

Edge Consulting UK		Page 0
Barton Arcade Manchester M3 2BH		
Date 24/05/2024 14:49 File 19310 - Redcued runoff r...	Designed by phill Checked by	
XP Solutions	Network 2020.1.3	

STORM SEWER DESIGN by the Modified Rational Method

Pipe Sizes STANDARD Manhole Sizes STANDARD

Return Period (years)	30	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.300	Minimum Backdrop Height (m)	0.600
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	3.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Network Design Table for SW

Network Results Table

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Manhole Schedules for SW

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdr (mm)
SW1	81.745	1.425	Open Manhole	1350	1.000	80.320	225			
SW2	81.819	1.685	Open Manhole	1350	1.001	80.134	300	1.000	80.209	225
SW3	81.712	1.725	Open Manhole	1350	1.002	79.987	300	1.001	79.987	300
SW4	81.234	1.575	Open Manhole	1350	1.003	79.659	375	1.002	79.734	300
SW15	80.809	1.251	Open Manhole	1500	2.000	79.558	375			
SW5	81.085	1.681	Open Manhole	1800	1.004	79.404	450	1.003	79.479	375
								2.000	79.479	375
SW6	81.222	1.984	Open Manhole	2100	1.005	79.238	525	1.004	79.313	450
SW16	80.628	1.276	Open Manhole	2100	3.000	79.352	450			
SW7	81.043	1.849	Open Manhole	2400	1.006	79.194	525	1.005	79.194	525
								3.000	79.268	450
SW8hwall	81.924	3.524	Open Manhole	2400	1.007	78.400	525	1.006	78.400	525
SW9hwall	81.924	3.624	Open Manhole	2400	1.008	78.300	750	1.007	78.300	525
S10 HYDROBRAKE	81.000	2.725	Open Manhole	2400	1.009	78.275	750	1.008	78.275	750
CUL1	81.000	1.639	Open Manhole	1800	4.000	79.361	600			
CUL2	81.200	1.950	Open Manhole	1800	4.001	79.250	600	4.000	79.250	600
CUL3	81.200	2.141	Open Manhole	1800	4.002	79.059	600	4.001	79.059	600
CUL4	81.250	2.254	Open Manhole	1800	4.003	78.996	600	4.002	78.996	600
SW17	80.500	2.170	Open Manhole	1800	4.004	78.330	750	4.003	78.947	600
SW11	80.800	2.560	Open Manhole	1800	1.010	78.240	750	1.009	78.240	750
								4.004	78.240	750
SW12	80.135	1.950	Open Manhole	1800	1.011	78.185	750	1.010	78.185	750
SW13	80.025	1.950	Open Manhole	1800	1.012	78.075	750	1.011	78.075	750
SW14	80.800	2.770	Open Manhole	1800		OUTFALL		1.012	78.030	750

MH Name

Manhole Easting (m)

Manhole Northing (m)

Intersection Easting (m)

Intersection Northing (m)

Manhole Access

Layout (North)

SW1

374356.378

442588.682

374356.378

442588.682

Required

SW2

374345.853

442573.371

374345.853

442573.371

Required

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Micro
Drainage

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MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
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<u>Simulation Criteria for SW</u> 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 Offline Controls 0 Number of Time/Area Diagrams 0 Number of Online Controls 3 Number of Storage Structures 1 Number of Real Time Controls 0 <u>Synthetic Rainfall Details</u> Rainfall Model FSR Profile Type Summer Return Period (years) 30 Cv (Summer) 0.750 Region England and Wales Cv (Winter) 0.840 M5-60 (mm) 19.000 Storm Duration (mins) 30 Ratio R 0.300		
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Online Controls for SW Non Return Valve Manhole: SW7, DS/PN: 1.006, Volume (m³): 16.7 Hydro-Brake® Optimum Manhole: S10 HYDROBRAKE, DS/PN: 1.009, Volume (m³): 15.1 <table><tr><td>Unit Reference</td><td colspan="2">MD-SHE-0135-1090-2100-1090</td></tr><tr><td>Design Head (m)</td><td colspan="2">2.100</td></tr><tr><td>Design Flow (l/s)</td><td colspan="2">10.9</td></tr><tr><td>Flush-Flo™</td><td colspan="2">Calculated</td></tr><tr><td>Objective</td><td colspan="2">Minimise upstream storage</td></tr><tr><td>Application</td><td colspan="2">Surface</td></tr><tr><td>Sump Available</td><td colspan="2">Yes</td></tr><tr><td>Diameter (mm)</td><td colspan="2">135</td></tr><tr><td>Invert Level (m)</td><td colspan="2">78.275</td></tr><tr><td>Minimum Outlet Pipe Diameter (mm)</td><td colspan="2">150</td></tr><tr><td>Suggested Manhole Diameter (mm)</td><td colspan="2">1500</td></tr></table> <table><tr><td>Control Points</td><td>Head (m)</td><td>Flow (l/s)</td><td>Control Points</td><td>Head (m)</td><td>Flow (l/s)</td></tr><tr><td>Design Point (Calculated)</td><td>2.100</td><td>10.9</td><td>Kick-Flo®</td><td>1.207</td><td>8.4</td></tr><tr><td>Flush-Flo™</td><td>0.591</td><td>10.6</td><td>Mean Flow over Head Range</td><td>-</td><td>9.4</td></tr></table> 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 <table><tr><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td></tr><tr><td>0.100</td><td>4.9</td><td>1.200</td><td>8.5</td><td>3.000</td><td>12.9</td><td>7.000</td><td>19.3</td></tr><tr><td>0.200</td><td>8.8</td><td>1.400</td><td>9.0</td><td>3.500</td><td>13.9</td><td>7.500</td><td>20.0</td></tr><tr><td>0.300</td><td>9.8</td><td>1.600</td><td>9.6</td><td>4.000</td><td>14.8</td><td>8.000</td><td>20.6</td></tr><tr><td>0.400</td><td>10.3</td><td>1.800</td><td>10.1</td><td>4.500</td><td>15.6</td><td>8.500</td><td>21.2</td></tr><tr><td>0.500</td><td>10.5</td><td>2.000</td><td>10.6</td><td>5.000</td><td>16.4</td><td>9.000</td><td>21.8</td></tr><tr><td>0.600</td><td>10.6</td><td>2.200</td><td>11.1</td><td>5.500</td><td>17.2</td><td>9.500</td><td>22.4</td></tr><tr><td>0.800</td><td>10.4</td><td>2.400</td><td>11.6</td><td>6.000</td><td>17.9</td><td></td><td></td></tr><tr><td>1.000</td><td>9.8</td><td>2.600</td><td>12.0</td><td>6.500</td><td>18.6</td><td></td><td></td></tr></table> Non Return Valve Manhole: SW11, DS/PN: 1.010, Volume (m³): 28.4			Unit Reference	MD-SHE-0135-1090-2100-1090		Design Head (m)	2.100		Design Flow (l/s)	10.9		Flush-Flo™	Calculated		Objective	Minimise upstream storage		Application	Surface		Sump Available	Yes		Diameter (mm)	135		Invert Level (m)	78.275		Minimum Outlet Pipe Diameter (mm)	150		Suggested Manhole Diameter (mm)	1500		Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	2.100	10.9	Kick-Flo®	1.207	8.4	Flush-Flo™	0.591	10.6	Mean Flow over Head Range	-	9.4	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	4.9	1.200	8.5	3.000	12.9	7.000	19.3	0.200	8.8	1.400	9.0	3.500	13.9	7.500	20.0	0.300	9.8	1.600	9.6	4.000	14.8	8.000	20.6	0.400	10.3	1.800	10.1	4.500	15.6	8.500	21.2	0.500	10.5	2.000	10.6	5.000	16.4	9.000	21.8	0.600	10.6	2.200	11.1	5.500	17.2	9.500	22.4	0.800	10.4	2.400	11.6	6.000	17.9			1.000	9.8	2.600	12.0	6.500	18.6		
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Storage Structures for SW Tank or Pond Manhole: S10 HYDROBRAKE, DS/PN: 1.009 Invert Level (m) 78.300 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>113.7</td><td>2.000</td><td>493.6</td><td>2.010</td><td>0.0</td></tr></tbody></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	113.7	2.000	493.6	2.010	0.0
Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)									
0.000	113.7	2.000	493.6	2.010	0.0									
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Summary of Critical Results by Maximum Level (Rank 1) for SW

		Water	Surcharged	Flooded			Half Drain	Pipe	
	US/MH	Level	Depth	Volume	Flow /	Overflow	Time	Flow	
PN	Name	(m)	(m)	(m³)	Cap.	(l/s)	(mins)	(l/s)	Status
1.000		SW1 80.627	0.082	0.000	1.11			39.8	SURCHARGED
1.001		SW2 80.489	0.055	0.000	0.95			61.9	SURCHARGED
1.002		SW3 80.352	0.065	0.000	1.12			96.9	SURCHARGED
1.003		SW4 79.973	-0.061	0.000	0.75			106.5	OK
2.000		SW15 79.892	-0.041	0.000	0.28			26.6	OK
1.004		SW5 79.874	0.020	0.000	1.17			164.7	SURCHARGED
1.005		SW6 79.675	-0.088	0.000	1.00			170.6	OK
3.000		SW16 79.527	-0.275	0.000	0.03			4.7	OK
1.006		SW7 79.527	-0.192	0.000	0.08			56.7	OK
1.007		SW8hwall 79.526	0.601	0.000	0.22			55.2	SURCHARGED
1.008		SW9hwall 79.525	0.475	0.000	0.16			54.2	SURCHARGED
1.009	S10 HYDROBRAKE	79.524	0.499	0.000	0.03			10.6	SURCHARGED
4.000		CUL1 79.549	-0.412	0.000	0.26			88.2	OK
4.001		CUL2 79.432	-0.418	0.000	0.19			83.9	OK
4.002		CUL3 79.266	-0.393	0.000	0.27			89.6	OK

PN	US/MH Name	Level Exceeded
1.000		SW1
1.001		SW2
1.002		SW3
1.003		SW4
2.000		SW15
1.004		SW5
1.005		SW6
3.000		SW16
1.006		SW7
1.007	SW8hwall	
1.008	SW9hwall	
1.009	S10 HYDROBRAKE	
4.000		CUL1
4.001		CUL2
4.002		CUL3

