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1 The Grove Felpham West Sussex PO22 7EY	Woodcroft SW Design	
Date 07/08/2019 12:43 File FC2789 Woodcroft- sw de...	Designed by mh 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)	100	PIMP (%)	100
M5-60 (mm)	19.400	Add Flow / Climate Change (%)	0
Ratio R	0.350	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 Inverts

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
1.000	17.600	0.176	100.0	0.050	1.00	0.0	0.600	o	150	Pipe/Conduit
1.001	21.400	1.199	17.8	0.019	0.00	0.0	0.600	o	150	Pipe/Conduit
1.002	19.000	0.934	20.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit
2.000	29.200	0.584	50.0	0.089	1.00	0.0	0.600	o	225	Pipe/Conduit
1.003	28.700	0.287	100.0	0.038	0.00	0.0	0.600	o	300	Pipe/Conduit
1.004	9.300	0.093	100.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit
1.005	39.500	0.040	987.5	0.152	0.00	0.0	0.600	o	1200	Pipe/Conduit
3.000	1.000	0.004	250.0	0.000	1.00	0.0	0.600	o	225	Pipe/Conduit
3.001	13.500	0.054	250.0	0.000	0.00	0.0	0.600	ooo	225	Triple Pipe
3.002	5.000	0.005	1000.0	0.000	0.00	0.0	0.600	o	1000	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)
1.000	50.00	1.29	67.100	0.050	0.0	0.0	0.0	1.00	17.8	6.8
1.001	50.00	1.44	66.924	0.069	0.0	0.0	0.0	2.40	42.3	9.3
1.002	50.00	1.55	65.650	0.069	0.0	0.0	0.0	2.91	115.9	9.3
2.000	50.00	1.26	65.300	0.089	0.0	0.0	0.0	1.85	73.7	12.1
1.003	50.00	1.85	64.641	0.196	0.0	0.0	0.0	1.57	111.1	26.5
1.004	50.00	1.95	64.354	0.196	0.0	0.0	0.0	1.57	111.1	26.5
1.005	50.00	2.51	62.910	0.348	0.0	0.0	0.0	1.18	1336.9	47.1
3.000	50.00	1.02	62.933	0.000	0.0	0.0	0.0	0.82	32.7	0.0
3.001	50.00	1.29	62.929	0.000	0.0	0.0	0.0	0.82	98.1	0.0
3.002	50.00	1.37	62.875	0.000	0.0	0.0	0.0	1.05	823.9	0.0

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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)	Section Type
1.006	10.000	0.010	1000.0	0.000	0.00	0.0	0.600	o	1200	Pipe/Conduit
1.007	14.400	0.014	1028.6	0.000	0.00	0.0	0.600	o	1200	Pipe/Conduit
4.000	29.100	1.529	19.0	0.054	1.00	0.0	0.600	o	225	Pipe/Conduit
1.008	38.200	0.038	1005.3	0.095	0.00	0.0	0.600	o	1200	Pipe/Conduit
1.009	56.400	0.056	1007.1	0.150	0.00	0.0	0.600	o	1000	Pipe/Conduit
1.010	6.300	0.064	98.4	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit
1.011	17.300	0.177	97.7	0.000	0.00	0.0	0.600	o	300	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)
1.006	50.00	2.65	62.870	0.348	0.0	0.0	0.0	1.17	1328.4	47.1
1.007	50.00	2.86	62.860	0.348	0.0	0.0	0.0	1.16	1309.7	47.1
4.000	50.00	1.16	65.250	0.054	0.0	0.0	0.0	3.01	119.8	7.3
1.008	50.00	3.40	62.846	0.497	0.0	0.0	0.0	1.17	1324.9	67.3
1.009	50.00	4.30	62.808	0.647	0.0	0.0	0.0	1.05	820.9	87.6
1.010	50.00	4.37	62.752	0.647	0.0	0.0	0.0	1.58	112.0	87.6
1.011	50.00	4.55	62.688	0.647	0.0	0.0	0.0	1.59	112.4	87.6

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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)	Backdrop (mm)
SWS13	68.510	1.410	Open Manhole	600	1.000	67.100	150				
SWS12	68.510	1.586	Open Manhole	600	1.001	66.924	150	1.000	66.924	150	
SWS11	67.180	1.530	Open Manhole	600	1.002	65.650	225	1.001	65.725	150	
SWS10.1	66.800	1.500	Open Manhole	600	2.000	65.300	225				
SWS10	66.290	1.649	Open Manhole	600	1.003	64.641	300	1.002	64.716	225	
								2.000	64.716	225	
SWS9	65.750	1.396	Open Manhole	600	1.004	64.354	300	1.003	64.354	300	
SWS8	65.650	2.740	Open Manhole	2200	1.005	62.910	1200	1.004	64.261	300	451
Dummy	66.100	3.167	Open Manhole	1200	3.000	62.933	225				
SW7.3	66.100	3.171	Open Manhole	1500	3.001	62.929	225	3.000	62.929	225	
SW7.1	65.800	2.925	Open Manhole	1900	3.002	62.875	1000	3.001	62.875	225	
SWS7	65.650	2.780	Open Manhole	2200	1.006	62.870	1200	1.005	62.870	1200	
								3.002	62.870	1000	
SWS6	65.650	2.790	Open Manhole	2200	1.007	62.860	1200	1.006	62.860	1200	
SWS5.1	66.750	1.500	Open Manhole	600	4.000	65.250	225				
SWS5	65.840	2.994	Open Manhole	2200	1.008	62.846	1200	1.007	62.846	1200	
								4.000	63.721	225	
SWS4	65.330	2.522	Open Manhole	2200	1.009	62.808	1000	1.008	62.808	1200	
SWS3	64.510	1.758	Open Manhole	2000	1.010	62.752	300	1.009	62.752	1000	
SWS2	64.250	1.562	Open Manhole	600	1.011	62.688	300	1.010	62.688	300	
SWS1	63.760	1.249	Open Manhole	1200		OUTFALL		1.011	62.511	300	

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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	150	SWS13	68.510	67.100	1.260	Open Manhole	600
1.001	o	150	SWS12	68.510	66.924	1.436	Open Manhole	600
1.002	o	225	SWS11	67.180	65.650	1.305	Open Manhole	600
2.000	o	225	SWS10.1	66.800	65.300	1.275	Open Manhole	600
1.003	o	300	SWS10	66.290	64.641	1.349	Open Manhole	600
1.004	o	300	SWS9	65.750	64.354	1.096	Open Manhole	600
1.005	o	1200	SWS8	65.650	62.910	1.540	Open Manhole	2200
3.000	o	225	Dummy	66.100	62.933	2.942	Open Manhole	1200
3.001	ooo	225	SW7.3	66.100	62.929	2.946	Open Manhole	1500
3.002	o	1000	SW7.1	65.800	62.875	1.925	Open Manhole	1900
1.006	o	1200	SWS7	65.650	62.870	1.580	Open Manhole	2200
1.007	o	1200	SWS6	65.650	62.860	1.590	Open Manhole	2200
4.000	o	225	SWS5.1	66.750	65.250	1.275	Open Manhole	600
1.008	o	1200	SWS5	65.840	62.846	1.794	Open Manhole	2200
1.009	o	1000	SWS4	65.330	62.808	1.522	Open Manhole	2200

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	17.600	100.0	SWS12	68.510	66.924	1.436	Open Manhole	600
1.001	21.400	17.8	SWS11	67.180	65.725	1.305	Open Manhole	600
1.002	19.000	20.3	SWS10	66.290	64.716	1.349	Open Manhole	600
2.000	29.200	50.0	SWS10	66.290	64.716	1.349	Open Manhole	600
1.003	28.700	100.0	SWS9	65.750	64.354	1.096	Open Manhole	600
1.004	9.300	100.0	SWS8	65.650	64.261	1.089	Open Manhole	2200
1.005	39.500	987.5	SWS7	65.650	62.870	1.580	Open Manhole	2200
3.000	1.000	250.0	SW7.3	66.100	62.929	2.946	Open Manhole	1500
3.001	13.500	250.0	SW7.1	65.800	62.875	2.700	Open Manhole	1900
3.002	5.000	1000.0	SWS7	65.650	62.870	1.780	Open Manhole	2200
1.006	10.000	1000.0	SWS6	65.650	62.860	1.590	Open Manhole	2200
1.007	14.400	1028.6	SWS5	65.840	62.846	1.794	Open Manhole	2200
4.000	29.100	19.0	SWS5	65.840	63.721	1.894	Open Manhole	2200
1.008	38.200	1005.3	SWS4	65.330	62.808	1.322	Open Manhole	2200
1.009	56.400	1007.1	SWS3	64.510	62.752	0.758	Open Manhole	2000

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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)
1.010	o	300	SWS3	64.510	62.752	1.458	Open Manhole	2000
1.011	o	300	SWS2	64.250	62.688	1.262	Open Manhole	600

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)
1.010	6.300	98.4	SWS2	64.250	62.688	1.262	Open Manhole	600
1.011	17.300	97.7	SWS1	63.760	62.511	0.949	Open Manhole	1200

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)
1.011	SWS1	63.760	62.511	0.000	1200	0

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Online Controls for Storm

Non Return Valve Manhole: SW7.3, DS/PN: 3.001, Volume (m³): 5.6

Hydro-Brake® Optimum Manhole: SWS3, DS/PN: 1.010, Volume (m³): 48.2

Unit Reference	MD-SHE-0234-3000-1200-3000
Design Head (m)	1.200
Design Flow (l/s)	30.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	234
Invert Level (m)	62.752
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	30.0
Flush-Flo™	0.406	29.8
Kick-Flo®	0.855	25.5
Mean Flow over Head Range	-	25.2

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)
0.100	7.8	1.200	30.0	3.000	46.6	7.000	70.3
0.200	23.6	1.400	32.3	3.500	50.2	7.500	72.7
0.300	29.4	1.600	34.4	4.000	53.5	8.000	75.0
0.400	29.8	1.800	36.4	4.500	56.7	8.500	77.2
0.500	29.6	2.000	38.3	5.000	59.7	9.000	79.4
0.600	29.1	2.200	40.1	5.500	62.5	9.500	81.5
0.800	26.9	2.400	41.8	6.000	65.2		
1.000	27.5	2.600	43.5	6.500	67.8		

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<u>Offline Controls for Storm</u> <u>Weir Manhole: SW7.1, DS/PN: 3.002, Loop to PN: 3.001</u> Discharge Coef 0.544 Width (m) 1.800 Invert Level (m) 63.770		
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Storage Structures for Storm

Tank or Pond Manhole: SW7.3, DS/PN: 3.001

Invert Level (m) 62.929

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	80.0	2.800	0.0	5.600	0.0	8.400	0.0
0.400	80.0	3.200	0.0	6.000	0.0	8.800	0.0
0.800	80.0	3.600	0.0	6.400	0.0	9.200	0.0
0.801	0.0	4.000	0.0	6.800	0.0	9.600	0.0
1.600	0.0	4.400	0.0	7.200	0.0	10.000	0.0
2.000	0.0	4.800	0.0	7.600	0.0		
2.400	0.0	5.200	0.0	8.000	0.0		