

Curtins Consulting Ltd		Page 1
Curtins House Columbus Quay Riverside Drive Liverpool L3 4DB	Police and Crime Commissioner for Merseyside OCC	
Date 10.07.15 File 37770B - site wide drai...	Designed by A.O'Neill Checked by	
Micro Drainage	Network 2015.1	

FOUL SEWERAGE DESIGN

Design Criteria for Foul - Unit

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Add Flow / Climate Change (%)	0
Industrial Peak Flow Factor	0.00	Minimum Backdrop Height (m)	0.200
Calculation Method	EN 752	Maximum Backdrop Height (m)	1.500
Frequency Factor	0.50	Min Design Depth for Optimisation (m)	1.200
Domestic (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	0.75
Domestic Peak Flow Factor	6.00	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Foul - Unit

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design
1.000	43.806	0.109	402.8	0.000	0.0	2.7	0.060	o	100	
1.001	13.330	0.050	266.6	0.000	0.0	0.0	0.060	o	100	
1.002	16.296	0.258	63.1	0.000	0.0	0.0	0.060	o	100	
2.000	33.981	0.227	150.0	0.000	31.2	0.0	0.060	o	100	
1.003	80.562	0.537	150.0	0.000	5.2	0.0	0.060	o	100	
1.004	16.263	0.108	150.0	0.000	0.0	0.0	0.060	o	100	
1.005	82.362	0.549	150.0	0.000	5.2	0.0	0.060	o	100	
1.006	30.688	0.205	150.0	0.000	0.0	0.0	0.060	o	100	
3.000	8.857	0.111	80.0	0.000	4.6	0.0	0.060	o	100	
3.001	49.449	0.618	80.0	0.000	2.6	0.0	0.060	o	100	
3.002	40.150	0.502	80.0	0.000	5.2	0.0	0.060	o	100	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	24.500	0.000	2.7	0.0	0.0	65	0.50	0.46	3.6	2.7
1.001	24.391	0.000	2.7	0.0	0.0	56	0.60	0.57	4.5	2.7
1.002	24.341	0.000	2.7	0.0	0.0	36	1.06	1.24	9.7	2.7
2.000	24.575	0.000	0.0	31.2	0.0	47	0.76	0.78	6.1	2.8
1.003	24.083	0.000	2.7	36.4	0.0	76	0.89	0.78	6.1	5.7
1.004	23.546	0.000	2.7	36.4	0.0	76	0.89	0.78	6.1	5.7
1.005	23.438	0.000	2.7	41.6	0.0	79	0.89	0.78	6.1	5.9
1.006	22.889	0.000	2.7	41.6	0.0	79	0.89	0.78	6.1	5.9
3.000	24.550	0.000	0.0	4.6	0.0	24	0.75	1.09	8.6	1.1
3.001	24.439	0.000	0.0	7.2	0.0	27	0.80	1.09	8.6	1.3
3.002	23.821	0.000	0.0	12.4	0.0	31	0.86	1.09	8.6	1.8

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Micro Drainage						Network 2015.1				
Network Design Table for Foul - Unit										
PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design
4.000	29.781	0.199	150.0	0.000	23.3	0.0	0.060	o	150	
4.001	45.087	0.301	150.0	0.000	40.0	0.0	0.060	o	150	
4.002	46.357	0.523	88.6	0.000	0.0	0.0	0.060	o	150	
5.000	44.426	0.296	150.1	0.000	35.8	0.0	0.060	o	100	
5.001	36.949	0.247	149.6	0.000	8.5	0.0	0.060	o	100	
4.003	8.284	0.258	32.1	0.000	0.0	0.0	0.060	o	150	
3.003	11.600	0.145	80.0	0.000	0.0	4.5	0.060	o	150	
1.007	51.466	0.343	150.0	0.000	0.0	0.0	0.060	o	150	
1.008	38.470	0.256	150.0	0.000	0.0	0.0	0.060	o	150	
Network Results Table										
PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
4.000	24.550	0.000	0.0	23.3	0.0	37	0.71	1.02	18.0	2.4
4.001	24.351	0.000	0.0	63.3	0.0	48	0.82	1.02	18.0	4.0
4.002	24.051	0.000	0.0	63.3	0.0	41	1.01	1.35	23.8	4.0
5.000	24.120	0.000	0.0	35.8	0.0	49	0.78	0.78	6.1	3.0
5.001	23.824	0.000	0.0	44.3	0.0	52	0.80	0.78	6.2	3.3
4.003	23.527	0.000	0.0	107.6	0.0	36	1.59	2.29	40.5	5.2
3.003	23.269	0.000	4.5	120.0	0.0	66	1.34	1.42	25.1	10.0
1.007	22.634	0.000	7.2	161.6	0.0	97	1.12	1.02	18.0	13.6
1.008	22.291	0.000	7.2	161.6	0.0	97	1.12	1.02	18.0	13.6
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Micro Drainage		Network 2015.1



Manhole Schedules for Foul - Unit

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)
FW1	25.900	1.400	Open Manhole	1200	1.000	24.500	100				
FW2	25.900	1.509	Open Manhole	1200	1.001	24.391	100	1.000	24.391	100	
FW2	26.000	1.659	Open Manhole	1200	1.002	24.341	100	1.001	24.341	100	
FW3	25.700	1.125	Open Manhole	1200	2.000	24.575	100				
FW4	26.600	2.517	Open Manhole	1200	1.003	24.083	100	1.002	24.083	100	
								2.000	24.348	100	265
FW5	25.600	2.054	Open Manhole	1200	1.004	23.546	100	1.003	23.546	100	
FW6	25.600	2.162	Open Manhole	1200	1.005	23.438	100	1.004	23.438	100	
FW7	25.600	2.711	Open Manhole	1200	1.006	22.889	100	1.005	22.889	100	
FW8	25.600	1.050	Open Manhole	1200	3.000	24.550	100				
FW9	25.600	1.161	Open Manhole	1200	3.001	24.439	100	3.000	24.439	100	
FW10	25.600	1.779	Open Manhole	1200	3.002	23.821	100	3.001	23.821	100	
FW11	25.600	1.050	Open Manhole	1200	4.000	24.550	150				
FW12	25.600	1.249	Open Manhole	1200	4.001	24.351	150	4.000	24.351	150	
FW13	25.550	1.499	Open Manhole	1200	4.002	24.051	150	4.001	24.051	150	
FW14	25.480	1.360	Open Manhole	1200	5.000	24.120	100				
FW15	25.600	1.776	Open Manhole	1200	5.001	23.824	100	5.000	23.824	100	
FW16	25.480	1.953	Open Manhole	1200	4.003	23.527	150	4.002	23.528	150	
								5.001	23.577	100	
FW17	25.600	2.331	Open Manhole	1200	3.003	23.269	150	3.002	23.319	100	
								4.003	23.269	150	
FW18	25.600	2.966	Open Manhole	1200	1.007	22.634	150	1.006	22.684	100	
								3.003	23.124	150	490
FW19	25.300	3.009	Open Manhole	1200	1.008	22.291	150	1.007	22.291	150	
FWUU1502	25.100	3.065	Open Manhole	1350		OUTFALL		1.008	22.035	150	

Free Flowing Outfall Details for Foul - Unit

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D, L (mm)	W (mm)
1.008	FWUU1502	25.100	22.035	23.750	1350	0

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Riverside Drive
Liverpool L3 4DB

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File 37770B - site wide drai...

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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

Add Flow / Climate Change (%)

0

M5-60 (mm)

20.000

Minimum Backdrop Height (m)

0.200

Ratio R

0.400

Maximum Backdrop Height (m)

1.500

Maximum Rainfall (mm/hr)

50

Min Design Depth for Optimisation (m)

1.200

Maximum Time of Concentration (mins)

30

Min Vel for Auto Design only (m/s)

1.00

Foul Sewage (l/s/ha)

0.000

Min Slope for Optimisation (1:X)

500

Volumetric Runoff Coeff.

0.750

Designed with Level Soffits

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)	Auto Design
1.000	27.895	0.300	93.0	0.018	5.00	0.0	0.060	0	225	
1.001	65.826	0.275	239.4	0.064	0.00	0.0	0.060	0	225	
2.000	9.361	0.075	124.8	0.307	5.00	0.0	0.060	0	225	
2.001	30.094	0.150	200.0	0.051	0.00	0.0	0.060	0	225	
3.000	3.551	0.025	142.0	0.291	5.00	0.0	0.060	0	225	
3.001	10.623	0.055	193.1	0.000	0.00	0.0	0.060	0	225	
2.002	26.816	0.135	198.6	0.079	0.00	0.0	0.060	0	300	
2.003	28.559	0.230	124.2	0.025	0.00	0.0	0.060	0	300	
1.002	42.577	0.215	198.0	0.082	0.00	0.0	0.060	0	300	

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	50.00	5.27	24.275	0.018	0.0	0.0	0.0	1.70	67.7	2.4
1.001	50.00	6.33	23.975	0.082	0.0	0.0	0.0	1.04	41.2	11.1
2.000	50.00	5.11	24.000	0.000	20.0	0.0	0.0	1.46	58.0	20.0
2.001	50.00	5.55	23.925	0.051	20.0	0.0	0.0	1.14	45.3	26.9
3.000	50.00	5.04	24.950	0.000	20.0	0.0	0.0	1.36	54.2	20.0
3.001	50.00	5.20	24.075	0.000	20.0	0.0	0.0	1.16	46.1	20.0
2.002	50.00	5.87	23.700	0.130	40.0	0.0	0.0	1.37	97.1	57.6
2.003	50.00	6.14	23.565	0.155	40.0	0.0	0.0	1.76	124.2	61.0
1.002	50.00	6.85	23.335	0.319	40.0	0.0	0.0	1.38	97.2	83.2

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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)	Auto Design	
1.003	30.897	0.934	33.1	0.065	0.00	0.0	0.060	o	300		
4.000	13.595	0.070	194.2	0.394	5.00	0.0	0.060	o	225		
4.001	59.738	0.300	199.1	0.110	0.00	0.0	0.060	o	225		
4.002	47.006	0.235	200.0	0.054	0.00	0.0	0.060	o	225		
4.003	35.421	0.745	47.5	0.000	0.00	0.0	0.060	o	225		
5.000	60.830	0.500	121.7	0.240	5.00	0.0	0.060	o	300		
5.001	44.189	0.300	147.3	0.200	0.00	0.0	0.060	o	375		
4.004	54.370	0.420	129.5	0.023	0.00	0.0	0.060	o	375		
6.000	46.098	0.350	131.7	0.117	5.00	0.0	0.060	o	300		
6.001	58.282	1.550	37.6	0.121	0.00	0.0	0.060	o	300		
4.005	27.579	0.340	81.1	0.000	0.00	0.0	0.060	o	375		
1.004	7.346	0.040	183.7	0.000	0.00	0.0	0.060	o	450		
1.005	3.000	0.015	200.0	0.000	0.00	0.0	0.060	o	450		
1.006	56.032	0.005	11206.4	0.044	0.00	0.0	0.060	1 _ /	2000		
7.000	42.389	0.210	201.9	0.408	20.00	0.0	0.060	o	225		
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)	
1.003	50.00	7.00	23.120	0.384	40.0	0.0	0.0	3.49	246.4	92.0	
4.000	50.00	5.20	25.250	0.000	20.0	0.0	0.0	1.16	46.0	20.0	
4.001	50.00	6.07	24.305	0.110	20.0	0.0	0.0	1.14	45.4	34.9	
4.002	50.00	6.76	24.005	0.164	20.0	0.0	0.0	1.14	45.3	42.2	
4.003	50.00	7.00	23.770	0.164	20.0	0.0	0.0	2.42	96.0	42.2	
5.000	50.00	5.57	23.900	0.240	0.0	0.0	0.0	1.78	125.5	32.5	
5.001	50.00	5.97	23.325	0.440	0.0	0.0	0.0	1.85	204.2	59.6	
4.004	50.00	7.46	22.875	0.627	20.0	0.0	0.0	1.98	218.4	104.9	
6.000	50.00	5.45	24.425	0.117	0.0	0.0	0.0	1.70	120.4	15.8	
6.001	50.00	5.75	24.075	0.238	0.0	0.0	0.0	3.26	230.7	32.2	
4.005	50.00	7.64	22.450	0.865	20.0	0.0	0.0	2.52	278.3	137.1	
1.004	50.00	7.71	22.035	1.249	60.0	0.0	0.0	1.85	293.7	229.1	
1.005	50.00	7.74	21.995	1.249	60.0	0.0	0.0	1.77	280.9	229.1	
1.006	48.98	10.50	21.980	1.293	60.0	0.0	0.0	0.34	233.0	231.5	
7.000	33.02	20.62	24.925	0.408	0.0	0.0	0.0	1.13	45.1	36.5	
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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)	Auto Design
7.001	87.439	2.100	41.6	0.429	0.00	0.0	0.060	1 \ /	300	
1.007	8.627	0.040	215.7	0.000	0.00	0.0	0.060	0	450	
1.008	10.493	0.200	52.5	0.000	0.00	0.0	0.060	0	450	
1.009	32.691	0.150	217.9	0.000	0.00	0.0	0.060	0	225	

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)
7.001	32.73	20.92	24.350	0.837	0.0	0.0	0.0	4.87	876.3	74.2
1.007	32.64	21.01	21.825	2.130	60.0	0.0	0.0	1.70	270.1	248.3
1.008	32.60	21.06	21.785	2.130	60.0	0.0	0.0	3.53	561.6	248.3
1.009	50.00	5.50	21.585	0.000	21.6	0.0	0.0	1.09	43.3	21.6

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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)	
SW1	25.700	1.425	Open Manhole	1200	1.000	24.275	225				
SW2	25.600	1.625	Open Manhole	1200	1.001	23.975	225	1.000	23.975		
SW3	24.650	0.650	Open Manhole	1200	2.000	24.000	225				
SW4	25.550	1.625	Open Manhole	1200	2.001	23.925	225	2.000	23.925		
SW5	25.650	0.700	Open Manhole	1200	3.000	24.950	225				
SW6	25.500	1.425	Open Manhole	1200	3.001	24.075	225	3.000	24.925		
SW7	25.550	1.850	Open Manhole	1200	2.002	23.700	300	2.001	23.775		
								3.001	24.020		
SW8	25.550	1.985	Open Manhole	1200	2.003	23.565	300	2.002	23.565		
SW9	25.650	2.315	Open Manhole	1200	1.002	23.335	300	1.001	23.700		
								2.003	23.335		
SW10	25.400	2.280	Open Manhole	1200	1.003	23.120	300	1.002	23.120		
SW11	25.800	0.550	Open Manhole	1200	4.000	25.250	225				
SW12	25.730	1.425	Open Manhole	1200	4.001	24.305	225	4.000	25.180		
SW13	25.620	1.615	Open Manhole	1200	4.002	24.005	225	4.001	24.005		
SW14	25.500	1.730	Open Manhole	1200	4.003	23.770	225	4.002	23.770		
SW15	25.400	1.500	Open Manhole	1200	5.000	23.900	300				
SW16	25.570	2.245	Open Manhole	1350	5.001	23.325	375	5.000	23.400		
SW17	25.450	2.575	Open Manhole	1350	4.004	22.875	375	4.003	23.025		
								5.001	23.025		
SW18	25.550	1.125	Open Manhole	1200	6.000	24.425	300				
SW19	25.680	1.605	Open Manhole	1200	6.001	24.075	300	6.000	24.075		
SW20	25.500	3.050	Open Manhole	1350	4.005	22.450	375	4.004	22.455		
								6.001	22.525		
SW21	25.400	3.365	Open Manhole	1350	1.004	22.035	450	1.003	22.185		
								4.005	22.110		
SW22	25.450	3.455	Open Manhole	1350	1.005	21.995	450	1.004	21.995		
SW23	25.800	3.820	Open Manhole		1.006	21.980	2000	1.005	21.980		
SW24	25.400	0.475	Junction		7.000	24.925	225				
SW25	25.350	1.000	Junction		7.001	24.350	300	7.000	24.715		
SW26	25.300	3.475	Junction	0	1.007	21.825	450	1.006	21.975		
								7.001	22.250		
SW27	25.300	3.515	Open Manhole	1350	1.008	21.785	450	1.007	21.785		
SW28	25.300	3.715	Open Manhole	1350	1.009	21.585	225	1.008	21.585		
SWUU2501	25.030	3.595	Open Manhole	1800		OUTFALL		1.009	21.435		
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File 37770B - site wide drai...		Checked by																	
Micro Drainage		Network 2015.1																	
<u>Free Flowing Outfall Details for Storm</u> <table><tr><th>Outfall Pipe Number</th><th>Outfall Name</th><th>C. Level (m)</th><th>I. Level (m)</th><th>Min I. Level (m)</th><th>D,L (mm)</th><th>W (mm)</th></tr><tr><td>1.009</td><td>SWUU2501</td><td>25.030</td><td>21.435</td><td>21.000</td><td>1800</td><td>0</td></tr></table>						Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)	1.009	SWUU2501	25.030	21.435	21.000	1800	0
Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)													
1.009	SWUU2501	25.030	21.435	21.000	1800	0													
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Online Controls for Storm

Hydro-Brake Optimum® Manhole: SW4, DS/PN: 2.001, Volume (m³): 2.2

Unit Reference	MD-SCL-0186-2000-0500-2000
Design Head (m)	0.500
Design Flow (l/s)	20.0
Flush-Flo™	Calculated
Objective	Minimise blockage risk
Diameter (mm)	186
Invert Level (m)	23.925
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	19.9
Flush-Flo™	0.228	19.9
Kick-Flo®	0.390	17.7
Mean Flow over Head Range	-	14.6

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	7.2	1.200	30.2	3.000	47.0	7.000	70.7
0.200	18.7	1.400	32.6	3.500	50.6	7.500	73.2
0.300	19.4	1.600	34.7	4.000	54.0	8.000	75.7
0.400	17.9	1.800	36.7	4.500	57.2	8.500	78.0
0.500	19.9	2.000	38.6	5.000	60.2	9.000	80.3
0.600	21.7	2.200	40.5	5.500	62.6	9.500	82.5
0.800	24.9	2.400	42.2	6.000	65.4		
1.000	27.7	2.600	43.8	6.500	68.1		

Hydro-Brake Optimum® Manhole: SW6, DS/PN: 3.001, Volume (m³): 1.7

Unit Reference	MD-SCL-0186-2000-0500-2000
Design Head (m)	0.500
Design Flow (l/s)	20.0
Flush-Flo™	Calculated
Objective	Minimise blockage risk
Diameter (mm)	186
Invert Level (m)	24.925
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	19.9
Flush-Flo™	0.228	19.9

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Micro Drainage Network 2015.1			

Hydro-Brake Optimum® Manhole: SW6, DS/PN: 3.001, Volume (m³): 1.7

Control Points		Head (m)	Flow (l/s)
Kick-Flo®		0.390	17.7
Mean Flow over Head Range		-	14.6

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	7.2	1.200	30.2	3.000	47.0	7.000	70.7
0.200	18.7	1.400	32.6	3.500	50.6	7.500	73.2
0.300	19.4	1.600	34.7	4.000	54.0	8.000	75.7
0.400	17.9	1.800	36.7	4.500	57.2	8.500	78.0
0.500	19.9	2.000	38.6	5.000	60.2	9.000	80.3
0.600	21.7	2.200	40.5	5.500	62.6	9.500	82.5
0.800	24.9	2.400	42.2	6.000	65.4		
1.000	27.7	2.600	43.8	6.500	68.1		

Hydro-Brake Optimum® Manhole: SW12, DS/PN: 4.001, Volume (m³): 2.1

Unit Reference MD-SCL-0186-2000-0500-2000			
Design Head (m)		0.500	
Design Flow (l/s)		20.0	
Flush-Flo™		Calculated	
Objective		Minimise blockage risk	
Diameter (mm)		186	
Invert Level (m)		25.180	
Minimum Outlet Pipe Diameter (mm)		225	
Suggested Manhole Diameter (mm)		1200	

Control Points		Head (m)	Flow (l/s)
Design Point (Calculated)		0.500	19.9
Flush-Flo™		0.228	19.9
Kick-Flo®		0.390	17.7
Mean Flow over Head Range		-	14.6

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	7.2	0.800	24.9	2.000	38.6	4.000	54.0
0.200	18.7	1.000	27.7	2.200	40.5	4.500	57.2
0.300	19.4	1.200	30.2	2.400	42.2	5.000	60.2
0.400	17.9	1.400	32.6	2.600	43.8	5.500	62.6
0.500	19.9	1.600	34.7	3.000	47.0	6.000	65.4
0.600	21.7	1.800	36.7	3.500	50.6	6.500	68.1

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Curtins House Columbus Quay Riverside Drive Liverpool L3 4DB		Police and Crime Commissioner for Merseyside OCC																																																																									
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Micro Drainage		Network 2015.1																																																																									
<u>Hydro-Brake Optimum® Manhole: SW12, DS/PN: 4.001, Volume (m³): 2.1</u>																																																																											
<table><tr><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td></tr><tr><td>7.000</td><td>70.7</td><td>8.000</td><td>75.7</td><td>9.000</td><td>80.3</td><td></td><td></td></tr><tr><td>7.500</td><td>73.2</td><td>8.500</td><td>78.0</td><td>9.500</td><td>82.5</td><td></td><td></td></tr></table>				Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	7.000	70.7	8.000	75.7	9.000	80.3			7.500	73.2	8.500	78.0	9.500	82.5																																																		
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)																																																																				
7.000	70.7	8.000	75.7	9.000	80.3																																																																						
7.500	73.2	8.500	78.0	9.500	82.5																																																																						
<u>Hydro-Brake® Manhole: SW28, DS/PN: 1.009, Volume (m³): 6.8</u>																																																																											
Design Head (m) 2.100 Hydro-Brake® Type Md4 Invert Level (m) 21.585 Design Flow (l/s) 21.7 Diameter (mm) 138																																																																											
<table><tr><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td></tr><tr><td>0.100</td><td>3.7</td><td>1.200</td><td>16.3</td><td>3.000</td><td>25.7</td><td>7.000</td><td>39.3</td></tr><tr><td>0.200</td><td>11.4</td><td>1.400</td><td>17.6</td><td>3.500</td><td>27.8</td><td>7.500</td><td>40.6</td></tr><tr><td>0.300</td><td>14.1</td><td>1.600</td><td>18.8</td><td>4.000</td><td>29.7</td><td>8.000</td><td>42.0</td></tr><tr><td>0.400</td><td>12.5</td><td>1.800</td><td>19.9</td><td>4.500</td><td>31.5</td><td>8.500</td><td>43.3</td></tr><tr><td>0.500</td><td>11.7</td><td>2.000</td><td>21.0</td><td>5.000</td><td>33.2</td><td>9.000</td><td>44.5</td></tr><tr><td>0.600</td><td>11.9</td><td>2.200</td><td>22.0</td><td>5.500</td><td>34.8</td><td>9.500</td><td>45.7</td></tr><tr><td>0.800</td><td>13.3</td><td>2.400</td><td>23.0</td><td>6.000</td><td>36.4</td><td></td><td></td></tr><tr><td>1.000</td><td>14.8</td><td>2.600</td><td>23.9</td><td>6.500</td><td>37.8</td><td></td><td></td></tr></table>				Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	3.7	1.200	16.3	3.000	25.7	7.000	39.3	0.200	11.4	1.400	17.6	3.500	27.8	7.500	40.6	0.300	14.1	1.600	18.8	4.000	29.7	8.000	42.0	0.400	12.5	1.800	19.9	4.500	31.5	8.500	43.3	0.500	11.7	2.000	21.0	5.000	33.2	9.000	44.5	0.600	11.9	2.200	22.0	5.500	34.8	9.500	45.7	0.800	13.3	2.400	23.0	6.000	36.4			1.000	14.8	2.600	23.9	6.500	37.8		
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)																																																																				
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Micro Drainage	Network 2015.1																																																																	
Storage Structures for Storm Cellular Storage Manhole: SW3, DS/PN: 2.000 Invert Level (m) 24.175 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>1564.0</td><td>1564.0</td><td>0.300</td><td>1564.0</td><td>1611.3</td></tr></table> Cellular Storage Manhole: SW5, DS/PN: 3.000 Invert Level (m) 25.175 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>1074.0</td><td>1074.0</td><td>0.300</td><td>1074.0</td><td>1113.3</td></tr></table> Cellular Storage Manhole: SW11, DS/PN: 4.000 Invert Level (m) 25.250 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>1794.0</td><td>1794.0</td><td>0.300</td><td>1794.0</td><td>1844.8</td></tr></table> Cellular Storage Manhole: SW24, DS/PN: 7.000 Invert Level (m) 24.925 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>1532.0</td><td>1532.0</td><td>0.300</td><td>1532.0</td><td>1579.0</td></tr></table> Tank or Pond Manhole: SW26, DS/PN: 1.007 Invert Level (m) 21.980 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>21.0</td><td>1.000</td><td>115.0</td><td>2.000</td><td>288.0</td><td>3.000</td><td>555.0</td></tr></table>			Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	1564.0	1564.0	0.300	1564.0	1611.3	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	1074.0	1074.0	0.300	1074.0	1113.3	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	1794.0	1794.0	0.300	1794.0	1844.8	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	1532.0	1532.0	0.300	1532.0	1579.0	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	21.0	1.000	115.0	2.000	288.0	3.000	555.0
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)																																																													
0.000	1564.0	1564.0	0.300	1564.0	1611.3																																																													
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0.000	1532.0	1532.0	0.300	1532.0	1579.0																																																													
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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 Storage Structures 5 Number of Online Controls 4 Number of Time/Area Diagrams 0 Number of Offline Controls 0 Number of Real Time Controls 0																																																																																																																																																																																																																
Synthetic Rainfall Details Rainfall Model FSR Ratio R 0.400 Region England and Wales Cv (Summer) 0.750 M5-60 (mm) 20.000 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, 960, 1440, 2160, 2880 Return Period(s) (years) 1, 30, 100 Climate Change (%) 0, 20, 20																																																																																																																																																																																																																
<table><tr><th>PN</th><th>US/MH Name</th><th>Storm</th><th>Return Period</th><th>Climate Change</th><th>First (X) Surge</th><th>First (Y) Flood</th><th>First (Z) Overflow</th><th>Overflow Act.</th><th>Water Level (m)</th></tr><tr><td>1.000</td><td>SW1</td><td>15 Winter</td><td>100</td><td>+20%</td><td>100/15 Summer</td><td></td><td></td><td></td><td>24.766</td></tr><tr><td>1.001</td><td>SW2</td><td>15 Winter</td><td>100</td><td>+20%</td><td>30/15 Winter</td><td></td><td></td><td></td><td>24.755</td></tr><tr><td>2.000</td><td>SW3</td><td>600 Winter</td><td>100</td><td>+20%</td><td>100/15 Winter</td><td></td><td></td><td></td><td>24.340</td></tr><tr><td>2.001</td><td>SW4</td><td>15 Winter</td><td>100</td><td>+20%</td><td>1/15 Summer</td><td></td><td></td><td></td><td>24.364</td></tr><tr><td>3.000</td><td>SW5</td><td>30 Winter</td><td>100</td><td>+20%</td><td>1/15 Summer</td><td></td><td></td><td></td><td>25.233</td></tr><tr><td>3.001</td><td>SW6</td><td>60 Winter</td><td>100</td><td>+20%</td><td>1/15 Summer</td><td></td><td></td><td></td><td>25.230</td></tr><tr><td>2.002</td><td>SW7</td><td>15 Winter</td><td>100</td><td>+20%</td><td>30/15 Summer</td><td></td><td></td><td></td><td>24.817</td></tr><tr><td>2.003</td><td>SW8</td><td>15 Winter</td><td>100</td><td>+20%</td><td>30/15 Summer</td><td></td><td></td><td></td><td>24.726</td></tr><tr><td>1.002</td><td>SW9</td><td>15 Winter</td><td>100</td><td>+20%</td><td>30/15 Summer</td><td></td><td></td><td></td><td>24.597</td></tr><tr><td>1.003</td><td>SW10</td><td>240 Winter</td><td>100</td><td>+20%</td><td>30/15 Summer</td><td></td><td></td><td></td><td>24.474</td></tr><tr><td>4.000</td><td>SW11</td><td>240 Winter</td><td>100</td><td>+20%</td><td></td><td></td><td></td><td></td><td>25.354</td></tr><tr><td>4.001</td><td>SW12</td><td>15 Summer</td><td>100</td><td>+20%</td><td>1/15 Summer</td><td></td><td></td><td></td><td>25.579</td></tr><tr><td>4.002</td><td>SW13</td><td>15 Winter</td><td>100</td><td>+20%</td><td>30/15 Winter</td><td></td><td></td><td></td><td>25.070</td></tr><tr><td>4.003</td><td>SW14</td><td>15 Winter</td><td>100</td><td>+20%</td><td>30/15 Summer</td><td></td><td></td><td></td><td>24.915</td></tr><tr><td>5.000</td><td>SW15</td><td>15 Winter</td><td>100</td><td>+20%</td><td>30/15 Summer</td><td></td><td></td><td></td><td>25.386</td></tr><tr><td>5.001</td><td>SW16</td><td>15 Winter</td><td>100</td><td>+20%</td><td>30/15 Summer</td><td></td><td></td><td></td><td>25.062</td></tr><tr><td>4.004</td><td>SW17</td><td>15 Winter</td><td>100</td><td>+20%</td><td>30/15 Summer</td><td></td><td></td><td></td><td>24.824</td></tr><tr><td>6.000</td><td>SW18</td><td>15 Winter</td><td>100</td><td>+20%</td><td>100/15 Winter</td><td></td><td></td><td></td><td>24.787</td></tr><tr><td>6.001</td><td>SW19</td><td>15 Winter</td><td>100</td><td>+20%</td><td>100/15 Summer</td><td></td><td></td><td></td><td>24.670</td></tr></table>									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	SW1	15 Winter	100	+20%	100/15 Summer				24.766	1.001	SW2	15 Winter	100	+20%	30/15 Winter				24.755	2.000	SW3	600 Winter	100	+20%	100/15 Winter				24.340	2.001	SW4	15 Winter	100	+20%	1/15 Summer				24.364	3.000	SW5	30 Winter	100	+20%	1/15 Summer				25.233	3.001	SW6	60 Winter	100	+20%	1/15 Summer				25.230	2.002	SW7	15 Winter	100	+20%	30/15 Summer				24.817	2.003	SW8	15 Winter	100	+20%	30/15 Summer				24.726	1.002	SW9	15 Winter	100	+20%	30/15 Summer				24.597	1.003	SW10	240 Winter	100	+20%	30/15 Summer				24.474	4.000	SW11	240 Winter	100	+20%					25.354	4.001	SW12	15 Summer	100	+20%	1/15 Summer				25.579	4.002	SW13	15 Winter	100	+20%	30/15 Winter				25.070	4.003	SW14	15 Winter	100	+20%	30/15 Summer				24.915	5.000	SW15	15 Winter	100	+20%	30/15 Summer				25.386	5.001	SW16	15 Winter	100	+20%	30/15 Summer				25.062	4.004	SW17	15 Winter	100	+20%	30/15 Summer				24.824	6.000	SW18	15 Winter	100	+20%	100/15 Winter				24.787	6.001	SW19	15 Winter	100	+20%	100/15 Summer				24.670
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Curtins House Columbus Quay Riverside Drive Liverpool L3 4DB				Police and Crime Commissioner for Merseyside OCC				
Date 10.07.15 File 37770B - site wide drai...				Designed by A.O'Neill Checked by				
Micro Drainage				Network 2015.1				
<u>Summary of Critical Results by Maximum Level (Rank 1) for Storm</u>								
PN	US/MH Name	Depth (m)	Surcharged Volume (m³)	Flooded Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SW1	0.266	0.000	0.15		8.9	SURCHARGED	
1.001	SW2	0.555	0.000	0.88		34.3	SURCHARGED	
2.000	SW3	0.115	0.000	0.36		13.8	SURCHARGED	
2.001	SW4	0.214	0.000	0.46		18.9	SURCHARGED	
3.000	SW5	0.058	0.000	0.68		20.3	SURCHARGED	
3.001	SW6	0.930	0.000	0.60		19.9	FLOOD RISK	
2.002	SW7	0.817	0.000	0.80		66.4	SURCHARGED	
2.003	SW8	0.861	0.000	0.63		67.2	SURCHARGED	
1.002	SW9	0.963	0.000	1.37		119.8	SURCHARGED	
1.003	SW10	1.055	0.000	0.28		60.6	SURCHARGED	
4.000	SW11	-0.121	0.000	0.31		11.4	OK	
4.001	SW12	1.049	0.000	0.45		19.3	FLOOD RISK	
4.002	SW13	0.840	0.000	0.93		39.2	SURCHARGED	
4.003	SW14	0.920	0.000	0.45		39.0	SURCHARGED	
5.000	SW15	1.186	0.000	0.85		99.1	FLOOD RISK	
5.001	SW16	1.362	0.000	0.92		164.8	SURCHARGED	
4.004	SW17	1.574	0.000	0.97		189.5	SURCHARGED	
6.000	SW18	0.062	0.000	0.55		60.5	SURCHARGED	
6.001	SW19	0.295	0.000	0.54		113.6	SURCHARGED	
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