

Technical Note: 001
Date: 28th February 2023
Site: Waipori Lodge Briggswath Whitby
Reference:2022/2922

Surface Water Drainage Design

Existing Runoff

The existing site is currently a domestic dwelling referred to as Waipori Lodge and consists of a single large single storey dwelling, access drive, paved areas and vegetated areas. The total site area has been estimated at 3715m² which includes 1071m² of roofed and paved with the remaining 2644m² being vegetation.

The site is currently drained by a 225mm diameter combined sewer which runs north to south from the site and into Carr Hill Lane and then into the Yorkshire Water public sewer. There are numerous connections from roof gutters and foul connections points into the combined sewer. There are also several road gullies which also connect into the combined sewer. The existing sewer network is shown at Appendix A of this report.

The modified rational method was used to estimate the existing runoff from the site for various. Tabulated below are the estimated flows from the site based on an impermeable area of 0.107 hectares.

Table 1: Modified Rational flows from existing site 0.107 hectares

Return Period	Flow in litres per second (l/s)
1 in 1 year	12.55
1 in 30 year	39.92
1 in 100 year	55.98

It is therefore estimated that during a 1 in 100 year plus climate change 40% storm that the site would generate a flow of 78.4l/s. The existing 225mm diameter combined sewer which is at a gradient of 1 in 8 has a free flow capacity of 166.1l/s. It is therefore considered that the existing combined sewer, even factoring in 2l/s for foul sewerage, is adequately sized to convey the 1 in 100 year plus climate change flow downstream.

The runoff and pipe capacity calculations are provide at Appendix A.

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Proposed Surface Water Drainage Strategy

The proposal is to introduce 3 additional residential dwellings each with an impermeable area of less than 200m². The site is steep and as such extensive retaining structures will be required around each dwelling. As such, each dwelling will be at a different level and there is very little room for ponds, tanks and swales within each plot. Therefore, a practical minimum discharge rate of 1l/s has been adopted for each of the three plots to give a total of 3l/s additional flow from the site. It is considered that the existing combined 225mm diameter sewer is adequate to convey the additional flow.

The proposed drainage layout is provided at Appendix C.

An assessment of the required balance volume for a paved area has been made using the estimated post development impermeable area of 200m² (0.02 hectares) from each plot. Using WinDes Source Control software developed by Microdrainage the required soakaway sizing has been calculated for the 1 in 100 year plus climate change (40%) event.

Reference should be made to Appendix D where the calculation sheets are provided. The drainage strategy drawing provided at Appendix C shows the location of the crate tanks within each plot. It is estimated that a tank 9m² by 0.8m deep will be required in each plot.

Proposed Foul Water Drainage Strategy

The foul drainage from each of the three new plots will be connected to the existing combined sewer as per the drainage strategy provided at Appendix C.

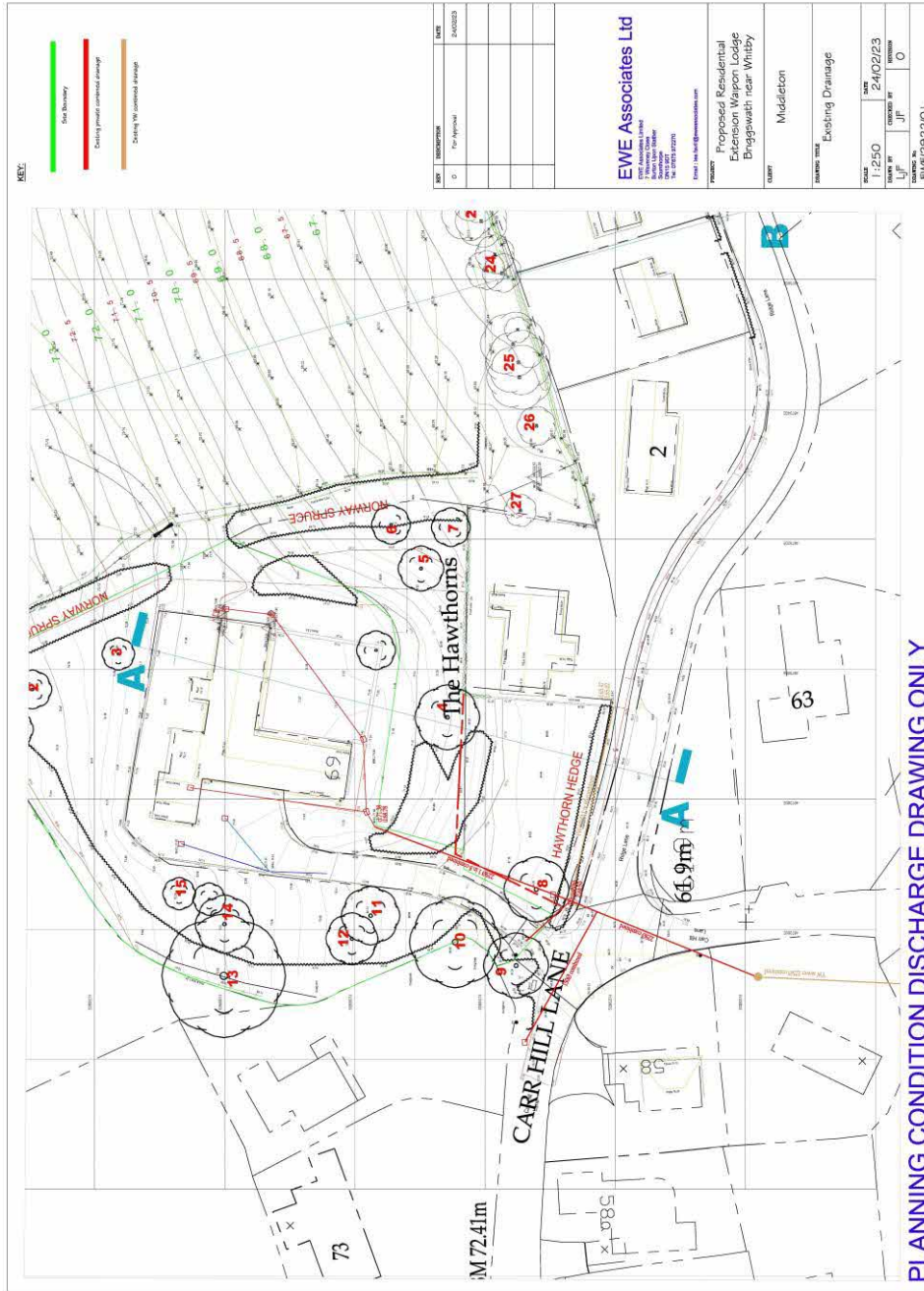
Adoption & Maintenance

The piped drainage and tank systems within the site will be the responsibility of the individual owners. This will also include the pipes and manholes.

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APPENDIX A – Existing Site Plan



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Modified Rational Method

Length (m)	76	m
Area (ha)	0.107	Ha
Max Height	72.5	mAOD
Min Height	66.0	mAOD
DeltaH	6.5	
Slope (%)	8.54	
Te (mins)	7.36	mins
ARF	0.999	
SAAR	706.000	mm
UCWI	85	mm
PIMP	100.0	%
SOIL	0.36	
Percentage Runoff PR	77.83	
DEEPSTOR	0.25	

Cv	0.7783
Cr	1.3
allowable outflow	
1 year	12.55 l/s

Post Development	Return Period		flood		1		2	
	Rainfall Duration (hours)	Rainfall Duration (days)	Rainfall Depth (mm)	Effective Depth (mm)	Rainfall Intensity (mm/hr)	FLOW (l/s)	FLOW (l/s/ha)	
0.12	0.005	5	6.0	41.7	12.6	117.2		
0.25	0.010	6.65	6.7	26.6	8.0	74.6		
0.5	0.021	8.7	8.8	17.4	5.2	48.9		
0.75	0.031	10.17	10.3	13.6	4.1	38.1		
1	0.042	11.36	11.5	11.4	3.4	32.0		
1.25	0.052	12.37	12.5	9.9	3.0	27.8		
1.5	0.063	13.26	13.4	8.8	2.7	24.9		
1.75	0.073	14.06	14.2	8.0	2.4	22.6		
2	0.083	14.79	15.0	7.4	2.2	20.6		
2.25	0.094	15.47	15.7	6.9	2.1	19.3		
2.5	0.104	16.1	16.3	6.4	1.9	18.1		
2.75	0.115	16.69	16.9	6.1	1.8	17.1		
3	0.125	17.24	17.4	5.7	1.7	16.2		
3.25	0.135	17.77	18.0	5.5	1.6	15.4		
3.5	0.146	18.28	18.5	5.2	1.6	14.7		
3.75	0.156	18.76	19.0	5.0	1.5	14.1		
4	0.167	19.22	19.4	4.8	1.4	13.5		
4.25	0.177	19.67	19.9	4.6	1.4	13.0		

Modified Rational Method

Length (m)	76	m
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DeltaH	6.5	
Slope (%)	8.54	
Te (mins)	7.36	mins
ARF	0.999	
SAAR	706.000	mm
UCWI	85	mm
PIMP	100.0	%
SOIL	0.36	
Percentage Runoff PR	77.83	
DEEPSTOR	0.25	

Cv	0.7783
Cr	1.3
allowable outflow	
30 year	39.92 l/s

Post Development	Return Period		flood		30		90	
	Rainfall Duration (hours)	Rainfall Duration (days)	Rainfall Depth (mm)	Effective Depth (mm)	Rainfall Intensity (mm/hr)	FLOW (l/s)	FLOW (l/s/ha)	
0.12	0.005	15.9	21.0	132.5	39.9	372.7		
0.25	0.010	20.11	20.3	80.4	24.2	226.3		
0.5	0.021	25.01	25.3	50.0	15.1	140.7		
0.75	0.031	28.37	28.7	37.6	11.4	106.4		
1	0.042	31	31.4	31.0	9.3	87.2		
1.25	0.052	33.21	33.6	26.6	8.0	74.7		
1.5	0.063	35.12	35.5	23.4	7.1	65.9		
1.75	0.073	36.61	37.2	21.0	6.3	59.2		
2	0.083	38.34	38.8	19.2	5.8	53.9		
2.25	0.094	39.75	40.2	17.7	5.3	49.7		
2.5	0.104	41.04	41.5	16.4	4.9	46.2		
2.75	0.115	42.25	42.7	15.4	4.6	43.2		
3	0.125	43.38	43.9	14.5	4.4	40.7		
3.25	0.135	44.45	45.0	13.7	4.1	38.5		
3.5	0.146	45.48	46.0	13.0	3.9	36.5		
3.75	0.156	46.42	47.0	12.4	3.7	34.8		
4	0.167	47.33	47.9	11.8	3.6	33.3		
4.25	0.177	48.21	48.8	11.3	3.4	31.9		

Modified Rational Method

Length (m)	76	m
Area (ha)	0.107	Ha
Max Height	72.5	mAOD
Min Height	66.0	mAOD
DeltaH	6.5	
Slope (%)	8.54	
Te (mins)	7.36	mins
ARF	0.999	
SAAR	706.000	mm
UCWI	85	mm
PIMP	100.0	%
SOIL	0.36	
Percentage Runoff PR	77.83	
DEEPSTOR	0.25	

Cv	0.7783
Cr	1.3
allowable outflow	
100 year	55.98 l/s

Post Development	Return Period		flood		100		140	
	Rainfall Duration (hours)	Rainfall Duration (days)	Rainfall Depth (mm)	Effective Depth (mm)	Rainfall Intensity (mm/hr)	FLOW (l/s)	FLOW (l/s/ha)	
0.12	0.005	22.3	29.3	185.6	56.0	522.7		
0.25	0.010	27.81	28.1	111.2	33.5	312.9		
0.5	0.021	34.07	34.5	68.1	20.5	191.7		
0.75	0.031	38.31	38.8	51.1	15.4	143.7		
1	0.042	41.61	42.1	41.6	12.5	117.0		
1.25	0.052	44.35	44.9	35.5	10.7	99.8		
1.5	0.063	46.72	47.3	31.1	9.4	87.6		
1.75	0.073	48.61	49.4	27.9	8.4	78.5		
2	0.083	50.69	51.3	25.3	7.6	71.5		
2.25	0.094	52.41	53.0	23.3	7.0	65.5		
2.5	0.104	54	54.6	21.6	6.5	60.8		
2.75	0.115	55.47	56.1	20.2	6.1	56.7		
3	0.125	56.85	57.5	19.0	5.7	53.3		
3.25	0.135	58.14	58.8	17.9	5.4	50.3		
3.5	0.146	59.37	60.1	17.0	5.1	47.7		
3.75	0.156	60.53	61.2	16.1	4.9	45.4		
4	0.167	61.64	62.4	15.4	4.6	43.3		
4.25	0.177	62.7	63.4	14.8	4.4	41.5		

EWE Associates Limited

7 Waveney Close, Burton Upon Stather, Scunthorpe, DN15 9DT

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COLEBROOK WHITE							
Roughness	1.5	mm	U/S level	68.78	m		
Diam(mm)	225	mm	D/S level	64.53	m		
Length	32.249	m	Gradient	0.131787		7.588	
PROPOR'N DEPTH	WETTED PERIMETER	AREA OF FLOW	HYDRAULIC MEAN DEPTH	VELOCITY (m/s)	DISCHARGE (l/s)	DEPTH (mm)	SURFACE WIDTH (mm)
FULL	0.7068583	0.03976078	0.0562500	4.18	166.16	225	
0.01	0.0450753	6.7297E-05	0.0014930	0.28	0.02	2	45
0.02	0.0638537	0.00018977	0.0029719	0.51	0.10	5	63
0.03	0.0783374	0.00034757	0.0044368	0.70	0.24	7	77
0.04	0.0906111	0.00053347	0.0058875	0.86	0.46	9	88
0.05	0.101481	0.00074325	0.0073240	1.02	0.76	11	98
0.1	0.1447877	0.00206931	0.0142920	1.65	3.40	23	135
0.15	0.1789647	0.00373991	0.0208975	2.14	8.02	34	161
0.2	0.2086414	0.00566108	0.0271331	2.56	14.52	45	180
0.25	0.2356194	0.00777328	0.0329908	2.93	22.76	56	195
0.3	0.2608379	0.01003227	0.0384617	3.25	32.56	68	206
0.35	0.2848733	0.01240214	0.0435356	3.53	43.73	79	215
0.4	0.3081236	0.01485185	0.0482009	3.77	56.04	90	220
0.45	0.3308915	0.01735337	0.0524443	3.99	69.24	101	224
0.5	0.3534292	0.01988039	0.0562500	4.18	83.08	113	225
0.55	0.3759668	0.02240742	0.0595994	4.34	97.27	124	224
0.6	0.3987347	0.02490894	0.0624699	4.48	111.52	135	220
0.65	0.421985	0.02735865	0.0648332	4.59	125.52	146	215
0.7	0.4460205	0.02972851	0.0666528	4.67	138.89	158	206
0.75	0.4712389	0.03198751	0.0678796	4.73	151.24	169	195
0.8	0.4982169	0.0340997	0.0684435	4.75	162.08	180	180
0.85	0.5278936	0.03602087	0.0682351	4.74	170.88	191	161
0.9	0.5620706	0.03769147	0.0670583	4.69	176.77	203	135
0.95	0.6053773	0.03901753	0.0644516	4.57	178.31	214	98
1	0.7068583	0.03976078	0.0562500	4.18	166.16	225	0

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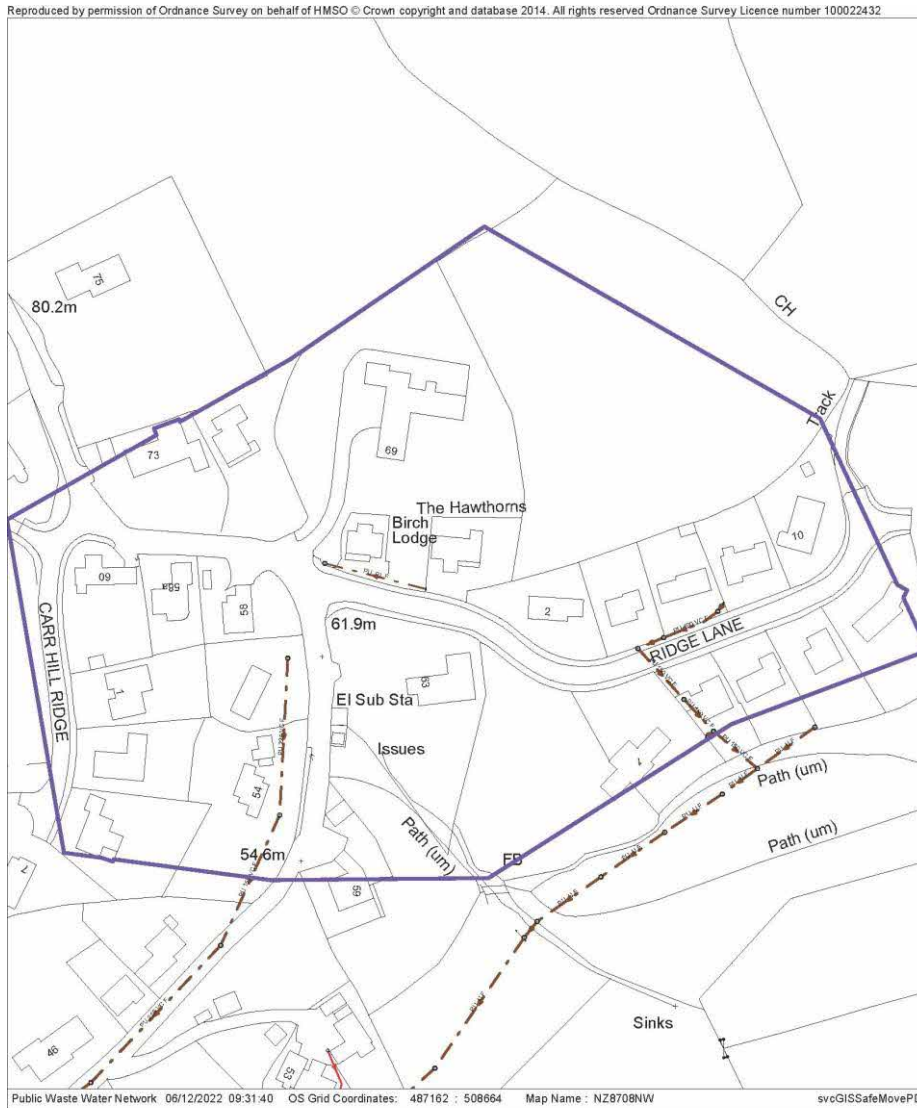
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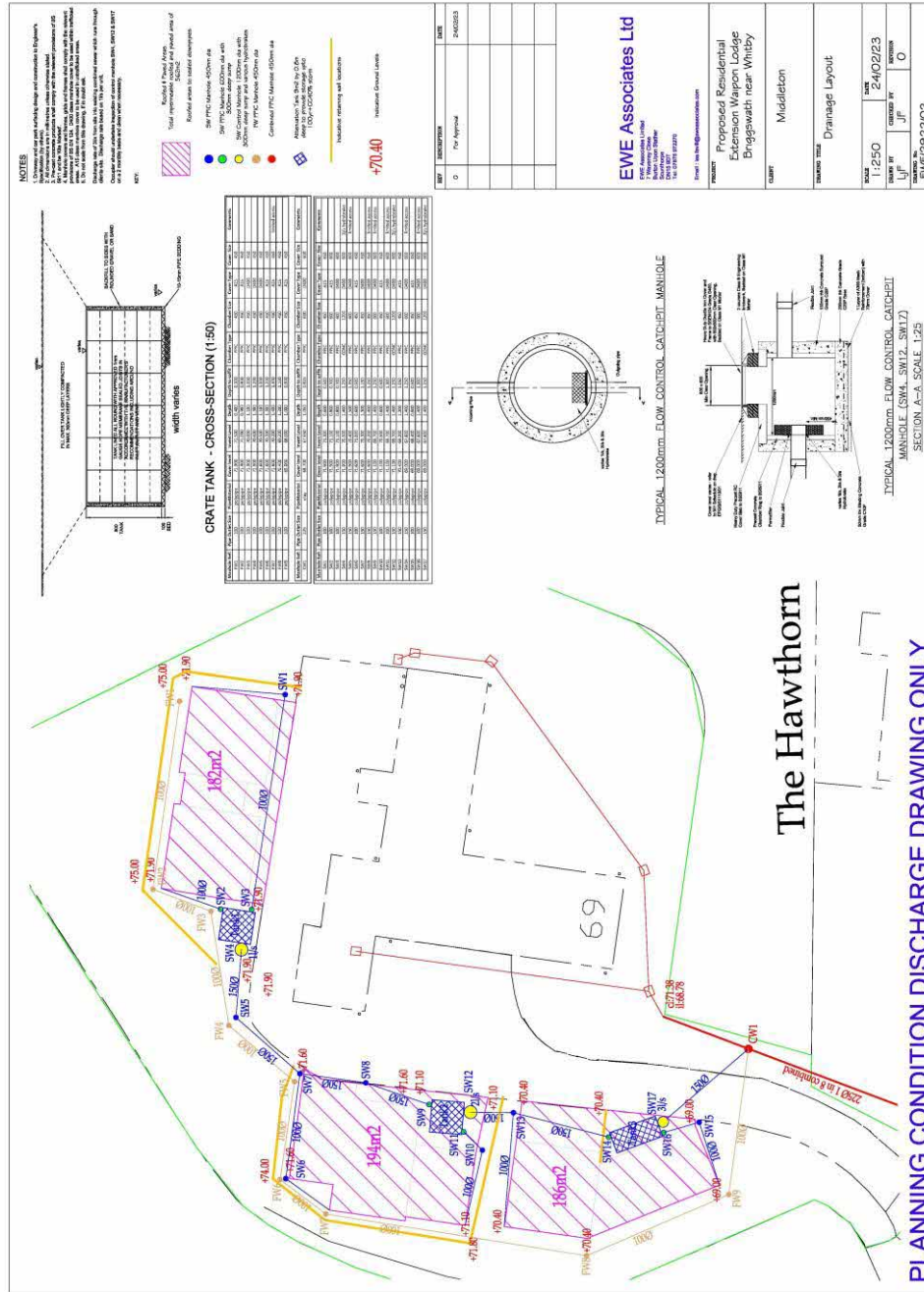
APPENDIX B – Sewer Plan



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APPENDIX C – Drainage Strategy Drawing





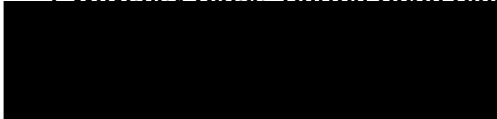
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APPENDIX D – WINDES 100yr+CC40% Calculations

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Windy Ridge Barn Thealby Lane Winterton DN15 9TG					
Date 12/08/2013 09:15	Designed By Lea				
File 100yr+CC40% tank ...	Checked By				
Micro Drainage	Source Control W.12.4				
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
15 min Summer	65.552	0.552	0.8	5.0	O K
30 min Summer	65.632	0.632	0.8	5.7	O K
60 min Summer	65.682	0.682	0.8	6.1	O K
120 min Summer	65.694	0.694	0.8	6.2	O K
180 min Summer	65.691	0.691	0.8	6.1	O K
240 min Summer	65.662	0.662	0.8	6.0	O K
360 min Summer	65.620	0.620	0.8	5.6	O K
480 min Summer	65.578	0.578	0.8	5.2	O K
600 min Summer	65.538	0.538	0.7	4.8	O K
720 min Summer	65.501	0.501	0.7	4.5	O K
960 min Summer	65.435	0.435	0.7	3.9	O K
1440 min Summer	65.332	0.332	0.6	3.0	O K
2160 min Summer	65.223	0.223	0.5	2.0	O K
2880 min Summer	65.109	0.109	0.5	1.0	O K
4320 min Summer	65.052	0.052	0.4	0.5	O K
5760 min Summer	65.043	0.043	0.3	0.4	O K
7200 min Summer	65.039	0.039	0.3	0.3	O K
8640 min Summer	65.035	0.035	0.2	0.3	O K
10080 min Summer	65.033	0.033	0.2	0.3	O K
Storm Event	Rain (mm/hr)	Time-Peak (mins)			
15 min Summer	148.338	20			
30 min Summer	90.081	33			
60 min Summer	54.703	58			
120 min Summer	33.219	90			
180 min Summer	24.813	124			
240 min Summer	20.173	160			
360 min Summer	15.068	228			
480 min Summer	12.250	294			
600 min Summer	10.433	360			
720 min Summer	9.150	426			
960 min Summer	7.443	552			
1440 min Summer	5.564	800			
2160 min Summer	4.160	1176			
2880 min Summer	3.384	1536			
4320 min Summer	2.421	2188			
5760 min Summer	1.909	2936			
7200 min Summer	1.588	3640			
8640 min Summer	1.366	4320			
10080 min Summer	1.203	5096			
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Windy Ridge Barn Thealby Lane Winterton DN15 9TG					
Date 12/08/2013 09:15	Designed By Lea				
File 100yr+CC40% tank ...	Checked By				
Micro Drainage	Source Control W.12.4				
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	65.623	0.623	0.8	5.6	O K
30 min Winter	65.717	0.717	0.9	6.5	Flood Risk
60 min Winter	65.782	0.782	0.9	7.0	Flood Risk
120 min Winter	65.793	0.793	0.9	7.1	Flood Risk
180 min Winter	65.772	0.772	0.9	7.0	Flood Risk
240 min Winter	65.740	0.740	0.9	6.7	Flood Risk
360 min Winter	65.669	0.669	0.8	6.0	O K
480 min Winter	65.603	0.603	0.8	5.4	O K
600 min Winter	65.542	0.542	0.7	4.9	O K
720 min Winter	65.489	0.489	0.7	4.4	O K
960 min Winter	65.399	0.399	0.6	3.6	O K
1440 min Winter	65.269	0.269	0.5	2.4	O K
2160 min Winter	65.069	0.069	0.5	0.6	O K
2880 min Winter	65.052	0.052	0.4	0.5	O K
4320 min Winter	65.041	0.041	0.3	0.4	O K
5760 min Winter	65.036	0.036	0.2	0.3	O K
7200 min Winter	65.032	0.032	0.2	0.3	O K
8640 min Winter	65.030	0.030	0.2	0.3	O K
10080 min Winter	65.028	0.028	0.1	0.2	O K
Storm Event	Rain (mm/hr)	Time-Peak (mins)			
15 min Winter	148.338	20			
30 min Winter	90.081	33			
60 min Winter	54.703	60			
120 min Winter	33.219	96			
180 min Winter	24.813	134			
240 min Winter	20.173	172			
360 min Winter	15.068	244			
480 min Winter	12.250	314			
600 min Winter	10.433	382			
720 min Winter	9.150	448			
960 min Winter	7.443	560			
1440 min Winter	5.564	840			
2160 min Winter	4.160	1124			
2880 min Winter	3.384	1472			
4320 min Winter	2.421	2196			
5760 min Winter	1.909	2904			
7200 min Winter	1.588	3632			
8640 min Winter	1.366	4376			
10080 min Winter	1.203	5112			
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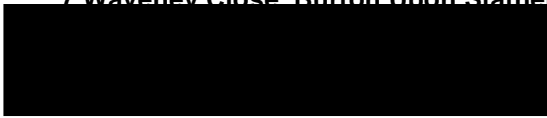





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Windy Ridge Barn Thealby Lane Winterton DN15 9TG			
Date 12/08/2013 09:15 File 100yr+CC40% tank ...	Designed By Lea Checked By		
Micro Drainage		Source Control W.12.4	
<u>Rainfall Details</u>			
Rainfall Model			PEH
Return Period (years)			100
Site Location	486950 508400 NZ	86950 08400	
C (1km)			-0.021
D1 (1km)			0.377
D2 (1km)			0.379
D3 (1km)			0.271
E (1km)			0.284
F (1km)			2.359
Summer Storms			Yes
Winter Storms			Yes
Cv (Summer)			0.750
Cv (Winter)			0.840
Shortest Storm (mins)			15
Longest Storm (mins)			10080
Climate Change %			+40
<u>Time / Area Diagram</u>			
Total Area (ha) 0.020			
Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.010	4-8	0.010
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Date 12/08/2013 09:15	Designed By Lea						
File 100yr+CC40% tank ...	Checked By						
Micro Drainage	Source Control W.12.4						
<u>Model Details</u>							
Storage is: Online Cover Level (m) 66.000							
<u>Tank or Pond Structure</u>							
Invert Level (m) 65.000							
Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	9.0	1.400	0.0	2.800	0.0	4.200	0.0
0.200	9.0	1.600	0.0	3.000	0.0	4.400	0.0
0.400	9.0	1.800	0.0	3.200	0.0	4.600	0.0
0.600	9.0	2.000	0.0	3.400	0.0	4.800	0.0
0.800	9.0	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		
<u>Hydro-Brake@ Outflow Control</u>							
Design Head (m)	1.000	Hydro-Brake@ Type	Md4	Invert Level (m)	65.000		
Design Flow (l/s)	1.0	Diameter (mm)	36				
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.4	1.200	1.1	3.000	1.7	7.000	2.7
0.200	0.5	1.400	1.2	3.500	1.9	7.500	2.8
0.300	0.6	1.600	1.3	4.000	2.0	8.000	2.9
0.400	0.6	1.800	1.4	4.500	2.1	8.500	2.9
0.500	0.7	2.000	1.4	5.000	2.3	9.000	3.0
0.600	0.8	2.200	1.5	5.500	2.4	9.500	3.1
0.800	0.9	2.400	1.6	6.000	2.5		
1.000	1.0	2.600	1.6	6.500	2.6		
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