1.9	1.9	45.6	O K
720 min Summer	99.091	0.711	0.0	1.9	1.9	43.9	O K
960 min Summer	99.067	0.687	0.0	1.9	1.9	40.3	O K
1440 min Summer	99.022	0.642	0.0	1.8	1.8	34.0	O K
2160 min Summer	98.967	0.587	0.0	1.7	1.7	26.3	O K
2880 min Summer	98.916	0.536	0.0	1.6	1.6	20.9	O K
4320 min Summer	98.769	0.389	0.0	1.4	1.4	14.8	O K
5760 min Summer	98.671	0.291	0.0	1.2	1.2	11.0	O K
7200 min Summer	98.607	0.227	0.0	1.0	1.0	8.6	O K
8640 min Summer	98.562	0.182	0.0	0.9	0.9	6.9	O K
10080 min Summer	98.532	0.152	0.0	0.8	0.8	5.8	O K
15 min Winter	99.011	0.631	0.0	1.8	1.8	32.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	147.659	0.0	29.6	18
30 min Summer	95.740	0.0	39.1	33
60 min Summer	59.033	0.0	48.9	62
120 min Summer	35.144	0.0	58.6	122
180 min Summer	25.604	0.0	64.2	180
240 min Summer	20.334	0.0	68.1	208
360 min Summer	14.690	0.0	73.9	268
480 min Summer	11.655	0.0	78.2	334
600 min Summer	9.733	0.0	81.6	404
720 min Summer	8.397	0.0	84.5	470
960 min Summer	6.647	0.0	89.1	606
1440 min Summer	4.776	0.0	95.8	866
2160 min Summer	3.426	0.0	102.7	1236
2880 min Summer	2.704	0.0	107.6	1588
4320 min Summer	1.935	0.0	114.5	2296
5760 min Summer	1.525	0.0	119.2	3048
7200 min Summer	1.267	0.0	122.7	3744
8640 min Summer	1.089	0.0	125.3	4416
10080 min Summer	0.957	0.0	127.4	5152
15 min Winter	147.659	0.0	33.5	18

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max E Outflow (l/s)	Max Volume (m ³)	Status
30 min Winter	99.078	0.698	0.0	1.9	1.9	41.9	O K
60 min Winter	99.137	0.757	0.0	2.0	2.0	50.4	O K
120 min Winter	99.179	0.799	0.0	2.0	2.0	56.5	O K
180 min Winter	99.189	0.809	0.0	2.0	2.0	57.9	O K
240 min Winter	99.186	0.806	0.0	2.0	2.0	57.5	O K
360 min Winter	99.173	0.793	0.0	2.0	2.0	55.7	O K
480 min Winter	99.159	0.779	0.0	2.0	2.0	53.6	O K
600 min Winter	99.142	0.762	0.0	2.0	2.0	51.2	O K
720 min Winter	99.125	0.745	0.0	1.9	1.9	48.7	O K
960 min Winter	99.089	0.709	0.0	1.9	1.9	43.6	O K
1440 min Winter	99.025	0.645	0.0	1.8	1.8	34.3	O K
2160 min Winter	98.946	0.566	0.0	1.7	1.7	23.8	O K
2880 min Winter	98.863	0.483	0.0	1.6	1.6	17.5	O K
4320 min Winter	98.674	0.294	0.0	1.2	1.2	11.2	O K
5760 min Winter	98.582	0.202	0.0	1.0	1.0	7.7	O K
7200 min Winter	98.529	0.149	0.0	0.8	0.8	5.7	O K
8640 min Winter	98.496	0.116	0.0	0.7	0.7	4.4	O K
10080 min Winter	98.474	0.094	0.0	0.6	0.6	3.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
30 min Winter	95.740	0.0	44.1	33
60 min Winter	59.033	0.0	55.0	62
120 min Winter	35.144	0.0	65.9	118
180 min Winter	25.604	0.0	72.2	174
240 min Winter	20.334	0.0	76.6	228
360 min Winter	14.690	0.0	83.1	284
480 min Winter	11.655	0.0	87.9	362
600 min Winter	9.733	0.0	91.8	438
720 min Winter	8.397	0.0	95.0	512
960 min Winter	6.647	0.0	100.2	656
1440 min Winter	4.776	0.0	107.8	924
2160 min Winter	3.426	0.0	115.6	1296
2880 min Winter	2.704	0.0	121.2	1640
4320 min Winter	1.935	0.0	129.0	2376
5760 min Winter	1.525	0.0	134.5	3056
7200 min Winter	1.267	0.0	138.6	3752
8640 min Winter	1.089	0.0	141.8	4488
10080 min Winter	0.957	0.0	144.3	5152

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.800	Shortest Storm (mins)	15
Ratio R	0.428	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.116

Time (mins)	Area
From:	To: (ha)
0	4 0.116

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Micro Drainage Source Control 2018.1.1

Model Details

Storage is Online Cover Level (m) 99.400

Complex Structure

Cellular Storage

Invert Level (m) 98.380 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	40.0	0.0	0.421	0.0	0.0
0.420	40.0	0.0			

Porous Car Park

Infiltration Coefficient Base (m/hr) 0.00000	Width (m) 27.4
Membrane Percolation (mm/hr) 1000	Length (m) 17.5
Max Percolation (1/s) 133.2	Slope (1:X) 90.0
Safety Factor 2.0	Depression Storage (mm) 5
Porosity 0.30	Evaporation (mm/day) 3
Invert Level (m) 98.800	Cap Volume Depth (m) 0.400

Orifice Outflow Control

Diameter (m) 0.033 Discharge Coefficient 0.600 Invert Level (m) 98.380

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

Half Drain Time : 161 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	98.381	0.481	0.0	0.8	0.8	8.9	O K
30 min Summer	98.444	0.544	0.0	0.9	0.9	11.3	O K
60 min Summer	98.488	0.588	0.0	0.9	0.9	13.3	O K
120 min Summer	98.504	0.604	0.0	0.9	0.9	14.0	O K
180 min Summer	98.501	0.601	0.0	0.9	0.9	13.9	O K
240 min Summer	98.493	0.593	0.0	0.9	0.9	13.5	O K
360 min Summer	98.474	0.574	0.0	0.9	0.9	12.7	O K
480 min Summer	98.454	0.554	0.0	0.9	0.9	11.8	O K
600 min Summer	98.435	0.535	0.0	0.9	0.9	11.0	O K
720 min Summer	98.416	0.516	0.0	0.9	0.9	10.2	O K
960 min Summer	98.380	0.480	0.0	0.8	0.8	8.9	O K
1440 min Summer	98.317	0.417	0.0	0.8	0.8	6.7	O K
2160 min Summer	98.240	0.340	0.0	0.7	0.7	4.4	O K
2880 min Summer	98.180	0.280	0.0	0.6	0.6	3.0	O K
4320 min Summer	98.096	0.196	0.0	0.5	0.5	1.5	O K
5760 min Summer	98.043	0.143	0.0	0.4	0.4	0.8	O K
7200 min Summer	98.008	0.108	0.0	0.4	0.4	0.4	O K
8640 min Summer	97.984	0.084	0.0	0.3	0.3	0.3	O K
10080 min Summer	97.968	0.068	0.0	0.3	0.3	0.2	O K
15 min Winter	98.412	0.512	0.0	0.9	0.9	10.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	147.659	0.0	9.4	18
30 min Summer	95.740	0.0	12.5	33
60 min Summer	59.033	0.0	15.6	62
120 min Summer	35.144	0.0	18.7	116
180 min Summer	25.604	0.0	20.5	144
240 min Summer	20.334	0.0	21.7	176
360 min Summer	14.690	0.0	23.5	244
480 min Summer	11.655	0.0	24.9	312
600 min Summer	9.733	0.0	26.0	380
720 min Summer	8.397	0.0	26.9	448
960 min Summer	6.647	0.0	28.4	578
1440 min Summer	4.776	0.0	30.5	826
2160 min Summer	3.426	0.0	32.7	1188
2880 min Summer	2.704	0.0	34.3	1532
4320 min Summer	1.935	0.0	36.4	2248
5760 min Summer	1.525	0.0	37.9	2944
7200 min Summer	1.267	0.0	39.0	3672
8640 min Summer	1.089	0.0	39.8	4400
10080 min Summer	0.957	0.0	40.5	5072
15 min Winter	147.659	0.0	10.7	18

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	98.480	0.580	0.0	0.9	0.9	12.9	O K
60 min Winter	98.528	0.628	0.0	0.9	0.9	15.2	O K
120 min Winter	98.551	0.651	0.0	1.0	1.0	16.3	O K
180 min Winter	98.546	0.646	0.0	1.0	1.0	16.0	O K
240 min Winter	98.536	0.636	0.0	0.9	0.9	15.5	O K
360 min Winter	98.512	0.612	0.0	0.9	0.9	14.4	O K
480 min Winter	98.486	0.586	0.0	0.9	0.9	13.2	O K
600 min Winter	98.458	0.558	0.0	0.9	0.9	12.0	O K
720 min Winter	98.432	0.532	0.0	0.9	0.9	10.9	O K
960 min Winter	98.382	0.482	0.0	0.8	0.8	8.9	O K
1440 min Winter	98.293	0.393	0.0	0.7	0.7	5.9	O K
2160 min Winter	98.190	0.290	0.0	0.6	0.6	3.2	O K
2880 min Winter	98.116	0.216	0.0	0.5	0.5	1.8	O K
4320 min Winter	98.029	0.129	0.0	0.4	0.4	0.6	O K
5760 min Winter	97.986	0.086	0.0	0.3	0.3	0.3	O K
7200 min Winter	97.963	0.063	0.0	0.3	0.3	0.2	O K
8640 min Winter	97.949	0.049	0.0	0.2	0.2	0.1	O K
10080 min Winter	97.941	0.041	0.0	0.2	0.2	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	95.740	0.0	14.1	32
60 min Winter	59.033	0.0	17.5	60
120 min Winter	35.144	0.0	21.0	116
180 min Winter	25.604	0.0	23.0	166
240 min Winter	20.334	0.0	24.4	188
360 min Winter	14.690	0.0	26.5	264
480 min Winter	11.655	0.0	28.0	338
600 min Winter	9.733	0.0	29.3	410
720 min Winter	8.397	0.0	30.3	480
960 min Winter	6.647	0.0	31.9	616
1440 min Winter	4.776	0.0	34.3	866
2160 min Winter	3.426	0.0	36.8	1216
2880 min Winter	2.704	0.0	38.6	1556
4320 min Winter	1.935	0.0	41.1	2244
5760 min Winter	1.525	0.0	42.8	2936
7200 min Winter	1.267	0.0	44.1	3672
8640 min Winter	1.089	0.0	45.1	4400
10080 min Winter	0.957	0.0	45.9	5104

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.800	Shortest Storm (mins)	15
Ratio R	0.428	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.037

Time (mins)	Area
From:	To: (ha)
0	4 0.037

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Micro Drainage	Source Control 2018.1.1	

Model Details

Storage is Online Cover Level (m) 98.700

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	8.0
Membrane Percolation (mm/hr)	1000	Length (m)	20.0
Max Percolation (l/s)	44.4	Slope (1:X)	32.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	97.900	Cap Volume Depth (m)	0.650

Orifice Outflow Control

Diameter (m) 0.024 Discharge Coefficient 0.600 Invert Level (m) 97.900

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Micro Drainage Source Control 2018.1.1

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

Half Drain Time : 131 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	97.142	0.242	0.0	0.8	0.8	7.8	O K
30 min Summer	97.202	0.302	0.0	0.9	0.9	9.8	O K
60 min Summer	97.246	0.346	0.0	0.9	0.9	11.2	O K
120 min Summer	97.260	0.360	0.0	1.0	1.0	11.6	O K
180 min Summer	97.258	0.358	0.0	1.0	1.0	11.6	O K
240 min Summer	97.250	0.350	0.0	0.9	0.9	11.3	O K
360 min Summer	97.231	0.331	0.0	0.9	0.9	10.7	O K
480 min Summer	97.210	0.310	0.0	0.9	0.9	10.0	O K
600 min Summer	97.191	0.291	0.0	0.9	0.9	9.4	O K
720 min Summer	97.172	0.272	0.0	0.8	0.8	8.8	O K
960 min Summer	97.141	0.241	0.0	0.8	0.8	7.8	O K
1440 min Summer	97.093	0.193	0.0	0.7	0.7	6.2	O K
2160 min Summer	97.045	0.145	0.0	0.6	0.6	4.7	O K
2880 min Summer	97.014	0.114	0.0	0.5	0.5	3.7	O K
4320 min Summer	96.978	0.078	0.0	0.4	0.4	2.5	O K
5760 min Summer	96.959	0.059	0.0	0.3	0.3	1.9	O K
7200 min Summer	96.947	0.047	0.0	0.3	0.3	1.5	O K
8640 min Summer	96.940	0.040	0.0	0.3	0.3	1.3	O K
10080 min Summer	96.937	0.037	0.0	0.2	0.2	1.2	O K
15 min Winter	97.172	0.272	0.0	0.8	0.8	8.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	147.659	0.0	8.3	18
30 min Summer	95.740	0.0	10.7	32
60 min Summer	59.033	0.0	13.3	60
120 min Summer	35.144	0.0	15.8	100
180 min Summer	25.604	0.0	17.3	132
240 min Summer	20.334	0.0	18.3	166
360 min Summer	14.690	0.0	19.8	234
480 min Summer	11.655	0.0	21.0	302
600 min Summer	9.733	0.0	21.9	368
720 min Summer	8.397	0.0	22.6	434
960 min Summer	6.647	0.0	23.9	566
1440 min Summer	4.776	0.0	25.7	810
2160 min Summer	3.426	0.0	27.7	1172
2880 min Summer	2.704	0.0	29.2	1532
4320 min Summer	1.935	0.0	31.3	2248
5760 min Summer	1.525	0.0	32.9	2944
7200 min Summer	1.267	0.0	34.2	3672
8640 min Summer	1.089	0.0	35.3	4400
10080 min Summer	0.957	0.0	36.2	5136
15 min Winter	147.659	0.0	9.3	18

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max E Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	97.241	0.341	0.0	0.9	0.9	11.0	OK
60 min Winter	97.292	0.392	0.0	1.0	1.0	12.7	OK
120 min Winter	97.310	0.410	0.0	1.0	1.0	13.2	OK
180 min Winter	97.304	0.404	0.0	1.0	1.0	13.1	OK
240 min Winter	97.292	0.392	0.0	1.0	1.0	12.7	OK
360 min Winter	97.263	0.363	0.0	1.0	1.0	11.7	OK
480 min Winter	97.233	0.333	0.0	0.9	0.9	10.7	OK
600 min Winter	97.205	0.305	0.0	0.9	0.9	9.8	OK
720 min Winter	97.179	0.279	0.0	0.8	0.8	9.0	OK
960 min Winter	97.136	0.236	0.0	0.8	0.8	7.6	OK
1440 min Winter	97.074	0.174	0.0	0.7	0.7	5.6	OK
2160 min Winter	97.019	0.119	0.0	0.5	0.5	3.8	OK
2880 min Winter	96.987	0.087	0.0	0.4	0.4	2.8	OK
4320 min Winter	96.955	0.055	0.0	0.3	0.3	1.8	OK
5760 min Winter	96.941	0.041	0.0	0.3	0.3	1.3	OK
7200 min Winter	96.936	0.036	0.0	0.2	0.2	1.1	OK
8640 min Winter	96.932	0.032	0.0	0.2	0.2	1.0	OK
10080 min Winter	96.930	0.030	0.0	0.2	0.2	1.0	OK

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	95.740	0.0	12.0	32
60 min Winter	59.033	0.0	14.9	60
120 min Winter	35.144	0.0	17.7	112
180 min Winter	25.604	0.0	19.3	140
240 min Winter	20.334	0.0	20.5	178
360 min Winter	14.690	0.0	22.2	252
480 min Winter	11.655	0.0	23.5	324
600 min Winter	9.733	0.0	24.5	394
720 min Winter	8.397	0.0	25.4	462
960 min Winter	6.647	0.0	26.8	596
1440 min Winter	4.776	0.0	28.8	850
2160 min Winter	3.426	0.0	31.1	1212
2880 min Winter	2.704	0.0	32.7	1560
4320 min Winter	1.935	0.0	35.1	2252
5760 min Winter	1.525	0.0	36.9	2944
7200 min Winter	1.267	0.0	38.3	3640
8640 min Winter	1.089	0.0	39.5	4328
10080 min Winter	0.957	0.0	40.5	5128

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.800	Shortest Storm (mins)	15
Ratio R	0.428	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.030

Time (mins)		Area
From:	To:	(ha)
0	4	0.030

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Model Details

Storage is Online Cover Level (m) 98.000

Cellular Storage Structure

Invert Level (m) 96.900 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	34.0	0.0	0.421	0.0	0.0
0.420	34.0	0.0			

Orifice Outflow Control

Diameter (m) 0.028 Discharge Coefficient 0.600 Invert Level (m) 96.900

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

Half Drain Time : 177 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Outflow (l/s)	Max Volume (m ³)	Status
15 min Summer	97.898	0.498	0.1	0.8	0.8	9.3	O K
30 min Summer	97.969	0.569	0.1	0.8	0.9	12.1	O K
60 min Summer	98.020	0.620	0.1	0.9	0.9	14.4	O K
120 min Summer	98.044	0.644	0.1	0.9	1.0	15.5	O K
180 min Summer	98.042	0.642	0.1	0.9	1.0	15.4	O K
240 min Summer	98.036	0.636	0.1	0.9	1.0	15.2	O K
360 min Summer	98.020	0.620	0.1	0.9	0.9	14.4	O K
480 min Summer	98.002	0.602	0.1	0.8	0.9	13.6	O K
600 min Summer	97.983	0.583	0.1	0.8	0.9	12.8	O K
720 min Summer	97.964	0.564	0.1	0.8	0.9	11.9	O K
960 min Summer	97.929	0.529	0.1	0.8	0.9	10.5	O K
1440 min Summer	97.865	0.465	0.1	0.7	0.8	8.1	O K
2160 min Summer	97.786	0.386	0.0	0.7	0.7	5.6	O K
2880 min Summer	97.724	0.324	0.0	0.6	0.7	3.9	O K
4320 min Summer	97.633	0.233	0.0	0.5	0.5	2.0	O K
5760 min Summer	97.574	0.174	0.0	0.4	0.5	1.1	O K
7200 min Summer	97.534	0.134	0.0	0.4	0.4	0.7	O K
8640 min Summer	97.505	0.105	0.0	0.3	0.4	0.4	O K
10080 min Summer	97.485	0.085	0.0	0.3	0.3	0.3	O K
15 min Winter	97.933	0.533	0.1	0.8	0.9	10.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	147.659	0.0	9.8	18
30 min Summer	95.740	0.0	13.2	33
60 min Summer	59.033	0.0	16.6	62
120 min Summer	35.144	0.0	20.0	120
180 min Summer	25.604	0.0	22.0	148
240 min Summer	20.334	0.0	23.4	180
360 min Summer	14.690	0.0	25.4	246
480 min Summer	11.655	0.0	26.9	314
600 min Summer	9.733	0.0	28.1	382
720 min Summer	8.397	0.0	29.0	450
960 min Summer	6.647	0.0	30.6	580
1440 min Summer	4.776	0.0	32.8	836
2160 min Summer	3.426	0.0	35.1	1192
2880 min Summer	2.704	0.0	36.6	1556
4320 min Summer	1.935	0.0	38.6	2248
5760 min Summer	1.525	0.0	39.9	2944
7200 min Summer	1.267	0.0	40.8	3672
8640 min Summer	1.089	0.0	41.3	4400
10080 min Summer	0.957	0.0	41.7	5136
15 min Winter	147.659	0.0	11.2	18

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max E Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	98.008	0.608	0.1	0.9	0.9	13.9	OK
60 min Winter	98.065	0.665	0.1	0.9	1.0	16.5	OK
120 min Winter	98.097	0.697	0.1	0.9	1.0	18.0	OK
180 min Winter	98.095	0.695	0.1	0.9	1.0	17.9	OK
240 min Winter	98.085	0.685	0.1	0.9	1.0	17.4	OK
360 min Winter	98.063	0.663	0.1	0.9	1.0	16.4	OK
480 min Winter	98.038	0.638	0.1	0.9	1.0	15.2	OK
600 min Winter	98.011	0.611	0.1	0.9	0.9	14.0	OK
720 min Winter	97.985	0.585	0.1	0.8	0.9	12.8	OK
960 min Winter	97.935	0.535	0.1	0.8	0.9	10.7	OK
1440 min Winter	97.846	0.446	0.1	0.7	0.8	7.5	OK
2160 min Winter	97.740	0.340	0.0	0.6	0.7	4.3	OK
2880 min Winter	97.660	0.260	0.0	0.6	0.6	2.5	OK
4320 min Winter	97.560	0.160	0.0	0.4	0.4	1.0	OK
5760 min Winter	97.508	0.108	0.0	0.3	0.4	0.4	OK
7200 min Winter	97.479	0.079	0.0	0.3	0.3	0.2	OK
8640 min Winter	97.461	0.061	0.0	0.2	0.3	0.1	OK
10080 min Winter	97.450	0.050	0.0	0.2	0.2	0.1	OK

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	95.740	0.0	15.0	32
60 min Winter	59.033	0.0	18.8	60
120 min Winter	35.144	0.0	22.6	116
180 min Winter	25.604	0.0	24.8	168
240 min Winter	20.334	0.0	26.4	190
360 min Winter	14.690	0.0	28.6	266
480 min Winter	11.655	0.0	30.3	342
600 min Winter	9.733	0.0	31.6	416
720 min Winter	8.397	0.0	32.8	484
960 min Winter	6.647	0.0	34.5	624
1440 min Winter	4.776	0.0	37.1	880
2160 min Winter	3.426	0.0	39.6	1236
2880 min Winter	2.704	0.0	41.4	1584
4320 min Winter	1.935	0.0	43.8	2248
5760 min Winter	1.525	0.0	45.4	2944
7200 min Winter	1.267	0.0	46.4	3640
8640 min Winter	1.089	0.0	47.2	4376
10080 min Winter	0.957	0.0	47.7	5128

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.800	Shortest Storm (mins)	15
Ratio R	0.428	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.041

Time (mins)	Area
From:	To: (ha)
0	4 0.041

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Model Details

Storage is Online Cover Level (m) 98.200

Porous Car Park Structure

Infiltration Coefficient Base (m/hr) 0.00360	Width (m) 5.0	
Membrane Percolation (mm/hr) 1000	Length (m) 60.0	
Max Percolation (l/s) 83.3	Slope (1:X) 50.0	
Safety Factor 2.0	Depression Storage (mm) 5	
Porosity 0.30	Evaporation (mm/day) 3	
Invert Level (m) 97.400	Cap Volume Depth (m) 0.600	

Orifice Outflow Control

Diameter (m) 0.023 Discharge Coefficient 0.600 Invert Level (m) 97.400