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The Flint Glass Works 64 Jersey Street Manchester M4 6JW	Velodrome Plant Room Surface Water Drainage	
Date 16/08/2021 File Plant Room.MDX	Designed by P Barrett Checked by	
Micro Drainage		Network 2018.1

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes Pipe Manhole Sizes Manhole

FSR Rainfall Model - England and Wales

Return Period (years)	1	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	0.357	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

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	55.000	0.110	500.0	0.065	10.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	20.000	0.040	500.0	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)
1.000	30.15	12.07	63.900	0.065	0.0	0.0	0.0	0.44	7.8	5.3
1.001	29.17	12.82	63.790	0.065	0.0	0.0	0.0	0.44	7.8	5.3

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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
1.002	5.000	0.030	166.7	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)
1.002	29.04	12.93	63.750	0.065	0.0	0.0	0.0	0.78	13.7	5.3

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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 Invert Level (m)	Diameter (mm)	Pipes In PN Invert Level (m)	Diameter (mm)	Backdrop (mm)
1	65.100	1.200	Open Manhole	2100	1.000	63.900	150		
2	65.700	1.910	Open Manhole	450	1.001	63.790	150	1.000	63.790
2	65.300	1.550	Open Manhole	1800	1.002	63.750	150	1.001	63.750
	65.300	1.580	Open Manhole	0		OUTFALL		1.002	63.720

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd	Diam	MH	C.Level	I.Level	D.Depth	MH	MH DIAM., L*W
	Sect	(mm)	Name	(m)	(m)	(m)	Connection	(mm)
1.000	o	150	1	65.100	63.900	1.050	Open Manhole	2100
1.001	o	150	2	65.700	63.790	1.760	Open Manhole	450
1.002	o	150	2	65.300	63.750	1.400	Open Manhole	1800

Downstream Manhole

PN	Length	Slope	MH	C.Level	I.Level	D.Depth	MH	MH DIAM., L*W
	(m)	(1:X)	Name	(m)	(m)	(m)	Connection	(mm)
1.000	55.000	500.0	2	65.700	63.790	1.760	Open Manhole	450
1.001	20.000	500.0	2	65.300	63.750	1.400	Open Manhole	1800
1.002	5.000	166.7		65.300	63.720	1.430	Open Manhole	0

Free Flowing Outfall Details for Storm

Outfall	Outfall	C. Level	I. Level	Min	D,L	W
Pipe Number	Name	(m)	(m)	I. Level	(mm)	(mm)
				(m)		
1.002		65.300	63.720	0.000	0	0

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Simulation Criteria for Storm

Volumetric Runoff Coeff 0.750 Manhole Headloss Coeff (Global) 0.500 Inlet Coefficient 0.800
 Areal Reduction Factor 1.000 Foul Sewage per hectare (l/s) 0.000 Flow per Person per Day (l/per/day) 0.000
 Hot Start (mins) 0 Additional Flow - % of Total Flow 0.000 Run Time (mins) 60
 Hot Start Level (mm) 0 MADD Factor * 10m³/ha Storage 2.000 Output Interval (mins) 1

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
 Return Period (years) 1 Ratio R 0.357 Cv (Winter) 0.840
 Region England and Wales Profile Type Summer Storm Duration (mins) 30

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: 2, DS/PN: 1.002, Volume (m³): 4.3

Unit Reference	MD-SHE-0116-7000-1500-7000	Sump Available	Yes
Design Head (m)	1.500	Diameter (mm)	116
Design Flow (l/s)	7.0	Invert Level (m)	63.750
Flush-Flo™	Calculated Minimum Outlet Pipe Diameter (mm)		150
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	7.0	Kick-Flo®	0.926	5.6
Flush-Flo™	0.448	7.0	Mean Flow over Head Range	-	6.1

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	4.1	0.600	6.9	1.600	7.2	2.600	9.1	5.000	12.4	7.500	15.0
0.200	6.3	0.800	6.4	1.800	7.6	3.000	9.7	5.500	12.9	8.000	15.5
0.300	6.8	1.000	5.8	2.000	8.0	3.500	10.4	6.000	13.5	8.500	15.9
0.400	7.0	1.200	6.3	2.200	8.4	4.000	11.1	6.500	14.0	9.000	16.4
0.500	7.0	1.400	6.8	2.400	8.7	4.500	11.7	7.000	14.5	9.500	16.8

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Storage Structures for Storm Tank or Pond Manhole: 2, DS/PN: 1.001 Invert Level (m) 63.800 Depth (m) Area (m²) Depth (m) Area (m²) Depth (m) Area (m²) 0.000 7.5 1.200 7.5 1.201 0.0					
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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 Coeffiecient 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 0.356 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 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

US/MH		Return Storm	Climate Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Water			Surcharged		Flooded		Pipe	
PN	Name							Level (m)	Depth (m)	Volume (m³)	Flow / Cap. (l/s)	Overflow (l/s)	Flow (l/s)	Status	Level Exceeded	
1.000	1 15 Winter	1	+0%	30/15 Summer				63.992	-0.058	0.000	0.68		5.2	OK		
1.001	2 15 Winter	1	+0%	30/15 Summer				63.882	-0.058	0.000	0.62		4.6	OK		

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm															
US/MH			Return Climate	First (X)	First (Y)	First (Z)	Overflow	Water	Surcharged	Flooded	Pipe				
PN	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act.	Level	Depth	Volume	Flow /	Overflow	Flow	Level
									(m)	(m)	(m³)	Cap.	(l/s)	(l/s)	Status Exceeded
1.002	2 15 Winter		1	+0%	30/15 Summer				63.858	-0.042	0.000	0.41		4.4	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 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 Coeffiecient 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 0.356 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 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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Pipe Flow / Overflow Cap. (l/s)	Pipe Flow (l/s)	Status
1.000	1	15 Winter	30	+0%	30/15 Summer			64.212	0.162	0.000	1.49	11.4	SURCHARGED
1.001	2	30 Winter	30	+0%	30/15 Summer			64.065	0.125	0.000	1.01	7.4	SURCHARGED

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

US/MH Level		
PN	Name	Exceeded
1.000		1
1.001		2

Velodrome Plant Room
Surface Water Drainage

Designed by P Barrett
Checked by



Network 2018.1

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

									Water	Surcharged	Flooded	Pipe			
PN	US/MH		Return	Climate	First (X)	First (Y)	First (Z)	Overflow	Level	Depth	Volume	Flow /	Overflow	Flow	Status
	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act.	(m)	(m)	(m³)	Cap.	(l/s)	(l/s)	
1.002	2 30 Winter		30	+0%	30/15 Summer				64.033	0.133	0.000	0.62		6.7	SURCHARGED

US/MH	Level
PN	Name Exceeded

1.002 2

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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 Coeffiecient 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 0.356 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 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

US/MH	Return Climate	First (X)	First (Y)	First (Z)	Overflow	Water Level	Surcharged Depth	Flooded Volume	Pipe Flow / Overflow	Pipe Flow					
PN	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act.	(m)	(m)	(m³)	Cap.	(l/s)	(l/s)	Status
1.000	1 30 Winter	100	+40%	30/15 Summer		64.800	0.750	0.000	2.23	17.1	FLOOD RISK				
1.001	2 30 Winter	100	+40%	30/15 Summer		64.568	0.628	0.000	1.29	9.5	SURCHARGED				

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

US/MH Level		
PN	Name	Exceeded
1.000		1
1.001		2

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

									Water	Surcharged	Flooded	Pipe			
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Status
1.002	2 30 Winter		100	+40%	30/15 Summer				64.537	0.637	0.000	0.64		7.0	SURCHARGED