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Surface Water Drainage Calculations

Client:	DT Developers
Architect:	Hayward Architects Ltd
Project:	Leicester Road, Barwell
Project No:	24-21177
Document No:	0-010
Issue:	Rev P1: January 2025 RevP2: February 2025
Status:	Preliminary
Date:	20th February 2025
Engineer:	LM

Issue Status:
A=Approval
B=Building Regulations
C=Construction
D=Draft
P=Preliminary
R=Review
T=Tender
Z=Final Construction

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Leigh Middleton
Site name:	Leicester Road, Barwell
Site location:	

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	52.56923° N
Longitude:	1.33196° W
Reference:	3674547351
Date:	Jan 14 2025 09:46

Runoff estimation approach

IH124

Site characteristics

Total site area (ha):	1.24

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	634	634
Hydrological region:	4	4
Growth curve factor 1 year:	0.83	0.83
Growth curve factor 30 years:	2	2
Growth curve factor 100 years:	2.57	2.57
Growth curve factor 200 years:	3.04	3.04

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited

Q_{BAR} (l/s):	5.33	5.33
1 in 1 year (l/s):	4.43	4.43
1 in 30 years (l/s):	10.66	10.66
1 in 100 year (l/s):	13.7	13.7
1 in 200 years (l/s):	16.21	16.21

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)	100	PIMP (%)	100
M5-60 (mm)	19.700	Add Flow / Climate Change (%)	0
Ratio R	0.404	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

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)	Section Type	Auto Design
1.000	9.000	1.100	8.2	0.057	4.00	0.0	0.600	o	300	Pipe/Conduit	
1.001	23.900	2.680	8.9	0.077	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.002	10.200	0.090	113.3	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.000	36.900	2.240	16.5	0.072	4.00	0.0	0.600	o	300	Pipe/Conduit	
2.001	8.000	0.060	133.3	0.008	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.003	27.900	1.350	20.7	0.090	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.004	16.800	0.750	22.4	0.044	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.005	14.100	0.100	141.0	0.046	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.006	7.600	0.060	126.7	0.038	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.007	11.600	0.080	145.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

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	4.03	124.100	0.057	0.0	0.0	0.0	5.53	390.8	7.7
1.001	50.00	4.10	123.000	0.134	0.0	0.0	0.0	5.30	374.3	18.1
1.002	50.00	4.22	120.320	0.134	0.0	0.0	0.0	1.48	104.3	18.1
2.000	50.00	4.16	122.550	0.072	0.0	0.0	0.0	3.89	275.2	9.7
2.001	50.00	4.26	120.310	0.080	0.0	0.0	0.0	1.36	96.1	10.8
1.003	50.00	4.39	120.250	0.304	0.0	0.0	0.0	3.47	245.6	41.2
1.004	50.00	4.47	118.900	0.348	0.0	0.0	0.0	3.34	235.8	47.1
1.005	50.00	4.65	118.150	0.394	0.0	0.0	0.0	1.32	93.5	53.4
1.006	50.00	4.74	118.050	0.432	0.0	0.0	0.0	1.40	98.6	58.5
1.007	50.00	4.89	117.990	0.432	0.0	0.0	0.0	1.30	92.1	58.5

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)	Section Type	Auto Design
3.000	26.500	0.190	139.5	0.008	4.00	0.0	0.600	o	300	Pipe/Conduit	
1.008	16.400	0.110	149.1	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.009	19.600	0.150	130.7	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.010	16.000	0.510	31.4	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.011	44.800	0.300	149.3	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.012	45.000	0.300	150.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.013	25.700	0.173	148.6	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.014	45.000	0.300	150.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.015	19.800	0.132	150.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.016	45.000	0.300	150.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.017	18.700	0.125	149.6	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

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)
3.000	50.00	4.33	118.100	0.008	0.0	0.0	0.0	1.33	94.0	1.1
1.008	50.00	5.10	117.910	0.440	0.0	0.0	0.0	1.29	90.9	59.6
1.009	50.00	5.34	117.800	0.440	0.0	0.0	0.0	1.37	97.1	59.6
1.010	50.00	5.44	117.650	0.440	0.0	0.0	0.0	2.82	199.1	59.6
1.011	50.00	6.02	117.140	0.440	0.0	0.0	0.0	1.28	90.8	59.6
1.012	50.00	6.60	116.840	0.440	0.0	0.0	0.0	1.28	90.6	59.6
1.013	50.00	6.93	116.540	0.440	0.0	0.0	0.0	1.29	91.0	59.6
1.014	50.00	7.52	116.367	0.440	0.0	0.0	0.0	1.28	90.6	59.6
1.015	50.00	7.78	116.067	0.440	0.0	0.0	0.0	1.28	90.6	59.6
1.016	50.00	8.36	115.935	0.440	0.0	0.0	0.0	1.28	90.6	59.6
1.017	50.00	8.61	115.635	0.440	0.0	0.0	0.0	1.28	90.7	59.6

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)
S1	125.700	1.600	Open Manhole	1200	1.000	124.100	300				
S2	124.600	1.600	Open Manhole	1200	1.001	123.000	300	1.000	123.000	300	
S3	122.110	1.790	Open Manhole	1200	1.002	120.320	300	1.001	120.320	300	
S4	124.150	1.600	Open Manhole	1200	2.000	122.550	300				
S5	121.900	1.590	Open Manhole	1200	2.001	120.310	300	2.000	120.310	300	
S6	121.850	1.620	Open Manhole	1200	1.003	120.250	300	1.002	120.230	300	
								2.001	120.250	300	
S7	120.500	1.600	Open Manhole	1200	1.004	118.900	300	1.003	118.900	300	
S8	119.600	1.450	Open Manhole	1200	1.005	118.150	300	1.004	118.150	300	
S9	119.250	1.200	Open Manhole	1200	1.006	118.050	300	1.005	118.050	300	
S10	119.200	1.210	Open Manhole	1200	1.007	117.990	300	1.006	117.990	300	
S11	121.400	3.300	Open Manhole	1200	3.000	118.100	300				
S12	119.200	1.290	Open Manhole	1200	1.008	117.910	300	1.007	117.910	300	
								3.000	117.910	300	
S13	119.000	1.200	Junction		1.009	117.800	300	1.008	117.800	300	
S14	119.250	1.600	Open Manhole	1200	1.010	117.650	300	1.009	117.650	300	
S15	119.600	2.460	Open Manhole	1200	1.011	117.140	300	1.010	117.140	300	
S16	119.600	2.760	Open Manhole	1200	1.012	116.840	300	1.011	116.840	300	
S17	119.000	2.460	Open Manhole	1200	1.013	116.540	300	1.012	116.540	300	
S18	118.500	2.133	Open Manhole	1200	1.014	116.367	300	1.013	116.367	300	
S19	118.000	1.933	Open Manhole	1200	1.015	116.067	300	1.014	116.067	300	
S10	117.500	1.565	Open Manhole	1200	1.016	115.935	300	1.015	115.935	300	
S21	117.000	1.365	Open Manhole	1200	1.017	115.635	300	1.016	115.635	300	
6901	116.750	1.240	Open Manhole	0		OUTFALL		1.017	115.510	300	

No coordinates have been specified, layout information cannot be produced.

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	300	S1	125.700	124.100	1.300	Open Manhole	1200
1.001	o	300	S2	124.600	123.000	1.300	Open Manhole	1200
1.002	o	300	S3	122.110	120.320	1.490	Open Manhole	1200
2.000	o	300	S4	124.150	122.550	1.300	Open Manhole	1200
2.001	o	300	S5	121.900	120.310	1.290	Open Manhole	1200
1.003	o	300	S6	121.850	120.250	1.300	Open Manhole	1200
1.004	o	300	S7	120.500	118.900	1.300	Open Manhole	1200
1.005	o	300	S8	119.600	118.150	1.150	Open Manhole	1200
1.006	o	300	S9	119.250	118.050	0.900	Open Manhole	1200
1.007	o	300	S10	119.200	117.990	0.910	Open Manhole	1200
3.000	o	300	S11	121.400	118.100	3.000	Open Manhole	1200
1.008	o	300	S12	119.200	117.910	0.990	Open Manhole	1200
1.009	o	300	S13	119.000	117.800	0.900	Junction	
1.010	o	300	S14	119.250	117.650	1.300	Open Manhole	1200
1.011	o	300	S15	119.600	117.140	2.160	Open Manhole	1200
1.012	o	300	S16	119.600	116.840	2.460	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	9.000	8.2	S2	124.600	123.000	1.300	Open Manhole	1200
1.001	23.900	8.9	S3	122.110	120.320	1.490	Open Manhole	1200
1.002	10.200	113.3	S6	121.850	120.230	1.320	Open Manhole	1200
2.000	36.900	16.5	S5	121.900	120.310	1.290	Open Manhole	1200
2.001	8.000	133.3	S6	121.850	120.250	1.300	Open Manhole	1200
1.003	27.900	20.7	S7	120.500	118.900	1.300	Open Manhole	1200
1.004	16.800	22.4	S8	119.600	118.150	1.150	Open Manhole	1200
1.005	14.100	141.0	S9	119.250	118.050	0.900	Open Manhole	1200
1.006	7.600	126.7	S10	119.200	117.990	0.910	Open Manhole	1200
1.007	11.600	145.0	S12	119.200	117.910	0.990	Open Manhole	1200
3.000	26.500	139.5	S12	119.200	117.910	0.990	Open Manhole	1200
1.008	16.400	149.1	S13	119.000	117.800	0.900	Junction	
1.009	19.600	130.7	S14	119.250	117.650	1.300	Open Manhole	1200
1.010	16.000	31.4	S15	119.600	117.140	2.160	Open Manhole	1200
1.011	44.800	149.3	S16	119.600	116.840	2.460	Open Manhole	1200
1.012	45.000	150.0	S17	119.000	116.540	2.160	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)
1.013	o	300	S17	119.000	116.540	2.160	Open Manhole	1200
1.014	o	300	S18	118.500	116.367	1.833	Open Manhole	1200
1.015	o	300	S19	118.000	116.067	1.633	Open Manhole	1200
1.016	o	300	S10	117.500	115.935	1.265	Open Manhole	1200
1.017	o	300	S21	117.000	115.635	1.065	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)
1.013	25.700	148.6	S18	118.500	116.367	1.833	Open Manhole	1200
1.014	45.000	150.0	S19	118.000	116.067	1.633	Open Manhole	1200
1.015	19.800	150.0	S10	117.500	115.935	1.265	Open Manhole	1200
1.016	45.000	150.0	S21	117.000	115.635	1.065	Open Manhole	1200
1.017	18.700	149.6	6901	116.750	115.510	0.940	Open Manhole	0

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)
1.017	6901	116.750	115.510	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	6
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.700	Storm Duration (mins)	30
Ratio R	0.404		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S3, DS/PN: 1.002, Volume (m³): 3.6

Unit Reference	MD-SHE-0134-1000-1790-1000
Design Head (m)	1.790
Design Flow (l/s)	10.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	134
Invert Level (m)	120.320
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.790	10.0	Kick-Flo®	1.095	7.9
Flush-Flo™	0.531	10.0	Mean Flow over Head Range	-	8.8

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.8	1.200	8.3	3.000	12.8	7.000	19.1
0.200	8.6	1.400	8.9	3.500	13.7	7.500	19.8
0.300	9.5	1.600	9.5	4.000	14.6	8.000	20.4
0.400	9.9	1.800	10.0	4.500	15.5	8.500	21.0
0.500	10.0	2.000	10.5	5.000	16.3	9.000	21.6
0.600	10.0	2.200	11.0	5.500	17.0	9.500	22.2
0.800	9.7	2.400	11.5	6.000	17.8		
1.000	8.8	2.600	11.9	6.500	18.5		

Hydro-Brake® Optimum Manhole: S14, DS/PN: 1.010, Volume (m³): 3.2

Unit Reference	MD-SHE-0103-5300-1400-5300
Design Head (m)	1.400
Design Flow (l/s)	5.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	103
Invert Level (m)	117.650
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Hydro-Brake® Optimum Manhole: S14, DS/PN: 1.010, Volume (m³): 3.2

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.400	5.3	Kick-Flo®	0.860	4.2
Flush-Flo™	0.419	5.3	Mean Flow over Head Range	-	4.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.4	1.200	4.9	3.000	7.6	7.000	11.3
0.200	4.8	1.400	5.3	3.500	8.1	7.500	11.7
0.300	5.2	1.600	5.6	4.000	8.7	8.000	12.1
0.400	5.3	1.800	6.0	4.500	9.2	8.500	12.4
0.500	5.3	2.000	6.3	5.000	9.6	9.000	12.8
0.600	5.2	2.200	6.5	5.500	10.1	9.500	13.1
0.800	4.6	2.400	6.8	6.000	10.5		
1.000	4.5	2.600	7.1	6.500	10.9		

Storage Structures for Storm

Complex Manhole: S3, DS/PN: 1.002

Cellular Storage

Invert Level (m) 120.320 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	42.5	42.5	0.801	0.0	64.1
0.800	42.5	64.1			

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	7.2
Membrane Percolation (mm/hr)	1000	Length (m)	65.6
Max Percolation (l/s)	131.2	Slope (1:X)	12.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	121.580	Cap Volume Depth (m)	0.400

Complex Manhole: S4, DS/PN: 2.000

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	3.3
Membrane Percolation (mm/hr)	1000	Length (m)	10.0
Max Percolation (l/s)	9.2	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	123.910	Cap Volume Depth (m)	0.300

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	4.8
Membrane Percolation (mm/hr)	1000	Length (m)	5.0
Max Percolation (l/s)	6.7	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	123.910	Cap Volume Depth (m)	0.300

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	3.3
Membrane Percolation (mm/hr)	1000	Length (m)	10.0
Max Percolation (l/s)	9.2	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	123.430	Cap Volume Depth (m)	0.300

Complex Manhole: S7, DS/PN: 1.004

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	3.3
Membrane Percolation (mm/hr)	1000	Length (m)	13.5
Max Percolation (l/s)	12.4	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	120.090	Cap Volume Depth (m)	0.300

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	6.0
Membrane Percolation (mm/hr)	1000	Length (m)	14.4
Max Percolation (l/s)	24.0	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	120.920	Cap Volume Depth (m)	0.300

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	6.0
Membrane Percolation (mm/hr)	1000	Length (m)	11.3
Max Percolation (l/s)	18.8	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	121.120	Cap Volume Depth (m)	0.300

Complex Manhole: S8, DS/PN: 1.005

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	7.4
Membrane Percolation (mm/hr)	1000	Length (m)	12.6
Max Percolation (l/s)	25.9	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	119.770	Cap Volume Depth (m)	0.100

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	6.0
Membrane Percolation (mm/hr)	1000	Length (m)	15.4
Max Percolation (l/s)	25.7	Slope (1:X)	150.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	119.770	Cap Volume Depth (m)	0.300

Complex Manhole: S9, DS/PN: 1.006

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	3.0
Membrane Percolation (mm/hr)	1000	Length (m)	15.1
Max Percolation (l/s)	12.6	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	118.820	Cap Volume Depth (m)	0.300

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	6.0
Membrane Percolation (mm/hr)	1000	Length (m)	12.8
Max Percolation (l/s)	21.3	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	118.970	Cap Volume Depth (m)	0.300

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	6.0
Membrane Percolation (mm/hr)	1000	Length (m)	13.3
Max Percolation (l/s)	22.2	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	119.320	Cap Volume Depth (m)	0.300

Tank or Pond Manhole: S13, DS/PN: 1.009

Invert Level (m) 117.800

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	205.1	1.100	473.9

1 year Return Period Summary of Critical Results by Maximum Outflow (Rank 1) for Storm

Simulation Criteria

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	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	6
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.401
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.700	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S1	15 Winter	1	+0%					124.135
1.001	S2	15 Winter	1	+0%					123.044
1.002	S3	30 Winter	1	+0%	30/15 Summer				120.465
2.000	S4	15 Winter	1	+0%					122.589
2.001	S5	15 Winter	1	+0%					120.398
1.003	S6	15 Winter	1	+0%					120.318
1.004	S7	15 Winter	1	+0%	100/15 Summer				118.978
1.005	S8	15 Winter	1	+0%	30/15 Summer				118.294
1.006	S9	15 Winter	1	+0%	30/15 Summer				118.228
1.007	S10	15 Winter	1	+0%	30/15 Summer				118.153
3.000	S11	15 Winter	1	+0%	100/15 Summer				118.120
1.008	S12	15 Winter	1	+0%	30/15 Summer				118.067
1.009	S13	30 Winter	1	+0%	30/60 Summer				117.904
1.010	S14	240 Summer	1	+0%	30/15 Summer				117.913
1.011	S15	240 Summer	1	+0%					117.187
1.012	S16	240 Summer	1	+0%					116.887

1 year Return Period Summary of Critical Results by Maximum Outflow (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S1	-0.265	0.000	0.03			8.4	OK	
1.001	S2	-0.256	0.000	0.05			17.4	OK	
1.002	S3	-0.155	0.000	0.10		17	7.2	OK	
2.000	S4	-0.261	0.000	0.04		5	10.6	OK	
2.001	S5	-0.212	0.000	0.19			11.5	OK	
1.003	S6	-0.232	0.000	0.12			25.6	OK	
1.004	S7	-0.222	0.000	0.15		10	30.8	OK	
1.005	S8	-0.156	0.000	0.47		9	36.1	OK	
1.006	S9	-0.122	0.000	0.65		6	40.0	OK	
1.007	S10	-0.137	0.000	0.57			40.2	OK	
3.000	S11	-0.280	0.000	0.01			1.2	OK	
1.008	S12	-0.143	0.000	0.53			41.2	OK	
1.009	S13	-0.196	0.000	0.08			7.8	OK*	
1.010	S14	-0.037	0.000	0.03			5.1	OK	
1.011	S15	-0.253	0.000	0.06			5.1	OK	
1.012	S16	-0.253	0.000	0.06			5.1	OK	

1 year Return Period Summary of Critical Results by Maximum Outflow (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.013	S17	240 Summer	1	+0%					116.588
1.014	S18	240 Summer	1	+0%					116.414
1.015	S19	240 Summer	1	+0%					116.116
1.016	S10	240 Summer	1	+0%					115.982
1.017	S21	240 Summer	1	+0%					115.684

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.013	S17	-0.252	0.000	0.06			5.1	OK	
1.014	S18	-0.253	0.000	0.06			5.1	OK	
1.015	S19	-0.251	0.000	0.06			5.1	OK	
1.016	S10	-0.253	0.000	0.06			5.1	OK	
1.017	S21	-0.251	0.000	0.06			5.1	OK	

30 year Return Period Summary of Critical Results by Maximum Outflow (Rank 1) for Storm

Simulation Criteria

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	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	6
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.401
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.700	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S1	15 Winter	30	+0%					124.155
1.001	S2	15 Winter	30	+0%					123.076
1.002	S3	30 Winter	30	+0%	30/15 Summer				120.736
2.000	S4	15 Winter	30	+0%					122.614
2.001	S5	15 Summer	30	+0%					120.455
1.003	S6	15 Winter	30	+0%					120.365
1.004	S7	15 Winter	30	+0%	100/15 Summer				119.036
1.005	S8	15 Winter	30	+0%	30/15 Summer				118.799
1.006	S9	15 Winter	30	+0%	30/15 Summer				118.662
1.007	S10	15 Winter	30	+0%	30/15 Summer				118.486
3.000	S11	15 Winter	30	+0%	100/15 Summer				118.308
1.008	S12	15 Winter	30	+0%	30/15 Summer				118.306
1.009	S13	15 Summer	30	+0%	30/60 Summer				117.992
1.010	S14	1440 Winter	30	+0%	30/15 Summer				117.932
1.011	S15	1440 Winter	30	+0%					117.187
1.012	S16	1440 Winter	30	+0%					116.887

30 year Return Period Summary of Critical Results by Maximum Outflow (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S1	-0.245	0.000	0.08			20.5	OK	
1.001	S2	-0.224	0.000	0.15			48.3	OK	
1.002	S3	0.116	0.000	0.13		21	9.9	SURCHARGED	
2.000	S4	-0.236	0.000	0.10		5	25.9	OK	
2.001	S5	-0.155	0.000	0.47			28.9	OK	
1.003	S6	-0.185	0.000	0.31			68.5	OK	
1.004	S7	-0.164	0.000	0.42		6	83.9	OK	
1.005	S8	0.349	0.000	1.22		3	94.6	SURCHARGED	
1.006	S9	0.312	0.000	1.72		5	105.6	SURCHARGED	
1.007	S10	0.196	0.000	1.48			104.6	SURCHARGED	
3.000	S11	-0.092	0.000	0.03			2.5	OK	
1.008	S12	0.096	0.000	1.40			108.1	SURCHARGED	
1.009	S13	-0.108	0.000	0.14			13.5	OK*	
1.010	S14	-0.018	0.000	0.03			5.1	OK	
1.011	S15	-0.253	0.000	0.06			5.1	OK	
1.012	S16	-0.253	0.000	0.06			5.1	OK	

30 year Return Period Summary of Critical Results by Maximum Outflow (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.013	S17	1440 Winter	30	+0%					116.588
1.014	S18	1440 Winter	30	+0%					116.414
1.015	S19	1440 Winter	30	+0%					116.116
1.016	S10	1440 Winter	30	+0%					115.982
1.017	S21	1440 Winter	30	+0%					115.684

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.013	S17	-0.252	0.000	0.06			5.1	OK	
1.014	S18	-0.253	0.000	0.06			5.1	OK	
1.015	S19	-0.251	0.000	0.06			5.1	OK	
1.016	S10	-0.253	0.000	0.06			5.1	OK	
1.017	S21	-0.251	0.000	0.06			5.1	OK	

100 year Return Period Summary of Critical Results by Maximum Outflow (Rank 1) for Storm

Simulation Criteria

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	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	6
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.401
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.700	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S1	15 Winter	100	+40%					124.175
1.001	S2	15 Winter	100	+40%					123.104
1.002	S3	240 Summer	100	+40%	30/15 Summer				120.847
2.000	S4	15 Winter	100	+40%					122.637
2.001	S5	15 Summer	100	+40%					120.524
1.003	S6	15 Winter	100	+40%					120.409
1.004	S7	15 Winter	100	+40%	100/15 Summer				119.950
1.005	S8	15 Winter	100	+40%	30/15 Summer				119.579
1.006	S9	15 Winter	100	+40%	30/15 Summer				119.192
1.007	S10	15 Winter	100	+40%	30/15 Summer				118.847
3.000	S11	15 Winter	100	+40%	100/15 Summer				118.505
1.008	S12	15 Winter	100	+40%	30/15 Summer				118.501
1.009	S13	15 Winter	100	+40%	30/60 Summer				118.185
1.010	S14	4320 Summer	100	+40%	30/15 Summer				117.954
1.011	S15	2880 Winter	100	+40%					117.187
1.012	S16	2880 Winter	100	+40%					116.887

100 year Return Period Summary of Critical Results by Maximum Outflow (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S1	-0.225	0.000	0.14			37.3	OK	
1.001	S2	-0.196	0.000	0.26			87.7	OK	
1.002	S3	0.227	0.000	0.13		41	10.0	SURCHARGED	
2.000	S4	-0.213	0.000	0.19		5	47.1	OK	
2.001	S5	-0.086	0.000	0.85			52.4	OK	
1.003	S6	-0.141	0.000	0.55			120.8	OK	
1.004	S7	0.750	0.000	0.70		5	140.8	SURCHARGED	
1.005	S8	1.129	0.000	2.15		6	166.6	FLOOD RISK	
1.006	S9	0.842	0.000	2.38		4	146.3	FLOOD RISK	
1.007	S10	0.557	0.000	2.07			146.8	SURCHARGED	
3.000	S11	0.105	0.000	0.05			4.3	SURCHARGED	
1.008	S12	0.291	0.000	1.94			149.6	SURCHARGED	
1.009	S13	0.085	0.000	0.16			15.2	SURCHARGED*	
1.010	S14	0.004	0.000	0.03			5.1	SURCHARGED	
1.011	S15	-0.253	0.000	0.06			5.1	OK	
1.012	S16	-0.253	0.000	0.06			5.1	OK	

100 year Return Period Summary of Critical Results by Maximum Outflow (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.013	S17	4320 Summer	100	+40%					116.588
1.014	S18	2880 Winter	100	+40%					116.414
1.015	S19	2880 Winter	100	+40%					116.116
1.016	S10	2880 Winter	100	+40%					115.982
1.017	S21	2880 Winter	100	+40%					115.684

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.013	S17	-0.252	0.000	0.06			5.1	OK	
1.014	S18	-0.253	0.000	0.06			5.1	OK	
1.015	S19	-0.251	0.000	0.06			5.1	OK	
1.016	S10	-0.253	0.000	0.06			5.1	OK	
1.017	S21	-0.251	0.000	0.06			5.1	OK	