

Mayer Brown Limited								Page 3
Lion House Oriental Road Woking, GU22 8AR				Littlehampton West Catchment Overflow into Phase 4				
Date 21/12/2020				Designed by S Foley				
File West Catchment Model - ...				Checked by SF				
Innovyze				Network 2020.1				
<u>Summary of Critical Results by Maximum Level (Rank 1) for Storm</u>								
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Water Level Act. (m)
12.000	Plots 101-110	120 Winter	100	+0%	100/120 Winter			3.854
8.893	SW02	120 Winter	100	+0%	100/120 Winter			3.845
1.010	Ex SB6	120 Winter	100	+0%	100/120 Winter			3.776
13.000	Ret Block A	480 Winter	100	+0%	100/120 Winter			3.586
13.001	Ret Block A	480 Winter	100	+0%	100/120 Winter			3.832
14.000	Plots 95-100	120 Winter	100	+0%	100/120 Winter			3.666
1.011	SW03	120 Winter	100	+0%	100/120 Winter			3.661
1.012	SW04	120 Winter	100	+0%	100/120 Winter			3.525
15.000	SW-IC2	120 Winter	100	+0%	100/120 Winter			3.559
16.000	Gully - Low Point	120 Winter	100	+0%	100/120 Winter			3.582
16.001	SW-IC3	120 Winter	100	+0%	100/120 Winter			3.575
15.001	SW-IC4	120 Winter	100	+0%	100/120 Winter			3.556
15.002	SW-IC5	120 Winter	100	+0%	100/120 Winter			3.531
17.000	SW-IC1	120 Winter	100	+0%	100/120 Winter			3.557
18.000	Gully: Low point	120 Winter	100	+0%	100/120 Winter			3.566
17.001	SW-IC2	120 Winter	100	+0%	100/120 Winter			3.553
17.892	SW-IC4	120 Winter	100	+0%	100/120 Winter			3.527
19.000	SW01	120 Winter	100	+0%	100/120 Winter			3.535
15.003	SW02	120 Winter	100	+0%	100/120 Winter			3.508
15.004	Permbase 02	120 Winter	100	+0%	100/120 Winter			3.420
20.000	Plots 80-86	120 Winter	100	+0%	100/120 Winter			3.434
21.000	Plots 87-94	120 Winter	100	+0%	100/120 Winter			3.408
1.813	SW05	120 Winter	100	+0%	100/120 Winter			3.388
22.000	C2 Resiblock A	120 Winter	100	+0%	100/120 Winter			3.249
1.814	SW06	120 Winter	100	+0%	100/120 Winter			3.231
1.015	Permbase 03	120 Winter	100	+0%	100/120 Winter			3.589
23.000	SW-N1	120 Winter	100	+0%	100/120 Winter			3.086
23.001	SW-N2	120 Winter	100	+0%	100/120 Winter			3.076
24.000	SW-N3	120 Winter	100	+0%	100/120 Winter			3.071
23.002	SW-N4	120 Winter	100	+0%	100/120 Winter			3.060
23.003	Permbase 04	240 Winter	100	+0%	100/120 Winter			3.039
25.000	Plots 69-73	120 Winter	100	+0%	100/120 Winter			3.067
26.000	Plots 74-78	120 Winter	100	+0%	100/120 Winter			3.071
23.004	SW07	240 Winter	100	+0%	100/120 Winter			3.036
23.005	Permbase 05	240 Winter	100	+0%	100/120 Winter			3.029
27.000	Plots 39-46	120 Winter	100	+0%				3.286
28.000	SW-LYM 01	120 Winter	100	+0%	100/120 Winter			4.039
29.000	Non resi	480 Winter	100	+0%	100/120 Winter			4.639
29.001	Non resi	480 Winter	100	+0%	100/120 Winter			4.888
28.001	SW-LYM 02	120 Winter	100	+0%	100/120 Winter			4.024
30.000	Parcel A1	120 Winter	100	+0%				4.298
30.001	As-built SA8	120 Winter	100	+0%	100/120 Winter			4.269
31.000	Non Resi	480 Winter	100	+0%	100/120 Winter			4.619
31.001	SW Stub 02	480 Winter	100	+0%	100/120 Winter			4.883
30.002	SW-LYM 03/1	120 Winter	100	+0%	100/120 Winter			4.014
28.002	SW-LYM 03	120 Winter	100	+0%	100/120 Winter			3.978
28.003	SW-LYM 04	120 Winter	100	+0%	100/120 Winter			3.805
32.000	SW-LYM 07	120 Winter	100	+0%				3.939
32.001	SW-LYM 08	120 Winter	100	+0%				3.777
33.000	SW-LYM 05A	120 Winter	100	+0%				7.321
33.001	SW-LYM 05	120 Winter	100	+0%	100/120 Winter			5.933
28.004	SW-LYM 10	120 Winter	100	+0%	100/120 Winter			3.719
28.005	SW-LYM11	240 Winter	100	+0%	100/120 Winter			3.576
34.000	ExSB17_Dum Node	120 Winter	100	+0%				3.853
28.006	SW-LYM 12	240 Winter	100	+0%	100/120 Winter			3.465
28.007	SW-FUT-03	240 Winter	100	+0%	100/120 Winter			3.316
35.000	Stub SW18/1	240 Winter	100	+0%	100/120 Winter			3.233
35.001	SW18	240 Winter	100	+0%	100/120 Winter			3.219
28.008	SW19	240 Winter	100	+0%	100/120 Winter			3.200
28.009	SW20	240 Winter	100	+0%	100/120 Winter			3.060
36.000	Car Park	240 Winter	100	+0%	100/120 Winter			4.649
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Lion House Oriental Road Woking, GU22 8AR				Littlehampton West Catchment Overflow into Phase 4					
Date 21/12/2020				Designed by S Foley					
File West Catchment Model - ...				Checked by SF					
Innovyze				Network 2020.1					
Summary of Critical Results by Maximum Level (Rank 1) for Storm									
PN	US/MB Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
12.000	Plots 101-110	0.629	0.000	0.41			14.5	SURCHARGED	
8.003	SW02	0.788	0.000	1.08			28.5	SURCHARGED	
1.010	Ex SB6	0.701	0.000	0.88			167.9	SURCHARGED	
13.000	Ret Block A	0.286	0.000	0.26			13.1	SURCHARGED	
13.001	Ret Block A	0.782	0.000	0.23			4.2	SURCHARGED	
14.000	Plots 95-100	0.441	0.000	0.21			9.5	SURCHARGED	
1.011	SW03	0.741	0.000	0.82			179.3	SURCHARGED	
1.012	SW04	0.785	0.000	0.88			184.5	SURCHARGED	
15.000	SW-IC2	0.469	0.000	0.11			1.4	SURCHARGED	
16.000	Gully - Low Point	0.332	0.000	0.22			3.7	SURCHARGED	
16.001	SW-IC3	0.425	0.000	0.54			7.4	SURCHARGED	
15.001	SW-IC4	0.526	0.000	0.76			10.2	SURCHARGED	
15.002	SW-IC5	0.601	0.000	0.87			11.8	SURCHARGED	
17.000	SW-IC1	0.067	0.000	0.06			1.7	SURCHARGED	
18.000	Gully: Low point	0.466	0.000	0.44			6.9	SURCHARGED	
17.001	SW-IC2	0.543	0.000	0.75			10.2	SURCHARGED	
17.002	SW-IC4	0.627	0.000	1.08			11.9	SURCHARGED	
19.000	SW01	0.270	0.000	0.31			13.3	SURCHARGED	
15.003	SW02	0.648	0.000	0.75			48.1	SURCHARGED	
15.004	Permbase 02	0.700	0.000	0.66		26	43.0	SURCHARGED	
20.000	Plots 80-86	0.734	0.000	0.58			13.3	SURCHARGED	
21.000	Plots 87-94	0.581	0.000	0.20			15.2	SURCHARGED	
1.013	SW05	0.738	0.000	1.31			243.8	SURCHARGED	
22.000	C2 Resiblock A	0.704	0.000	0.30			21.8	SURCHARGED	
1.014	SW06	0.731	0.000	1.58			286.3	SURCHARGED	
1.015	Permbase 03	0.733	0.000	2.40		44	339.3	SURCHARGED	
23.000	SW-N1	0.171	0.000	0.22			8.5	SURCHARGED	
23.001	SW-N2	0.311	0.000	0.41			16.1	SURCHARGED	
24.000	SW-N3	0.196	0.000	0.19			9.7	SURCHARGED	
23.002	SW-N4	0.430	0.000	0.43			28.0	SURCHARGED	
23.003	Permbase 04	0.564	0.000	0.39		77	23.6	SURCHARGED	
25.000	Plots 66-73	0.117	0.000	1.01			11.1	SURCHARGED	
26.000	Plots 74-78	0.321	0.000	0.82			13.1	SURCHARGED	
23.004	SW07	0.636	0.000	0.83			46.2	SURCHARGED	
23.005	Permbase 05	0.674	0.000	0.79		81	45.7	SURCHARGED	
27.000	Plots 39-46	-0.104	0.000	0.21			12.3	OK	
28.000	SW-LYM 01	0.074	0.000	0.28			8.5	SURCHARGED	
29.000	Non resi	0.189	0.000	0.07			15.9	SURCHARGED	
29.001	Non resi	0.943	0.000	0.13			4.5	SURCHARGED	
28.001	SW-LYM 02	0.159	0.000	0.52			17.6	SURCHARGED	
30.000	Parcel A1	-0.152	0.000	0.12		80	26.7	OK	
30.001	As-built SA8	0.281	0.000	0.62			24.8	SURCHARGED	
31.000	Non Resi	0.169	0.000	0.04			12.7	SURCHARGED	
31.001	SW Stub 02	1.018	0.000	0.12			4.6	SURCHARGED	
30.002	SW-LYM 03/1	0.219	0.000	0.69			29.7	SURCHARGED	
28.002	SW-LYM 03	0.403	0.000	1.48			48.6	SURCHARGED	
28.003	SW-LYM 04	0.280	0.000	0.84			52.6	SURCHARGED	
32.000	SW-LYM 07	-0.156	0.000	0.21			8.8	OK	
32.001	SW-LYM 08	-0.118	0.000	0.40			24.5	OK	
33.000	SW-LYM 05A	-0.179	0.000	0.34			48.1	FLOOD RISK	
33.001	SW-LYM 05	0.093	0.000	2.37			58.8	SURCHARGED	
28.004	SW-LYM 10	0.364	0.000	1.04			135.9	SURCHARGED	
28.005	SW-LYM11	0.446	0.000	0.65			118.7	SURCHARGED	
34.000	ExSB17_Dum Node	-0.072	0.000	0.75			51.9	OK	
28.006	SW-LYM 12	0.495	0.000	0.58			143.1	SURCHARGED	
28.007	SW-FUT-03	0.626	0.000	0.75			145.2	SURCHARGED	
35.000	Stub SW18/1	0.508	0.000	0.57			19.1	SURCHARGED	
35.001	SW18	0.614	0.000	0.65			22.6	SURCHARGED	
28.008	SW19	0.780	0.000	0.73			169.6	SURCHARGED	
28.009	SW20	0.775	0.000	0.82			168.1	SURCHARGED	
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Lion House	Littlehampton	
Oriental Road	West Catchment	
Woking, GU22 8AR	Overflow into Phase 4	
Date 21/12/2020	Designed by S Foley	
File West Catchment Model - ...	Checked by SF	
Innovyze	Network 2020.1	

Summary of Critical Results by Maximum Level (Rank 1) for Storm

FN	US/MR Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
36.000	Car Park	0.699	0.000	0.03	225	5.8	SURCHARGED	

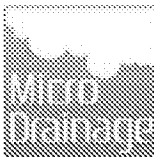
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Lion House	Littlehampton	
Oriental Road	West Catchment	
Woking, GU22 8AR	Overflow into Phase 4	
Date 21/12/2020	Designed by S Foley	
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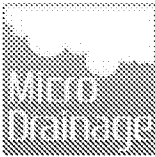
Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) SurchARGE	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
36.001	Car Park	240 Winter	100	+0%	100/120 Winter				4.689
37.000	Non Resi	480 Winter	100	+0%	100/120 Winter				3.364
37.001	Stub SW9/1	480 Winter	100	+0%	100/120 Winter				3.524
38.000	SW08	120 Winter	100	+0%					3.609
39.000	Non Resi	240 Winter	100	+0%	100/120 Winter				3.323
39.001	Stub SW9/2	240 Winter	100	+0%	100/120 Winter				3.344
40.000	Plots 1 - 4	120 Winter	100	+0%					4.338
37.002	SW09	240 Winter	100	+0%	100/120 Winter				3.153
41.000	SW12	120 Winter	100	+0%	100/120 Winter				3.191
41.001	SW13	240 Winter	100	+0%	100/120 Winter				3.182
41.002	SW14	240 Winter	100	+0%	100/120 Winter				3.167
41.003	SW15	240 Winter	100	+0%	100/120 Winter				3.136
42.000	Plots 16-22	120 Winter	100	+0%					3.481
37.003	SW16	240 Winter	100	+0%	100/120 Winter				3.122
37.004	SW17	240 Winter	100	+0%	100/120 Winter				3.092
28.010	SW21	240 Winter	100	+0%	100/120 Winter				3.034
27.001	SW22	240 Winter	100	+0%	100/120 Winter				3.030
43.000	Plots 47-55	240 Winter	100	+0%	100/120 Winter				3.030
27.002	SW23	240 Winter	100	+0%	100/120 Winter				3.028
1.016	SW24	240 Winter	100	+0%	100/120 Winter				3.020
1.017	Permbase 06	240 Winter	100	+0%	100/120 Winter				2.999
44.000	Plots	240 Winter	100	+0%	100/120 Winter				3.003
44.001	Stub SW25/1	240 Winter	100	+0%	100/120 Winter				2.995
45.000	Stub SW25/2	120 Winter	100	+0%	100/120 Winter				3.001
1.018	SW25	240 Winter	100	+0%	100/120 Winter				2.989

PN	US/MH Name	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
36.001	Car Park	1.139	0.000	0.11			4.5	SURCHARGED	
37.000	Non Resi	0.214	0.000	0.04			6.4	SURCHARGED	
37.001	Stub SW9/1	0.699	0.000	0.10			4.0	SURCHARGED	
38.000	SW08	-0.166	0.000	0.16			14.7	OK	
39.000	Non Resi	0.173	0.000	0.02		210	4.5	SURCHARGED	
39.001	Stub SW9/2	0.619	0.000	0.08			3.5	SURCHARGED	
40.000	Plots 1 - 4	-0.122	0.000	0.08			4.1	OK	
37.002	SW09	0.528	0.000	0.53			21.4	SURCHARGED	
41.000	SW12	0.176	0.000	0.32			10.7	SURCHARGED	
41.001	SW13	0.277	0.000	0.30			12.0	SURCHARGED	
41.002	SW14	0.342	0.000	0.39			17.7	SURCHARGED	
41.003	SW15	0.666	0.000	0.38			23.7	SURCHARGED	
42.000	Plots 16-22	-0.109	0.000	0.17			10.4	OK	
37.003	SW16	0.722	0.000	0.37			49.6	SURCHARGED	
37.004	SW17	0.822	0.000	0.30			49.3	SURCHARGED	
28.010	SW21	0.474	0.000	0.40			239.1	SURCHARGED	
27.001	SW22	0.500	0.000	0.23			190.9	SURCHARGED	
43.000	Plots 47-55	0.305	0.000	0.76			17.4	SURCHARGED	
27.002	SW23	0.633	0.000	0.20			151.9	SURCHARGED	
1.016	SW24	0.710	0.000	0.40			315.0	SURCHARGED	
1.017	Permbase 06	0.799	0.000	0.55		223	275.9	SURCHARGED	
44.000	Plots	0.408	0.000	0.39			15.6	SURCHARGED	
44.001	Stub SW25/1	0.780	0.000	2.23			27.9	SURCHARGED	
45.000	Stub SW25/2	0.736	0.000	1.00			24.7	SURCHARGED	
1.018	SW25	1.264	0.000	0.79			272.3	SURCHARGED	

APPENDIX J: Catchment 03 Microdrainage Calculations

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Lion House Oriental Road Woking, GU22 8AR	Hampton Park, Littlehampton Phase 4 Catchment 03 Simulation Results																																																																																																																																																																																																																																																																																																																																	
Date 26/03/2021	Designed by SF																																																																																																																																																																																																																																																																																																																																	
File Phase 4 Catchment 26_03...	Checked by SF																																																																																																																																																																																																																																																																																																																																	
Innovyze	Network 2020.1																																																																																																																																																																																																																																																																																																																																	
Existing Network Details for Storm * - Indicates pipe has been modified outside of System 1 <table><tr><th>PN</th><th>Length (m)</th><th>Fall (m)</th><th>Slope (1:X)</th><th>I.Area (ha)</th><th>T.E. (mins)</th><th>k (mm)</th><th>HYD SECT</th><th>DIA (mm)</th><th>Section Type</th></tr><tr><td>* 1.000</td><td>14.566</td><td>0.000</td><td>0.0</td><td>0.000</td><td>5.00</td><td>0.600</td><td>\/</td><td>27</td><td>Pipe/Conduit</td></tr><tr><td>* 2.000</td><td>19.169</td><td>0.140</td><td>136.9</td><td>0.048</td><td>5.00</td><td>0.600</td><td>o</td><td>225</td><td>Pipe/Conduit</td></tr><tr><td>* 2.001</td><td>23.083</td><td>0.150</td><td>153.9</td><td>0.048</td><td>5.00</td><td>0.600</td><td>o</td><td>300</td><td>Pipe/Conduit</td></tr><tr><td>* 2.002</td><td>10.543</td><td>0.070</td><td>150.6</td><td>0.048</td><td>0.00</td><td>0.600</td><td>o</td><td>300</td><td>Pipe/Conduit</td></tr><tr><td>* 2.003</td><td>24.538</td><td>0.160</td><td>153.4</td><td>0.048</td><td>0.00</td><td>0.600</td><td>o</td><td>300</td><td>Pipe/Conduit</td></tr><tr><td>* 2.004</td><td>44.885</td><td>0.300</td><td>149.6</td><td>0.048</td><td>0.00</td><td>0.600</td><td>o</td><td>300</td><td>Pipe/Conduit</td></tr><tr><td>* 2.005</td><td>5.444</td><td>0.190</td><td>28.7</td><td>0.051</td><td>0.00</td><td>0.600</td><td>o</td><td>300</td><td>Pipe/Conduit</td></tr><tr><td>* 2.006</td><td>10.994</td><td>0.060</td><td>183.2</td><td>0.000</td><td>0.00</td><td>0.600</td><td>o</td><td>300</td><td>Pipe/Conduit</td></tr><tr><td>* 3.000</td><td>19.284</td><td>0.590</td><td>32.7</td><td>0.024</td><td>5.00</td><td>0.600</td><td>o</td><td>150</td><td>Pipe/Conduit</td></tr><tr><td>* 3.001</td><td>59.447</td><td>0.400</td><td>148.6</td><td>0.048</td><td>0.00</td><td>0.600</td><td>o</td><td>225</td><td>Pipe/Conduit</td></tr><tr><td>* 3.002</td><td>10.000</td><td>0.110</td><td>90.9</td><td>0.048</td><td>0.00</td><td>0.600</td><td>o</td><td>225</td><td>Pipe/Conduit</td></tr><tr><td>* 3.003</td><td>33.001</td><td>0.170</td><td>194.1</td><td>0.024</td><td>0.00</td><td>0.600</td><td>o</td><td>300</td><td>Pipe/Conduit</td></tr><tr><td>* 2.007</td><td>3.818</td><td>0.200</td><td>19.1</td><td>0.000</td><td>0.00</td><td>0.600</td><td>o</td><td>225</td><td>Pipe/Conduit</td></tr><tr><td>* 2.008</td><td>14.044</td><td>0.050</td><td>280.9</td><td>0.000</td><td>0.00</td><td>0.600</td><td>\/</td><td>27</td><td>Pipe/Conduit</td></tr><tr><td>* 1.001</td><td>22.887</td><td>0.000</td><td>0.0</td><td>0.000</td><td>0.00</td><td>0.600</td><td>\/</td><td>27</td><td>Pipe/Conduit</td></tr></table> <table><tr><th>PN</th><th>US/MH Name</th><th>US/CL (m)</th><th>US/IL (m)</th><th>US C.Depth (m)</th><th>DS/CL (m)</th><th>DS/IL (m)</th><th>DS C.Depth (m)</th><th>Ctrl</th><th>US/MH (mm)</th></tr><tr><td>* 1.000</td><td>CWA Swale</td><td>1.380</td><td>1.000</td><td>-0.073</td><td>1.380</td><td>1.000</td><td>-0.073</td><td></td><td>1800</td></tr><tr><td>* 2.000</td><td>PH4-S1</td><td>3.800</td><td>2.390</td><td>1.185</td><td>3.630</td><td>2.250</td><td>1.155</td><td></td><td>1200</td></tr><tr><td>* 2.001</td><td>PH4-S2</td><td>3.630</td><td>2.250</td><td>1.080</td><td>3.710</td><td>2.100</td><td>1.310</td><td></td><td>1200</td></tr><tr><td>* 2.002</td><td>PH4-S3</td><td>3.710</td><td>2.100</td><td>1.310</td><td>3.820</td><td>2.030</td><td>1.490</td><td></td><td>1200</td></tr><tr><td>* 2.003</td><td>PH4-S4</td><td>3.820</td><td>2.030</td><td>1.490</td><td>3.930</td><td>1.870</td><td>1.760</td><td></td><td>1200</td></tr><tr><td>* 2.004</td><td>PH4-S5</td><td>3.930</td><td>1.870</td><td>1.760</td><td>3.580</td><td>1.570</td><td>1.710</td><td></td><td>1200</td></tr><tr><td>* 2.005</td><td>PH4-S6</td><td>3.580</td><td>1.570</td><td>1.710</td><td>3.470</td><td>1.380</td><td>1.790</td><td></td><td>1200</td></tr><tr><td>* 2.006</td><td>PH4-S7</td><td>3.470</td><td>1.310</td><td>1.860</td><td>3.650</td><td>1.250</td><td>2.100</td><td></td><td>1200</td></tr><tr><td>* 3.000</td><td>IC</td><td>3.500</td><td>2.740</td><td>0.610</td><td>3.620</td><td>2.150</td><td>1.320</td><td></td><td>450</td></tr><tr><td>* 3.001</td><td>PH4-S8</td><td>3.620</td><td>2.000</td><td>1.395</td><td>3.820</td><td>1.600</td><td>1.995</td><td></td><td>1200</td></tr><tr><td>* 3.002</td><td>PH4-S9</td><td>3.820</td><td>1.600</td><td>1.995</td><td>3.600</td><td>1.490</td><td>1.885</td><td></td><td>1200</td></tr><tr><td>* 3.003</td><td>PH4-S10</td><td>3.600</td><td>1.420</td><td>1.880</td><td>3.650</td><td>1.250</td><td>2.100</td><td></td><td>1200</td></tr><tr><td>* 2.007</td><td>PH4-S11_Control MH</td><td>3.650</td><td>1.250</td><td>2.175</td><td>1.380</td><td>1.050</td><td>0.105</td><td>Hydro-Brake®</td><td>1200</td></tr><tr><td>* 2.008</td><td>Outfall</td><td>1.380</td><td>1.050</td><td>-0.123</td><td>1.380</td><td>1.000</td><td>-0.073</td><td></td><td>1200</td></tr><tr><td>* 1.001</td><td>CWA Swale</td><td>1.380</td><td>1.000</td><td>-0.073</td><td>1.380</td><td>1.000</td><td>-0.073</td><td></td><td>1200</td></tr></table>			PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	k (mm)	HYD SECT	DIA (mm)	Section Type	* 1.000	14.566	0.000	0.0	0.000	5.00	0.600	\/	27	Pipe/Conduit	* 2.000	19.169	0.140	136.9	0.048	5.00	0.600	o	225	Pipe/Conduit	* 2.001	23.083	0.150	153.9	0.048	5.00	0.600	o	300	Pipe/Conduit	* 2.002	10.543	0.070	150.6	0.048	0.00	0.600	o	300	Pipe/Conduit	* 2.003	24.538	0.160	153.4	0.048	0.00	0.600	o	300	Pipe/Conduit	* 2.004	44.885	0.300	149.6	0.048	0.00	0.600	o	300	Pipe/Conduit	* 2.005	5.444	0.190	28.7	0.051	0.00	0.600	o	300	Pipe/Conduit	* 2.006	10.994	0.060	183.2	0.000	0.00	0.600	o	300	Pipe/Conduit	* 3.000	19.284	0.590	32.7	0.024	5.00	0.600	o	150	Pipe/Conduit	* 3.001	59.447	0.400	148.6	0.048	0.00	0.600	o	225	Pipe/Conduit	* 3.002	10.000	0.110	90.9	0.048	0.00	0.600	o	225	Pipe/Conduit	* 3.003	33.001	0.170	194.1	0.024	0.00	0.600	o	300	Pipe/Conduit	* 2.007	3.818	0.200	19.1	0.000	0.00	0.600	o	225	Pipe/Conduit	* 2.008	14.044	0.050	280.9	0.000	0.00	0.600	\/	27	Pipe/Conduit	* 1.001	22.887	0.000	0.0	0.000	0.00	0.600	\/	27	Pipe/Conduit	PN	US/MH Name	US/CL (m)	US/IL (m)	US C.Depth (m)	DS/CL (m)	DS/IL (m)	DS C.Depth (m)	Ctrl	US/MH (mm)	* 1.000	CWA Swale	1.380	1.000	-0.073	1.380	1.000	-0.073		1800	* 2.000	PH4-S1	3.800	2.390	1.185	3.630	2.250	1.155		1200	* 2.001	PH4-S2	3.630	2.250	1.080	3.710	2.100	1.310		1200	* 2.002	PH4-S3	3.710	2.100	1.310	3.820	2.030	1.490		1200	* 2.003	PH4-S4	3.820	2.030	1.490	3.930	1.870	1.760		1200	* 2.004	PH4-S5	3.930	1.870	1.760	3.580	1.570	1.710		1200	* 2.005	PH4-S6	3.580	1.570	1.710	3.470	1.380	1.790		1200	* 2.006	PH4-S7	3.470	1.310	1.860	3.650	1.250	2.100		1200	* 3.000	IC	3.500	2.740	0.610	3.620	2.150	1.320		450	* 3.001	PH4-S8	3.620	2.000	1.395	3.820	1.600	1.995		1200	* 3.002	PH4-S9	3.820	1.600	1.995	3.600	1.490	1.885		1200	* 3.003	PH4-S10	3.600	1.420	1.880	3.650	1.250	2.100		1200	* 2.007	PH4-S11_Control MH	3.650	1.250	2.175	1.380	1.050	0.105	Hydro-Brake®	1200	* 2.008	Outfall	1.380	1.050	-0.123	1.380	1.000	-0.073		1200	* 1.001	CWA Swale	1.380	1.000	-0.073	1.380	1.000	-0.073		1200
PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	k (mm)	HYD SECT	DIA (mm)	Section Type																																																																																																																																																																																																																																																																																																																									
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* 3.001	PH4-S8	3.620	2.000	1.395	3.820	1.600	1.995		1200																																																																																																																																																																																																																																																																																																																									
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Innovyze	Network 2020.1	

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 Online Controls	1	Number of Time/Area Diagrams	0
		Number of Storage Structures	1
		Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH	Data Type	Catchment
FEH Rainfall Version	2013	Cv (Summer)	0.750
Site Location	GB 502950 104450 TQ 02950 04450	Cv (Winter)	1.000

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	ON

Profile(s)	Winter
Duration(s) (mins)	60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	100
Climate Change (%)	30

WARNING: Half Drain Time has not been calculated as the structure is too full.

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	CWA Swale	480 Winter	100	+30%	100/240 Winter	100/60 Winter			1.490
2.000	PH4-S1	60 Winter	100	+30%	100/60 Winter				2.873
2.001	PH4-S2	60 Winter	100	+30%	100/60 Winter				2.841
2.002	PH4-S3	60 Winter	100	+30%	100/60 Winter				2.807
2.003	PH4-S4	60 Winter	100	+30%	100/60 Winter				2.775
2.004	PH4-S5	120 Winter	100	+30%	100/60 Winter				2.704
2.005	PH4-S6	120 Winter	100	+30%	100/60 Winter				2.692
2.006	PH4-S7	120 Winter	100	+30%	100/60 Winter				2.688
3.000	IC	60 Winter	100	+30%					2.799
3.001	PH4-S8	120 Winter	100	+30%	100/60 Winter				2.700
3.002	PH4-S9	120 Winter	100	+30%	100/60 Winter				2.692
3.003	PH4-S10	120 Winter	100	+30%	100/60 Winter				2.687
2.007	PH4-S11_Control MH	120 Winter	100	+30%	100/60 Winter				2.682
2.008	Outfall	480 Winter	100	+30%		100/60 Winter			1.493
1.001	CWA Swale	480 Winter	100	+30%	100/240 Winter	100/60 Winter			1.491

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	CWA Swale	0.037	110.473	1.16			184.6	FLOOD	7
2.000	PH4-S1	0.258	0.000	0.47			18.7	SURCHARGED	
2.001	PH4-S2	0.291	0.000	0.44			34.8	SURCHARGED	
2.002	PH4-S3	0.407	0.000	0.75			49.4	SURCHARGED	
2.003	PH4-S4	0.445	0.000	0.82			65.4	SURCHARGED	
2.004	PH4-S5	0.534	0.000	0.61			52.0	SURCHARGED	
2.005	PH4-S6	0.822	0.000	0.56			61.2	SURCHARGED	
2.006	PH4-S7	1.078	0.000	0.99			60.6	SURCHARGED	
3.000	IC	-0.091	0.000	0.33			9.7	OK	

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Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged	Flooded	Flow / Overflow		Half Drain	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Time (mins)	Flow (l/s)		
3.001	PH4-S8	0.475	0.000	0.41			17.0	SURCHARGED	
3.002	PH4-S9	0.867	0.000	0.56			25.6	SURCHARGED	
3.003	PH4-S10	0.967	0.000	0.41			30.2	SURCHARGED	
2.007	PH4-S11_Control MH	1.207	0.000	0.21			13.0	SURCHARGED	
2.008	Outfall	-0.010	112.519	0.46			193.1	FLOOD	7
1.001	CWA Swale	0.038	111.264	4.28			223.5	FLOOD	7

APPENDIX K: Geolight Proprietary Attenuation Tank

SDS

Water
Infrastructure
Systems

INNOVATORS IN
WATER TECHNOLOGY

SDS GEOLight®

Stormwater Management System



SDS GEOLight® is an ultra lightweight honeycombed modular structure, made from recycled PVC, that provides an underground storage facility for the application of stormwater attenuation or infiltration.

SDS
Water
Infrastructure
Systems

Stormwater Management

The Environment Agency is keen to promote the wider use of sustainable drainage systems, which reduce the impact of surface water runoff. There are two main ways of storing surface water for stormwater management:

- Stormwater attenuation tanks
- Soakaway infiltration systems

Stormwater Attenuation Systems

This consists of underground water storage facilities that hold excess water during periods of peak rainfall.

The stored water is gradually released in a controlled manner into the surface water drainage system or directly into watercourses, reducing the risk of upstream and downstream flooding.

Soakaway Infiltration Systems

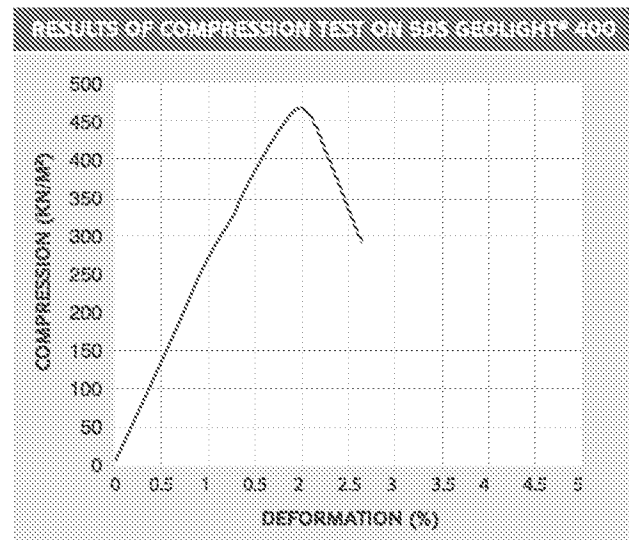
Soakaways are designed to store surface water runoff until it can be gradually absorbed by the surrounding ground.

SDS GEOLight® – an efficient and economic solution for stormwater management.

SDS GEOLight® Attenuation

SDS GEOLight® has been specifically designed to form underground water storage reservoirs in stormwater management schemes. Its honeycombed structure gives it certain unique characteristics that make it ideal for this purpose:

- The high void rate (95%) of GEOLight® means that the maximum volume of water is stored in the minimum volume of storage unit.
- High compressive strength. GEOLight® is available in two strengths as standard: 200 and 400kN/m². Note: Higher compressive strengths available from 600 to 1000 kN/m². The graph on the right shows the results of a compression test, where samples of GEOLight® 400 were compressed at the rate of 1mm per minute. The deformation at 400kN/m² is about 1.6%.



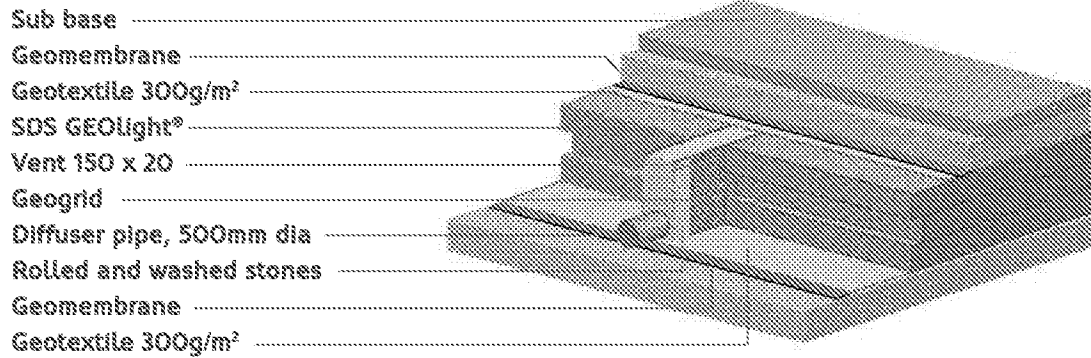
The GEOLight® Stormwater Attenuation System consists of two manholes (inspection chambers) connected by a length of perforated distribution pipe which feeds the stormwater storage reservoirs on either side formed from GEOLight®.

The distribution pipe is normally from 225mm up to 500mm diameter, generally covered in a trench that is filled with draining material such as 15/25 clean graded stone, free from fines.

The reservoirs and distribution pipe are wrapped in a waterproof membrane, such as butyl, to prevent seepage of water into the surrounding ground. The top of each GEOLight® reservoir has a vent which is connected back to the upstream manhole.

A geotextile or 10mm mesh geogrid is laid between the distribution pipe and GEOLight® to prevent the GEOLight® units being clogged by the draining materials.

SDS GEOLight® Attenuation



How does it work?

- 1. In normal conditions, water enters a back drop manhole. This is the upstream manhole and any silt or sediment will collect in the bottom of the chamber. The water then flows along the distribution pipe into the downstream manhole. The upstream pipework is sized to cope with normal flow conditions. The distribution pipe and attenuation tank are sized to cope with storm conditions. The outflow pipe is sized to cope with the permissible discharge.
- 2. In storm conditions the flow restrictor (vortex flow control or orifice plate) in the downstream manhole limits the amount of water flowing out of the manhole. This causes the water level in the distribution pipe to rise and water to spill into the GEOLight® reservoirs on either side. As the water level rises in the reservoirs, air is forced out of the high level vents into the upstream manhole.

- 3. Once the storm has passed, the water level in the GEOLight® reservoirs gradually falls as water passes through the flow restrictor in the downstream manhole. The vents now allow air to return into the GEOLight® reservoirs. Gradually the reservoirs empty. The flow restrictor prevents excess surges of flood water to pass downstream and uses the storage reservoirs to store the water for the period of the storm.

Calculating the storage capacity

The storage capacity of the GEOLight® reservoirs is determined by the maximum outflow permitted, (set by the water company or Environment Agency), the impermeable area of the site and the rainfall return period – normally 1 in 30 years, but again can be dictated by the water company. A full design service, including calculations, can be supplied via a third party consultant. **Please contact SDS for details.**

Other uses

The water storage ability of SDS GEOLight® lends itself to a number of other uses:

- Water recycling combines with Irrigation systems – this is increasingly popular: GEOLight® is used to retain stormwater which is then pumped as required to a network of standpipes for irrigation.
- Drainage channels – the natural permeability of GEOLight® lends itself for use as an underground drainage channel that collects and drains away groundwater.
- Pollution control – Improved water runoff quality. When used in combination with oil / petrol separators, GEOLight® can replenish groundwater without the risk of contamination from oil, chemicals or suspended solids.
- To form lightweight embankments (slope stabilisation) – GEOLight® can be used to quickly form the base of embankments that only weigh a fraction of earth embankments.

Stormwater Attenuation System

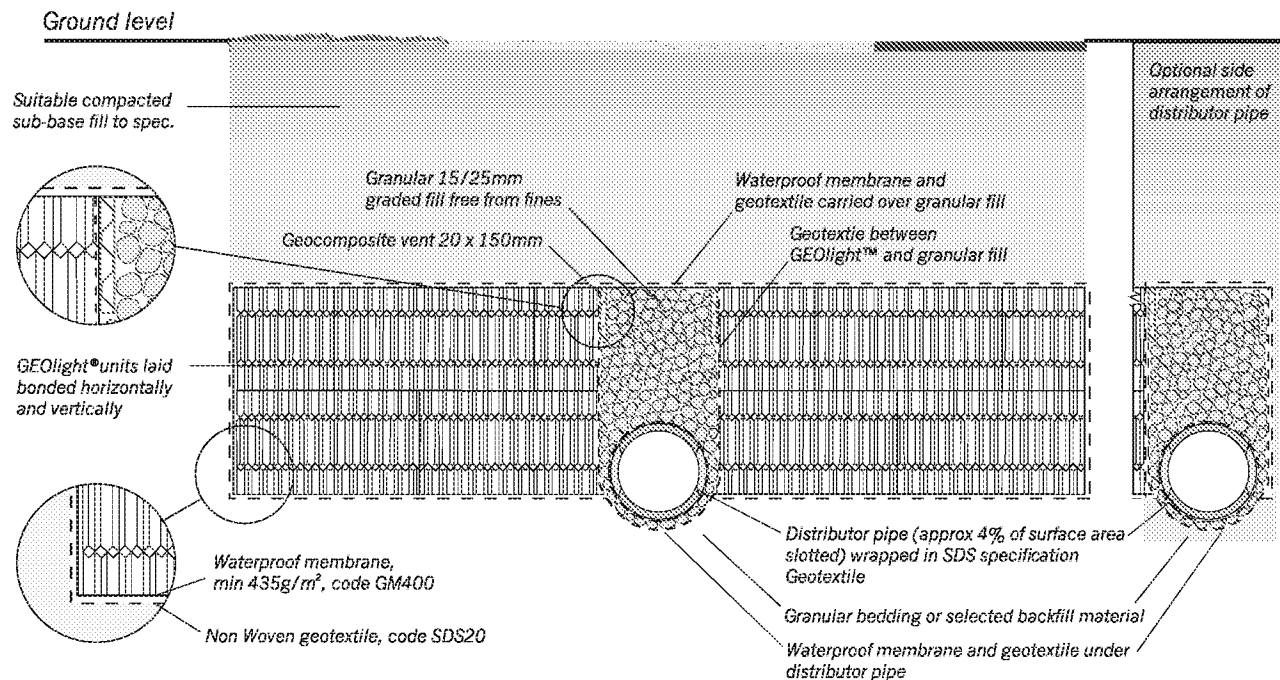
Design Details

The details on these two pages illustrate the construction of a typical SDS GEOLight® Stormwater Attenuation System. The length and height of the GEOLight® reservoirs is determined by the quantity of water to be stored.

The layout of each scheme is specifically designed to suit the characteristics and limitation of the site. Typically the distributor pipe would be arranged in the centre of the reservoir, but can alternatively be placed at the side where topographical constraints dictate.

The high performance waterproof membrane should be sealed continuously to encapsulate the GEOLight® reservoirs, distributor pipe and granular fill. It is protected by a heavyweight needle punched, non woven geotextile. To help with maintenance a high flow geotextile is placed between the granular fill and GEOLight® attenuation units to prevent silt and particles being washed into the reservoir. GEOLight® can be used under a range of surfaces e.g. grass, porous paving, standard paving block, tarmac and concrete.

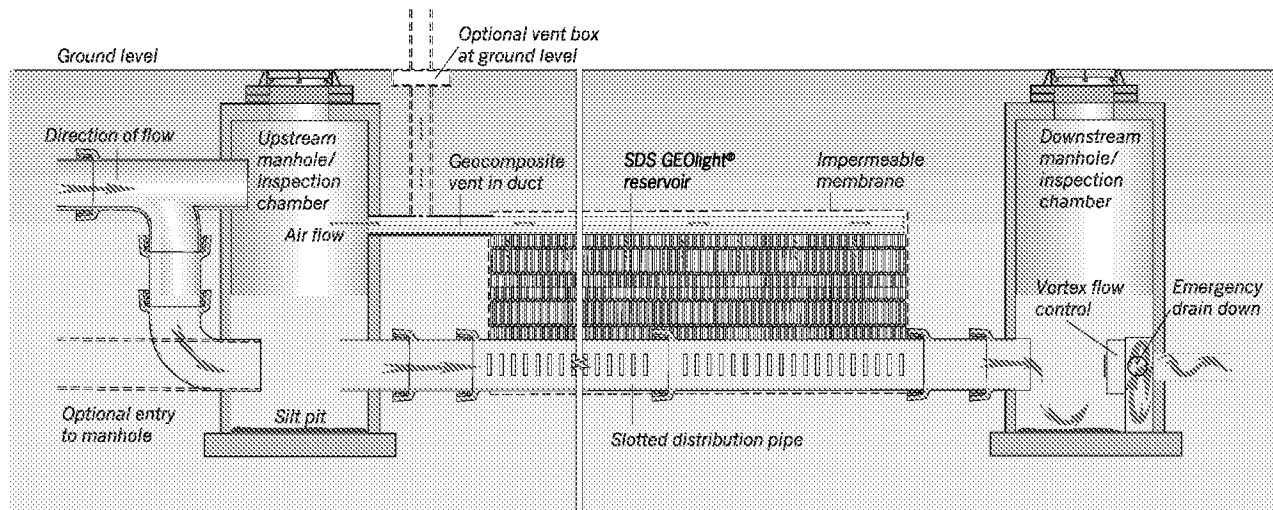
Cross Section



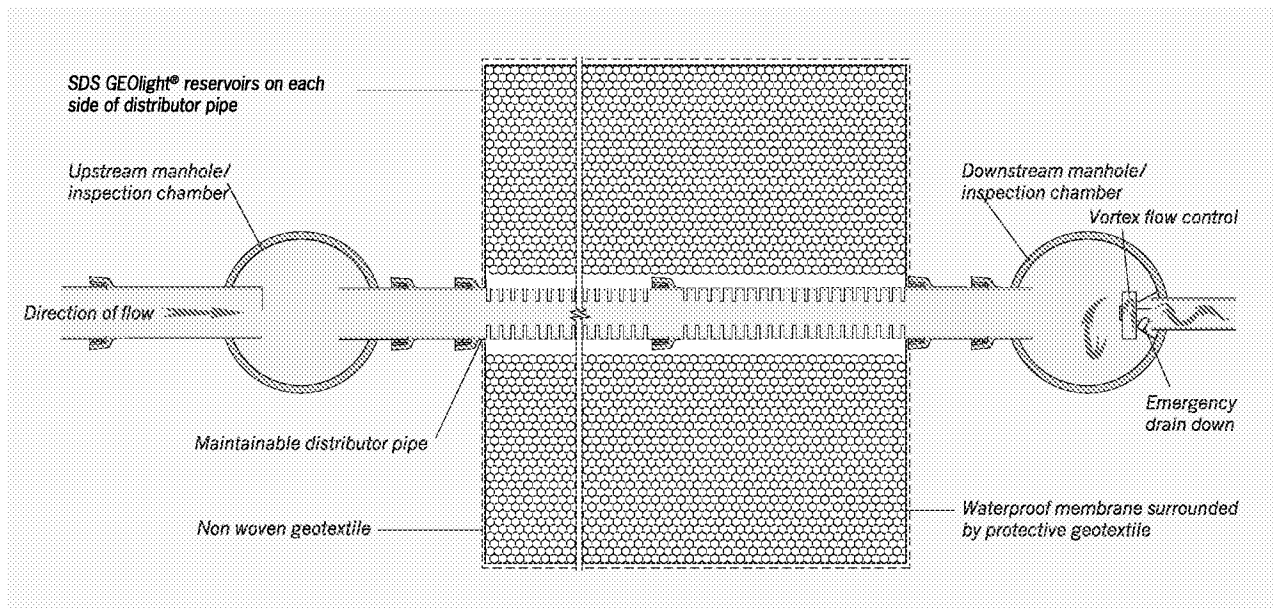
Stormwater Attenuation System

Design Details

Long Section



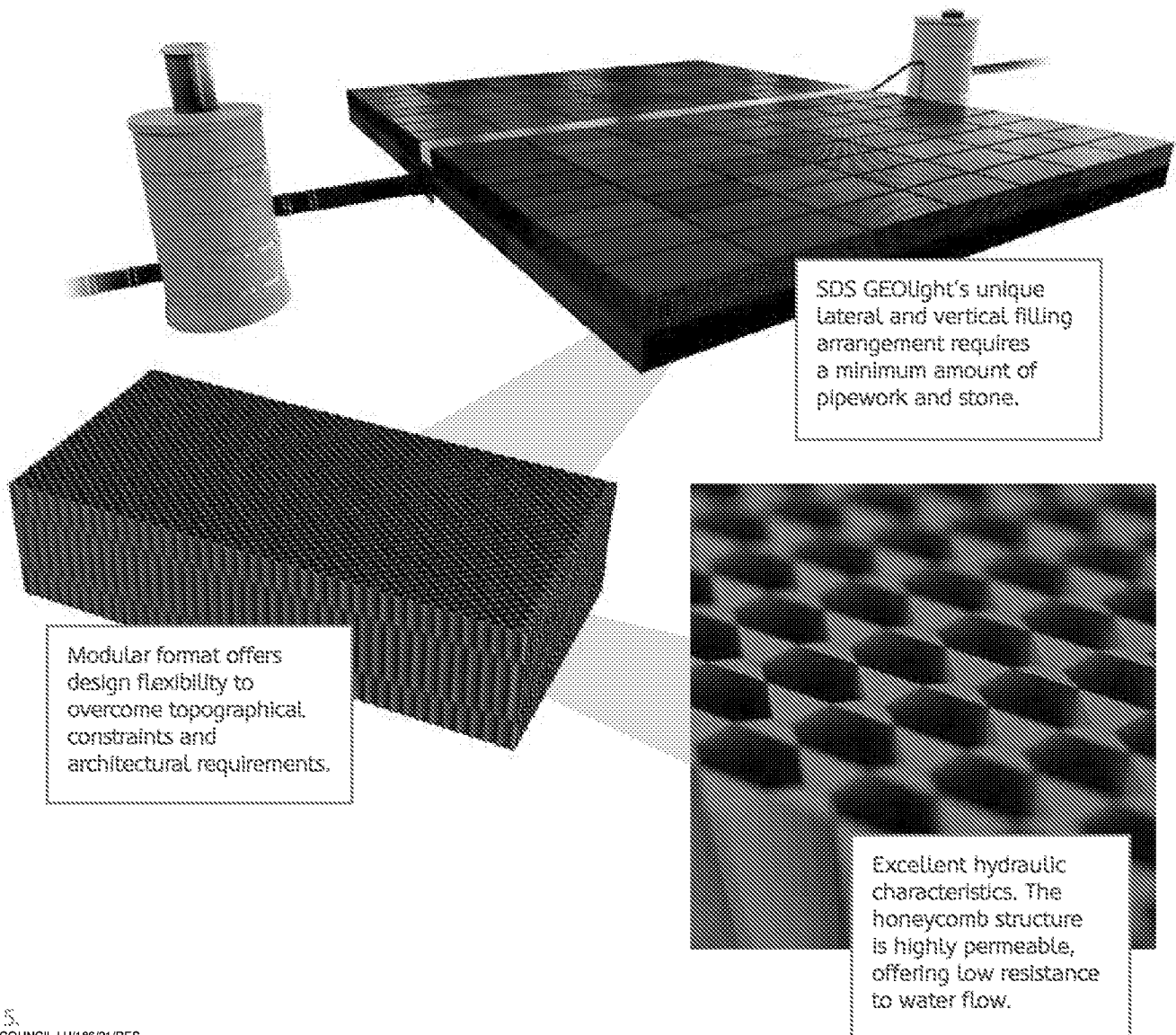
Plan



Benefits

- High compressive strength – can be located under all roads, car parks and amenity area surfaces.
- Reduced excavation costs – the very high void rate (95%) minimises the required volume of earthworks.
- Speed of installation – 1000m³ reservoir, completed in one week.
- Light and easy to handle.
- Depth of tank invert reduced by using patented lateral supply.
- Simplified distribution pipe network, easy maintenance – dispensing with costly and complicated pipework configurations.
- Greatly reduces the risk of flooding when used as stormwater storage.
- Can also be used for water recycling and combining with irrigation systems.
- Can virtually eliminate pollution when used in combination with specialist petrol / oil separators.
- Design service available, including calculations.

GEOlight® block



COSHH and Handling Information

1. COMPOSITION/INFORMATION ON INGREDIENTS

Hazardous ingredients:

None as finished goods or products.

Types of materials:

Polyvinyl chloride (PVC)

MEK

2. HAZARDS IDENTIFICATION

Nature of hazard:

There are no health risks from the products during normal use. The products may contain various pigment colours and stabilisers that may be toxic. The chemicals are, however, bound within the product material and not easily extracted.

3. FIRST-AID MEASURES

Eye contact:

Plastic materials may cause physical irritation in the eyes. Wash out with large amounts of water. If irritation persists, seek medical advice.

Skin contact:

Not applicable.

Inhalation:

Not applicable.

Ingestion:

Not expected to have any toxic effects.

4. FIRE-FIGHTING MEASURES

Extinguishing media:

On small fires use any hand-held extinguisher type.

On large fires use water.

Fire and explosion hazards:

Melting plastics may flow and spread in a large fire.

Products of fire will be thick black toxic smoke.

Material characteristics:

PVC products will burn in the presence of a flame but are classed as self-extinguishing.

Protective equipment:

Wear self-contained breathing apparatus and protective clothing.

5. HANDLING AND STORAGE

Handling:

There are no hazards associated with the finished products. However, when cutting SDS GEOLight®, we recommend that the correct tools are used e.g. Handsaw or Alligator saw. When cutting, dust may be created; avoid inhaling these dusts. Take care of heat build-up within materials during cutting etc. The pallets of SDS GEOLight® units should be placed on level ground and should not be stacked on site. The maximum weight of the pallet of SDS GEOLight® units as delivered to site is 650kg (700kg on one copy), including packaging. Machines used to lift the pallet should be able to lift this weight safely. Loose individual units should not be stored more than three units high. SDS GEOLight® units are lightweight ranging from 23kg to 55kg and can be easily handled -- one or two person lift.

Storage:

SDS GEOLight® units will resist the effects of UV light for up to six months; however, prolonged storage in direct sunlight should be avoided. SDS GEOLight® units should not be stored near any fuel storage areas or any other solvents. SDS GEOLight® units are very robust and resistant to damage during normal handling; however, they should be secured in areas where impacts from vehicles or construction plant will be avoided.

Material characteristics:

PVC products will burn in the presence of a flame but are classed as self-extinguishing.

Protective equipment:

Wear self-contained breathing apparatus and protective clothing.

6. EXPOSURE CONTROLS / PERSONAL PROTECTION

Respiratory protection:

Not required under normal conditions of use. Where cutting etc. creates dust, wear a disposable half-mask to the standard FFP2S.

Hand protection:

Wear impervious strong gloves to prevent cuts to the hands while handling, cutting etc.

Eye protection:

Wear safety glasses when cutting etc.

Skin protection:

Wear overalls.

7. SITE HAZARDS

Other hazards for consideration:

Working in excavations and trenches -- SDS GEOLight® may be designed with a shallow invert for infiltration (soakaway) or attenuation (storage) system. This negates the need for deep excavations or trenches, excavation near services e.g. gas, electricity or contaminated soil areas. N.B. All risk assessments should be undertaken by the main contractor for forklift, access to and working in excavations and trench support.

8. STABILITY AND REACTIVITY

Decomposition products:

Major thermal decomposition products are oxides of carbon.

Relevant differences are (in addition): PVC may produce amounts of Hydrogen Chloride.

Stability:

These materials are stable at temperatures up to normal operating limits (moulding parameters).

9. ECOLOGICAL INFORMATION

Biodegradability:

Plastic products are not readily biodegradable but are not detrimental to terrestrial wildlife.

Aquatic toxicity:

Non-toxic to marine life.

10. DISPOSAL CONSIDERATIONS

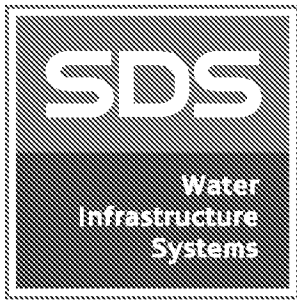
Method:

The preferred method of disposal is collection and recycling. Plastics can safely be placed with regular industrial or household wastes where recycling is not available.

11. OTHER INFORMATION

As the handling, storage, use and disposal of the product are beyond our control SDS disclaims all liability for loss, damage, injury or expense in any way connected with such activities and further makes no warranties, expressed or implied, as to the suitability of the product for any particular use.

The preferred method of disposal is collection and recycling. Plastics can safely be placed with regular industrial or household wastes where recycling is not available.



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