STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for NETWORK 2 20.05.14.SWS

Pipe Sizes NETWORK 2 20.05.13 Manhole Sizes NETWORK 2 20.05.13

FEH Rainfall Model	
Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 503220 103890
Data Type	Point
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	0.000
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	0.75
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for NETWORK 2 20.05.14.SWS

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.109	4-8	0.051

Total Area Contributing (ha) = 0.160

Total Pipe Volume (m^3) = 2.705

Network Design Table for NETWORK 2 20.05.14.SWS

« - Indicates pipe capacity < flow

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
S1.000	14.508	0.090	161.2	0.090	6.00	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)
S1.000	50.00	6.24	5.670	0.090	0.0	0.0	0.0	1.03	40.8	12.2

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Network Design Table for NETWORK 2 20.05.14.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
S1.001	3.402	0.460	7.4	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	5.637	0.040	140.9	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	9.937	0.080	124.2	0.035	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.004	17.137	0.075	228.5	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.005	9.206	0.065	141.6	0.035	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)
S1.001	50.00	6.25	5.580	0.090	0.0	0.0	0.0	4.84	192.5	12.2
S1.002	50.00	6.33	5.120	0.090	0.0	0.0	0.0	1.10	43.7	12.2
S1.003	50.00	6.47	5.080	0.125	0.0	0.0	0.0	1.17	46.6	16.9
S1.004	50.00	6.75	4.925	0.125	0.0	0.0	0.0	1.04	73.2	16.9
S1.005	50.00	6.93	4.850	0.160	0.0	0.0	0.0	0.84	14.9«	21.7

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Area Summary for NETWORK 2 20.05.14.SWS

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.090	0.090	0.090
1.001	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.035	0.035	0.035
1.004	-	-	100	0.000	0.000	0.000
1.005	-	-	100	0.035	0.035	0.035
				Total	Total	Total
				0.160	0.160	0.160

Free Flowing Outfall Details for NETWORK 2 20.05.14.SWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.005	SSWB6_01	6.900	4.785	0.000	1200	0

Simulation Criteria for NETWORK 2 20.05.14.SWS

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	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	FEH	Summer Storms	Yes
Return Period (years)	2	Winter Storms	Yes
FEH Rainfall Version	2013	Cv (Summer)	0.750
Site Location	GB 503220 103890	Cv (Winter)	0.840
Data Type	Point	Storm Duration (mins)	30

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Online Controls for NETWORK 2 20.05.14.SWS

Hydro-Brake® Optimum Manhole: SHB2, DS/PN: S1.005, Volume (m³): 4.9

Unit Reference	MD-SHE-0101-5000-1290-5000
Design Head (m)	1.290
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	101
Invert Level (m)	4.850
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	**Head (m)**	**Flow (l/s)**
Design Point (Calculated)	1.290	5.0
Flush-Flo™	0.387	5.0
Kick-Flo®	0.802	4.0
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)**
0.100	3.4	1.200	4.8	3.000	7.4	7.000	11.1
0.200	4.6	1.400	5.2	3.500	8.0	7.500	11.4
0.300	4.9	1.600	5.5	4.000	8.5	8.000	11.8
0.400	5.0	1.800	5.8	4.500	9.0	8.500	12.1
0.500	4.9	2.000	6.1	5.000	9.4	9.000	12.5
0.600	4.8	2.200	6.4	5.500	9.9	9.500	12.8
0.800	4.0	2.400	6.7	6.000	10.3		
1.000	4.4	2.600	6.9	6.500	10.7		

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Storage Structures for NETWORK 2 20.05.14.SWS

Cellular Storage Manhole: SCS2, DS/PN: S1.002

Invert Level (m) 5.120 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	77.0	77.0	0.801	0.0	105.1
0.800	77.0	105.1			

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Summary of Critical Results by Maximum Level (Rank 1) for NETWORK 2 20.05.14.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 FEH Data Type Point
FEH Rainfall Version 2013 Cv (Summer) 0.750
Site Location GB 503220 103890 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 30
Climate Change (%) 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S18	15 Winter	30	+0%					5.834
S1.001	SCP2	15 Winter	30	+0%					5.669
S1.002	SCS2	60 Winter	30	+0%	30/15 Summer				5.500
S1.003	S20	60 Winter	30	+0%	30/15 Summer				5.497
S1.004	S22	60 Winter	30	+0%	30/15 Summer				5.493
S1.005	SHB2	60 Winter	30	+0%	30/15 Summer				5.489

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S18	-0.061	0.000	0.88		31.4	OK	
S1.001	SCP2	-0.136	0.000	0.33		31.5	OK	
S1.002	SCS2	0.155	0.000	0.17		4.9	SURCHARGED	
S1.003	S20	0.192	0.000	0.19		7.2	SURCHARGED	
S1.004	S22	0.268	0.000	0.08		5.0	SURCHARGED	
S1.005	SHB2	0.489	0.000	0.38		5.0	SURCHARGED	

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