

Paul Waite Associates Ltd		Page 1
Summit House, Riparian Way The Crossings, Cross Hills Keighley, BD20 7BW	MSM Microdrainage Calcs Hanson Close	
Date 02/12/2024 File 24136-PWA-00-XX-CA-C-10...	Designed by JLE Checked by LS	
Innovyze	Network 2020.1.3	

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)	100	PIMP (%)	100
M5-60 (mm)	20.000	Add Flow / Climate Change (%)	0
Ratio R	0.300	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

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.445	4-8	0.191

Total Area Contributing (ha) = 0.636

Total Pipe Volume (m³) = 21.297

Network Design Table for Storm

« - 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	43.000	0.795	54.1	0.077	4.00	0.0	0.600	o	225	Pipe/Conduit	🔴
1.001	20.000	0.120	166.7	0.044	0.00	0.0	0.600	o	225	Pipe/Conduit	🔴
2.000	20.000	0.560	35.7	0.047	4.00	0.0	0.600	o	150	Pipe/Conduit	🔴
1.002	39.000	0.195	200.0	0.034	0.00	0.0	0.600	o	300	Pipe/Conduit	🔴
1.003	16.950	0.170	99.7	0.008	0.00	0.0	0.600	o	300	Pipe/Conduit	🔴
3.000	7.000	0.315	22.2	0.092	4.00	0.0	0.600	o	150	Pipe/Conduit	🔴
1.004	1.500	0.010	150.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	🔴
1.005	1.800	0.120	15.0	0.000	0.00	0.0	0.600	o	450	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	50.00	4.40	86.165	0.077	0.0	0.0	0.0	1.78	70.9	10.4
1.001	50.00	4.73	85.370	0.121	0.0	0.0	0.0	1.01	40.2	16.4
2.000	50.00	4.20	85.885	0.047	0.0	0.0	0.0	1.69	29.9	6.4
1.002	50.00	5.32	85.175	0.202	0.0	0.0	0.0	1.11	78.3	27.4
1.003	50.00	5.50	84.980	0.210	0.0	0.0	0.0	1.57	111.3	28.4
3.000	50.00	4.05	85.275	0.092	0.0	0.0	0.0	2.15	37.9	12.5
1.004	50.00	5.51	84.660	0.302	0.0	0.0	0.0	1.66	263.6	40.9
1.005	50.00	5.52	84.650	0.302	0.0	0.0	0.0	5.27	838.2	40.9

Paul Waite Associates Ltd		Page 3
Summit House, Riparian Way The Crossings, Cross Hills Keighley, BD20 7BW	MSM Microdrainage Calcs Hanson Close	
Date 02/12/2024 File 24136-PWA-00-XX-CA-C-10...	Designed by JLE Checked by LS	
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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)	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
SW.01	87.590	1.425	Open Manhole	1200	1.000	86.165	225			
SW.02	87.460	2.090	Open Manhole	1200	1.001	85.370	225	1.000	85.370	225
SW.03	87.235	1.350	Open Manhole	450	2.000	85.885	150			
SW.04	87.310	2.135	Open Manhole	1500	1.002	85.175	300	1.001	85.250	225
								2.000	85.325	150
SW.05	87.450	2.470	Open Manhole	1500	1.003	84.980	300	1.002	84.980	300
SW.06	87.335	2.060	Open Manhole	1500	3.000	85.275	150			
SW.07	87.335	2.675	Open Manhole	1500	1.004	84.660	450	1.003	84.810	300
								3.000	84.960	150
INTERCEPTOR	87.335	2.685	Junction		1.005	84.650	450	1.004	84.650	450
SW.08	87.700	1.125	Open Manhole	1200	4.000	86.575	225			
SW.09	87.670	1.425	Open Manhole	1200	4.001	86.245	225	4.000	86.245	225
SW.10	87.180	1.785	Open Manhole	1200	5.000	85.395	150			
SW.11	87.205	2.675	Open Manhole	1800	1.006	84.530	450	1.005	84.530	450
								4.001	84.755	225
								5.000	84.830	150
PERFORATED PIPE	87.120	2.605	Junction		1.007	84.515	450	1.006	84.515	450
TANK	87.235	2.775	Junction		1.008	84.460	450	1.007	84.460	450
SW.12	87.625	1.425	Open Manhole	1200	6.000	86.200	225			
SW.13	87.615	1.710	Open Manhole	1200	6.001	85.905	225	6.000	85.905	225
SW.14	87.160	0.575	Open Manhole	450	7.000	86.585	225			
SW.15	87.225	0.815	Open Manhole	1200	7.001	86.410	225	7.000	86.410	225
SW.16	87.235	1.175	Open Manhole	1200	7.002	86.060	225	7.001	86.060	225
SW.17	87.230	2.790	Open Manhole	1350	1.009	84.440	150	1.008	84.440	450
								6.001	84.665	225
								7.002	85.260	225
	84.970	0.690	Open Manhole	0		OUTFALL		1.009	84.280	150

300
895

No coordinates have been specified, layout information cannot be produced.

Paul Waite Associates Ltd		Page 4
Summit House, Riparian Way The Crossings, Cross Hills Keighley, BD20 7BW	MSM Microdrainage Calcs Hanson Close	
Date 02/12/2024 File 24136-PWA-00-XX-CA-C-10...	Designed by JLE Checked by LS	
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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	225	SW.01	87.590	86.165	1.200	Open Manhole	1200
1.001	o	225	SW.02	87.460	85.370	1.865	Open Manhole	1200
2.000	o	150	SW.03	87.235	85.885	1.200	Open Manhole	450
1.002	o	300	SW.04	87.310	85.175	1.835	Open Manhole	1500
1.003	o	300	SW.05	87.450	84.980	2.170	Open Manhole	1500
3.000	o	150	SW.06	87.335	85.275	1.910	Open Manhole	1500
1.004	o	450	SW.07	87.335	84.660	2.225	Open Manhole	1500
1.005	o	450	INTERCEPTOR	87.335	84.650	2.235	Junction	
4.000	o	225	SW.08	87.700	86.575	0.900	Open Manhole	1200
4.001	o	225	SW.09	87.670	86.245	1.200	Open Manhole	1200
5.000	o	150	SW.10	87.180	85.395	1.635	Open Manhole	1200
1.006	o	450	SW.11	87.205	84.530	2.225	Open Manhole	1800
1.007	o	450	PERFORATED PIPE	87.120	84.515	2.155	Junction	
1.008	o	450	TANK	87.235	84.460	2.325	Junction	
6.000	o	225	SW.12	87.625	86.200	1.200	Open Manhole	1200
6.001	o	225	SW.13	87.615	85.905	1.485	Open Manhole	1200
7.000	o	225	SW.14	87.160	86.585	0.350	Open Manhole	450
7.001	o	225	SW.15	87.225	86.410	0.590	Open Manhole	1200
7.002	o	225	SW.16	87.235	86.060	0.950	Open Manhole	1200
1.009	o	150	SW.17	87.230	84.440	2.640	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	43.000	54.1	SW.02	87.460	85.370	1.865	Open Manhole	1200
1.001	20.000	166.7	SW.04	87.310	85.250	1.835	Open Manhole	1500
2.000	20.000	35.7	SW.04	87.310	85.325	1.835	Open Manhole	1500
1.002	39.000	200.0	SW.05	87.450	84.980	2.170	Open Manhole	1500
1.003	16.950	99.7	SW.07	87.335	84.810	2.225	Open Manhole	1500
3.000	7.000	22.2	SW.07	87.335	84.960	2.225	Open Manhole	1500
1.004	1.500	150.0	INTERCEPTOR	87.335	84.650	2.235	Junction	
1.005	1.800	15.0	SW.11	87.205	84.530	2.225	Open Manhole	1800
4.000	46.500	140.9	SW.09	87.670	86.245	1.200	Open Manhole	1200
4.001	31.500	21.1	SW.11	87.205	84.755	2.225	Open Manhole	1800
5.000	10.000	17.7	SW.11	87.205	84.830	2.225	Open Manhole	1800
1.006	4.000	266.7	PERFORATED PIPE	87.120	84.515	2.155	Junction	
1.007	19.000	345.5	TANK	87.235	84.460	2.325	Junction	
1.008	5.500	275.0	SW.17	87.230	84.440	2.340	Open Manhole	1350
6.000	50.000	169.5	SW.13	87.615	85.905	1.485	Open Manhole	1200
6.001	38.000	30.6	SW.17	87.230	84.665	2.340	Open Manhole	1350
7.000	17.400	99.4	SW.15	87.225	86.410	0.590	Open Manhole	1200
7.001	35.000	100.0	SW.16	87.235	86.060	0.950	Open Manhole	1200
7.002	8.000	10.0	SW.17	87.230	85.260	1.745	Open Manhole	1350
1.009	7.000	43.8		84.970	84.280	0.540	Open Manhole	0

Paul Waite Associates Ltd		Page 6
Summit House, Riparian Way The Crossings, Cross Hills Keighley, BD20 7BW	MSM Microdrainage Calcs Hanson Close	
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Online Controls for Storm

Hydro-Brake® Optimum Manhole: SW.17, DS/PN: 1.009, Volume (m³): 6.5

Unit Reference	MD-SHE-0122-8200-1750-8200	Sump Available	Yes
Design Head (m)	1.750	Diameter (mm)	122
Design Flow (l/s)	8.2	Invert Level (m)	84.440
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	150
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.750	8.2	Kick-Flo®	1.058	6.5
Flush-Flo™	0.514	8.2	Mean Flow over Head Range	-	7.2

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	4.3	0.800	7.8	2.000	8.7	4.000	12.1	7.000	15.8
0.200	7.1	1.000	6.9	2.200	9.1	4.500	12.8	7.500	16.4
0.300	7.8	1.200	6.9	2.400	9.5	5.000	13.5	8.000	16.9
0.400	8.1	1.400	7.4	2.600	9.9	5.500	14.1	8.500	17.4
0.500	8.2	1.600	7.9	3.000	10.6	6.000	14.7	9.000	17.8
0.600	8.1	1.800	8.3	3.500	11.4	6.500	15.3	9.500	18.3

Paul Waite Associates Ltd		Page 7
Summit House, Riparian Way The Crossings, Cross Hills Keighley, BD20 7BW	MSM Microdrainage Calcs Hanson Close	
Date 02/12/2024 File 24136-PWA-00-XX-CA-C-10...	Designed by JLE Checked by LS	
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Storage Structures for Storm

Cellular Storage Manhole: TANK, DS/PN: 1.008

Invert Level (m) 85.060 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	266.0	0.0	1.199	266.0	0.0	1.200	0.0	0.0

Manhole Headloss for Storm

PN	US/MH Name	US/MH Headloss
1.000	SW.01	0.500
1.001	SW.02	0.500
2.000	SW.03	0.500
1.002	SW.04	0.500
1.003	SW.05	0.500
3.000	SW.06	0.500
1.004	SW.07	0.500
1.005	INTERCEPTOR	0.000
4.000	SW.08	0.500
4.001	SW.09	0.500
5.000	SW.10	0.500
1.006	SW.11	0.500
1.007	PERFORATED PIPE	0.000
1.008	TANK	0.000
6.000	SW.12	0.500
6.001	SW.13	0.500
7.000	SW.14	0.500
7.001	SW.15	0.500
7.002	SW.16	0.500
1.009	SW.17	0.500

for Storm

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m ³ /ha Storage	0.000
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 Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details						
Rainfall Model			FSR M5-60 (mm)	20.000	Cv (Summer)	0.750
Region	England and Wales		Ratio R	0.300	Cv (Winter)	0.840

Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
n Period(s) (years)	1, 30, 100
Climate Change (%)	0, 30, 30

FN	US/MH	Event						US/CL	Water Level	Surcharged	Flooded	Pipe	Status
	Name							(m)	(m)	Depth (m)	Volume (m³)	Flow / Cap.	
1.000		SW.01	15 minute	30 year	Winter	I+30%	87.590	86.308	-0.082	0.000	0.49	32.8	OK
1.001		SW.02	15 minute	30 year	Winter	I+30%	87.460	86.133	0.538	0.000	1.33	48.4	SURCHARGED
2.000		SW.03	15 minute	30 year	Summer	I+30%	87.235	86.209	0.174	0.000	0.69	19.4	SURCHARGED
1.002		SW.04	60 minute	30 year	Winter	I+30%	87.310	85.946	0.471	0.000	0.61	44.1	SURCHARGED
1.003		SW.05	240 minute	30 year	Winter	I+30%	87.450	85.870	0.590	0.000	0.19	17.9	SURCHARGED
3.000		SW.06	15 minute	30 year	Summer	I+30%	87.335	85.995	0.570	0.000	1.16	37.4	SURCHARGED
1.004		SW.07	240 minute	30 year	Winter	I+30%	87.335	85.868	0.758	0.000	0.20	25.6	SURCHARGED
1.005	INTERCEPTOR		15 minute	30 year	Summer	I+30%	87.335	85.100	0.000	0.000	0.57	110.8	SURCHARGED*
4.000		SW.08	15 minute	30 year	Winter	I+30%	87.700	86.955	0.155	0.000	1.18	49.1	SURCHARGED
4.001		SW.09	15 minute	30 year	Winter	I+30%	87.670	86.353	-0.117	0.000	0.47	49.5	OK
5.000		SW.10	240 minute	30 year	Winter	I+30%	87.180	85.869	0.324	0.000	0.11	4.3	SURCHARGED
1.006		SW.11	240 minute	30 year	Winter	I+30%	87.205	85.867	0.887	0.000	0.34	40.0	SURCHARGED
1.007	PERFORATED PIPE		15 minute	30 year	Summer	I+30%	87.120	84.965	0.000	0.000	1.01	170.9	SURCHARGED*
1.008	TANK		240 minute	30 year	Winter	I+30%	87.235	85.865	0.955	0.000	0.05	7.9	SURCHARGED*
6.000		SW.12	15 minute	30 year	Winter	I+30%	87.625	86.582	0.157	0.000	1.19	45.6	SURCHARGED
6.001		SW.13	15 minute	30 year	Winter	I+30%	87.615	86.019	-0.111	0.000	0.51	45.7	OK
7.000		SW.14	15 minute	30 year	Winter	I+30%	87.160	86.699	-0.111	0.000	0.51	23.7	OK
7.001		SW.15	15 minute	30 year	Winter	I+30%	87.225	86.520	-0.115	0.000	0.48	23.4	OK
7.002		SW.16	15 minute	30 year	Winter	I+30%	87.235	86.126	-0.159	0.000	0.18	23.3	OK
1.009		SW.17	240 minute	30 year	Winter	I+30%	87.230	85.877	1.287	0.000	0.36	8.2	SURCHARGED

