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King John's Gallery Mythe Road Tewkesbury GL20 6EB		
Date 15/01/2024 09:27	Designed by RBannis	
File C3D-WE102 - 02.01.24.MDX	Checked by	
Micro Drainage	Network 2020.1.3	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm Network 3










Pipe Sizes BH Pipes Manhole Sizes BH MHs

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	19.700	Add Flow / Climate Change (%)	0
Ratio R	0.408	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
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)	350

Designed with Level Soffits

Network Design Table for Storm Network 3

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
1.000	52.784	2.339	22.6	0.159	5.00	0.0	0.600	o	225	Pipe/Conduit	
2.000	66.102	1.600	41.3	0.194	5.00	0.0	0.600	o	225	Pipe/Conduit	
2.001	67.033	0.214	313.2	0.229	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.001	50.372	2.064	24.4	0.181	0.00	0.0	0.600	o	375	Pipe/Conduit	
3.000	46.376	0.207	224.0	0.188	5.00	0.0	0.600	o	300	Pipe/Conduit	
1.002	77.696	0.222	350.0	0.184	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.003	18.736	0.054	347.0	0.200	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.004	23.832	0.068	350.5	0.036	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.005	60.124	0.172	350.0	0.181	0.00	0.0	0.600	o	600	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)
1.000	50.00	5.32	156.100	0.159	0.0	0.0	0.0	2.77	110.0	21.5
2.000	50.00	5.54	155.575	0.194	0.0	0.0	0.0	2.04	81.2	26.3
2.001	50.00	6.64	153.825	0.423	0.0	0.0	0.0	1.02	112.5	57.3
1.001	50.00	6.86	153.611	0.763	0.0	0.0	0.0	3.68	406.5	103.3
3.000	50.00	5.74	151.829	0.188	0.0	0.0	0.0	1.05	74.0	25.5
1.002	50.00	7.86	151.322	1.135	0.0	0.0	0.0	1.30	366.4	153.7
1.003	50.00	8.10	151.100	1.335	0.0	0.0	0.0	1.30	368.0	180.8
1.004	50.00	8.41	151.046	1.371	0.0	0.0	0.0	1.30	366.2	185.7
1.005	50.00	9.18	150.978	1.552	0.0	0.0	0.0	1.30	366.4	210.2

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Network Design Table for Storm Network 3

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
1.006	8.206	0.023	356.8	0.000	0.00	0.0	0.600	o	600	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)
1.006	50.00	9.29	150.806	1.552	0.0	0.0	0.0	1.28	362.9	210.2


Simulation Criteria for Storm Network 3

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 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 1 Number of Time/Area Diagrams 0
 Number of Offline Controls 0 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) 19.700 Storm Duration (mins) 30
 Ratio R 0.408

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Online Controls for Storm Network 3

Orifice Manhole: S7, DS/PN: 1.006, Volume (m³): 20.3

Diameter (m) 0.001 Discharge Coefficient 0.600 Invert Level (m) 150.806

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Storage Structures for Storm Network 3

Infiltration Basin Manhole: S7, DS/PN: 1.006

Invert Level (m) 150.806 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00006 Porosity 1.00
 Infiltration Coefficient Side (m/hr) 0.00006

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	700.0	1.400	1149.3	2.800	0.0	4.200	0.0
0.200	757.4	1.600	1222.6	3.000	0.0	4.400	0.0
0.400	817.1	1.800	1298.1	3.200	0.0	4.600	0.0
0.600	879.0	2.000	1375.8	3.400	0.0	4.800	0.0
0.800	943.2	2.200	1455.9	3.600	0.0	5.000	0.0
1.000	1009.6	2.400	0.0	3.800	0.0		
1.200	1078.4	2.600	0.0	4.000	0.0		

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm Network 3

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m ³ /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	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.408
Region England and Wales Cv (Summer)			0.750
M5-60 (mm)	19.700	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	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	S1	15 Winter	1	+0%	100/15 Winter			
2.000	S10	15 Winter	1	+0%	100/15 Summer	100/15 Summer		
2.001	S11	15 Winter	1	+0%	30/15 Summer			
1.001	S2	15 Winter	1	+0%	100/15 Summer			
3.000	S20	15 Winter	1	+0%	30/15 Winter	100/15 Summer		
1.002	S3	15 Winter	1	+0%	30/15 Summer			
1.003	S4	15 Winter	1	+0%	30/15 Summer			
1.004	S5	15 Winter	1	+0%	30/15 Summer			
1.005	S6	1440 Winter	1	+0%	30/15 Summer			
1.006	S7	1440 Winter	1	+0%	30/1440 Summer			

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm Network 3

PN	US/MH Name	Water	Surcharged	Flooded	Half Drain		Pipe	Status	Level Exceeded
		Level (m)	Depth (m)	Volume (m ³)	Flow / Overflow Cap. (l/s)	Time (mins)	Flow (l/s)		
1.000	S1	156.170	-0.155	0.000	0.21		21.7	OK	
2.000	S10	155.666	-0.134	0.000	0.33		26.3	OK	2
2.001	S11	154.014	-0.186	0.000	0.47		50.3	OK	
1.001	S2	153.736	-0.250	0.000	0.24		91.1	OK	
3.000	S20	151.957	-0.172	0.000	0.38		26.1	OK	2
1.002	S3	151.590	-0.332	0.000	0.39		132.1	OK	
1.003	S4	151.416	-0.284	0.000	0.54		147.2	OK	
1.004	S5	151.356	-0.290	0.000	0.52		148.2	OK	
1.005	S6	151.298	-0.280	0.000	0.04		11.6	OK	
1.006	S7	151.298	-0.109	0.000	0.00		0.0	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm Network 3

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

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.408
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.700 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 ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	S1	15 Winter	30	+0%	100/15 Winter			
2.000	S10	15 Winter	30	+0%	100/15 Summer	100/15 Summer		
2.001	S11	15 Winter	30	+0%	30/15 Summer			
1.001	S2	15 Winter	30	+0%	100/15 Summer			
3.000	S20	15 Winter	30	+0%	30/15 Winter	100/15 Summer		
1.002	S3	15 Winter	30	+0%	30/15 Summer			
1.003	S4	15 Winter	30	+0%	30/15 Summer			
1.004	S5	15 Winter	30	+0%	30/15 Summer			
1.005	S6	1440 Winter	30	+0%	30/15 Summer			
1.006	S7	1440 Winter	30	+0%	30/1440 Summer			

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm Network 3

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.000	S1	156.215	-0.110	0.000	0.50		53.2	OK
2.000	S10	155.734	-0.066	0.000	0.82		64.4	OK
2.001	S11	154.371	0.171	0.000	1.26		133.6	SURCHARGED
1.001	S2	153.833	-0.153	0.000	0.65		243.1	OK
3.000	S20	152.135	0.006	0.000	0.85		59.2	SURCHARGED
1.002	S3	152.043	0.121	0.000	0.97		324.5	SURCHARGED
1.003	S4	151.871	0.171	0.000	1.28		350.4	SURCHARGED
1.004	S5	151.743	0.097	0.000	1.24		355.0	SURCHARGED
1.005	S6	151.728	0.150	0.000	0.07		22.2	SURCHARGED
1.006	S7	151.728	0.322	0.000	0.00		0.0	SURCHARGED

PN	US/MH Name	Level Exceeded
1.000	S1	
2.000	S10	2
2.001	S11	
1.001	S2	
3.000	S20	2
1.002	S3	
1.003	S4	
1.004	S5	
1.005	S6	
1.006	S7	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm Network 3

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m ³ /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	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.408
Region England and Wales	Cv (Summer)		0.750
M5-60 (mm)	19.700	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			ON
Profile(s)	Summer and Winter		
Duration(s) (mins)	15, 1440		
Return Period(s) (years)	1, 30, 100		
Climate Change (%)	0, 0, 40		

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	S1	15 Winter	100	+40%	100/15 Winter			
2.000	S10	15 Winter	100	+40%	100/15 Summer	100/15 Summer		
2.001	S11	15 Winter	100	+40%	30/15 Summer			
1.001	S2	15 Winter	100	+40%	100/15 Summer			
3.000	S20	15 Winter	100	+40%	30/15 Winter	100/15 Summer		
1.002	S3	15 Winter	100	+40%	30/15 Summer			
1.003	S4	15 Winter	100	+40%	30/15 Summer			
1.004	S5	15 Winter	100	+40%	30/15 Summer			
1.005	S6	1440 Winter	100	+40%	30/15 Summer			
1.006	S7	1440 Winter	100	+40%	30/1440 Summer			

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm Network 3

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.000	S1	156.476	0.151	0.000	0.91		95.9	SURCHARGED
2.000	S10	157.003	1.203	3.449	1.18		92.4	FLOOD
2.001	S11	155.633	1.433	0.000	1.78		188.5	FLOOD RISK
1.001	S2	155.034	1.048	0.000	0.92		347.8	FLOOD RISK
3.000	S20	153.335	1.206	5.594	1.30		89.9	FLOOD
1.002	S3	153.256	1.334	0.000	1.44		481.5	SURCHARGED
1.003	S4	152.764	1.064	0.000	2.07		565.2	SURCHARGED
1.004	S5	152.433	0.787	0.000	2.02		578.7	SURCHARGED
1.005	S6	152.309	0.731	0.000	0.13		43.0	SURCHARGED
1.006	S7	152.309	0.903	0.000	0.00		0.0	SURCHARGED

PN	US/MH Name	Level Exceeded
1.000	S1	
2.000	S10	2
2.001	S11	
1.001	S2	
3.000	S20	2
1.002	S3	
1.003	S4	
1.004	S5	
1.005	S6	
1.006	S7	