STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	2
FEH Rainfall Version	1999
Site Location	GB 436500 402000 SE 36500 02000
C (1km)	-0.024
D1 (1km)	0.358
D2 (1km)	0.441
D3 (1km)	0.229
E (1km)	0.296
F (1km)	2.384
Maximum Rainfall (mm/hr)	100
Maximum Time of Concentration (mins)	60
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)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
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	28.530	0.118	241.2	0.348	4.00	0.0	0.600	o	300	Pipe/Conduit	
S2.000	12.809	0.118	108.3	0.197	4.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	46.348	0.145	320.5	0.035	0.00	0.0	0.600	o	375	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	73.65	4.47	156.500	0.348	0.0	0.0	0.0	1.01	71.2	69.3
S2.000	77.12	4.17	156.575	0.197	0.0	0.0	0.0	1.26	49.9	41.2
S1.001	66.36	5.24	156.307	0.580	0.0	0.0	0.0	1.01	111.2	104.2

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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
S3.000	30.777	0.213	144.6	0.235	4.00	0.0	0.600	o	300	Pipe/Conduit	
S1.002	36.200	0.737	49.1	0.060	0.00	0.0	0.600	o	375	Pipe/Conduit	
S4.000	27.789	1.200	23.2	0.216	4.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	49.799	2.925	17.0	0.018	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.004	17.114	0.293	58.4	0.076	0.00	0.0	0.600	o	375	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)
S3.000	74.52	4.39	156.450	0.235	0.0	0.0	0.0	1.31	92.3	47.4
S1.002	64.48	5.47	156.162	0.875	0.0	0.0	0.0	2.59	286.2	152.8
S4.000	77.13	4.17	156.775	0.216	0.0	0.0	0.0	2.73	108.6	45.0
S1.003	63.06	5.66	155.425	1.108	0.0	0.0	0.0	4.41	487.0	189.3
S1.004	62.20	5.78	152.500	1.184	0.0	0.0	0.0	2.37	262.3	199.5

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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	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S1	158.000	1.500	Open Manhole	1200	S1.000	156.500	300				
S2	158.000	1.425	Open Manhole	1200	S2.000	156.575	225				
S1	158.280	1.973	Open Manhole	1350	S1.001	156.307	375	S1.000	156.382	300	
								S2.000	156.457	225	
S4	157.950	1.500	Open Manhole	1200	S3.000	156.450	300				
S2	158.160	1.998	Open Manhole	1350	S1.002	156.162	375	S1.001	156.162	375	
								S3.000	156.237	300	
S6	158.200	1.425	Open Manhole	1200	S4.000	156.775	225				
S3	157.000	1.575	Open Manhole	1350	S1.003	155.425	375	S1.002	155.425	375	
								S4.000	155.575	225	
S4	154.500	2.000	Open Manhole	1350	S1.004	152.500	375	S1.003	152.500	375	
S	154.000	1.793	Open Manhole	0		OUTFALL		S1.004	152.207	375	

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PIPELINE SCHEDULES for Storm

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)
S1.000	o	300	S1	158.000	156.500	1.200	Open Manhole	1200
S2.000	o	225	S2	158.000	156.575	1.200	Open Manhole	1200
S1.001	o	375	S1	158.280	156.307	1.598	Open Manhole	1350
S3.000	o	300	S4	157.950	156.450	1.200	Open Manhole	1200
S1.002	o	375	S2	158.160	156.162	1.623	Open Manhole	1350
S4.000	o	225	S6	158.200	156.775	1.200	Open Manhole	1200
S1.003	o	375	S3	157.000	155.425	1.200	Open Manhole	1350
S1.004	o	375	S4	154.500	152.500	1.625	Open Manhole	1350

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)
S1.000	28.530	241.2	S1	158.280	156.382	1.598	Open Manhole	1350
S2.000	12.809	108.3	S1	158.280	156.457	1.598	Open Manhole	1350
S1.001	46.348	320.5	S2	158.160	156.162	1.623	Open Manhole	1350
S3.000	30.777	144.6	S2	158.160	156.237	1.623	Open Manhole	1350
S1.002	36.200	49.1	S3	157.000	155.425	1.200	Open Manhole	1350
S4.000	27.789	23.2	S3	157.000	155.575	1.200	Open Manhole	1350
S1.003	49.799	17.0	S4	154.500	152.500	1.625	Open Manhole	1350
S1.004	17.114	58.4	S	154.000	152.207	1.418	Open Manhole	0

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	100	0.198	0.198	0.198
	User	-	100	0.150	0.150	0.348
2.000	User	-	100	0.101	0.101	0.101
	User	-	100	0.096	0.096	0.197
1.001	User	-	100	0.035	0.035	0.035
3.000	User	-	100	0.121	0.121	0.121
	User	-	100	0.114	0.114	0.235
1.002	User	-	100	0.060	0.060	0.060
4.000	User	-	100	0.101	0.101	0.101
	User	-	100	0.115	0.115	0.216
1.003	User	-	100	0.018	0.018	0.018
1.004	User	-	100	0.076	0.076	0.076
				Total	Total	Total
				1.184	1.184	1.184

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.004	S	154.000	152.207	152.000	0	0

Simulation Criteria for Storm

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	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	2
FEH Rainfall Version	1999
Site Location	GB 436500 402000 SE 36500 02000
C (1km)	-0.024
D1 (1km)	0.358
D2 (1km)	0.441
D3 (1km)	0.229
E (1km)	0.296
F (1km)	2.384

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Synthetic Rainfall Details

Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

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	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	1999
Site Location	GB 436500 402000 SE 36500 02000
C (1km)	-0.024
D1 (1km)	0.358
D2 (1km)	0.441
D3 (1km)	0.229
E (1km)	0.296
F (1km)	2.384
Cv (Summer)	0.750
Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	450.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 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)
S1.000	S1	60 Summer	1	+0%	30/60 Summer				156.637
S2.000	S2	60 Summer	1	+0%	30/60 Summer				156.669
S1.001	S1	60 Summer	1	+0%	30/60 Summer				156.482
S3.000	S4	60 Summer	1	+0%	100/60 Summer				156.546
S1.002	S2	60 Summer	1	+0%	100/60 Summer				156.291
S4.000	S6	60 Summer	1	+0%					156.837
S1.003	S3	60 Summer	1	+0%					155.534
S1.004	S4	60 Summer	1	+0%	30/60 Summer				152.669

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.163	0.000	0.41		26.3	OK	
S2.000	S2	-0.131	0.000	0.36		15.3	OK	
S1.001	S1	-0.200	0.000	0.43		43.8	OK	
S3.000	S4	-0.204	0.000	0.21		18.0	OK	
S1.002	S2	-0.246	0.000	0.26		65.9	OK	
S4.000	S6	-0.163	0.000	0.17		16.9	OK	
S1.003	S3	-0.266	0.000	0.18		82.9	OK	
S1.004	S4	-0.206	0.000	0.42		88.4	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

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	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	1999
Site Location	GB 436500 402000 SE 36500 02000
C (1km)	-0.024
D1 (1km)	0.358
D2 (1km)	0.441
D3 (1km)	0.229
E (1km)	0.296
F (1km)	2.384
Cv (Summer)	0.750
Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	450.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 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)
S1.000	S1	60 Summer	30	+0%	30/60 Summer				156.859
S2.000	S2	60 Summer	30	+0%	30/60 Summer				156.816
S1.001	S1	60 Summer	30	+0%	30/60 Summer				156.709
S3.000	S4	60 Summer	30	+0%	100/60 Summer				156.619
S1.002	S2	60 Summer	30	+0%	100/60 Summer				156.386
S4.000	S6	60 Summer	30	+0%					156.883
S1.003	S3	60 Summer	30	+0%					155.610
S1.004	S4	60 Summer	30	+0%	30/60 Summer				152.920

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.059	0.000	1.07		69.2	SURCHARGED	
S2.000	S2	0.016	0.000	0.92		39.5	SURCHARGED	
S1.001	S1	0.028	0.000	1.12		114.6	SURCHARGED	
S3.000	S4	-0.131	0.000	0.59		49.3	OK	
S1.002	S2	-0.151	0.000	0.67		172.5	OK	
S4.000	S6	-0.117	0.000	0.46		46.1	OK	
S1.003	S3	-0.190	0.000	0.48		218.0	OK	
S1.004	S4	0.045	0.000	1.10		232.9	SURCHARGED	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

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	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	1999
Site Location	GB 436500 402000 SE 36500 02000
C (1km)	-0.024
D1 (1km)	0.358
D2 (1km)	0.441
D3 (1km)	0.229
E (1km)	0.296
F (1km)	2.384
Cv (Summer)	0.750
Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	450.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 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)
S1.000	S1	60 Summer	100	+30%	30/60 Summer				157.736
S2.000	S2	60 Summer	100	+30%	30/60 Summer				157.619
S1.001	S1	60 Summer	100	+30%	30/60 Summer				157.327
S3.000	S4	60 Summer	100	+30%	100/60 Summer				156.982
S1.002	S2	60 Summer	100	+30%	100/60 Summer				156.781
S4.000	S6	60 Summer	100	+30%					156.937
S1.003	S3	60 Summer	100	+30%					155.712
S1.004	S4	60 Summer	100	+30%	30/60 Summer				153.635

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.936	0.000	1.86		119.8	FLOOD RISK	
S2.000	S2	0.819	0.000	1.57		67.5	FLOOD RISK	
S1.001	S1	0.645	0.000	1.93		197.0	SURCHARGED	
S3.000	S4	0.232	0.000	1.03		86.2	SURCHARGED	
S1.002	S2	0.244	0.000	1.15		295.5	SURCHARGED	
S4.000	S6	-0.063	0.000	0.85		85.8	OK	
S1.003	S3	-0.088	0.000	0.84		377.5	OK	
S1.004	S4	0.760	0.000	1.89		400.7	SURCHARGED	

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