

Carley Daines and Partners Limited		Page 0
11 Bridgewater Road Worsley Manchester, M28 3JE	13126 BLACKWIN STREET SW HYDRAULIC ANALYSIS SEPTEMBER 2024	
Date 05/09/2024 File BLACKWIN MDX.MDX	Designed by A MULLIGAN Checked by D MIDDLETON	
Innovyze	Network 2019.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm Network 1

Pipe Sizes Circular Manhole Sizes Adoptable

FSR Rainfall Model - England and Wales			
Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.360	Minimum Backdrop Height (m)	1.000
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	0.600
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)	1000
Designed with Level Soffits			

Network Design Table for Storm Network 1

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	24.219	0.324	74.8	0.012	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	13.261	0.133	99.7	0.003	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.000	22.514	0.557	40.4	0.007	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	9.169	0.092	99.7	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
3.000	12.005	0.120	100.0	0.007	5.00	0.0	0.600	o	150	Pipe/Conduit	
3.001	14.563	0.779	18.7	0.003	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.003	7.908	0.079	100.1	0.003	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.004	8.194	0.082	99.9	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
4.000	11.550	1.060	10.9	0.007	5.00	0.0	0.600	o	150	Pipe/Conduit	
4.001	6.937	0.070	99.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.005	3.602	0.090	40.0	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)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.35	56.950	0.012	0.0	0.0	0.0	1.16	20.6	1.6
1.001	50.00	5.57	56.626	0.015	0.0	0.0	0.0	1.01	17.8	2.0
2.000	50.00	5.24	57.050	0.007	0.0	0.0	0.0	1.59	28.1	0.9
1.002	50.00	5.68	56.418	0.022	0.0	0.0	0.0	1.31	52.1	3.0
3.000	50.00	5.20	57.300	0.007	0.0	0.0	0.0	1.00	17.8	0.9
3.001	50.00	5.30	57.180	0.010	0.0	0.0	0.0	2.34	41.4	1.4
1.003	50.00	5.78	56.326	0.035	0.0	0.0	0.0	1.31	52.0	4.7
1.004	50.00	5.89	56.247	0.035	0.0	0.0	0.0	1.31	52.0	4.7
4.000	50.00	5.06	57.300	0.007	0.0	0.0	0.0	3.07	54.2	0.9
4.001	50.00	5.15	56.165	0.007	0.0	0.0	0.0	1.31	52.2	0.9
1.005	50.00	5.93	56.095	0.042	0.0	0.0	0.0	1.60	28.2	5.7

Manhole Schedules for Storm Network 1

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
1	57.700	0.750	Open Manhole	450	1.000	56.950	150				
2	57.800	1.174	Open Manhole	450	1.001	56.626	150	1.000	56.626	150	
3	57.800	0.750	Open Manhole	450	2.000	57.050	150				
4	57.854	1.436	Open Manhole	600	1.002	56.418	225	1.001	56.493	150	75
								2.000	56.493	150	75
5	58.050	0.750	Open Manhole	450	3.000	57.300	150				
6	58.050	0.870	Open Manhole	450	3.001	57.180	150	3.000	57.180	150	
7	58.050	1.724	Open Manhole	600	1.003	56.326	225	1.002	56.326	225	
								3.001	56.401	150	75
8	58.050	1.803	Open Manhole	900	1.004	56.247	225	1.003	56.247	225	
9	58.050	0.750	Open Manhole	450	4.000	57.300	150				
10	58.050	1.885	Open Manhole	600	4.001	56.165	225	4.000	56.240	150	75
11	57.594	1.499	Open Manhole	1200	1.005	56.095	150	1.004	56.165	225	70
								4.001	56.095	225	
12	57.580	1.575	Open Manhole	1200		OUTFALL		1.005	56.005	150	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
1	387453.349	396782.424	387453.349	396782.424	Required	
2	387438.886	396801.850	387438.886	396801.850	Required	
3	387462.946	396791.778	387462.946	396791.778	Required	
4	387449.482	396809.823	387449.482	396809.823	Required	
5	387475.359	396811.000	387475.359	396811.000	Required	
6	387465.747	396803.808	387465.747	396803.808	Required	
7	387456.823	396815.316	387456.823	396815.316	Required	
8	387452.131	396821.682	387452.131	396821.682	Required	
9	387467.628	396819.056	387467.628	396819.056	Required	
10	387460.683	396828.285	387460.683	396828.285	Required	

Manhole Schedules for Storm Network 1

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
11	387453.889	396829.685	387453.889	396829.685	Required	
12	387451.372	396832.262			No Entry	

PIPELINE SCHEDULES for Storm Network 1

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	150	1	57.700	56.950	0.600	Open Manhole	450
1.001	o	150	2	57.800	56.626	1.024	Open Manhole	450
2.000	o	150	3	57.800	57.050	0.600	Open Manhole	450
1.002	o	225	4	57.854	56.418	1.286	Open Manhole	600
3.000	o	150	5	58.050	57.300	0.600	Open Manhole	450
3.001	o	150	6	58.050	57.180	0.720	Open Manhole	450
1.003	o	225	7	58.050	56.326	1.574	Open Manhole	600
1.004	o	225	8	58.050	56.247	1.653	Open Manhole	900
4.000	o	150	9	58.050	57.300	0.600	Open Manhole	450
4.001	o	225	10	58.050	56.165	1.735	Open Manhole	600
1.005	o	150	11	57.594	56.095	1.349	Open Manhole	1200

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	24.219	74.8	2	57.800	56.626	1.024	Open Manhole	450
1.001	13.261	99.7	4	57.854	56.493	1.211	Open Manhole	600
2.000	22.514	40.4	4	57.854	56.493	1.211	Open Manhole	600
1.002	9.169	99.7	7	58.050	56.326	1.574	Open Manhole	600
3.000	12.005	100.0	6	58.050	57.180	0.720	Open Manhole	450
3.001	14.563	18.7	7	58.050	56.401	1.499	Open Manhole	600
1.003	7.908	100.1	8	58.050	56.247	1.653	Open Manhole	900
1.004	8.194	99.9	11	57.594	56.165	1.279	Open Manhole	1200
4.000	11.550	10.9	10	58.050	56.240	1.660	Open Manhole	600
4.001	6.937	99.1	11	57.594	56.095	1.349	Open Manhole	1200
1.005	3.602	40.0	12	57.580	56.005	1.425	Open Manhole	1200

Setting Out Information - Site Coordinates (Storm Network 1)

PN	USMH Name	Dia/Len (mm)	Width (mm)	US Easting (m)	US Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Layout (North)
1.000	1	450		387453.349	396782.424	387453.349	396782.424	
1.001	2	450		387438.886	396801.850	387438.886	396801.850	
2.000	3	450		387462.946	396791.778	387462.946	396791.778	
1.002	4	600		387449.482	396809.823	387449.482	396809.823	
3.000	5	450		387475.359	396811.000	387475.359	396811.000	
3.001	6	450		387465.747	396803.808	387465.747	396803.808	
1.003	7	600		387456.823	396815.316	387456.823	396815.316	
1.004	8	900		387452.131	396821.682	387452.131	396821.682	
4.000	9	450		387467.628	396819.056	387467.628	396819.056	
4.001	10	600		387460.683	396828.285	387460.683	396828.285	
1.005	11	1200		387453.889	396829.685	387453.889	396829.685	

PN	DSMH Name	Dia/Len (mm)	Width (mm)	DS Easting (m)	DS Northing (m)	Layout (North)
1.005	12	1200		387451.372	396832.262	

Area Summary for Storm Network 1

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.012	0.012	0.012
1.001	-	-	100	0.003	0.003	0.003
2.000	-	-	100	0.007	0.007	0.007
1.002	-	-	100	0.000	0.000	0.000
3.000	-	-	100	0.007	0.007	0.007
3.001	-	-	100	0.003	0.003	0.003
1.003	-	-	100	0.003	0.003	0.003
1.004	-	-	100	0.000	0.000	0.000
4.000	-	-	100	0.007	0.007	0.007
4.001	-	-	100	0.000	0.000	0.000
1.005	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.042	0.042	0.042

Surcharged Outfall Details for Storm Network 1

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
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1.0051257.58056.0050.00012000

Datum (m) 56.005 Offset (mins) 0

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
1440	0.000	4320	0.000	7200	0.000	10080	0.000	12960	0.000	15840	0.000	18720	0.000
2880	0.000	5760	0.000	8640	0.000	11520	0.000	14400	0.000	17280	0.000	20160	0.000

Simulation Criteria for Storm Network 1

Volumetric Runoff Coeff 0.750 Additional Flow - % of Total Flow 0.000
Areal Reduction Factor 1.000 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Inlet Coeffiecient 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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 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	0.360		

Online Controls for Storm Network 1

Hydro-Brake® Optimum Manhole: 11, DS/PN: 1.005, Volume (m³): 2.2

Unit Reference	MD-SHE-0100-5000-1400-5000
Design Head (m)	1.400
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	100
Invert Level (m)	56.095
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.400	5.0	Kick-Flo®	0.855	4.0
Flush-Flo™	0.416	5.0	Mean Flow over Head Range	-	4.4

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)
0.100	3.3	0.800	4.3	2.000	5.9	4.000	8.2	7.000	10.7
0.200	4.6	1.000	4.3	2.200	6.2	4.500	8.6	7.500	11.0
0.300	4.9	1.200	4.7	2.400	6.4	5.000	9.1	8.000	11.4
0.400	5.0	1.400	5.0	2.600	6.7	5.500	9.5	8.500	11.7
0.500	5.0	1.600	5.3	3.000	7.1	6.000	9.9	9.000	12.0
0.600	4.9	1.800	5.6	3.500	7.7	6.500	10.3	9.500	12.3

Carley Daines and Partners Limited			Page 7
11 Bridgewater Road Worsley Manchester, M28 3JE	13126 BLACKWIN STREET SW HYDRAULIC ANALYSIS SEPTEMBER 2024		
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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm Network 1

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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 0 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 OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

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, 45

US/MH			Return Climate		First (X)		First (Y)		First (Z)		Overflow	Water Level	Surcharged Depth	Flooded Volume
PN	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act.				(m)	(m)	(m³)
1.000	1 15 Winter		1	+0%	100/15 Summer							56.977	-0.123	0.000
1.001	2 15 Winter		1	+0%	100/15 Summer							56.659	-0.117	0.000
2.000	3 15 Winter		1	+0%	100/15 Summer							57.067	-0.133	0.000
1.002	4 15 Winter		1	+0%	100/15 Summer							56.454	-0.189	0.000
3.000	5 15 Winter		1	+0%	100/15 Winter							57.322	-0.128	0.000
3.001	6 15 Winter		1	+0%	100/15 Winter							57.197	-0.133	0.000
1.003	7 15 Winter		1	+0%	30/15 Summer							56.374	-0.177	0.000
1.004	8 15 Winter		1	+0%	30/15 Summer							56.294	-0.178	0.000
4.000	9 15 Winter		1	+0%	100/15 Winter							57.312	-0.138	0.000
4.001	10 15 Winter		1	+0%	30/15 Summer							56.238	-0.152	0.000
1.005	11 15 Winter		1	+0%	30/15 Summer							56.237	-0.008	0.000

US/MH			Pipe		Level	
PN	Name	Cap.	Flow / (l/s)	Overflow Flow (l/s)	Status	Exceeded
1.000	1	0.07		1.4	OK	
1.001	2	0.11		1.7	OK	
2.000	3	0.03		0.8	OK	
1.002	4	0.06		2.6	OK	
3.000	5	0.05		0.8	OK	
3.001	6	0.03		1.1	OK	
1.003	7	0.10		4.0	OK	
1.004	8	0.10		4.0	OK	
4.000	9	0.02		0.8	OK	
4.001	10	0.02		0.8	OK	
1.005	11	0.22		4.2	OK	

Carley Daines and Partners Limited			Page 8
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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm Network 1

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 Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 1 Number of Storage Structures 0 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 OFF
 Analysis Timestep Fine Inertia Status OFF
 DTS Status ON

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, 45

									Water	Surcharged	Flooded
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)
1.000	1	15 Winter	30	+0%	100/15 Summer				56.992	-0.108	0.000
1.001	2	15 Winter	30	+0%	100/15 Summer				56.680	-0.096	0.000
2.000	3	15 Winter	30	+0%	100/15 Summer				57.077	-0.123	0.000
1.002	4	15 Winter	30	+0%	100/15 Summer				56.641	-0.002	0.000
3.000	5	15 Winter	30	+0%	100/15 Winter				57.335	-0.115	0.000
3.001	6	15 Winter	30	+0%	100/15 Winter				57.208	-0.122	0.000
1.003	7	15 Winter	30	+0%	30/15 Summer				56.638	0.087	0.000
1.004	8	15 Winter	30	+0%	30/15 Summer				56.633	0.161	0.000
4.000	9	15 Winter	30	+0%	100/15 Winter				57.319	-0.131	0.000
4.001	10	15 Winter	30	+0%	30/15 Summer				56.630	0.240	0.000
1.005	11	15 Winter	30	+0%	30/15 Summer				56.629	0.384	0.000

				Pipe		
PN	US/MH Name	Flow Cap.	Flow (l/s)	Overflow (l/s)	Status	Level Exceeded
1.000	1	0.17		3.5	OK	
1.001	2	0.27		4.4	OK	
2.000	3	0.08		2.1	OK	
1.002	4	0.15		6.4	OK	
3.000	5	0.12		2.1	OK	
3.001	6	0.08		3.0	OK	
1.003	7	0.23		9.0	SURCHARGED	
1.004	8	0.19		7.5	SURCHARGED	
4.000	9	0.04		2.1	OK	
4.001	10	0.04		1.4	SURCHARGED	
1.005	11	0.27		5.0	SURCHARGED	

Carley Daines and Partners Limited			Page 9
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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm Network 1

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 Coeffiecient 0.800
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Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
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Synthetic Rainfall Details

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 Region England and Wales Ratio R 0.360 Cv (Winter) 0.840

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

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, 45

									Water	Surcharged	Flooded
PN	US/MH		Return	Climate	First (X)	First (Y)	First (Z)	Overflow	Level	Depth	Volume
	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act.	(m)	(m)	(m³)
1.000	1	30 Winter	100	+45%	100/15 Summer				57.609	0.509	0.000
1.001	2	30 Winter	100	+45%	100/15 Summer				57.601	0.825	0.000
2.000	3	30 Winter	100	+45%	100/15 Summer				57.598	0.398	0.000
1.002	4	30 Winter	100	+45%	100/15 Summer				57.593	0.950	0.000
3.000	5	30 Winter	100	+45%	100/15 Winter				57.598	0.148	0.000
3.001	6	30 Winter	100	+45%	100/15 Winter				57.595	0.265	0.000
1.003	7	30 Winter	100	+45%	30/15 Summer				57.590	1.039	0.000
1.004	8	30 Winter	100	+45%	30/15 Summer				57.585	1.113	0.000
4.000	9	30 Winter	100	+45%	100/15 Winter				57.584	0.134	0.000
4.001	10	30 Winter	100	+45%	30/15 Summer				57.581	1.191	0.000
1.005	11	30 Winter	100	+45%	30/15 Summer				57.580	1.335	0.000

				Pipe		
PN	US/MH Name	Flow Cap.	Flow / Overflow (l/s)	Flow (l/s)	Status	Level Exceeded
1.000	1	0.26		5.2	FLOOD RISK	
1.001	2	0.36		5.8	FLOOD RISK	
2.000	3	0.11		3.1	FLOOD RISK	
1.002	4	0.15		6.6	FLOOD RISK	
3.000	5	0.18		3.1	SURCHARGED	
3.001	6	0.12		4.4	SURCHARGED	
1.003	7	0.23		9.0	SURCHARGED	
1.004	8	0.17		6.7	SURCHARGED	
4.000	9	0.06		3.1	SURCHARGED	
4.001	10	0.05		1.8	SURCHARGED	
1.005	11	0.27		5.0	FLOOD RISK	