


Civic Engineers		Page 1
Carvers Warehouse 77 Dale Street Manchester, M1 2HG	846-04 Brunswick Mill Manchester Existing Mill Site	
Date 08/04/2021 15:46 File 846-04 Existing Mill Si...	Designed by TC 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)	1	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.352	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	0.348	4-8	0.092

Total Area Contributing (ha) = 0.440


Total Pipe Volume (m³) = 3.930

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
S1.000	26.000	1.300	20.0	0.089	5.00	0.0	0.600	o	150	Pipe/Conduit	
S2.000	26.430	0.961	27.5	0.042	5.00	0.0	0.600	o	150	Pipe/Conduit	
S2.001	35.460	0.355	100.0	0.042	0.00	0.0	0.600	o	150	Pipe/Conduit	
S2.002	26.000	0.260	100.0	0.089	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	16.000	0.128	125.0	0.089	0.00	0.0	0.600	o	225	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)
S1.000	45.55	5.19	51.780	0.089	0.0	0.0	0.0	2.26	40.0	11.0
S2.000	45.42	5.23	51.770	0.042	0.0	0.0	0.0	1.93	34.1	5.2
S2.001	43.36	5.82	50.809	0.084	0.0	0.0	0.0	1.00	17.8	9.9
S2.002	42.30	6.15	50.379	0.173	0.0	0.0	0.0	1.31	52.0	19.8
S1.001	41.60	6.38	50.119	0.351	0.0	0.0	0.0	1.17	46.4	39.5

Civic Engineers		Page 2
Carvers Warehouse 77 Dale Street Manchester, M1 2HG	846-04 Brunswick Mill Manchester Existing Mill Site	
Date 08/04/2021 15:46 File 846-04 Existing Mill Si...	Designed by TC 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
S1.002	10.000	0.042	240.0	0.089	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)
S1.002	41.11	6.54	49.916	0.440	0.0	0.0	0.0	1.01	71.4	49.0

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)
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S1.002	S	53.500	49.875	49.875	0	0
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Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
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)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	30
Ratio R	0.352		

Civic Engineers		Page 3
Carvers Warehouse 77 Dale Street Manchester, M1 2HG	846-04 Brunswick Mill Manchester Existing Mill Site	
Date 08/04/2021 15:46 File 846-04 Existing Mill Si...	Designed by TC Checked by	
Innovyze	Network 2020.1	

Online Controls for Storm


Hydro-Brake® Optimum Manhole: S3, DS/PN: S1.002, Volume (m³): 6.9

Unit Reference	MD-SHE-0251-3900-2000-3900
Design Head (m)	2.000
Design Flow (l/s)	39.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	251
Invert Level (m)	49.991
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	2100

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	38.9
Flush-Flo™	0.597	38.8
Kick-Flo®	1.296	31.6
Mean Flow over Head Range	-	33.6

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	8.1	1.200	34.2	3.000	47.3	7.000	71.3
0.200	25.7	1.400	32.8	3.500	50.9	7.500	73.7
0.300	35.9	1.600	34.9	4.000	54.3	8.000	76.1
0.400	37.7	1.800	37.0	4.500	57.5	8.500	78.3
0.500	38.6	2.000	38.9	5.000	60.5	9.000	80.5
0.600	38.8	2.200	40.7	5.500	63.4	9.500	82.7
0.800	38.3	2.400	42.5	6.000	66.1		
1.000	37.0	2.600	44.1	6.500	68.8		


Civic Engineers		Page 4
Carvers Warehouse 77 Dale Street Manchester, M1 2HG	846-04 Brunswick Mill Manchester Existing Mill Site	
Date 08/04/2021 15:46 File 846-04 Existing Mill Si...	Designed by TC Checked by	
Innovyze	Network 2020.1	

Storage Structures for Storm

Cellular Storage Manhole: S2, DS/PN: S1.001

Invert Level (m) 50.119 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	215.0	215.0	0.500	0.0	240.2
0.400	215.0	240.2			

Civic Engineers		Page 5
Carvers Warehouse 77 Dale Street Manchester, M1 2HG	846-04 Brunswick Mill Manchester Existing Mill Site	
Date 08/04/2021 15:46 File 846-04 Existing Mill Si...	Designed by TC 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 2.000
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 0.352
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600,
720, 960, 1440, 2160, 2880, 4320, 5760,
7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

US/MH PN	Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	1	+0%	100/15 Summer				51.834
S2.000	S2	15 Winter	1	+0%	100/15 Summer				51.809
S2.001	S2	15 Winter	1	+0%	30/15 Summer				50.888
S2.002	S2	15 Winter	1	+0%	100/15 Summer				50.476
S1.001	S2	60 Winter	1	+0%	100/15 Summer				50.205
S1.002	S3	60 Winter	1	+0%	30/15 Summer				50.141

PN	US/MH Name	Surcharged Flooded			Half Drain Pipe		Level Exceeded
		Depth (m)	Volume (m ³)	Flow / Cap. (l/s)	Time (mins)	Pipe Flow (l/s)	
S1.000	S1	-0.096	0.000	0.28		10.6	OK
S2.000	S2	-0.111	0.000	0.15		5.0	OK
S2.001	S2	-0.071	0.000	0.54		9.2	OK
S2.002	S2	-0.129	0.000	0.38		18.1	OK
S1.001	S2	-0.139	0.000	0.31	36	12.8	OK
S1.002	S3	-0.075	0.000	0.29		16.4	OK

Civic Engineers		Page 6
Carvers Warehouse 77 Dale Street Manchester, M1 2HG	846-04 Brunswick Mill Manchester Existing Mill Site	
Date 08/04/2021 15:46 File 846-04 Existing Mill Si...	Designed by TC 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 * 10m³/ha Storage 2.000
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 0.352
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600,
720, 960, 1440, 2160, 2880, 4320, 5760,
7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	30	+0%	100/15 Summer				51.872
S2.000	S2	15 Winter	30	+0%	100/15 Summer				51.834
S2.001	S2	15 Winter	30	+0%	30/15 Summer				51.308
S2.002	S2	15 Winter	30	+0%	100/15 Summer				50.604
S1.001	S2	30 Winter	30	+0%	100/15 Summer				50.331
S1.002	S3	30 Winter	30	+0%	30/15 Summer				50.275

PN	US/MH Name	Surcharged		Flooded	Half Drain		Pipe	Status	Level Exceeded
		Depth (m)	Volume (m ³)	Flow / Cap. (l/s)	Time (mins)	Pipe Flow (l/s)			
S1.000	S1	-0.058	0.000	0.68			26.0	OK	
S2.000	S2	-0.086	0.000	0.38			12.3	OK	
S2.001	S2	0.349	0.000	1.38			23.7	SURCHARGED	
S2.002	S2	0.000	0.000	1.00			48.1	OK	
S1.001	S2	-0.014	0.000	0.74		20	30.3	OK	
S1.002	S3	0.059	0.000	0.63			35.4	SURCHARGED	

Civic Engineers		Page 7
Carvers Warehouse 77 Dale Street Manchester, M1 2HG	846-04 Brunswick Mill Manchester Existing Mill Site	
Date 08/04/2021 15:46 File 846-04 Existing Mill Si...	Designed by TC 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 * 10m³/ha Storage 2.000
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 0.352
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600,
720, 960, 1440, 2160, 2880, 4320, 5760,
7200, 8640, 10080
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)
S1.000	S1	15 Winter	100	+40%	100/15 Summer				52.220
S2.000	S2	15 Winter	100	+40%	100/15 Summer				52.621
S2.001	S2	15 Winter	100	+40%	30/15 Summer				52.463
S2.002	S2	60 Winter	100	+40%	100/15 Summer				52.046
S1.001	S2	60 Winter	100	+40%	100/15 Summer				52.012
S1.002	S3	60 Winter	100	+40%	30/15 Summer				51.912

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m ³)	Flow / Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.290	0.000	1.10		41.9	SURCHARGED	
S2.000	S2	0.701	0.000	0.67		21.6	FLOOD RISK	
S2.001	S2	1.504	0.000	1.98		33.9	SURCHARGED	
S2.002	S2	1.442	0.000	0.99		47.6	SURCHARGED	
S1.001	S2	1.667	0.000	0.89	40	36.6	SURCHARGED	
S1.002	S3	1.696	0.000	0.69		38.6	SURCHARGED	