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Technical Note: 001
Date: 5th July 2019
Site: Howarth Timber Ltd, Chester Road, Broughton, Chester
Reference:2019/2418

Commercial Site Chester Road Broughton
Surface Water Onsite Runoff

Existing Runoff from the Site

The total site area affected by this development has been estimated at approximately 6654m² (0.665 ha). The site is currently a commercial development which includes several buildings and yard area.

There is surface water drainage system within the site which collects runoff from the buildings, access road and yard areas within the site. During the site visit there was evidence of roof gutters and downpipes to all the buildings and drainage channels and gullies to access road and yard areas. It is therefore considered that the site is positively drained.

The manholes where lifted within the site and it appears that the drainage is directed north via a 100mm diameter surface water sewer. At the northern boundary of the site the sewer is only 1.25m deep. The sewer heads north into the adjacent commercial development where it is believed to turn east to discharge into an open watercourse.

The existing impermeable area within the site has been estimated at 3790m². the remainder of the site is generally compacted stone.

The existing site plan which shows the impermeable area and sewers within the site is provided at Appendix A of this report.

The site is within an area with an SPR value of 39.9% suggesting that the site will not allow adequate infiltration.

Table 1: Modified Rational Method flows from existing site 0.379 hectares

Return Period	Flow in litres per second (l/s)
1 in 1 year	32.13
1 in 30 year	99.63
1 in 100 year	139.07

The Modified Rational Method has been used to calculate the existing runoff from the impermeable part of the site. The calculation sheet is provided at Appendix B of this report. However, the discharge from the site is currently controlled by the final length of 100mm diameter sewer which exits the site to the north. The sewer has a gradient of 1 in 83. Using the pipe table provided at Appendix C the peak pipe capacity has been estimate at 5.72l/s.

Any discharge from the site will require the consent of the appropriate water authority/riparian owner, as such, they will also need to be approached to agree the discharge restriction from the site.
Therefore, a peak discharge rate of 5.72l/s has been adopted for this development.

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Discharge to surface water sewer

It is proposed that the roofed and paved areas within the site is directed to the existing 100mm diameter sewer within the site. The discharge into the sewer will be restricted to 5.72l/s. The impermeable area has been calculated at 6151m² (0.615 hectares). This area will be 100% roofed and paved.

An assessment of the required balance volume has been made using the estimated post development impermeable area of 0.615 hectares discharging to the 100mm diameter sewer at a peak rate of 5.72ls. Using WinDes Source Control software developed by Microdrainage the required attenuation has been calculated for the 1 in 100 year plus climate change (30%) event.

Reference should be made to Appendix D where the calculation sheets are provided. The attenuation size has been tabulated below in Table 2. It is estimated that during the 1 in 100 year plus climate change (30%) event that 327.5m³ of storage will be required. This will be provided within a 0.4m deep crate tank. The drainage strategy drawing provided at Appendix E shows the initial drainage strategy for the site which includes the tank.

Table 2: WinDes 1 in 100 year+CC Storage Volume

Return Period	Required Attenuation	Approx Volume (m³)
1 in 100 year + CC	715m2 of 0.4m deep crate tank	327.5

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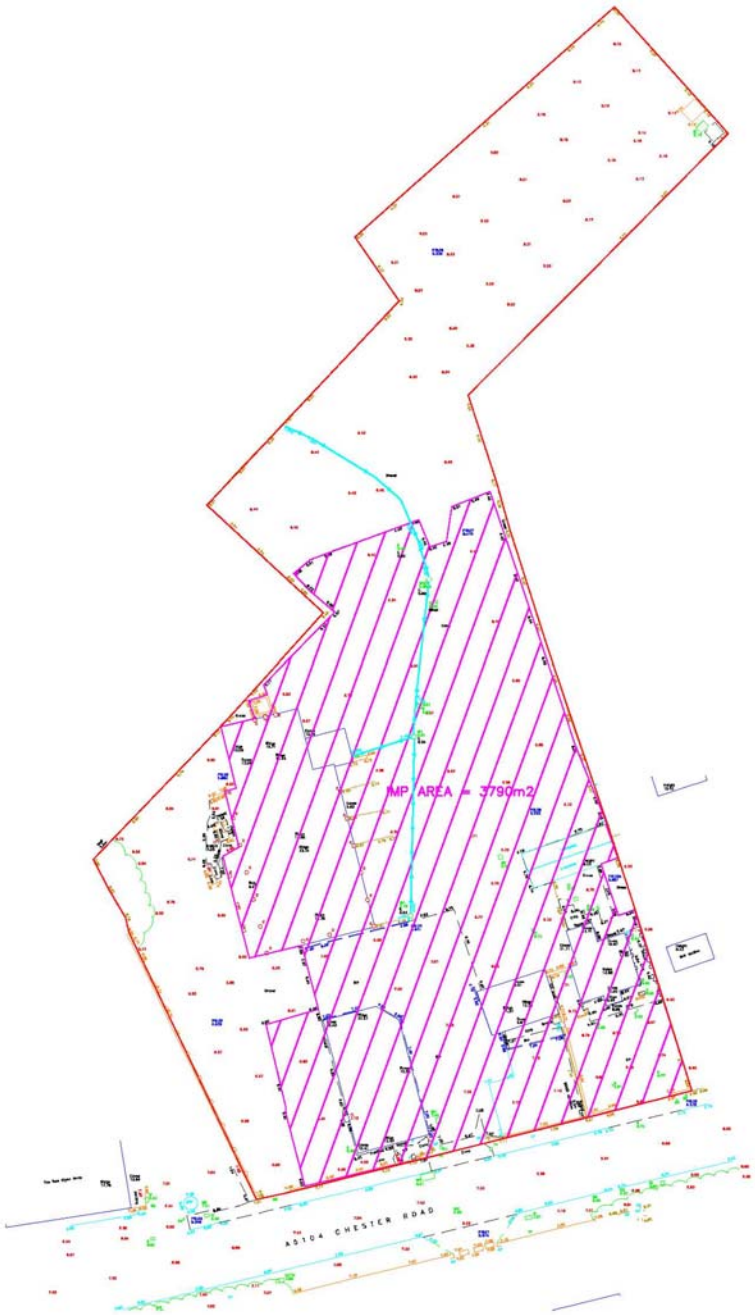
Attachment A – Existing Site Plan



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Attachment B – Modified Rational Runoff Calculation

Modified Rational Method

Length (m)	95	m
Area (ha)	0.379	Ha
Max Height	7.0	mAOD
Min Height	6.5	mAOD
DeltaH	0.5	
Slope (%)	0.55	
Te (mins)	16.08	mins
ARF	0.998	
SAAR	707.000	mm
UCWI	70	mm
PIMP	100.0	%
SOIL	0.50	
Percentage Runoff PR	80.16	
DEEPSTOR	0.95	
Cv	0.8016	
Cr	1.3	
allowable outflow		
1 year	32.13	l/s

Return Period 1 years; flood Rainfall 2 years; Post Development

Rainfall Duration (hours)	Rainfall Duration (days)	Rainfall Depth (mm)	Effective Depth (mm)	Rainfall Intensity (mm/hr)	FLOW (l/s)	FLOW (l/s/ha)
0.25	0.010	5.2	5.4	20.8	22.8	60.3
0.27	0.011	7.9	8.2	29.3	32.1	84.8
0.5	0.021	8.43	8.8	16.9	18.5	48.8
0.75	0.031	10	10.4	13.3	14.6	38.6
1	0.042	11.27	11.7	11.3	12.4	32.6
1.25	0.052	12.36	12.9	9.9	10.9	28.6
1.5	0.063	13.32	13.9	8.9	9.7	25.7
1.75	0.073	14.18	14.8	8.1	8.9	23.5
2	0.083	14.97	15.6	7.5	8.2	21.7
2.25	0.094	15.7	16.4	7.0	7.7	20.2
2.5	0.104	16.38	17.1	6.6	7.2	19.0
2.75	0.115	17.02	17.7	6.2	6.8	17.9
3	0.125	17.63	18.4	5.9	6.5	17.0
3.25	0.135	18.21	19.0	5.6	6.2	16.2
3.5	0.146	18.75	19.5	5.4	5.9	15.5
3.75	0.156	19.28	20.1	5.1	5.6	14.9
4	0.167	19.78	20.6	4.9	5.4	14.3
4.25	0.177	20.27	21.1	4.8	5.2	13.8

Modified Rational Method

Length (m)	95	m
Area (ha)	0.379	Ha
Max Height	7.0	mAOD
Min Height	6.5	mAOD
DeltaH	0.5	
Slope (%)	0.55	
Te (mins)	16.08	mins
ARF	0.998	
SAAR	707.000	mm
UCWI	70	mm
PIMP	100.0	%
SOIL	0.50	
Percentage Runoff PR	80.16	
DEEPSTOR	0.95	
Cv	0.8016	
Cr	1.3	
allowable outflow		
30 year	99.63	l/s

Return Period 30 years; flood Rainfall 50 years; Post Development

Rainfall Duration (hours)	Rainfall Duration (days)	Rainfall Depth (mm)	Effective Depth (mm)	Rainfall Intensity (mm/hr)	FLOW (l/s)	FLOW (l/s/ha)
0.25	0.010	19.5	21.2	78.0	85.6	226.0
0.27	0.011	24.5	25.5	90.7	99.6	262.9
0.5	0.021	26.13	27.2	52.3	57.4	151.4
0.75	0.031	29.99	31.3	40.0	43.9	115.8
1	0.042	33.02	34.4	33.0	36.3	95.7
1.25	0.052	35.55	37.0	28.4	31.2	82.4
1.5	0.063	37.75	39.3	25.2	27.6	72.9
1.75	0.073	39.69	41.4	22.7	24.9	65.7
2	0.083	41.45	43.2	20.7	22.8	60.0
2.25	0.094	43.06	44.9	19.1	21.0	55.4
2.5	0.104	44.55	46.4	17.8	19.6	51.6
2.75	0.115	45.93	47.9	16.7	18.3	48.4
3	0.125	47.23	49.2	15.7	17.3	45.6
3.25	0.135	48.46	50.5	14.9	16.4	43.2
3.5	0.146	49.62	51.7	14.2	15.6	41.1
3.75	0.156	50.72	52.9	13.5	14.9	39.2
4	0.167	51.77	53.9	12.9	14.2	37.5
4.25	0.177	52.78	55.0	12.4	13.6	36.0

Modified Rational Method

Length (m)	95	m
Area (ha)	0.379	Ha
Max Height	7.0	mAOD
Min Height	6.5	mAOD
DeltaH	0.5	
Slope (%)	0.55	
Te (mins)	16.08	mins
ARF	0.998	
SAAR	707.000	mm
UCWI	70	mm
PIMP	100.0	%
SOIL	0.50	
Percentage Runoff PR	80.16	
DEEPSTOR	0.95	
Cv	0.8016	
Cr	1.3	
allowable outflow		
100 year	139.07	l/s

Return Period 100 years; flood Rainfall 140 years; Post Development

Rainfall Duration (hours)	Rainfall Duration (days)	Rainfall Depth (mm)	Effective Depth (mm)	Rainfall Intensity (mm/hr)	FLOW (l/s)	FLOW (l/s/ha)
0.25	0.010	28	29.2	112.0	123.0	324.5
0.27	0.011	34.2	35.6	126.7	139.1	367.0
0.5	0.021	36.39	37.9	72.8	79.9	210.8
0.75	0.031	41.38	43.1	55.2	60.6	159.8
1	0.042	45.25	47.2	45.3	49.7	131.1
1.25	0.052	48.46	50.5	38.8	42.6	112.3
1.5	0.063	51.22	53.4	34.1	37.5	98.9
1.75	0.073	53.67	55.9	30.7	33.7	88.8
2	0.083	55.87	58.2	27.9	30.7	80.9
2.25	0.094	57.87	60.3	25.7	28.2	74.5
2.5	0.104	59.72	62.2	23.9	26.2	69.2
2.75	0.115	61.44	64.0	22.3	24.5	64.7
3	0.125	63.05	65.7	21.0	23.1	60.9
3.25	0.135	64.56	67.3	19.9	21.8	57.5
3.5	0.146	65.99	68.8	18.9	20.7	54.6
3.75	0.156	67.34	70.2	18.0	19.7	52.0
4	0.167	68.63	71.5	17.2	18.8	49.7
4.25	0.177	69.86	72.8	16.4	18.0	47.6

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Technical Note: 001
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Attachment C – Pipe Table

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COLEBROOK WHITE

Roughness	1.5	mm	**U/S level**	5.94	m	
Diam(mm)	100	mm	**D/S level**	5.69	m	
Length	20.77	m	**Gradient**	0.01203659		83.08

PROPOR'N DEPTH	WETTED PERIMETER	AREA OF FLOW	HYDRAULIC MEAN DEPTH	VELOCITY (m/s)	DISCHARGE (l/s)	DEPTH (mm)	SURFACE WIDTH (mm)
FULL	0.31415927	0.007853982	0.0250000	0.73	5.72	100	
0.01	0.02003348	1.32933E-05	0.0006636	0.04	0.00	1	20
0.02	0.02837941	3.74853E-05	0.0013209	0.07	0.00	2	28
0.03	0.0348166	6.86551E-05	0.0019719	0.11	0.01	3	34
0.04	0.04027158	0.000105377	0.0026167	0.13	0.01	4	39
0.05	0.04510268	0.000146815	0.0032551	0.16	0.02	5	44
0.1	0.06435011	0.000408753	0.0063520	0.27	0.11	10	60
0.15	0.07953988	0.000738747	0.0092878	0.36	0.27	15	71
0.2	0.09272952	0.001118238	0.0120591	0.44	0.49	20	80
0.25	0.10471976	0.001535462	0.0146626	0.50	0.77	25	87
0.3	0.11592795	0.001981684	0.0170941	0.56	1.11	30	92
0.35	0.12661037	0.002449805	0.0193492	0.61	1.49	35	95
0.4	0.13694384	0.002933698	0.0214226	0.65	1.92	40	98
0.45	0.14706289	0.003427825	0.0233086	0.69	2.38	45	99
0.5	0.15707963	0.003926991	0.0250000	0.73	2.86	50	100
0.55	0.16709637	0.004426156	0.0264886	0.76	3.36	55	99
0.6	0.17721542	0.004920284	0.0277644	0.78	3.85	60	98
0.65	0.1875489	0.005404177	0.0288148	0.80	4.33	65	95
0.7	0.19823132	0.005872298	0.0296235	0.82	4.80	70	92
0.75	0.20943951	0.00631852	0.0301687	0.83	5.23	75	87
0.8	0.22142974	0.006735744	0.0304193	0.83	5.61	80	80
0.85	0.23461938	0.007115235	0.0303267	0.83	5.91	85	71
0.9	0.24980915	0.007445229	0.0298037	0.82	6.11	90	60
0.95	0.26905658	0.007707167	0.0286452	0.80	6.16	95	44
1	0.31415927	0.007853982	0.0250000	0.73	5.72	100	0

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Attachment D – WinDes Calculations discharge to sewer

EWE Associates Ltd		Page 1
Windy Ridge Barn Thealby Lane Winterton DN15 9TG		Micro Drainage
Date 05/07/2019 18:22 File 100yr+CC30% tank ...	Designed By Windows7 Checked By	
Micro Drainage	Source Control W.12.4	

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	5.967	0.267	5.4	190.7	O K
30 min Summer	6.001	0.301	5.4	215.5	O K
60 min Summer	6.038	0.338	5.4	241.4	O K
120 min Summer	6.072	0.372	5.4	266.2	O K
180 min Summer	6.089	0.389	5.4	278.2	O K
240 min Summer	6.098	0.398	5.4	284.6	O K
360 min Summer	6.104	0.404	5.4	288.5	Flood Risk
480 min Summer	6.100	0.400	5.4	286.2	Flood Risk
600 min Summer	6.096	0.396	5.4	282.9	O K
720 min Summer	6.091	0.391	5.4	279.3	O K
960 min Summer	6.094	0.394	5.4	281.4	O K
1440 min Summer	6.088	0.388	5.4	277.6	O K
2160 min Summer	6.067	0.367	5.4	262.2	O K
2880 min Summer	6.039	0.339	5.4	242.1	O K
4320 min Summer	5.948	0.248	5.4	177.3	O K
5760 min Summer	5.892	0.192	5.4	137.1	O K
7200 min Summer	5.863	0.163	5.1	116.4	O K
8640 min Summer	5.845	0.145	4.7	103.8	O K
10080 min Summer	5.833	0.133	4.3	95.1	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Summer	169.665	27
30 min Summer	96.546	41
60 min Summer	54.938	70
120 min Summer	31.262	128
180 min Summer	22.479	186
240 min Summer	17.789	244
360 min Summer	12.792	362
480 min Summer	10.123	458
600 min Summer	8.442	508
720 min Summer	7.279	570
960 min Summer	5.935	698
1440 min Summer	4.452	976
2160 min Summer	3.339	1388
2880 min Summer	2.722	1792
4320 min Summer	1.937	2508
5760 min Summer	1.522	3128
7200 min Summer	1.262	3824
8640 min Summer	1.083	4504
10080 min Summer	0.951	5248

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EWE Associates Ltd		Page 2
Windy Ridge Barn Thealby Lane Winterton DN15 9TG		Micro Drainage
Date 05/07/2019 18:22	Designed By Windows7	
File 100yr+CC30% tank ...	Checked By	
Micro Drainage	Source Control W.12.4	

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	5.999	0.299	5.4	214.1	O K
30 min Winter	6.039	0.339	5.4	242.2	O K
60 min Winter	6.080	0.380	5.4	271.5	O K
120 min Winter	6.121	0.421	5.4	299.9	Flood Risk
180 min Winter	6.144	0.444	5.4	314.0	Flood Risk
240 min Winter	6.159	0.459	5.4	321.8	Flood Risk
360 min Winter	6.170	0.470	5.4	327.5	Flood Risk
480 min Winter	6.168	0.468	5.4	326.3	Flood Risk
600 min Winter	6.158	0.458	5.4	321.7	Flood Risk
720 min Winter	6.146	0.446	5.4	315.3	Flood Risk
960 min Winter	6.148	0.448	5.4	316.0	Flood Risk
1440 min Winter	6.131	0.431	5.4	306.6	Flood Risk
2160 min Winter	6.091	0.391	5.4	279.5	O K
2880 min Winter	6.043	0.343	5.4	244.9	O K
4320 min Winter	5.909	0.209	5.4	149.4	O K
5760 min Winter	5.858	0.158	5.0	113.0	O K
7200 min Winter	5.835	0.135	4.3	96.7	O K
8640 min Winter	5.821	0.121	3.8	86.7	O K
10080 min Winter	5.811	0.111	3.4	79.6	O K

Storm Event	Rain (mm/hr)	Time-Peak (mins)
15 min Winter	169.665	27
30 min Winter	96.546	41
60 min Winter	54.938	70
120 min Winter	31.262	126
180 min Winter	22.479	184
240 min Winter	17.789	240
360 min Winter	12.792	354
480 min Winter	10.123	464
600 min Winter	8.442	568
720 min Winter	7.279	608
960 min Winter	5.935	746
1440 min Winter	4.452	1058
2160 min Winter	3.339	1516
2880 min Winter	2.722	1936
4320 min Winter	1.937	2552
5760 min Winter	1.522	3176
7200 min Winter	1.262	3832
8640 min Winter	1.083	4576
10080 min Winter	0.951	5256

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EWE Associates Ltd		Page 3
Windy Ridge Barn Thealby Lane Winterton DN15 9TG		Micro Drainage
Date 05/07/2019 18:22 File 100yr+CC30% tank ...	Designed By Windows7 Checked By	
Micro Drainage	Source Control W.12.4	

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
Site Location	334950 364300 SJ 34950 64300
C (1km)	-0.024
D1 (1km)	0.297
D2 (1km)	0.401
D3 (1km)	0.271
E (1km)	0.288
F (1km)	2.419
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+30

Time / Area Diagram

Total Area (ha) 0.615

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.200	4-8	0.200	8-12	0.200	12-16	0.015

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EWE Associates Ltd		Page 4
Windy Ridge Barn Thealby Lane Winterton DN15 9TG		Micro Drainage
Date 05/07/2019 18:22 File 100yr+CC30% tank ...	Designed By Windows7 Checked By	
Micro Drainage	Source Control W.12.4	

Model Details

Storage is Online Cover Level (m) 6.400

Tank or Pond Structure

Invert Level (m) 5.700

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	715.0	1.400	0.0	2.800	0.0	4.200	0.0
0.200	715.0	1.600	0.0	3.000	0.0	4.400	0.0
0.400	715.0	1.800	0.0	3.200	0.0	4.600	0.0
0.600	0.0	2.000	0.0	3.400	0.0	4.800	0.0
0.800	0.0	2.200	0.0	3.600	0.0	5.000	0.0
1.000	0.0	2.400	0.0	3.800	0.0		
1.200	0.0	2.600	0.0	4.000	0.0		

Hydro-Brake® Outflow Control

Design Head (m) 0.700 Hydro-Brake® Type Md4 Invert Level (m) 5.700
Design Flow (l/s) 5.7 Diameter (mm) 94

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.8	1.200	7.5	3.000	11.9	7.000	18.2
0.200	5.4	1.400	8.1	3.500	12.9	7.500	18.9
0.300	4.6	1.600	8.7	4.000	13.8	8.000	19.5
0.400	4.5	1.800	9.2	4.500	14.6	8.500	20.1
0.500	4.9	2.000	9.7	5.000	15.4	9.000	20.7
0.600	5.3	2.200	10.2	5.500	16.1	9.500	21.2
0.800	6.2	2.400	10.7	6.000	16.9		
1.000	6.9	2.600	11.1	6.500	17.6		

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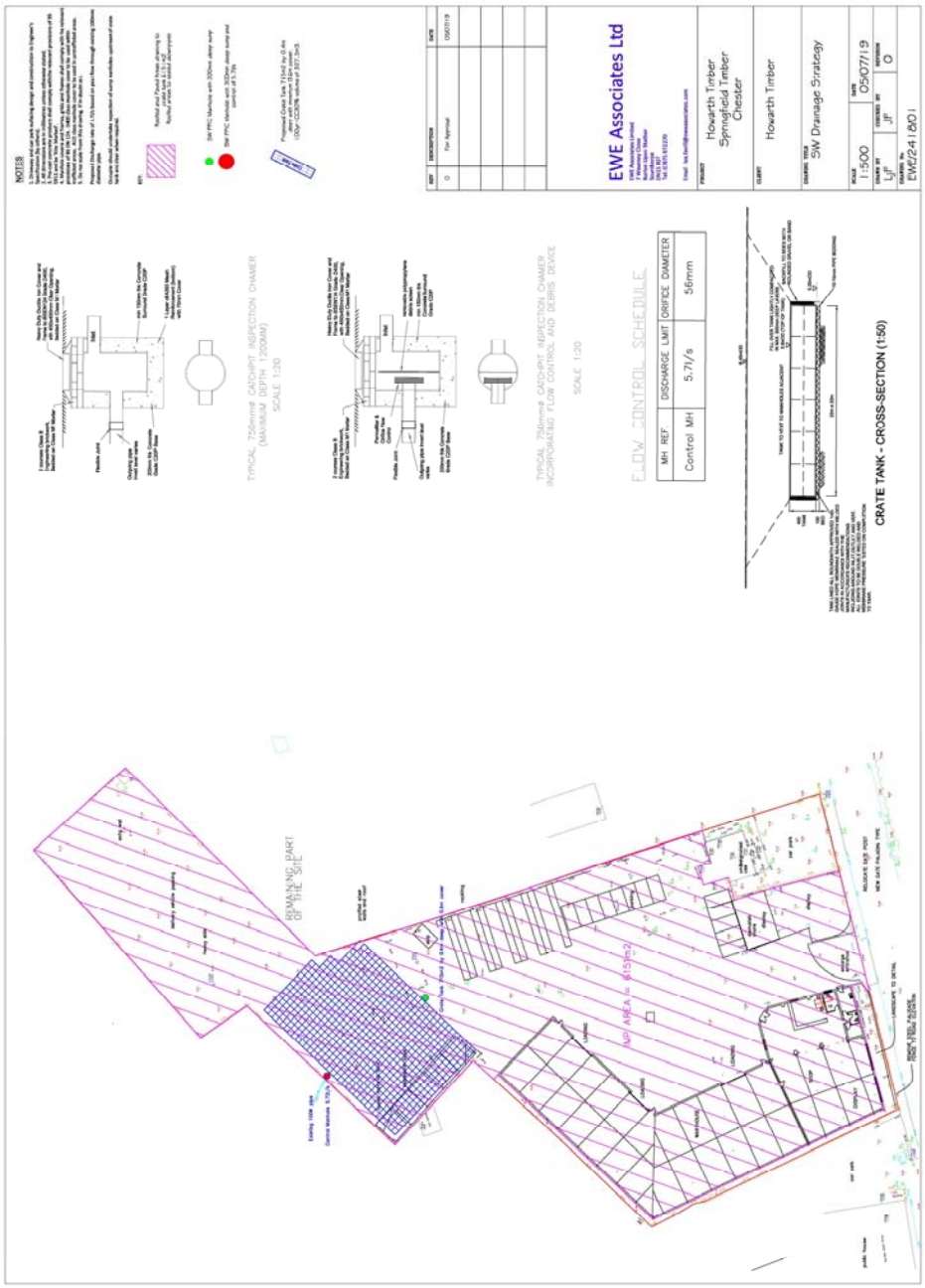
Technical Note: 001
Date: 5th July 2019
Site: Howarth Timber Ltd, Chester Road, Broughton, Chester
Reference:2019/2418

Attachment E – Drainage Strategy Drawing



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