


Topping Engineers Ltd		Page 1
Aire House 12 Victoria Avenue Harrogate, HG1 1ED		
Date 03/01/2023 16:21 File 290922.MDX	Designed by Rob Checked by	
Innovyze		Network 2020.1

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales			
Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.350	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	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






Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.342	4-8	0.015

Total Area Contributing (ha) = 0.357


Total Pipe Volume (m³) = 8.368

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
1.000	9.500	0.082	115.9	0.032	2.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	19.600	0.867	22.6	0.015	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	8.200	0.800	10.3	0.015	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.000	30.500	0.200	152.5	0.110	2.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	9.600	0.043	223.3	0.049	0.00	0.0	0.600	o	300	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	2.13	151.950	0.032	0.0	0.0	0.0	1.21	48.3	4.3
1.001	50.00	2.25	151.867	0.047	0.0	0.0	0.0	2.76	109.9	6.4
1.002	50.00	2.28	151.000	0.062	0.0	0.0	0.0	4.11	163.5	8.4
2.000	50.00	2.48	150.400	0.110	0.0	0.0	0.0	1.06	42.0	14.9
1.003	50.00	2.63	150.125	0.221	0.0	0.0	0.0	1.05	74.1	29.9

Topping Engineers Ltd		Page 2
Aire House 12 Victoria Avenue Harrogate, HG1 1ED		
Date 03/01/2023 16:21 File 290922.MDX	Designed by Rob Checked by	
Innovyze		Network 2020.1

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
1.004	19.700	0.066	298.5	0.030	0.00	0.0	0.600	o	375	Pipe/Conduit	
3.000	12.600	1.260	10.0	0.069	2.00	0.0	0.600	o	150	Pipe/Conduit	
1.005	13.700	1.369	10.0	0.037	0.00	0.0	0.600	o	375	Pipe/Conduit	
4.000	8.500	0.629	13.5	0.000	2.00	0.0	0.600	o	375	Pipe/Conduit	
1.006	8.100	0.810	10.0	0.000	0.00	0.0	0.600	o	150	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)
1.004	50.00	2.95	150.007	0.251	0.0	0.0	0.0	1.04	115.3	34.0
3.000	50.00	2.07	151.426	0.069	0.0	0.0	0.0	3.20	56.6	9.3
1.005	50.00	2.99	149.941	0.357	0.0	0.0	0.0	5.76	635.7	48.3
4.000	50.00	2.03	149.200	0.000	0.0	0.0	0.0	4.95	546.8	0.0
1.006	50.00	3.03	147.860	0.357	0.0	0.0	0.0	3.20	56.6	48.3

Aire House
12 Victoria Avenue
Harrogate, HG1 1ED



Date 03/01/2023 16:21
File 290922.MDX

Designed by Rob
Checked by

Innovyze Network 2020.1

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	Pipe Out		Pipes In			Backdrop (mm)	
					PN	Invert Level (m)	Diameter (mm)	PN	Invert Level (m)		Diameter (mm)
SW01	153.650	1.700	Open Manhole	1200	1.000	151.950	225				
SW01a	153.548	1.681	Open Manhole	1200	1.001	151.867	225	1.000	151.868	225	1
SW02	153.275	2.275	Open Manhole	1200	1.002	151.000	225	1.001	151.000	225	
SW04	151.500	1.100	Open Manhole	1200	2.000	150.400	225				
SW03	153.100	2.975	Open Manhole	1200	1.003	150.125	300	1.002	150.200	225	
								2.000	150.200	225	
SW05	152.850	2.843	Open Manhole	1500	1.004	150.007	375	1.003	150.082	300	
SW07	152.800	1.374	Open Manhole	1200	3.000	151.426	150				
SW06	152.400	2.459	Open Manhole	1500	1.005	149.941	375	1.004	149.941	375	
								3.000	150.166	150	
Tank	152.400	3.200	Open Manhole	1500	4.000	149.200	375				
SW08	152.095	4.235	Open Manhole	1800	1.006	147.860	150	1.005	148.572	375	937
								4.000	148.571	375	936
	151.700	4.650	Open Manhole	0		OUTFALL		1.006	147.050	150	

No coordinates have been specified, layout information cannot be produced.

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)
1.000	o	225	SW01	153.650	151.950	1.475	Open Manhole	1200
1.001	o	225	SW01a	153.548	151.867	1.456	Open Manhole	1200
1.002	o	225	SW02	153.275	151.000	2.050	Open Manhole	1200
2.000	o	225	SW04	151.500	150.400	0.875	Open Manhole	1200
1.003	o	300	SW03	153.100	150.125	2.675	Open Manhole	1200
1.004	o	375	SW05	152.850	150.007	2.468	Open Manhole	1500
3.000	o	150	SW07	152.800	151.426	1.224	Open Manhole	1200
1.005	o	375	SW06	152.400	149.941	2.084	Open Manhole	1500
4.000	o	375	Tank	152.400	149.200	2.825	Open Manhole	1500
1.006	o	150	SW08	152.095	147.860	4.085	Open Manhole	1800

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)
1.000	9.500	115.9	SW01a	153.548	151.868	1.455	Open Manhole	1200
1.001	19.600	22.6	SW02	153.275	151.000	2.050	Open Manhole	1200
1.002	8.200	10.3	SW03	153.100	150.200	2.675	Open Manhole	1200
2.000	30.500	152.5	SW03	153.100	150.200	2.675	Open Manhole	1200
1.003	9.600	223.3	SW05	152.850	150.082	2.468	Open Manhole	1500
1.004	19.700	298.5	SW06	152.400	149.941	2.084	Open Manhole	1500
3.000	12.600	10.0	SW06	152.400	150.166	2.084	Open Manhole	1500
1.005	13.700	10.0	SW08	152.095	148.572	3.148	Open Manhole	1800
4.000	8.500	13.5	SW08	152.095	148.571	3.149	Open Manhole	1800
1.006	8.100	10.0		151.700	147.050	4.500	Open Manhole	0

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)
1.006		151.700	147.050	0.000	0	0

Topping Engineers Ltd		Page 5
Aire House 12 Victoria Avenue Harrogate, HG1 1ED		
Date 03/01/2023 16:21 File 290922.MDX	Designed by Rob Checked by	
Innovyze		Network 2020.1

Online Controls for Storm

Hydro-Brake® Optimum Manhole: SW08, DS/PN: 1.006, Volume (m³): 12.9

Unit Reference	MD-SHE-0088-5000-2400-5000
Design Head (m)	2.400
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	88
Invert Level (m)	148.521
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.400	5.0
Flush-Flo™	0.381	3.7
Kick-Flo®	0.784	3.0
Mean Flow over Head Range	-	3.8

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)
0.100	2.7	1.200	3.6	3.000	5.5	7.000	8.3
0.200	3.5	1.400	3.9	3.500	6.0	7.500	8.5
0.300	3.7	1.600	4.1	4.000	6.4	8.000	8.8
0.400	3.7	1.800	4.4	4.500	6.7	8.500	9.1
0.500	3.7	2.000	4.6	5.000	7.1	9.000	9.3
0.600	3.6	2.200	4.8	5.500	7.4	9.500	9.6
0.800	3.0	2.400	5.0	6.000	7.7		
1.000	3.3	2.600	5.2	6.500	8.0		

Aire House
 12 Victoria Avenue
 Harrogate, HG1 1ED



Date 03/01/2023 16:21
 File 290922.MDX

Designed by Rob
 Checked by

Innovyze Network 2020.1

Storage Structures for Storm

Cellular Storage Manhole: Tank, DS/PN: 4.000

Invert Level (m) 149.200 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	76.5	76.5	2.500	0.0	160.5
2.400	76.5	160.5			

Aire House
 12 Victoria Avenue
 Harrogate, HG1 1ED



Date 03/01/2023 16:21
 File 290922.MDX

Designed by Rob
 Checked by

Innovyze Network 2020.1

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 0.000
 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 0.350
 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 OFF
 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, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	SW01	15 Summer	1	+0%					152.005
1.001	SW01a	15 Summer	1	+0%					151.906
1.002	SW02	15 Summer	1	+0%					151.038
2.000	SW04	15 Summer	1	+0%	30/15 Summer				150.509
1.003	SW03	15 Summer	1	+0%	30/15 Summer				150.285
1.004	SW05	15 Summer	1	+0%	100/15 Summer				150.162
3.000	SW07	15 Summer	1	+0%					151.474
1.005	SW06	15 Summer	1	+0%	100/30 Summer				150.022
4.000	Tank	120 Winter	1	+0%	30/15 Summer				149.488
1.006	SW08	15 Winter	1	+0%	1/15 Summer				149.598

PN	US/MH Name	Depth (m)	Surcharged Volume (m ³)	Flooded Flow / Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SW01	-0.170	0.000	0.14		5.4	OK	
1.001	SW01a	-0.186	0.000	0.07		6.9	OK	
1.002	SW02	-0.187	0.000	0.07		8.3	OK	

Aire House
 12 Victoria Avenue
 Harrogate, HG1 1ED



Date 03/01/2023 16:21
 File 290922.MDX

Designed by Rob
 Checked by

Innovyze Network 2020.1

1 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 / Overflow Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
2.000	SW04	-0.116	0.000	0.47		18.3	OK	
1.003	SW03	-0.140	0.000	0.53		30.3	OK	
1.004	SW05	-0.220	0.000	0.35		34.0	OK	
3.000	SW07	-0.102	0.000	0.23		11.7	OK	
1.005	SW06	-0.294	0.000	0.10		46.5	OK	
4.000	Tank	-0.087	0.000	0.01	81	3.1	OK	
1.006	SW08	1.588	0.000	0.07		3.6	SURCHARGED	

Aire House
 12 Victoria Avenue
 Harrogate, HG1 1ED



Date 03/01/2023 16:21
 File 290922.MDX

Designed by Rob
 Checked by

Innovyze Network 2020.1

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 * 10m ³ /ha Storage	0.000
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	0.350
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	OFF
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, 30

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.	Water Level (m)
1.000	SW01	15 Summer	30	+0%					152.039
1.001	SW01a	15 Summer	30	+0%					151.932
1.002	SW02	15 Summer	30	+0%					151.065
2.000	SW04	15 Summer	30	+0%	30/15 Summer				150.758
1.003	SW03	15 Summer	30	+0%	30/15 Summer				150.487
1.004	SW05	15 Summer	30	+0%	100/15 Summer				150.298
3.000	SW07	15 Summer	30	+0%					151.506
1.005	SW06	120 Winter	30	+0%	100/30 Summer				150.196
4.000	Tank	120 Winter	30	+0%	30/15 Summer				150.194
1.006	SW08	120 Winter	30	+0%	1/15 Summer				150.194

Topping Engineers Ltd		Page 10
Aire House 12 Victoria Avenue Harrogate, HG1 1ED		
Date 03/01/2023 16:21 File 290922.MDX	Designed by Rob Checked by	
Innovyze		Network 2020.1

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

PN	US/MH Name	Surcharged Flooded		Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m ³)						
1.000	SW01	-0.136	0.000	0.33			13.3	OK	
1.001	SW01a	-0.160	0.000	0.18			18.2	OK	
1.002	SW02	-0.160	0.000	0.18			22.9	OK	
2.000	SW04	0.133	0.000	1.09			42.7	SURCHARGED	
1.003	SW03	0.062	0.000	1.44			82.7	SURCHARGED	
1.004	SW05	-0.084	0.000	0.94			90.8	OK	
3.000	SW07	-0.070	0.000	0.56			28.7	OK	
1.005	SW06	-0.120	0.000	0.08			37.9	OK	
4.000	Tank	0.619	0.000	0.01			3.7	SURCHARGED	
1.006	SW08	2.184	0.000	0.09			4.2	SURCHARGED	

Aire House
 12 Victoria Avenue
 Harrogate, HG1 1ED



Date 03/01/2023 16:21
 File 290922.MDX

Designed by Rob
 Checked by

Innovyze Network 2020.1

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 * 10m ³ /ha Storage	0.000
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	0.350
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	OFF
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, 30

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.	Water Level (m)
1.000	SW01	15 Summer	100	+30%					152.071
1.001	SW01a	15 Summer	100	+30%					151.953
1.002	SW02	240 Winter	100	+30%					151.151
2.000	SW04	15 Summer	100	+30%	30/15 Summer				151.481
1.003	SW03	240 Winter	100	+30%	30/15 Summer				151.150
1.004	SW05	240 Winter	100	+30%	100/15 Summer				151.148
3.000	SW07	15 Summer	100	+30%					151.541
1.005	SW06	240 Winter	100	+30%	100/30 Summer				151.145
4.000	Tank	240 Winter	100	+30%	30/15 Summer				151.142
1.006	SW08	240 Winter	100	+30%	1/15 Summer				151.142

Topping Engineers Ltd		Page 12
Aire House 12 Victoria Avenue Harrogate, HG1 1ED		
Date 03/01/2023 16:21 File 290922.MDX	Designed by Rob Checked by	
Innovyze	Network 2020.1	

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 / Overflow Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SW01	-0.104	0.000	0.56		22.4	OK	
1.001	SW01a	-0.139	0.000	0.31		30.5	OK	
1.002	SW02	-0.074	0.000	0.05		6.8	OK	
2.000	SW04	0.856	0.000	1.71		67.0	FLOOD RISK	
1.003	SW03	0.725	0.000	0.41		23.8	SURCHARGED	
1.004	SW05	0.766	0.000	0.27		25.7	SURCHARGED	
3.000	SW07	-0.035	0.000	0.94		48.6	OK	
1.005	SW06	0.829	0.000	0.08		35.5	SURCHARGED	
4.000	Tank	1.567	0.000	0.01		4.5	SURCHARGED	
1.006	SW08	3.132	0.000	0.11		5.2	SURCHARGED	