

Drainage Design Report

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Network	Storm Network
Filename	C:\Users\Pawel AJS\Dropbox\Workflow Max\George Dutton Trading Ltd\Jobs\A4581 - NEW INDUSTRIAL DEVELOPMENT AT SWADLINCOTE_\Drawings\CacIs\FLOW\10Sept21\SW 10Sept21.pfd
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Rainfall Methodology	FSR
Return Period (years)	1
Additional Flow (%)	0
FSR Region	England and Wales
M5-60 (mm)	20.000
Ratio-R	0.400
CV	0.750
Time of Entry (mins)	5.00
Maximum Time of Concentration (mins)	30.00
Maximum Rainfall (mm/hr)	50.0
Minimum Velocity (m/s)	1.00
Connection Type	Level Soffits
Minimum Backdrop Height (m)	0.200
Preferred Cover Depth (m)	1.200
Enforce best practice design rules	x

	Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Node Type	Diameter (mm)	Width (mm)	Easting (m)	Northing (m)	Depth (m)
1		0.160	5.00		68.477	Manhole	1200		428007.217	319501.739	1.777
2		0.160	5.00		68.467	Manhole	1200		428012.071	319481.834	1.852
3		0.160	5.00		68.320	Manhole	1200		428017.154	319460.988	1.794
4		0.079	5.00		68.878	Manhole	1200		428023.765	319433.879	2.468
5					68.909	Manhole	150		428017.806	319432.303	2.525
6					68.928	Manhole	1200		428008.195	319429.761	2.585
7					68.948	Manhole	1200		427997.910	319427.040	2.649
8					68.974	Manhole	1200		427986.473	319424.016	2.724
Out					69.000	Manhole	1200		427986.841	319422.621	2.809
11		0.043	5.00		68.950	Manhole	1200		427979.973	319495.280	1.558
12					68.950	Manhole	150		427981.377	319489.939	1.581
13		0.043	5.00		68.932	Manhole	1200		427986.920	319468.850	1.653
14					68.954	Manhole	150		427991.794	319450.308	2.111
21		0.043	5.00		68.718	Manhole	1200		427952.353	319487.233	1.506
22		0.043	5.00		68.895	Manhole	1200		427969.851	319419.649	1.974

Name	US Node	DS Node	Length (m)	ks (mm) / n	Velocity Equation	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	Link Type	T of C (mins)	Rain (mm/hr)	Con Offset (m)	Min DS IL (m)
1.000	1	2	20.488	0.600	Colebrook-White	66.700	66.615	0.085	241.0	300	Circular_Default Sewer Type	5.34	50.0		
1.001	2	3	21.457	0.600	Colebrook-White	66.615	66.526	0.089	241.1	300	Circular_Default Sewer Type	5.69	50.0		
1.002	3	4	27.903	0.600	Colebrook-White	66.526	66.410	0.116	240.5	300	Circular_Default Sewer Type	6.15	49.8		
1.003	4	5	6.164	0.600	Colebrook-White	66.410	66.384	0.026	237.1	300	Circular_Default Sewer Type	6.26	49.4		
1.004	5	6	9.941	0.600	Colebrook-White	66.385	66.343	0.042	236.7	300	Circular_Default Sewer Type	6.42	48.8		
1.005	6	7	10.639	0.600	Colebrook-White	66.343	66.299	0.044	241.8	300	Circular_Default Sewer Type	6.59	48.1		
1.006	7	8	11.830	0.600	Colebrook-White	66.299	66.250	0.049	241.4	300	Circular_Default Sewer Type	6.79	47.4		
1.007	8	Out	1.443	0.600	Colebrook-White	66.250	66.191	0.059	24.5	300	Circular_Default Sewer Type	6.80	47.4		
2.000	11	12	5.522	0.600	Colebrook-White	67.392	67.369	0.023	241.0	300	Circular_Default Sewer Type	5.09	50.0		
2.001	12	13	21.805	0.600	Colebrook-White	67.369	67.279	0.090	242.3	300	Circular_Default Sewer Type	5.45	50.0		
2.002	13	14	19.172	0.600	Colebrook-White	67.279	66.843	0.436	44.0	300	Circular_Default Sewer Type	5.59	50.0		
2.003	14	7	24.058	0.600	Colebrook-White	66.843	66.299	0.544	44.2	300	Circular_Default Sewer Type	5.76	50.0		
3.000	21	22	69.812	0.600	Colebrook-White	67.212	66.921	0.291	239.9	300	Circular_Default Sewer Type	6.15	49.8		
3.001	22	8	17.186	0.600	Colebrook-White	66.921	66.250	0.671	25.6	300	Circular_Default Sewer Type	6.24	49.4		

Name	US Node	DS Node	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Minimum Depth (m)	Maximum Depth (m)	Σ Area (ha)	Σ Add Inflow (ha)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1	2	1.008	71.3	21.7	1.477	1.552	1.477	1.552	0.160	0.0	113	0.888
1.001	2	3	1.008	71.2	43.4	1.552	1.494	1.494	1.552	0.320	0.0	169	1.055
1.002	3	4	1.009	71.3	64.7	1.494	2.168	1.494	2.168	0.480	0.0	225	1.138
1.003	4	5	1.017	71.9	74.8	2.168	2.225	2.168	2.225	0.559	0.0	261	1.146
1.004	5	6	1.017	71.9	73.9	2.224	2.285	2.224	2.285	0.559	0.0	256	1.151
1.005	6	7	1.006	71.1	72.9	2.285	2.349	2.285	2.349	0.559	0.0	255	1.139
1.006	7	8	1.007	71.2	83.0	2.349	2.424	2.349	2.424	0.645	0.0	300	1.020
1.007	8	Out	3.192	225.6	94.0	2.424	2.509	2.424	2.509	0.731	0.0	135	3.053
2.000	11	12	1.008	71.3	5.8	1.258	1.281	1.258	1.281	0.043	0.0	58	0.614
2.001	12	13	1.005	71.1	5.8	1.281	1.353	1.281	1.353	0.043	0.0	58	0.612
2.002	13	14	2.376	168.0	11.7	1.353	1.811	1.353	1.811	0.086	0.0	53	1.382
2.003	14	7	2.370	167.5	11.7	1.811	2.349	1.811	2.349	0.086	0.0	53	1.378
3.000	21	22	1.010	71.4	5.8	1.206	1.674	1.206	1.674	0.043	0.0	58	0.615
3.001	22	8	3.119	220.4	11.5	1.674	2.424	1.674	2.424	0.086	0.0	46	1.667

Link ID	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)	US Node ID	Dia (mm)	Width (mm)	Node Type	DS Node ID	Dia (mm)	Width (mm)	Node Type
1.000	20.488	241.0	300	Circular_Default Sewer Type	68.477	66.700	1.477	68.467	66.615	1.552	1	1200		Manhole	2	1200		Manhole
1.001	21.457	241.1	300	Circular_Default Sewer Type	68.467	66.615	1.552	68.320	66.526	1.494	2	1200		Manhole	3	1200		Manhole
1.002	27.903	240.5	300	Circular_Default Sewer Type	68.320	66.526	1.494	68.878	66.410	2.168	3	1200		Manhole	4	1200		Manhole
1.003	6.164	237.1	300	Circular_Default Sewer Type	68.878	66.410	2.168	68.909	66.384	2.225	4	1200		Manhole	5	150		Manhole
1.004	9.941	236.7	300	Circular_Default Sewer Type	68.909	66.385	2.224	68.928	66.343	2.285	5	150		Manhole	6	1200		Manhole
1.005	10.639	241.8	300	Circular_Default Sewer Type	68.928	66.343	2.285	68.948	66.299	2.349	6	1200		Manhole	7	1200		Manhole
1.006	11.830	241.4	300	Circular_Default Sewer Type	68.948	66.299	2.349	68.974	66.250	2.424	7	1200		Manhole	8	1200		Manhole
1.007	1.443	24.5	300	Circular_Default Sewer Type	68.974	66.250	2.424	69.000	66.191	2.509	8	1200		Manhole	Out	1200		Manhole
2.000	5.522	241.0	300	Circular_Default Sewer Type	68.950	67.392	1.258	68.950	67.369	1.281	11	1200		Manhole	12	150		Manhole
2.001	21.805	242.3	300	Circular_Default Sewer Type	68.950	67.369	1.281	68.932	67.279	1.353	12	150		Manhole	13	1200		Manhole
2.002	19.172	44.0	300	Circular_Default Sewer Type	68.932	67.279	1.353	68.954	66.843	1.811	13	1200		Manhole	14	150		Manhole
2.003	24.058	44.2	300	Circular_Default Sewer Type	68.954	66.843	1.811	68.948	66.299	2.349	14	150		Manhole	7	1200		Manhole
3.000	69.812	239.9	300	Circular_Default Sewer Type	68.718	67.212	1.206	68.895	66.921	1.674	21	1200		Manhole	22	1200		Manhole
3.001	17.186	25.6	300	Circular_Default Sewer Type	68.895	66.921	1.674	68.974	66.250	2.424	22	1200		Manhole	8	1200		Manhole

Rainfall Methodology	FSR		Return Period (years)	Climate Change (%)
FSR Region	England and Wales		1	0
M5-60 (mm)	20.000		30	0
Ratio-R	0.400		100	40
Summer CV	0.750			
Winter CV	0.840			
Analysis Speed	Normal			
Drain Down Time (mins)	240			
Additional Storage (m³/ha)	20.0			
Storm Durations (mins)	15			
	30			
	60			
	120			
	180			
	240			
	360			
	480			
	600			
	720			
	960			
	1440			
Check Discharge Rate(s)	x			
1 year (l/s)				
30 year (l/s)				
100 year (l/s)				
Check Discharge Volume	x			
100 year 360 minute (m³)				

ACO Q-Brake Vortex											
Node	Flap Valve	Online / Offline	Downstream Link	Replaces Downstream Link	Loop to Node	Invert Level (m)	Design Depth (m)	Design Flow (l/s)	Min Outlet Diameter (m)	Min Node Diameter (mm)	Orifice Diameter (mm)
3x	x	Online				0.000	2.700	3.0	0.095	1050	0.070

Soakaway											
Node	Base Inf Coefficient (m/hr)	Side Inf Coefficient (m/hr)	Safety Factor	Porosity	Invert Level (m)	Time to half empty (mins)	Plt Width (m)	Plt Length (m)	Depth (m)	Inf Depth (m)	Number Required
12x	0.00000	0.00000	2.0	0.95	0.000		11.000	4.000	1.000		1
13x	0.00000	0.00000	2.0	0.95	0.000		11.000	8.000	1.000		1
14x	0.00000	0.00000	2.0	0.95	0.000		8.000	11.000	1.200		1
7	0.00000	0.00000	2.0	0.95	66.319	7	10.000	4.000	0.800		1
5x	0.00000	0.00000	2.0	0.95	0.000		11.000	8.000	1.000		1
3	0.00000	0.00000	2.0	0.95	66.546	18	6.500	9.000	0.800		1
2	0.00000	0.00000	2.0	0.95	66.635	18	11.000	4.000	0.800		1

Default Values		Overrides					
Entry Loss (manhole)	0.250	Link	Entry Loss	Exit Loss		Node	Flood Risk (m)
Exit Loss (manhole)	0.250						
Entry Loss (junction)	0.000						
Exit Loss (junction)	0.000						
Flood Risk (m)	0.300						

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.94%															
Event	US Node ID	Peak (mlns)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link ID	DS Node ID	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	10	66.821	0.121	22.6	0.3555	0.0000	OK	1.000	2	22.2	0.815	0.312	0.6336	
15 minute winter	2	12	66.775	0.160	44.8	6.3184	0.0000	OK	1.001	3	35.3	0.999	0.496	0.8436	
15 minute winter	3	14	66.700	0.174	54.6	9.0852	0.0000	OK	1.002	4	40.9	0.849	0.573	1.3429	
15 minute winter	4	14	66.625	0.215	46.2	0.3801	0.0000	OK	1.003	5	45.6	0.879	0.635	0.3242	
15 minute winter	5	14	66.589	0.205	45.6	0.0037	0.0000	OK	1.004	6	45.6	0.930	0.635	0.4976	
30 minute winter	6	22	66.541	0.198	45.0	0.2237	0.0000	OK	1.005	7	45.0	0.964	0.632	0.5072	
30 minute winter	7	23	66.486	0.187	52.4	6.5903	0.0000	OK	1.006	8	50.4	1.247	0.709	0.4797	
30 minute winter	8	22	66.399	0.149	56.4	0.1686	0.0000	OK	1.007	Out	56.3	2.024	0.250	0.0403	62.2
30 minute winter	Out	22	66.292	0.101	56.3	0.0000	0.0000	OK							
15 minute winter	11	10	67.455	0.063	6.1	0.1064	0.0000	OK	2.000	12	6.0	0.581	0.084	0.0571	
15 minute winter	12	10	67.429	0.060	6.0	0.0011	0.0000	OK	2.001	13	5.9	0.633	0.083	0.2048	
15 minute winter	13	10	67.334	0.055	12.0	0.0913	0.0000	OK	2.002	14	11.8	1.363	0.070	0.1666	
15 minute winter	14	11	66.897	0.054	11.8	0.0010	0.0000	OK	2.003	7	11.9	0.996	0.071	0.6126	
15 minute winter	21	11	67.272	0.060	6.1	0.1014	0.0000	OK	3.000	22	5.8	0.696	0.082	0.5873	
15 minute winter	22	11	66.968	0.047	11.7	0.0729	0.0000	OK	3.001	8	11.6	1.049	0.053	0.3342	

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.94%															
Event	US Node ID	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link ID	DS Node ID	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	13	67.032	0.332	55.4	0.9725	0.0000	SURCHARGED	1.000	2	52.2	0.916	0.733	1.4428	
15 minute winter	2	14	67.019	0.404	107.6	17.2083	0.0000	SURCHARGED	1.001	3	69.8	1.112	0.979	1.5110	
15 minute winter	3	14	66.966	0.440	125.2	24.6565	0.0000	SURCHARGED	1.002	4	68.2	0.969	0.956	1.9649	
15 minute winter	4	14	66.844	0.434	77.1	0.7680	0.0000	SURCHARGED	1.003	5	76.2	1.082	1.060	0.4341	
15 minute winter	5	14	66.784	0.400	76.2	0.0072	0.0000	SURCHARGED	1.004	6	76.0	1.079	1.056	0.7000	
15 minute winter	6	14	66.707	0.364	76.0	0.4115	0.0000	SURCHARGED	1.005	7	75.9	1.174	1.066	0.7492	
15 minute winter	7	14	66.626	0.327	103.3	12.0497	0.0000	SURCHARGED	1.006	8	92.5	1.444	1.299	0.7630	
15 minute winter	8	13	66.482	0.232	111.3	0.2629	0.0000	OK	1.007	Out	111.5	2.370	0.494	0.0671	116.6
15 minute winter	Out	13	66.339	0.148	111.5	0.0000	0.0000	OK							
15 minute winter	11	10	67.495	0.103	14.9	0.1731	0.0000	OK	2.000	12	14.8	0.729	0.207	0.1119	
15 minute winter	12	10	67.464	0.095	14.8	0.0017	0.0000	OK	2.001	13	14.5	0.803	0.204	0.3991	
15 minute winter	13	10	67.368	0.089	29.4	0.1465	0.0000	OK	2.002	14	29.1	1.744	0.173	0.3197	
15 minute winter	14	11	66.927	0.084	29.1	0.0015	0.0000	OK	2.003	7	29.0	1.162	0.173	1.0259	
15 minute winter	21	10	67.306	0.094	14.9	0.1600	0.0000	OK	3.000	22	14.4	0.907	0.202	1.1152	
15 minute winter	22	11	66.994	0.073	29.1	0.1138	0.0000	OK	3.001	8	28.7	1.172	0.130	0.6038	

Results for 100 year +40% Critical Storm Duration. Lowest mass balance: 99.94%															
Event	US Node ID	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link ID	DS Node ID	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	1	22	68.353	1.653	77.9	4.8460	0.0000	FLOOD RISK	1.000	2	72.7	1.032	1.020	1.4428	
30 minute winter	2	22	68.312	1.697	150.6	38.3339	0.0000	FLOOD RISK	1.001	3	106.9	1.518	1.500	1.5110	
30 minute winter	3	22	68.148	1.622	172.9	49.2439	0.0000	FLOOD RISK	1.002	4	126.0	1.790	1.767	1.9649	
30 minute winter	4	23	67.708	1.298	148.9	2.2990	0.0000	SURCHARGED	1.003	5	146.6	2.083	2.041	0.4341	
30 minute winter	5	23	67.496	1.112	146.6	0.0200	0.0000	SURCHARGED	1.004	6	145.4	2.065	2.022	0.7000	
30 minute winter	6	23	67.217	0.874	145.4	0.9884	0.0000	SURCHARGED	1.005	7	144.2	2.048	2.027	0.7492	
30 minute winter	7	24	66.940	0.641	172.2	24.3443	0.0000	SURCHARGED	1.006	8	150.6	2.139	2.115	0.8331	
30 minute winter	8	23	66.602	0.352	169.0	0.3982	0.0000	SURCHARGED	1.007	Out	168.9	2.598	0.748	0.0850	278.4
30 minute winter	Out	23	66.382	0.191	168.9	0.0000	0.0000	OK							
15 minute winter	11	10	67.538	0.146	27.0	0.2451	0.0000	OK	2.000	12	26.8	0.836	0.376	0.1770	
15 minute winter	12	10	67.502	0.133	26.8	0.0024	0.0000	OK	2.001	13	26.4	0.925	0.372	0.6294	
15 minute winter	13	10	67.403	0.124	53.4	0.2051	0.0000	OK	2.002	14	52.9	2.029	0.315	0.4999	
15 minute winter	14	11	66.957	0.114	52.9	0.0021	0.0000	OK	2.003	7	52.5	1.294	0.313	1.1432	
15 minute winter	21	10	67.342	0.130	27.0	0.2211	0.0000	OK	3.000	22	26.2	1.072	0.367	1.7225	
15 minute winter	22	11	67.020	0.099	53.0	0.1544	0.0000	OK	3.001	8	52.1	1.258	0.237	0.7780	

Circular_Default Sewer Type						
Shape	Circular		Dia (mm)			
Barrels	1		100			
Height (mm)			150			
Width (mm)						
Side Slope (1:X)						
Auto Increment (mm)	75					
Preferred Cover (m)						
Steep Slope (1:X)						
Follow Ground	x					
Velocity	Default					
ks (mm) / n						
Short Name						
swale						
Shape	Trapezoidal		Dia (mm)			
Barrels	1		7000			
Height (mm)			10000			
Width (mm)	500					
Side Slope (1:X)	3.0					
Auto Increment (mm)	250					
Preferred Cover (m)						
Steep Slope (1:X)	400					
Follow Ground						
Velocity	Manning					
ks (mm) / n	100.000					
Short Name						
double pipes						
Shape	Rectangular		Dia (mm)			
Barrels	2		100			
Height (mm)			150			
Width (mm)						
Side Slope (1:X)						
Auto Increment (mm)	75					
Preferred Cover (m)						
Steep Slope (1:X)						

Follow Ground	x					
Velocity	Default					
ks (mm) / n						
Short Name						
rectang						
Shape	Rectangular		Dia (mm)			
Barrels	1		300			
Height (mm)	500					
Width (mm)						
Side Slope (1:X)						
Auto Increment (mm)	50					
Preferred Cover (m)						
Steep Slope (1:X)						
Follow Ground	x					
Velocity	Default					
ks (mm) / n						
Short Name						
fsdfs						
Shape	Closed Rectangular		Dia (mm)			
Barrels	1		3000			
Height (mm)	1000					
Width (mm)						
Side Slope (1:X)						
Auto Increment (mm)	50					
Preferred Cover (m)						
Steep Slope (1:X)						
Follow Ground	x					
Velocity	Default					
ks (mm) / n						
Short Name						
swale1						
Shape	Open User Defined		Dia (mm)		Width / Total	Depth / Total
Barrels	1		300		0.000	1.000
Height (mm)					2.000	0.500

Width (mm)					2.001	0.000
Side Slope (1:X)					4.000	0.000
Auto Increment (mm)	50				4.001	0.500
Preferred Cover (m)					6.000	1.000
Steep Slope (1:X)						
Follow Ground	x					
Velocity	Default					
ks (mm) / n						
Short Name						
filter drain						
Shape	Rectangular		Dia (mm)			
Barrels	1		450			
Height (mm)						
Width (mm)	2000					
Side Slope (1:X)						
Auto Increment (mm)	50					
Preferred Cover (m)	0.500					
Steep Slope (1:X)	400					
Follow Ground	x					
Velocity	Default					
ks (mm) / n						
Short Name						
swale2						
Shape	Open User Defined		Dia (mm)	Width / Total	Depth / Total	
Barrels	1		300	0.000	1.000	
Height (mm)				2.000	0.500	
Width (mm)				2.001	0.000	
Side Slope (1:X)				7.999	0.000	
Auto Increment (mm)	50			8.000	0.500	
Preferred Cover (m)				9.990	1.000	
Steep Slope (1:X)	400					
Follow Ground	x					
Velocity	Default					
ks (mm) / n						
Short Name						



swale3						
Shape	Open User Defined		Dia (mm)		Width / Total	Depth / Total
Barrels	1		300		0.000	1.000
Height (mm)					2.000	0.500
Width (mm)					2.001	0.000
Side Slope (1:X)					7.999	0.000
Auto Increment (mm)	50				8.000	0.500
Preferred Cover (m)					9.990	1.000
Steep Slope (1:X)						
Follow Ground	x					
Velocity	Default					
ks (mm) / n						
Short Name						