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The Flint Glass Works 64 Jersey Street Manchester M4 6JW	Full SW Calcs Goulden Street	
Date 03/11/2021	Designed by EJD	
File Full Surface Water Drainage Calculations 03.11...	Checked by	
Micro Drainage		Network 2018.1

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)	2	Foul Sewage (l/s/ha)	0.000	Maximum Backdrop Height (m)	1.500
M5-60 (mm)	18.000	Volumetric Runoff Coeff.	0.750	Min Design Depth for Optimisation (m)	1.200
Ratio R	0.361	PIMP (%)	100	Min Vel for Auto Design only (m/s)	1.00
Maximum Rainfall (mm/hr)	50	Add Flow / Climate Change (%)	0	Min Slope for Optimisation (1:X)	500
Maximum Time of Concentration (mins)	30	Minimum Backdrop Height (m)	0.200		

Designed with Level Soffits

Network Design Table for Storm

« - Indicates pipe capacity < flow

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	5.067	0.080	63.3	0.009	5.00	0.0	0.600	o	100	Pipe/Conduit	🟢
1.001	5.787	0.280	20.7	0.013	0.00	0.0	0.600	o	100	Pipe/Conduit	🟢
1.002	7.021	0.095	73.9	0.018	0.00	0.0	0.600	o	100	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	5.09	50.185	0.009	0.0	0.0	0.0	0.97	7.6	1.2
1.001	50.00	5.14	50.105	0.022	0.0	0.0	0.0	1.71	13.4	3.0
1.002	50.00	5.27	49.825	0.040	0.0	0.0	0.0	0.90	7.0	5.4

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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
1.003	7.218	0.090	80.2	0.008	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.000	1.378	0.140	9.8	0.016	5.00	0.0	0.600	o	100	Pipe/Conduit	
1.004	2.933	0.060	48.9	0.005	0.00	0.0	0.600	o	150	Pipe/Conduit	
3.000	10.057	1.000	10.1	0.018	5.00	0.0	0.600	o	100	Pipe/Conduit	
3.001	7.213	0.123	58.6	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	
1.005	6.874	0.900	7.6	0.036	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.006	3.000	0.025	120.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.007	5.073	0.035	144.9	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)
1.003	50.00	5.38	49.730	0.048	0.0	0.0	0.0	1.12	19.9	6.5
2.000	50.00	5.01	49.780	0.016	0.0	0.0	0.0	2.48	19.5	2.2
1.004	50.00	5.42	49.640	0.069	0.0	0.0	0.0	1.44	25.5	9.3
3.000	50.00	5.07	50.000	0.018	0.0	0.0	0.0	2.45	19.3	2.4
3.001	50.00	5.19	49.000	0.018	0.0	0.0	0.0	1.01	7.9	2.4
1.005	50.00	5.44	48.300	0.123	0.0	0.0	0.0	4.76	189.4	16.7
1.006	50.00	5.48	47.400	0.123	0.0	0.0	0.0	1.19	47.4	16.7
1.007	50.00	5.58	47.375	0.123	0.0	0.0	0.0	0.83	14.7«	16.7

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)
1.007		50.750	47.340	0.000	0	0

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: FLOW CONTROL, DS/PN: 1.007, Volume (m³): 2.2

Unit Reference	MD-SHE-0101-6000-2000-6000	Sump Available	Yes
Design Head (m)	2.000	Diameter (mm)	101
Design Flow (l/s)	6.0	Invert Level (m)	47.375
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	150
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points			Control Points		
	Head (m)	Flow (l/s)		Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	6.0	Kick-Flo®	0.900	4.1
Flush-Flo™	0.438	5.2	Mean Flow over Head Range	-	4.8

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)	Depth (m)	Flow (l/s)
0.100	3.3	0.600	5.1	1.600	5.4	2.600	6.8	5.000	9.2	7.500	11.2
0.200	4.7	0.800	4.7	1.800	5.7	3.000	7.3	5.500	9.7	8.000	11.5
0.300	5.1	1.000	4.3	2.000	6.0	3.500	7.8	6.000	10.1	8.500	11.9
0.400	5.2	1.200	4.7	2.200	6.3	4.000	8.3	6.500	10.5	9.000	12.2
0.500	5.2	1.400	5.1	2.400	6.5	4.500	8.8	7.000	10.8	9.500	12.5

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Storage Structures for Storm

Cellular Storage Manhole: TANK, DS/PN: 1.006

Invert Level (m) 47.400 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	18.0	18.0	2.000	18.0	51.9	2.001	0.0	51.9

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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 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coefficient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.000 Cv (Summer) 0.750
Region England and Wales Ratio R 0.360 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep 2.5 Second Increment (Extended) Inertia Status ON
DTS Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

									Water	Surcharged	Flooded	Pipe				
PN	US/MH			Return	Climate	First (X)	First (Y)	First (Z)	Overflow	Level	Depth	Volume	Flow / Overflow	Flow	Level	
	Name	Storm		Period	Change	Surcharge	Flood	Overflow	Act.	(m)	(m)	(m³)	Cap.	(l/s)	Status	Exceeded
1.000	S01	15 Winter		1	+0%	100/15 Summer				50.212	-0.073	0.000	0.16	1.1	OK	
1.001	S02	15 Winter		1	+0%	30/15 Summer				50.136	-0.069	0.000	0.20	2.4	OK	
1.002	S03	15 Winter		1	+0%	30/15 Summer				49.885	-0.040	0.000	0.66	4.2	OK	
1.003	S04	15 Winter		1	+0%	30/15 Winter				49.786	-0.094	0.000	0.30	5.1	OK	
2.000	S05	15 Winter		1	+0%	100/15 Summer				49.809	-0.071	0.000	0.18	1.9	OK	
1.004	S06	15 Winter		1	+0%	30/15 Summer				49.715	-0.075	0.000	0.49	7.5	OK	
3.000	S07	15 Winter		1	+0%					50.023	-0.077	0.000	0.12	2.2	OK	
3.001	S08	15 Winter		1	+0%	100/15 Summer				49.038	-0.062	0.000	0.30	2.1	OK	
1.005	S09	15 Winter		1	+0%	100/15 Summer				48.348	-0.177	0.000	0.10	13.3	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Surcharged Flooded			Pipe		Status	
									Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)		Flow (l/s)
1.006	TANK	30 Winter	1	+0%	30/15 Summer				47.624	-0.001	0.000	0.17		5.2	OK
1.007	FLOW CONTROL	30 Winter	1	+0%	1/15 Summer				47.627	0.102	0.000	0.42		4.9	SURCHARGED

PN	US/MH Name	Level Exceeded
1.006	TANK	
1.007	FLOW CONTROL	

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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 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
 Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coefficient 0.800
 Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.000 Cv (Summer) 0.750
 Region England and Wales Ratio R 0.360 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
 Analysis Timestep 2.5 Second Increment (Extended) Inertia Status ON
 DTS Status OFF

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 40

PN	US/MH		Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Surcharged Flooded			Pipe Flow		Status	Level Exceeded
	Name	Storm							Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)		
1.000	S01	15 Winter	30	+0%	100/15 Summer				50.268	-0.017	0.000	0.39	2.6	OK	
1.001	S02	15 Winter	30	+0%	30/15 Summer				50.255	0.050	0.000	0.53	6.3	SURCHARGED	
1.002	S03	15 Winter	30	+0%	30/15 Summer				50.183	0.258	0.000	1.76	11.2	SURCHARGED	
1.003	S04	15 Winter	30	+0%	30/15 Winter				49.883	0.003	0.000	0.80	13.5	SURCHARGED	
2.000	S05	15 Winter	30	+0%	100/15 Summer				49.853	-0.027	0.000	0.44	4.6	OK	
1.004	S06	15 Winter	30	+0%	30/15 Summer				49.824	0.034	0.000	1.28	19.6	SURCHARGED	
3.000	S07	15 Winter	30	+0%					50.037	-0.063	0.000	0.30	5.3	OK	
3.001	S08	15 Winter	30	+0%	100/15 Summer				49.065	-0.035	0.000	0.73	5.3	OK	
1.005	S09	15 Winter	30	+0%	100/15 Summer				48.380	-0.145	0.000	0.26	35.4	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Surcharged Flooded			Pipe		Status	
									Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)		Flow (l/s)
1.006	TANK	60 Winter	30	+0%	30/15 Summer				48.242	0.617	0.000	0.19		5.7	SURCHARGED
1.007	FLOW CONTROL	60 Winter	30	+0%	1/15 Summer				48.210	0.685	0.000	0.44		5.2	SURCHARGED

PN	US/MH Name	Level Exceeded
1.006	TANK	
1.007	FLOW CONTROL	

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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 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
 Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coefficient 0.800
 Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.000 Cv (Summer) 0.750
 Region England and Wales Ratio R 0.360 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
 Analysis Timestep 2.5 Second Increment (Extended) Inertia Status ON
 DTS Status OFF

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S01	15 Winter	100	+40%	100/15 Summer				50.746	0.461	0.000	1.20		8.0	FLOOD RISK	
1.001	S02	15 Winter	100	+40%	30/15 Summer				50.745	0.540	0.000	0.89		10.6	FLOOD RISK	
1.002	S03	15 Summer	100	+40%	30/15 Summer				50.700	0.775	0.000	2.46		15.7	FLOOD RISK	
1.003	S04	15 Winter	100	+40%	30/15 Winter				50.111	0.231	0.000	1.17		19.9	SURCHARGED	
2.000	S05	15 Winter	100	+40%	100/15 Summer				50.074	0.194	0.000	0.81		8.5	SURCHARGED	
1.004	S06	15 Winter	100	+40%	30/15 Summer				49.980	0.190	0.000	2.02		31.0	SURCHARGED	
3.000	S07	15 Winter	100	+40%					50.052	-0.048	0.000	0.54		9.6	OK	
3.001	S08	60 Winter	100	+40%	100/15 Summer				49.297	0.197	0.000	0.73		5.2	SURCHARGED	
1.005	S09	60 Winter	100	+40%	100/15 Summer				49.291	0.766	0.000	0.25		34.0	SURCHARGED	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Surcharged Flooded			Pipe		Status	
									Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (1/s)		Flow (1/s)
1.006	TANK	60 Winter	100	+40%	30/15 Summer				49.286	1.661	0.000	0.20		6.1	SURCHARGED
1.007	FLOW CONTROL	60 Winter	100	+40%	1/15 Summer				49.307	1.782	0.000	0.50		5.9	SURCHARGED

PN	US/MH Name	Level Exceeded
1.006	TANK	
1.007	FLOW CONTROL	