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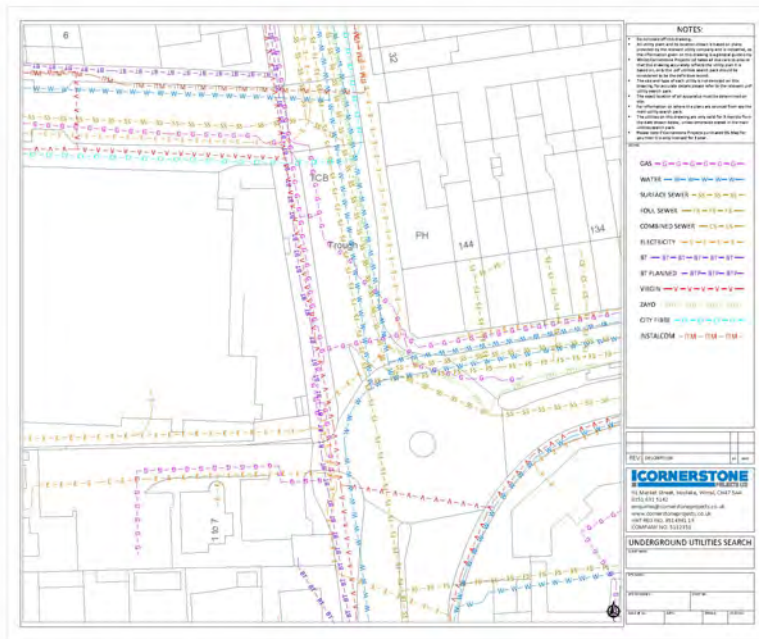
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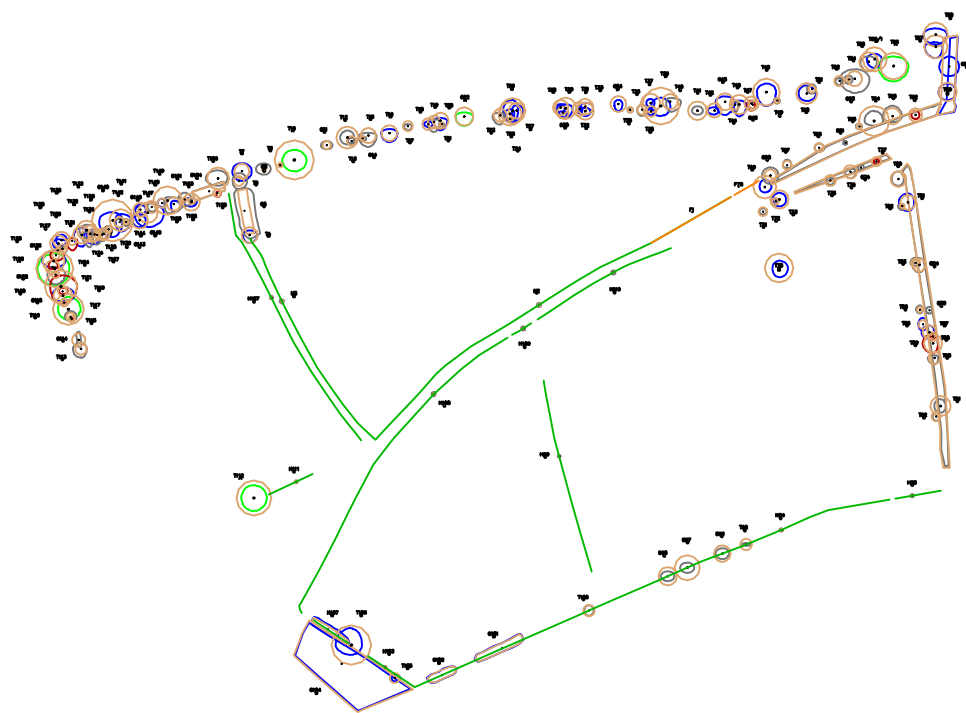
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D Tree Survey



E GI Report

Infiltration Testing For:

Legacy substation,
Wrexham,
Lat/Long 53.027333, -3.035063

Prepared for: Stantec

REF: Wrexham #398

DATE: 21.05.2023



GibbsGeoTechnical

Document Control

Project	Legacy substation, Wrexham
Client	Stantec
Ref:	Wrexham #398

Document Checking:

Prepared By: Oliver Gibbs

Signed:



Issue	Date	Status
01	21/05/2023	Written and submitted
02		
03		

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1 Introduction

1.1 Brief

Gibbs Geotechnical has been instructed by Stantec (the Client) to undertake 10 soil infiltration tests to BRE365 standard, at the legacy substation, located at Lat/Long 53.027333, -3.035063.

National Grid Reference: **SJ306482– Easting 330677, Northing 348284**

Latitude, Longitude: **53.027333, -3.035063**

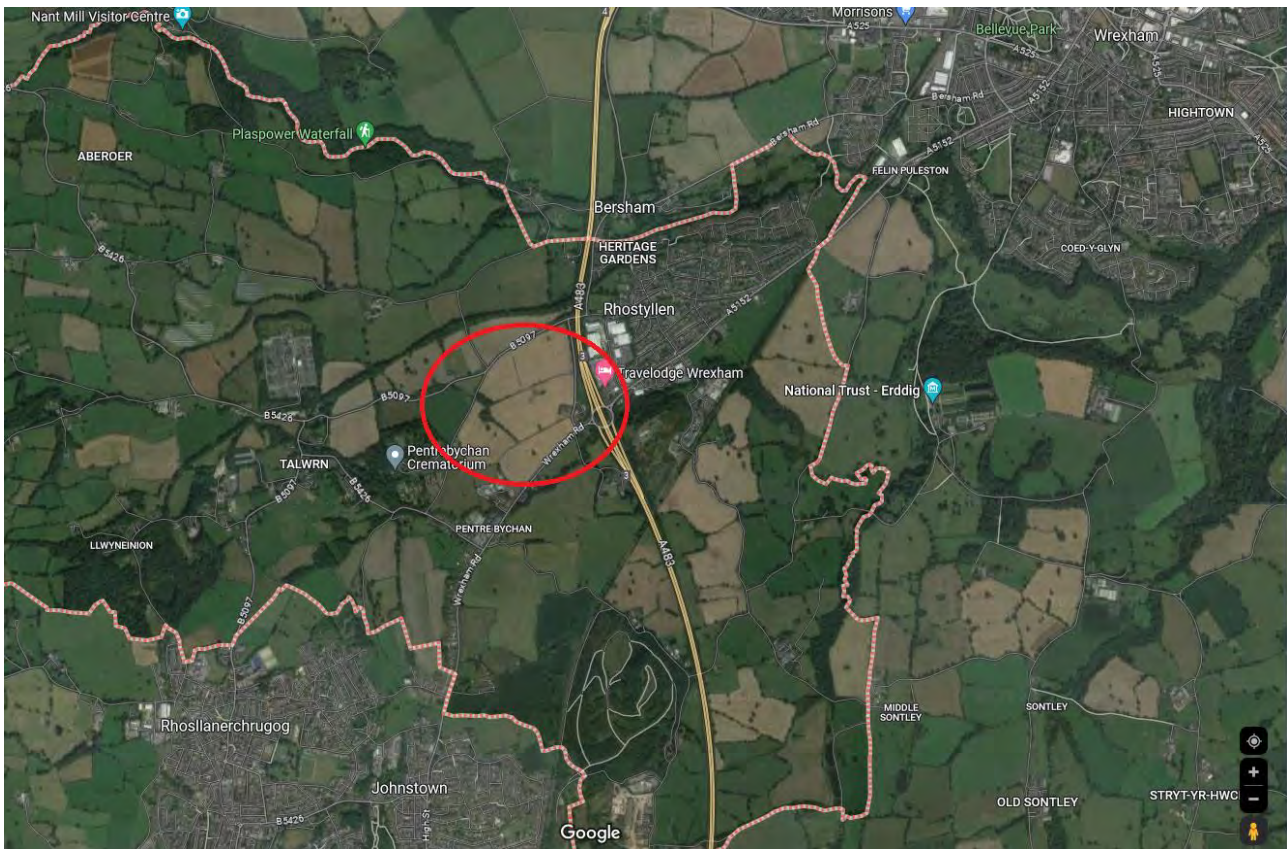


Figure 1 - Site location

Ten BRE365 infiltration tests have been proposed to determine the local geology and permeation rates on site. These test pits will be 0.5x1x0.5m minimum and tested a maximum of 3 times or as many as possible in the timeframe allowed. Refer to **Appendix A – Site Test Plans**

1.2 Site Investigations

The site was located to the South-West of the town of Rhostyllen, bordered to the East by the A483. The test pits were located evenly across the site, which consisted of 2x grassed fields, one to the North and one to the South. Both fields were level across their span.

The tests were performed by Gabriel Usher (of Gibbs Geotechnical) on the 9+10th of May 2023. Refer to **Appendix B – Site photos**

2 Site findings

The following tests were performed to the best of the ability of those involved, subject to site constraints and weather conditions. All pits were successfully excavated to 1.0m depth, shown in the location on **Appendix A**. Grassed loam was present from surface level to 0.2m depth at which point a till/clay mix was encountered until the full 1.0m depth was attained. Due to the size of the bucket on the excavator (provided by the client), the test pits were dug 1.0m x 1.0m x 1.0m in size.

2.1 British Geological Records

Local searches from the British Geological Survey (BGS) online records show the site to have the following superficial soils and bedrock:

Bedrock: Etruria Formation - Mudstone. Sedimentary bedrock formed between 319 and 308 million years ago during the Carboniferous period.

Superficial soils Glaciofluvial Deposits, Devensian - Sand and gravel. Sedimentary superficial deposit formed between 116 and 11.8 thousand years ago during the Quaternary period.

Refer to **Appendix C** for BGS records <https://geologyviewer.bgs.ac.uk/>

2.2 Trial pit soil conditions

Soils encountered were logged at the following approximate depths:

Pit 1

Topsoil:	0-0.2m	- Grassed loam
Superficial soils:	0.2-1.0m	- Till/clay mix

Pit 2

Topsoil:	0-0.2m	- Grassed loam
Superficial soils:	0.2-1.0m	- Till/clay mix

Pit 3 -

Topsoil:	0-0.2m	- Grassed loam
Superficial soils:	0.2-1.0m	- Till/clay mix

Pit 4 -

Topsoil:	0-0.2m	- Grassed loam
Superficial soils:	0.2-1.0m	- Till/clay mix

Pit 5 -

Topsoil:	0-0.2m	- Grassed loam
Superficial soils:	0.2-1.0m	- Till/clay mix

Pit 6 -

Topsoil:	0-0.2m	- Grassed loam
Superficial soils:	0.2-1.0m	- Till/clay mix

Pit 7 -

Topsoil:	0-0.2m	- Grassed loam
Superficial soils:	0.2-1.0m	- Till/clay mix

Pit 8 -

Topsoil:	0-0.2m	- Grassed loam
Superficial soils:	0.2-1.0m	- Till/clay mix

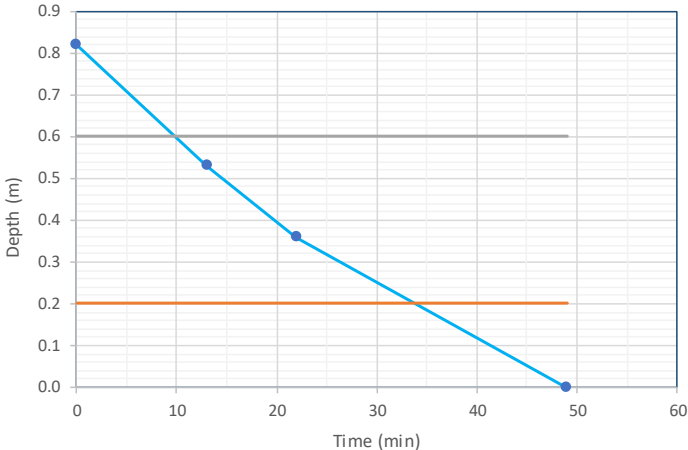
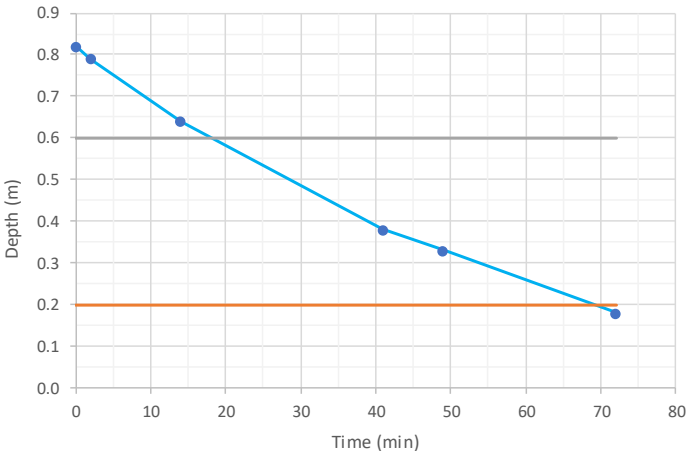
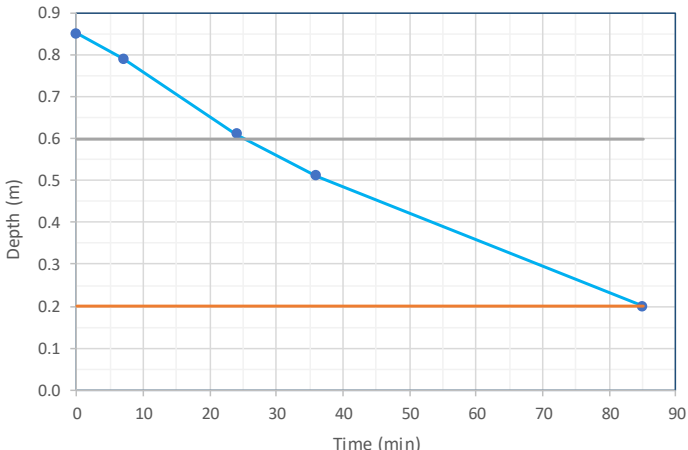
Pit 9 -

Topsoil:	0-0.2m	- Grassed loam
Superficial soils:	0.2-1.0m	- Till/clay mix

Pit 10 -

Topsoil:	0-0.2m	- Grassed loam
Superficial soils:	0.2-1.0m	- Till/clay mix

Results

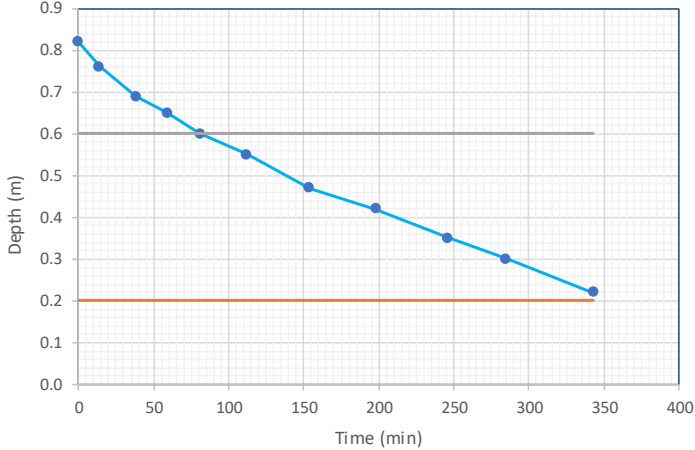
Soakaway Test Results - BRE 365 Digest standards					Site: Wrexham
					Client: Stantec
Trial Pit	1	Date: 9+10th May 2023			 GibbsGeoTechnical
Dimensions	(m)	Performed by: Oliver Gibbs			
Width	1	Weather: Sunny			
Length	1	Topsoil: Grassed loam			
Effective depth	0.9	Superficial soil: Till/clay mix			
Total depth of hole	0.9	Comments:			
Test No.	Time (min)	Depth (m)			
1	0	0.82	time 75% =	10	
	13	0.53	time 25% =	34	
	22	0.36	Area =	1	
	49	0.00	Vp 75% =	0.6	
			Vp 25% =	0.2	
			Vp75-25 =	0.4 m	
			As50 =	2.8 m ²	
			tp75-25 =	1440 s	
			f =	9.92E-05 m/s	
Test No.	Time (min)	Depth (m)			
2	0	0.82	time 75% =	18	
	2	0.79	time 25% =	70	
	14	0.64	Area =	1	
	41	0.38	Vp 75% =	0.6	
	49	0.33	Vp 25% =	0.2	
	72	0.18			
			Vp75-25 =	0.4 m	
			As50 =	2.8 m ²	
			tp75-25 =	3120 s	
			f =	4.58E-05 m/s	
Test No.	Time (min)	Depth (m)			
3	0	0.85	time 75% =	25	
	7	0.79	time 25% =	85	
	24	0.61	Area =	1	
	36	0.51	Vp 75% =	0.6	
	85	0.20	Vp 25% =	0.2	
			Vp75-25 =	0.4 m	
			As50 =	2.8 m ²	
			tp75-25 =	3600 s	
			f =	3.97E-05 m/s	

Soakaway Test Results - BRE 365 Digest standards				Site: Wrexham
				Client: Stantec
Trial Pit	2	Date:	9+10th May 2023	
Dimensions	(m)	Performed by:	Oliver Gibbs	
Width	1	Weather:	Sunny	
Length	1	Topsoil:	Grassed loam	
Effective depth	0.9	Superficial soil:	Till/clay mix	
Total depth of hole	0.9	Comments:		

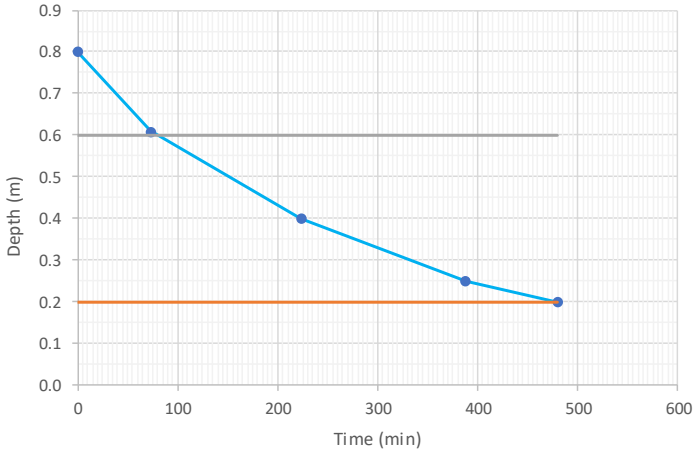


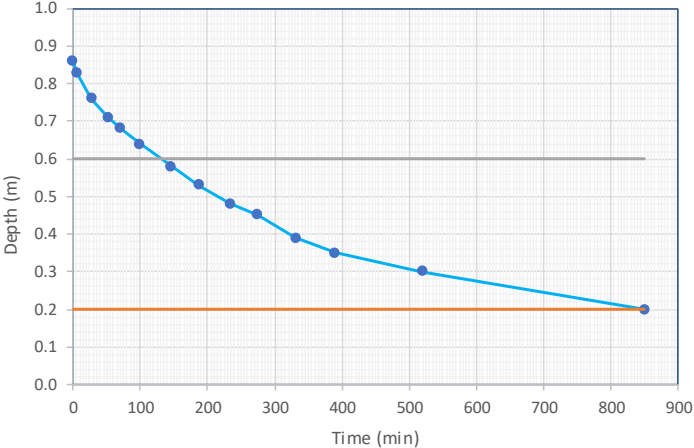
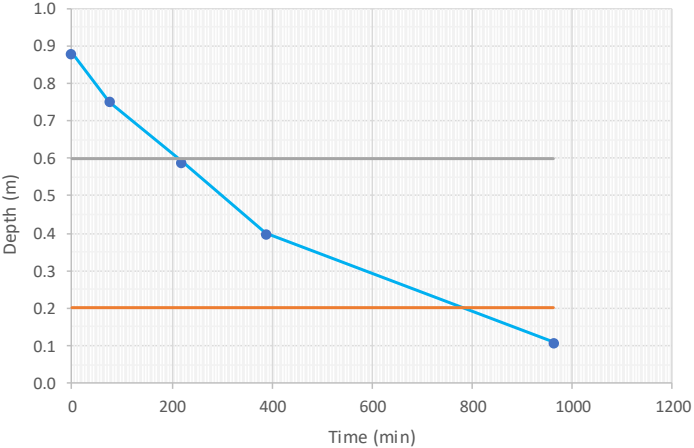
GibbsGeoTechnical

Test No.	Time (min)	Depth (m)			
1	0	0.82	time 75% =	10	
	14	0.76	time 25% =	34	
	38	0.69	Area =	1	
	59	0.65	Vp 75% =	0.6	
	81	0.60	Vp 25% =	0.2	
	112	0.55			
	154	0.47			
	198	0.42			
	246	0.35			
	285	0.30			
	343	0.22	Vp75-25 =	0.4	m
			As50 =	2.8	m ²
			tp75-25 =	1440	s
			f =	9.92E-05	m/s

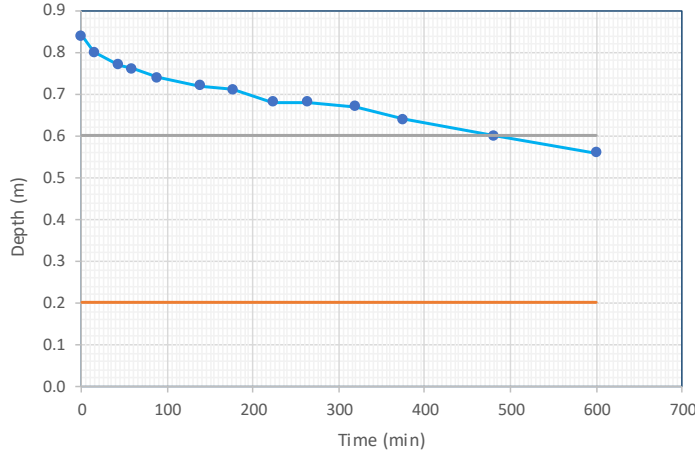
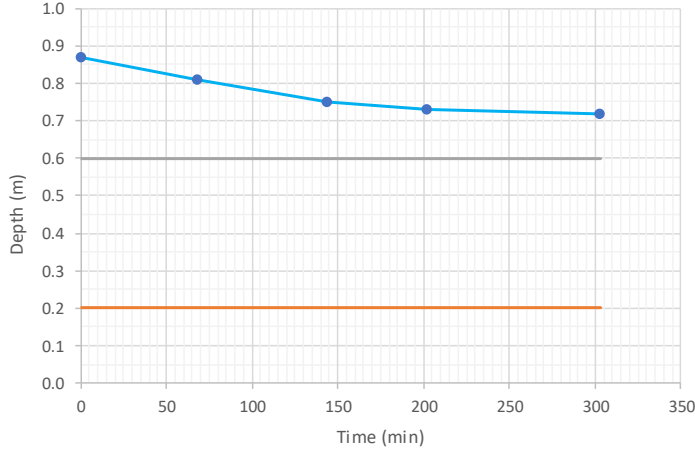


Test No.	Time (min)	Depth (m)			
2	0	0.80	time 75% =	70	
	73	0.61	time 25% =	480	
	224	0.40	Area =	1	
	388	0.25	Vp 75% =	0.6	
	480	0.20	Vp 25% =	0.2	
			Vp75-25 =	0.4	m
			As50 =	2.8	m ²
			tp75-25 =	24600	s
			f =	5.81E-06	m/s



Soakaway Test Results - BRE 365 Digest standards					Site: Wrexham	
					Client: Stantec	
Trial Pit	3	Date: 9+10th May 2023			 GibbsGeoTechnical	
		Performed by: Oliver Gibbs				
	Dimensions	(m)	Weather: Sunny			
	Width	1	Topsoil: Grassed loam			
	Length	1	Superficial soil: Till/clay mix			
	Effective depth	0.9	Comments:			
	Total depth of hole	0.9				
Test No.	Time (min)	Depth (m)				
1	0	0.86	time 75% =	125		
	6	0.83	time 25% =	850		
	28	0.76	Area =	1		
	52	0.71	Vp 75% =	0.6		
	71	0.68	Vp 25% =	0.2		
	100	0.64				
	146	0.58				
	187	0.53				
	234	0.48				
	275	0.45				
	332	0.39	Vp75-25 =	0.4 m		
	390	0.35	As50 =	2.8 m ²		
	520	0.30	tp75-25 =	43500 s		
	850	0.20	f =	3.28E-06 m/s		
Test No.	Time (min)	Depth (m)				
2	0	0.88	time 75% =	230		
	76	0.75	time 25% =	790		
	220	0.59	Area =	1		
	388	0.40	Vp 75% =	0.6		
	963	0.11	Vp 25% =	0.2		
			Vp75-25 =	0.4 m		
			As50 =	2.8 m ²		
			tp75-25 =	33600 s		
			f =	4.25E-06 m/s		



Soakaway Test Results - BRE 365 Digest standards					Site: Wrexham
					Client: Stantec
Trial Pit	4	Date: 9+10th May 2023			 GibbsGeoTechnical
Dimensions	(m)	Performed by: Oliver Gibbs			
Width	1	Weather: Sunny			
Length	1	Topsoil: Grassed loam			
Effective depth	0.9	Superficial soil: Till/clay mix			
Total depth of hole	0.9	Comments:			
Test No.	Time (min)	Depth (m)			
1	0	0.84	time 75% =	125	
	15	0.80	time 25% =	N/A	
	43	0.77	Area =	1	
	59	0.76	Vp 75% =	0.6	
	89	0.74	Vp 25% =	0.2	
	138	0.72			
	176	0.71			
	223	0.68			
	264	0.68			
	320	0.67			
	375	0.64	Vp75-25 =	0.4	m
	480	0.60	As50 =	2.8	m ²
	600	0.56	tp75-25 =	#VALUE!	s
			f =	#VALUE!	m/s
					
Test No.	Time (min)	Depth (m)			
2	0	0.87	time 75% =	N/A	
	68	0.81	time 25% =	N/A	
	144	0.75	Area =	1	
	202	0.73	Vp 75% =	0.6	
	303	0.72	Vp 25% =	0.2	
					
			Vp75-25 = 0.4 m As50 = 2.8 m ² tp75-25 = #VALUE! s f = #VALUE! m/s		

Soakaway Test Results - BRE 365 Digest standards					Site: Wrexham
					Client: Stantec
Trial Pit	5	Date:	9+10th May 2023		
		Performed by:	Oliver Gibbs		
Dimensions	(m)	Weather:	Sunny		
Width	1	Topsoil:	Grassed loam		
Length	1	Superficial soil:	Till/clay mix		
Effective depth	0.9	Comments:			
Total depth of hole	0.9				

1	Test No.	Time (min)	Depth (m)			
		0	0.84	time 75% =	6	
		1	0.77	time 25% =	22	
		5	0.62	Area =	1	
		12	0.42	Vp 75% =	0.6	
		22	0.20	Vp 25% =	0.2	
		34	0.00			
				Vp75-25 =	0.4	m
				As50 =	2.8	m ²
				tp75-25 =	960	s
				f =	1.49E-04	m/s

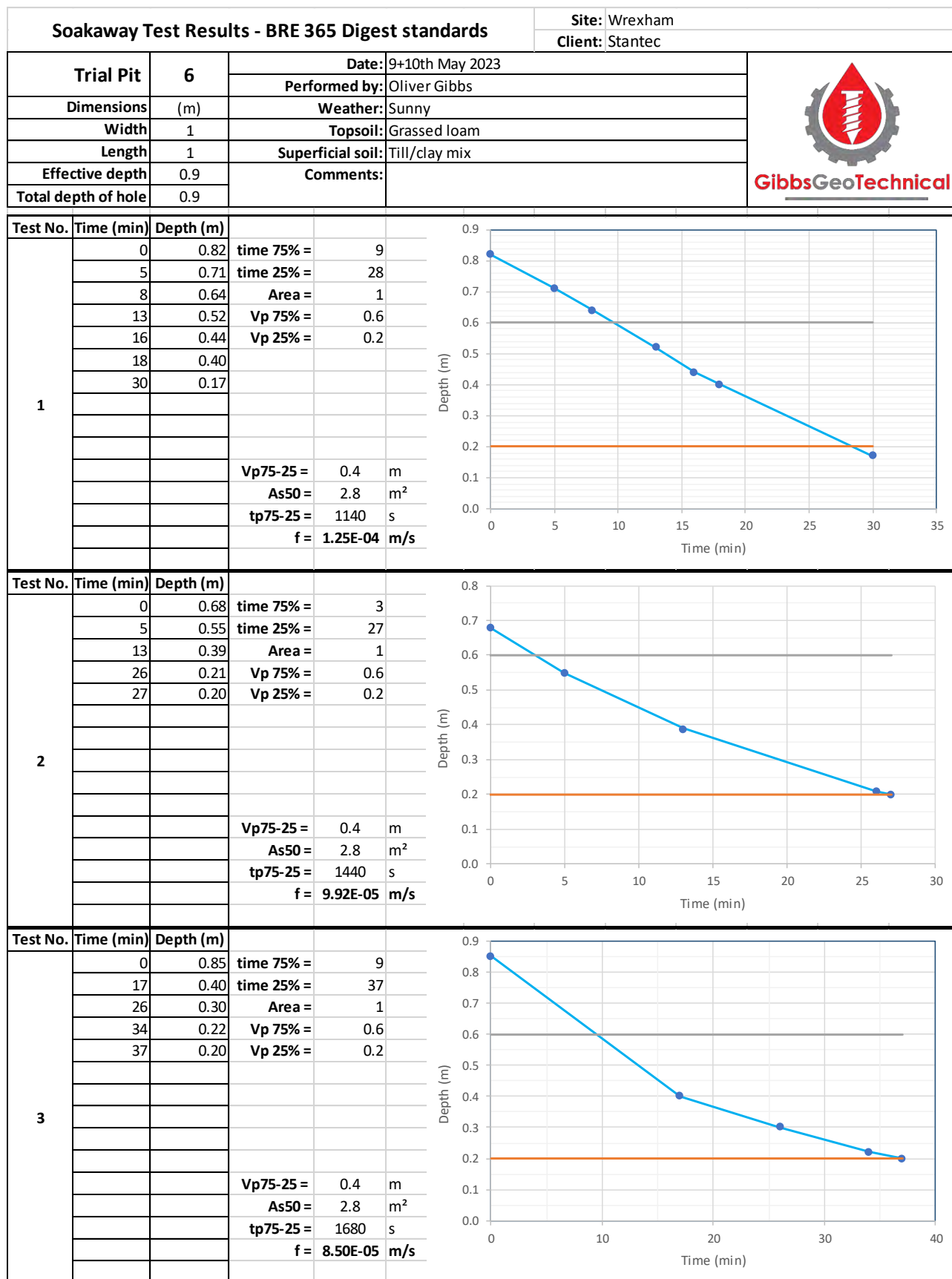
2	Test No.	Time (min)	Depth (m)			
		0	0.75	time 75% =	7	
		2	0.70	time 25% =	40	
		11	0.53	Area =	1	
		31	0.27	Vp 75% =	0.6	
		35	0.23	Vp 25% =	0.2	
		40	0.20			
				Vp75-25 =	0.4	m
				As50 =	2.8	m ²
				tp75-25 =	1980	s
				f =	7.22E-05	m/s

3	Test No.	Time (min)	Depth (m)			
		0	0.76	time 75% =	10	
		14	0.54	time 25% =	51	
		37	0.30	Area =	1	
		58	0.15	Vp 75% =	0.6	
				Vp 25% =	0.2	
				Vp75-25 =	0.4	m
				As50 =	2.8	m ²
				tp75-25 =	2460	s
				f =	5.81E-05	m/s

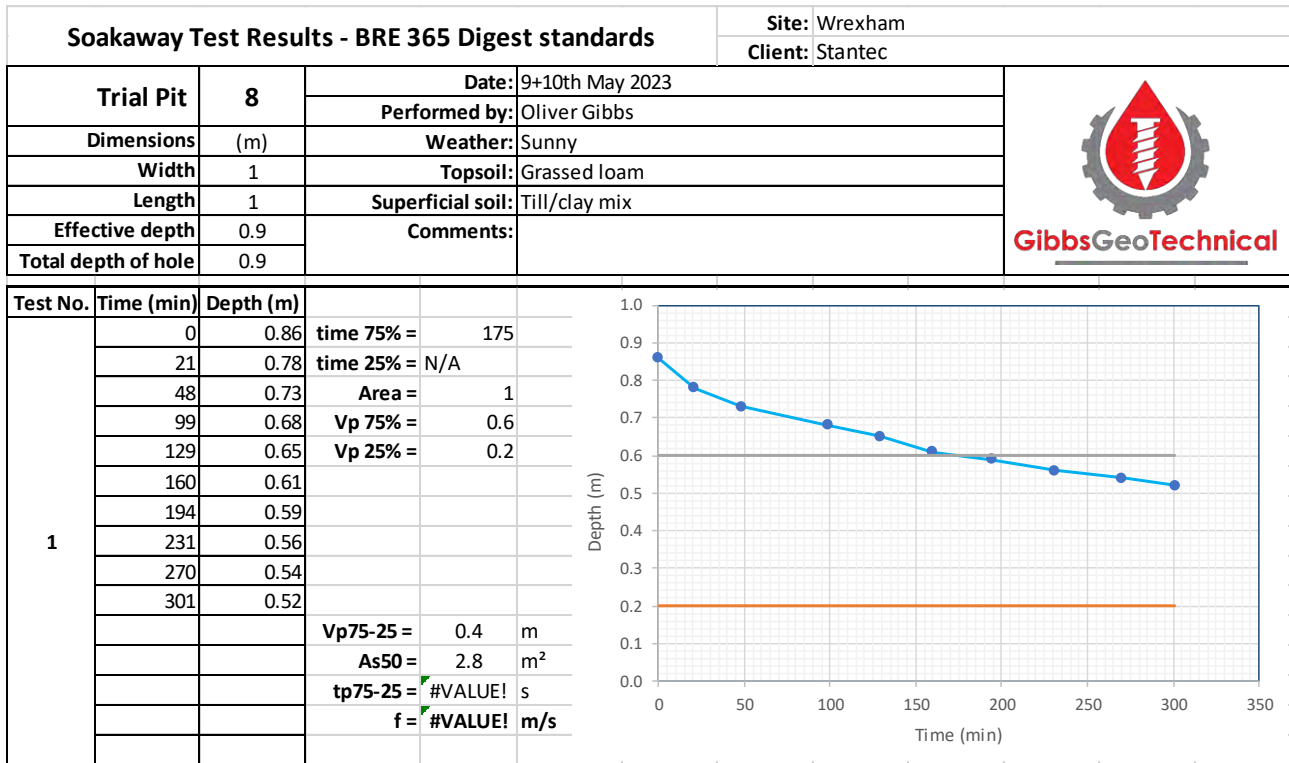
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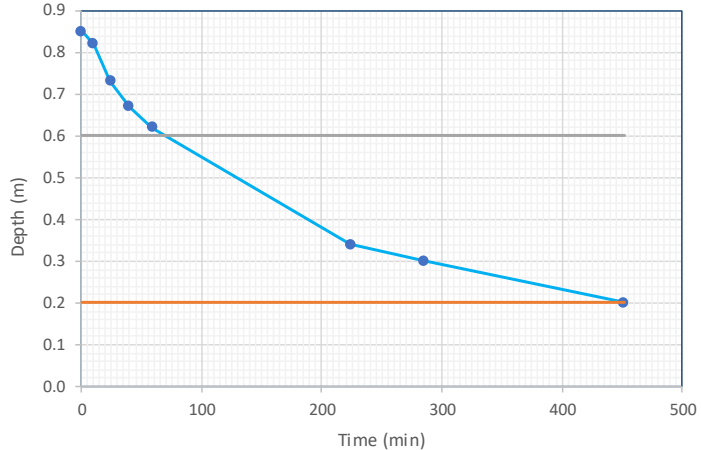
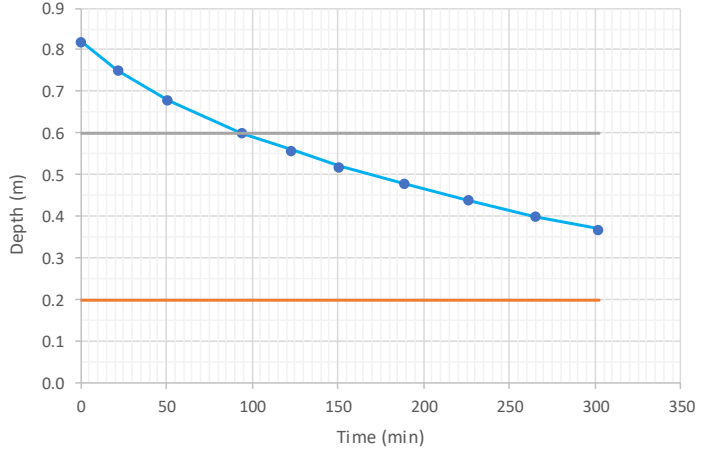


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Soakaway Test Results - BRE 365 Digest standards					Site: Wrexham	
					Client: Stantec	
Trial Pit		7	Date: 9+10th May 2023			
Dimensions		(m)	Performed by: Oliver Gibbs			
Width		1	Weather: Sunny			
Length		1	Topsoil: Grassed loam			
Effective depth		0.9	Superficial soil: Till/clay mix			
Total depth of hole		0.9	Comments:			



Soakaway Test Results - BRE 365 Digest standards					Site: Wrexham
					Client: Stantec
Trial Pit	9	Date: 9+10th May 2023			 GibbsGeoTechnical
		Performed by: Oliver Gibbs			
Dimensions	(m)	Weather: Sunny			
Width	1	Topsoil: Grassed loam			
Length	1	Superficial soil: Till/clay mix			
Effective depth	0.9	Comments:			
Total depth of hole	0.9				
Test No.	Time (min)	Depth (m)			
1	0	0.85	time 75% =	70	
	10	0.82	time 25% =	452	
	24	0.73	Area =	1	
	40	0.67	Vp 75% =	0.6	
	59	0.62	Vp 25% =	0.2	
	224	0.34			
	285	0.30			
	452	0.20			
			Vp75-25 =	0.4 m	
			As50 =	2.8 m ²	
			tp75-25 =	22920 s	
			f =	6.23E-06 m/s	
Test No.	Time (min)	Depth (m)			
2	0	0.82	time 75% =	95	
	22	0.75	time 25% =	N/A	
	51	0.68	Area =	1	
	94	0.60	Vp 75% =	0.6	
	123	0.56	Vp 25% =	0.2	
	151	0.52			
	189	0.48			
	226	0.44			
	265	0.40			
	302	0.37			
			Vp75-25 =	0.4 m	
			As50 =	2.8 m ²	
			tp75-25 =	#VALUE! s	
		f =	#VALUE! m/s		

16

3 Conclusions

The tests which could be performed in the timeframe allowed found infiltration results of:

Test Pit 1:	3.97E-05m/s
Test Pit 2:	5.81E-06m/s
Test Pit 4:	N/A – Test pit did not drain within the 6 hour timeframe allowed (2x tests performed)
Test Pit 5:	5.81E-05m/s
Test Pit 6:	8.50E-05m/s
Test Pit 7:	2.53E-05m/s
Test Pit 8:	Test pit did not drain to 25% in timeframe allowed
Test Pit 9:	Second filling test pit did not drain to 25% in timeframe allowed – reading of 6.23E-06 obtained for first fill
Test Pit 10:	1.19E-05m/s

APPENDIX A: Site Test Plans

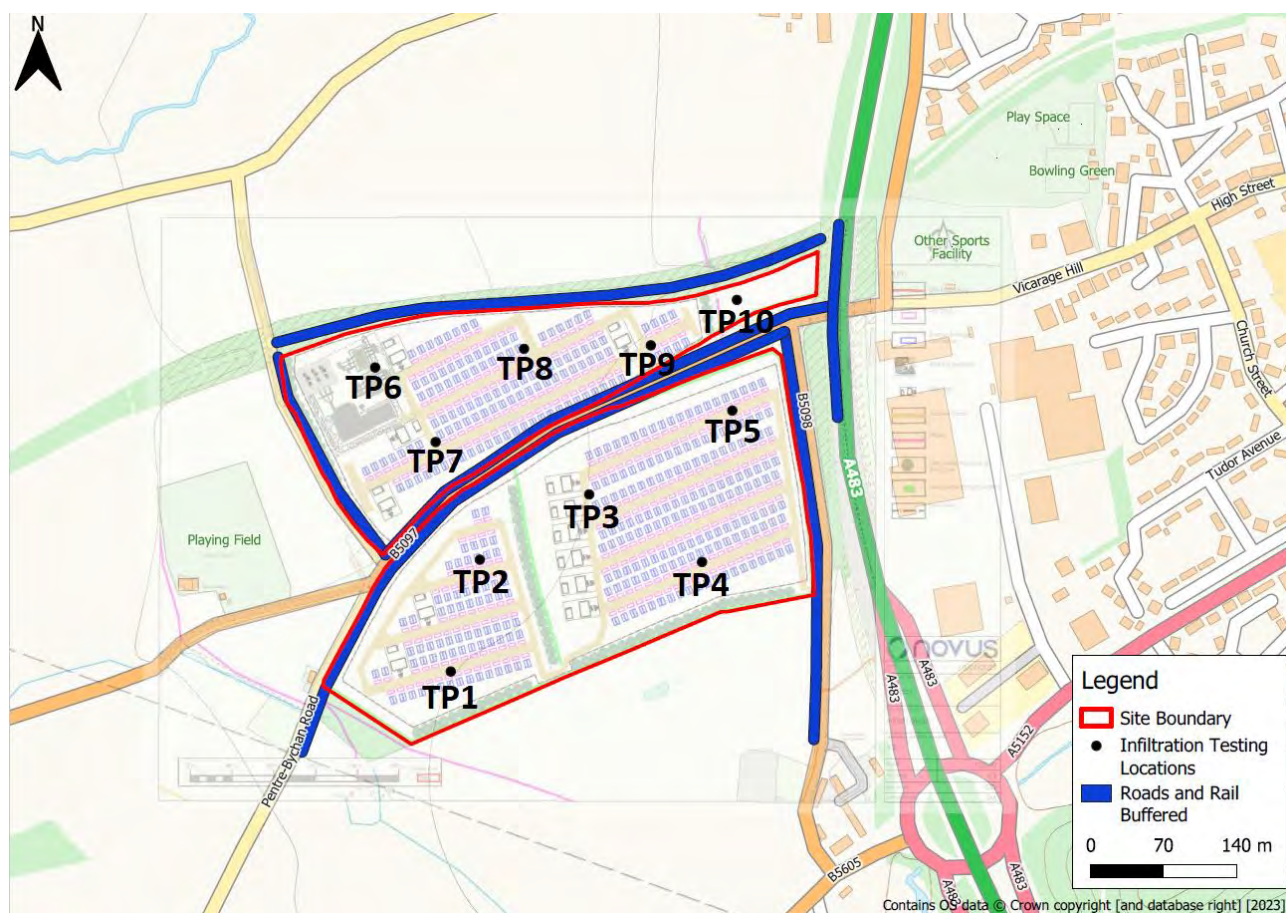


Figure 1- Test pit locations



Figure 2 - Drone pictures of test pit locations



APPENDIX B: Site Photos



Figure 3 - Test pit 1 after filling



Figure 4 – TP2 draining



Figure 5 – TP3 during filling

APPENDIX C: BGS Records

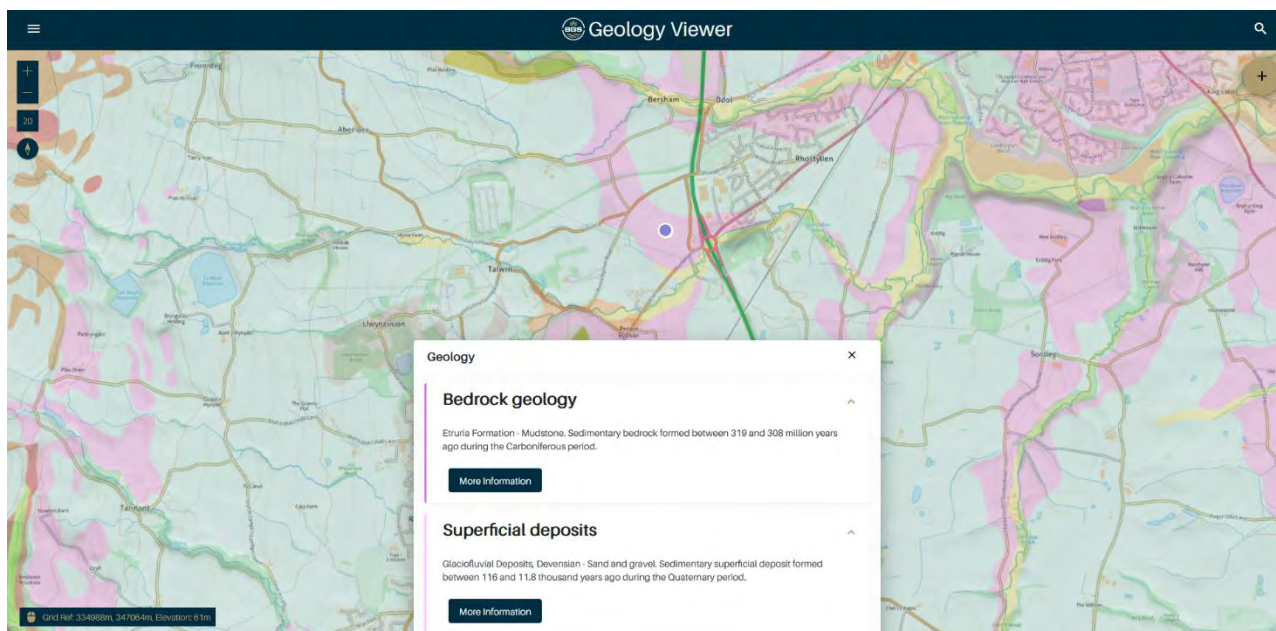


Figure 6 - British Geological Survey records of the site

F Greenfield Runoff Rates

Calculated by:	CHARLOTTE LICKMAN
Site name:	Legacy Substation
Site location:	Legacy Substation

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	53.03063° N
Longitude:	3.03569° W
Reference:	3686152790
Date:	Jun 27 2023 16:31

Runoff estimation approach

FEH Statistical

Site characteristics

Total site area (ha):	5.48
-----------------------	------

Methodology

Q _{MED} estimation method:	Calculate from BFI and SAAR
BFI and SPR method:	Specify BFI manually
HOST class:	N/A
BFI / BFIHOST:	0.413
Q _{MED} (l/s):	
Q _{BAR} / Q _{MED} factor:	1.08

Hydrological characteristics

	Default	Edited
SAAR (mm):	823	958
Hydrological region:	9	9
Growth curve factor 1 year:	0.88	0.88
Growth curve factor 30 years:	1.78	1.78
Growth curve factor 100 years:	2.18	2.18
Growth curve factor 200 years:	2.46	2.46

Notes

(1) Is $Q_{BAR} < 2.0$ l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

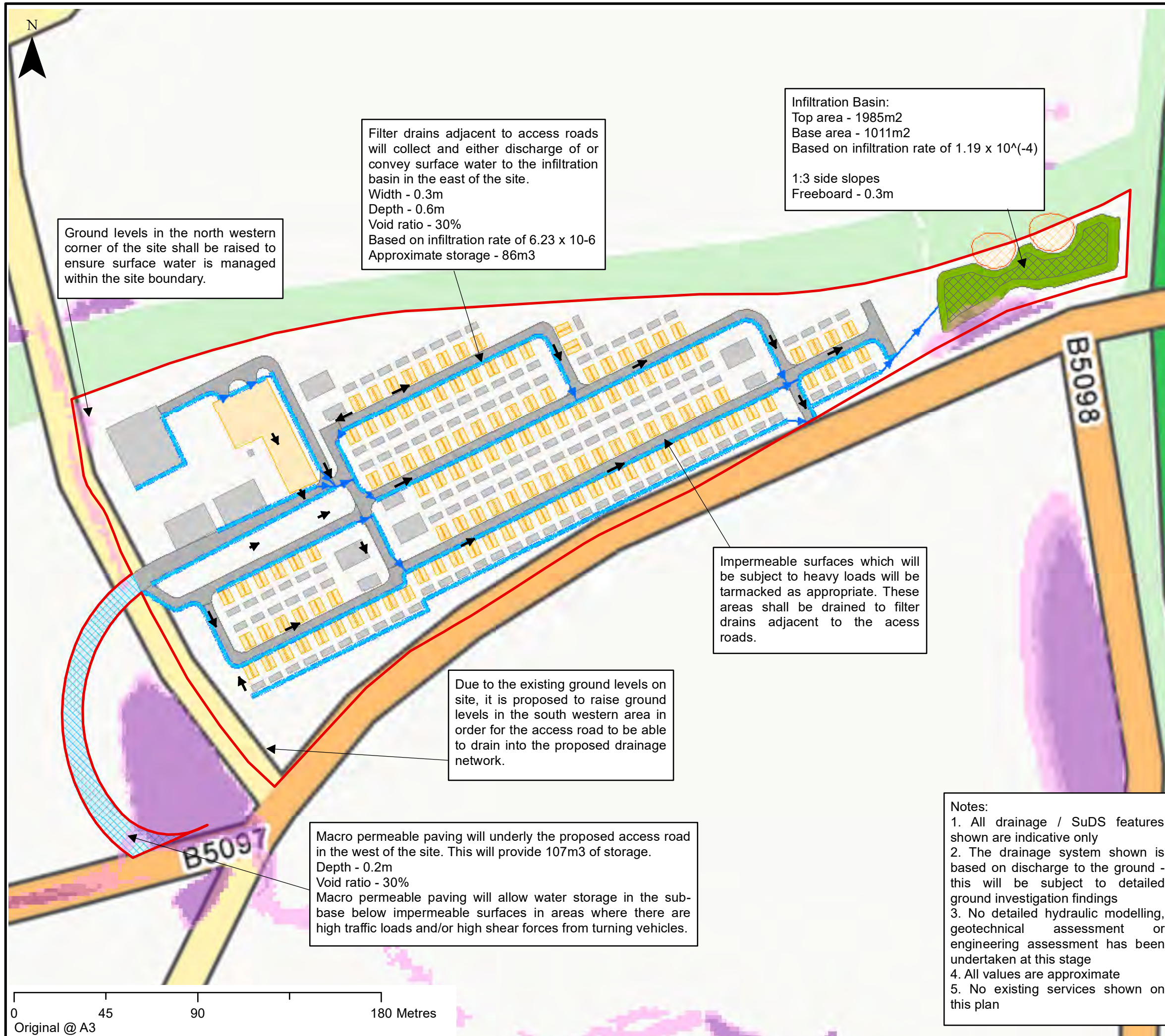
(3) Is $SPR/SPRHOST \leq 0.3$?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Q_{BAR} (l/s):		45.4
1 in 1 year (l/s):		39.95
1 in 30 years (l/s):		80.82
1 in 100 year (l/s):		98.98
1 in 200 years (l/s):		111.69

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

G Outline Drainage Strategy



KEYPLAN



KEY

	Exceedance flow path	Flood Risk from Surface Water and Small Watercourses
	Site Boundary Oct 23	
	Filter Drain	Risk Level  High  Medium  Low
	SW Pipe	
	Macro permeable paving	
	Basin	
	Other Hardstanding	
	Road	
	Roof	
	Tree RPZ	

Notes:
Proposed outline drainage strategy is based on site layout drawing ref 20230929 - L10 - Layout Plan.
The proposed site layout has since been updated - drawing ref 20230929 - L11 - Layout Plan. These updates are relatively minor, and there is negligible impact to the drainage strategy proposed, with the principles of surface water drainage remaining the same as shown.

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Outline Surface Water Drainage Strategy - Legacy Substation

KIR-JBAU-XX-XX-DR-D-0001-S3-P02

October 2023

Drawn by:	Reviewed by:	Approved by:
Charlotte Lickman	Luke Virgo	Faye Tomalin
12/10/2023	13/10/2023	13/10/2023

- Notes:
1. All drainage / SuDS features shown are indicative only
 2. The drainage system shown is based on discharge to the ground - this will be subject to detailed ground investigation findings
 3. No detailed hydraulic modelling, geotechnical assessment or engineering assessment has been undertaken at this stage
 4. All values are approximate
 5. No existing services shown on this plan

Filter drains adjacent to access roads will collect and either discharge of or convey surface water to the infiltration basin in the east of the site.
Width - 0.3m
Depth - 0.6m
Void ratio - 30%
Based on infiltration rate of 6.23×10^{-6}
Approximate storage - 86m³

Infiltration Basin:
Top area - 1985m²
Base area - 1011m²
Based on infiltration rate of 1.19×10^{-4}

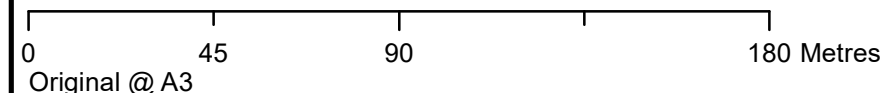
1:3 side slopes
Freeboard - 0.3m

Ground levels in the north western corner of the site shall be raised to ensure surface water is managed within the site boundary.

Impermeable surfaces which will be subject to heavy loads will be tarmacked as appropriate. These areas shall be drained to filter drains adjacent to the access roads.

Due to the existing ground levels on site, it is proposed to raise ground levels in the south western area in order for the access road to be able to drain into the proposed drainage network.

Macro permeable paving will underly the proposed access road in the west of the site. This will provide 107m³ of storage.
Depth - 0.2m
Void ratio - 30%
Macro permeable paving will allow water storage in the sub-base below impermeable surfaces in areas where there are high traffic loads and/or high shear forces from turning vehicles.



Original @ A3

H **MicroDrainage Calculation Record**

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Summer</td><td>103.559</td><td>0.759</td><td>18.1</td><td>859.8</td><td>O K</td></tr><tr><td>600 min Summer</td><td>103.555</td><td>0.755</td><td>18.1</td><td>854.2</td><td>O K</td></tr><tr><td>720 min Summer</td><td>103.548</td><td>0.748</td><td>18.1</td><td>845.8</td><td>O K</td></tr><tr><td>960 min Summer</td><td>103.536</td><td>0.736</td><td>18.1</td><td>830.0</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>103.505</td><td>0.705</td><td>18.0</td><td>791.4</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>103.455</td><td>0.655</td><td>17.6</td><td>729.6</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>103.404</td><td>0.604</td><td>17.1</td><td>667.0</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>103.276</td><td>0.476</td><td>16.0</td><td>515.5</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>103.170</td><td>0.370</td><td>15.1</td><td>393.9</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>103.082</td><td>0.282</td><td>14.3</td><td>296.0</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>103.011</td><td>0.211</td><td>13.7</td><td>218.8</td><td>O K</td></tr><tr><td>10080 min Summer</td><td>102.954</td><td>0.154</td><td>13.2</td><td>157.7</td><td>O K</td></tr><tr><td>15 min Winter</td><td>103.305</td><td>0.505</td><td>16.3</td><td>549.3</td><td>O K</td></tr></tbody></table> <table><thead><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Time-Peak (mins)</th></tr></thead><tbody><tr><td>15 min Summer</td><td>158.359</td><td>0.0</td><td>26</td></tr><tr><td>30 min Summer</td><td>95.039</td><td>0.0</td><td>40</td></tr><tr><td>60 min Summer</td><td>57.038</td><td>0.0</td><td>68</td></tr><tr><td>120 min Summer</td><td>34.231</td><td>0.0</td><td>126</td></tr><tr><td>180 min Summer</td><td>25.393</td><td>0.0</td><td>184</td></tr><tr><td>240 min Summer</td><td>20.544</td><td>0.0</td><td>242</td></tr><tr><td>360 min Summer</td><td>15.240</td><td>0.0</td><td>356</td></tr><tr><td>480 min 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Micro Drainage		Source Control 2020.1.3			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	103.391	0.591	17.0	651.9	O K
60 min Winter	103.483	0.683	17.8	764.0	O K
120 min Winter	103.574	0.774	18.1	877.5	O K
180 min Winter	103.621	0.821	18.2	937.4	O K
240 min Winter	103.649	0.849	18.2	972.2	O K
360 min Winter	103.674	0.874	18.3	1003.3	O K
480 min Winter	103.677	0.877	18.3	1006.6	O K
600 min Winter	103.668	0.868	18.3	995.7	O K
720 min Winter	103.660	0.860	18.2	985.1	O K
960 min Winter	103.641	0.841	18.2	962.0	O K
1440 min Winter	103.590	0.790	18.1	897.9	O K
2160 min Winter	103.505	0.705	18.0	791.9	O K
2880 min Winter	103.425	0.625	17.3	692.4	O K
4320 min Winter	103.244	0.444	15.7	477.6	O K
5760 min Winter	103.098	0.298	14.4	312.9	O K
7200 min Winter	102.983	0.183	13.5	188.5	O K
8640 min Winter	102.897	0.097	12.7	98.7	O K
10080 min Winter	102.850	0.050	12.3	50.6	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
30 min Winter	95.039	0.0	40		
60 min Winter	57.038	0.0	68		
120 min Winter	34.231	0.0	124		
180 min Winter	25.393	0.0	182		
240 min Winter	20.544	0.0	238		
360 min Winter	15.240	0.0	350		
480 min Winter	12.329	0.0	458		
600 min Winter	10.461	0.0	548		
720 min Winter	9.146	0.0	574		
960 min Winter	7.432	0.0	728		
1440 min Winter	5.546	0.0	1034		
2160 min Winter	4.139	0.0	1472		
2880 min Winter	3.363	0.0	1884		
4320 min Winter	2.427	0.0	2684		
5760 min Winter	1.926	0.0	3416		
7200 min Winter	1.609	0.0	4112		
8640 min Winter	1.390	0.0	4752		
10080 min Winter	1.228	0.0	5144		
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St Philips Courtyard
Coleshill B46 3AD

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Designed by jflow_atherstone
Checked by



Micro Drainage

Source Control 2020.1.3

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 331150 348300 SJ 31150 48300
C (1km)	-0.026
D1 (1km)	0.383
D2 (1km)	0.398
D3 (1km)	0.315
E (1km)	0.287
F (1km)	2.387
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

Time Area Diagram

Total Area (ha) 1.707

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)	From: To:	(ha)
0 4	0.569	4 8	0.569	8 12	0.569

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Micro Drainage Source Control 2020.1.3		

Model Details

Storage is Online Cover Level (m) 104.000

Infiltration Basin Structure

Invert Level (m) 102.800 Safety Factor 10.0

Infiltration Coefficient Base (m/hr) 0.42840 Porosity 1.00

Infiltration Coefficient Side (m/hr) 0.42840

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	1000.0	0.700	1249.3	0.701	1249.6

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Summer</td><td>102.960</td><td>0.160</td><td>3.8</td><td>69.1</td><td>O K</td></tr><tr><td>600 min Summer</td><td>102.954</td><td>0.154</td><td>3.8</td><td>66.5</td><td>O K</td></tr><tr><td>720 min Summer</td><td>102.947</td><td>0.147</td><td>3.8</td><td>63.7</td><td>O K</td></tr><tr><td>960 min Summer</td><td>102.935</td><td>0.135</td><td>3.7</td><td>58.4</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>102.912</td><td>0.112</td><td>3.7</td><td>48.3</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>102.883</td><td>0.083</td><td>3.7</td><td>35.7</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>102.862</td><td>0.062</td><td>3.7</td><td>26.9</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>102.844</td><td>0.044</td><td>3.2</td><td>18.8</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>102.836</td><td>0.036</td><td>2.6</td><td>15.4</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>102.830</td><td>0.030</td><td>2.2</td><td>13.2</td><td>O K</td></tr><tr><td>8640 min 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The Library St Philips Courtyard Coleshill B46 3AD					
Date 12/10/2023 10:10 File Legacy V4.2 Road.SRCX		Designed by jflow_atherstone Checked by			
Micro Drainage		Source Control 2020.1.3			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	102.950	0.150	3.8	64.7	O K
60 min Winter	102.972	0.172	3.8	74.3	O K
120 min Winter	102.989	0.189	3.8	81.6	O K
180 min Winter	102.993	0.193	3.8	83.4	O K
240 min Winter	102.992	0.192	3.8	82.9	O K
360 min Winter	102.987	0.187	3.8	80.9	O K
480 min Winter	102.979	0.179	3.8	77.4	O K
600 min Winter	102.969	0.169	3.8	73.2	O K
720 min Winter	102.959	0.159	3.8	68.7	O K
960 min Winter	102.939	0.139	3.8	60.0	O K
1440 min Winter	102.902	0.102	3.7	43.9	O K
2160 min Winter	102.861	0.061	3.7	26.2	O K
2880 min Winter	102.846	0.046	3.4	19.8	O K
4320 min Winter	102.834	0.034	2.5	14.5	O K
5760 min Winter	102.827	0.027	2.0	11.7	O K
7200 min Winter	102.823	0.023	1.7	9.7	O K
8640 min Winter	102.820	0.020	1.5	8.4	O K
10080 min Winter	102.817	0.017	1.3	7.5	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
30 min Winter	95.039	0.0	38		
60 min Winter	57.038	0.0	66		
120 min Winter	34.231	0.0	120		
180 min Winter	25.393	0.0	176		
240 min Winter	20.544	0.0	208		
360 min Winter	15.240	0.0	278		
480 min Winter	12.329	0.0	356		
600 min Winter	10.461	0.0	430		
720 min Winter	9.146	0.0	502		
960 min Winter	7.432	0.0	642		
1440 min Winter	5.546	0.0	900		
2160 min Winter	4.139	0.0	1224		
2880 min Winter	3.363	0.0	1532		
4320 min Winter	2.427	0.0	2252		
5760 min Winter	1.926	0.0	3000		
7200 min Winter	1.609	0.0	3672		
8640 min Winter	1.390	0.0	4352		
10080 min Winter	1.228	0.0	5152		
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Micro Drainage		Source Control 2020.1.3

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 331150 348300 SJ 31150 48300
C (1km)	-0.026
D1 (1km)	0.383
D2 (1km)	0.398
D3 (1km)	0.315
E (1km)	0.287
F (1km)	2.387
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

Time Area Diagram

Total Area (ha) 0.177

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From:	To:	From:	To:	From:	To:
0	4 0.059	4	8 0.059	8	12 0.059

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Micro Drainage		Source Control 2020.1.3

Model Details

Storage is Online Cover Level (m) 104.000

Cellular Storage Structure

Invert Level (m) 102.800 Safety Factor 10.0

Infiltration Coefficient Base (m/hr) 0.09108 Porosity 0.30

Infiltration Coefficient Side (m/hr) 0.09108

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	1440.0	1440.0	0.201	0.0	1501.6
0.200	1440.0	1501.6			

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I Designer's Risk Assessment

Appendix H - Preliminary CDM Design Risk Assessment

Project element	Hazard	Risk	Control measures
Health and Safety Considerations/ Design of the drainage system			
Health and Safety Considerations/ Construction and Operation Stage			
Plant / material delivery	Access to the site via B5097.	Collisions and injury. Damage to people / vehicles.	Traffic management to be prepared prior to construction activities commencing. Public to be notified of construction activities to take place.
Excavations	Underground services crossing the site. It is known that assets relating to gas, water, and electricity are not present across the site.	Services strikes Injury / death. Damage to existing infrastructure.	Detailed utility survey to be carried out prior to detailed design. Care to be taken when excavating around any existing services to minimise the risk of structural damage.
Excavations	Ground and groundwater conditions – unknown seasonal groundwater fluctuations.	Potential for instability and/or groundwater in excavations	Review the GI report findings and follow recommendations. Preliminary drainage design assumes largely shallow drainage / SuDS features
Excavations	UXO – Unexploded Ordnance	Explosion, injury, death, damage to infrastructure.	A regional 'unexploded bomb (UXB) risk map' for the area has been reviewed through www.zetica.com website. The map shows that the area has low UXO risk.
Design of above ground SuDS features	Risk of trips, falls, and drowning	End user	Detailed design should consider the use of appropriate kerbing where the basin could be located near to vehicular access routes to reduce the risk of vehicles entering SuDS assets. Maintenance schedule should be prepared.
Construction of drainage system	Striking of services Contamination Unstable excavation	Site personnel	Hazard cannot be eliminated by design. Limit the depth of excavation where possible.
Maintenance and inspection	Potential for failure of the	End users Maintenance	Design drainage to an appropriate design life and

of drainage systems	drainage system and flooding of the site.	personnel	design storm event. Regular maintenance in accordance with O&M manual, normal site safety controls, designated overland flow route away from proposed storage units.
Environmental Considerations			
Design of drainage system	Potential for ground contamination Risk of pollution	Pollution of groundwater	Ground investigation to be undertaken to assess the risk of ground contamination, and any remediation measures needed in order to mitigate risk of mobilisation on contaminants.
Design of drainage system	Oil spillage Pollution	Groundwater	SuDS including swales, infiltration basins, and filter drains have been used to treat flows. The Simple Index Approach has been utilised to demonstrate that the proposed SuDS features provide sufficient treatment to ensure there is no detrimental effect to water quality. Therefore, the SuDS measures are considered sufficient to control pollution within the development. Regular maintenance shall be required.
Inspection and clearance of manholes/basins	Oil/fuel, sediment Pollution	Environment Maintenance personnel	Regular maintenance in accordance with O&M manual, normal site safety controls. Materials/sediment removed to be treated as contaminated and disposed of to a licensed waste management facility.
Decommissioning Stage			
Risk and hazards largely as per the construction stage, with the exception that removal of the drainage systems will increase the risk of flooding and water quality deterioration. A replacement SuDS based system in line with the relevant guidance would need to be installed or the site returned to greenfield condition. Diversion of upstream sewer flows would be required, or replacement system installed.			

UNEXPLODED BOMB RISK MAP



SITE LOCATION

Map Centre: 330584,348621



LEGEND

-  **High:** Areas indicated as having a bombing density of 50 bombs per 1000acre or higher.
-  **Moderate:** Areas indicated as having a bombing density of 15 to 49 bombs per 1000acre.
-  **Low:** Areas indicated as having 15 bombs per 1000acre or less.

- | | | |
|--|--|--|
|  military |  industry |  UXO find |
|  transport |  dock |  Luftwaffe targets |
|  utilities |  Bombing decoy |  other |

How to use your Unexploded Bomb (UXB) risk map?

The map indicates the potential for Unexploded Bombs (UXB) to be present as a result of World War Two (WWII) bombing.

You can incorporate the map into your preliminary risk assessment* for potential Unexploded Ordnance (UXO) for a site. Using this map, you can make an informed decision as to whether more in-depth detailed risk assessment* is necessary.

What do I do if my site is in a moderate or high risk area?

Generally, we recommend that a detailed UXO desk study and risk assessment is undertaken for sites in a moderate or high UXB risk area.

Similarly, if your site is near to a designated Luftwaffe target or bombing decoy then additional detailed research is recommended.

More often than not, this further detailed research will conclude that the potential for a significant UXO hazard to be present on your site is actually low.

Never plan site work or undertake a risk assessment using these maps alone. More detail is required, particularly where there may be a source of UXO from other military operations which are not reflected on these maps.

If my site is in a low risk area, do I need to do anything?

If both the map and other research confirms that there is a low potential for UXO to be present on your site then, subject to your own comfort and risk tolerance, works can proceed with no special precautions.

A low risk really means that there is no greater probability of encountering UXO than anywhere else in the UK.

If you are unsure whether other sources of UXO may be present, you can ask for one of our **pre-desk study assessments (PDSA)**

If I have any questions, who do I contact?

tel: **+44 (0) 1993 886682**

email: **uxo@zetica.com**

web: **www.zeticauxo.com**

The information in this UXB risk map is derived from a number of sources and should be used in conjunction with the accompanying notes on our website: (<https://zeticauxo.com/downloads-and-resources/risk-maps/>)

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It is important to note that this map is not a UXO risk assessment and should not be reported as such when reproduced.

*Preliminary and detailed UXO risk assessments are advocated as good practice by industry guidance such as CIRIA C681 'Unexploded Ordnance (UXO), a guide for the construction industry'.

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