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Suite E8 Joseph's Well Hanover Walk Leeds LS3 1AB	19-157 - Land Off Mill Moor Road Meltham, Holmfirth	
Date 01/01/0001 File 19-157-001-RevB 100yr+3...	Designed by RBinnersley Checked by	
Elstree Computing Ltd	Network 2019.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for 19-157-PDS-EXPORT.SWS

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	1	PIMP (%)	100
M5-60 (mm)	19.800	Add Flow / Climate Change (%)	0
Ratio R	0.271	Minimum Backdrop Height (m)	1.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	3.000
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

Network Design Table for 19-157-PDS-EXPORT.SWS

- Indicates pipe length does not match coordinates
« - Indicates pipe capacity < flow

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	15.113	0.421	35.9	0.201	6.00	0.0	0.600	o	1200	Pipe/Conduit	
2.000	9.880	0.050	197.6	0.000	6.00	0.0	0.600	o	900	Pipe/Conduit	
2.001	19.999	0.556	36.0	0.000	0.00	0.0	0.600	o	1350	Pipe/Conduit	
1.001	15.175	0.529	28.7	0.000	0.00	0.0	0.600	o	1350	Pipe/Conduit	
1.002	24.365	2.366	10.3	0.013	0.00	0.0	0.600	o	150	Pipe/Conduit	
3.000	16.034	0.484	33.1	0.031	6.00	0.0	0.600	o	150	Pipe/Conduit	
3.001	10.402	1.040	10.0	0.029	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)
1.000	41.33	6.04	207.715	0.201	0.0	0.0	0.0	6.25	7072.8	22.5
2.000	41.23	6.07	208.200	0.000	0.0	0.0	0.0	2.23	1415.8	0.0
2.001	41.10	6.12	207.700	0.000	0.0	0.0	0.0	6.72	9611.8	0.0
1.001	41.00	6.16	207.144	0.201	0.0	0.0	0.0	7.52	10765.3	22.5
1.002	40.66	6.29	206.615	0.214	0.0	0.0	0.0	3.16	55.8	23.6
3.000	41.02	6.15	205.773	0.031	0.0	0.0	0.0	1.76	31.0	3.4
3.001	40.87	6.21	205.289	0.060	0.0	0.0	0.0	3.20	56.6	6.6

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Network Design Table for 19-157-PDS-EXPORT.SWS

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
1.003	7.371	0.680	10.8	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.004	13.019	1.267	10.3	0.113	0.00	0.0	0.600	o	150	Pipe/Conduit	
4.000	21.000#	0.021	1000.0	0.000	6.00	0.0	0.030	o	1950	Pipe/Conduit	
5.000	18.000	0.018	1000.0	0.051	6.00	0.0	0.030	o	1950	Pipe/Conduit	
4.001	8.776	0.009	975.1	0.021	0.00	0.0	0.600	o	900	Pipe/Conduit	
1.005	2.476	0.112	22.1	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.006	6.275	0.476	13.2	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.007	33.057	0.395	83.7	0.013	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.008	30.590	3.059	10.0	0.019	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.009	13.275	1.230	10.8	0.029	0.00	0.0	0.600	o	150	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)
1.003	40.55	6.33	204.249	0.274	0.0	0.0	0.0	3.08	54.4	30.1
1.004	40.37	6.39	203.569	0.387	0.0	0.0	0.0	3.16	55.9	42.3
4.000	40.94	6.18	201.182	0.000	0.0	0.0	0.0	1.94	5805.4	0.0
5.000	41.01	6.15	201.179	0.051	0.0	0.0	0.0	1.94	5805.4	5.7
4.001	40.54	6.33	201.161	0.072	0.0	0.0	0.0	1.00	633.0	7.9
1.005	40.32	6.41	201.102	0.459	0.0	0.0	0.0	2.15	38.0<	50.1
1.006	40.22	6.45	200.990	0.459	0.0	0.0	0.0	2.79	49.3<	50.1
1.007	38.96	6.95	200.514	0.472	0.0	0.0	0.0	1.10	19.4<	50.1
1.008	38.58	7.11	200.119	0.491	0.0	0.0	0.0	3.20	56.6	51.3
1.009	38.41	7.18	195.480	0.520	0.0	0.0	0.0	3.08	54.5	54.1

Free Flowing Outfall Details for 19-157-PDS-EXPORT.SWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.009	16	195.100	194.250	0.000	1200	0

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Simulation Criteria for 19-157-PDS-EXPORT.SWS

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 Storage Structures	0
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.324		

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Online Controls for 19-157-PDS-EXPORT.SWS

Hydro-Brake® Optimum Manhole: EXGS5, DS/PN: 1.002, Volume (m³): 33.3

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Unit Reference MD-SHE-0084-4200-2000-4200
Design Head (m) 2.000
Design Flow (l/s) 4.2
  Flush-Flo™ Calculated
Objective Minimise upstream storage
Application Surface
Sump Available Yes
Diameter (mm) 84
Invert Level (m) 206.615
Minimum Outlet Pipe Diameter (mm) 100
Suggested Manhole Diameter (mm) 1200

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Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	4.2
Flush-Flo™	0.363	3.3
Kick-Flo®	0.745	2.7
Mean Flow over Head Range	-	3.3

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)						
0.100	2.5	1.200	3.3	3.000	5.1	7.000	7.6
0.200	3.1	1.400	3.6	3.500	5.4	7.500	7.8
0.300	3.3	1.600	3.8	4.000	5.8	8.000	8.0
0.400	3.3	1.800	4.0	4.500	6.1	8.500	8.3
0.500	3.3	2.000	4.2	5.000	6.4	9.000	8.5
0.600	3.1	2.200	4.4	5.500	6.7	9.500	8.7
0.800	2.8	2.400	4.6	6.000	7.0		
1.000	3.0	2.600	4.7	6.500	7.3		

Hydro-Brake® Optimum Manhole: 10, DS/PN: 1.005, Volume (m³): 15.6

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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) 201.102
Minimum Outlet Pipe Diameter (mm) 150
Suggested Manhole Diameter (mm) 1200

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Hydro-Brake® Optimum Manhole: 10, DS/PN: 1.005, Volume (m³): 15.6

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	5.0
Flush-Flo™	0.431	4.9
Kick-Flo®	0.878	3.9
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)						
0.100	3.2	1.200	4.5	3.000	6.9	7.000	10.3
0.200	4.4	1.400	4.8	3.500	7.4	7.500	10.7
0.300	4.8	1.600	5.1	4.000	7.9	8.000	11.0
0.400	4.9	1.800	5.4	4.500	8.4	8.500	11.3
0.500	4.9	2.000	5.7	5.000	8.8	9.000	11.6
0.600	4.8	2.200	6.0	5.500	9.2	9.500	11.9
0.800	4.3	2.400	6.2	6.000	9.6		
1.000	4.1	2.600	6.5	6.500	10.0		

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 19-157-PDS-EXPORT.SWS

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap. (l/s)	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	EXGS1	208.927	0.012	0.000	0.01		23.0	SURCHARGED	
2.000	EXGS2	208.927	-0.173	0.000	0.00		0.3	OK	
2.001	EXGS3	208.927	-0.123	0.000	0.00		1.8	OK	
1.001	EXGS4	208.927	0.433	0.000	0.00		8.8	SURCHARGED	
1.002	EXGS5	208.927	2.162	0.000	0.08		4.5	SURCHARGED	
3.000	6	205.848	-0.075	0.000	0.50		14.3	OK	
3.001	7	205.547	0.108	0.000	0.55		27.9	SURCHARGED	
1.003	8	205.312	0.913	0.000	0.72		33.6	SURCHARGED	
1.004	9	205.118	1.399	0.000	1.44		73.1	SURCHARGED	
4.000	12	204.679	1.547	0.000	0.00		1.9	FLOOD RISK	
5.000	18	204.625	1.496	4.958	0.00		5.9	FLOOD	3
4.001	17	204.678	2.617	0.000	0.02		6.1	SURCHARGED	
1.005	10	204.659	3.407	0.000	0.36		7.4	SURCHARGED	
1.006	11	201.033	-0.107	0.000	0.18		7.4	OK	
1.007	13	200.600	-0.064	0.000	0.62		11.7	OK	
1.008	14	200.185	-0.084	0.000	0.40		21.8	OK	
1.009	15	195.577	-0.053	0.000	0.75		37.2	OK	