

Appendix J

Microdrainage Calculations

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)	2	Foul Sewage (l/s/ha)	0.000
M5-60 (mm)	18.500	Volumetric Runoff Coeff.	0.750
Ratio R	0.334	PIMP (%)	100
Maximum Rainfall (mm/hr)	125	Add Flow / Climate Change (%)	0
Maximum Time of Concentration (mins)	30	Minimum Backdrop Height (m)	0.000
		Maximum Backdrop Height (m)	0.000
		Min Design Depth for Optimisation (m)	1.200
		Min Vel for Auto Design only (m/s)	1.00
		Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm

- Indicates pipe length does not match coordinates
« - Indicates pipe capacity < flow

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
S1.000	15.861	0.125	126.9	0.070	5.00	0.0	0.600	o	225	Pipe/Conduit	🔴
S1.001	75.533	0.733	103.0	0.100	0.00	0.0	0.600	o	300	Pipe/Conduit	🔴
S1.002	92.790	0.901	103.0	0.078	0.00	0.0	0.600	o	300	Pipe/Conduit	🔴
S2.000	8.045	0.201	40.0	1.333	5.00	0.0	0.600	o	300	Pipe/Conduit	🔴
S3.000	38.308	0.120	319.2	0.076	5.00	5.0	0.600	o	375	Pipe/Conduit	🔴
S2.001	19.666	0.050	393.3	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	🔴
S1.003	86.881	0.430	202.0	0.234	0.00	0.0	0.600	o	525	Pipe/Conduit	🔴
S1.004	86.316	0.430	200.7	0.032	0.00	0.0	0.600	o	525	Pipe/Conduit	🔴
S1.005	45.315	0.240	188.8	0.050	0.00	0.0	0.600	o	525	Pipe/Conduit	🔴
S4.000	26.822	0.435	61.7	0.350	10.00	0.0	0.600	o	225	Pipe/Conduit	🔴
S1.006	25.870	0.890	29.1	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	🔴
S5.000	5.000	0.020	250.0	0.414	10.00	0.0	0.600	o	300	Pipe/Conduit	🔴
S5.001	9.073	0.202	44.9	0.160	0.00	0.0	0.600	o	375	Pipe/Conduit	🔴
S6.000	17.932	0.195	92.0	0.460	10.00	0.0	0.600	o	375	Pipe/Conduit	🔴
S6.001	17.713	0.118	150.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	🔴
S6.002	29.401	0.196	150.0	0.115	0.00	0.0	0.600	o	375	Pipe/Conduit	🔴
S6.003	4.652	0.031	150.1	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	🔴
S6.004	27.851	0.186	150.0	0.115	0.00	0.0	0.600	o	375	Pipe/Conduit	🔴
S6.005	34.880	0.233	150.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	🔴
S6.006	7.750	0.052	150.0	0.000	0.00	0.0	0.600	o	375	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)
S1.000	58.18	5.23	34.000	0.070	0.0	0.0	0.0	1.16	46.1	11.0
S1.001	54.78	6.04	33.800	0.170	0.0	0.0	0.0	1.55	109.5	25.2
S1.002	51.19	7.04	33.067	0.248	0.0	0.0	0.0	1.55	109.5	34.4
S2.000	58.97	5.05	33.000	1.333	0.0	0.0	0.0	2.49	176.2«	212.9
S3.000	56.42	5.63	32.260	0.076	5.0	0.0	0.0	1.01	111.4	16.6
S2.001	55.11	5.95	32.065	1.409	5.0	0.0	0.0	1.02	162.1«	215.3
S1.003	48.35	7.96	31.940	1.891	5.0	0.0	0.0	1.57	340.3	252.6
S1.004	45.88	8.87	31.510	1.923	5.0	0.0	0.0	1.58	341.4	252.6
S1.005	44.74	9.34	31.080	1.973	5.0	0.0	0.0	1.63	352.1	252.6
S4.000	42.63	10.27	31.575	0.350	0.0	0.0	0.0	1.67	66.3	40.4
S1.006	42.41	10.37	30.840	2.323	5.0	0.0	0.0	4.17	901.8	271.8
S5.000	43.03	10.08	30.670	0.414	0.0	0.0	0.0	0.99	70.0	48.2
S5.001	42.91	10.14	30.650	0.574	0.0	0.0	0.0	2.71	299.3	66.7
S6.000	42.87	10.16	32.300	0.460	0.0	0.0	0.0	1.89	208.7	53.4
S6.001	42.44	10.36	32.105	0.460	0.0	0.0	0.0	1.48	163.1	53.4
S6.002	41.76	10.69	31.987	0.575	0.0	0.0	0.0	1.48	163.1	65.0
S6.003	41.65	10.74	31.791	0.575	0.0	0.0	0.0	1.48	163.1	65.0
S6.004	41.03	11.06	31.760	0.690	0.0	0.0	0.0	1.48	163.1	76.7
S6.005	40.28	11.45	31.575	0.690	0.0	0.0	0.0	1.48	163.1	76.7
S6.006	40.12	11.54	30.500	0.690	0.0	0.0	0.0	1.48	163.1	76.7

11 Ducie Street
 Piccadilly Basin
 Manchester M1 2JB

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 SW NETWORK
 P08



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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
S5.002	12.688	0.158	80.3	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S7.000	35.947	0.550	65.4	0.079	5.00	0.0	0.600	o	225	Pipe/Conduit	
S5.003	30.729	0.080	384.1	0.028	0.00	0.0	0.600	o	450	Pipe/Conduit	
S5.004	19.547	0.050	390.9	0.015	0.00	0.0	0.600	o	450	Pipe/Conduit	
S5.005	21.138	0.055	384.3	0.000	0.00	5.0	0.600	o	450	Pipe/Conduit	
S5.006	30.300#	0.080	378.8	0.015	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.007	13.822	0.100	138.2	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.008	4.742	0.017	278.9	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S5.002	39.95	11.63	30.373	1.264	0.0	0.0	0.0	2.27	361.1	136.7
S7.000	57.55	5.37	30.990	0.079	0.0	0.0	0.0	1.62	64.4	12.3
S5.003	39.07	12.13	30.215	1.371	0.0	0.0	0.0	1.03	164.0	145.1
S5.004	38.54	12.45	30.135	1.386	0.0	0.0	0.0	1.02	162.6	145.1
S5.005	37.99	12.79	30.085	1.386	5.0	0.0	0.0	1.03	164.0	147.6
S5.006	37.24	13.27	30.030	1.401	5.0	0.0	0.0	1.04	165.2	147.6
S1.007	37.01	13.42	29.950	3.724	10.0	0.0	0.0	1.54	170.0<	383.3
S1.008	36.91	13.50	29.850	3.724	10.0	0.0	0.0	1.08	119.3<	383.3

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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		Pipes In			Backdrop (mm)
					PN	Invert Level (m)	Diameter (mm)	PN	Invert Level (m)	
S1.0	35.500	1.500	Open Manhole	1200	S1.000	34.000	225			
S1.1	35.300	1.500	Open Manhole	1350	S1.001	33.800	300	S1.000	33.875	225
S1.2	34.650	1.583	Open Manhole	1350	S1.002	33.067	300	S1.001	33.067	300
S1.3	33.600	0.600	Open Manhole	1350	S2.000	33.000	300			
S1.4	33.850	1.590	Open Manhole	1350	S3.000	32.260	375			
S1.5	34.500	2.435	Open Manhole	1800	S2.001	32.065	450	S2.000	32.799	300
								S3.000	32.140	375
S1.6	33.800	1.860	Open Manhole	1800	S1.003	31.940	525	S1.002	32.166	300
								S2.001	32.015	450
S1.7	33.100	1.590	Open Manhole	1800	S1.004	31.510	525	S1.003	31.510	525
S1.8	33.500	2.420	Open Manhole	1800	S1.005	31.080	525	S1.004	31.080	525
S1.9	32.575	1.000	Open Manhole	1200	S4.000	31.575	225			
S1.10	33.850	3.010	Open Manhole	1800	S1.006	30.840	525	S1.005	30.840	525
								S4.000	31.140	225
SFD	31.300	0.630	Open Manhole	1350	S5.000	30.670	300			
SP1	31.300	0.650	Open Manhole	1350	S5.001	30.650	375	S5.000	30.650	300
S1.11	33.200	0.900	Open Manhole	1350	S6.000	32.300	375			
S1.12	35.400	3.295	Open Manhole	1350	S6.001	32.105	375	S6.000	32.105	375
S1.13	35.400	3.413	Open Manhole	1350	S6.002	31.987	375	S6.001	31.987	375
S1.14	35.500	3.709	Open Manhole	1350	S6.003	31.791	375	S6.002	31.791	375
S1.15	35.500	3.740	Open Manhole	1350	S6.004	31.760	375	S6.003	31.760	375
S1.16	35.400	3.825	Open Manhole	1350	S6.005	31.575	375	S6.004	31.575	375
S1.17	35.400	4.900	Open Manhole	1350	S6.006	30.500	375	S6.005	31.342	375
S1.18	31.800	1.427	Open Manhole	1800	S5.002	30.373	450	S5.001	30.448	375
								S6.006	30.448	375
SRE	31.900	0.910	Open Manhole	1200	S7.000	30.990	225			
S1.19	31.600	1.385	Open Manhole	1800	S5.003	30.215	450	S5.002	30.215	450
								S7.000	30.440	225
S1.20	32.400	2.265	Open Manhole	1800	S5.004	30.135	450	S5.003	30.135	450
S1.21	32.900	2.815	Open Manhole	1800	S5.005	30.085	450	S5.004	30.085	450
S1.22	33.500	3.470	Open Manhole	1800	S5.006	30.030	450	S5.005	30.030	450
SOF2	31.200	1.250	Open Manhole	1800	S1.007	29.950	375	S1.006	29.950	525
								S5.006	29.950	450
S1.26	31.600	1.750	Open Manhole	1500	S1.008	29.850	375	S1.007	29.850	375
s	32.500	2.667	Open Manhole	0		OUTFALL		S1.008	29.833	375

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S1.0	355022.517	424898.905	355022.517	424898.905	Required	
S1.1	355010.933	424909.738	355010.933	424909.738	Required	
S1.2	354935.642	424903.696	354935.642	424903.696	Required	
S1.4	354890.467	424872.702	354890.467	424872.702	Required	
S1.5	354852.175	424871.583	354852.175	424871.583	Required	
S1.6	354843.952	424889.447	354843.952	424889.447	Required	
S1.7	354757.078	424890.487	354757.078	424890.487	Required	
S1.8	354670.762	424890.593	354670.762	424890.593	Required	
S1.9	354645.720	424851.920	354645.720	424851.920	Required	
S1.10	354629.035	424872.920	354629.035	424872.920	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)
SP1	354609.888	424737.539	354609.888	424737.539	Required	
S1.11	354639.490	424669.716	354639.490	424669.716	Required	
S1.12	354628.338	424683.759	354628.338	424683.759	Required	
S1.13	354642.209	424694.775	354642.209	424694.775	Required	
S1.14	354669.352	424706.075	354669.352	424706.075	Required	
S1.15	354669.414	424710.726	354669.414	424710.726	Required	
S1.16	354643.228	424720.213	354643.228	424720.213	Required	
S1.17	354615.198	424740.970	354615.198	424740.970	Required	
S1.18	354609.884	424746.612	354609.884	424746.612	Required	
SRE	354564.660	424748.880	354564.660	424748.880	Required	
S1.19	354600.129	424754.725	354600.129	424754.725	Required	
S1.20	354594.605	424784.953	354594.605	424784.953	Required	
S1.21	354594.181	424804.495	354594.181	424804.495	Required	
S1.22	354598.111	424825.264	354598.111	424825.264	Required	
SOF2	354613.229	424893.400	354613.229	424893.400	Required	
S1.26	354601.627	424900.913	354601.627	424900.913	Required	
S	354597.781	424903.687			No Entry	

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PIPELINE SCHEDULES for Storm

Upstream Manhole

- Indicates pipe length does not match coordinates

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	225	S1.0	35.500	34.000	1.275	Open Manhole	1200
S1.001	o	300	S1.1	35.300	33.800	1.200	Open Manhole	1350
S1.002	o	300	S1.2	34.650	33.067	1.283	Open Manhole	1350
S2.000	o	300	S1.3	33.600	33.000	0.300	Open Manhole	1350
S3.000	o	375	S1.4	33.850	32.260	1.215	Open Manhole	1350
S2.001	o	450	S1.5	34.500	32.065	1.985	Open Manhole	1800
S1.003	o	525	S1.6	33.800	31.940	1.335	Open Manhole	1800
S1.004	o	525	S1.7	33.100	31.510	1.065	Open Manhole	1800
S1.005	o	525	S1.8	33.500	31.080	1.895	Open Manhole	1800
S4.000	o	225	S1.9	32.575	31.575	0.775	Open Manhole	1200
S1.006	o	525	S1.10	33.850	30.840	2.485	Open Manhole	1800
S5.000	o	300	SFD	31.300	30.670	0.330	Open Manhole	1350
S5.001	o	375	SP1	31.300	30.650	0.275	Open Manhole	1350
S6.000	o	375	S1.11	33.200	32.300	0.525	Open Manhole	1350
S6.001	o	375	S1.12	35.400	32.105	2.920	Open Manhole	1350
S6.002	o	375	S1.13	35.400	31.987	3.038	Open Manhole	1350
S6.003	o	375	S1.14	35.500	31.791	3.334	Open Manhole	1350
S6.004	o	375	S1.15	35.500	31.760	3.365	Open Manhole	1350
S6.005	o	375	S1.16	35.400	31.575	3.450	Open Manhole	1350
S6.006	o	375	S1.17	35.400	30.500	4.525	Open Manhole	1350
S5.002	o	450	S1.18	31.800	30.373	0.977	Open Manhole	1800
S7.000	o	225	SRE	31.900	30.990	0.685	Open Manhole	1200
S5.003	o	450	S1.19	31.600	30.215	0.935	Open Manhole	1800
S5.004	o	450	S1.20	32.400	30.135	1.815	Open Manhole	1800
S5.005	o	450	S1.21	32.900	30.085	2.365	Open Manhole	1800

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)
S1.000	15.861	126.9	S1.1	35.300	33.875	1.200	Open Manhole	1350
S1.001	75.533	103.0	S1.2	34.650	33.067	1.283	Open Manhole	1350
S1.002	92.790	103.0	S1.6	33.800	32.166	1.334	Open Manhole	1800
S2.000	8.045	40.0	S1.5	34.500	32.799	1.401	Open Manhole	1800
S3.000	38.308	319.2	S1.5	34.500	32.140	1.985	Open Manhole	1800
S2.001	19.666	393.3	S1.6	33.800	32.015	1.335	Open Manhole	1800
S1.003	86.881	202.0	S1.7	33.100	31.510	1.065	Open Manhole	1800
S1.004	86.316	200.7	S1.8	33.500	31.080	1.895	Open Manhole	1800
S1.005	45.315	188.8	S1.10	33.850	30.840	2.485	Open Manhole	1800
S4.000	26.822	61.7	S1.10	33.850	31.140	2.485	Open Manhole	1800
S1.006	25.870	29.1	SOF2	31.200	29.950	0.725	Open Manhole	1800
S5.000	5.000	250.0	SP1	31.300	30.650	0.350	Open Manhole	1350
S5.001	9.073	44.9	S1.18	31.800	30.448	0.977	Open Manhole	1800
S6.000	17.932	92.0	S1.12	35.400	32.105	2.920	Open Manhole	1350
S6.001	17.713	150.0	S1.13	35.400	31.987	3.038	Open Manhole	1350
S6.002	29.401	150.0	S1.14	35.500	31.791	3.334	Open Manhole	1350
S6.003	4.652	150.1	S1.15	35.500	31.760	3.365	Open Manhole	1350
S6.004	27.851	150.0	S1.16	35.400	31.575	3.450	Open Manhole	1350
S6.005	34.880	150.0	S1.17	35.400	31.342	3.683	Open Manhole	1350
S6.006	7.750	150.0	S1.18	31.800	30.448	0.977	Open Manhole	1800
S5.002	12.688	80.3	S1.19	31.600	30.215	0.935	Open Manhole	1800
S7.000	35.947	65.4	S1.19	31.600	30.440	0.935	Open Manhole	1800
S5.003	30.729	384.1	S1.20	32.400	30.135	1.815	Open Manhole	1800
S5.004	19.547	390.9	S1.21	32.900	30.085	2.365	Open Manhole	1800
S5.005	21.138	384.3	S1.22	33.500	30.030	3.020	Open Manhole	1800

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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)
S5.006	o	450	S1.22	33.500	30.030	3.020	Open Manhole	1800
S1.007	o	375	SOF2	31.200	29.950	0.875	Open Manhole	1800
S1.008	o	375	S1.26	31.600	29.850	1.375	Open Manhole	1500

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)
S5.006	30.300#	378.8	SOF2	31.200	29.950	0.800	Open Manhole	1800
S1.007	13.822	138.2	S1.26	31.600	29.850	1.375	Open Manhole	1500
S1.008	4.742	278.9	S	32.500	29.833	2.292	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)
S1.008	S	32.500	29.833	0.000	0	0


Simulation Criteria for Storm

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

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

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.500 Cv (Summer) 0.750
 Return Period (years) 2 Ratio R 0.334 Cv (Winter) 0.840
 Region England and Wales Profile Type Summer Storm Duration (mins) 30

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Online Controls for Storm

Orifice Manhole: SP1, DS/PN: S5.001, Volume (m³): 1.2

Diameter (m) 0.137 Discharge Coefficient 0.600 Invert Level (m) 30.650

Hydro-Brake® Optimum Manhole: S1.26, DS/PN: S1.008, Volume (m³): 4.4

Unit Reference	MD-SHE-0360-8190-1250-8190	Sump Available	Yes
Design Head (m)	1.250	Diameter (mm)	360
Design Flow (l/s)	81.9	Invert Level (m)	29.850
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	375
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	2100
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.250	81.9	Kick-Flo®	0.973	72.6
Flush-Flo™	0.548	81.9	Mean Flow over Head Range	-	66.1

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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	10.3	0.600	81.7	1.600	92.3	2.600	116.9	5.000	160.8	7.500	196.2
0.200	36.2	0.800	79.0	1.800	97.7	3.000	125.3	5.500	168.5	8.000	202.5
0.300	67.3	1.000	73.5	2.000	102.9	3.500	135.1	6.000	175.9	8.500	208.6
0.400	80.3	1.200	80.3	2.200	107.8	4.000	144.2	6.500	182.9	9.000	214.5
0.500	81.8	1.400	86.5	2.400	112.4	4.500	152.8	7.000	189.6	9.500	220.3

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Storage Structures for Storm

Porous Car Park Manhole: S1.3, DS/PN: S2.000

Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.30 Slope (1:X) 69.0
 Membrane Percolation (mm/hr) 1000 Invert Level (m) 33.000 Depression Storage (mm) 5
 Max Percolation (l/s) 1444.4 Width (m) 65.0 Evaporation (mm/day) 3
 Safety Factor 2.0 Length (m) 80.0 Cap Volume Depth (m) 0.400

Filter Drain Manhole: S1.9, DS/PN: S4.000

Infiltration Coefficient Base (m/hr) 0.00000 Trench Width (m) 0.5 Slope (1:X) 140.0
 Infiltration Coefficient Side (m/hr) 0.00000 Trench Length (m) 435.0 Cap Volume Depth (m) 0.000
 Safety Factor 2.0 Pipe Diameter (m) 0.150 Cap Infiltration Depth (m) 0.000
 Porosity 0.30 Pipe Depth above Invert (m) 0.000
 Invert Level (m) 31.575 Number of Pipes 1

Filter Drain Manhole: SFD, DS/PN: S5.000

Infiltration Coefficient Base (m/hr) 0.00000 Trench Width (m) 1.0 Slope (1:X) 200.0
 Infiltration Coefficient Side (m/hr) 0.00000 Trench Length (m) 247.0 Cap Volume Depth (m) 0.000
 Safety Factor 2.0 Pipe Diameter (m) 0.225 Cap Infiltration Depth (m) 0.000
 Porosity 0.30 Pipe Depth above Invert (m) 0.000
 Invert Level (m) 30.670 Number of Pipes 1

Porous Car Park Manhole: SP1, DS/PN: S5.001

Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.30 Slope (1:X) 200.0
 Membrane Percolation (mm/hr) 1000 Invert Level (m) 30.650 Depression Storage (mm) 5
 Max Percolation (l/s) 355.6 Width (m) 80.0 Evaporation (mm/day) 3
 Safety Factor 2.0 Length (m) 16.0 Cap Volume Depth (m) 0.600

Filter Drain Manhole: S1.11, DS/PN: S6.000

Infiltration Coefficient Base (m/hr) 0.00000 Trench Width (m) 1.0 Slope (1:X) 140.0
 Infiltration Coefficient Side (m/hr) 0.00000 Trench Length (m) 498.0 Cap Volume Depth (m) 0.000
 Safety Factor 2.0 Pipe Diameter (m) 0.225 Cap Infiltration Depth (m) 0.000
 Porosity 0.30 Pipe Depth above Invert (m) 0.000
 Invert Level (m) 32.300 Number of Pipes 1

Tank or Pond Manhole: SOF2, DS/PN: S1.007

Invert Level (m) 29.950

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	1202.0	0.950	1887.0	1.250	2050.0

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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 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coefficient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

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

Synthetic Rainfall Details


Rainfall Model FSR M5-60 (mm) 18.500 Cv (Summer) 0.750
Region England and Wales Ratio R 0.333 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 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) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water	Surcharged	Flooded	Pipe Flow (l/s)	
									Level (m)	Depth (m)	Volume (m ³)		Flow / Cap. (l/s)
S1.000	S1.0	15 Winter	2	+0%					34.079	-0.146	0.000	0.27	10.9
S1.001	S1.1	15 Winter	2	+0%					33.898	-0.202	0.000	0.22	23.6
S1.002	S1.2	15 Winter	2	+0%	100/15 Summer				33.183	-0.184	0.000	0.32	33.6
S2.000	S1.3	30 Winter	2	+0%	30/15 Summer	100/30 Winter			33.217	-0.083	0.000	0.87	97.9
S3.000	S1.4	30 Winter	2	+0%	100/15 Summer				32.393	-0.242	0.000	0.14	14.0
S2.001	S1.5	30 Winter	2	+0%	100/15 Summer				32.380	-0.135	0.000	0.83	108.8
S1.003	S1.6	30 Winter	2	+0%	100/15 Summer				32.200	-0.265	0.000	0.48	152.7
S1.004	S1.7	30 Winter	2	+0%	100/15 Summer				31.769	-0.266	0.000	0.48	153.7
S1.005	S1.8	30 Winter	2	+0%	100/15 Summer				31.344	-0.261	0.000	0.50	155.9
S4.000	S1.9	15 Winter	2	+0%	30/15 Winter				31.702	-0.098	0.000	0.61	37.5
S1.006	S1.10	30 Winter	2	+0%					31.020	-0.345	0.000	0.26	186.9
S5.000	SFD	15 Winter	2	+0%	30/15 Summer				30.894	-0.076	0.000	0.91	42.1
S5.001	SP1	120 Winter	2	+0%	100/30 Summer				30.814	-0.211	0.000	0.06	10.9
S6.000	S1.11	15 Winter	2	+0%	100/15 Summer				32.436	-0.239	0.000	0.29	49.3
S6.001	S1.12	15 Winter	2	+0%	100/15 Summer				32.262	-0.218	0.000	0.37	49.2
S6.002	S1.13	15 Winter	2	+0%	100/15 Summer				32.159	-0.203	0.000	0.43	61.6
S6.003	S1.14	15 Winter	2	+0%	30/15 Summer				32.009	-0.158	0.000	0.64	61.7
S6.004	S1.15	15 Winter	2	+0%	100/15 Summer				31.953	-0.183	0.000	0.52	73.7
S6.005	S1.16	15 Winter	2	+0%	100/15 Summer				31.763	-0.187	0.000	0.50	73.4
S6.006	S1.17	15 Winter	2	+0%	30/15 Summer				30.729	-0.146	0.000	0.69	73.6
S5.002	S1.18	15 Winter	2	+0%	100/15 Summer				30.554	-0.269	0.000	0.34	76.7
S7.000	SRE	15 Winter	2	+0%					31.059	-0.156	0.000	0.20	12.2
S5.003	S1.19	15 Winter	2	+0%	30/15 Winter				30.484	-0.181	0.000	0.60	84.4
S5.004	S1.20	30 Winter	2	+0%	30/15 Winter				30.411	-0.174	0.000	0.64	83.7
S5.005	S1.21	30 Winter	2	+0%	30/15 Winter				30.356	-0.179	0.000	0.66	88.3
S5.006	S1.22	30 Winter	2	+0%	30/120 Winter				30.289	-0.191	0.000	0.62	88.9
S1.007	SOF2	180 Winter	2	+0%	30/60 Summer				30.224	-0.101	0.000	0.58	71.8
S1.008	S1.26	180 Winter	2	+0%	30/30 Summer				30.198	-0.027	0.000	0.89	69.4

PN	US/MH Name	Status	Level Exceeded
S1.000	S1.0	OK	
S1.001	S1.1	OK	
S1.002	S1.2	OK	
S2.000	S1.3	OK	1
S3.000	S1.4	OK	
S2.001	S1.5	OK	
S1.003	S1.6	OK	
S1.004	S1.7	OK	
S1.005	S1.8	OK	
S4.000	S1.9	OK	
S1.006	S1.10	OK	
S5.000	SFD	OK	
S5.001	SP1	OK	
S6.000	S1.11	OK	
S6.001	S1.12	OK	
S6.002	S1.13	OK	
S6.003	S1.14	OK	
S6.004	S1.15	OK	
S6.005	S1.16	OK	
S6.006	S1.17	OK	
S5.002	S1.18	OK	
S7.000	SRE	OK	
S5.003	S1.19	OK	
S5.004	S1.20	OK	
S5.005	S1.21	OK	
S5.006	S1.22	OK	

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

	US/MH	Level
PN	Name	Status Exceeded
S1.007	SOF2	OK
S1.008	S1.26	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 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coefficient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

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

Synthetic Rainfall Details


Rainfall Model FSR M5-60 (mm) 18.500 Cv (Summer) 0.750
Region England and Wales Ratio R 0.333 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 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) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m ³)	Flow / Cap. (l/s)	Overflow (l/s)	Pipe Flow (l/s)
S1.000	S1.0	15 Winter	30	+0%					34.114	-0.111	0.000	0.51		20.6
S1.001	S1.1	15 Winter	30	+0%					33.950	-0.150	0.000	0.47		49.8
S1.002	S1.2	15 Winter	30	+0%	100/15 Summer				33.254	-0.113	0.000	0.66		69.8
S2.000	S1.3	30 Winter	30	+0%	30/15 Summer	100/30 Winter			33.367	0.067	0.000	1.18		133.0
S3.000	S1.4	30 Winter	30	+0%	100/15 Summer				32.557	-0.078	0.000	0.22		22.0
S2.001	S1.5	30 Summer	30	+0%	100/15 Summer				32.515	0.000	0.000	1.10		144.1
S1.003	S1.6	15 Winter	30	+0%	100/15 Summer				32.305	-0.160	0.000	0.77		245.5
S1.004	S1.7	15 Winter	30	+0%	100/15 Summer				31.861	-0.174	0.000	0.76		241.7
S1.005	S1.8	30 Winter	30	+0%	100/15 Summer				31.434	-0.171	0.000	0.79		245.4
S4.000	S1.9	15 Winter	30	+0%	30/15 Winter				31.863	0.063	0.000	1.08		66.5
S1.006	S1.10	30 Winter	30	+0%					31.080	-0.285	0.000	0.43		311.0
S5.000	SFD	15 Winter	30	+0%	30/15 Summer				31.038	0.068	0.000	1.72		80.0
S5.001	SP1	120 Winter	30	+0%	100/30 Summer				30.937	-0.088	0.000	0.10		17.9
S6.000	S1.11	15 Winter	30	+0%	100/15 Summer				32.497	-0.178	0.000	0.54		93.1
S6.001	S1.12	15 Winter	30	+0%	100/15 Summer				32.378	-0.102	0.000	0.70		94.2
S6.002	S1.13	15 Winter	30	+0%	100/15 Summer				32.323	-0.039	0.000	0.77		110.3
S6.003	S1.14	30 Winter	30	+0%	30/15 Summer				32.204	0.038	0.000	1.12		108.5
S6.004	S1.15	15 Winter	30	+0%	100/15 Summer				32.045	-0.091	0.000	0.90		129.3
S6.005	S1.16	15 Winter	30	+0%	100/15 Summer				31.847	-0.102	0.000	0.88		128.3
S6.006	S1.17	15 Winter	30	+0%	30/15 Summer				30.914	0.039	0.000	1.20		128.7
S5.002	S1.18	30 Winter	30	+0%	100/15 Summer				30.716	-0.107	0.000	0.58		129.4
S7.000	SRE	15 Winter	30	+0%					31.087	-0.128	0.000	0.38		22.9
S5.003	S1.19	30 Winter	30	+0%	30/15 Winter				30.677	0.012	0.000	1.01		142.3
S5.004	S1.20	30 Winter	30	+0%	30/15 Winter				30.601	0.016	0.000	1.09		143.3
S5.005	S1.21	30 Winter	30	+0%	30/15 Winter				30.545	0.010	0.000	1.10		147.5
S5.006	S1.22	180 Winter	30	+0%	30/120 Winter				30.481	0.001	0.000	0.57		81.4
S1.007	SOF2	180 Winter	30	+0%	30/60 Summer				30.459	0.134	0.000	0.67		82.4
S1.008	S1.26	180 Winter	30	+0%	30/30 Summer				30.418	0.193	0.000	1.05		81.6

PN	US/MH Name	Status	Level Exceeded
S1.000	S1.0	OK	
S1.001	S1.1	OK	
S1.002	S1.2	OK	
S2.000	S1.3	FLOOD RISK	1
S3.000	S1.4	OK	
S2.001	S1.5	OK	
S1.003	S1.6	OK	
S1.004	S1.7	OK	
S1.005	S1.8	OK	
S4.000	S1.9	SURCHARGED	
S1.006	S1.10	OK	
S5.000	SFD	FLOOD RISK	
S5.001	SP1	OK	
S6.000	S1.11	OK	
S6.001	S1.12	OK	
S6.002	S1.13	OK	
S6.003	S1.14	SURCHARGED	
S6.004	S1.15	OK	
S6.005	S1.16	OK	
S6.006	S1.17	SURCHARGED	
S5.002	S1.18	OK	
S7.000	SRE	OK	
S5.003	S1.19	SURCHARGED	
S5.004	S1.20	SURCHARGED	
S5.005	S1.21	SURCHARGED	
S5.006	S1.22	SURCHARGED	

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

	US/MH		Level
PN	Name	Status	Exceeded
S1.007	SOF2	SURCHARGED	
S1.008	S1.26	SURCHARGED	

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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 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coefficient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

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

Synthetic Rainfall Details


Rainfall Model FSR M5-60 (mm) 18.500 Cv (Summer) 0.750
Region England and Wales Ratio R 0.333 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 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) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m ³)	Flow / Cap. (l/s)	Overflow (l/s)	Pipe Flow (l/s)
S1.000	S1.0	15 Winter	100	+40%					34.170	-0.055	0.000	0.91		37.3
S1.001	S1.1	15 Winter	100	+40%					34.062	-0.038	0.000	0.83		87.6
S1.002	S1.2	15 Winter	100	+40%	100/15 Summer				33.631	0.264	0.000	1.03		109.1
S2.000	S1.3	30 Winter	100	+40%	30/15 Summer	100/30 Winter			33.601	0.301	1.004	1.60		180.1
S3.000	S1.4	30 Winter	100	+40%	100/15 Summer				32.887	0.252	0.000	0.34		34.1
S2.001	S1.5	30 Winter	100	+40%	100/15 Summer				32.805	0.290	0.000	1.58		205.8
S1.003	S1.6	30 Winter	100	+40%	100/15 Summer				32.678	0.213	0.000	1.14		363.2
S1.004	S1.7	30 Winter	100	+40%	100/15 Summer				32.169	0.134	0.000	1.10		349.5
S1.005	S1.8	30 Winter	100	+40%	100/15 Summer				31.653	0.048	0.000	1.14		354.8
S4.000	S1.9	30 Winter	100	+40%	30/15 Winter				32.493	0.693	0.000	1.62		99.4
S1.006	S1.10	30 Winter	100	+40%					31.142	-0.223	0.000	0.63		454.6
S5.000	SFD	30 Winter	100	+40%	30/15 Summer				31.247	0.277	0.000	2.86		132.4
S5.001	SP1	180 Winter	100	+40%	100/30 Summer				31.225	0.200	0.000	0.11		18.9
S6.000	S1.11	30 Winter	100	+40%	100/15 Summer				33.061	0.386	0.000	0.82		140.6
S6.001	S1.12	30 Winter	100	+40%	100/15 Summer				32.928	0.447	0.000	1.05		141.5
S6.002	S1.13	30 Winter	100	+40%	100/15 Summer				32.804	0.442	0.000	1.12		161.0
S6.003	S1.14	30 Winter	100	+40%	30/15 Summer				32.554	0.387	0.000	1.66		161.4
S6.004	S1.15	30 Winter	100	+40%	100/15 Summer				32.392	0.257	0.000	1.30		185.7
S6.005	S1.16	30 Winter	100	+40%	100/15 Summer				32.073	0.124	0.000	1.27		185.7
S6.006	S1.17	30 Winter	100	+40%	30/15 Summer				31.337	0.462	0.000	1.73		185.6
S5.002	S1.18	30 Winter	100	+40%	100/15 Summer				31.113	0.290	0.000	0.78		175.1
S7.000	SRE	15 Winter	100	+40%					31.130	-0.085	0.000	0.68		41.4
S5.003	S1.19	240 Winter	100	+40%	30/15 Winter				30.985	0.320	0.000	0.78		110.7
S5.004	S1.20	240 Winter	100	+40%	30/15 Winter				30.971	0.386	0.000	0.85		110.7
S5.005	S1.21	240 Winter	100	+40%	30/15 Winter				30.959	0.424	0.000	0.86		114.5
S5.006	S1.22	240 Winter	100	+40%	30/120 Winter				30.945	0.465	0.000	0.81		115.1
S1.007	SOF2	240 Winter	100	+40%	30/60 Summer				30.928	0.603	0.000	0.68		83.7
S1.008	S1.26	180 Winter	100	+40%	30/30 Summer				30.892	0.667	0.000	1.05		81.7

PN	US/MH Name	Status	Level Exceeded
S1.000	S1.0	OK	
S1.001	S1.1	OK	
S1.002	S1.2	SURCHARGED	
S2.000	S1.3	FLOOD	1
S3.000	S1.4	SURCHARGED	
S2.001	S1.5	SURCHARGED	
S1.003	S1.6	SURCHARGED	
S1.004	S1.7	SURCHARGED	
S1.005	S1.8	SURCHARGED	
S4.000	S1.9	FLOOD RISK	
S1.006	S1.10	OK	
S5.000	SFD	FLOOD RISK	
S5.001	SP1	FLOOD RISK	
S6.000	S1.11	FLOOD RISK	
S6.001	S1.12	SURCHARGED	
S6.002	S1.13	SURCHARGED	
S6.003	S1.14	SURCHARGED	
S6.004	S1.15	SURCHARGED	
S6.005	S1.16	SURCHARGED	
S6.006	S1.17	SURCHARGED	
S5.002	S1.18	SURCHARGED	
S7.000	SRE	OK	
S5.003	S1.19	SURCHARGED	
S5.004	S1.20	SURCHARGED	
S5.005	S1.21	SURCHARGED	
S5.006	S1.22	SURCHARGED	

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Date 22/07/2022 File P3000932 Drainage Network P08.MDX	Designed by EH Checked by	
Innovyze	Network 2019.1	

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

	US/MH		Level
PN	Name	Status	Exceeded
S1.007	SOF2	FLOOD RISK	
S1.008	S1.26	SURCHARGED	