



Date 13/12/2018 11:44

Designed by chrisdolecki

File 18_12_11_Labour Exchange Slope...

Checked by

Innovyze

Network 2018.1

STORM SEWER DESIGN by the Modified Rational MethodDesign Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	1	PIMP (%)	100
M5-60 (mm)	20.000	Add Flow / Climate Change (%)	0
Ratio R	0.200	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	100	Maximum Backdrop Height (m)	1.500
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

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)	Section Type	Auto Design
S1.000	19.987	0.040	499.7	0.000	5.00	1.0	0.600	o	500	Pipe/Conduit	
S1.001	25.243	1.162	21.7	0.000	0.00	1.5	1.000	o	900	Pipe/Conduit	
S1.002	20.921	0.211	99.2	0.000	0.00	1.5	0.600	o	900	Pipe/Conduit	
S1.003	19.324	0.098	197.2	0.000	0.00	1.5	0.600	o	900	Pipe/Conduit	
S1.004	17.063	0.765	22.3	0.000	0.00	1.5	0.600	o	900	Pipe/Conduit	
S1.005	3.605	1.435	2.5	0.000	0.00	1.5	0.600	o	225	Pipe/Conduit	
S1.006	5.775	0.150	38.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	37.70	5.35	193.860	0.000	1.0	0.0	0.0	0.96	189.5	1.0
S1.001	37.54	5.41	193.420	0.000	2.5	0.0	0.0	6.34	4035.6	2.5
S1.002	37.28	5.52	192.264	0.000	4.0	0.0	0.0	3.15	2002.1	4.0
S1.003	36.94	5.67	191.210	0.000	5.5	0.0	0.0	2.23	1417.3	5.5
S1.004	36.85	5.71	190.900	0.000	7.0	0.0	0.0	6.65	4230.4	7.0
S1.005	36.83	5.72	190.135	0.000	8.5	0.0	0.0	8.32	330.7	8.5
S1.006	36.73	5.76	188.700	0.000	8.5	0.0	0.0	2.11	84.1	8.5



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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	Pipe Out PN	Invert Level (m)	Diameter (mm)	Pipes In PN	Invert Level (m)	Diameter (mm)	Backdrop (mm)
SMH9	194.740	0.880	Open Manhole	1500	S1.000	193.860	500				
SMH7	195.000	1.580	Open Manhole	1800	S1.001	193.420	900	S1.000	193.820	500	
SMH6	193.930	1.672	Open Manhole	1800	S1.002	192.264	900	S1.001	192.258	900	
SMH5	193.430	2.220	Open Manhole	1800	S1.003	191.210	900	S1.002	192.053	900	843
SMH4	192.490	1.590	Open Manhole	1800	S1.004	190.900	900	S1.003	191.112	900	212
SMH3	191.410	1.275	Open Manhole	1800	S1.005	190.135	225	S1.004	190.135	900	
SMH2	191.280	2.580	Open Manhole	1200	S1.006	188.700	225	S1.005	188.700	225	
S	190.270	1.720	Open Manhole	0		OUTFALL		S1.006	188.550	225	



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PIPELINE SCHEDULES for StormUpstream Manhole

PN	Hyd	Diam	MH	C.Level	I.Level	D.Depth	MH	MH DIAM., L*W
	Sect	(mm)	Name	(m)	(m)	(m)	Connection	(mm)
S1.000	o	500	SMH9	194.740	193.860	0.380	Open Manhole	1500
S1.001	o	900	SMH7	195.000	193.420	0.680	Open Manhole	1800
S1.002	o	900	SMH6	193.930	192.264	0.766	Open Manhole	1800
S1.003	o	900	SMH5	193.430	191.210	1.320	Open Manhole	1800
S1.004	o	900	SMH4	192.490	190.900	0.690	Open Manhole	1800
S1.005	o	225	SMH3	191.410	190.135	1.050	Open Manhole	1800
S1.006	o	225	SMH2	191.280	188.700	2.355	Open Manhole	1200

Downstream Manhole

PN	Length	Slope	MH	C.Level	I.Level	D.Depth	MH	MH DIAM., L*W
	(m)	(1:X)	Name	(m)	(m)	(m)	Connection	(mm)
S1.000	19.987	499.7	SMH7	195.000	193.820	0.680	Open Manhole	1800
S1.001	25.243	21.7	SMH6	193.930	192.258	0.772	Open Manhole	1800
S1.002	20.921	99.2	SMH5	193.430	192.053	0.477	Open Manhole	1800
S1.003	19.324	197.2	SMH4	192.490	191.112	0.478	Open Manhole	1800
S1.004	17.063	22.3	SMH3	191.410	190.135	0.375	Open Manhole	1800
S1.005	3.605	2.5	SMH2	191.280	188.700	2.355	Open Manhole	1200
S1.006	5.775	38.5	S	190.270	188.550	1.495	Open Manhole	0

Free Flowing Outfall Details for Storm

Outfall	Outfall	C. Level	I. Level	Min	D,L	W
Pipe Number	Name	(m)	(m)	I. Level	(mm)	(mm)
				(m)		

S1.006	S	190.270	188.550	188.550	0	0
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Simulation Criteria for Storm

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 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)	7200
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	24

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	5	Number of Storage Structures	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	20.000
Return Period (years)	1	Ratio R	0.200
Region England and Wales Profile Type Winter			



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Synthetic Rainfall Details

Cv (Summer) 0.750 Storm Duration (mins) 3600
Cv (Winter) 0.840



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Online Controls for Storm

Complex Manhole: SMH7, DS/PN: S1.001, Volume (m³): 7.6

Hydro-Brake® Optimum

Unit Reference MD-CHE-0072-2500-0982-2500
 Design Head (m) 0.982
 Design Flow (l/s) 2.5
 Flush-Flo™ Calculated
 Objective Minimise upstream storage
 Application Surface
 Sump Available No
 Diameter (mm) 72
 Invert Level (m) 193.420
 Minimum Outlet Pipe Diameter (mm) 100
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.982	2.5	Kick-Flo®	0.250	1.3
Flush-Flo™	0.176	2.3	Mean Flow over Head Range	-	1.8

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)	Depth (m)	Flow (l/s)
0.100	1.6	0.800	2.3	2.000	3.5	4.000	5.0	7.000	6.6
0.200	2.0	1.000	2.5	2.200	3.7	4.500	5.3	7.500	6.8
0.300	1.4	1.200	2.8	2.400	3.9	5.000	5.6	8.000	7.0
0.400	1.6	1.400	3.0	2.600	4.0	5.500	5.8	8.500	7.2
0.500	1.8	1.600	3.2	3.000	4.3	6.000	6.1	9.000	7.4
0.600	2.0	1.800	3.4	3.500	4.7	6.500	6.3	9.500	7.6

Weir

Discharge Coef 0.544 Width (m) 1.800 Invert Level (m) 194.402

Complex Manhole: SMH6, DS/PN: S1.002, Volume (m³): 19.2

Hydro-Brake® Optimum

Unit Reference MD-CHE-0106-6000-1225-6000
 Design Head (m) 1.225
 Design Flow (l/s) 6.0
 Flush-Flo™ Calculated
 Objective Minimise upstream storage
 Application Surface



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Hydro-Brake® Optimum

Sump Available No
 Diameter (mm) 106
 Invert Level (m) 192.264
 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)	1.225	6.0	Kick-Flo®	0.367	3.4
Flush-Flo™	0.260	6.0	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)	Depth (m)	Flow (l/s)
0.100	3.0	0.800	4.9	2.000	7.6	4.000	10.7	7.000	14.1
0.200	5.3	1.000	5.4	2.200	8.0	4.500	11.3	7.500	14.6
0.300	5.0	1.200	5.9	2.400	8.3	5.000	11.9	8.000	15.0
0.400	3.5	1.400	6.4	2.600	8.7	5.500	12.5	8.500	15.5
0.500	3.9	1.600	6.8	3.000	9.3	6.000	13.1	9.000	15.9
0.600	4.2	1.800	7.2	3.500	10.0	6.500	13.6	9.500	16.4

Weir

Discharge Coef 0.544 Width (m) 1.800 Invert Level (m) 193.489

Complex Manhole: SMH5, DS/PN: S1.003, Volume (m³): 17.8

Hydro-Brake® Optimum

Unit Reference MD-CHE-0101-6500-1817-6500
 Design Head (m) 1.817
 Design Flow (l/s) 6.5
 Flush-Flo™ Calculated
 Objective Minimise upstream storage
 Application Surface
 Sump Available No
 Diameter (mm) 101
 Invert Level (m) 191.210
 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)	1.817	6.5	Kick-Flo®	0.351	3.0
Flush-Flo™	0.249	5.2	Mean Flow over Head Range	-	4.6

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



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Hydro-Brake® Optimum

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.8	0.800	4.4	2.000	6.8	4.000	9.6	7.000	12.6
0.200	4.8	1.000	4.9	2.200	7.1	4.500	10.2	7.500	13.0
0.300	3.8	1.200	5.3	2.400	7.5	5.000	10.7	8.000	13.5
0.400	3.1	1.400	5.7	2.600	7.8	5.500	11.2	8.500	13.9
0.500	3.5	1.600	6.1	3.000	8.3	6.000	11.7	9.000	14.3
0.600	3.8	1.800	6.5	3.500	9.0	6.500	12.2	9.500	14.6

Weir

Discharge Coef 0.544 Width (m) 1.800 Invert Level (m) 193.027

Complex Manhole: SMH4, DS/PN: S1.004, Volume (m³): 15.2Hydro-Brake® Optimum

Unit Reference MD-SHE-0121-7000-1184-7000
 Design Head (m) 1.184
 Design Flow (l/s) 7.0
 Flush-Flo™ Calculated
 Objective Minimise upstream storage
 Application Surface
 Sump Available Yes
 Diameter (mm) 121
 Invert Level (m) 190.900
 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)	1.184	7.0	Kick-Flo®	0.749	5.7
Flush-Flo™	0.349	7.0	Mean Flow over Head Range	-	6.1

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)	Depth (m)	Flow (l/s)
0.100	4.3	0.800	5.8	2.000	9.0	4.000	12.4	7.000	16.2
0.200	6.6	1.000	6.5	2.200	9.4	4.500	13.1	7.500	16.8
0.300	7.0	1.200	7.0	2.400	9.8	5.000	13.8	8.000	17.3
0.400	7.0	1.400	7.6	2.600	10.1	5.500	14.5	8.500	17.8
0.500	6.8	1.600	8.1	3.000	10.8	6.000	15.1	9.000	18.3
0.600	6.6	1.800	8.5	3.500	11.7	6.500	15.7	9.500	18.8



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Weir

Discharge Coef 0.544 Width (m) 1.800 Invert Level (m) 192.084

Complex Manhole: SMH3, DS/PN: S1.005, Volume (m³): 13.0Hydro-Brake® Optimum

Unit Reference MD-SHE-0136-8600-1008-8600
 Design Head (m) 1.008
 Design Flow (l/s) 8.6
 Flush-Flo™ Calculated
 Objective Minimise upstream storage
 Application Surface
 Sump Available Yes
 Diameter (mm) 136
 Invert Level (m) 190.135
 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)	1.008	8.6	Kick-Flo®	0.670	7.1
Flush-Flo™	0.302	8.6	Mean Flow over Head Range	-	7.4

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)	Depth (m)	Flow (l/s)
0.100	4.9	0.800	7.7	2.000	11.9	4.000	16.5	7.000	21.6
0.200	8.4	1.000	8.6	2.200	12.4	4.500	17.5	7.500	22.3
0.300	8.6	1.200	9.3	2.400	12.9	5.000	18.4	8.000	23.0
0.400	8.5	1.400	10.0	2.600	13.4	5.500	19.2	8.500	23.7
0.500	8.3	1.600	10.7	3.000	14.4	6.000	20.1	9.000	24.4
0.600	7.8	1.800	11.3	3.500	15.5	6.500	20.8	9.500	25.0

Weir

Discharge Coef 0.544 Width (m) 1.800 Invert Level (m) 191.143



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Summary of Results for 3600 minute 1 year Winter (Storm)

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF

Analysis Timestep Fine Inertia Status OFF

DTS Status ON

		Water	Surcharged	Flooded		Pipe	
	US/MH	Level	Depth	Volume	Flow / Overflow	Flow	
PN	Name	(m)	(m)	(m³)	Cap.	(l/s)	(l/s) Status
SI.000	SMH9	194.487	0.127	0.000	0.01	1.1	FLOOD RISK
SI.001	SMH7	194.487	0.167	0.000	0.00	2.6	SURCHARGED
SI.002	SMH6	193.510	0.346	0.000	0.00	4.0	SURCHARGED
SI.003	SMH5	193.373	1.263	0.000	0.01	5.5	FLOOD RISK
SI.004	SMH4	192.084	0.284	0.000	0.00	7.0	SURCHARGED
SI.005	SMH3	190.368	0.008	0.000	0.05	8.5	SURCHARGED
SI.006	SMH2	188.759	-0.166	0.000	0.16	8.5	OK