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11 Bridgewater Road Worsley Manchester, M28 3JE	12277 Dorris Street Drainage Calcs	
Date 29/09/2020 File 12277 DORRIS STREET MICRODRAI...	Designed by A.Mulligan Checked by D.Middleton	
Innovyze	Network 2019.1	

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)	30	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.360	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

Network Design Table for Storm

- Indicates pipe length does not match coordinates

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	3.000	0.025	120.0	0.002	5.00	0.0	0.600	o	100	Pipe/Conduit	
S1.001	10.000#	0.125	80.0	0.005	0.00	0.0	0.600	o	100	Pipe/Conduit	
S2.000	12.000#	0.150	80.0	0.005	5.00	0.0	0.600	o	100	Pipe/Conduit	
S1.002	13.000#	0.090	144.4	0.004	0.00	0.0	0.600	o	150	Pipe/Conduit	
S3.000	10.500#	0.130	80.8	0.005	5.00	0.0	0.600	o	100	Pipe/Conduit	
S4.000	13.000#	0.100	130.0	0.005	5.00	0.0	0.600	o	100	Pipe/Conduit	
S1.003	4.000#	0.030	133.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.004	8.500#	0.330	25.8	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)
S1.000	50.00	5.07	58.100	0.002	0.0	0.0	0.0	0.70	5.5	0.3
S1.001	50.00	5.26	58.075	0.007	0.0	0.0	0.0	0.86	6.8	0.9
S2.000	50.00	5.23	58.100	0.005	0.0	0.0	0.0	0.86	6.8	0.7
S1.002	50.00	5.52	57.900	0.016	0.0	0.0	0.0	0.83	14.7	2.2
S3.000	50.00	5.20	57.990	0.005	0.0	0.0	0.0	0.86	6.7	0.7
S4.000	50.00	5.32	57.960	0.005	0.0	0.0	0.0	0.67	5.3	0.7
S1.003	50.00	5.60	57.810	0.026	0.0	0.0	0.0	0.87	15.3	3.5
S1.004	50.00	5.67	57.780	0.026	0.0	0.0	0.0	1.99	35.2	3.5

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Manchester, M28 3JE	Drainage Calcs	
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File 12277 DORRIS STREET MICRODRAI...	Checked by D.Middleton	
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Manhole Schedules for Storm

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)
SS10	59.150	1.050	Open Manhole	1200	S1.000	58.100	100				
SS10	59.150	1.075	Open Manhole	450	S1.001	58.075	100	S1.000	58.075	100	
SS21	59.150	1.050	Open Manhole	450	S2.000	58.100	100				
SS11	59.150	1.250	Open Manhole	450	S1.002	57.900	150	S1.001	57.950	100	
								S2.000	57.950	100	
SS30	59.100	1.110	Open Manhole	450	S3.000	57.990	100				
SS40	59.100	1.140	Open Manhole	450	S4.000	57.960	100				
SS13	59.100	1.290	Open Manhole	450	S1.003	57.810	150	S1.002	57.810	150	
								S3.000	57.860	100	
								S4.000	57.860	100	
SS14 HB	58.840	1.060	Open Manhole	1050	S1.004	57.780	150	S1.003	57.780	150	
S	59.150	1.700	Open Manhole	0		OUTFALL		S1.004	57.450	150	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SS10	222.134	65.372	222.134	65.372	Required	
SS21	148.968	94.101	148.968	94.101	Required	
SS11	180.938	80.945	180.938	80.945	Required	
SS30	115.859	52.789	115.859	52.789	Required	
SS40	212.281	7.898	212.281	7.898	Required	
SS13	154.790	30.326	154.790	30.326	Required	
SS14 HB	145.833	11.692	145.833	11.692	Required	
S	159.953	-5.648			No Entry	

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PIPELINE SCHEDULES for Storm

Upstream Manhole

- Indicates pipe length does not match coordinates

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	100	SS10	59.150	58.100	0.950	Open Manhole	1200
S1.001	o	100	SS10	59.150	58.075	0.975	Open Manhole	450
S2.000	o	100	SS21	59.150	58.100	0.950	Open Manhole	450
S1.002	o	150	SS11	59.150	57.900	1.100	Open Manhole	450
S3.000	o	100	SS30	59.100	57.990	1.010	Open Manhole	450
S4.000	o	100	SS40	59.100	57.960	1.040	Open Manhole	450
S1.003	o	150	SS13	59.100	57.810	1.140	Open Manhole	450
S1.004	o	150	SS14 HB	58.840	57.780	0.910	Open Manhole	1050

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)
S1.000	3.000	120.0	SS10	59.150	58.075	0.975	Open Manhole	450
S1.001	10.000#	80.0	SS11	59.150	57.950	1.100	Open Manhole	450
S2.000	12.000#	80.0	SS11	59.150	57.950	1.100	Open Manhole	450
S1.002	13.000#	144.4	SS13	59.100	57.810	1.140	Open Manhole	450
S3.000	10.500#	80.8	SS13	59.100	57.860	1.140	Open Manhole	450
S4.000	13.000#	130.0	SS13	59.100	57.860	1.140	Open Manhole	450
S1.003	4.000#	133.3	SS14 HB	58.840	57.780	0.910	Open Manhole	1050
S1.004	8.500#	25.8	S	59.150	57.450	1.550	Open Manhole	0

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.002	0.002	0.002
1.001	-	-	100	0.005	0.005	0.005
2.000	-	-	100	0.005	0.005	0.005
1.002	-	-	100	0.004	0.004	0.004
3.000	-	-	100	0.005	0.005	0.005
4.000	-	-	100	0.005	0.005	0.005
1.003	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.026	0.026	0.026

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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S1.004	S	59.150	57.450	0.000	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 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)	30	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		

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: SS14 HB, DS/PN: S1.004, Volume (m³): 1.0

Unit Reference	MD-SHE-0105-5000-1000-5000
Design Head (m)	1.000
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	105
Invert Level (m)	57.780
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)	1.000	5.0	Kick-Flo®	0.637	4.1
Flush-Flo™	0.296	5.0	Mean Flow over Head Range	-	4.3

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	3.6	0.800	4.5	2.000	6.9	4.000	9.6	7.000	12.5
0.200	4.8	1.000	5.0	2.200	7.2	4.500	10.1	7.500	12.9
0.300	5.0	1.200	5.4	2.400	7.5	5.000	10.6	8.000	13.3
0.400	4.9	1.400	5.8	2.600	7.8	5.500	11.1	8.500	13.7
0.500	4.7	1.600	6.2	3.000	8.4	6.000	11.6	9.000	14.1
0.600	4.3	1.800	6.6	3.500	9.0	6.500	12.1	9.500	14.5

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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 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, 360, 600, 1440
 Return Period(s) (years) 1, 10, 30, 100
 Climate Change (%) 0, 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water	Surcharged
									Level (m)	Depth (m)
S1.000	SS10	15 Winter	1	+0%	100/15 Summer				58.115	-0.085
S1.001	SS10	15 Winter	1	+0%	100/15 Summer				58.098	-0.077
S2.000	SS21	15 Winter	1	+0%	100/15 Summer				58.121	-0.079
S1.002	SS11	15 Winter	1	+0%	30/15 Summer				57.936	-0.114
S3.000	SS30	15 Winter	1	+0%	100/15 Summer				58.011	-0.079
S4.000	SS40	15 Winter	1	+0%	30/15 Winter				57.983	-0.077
S1.003	SS13	15 Winter	1	+0%	10/15 Winter				57.871	-0.089
S1.004	SS14 HB	15 Winter	1	+0%	10/15 Summer				57.864	-0.066

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	SS10	0.000	0.05		0.2	OK	
S1.001	SS10	0.000	0.12		0.7	OK	
S2.000	SS21	0.000	0.09		0.6	OK	
S1.002	SS11	0.000	0.13		1.7	OK	
S3.000	SS30	0.000	0.10		0.6	OK	
S4.000	SS40	0.000	0.12		0.6	OK	
S1.003	SS13	0.000	0.27		2.9	OK	
S1.004	SS14 HB	0.000	0.09		2.9	OK	

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10 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 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, 360, 600, 1440
 Return Period(s) (years) 1, 10, 30, 100
 Climate Change (%) 0, 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water	Surcharged
									Level (m)	Depth (m)
S1.000	SS10	15 Winter	10	+0%	100/15 Summer				58.122	-0.078
S1.001	SS10	15 Winter	10	+0%	100/15 Summer				58.110	-0.065
S2.000	SS21	15 Winter	10	+0%	100/15 Summer				58.129	-0.071
S1.002	SS11	15 Winter	10	+0%	30/15 Summer				57.980	-0.070
S3.000	SS30	15 Winter	10	+0%	100/15 Summer				58.019	-0.071
S4.000	SS40	15 Winter	10	+0%	30/15 Winter				57.993	-0.067
S1.003	SS13	15 Winter	10	+0%	10/15 Winter				57.969	0.009
S1.004	SS14 HB	15 Winter	10	+0%	10/15 Summer				57.961	0.031

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	SS10	0.000	0.10		0.5	OK	
S1.001	SS10	0.000	0.27		1.7	OK	
S2.000	SS21	0.000	0.18		1.2	OK	
S1.002	SS11	0.000	0.28		3.8	OK	
S3.000	SS30	0.000	0.19		1.2	OK	
S4.000	SS40	0.000	0.23		1.2	OK	
S1.003	SS13	0.000	0.46		5.0	SURCHARGED	
S1.004	SS14 HB	0.000	0.15		4.8	SURCHARGED	

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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 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, 360, 600, 1440
 Return Period(s) (years) 1, 10, 30, 100
 Climate Change (%) 0, 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water	Surcharged
									Level (m)	Depth (m)
S1.000	SS10	15 Winter	30	+0%	100/15 Summer				58.125	-0.075
S1.001	SS10	15 Winter	30	+0%	100/15 Summer				58.115	-0.060
S2.000	SS21	15 Winter	30	+0%	100/15 Summer				58.133	-0.067
S1.002	SS11	15 Winter	30	+0%	30/15 Summer				58.086	0.036
S3.000	SS30	15 Winter	30	+0%	100/15 Summer				58.083	-0.007
S4.000	SS40	15 Winter	30	+0%	30/15 Winter				58.084	0.024
S1.003	SS13	15 Winter	30	+0%	10/15 Winter				58.076	0.116
S1.004	SS14 HB	15 Winter	30	+0%	10/15 Summer				58.068	0.138

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	SS10	0.000	0.13		0.6	OK	
S1.001	SS10	0.000	0.34		2.1	OK	
S2.000	SS21	0.000	0.23		1.5	OK	
S1.002	SS11	0.000	0.33		4.5	SURCHARGED	
S3.000	SS30	0.000	0.23		1.5	OK	
S4.000	SS40	0.000	0.29		1.4	SURCHARGED	
S1.003	SS13	0.000	0.51		5.5	SURCHARGED	
S1.004	SS14 HB	0.000	0.16		4.8	SURCHARGED	

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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 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, 360, 600, 1440
 Return Period(s) (years) 1, 10, 30, 100
 Climate Change (%) 0, 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water	Surcharged
									Level (m)	Depth (m)
S1.000	SS10 15	Winter	100	+40%	100/15	Summer			58.707	0.507
S1.001	SS10 15	Winter	100	+40%	100/15	Summer			58.706	0.531
S2.000	SS21 15	Winter	100	+40%	100/15	Summer			58.705	0.505
S1.002	SS11 15	Winter	100	+40%	30/15	Summer			58.696	0.646
S3.000	SS30 15	Winter	100	+40%	100/15	Summer			58.693	0.603
S4.000	SS40 15	Winter	100	+40%	30/15	Winter			58.694	0.634
S1.003	SS13 15	Winter	100	+40%	10/15	Winter			58.685	0.725
S1.004	SS14 HB 15	Winter	100	+40%	10/15	Summer			58.676	0.746

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level
							Exceeded
S1.000	SS10	0.000	0.35		1.6	SURCHARGED	
S1.001	SS10	0.000	0.46		2.9	SURCHARGED	
S2.000	SS21	0.000	0.33		2.1	SURCHARGED	
S1.002	SS11	0.000	0.41		5.5	SURCHARGED	
S3.000	SS30	0.000	0.31		2.0	SURCHARGED	
S4.000	SS40	0.000	0.38		1.9	SURCHARGED	
S1.003	SS13	0.000	0.66		7.2	SURCHARGED	
S1.004	SS14 HB	0.000	0.15		4.8	FLOOD RISK	