


JS Bloor (Tewkesbury) Ltd		Page 1
King John's Gallery Mythe Road Tewkesbury GL20 6EB	Withycombe Farm Netwrok 1	
Date 19/12/2023 File C3D-WE102 - 05.01.24.MDX	Designed by JB Checked by	
Micro Drainage	Network 2020.1.3	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm Network 1 (1)










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 1 (1)




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	53.699	0.398	134.9	0.155	5.00	0.0	0.600	o	225	Pipe/Conduit	
2.000	31.011	0.316	98.1	0.121	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	29.109	0.305	95.4	0.144	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.002	24.322	0.268	90.8	0.056	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.003	44.517	0.435	102.3	0.100	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.004	30.702	0.322	95.3	0.095	0.00	0.0	0.600	o	450	Pipe/Conduit	
3.000	43.310	0.328	132.0	0.175	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.005	24.944	0.127	196.4	0.155	0.00	0.0	0.600	o	500	Pipe/Conduit	
1.006	62.699	0.179	350.0	0.087	0.00	0.0	0.600	o	500	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	5.80	151.350	0.155	0.0	0.0	0.0	1.12	44.7	21.0
2.000	50.00	5.39	151.268	0.121	0.0	0.0	0.0	1.32	52.5	16.4
1.001	50.00	6.06	150.802	0.420	0.0	0.0	0.0	1.86	204.9	56.9
1.002	50.00	6.27	150.497	0.476	0.0	0.0	0.0	1.90	210.1	64.5
1.003	50.00	6.64	150.154	0.576	0.0	0.0	0.0	2.01	319.6	78.0
1.004	50.00	6.89	149.719	0.671	0.0	0.0	0.0	2.08	331.2	90.9
3.000	50.00	5.64	149.950	0.175	0.0	0.0	0.0	1.14	45.2	23.7
1.005	50.00	7.15	149.347	1.001	0.0	0.0	0.0	1.55	303.7	135.5
1.006	50.00	8.06	149.220	1.088	0.0	0.0	0.0	1.16	226.9	147.3

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Micro Drainage	Network 2020.1.3	

Network Design Table for Storm Network 1 (1)

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
1.007	53.286	0.152	350.0	0.108	0.00	0.0	0.600	o	500	Pipe/Conduit		
1.008	28.105	0.080	350.0	0.072	0.00	0.0	0.600	o	500	Pipe/Conduit		
1.009	18.811	0.054	348.4	0.000	0.00	0.0	0.600	o	500	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)
1.007	50.00	8.83	149.041	1.196	0.0	0.0	0.0	1.16	226.9	162.0
1.008	50.00	9.23	148.889	1.268	0.0	0.0	0.0	1.16	226.9	171.7
1.009	50.00	9.50	148.808	1.268	0.0	0.0	0.0	1.16	227.4	171.7

Simulation Criteria for Storm Network 1 (1)

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	0.000
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 1 (1)

Orifice Manhole: S9, DS/PN: 1.009, Volume (m³): 9.7

Diameter (m) 0.001 Discharge Coefficient 0.600 Invert Level (m) 148.808


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Storage Structures for Storm Network 1 (1)

Infiltration Basin Manhole: S9, DS/PN: 1.009

Invert Level (m) 148.783 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00003 Porosity 1.00
 Infiltration Coefficient Side (m/hr) 0.00003

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	350.0	1.400	684.0	2.800	0.0	4.200	0.0
0.200	390.9	1.600	740.7	3.000	0.0	4.400	0.0
0.400	434.1	1.800	799.7	3.200	0.0	4.600	0.0
0.600	479.6	2.000	861.0	3.400	0.0	4.800	0.0
0.800	527.3	2.200	924.6	3.600	0.0	5.000	0.0
1.000	577.2	2.400	990.4	3.800	0.0		
1.200	629.5	2.600	1058.4	4.000	0.0		

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

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 0.000
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 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, 30, 60, 120, 240, 360, 480, 960, 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	1	+0%	30/15 Summer	100/15 Summer		
2.000	S20	15 Winter	1	+0%	100/15 Summer	100/15 Summer		
1.001	S2	15 Winter	1	+0%	100/15 Summer	100/15 Summer		
1.002	S1.6	15 Winter	1	+0%	100/15 Summer	100/15 Summer		
1.003	S3	15 Winter	1	+0%	100/15 Summer			
1.004	S4	15 Winter	1	+0%	30/15 Summer	100/15 Summer		
3.000	S30	15 Winter	1	+0%	30/15 Summer	100/15 Summer		
1.005	S5	15 Winter	1	+0%	30/15 Summer	100/15 Summer		
1.006	S6	15 Winter	1	+0%	30/15 Summer			
1.007	S7	1440 Winter	1	+0%	30/15 Summer			
1.008	S8	1440 Winter	1	+0%	1/960 Winter			
1.009	S9	1440 Winter	1	+0%	1/480 Winter			

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

PN	US/MH Name	Water	Surcharged	Flooded	Half Drain		Pipe	Status
		Level (m)	Depth (m)	Volume (m ³)	Flow / Cap.	Overflow (l/s)	Time (mins)	
1.000	S1	151.463	-0.112	0.000	0.50		21.5	OK
2.000	S20	151.359	-0.134	0.000	0.33		16.4	OK
1.001	S2	150.944	-0.233	0.000	0.30		54.7	OK
1.002	S1.6	150.647	-0.225	0.000	0.34		61.0	OK
1.003	S3	150.307	-0.297	0.000	0.25		71.2	OK
1.004	S4	149.884	-0.285	0.000	0.29		82.0	OK
3.000	S30	150.071	-0.104	0.000	0.56		24.1	OK
1.005	S5	149.596	-0.251	0.000	0.49		121.8	OK
1.006	S6	149.507	-0.213	0.000	0.61		126.6	OK
1.007	S7	149.484	-0.057	0.000	0.04		8.7	OK
1.008	S8	149.484	0.095	0.000	0.05		8.7	SURCHARGED
1.009	S9	149.484	0.175	0.000	0.00		0.0	SURCHARGED

PN	US/MH Name	Level Exceeded
1.000	S1	4
2.000	S20	3
1.001	S2	2
1.002	S1.6	2
1.003	S3	
1.004	S4	4
3.000	S30	4
1.005	S5	4
1.006	S6	
1.007	S7	
1.008	S8	
1.009	S9	

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m ³ /ha Storage	0.000
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	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, 30, 60, 120, 240, 360, 480, 960, 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%	30/15 Summer	100/15 Summer		
2.000	S20	15 Winter	30	+0%	100/15 Summer	100/15 Summer		
1.001	S2	15 Winter	30	+0%	100/15 Summer	100/15 Summer		
1.002	S1.6	15 Winter	30	+0%	100/15 Summer	100/15 Summer		
1.003	S3	15 Winter	30	+0%	100/15 Summer			
1.004	S4	15 Winter	30	+0%	30/15 Summer	100/15 Summer		
3.000	S30	15 Winter	30	+0%	30/15 Summer	100/15 Summer		
1.005	S5	15 Winter	30	+0%	30/15 Summer	100/15 Summer		
1.006	S6	15 Winter	30	+0%	30/15 Summer			
1.007	S7	1440 Winter	30	+0%	30/15 Summer			
1.008	S8	1440 Winter	30	+0%	1/960 Winter			
1.009	S9	1440 Winter	30	+0%	1/480 Winter			

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m ³)	Flow / Overflow Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.000	S1	151.758	0.183	0.000	1.17		50.3	SURCHARGED
2.000	S20	151.427	-0.066	0.000	0.82		40.2	OK
1.001	S2	151.054	-0.123	0.000	0.76		137.4	OK
1.002	S1.6	150.770	-0.102	0.000	0.87		156.8	OK
1.003	S3	150.545	-0.059	0.000	0.65		186.5	OK
1.004	S4	150.418	0.249	0.000	0.62		177.0	SURCHARGED
3.000	S30	150.702	0.527	0.000	1.26		54.3	SURCHARGED
1.005	S5	150.254	0.407	0.000	1.05		260.6	SURCHARGED
1.006	S6	150.119	0.399	0.000	1.32		273.9	SURCHARGED
1.007	S7	150.056	0.515	0.000	0.09		18.9	SURCHARGED
1.008	S8	150.056	0.668	0.000	0.10		19.8	SURCHARGED
1.009	S9	150.056	0.748	0.000	0.00		0.0	SURCHARGED

PN	US/MH Name	Level Exceeded
1.000	S1	4
2.000	S20	3
1.001	S2	2
1.002	S1.6	2
1.003	S3	
1.004	S4	4
3.000	S30	4
1.005	S5	4
1.006	S6	
1.007	S7	
1.008	S8	
1.009	S9	

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m ³ /ha Storage	0.000
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	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, 30, 60, 120, 240, 360, 480, 960, 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	100	+40%	30/15 Summer	100/15 Summer		
2.000	S20	15 Winter	100	+40%	100/15 Summer	100/15 Summer		
1.001	S2	15 Winter	100	+40%	100/15 Summer	100/15 Summer		
1.002	S1.6	15 Winter	100	+40%	100/15 Summer	100/15 Summer		
1.003	S3	15 Winter	100	+40%	100/15 Summer			
1.004	S4	15 Winter	100	+40%	30/15 Summer	100/15 Summer		
3.000	S30	15 Winter	100	+40%	30/15 Summer	100/15 Summer		
1.005	S5	15 Winter	100	+40%	30/15 Summer	100/15 Summer		
1.006	S6	15 Summer	100	+40%	30/15 Summer			
1.007	S7	1440 Winter	100	+40%	30/15 Summer			
1.008	S8	1440 Winter	100	+40%	1/960 Winter			
1.009	S9	1440 Winter	100	+40%	1/480 Winter			

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

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	152.957	1.382	5.955	1.64		70.5	FLOOD
2.000	S20	152.696	1.203	2.579	1.38		67.6	FLOOD
1.001	S2	152.378	1.201	1.205	1.00		180.4	FLOOD
1.002	S1.6	152.073	1.201	0.788	1.16		209.6	FLOOD
1.003	S3	151.741	1.137	0.000	0.88		254.2	FLOOD RISK
1.004	S4	151.373	1.204	4.105	0.94		269.2	FLOOD
3.000	S30	151.951	1.776	5.405	1.71		73.6	FLOOD
1.005	S5	151.091	1.244	17.742	1.51		373.3	FLOOD
1.006	S6	150.901	1.181	0.000	1.82		378.7	FLOOD RISK
1.007	S7	150.739	1.198	0.000	0.15		31.1	SURCHARGED
1.008	S8	150.739	1.350	0.000	0.17		33.0	SURCHARGED
1.009	S9	150.739	1.431	0.000	0.00		0.0	SURCHARGED

PN	US/MH Name	Level Exceeded
1.000	S1	4
2.000	S20	3
1.001	S2	2
1.002	S1.6	2
1.003	S3	
1.004	S4	4
3.000	S30	4
1.005	S5	4
1.006	S6	
1.007	S7	
1.008	S8	
1.009	S9	