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	PIMP (%)	100
M5-60 (mm)	19.900	Add Flow / Climate Change (%)	0
Ratio R	0.350	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	0.800
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
2.000	3.698	0.616	6.0	0.010	5.00	0.0	0.600	o	225	Pipe/Conduit	
3.000	10.370	0.104	100.0	0.009	5.00	0.0	0.600	o	150	Pipe/Conduit	
3.001	11.672	0.117	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
3.002	8.298	0.083	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
3.003	37.195	0.372	100.0	0.039	0.00	0.0	0.600	o	225	Pipe/Conduit	
3.004	9.294	0.046	200.0	0.029	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.000	9.491	0.150	63.3	0.025	5.00	0.0	0.600	o	150	Pipe/Conduit	
4.001	22.824	0.152	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
4.002	25.245	0.168	150.0	0.020	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.003	30.499	0.258	118.2	0.021	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.004	14.367	0.072	200.0	0.014	0.00	0.0	0.600	o	225	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)
2.000	50.00	5.01	4.590	0.010	0.0	0.0	0.0	5.38	213.8	1.4
3.000	50.00	5.17	4.840	0.009	0.0	0.0	0.0	1.00	17.8	1.2
3.001	49.41	5.37	4.736	0.009	0.0	0.0	0.0	1.00	17.8	1.2
3.002	48.87	5.50	4.619	0.009	0.0	0.0	0.0	1.00	17.8	1.2
3.003	47.12	5.98	4.461	0.048	0.0	0.0	0.0	1.31	52.0	6.2
3.004	46.53	6.15	4.070	0.077	0.0	0.0	0.0	0.92	36.6	9.7
4.000	50.00	5.12	5.000	0.025	0.0	0.0	0.0	1.27	22.4	3.4
4.001	48.54	5.59	4.830	0.025	0.0	0.0	0.0	0.82	14.5	3.4
4.002	47.09	5.98	4.678	0.045	0.0	0.0	0.0	1.07	42.4	5.7
4.003	45.65	6.41	4.430	0.066	0.0	0.0	0.0	1.20	47.8	8.2
4.004	44.82	6.67	4.172	0.080	0.0	0.0	0.0	0.92	36.6	9.8

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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
3.005	1.659	0.224	7.4	0.005	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.001	2.296	0.011	200.0	0.067	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.002	13.218	0.066	200.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.003	9.074	0.045	200.0	0.000	0.00	0.0	0.600	o	225	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)
3.005	44.80	6.67	4.024	0.163	0.0	0.0	0.0	5.81	410.8	19.8
2.001	44.69	6.71	3.700	0.240	0.0	0.0	0.0	1.11	78.3	29.1
2.002	43.96	6.95	3.689	0.240	0.0	0.0	0.0	0.92	36.6	29.1
2.003	43.47	7.11	3.622	0.240	0.0	0.0	0.0	0.92	36.6	29.1

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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)
IC3.00	5.380	0.790	Open Manhole	600	2.000	4.590	225				
AC 09	5.450	0.610	Open Manhole	450	3.000	4.840	150				
IC10	5.450	0.714	Open Manhole	450	3.001	4.736	150	3.000	4.736	150	
IC11	5.640	1.021	Open Manhole	600	3.002	4.619	150	3.001	4.619	150	
IC12	5.450	0.989	Open Manhole	600	3.003	4.461	225	3.002	4.536	150	
IC13	5.450	1.380	Open Manhole	600	3.004	4.070	225	3.003	4.089	225	19
YG	5.450	0.450	Junction		4.000	5.000	150				
IC01	5.420	0.590	Open Manhole	600	4.001	4.830	150	4.000	4.850	150	20
IC02	5.450	0.772	Open Manhole	600	4.002	4.678	225	4.001	4.678	150	
IC03	5.150	0.720	Open Manhole	600	4.003	4.430	225	4.002	4.510	225	80
MH04	5.580	1.408	Open Manhole	1200	4.004	4.172	225	4.003	4.172	225	
IC05	5.450	1.426	Open Manhole	600	3.005	4.024	300	3.004	4.024	225	
								4.004	4.100	225	1
MH06	5.420	1.720	Open Manhole	2100	2.001	3.700	300	2.000	3.974	225	199
								3.005	3.800	300	100
IC07	5.420	1.731	Open Manhole	600	2.002	3.689	225	2.001	3.689	300	
MH08	5.510	1.888	Open Manhole	1200	2.003	3.622	225	2.002	3.622	225	
EX. SWMH	5.760	2.183	Open Manhole	0		OUTFALL		2.003	3.577	225	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
IC3.00	521881.578	105173.913	521881.578	105173.913	Required	
AC 09	521901.920	105218.624	521901.920	105218.624	Required	
IC10	521891.602	105219.664	521891.602	105219.664	Required	
IC11	521889.857	105208.124	521889.857	105208.124	Required	
IC12	521898.088	105207.073	521898.088	105207.073	Required	
IC13	521893.041	105170.222	521893.041	105170.222	Required	



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Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
YG	521920.071	105210.127			No Entry	
IC01	521918.882	105200.711	521918.882	105200.711	Required	
IC02	521915.827	105178.093	521915.827	105178.093	Required	
IC03	521912.228	105153.105	521912.228	105153.105	Required	
MH04	521881.992	105157.110	521881.992	105157.110	Required	
IC05	521883.817	105171.361	521883.817	105171.361	Required	
MH06	521885.004	105172.521	521885.004	105172.521	Required	
IC07	521882.715	105172.701	521882.715	105172.701	Required	
MH08	521880.433	105159.682	521880.433	105159.682	Required	
EX. SWMH	521877.020	105151.274			No Entry	



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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)
2.000	o	225	IC3.00	5.380	4.590	0.565	Open Manhole	600
3.000	o	150	AC 09	5.450	4.840	0.460	Open Manhole	450
3.001	o	150	IC10	5.450	4.736	0.564	Open Manhole	450
3.002	o	150	IC11	5.640	4.619	0.871	Open Manhole	600
3.003	o	225	IC12	5.450	4.461	0.764	Open Manhole	600
3.004	o	225	IC13	5.450	4.070	1.155	Open Manhole	600
4.000	o	150	YG	5.450	5.000	0.300	Junction	
4.001	o	150	IC01	5.420	4.830	0.440	Open Manhole	600
4.002	o	225	IC02	5.450	4.678	0.547	Open Manhole	600
4.003	o	225	IC03	5.150	4.430	0.495	Open Manhole	600
4.004	o	225	MH04	5.580	4.172	1.183	Open Manhole	1200
3.005	o	300	IC05	5.450	4.024	1.126	Open Manhole	600
2.001	o	300	MH06	5.420	3.700	1.420	Open Manhole	2100
2.002	o	225	IC07	5.420	3.689	1.506	Open Manhole	600
2.003	o	225	MH08	5.510	3.622	1.663	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)
2.000	3.698	6.0	MH06	5.420	3.974	1.221	Open Manhole	2100
3.000	10.370	100.0	IC10	5.450	4.736	0.564	Open Manhole	450
3.001	11.672	100.0	IC11	5.640	4.619	0.871	Open Manhole	600
3.002	8.298	100.0	IC12	5.450	4.536	0.764	Open Manhole	600
3.003	37.195	100.0	IC13	5.450	4.089	1.136	Open Manhole	600
3.004	9.294	200.0	IC05	5.450	4.024	1.201	Open Manhole	600
4.000	9.491	63.3	IC01	5.420	4.850	0.420	Open Manhole	600
4.001	22.824	150.0	IC02	5.450	4.678	0.622	Open Manhole	600
4.002	25.245	150.0	IC03	5.150	4.510	0.415	Open Manhole	600
4.003	30.499	118.2	MH04	5.580	4.172	1.183	Open Manhole	1200
4.004	14.367	200.0	IC05	5.450	4.100	1.125	Open Manhole	600
3.005	1.659	7.4	MH06	5.420	3.800	1.320	Open Manhole	2100
2.001	2.296	200.0	IC07	5.420	3.689	1.431	Open Manhole	600
2.002	13.218	200.0	MH08	5.510	3.622	1.663	Open Manhole	1200
2.003	9.074	200.0	EX. SWMH	5.760	3.577	1.958	Open Manhole	0

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
2.000	User	-	100	0.010	0.010	0.010
3.000	User	-	100	0.009	0.009	0.009
3.001	-	-	100	0.000	0.000	0.000
3.002	-	-	100	0.000	0.000	0.000
3.003	User	-	100	0.018	0.018	0.018
	User	-	100	0.008	0.008	0.026
	User	-	100	0.013	0.013	0.039
3.004	User	-	100	0.029	0.029	0.029
4.000	User	-	100	0.008	0.008	0.008
	User	-	100	0.017	0.017	0.025
4.001	-	-	100	0.000	0.000	0.000
4.002	User	-	100	0.020	0.020	0.020
4.003	User	-	100	0.013	0.013	0.013
	User	-	100	0.005	0.005	0.018
	User	-	100	0.003	0.003	0.021
4.004	User	-	100	0.014	0.014	0.014
3.005	User	-	100	0.005	0.005	0.005
2.001	User	-	100	0.067	0.067	0.067
2.002	-	-	100	0.000	0.000	0.000
2.003	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.240	0.240	0.240

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Network Classifications for Storm

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
2.000	IC3.00	225	0.565	1.221	Unclassified	600	0	0.565	Unclassified
3.000	AC 09	150	0.460	0.564	Unclassified	450	0	0.460	Unclassified
3.001	IC10	150	0.564	0.871	Unclassified	450	0	0.564	Unclassified
3.002	IC11	150	0.764	0.871	Unclassified	600	0	0.871	Unclassified
3.003	IC12	225	0.764	1.136	Unclassified	600	0	0.764	Unclassified
3.004	IC13	225	1.155	1.201	Unclassified	600	0	1.155	Unclassified
4.000	YG	150	0.300	0.420	Unclassified				Junction
4.001	IC01	150	0.440	0.622	Unclassified	600	0	0.440	Unclassified
4.002	IC02	225	0.415	0.547	Unclassified	600	0	0.547	Unclassified
4.003	IC03	225	0.495	1.183	Unclassified	600	0	0.495	Unclassified
4.004	MH04	225	1.125	1.183	Unclassified	1200	0	1.183	Unclassified
3.005	IC05	300	1.126	1.320	Unclassified	600	0	1.126	Unclassified
2.001	MH06	300	1.420	1.431	Unclassified	2100	0	1.420	Unclassified
2.002	IC07	225	1.506	1.663	Unclassified	600	0	1.506	Unclassified
2.003	MH08	225	1.663	1.958	Unclassified	1200	0	1.663	Unclassified

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	3
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 521800 105150 TQ 21800 05150
Data Type	Catchment
Summer Storms	Yes
Winter Storms	No
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

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Online Controls for Storm

Complex Manhole: MH06, DS/PN: 2.001, Volume (m³): 6.1

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0128-8000-1200-8000
Design Head (m)	1.200
Design Flow (l/s)	8.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	128
Invert Level (m)	3.700
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	8.0
Flush-Flo™	0.357	8.0
Kick-Flo®	0.767	6.5
Mean Flow over Head Range	-	6.9

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	4.6	1.200	8.0	3.000	12.3	7.000	18.4
0.200	7.5	1.400	8.6	3.500	13.2	7.500	19.1
0.300	7.9	1.600	9.1	4.000	14.1	8.000	19.7
0.400	8.0	1.800	9.7	4.500	14.9	8.500	20.2
0.500	7.8	2.000	10.2	5.000	15.7	9.000	20.8
0.600	7.6	2.200	10.6	5.500	16.4	9.500	21.4
0.800	6.6	2.400	11.1	6.000	17.1		
1.000	7.3	2.600	11.5	6.500	17.8		

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0193-1780-0600-1780
Design Head (m)	0.600
Design Flow (l/s)	17.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	193
Invert Level (m)	4.374

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Hydro-Brake® Optimum

Minimum Outlet Pipe Diameter (mm) 225
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.600	17.8
Flush-Flo™	0.286	17.8
Kick-Flo®	0.483	16.1
Mean Flow over Head Range	-	14.0

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	6.7	1.200	24.8	3.000	38.5	7.000	57.7
0.200	17.3	1.400	26.7	3.500	41.4	7.500	59.8
0.300	17.8	1.600	28.4	4.000	44.2	8.000	61.8
0.400	17.3	1.800	30.1	4.500	46.8	8.500	63.7
0.500	16.3	2.000	31.6	5.000	49.3	9.000	65.6
0.600	17.8	2.200	33.1	5.500	51.6	9.500	67.4
0.800	20.4	2.400	34.5	6.000	53.8		
1.000	22.7	2.600	35.9	6.500	55.6		

Weir

Discharge Coef 0.544 Width (m) 0.150 Invert Level (m) 4.900

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Storage Structures for Storm

Porous Car Park Manhole: IC3.00, DS/PN: 2.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	4.5
Membrane Percolation (mm/hr)	1000	Length (m)	25.0
Max Percolation (l/s)	31.3	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	5.000	Cap Volume Depth (m)	0.300

Porous Car Park Manhole: IC13, DS/PN: 3.004

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	4.5
Membrane Percolation (mm/hr)	1000	Length (m)	37.0
Max Percolation (l/s)	46.3	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	4.820	Cap Volume Depth (m)	0.400

Cellular Storage Manhole: MH06, DS/PN: 2.001

Invert Level (m)	3.700	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	56.0	0.0	1.001	0.0	0.0
1.000	56.0	0.0	1.251	0.0	0.0

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Areas for Storm

PN	C. Area (ha)	PIMP (%)	Imp. Area (ha)	X (m)	Y (m)
2.000	0.010	100	0.010	521874.255	105175.036
				521881.057	105173.863
				521878.985	105160.245
				521870.813	105161.832
3.000	0.009	100	0.009	521892.088	105219.063
				521895.802	105218.647
				521895.930	105219.079
				521901.837	105218.294
				521901.725	105217.654
				521906.735	105217.014
				521906.895	105217.526
				521912.706	105216.710
				521912.210	105212.420
				521891.416	105214.677
3.003	0.018	100	0.018	521899.389	105208.295
				521910.989	105206.837
				521910.546	105205.041
				521908.454	105190.144
				521898.036	105191.771
				521899.410	105208.168
3.003	0.008	100	0.008	521897.764	105191.691
				521908.397	105190.231
				521907.406	105182.569
				521897.086	105184.550
3.003	0.013	100	0.013	521891.341	105214.542
				521912.185	105212.257
				521911.023	105206.605
				521887.894	105209.692
				521889.016	105214.782
3.004	0.029	100	0.029	521894.740	105167.788
				521897.128	105184.333
				521907.461	105182.727
				521904.523	105160.984
				521883.646	105163.815
				521884.323	105169.161
4.000	0.008	100	0.008	521912.849	105216.198
				521918.575	105215.268
				521918.005	105209.732
				521920.329	105209.563
				521919.632	105203.625
				521910.672	105204.935
				521911.180	105206.879
4.000	0.017	100	0.017	521910.799	105204.736
				521919.755	105203.504
				521918.144	105186.540
				521907.956	105187.393
4.002	0.020	100	0.020	521908.003	105187.346
				521918.049	105186.682
				521915.301	105166.639
				521905.634	105168.439
4.003	0.013	100	0.013	521905.615	105168.295

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Areas for Storm

PN	C. Area (ha)	PIMP (%)	Imp. Area (ha)	X (m)	Y (m)
				521915.333	105166.622
				521913.336	105153.747
				521903.656	105155.078
4.003	0.005	100	0.005	521883.856	105154.160
				521884.161	105156.347
				521907.932	105152.392
				521909.891	105150.129
				521884.066	105154.179
4.003	0.003	100	0.003	521884.505	105156.279
				521903.600	105154.966
				521913.276	105153.757
				521913.096	105153.139
				521907.846	105152.444
4.004	0.014	100	0.014	521883.337	105163.829
				521904.446	105160.973
				521903.452	105154.982
				521882.240	105156.333
3.005	0.005	100	0.005	521880.802	105171.708
				521884.384	105169.515
				521882.484	105157.186
				521878.731	105157.746
2.001	0.067	100	0.067	521881.111	105175.422
				521876.197	105176.199
				521880.474	105201.783
				521885.666	105200.790
				521887.255	105207.996
				521887.676	105209.884
				521894.374	105209.218
				521899.295	105208.280
				521896.238	105180.792
				521894.644	105168.185
				521892.589	105168.531
				521884.474	105169.496
				521880.587	105171.879

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2 year Return Period Summary of Critical Results by Maximum Level (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	3
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 521800 105150 TQ 21800 05150
Data Type	Catchment
Cv (Summer)	0.750
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, 240, 360, 480, 960, 1440
Return Period(s) (years)	2, 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)
2.000	IC3.00	15 Summer	2	+0%	100/30 Summer				4.605
3.000	AC 09	15 Winter	2	+0%	100/30 Winter				4.871
3.001	IC10	15 Winter	2	+0%	100/30 Winter				4.767
3.002	IC11	15 Winter	2	+0%	100/15 Winter				4.651
3.003	IC12	15 Winter	2	+0%	100/15 Summer				4.518
3.004	IC13	15 Summer	2	+0%	30/15 Winter				4.164
4.000	YG	15 Winter	2	+0%					5.044
4.001	IC01	15 Winter	2	+0%	100/15 Summer				4.887
4.002	IC02	15 Winter	2	+0%	100/15 Winter				4.741
4.003	IC03	15 Winter	2	+0%	100/15 Summer				4.501
4.004	MH04	15 Winter	2	+0%	30/30 Winter				4.266
3.005	IC05	15 Winter	2	+0%	30/30 Summer				4.114
2.001	MH06	120 Winter	2	+0%	2/120 Winter				4.007
2.002	IC07	120 Winter	2	+0%					3.764
2.003	MH08	120 Winter	2	+0%					3.699

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2 year Return Period Summary of Critical Results by Maximum Level (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
2.000	IC3.00	-0.210	0.000	0.01		2	0.9	OK	
3.000	AC 09	-0.119	0.000	0.10			1.5	OK	
3.001	IC10	-0.119	0.000	0.09			1.5	OK	
3.002	IC11	-0.118	0.000	0.10			1.5	OK	
3.003	IC12	-0.169	0.000	0.14			6.9	OK	
3.004	IC13	-0.131	0.000	0.34		8	10.3	OK	
4.000	YG	-0.106	0.000	0.18			4.1	OK*	
4.001	IC01	-0.093	0.000	0.30			4.1	OK	
4.002	IC02	-0.162	0.000	0.17			6.8	OK	
4.003	IC03	-0.154	0.000	0.21			9.6	OK	
4.004	MH04	-0.131	0.000	0.36			11.5	OK	
3.005	IC05	-0.210	0.000	0.19			22.8	OK	
2.001	MH06	0.007	0.000	0.15		42	7.8	SURCHARGED	
2.002	IC07	-0.150	0.000	0.25			7.8	OK	
2.003	MH08	-0.148	0.000	0.26			7.8	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (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	3
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 521800 105150 TQ 21800 05150
Data Type	Catchment
Cv (Summer)	0.750
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, 240, 360, 480, 960, 1440
Return Period(s) (years)	2, 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)
2.000	IC3.00	15 Winter	30	+0%	100/30 Summer				4.618
3.000	AC 09	15 Winter	30	+0%	100/30 Winter				4.888
3.001	IC10	15 Winter	30	+0%	100/30 Winter				4.784
3.002	IC11	15 Winter	30	+0%	100/15 Winter				4.668
3.003	IC12	15 Winter	30	+0%	100/15 Summer				4.560
3.004	IC13	120 Winter	30	+0%	30/15 Winter				4.518
4.000	YG	15 Winter	30	+0%					5.069
4.001	IC01	15 Winter	30	+0%	100/15 Summer				4.924
4.002	IC02	15 Winter	30	+0%	100/15 Winter				4.783
4.003	IC03	15 Winter	30	+0%	100/15 Summer				4.552
4.004	MH04	120 Winter	30	+0%	30/30 Winter				4.520
3.005	IC05	120 Winter	30	+0%	30/30 Summer				4.514
2.001	MH06	120 Winter	30	+0%	2/120 Winter				4.513
2.002	IC07	120 Winter	30	+0%					3.774
2.003	MH08	120 Winter	30	+0%					3.710

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30 year Return Period Summary of Critical Results by Maximum Level (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
2.000	IC3.00	-0.197	0.000	0.04		5	4.0	OK	
3.000	AC 09	-0.102	0.000	0.22			3.5	OK	
3.001	IC10	-0.102	0.000	0.22			3.5	OK	
3.002	IC11	-0.101	0.000	0.23			3.5	OK	
3.003	IC12	-0.127	0.000	0.39			19.0	OK	
3.004	IC13	0.223	0.000	0.32		48	9.6	SURCHARGED	
4.000	YG	-0.081	0.000	0.43			9.5	OK*	
4.001	IC01	-0.056	0.000	0.69			9.5	OK	
4.002	IC02	-0.120	0.000	0.43			16.8	OK	
4.003	IC03	-0.103	0.000	0.56			24.8	OK	
4.004	MH04	0.123	0.000	0.32			10.4	SURCHARGED	
3.005	IC05	0.190	0.000	0.16			19.3	SURCHARGED	
2.001	MH06	0.513	0.000	0.18		82	9.8	SURCHARGED	
2.002	IC07	-0.139	0.000	0.31			9.8	OK	
2.003	MH08	-0.137	0.000	0.33			9.8	OK	

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100 year Return Period Summary of Critical Results by Maximum Level (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	3
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 521800 105150 TQ 21800 05150
Data Type	Catchment
Cv (Summer)	0.750
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, 240, 360, 480, 960, 1440
Return Period(s) (years)	2, 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)
2.000	IC3.00	60 Winter	100	+40%	100/30 Summer				5.071
3.000	AC 09	60 Winter	100	+40%	100/30 Winter				5.111
3.001	IC10	60 Winter	100	+40%	100/30 Winter				5.107
3.002	IC11	60 Winter	100	+40%	100/15 Winter				5.103
3.003	IC12	60 Winter	100	+40%	100/15 Summer				5.099
3.004	IC13	60 Winter	100	+40%	30/15 Winter				5.084
4.000	YG	30 Winter	100	+40%					5.150
4.001	IC01	60 Winter	100	+40%	100/15 Summer				5.171
4.002	IC02	60 Winter	100	+40%	100/15 Winter				5.142
4.003	IC03	60 Winter	100	+40%	100/15 Summer				5.121
4.004	MH04	60 Winter	100	+40%	30/30 Winter				5.095
3.005	IC05	60 Winter	100	+40%	30/30 Summer				5.075
2.001	MH06	60 Winter	100	+40%	2/120 Winter				5.072
2.002	IC07	60 Winter	100	+40%					3.845
2.003	MH08	60 Winter	100	+40%					3.785

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100 year Return Period Summary of Critical Results by Maximum Level (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
2.000	IC3.00	0.256	0.000	0.05		10	5.2	SURCHARGED	
3.000	AC 09	0.121	0.000	0.22			3.4	SURCHARGED	
3.001	IC10	0.221	0.000	0.21			3.3	SURCHARGED	
3.002	IC11	0.334	0.000	0.20			3.1	SURCHARGED	
3.003	IC12	0.413	0.000	0.33			16.2	SURCHARGED	
3.004	IC13	0.789	0.000	0.80		20	24.3	SURCHARGED	
4.000	YG	0.000	0.000	0.61			13.7	FLOOD RISK*	
4.001	IC01	0.191	0.000	0.68			9.3	FLOOD RISK	
4.002	IC02	0.239	0.000	0.40			15.8	SURCHARGED	
4.003	IC03	0.466	0.000	0.46			20.7	FLOOD RISK	
4.004	MH04	0.698	0.000	0.74			23.8	SURCHARGED	
3.005	IC05	0.751	0.000	0.39			46.8	SURCHARGED	
2.001	MH06	1.072	0.000	0.49		86	26.2	SURCHARGED	
2.002	IC07	-0.068	0.000	0.82			26.2	OK	
2.003	MH08	-0.062	0.000	0.87			26.2	OK	

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