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11 Bridgewater Road Worsley Manchester, M28 3JE	12490 DOWNLEY DRIVE SECTION 104 SURFACE WATER HYDRAULIC SIMULATIONS	
Date 11/04/2022 File 12490 MicroDrainage Calcs Dow...	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)	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.	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	22.000#	0.080	275.0	0.022	5.00	0.0	0.600	o	450	Pipe/Conduit	
S1.001	15.000#	0.060	250.0	0.041	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.002	20.000#	0.070	285.7	0.041	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.003	15.000#	0.060	250.0	0.054	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.004	5.000#	0.020	250.0	0.081	0.00	0.0	0.600	o	600	Pipe/Conduit	
S2.000	3.000#	0.001	3000.0	0.000	5.00	0.0	0.600	o	300	Pipe/Conduit	
S1.005	5.000#	0.020	250.0	0.029	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.006	5.000#	0.040	125.0	0.000	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	50.00	5.30	46.000	0.022	0.0	0.0	0.0	1.22	194.2	2.9
S1.001	50.00	5.50	45.920	0.062	0.0	0.0	0.0	1.28	203.8	8.4
S1.002	50.00	5.77	45.860	0.103	0.0	0.0	0.0	1.20	190.5	13.9
S1.003	50.00	5.97	45.790	0.157	0.0	0.0	0.0	1.28	203.8	21.2
S1.004	50.00	6.02	45.580	0.238	0.0	0.0	0.0	1.54	434.2	32.2
S2.000	50.00	5.18	46.500	0.000	0.0	0.0	0.0	0.28	19.6	0.0
S1.005	50.00	6.08	45.560	0.266	0.0	0.0	0.0	1.54	434.2	36.1
S1.006	50.00	6.15	45.540	0.266	0.0	0.0	0.0	1.17	46.4	36.1

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)
SS100	47.800	1.800	Open Manhole	1350	S1.000	46.000	450				
SS101	47.800	1.880	Open Manhole	1500	S1.001	45.920	450	S1.000	45.920	450	
SS102	47.900	2.040	Open Manhole	1500	S1.002	45.860	450	S1.001	45.860	450	
SS103	48.000	2.210	Open Manhole	1500	S1.003	45.790	450	S1.002	45.790	450	
SS104	48.300	2.720	Open Manhole	1500	S1.004	45.580	600	S1.003	45.730	450	
STANK	48.300	1.800	Open Manhole	1800	S2.000	46.500	300				
SS105	48.300	2.740	Open Manhole	1800	S1.005	45.560	600	S1.004	45.560	600	
SS106 HB S	48.300	2.760	Open Manhole	2100	S1.006	45.540	225	S2.000	46.499	300	639
	48.500	3.000	Open Manhole	0		OUTFALL		S1.005	45.540	600	
								S1.006	45.500	225	
MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)					
SS100	103.906	48.406	103.906	48.406	Required						
SS101	147.469	48.672	147.469	48.672	Required						
SS102	177.750	48.672	177.750	48.672	Required						
SS103	201.656	48.141	201.656	48.141	Required						
SS104	232.469	47.078	232.469	47.078	Required						
STANK	240.834	36.791	240.834	36.791	Required						
SS105	232.469	37.383	232.469	37.383	Required						
SS106 HB	232.469	27.688	232.469	27.688	Required						
S	219.453	18.391			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	450	SS100	47.800	46.000	1.350	Open Manhole	1350
S1.001	o	450	SS101	47.800	45.920	1.430	Open Manhole	1500
S1.002	o	450	SS102	47.900	45.860	1.590	Open Manhole	1500
S1.003	o	450	SS103	48.000	45.790	1.760	Open Manhole	1500
S1.004	o	600	SS104	48.300	45.580	2.120	Open Manhole	1500
S2.000	o	300	STANK	48.300	46.500	1.500	Open Manhole	1800
S1.005	o	600	SS105	48.300	45.560	2.140	Open Manhole	1800
S1.006	o	225	SS106 HB	48.300	45.540	2.535	Open Manhole	2100

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	22.000#	275.0	SS101	47.800	45.920	1.430	Open Manhole	1500
S1.001	15.000#	250.0	SS102	47.900	45.860	1.590	Open Manhole	1500
S1.002	20.000#	285.7	SS103	48.000	45.790	1.760	Open Manhole	1500
S1.003	15.000#	250.0	SS104	48.300	45.730	2.120	Open Manhole	1500
S1.004	5.000#	250.0	SS105	48.300	45.560	2.140	Open Manhole	1800
S2.000	3.000#	3000.0	SS105	48.300	46.499	1.501	Open Manhole	1800
S1.005	5.000#	250.0	SS106 HB	48.300	45.540	2.160	Open Manhole	2100
S1.006	5.000#	125.0	S	48.500	45.500	2.775	Open Manhole	0

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Setting Out Information - Site Coordinates (Storm)

- Indicates pipe length does not match coordinates

PN	USMH Name	Dia/Len (mm)	Width (mm)	US Easting (m)	US Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Layout (North)
S1.000	SS100	1350		103.906 #	48.406 #	103.906	48.406	
S1.001	SS101	1500		147.469 #	48.672 #	147.469	48.672	
S1.002	SS102	1500		177.750 #	48.672 #	177.750	48.672	
S1.003	SS103	1500		201.656 #	48.141 #	201.656	48.141	
S1.004	SS104	1500		232.469 #	47.078 #	232.469	47.078	
S2.000	STANK	1800		240.834 #	36.791 #	240.834	36.791	
S1.005	SS105	1800		232.469 #	37.383 #	232.469	37.383	
S1.006	SS106 HB	2100		232.469 #	27.688 #	232.469	27.688	

- Indicates pipe length does not match coordinates

PN	DSMH Name	Dia/Len (mm)	Width (mm)	DS Easting (m)	DS Northing (m)	Layout (North)
S1.006	S	0		219.453 #	18.391 #	

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)
S1.006	S	48.500	45.500	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 Online Controls	1	Number of Time/Area Diagrams	0
		Number of Storage Structures	1
		Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	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: SS106 HB, DS/PN: S1.006, Volume (m³): 10.4

Unit Reference	MD-SHE-0098-5000-1500-5000
Design Head (m)	1.500
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	98
Invert Level (m)	45.540
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)	1.500	5.0	Kick-Flo®	0.878	3.9
Flush-Flo™	0.431	4.9	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	3.2	0.800	4.3	2.000	5.7	4.000	7.9	7.000	10.3
0.200	4.4	1.000	4.1	2.200	6.0	4.500	8.4	7.500	10.7
0.300	4.8	1.200	4.5	2.400	6.2	5.000	8.8	8.000	11.0
0.400	4.9	1.400	4.8	2.600	6.5	5.500	9.2	8.500	11.3
0.500	4.9	1.600	5.1	3.000	6.9	6.000	9.6	9.000	11.6
0.600	4.8	1.800	5.4	3.500	7.4	6.500	10.0	9.500	11.9

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Storage Structures for Storm

Tank or Pond Manhole: STANK, DS/PN: S2.000

Invert Level (m) 46.500

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	100.0	0.800	100.0	0.801	0.0

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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 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 0.359 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, 7200
 Return Period(s) (years) 1, 2, 30, 100
 Climate Change (%) 0, 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	SS100	60 Winter	1	+0%	30/15 Summer	100/480 Winter			46.095
S1.001	SS101	60 Winter	1	+0%	30/15 Summer	100/480 Winter			46.095
S1.002	SS102	60 Winter	1	+0%	30/15 Summer	100/480 Winter			46.095
S1.003	SS103	60 Winter	1	+0%	30/15 Summer	100/480 Winter			46.094
S1.004	SS104	60 Winter	1	+0%	2/30 Winter				46.093
S2.000	STANK	120 Winter	1	+0%	100/30 Summer				46.500
S1.005	SS105	60 Winter	1	+0%	2/30 Winter				46.093
S1.006	SS106 HB	60 Winter	1	+0%	1/15 Summer				46.092

PN	US/MH Name	Surcharged Flooded		Pipe		Status	Level Exceeded
		Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)		
S1.000	SS100	-0.355	0.000	0.01	1.4	OK	
S1.001	SS101	-0.275	0.000	0.02	3.6	OK	
S1.002	SS102	-0.215	0.000	0.03	5.3	OK	
S1.003	SS103	-0.146	0.000	0.04	6.7	OK	
S1.004	SS104	-0.087	0.000	0.04	8.0	OK	
S2.000	STANK	-0.300	0.000	0.00	0.0	OK	
S1.005	SS105	-0.067	0.000	0.03	7.4	OK	
S1.006	SS106 HB	0.327	0.000	0.16	4.9	SURCHARGED	