



ARCH
ASSOCIATES

APPENDIX 8

SURFACE WATER DRAINAGE CALCULATIONS



Arch Associates Limited
The Town House
Bishops Waltham
SO32 1AF

File: Goodwillies Timber Yard - Storm.
Network: Storm
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Goodwillies Timber Yard,
Purbrook.
Storm Water Calculations.

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	1	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	100.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)
Catchment 1	0.082	5.00	59.488	467661.339	108728.956	1.050
Catchment 2	0.176	5.00	60.782	467677.933	108703.197	1.275
Catchment 7	0.203	5.00	59.053	467742.464	108544.744	1.000
Catchment 8	0.054	5.00	61.102	467714.665	108588.014	0.600
Catchment 5	0.189	5.00	60.106	467620.271	108528.208	0.850
Catchment 4.1	0.071	5.00	61.551	467610.889	108588.010	1.400
Catchment 3	0.329	5.00	60.573	467679.325	108570.425	1.000
Catchment 9	0.161	5.00	58.150	467637.223	108472.738	0.650
Catchment 6	0.151	5.00	58.860	467708.311	108529.455	1.250
Catchment 10.1	0.062	5.00	57.660	467649.457	108445.578	1.625
Catchment 11	0.133	5.00	57.501	467732.396	108495.643	1.050
Catchment 12	0.121		57.416	467754.748	108507.407	0.600
Catchment 4.2	0.067		61.900	467633.675	108602.909	1.400
Catchment 10.2	0.059		57.850	467686.375	108465.986	1.625

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Starting Level (m)	
Rainfall Events	Singular	Skip Steady State	x	Check Discharge Rate(s)	x
Summer CV	1.000	Drain Down Time (mins)	1440	Check Discharge Volume	x
Winter CV	1.000	Additional Storage (m³/ha)	0.0		

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 %)
1	0	0	0
10	0	0	0
30	45	0	0
100	45	10	0

Node Catchment 1 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00248	Invert Level (m)	58.438	Slope (1:X)	9999.9
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	8165	Depth (m)	1.050
Safety Factor	3.0	Width (m)	6.000	Inf Depth (m)	
Porosity	0.30	Length (m)	56.000		



Node Catchment 2 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.01732	Invert Level (m)	59.507	Slope (1:X)	9999.9
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	2533	Depth (m)	1.275
Safety Factor	5.0	Width (m)	20.000	Inf Depth (m)	
Porosity	0.30	Length (m)	26.100		

Node Catchment 3 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.01285	Invert Level (m)	59.573	Slope (1:X)	9999.9
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	2451	Depth (m)	1.000
Safety Factor	5.0	Width (m)	20.000	Inf Depth (m)	
Porosity	0.30	Length (m)	63.500		

Node Catchment 4.1 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00763	Invert Level (m)	60.151	Slope (1:X)	9999.9
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	3893	Depth (m)	1.400
Safety Factor	3.0	Width (m)	10.000	Inf Depth (m)	
Porosity	0.30	Length (m)	20.000		

Node Catchment 8 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00684	Invert Level (m)	60.502	Slope (1:X)	9999.9
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	1184	Depth (m)	0.600
Safety Factor	3.0	Width (m)	19.300	Inf Depth (m)	
Porosity	0.30	Length (m)	20.000		

Node Catchment 7 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00684	Invert Level (m)	58.053	Slope (1:X)	9999.9
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	4605	Depth (m)	1.000
Safety Factor	5.0	Width (m)	20.000	Inf Depth (m)	
Porosity	0.30	Length (m)	44.150		

Node Catchment 12 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.01411	Invert Level (m)	56.816	Slope (1:X)	9999.9
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	957	Depth (m)	0.600
Safety Factor	5.0	Width (m)	20.000	Inf Depth (m)	
Porosity	0.30	Length (m)	35.250		

Node Catchment 11 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00116	Invert Level (m)	56.451	Slope (1:X)	9999.9
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	29095	Depth (m)	1.050
Safety Factor	5.0	Width (m)	20.000	Inf Depth (m)	
Porosity	0.30	Length (m)	27.950		

Node Catchment 10.1 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00300	Invert Level (m)	56.035	Slope (1:X)	9999.9
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	11925	Depth (m)	1.625
Safety Factor	3.0	Width (m)	3.500	Inf Depth (m)	
Porosity	0.30	Length (m)	47.000		



Node Catchment 9 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.02966	Invert Level (m)	57.500	Slope (1:X)	9999.9
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	531	Depth (m)	0.650
Safety Factor	5.0	Width (m)	20.000	Inf Depth (m)	
Porosity	0.30	Length (m)	36.800		

Node Catchment 6 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00296	Invert Level (m)	57.610	Slope (1:X)	9999.9
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	14443	Depth (m)	1.250
Safety Factor	5.0	Width (m)	15.000	Inf Depth (m)	
Porosity	0.30	Length (m)	35.000		

Node Catchment 5 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00990	Invert Level (m)	59.256	Slope (1:X)	9999.9
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	2500	Depth (m)	0.850
Safety Factor	5.0	Width (m)	20.000	Inf Depth (m)	
Porosity	0.30	Length (m)	44.750		

Node Catchment 4.2 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00763	Invert Level (m)	60.500	Slope (1:X)	9999.9
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	3893	Depth (m)	1.400
Safety Factor	3.0	Width (m)	10.000	Inf Depth (m)	
Porosity	0.30	Length (m)	20.000		

Node Catchment 10.2 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00300	Invert Level (m)	56.225	Slope (1:X)	9999.9
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	11925	Depth (m)	1.625
Safety Factor	3.0	Width (m)	3.500	Inf Depth (m)	
Porosity	0.30	Length (m)	47.000		



Results for 1 year Critical Storm Duration. Lowest mass balance: 99.89%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute summer	Catchment 1	1440	58.651	0.213	1.2	21.1438	0.0000	OK
960 minute summer	Catchment 2	705	59.708	0.201	3.4	31.2000	0.0000	OK
1440 minute summer	Catchment 7	1170	58.242	0.189	2.9	45.3994	0.0000	OK
960 minute summer	Catchment 8	645	60.579	0.077	1.0	8.8083	0.0000	OK
960 minute summer	Catchment 5	750	59.405	0.149	3.6	35.6456	0.0000	OK
960 minute winter	Catchment 4.1	900	60.396	0.245	0.9	14.6400	0.0000	OK
960 minute summer	Catchment 3	705	59.741	0.168	6.3	59.6097	0.0000	OK
480 minute summer	Catchment 9	312	57.590	0.090	4.8	19.4902	0.0000	OK
1440 minute winter	Catchment 6	1410	57.888	0.278	1.4	43.5033	0.0000	OK
1440 minute summer	Catchment 10.1	1470	56.383	0.348	0.9	17.0596	0.0000	OK
1440 minute summer	Catchment 11	1470	56.703	0.252	1.9	42.0053	0.0000	OK
720 minute summer	Catchment 12	495	56.908	0.092	2.7	19.0186	0.0000	OK
960 minute winter	Catchment 4.2	825	60.725	0.225	0.8	13.4342	0.0000	OK
1440 minute summer	Catchment 10.2	1470	56.551	0.326	0.8	15.9876	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
1440 minute summer	Catchment 1	Infiltration	0.1
960 minute summer	Catchment 2	Infiltration	0.5
1440 minute summer	Catchment 7	Infiltration	0.3
960 minute summer	Catchment 8	Infiltration	0.2
960 minute summer	Catchment 5	Infiltration	0.5
960 minute winter	Catchment 4.1	Infiltration	0.1
960 minute summer	Catchment 3	Infiltration	0.9
480 minute summer	Catchment 9	Infiltration	1.2
1440 minute winter	Catchment 6	Infiltration	0.1
1440 minute summer	Catchment 10.1	Infiltration	0.0
1440 minute summer	Catchment 11	Infiltration	0.0
720 minute summer	Catchment 12	Infiltration	0.6
960 minute winter	Catchment 4.2	Infiltration	0.1
1440 minute summer	Catchment 10.2	Infiltration	0.0



Results for 10 year Critical Storm Duration. Lowest mass balance: 99.89%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
1440 minute summer	Catchment 1	1470	58.843	0.405	2.0	40.5497	0.0000	OK
960 minute winter	Catchment 2	930	59.935	0.428	4.0	66.8612	0.0000	OK
1440 minute winter	Catchment 7	1410	58.427	0.374	3.3	90.9258	0.0000	OK
720 minute winter	Catchment 8	675	60.663	0.161	1.5	18.5309	0.0000	OK
960 minute winter	Catchment 5	930	59.564	0.308	4.3	75.0442	0.0000	OK
1440 minute winter	Catchment 4.1	1410	60.655	0.504	1.2	30.1623	0.0000	OK
960 minute winter	Catchment 3	930	59.926	0.353	7.4	127.2718	0.0000	OK
240 minute winter	Catchment 9	232	57.710	0.210	10.3	45.9202	0.0000	OK
1440 minute summer	Catchment 6	1470	58.117	0.507	3.7	79.6144	0.0000	OK
1440 minute summer	Catchment 10.1	1470	56.693	0.658	1.5	32.3384	0.0000	OK
1440 minute winter	Catchment 11	1470	56.889	0.438	2.2	73.1901	0.0000	OK
600 minute winter	Catchment 12	570	57.013	0.197	3.9	41.2058	0.0000	OK
1440 minute winter	Catchment 4.2	1410	60.974	0.474	1.1	28.3623	0.0000	OK
1440 minute winter	Catchment 10.2	1440	56.842	0.617	1.0	30.3418	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
1440 minute summer	Catchment 1	Infiltration	0.1
960 minute winter	Catchment 2	Infiltration	0.5
1440 minute winter	Catchment 7	Infiltration	0.3
720 minute winter	Catchment 8	Infiltration	0.2
960 minute winter	Catchment 5	Infiltration	0.5
1440 minute winter	Catchment 4.1	Infiltration	0.1
960 minute winter	Catchment 3	Infiltration	0.9
240 minute winter	Catchment 9	Infiltration	1.2
1440 minute summer	Catchment 6	Infiltration	0.1
1440 minute summer	Catchment 10.1	Infiltration	0.0
1440 minute winter	Catchment 11	Infiltration	0.0
600 minute winter	Catchment 12	Infiltration	0.6
1440 minute winter	Catchment 4.2	Infiltration	0.1
1440 minute winter	Catchment 10.2	Infiltration	0.0



Results for 30 year +45% CC Critical Storm Duration. Lowest mass balance: 99.89%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	Catchment 1	1440	59.191	0.753	2.4	75.6320	0.0000	OK
1440 minute winter	Catchment 2	1410	60.379	0.872	5.1	136.3834	0.0000	OK
1440 minute winter	Catchment 7	1440	58.763	0.710	5.9	176.2435	0.0000	OK
960 minute winter	Catchment 8	930	60.827	0.325	2.1	37.5592	0.0000	OK
1440 minute winter	Catchment 5	1410	59.862	0.606	5.5	150.9582	0.0000	OK
1440 minute winter	Catchment 4.1	1440	61.147	0.996	2.0	59.7007	0.0000	OK
1440 minute winter	Catchment 3	1410	60.279	0.706	9.5	258.2202	0.0000	OK
480 minute winter	Catchment 9	464	57.936	0.436	10.9	95.8866	0.0000	OK
1440 minute summer	Catchment 6	1470	58.523	0.913	6.5	143.4133	0.0000	OK
1440 minute winter	Catchment 10.1	1470	57.222	1.187	1.8	58.4446	0.0000	OK
1440 minute winter	Catchment 11	1470	57.225	0.774	3.8	129.5616	0.0000	OK
960 minute winter	Catchment 12	930	57.215	0.399	4.8	83.9146	0.0000	OK
1440 minute summer	Catchment 4.2	1470	61.429	0.929	2.9	55.6914	0.0000	OK
1440 minute winter	Catchment 10.2	1470	57.325	1.100	1.7	54.1448	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
1440 minute winter	Catchment 1	Infiltration	0.1
1440 minute winter	Catchment 2	Infiltration	0.5
1440 minute winter	Catchment 7	Infiltration	0.3
960 minute winter	Catchment 8	Infiltration	0.2
1440 minute winter	Catchment 5	Infiltration	0.5
1440 minute winter	Catchment 4.1	Infiltration	0.1
1440 minute winter	Catchment 3	Infiltration	0.9
480 minute winter	Catchment 9	Infiltration	1.2
1440 minute summer	Catchment 6	Infiltration	0.1
1440 minute winter	Catchment 10.1	Infiltration	0.0
1440 minute winter	Catchment 11	Infiltration	0.0
960 minute winter	Catchment 12	Infiltration	0.6
1440 minute summer	Catchment 4.2	Infiltration	0.1
1440 minute winter	Catchment 10.2	Infiltration	0.0



Results for 100 year +45% CC +10% A Critical Storm Duration. Lowest mass balance: 99.89%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	Catchment 1	1440	59.476	1.038	3.2	104.2939	0.0000	OK
1440 minute winter	Catchment 2	1410	60.759	1.252	6.8	195.7781	0.0000	OK
1440 minute winter	Catchment 7	1440	59.025	0.972	7.9	244.5448	0.0000	OK
1440 minute winter	Catchment 8	1410	60.976	0.474	2.1	54.8301	0.0000	OK
1440 minute winter	Catchment 5	1410	60.096	0.840	7.3	212.8173	0.0000	OK
1440 minute winter	Catchment 4.1	1440	61.540	1.389	2.8	83.2770	0.0000	OK
1440 minute winter	Catchment 3	1410	60.570	0.997	12.8	368.0379	0.0000	OK
600 minute winter	Catchment 9	585	58.132	0.632	12.3	139.0391	0.0000	OK
1440 minute summer	Catchment 6	1470	58.850	1.240	8.7	194.9324	0.0000	OK
1440 minute summer	Catchment 10.1	1470	57.640	1.605	3.6	79.0919	0.0000	OK
1440 minute summer	Catchment 11	1470	57.494	1.043	7.7	174.6657	0.0000	OK
1440 minute winter	Catchment 12	1410	57.388	0.572	4.7	120.6355	0.0000	OK
1440 minute winter	Catchment 4.2	1440	61.811	1.311	2.6	78.5970	0.0000	OK
1440 minute winter	Catchment 10.2	1470	57.732	1.507	2.3	74.2663	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
1440 minute winter	Catchment 1	Infiltration	0.1
1440 minute winter	Catchment 2	Infiltration	0.5
1440 minute winter	Catchment 7	Infiltration	0.3
1440 minute winter	Catchment 8	Infiltration	0.2
1440 minute winter	Catchment 5	Infiltration	0.5
1440 minute winter	Catchment 4.1	Infiltration	0.1
1440 minute winter	Catchment 3	Infiltration	0.9
600 minute winter	Catchment 9	Infiltration	1.2
1440 minute summer	Catchment 6	Infiltration	0.1
1440 minute summer	Catchment 10.1	Infiltration	0.0
1440 minute summer	Catchment 11	Infiltration	0.0
1440 minute winter	Catchment 12	Infiltration	0.6
1440 minute winter	Catchment 4.2	Infiltration	0.1
1440 minute winter	Catchment 10.2	Infiltration	0.0