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56 The Ropewalk Nottingham NG1 5DW		
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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Surface Network 1

Pipe Sizes STANDARD Manhole Sizes STANDARD

	FSR Rainfall Model - England and Wales				
Return Period (years)	1	Foul Sewage (l/s/ha)	0.000	Maximum Backdrop Height (m)	1.500
M5-60 (mm)	20.000	Volumetric Runoff Coeff.	0.750	Min Design Depth for Optimisation (m)	1.200
Ratio R	0.403	PIMP (%)	100	Min Vel for Auto Design only (m/s)	1.00
Maximum Rainfall (mm/hr)	50	Add Flow / Climate Change (%)	0	Min Slope for Optimisation (1:X)	500
Maximum Time of Concentration (mins)	30	Minimum Backdrop Height (m)	0.200		

Designed with Level Soffits


Time Area Diagram for Surface Network 1

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.586	4-8	0.456	8-12	0.004

Total Area Contributing (ha) = 1.046







Total Pipe Volume (m³) = 34.355

Network Design Table for Surface Network 1

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Network Design Table for Surface Network 1

- Indicates pipe length does not match coordinates

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	3.600#	0.293	12.3	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	13.668	0.291	47.0	0.139	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.000	49.800	0.332	150.0	0.012	5.00	0.0	0.600	o	150	Pipe/Conduit	
2.001	1.741	0.012	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	31.852	0.228	140.0	0.029	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	14.506	0.104	140.0	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)
1.000	50.00	5.02	17.911	0.000	0.0	0.0	0.0	3.75	149.3	0.0
1.001	50.00	5.14	17.548	0.139	0.0	0.0	0.0	1.91	76.1	18.8
2.000	50.00	6.01	17.694	0.012	0.0	0.0	0.0	0.82	14.5	1.6
2.001	50.00	6.05	17.362	0.012	0.0	0.0	0.0	0.82	14.5	1.6
1.002	48.53	6.53	17.243	0.180	0.0	0.0	0.0	1.10	43.9	23.7
1.003	47.75	6.75	17.016	0.180	0.0	0.0	0.0	1.10	43.9	23.7

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Network Design Table for Surface Network 1








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	11.477	0.330	34.8	0.013	5.00	0.0	0.600	o	225	Pipe/Conduit	🔒
3.001	37.979	0.455	83.5	0.063	0.00	0.0	0.600	o	225	Pipe/Conduit	🔒
4.000	13.105	0.199	65.9	0.043	5.00	0.0	0.600	o	150	Pipe/Conduit	🔒
4.001	10.059	0.456	22.1	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	🔒
3.002	16.483	0.333	49.5	0.008	0.00	0.0	0.600	o	225	Pipe/Conduit	🔒
1.004	64.643	0.183	353.2	0.073	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)
3.000	50.00	5.09	18.030	0.013	0.0	0.0	0.0	2.23	88.5	1.8
3.001	50.00	5.53	17.700	0.076	0.0	0.0	0.0	1.43	56.9	10.3
4.000	50.00	5.18	18.000	0.043	0.0	0.0	0.0	1.24	21.9	5.8
4.001	50.00	5.25	17.776	0.043	0.0	0.0	0.0	2.15	38.1	5.8
3.002	50.00	5.68	17.245	0.127	0.0	0.0	0.0	1.86	74.1	17.2
1.004	44.16	7.87	16.756	0.380	0.0	0.0	0.0	0.96	105.8	45.4

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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
5.000	45.722	0.305	149.9	0.011	5.00	0.0	0.600	o	150	Pipe/Conduit	
5.001	37.477	0.250	149.9	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
5.002	2.978	1.147	2.6	0.019	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.005	19.650	0.109	180.3	0.161	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.006	18.177	0.064	284.0	0.018	0.00	0.0	0.600	o	375	Pipe/Conduit	
6.000	57.532	0.384	149.8	0.062	5.00	0.0	0.600	o	225	Pipe/Conduit	
6.001	5.461	0.036	150.0	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)
5.000	50.00	5.93	18.500	0.011	0.0	0.0	0.0	0.82	14.5	1.5
5.001	47.94	6.69	18.195	0.011	0.0	0.0	0.0	0.82	14.5	1.5
5.002	47.92	6.70	17.945	0.030	0.0	0.0	0.0	6.30	111.4	3.9
1.005	43.46	8.12	16.573	0.571	0.0	0.0	0.0	1.35	148.7	67.2
1.006	42.68	8.40	16.464	0.589	0.0	0.0	0.0	1.07	118.2	68.1
6.000	50.00	5.90	18.355	0.062	0.0	0.0	0.0	1.07	42.4	8.4
6.001	50.00	5.99	17.971	0.062	0.0	0.0	0.0	1.07	42.4	8.4

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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
6.002	11.164	0.074	150.0	0.005	0.00	0.0	0.600	o	225	Pipe/Conduit	🔴
6.003	46.633	0.311	150.0	0.014	0.00	0.0	0.600	o	225	Pipe/Conduit	🔴
6.004	10.390	0.069	150.0	0.002	0.00	0.0	0.600	o	225	Pipe/Conduit	🔴
6.005	7.739	0.052	150.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	🔴
6.006	14.925	0.100	150.0	0.012	0.00	0.0	0.600	o	225	Pipe/Conduit	🔴
6.007	37.362	0.249	150.0	0.155	0.00	0.0	0.600	o	225	Pipe/Conduit	🔴
7.000	46.678	0.229	203.8	0.023	5.00	0.0	0.600	o	150	Pipe/Conduit	🔴
7.001	39.639	0.175	226.4	0.000	0.00	0.0	0.600	o	150	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)
6.002	49.92	6.16	17.935	0.067	0.0	0.0	0.0	1.07	42.4	9.1
6.003	47.27	6.89	17.860	0.081	0.0	0.0	0.0	1.07	42.4	10.4
6.004	46.72	7.05	17.549	0.083	0.0	0.0	0.0	1.07	42.4	10.5
6.005	46.32	7.17	17.480	0.083	0.0	0.0	0.0	1.07	42.4	10.5
6.006	45.57	7.41	17.429	0.095	0.0	0.0	0.0	1.07	42.4	11.7
6.007	43.82	7.99	17.329	0.250	0.0	0.0	0.0	1.07	42.3	29.7
7.000	50.00	6.11	17.950	0.023	0.0	0.0	0.0	0.70	12.4	3.1
7.001	46.54	7.11	17.721	0.023	0.0	0.0	0.0	0.66	11.7	3.1

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Network Design Table for Surface Network 1




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
8.000	30.354	0.209	145.2	0.061	5.00	0.0	0.600	o	225	Pipe/Conduit	🔒
8.001	8.071	0.177	45.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	🔒
9.000	31.692	0.234	135.4	0.064	5.00	0.0	0.600	o	150	Pipe/Conduit	🔒
9.001	6.231	0.076	82.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	🔒
8.002	2.728	0.083	32.9	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	🔒
10.000	7.986	0.074	107.9	0.023	5.00	0.0	0.600	o	150	Pipe/Conduit	🔒
10.001	28.422	0.454	62.6	0.036	0.00	0.0	0.600	o	150	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)
8.000	50.00	5.47	17.950	0.061	0.0	0.0	0.0	1.08	43.1	8.3
8.001	50.00	5.54	17.741	0.061	0.0	0.0	0.0	1.94	77.2	8.3
9.000	50.00	5.61	17.950	0.064	0.0	0.0	0.0	0.86	15.2	8.7
9.001	50.00	5.71	17.716	0.064	0.0	0.0	0.0	1.11	19.6	8.7
8.002	50.00	5.73	17.564	0.125	0.0	0.0	0.0	2.29	91.1	16.9
10.000	50.00	5.14	18.098	0.023	0.0	0.0	0.0	0.97	17.1	3.1
10.001	50.00	5.51	18.024	0.059	0.0	0.0	0.0	1.27	22.5	8.0

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Network Design Table for Surface Network 1

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
8.003	8.018	0.100	80.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.007	5.461	0.050	109.2	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.008	18.504	0.162	114.2	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)
8.003	50.00	5.82	17.481	0.184	0.0	0.0	0.0	1.46	58.1	24.9
1.007	42.54	8.45	16.400	1.046	0.0	0.0	0.0	1.73	191.4	120.5
1.008	42.05	8.64	16.350	1.046	0.0	0.0	0.0	1.69	187.2	120.5

PIPELINE SCHEDULES for Surface Network 1

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)
1.000	o	225	SW01	19.638	17.911	1.502	Open Manhole	1200
1.001	o	225	SW02A	19.308	17.548	1.535	Open Manhole	600
2.000	o	150	SW09	19.119	17.694	1.275	Open Manhole	450
2.001	o	150	SW10	19.298	17.362	1.787	Open Manhole	600
1.002	o	225	SW02B	19.276	17.243	1.808	Open Manhole	600

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	3.600#	12.3	SW02A	19.308	17.617	1.466	Open Manhole	600
1.001	13.668	47.0	SW02B	19.276	17.257	1.794	Open Manhole	600
2.000	49.800	150.0	SW10	19.298	17.362	1.787	Open Manhole	600
2.001	1.741	150.0	SW02B	19.276	17.350	1.776	Open Manhole	600
1.002	31.852	140.0	SW03	19.166	17.016	1.925	Open Manhole	1200

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PIPELINE SCHEDULES for Surface Network 1

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)
1.003	o	225	SW03	19.166	17.016	1.925	Open Manhole	1200
3.000	o	225	SW11	19.176	18.030	0.921	Open Manhole	600
3.001	o	225	SW12	19.298	17.700	1.373	Open Manhole	600
4.000	o	150	SW14	19.098	18.000	0.948	Open Manhole	450
4.001	o	150	SW15	19.066	17.776	1.140	Open Manhole	1200
3.002	o	225	SW13	19.042	17.245	1.572	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)
1.003	14.506	140.0	SW04	19.125	16.912	1.988	Open Manhole	1350
3.000	11.477	34.8	SW12	19.298	17.700	1.373	Open Manhole	600
3.001	37.979	83.5	SW13	19.042	17.245	1.572	Open Manhole	1200
4.000	13.105	65.9	SW15	19.066	17.801	1.115	Open Manhole	1200
4.001	10.059	22.1	SW13	19.042	17.320	1.572	Open Manhole	1200
3.002	16.483	49.5	SW04	19.125	16.912	1.988	Open Manhole	1350

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PIPELINE SCHEDULES for Surface Network 1

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)
1.004	o	375	SW04	19.125	16.756	1.994	Open Manhole	1350
5.000	o	150	SW16	19.255	18.500	0.605	Open Manhole	450
5.001	o	150	SW17	19.068	18.195	0.723	Open Manhole	600
5.002	o	150	SW18	19.091	17.945	0.996	Open Manhole	600
1.005	o	375	SW05	19.089	16.573	2.141	Open Manhole	1350
1.006	o	375	SW06	18.967	16.464	2.128	Open Manhole	1350

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)
1.004	64.643	353.2	SW05	19.089	16.573	2.141	Open Manhole	1350
5.000	45.722	149.9	SW17	19.068	18.195	0.723	Open Manhole	600
5.001	37.477	149.9	SW18	19.091	17.945	0.996	Open Manhole	600
5.002	2.978	2.6	SW05	19.089	16.798	2.141	Open Manhole	1350
1.005	19.650	180.3	SW06	18.967	16.464	2.128	Open Manhole	1350
1.006	18.177	284.0	TANK	18.941	16.400	2.166	Open Manhole	1350

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PIPELINE SCHEDULES for Surface Network 1

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)
6.000	o	225	SW19	19.100	18.355	0.520	Open Manhole	450
6.001	o	225	SW20	19.095	17.971	0.899	Open Manhole	600
6.002	o	225	SW21	19.096	17.935	0.936	Open Manhole	600
6.003	o	225	SW22	19.110	17.860	1.025	Open Manhole	600
6.004	o	225	SW23	19.095	17.549	1.321	Open Manhole	600
6.005	o	225	SW24	19.096	17.480	1.391	Open Manhole	600
6.006	o	225	SW25	19.098	17.429	1.444	Open Manhole	600
6.007	o	225	SW26	19.027	17.329	1.473	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)
6.000	57.532	149.8	SW20	19.095	17.971	0.899	Open Manhole	600
6.001	5.461	150.0	SW21	19.096	17.935	0.936	Open Manhole	600
6.002	11.164	150.0	SW22	19.110	17.860	1.025	Open Manhole	600
6.003	46.633	150.0	SW23	19.095	17.549	1.321	Open Manhole	600
6.004	10.390	150.0	SW24	19.096	17.480	1.391	Open Manhole	600
6.005	7.739	150.0	SW25	19.098	17.429	1.444	Open Manhole	600
6.006	14.925	150.0	SW26	19.027	17.329	1.473	Open Manhole	1200
6.007	37.362	150.0	TANK	18.941	17.080	1.636	Open Manhole	1350

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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)
7.000	o	150	SW33	19.204	17.950	1.104	Open Manhole	450
7.001	o	150	SW34	19.247	17.721	1.376	Open Manhole	450
8.000	o	225	SW27	18.849	17.950	0.674	Open Manhole	600
8.001	o	225	SW28	18.857	17.741	0.891	Open Manhole	600
9.000	o	150	SW31	18.835	17.950	0.735	Open Manhole	600
9.001	o	150	SW32	18.861	17.716	0.995	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)
7.000	46.678	203.8	SW34	19.247	17.721	1.376	Open Manhole	450
7.001	39.639	226.4	TANK	18.941	17.546	1.245	Open Manhole	1350
8.000	30.354	145.2	SW28	18.857	17.741	0.891	Open Manhole	600
8.001	8.071	45.6	SW29	19.120	17.564	1.331	Open Manhole	1200
9.000	31.692	135.4	SW32	18.861	17.716	0.995	Open Manhole	1200
9.001	6.231	82.0	SW29	19.120	17.640	1.330	Open Manhole	1200

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PIPELINE SCHEDULES for Surface Network 1

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)
8.002	o	225	SW29	19.120	17.564	1.331	Open Manhole	1200
10.000	o	150	SW35	19.380	18.098	1.132	Open Manhole	600
10.001	o	150	SW36	19.750	18.024	1.576	Open Manhole	600
8.003	o	225	SW30	19.175	17.481	1.469	Open Manhole	1200
1.007	o	375	TANK	18.941	16.400	2.166	Open Manhole	1350

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)
8.002	2.728	32.9	SW30	19.175	17.481	1.469	Open Manhole	1200
10.000	7.986	107.9	SW36	19.750	18.024	1.576	Open Manhole	600
10.001	28.422	62.6	SW30	19.175	17.570	1.455	Open Manhole	1200
8.003	8.018	80.2	TANK	18.941	17.381	1.335	Open Manhole	1350
1.007	5.461	109.2	SW07	19.126	16.350	2.401	Open Manhole	1350

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PIPELINE SCHEDULES for Surface Network 1

Upstream Manhole

PN	Hyd	Diam	MH	C.Level	I.Level	D.Depth	MH	MH DIAM.,	L*W
Sect	(mm)	Name	(m)	(m)	(m)	Connection	(mm)		
1.008	o	375	SW07	19.126	16.350	2.401	Open Manhole	1350	


Downstream Manhole

PN	Length	Slope	MH	C.Level	I.Level	D.Depth	MH	MH DIAM.,	L*W
(m)	(1:X)	Name	(m)	(m)	(m)	Connection	(mm)		
1.008	18.504	114.2	SW08	19.569	16.188	3.006	Open Manhole	1350	

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Area Summary for Surface Network 1

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.000	0.000	0.000
1.001	-	-	100	0.139	0.139	0.139
2.000	-	-	100	0.012	0.012	0.012
2.001	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.029	0.029	0.029
1.003	-	-	100	0.000	0.000	0.000
3.000	-	-	100	0.013	0.013	0.013
3.001	-	-	100	0.063	0.063	0.063
4.000	-	-	100	0.043	0.043	0.043
4.001	-	-	100	0.000	0.000	0.000
3.002	-	-	100	0.008	0.008	0.008
1.004	-	-	100	0.073	0.073	0.073
5.000	-	-	100	0.011	0.011	0.011
5.001	-	-	100	0.000	0.000	0.000
5.002	-	-	100	0.019	0.019	0.019
1.005	-	-	100	0.161	0.161	0.161
1.006	-	-	100	0.018	0.018	0.018
6.000	-	-	100	0.062	0.062	0.062
6.001	-	-	100	0.000	0.000	0.000
6.002	-	-	100	0.005	0.005	0.005
6.003	-	-	100	0.014	0.014	0.014
6.004	-	-	100	0.002	0.002	0.002
6.005	-	-	100	0.000	0.000	0.000
6.006	-	-	100	0.012	0.012	0.012
6.007	-	-	100	0.155	0.155	0.155
7.000	-	-	100	0.023	0.023	0.023
7.001	-	-	100	0.000	0.000	0.000


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Area Summary for Surface Network 1

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
8.000	-	-	100	0.061	0.061	0.061
8.001	-	-	100	0.000	0.000	0.000
9.000	-	-	100	0.064	0.064	0.064
9.001	-	-	100	0.000	0.000	0.000
8.002	-	-	100	0.000	0.000	0.000
10.000	-	-	100	0.023	0.023	0.023
10.001	-	-	100	0.036	0.036	0.036
8.003	-	-	100	0.000	0.000	0.000
1.007	-	-	100	0.000	0.000	0.000
1.008	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				1.046	1.046	1.046

Free Flowing Outfall Details for Surface Network 1

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.008	SW08	19.569	16.188	0.000	1350	0

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Simulation Criteria for Surface Network 1

Volumetric Runoff Coeff	0.750	Manhole Headloss Coeff (Global)	0.500	Inlet Coeffiecient	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 * 10m ³ /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 5 Number of Storage Structures 5 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	20.000	Cv (Summer)	0.750
Return Period (years)	1	Ratio R	0.403	Cv (Winter)	0.840
Region	England and Wales	Profile Type	Summer Storm	Duration (mins)	30

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Online Controls for Surface Network 1

Orifice Manhole: SW02A, DS/PN: 1.001, Volume (m³): 0.6

Diameter (m) 0.020 Discharge Coefficient 0.600 Invert Level (m) 17.548

Orifice Manhole: SW34, DS/PN: 7.001, Volume (m³): 1.1

Diameter (m) 0.080 Discharge Coefficient 0.600 Invert Level (m) 17.721

Orifice Manhole: SW28, DS/PN: 8.001, Volume (m³): 1.5


Diameter (m) 0.040 Discharge Coefficient 0.600 Invert Level (m) 17.741

Orifice Manhole: SW32, DS/PN: 9.001, Volume (m³): 1.8

Diameter (m) 0.110 Discharge Coefficient 0.600 Invert Level (m) 17.716

Hydro-Brake® Optimum Manhole: TANK, DS/PN: 1.007, Volume (m³): 7.9

Unit Reference	MD-SHE-0103-5000-1200-5000	Sump Available	Yes
Design Head (m)	1.200	Diameter (mm)	103
Design Flow (l/s)	5.0	Invert Level (m)	16.400
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	150
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		


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Hydro-Brake® Optimum Manhole: TANK, DS/PN: 1.007, Volume (m³): 7.9

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	5.0	Kick-Flo®	0.745	4.0
Flush-Flo™	0.354	5.0	Mean Flow over Head Range	-	4.4

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	3.4	0.600	4.7	1.600	5.7	2.600	7.2	5.000	9.8	7.500	11.8
0.200	4.7	0.800	4.1	1.800	6.0	3.000	7.7	5.500	10.2	8.000	12.2
0.300	5.0	1.000	4.6	2.000	6.3	3.500	8.3	6.000	10.7	8.500	12.6
0.400	5.0	1.200	5.0	2.200	6.6	4.000	8.8	6.500	11.1	9.000	12.9
0.500	4.9	1.400	5.4	2.400	6.9	4.500	9.3	7.000	11.5	9.500	13.3

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Storage Structures for Surface Network 1

Porous Car Park Manhole: SW02A, DS/PN: 1.001

Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.30	Slope (1:X)	350.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	18.950	Depression Storage (mm)	5
Max Percolation (l/s)	527.2	Width (m)	36.5	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	52.0	Membrane Depth (mm)	0

Porous Car Park Manhole: SW34, DS/PN: 7.001


Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.30	Slope (1:X)	500.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	18.900	Depression Storage (mm)	5
Max Percolation (l/s)	64.0	Width (m)	4.8	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	48.0	Membrane Depth (mm)	0

Porous Car Park Manhole: SW28, DS/PN: 8.001

Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.30	Slope (1:X)	500.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	18.500	Depression Storage (mm)	5
Max Percolation (l/s)	43.3	Width (m)	4.8	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	32.5	Membrane Depth (mm)	0

Porous Car Park Manhole: SW32, DS/PN: 9.001

Infiltration Coefficient Base (m/hr)	0.00000	Safety Factor	2.0	Width (m)	4.8
Membrane Percolation (mm/hr)	1000	Porosity	0.30	Length (m)	36.0
Max Percolation (l/s)	48.0	Invert Level (m)	18.500	Slope (1:X)	500.0

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Porous Car Park Manhole: SW32, DS/PN: 9.001

Depression Storage (mm) 5 Evaporation (mm/day) 3 Membrane Depth (mm) 0

Cellular Storage Manhole: TANK, DS/PN: 1.007


Invert Level (m) 16.400 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95
 Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	530.0	0.0	1.200	530.0	0.0	1.201	0.0	0.0

Volume Summary (Static)

Length Calculations based on Centre-Centre

Pipe Number	USMH Name	Manhole Volume (m ³)	Total Volume (m ³)
1.000	SW01	1.954	1.954
1.001	SW02A	0.498	0.498
2.000	SW09	0.227	0.227
2.001	SW10	0.548	0.548
1.002	SW02B	0.575	0.575
1.003	SW03	2.432	2.432
3.000	SW11	0.324	0.324
3.001	SW12	0.452	0.452
4.000	SW14	0.175	0.175
4.001	SW15	1.459	1.459
3.002	SW13	2.032	2.032
1.004	SW04	3.390	3.390
5.000	SW16	0.120	0.120
5.001	SW17	0.247	0.247
5.002	SW18	0.324	0.324
1.005	SW05	3.602	3.602
1.006	SW06	3.582	3.582
6.000	SW19	0.118	0.118
6.001	SW20	0.318	0.318
6.002	SW21	0.328	0.328
6.003	SW22	0.353	0.353
6.004	SW23	0.437	0.437
6.005	SW24	0.457	0.457
6.006	SW25	0.472	0.472
6.007	SW26	1.920	1.920

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Volume Summary (Static)

Pipe Number	USMH Name	Manhole Volume (m³)	Total Volume (m³)
7.000	SW33	0.199	0.199
7.001	SW34	0.243	0.243
8.000	SW27	0.254	0.254
8.001	SW28	0.315	0.315
9.000	SW31	0.250	0.250
9.001	SW32	1.295	1.295
8.002	SW29	1.760	1.760
10.000	SW35	0.362	0.362
10.001	SW36	0.488	0.488
8.003	SW30	1.915	1.915
1.007	TANK	3.638	3.638
1.008	SW07	3.973	3.973
Total		41.037	41.037

Volume Summary (Static)


Length Calculations based on True Length

Pipe Number	USMH Name	Manhole Volume (m ³)	Total Volume (m ³)
1.000	SW01	1.954	1.954
1.001	SW02A	0.498	0.498
2.000	SW09	0.227	0.227
2.001	SW10	0.548	0.548
1.002	SW02B	0.575	0.575
1.003	SW03	2.432	2.432
3.000	SW11	0.324	0.324
3.001	SW12	0.452	0.452
4.000	SW14	0.175	0.175
4.001	SW15	1.459	1.459
3.002	SW13	2.032	2.032
1.004	SW04	3.390	3.390
5.000	SW16	0.120	0.120
5.001	SW17	0.247	0.247
5.002	SW18	0.324	0.324
1.005	SW05	3.602	3.602
1.006	SW06	3.582	3.582
6.000	SW19	0.118	0.118
6.001	SW20	0.318	0.318
6.002	SW21	0.328	0.328
6.003	SW22	0.353	0.353
6.004	SW23	0.437	0.437
6.005	SW24	0.457	0.457
6.006	SW25	0.472	0.472
6.007	SW26	1.920	1.920

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Volume Summary (Static)

Pipe Number	USMH Name	Manhole Volume (m ³)	Total Volume (m ³)
7.000	SW33	0.199	0.199
7.001	SW34	0.243	0.243
8.000	SW27	0.254	0.254
8.001	SW28	0.315	0.315
9.000	SW31	0.250	0.250
9.001	SW32	1.295	1.295
8.002	SW29	1.760	1.760
10.000	SW35	0.362	0.362
10.001	SW36	0.488	0.488
8.003	SW30	1.915	1.915
1.007	TANK	3.638	3.638
1.008	SW07	3.973	3.973
Total		41.037	41.037

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

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 5 Number of Storage Structures 5 Number of Real Time Controls 0


Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 20.000 Cv (Summer) 0.750
Region England and Wales Ratio R 0.404 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DTS Status OFF Inertia Status ON
Analysis Timestep Coarse DVD 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) Surchage	First (Y) Flood	First (Z) Overflow	Water			Surcharged		Flooded		Pipe Flow (l/s)	Status
								Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)				
1.000	SW01	360 Winter	1	+0%	1/30 Winter			18.989	0.854	0.000	0.00			0.3	SURCHARGED	
1.001	SW02A	360 Winter	1	+0%	1/30 Summer			18.990	1.216	0.000	0.02			1.0	SURCHARGED	

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

	US/MH	Level
PN	Name	Exceeded
1.000	SW01	
1.001	SW02A	

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

PN	US/MH		Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water	Surcharged	Flooded	Flow / Overflow Cap.	Pipe Flow (1/s)	Status
	Name	Storm							Level (m)	Depth (m)	Volume (m ³)			
2.000	SW09	15	Winter	1	+0%	100/15	Summer		17.728	-0.116	0.000	0.12	1.6	OK
2.001	SW10	15	Winter	1	+0%	100/15	Summer		17.400	-0.111	0.000	0.15	1.6	OK
1.002	SW02B	15	Winter	1	+0%	100/15	Summer		17.295	-0.173	0.000	0.12	5.0	OK
1.003	SW03	15	Winter	1	+0%	100/15	Summer		17.069	-0.172	0.000	0.13	4.9	OK
3.000	SW11	15	Winter	1	+0%	100/15	Winter		18.054	-0.201	0.000	0.02	1.8	OK
3.001	SW12	15	Winter	1	+0%	100/15	Summer		17.763	-0.162	0.000	0.17	9.3	OK
4.000	SW14	15	Winter	1	+0%	100/15	Summer		18.056	-0.094	0.000	0.30	6.0	OK
4.001	SW15	15	Winter	1	+0%	100/15	Summer		17.819	-0.107	0.000	0.18	6.0	OK
3.002	SW13	15	Winter	1	+0%	100/15	Summer		17.321	-0.149	0.000	0.25	16.2	OK
1.004	SW04	15	Winter	1	+0%	100/15	Summer		16.896	-0.235	0.000	0.29	28.6	OK
5.000	SW16	15	Winter	1	+0%				18.533	-0.117	0.000	0.11	1.5	OK
5.001	SW17	15	Winter	1	+0%				18.228	-0.117	0.000	0.11	1.5	OK
5.002	SW18	15	Winter	1	+0%				17.968	-0.127	0.000	0.05	3.6	OK
1.005	SW05	15	Winter	1	+0%	30/15	Summer		16.736	-0.212	0.000	0.39	48.7	OK
1.006	SW06	15	Winter	1	+0%	30/15	Summer		16.656	-0.183	0.000	0.52	50.6	OK
6.000	SW19	15	Winter	1	+0%	100/15	Summer	100/15 Summer	18.425	-0.155	0.000	0.21	8.5	OK
6.001	SW20	15	Winter	1	+0%	30/15	Winter	100/15 Summer	18.052	-0.144	0.000	0.28	8.5	OK
6.002	SW21	15	Winter	1	+0%	100/15	Summer	100/15 Summer	18.012	-0.148	0.000	0.25	9.0	OK
6.003	SW22	15	Winter	1	+0%	30/15	Winter	100/15 Summer	17.938	-0.147	0.000	0.26	10.4	OK
6.004	SW23	15	Winter	1	+0%	30/15	Summer	100/15 Winter	17.634	-0.141	0.000	0.30	10.6	OK
6.005	SW24	15	Winter	1	+0%	30/15	Summer	100/15 Winter	17.569	-0.136	0.000	0.33	10.6	OK
6.006	SW25	15	Winter	1	+0%	30/15	Summer		17.515	-0.138	0.000	0.31	11.6	OK
6.007	SW26	15	Winter	1	+0%	30/15	Summer		17.464	-0.090	0.000	0.67	26.7	OK
7.000	SW33	15	Winter	1	+0%	100/15	Summer		18.003	-0.097	0.000	0.26	3.2	OK
7.001	SW34	15	Winter	1	+0%	30/15	Summer		17.824	-0.047	0.000	0.27	3.1	OK

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XP Solutions	Network 2017.1.2	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

PN	US/MH Name	Level Exceeded
2.000	SW09	
2.001	SW10	
1.002	SW02B	
1.003	SW03	
3.000	SW11	
3.001	SW12	
4.000	SW14	
4.001	SW15	
3.002	SW13	
1.004	SW04	
5.000	SW16	
5.001	SW17	
5.002	SW18	
1.005	SW05	
1.006	SW06	
6.000	SW19	2
6.001	SW20	3
6.002	SW21	2
6.003	SW22	2
6.004	SW23	1
6.005	SW24	
6.006	SW25	
6.007	SW26	
7.000	SW33	

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

	US/MH	Level
PN	Name	Exceeded
7.001	SW34	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m ³)	Flow / Overflow Cap. (l/s)	Pipe Flow (l/s)	
8.000	SW27	60	Summer	1	+0%	1/15	Summer	100/60	Winter	18.536	0.361	0.000	0.11	4.2
8.001	SW28	60	Summer	1	+0%	1/15	Summer			18.530	0.564	0.000	0.05	2.9
9.000	SW31	15	Winter	1	+0%	30/15	Summer	100/15	Summer	18.036	-0.064	0.000	0.61	8.9
9.001	SW32	15	Winter	1	+0%	1/15	Summer			17.884	0.018	0.000	0.52	8.5
8.002	SW29	15	Winter	1	+0%	100/15	Summer			17.644	-0.145	0.000	0.27	10.9
10.000	SW35	15	Winter	1	+0%	100/15	Summer			18.145	-0.103	0.000	0.22	3.2
10.001	SW36	15	Winter	1	+0%	100/15	Summer			18.085	-0.089	0.000	0.34	7.4
8.003	SW30	15	Winter	1	+0%	100/15	Summer			17.579	-0.127	0.000	0.40	17.6
1.007	TANK	480	Winter	1	+0%	30/60	Winter			16.630	-0.145	0.000	0.04	4.8
1.008	SW07	480	Winter	1	+0%					16.393	-0.332	0.000	0.03	4.8

PN	US/MH Name	Status	Level Exceeded
8.000	SW27	SURCHARGED	1
8.001	SW28	SURCHARGED	
9.000	SW31	OK	4
9.001	SW32	SURCHARGED	
8.002	SW29	OK	
10.000	SW35	OK	
10.001	SW36	OK	
8.003	SW30	OK	
1.007	TANK	OK	

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XP Solutions	Network 2017.1.2	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

	US/MH		Level
PN	Name	Status	Exceeded
1.008	SW07	OK	