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3 Worsley Court Walkden Manchester M28 3NJ	Proposed SW RevC Marsh Lane New Mills	
Date 01/08/2017 File 30212 Proposed SW RevC...	Designed by SRG Checked by	
Micro Drainage Network 2017.1.2		

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	0.335	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	0	Maximum Backdrop Height (m)	0.000
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	0.339	4-8	0.121

Total Area Contributing (ha) = 0.460

Total Pipe Volume (m³) = 150.323

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
1.000	48.445	0.121	400.0	0.100	4.00	0.0	0.600	o	1050	Pipe/Conduit	
1.001	18.874	0.047	400.0	0.089	0.00	0.0	0.600	o	1050	Pipe/Conduit	
2.000	36.860	0.092	400.0	0.093	4.00	0.0	0.600	o	1050	Pipe/Conduit	
1.002	5.248	0.035	149.9	0.027	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	39.995	0.100	400.0	0.060	0.00	0.0	0.600	o	1050	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)
1.000	0.00	4.47	179.376	0.100	0.0	0.0	0.0	1.72	1486.6	0.0
1.001	0.00	4.65	179.255	0.189	0.0	0.0	0.0	1.72	1486.6	0.0
2.000	0.00	4.36	179.300	0.093	0.0	0.0	0.0	1.72	1486.6	0.0
1.002	0.00	4.74	179.208	0.309	0.0	0.0	0.0	1.07	42.4	0.0
1.003	0.00	5.12	177.379	0.369	0.0	0.0	0.0	1.72	1486.7	0.0

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PIPELINE SCHEDULES for Storm

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	1050	1	183.144	179.376	2.718	Open Manhole	2400
1.001	o	1050	2	182.212	179.255	1.907	Open Manhole	2400
2.000	o	1050	3	181.950	179.300	1.600	Open Manhole	2400
1.002	o	225	4	181.601	179.208	2.168	Open Manhole	2700
1.003	o	1050	4	181.500	177.379	3.071	Open Manhole	2400
1.004	o	1050	5	180.660	177.279	2.331	Open Manhole	2400
1.005	o	1050	6	180.200	177.248	1.902	Open Manhole	2400
1.006	o	150	7	179.500	177.206	2.144	Open Manhole	2700
1.007	o	150	8	179.300	177.140	2.010	Open Manhole	1350

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	48.445	400.0	2	182.212	179.255	1.907	Open Manhole	2400
1.001	18.874	400.0	4	181.601	179.208	1.343	Open Manhole	2700
2.000	36.860	400.0	4	181.601	179.208	1.343	Open Manhole	2700
1.002	5.248	149.9	4	181.500	179.173	2.102	Open Manhole	2400
1.003	39.995	400.0	5	180.660	177.279	2.331	Open Manhole	2400
1.004	12.260	395.5	6	180.200	177.248	1.902	Open Manhole	2400
1.005	16.631	400.0	7	179.500	177.206	1.244	Open Manhole	2700
1.006	5.000	75.0	8	179.300	177.140	2.010	Open Manhole	1350
1.007	9.555	30.0		178.830	176.821	1.859	Open Manhole	1350

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	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 Online Controls	2	Number of Storage Structures	0
		Number of Time/Area Diagrams	0
		Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.335
Return Period (years)	2	Profile Type	Winter
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

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<u>Synthetic Rainfall Details</u> Storm Duration (mins) 30		
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Online Controls for Storm

Hydro-Brake® Optimum Manhole: 4, DS/PN: 1.002, Volume (m³): 57.5

Unit Reference	MD-SHE-0100-6300-2300-6300
Design Head (m)	2.300
Design Flow (l/s)	6.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	100
Invert Level (m)	179.208
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)	2.300	6.3	Kick-Flo®	0.888	4.0
Flush-Flo™	0.431	5.1	Mean Flow over Head Range	-	4.9

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	3.3	1.200	4.6	3.000	7.1	7.000	10.6
0.200	4.6	1.400	5.0	3.500	7.7	7.500	11.0
0.300	5.0	1.600	5.3	4.000	8.2	8.000	11.3
0.400	5.1	1.800	5.6	4.500	8.6	8.500	11.7
0.500	5.1	2.000	5.9	5.000	9.1	9.000	12.0
0.600	5.0	2.200	6.2	5.500	9.5	9.500	12.3
0.800	4.5	2.400	6.4	6.000	9.9		
1.000	4.3	2.600	6.7	6.500	10.3		

Hydro-Brake® Optimum Manhole: 7, DS/PN: 1.006, Volume (m³): 25.3

Unit Reference	MD-SHE-0100-6200-2200-6200
Design Head (m)	2.200
Design Flow (l/s)	6.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	100
Invert Level (m)	177.206
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)	2.200	6.2	Kick-Flo®	0.894	4.1
Flush-Flo™	0.435	5.1	Mean Flow over Head Range	-	4.9

The hydrological calculations have been based on the Head/Discharge relationship for the

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Hydro-Brake® Optimum Manhole: 7, DS/PN: 1.006, Volume (m³): 25.3

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	3.3	1.200	4.7	3.000	7.2	7.000	10.7
0.200	4.6	1.400	5.0	3.500	7.7	7.500	11.1
0.300	5.0	1.600	5.3	4.000	8.2	8.000	11.4
0.400	5.1	1.800	5.6	4.500	8.7	8.500	11.8
0.500	5.1	2.000	5.9	5.000	9.1	9.000	12.1
0.600	5.0	2.200	6.2	5.500	9.6	9.500	12.4
0.800	4.6	2.400	6.5	6.000	10.0		
1.000	4.3	2.600	6.7	6.500	10.3		

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2 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 2 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.335
 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
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status ON
 DVD Status ON
 Inertia Status OFF

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720
 Return Period(s) (years) 2, 30, 100
 Climate Change (%) 0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	60 Winter	2	+0%	100/120 Winter				179.601
1.001	2	60 Winter	2	+0%	100/60 Winter				179.601
2.000	3	60 Winter	2	+0%	100/60 Winter				179.601
1.002	4	60 Winter	2	+0%	2/15 Summer				179.601
1.003	4	240 Winter	2	+0%	100/120 Winter				177.714
1.004	5	240 Winter	2	+0%	100/120 Winter				177.713
1.005	6	240 Winter	2	+0%	100/120 Winter				177.713
1.006	7	240 Winter	2	+0%	2/15 Summer				177.713
1.007	8	120 Winter	2	+0%					177.185

PN	US/MH Name	Surcharged Flooded		Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)					
1.000	1	-0.825	0.000	0.01		7.5	OK	
1.001	2	-0.704	0.000	0.01		7.4	OK	
2.000	3	-0.749	0.000	0.01		6.5	OK	
1.002	4	0.168	0.000	0.17		5.1	SURCHARGED	
1.003	4	-0.715	0.000	0.01		6.6	OK	
1.004	5	-0.616	0.000	0.01		5.9	OK	
1.005	6	-0.585	0.000	0.01		6.4	OK	

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged		Flooded		Pipe		Status	Level Exceeded
		Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)			
1.006	7	0.356	0.000	0.32		5.1		SURCHARGED	
1.007	8	-0.105	0.000	0.20		5.1		OK	

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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 * 10m ³ /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 2 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.335
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
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status ON
Inertia Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) SurchARGE	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	120 Winter	30	+0%	100/120 Winter				179.902
1.001	2	120 Winter	30	+0%	100/60 Winter				179.902
2.000	3	120 Winter	30	+0%	100/60 Winter				179.901
1.002	4	120 Winter	30	+0%	2/15 Summer				179.901
1.003	4	600 Winter	30	+0%	100/120 Winter				178.244
1.004	5	600 Winter	30	+0%	100/120 Winter				178.242
1.005	6	600 Winter	30	+0%	100/120 Winter				178.241
1.006	7	600 Winter	30	+0%	2/15 Summer				178.239
1.007	8	480 Winter	30	+0%					177.185

Surcharged Flooded					Pipe		Level	
PN	US/MH Name	Depth (m)	Volume (m ³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Status	Exceeded
1.000	1	-0.524	0.000	0.01		8.9	OK	
1.001	2	-0.403	0.000	0.01		7.1	OK	
2.000	3	-0.449	0.000	0.01		8.2	OK	
1.002	4	0.469	0.000	0.17		5.1	SURCHARGED	
1.003	4	-0.185	0.000	0.01		6.7	OK	
1.004	5	-0.087	0.000	0.01		5.8	OK	
1.005	6	-0.057	0.000	0.01		6.3	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Flooded		Flow / Overflow		Pipe Flow	Status	Level Exceeded
		Depth (m)	Volume (m³)	Cap.	(l/s)	(l/s)		
1.006	7	0.883	0.000	0.32		5.1	SURCHARGED	
1.007	8	-0.105	0.000	0.20		5.1	OK	

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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 * 10m ³ /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	2	Number of Storage Structures	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.335
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
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) SurchARGE	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	180 Winter	100	+30%	100/120 Winter				181.091
1.001	2	180 Winter	100	+30%	100/60 Winter				181.091
2.000	3	180 Winter	100	+30%	100/60 Winter				181.091
1.002	4	180 Winter	100	+30%	2/15 Summer				181.091
1.003	4	360 Winter	100	+30%	100/120 Winter				179.261
1.004	5	360 Winter	100	+30%	100/120 Winter				179.261
1.005	6	360 Winter	100	+30%	100/120 Winter				179.261
1.006	7	360 Winter	100	+30%	2/15 Summer				179.261
1.007	8	360 Winter	100	+30%					177.189

Surcharged Flooded					Pipe		Level
PN	US/MH Name	Depth (m)	Volume (m ³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Status
1.000	1	0.665	0.000	0.01		11.5	SURCHARGED
1.001	2	0.786	0.000	0.01		8.0	SURCHARGED
2.000	3	0.741	0.000	0.01		10.6	SURCHARGED
1.002	4	1.658	0.000	0.19		5.7	SURCHARGED
1.003	4	0.832	0.000	0.01		8.9	SURCHARGED
1.004	5	0.932	0.000	0.01		7.4	SURCHARGED
1.005	6	0.963	0.000	0.01		8.3	SURCHARGED

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100 year Return Period Summary of Critical Results by Maximum Level
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PN	US/MH Name	Surcharged Flooded		Flow / Overflow		Pipe Flow	Status	Level Exceeded
		Depth (m)	Volume (m³)	Cap.	(l/s)	(l/s)		
1.006	7	1.904	0.000	0.37		6.0	FLOOD RISK	
1.007	8	-0.101	0.000	0.23		6.0	OK	