PEARS BUILDING, ROYAL FREE HOSPITAL, LONDON

Surface Water Discharge & Attenuation Calculations

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1 Introduction

The purpose of this report is to establish the pre development surface water run-off rates from an existing site, to determine the require restricted surface water run-off rates to achieve a 50% betterment of the pre development rates, assuming 30% increase for climate change, and to establish the associated attenuation volumes when restricting the post development surface water run-off.

The pre and post development areas of the site are as follows:

Overall Site Area	=	4000m² / 0.400 ha
Existing Impermeable Area	=	1100m² / 0.110 ha
Existing Permeable Area	=	1285m² / 0.129 ha
Existing 'green' area of structure	=	1610m² / 0.161 ha
Proposed Impermeable Area	=	4000m² / 0.400 ha
Proposed Permeable Area	=	0m²

Note for the purpose of this report and to be conservative, the proposed green / brown roofs have been ignored to be conservative.

2 Pre-development Surface Water Run-off Rates

In order to determine what the post development surface water run-off rates are to be, in order for the 50% betterment to be achieved, the existing / pre development surface water run-off rates are to be calculated.

The existing / pre development impermeable area is 0.11ha which is assumed to be positively drained to the local sewer network. There is also a 'green' area of 0.161 ha over a basement structure which is also assumed to drains to the local sewer network. This area is deemed to be the equivalent of a green roof.

The variables to calculate the pre development surface water run-off rates have been taken from the Flood Studies Report (FSR) and Wallingford Procedure, and have been checked against XP Solution WinDes computer software via a 'mock' drainage network (refer Appendix A).

The variables used to calculate the surface water run-off rates for the pre development site are as follows:

Existing Impermeable Area	=	0.110 ha
Existing Green Roof Area	=	0.161 ha
M5 – 60 (mm)	=	20.600
Ratio R	=	0.437
Cv (Summer)	=	0.750
Cv (Winter)	=	0.840
Time of Entry	=	5 minutes
Climate Change	=	0

Based on the above variables and computer software results, the pre development surface water run-off rates will be as follows:

Q1	=	16 l/s

Q30	=	39 l/s
Q100	=	51 l/s

3 Post-development Surface Water Run-off Rates & Volumes – No Restrictions

In order to determine the impact of the development in terms of surface water run-off rates, the proposed / post development surface water run-off rates are to be calculated with no restrictions.

As stated above, the proposed / post development impermeable will over the entire site of 0.400 ha, with the two areas being 0.139 ha and 0.261 ha.

The variables to calculate the post development surface water run-off rates have also been taken from the Flood Studies Report (FSR) and Wallingford Procedure, have also been checked against XP Solution WinDes computer software via a 'mock' drainage network (refer to Appendix B)

The variables used to calculate the surface water run-off rates for the post development site are as follows:

Proposed Impermeable Area 1	=	0.139 ha
Proposed Impermeable Area 2	=	0.261 ha
M5 – 60 (mm)	=	20.600
Ratio R	=	0.437
Cv (Summer)	=	0.750
Cv (Winter)	=	0.840
Time of Entry	=	5 minutes
Climate Change	=	30%*

Based on the above variables and computer software results, the post development surface water run-off rates will be as follows:

Q1	=	59 l/s
Q30	=	141 l/s
Q100 + CC	=	231 l/s

4 Required Surface Attenuation Volumes – 50% Betterment

It is proposed to restrict the post development run-off rates to 50% betterment of the pre development surface water run-off rate.

In order to ensure that the 50% betterment is achieved, the proposed / post development surface water run-off is to be restricted to 50% of the existing / pre development peak 1 in 1-year rate of 16 l/s. Therefore, the maximum surface water discharge rate from the proposed / post development site is to be 8 l/s.

It is proposed to have below and above ground structures to store the attenuated water when being restricted to the desired rate of 8 l/s. The surface water catchment area that will be associated with the below ground attenuation will be 'Area 1' with an area of 1390m^2 (0.139 ha) and the surface water catchment area that will be associated with the above ground attenuation will be 'Area 2' with an area of 2610m^2 (0.261 ha).

In order to minimise ground excavation, it is proposed to maximise the above ground attenuation volume, and therefore reducing the surface water run-off rate to as low as possible for the surface water catchment of Area 2 – 0.261ha.

The minimum restricted rate (to minimise blockage) is 3.5 l/s with an orifice size of 75mm. This therefore means that the restricted discharge rate for the two areas will be as follows:

Area 1	-	0.139 ha	-	4.5 l/s	-	Below Ground
Area 2	-	0.261 ha	-	3.5 l/s	-	Above Ground

The required attenuation volumes when restricting the surface water to the above rates have been calculated via the XP Solutions software, using the variables and data set out in Sections 2 and 3 (refer to Appendix C).

The WinDes output file indicates the maximum volume of attenuation required (highlighted in red), which is the equivalent required attenuation volume.

Area 1

The summary of the required attenuation volumes for each of the storm event for 'Area 1' (area of 0.139ha restricted to 4.5 l/s) are as follows:

Q1	=	5.7m³
Q30	=	22.2m³
Q100 + CC	=	**47.5m³**

Note: for the purpose of the attenuation volume calculations, an attenuation structure in the form 50m³ cellular tank has been used to ensure no flooding occurs in the simulation of the results, in order to gain an accurate figure of maximum volume / attenuation volume.

The flow control is also indicated as a pump, as this will ensure the results show a discharge rate (maximum outflow) of 4.5 l/s. The actual flow control is likely to be a vortex or an orifice.

Area 2

The summary of the required attenuation volumes for each of the storm event for 'Area 2' (area of 0.261ha restricted to 3.5 l/s) are as follows:

Q1	=	17.2m³
Q30	=	58.4m³
Q100 + CC	=	**117.5m³**

Note: for the purpose of the attenuation volume calculations, an attenuation structure in the form 120m³ cellular tank has been used to ensure no flooding occurs in the simulation of the results, in order to gain an accurate figure of maximum volume / attenuation volume.

The flow control is also indicated as a pump, as this will ensure the results show a discharge rate (maximum outflow) of 3.5 l/s. The actual flow control is likely to be a vortex or an orifice.

Due to the layout of the building, no flooding can be controlled at the surface for up to the 1in 100-year (inc climate change) storm event. Therefore, the above and below ground attenuation structures are to be sized to accommodate the require volume for up to the 1 in 100-year (inc climate change) storm event.

5 Surface Water Discharge Rate & Attenuation Summary

Total Restricted Surface Water Run-Off Rate	-	8 l/s
Total Surface Water Attenuation Volume	-	166m³
Below Ground Attenuation Volume	-	48m³

Above Ground Attenuation Volume - 118m³

6 Surface Water Run-off with Foul Water Discharge

The peak foul water discharge from the development has been calculated to be 9.7 l/s. This figure is to be included in the proposed surface water discharge rate in order to establish the total combined discharge rate from the site.

The total combined discharge rates from the site for each of the storm events (assuming peak foul discharge during peak storm events) will be 17.27 l/s (8 l/s + 9.27 l/s).

This rate is greater than the pre development 1 in 1-year surface water run-off rate of 1.7 l/s, but is a 55% betterment of the pre development the 1 in 30-year surface water run-off rate, and a 65% betterment of the pre development the 1 in 100-year surface water run-off.

The likelihood of the peak foul water discharge occurring at the same time as the peak surface water run-off rates for each storm event is deemed to be low.

This with the 50% betterment being achieved during the extreme storm events means that the restricted surface water run-off rate of 8 l/s is acceptable.

7 Thames Water

During previous correspondence with Thames Water, completed by BDP on behalf of the Client, Thames Water have confirmed acceptance of peak discharge rates of 9.27l/s and 23.5;/s for foul and surface water respectively. Noting the final designed peak leaves are lower than these and together with the above, the proposed is deemed acceptable.

Appendix A

Pre-development - WinDes Calculations
Surface Water Run-off Rates

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	1	Add Flow / Climate Change (%)	0
M5-60 (mm)	20.600	Minimum Backdrop Height (m)	0.200
Ratio R	0.437	Maximum Backdrop Height (m)	1.500
Maximum Rainfall (mm/hr)	50	Min Design Depth for Optimisation (m)	1.200
Maximum Time of Concentration (mins)	30	Min Vel for Auto Design only (m/s)	1.00
Foul Sewage (l/s/ha)	0.000	Min Slope for Optimisation (1:X)	500
Volumetric Runoff Coeff.	0.750		

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.083	4-8	0.027

Total Area Contributing (ha) = 0.110

Total Pipe Volume (m³) = 2.121

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	10.000	0.100	100.0	0.110	5.00	0.0	0.600	o	300
2.000	10.000	0.100	100.0	0.000	5.00	0.0	0.600	o	300
1.001	10.000	0.100	100.0	0.000	0.00	0.0	0.600	o	300

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.11	10.000	0.110	0.0	0.0	0.0	1.57	111.1	14.9
2.000	50.00	5.11	10.000	0.000	0.0	0.0	0.0	1.57	111.1	0.0
1.001	50.00	5.21	9.900	0.110	0.0	0.0	0.0	1.57	111.1	14.9

Time Area Diagram for Green Roof at Pipe Number 2.000 (Storm)

Area (m^3) 1610 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.029257	32	36	0.005907	64	68	0.001193	96	100	0.000241
4	8	0.023953	36	40	0.004836	68	72	0.000976	100	104	0.000197
8	12	0.019611	40	44	0.003959	72	76	0.000799	104	108	0.000161
12	16	0.016057	44	48	0.003242	76	80	0.000654	108	112	0.000132
16	20	0.013146	48	52	0.002654	80	84	0.000536	112	116	0.000108
20	24	0.010763	52	56	0.002173	84	88	0.000439	116	120	0.000089
24	28	0.008812	56	60	0.001779	88	92	0.000359			
28	32	0.007215	60	64	0.001457	92	96	0.000294			

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	60
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	1
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.600	Storm Duration (mins)	15
Ratio R	0.437		

Summary of Results for 15 minute 1 year Winter (Storm)

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	10.092	-0.208	0.000	0.20		16.2	OK
2.000	2	10.034	-0.266	0.000	0.03		2.4	OK
1.001	2	9.993	-0.207	0.000	0.20		16.1	OK

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	60
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	1
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.600	Storm Duration (mins)	15
Ratio R	0.437		

Summary of Results for 15 minute 30 year Winter (Storm)

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	10.152	-0.148	0.000	0.50		39.8	OK
2.000	2	10.095	-0.205	0.000	0.20		15.6	OK
1.001	2	10.051	-0.149	0.000	0.50		39.2	OK

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	60
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	1
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.600	Storm Duration (mins)	15
Ratio R	0.437		

Summary of Results for 15 minute 100 year Winter (Storm)

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	10.179	-0.121	0.000	0.65		51.9	OK
2.000	2	10.111	-0.189	0.000	0.27		21.6	OK
1.001	2	10.077	-0.123	0.000	0.64		50.5	OK

Appendix B

Post-development - WinDes Calculations

Surface Water Run-off Rates & Volumes – No Restrictions

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	1	Add Flow / Climate Change (%)	0
M5-60 (mm)	20.600	Minimum Backdrop Height (m)	0.200
Ratio R	0.437	Maximum Backdrop Height (m)	1.500
Maximum Rainfall (mm/hr)	50	Min Design Depth for Optimisation (m)	1.200
Maximum Time of Concentration (mins)	30	Min Vel for Auto Design only (m/s)	1.00
Foul Sewage (l/s/ha)	0.000	Min Slope for Optimisation (1:X)	500
Volumetric Runoff Coeff.	0.750		

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.303	4-8	0.097

Total Area Contributing (ha) = 0.400

Total Pipe Volume (m^3) = 2.121

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	10.000	0.100	100.0	0.139	5.00	0.0	0.600	o	300
2.000	10.000	0.100	100.0	0.261	5.00	0.0	0.600	o	300
1.001	10.000	0.100	100.0	0.000	0.00	0.0	0.600	o	300

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.11	10.000	0.139	0.0	0.0	0.0	1.57	111.1	18.8
2.000	50.00	5.11	10.000	0.261	0.0	0.0	0.0	1.57	111.1	35.3
1.001	50.00	5.21	9.900	0.400	0.0	0.0	0.0	1.57	111.1	54.2

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	60
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.600	Storm Duration (mins)	15
Ratio R	0.437		

Summary of Results for 15 minute 1 year Winter (Storm)

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	10.117	-0.183	0.000	0.26		20.3	OK
2.000	2	10.149	-0.151	0.000	0.48		38.4	OK
1.001	2	10.096	-0.104	0.000	0.74		58.8	OK

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	60
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.600	Storm Duration (mins)	15
Ratio R	0.437		

Summary of Results for 15 minute 30 year Winter (Storm)

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	10.442	0.142	0.000	0.62		48.9	SURCHARGED
2.000	2	10.549	0.249	0.000	1.16		92.1	SURCHARGED
1.001	2	10.409	0.209	0.000	1.78		141.4	SURCHARGED

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	30.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	60
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.600	Storm Duration (mins)	15
Ratio R	0.437		

Summary of Results for 15 minute 100 year Winter (Storm)

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	11.056	0.756	0.000	1.02		80.5	SURCHARGED
2.000	2	11.320	1.020	0.000	1.92		151.7	SURCHARGED
1.001	2	10.951	0.751	0.000	2.92		231.1	SURCHARGED

Appendix C

Post-development - WinDes Calculations
Surface Water Run-off Rates & Volumes – 50% Betterment

Summary of Results for 1 year Return Period

Half Drain Time : 13 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	10.101	0.101	0.0	4.5	4.5	4.8	O K
30	min Summer	10.103	0.103	0.0	4.5	4.5	4.9	O K
60	min Summer	10.090	0.090	0.0	4.5	4.5	4.3	O K
120	min Summer	10.056	0.056	0.0	4.5	4.5	2.6	O K
180	min Summer	10.028	0.028	0.0	4.5	4.5	1.3	O K
240	min Summer	10.010	0.010	0.0	4.5	4.5	0.5	O K
360	min Summer	10.000	0.000	0.0	4.1	4.1	0.0	O K
480	min Summer	10.000	0.000	0.0	3.3	3.3	0.0	O K
600	min Summer	10.000	0.000	0.0	2.8	2.8	0.0	O K
720	min Summer	10.000	0.000	0.0	2.4	2.4	0.0	O K
960	min Summer	10.000	0.000	0.0	1.9	1.9	0.0	O K
1440	min Summer	10.000	0.000	0.0	1.4	1.4	0.0	O K
2160	min Summer	10.000	0.000	0.0	1.1	1.1	0.0	O K
2880	min Summer	10.000	0.000	0.0	0.9	0.9	0.0	O K
4320	min Summer	10.000	0.000	0.0	0.6	0.6	0.0	O K
5760	min Summer	10.000	0.000	0.0	0.5	0.5	0.0	O K
7200	min Summer	10.000	0.000	0.0	0.4	0.4	0.0	O K
8640	min Summer	10.000	0.000	0.0	0.4	0.4	0.0	O K
10080	min Summer	10.000	0.000	0.0	0.3	0.3	0.0	O K
15	min Winter	10.120	0.120	0.0	4.5	4.5	5.7	O K

	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15	min Summer	32.914	0.0	8.6	14
30	min Summer	21.228	0.0	11.0	23
60	min Summer	13.233	0.0	13.7	40
120	min Summer	8.073	0.0	16.7	72
180	min Summer	6.014	0.0	18.9	102
240	min Summer	4.874	0.0	20.3	128
360	min Summer	3.603	0.0	22.5	0
480	min Summer	2.900	0.0	24.2	0
600	min Summer	2.450	0.0	25.5	0
720	min Summer	2.134	0.0	26.7	0
960	min Summer	1.717	0.0	28.6	0
1440	min Summer	1.264	0.0	31.6	0
2160	min Summer	0.931	0.0	34.9	0
2880	min Summer	0.749	0.0	37.5	0
4320	min Summer	0.551	0.0	41.4	0
5760	min Summer	0.443	0.0	44.4	0
7200	min Summer	0.375	0.0	46.9	0
8640	min Summer	0.326	0.0	49.0	0
10080	min Summer	0.291	0.0	50.9	0
15	min Winter	32.914	0.0	9.5	15

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	10.121	0.121	0.0	4.5	4.5	5.7	O K
60 min Winter	10.097	0.097	0.0	4.5	4.5	4.6	O K
120 min Winter	10.042	0.042	0.0	4.5	4.5	2.0	O K
180 min Winter	10.005	0.005	0.0	4.5	4.5	0.3	O K
240 min Winter	10.000	0.000	0.0	4.0	4.0	0.0	O K
360 min Winter	10.000	0.000	0.0	3.0	3.0	0.0	O K
480 min Winter	10.000	0.000	0.0	2.4	2.4	0.0	O K
600 min Winter	10.000	0.000	0.0	2.0	2.0	0.0	O K
720 min Winter	10.000	0.000	0.0	1.8	1.8	0.0	O K
960 min Winter	10.000	0.000	0.0	1.4	1.4	0.0	O K
1440 min Winter	10.000	0.000	0.0	1.0	1.0	0.0	O K
2160 min Winter	10.000	0.000	0.0	0.8	0.8	0.0	O K
2880 min Winter	10.000	0.000	0.0	0.6	0.6	0.0	O K
4320 min Winter	10.000	0.000	0.0	0.5	0.5	0.0	O K
5760 min Winter	10.000	0.000	0.0	0.4	0.4	0.0	O K
7200 min Winter	10.000	0.000	0.0	0.3	0.3	0.0	O K
8640 min Winter	10.000	0.000	0.0	0.3	0.3	0.0	O K
10080 min Winter	10.000	0.000	0.0	0.2	0.2	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	21.228	0.0	12.4	25
60 min Winter	13.233	0.0	15.4	44
120 min Winter	8.073	0.0	19.0	76
180 min Winter	6.014	0.0	21.1	100
240 min Winter	4.874	0.0	22.8	0
360 min Winter	3.603	0.0	25.2	0
480 min Winter	2.900	0.0	27.1	0
600 min Winter	2.450	0.0	28.6	0
720 min Winter	2.134	0.0	29.9	0
960 min Winter	1.717	0.0	32.1	0
1440 min Winter	1.264	0.0	35.4	0
2160 min Winter	0.931	0.0	39.1	0
2880 min Winter	0.749	0.0	42.0	0
4320 min Winter	0.551	0.0	46.3	0
5760 min Winter	0.443	0.0	49.7	0
7200 min Winter	0.375	0.0	52.5	0
8640 min Winter	0.326	0.0	54.9	0
10080 min Winter	0.291	0.0	57.0	0

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.600	Shortest Storm (mins)	15
Ratio R	0.437	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.139

Time (mins) From:	To:	Area (ha)
0	4	0.139

Model Details

Storage is Online Cover Level (m) 11.000

Cellular Storage Structure

Invert Level (m) 10.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	50.0	50.0	1.100	0.0	80.0
1.000	50.0	80.0			

Pump Outflow Control

Invert Level (m) 0.000

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.5000	0.900	4.5000	1.700	4.5000	2.500	4.5000
0.200	4.5000	1.000	4.5000	1.800	4.5000	2.600	4.5000
0.300	4.5000	1.100	4.5000	1.900	4.5000	2.700	4.5000
0.400	4.5000	1.200	4.5000	2.000	4.5000	2.800	4.5000
0.500	4.5000	1.300	4.5000	2.100	4.5000	2.900	4.5000
0.600	4.5000	1.400	4.5000	2.200	4.5000	3.000	4.5000
0.700	4.5000	1.500	4.5000	2.300	4.5000		
0.800	4.5000	1.600	4.5000	2.400	4.5000		

Summary of Results for 30 year Return Period

Half Drain Time : 49 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	10.348	0.348	0.0	4.5	4.5	16.5	O K
30 min Summer	10.396	0.396	0.0	4.5	4.5	18.8	O K
60 min Summer	10.387	0.387	0.0	4.5	4.5	18.4	O K
120 min Summer	10.346	0.346	0.0	4.5	4.5	16.4	O K
180 min Summer	10.297	0.297	0.0	4.5	4.5	14.1	O K
240 min Summer	10.248	0.248	0.0	4.5	4.5	11.8	O K
360 min Summer	10.162	0.162	0.0	4.5	4.5	7.7	O K
480 min Summer	10.095	0.095	0.0	4.5	4.5	4.5	O K
600 min Summer	10.047	0.047	0.0	4.5	4.5	2.2	O K
720 min Summer	10.016	0.016	0.0	4.5	4.5	0.8	O K
960 min Summer	10.000	0.000	0.0	4.1	4.1	0.0	O K
1440 min Summer	10.000	0.000	0.0	3.0	3.0	0.0	O K
2160 min Summer	10.000	0.000	0.0	2.1	2.1	0.0	O K
2880 min Summer	10.000	0.000	0.0	1.7	1.7	0.0	O K
4320 min Summer	10.000	0.000	0.0	1.2	1.2	0.0	O K
5760 min Summer	10.000	0.000	0.0	1.0	1.0	0.0	O K
7200 min Summer	10.000	0.000	0.0	0.8	0.8	0.0	O K
8640 min Summer	10.000	0.000	0.0	0.7	0.7	0.0	O K
10080 min Summer	10.000	0.000	0.0	0.6	0.6	0.0	O K
15 min Winter	10.402	0.402	0.0	4.5	4.5	19.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	80.827	0.0	21.2	17
30 min Summer	51.838	0.0	26.9	31
60 min Summer	31.749	0.0	33.0	48
120 min Summer	18.872	0.0	39.3	82
180 min Summer	13.779	0.0	42.8	116
240 min Summer	10.980	0.0	45.9	148
360 min Summer	7.955	0.0	49.7	212
480 min Summer	6.327	0.0	52.6	270
600 min Summer	5.294	0.0	55.1	324
720 min Summer	4.575	0.0	57.2	376
960 min Summer	3.633	0.0	60.6	0
1440 min Summer	2.622	0.0	65.6	0
2160 min Summer	1.890	0.0	70.9	0
2880 min Summer	1.498	0.0	74.9	0
4320 min Summer	1.078	0.0	80.9	0
5760 min Summer	0.853	0.0	85.4	0
7200 min Summer	0.712	0.0	89.0	0
8640 min Summer	0.613	0.0	92.1	0
10080 min Summer	0.541	0.0	94.7	0
15 min Winter	80.827	0.0	23.6	17

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	10.467	0.467	0.0	4.5	4.5	22.2	O K
60 min Winter	10.461	0.461	0.0	4.5	4.5	21.9	O K
120 min Winter	10.399	0.399	0.0	4.5	4.5	19.0	O K
180 min Winter	10.323	0.323	0.0	4.5	4.5	15.3	O K
240 min Winter	10.248	0.248	0.0	4.5	4.5	11.8	O K
360 min Winter	10.119	0.119	0.0	4.5	4.5	5.7	O K
480 min Winter	10.031	0.031	0.0	4.5	4.5	1.5	O K
600 min Winter	10.000	0.000	0.0	4.3	4.3	0.0	O K
720 min Winter	10.000	0.000	0.0	3.8	3.8	0.0	O K
960 min Winter	10.000	0.000	0.0	3.0	3.0	0.0	O K
1440 min Winter	10.000	0.000	0.0	2.2	2.2	0.0	O K
2160 min Winter	10.000	0.000	0.0	1.6	1.6	0.0	O K
2880 min Winter	10.000	0.000	0.0	1.2	1.2	0.0	O K
4320 min Winter	10.000	0.000	0.0	0.9	0.9	0.0	O K
5760 min Winter	10.000	0.000	0.0	0.7	0.7	0.0	O K
7200 min Winter	10.000	0.000	0.0	0.6	0.6	0.0	O K
8640 min Winter	10.000	0.000	0.0	0.5	0.5	0.0	O K
10080 min Winter	10.000	0.000	0.0	0.4	0.4	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	51.838	0.0	30.4	31
60 min Winter	31.749	0.0	37.0	56
120 min Winter	18.872	0.0	44.1	90
180 min Winter	13.779	0.0	48.1	126
240 min Winter	10.980	0.0	51.4	160
360 min Winter	7.955	0.0	55.6	222
480 min Winter	6.327	0.0	59.2	272
600 min Winter	5.294	0.0	61.8	0
720 min Winter	4.575	0.0	64.1	0
960 min Winter	3.633	0.0	67.9	0
1440 min Winter	2.622	0.0	73.5	0
2160 min Winter	1.890	0.0	79.4	0
2880 min Winter	1.498	0.0	83.9	0
4320 min Winter	1.078	0.0	90.6	0
5760 min Winter	0.853	0.0	95.6	0
7200 min Winter	0.712	0.0	99.7	0
8640 min Winter	0.613	0.0	103.1	0
10080 min Winter	0.541	0.0	106.1	0

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.600	Shortest Storm (mins)	15
Ratio R	0.437	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.139

Time (mins) From:	To:	Area (ha)
0	4	0.139

Model Details

Storage is Online Cover Level (m) 11.000

Cellular Storage Structure

Invert Level (m) 10.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	50.0	50.0	1.100	0.0	80.0
1.000	50.0	80.0			

Pump Outflow Control

Invert Level (m) 0.000

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.5000	0.900	4.5000	1.700	4.5000	2.500	4.5000
0.200	4.5000	1.000	4.5000	1.800	4.5000	2.600	4.5000
0.300	4.5000	1.100	4.5000	1.900	4.5000	2.700	4.5000
0.400	4.5000	1.200	4.5000	2.000	4.5000	2.800	4.5000
0.500	4.5000	1.300	4.5000	2.100	4.5000	2.900	4.5000
0.600	4.5000	1.400	4.5000	2.200	4.5000	3.000	4.5000
0.700	4.5000	1.500	4.5000	2.300	4.5000		
0.800	4.5000	1.600	4.5000	2.400	4.5000		

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

Half Drain Time : 105 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	10.650	0.650	0.0	4.5	4.5	30.9	O K
30 min Summer	10.788	0.788	0.0	4.5	4.5	37.4	Flood Risk
60 min Summer	10.847	0.847	0.0	4.5	4.5	40.2	Flood Risk
120 min Summer	10.793	0.793	0.0	4.5	4.5	37.7	Flood Risk
180 min Summer	10.736	0.736	0.0	4.5	4.5	35.0	Flood Risk
240 min Summer	10.677	0.677	0.0	4.5	4.5	32.2	O K
360 min Summer	10.565	0.565	0.0	4.5	4.5	26.8	O K
480 min Summer	10.462	0.462	0.0	4.5	4.5	22.0	O K
600 min Summer	10.369	0.369	0.0	4.5	4.5	17.5	O K
720 min Summer	10.287	0.287	0.0	4.5	4.5	13.6	O K
960 min Summer	10.156	0.156	0.0	4.5	4.5	7.4	O K
1440 min Summer	10.015	0.015	0.0	4.5	4.5	0.7	O K
2160 min Summer	10.000	0.000	0.0	3.5	3.5	0.0	O K
2880 min Summer	10.000	0.000	0.0	2.8	2.8	0.0	O K
4320 min Summer	10.000	0.000	0.0	2.0	2.0	0.0	O K
5760 min Summer	10.000	0.000	0.0	1.6	1.6	0.0	O K
7200 min Summer	10.000	0.000	0.0	1.3	1.3	0.0	O K
8640 min Summer	10.000	0.000	0.0	1.1	1.1	0.0	O K
10080 min Summer	10.000	0.000	0.0	1.0	1.0	0.0	O K
15 min Winter	10.741	0.741	0.0	4.5	4.5	35.2	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	136.659	0.0	35.6	18
30 min Summer	88.315	0.0	46.0	32
60 min Summer	54.281	0.0	56.5	60
120 min Summer	32.230	0.0	67.4	96
180 min Summer	23.456	0.0	73.5	128
240 min Summer	18.621	0.0	77.6	162
360 min Summer	13.418	0.0	83.9	230
480 min Summer	10.633	0.0	88.5	294
600 min Summer	8.872	0.0	92.4	356
720 min Summer	7.649	0.0	95.8	418
960 min Summer	6.048	0.0	100.8	530
1440 min Summer	4.339	0.0	108.6	740
2160 min Summer	3.108	0.0	116.6	0
2880 min Summer	2.451	0.0	122.6	0
4320 min Summer	1.752	0.0	131.5	0
5760 min Summer	1.379	0.0	138.0	0
7200 min Summer	1.145	0.0	143.2	0
8640 min Summer	0.983	0.0	147.6	0
10080 min Summer	0.864	0.0	151.4	0
15 min Winter	136.659	0.0	39.8	18

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 Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	10.909	0.909	0.0	4.5	4.5	43.2	Flood Risk
60 min Winter	11.000	1.000	0.0	4.5	4.5	47.5	Flood Risk
120 min Winter	10.944	0.944	0.0	4.5	4.5	44.8	Flood Risk
180 min Winter	10.865	0.865	0.0	4.5	4.5	41.1	Flood Risk
240 min Winter	10.780	0.780	0.0	4.5	4.5	37.0	Flood Risk
360 min Winter	10.609	0.609	0.0	4.5	4.5	28.9	O K
480 min Winter	10.453	0.453	0.0	4.5	4.5	21.5	O K
600 min Winter	10.314	0.314	0.0	4.5	4.5	14.9	O K
720 min Winter	10.196	0.196	0.0	4.5	4.5	9.3	O K
960 min Winter	10.034	0.034	0.0	4.5	4.5	1.6	O K
1440 min Winter	10.000	0.000	0.0	3.6	3.6	0.0	O K
2160 min Winter	10.000	0.000	0.0	2.5	2.5	0.0	O K
2880 min Winter	10.000	0.000	0.0	2.0	2.0	0.0	O K
4320 min Winter	10.000	0.000	0.0	1.4	1.4	0.0	O K
5760 min Winter	10.000	0.000	0.0	1.1	1.1	0.0	O K
7200 min Winter	10.000	0.000	0.0	0.9	0.9	0.0	O K
8640 min Winter	10.000	0.000	0.0	0.8	0.8	0.0	O K
10080 min Winter	10.000	0.000	0.0	0.7	0.7	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	88.315	0.0	51.6	32
60 min Winter	54.281	0.0	63.3	60
120 min Winter	32.230	0.0	75.4	112
180 min Winter	23.456	0.0	82.4	138
240 min Winter	18.621	0.0	86.8	176
360 min Winter	13.418	0.0	93.8	248
480 min Winter	10.633	0.0	99.2	316
600 min Winter	8.872	0.0	103.5	378
720 min Winter	7.649	0.0	107.2	434
960 min Winter	6.048	0.0	113.0	530
1440 min Winter	4.339	0.0	121.6	0
2160 min Winter	3.108	0.0	130.6	0
2880 min Winter	2.451	0.0	137.4	0
4320 min Winter	1.752	0.0	147.3	0
5760 min Winter	1.379	0.0	154.6	0
7200 min Winter	1.145	0.0	160.4	0
8640 min Winter	0.983	0.0	165.3	0
10080 min Winter	0.864	0.0	169.6	0

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)	20.600	Shortest Storm (mins)	15
Ratio R	0.437	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.139

Time (mins) From:	To:	Area (ha)
0	4	0.139

Model Details

Storage is Online Cover Level (m) 11.000

Cellular Storage Structure

Invert Level (m) 10.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	50.0	50.0	1.100	0.0	80.0
1.000	50.0	80.0			

Pump Outflow Control

Invert Level (m) 0.000

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.5000	0.900	4.5000	1.700	4.5000	2.500	4.5000
0.200	4.5000	1.000	4.5000	1.800	4.5000	2.600	4.5000
0.300	4.5000	1.100	4.5000	1.900	4.5000	2.700	4.5000
0.400	4.5000	1.200	4.5000	2.000	4.5000	2.800	4.5000
0.500	4.5000	1.300	4.5000	2.100	4.5000	2.900	4.5000
0.600	4.5000	1.400	4.5000	2.200	4.5000	3.000	4.5000
0.700	4.5000	1.500	4.5000	2.300	4.5000		
0.800	4.5000	1.600	4.5000	2.400	4.5000		

Summary of Results for 1 year Return Period

Half Drain Time : 41 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	10.102	0.102	0.0	3.5	3.5	12.6	O K
30 min Summer	10.116	0.116	0.0	3.5	3.5	14.4	O K
60 min Summer	10.117	0.117	0.0	3.5	3.5	14.4	O K
120 min Summer	10.109	0.109	0.0	3.5	3.5	13.5	O K
180 min Summer	10.098	0.098	0.0	3.5	3.5	12.1	O K
240 min Summer	10.086	0.086	0.0	3.5	3.5	10.7	O K
360 min Summer	10.063	0.063	0.0	3.5	3.5	7.7	O K
480 min Summer	10.042	0.042	0.0	3.5	3.5	5.2	O K
600 min Summer	10.026	0.026	0.0	3.5	3.5	3.2	O K
720 min Summer	10.014	0.014	0.0	3.5	3.5	1.7	O K
960 min Summer	10.001	0.001	0.0	3.5	3.5	0.2	O K
1440 min Summer	10.000	0.000	0.0	2.7	2.7	0.0	O K
2160 min Summer	10.000	0.000	0.0	2.0	2.0	0.0	O K
2880 min Summer	10.000	0.000	0.0	1.6	1.6	0.0	O K
4320 min Summer	10.000	0.000	0.0	1.2	1.2	0.0	O K
5760 min Summer	10.000	0.000	0.0	0.9	0.9	0.0	O K
7200 min Summer	10.000	0.000	0.0	0.8	0.8	0.0	O K
8640 min Summer	10.000	0.000	0.0	0.7	0.7	0.0	O K
10080 min Summer	10.000	0.000	0.0	0.6	0.6	0.0	O K
15 min Winter	10.118	0.118	0.0	3.5	3.5	14.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	32.914	0.0	16.0	17
30 min Summer	21.228	0.0	20.7	31
60 min Summer	13.233	0.0	25.7	48
120 min Summer	8.073	0.0	31.5	82
180 min Summer	6.014	0.0	35.3	116
240 min Summer	4.874	0.0	38.2	150
360 min Summer	3.603	0.0	42.4	214
480 min Summer	2.900	0.0	45.4	274
600 min Summer	2.450	0.0	47.9	332
720 min Summer	2.134	0.0	50.1	386
960 min Summer	1.717	0.0	53.8	492
1440 min Summer	1.264	0.0	59.4	0
2160 min Summer	0.931	0.0	65.6	0
2880 min Summer	0.749	0.0	70.4	0
4320 min Summer	0.551	0.0	77.7	0
5760 min Summer	0.443	0.0	83.3	0
7200 min Summer	0.375	0.0	88.0	0
8640 min Summer	0.326	0.0	92.0	0
10080 min Summer	0.291	0.0	95.6	0
15 min Winter	32.914	0.0	17.9	17

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	10.138	0.138	0.0	3.5	3.5	17.0	O K
60 min Winter	10.139	0.139	0.0	3.5	3.5	17.2	O K
120 min Winter	10.126	0.126	0.0	3.5	3.5	15.6	O K
180 min Winter	10.108	0.108	0.0	3.5	3.5	13.3	O K
240 min Winter	10.089	0.089	0.0	3.5	3.5	11.0	O K
360 min Winter	10.052	0.052	0.0	3.5	3.5	6.5	O K
480 min Winter	10.023	0.023	0.0	3.5	3.5	2.8	O K
600 min Winter	10.004	0.004	0.0	3.5	3.5	0.5	O K
720 min Winter	10.000	0.000	0.0	3.3	3.3	0.0	O K
960 min Winter	10.000	0.000	0.0	2.6	2.6	0.0	O K
1440 min Winter	10.000	0.000	0.0	1.9	1.9	0.0	O K
2160 min Winter	10.000	0.000	0.0	1.4	1.4	0.0	O K
2880 min Winter	10.000	0.000	0.0	1.2	1.2	0.0	O K
4320 min Winter	10.000	0.000	0.0	0.8	0.8	0.0	O K
5760 min Winter	10.000	0.000	0.0	0.7	0.7	0.0	O K
7200 min Winter	10.000	0.000	0.0	0.6	0.6	0.0	O K
8640 min Winter	10.000	0.000	0.0	0.5	0.5	0.0	O K
10080 min Winter	10.000	0.000	0.0	0.4	0.4	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	21.228	0.0	23.2	31
60 min Winter	13.233	0.0	28.8	56
120 min Winter	8.073	0.0	35.3	90
180 min Winter	6.014	0.0	39.3	128
240 min Winter	4.874	0.0	42.6	162
360 min Winter	3.603	0.0	47.4	226
480 min Winter	2.900	0.0	50.8	282
600 min Winter	2.450	0.0	53.6	326
720 min Winter	2.134	0.0	56.1	0
960 min Winter	1.717	0.0	60.2	0
1440 min Winter	1.264	0.0	66.5	0
2160 min Winter	0.931	0.0	73.5	0
2880 min Winter	0.749	0.0	78.9	0
4320 min Winter	0.551	0.0	87.0	0
5760 min Winter	0.443	0.0	93.3	0
7200 min Winter	0.375	0.0	98.6	0
8640 min Winter	0.326	0.0	103.1	0
10080 min Winter	0.291	0.0	107.1	0

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.600	Shortest Storm (mins)	15
Ratio R	0.437	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.261

Time (mins) From:	To:	Area (ha)
0	4	0.261

Model Details

Storage is Online Cover Level (m) 11.000

Cellular Storage Structure

Invert Level (m) 10.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	130.0	130.0	1.100	0.0	176.0
1.000	130.0	176.0			

Pump Outflow Control

Invert Level (m) 0.000

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.5000	0.900	3.5000	1.700	3.5000	2.500	3.5000
0.200	3.5000	1.000	3.5000	1.800	3.5000	2.600	3.5000
0.300	3.5000	1.100	3.5000	1.900	3.5000	2.700	3.5000
0.400	3.5000	1.200	3.5000	2.000	3.5000	2.800	3.5000
0.500	3.5000	1.300	3.5000	2.100	3.5000	2.900	3.5000
0.600	3.5000	1.400	3.5000	2.200	3.5000	3.000	3.5000
0.700	3.5000	1.500	3.5000	2.300	3.5000		
0.800	3.5000	1.600	3.5000	2.400	3.5000		

Summary of Results for 30 year Return Period

Half Drain Time : 139 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	10.290	0.290	0.0	3.5	3.5	35.8	O K
30 min Summer	10.356	0.356	0.0	3.5	3.5	43.9	O K
60 min Summer	10.399	0.399	0.0	3.5	3.5	49.2	O K
120 min Summer	10.395	0.395	0.0	3.5	3.5	48.7	O K
180 min Summer	10.373	0.373	0.0	3.5	3.5	46.1	O K
240 min Summer	10.354	0.354	0.0	3.5	3.5	43.7	O K
360 min Summer	10.320	0.320	0.0	3.5	3.5	39.5	O K
480 min Summer	10.287	0.287	0.0	3.5	3.5	35.5	O K
600 min Summer	10.256	0.256	0.0	3.5	3.5	31.6	O K
720 min Summer	10.226	0.226	0.0	3.5	3.5	27.9	O K
960 min Summer	10.171	0.171	0.0	3.5	3.5	21.2	O K
1440 min Summer	10.085	0.085	0.0	3.5	3.5	10.5	O K
2160 min Summer	10.015	0.015	0.0	3.5	3.5	1.8	O K
2880 min Summer	10.000	0.000	0.0	3.2	3.2	0.0	O K
4320 min Summer	10.000	0.000	0.0	2.3	2.3	0.0	O K
5760 min Summer	10.000	0.000	0.0	1.8	1.8	0.0	O K
7200 min Summer	10.000	0.000	0.0	1.5	1.5	0.0	O K
8640 min Summer	10.000	0.000	0.0	1.3	1.3	0.0	O K
10080 min Summer	10.000	0.000	0.0	1.2	1.2	0.0	O K
15 min Winter	10.329	0.329	0.0	3.5	3.5	40.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	80.827	0.0	39.5	18
30 min Summer	51.838	0.0	50.7	33
60 min Summer	31.749	0.0	62.1	62
120 min Summer	18.872	0.0	73.7	116
180 min Summer	13.779	0.0	81.1	144
240 min Summer	10.980	0.0	86.0	176
360 min Summer	7.955	0.0	93.5	244
480 min Summer	6.327	0.0	99.2	310
600 min Summer	5.294	0.0	103.4	378
720 min Summer	4.575	0.0	107.5	442
960 min Summer	3.633	0.0	113.6	568
1440 min Summer	2.622	0.0	123.1	808
2160 min Summer	1.890	0.0	133.2	1124
2880 min Summer	1.498	0.0	140.7	0
4320 min Summer	1.078	0.0	151.9	0
5760 min Summer	0.853	0.0	160.3	0
7200 min Summer	0.712	0.0	167.1	0
8640 min Summer	0.613	0.0	172.9	0
10080 min Summer	0.541	0.0	177.8	0
15 min Winter	80.827	0.0	44.3	18

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	10.406	0.406	0.0	3.5	3.5	50.2	O K
60 min Winter	10.461	0.461	0.0	3.5	3.5	57.0	O K
120 min Winter	10.473	0.473	0.0	3.5	3.5	58.4	O K
180 min Winter	10.445	0.445	0.0	3.5	3.5	55.0	O K
240 min Winter	10.419	0.419	0.0	3.5	3.5	51.7	O K
360 min Winter	10.370	0.370	0.0	3.5	3.5	45.7	O K
480 min Winter	10.320	0.320	0.0	3.5	3.5	39.6	O K
600 min Winter	10.272	0.272	0.0	3.5	3.5	33.6	O K
720 min Winter	10.226	0.226	0.0	3.5	3.5	27.9	O K
960 min Winter	10.144	0.144	0.0	3.5	3.5	17.8	O K
1440 min Winter	10.028	0.028	0.0	3.5	3.5	3.5	O K
2160 min Winter	10.000	0.000	0.0	2.9	2.9	0.0	O K
2880 min Winter	10.000	0.000	0.0	2.3	2.3	0.0	O K
4320 min Winter	10.000	0.000	0.0	1.7	1.7	0.0	O K
5760 min Winter	10.000	0.000	0.0	1.3	1.3	0.0	O K
7200 min Winter	10.000	0.000	0.0	1.1	1.1	0.0	O K
8640 min Winter	10.000	0.000	0.0	0.9	0.9	0.0	O K
10080 min Winter	10.000	0.000	0.0	0.8	0.8	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	51.838	0.0	56.8	32
60 min Winter	31.749	0.0	69.5	60
120 min Winter	18.872	0.0	82.5	116
180 min Winter	13.779	0.0	90.7	168
240 min Winter	10.980	0.0	96.4	190
360 min Winter	7.955	0.0	104.5	266
480 min Winter	6.327	0.0	111.1	338
600 min Winter	5.294	0.0	116.2	410
720 min Winter	4.575	0.0	120.4	476
960 min Winter	3.633	0.0	127.4	600
1440 min Winter	2.622	0.0	137.9	808
2160 min Winter	1.890	0.0	149.2	0
2880 min Winter	1.498	0.0	157.6	0
4320 min Winter	1.078	0.0	170.2	0
5760 min Winter	0.853	0.0	179.6	0
7200 min Winter	0.712	0.0	187.2	0
8640 min Winter	0.613	0.0	193.6	0
10080 min Winter	0.541	0.0	199.2	0

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.600	Shortest Storm (mins)	15
Ratio R	0.437	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.261

Time (mins) From:	To:	Area (ha)
0	4	0.261

Model Details

Storage is Online Cover Level (m) 11.000

Cellular Storage Structure

Invert Level (m) 10.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	130.0	130.0	1.100	0.0	176.0
1.000	130.0	176.0			

Pump Outflow Control

Invert Level (m) 0.000

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.5000	0.900	3.5000	1.700	3.5000	2.500	3.5000
0.200	3.5000	1.000	3.5000	1.800	3.5000	2.600	3.5000
0.300	3.5000	1.100	3.5000	1.900	3.5000	2.700	3.5000
0.400	3.5000	1.200	3.5000	2.000	3.5000	2.800	3.5000
0.500	3.5000	1.300	3.5000	2.100	3.5000	2.900	3.5000
0.600	3.5000	1.400	3.5000	2.200	3.5000	3.000	3.5000
0.700	3.5000	1.500	3.5000	2.300	3.5000		
0.800	3.5000	1.600	3.5000	2.400	3.5000		

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

Half Drain Time : 280 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	10.510	0.510	0.0	3.5	3.5	62.9	O K
30 min Summer	10.644	0.644	0.0	3.5	3.5	79.5	O K
60 min Summer	10.754	0.754	0.0	3.5	3.5	93.1	Flood Risk
120 min Summer	10.815	0.815	0.0	3.5	3.5	100.7	Flood Risk
180 min Summer	10.808	0.808	0.0	3.5	3.5	99.8	Flood Risk
240 min Summer	10.774	0.774	0.0	3.5	3.5	95.6	Flood Risk
360 min Summer	10.717	0.717	0.0	3.5	3.5	88.6	Flood Risk
480 min Summer	10.675	0.675	0.0	3.5	3.5	83.3	O K
600 min Summer	10.636	0.636	0.0	3.5	3.5	78.6	O K
720 min Summer	10.600	0.600	0.0	3.5	3.5	74.0	O K
960 min Summer	10.530	0.530	0.0	3.5	3.5	65.4	O K
1440 min Summer	10.401	0.401	0.0	3.5	3.5	49.6	O K
2160 min Summer	10.242	0.242	0.0	3.5	3.5	29.8	O K
2880 min Summer	10.126	0.126	0.0	3.5	3.5	15.6	O K
4320 min Summer	10.010	0.010	0.0	3.5	3.5	1.2	O K
5760 min Summer	10.000	0.000	0.0	2.9	2.9	0.0	O K
7200 min Summer	10.000	0.000	0.0	2.4	2.4	0.0	O K
8640 min Summer	10.000	0.000	0.0	2.1	2.1	0.0	O K
10080 min Summer	10.000	0.000	0.0	1.8	1.8	0.0	O K
15 min Winter	10.575	0.575	0.0	3.5	3.5	71.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	136.659	0.0	66.8	18
30 min Summer	88.315	0.0	86.3	33
60 min Summer	54.281	0.0	106.3	62
120 min Summer	32.230	0.0	125.9	122
180 min Summer	23.456	0.0	137.6	180
240 min Summer	18.621	0.0	145.9	230
360 min Summer	13.418	0.0	157.3	284
480 min Summer	10.633	0.0	166.5	346
600 min Summer	8.872	0.0	173.7	412
720 min Summer	7.649	0.0	179.4	480
960 min Summer	6.048	0.0	189.5	616
1440 min Summer	4.339	0.0	203.7	880
2160 min Summer	3.108	0.0	218.9	1252
2880 min Summer	2.451	0.0	230.2	1584
4320 min Summer	1.752	0.0	246.8	2208
5760 min Summer	1.379	0.0	259.2	0
7200 min Summer	1.145	0.0	269.0	0
8640 min Summer	0.983	0.0	277.2	0
10080 min Summer	0.864	0.0	284.3	0
15 min Winter	136.659	0.0	74.8	18

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 Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	10.729	0.729	0.0	3.5	3.5	90.0	Flood Risk
60 min Winter	10.860	0.860	0.0	3.5	3.5	106.2	Flood Risk
120 min Winter	10.943	0.943	0.0	3.5	3.5	116.5	Flood Risk
180 min Winter	10.952	0.952	0.0	3.5	3.5	117.5	Flood Risk
240 min Winter	10.930	0.930	0.0	3.5	3.5	114.8	Flood Risk
360 min Winter	10.854	0.854	0.0	3.5	3.5	105.5	Flood Risk
480 min Winter	10.796	0.796	0.0	3.5	3.5	98.4	Flood Risk
600 min Winter	10.743	0.743	0.0	3.5	3.5	91.8	Flood Risk
720 min Winter	10.690	0.690	0.0	3.5	3.5	85.2	O K
960 min Winter	10.584	0.584	0.0	3.5	3.5	72.1	O K
1440 min Winter	10.390	0.390	0.0	3.5	3.5	48.1	O K
2160 min Winter	10.159	0.159	0.0	3.5	3.5	19.7	O K
2880 min Winter	10.020	0.020	0.0	3.5	3.5	2.5	O K
4320 min Winter	10.000	0.000	0.0	2.7	2.7	0.0	O K
5760 min Winter	10.000	0.000	0.0	2.1	2.1	0.0	O K
7200 min Winter	10.000	0.000	0.0	1.8	1.8	0.0	O K
8640 min Winter	10.000	0.000	0.0	1.5	1.5	0.0	O K
10080 min Winter	10.000	0.000	0.0	1.3	1.3	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	88.315	0.0	96.7	33
60 min Winter	54.281	0.0	119.1	62
120 min Winter	32.230	0.0	141.1	120
180 min Winter	23.456	0.0	154.2	176
240 min Winter	18.621	0.0	163.1	232
360 min Winter	13.418	0.0	176.4	332
480 min Winter	10.633	0.0	186.2	374
600 min Winter	8.872	0.0	194.4	450
720 min Winter	7.649	0.0	201.0	524
960 min Winter	6.048	0.0	212.2	672
1440 min Winter	4.339	0.0	228.2	938
2160 min Winter	3.108	0.0	245.4	1296
2880 min Winter	2.451	0.0	257.8	1560
4320 min Winter	1.752	0.0	276.5	0
5760 min Winter	1.379	0.0	290.3	0
7200 min Winter	1.145	0.0	301.3	0
8640 min Winter	0.983	0.0	310.5	0
10080 min Winter	0.864	0.0	318.4	0

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)	20.600	Shortest Storm (mins)	15
Ratio R	0.437	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.261

Time (mins) From:	To:	Area (ha)
0	4	0.261

Model Details

Storage is Online Cover Level (m) 11.000

Cellular Storage Structure

Invert Level (m) 10.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	130.0	130.0	1.100	0.0	176.0
1.000	130.0	176.0			

Pump Outflow Control

Invert Level (m) 0.000

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.5000	0.900	3.5000	1.700	3.5000	2.500	3.5000
0.200	3.5000	1.000	3.5000	1.800	3.5000	2.600	3.5000
0.300	3.5000	1.100	3.5000	1.900	3.5000	2.700	3.5000
0.400	3.5000	1.200	3.5000	2.000	3.5000	2.800	3.5000
0.500	3.5000	1.300	3.5000	2.100	3.5000	2.900	3.5000
0.600	3.5000	1.400	3.5000	2.200	3.5000	3.000	3.5000
0.700	3.5000	1.500	3.5000	2.300	3.5000		
0.800	3.5000	1.600	3.5000	2.400	3.5000		

Appendix D

Post-development - WinDes Calculations
Surface Water drainage network

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	1	Add Flow / Climate Change (%)	0
M5-60 (mm)	20.600	Minimum Backdrop Height (m)	0.000
Ratio R	0.437	Maximum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	0	Min Design Depth for Optimisation (m)	1.200
Maximum Time of Concentration (mins)	30	Min Vel for Auto Design only (m/s)	1.00
Foul Sewage (l/s/ha)	0.000	Min Slope for Optimisation (1:X)	500
Volumetric Runoff Coeff.	0.750		

Designed with Level Inverts

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	26.680	0.177	150.7	0.038	5.00	0.0	0.600	o	225
1.001	12.430	0.225	55.2	0.014	0.00	0.0	0.600	o	225
2.000	15.456	0.485	31.9	0.014	5.00	0.0	0.600	o	225
1.002	15.471	0.200	77.4	0.014	0.00	0.0	0.600	o	225
1.003	6.119	0.063	97.1	0.014	0.00	0.0	0.600	o	225
1.004	6.665	0.167	39.9	0.014	0.00	0.0	0.600	o	225
3.000	4.992	0.345	14.5	0.014	5.00	0.0	0.600	o	225
3.001	6.654	0.085	78.3	0.053	0.00	0.0	0.600	o	225
3.002	12.932	0.460	28.1	0.014	0.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	0.00	5.42	67.917	0.038	0.0	0.0	0.0	1.06	42.3	0.0
1.001	0.00	5.54	67.740	0.052	0.0	0.0	0.0	1.76	70.1	0.0
2.000	0.00	5.11	68.000	0.014	0.0	0.0	0.0	2.33	92.5	0.0
1.002	0.00	5.71	67.515	0.080	0.0	0.0	0.0	1.49	59.2	0.0
1.003	0.00	5.79	67.315	0.094	0.0	0.0	0.0	1.33	52.8	0.0
1.004	0.00	5.84	67.252	0.108	0.0	0.0	0.0	2.08	82.6	0.0
3.000	0.00	5.02	67.975	0.014	0.0	0.0	0.0	3.46	137.5	0.0
3.001	0.00	5.10	67.630	0.067	0.0	0.0	0.0	1.48	58.8	0.0
3.002	0.00	5.19	67.545	0.081	0.0	0.0	0.0	2.48	98.5	0.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
1.005	19.277	0.245	78.7	0.014	0.00	0.0	0.600	o	225
1.006	4.650	0.040	116.3	0.000	0.00	0.0	0.600	o	225
1.007	9.464	0.050	189.3	0.000	0.00	0.0	0.600	o	225
1.008	3.294	1.250	2.6	0.000	0.00	0.0	0.600	o	225
4.000	14.199	0.350	40.6	0.000	5.00	3.5	0.600	o	300
4.001	19.998	0.490	40.8	0.000	0.00	0.0	0.600	o	300
4.002	23.738	1.490	15.9	0.000	0.00	0.0	0.600	o	300
1.009	3.057	0.015	203.8	0.000	0.00	0.0	0.600	o	300

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.005	0.00	6.06	67.085	0.203	0.0	0.0	0.0	1.48	58.7	0.0
1.006	0.00	6.12	66.840	0.203	0.0	0.0	0.0	1.21	48.2	0.0
1.007	0.00	6.29	66.800	0.203	0.0	0.0	0.0	0.95	37.7	0.0
1.008	0.00	6.29	66.750	0.203	0.0	0.0	0.0	8.12	322.9	0.0
4.000	0.00	5.10	67.680	0.000	3.5	0.0	0.0	2.48	175.0	3.5
4.001	0.00	5.23	67.330	0.000	3.5	0.0	0.0	2.47	174.5	3.5
4.002	0.00	5.33	66.840	0.000	3.5	0.0	0.0	3.96	279.8	3.5
1.009	0.00	6.34	65.350	0.203	3.5	0.0	0.0	1.10	77.6	3.5

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
SWMH 3	68.525	0.608	Open Manhole	1500	1.000	67.917	225				
SWMH 4	68.525	0.785	Open Manhole	1200 x 675	1.001	67.740	225	1.000	67.740	225	
SWMH 5	68.525	0.525	Open Manhole	1200 x 675	2.000	68.000	225				
SWMH 6	68.525	1.010	Open Manhole	1200 x 675	1.002	67.515	225	1.001	67.515	225	
								2.000	67.515	225	
SWMH 7	68.525	1.210	Open Manhole	1200 x 675	1.003	67.315	225	1.002	67.315	225	
SWMH 17	68.525	1.273	Open Manhole	1200 x 675	1.004	67.252	225	1.003	67.252	225	
SWMH 8	68.525	0.550	Open Manhole	1200	3.000	67.975	225				
SWMH 9	68.525	0.895	Open Manhole	1200 x 675	3.001	67.630	225	3.000	67.630	225	
SWMH 10	68.525	0.980	Open Manhole	1200 x 675	3.002	67.545	225	3.001	67.545	225	
SWMH 11	68.525	1.440	Open Manhole	1200 x 675	1.005	67.085	225	1.004	67.085	225	
								3.002	67.085	225	
SWMH 12	68.525	1.685	Open Manhole	1200	1.006	66.840	225	1.005	66.840	225	
SWMH 13	68.525	1.725	Open Manhole	1200	1.007	66.800	225	1.006	66.800	225	
SWMH 14	68.525	1.775	Open Manhole	1200	1.008	66.750	225	1.007	66.750	225	
SWMH 1	68.525	0.845	Open Manhole	1200 x 675	4.000	67.680	300				
SWMH 16	68.525	1.195	Open Manhole	1200 x 675	4.001	67.330	300	4.000	67.330	300	
SWMH 2	68.525	1.685	Open Manhole	1200	4.002	66.840	300	4.001	66.840	300	
SWMH 15	68.525	3.175	Open Manhole	1200	1.009	65.350	300	1.008	65.500	225	75
								4.002	65.350	300	
CWMH 2	68.525	3.190	Open Manhole	1200		OUTFALL		1.009	65.335	300	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	225	SWMH 3	68.525	67.917	0.383	Open Manhole	1500
1.001	o	225	SWMH 4	68.525	67.740	0.560	Open Manhole	1200 x 675
2.000	o	225	SWMH 5	68.525	68.000	0.300	Open Manhole	1200 x 675
1.002	o	225	SWMH 6	68.525	67.515	0.785	Open Manhole	1200 x 675
1.003	o	225	SWMH 7	68.525	67.315	0.985	Open Manhole	1200 x 675
1.004	o	225	SWMH 17	68.525	67.252	1.048	Open Manhole	1200 x 675
3.000	o	225	SWMH 8	68.525	67.975	0.325	Open Manhole	1200
3.001	o	225	SWMH 9	68.525	67.630	0.670	Open Manhole	1200 x 675
3.002	o	225	SWMH 10	68.525	67.545	0.755	Open Manhole	1200 x 675
1.005	o	225	SWMH 11	68.525	67.085	1.215	Open Manhole	1200 x 675
1.006	o	225	SWMH 12	68.525	66.840	1.460	Open Manhole	1200
1.007	o	225	SWMH 13	68.525	66.800	1.500	Open Manhole	1200
1.008	o	225	SWMH 14	68.525	66.750	1.550	Open Manhole	1200
4.000	o	300	SWMH 1	68.525	67.680	0.545	Open Manhole	1200 x 675
4.001	o	300	SWMH 16	68.525	67.330	0.895	Open Manhole	1200 x 675
4.002	o	300	SWMH 2	68.525	66.840	1.385	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	26.680	150.7	SWMH 4	68.525	67.740	0.560	Open Manhole	1200 x 675
1.001	12.430	55.2	SWMH 6	68.525	67.515	0.785	Open Manhole	1200 x 675
2.000	15.456	31.9	SWMH 6	68.525	67.515	0.785	Open Manhole	1200 x 675
1.002	15.471	77.4	SWMH 7	68.525	67.315	0.985	Open Manhole	1200 x 675
1.003	6.119	97.1	SWMH 17	68.525	67.252	1.048	Open Manhole	1200 x 675
1.004	6.665	39.9	SWMH 11	68.525	67.085	1.215	Open Manhole	1200 x 675
3.000	4.992	14.5	SWMH 9	68.525	67.630	0.670	Open Manhole	1200 x 675
3.001	6.654	78.3	SWMH 10	68.525	67.545	0.755	Open Manhole	1200 x 675
3.002	12.932	28.1	SWMH 11	68.525	67.085	1.215	Open Manhole	1200 x 675
1.005	19.277	78.7	SWMH 12	68.525	66.840	1.460	Open Manhole	1200
1.006	4.650	116.3	SWMH 13	68.525	66.800	1.500	Open Manhole	1200
1.007	9.464	189.3	SWMH 14	68.525	66.750	1.550	Open Manhole	1200
1.008	3.294	2.6	SWMH 15	68.525	65.500	2.800	Open Manhole	1200
4.000	14.199	40.6	SWMH 16	68.525	67.330	0.895	Open Manhole	1200 x 675
4.001	19.998	40.8	SWMH 2	68.525	66.840	1.385	Open Manhole	1200
4.002	23.738	15.9	SWMH 15	68.525	65.350	2.875	Open Manhole	1200

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.009	o	300	SWMH 15	68.525	65.350	2.875	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.009	3.057	203.8	CWMH 2	68.525	65.335	2.890	Open Manhole	1200

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.009	CWMH 2	68.525	65.335	65.335	1200	0

Online Controls for Storm

Hydro-Brake® Manhole: SWMH 15, DS/PN: 1.009, Volume (m³): 5.3

Design Head (m) 1.900 Hydro-Brake® Type Md6 SW Only Invert Level (m) 65.350
Design Flow (l/s) 8.0 Diameter (mm) 100

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.0	1.200	6.3	3.000	9.9	7.000	15.1
0.200	4.7	1.400	6.8	3.500	10.7	7.500	15.6
0.300	4.6	1.600	7.2	4.000	11.4	8.000	16.1
0.400	4.4	1.800	7.7	4.500	12.1	8.500	16.6
0.500	4.4	2.000	8.1	5.000	12.8	9.000	17.1
0.600	4.6	2.200	8.5	5.500	13.4	9.500	17.6
0.800	5.1	2.400	8.8	6.000	14.0		
1.000	5.7	2.600	9.2	6.500	14.5		

Storage Structures for Storm

Cellular Storage Manhole: SWMH 14, DS/PN: 1.008

Invert Level (m) 66.775 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	40.0	40.0	1.300	0.0	71.2
1.200	40.0	71.2			

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	60
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.600	Storm Duration (mins)	15
Ratio R	0.437		

Summary of Results for 15 minute 30 year Winter (Storm)

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status OFF
Inertia Status OFF

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	SWMH 3	68.010	-0.132	0.000	0.35		13.6	OK
1.001	SWMH 4	67.831	-0.134	0.000	0.31		18.5	OK
2.000	SWMH 5	68.037	-0.188	0.000	0.06		5.1	OK
1.002	SWMH 6	67.803	0.063	0.000	0.48		25.0	SURCHARGED
1.003	SWMH 7	67.759	0.219	0.000	0.78		27.6	SURCHARGED
1.004	SWMH 17	67.729	0.252	0.000	0.54		31.0	SURCHARGED
3.000	SWMH 8	68.011	-0.189	0.000	0.06		5.1	OK
3.001	SWMH 9	67.759	-0.096	0.000	0.62		25.6	OK
3.002	SWMH 10	67.722	-0.048	0.000	0.35		29.8	OK
1.005	SWMH 11	67.680	0.370	0.000	1.14		60.2	SURCHARGED
1.006	SWMH 12	67.422	0.357	0.000	1.97		59.0	SURCHARGED
1.007	SWMH 13	67.354	0.329	0.000	1.86		57.9	SURCHARGED
1.008	SWMH 14	67.347	0.372	0.000	0.15		23.0	SURCHARGED
4.000	SWMH 1	67.711	-0.269	0.000	0.02		3.5	OK
4.001	SWMH 16	67.369	-0.261	0.000	0.02		3.5	OK
4.002	SWMH 2	67.348	0.208	0.000	0.02		4.1	SURCHARGED
1.009	SWMH 15	67.376	1.726	0.000	0.16		8.0	SURCHARGED

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	60
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.600	Storm Duration (mins)	30
Ratio R	0.437		

Summary of Results for 30 minute 30 year Winter (Storm)

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status OFF
Inertia Status OFF

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	SWMH 3	67.996	-0.146	0.000	0.27		10.5	OK
1.001	SWMH 4	67.814	-0.151	0.000	0.24		14.4	OK
2.000	SWMH 5	68.031	-0.194	0.000	0.05		3.9	OK
1.002	SWMH 6	67.657	-0.083	0.000	0.43		22.2	OK
1.003	SWMH 7	67.624	0.084	0.000	0.66		23.2	SURCHARGED
1.004	SWMH 17	67.605	0.128	0.000	0.43		25.0	SURCHARGED
3.000	SWMH 8	68.006	-0.194	0.000	0.05		3.9	OK
3.001	SWMH 9	67.738	-0.117	0.000	0.46		18.9	OK
3.002	SWMH 10	67.625	-0.145	0.000	0.27		22.9	OK
1.005	SWMH 11	67.581	0.271	0.000	0.92		48.9	SURCHARGED
1.006	SWMH 12	67.481	0.416	0.000	1.59		47.6	SURCHARGED
1.007	SWMH 13	67.476	0.451	0.000	1.49		46.5	SURCHARGED
1.008	SWMH 14	67.470	0.495	0.000	0.08		12.6	SURCHARGED
4.000	SWMH 1	67.711	-0.269	0.000	0.02		3.5	OK
4.001	SWMH 16	67.474	-0.156	0.000	0.02		3.7	OK
4.002	SWMH 2	67.474	0.334	0.000	0.02		4.0	SURCHARGED
1.009	SWMH 15	67.481	1.831	0.000	0.16		8.3	SURCHARGED

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	120
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	2

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.600	Storm Duration (mins)	60
Ratio R	0.437		

Summary of Results for 60 minute 30 year Winter (Storm)

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status OFF
Inertia Status OFF

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	SWMH 3	67.980	-0.162	0.000	0.17		6.8	OK
1.001	SWMH 4	67.799	-0.166	0.000	0.15		9.3	OK
2.000	SWMH 5	68.026	-0.199	0.000	0.03		2.5	OK
1.002	SWMH 6	67.595	-0.145	0.000	0.27		14.3	OK
1.003	SWMH 7	67.560	0.020	0.000	0.47		16.7	SURCHARGED
1.004	SWMH 17	67.558	0.081	0.000	0.33		18.8	SURCHARGED
3.000	SWMH 8	68.001	-0.199	0.000	0.03		2.5	OK
3.001	SWMH 9	67.714	-0.141	0.000	0.30		12.2	OK
3.002	SWMH 10	67.608	-0.162	0.000	0.17		14.7	OK
1.005	SWMH 11	67.555	0.245	0.000	0.64		33.9	SURCHARGED
1.006	SWMH 12	67.543	0.478	0.000	1.09		32.7	SURCHARGED
1.007	SWMH 13	67.539	0.514	0.000	1.03		32.0	SURCHARGED
1.008	SWMH 14	67.533	0.558	0.000	0.05		7.5	SURCHARGED
4.000	SWMH 1	67.711	-0.269	0.000	0.02		3.5	OK
4.001	SWMH 16	67.540	-0.090	0.000	0.02		3.7	OK
4.002	SWMH 2	67.541	0.401	0.000	0.02		4.0	SURCHARGED
1.009	SWMH 15	67.542	1.892	0.000	0.16		8.4	SURCHARGED

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	720
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	6

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.600	Storm Duration (mins)	360
Ratio R	0.437		

Summary of Results for 360 minute 30 year Winter (Storm)

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	SWMH 3	67.948	-0.194	0.000	0.05		1.8	OK
1.001	SWMH 4	67.769	-0.196	0.000	0.04		2.4	OK
2.000	SWMH 5	68.009	-0.216	0.000	0.01		0.7	OK
1.002	SWMH 6	67.554	-0.186	0.000	0.07		3.7	OK
1.003	SWMH 7	67.367	-0.173	0.000	0.12		4.4	OK
1.004	SWMH 17	67.312	-0.165	0.000	0.09		5.0	OK
3.000	SWMH 8	67.983	-0.217	0.000	0.01		0.7	OK
3.001	SWMH 9	67.671	-0.184	0.000	0.08		3.1	OK
3.002	SWMH 10	67.575	-0.195	0.000	0.04		3.8	OK
1.005	SWMH 11	67.309	-0.001	0.000	0.18		9.5	OK
1.006	SWMH 12	67.300	0.235	0.000	0.30		9.0	SURCHARGED
1.007	SWMH 13	67.296	0.271	0.000	0.29		8.9	SURCHARGED
1.008	SWMH 14	67.290	0.315	0.000	0.03		4.6	SURCHARGED
4.000	SWMH 1	67.711	-0.269	0.000	0.02		3.5	OK
4.001	SWMH 16	67.361	-0.269	0.000	0.02		3.5	OK
4.002	SWMH 2	67.288	0.148	0.000	0.01		3.7	SURCHARGED
1.009	SWMH 15	67.274	1.624	0.000	0.16		7.9	SURCHARGED

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	2880
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	24

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.600	Storm Duration (mins)	1440
Ratio R	0.437		

Summary of Results for 1440 minute 30 year Winter (Storm)

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	SWMH 3	67.933	-0.209	0.000	0.01		0.6	OK
1.001	SWMH 4	67.754	-0.211	0.000	0.01		0.8	OK
2.000	SWMH 5	68.003	-0.222	0.000	0.00		0.2	OK
1.002	SWMH 6	67.538	-0.202	0.000	0.02		1.2	OK
1.003	SWMH 7	67.344	-0.196	0.000	0.04		1.4	OK
1.004	SWMH 17	67.277	-0.200	0.000	0.03		1.7	OK
3.000	SWMH 8	67.978	-0.222	0.000	0.00		0.2	OK
3.001	SWMH 9	67.654	-0.201	0.000	0.03		1.0	OK
3.002	SWMH 10	67.561	-0.209	0.000	0.01		1.2	OK
1.005	SWMH 11	67.120	-0.190	0.000	0.06		3.1	OK
1.006	SWMH 12	66.888	-0.177	0.000	0.10		3.1	OK
1.007	SWMH 13	66.847	-0.178	0.000	0.10		3.1	OK
1.008	SWMH 14	66.771	-0.204	0.000	0.02		3.1	OK
4.000	SWMH 1	67.711	-0.269	0.000	0.02		3.5	OK
4.001	SWMH 16	67.361	-0.269	0.000	0.02		3.5	OK
4.002	SWMH 2	66.860	-0.280	0.000	0.01		3.5	OK
1.009	SWMH 15	66.712	1.062	0.000	0.13		6.6	SURCHARGED

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	30.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	60
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.600	Storm Duration (mins)	15
Ratio R	0.437		

Summary of Results for 15 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status OFF
Inertia Status OFF

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	SWMH 3	68.518	0.376	0.000	0.49		19.3	FLOOD RISK
1.001	SWMH 4	68.503	0.538	0.000	0.36		21.5	FLOOD RISK
2.000	SWMH 5	68.488	0.263	0.000	0.10		7.9	FLOOD RISK
1.002	SWMH 6	68.477	0.737	0.000	0.57		29.7	FLOOD RISK
1.003	SWMH 7	68.419	0.879	0.000	0.94		33.3	FLOOD RISK
1.004	SWMH 17	68.363	0.886	0.000	0.65		37.4	FLOOD RISK
3.000	SWMH 8	68.384	0.184	0.000	0.08		7.0	FLOOD RISK
3.001	SWMH 9	68.380	0.525	0.000	0.79		32.6	FLOOD RISK
3.002	SWMH 10	68.352	0.582	0.000	0.43		37.0	FLOOD RISK
1.005	SWMH 11	68.290	0.980	0.000	1.44		76.4	FLOOD RISK
1.006	SWMH 12	67.850	0.785	0.000	2.49		74.5	SURCHARGED
1.007	SWMH 13	67.773	0.748	0.000	2.34		72.8	SURCHARGED
1.008	SWMH 14	67.766	0.791	0.000	0.12		19.5	SURCHARGED
4.000	SWMH 1	67.777	-0.203	0.000	0.03		4.6	OK
4.001	SWMH 16	67.773	0.143	0.000	0.03		4.8	SURCHARGED
4.002	SWMH 2	67.771	0.631	0.000	0.02		4.9	SURCHARGED
1.009	SWMH 15	67.768	2.118	0.000	0.17		8.8	SURCHARGED

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	30.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	60
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.600	Storm Duration (mins)	30
Ratio R	0.437		

Summary of Results for 30 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	SWMH 3	68.404	0.262	0.000	0.41		15.9	FLOOD RISK
1.001	SWMH 4	68.376	0.411	0.000	0.32		19.1	FLOOD RISK
2.000	SWMH 5	68.358	0.133	0.000	0.08		6.3	FLOOD RISK
1.002	SWMH 6	68.350	0.610	0.000	0.47		24.5	FLOOD RISK
1.003	SWMH 7	68.306	0.766	0.000	0.81		28.5	FLOOD RISK
1.004	SWMH 17	68.274	0.797	0.000	0.57		32.6	FLOOD RISK
3.000	SWMH 8	68.283	0.083	0.000	0.07		6.1	FLOOD RISK
3.001	SWMH 9	68.280	0.425	0.000	0.66		27.2	FLOOD RISK
3.002	SWMH 10	68.261	0.491	0.000	0.35		29.9	FLOOD RISK
1.005	SWMH 11	68.221	0.911	0.000	1.22		64.4	SURCHARGED
1.006	SWMH 12	68.010	0.945	0.000	2.10		62.8	SURCHARGED
1.007	SWMH 13	68.006	0.981	0.000	1.98		61.4	SURCHARGED
1.008	SWMH 14	68.001	1.026	0.000	0.09		14.8	SURCHARGED
4.000	SWMH 1	68.014	0.034	0.000	0.03		4.6	SURCHARGED
4.001	SWMH 16	68.010	0.380	0.000	0.03		4.7	SURCHARGED
4.002	SWMH 2	68.006	0.866	0.000	0.02		4.8	SURCHARGED
1.009	SWMH 15	68.001	2.351	0.000	0.18		9.2	SURCHARGED

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	30.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	120
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	2

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.600	Storm Duration (mins)	60
Ratio R	0.437		

Summary of Results for 60 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	SWMH 3	68.466	0.324	0.000	0.29		11.5	FLOOD RISK
1.001	SWMH 4	68.464	0.499	0.000	0.24		14.5	FLOOD RISK
2.000	SWMH 5	68.462	0.237	0.000	0.05		4.3	FLOOD RISK
1.002	SWMH 6	68.461	0.721	0.000	0.36		18.9	FLOOD RISK
1.003	SWMH 7	68.457	0.917	0.000	0.57		20.0	FLOOD RISK
1.004	SWMH 17	68.455	0.978	0.000	0.40		23.3	FLOOD RISK
3.000	SWMH 8	68.457	0.257	0.000	0.05		4.3	FLOOD RISK
3.001	SWMH 9	68.457	0.602	0.000	0.46		18.9	FLOOD RISK
3.002	SWMH 10	68.455	0.685	0.000	0.25		21.0	FLOOD RISK
1.005	SWMH 11	68.452	1.142	0.000	0.89		47.3	FLOOD RISK
1.006	SWMH 12	68.440	1.375	0.000	1.55		46.3	FLOOD RISK
1.007	SWMH 13	68.436	1.411	0.000	1.45		45.2	FLOOD RISK
1.008	SWMH 14	68.429	1.454	0.000	0.06		10.1	FLOOD RISK
4.000	SWMH 1	68.439	0.459	0.000	0.03		4.7	FLOOD RISK
4.001	SWMH 16	68.435	0.805	0.000	0.03		4.9	FLOOD RISK
4.002	SWMH 2	68.431	1.291	0.000	0.02		5.2	FLOOD RISK
1.009	SWMH 15	68.426	2.776	0.000	0.19		9.9	FLOOD RISK

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	30.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	720
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	6

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.600	Storm Duration (mins)	360
Ratio R	0.437		

Summary of Results for 360 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status OFF
Inertia Status OFF

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	SWMH 3	68.206	0.064	0.000	0.08		3.0	SURCHARGED
1.001	SWMH 4	68.204	0.239	0.000	0.07		4.1	SURCHARGED
2.000	SWMH 5	68.202	-0.023	0.000	0.01		1.1	OK
1.002	SWMH 6	68.202	0.462	0.000	0.12		6.0	SURCHARGED
1.003	SWMH 7	68.198	0.658	0.000	0.18		6.4	SURCHARGED
1.004	SWMH 17	68.196	0.719	0.000	0.12		7.2	SURCHARGED
3.000	SWMH 8	68.199	-0.001	0.000	0.01		1.1	OK
3.001	SWMH 9	68.199	0.344	0.000	0.13		5.3	SURCHARGED
3.002	SWMH 10	68.197	0.427	0.000	0.07		6.2	SURCHARGED
1.005	SWMH 11	68.193	0.883	0.000	0.26		14.0	SURCHARGED
1.006	SWMH 12	68.183	1.118	0.000	0.46		13.8	SURCHARGED
1.007	SWMH 13	68.179	1.154	0.000	0.43		13.5	SURCHARGED
1.008	SWMH 14	68.173	1.198	0.000	0.03		5.3	SURCHARGED
4.000	SWMH 1	68.184	0.204	0.000	0.03		4.6	SURCHARGED
4.001	SWMH 16	68.180	0.550	0.000	0.03		4.8	SURCHARGED
4.002	SWMH 2	68.175	1.035	0.000	0.02		4.9	SURCHARGED
1.009	SWMH 15	68.170	2.520	0.000	0.19		9.5	SURCHARGED

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	30.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	2880
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	24

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.600	Storm Duration (mins)	1440
Ratio R	0.437		

Summary of Results for 1440 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status OFF
Inertia Status OFF

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	SWMH 3	67.941	-0.201	0.000	0.02		1.0	OK
1.001	SWMH 4	67.763	-0.202	0.000	0.02		1.3	OK
2.000	SWMH 5	68.005	-0.220	0.000	0.00		0.4	OK
1.002	SWMH 6	67.543	-0.197	0.000	0.04		2.0	OK
1.003	SWMH 7	67.416	-0.124	0.000	0.07		2.4	OK
1.004	SWMH 17	67.415	-0.062	0.000	0.05		2.7	OK
3.000	SWMH 8	67.980	-0.220	0.000	0.00		0.4	OK
3.001	SWMH 9	67.659	-0.196	0.000	0.04		1.7	OK
3.002	SWMH 10	67.569	-0.201	0.000	0.02		2.1	OK
1.005	SWMH 11	67.413	0.103	0.000	0.10		5.1	SURCHARGED
1.006	SWMH 12	67.405	0.340	0.000	0.17		5.0	SURCHARGED
1.007	SWMH 13	67.402	0.377	0.000	0.16		4.9	SURCHARGED
1.008	SWMH 14	67.397	0.422	0.000	0.02		3.6	SURCHARGED
4.000	SWMH 1	67.715	-0.265	0.000	0.03		4.6	OK
4.001	SWMH 16	67.406	-0.224	0.000	0.03		4.6	OK
4.002	SWMH 2	67.397	0.257	0.000	0.02		4.7	SURCHARGED
1.009	SWMH 15	67.410	1.760	0.000	0.16		8.1	SURCHARGED