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SURFACE WATER CALCULATIONS

Proposed Dwelling
Land Off Headlands Road, Liversedge

REF No. 712-100

May 2022

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	19.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.300	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S1	0.033	4.00	85.200	450	26.688	35.422	0.600
RE 1	0.011	4.00	85.200		12.132	42.775	0.500
S2			85.050	450	26.744	42.692	0.570
S3	0.002	4.00	84.900	450	23.134	48.969	0.730
Soakaway			84.900		16.786	49.012	0.750

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	S1	S2	9.750	0.600	84.600	84.480	0.120	81.3	150	4.15	50.0
2.000	RE 1	S2	13.250	0.600	84.700	84.530	0.170	77.9	100	4.25	50.0
1.001	S2	S3	6.100	0.600	84.480	84.170	0.310	19.7	150	4.30	50.0
1.002	S3	Soakaway	2.000	0.600	84.170	84.150	0.020	100.0	150	4.33	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.116	19.7	4.5	0.450	0.420	0.033	0.0	48	0.903
2.000	0.872	6.9	1.5	0.400	0.420	0.011	0.0	32	0.696
1.001	2.281	40.3	6.0	0.420	0.580	0.044	0.0	39	1.642
1.002	1.005	17.8	6.2	0.580	0.600	0.046	0.0	61	0.917

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	9.750	81.3	150	Circular	85.200	84.600	0.450	85.050	84.480	0.420
2.000	13.250	77.9	100	Circular	85.200	84.700	0.400	85.050	84.530	0.420
1.001	6.100	19.7	150	Circular	85.050	84.480	0.420	84.900	84.170	0.580
1.002	2.000	100.0	150	Circular	84.900	84.170	0.580	84.900	84.150	0.600

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	S1	450	Manhole	Adoptable	S2	450	Manhole	Adoptable
2.000	RE 1		Junction		S2	450	Manhole	Adoptable
1.001	S2	450	Manhole	Adoptable	S3	450	Manhole	Adoptable
1.002	S3	450	Manhole	Adoptable	Soakaway		Junction	

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	18.500	Drain Down Time (mins)	240
Ratio-R	0.300	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0	100	40	0	0
30	0	0	0				

Node Soakaway Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	83.100	Depth (m)	1.200
Side Inf Coefficient (m/hr)	0.36000	Time to half empty (mins)	375	Inf Depth (m)	
Safety Factor	2.0	Pit Width (m)	4.500	Number Required	1
Porosity	0.95	Pit Length (m)	5.000		

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 15 minute summer	91.835	25.986	30 year 360 minute summer	32.778	8.435
1 year 15 minute winter	64.446	25.986	30 year 360 minute winter	21.306	8.435
1 year 30 minute summer	62.374	17.650	30 year 480 minute summer	26.030	6.879
1 year 30 minute winter	43.771	17.650	30 year 480 minute winter	17.294	6.879
1 year 60 minute summer	44.383	11.729	30 year 600 minute summer	21.454	5.868
1 year 60 minute winter	29.487	11.729	30 year 600 minute winter	14.659	5.868
1 year 120 minute summer	29.104	7.691	30 year 720 minute summer	19.220	5.151
1 year 120 minute winter	19.336	7.691	30 year 720 minute winter	12.917	5.151
1 year 180 minute summer	23.282	5.991	30 year 960 minute summer	15.913	4.190
1 year 180 minute winter	15.134	5.991	30 year 960 minute winter	10.541	4.190
1 year 240 minute summer	18.983	5.017	30 year 1440 minute summer	11.668	3.127
1 year 240 minute winter	12.612	5.017	30 year 1440 minute winter	7.842	3.127
1 year 360 minute summer	15.022	3.866	100 year +40% CC 15 minute summer	405.260	114.675
1 year 360 minute winter	9.765	3.866	100 year +40% CC 15 minute winter	284.393	114.675
1 year 480 minute summer	12.148	3.210	100 year +40% CC 30 minute summer	279.766	79.164
1 year 480 minute winter	8.071	3.210	100 year +40% CC 30 minute winter	196.327	79.164
1 year 600 minute summer	10.164	2.780	100 year +40% CC 60 minute summer	197.898	52.299
1 year 600 minute winter	6.945	2.780	100 year +40% CC 60 minute winter	131.479	52.299
1 year 720 minute summer	9.224	2.472	100 year +40% CC 120 minute summer	126.159	33.340
1 year 720 minute winter	6.199	2.472	100 year +40% CC 120 minute winter	83.817	33.340
1 year 960 minute summer	7.805	2.055	100 year +40% CC 180 minute summer	97.886	25.189
1 year 960 minute winter	5.170	2.055	100 year +40% CC 180 minute winter	63.628	25.189
1 year 1440 minute summer	5.909	1.584	100 year +40% CC 240 minute summer	77.425	20.461
1 year 1440 minute winter	3.971	1.584	100 year +40% CC 240 minute winter	51.439	20.461
30 year 15 minute summer	224.477	63.519	100 year +40% CC 360 minute summer	59.325	15.266
30 year 15 minute winter	157.528	63.519	100 year +40% CC 360 minute winter	38.563	15.266
30 year 30 minute summer	153.285	43.374	100 year +40% CC 480 minute summer	46.854	12.382
30 year 30 minute winter	107.569	43.374	100 year +40% CC 480 minute winter	31.128	12.382
30 year 60 minute summer	107.642	28.447	100 year +40% CC 600 minute summer	38.442	10.515
30 year 60 minute winter	71.515	28.447	100 year +40% CC 600 minute winter	26.266	10.515
30 year 120 minute summer	68.544	18.114	100 year +40% CC 720 minute summer	34.304	9.194
30 year 120 minute winter	45.539	18.114	100 year +40% CC 720 minute winter	23.055	9.194
30 year 180 minute summer	53.388	13.739	100 year +40% CC 960 minute summer	28.217	7.430
30 year 180 minute winter	34.704	13.739	100 year +40% CC 960 minute winter	18.691	7.430
30 year 240 minute summer	42.467	11.223	100 year +40% CC 1440 minute summer	20.484	5.490
30 year 240 minute winter	28.214	11.223	100 year +40% CC 1440 minute winter	13.767	5.490

Results for 1 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S1	10	84.650	0.050	4.1	0.0624	0.0000	OK
15 minute winter	RE 1	10	84.731	0.031	1.4	0.0136	0.0000	OK
15 minute winter	S2	10	84.517	0.037	5.5	0.0060	0.0000	OK
15 minute winter	S3	10	84.233	0.063	5.8	0.0135	0.0000	OK
720 minute winter	Soakaway	525	83.386	-0.764	0.7	6.1204	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute summer	S1	1.000	S2	4.1	0.969	0.208	0.0414
15 minute winter	RE 1	2.000	S2	1.4	0.682	0.203	0.0271
15 minute winter	S2	1.001	S3	5.5	1.059	0.136	0.0320
15 minute winter	S3	1.002	Soakaway	5.8	0.860	0.326	0.0135
720 minute winter	Soakaway	Infiltration		0.3			

Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S1	10	84.682	0.082	10.1	0.1038	0.0000	OK
15 minute winter	RE 1	10	84.751	0.051	3.4	0.0223	0.0000	OK
15 minute winter	S2	10	84.541	0.061	13.5	0.0097	0.0000	OK
15 minute winter	S3	10	84.280	0.110	14.1	0.0236	0.0000	OK
600 minute winter	Soakaway	435	83.744	-0.406	1.6	13.7663	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute summer	S1	1.000	S2	10.1	1.213	0.512	0.0812
15 minute winter	RE 1	2.000	S2	3.4	0.864	0.496	0.0521
15 minute winter	S2	1.001	S3	13.5	1.299	0.335	0.0629
15 minute winter	S3	1.002	Soakaway	14.1	1.067	0.794	0.0264
600 minute winter	Soakaway	Infiltration		0.6			

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	10	84.726	0.126	18.2	0.1588	0.0000	OK
15 minute winter	RE 1	10	84.776	0.076	6.1	0.0333	0.0000	OK
15 minute winter	S2	10	84.581	0.101	24.3	0.0160	0.0000	OK
15 minute winter	S3	10	84.363	0.193	25.4	0.0413	0.0000	SURCHARGED
360 minute winter	Soakaway	272	84.238	0.088	4.2	24.3271	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute winter	S1	1.000	S2	18.2	1.293	0.923	0.1385
15 minute winter	RE 1	2.000	S2	6.1	0.973	0.889	0.0829
15 minute winter	S2	1.001	S3	24.3	1.470	0.602	0.0921
15 minute winter	S3	1.002	Soakaway	25.3	1.440	1.428	0.0347
360 minute winter	Soakaway	Infiltration		1.1			

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