STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for FITZJOHNS NETWORK 1.SWS

Pipe Sizes FITZJOHNS Manhole Sizes FITZJOHNS

FSR Rainfall Model - England and Wales

Return Period (years)	2	Add Flow / Climate Change (%)	10
M5-60 (mm)	20.800	Minimum Backdrop Height (m)	0.200
Ratio R	0.438	Maximum Backdrop Height (m)	0.000
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)	0.75
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 FITZJOHNS NETWORK 1.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)
1.000	5.351	1.098	4.9	0.013	5.00	0.0	0.600	o	100
1.001	7.668	0.031	247.4	0.013	0.00	0.0	0.600	o	300
1.002	11.286	0.045	250.0	0.013	0.00	0.0	0.600	o	300
1.003	28.582	0.114	250.0	0.013	0.00	0.0	0.600	o	300
1.004	12.638	0.051	250.0	0.013	0.00	0.0	0.600	o	300
1.005	11.538	0.046	250.0	0.013	0.00	0.0	0.600	o	300
1.006	26.416	0.106	250.0	0.013	0.00	0.0	0.600	o	300
1.007	3.583	0.014	255.9	0.000	0.00	0.0	0.600	o	300
1.008	10.002	0.040	250.1	0.000	0.00	0.0	0.600	o	225

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	5.03	101.470	0.013	0.0	0.0	0.2	3.53	27.7	1.9
1.001	50.00	5.15	100.172	0.026	0.0	0.0	0.4	1.00	70.3	3.9
1.002	50.00	5.34	100.141	0.039	0.0	0.0	0.5	0.99	70.0	5.8
1.003	50.00	5.83	100.096	0.052	0.0	0.0	0.7	0.99	70.0	7.7
1.004	50.00	6.04	99.982	0.065	0.0	0.0	0.9	0.99	70.0	9.7
1.005	50.00	6.23	99.931	0.078	0.0	0.0	1.1	0.99	70.0	11.6
1.006	50.00	6.68	99.885	0.091	0.0	0.0	1.2	0.99	70.0	13.6
1.007	50.00	6.74	99.779	0.091	0.0	0.0	1.2	0.98	69.1	13.6
1.008	50.00	6.94	99.765	0.091	0.0	0.0	1.2	0.82	32.7	13.6

Manhole Schedules for FITZJOHNS NETWORK 1.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)
1	102.670	1.200	Open Manhole	450	1.000	101.470	100				
2	100.920	0.748	Open Manhole	1800	1.001	100.172	300	1.000	100.372	100	
3	100.920	0.779	Open Manhole	1200	1.002	100.141	300	1.001	100.141	300	
4	100.920	0.824	Open Manhole	1200	1.003	100.096	300	1.002	100.096	300	
5	100.920	0.938	Open Manhole	1200	1.004	99.982	300	1.003	99.982	300	
6	100.920	0.989	Open Manhole	1200	1.005	99.931	300	1.004	99.931	300	
7	106.400	6.515	Open Manhole	1200	1.006	99.885	300	1.005	99.885	300	
8	106.000	6.221	Open Manhole	2400	1.007	99.779	300	1.006	99.779	300	
9	105.800	6.035	Open Manhole	1200	1.008	99.765	225	1.007	99.765	300	
10	105.600	5.875	Open Manhole	0		OUTFALL		1.008	99.725	225	

PIPELINE SCHEDULES for FITZJOHNS NETWORK 1.SWS

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	100	1	102.670	101.470	1.100	Open Manhole	450
1.001	o	300	2	100.920	100.172	0.448	Open Manhole	1800
1.002	o	300	3	100.920	100.141	0.479	Open Manhole	1200
1.003	o	300	4	100.920	100.096	0.524	Open Manhole	1200
1.004	o	300	5	100.920	99.982	0.638	Open Manhole	1200
1.005	o	300	6	100.920	99.931	0.689	Open Manhole	1200
1.006	o	300	7	106.400	99.885	6.215	Open Manhole	1200
1.007	o	300	8	106.000	99.779	5.921	Open Manhole	2400
1.008	o	225	9	105.800	99.765	5.810	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	5.351	4.9	2	100.920	100.372	0.448	Open Manhole	1800
1.001	7.668	247.4	3	100.920	100.141	0.479	Open Manhole	1200
1.002	11.286	250.0	4	100.920	100.096	0.524	Open Manhole	1200
1.003	28.582	250.0	5	100.920	99.982	0.638	Open Manhole	1200
1.004	12.638	250.0	6	100.920	99.931	0.689	Open Manhole	1200
1.005	11.538	250.0	7	106.400	99.885	6.215	Open Manhole	1200
1.006	26.416	250.0	8	106.000	99.779	5.921	Open Manhole	2400
1.007	3.583	255.9	9	105.800	99.765	5.735	Open Manhole	1200
1.008	10.002	250.1	10	105.600	99.725	5.650	Open Manhole	0

Free Flowing Outfall Details for FITZJOHNS NETWORK 1.SWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.008	10	105.600	99.725	0.000	0	0

Simulation Criteria for FITZJOHNS NETWORK 1.SWS

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	30.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Run Time (mins)	60
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

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)	20.800	Storm Duration (mins)	30
Ratio R	0.438		

Online Controls for FITZJOHNS NETWORK 1.SWS

Hydro-Brake Optimum® Manhole: 8, DS/PN: 1.007, Volume (m³): 29.9

Unit Reference	MD-SHE-0146-1000-0900-1000
Design Head (m)	0.900
Design Flow (l/s)	10.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	146
Invert Level (m)	99.779
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	9.9
Flush-Flo™	0.280	9.9
Kick-Flo®	0.622	8.3
Mean Flow over Head Range	-	8.4

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	5.3	1.200	11.3	3.000	17.5	7.000	26.2
0.200	9.7	1.400	12.2	3.500	18.8	7.500	27.1
0.300	9.9	1.600	12.9	4.000	20.0	8.000	28.0
0.400	9.7	1.800	13.7	4.500	21.2	8.500	28.8
0.500	9.4	2.000	14.4	5.000	22.3	9.000	29.6
0.600	8.6	2.200	15.1	5.500	23.3	9.500	30.3
0.800	9.3	2.400	15.7	6.000	24.3		
1.000	10.4	2.600	16.3	6.500	25.3		

Summary of Results for 30 minute 100 year Winter (FITZJOHNS NETWORK 1.SWS)

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	101.504	-0.066	0.000	0.26		6.2	OK
1.001	2	100.919	0.447	0.000	0.19		10.1	FLOOD RISK
1.002	3	100.918	0.477	0.000	0.26		14.7	FLOOD RISK
1.003	4	100.916	0.520	0.000	0.28		17.6	FLOOD RISK
1.004	5	100.915	0.633	0.000	0.26		14.7	FLOOD RISK
1.005	6	100.914	0.683	0.000	0.31		17.4	FLOOD RISK
1.006	7	100.910	0.725	0.000	0.32		20.3	SURCHARGED
1.007	8	100.903	0.823	0.000	0.21		10.5	SURCHARGED
1.008	9	99.862	-0.128	0.000	0.39		10.5	OK