STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for 4950 HD NETWORK6.sws

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.323	Minimum Backdrop Height (m)	1.200
Maximum Rainfall (mm/hr)	0	Maximum Backdrop Height (m)	2.500
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

Designed with Level Soffits

Time Area Diagram for 4950 HD NETWORK6.sws

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.169	4-8	0.041

Total Area Contributing (ha) = 0.210

Total Pipe Volume (m^3) = 5.879

Network Design Table for 4950 HD NETWORK6.sws

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	45.000	1.750	25.7	0.090	4.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	66.000	3.000	22.0	0.101	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	10.733	0.050	214.7	0.019	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.003	5.000	0.050	100.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.004	5.000	0.025	200.0	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)	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	0.00	4.29	156.650	0.090	0.0	0.0	0.0	2.59	103.0	0.0
1.001	0.00	4.68	154.900	0.191	0.0	0.0	0.0	2.80	111.4	0.0
1.002	0.00	4.85	151.825	0.210	0.0	0.0	0.0	1.07	75.6	0.0
1.003	0.00	4.90	151.775	0.210	0.0	0.0	0.0	1.57	111.1	0.0
1.004	0.00	4.98	151.725	0.210	0.0	0.0	0.0	1.11	78.3	0.0

Manhole Schedules for 4950 HD NETWORK6.sws

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
HD6-1	158.184	1.534	Open Manhole	1200	1.000	156.650	225				
HD6-2	156.423	1.523	Open Manhole	1200	1.001	154.900	225	1.000	154.900	225	
HD6-3	153.445	1.620	Open Manhole	1200	1.002	151.825	300	1.001	151.900	225	
HD6-4	153.350	1.575	Open Manhole	1200	1.003	151.775	300	1.002	151.775	300	
HSA06	153.350	1.625	Open Manhole	2400	1.004	151.725	300	1.003	151.725	300	
OF	153.350	1.650	Open Manhole	1200		OUTFALL		1.004	151.700	300	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
HD6-1	413073.845	412809.310	413073.845	412809.310	Required	
HD6-2	413110.711	412783.506	413110.711	412783.506	Required	
HD6-3	413164.902	412745.831	413164.902	412745.831	Required	
HD6-4	413161.822	412735.694	413161.822	412735.694	Required	
HSA06	413159.135	412731.478	413159.135	412731.478	Required	
OF	413154.918	412734.166			No Entry	

Free Flowing Outfall Details for 4950 HD NETWORK6.sws

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.004	OF	153.350	151.700	1.900	1200	0

Simulation Criteria for 4950 HD NETWORK6.sws

Volumetric Runoff Coeff	0.840	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)	1440
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	12

Number of Input Hydrographs	0	Number of Storage Structures	1
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	Winter
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	720
Ratio R	0.323		

Online Controls for 4950 HD NETWORK6.sws

Pump Manhole: HSA06, DS/PN: 1.004, Volume (m^3): 7.6

Invert Level (m) 151.725

Storage Structures for 4950 HD NETWORK6.sws

Lined Soakaway Manhole: HSA06, DS/PN: 1.004

Infiltration Coefficient Base (m/hr)	0.05256	Ring Diameter (m)	2.40
Infiltration Coefficient Side (m/hr)	0.02186	Pit Multiplier	2.1
Safety Factor	2.0	Number Required	6
Porosity	0.30	Cap Volume Depth (m)	1.750
Invert Level (m)	151.100	Cap Infiltration Depth (m)	1.750

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 4950 HD NETWORK6.sws

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
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	Ratio R	0.323
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	ON
Analysis Timestep	Fine	Inertia Status	ON
DTS Status	OFF		

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)	2, 30, 100
Climate Change (%)	0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	HD6-1	15 Winter	2	+0%					156.709
1.001	HD6-2	15 Winter	2	+0%					154.979
1.002	HD6-3	15 Winter	2	+0%	30/15 Summer				151.980
1.003	HD6-4	15 Winter	2	+0%	30/15 Summer				151.927
1.004	HSA06	240 Winter	2	+0%	100/30 Winter				151.520

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	HD6-1	-0.166	0.000	0.16			15.3	OK	
1.001	HD6-2	-0.146	0.000	0.26			28.5	OK	
1.002	HD6-3	-0.145	0.000	0.52			31.2	OK	
1.003	HD6-4	-0.148	0.000	0.51			31.4	OK	
1.004	HSA06	-0.505	0.000	0.00		216	0.0	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 4950 HD NETWORK6.sws

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
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	Ratio R	0.323
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	ON
Analysis Timestep	Fine	Inertia Status	ON
DTS Status	OFF		

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)	2, 30, 100
Climate Change (%)	0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	HD6-1	15 Winter	30	+0%					156.733
1.001	HD6-2	15 Winter	30	+0%					155.022
1.002	HD6-3	15 Winter	30	+0%	30/15 Summer				152.157
1.003	HD6-4	15 Winter	30	+0%	30/15 Summer				152.086
1.004	HSA06	360 Winter	30	+0%	100/30 Winter				152.004

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	HD6-1	-0.142	0.000	0.29			29.0	OK	
1.001	HD6-2	-0.103	0.000	0.57			61.0	OK	
1.002	HD6-3	0.032	0.000	1.10			65.7	SURCHARGED	
1.003	HD6-4	0.011	0.000	1.06			65.0	SURCHARGED	
1.004	HSA06	-0.021	0.000	0.00		420	0.0	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 4950 HD NETWORK6.sws

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
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	Ratio R	0.323
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	ON
Analysis Timestep	Fine	Inertia Status	ON
DTS Status	OFF		

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)	2, 30, 100
Climate Change (%)	0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	HD6-1	15 Winter	100	+30%					156.762
1.001	HD6-2	15 Winter	100	+30%					155.102
1.002	HD6-3	480 Winter	100	+30%	30/15 Summer				152.804
1.003	HD6-4	480 Winter	100	+30%	30/15 Summer				152.802
1.004	HSA06	480 Winter	100	+30%	100/30 Winter				152.802

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	HD6-1	-0.113	0.000	0.50			48.7	OK	
1.001	HD6-2	-0.023	0.000	0.94			101.4	OK	
1.002	HD6-3	0.679	0.000	0.23			13.7	SURCHARGED	
1.003	HD6-4	0.727	0.000	0.21			13.1	SURCHARGED	
1.004	HSA06	0.777	0.000	0.00		680	0.0	SURCHARGED	