

Scott Hughes Design Ltd		Page 1
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	
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)
1.000	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
1.002	29.04	12.93	63.750	0.065	0.0	0.0	0.0	0.78	13.7	5.3

Scott Hughes Design Ltd		Page 2
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		
Simulation Criteria for Storm Volumetric Runoff Coeff 0.750 Manhole Headloss Coeff (Global) 0.500 Inlet Coeffiecient 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		
©1982-2018 Innovyze		

Scott Hughes Design Ltd		Page 3
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	

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

Scott Hughes Design Ltd		Page 4
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	

Storage Structures for Storm

Tank or Pond Manhole: 2, DS/PN: 1.001

Invert Level (m) 63.800

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	7.5	1.200	7.5	1.201	0.0

Scott Hughes Design Ltd		Page 5
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	

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 0.356 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

									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)	(l/s)	Status	Exceeded
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	
1.002	2 30 Winter		100	+40%	30/15 Summer				64.537	0.637	0.000	0.64		7.0	SURCHARGED	

Scott Hughes Design Ltd		Page 6
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	

Rainfall Hyetograph for 30 minute 100 year Winter I+40%
for Pipe 1.000 (Storm)

Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)
1	10.916	4	35.270	7	40.940	10	83.205	13	157.905	16	196.546	19	131.585	22	63.752	25	36.437
2	26.820	5	35.284	8	49.851	11	106.184	14	180.507	17	180.507	20	106.184	23	49.851	26	35.284
3	33.592	6	36.437	9	63.752	12	131.585	15	196.546	18	157.905	21	83.205	24	40.940	27	35.270
																30	10.916

Scott Hughes Design Ltd		Page 7
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	

Rainfall Hyetograph for 30 minute 100 year Winter I+40%
for Pipe 1.001 (Storm)

Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)
1	10.916	4	35.270	7	40.940	10	83.205	13	157.905	16	196.546	19	131.585	22	63.752	25	36.437
2	26.820	5	35.284	8	49.851	11	106.184	14	180.507	17	180.507	20	106.184	23	49.851	26	35.284
3	33.592	6	36.437	9	63.752	12	131.585	15	196.546	18	157.905	21	83.205	24	40.940	27	35.270
																30	10.916

Scott Hughes Design Ltd		Page 8
The Flint Glass Works 64 Jersey Street Manchester M4 6JW	Velodrome Plant Room Surface Water Drainage	
	Designed by P Barrett Checked by	
Date 16/08/2021 File PLANT ROOM.MDX	Network 2018.1	

Rainfall Hyetograph for 30 minute 100 year Winter I+40%
for Pipe 1.002 (Storm)

Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)
1	10.916	4	35.270	7	40.940	10	83.205	13	157.905	16	196.546	19	131.585	22	63.752	25	36.437
2	26.820	5	35.284	8	49.851	11	106.184	14	180.507	17	180.507	20	106.184	23	49.851	26	35.284
3	33.592	6	36.437	9	63.752	12	131.585	15	196.546	18	157.905	21	83.205	24	40.940	27	35.270
																30	10.916