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)	100	Add Flow / Climate Change (%)	0
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio R	0.400	Maximum Backdrop Height (m)	1.500
Maximum Rainfall (mm/hr)	50	Min Design Depth for Optimisation (m)	1.200
Maximum Time of Concentration (mins)	30	Min Vel for Auto Design only (m/s)	1.00
Foul Sewage (l/s/ha)	0.000	Min Slope for Optimisation (1:X)	500
Volumetric Runoff Coeff.	0.750		

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)	Auto Design
1.000	32.170	0.700	46.0	0.097	5.00	0.0	0.600	o	150	
1.001	9.324	0.300	31.1	0.076	0.00	0.0	0.600	o	225	
1.002	22.976	0.500	46.0	0.016	0.00	0.0	0.600	o	300	
1.003	8.438	0.030	281.3	0.046	0.00	0.0	0.600	o	750	
2.000	15.000	0.105	142.9	0.088	5.00	0.0	0.600	o	225	
1.004	8.105	0.030	270.2	0.049	0.00	0.0	0.600	o	750	
1.005	7.264	0.025	290.6	0.020	0.00	0.0	0.600	o	750	
3.000	15.000	0.110	136.4	0.128	5.00	0.0	0.600	o	225	
1.006	30.110	0.100	301.1	0.000	0.00	0.0	0.600	o	750	
1.007	6.962	0.045	154.7	0.016	0.00	0.0	0.600	o	375	

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	5.36	69.800	0.097	0.0	0.0	0.0	1.49	26.3	13.1
1.001	50.00	5.43	69.025	0.173	0.0	0.0	0.0	2.36	93.6	23.4
1.002	50.00	5.59	68.650	0.189	0.0	0.0	0.0	2.33	164.4	25.6
1.003	50.00	5.68	67.700	0.235	0.0	0.0	0.0	1.66	735.0	31.8
2.000	50.00	5.23	68.300	0.088	0.0	0.0	0.0	1.09	43.4	11.9
1.004	50.00	5.76	67.670	0.372	0.0	0.0	0.0	1.70	750.0	50.4
1.005	50.00	5.83	67.640	0.392	0.0	0.0	0.0	1.64	723.0	53.1
3.000	50.00	5.22	68.250	0.128	0.0	0.0	0.0	1.12	44.4	17.3
1.006	50.00	6.14	67.615	0.520	0.0	0.0	0.0	1.61	710.2	70.4
1.007	50.00	6.22	67.515	0.536	0.0	0.0	0.0	1.45	160.6	72.6

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	2
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	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Storm Duration (mins)	30
Ratio R	0.409		

Online Controls for Storm

Complex Manhole: 8, DS/PN: 1.007, Volume (m³): 19.6

Hydro-Brake Optimum®

Unit Reference	MD-SFP-0099-5200-1350-5200
Design Head (m)	1.350
Design Flow (l/s)	5.2
Flush-Flo™	Calculated
Objective	Future Proof
Diameter (mm)	99
Invert Level (m)	67.515
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.350	5.2	Kick-Flo®	0.772	4.0
Flush-Flo™	0.351	5.1	Mean Flow over Head Range	-	4.5

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	3.4	1.200	4.9	3.000	7.5	7.000	11.2
0.200	4.9	1.400	5.2	3.500	8.0	7.500	11.5
0.300	5.1	1.600	5.6	4.000	8.6	8.000	11.9
0.400	5.1	1.800	5.9	4.500	9.0	8.500	12.2
0.500	5.0	2.000	6.2	5.000	9.5	9.000	12.6
0.600	4.8	2.200	6.5	5.500	10.0	9.500	12.9
0.800	4.0	2.400	6.7	6.000	10.4		
1.000	4.5	2.600	7.0	6.500	10.8		

Weir

Discharge Coef 0.544 Width (m) 1.500 Invert Level (m) 68.865

Storage Structures for Storm

Cellular Storage Manhole: Tank1, DS/PN: 2.000

Invert Level (m) 68.300 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	40.0	40.0	0.800	40.0	60.2

Cellular Storage Manhole: Tank2, DS/PN: 3.000

Invert Level (m) 68.250 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	60.0	60.0	0.800	60.0	84.8