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Date 11-12-2014	Designed by scm	
File PENNYCROFT SWS NETWORK ...	Checked by	
XP Solutions	Network 2015.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for STORM WATER NETWORK 2 15.02.16.SWS










Pipe Sizes STORM WATER NETWORK 1 15.02.16 Manhole Sizes STORM WATER NETWORK 1 15.02.16

FSR Rainfall Model - England and Wales

Return Period (years)	2	Add Flow / Climate Change (%)	0
M5-60 (mm)	18.300	Minimum Backdrop Height (m)	5.000
Ratio R	0.361	Maximum Backdrop Height (m)	10.000
Maximum Rainfall (mm/hr)	5	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 WATER NETWORK 2 15.02.16.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)	Auto Design
S1.000	9.276	0.062	149.6	0.121	4.00	0.0	0.600	o	225	
S1.001	5.693	0.038	149.8	0.004	0.00	0.0	0.600	o	225	
S1.002	33.899	2.148	15.8	0.041	0.00	0.0	0.600	o	225	
S1.003	26.039	0.052	500.8	0.111	0.00	0.0	0.600	o	750	
S1.004	13.284	0.026	510.9	0.000	0.00	0.0	0.600	o	750	
S2.000	3.591	0.035	102.6	0.000	4.00	0.0	0.600	o	150	
S2.001	5.654	0.050	113.1	0.000	0.00	0.0	0.600	o	150	
S2.002	15.291	0.030	509.7	0.104	0.00	0.0	0.600	o	750	
S1.005	10.254	0.249	41.2	0.000	0.00	0.0	0.600	o	300	


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	5.00	4.14	82.500	0.121	0.0	0.0	0.0	1.07	42.4	1.6
S1.001	5.00	4.23	82.438	0.125	0.0	0.0	0.0	1.07	42.4	1.7
S1.002	5.00	4.40	82.400	0.166	0.0	0.0	0.0	3.31	131.6	2.2
S1.003	5.00	4.75	79.727	0.277	0.0	0.0	0.0	1.24	549.4	3.8
S1.004	5.00	4.93	79.675	0.277	0.0	0.0	0.0	1.23	543.9	3.8
S2.000	5.00	4.06	79.760	0.000	0.0	0.0	0.0	0.99	17.5	0.0
S2.001	5.00	4.16	79.725	0.000	0.0	0.0	0.0	0.94	16.7	0.0
S2.002	5.00	4.37	79.679	0.104	0.0	0.0	0.0	1.23	544.6	1.4
S1.005	5.00	5.00	79.649	0.381	0.0	0.0	0.0	2.46	173.7	5.2

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Manhole Schedules for STORM WATER NETWORK 2 15.02.16.SWS

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)	PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S1	84.045	1.545	Open Manhole	1200	S1.000	82.500	225				
S2	84.047	1.609	Open Manhole	1200	S1.001	82.438	225	S1.000	82.438	225	
S3	84.061	1.661	Open Manhole	1200	S1.002	82.400	225	S1.001	82.400	225	
S4	82.737	3.010	Open Manhole	2100	S1.003	79.727	750	S1.002	80.252	225	
S5	81.892	2.217	Open Manhole	2100	S1.004	79.675	750	S1.003	79.675	750	
S7	81.800	2.040	Open Manhole	1200	S2.000	79.760	150				
S8	81.800	2.075	Open Manhole	1200	S2.001	79.725	150	S2.000	79.725	150	
S9	82.361	2.686	Open Manhole	2100	S2.002	79.679	750	S2.001	79.675	150	
S6	81.322	1.673	Open Manhole	2700	S1.005	79.649	300	S1.004	79.649	750	
S10	80.501	1.101	Open Manhole	0		OUTFALL		S2.002	79.649	750	
								S1.005	79.400	300	

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Area Summary for STORM WATER NETWORK 2 15.02.16.SWS

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.121	0.121	0.121
1.001	-	-	100	0.004	0.004	0.004
1.002	-	-	100	0.041	0.041	0.041
1.003	-	-	100	0.111	0.111	0.111
1.004	-	-	100	0.000	0.000	0.000
2.000	-	-	100	0.000	0.000	0.000
2.001	-	-	100	0.000	0.000	0.000
2.002	-	-	100	0.104	0.104	0.104
1.005	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.381	0.381	0.381

Free Flowing Outfall Details for STORM WATER NETWORK 2 15.02.16.SWS


Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L	W
S1.005	S10	80.501	79.400	79.400	0	0

Simulation Criteria for STORM WATER NETWORK 2 15.02.16.SWS

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	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	2	Number of Time/Area Diagrams	0
Number of Offline Controls	1	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.400	Storm Duration (mins)	30
Ratio R	0.362		

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Online Controls for STORM WATER NETWORK 2 15.02.16.SWS

Non Return Valve Manhole: S8, DS/PN: S2.001, Volume (m³): 2.4


Hydro-Brake Optimum® Manhole: S6, DS/PN: S1.005, Volume (m³): 20.1

Unit Reference	MD-SHE-0241-3200-1100-3200
Design Head (m)	1.100
Design Flow (l/s)	32.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	241
Invert Level (m)	79.649
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.100	31.7
Flush-Flo™	0.395	31.6
Kick-Flo®	0.805	27.3
Mean Flow over Head Range	-	26.4

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	7.9	1.200	33.0	3.000	51.3	7.000	77.4
0.200	24.5	1.400	35.5	3.500	55.3	7.500	80.1
0.300	31.2	1.600	37.9	4.000	59.0	8.000	82.6
0.400	31.6	1.800	40.1	4.500	62.5	8.500	85.1
0.500	31.3	2.000	42.2	5.000	65.7	9.000	87.5
0.600	30.7	2.200	44.2	5.500	68.8	9.500	89.8
0.800	27.4	2.400	46.1	6.000	71.8		
1.000	30.2	2.600	47.9	6.500	74.7		

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Summary of Critical Results by Maximum Level (Rank 1) for STORM WATER NETWORK 2 15.02.16.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 Coefficient 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 2 Number of Time/Area Diagrams 0
Number of Offline Controls 1 Number of Real Time Controls 0

Synthetic Rainfall Details


Rainfall Model FSR Ratio R 0.378
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
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status ON
Inertia Status OFF

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) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	30	+0%	30/15 Summer				82.791
S1.001	S2	15 Winter	30	+0%	30/15 Summer				82.705
S1.002	S3	15 Winter	30	+0%					82.506
S1.003	S4	15 Winter	30	+0%					80.376
S1.004	S5	15 Winter	30	+0%					80.325
S2.000	S7	30 Winter	30	+0%	30/15 Summer				80.105
S2.001	S8	30 Winter	30	+0%	30/15 Summer				80.105
S2.002	S9	15 Winter	30	+0%			30/15 Summer	6	80.297
S1.005	S6	15 Winter	30	+0%	30/15 Summer				80.308

PN	US/MH Name	Depth (m)	Volume (m ³)	Flow / Cap. (l/s)	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.066	0.000	1.17		40.8	SURCHARGED	
S1.001	S2	0.042	0.000	1.40		41.9	SURCHARGED	
S1.002	S3	-0.119	0.000	0.45		55.3	OK	

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Summary of Critical Results by Maximum Level (Rank 1) for STORM WATER
NETWORK 2 15.02.16.SWS

PN	US/MH Name	Surcharged Flooded		Flow / Overflow		Pipe	Status	Level Exceeded
		Depth (m)	Volume (m ³)	Cap.	(l/s)	Flow (l/s)		
S1.003	S4	-0.101	0.000	0.20		82.8	OK	
S1.004	S5	-0.100	0.000	0.20		51.3	OK	
S2.000	S7	0.195	0.000	1.05		12.3	SURCHARGED	
S2.001	S8	0.230	0.000	0.92		12.7	SURCHARGED	
S2.002	S9	-0.132	0.000	0.10	35.9	27.5	OK	
S1.005	S6	0.359	0.000	0.25		31.6	SURCHARGED	