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STORM SEWER DESIGN by the Modified Rational Method

Pipe Sizes STANDARD Manhole Sizes STANDARD

Designed with Level Soffits

« - Indicates pipe capacity < flow

Network Results Table

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Network Design Table for Surface Network 4

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
1.004	38.768	0.078	497.0	0.185	0.00	0.0	0.600	o	600	Pipe/Conduit	
4.000	26.077	1.030	25.3	0.135	5.00	0.0	0.600	o	300	Pipe/Conduit	
4.001	32.208	0.740	43.5	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.005	20.022	0.040	500.5	0.093	0.00	0.0	0.600	o	600	Pipe/Conduit	
5.000	56.434	0.554	101.9	0.104	5.00	0.0	0.600	o	375	Pipe/Conduit	
1.006	49.499	0.741	66.8	0.189	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.007	21.990	0.044	499.8	0.114	0.00	0.0	0.600	o	675	Pipe/Conduit	
1.008	23.168	0.080	289.6	0.287	0.00	0.0	0.600	ooo	46	Pipe/Conduit	
1.009	87.576	0.210	417.0	0.086	0.00	0.0	0.600	o	675	Pipe/Conduit	
1.010	19.277	0.040	481.9	0.024	0.00	0.0	0.600	o	675	Pipe/Conduit	
1.011	41.556	0.083	500.7	0.064	0.00	0.0	0.600	o	675	Pipe/Conduit	
1.012	18.054	0.097	186.1	0.000	0.00	0.0	0.600	o	675	Pipe/Conduit	
1.013	30.881	0.000	0.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
6.000	37.185	0.490	75.9	0.237	5.00	0.0	0.600	o	375	Pipe/Conduit	
6.001	17.625	0.181	97.6	0.124	0.00	0.0	0.600	o	450	Pipe/Conduit	
6.002	42.117	0.109	385.0	0.017	0.00	0.0	0.600	o	450	Pipe/Conduit	
6.003	18.109	0.351	51.5	0.080	0.00	0.0	0.600	o	450	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)
1.004	50.00	6.40	96.008	0.787	0.0	0.0	0.0	1.09	306.9	106.5
4.000	50.00	5.14	98.000	0.135	0.0	0.0	0.0	3.14	221.8	18.3
4.001	50.00	5.36	96.970	0.135	0.0	0.0	0.0	2.39	168.9	18.3
1.005	50.00	6.71	95.930	1.015	0.0	0.0	0.0	1.08	305.8	137.4
5.000	50.00	5.52	96.637	0.104	0.0	0.0	0.0	1.80	198.3	14.1
1.006	50.00	6.99	95.890	1.308	0.0	0.0	0.0	2.98	843.3	177.1
1.007	50.00	7.30	95.074	1.422	0.0	0.0	0.0	1.17	417.1	192.5
1.008	50.00	7.67	95.030	1.708	0.0	0.0	0.0	1.06	350.5	231.3
1.009	50.00	8.81	94.950	1.794	0.0	0.0	0.0	1.28	457.0	243.0
1.010	50.00	9.08	94.740	1.818	0.0	0.0	0.0	1.19	424.8	246.2
1.011	50.00	9.68	94.700	1.882	0.0	0.0	0.0	1.16	416.7	254.8
1.012	49.67	9.83	94.617	1.882	0.0	0.0	0.0	1.92	686.3	254.8
1.013	44.48	12.02	94.595	1.882	0.0	0.0	0.0	0.23	66.4«	254.8
6.000	50.00	5.30	96.725	0.237	0.0	0.0	0.0	2.08	229.9	32.1
6.001	50.00	5.44	96.160	0.361	0.0	0.0	0.0	2.06	327.3	48.9
6.002	50.00	6.12	95.979	0.378	0.0	0.0	0.0	1.03	163.8	51.2
6.003	50.00	6.23	95.870	0.458	0.0	0.0	0.0	2.84	451.2	62.0

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Network Design Table for Surface Network 4

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
7.000	31.269	0.100	313.0	0.153	5.00	0.0	0.600	o	375	Pipe/Conduit	
6.004	28.670	0.375	76.5	0.127	0.00	0.0	0.600	o	450	Pipe/Conduit	
6.005	32.335	0.084	384.9	0.025	0.00	0.0	0.600	o	450	Pipe/Conduit	
8.000	13.598	0.043	313.0	0.094	5.00	0.0	0.600	o	375	Pipe/Conduit	
6.006	30.932	0.146	211.9	0.114	0.00	0.0	0.600	o	600	Pipe/Conduit	
6.007	48.896	0.164	298.1	0.116	0.00	0.0	0.600	o	525	Pipe/Conduit	
6.008	8.369	0.080	104.6	0.063	0.00	0.0	0.600	o	600	Pipe/Conduit	
6.009	23.968	0.000	0.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.014	6.033	0.020	301.7	0.000	0.00	0.0	0.600	o	675	Pipe/Conduit	
1.015	12.463	0.050	249.3	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)	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)
7.000	50.00	5.51	95.694	0.153	0.0	0.0	0.0	1.02	112.5	20.7
6.004	50.00	6.43	95.519	0.738	0.0	0.0	0.0	2.33	370.1	99.9
6.005	50.00	6.96	95.144	0.762	0.0	0.0	0.0	1.03	163.8	103.2
8.000	50.00	5.22	95.178	0.094	0.0	0.0	0.0	1.02	112.5	12.8
6.006	50.00	7.27	95.060	0.971	0.0	0.0	0.0	1.67	471.9	131.5
6.007	50.00	7.90	94.839	1.087	0.0	0.0	0.0	1.29	279.7	147.2
6.008	50.00	7.95	94.600	1.150	0.0	0.0	0.0	2.38	673.2	155.8
6.009	50.00	9.65	94.520	1.150	0.0	0.0	0.0	0.23	66.4«	155.8
1.014	44.34	12.09	94.520	3.032	0.0	0.0	0.0	1.50	538.1	364.1
1.015	43.91	12.30	94.500	3.032	0.0	0.0	0.0	0.99	70.1«	364.1

Free Flowing Outfall Details for Surface Network 4

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.015	S4024	95.700	94.450	0.000	0	0

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Online Controls for Surface Network 4

Hydro-Brake® Optimum Manhole: S4023 - Control Chamber, DS/PN: 1.015, Volume (m³): 12.1

Unit Reference	MD-SHE-0114-7100-1700-7100
Design Head (m)	1.700
Design Flow (l/s)	7.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	114
Invert Level (m)	94.500
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.700	7.1
Flush-Flo™	0.500	7.0
Kick-Flo®	1.022	5.6
Mean Flow over Head Range	-	6.2

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	4.0	1.200	6.0	3.000	9.3	7.000	13.9
0.200	6.2	1.400	6.5	3.500	10.0	7.500	14.3
0.300	6.7	1.600	6.9	4.000	10.6	8.000	14.8
0.400	7.0	1.800	7.3	4.500	11.2	8.500	15.2
0.500	7.0	2.000	7.7	5.000	11.8	9.000	15.6
0.600	7.0	2.200	8.0	5.500	12.4	9.500	16.0
0.800	6.7	2.400	8.3	6.000	12.9		
1.000	5.8	2.600	8.7	6.500	13.4		

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Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 4

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood
6.001	S8130	15 Winter	100	+40%	100/15 Summer	
6.002	S8158	15 Winter	100	+40%	100/15 Summer	
6.003	S8129	15 Winter	100	+40%	100/15 Summer	
7.000	S4004	15 Winter	100	+40%	100/15 Summer	
6.004	S4005	15 Winter	100	+40%	100/15 Summer	
6.005	S8122	15 Winter	100	+40%	30/15 Summer	
8.000	S8166	15 Winter	100	+40%	30/15 Winter	
6.006	S8123	15 Winter	100	+40%	100/15 Summer	
6.007	S8125	15 Winter	100	+40%	30/15 Summer	
6.008	S4020	15 Winter	100	+40%	30/15 Summer	
6.009	S4021 - Headwall	1440 Winter	100	+40%	30/15 Summer	
1.014	S4022	1440 Winter	100	+40%	30/15 Summer	
1.015	S4023 - Control Chamber	1440 Winter	100	+40%	1/180 Winter	

PN	US/MH Name	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
6.001	S8130			97.003	0.393	0.000	0.84
6.002	S8158			96.936	0.507	0.000	1.34
6.003	S8129			96.847	0.527	0.000	0.59
7.000	S4004			96.823	0.755	0.000	0.84
6.004	S4005			96.786	0.817	0.000	0.80
6.005	S8122			96.572	0.978	0.000	1.75
8.000	S8166			96.350	0.796	0.000	0.58
6.006	S8123			96.329	0.669	0.000	0.91
6.007	S8125			96.234	0.870	0.000	1.58
6.008	S4020			95.941	0.741	0.000	1.21
6.009	S4021 - Headwall			95.858	0.738	0.000	0.25
1.014	S4022			95.857	0.662	0.000	0.28
1.015	S4023 - Control Chamber			95.856	1.056	0.000	0.12

PN	US/MH Name	Half Drain Overflow (l/s)	Pipe Time (mins)	Flow (l/s)	Status	Level Exceeded
6.001	S8130			202.3	SURCHARGED	
6.002	S8158			196.9	SURCHARGED	
6.003	S8129			196.9	SURCHARGED	
7.000	S4004			83.8	SURCHARGED	
6.004	S4005			254.2	SURCHARGED	
6.005	S8122			248.5	SURCHARGED	
8.000	S8166			50.1	SURCHARGED	
6.006	S8123			347.7	SURCHARGED	
6.007	S8125			392.2	SURCHARGED	
6.008	S4020			419.5	SURCHARGED	
6.009	S4021 - Headwall			29.1	FLOOD RISK	

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Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 4

PN	US/MH Name	Half Drain		Pipe Flow (l/s)	Status	Level Exceeded
		Overflow (l/s)	Time (mins)			
1.014	S4022			75.3	SURCHARGED	
1.015	S4023 - Control Chamber			7.0	FLOOD RISK	