

DRAINAGE STRATEGY REPORT

**BANK TOP FARM SHOP
SMITHY BRIDGE
LITTLEBOROUGH
ROCHDALE
LANCASHIRE**

Author: Daniel Slattery
Client: Mr & Mrs Davies
Doc Ref: rep-tjba-davies-bank top farm shop-DSR-110826.docx

Revision	Date	Reason
0	August 2026	Original to address planning condition & LLFA consultation.

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1 Introduction.

1.1 Purpose of Assessment.

The primary purpose of this report is to identify drainage strategy for a proposed farm shop on a greenfield piece of land.

The Site will be assessed 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 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.

1.2 LLFA Consultation.

The LLFA have provided a consultation summarised as follows:

Further to your submission of the application to discharge drainage details at Bank Top Farm (application OTH/2026/0487), the Council's Drainage Officer has provided the following comments:

1. The aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable: The ordered drainage techniques to be assessed with the aim to reduce or omit lower techniques:
 - Control at Source (Infiltration / Recycling)
 - On Site Treatment (Basins, Swales, Rain gardens, Tree pits)
 - Local Treatment (Adoptable Ponds, Basins, Swales etc)
 - Regional Treatment (ditto usually to a larger scale)
 - Discharge to Watercourses / Bodies
 - Discharge to SW Sewers
 - Discharge to Combined Sewers
2. Under BRE365 Testing conditions, both SA1 and SA2 failed to obtain an infiltration rate due to minimal change in effective depths. Therefore, it is accepted that infiltration techniques won't be viable.
3. The drainage proposals have been revised to discharge surface water to an existing culvert rather than a combined sewer. This is considered to be a significant betterment from the original submission. However, the culvert route to an outfall has not been proven and its status should be clarified.
4. Other than mentioning "it is considered that infiltration is unlikely to provide a viable drainage solution" there's no indication of any SuDS source control in the original drainage strategy or the newly submitted drainage plan. e.g. tree pits, rain gardens, hydro-planters and rainwater harvesting and recycling techniques.
5. Microdrainage calculations show the system to successfully contain a 1-in-100-year storm + 45% climate change allowance whilst limiting outfall to an acceptable 5.0 l/s.

Can you please provide additional information in respect of the culvert and the incorporation of surface based SuDS controls into the design.

2 Site Proposals.

See Location Plan in Appendix showing the area features.

Farm shop comprising a building and carpark/terrace area.

2.1 Derivation of Data, Surveys and Models.

2.1.1 Site Investigations.

Site investigations have been undertaken by others including trial holes and infiltration tests to BRE365.

The infiltration tests confirmed infiltration not suitable, ref BEK Site Investigation Report, ref: BEK-22019-250227-PC; pages 4, 43 & 44.

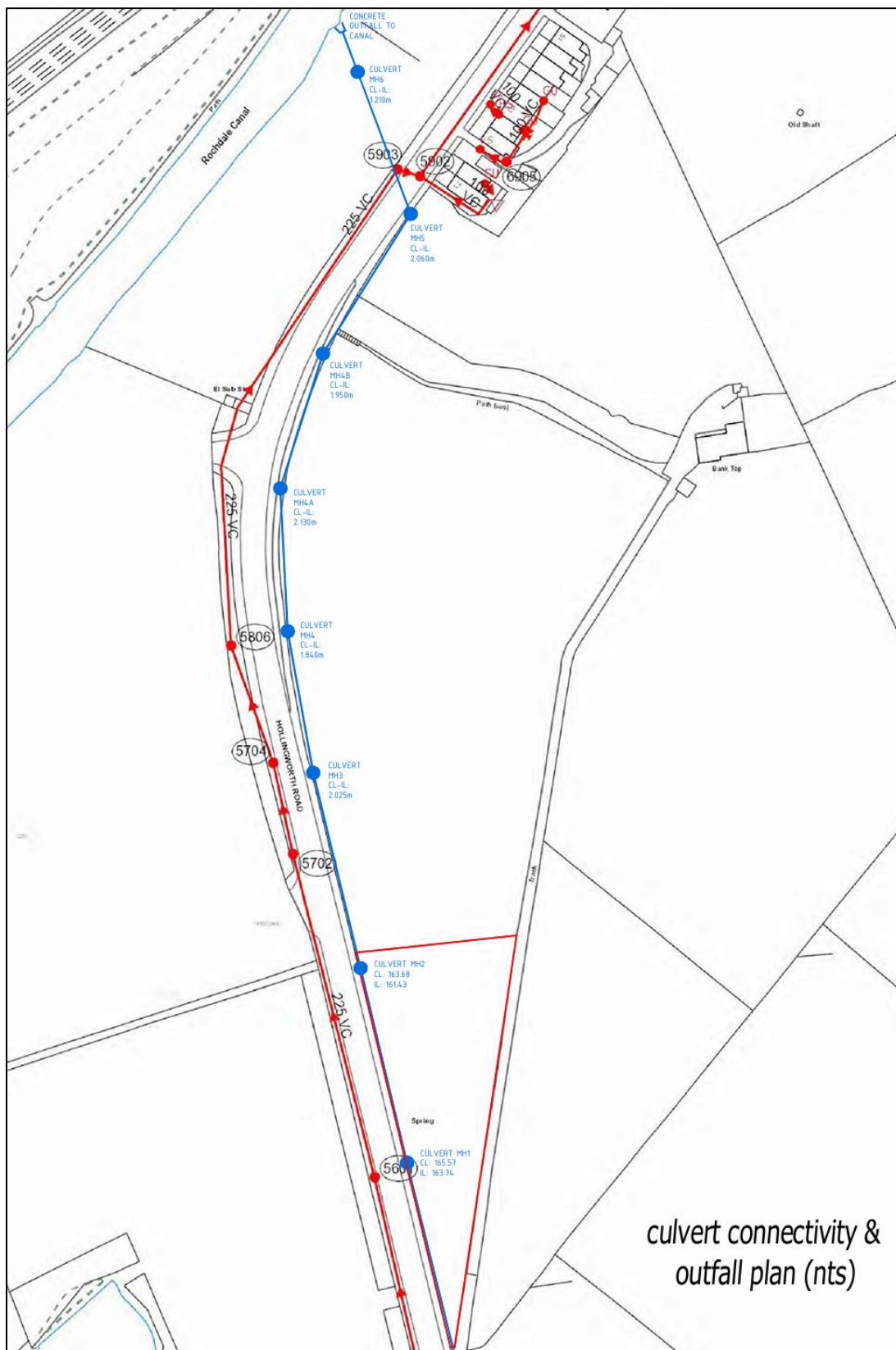
2.1.2 Sewer Undertaker Records.

There is a 275 diameter vitrified clay combined sewer in Hollingworth Road opposite the site.

2.1.3 Drainage Surveys.

An existing survey of the culvert to the front of the site has been requested by the LLFA, and subsequently undertaken by TJ Booth Associates. The culvert comprises a 300mm diameter pipe, with manholes spaced down Hollingworth Road.

The manholes were assessed for depth and connectivity in close proximity to the site, and then dye tested to chase the route to outfall. It was found that the outfall was a concrete cill, discharging to the Rochdale Canal downstream.



The culvert manholes were given a reference, MH1, MH2, MH3, MH4, MH4A, MH4B, MH5, MH6 & outfall. Photos are given below:

Manhole Reference	Photo
Culvert MH1	
Culvert MH2	
Culvert MH3	

Culvert MH4A



Culvert MH4B



Culvert MH5– silt trap & weir.



Culvert MH6



Culvert outfall



3 Drainage Strategy.

3.1 Proposed Surface Water Drainage.

3.1.1 Infiltration.

BGS maps suggest the site is underlain by glacial clay.

Infiltration tests have been undertaken and found unsuitable for infiltration.

3.1.2 On-site treatment & discharge to watercourse.

Due to the above, discharge to the culvert to the front of the site is to be the preferred method of discharge.

Permeable paving is to be used to further attenuate flows.

A rain garden has been included to attenuated roof flows further, and to provide some volume control.

All surface water will be controlled and attenuated on site via a crated attenuation system & hydrobrake, including a 100yr+45% rainfall event, discharging at not greater than 5l/s to the culvert.

Refer to Microdrainage calculation in the Appendix.

3.1.3 SW Sewer.

Not required.

3.1.4 Combined Sewer.

Foul water connections only.

3.2 Proposed Foul Water Drainage.

It is proposed to connect the site foul to the United Utilities across Hollingworth Road.

3.3 Adoption.

The drainage systems drainage will remain private.

3.4 Maintenance & Management Plan.

3.4.1 Future Management.

The site, all dwellings, and drainage systems are to remain as a private system under one ownership.

No adoption is proposed.

3.4.2 Access.

The detention basins and control are adjacent to the access roads, ensuring easy access for maintenance etc.

4 Conclusion & Residual risks.

This report should be suitable for initial planning validation.

Detailed design will be undertaken in due course.

5 Commentary on LLFA consultation.

Referring to the outstanding points on the drainage consultation:

- 3. The drainage proposals have been revised to discharge surface water to an existing culvert rather than a combined sewer. This is considered to be a significant betterment from the original submission. However, the culvert route to an outfall has not been proven and its status should be clarified.*

The full drainage route of the culvert has now been provided from site to outfall to the Rochdale Canal.

- 4. Other than mentioning "it is considered that infiltration is unlikely to provide a viable drainage solution" there's no indication of any SuDS source control in the original drainage strategy or the newly submitted drainage plan. e.g. tree pits, rain gardens, hydro-planters and rainwater harvesting and recycling techniques.*

Permeable paving has been used to further attenuate rainwater flows, and a rain garden has been proposed to attenuation and lower volumes from roof areas.

Signed.....  .

D.S. Slattery BSc (Hons).

T J Booth Associates.

Authorised...  .

T J Booth BSc (Hons), C. Eng. C. Env. MICE.

T J Booth Associates.

6 Appendix.

6.1 Attenuation Calculations.

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104 Yorkshire St			SW attenuation					
Rochdale			davies					
Lancashire OL16 1JY			bank top farm shop					
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Micro Drainage			Source Control W.10.4					
Summary of Results for 1 year Return Period								
Half Drain Time : 7 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	4.3	0.0	4.3	161.9953	0.0553	2.4	O K	
30 Summer	4.4	0.0	4.4	161.9987	0.0588	2.5	O K	
60 Summer	4.3	0.0	4.3	161.9933	0.0533	2.3	O K	
120 Summer	4.1	0.0	4.1	161.9747	0.0347	1.5	O K	
180 Summer	3.9	0.0	3.9	161.9593	0.0192	0.8	O K	
240 Summer	3.7	0.0	3.7	161.9483	0.0083	0.4	O K	
360 Summer	3.4	0.0	3.4	161.9400	0.0000	0.0	O K	
480 Summer	2.9	0.0	2.9	161.9400	0.0000	0.0	O K	
600 Summer	2.5	0.0	2.5	161.9400	0.0000	0.0	O K	
720 Summer	2.2	0.0	2.2	161.9400	0.0000	0.0	O K	
960 Summer	1.8	0.0	1.8	161.9400	0.0000	0.0	O K	
1440 Summer	1.4	0.0	1.4	161.9400	0.0000	0.0	O K	
2160 Summer	1.1	0.0	1.1	161.9400	0.0000	0.0	O K	
2880 Summer	0.9	0.0	0.9	161.9400	0.0000	0.0	O K	
4320 Summer	0.7	0.0	0.7	161.9400	0.0000	0.0	O K	
5760 Summer	0.6	0.0	0.6	161.9400	0.0000	0.0	O K	
7200 Summer	0.5	0.0	0.5	161.9400	0.0000	0.0	O K	
8640 Summer	0.4	0.0	0.4	161.9400	0.0000	0.0	O K	
10080 Summer	0.4	0.0	0.4	161.9400	0.0000	0.0	O K	
15 Winter	4.4	0.0	4.4	162.0047	0.0648	2.8	O K	
30 Winter	4.5	0.0	4.5	162.0058	0.0658	2.8	O K	
60 Winter	4.3	0.0	4.3	161.9917	0.0518	2.2	O K	
120 Winter	3.9	0.0	3.9	161.9622	0.0222	0.9	O K	
180 Winter	3.6	0.0	3.6	161.9427	0.0028	0.1	O K	
240 Winter	3.2	0.0	3.2	161.9400	0.0000	0.0	O K	
360 Winter	2.5	0.0	2.5	161.9400	0.0000	0.0	O K	
480 Winter	2.1	0.0	2.1	161.9400	0.0000	0.0	O K	
600 Winter	1.8	0.0	1.8	161.9400	0.0000	0.0	O K	
720 Winter	1.6	0.0	1.6	161.9400	0.0000	0.0	O K	
Storm Duration (mins)	Rain (mm/hr)		Time-Peak (mins)					
15 Summer	28.17		13					
30 Summer	19.18		21					
60 Summer	12.80		38					
120 Summer	8.41		70					
180 Summer	6.56		100					
240 Summer	5.47		128					
360 Summer	4.21		0					
480 Summer	3.50		0					
600 Summer	3.03		0					
720 Summer	2.70		0					
960 Summer	2.25		0					
1440 Summer	1.73		0					
2160 Summer	1.33		0					
2880 Summer	1.11		0					
4320 Summer	0.85		0					
5760 Summer	0.71		0					
7200 Summer	0.61		0					
8640 Summer	0.54		0					
10080 Summer	0.49		0					
15 Winter	28.17		14					
30 Winter	19.18		23					
60 Winter	12.80		40					
120 Winter	8.41		72					
180 Winter	6.56		98					
240 Winter	5.47		0					
360 Winter	4.21		0					
480 Winter	3.50		0					
600 Winter	3.03		0					
720 Winter	2.70		0					
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104 Yorkshire St
Rochdale
Lancashire OL16 1JYSW attenuation
davies
bank top farm shop

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Micro Drainage

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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
960 Winter	1.3	0.0	1.3	161.9400	0.0000	0.0	OK
1440 Winter	1.0	0.0	1.0	161.9400	0.0000	0.0	OK
2160 Winter	0.8	0.0	0.8	161.9400	0.0000	0.0	OK
2880 Winter	0.7	0.0	0.7	161.9400	0.0000	0.0	OK
4320 Winter	0.5	0.0	0.5	161.9400	0.0000	0.0	OK
5760 Winter	0.4	0.0	0.4	161.9400	0.0000	0.0	OK
7200 Winter	0.4	0.0	0.4	161.9400	0.0000	0.0	OK
8640 Winter	0.3	0.0	0.3	161.9400	0.0000	0.0	OK
10080 Winter	0.3	0.0	0.3	161.9400	0.0000	0.0	OK

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
960 Winter	2.25	0
1440 Winter	1.73	0
2160 Winter	1.33	0
2880 Winter	1.11	0
4320 Winter	0.85	0
5760 Winter	0.71	0
7200 Winter	0.61	0
8640 Winter	0.54	0
10080 Winter	0.49	0

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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) = 0.100

Time	(mins)	Area
from:	to:	(ha)

0	4	0.100
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Cellular Storage Details

Infil Coef - Base (m/hr) 0.000000 Porosity 0.95
Infil Coef - Sides (m/hr) 0.000000 Invert Level (m) 161.940
Safety Factor 2.0 Ground Level (m) 163.650

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.00	45.0	0.40	45.0	0.80	45.0	1.20	45.0	1.60	45.0	2.00	45.0	2.40	45.0
0.10	45.0	0.50	45.0	0.90	45.0	1.30	45.0	1.70	45.0	2.10	45.0	2.50	45.0
0.20	45.0	0.60	45.0	1.00	45.0	1.40	45.0	1.80	45.0	2.20	45.0		
0.30	45.0	0.70	45.0	1.10	45.0	1.50	45.0	1.90	45.0	2.30	45.0		

Depth / Flow Outflow Control

Invert Level of Control 161.840

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.10	3.6	0.60	4.1	1.60	6.7	2.60	8.6	5.00	11.9	7.50	14.6
0.20	4.9	0.80	4.7	1.80	7.1	3.00	9.2	5.50	12.5	8.00	15.1
0.30	5.0	1.00	5.2	2.00	7.5	3.50	10.0	6.00	13.0	8.50	15.5
0.40	4.9	1.20	5.8	2.20	7.9	4.00	10.7	6.50	13.6	9.00	16.0
0.50	4.6	1.40	6.3	2.40	8.3	4.50	11.3	7.00	14.1	9.50	16.4

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

Half Drain Time : 48 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	5.0	0.0	5.0	162.2598	0.3197	13.7	O K
30 Summer	5.0	0.0	5.0	162.3313	0.3912	16.7	O K
60 Summer	5.0	0.0	5.0	162.3618	0.4217	18.0	O K
120 Summer	5.0	0.0	5.0	162.3533	0.4132	17.7	O K
180 Summer	5.0	0.0	5.0	162.3177	0.3777	16.2	O K
240 Summer	5.0	0.0	5.0	162.2767	0.3367	14.4	O K
360 Summer	5.0	0.0	5.0	162.1978	0.2577	11.0	O K
480 Summer	5.0	0.0	5.0	162.1308	0.1907	8.2	O K
600 Summer	4.9	0.0	4.9	162.0793	0.1393	6.0	O K
720 Summer	4.9	0.0	4.9	162.0413	0.1013	4.3	O K
960 Summer	4.3	0.0	4.3	161.9962	0.0563	2.4	O K
1440 Summer	3.7	0.0	3.7	161.9467	0.0068	0.3	O K
2160 Summer	2.8	0.0	2.8	161.9400	0.0000	0.0	O K
2880 Summer	2.3	0.0	2.3	161.9400	0.0000	0.0	O K
4320 Summer	1.7	0.0	1.7	161.9400	0.0000	0.0	O K
5760 Summer	1.4	0.0	1.4	161.9400	0.0000	0.0	O K
7200 Summer	1.2	0.0	1.2	161.9400	0.0000	0.0	O K
8640 Summer	1.0	0.0	1.0	161.9400	0.0000	0.0	O K
10080 Summer	0.9	0.0	0.9	161.9400	0.0000	0.0	O K
15 Winter	5.0	0.0	5.0	162.3107	0.3707	15.9	O K
30 Winter	5.0	0.0	5.0	162.4048	0.4647	19.9	O K
60 Winter	5.0	0.0	5.0	162.4492	0.5092	21.8	O K
120 Winter	5.0	0.0	5.0	162.4218	0.4817	20.6	O K
180 Winter	5.0	0.0	5.0	162.3568	0.4167	17.8	O K
240 Winter	5.0	0.0	5.0	162.2843	0.3442	14.7	O K
360 Winter	5.0	0.0	5.0	162.1588	0.2187	9.3	O K
480 Winter	4.9	0.0	4.9	162.0688	0.1288	5.5	O K
600 Winter	4.6	0.0	4.6	162.0193	0.0793	3.4	O K
720 Winter	4.2	0.0	4.2	161.9863	0.0462	2.0	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
15 Summer	68.99	16
30 Summer	47.08	30
60 Summer	30.81	48
120 Summer	19.53	82
180 Summer	14.75	116
240 Summer	12.05	150
360 Summer	9.05	212
480 Summer	7.38	272
600 Summer	6.29	330
720 Summer	5.52	386
960 Summer	4.49	504
1440 Summer	3.35	736
2160 Summer	2.49	0
2880 Summer	2.02	0
4320 Summer	1.50	0
5760 Summer	1.21	0
7200 Summer	1.03	0
8640 Summer	0.90	0
10080 Summer	0.81	0
15 Winter	68.99	17
30 Winter	47.08	31
60 Winter	30.81	56
120 Winter	19.53	92
180 Winter	14.75	128
240 Winter	12.05	162
360 Winter	9.05	224
480 Winter	7.38	280
600 Winter	6.29	334
720 Winter	5.52	392

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Micro Drainage

Source Control W.10.4

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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	3.6	0.0	3.6	161.9433	0.0033	0.1	O K
1440 Winter	2.8	0.0	2.8	161.9400	0.0000	0.0	O K
2160 Winter	2.1	0.0	2.1	161.9400	0.0000	0.0	O K
2880 Winter	1.7	0.0	1.7	161.9400	0.0000	0.0	O K
4320 Winter	1.2	0.0	1.2	161.9400	0.0000	0.0	O K
5760 Winter	1.0	0.0	1.0	161.9400	0.0000	0.0	O K
7200 Winter	0.9	0.0	0.9	161.9400	0.0000	0.0	O K
8640 Winter	0.7	0.0	0.7	161.9400	0.0000	0.0	O K
10080 Winter	0.7	0.0	0.7	161.9400	0.0000	0.0	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
960 Winter	4.49	500
1440 Winter	3.35	0
2160 Winter	2.49	0
2880 Winter	2.02	0
4320 Winter	1.50	0
5760 Winter	1.21	0
7200 Winter	1.03	0
8640 Winter	0.90	0
10080 Winter	0.81	0

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SW attenuation
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Micro Drainage

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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) = 0.100

Time	(mins)	Area
from:	to:	(ha)
0	4	0.100

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SW attenuation
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Micro Drainage

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Cellular Storage Details

Infil Coef - Base (m/hr) 0.000000 Porosity 0.95
 Infil Coef - Sides (m/hr) 0.000000 Invert Level (m) 161.940
 Safety Factor 2.0 Ground Level (m) 163.650

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.00	45.0	0.40	45.0	0.80	45.0	1.20	45.0	1.60	45.0	2.00	45.0	2.40	45.0
0.10	45.0	0.50	45.0	0.90	45.0	1.30	45.0	1.70	45.0	2.10	45.0	2.50	45.0
0.20	45.0	0.60	45.0	1.00	45.0	1.40	45.0	1.80	45.0	2.20	45.0		
0.30	45.0	0.70	45.0	1.10	45.0	1.50	45.0	1.90	45.0	2.30	45.0		

Depth / Flow Outflow Control

Invert Level of Control 161.840

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.10	3.6	0.60	4.1	1.60	6.7	2.60	8.6	5.00	11.9	7.50	14.6
0.20	4.9	0.80	4.7	1.80	7.1	3.00	9.2	5.50	12.5	8.00	15.1
0.30	5.0	1.00	5.2	2.00	7.5	3.50	10.0	6.00	13.0	8.50	15.5
0.40	4.9	1.20	5.8	2.20	7.9	4.00	10.7	6.50	13.6	9.00	16.0
0.50	4.6	1.40	6.3	2.40	8.3	4.50	11.3	7.00	14.1	9.50	16.4

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

Half Drain Time : 64 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	5.0	0.0	5.0	162.4023	0.4622	19.8	O K
30 Summer	5.0	0.0	5.0	162.5348	0.5948	25.4	O K
60 Summer	5.0	0.0	5.0	162.6083	0.6683	28.6	O K
120 Summer	5.0	0.0	5.0	162.6158	0.6758	28.9	O K
180 Summer	5.0	0.0	5.0	162.5878	0.6478	27.7	O K
240 Summer	5.0	0.0	5.0	162.5508	0.6108	26.1	O K
360 Summer	5.0	0.0	5.0	162.4682	0.5282	22.6	O K
480 Summer	5.0	0.0	5.0	162.3647	0.4247	18.2	O K
600 Summer	5.0	0.0	5.0	162.2733	0.3332	14.2	O K
720 Summer	5.0	0.0	5.0	162.1992	0.2592	11.1	O K
960 Summer	5.0	0.0	5.0	162.0943	0.1542	6.6	O K
1440 Summer	4.4	0.0	4.4	161.9998	0.0598	2.5	O K
2160 Summer	3.6	0.0	3.6	161.9413	0.0013	0.0	O K
2880 Summer	2.9	0.0	2.9	161.9400	0.0000	0.0	O K
4320 Summer	2.1	0.0	2.1	161.9400	0.0000	0.0	O K
5760 Summer	1.7	0.0	1.7	161.9400	0.0000	0.0	O K
7200 Summer	1.5	0.0	1.5	161.9400	0.0000	0.0	O K
8640 Summer	1.3	0.0	1.3	161.9400	0.0000	0.0	O K
10080 Summer	1.1	0.0	1.1	161.9400	0.0000	0.0	O K
15 Winter	5.0	0.0	5.0	162.4722	0.5322	22.8	O K
30 Winter	5.0	0.0	5.0	162.6268	0.6868	29.4	O K
60 Winter	5.0	0.0	5.0	162.7273	0.7873	33.6	O K
120 Winter	5.0	0.0	5.0	162.7283	0.7883	33.7	O K
180 Winter	5.0	0.0	5.0	162.6798	0.7398	31.6	O K
240 Winter	5.0	0.0	5.0	162.6203	0.6803	29.1	O K
360 Winter	5.0	0.0	5.0	162.4868	0.5467	23.4	O K
480 Winter	5.0	0.0	5.0	162.3167	0.3767	16.1	O K
600 Winter	5.0	0.0	5.0	162.1873	0.2472	10.6	O K
720 Winter	5.0	0.0	5.0	162.0977	0.1577	6.7	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
15 Summer	89.23	17
30 Summer	61.54	31
60 Summer	40.51	56
120 Summer	25.63	88
180 Summer	19.23	124
240 Summer	15.63	158
360 Summer	11.65	228
480 Summer	9.44	290
600 Summer	8.01	350
720 Summer	7.00	406
960 Summer	5.65	520
1440 Summer	4.17	750
2160 Summer	3.07	1100
2880 Summer	2.46	0
4320 Summer	1.81	0
5760 Summer	1.45	0
7200 Summer	1.23	0
8640 Summer	1.07	0
10080 Summer	0.95	0
15 Winter	89.23	17
30 Winter	61.54	31
60 Winter	40.51	58
120 Winter	25.63	94
180 Winter	19.23	134
240 Winter	15.63	172
360 Winter	11.65	246
480 Winter	9.44	308
600 Winter	8.01	362
720 Winter	7.00	414

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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	4.5	0.0	4.5	162.0103	0.0703	3.0	O K
1440 Winter	3.6	0.0	3.6	161.9400	0.0000	0.0	O K
2160 Winter	2.6	0.0	2.6	161.9400	0.0000	0.0	O K
2880 Winter	2.1	0.0	2.1	161.9400	0.0000	0.0	O K
4320 Winter	1.5	0.0	1.5	161.9400	0.0000	0.0	O K
5760 Winter	1.2	0.0	1.2	161.9400	0.0000	0.0	O K
7200 Winter	1.0	0.0	1.0	161.9400	0.0000	0.0	O K
8640 Winter	0.9	0.0	0.9	161.9400	0.0000	0.0	O K
10080 Winter	0.8	0.0	0.8	161.9400	0.0000	0.0	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
960 Winter	5.65	520
1440 Winter	4.17	0
2160 Winter	3.07	0
2880 Winter	2.46	0
4320 Winter	1.81	0
5760 Winter	1.45	0
7200 Winter	1.23	0
8640 Winter	1.07	0
10080 Winter	0.95	0

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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) = 0.100

Time	(mins)	Area
from:	to:	(ha)
0	4	0.100

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Cellular Storage Details

Infil Coef - Base (m/hr)	0.000000	Porosity	0.95
Infil Coef - Sides (m/hr)	0.000000	Invert Level (m)	161.940
Safety Factor	2.0	Ground Level (m)	163.650

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.00	45.0	0.40	45.0	0.80	45.0	1.20	45.0	1.60	45.0	2.00	45.0	2.40	45.0
0.10	45.0	0.50	45.0	0.90	45.0	1.30	45.0	1.70	45.0	2.10	45.0	2.50	45.0
0.20	45.0	0.60	45.0	1.00	45.0	1.40	45.0	1.80	45.0	2.20	45.0		
0.30	45.0	0.70	45.0	1.10	45.0	1.50	45.0	1.90	45.0	2.30	45.0		

Depth / Flow Outflow Control

Invert Level of Control 161.840

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.10	3.6	0.60	4.1	1.60	6.7	2.60	8.6	5.00	11.9	7.50	14.6
0.20	4.9	0.80	4.7	1.80	7.1	3.00	9.2	5.50	12.5	8.00	15.1
0.30	5.0	1.00	5.2	2.00	7.5	3.50	10.0	6.00	13.0	8.50	15.5
0.40	4.9	1.20	5.8	2.20	7.9	4.00	10.7	6.50	13.6	9.00	16.0
0.50	4.6	1.40	6.3	2.40	8.3	4.50	11.3	7.00	14.1	9.50	16.4

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