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11 Bridgewater Road Worsley Manchester, M28 3JE	12068 - Bank Bridge Road Surface Water Hydraulic Analys For Section 104 Review	
Date 22/11/2019	Designed by A.Mulligan	
File 12068 - BANK BRIDGE MD MODEL...	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)	2	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.	1.000	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	33.800#	0.215	157.2	0.067	5.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	17.750#	0.080	221.9	0.025	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.002	38.000#	0.170	223.5	0.105	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.003	33.300#	0.300	111.0	0.027	0.00	0.0	0.600	o	600	Pipe/Conduit	
S2.000	14.500#	0.145	100.0	0.019	5.00	0.0	0.600	o	150	Pipe/Conduit	
S2.001	22.600#	0.365	61.9	0.021	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.004	43.250#	0.220	196.6	0.022	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S1.005	25.000#	0.420	59.5	0.100	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S1.006	15.000#	0.120	125.0	0.000	0.00	0.0	0.600	o	300	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)
S1.000	50.00	5.54	66.660	0.067	0.0	0.0	0.0	1.04	41.4	12.0
S1.001	50.00	5.82	66.370	0.091	0.0	0.0	0.0	1.05	74.3	16.5
S1.002	50.00	6.43	66.290	0.196	0.0	0.0	0.0	1.05	74.0	35.3
S1.003	50.00	6.67	65.820	0.222	0.0	0.0	0.0	2.31	653.4	40.1
S2.000	50.00	5.24	66.630	0.019	0.0	0.0	0.0	1.00	17.8	3.4
S2.001	50.00	5.47	66.410	0.040	0.0	0.0	0.0	1.66	66.2	7.2
S1.004	50.00	6.94	64.920	0.284	0.0	0.0	0.0	2.66	3013.9	51.3
S1.005	50.00	7.02	64.700	0.384	0.0	0.0	0.0	4.85	5489.3	69.3
S1.006	50.00	7.20	64.280	0.384	0.0	0.0	0.0	1.40	99.3	69.3

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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	225	S1	68.100	66.660	1.215	Open Manhole	1500
S1.001	o	300	S2	67.980	66.370	1.310	Open Manhole	1500
S1.002	o	300	S3	68.110	66.290	1.520	Open Manhole	1500
S1.003	o	600	S4	68.360	65.820	1.940	Open Manhole	1500
S2.000	o	150	S5	68.010	66.630	1.230	Open Manhole	1200
S2.001	o	225	S6	68.110	66.410	1.475	Open Manhole	1500
S1.004	o	1200	S5	68.270	64.920	2.150	Open Manhole	2700
S1.005	o	1200	S6	67.560	64.700	1.660	Open Manhole	2700
S1.006	o	300	S7	66.930	64.280	2.350	Open Manhole	2700

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	33.800#	157.2	S2	67.980	66.445	1.310	Open Manhole	1500
S1.001	17.750#	221.9	S3	68.110	66.290	1.520	Open Manhole	1500
S1.002	38.000#	223.5	S4	68.360	66.120	1.940	Open Manhole	1500
S1.003	33.300#	111.0	S5	68.270	65.520	2.150	Open Manhole	2700
S2.000	14.500#	100.0	S6	68.110	66.485	1.475	Open Manhole	1500
S2.001	22.600#	61.9	S5	68.270	66.045	2.000	Open Manhole	2700
S1.004	43.250#	196.6	S6	67.560	64.700	1.660	Open Manhole	2700
S1.005	25.000#	59.5	S7	66.930	64.280	1.450	Open Manhole	2700
S1.006	15.000#	125.0	S	66.480	64.160	2.020	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	-	-	95	0.070	0.067	0.067
1.001	-	-	95	0.026	0.025	0.025
1.002	-	-	95	0.110	0.105	0.105
1.003	-	-	95	0.028	0.027	0.027
2.000	-	-	95	0.020	0.019	0.019
2.001	-	-	95	0.022	0.021	0.021
1.004	-	-	95	0.023	0.022	0.022
1.005	-	-	95	0.105	0.100	0.100
1.006	-	-	95	0.000	0.000	0.000
				Total	Total	Total
				0.404	0.384	0.384

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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S1.006	S	66.480	64.160	0.000	0	0
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Simulation Criteria for Storm

Volumetric Runoff Coeff	1.000	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/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)	2	Cv (Summer)	1.000
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: S7, DS/PN: S1.006, Volume (m³): 40.4

Unit Reference	MD-SHE-0136-9000-1200-9000
Design Head (m)	1.200
Design Flow (l/s)	9.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	136
Invert Level (m)	64.280
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)	1.200	9.0	Kick-Flo®	0.769	7.3
Flush-Flo™	0.354	9.0	Mean Flow over Head Range	-	7.8

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	4.9	1.200	9.0	3.000	13.9	7.000	20.8
0.200	8.5	1.400	9.7	3.500	14.9	7.500	21.5
0.300	8.9	1.600	10.3	4.000	15.9	8.000	22.2
0.400	9.0	1.800	10.9	4.500	16.8	8.500	22.8
0.500	8.8	2.000	11.4	5.000	17.7	9.000	23.5
0.600	8.5	2.200	12.0	5.500	18.5	9.500	24.1
0.800	7.4	2.400	12.5	6.000	19.3		
1.000	8.3	2.600	13.0	6.500	20.1		

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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, 240, 360, 480, 600, 720, 960, 1440
 Return Period(s) (years) 1, 2, 10, 30, 100
 Climate Change (%) 0, 0, 0, 0, 40

PN	US/MH		Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
	Name	Storm							
S1.000	S1	15 Winter	100	+40%	100/15 Summer				66.939
S1.001	S2	120 Winter	100	+40%	100/15 Summer				66.920
S1.002	S3	120 Winter	100	+40%	100/15 Summer				66.917
S1.003	S4	120 Winter	100	+40%	100/60 Winter				66.908
S2.000	S5	120 Winter	100	+40%	100/120 Winter				66.912
S2.001	S6	120 Winter	100	+40%	100/60 Winter				66.909
S1.004	S5	120 Winter	100	+40%	100/30 Winter				66.906
S1.005	S6	120 Winter	100	+40%	100/30 Summer	100/360 Summer			66.906
S1.006	S7	120 Winter	100	+40%	1/15 Summer	100/180 Winter			66.906

PN	US/MH Name	Surcharged		Flooded		Pipe		Level Exceeded
		Depth (m)	Volume (m ³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Status	
S1.000	S1	0.054	0.000	0.85		33.2	SURCHARGED	
S1.001	S2	0.250	0.000	0.26		16.6	SURCHARGED	
S1.002	S3	0.327	0.000	0.52		35.5	SURCHARGED	
S1.003	S4	0.488	0.000	0.07		40.4	SURCHARGED	
S2.000	S5	0.132	0.000	0.21		3.5	SURCHARGED	
S2.001	S6	0.274	0.000	0.12		7.3	SURCHARGED	
S1.004	S5	0.786	0.000	0.02		45.6	SURCHARGED	
S1.005	S6	1.006	0.000	0.02		44.7	SURCHARGED	
S1.006	S7	2.326	0.000	0.16		12.9	FLOOD RISK	