

 T J Booth Associates. Consulting Engineers 20A Eastgate St, Rochdale OL16 1DH	Project Rollins / Salley Street, Calderbrook				Job Ref. calc-tjba-rollins-salley st-DSR-260721	
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History.

Revision	Date	Reason
0	Jul 2021	Original.
1	August 2024	Updated for recent planning application.
2	January 2025	Update as per LLFA consultation & FW proposals.
3	Sept 2026	Agricultural planning application.

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Introduction.

Reference:

To support a planning application for an agricultural barn with integrated stables.

Purpose of Report:

The primary purpose of this report is to identify specific drainage proposals in accordance with the national drainage hierarchy for surface water disposal & exceedance characteristics, also considering the proposed end adopters and their requirements.

Regarding site assessment, this report will appraise the existing site and local drainage infrastructure, assess the suitability of the proposed development, giving recommendations for drainage design & management, specifically for approval of the LLFA/EA/sewerage undertakers, as applicable.

Plans.

Location Plan.

Refer to the appended Location Plan.

The site within a rural part of north Littleborough, on the upper west side of a steep valley. It comprises a small greenfield plot of land most recently used for agricultural uses. Natural topography falls to the east.

The River Roch can be found in the valley bottom approximately 240m east. The Rochdale Canal is approximately 280m east.

Site Plan.

There site is greenfield, and comprises an agricultural plot of land. It is highest on the west side at approximately 225m aOD, and falls to around 220m aOD to the east side adjacent to Salley Street.

There is a minor drainage ditch nominally up to a 1m wide and 500mm deep which runs through the centre of the site. This connects into a highways drainage ditch between the site and Salley Street. There are gulleys in the ditch that take surface water from the highway.

The Salley Street drainage ditch flows to the northeast and gullies were noted in the bottom as well as a MH at the ditch end, which anecdotally (local knowledge) discharges beneath the road to the southeast. The gullies in the bottom of the drainage ditch suggest there is a lower carrier pipe.

The predevelopment site areas are:

- *Total area* 1250 sqm.
- *Hardstanding area (impermeable & positively drained)* 0 sqm.
- *Landscaped/greenfield area (assumed permeable)* 1250 sqm.

The proposed agricultural building will be fronted by yard and parking area.

The post development site areas are as follows:

- *Total area* 1250 sqm.
- *Agricultural shed* 225 sqm.
- *Yard* 190 sqm.
- *General soft landscaping & permeable pathways* 835 sqm.

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Desk Surveys & Investigations.

Existing and proposed topography.

A pre-development topographic survey was undertaken which indicates the site to be on a slope from the northwest to southeast boundaries of between 225.00maOD to 220.00maOD. The road level at the site entrance is approximately 219.35maOD.

The level of the Salley Street drainage ditch is nominally 118.60maOD.

BGS Geology.

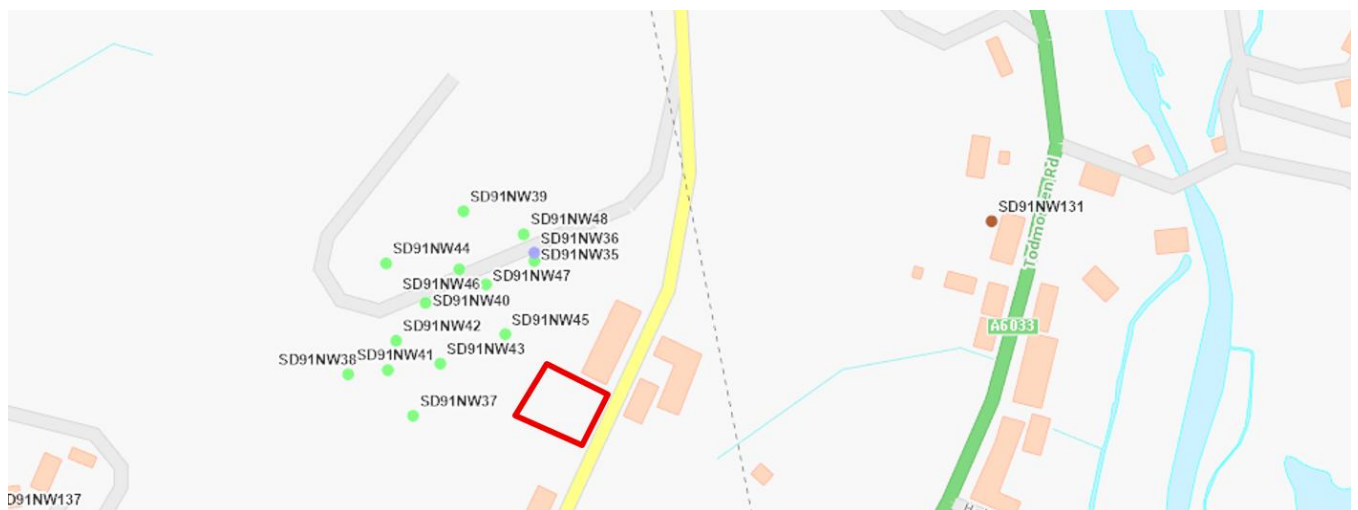
Extracts from the regional BGS geological maps indicate the site is not underlain by superficial (glacial) cover.

The solid geology beneath the site is mudstone & siltstone of the Namurian Marsden Formation.

Borehole records in the local area suggest there is clay at shallow depth beneath the upper topsoil.

Site Investigations.

While no site specific site investigations have been undertaken at this stage, there have been site investigations in the adjacent field west of the site. See image inset:



The closest BH to the site is SD91NW45. The borehole log reveals the following:

SD 91 NW/45

Holst Soil Engineering Limited

Borehole No. 10

BOREHOLE LOG

Contract No. S10762/F2377

Location. Walderbrook

Client. West Pennine Water Board.

Method of Boring. Openhole drilling

Diameter of Borehole. 0.14m

Sheet 1 of 1

Chainage

Ground Level. 230.10m

Date. March-1973

SD 94397 18736

Description of Strata	Legend	Depth Below GL (m)	O.D. Level (m)	Depth of Casing When Sampling	Sampling and Coring	N/Z R.Q.D. %	Daily Progress
TOPSOIL		0.95	229.15				
Grey to dark grey MUDSTONE							
		2.35	227.75				
CLAY		2.60	227.50				
Grey SANDSTONE (Siltstone)		3.20	226.90				

Many of the other boreholes record either similar or less topsoil depths prior to shallow bedrock beneath.

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Assessments.

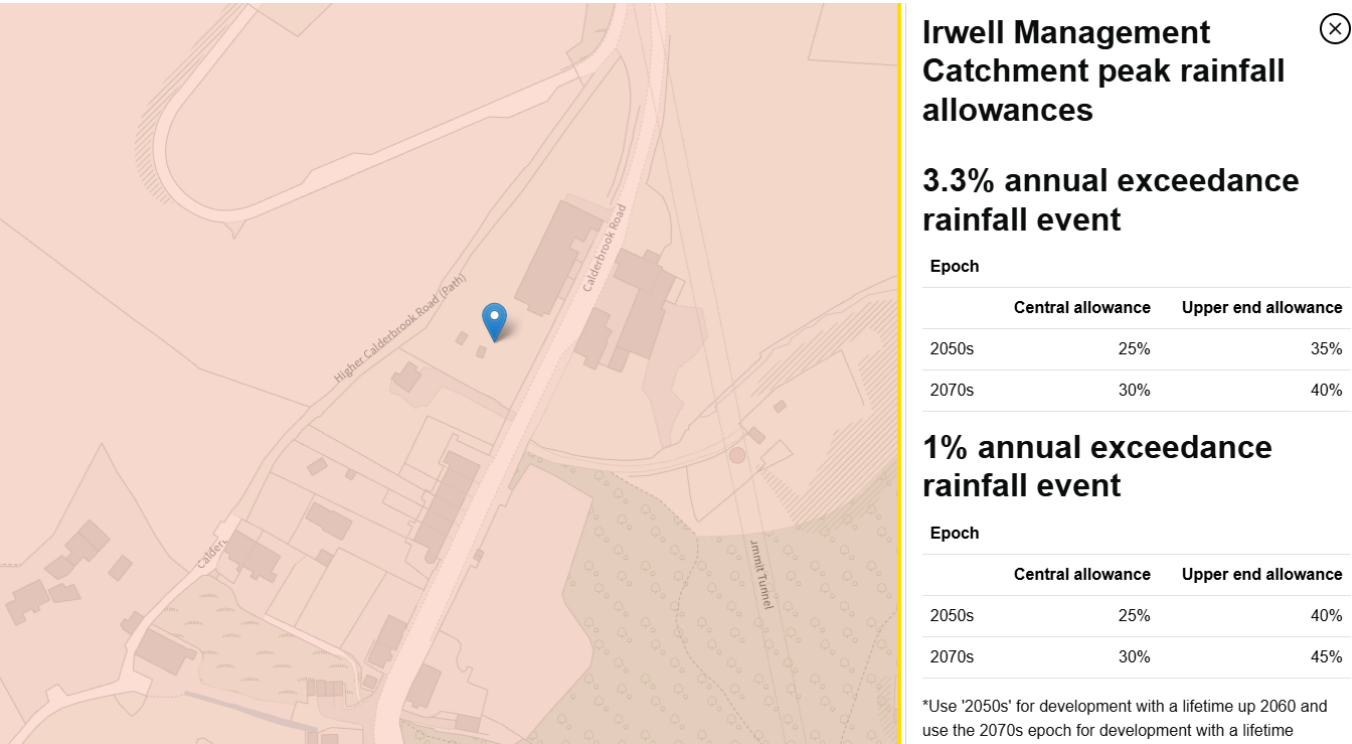
Flood zone category.

Refer to the .gov flood maps appended. The site is within Food Zone 1, ie a LOW probability of flooding. Surface water flooding is not a risk to the site.

The site area is less than 1.0 Ha so a specific flood risk assessment isn't required.

Climate change impacts.

Climate change allowances to peak rainfall intensity are given nationally across the whole of England, based upon river management catchment areas. Refer to graphic inset:



Given the proposed residential Site end use, the 2070s epoch is considered suitable for climate change allowance estimation which suggests the following allowance to be used:

30yr rainfalls +40% climate change allowance.

100yr rainfalls +45% climate change allowance.

Existing surface water system.

The site is a vacant plot of agricultural land and has not been developed historically. As such it shall be assessed for the purposes of drainage design as a greenfield site.

Hydrological characteristics for the site were obtained from the HR Wallingford mapping database:

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SAAR (mm) ⓘ	1354
M5-60 rainfall depth (mm) ⓘ	20
'r' ratio M5-60 / M5-2day ⓘ	0.2
FEH/FSR conversion factor ⓘ	1.25
Hydrological region ⓘ	3
Specify SOIL type ⓘ	5

Rainfall Runoff Assessment.

Greenfield Flow Estimate

Attenuation design

In accordance with CIRIA publication C753 - The SUDS Manual

Tedds calculation version 1.0.04

Pre post runoff method

Site characteristics

Location; Leeds
Hydrological region; 3
Soil type (Wallingford Procedure W.R.A.P map); 5
Standard percentage runoff; SPR = **0.53**
Average annual rainfall; SAAR = **720** mm
5 year return period rainfall of 60 minute duration; M5_60min = **19.0** mm
Ratio 60-minute to 2 day rainfalls of 5 year return; r = **0.36**
Rainfall intensity increase due to global warming; p_{climate} = **0%**
Routing coefficient; C_r = **1.30**
Volumetric runoff coefficient; C_v = **0.75**

Catchment details

Subcatchment	Name	Area (ha)	PIMP (%);	Impermeable area (ha)
1;	site;	0.13;	0.0;	0.00;
Total		0.13;	0.0;	0.00;

Greenfield runoff rates

Catchment area; AREA = **50.00** hectare
Greenfield runoff rate (50 hectare site); $Q_{\text{rural}} = 0.00108 \text{ m}^3/\text{s} \times (\text{AREA}/1 \text{ km}^2)^{0.89} \times (\text{SAAR}/1 \text{ mm})^{1.17} \times \text{SPR}^{2.17} = \mathbf{323.8 \text{ l/s}}$
Greenfield runoff rate; $Q = Q_{\text{rural}} / \text{AREA} \times A = \mathbf{0.8 \text{ l/s}}$
Greenfield runoff rate per unit area; $Q_A = Q / A = \mathbf{6.5 \text{ l/s/hectare}}$

Estimated site discharges

FSR growth rate (1 year); FSR_{1yr} = **0.86**
Discharge (1 year); Q_{1yr} = Q × FSR_{1yr} = **0.7 l/s**
FSR growth rate (30 year); FSR_{30yr} = **1.75**
Discharge (30 year); Q_{30yr} = Q × FSR_{30yr} = **1.4 l/s**

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FSR growth rate (100 year);

$FSR_{100yr} = 2.08$

Discharge (100 year);

$Q_{100yr} = \sqrt[3]{Q} \quad FSR_{100yr} = 1.7 \text{ l/s}$

Proposed Surface Water System.

Following the guidance of hierarchy for disposal of surface water (SUDS):

INFILTRATION: There are borehole records within 20m of the site boundary which indicate CLAY subsoil onto shallow bedrock, which is expected at this elevation. The presence of a drainage ditch through the site also suggests low permeability of superficial soils.

Due to the low permeability of the ground, it will not be suitable for discharge via infiltration, apart from minor areas of pathways around the site.

The yard and roof area will have to discharge via different methods as below.

ON-SITE TREATMENT & DISCHARGE TO WATERCOURSE:

There is a drainage ditch that runs through the site. It is primarily dry, but is suspected of providing a flow route for rainfall runoff in extreme events. This will have to be diverted to ensure the development can progress, but can be swept around the proposed building at the keeping the same dimensions runoff from higher elevation can still run through to the drainage ditch in Salley Street.

Regarding rainfall events within the site, hydroplanters can also be used on each downpipe to manage volume.

There is some available area at the bottom of the site where a planted basin/rain garden can be included within SUDS proposals. This can be planted with species resistant to moisture. The rain garden/basin will be able to flood as required with flow rate restriction provided via a control manhole to max 5l/s, and discharging to the drainage ditch at the front of the site.

Refer to Microdrainage calculation in the Appendix which simulates a single detention basin. Both detention basins are to be the same size and level.

Stable wash down is an intermittent procedure requiring minimal water, at relatively wide intervals. Because of this it is not considered cost effective to include large rainwater harvesting equipment for what would be minimal washdown volume, and relatively long wash down intervals. There are no toilets provided on site.

Refer also to separate Indicative Drainage Plan - dwg-tjba-rollins-salley st-indicative drainage plan-rev0.

SEWER: Not required.

Proposed Foul Water System.

A foul connection at the site is not required apart from stable wash down capacity.

Primarily the foul drainage for horses is managed by straw & associated storage before removal from site.

While there is a foul sewer within 30m, it is attached to the front of residential cottages, and is not suitable for connection.

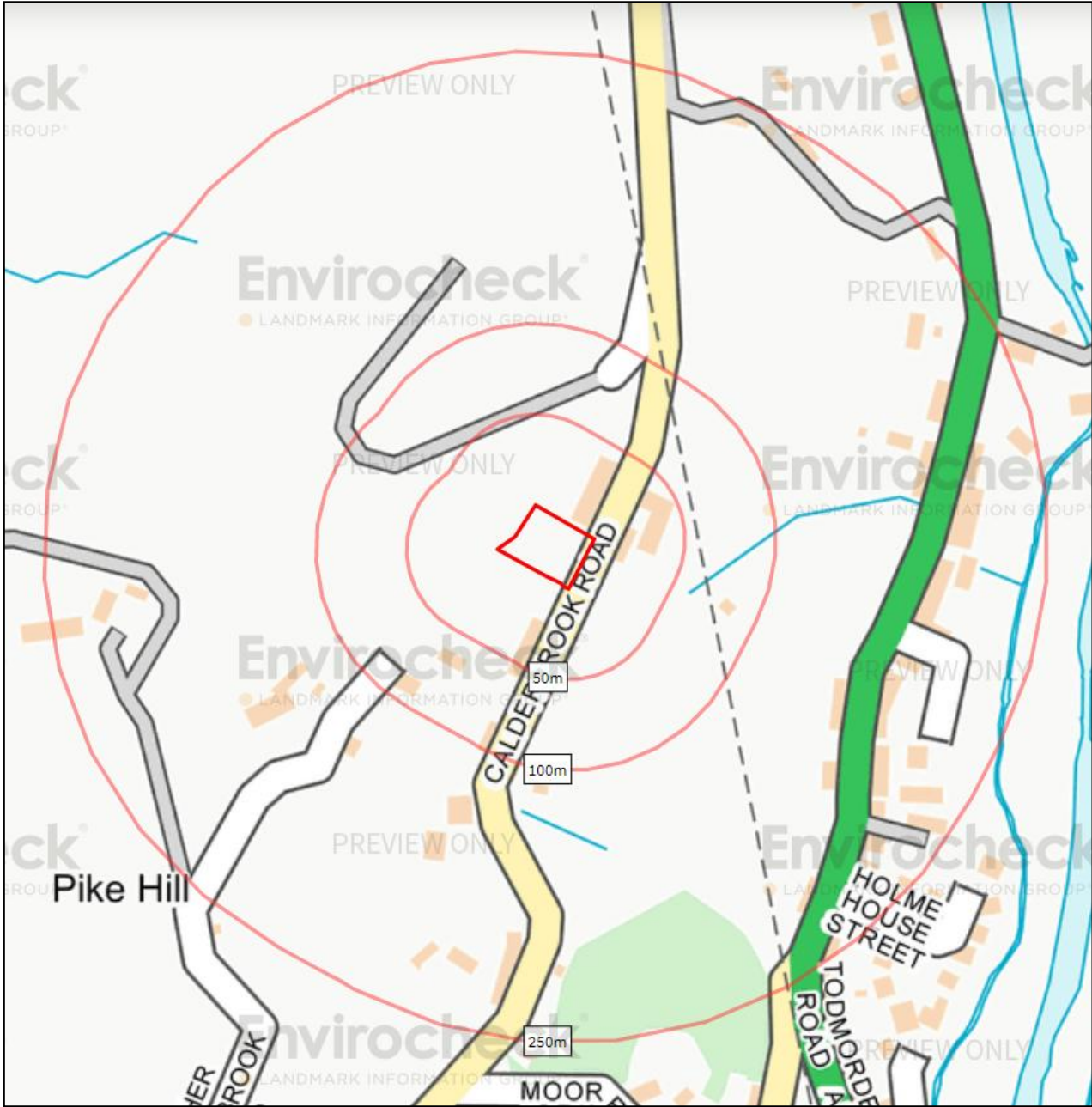
The closest point of FW connection is within the highway approximately 60m away.

Due to the cost of connection, and because stable wash down is an intermittent procedure requiring minimal water, at relatively wide intervals, it would not be a cost-effective solution to connect, and therefore a cesspool/storage tank will be included that will be managed by an off-site contractor.

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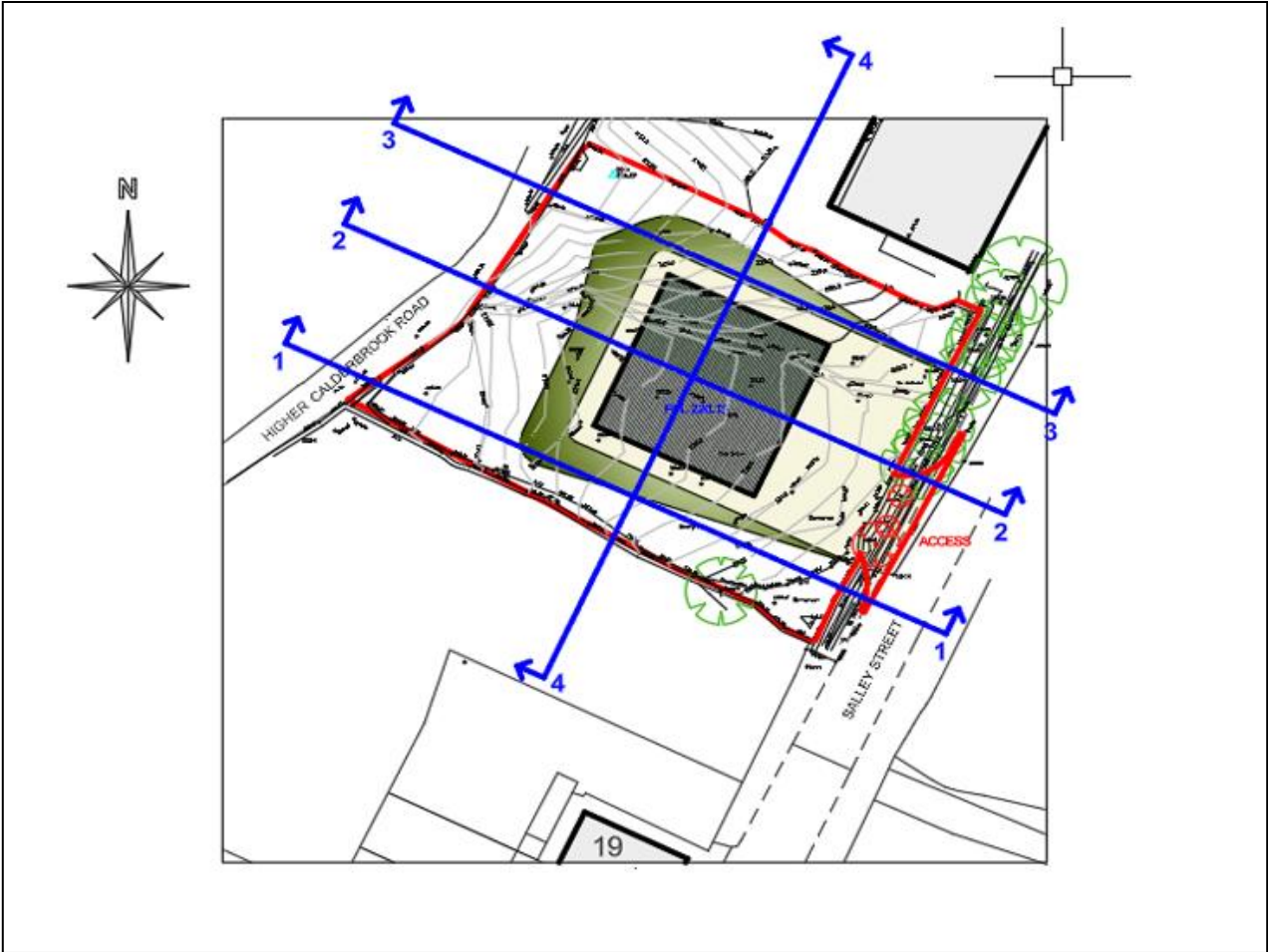
Appendix.

Location Plan.



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Proposed Site Plan & Aerial View.





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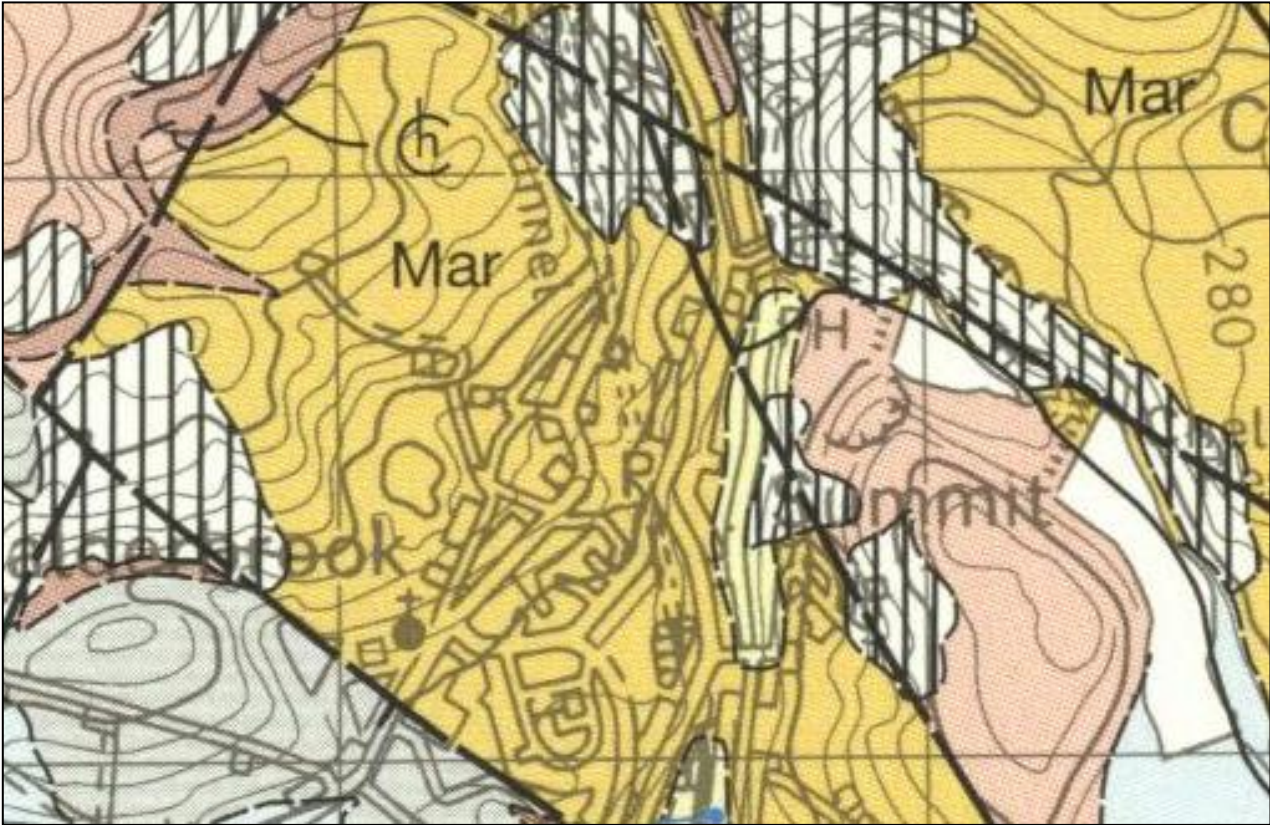
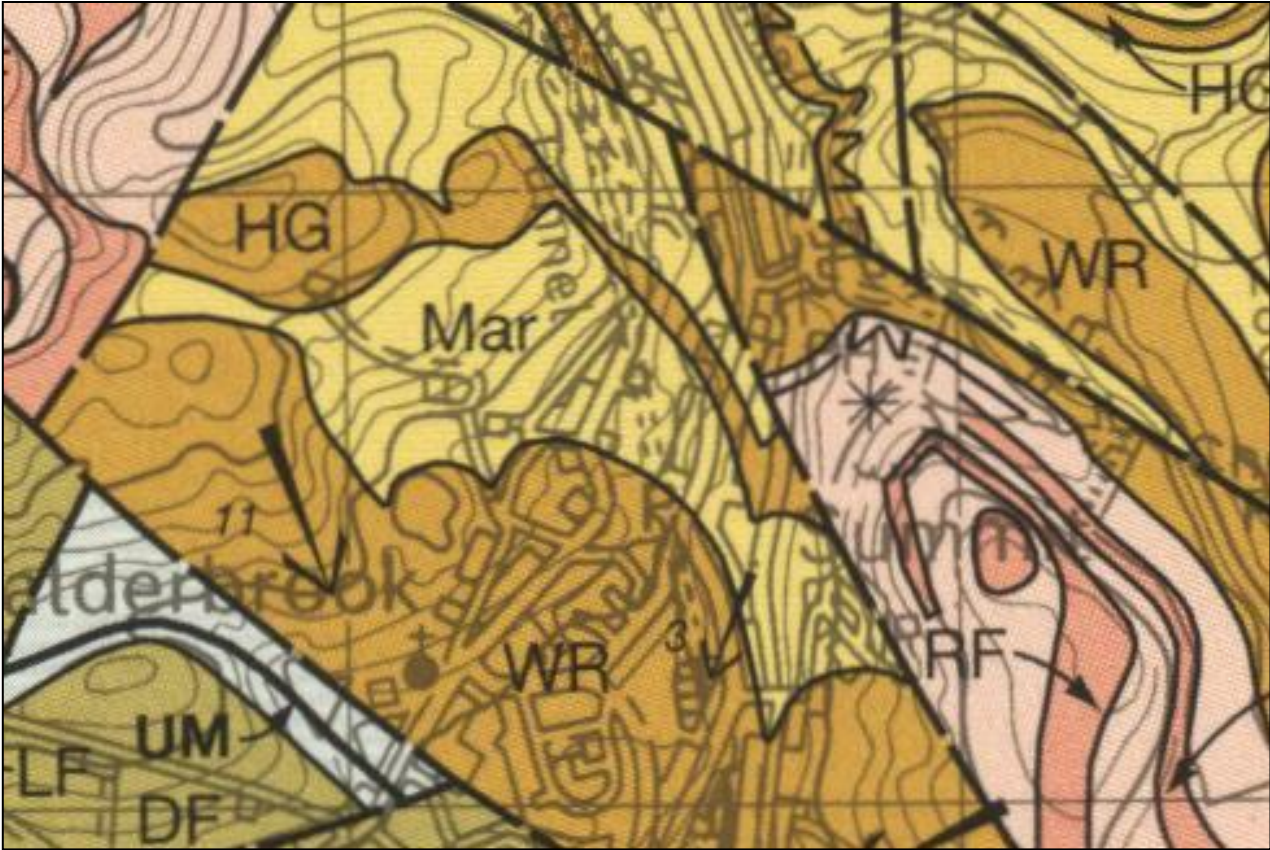
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Topographic Survey Plan



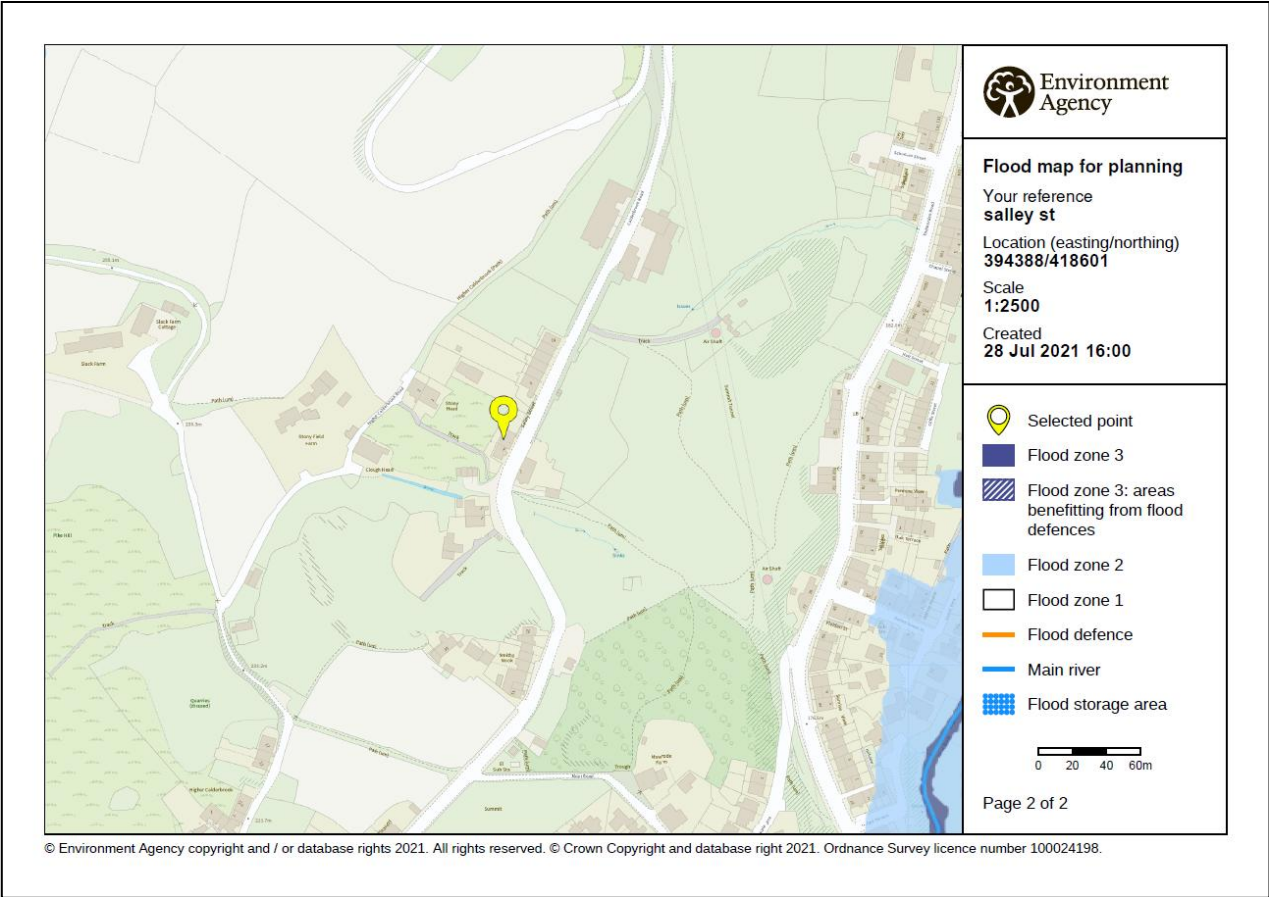
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BGS Solid & Superficial Geology Maps.

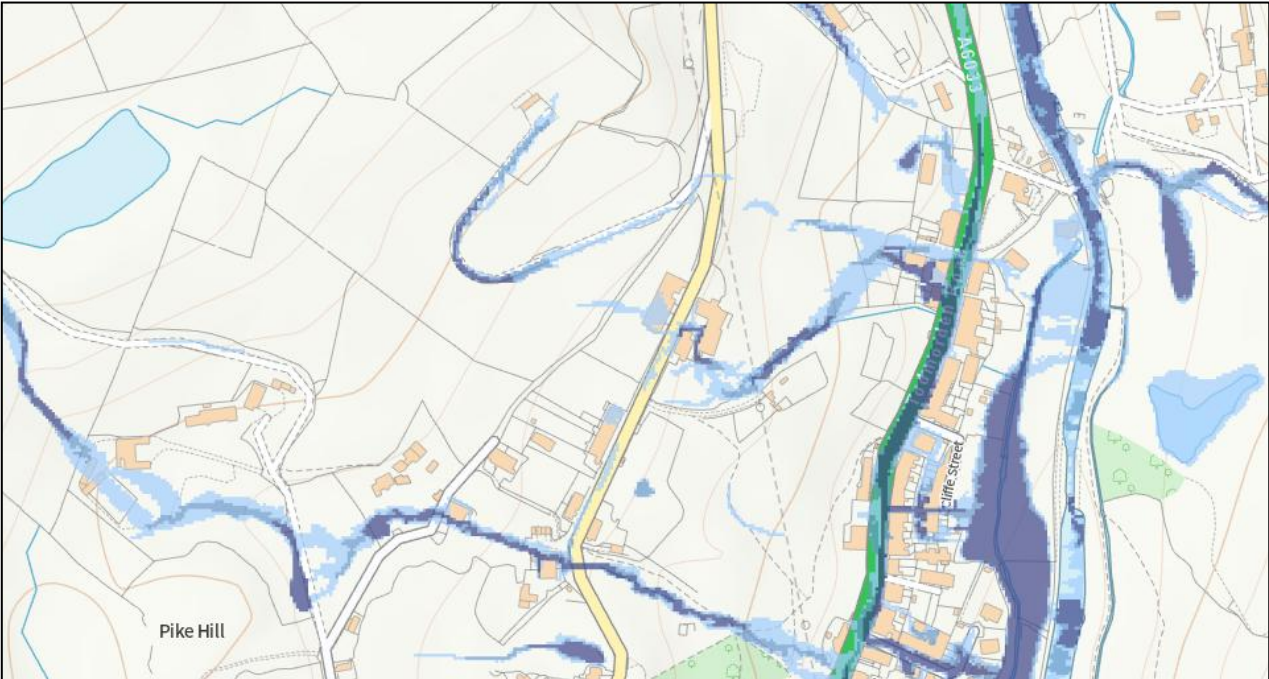


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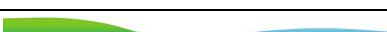
Gov River Flood Map (Flood Zones).



Gov Surface Water Flood Map.



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Drainage Calculations.

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Summary of Results for 1 year Return Period

Storm Duration (mins)	Maximum Control (l/s)	Maximum Filtration (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Maximum Volume (m³)	Status
15 Summer	2.1	0.0	2.1	219.3618	0.1118	1.3	O K
30 Summer	2.2	0.0	2.2	219.3703	0.1203	1.4	O K
60 Summer	2.2	0.0	2.2	219.3652	0.1153	1.3	O K
120 Summer	2.0	0.0	2.0	219.3483	0.0983	1.1	O K
180 Summer	1.8	0.0	1.8	219.3342	0.0843	0.9	O K
240 Summer	1.6	0.0	1.6	219.3248	0.0748	0.8	O K
360 Summer	1.3	0.0	1.3	219.3132	0.0633	0.7	O K
480 Summer	1.1	0.0	1.1	219.3062	0.0563	0.6	O K
600 Summer	1.0	0.0	1.0	219.3013	0.0513	0.5	O K
720 Summer	0.9	0.0	0.9	219.2973	0.0473	0.5	O K
960 Summer	0.8	0.0	0.8	219.2917	0.0417	0.4	O K
1440 Summer	0.6	0.0	0.6	219.2838	0.0337	0.3	O K
2160 Summer	0.5	0.0	0.5	219.2767	0.0267	0.2	O K
2880 Summer	0.4	0.0	0.4	219.2733	0.0232	0.2	O K
4320 Summer	0.3	0.0	0.3	219.2697	0.0198	0.2	O K
5760 Summer	0.2	0.0	0.2	219.2677	0.0178	0.1	O K
7200 Summer	0.2	0.0	0.2	219.2652	0.0153	0.1	O K
8640 Summer	0.2	0.0	0.2	219.2637	0.0138	0.1	O K
10080 Summer	0.2	0.0	0.2	219.2623	0.0123	0.1	O K
15 Winter	2.2	0.0	2.2	219.3717	0.1218	1.4	O K
30 Winter	2.3	0.0	2.3	219.3763	0.1263	1.5	O K
60 Winter	2.1	0.0	2.1	219.3633	0.1133	1.3	O K
120 Winter	1.8	0.0	1.8	219.3358	0.0858	0.9	O K
180 Winter	1.5	0.0	1.5	219.3212	0.0713	0.8	O K
240 Winter	1.3	0.0	1.3	219.3127	0.0628	0.6	O K
360 Winter	1.0	0.0	1.0	219.3022	0.0523	0.5	O K
480 Winter	0.9	0.0	0.9	219.2957	0.0457	0.4	O K
600 Winter	0.8	0.0	0.8	219.2912	0.0412	0.4	O K
720 Winter	0.7	0.0	0.7	219.2878	0.0377	0.4	O K

Storm Duration (mins)		Rain (mm/hr)	Time-Peak (mins)
15	Summer	28.17	13
30	Summer	19.18	22
60	Summer	12.80	38
120	Summer	8.41	68
180	Summer	6.56	98
240	Summer	5.47	128
360	Summer	4.21	188
480	Summer	3.50	248
600	Summer	3.03	308
720	Summer	2.70	370
960	Summer	2.25	490
1440	Summer	1.73	734
2160	Summer	1.33	1096
2880	Summer	1.11	1452
4320	Summer	0.85	2144
5760	Summer	0.71	2936
7200	Summer	0.61	3640
8640	Summer	0.54	4288
10080	Summer	0.49	5112
15	Winter	28.17	13
30	Winter	19.18	22
60	Winter	12.80	38
120	Winter	8.41	70
180	Winter	6.56	98
240	Winter	5.47	128
360	Winter	4.21	188
480	Winter	3.50	248
600	Winter	3.03	308
720	Winter	2.70	370

(c)1982-2006 Micro Drainage

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Micro Drainage		Source Control W.10.4	



Summary of Results for 1 year Return Period

Storm Duration (mins)	Maximum Control (l/s)	Maximum Filtration (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Maximum Volume (m³)	Status
960 Winter	0.6	0.0	0.6	219.2818	0.0317	0.3	O K
1440 Winter	0.4	0.0	0.4	219.2753	0.0252	0.2	O K
2160 Winter	0.3	0.0	0.3	219.2713	0.0212	0.2	O K
2880 Winter	0.3	0.0	0.3	219.2693	0.0193	0.2	O K
4320 Winter	0.2	0.0	0.2	219.2652	0.0153	0.1	O K
5760 Winter	0.2	0.0	0.2	219.2628	0.0128	0.1	O K
7200 Winter	0.2	0.0	0.2	219.2612	0.0113	0.1	O K
8640 Winter	0.1	0.0	0.1	219.2603	0.0103	0.1	O K
10080 Winter	0.1	0.0	0.1	219.2592	0.0093	0.1	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
960 Winter	2.25	492
1440 Winter	1.73	722
2160 Winter	1.33	1068
2880 Winter	1.11	1472
4320 Winter	0.85	2156
5760 Winter	0.71	2880
7200 Winter	0.61	3696
8640 Winter	0.54	4296
10080 Winter	0.49	5184

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Rainfall Details

Region	ENG+WAL	Cv (Summer)	0.750	Summer Storms	Yes
Return Period (years)	1	Cv (Winter)	0.840	Winter Storms	Yes
M5-60 (mm)	20.000	Shortest Storm (mins)	15	Climate Change %	+0
Ratio-R	0.300	Longest Storm (mins)	10080		

Time / Area Diagram

Total Area (ha) = 0.042

Time	(mins)	Area
from:	to:	(ha)
0	4	0.042

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Micro Drainage

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Swale Details

Infil Coef - Base (m/hr)	0.000000	Length (m)	6.5
Infil Coef - Sides (m/hr)	0.000000	Side Slope (1:x)	3.0
Safety Factor	2.0	Invert Level (m)	219.250
Porosity	1.00	Cover Level (m)	219.800
Base Width (m)	1.5	Slope (1:x)	1000.0

Orifice Outflow Control

Diameter (m) 0.060 Discharge Coefficient 0.560 Invert Level (m) 219.240

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Summary of Results for 30 year Return Period (+40%)

Half Drain Time : 18 minutes

Storm Duration (mins)	Maximum Control (l/s)	Maximum Filtration (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Maximum Volume (m³)	Status
15 Summer	3.9	0.0	3.9	219.5827	0.3327	5.3	O K
30 Summer	4.2	0.0	4.2	219.6202	0.3702	6.2	FLOOD RISK
60 Summer	4.2	0.0	4.2	219.6283	0.3782	6.4	FLOOD RISK
120 Summer	4.0	0.0	4.0	219.5992	0.3492	5.7	O K
180 Summer	3.8	0.0	3.8	219.5622	0.3122	4.9	O K
240 Summer	3.6	0.0	3.6	219.5293	0.2792	4.2	O K
360 Summer	3.2	0.0	3.2	219.4762	0.2262	3.1	O K
480 Summer	2.9	0.0	2.9	219.4368	0.1867	2.4	O K
600 Summer	2.6	0.0	2.6	219.4073	0.1572	2.0	O K
720 Summer	2.4	0.0	2.4	219.3853	0.1353	1.6	O K
960 Summer	2.0	0.0	2.0	219.3548	0.1048	1.2	O K
1440 Summer	1.6	0.0	1.6	219.3237	0.0738	0.8	O K
2160 Summer	1.2	0.0	1.2	219.3087	0.0588	0.6	O K
2880 Summer	1.0	0.0	1.0	219.2997	0.0497	0.5	O K
4320 Summer	0.7	0.0	0.7	219.2903	0.0402	0.4	O K
5760 Summer	0.6	0.0	0.6	219.2838	0.0337	0.3	O K
7200 Summer	0.5	0.0	0.5	219.2787	0.0287	0.3	O K
8640 Summer	0.4	0.0	0.4	219.2758	0.0257	0.2	O K
10080 Summer	0.4	0.0	0.4	219.2737	0.0238	0.2	O K
15 Winter	4.1	0.0	4.1	219.6152	0.3652	6.1	FLOOD RISK
30 Winter	4.3	0.0	4.3	219.6523	0.4022	7.0	FLOOD RISK
60 Winter	4.3	0.0	4.3	219.6517	0.4017	7.0	FLOOD RISK
120 Winter	4.0	0.0	4.0	219.6003	0.3502	5.7	FLOOD RISK
180 Winter	3.7	0.0	3.7	219.5452	0.2952	4.5	O K
240 Winter	3.4	0.0	3.4	219.4987	0.2487	3.6	O K
360 Winter	2.8	0.0	2.8	219.4317	0.1817	2.4	O K
480 Winter	2.4	0.0	2.4	219.3887	0.1388	1.7	O K
600 Winter	2.1	0.0	2.1	219.3607	0.1108	1.3	O K
720 Winter	1.9	0.0	1.9	219.3418	0.0918	1.0	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
15 Summer	68.99	14
30 Summer	47.08	23
60 Summer	30.81	40
120 Summer	19.53	74
180 Summer	14.75	106
240 Summer	12.05	136
360 Summer	9.05	196
480 Summer	7.38	256
600 Summer	6.29	314
720 Summer	5.52	376
960 Summer	4.49	492
1440 Summer	3.35	734
2160 Summer	2.49	1096
2880 Summer	2.02	1468
4320 Summer	1.50	2176
5760 Summer	1.21	2864
7200 Summer	1.03	3648
8640 Summer	0.90	4336
10080 Summer	0.81	5040
15 Winter	68.99	15
30 Winter	47.08	25
60 Winter	30.81	44
120 Winter	19.53	78
180 Winter	14.75	110
240 Winter	12.05	142
360 Winter	9.05	200
480 Winter	7.38	258
600 Winter	6.29	316
720 Winter	5.52	376

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Summary of Results for 30 year Return Period (+40%)

Storm Duration (mins)	Maximum Control (l/s)	Maximum Filtration (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Maximum Volume (m³)	Status
960 Winter	1.6	0.0	1.6	219.3217	0.0718	0.8	O K
1440 Winter	1.2	0.0	1.2	219.3073	0.0572	0.6	O K
2160 Winter	0.9	0.0	0.9	219.2957	0.0457	0.4	O K
2880 Winter	0.7	0.0	0.7	219.2892	0.0392	0.4	O K
4320 Winter	0.5	0.0	0.5	219.2802	0.0302	0.3	O K
5760 Winter	0.4	0.0	0.4	219.2753	0.0252	0.2	O K
7200 Winter	0.4	0.0	0.4	219.2722	0.0223	0.2	O K
8640 Winter	0.3	0.0	0.3	219.2708	0.0208	0.2	O K
10080 Winter	0.3	0.0	0.3	219.2693	0.0193	0.2	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
960 Winter	4.49	490
1440 Winter	3.35	724
2160 Winter	2.49	1092
2880 Winter	2.02	1436
4320 Winter	1.50	2168
5760 Winter	1.21	2904
7200 Winter	1.03	3488
8640 Winter	0.90	4376
10080 Winter	0.81	4960

 T J Booth Associates. Consulting Engineers 20A Eastgate St, Rochdale OL16 1DH	Project				Job Ref.	
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Rainfall Details

Region	ENG+WAL	Cv (Summer)	0.750	Summer Storms	Yes
Return Period (years)	30	Cv (Winter)	0.840	Winter Storms	Yes
M5-60 (mm)	20.000	Shortest Storm (mins)	15	Climate Change %	+40
Ratio-R	0.300	Longest Storm (mins)	10080		

Time / Area Diagram

Total Area (ha) = 0.042

Time	(mins)	Area
from:	to:	(ha)
0	4	0.042

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Micro Drainage	Source Control W.10.4	

Swale Details

Infil Coef - Base (m/hr)	0.000000	Length (m)	6.5
Infil Coef - Sides (m/hr)	0.000000	Side Slope (1:x)	3.0
Safety Factor	2.0	Invert Level (m)	219.250
Porosity	1.00	Cover Level (m)	219.800
Base Width (m)	1.5	Slope (1:x)	1000.0

Orifice Outflow Control

Diameter (m)	0.060	Discharge Coefficient	0.560	Invert Level (m)	219.240
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Consulting Engineers
20A Eastgate St,
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OL16 1DH

Project

Rollins / Salley Street, Calderbrook

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Micro Drainage	Source Control W.10.4		

Summary of Results for 100 year Return Period (+45%)

Half Drain Time : 24 minutes

Storm Duration (mins)	Maximum Control (l/s)	Maximum Filtration (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Maximum Volume (m³)	Status
15 Summer	4.4	0.0	4.4	219.6712	0.4212	7.5	FLOOD RISK
30 Summer	4.7	0.0	4.7	219.7242	0.4742	8.9	FLOOD RISK
60 Summer	4.8	0.0	4.8	219.7452	0.4952	9.5	FLOOD RISK
120 Summer	4.7	0.0	4.7	219.7202	0.4702	8.8	FLOOD RISK
180 Summer	4.5	0.0	4.5	219.6792	0.4292	7.7	FLOOD RISK
240 Summer	4.3	0.0	4.3	219.6397	0.3897	6.7	FLOOD RISK
360 Summer	3.9	0.0	3.9	219.5742	0.3242	5.1	O K
480 Summer	3.5	0.0	3.5	219.5228	0.2727	4.0	O K
600 Summer	3.2	0.0	3.2	219.4823	0.2322	3.3	O K
720 Summer	3.0	0.0	3.0	219.4503	0.2002	2.7	O K
960 Summer	2.6	0.0	2.6	219.4037	0.1537	1.9	O K
1440 Summer	2.0	0.0	2.0	219.3528	0.1028	1.2	O K
2160 Summer	1.5	0.0	1.5	219.3208	0.0708	0.7	O K
2880 Summer	1.2	0.0	1.2	219.3098	0.0598	0.6	O K
4320 Summer	0.9	0.0	0.9	219.2973	0.0472	0.5	O K
5760 Summer	0.7	0.0	0.7	219.2903	0.0402	0.4	O K
7200 Summer	0.6	0.0	0.6	219.2852	0.0352	0.3	O K
8640 Summer	0.5	0.0	0.5	219.2807	0.0308	0.3	O K
10080 Summer	0.5	0.0	0.5	219.2778	0.0277	0.2	O K
15 Winter	4.7	0.0	4.7	219.7103	0.4602	8.5	FLOOD RISK
30 Winter	4.9	0.0	4.9	219.7667	0.5167	10.1	FLOOD RISK
60 Winter	5.0	0.0	5.0	219.7818	0.5317	10.6	FLOOD RISK
120 Winter	4.8	0.0	4.8	219.7342	0.4842	9.2	FLOOD RISK
180 Winter	4.4	0.0	4.4	219.6712	0.4212	7.5	FLOOD RISK
240 Winter	4.1	0.0	4.1	219.6147	0.3647	6.1	FLOOD RISK
360 Winter	3.6	0.0	3.6	219.5262	0.2762	4.1	O K
480 Winter	3.1	0.0	3.1	219.4642	0.2142	2.9	O K
600 Winter	2.7	0.0	2.7	219.4207	0.1707	2.2	O K
720 Winter	2.4	0.0	2.4	219.3902	0.1403	1.7	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
15 Summer	89.23	15
30 Summer	61.54	24
60 Summer	40.51	42
120 Summer	25.63	76
180 Summer	19.23	108
240 Summer	15.63	140
360 Summer	11.65	200
480 Summer	9.44	260
600 Summer	8.01	320
720 Summer	7.00	378
960 Summer	5.65	498
1440 Summer	4.17	736
2160 Summer	3.07	1100
2880 Summer	2.46	1440
4320 Summer	1.81	2184
5760 Summer	1.45	2928
7200 Summer	1.23	3576
8640 Summer	1.07	4272
10080 Summer	0.95	5136
15 Winter	89.23	15
30 Winter	61.54	25
60 Winter	40.51	44
120 Winter	25.63	80
180 Winter	19.23	114
240 Winter	15.63	146
360 Winter	11.65	206
480 Winter	9.44	264
600 Winter	8.01	322
720 Winter	7.00	380

T J Booth Associates.
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20A Eastgate St,
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OL16 1DH

Project

Rollins / Salley Street, Calderbrook

Section

DRAINAGE STRATEGY REPORT

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Summary of Results for 100 year Return Period (+45%)							
Storm Duration (mins)	Maximum Control (l/s)	Maximum Filtration (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Maximum Volume (m³)	Status
960 Winter	2.0	0.0	2.0	219.3513	0.1013	1.1	O K
1440 Winter	1.5	0.0	1.5	219.3197	0.0698	0.7	O K
2160 Winter	1.1	0.0	1.1	219.3047	0.0547	0.6	O K
2880 Winter	0.9	0.0	0.9	219.2968	0.0467	0.5	O K
4320 Winter	0.7	0.0	0.7	219.2872	0.0372	0.4	O K
5760 Winter	0.5	0.0	0.5	219.2802	0.0302	0.3	O K
7200 Winter	0.4	0.0	0.4	219.2758	0.0257	0.2	O K
8640 Winter	0.4	0.0	0.4	219.2737	0.0237	0.2	O K
10080 Winter	0.3	0.0	0.3	219.2717	0.0217	0.2	O K
	Storm Duration (mins)		Rain (mm/hr)		Time-Peak (mins)		
	960 Winter		5.65		500		
	1440 Winter		4.17		734		
	2160 Winter		3.07		1100		
	2880 Winter		2.46		1468		
	4320 Winter		1.81		2156		
	5760 Winter		1.45		2904		
	7200 Winter		1.23		3544		
	8640 Winter		1.07		4408		
	10080 Winter		0.95		5080		
(c)1982-2006 Micro Drainage							

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Rainfall Details

Region	ENG+WAL	Cv (Summer)	0.750	Summer Storms	Yes
Return Period (years)	100	Cv (Winter)	0.840	Winter Storms	Yes
M5-60 (mm)	20.000	Shortest Storm (mins)	15	Climate Change %	+45
Ratio-R	0.300	Longest Storm (mins)	10080		

Time / Area Diagram

Total Area (ha) = 0.042

Time	(mins)	Area
from:	to:	(ha)
0	4	0.042

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Micro Drainage	Source Control W.10.4	

Swale Details

Infil Coef - Base (m/hr)	0.000000	Length (m)	6.5
Infil Coef - Sides (m/hr)	0.000000	Side Slope (1:x)	3.0
Safety Factor	2.0	Invert Level (m)	219.250
Porosity	1.00	Cover Level (m)	219.800
Base Width (m)	1.5	Slope (1:x)	1000.0

Orifice Outflow Control

Diameter (m) 0.060 Discharge Coefficient 0.560 Invert Level (m) 219.240