

Broad Oak Farm, Rossett

Infiltration Test Report

May 2024

Project Information	
Project:	Broad Oak Farm, Rossett
Report Title:	Infiltration Test Report
Client:	Funky Furniture Hire (Properties) Ltd
Instruction:	The instruction to undertake this Infiltration Test Report was received from Ian Jones of COF solutions.
File Ref:	15923-Infiltration Test Report-01

Approval Record	
Author:	Iwan Thomas BSc (Hons)
Checker:	Megan Williams BSc (Hons) MSc MCIWEM
Approver:	Aled Williams BSc (Hons) MCIWEM C.WEM

Document History		
Revision	Date	Comment
01	07/05/2024	First issue

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This report will remain valid for a period of twelve months (from the date of last issue) after which the source data should be reviewed in order to reassess the findings and conclusions on the basis of latest available information.

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Introduction

Waterco has been commissioned to undertake infiltration testing in accordance with the BRE365 specification in relation to a proposed residential development at Broad Oak Farm, Llyndir Lane, Rossett, LL12 0AU.

The infiltration testing will establish soil permeability and will be used to inform sustainable drainage measures to be used in the development.

Site Overview

The site covers an area of approximately 9,616m² and is located at National Grid Reference (NGR): 336734, 358490. A location plan and an aerial image are included in Appendix A.

Online mapping (including Google Maps / Google Streetview imagery, accessed May 2024) shows that the site comprises farm buildings with associated yards. The site is bordered by an unnamed watercourse with agricultural land beyond to the north, agricultural land to the east and south, and Llyndir Lane / Cobblers Lane to the west.

Local Topography

Topographic levels to metres Above Ordnance Datum (m AOD) have been derived from a 1m resolution Natural Resources Wales (NRW) composite 'Light Detecting and Ranging' (LiDAR) Digital Terrain Model (DTM). A review of LiDAR data shows that the site is relatively flat, with levels ranging from 12.78m AOD in the centre to 12m AOD in the north-west. A LiDAR extract is provided as Appendix B.

Published Ground Conditions

The British Geological Survey (BGS) online mapping (1:50,000 scale) shows that the site is underlain by superficial River Terrace Deposits, generally comprising sand and gravel. The north-western boundary of the site, along the unnamed watercourse, is identified as being underlain by superficial deposits of Alluvium, generally comprising clay, silt, sand, and gravel. The superficial deposits are identified as being underlain by the Kinnerton Sandstone formation.

The geological mapping is available at a scale of 1:50,000 and as such may not be accurate on a site-specific basis.

The closest historical BGS borehole record (BGS reference: SJ35NE1) is located in the southern extent site. A copy of the borehole record is included in Appendix C together with a borehole location plan. The borehole record identifies alternating layers of gravel, clay and sand. Sandstone is identified at 42.67m below ground level (m.bgl).

According to the EA's Aquifer Designation data, obtained from MAGIC's online mapping [accessed May 2024], the superficial deposits are classified as a Secondary A Aquifer. Secondary A Aquifers are '*permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an*

important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers'.

The underlying Kinnerton Sandstone formation is described as a Principal Aquifer. Principal Aquifers are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.

Development Proposals

The proposed development is for the conversion of a farm to form 10no. residential dwellings with associated access and parking. A proposed development plan is included in Appendix D.

Infiltration Testing

Fieldworks

Infiltration testing in accordance with the BRE365 specification was completed by Waterco on 23rd April 2024. In total, 3no trial pits (TP) were excavated by others in general accordance with the BRE Digest 365 specification. TP1 was excavated on the 22nd April, with TP2 and TP3 excavated on the 23rd April 2024. The trial pit locations were selected based on the site layout, access and health and safety considerations.

The weather conditions were dry throughout the day. The trial pits were excavated using an excavator and water was provided from a water bowser. A trial pit location plan and photographic record are provided as Appendix E.

The excavated material/arising stockpiled adjacent to the trial pits were generally consistent and comprised Made Ground (concrete, sand and gravel), underlain by gravelly, sandy clay. Clay became firmer and wetter at depth. Groundwater was recorded at the base of each of the trial pits. The groundwater may be associated with water perched above clay.

The trial pits were excavated to depths of between 1.8m-2m.bgl. The trial pit dimensions are provided in Table 1.

Table 1 – Trial Pit Dimensions

Trial Pit	Depth (m)	Width (m)	Length (m)
TP1	1.8	0.5	2.2
TP2	1.8	0.5	2.2
TP3	2.0	0.4	2.1

Results

A summary of the infiltration tests at TP1, TP2 & TP3 is provided in Table 2. The infiltration test results are included in Appendix F.

Table 2 – Infiltration Test Summary

Trial Pit	Description	Slowest Infiltration Rate
1	The trial pit was excavated to a depth of 1.8m.bgl. Groundwater was recorded at 1.72m.bgl. No tests were undertaken in TP1 as the pit was unstable and sides were collapsing. The groundwater level in TP1 rose from 1.72m.bgl to 1.17m.bgl in 4 hours.	N/A – Rising groundwater and pit collapse.
2	The trial pit was excavated to a depth of 1.8m.bgl. Groundwater was recorded at 1.7m.bgl. The trial pit was filled with water to a depth of 0.24m.bgl. The water level initially drained rapidly through the Made Ground from 0.24m.bgl to 0.63m.bgl within 1 minute. The rate of infiltration slowed rapidly below 0.63m.bgl due to the clay geology. The water level fell from 0.63m.bgl. to 0.78m.bgl (150mm) in 226 minutes (3 hours and 46mins). No further drop in water level was recorded below 0.78m.bgl.	N/A – No infiltration below 0.78m.bgl. Trial pit did not empty, and an infiltration rate cannot be calculated.
3	The trial pit was excavated to a depth of 2m.bgl. Groundwater was recorded at 1.93m.bgl. The trial pit was filled with water to a depth of 0.23m.bgl. The water level initially drained rapidly through the Made Ground from 0.23m.bgl to 0.33m.bgl in 5 minutes. The water level fell from 0.33m.bgl to 0.79m.bgl (570mm) in 197 minutes (3 hours and 17 minutes). The rate of infiltration significantly slowed from a depth of 0.79m.bgl due to the clay geology. The water level fell from 0.79m.bgl to 0.83m.bgl (40mm) in 46 minutes with no fall in water recorded beyond 0.83m.bgl.	N/A – No infiltration below 0.83m.bgl. Trial pit did not empty, and an infiltration rate cannot be calculated

It can be concluded that soakaways are not considered feasible on site due to the presence of clay and groundwater. However, shallow depth infiltration techniques such as permeable surfacing may be feasible.

Conclusions

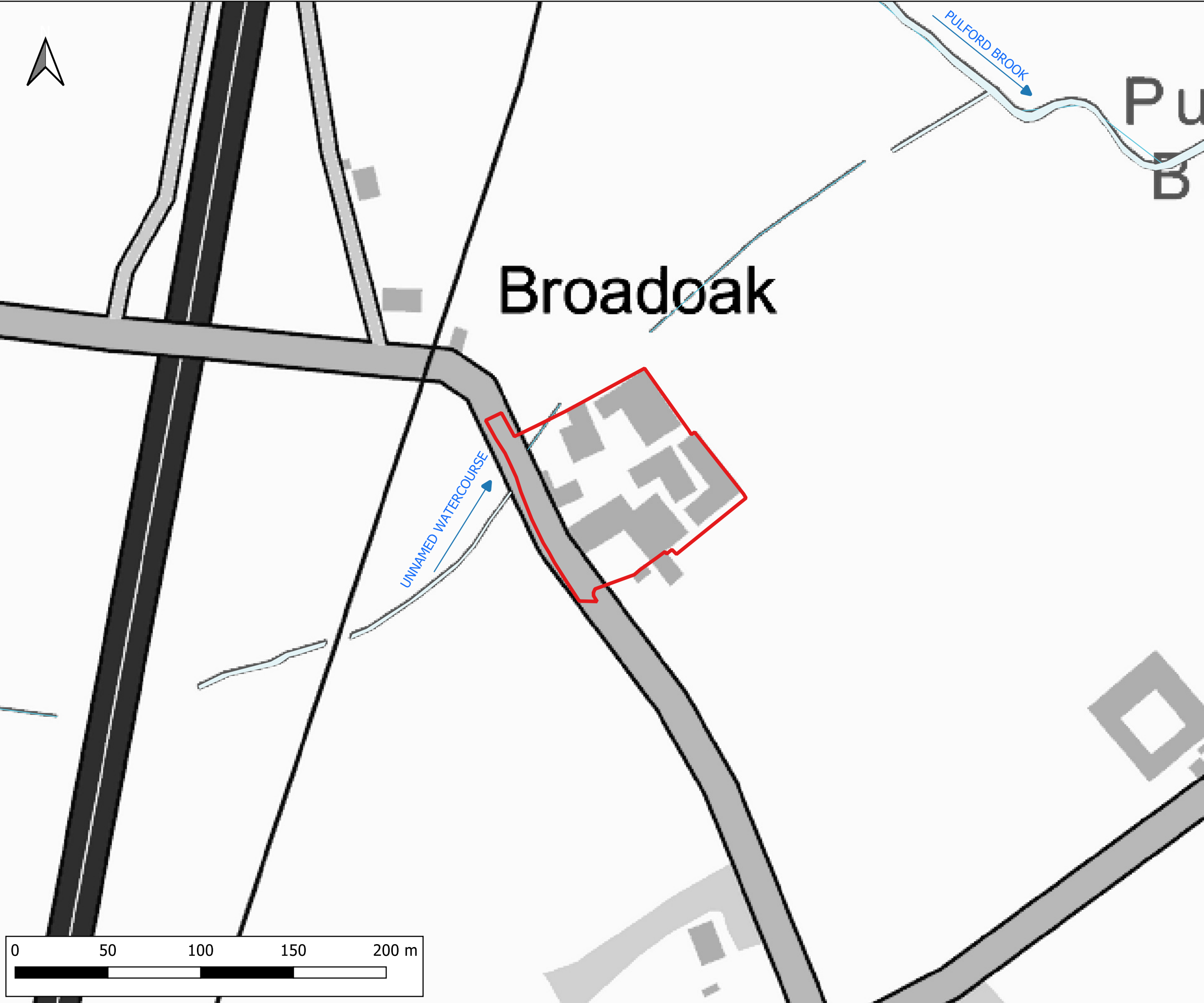
The proposed development is for the conversion of a farm to form 10no. residential dwellings.

Infiltration testing has been undertaken by Waterco in general accordance with the BRE Digest 365 specification. Three trial pits were excavated across the site to depths of between 1.8m-2m.bgl. Groundwater was recorded in all trial pits to depths of between 1.7m.bgl to 1.93m.bgl.

During the infiltration tests, water initially drained rapidly through Made Ground. However, no drop in water level was recorded beyond 0.78m.bgl in trial pit 2 and 0.83m.bgl in trial pit 3. Soakaways are therefore not considered feasible on site due to the presence of clay and groundwater.

It is recommended that an alternative discharge method is used, such as discharge to the unnamed watercourse along the northern boundary of the site.

Appendix A Location Plan & Aerial Image



Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise

LEGEND

- Site boundary
- Watercourses
- Waterbodies

CLIENT:

Funky Furniture Hire (Properties) Ltd

waterco
www.waterco.co.uk

SCHEME:

Broad Oak Farm, Rossett

PLOT TITLE:

Location Plan

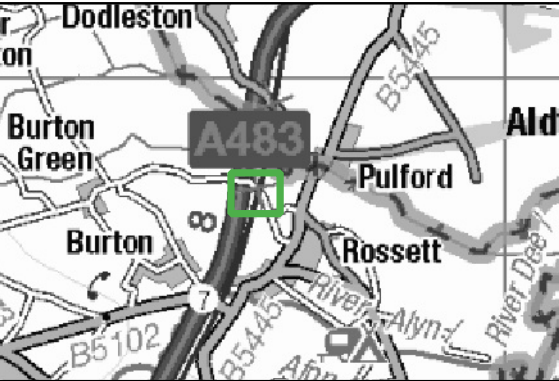
PLOT STATUS:		DATE:	
FINAL		07-05-2024	
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
IT	MW	AW	1:2000
PLOT NAME:			REVISION:
15923_Location_Plan			-



Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise

LEGEND

Site boundary



CLIENT:
Funky Furniture Hire (Properties) Ltd



SCHEME:
Broad Oak Farm, Rossett

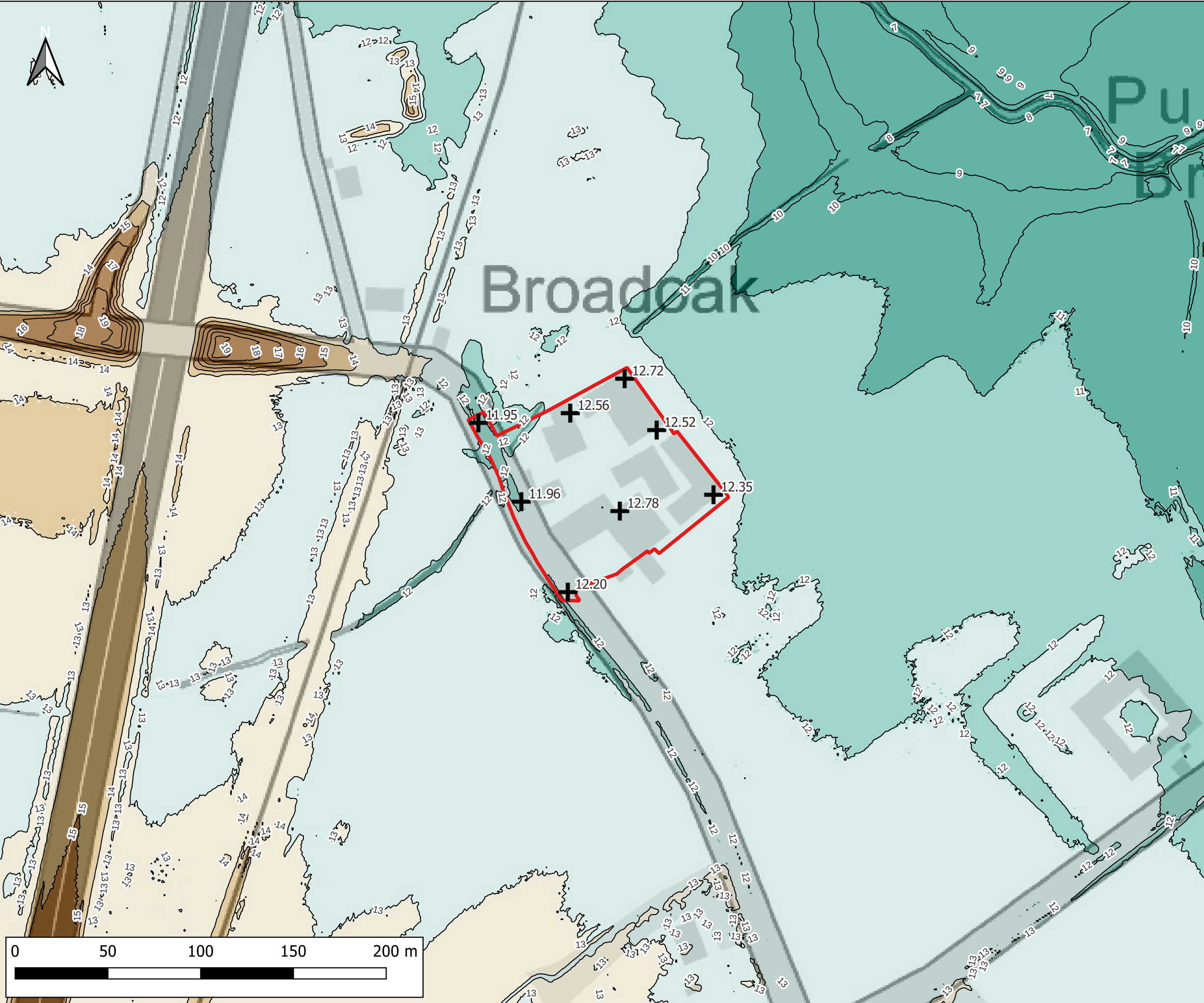
PLOT TITLE:
Aerial Plan

PLOT STATUS:	FINAL	DATE:	07-05-2024
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DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
IT	MW	AW	1:2000

PLOT NAME:	REVISION:
15923_Aerial_Plan	-

Appendix B Topographical Information



Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise

LEGEND

- Site boundary
- 1m contour
- Site Levels (m AOD)

Ground Elevations (m AOD)

- <= 11
- 11 - 12
- 12 - 13
- 13 - 14
- 14 - 15
- > 15

CLIENT:

Funky Furniture Hire (Properties) Ltd

waterco
www.waterco.co.uk

SCHEME:

Broad Oak Farm, Rossett

PLOT TITLE:

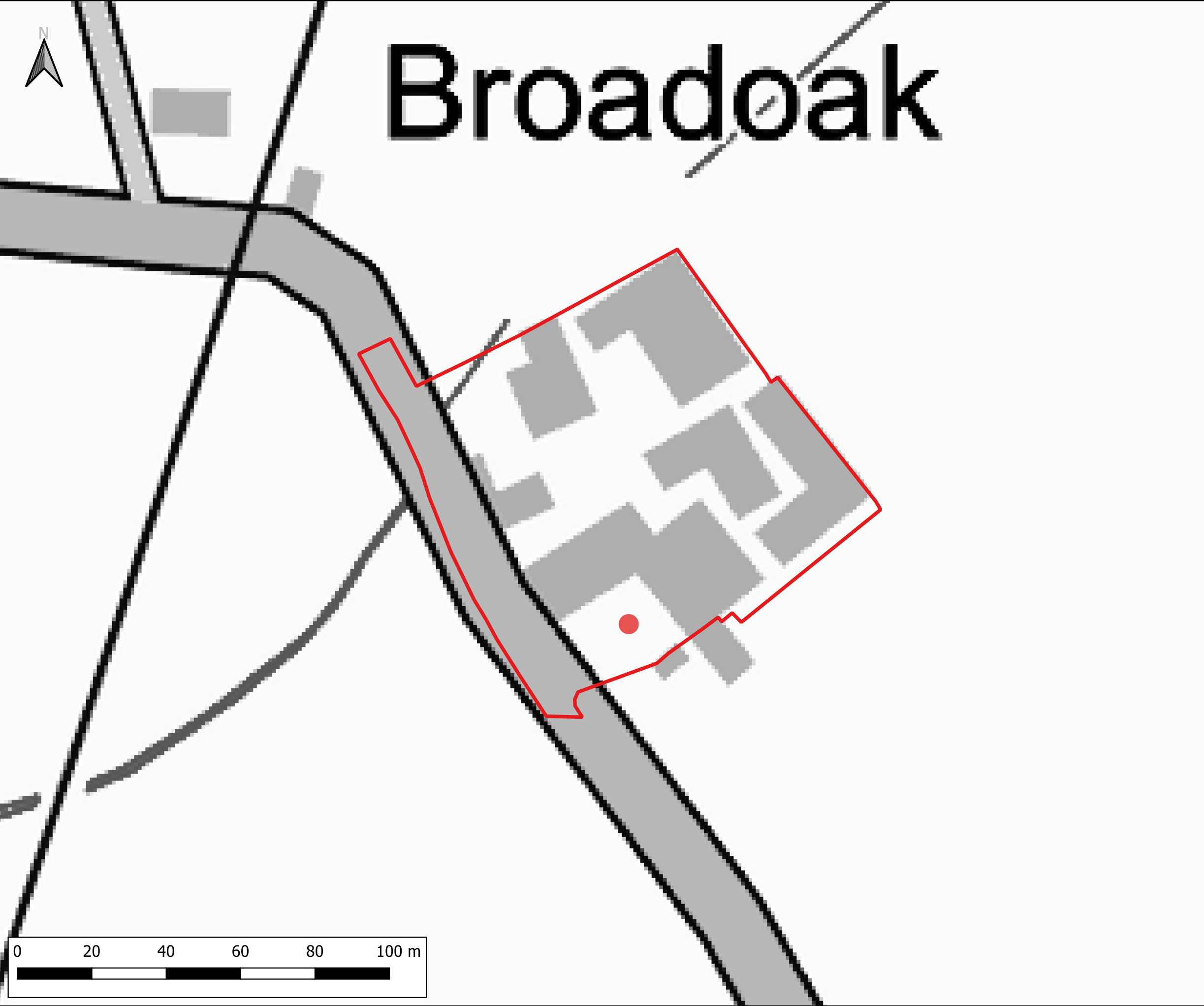
LiDAR Plan
1m Resolution
Data from Natural Resources Wales

PLOT STATUS:		DATE:	
FINAL		07-05-2024	

DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
IT	MW	AW	1:2000

PLOT NAME:	REVISION:
15923_LiDAR_Plan	-

Appendix C Historical BGS Borehole Record and Location Plan



Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise

LEGEND

- Site boundary
- BGS Borehole SJ35NE1



CLIENT:

Funky Furniture Hire (Properties) Ltd

waterco
www.waterco.co.uk

SCHEME:

Broad Oak Farm, Rossett

PLOT TITLE:

Historical BGS Borehole Location Plan
Data from British Geological Survey (BGS)

PLOT STATUS:		DATE:	
FINAL		07-05-2024	

DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
IT	MW	AW	1:1000

PLOT NAME:	REVISION:
15923_BGS_Borehole_Location_Plan	-



RECORD OF WELL (SHAFT OR BORE)

(attach copy of analysis if available)

For Survey use only

N. _____

EXACT SITE
OF WELL

At

Broad oak Farm

SJ35NE1/1

Town or Village

Broad oak

County

Denbigh

Six-inch quarter sheet

State whether owner, tenant, builder,
contractor, consultant, etc. :-

For Mr.

Address (if different from above)

Level of ground surface
above sea-level (O.D.) _____ ft.

If well-top is not at ground (above ;
level, state how far ... (below ; _____ ft.

SHAFT _____ ft. ; diameter _____ ft. ; Details of headings _____

BORE _____ ft. ; diameter of bore : at top _____ ins. ; at bottom _____ ins.

Details of permanent lining tubes _____

Water struck at depths of _____ ft. below well-top.

TEST
CONDITIONS

Rest-level of water _____ ft. above well-top. Suction at _____ ft. Yield on _____ hours' test
below days'

pumping at _____ galls. per _____ with depression to _____ ft. below well-top.

Recovery to rest-level in _____ mins. Capacity of pump _____ g.p.h. Date of measurements _____
hours

Description of permanent pumping equipment :

NORMAL
CONDITIONS

Make and/or type _____ Motive power _____

Capacity _____ gallons per hour. Suction at _____ ft.

Amount pumped _____ galls. per day. Estimated consumption _____ galls. per week.

Well made by _____ Date of well _____

Information from Original site map.

ADDITIONAL NOTES

LOG OF STRATA OVERLEAF.

GEOLOGICAL SURVEY AND MUSEUM,
SOUTH KENSINGTON,
LONDON, S.W.7.

Date
Received

1" O.S. Map
No.

Site marked (use symbol)
on 1" Map on 6" Map



1063 W. 22438/0384 10m 7/45 (51) F&S.

RECORD OF WELL (SHAFT OR BORE)

(For Survey use only)

1-inch Map Registered No.

SJ35NE/1
22NW/1

At Mr. H. Rogers, Broad Oak Farm.

Town or Village Rossett.

County Denbighshire. Six-inch quarter sheet 22 NW

For Mr.

Exact site of well In farmyard about 30 ft. from house and 100 ft. from road.

Attach a tracing from a map, or a sketch-map, if possible.

Level of ground surface above sea-level (O.D.) ft.

If well-top is not at ground level, state how far ... above; below; ft.

SHAFT ft.; diameter ft. Details of headings

BORE 156 ft. 6 in.; diameter of bore: at top 6 ins.; at bottom 2 ins. Lengths, diameters, perforations, etc., of lining tubes 12 ft. by 6 ins., 46 ft. by 4 ins., 59 ft. by 3 ins., 36 ft. by 2 ins.

Water struck at depths, below well top, of (feet) 23 ft. 6 ins., 46 ft. and 140 ft.

Rest-level of water 4 ft. above well-top. Suction at ft. Yield on hours' pumping, gal. per with depression to ft. below well-top, Capacity of pump g.p.h. Recovery to rest level in mins. Date of measurements Date of well

Quality of water (attach copy of analysis if available)

Well made by F.J. Ridgway, Marford Hill, Nr. Wrexham.

Information from F.J. Ridgway.

Additional notes in space overleaf.

(For Survey use only)
GEOLOGICAL CLASSIFICATION

NATURE OF STRATA

THICKNESS

DEPTH

Feet

Ins.

Feet

Ins.

If measurements start below ground surface, e.g., from bottom of an existing shaft, state how far

Gravel

2.44

8

8

7.44

Clay

4.57

15

23

7.01

Gravel

0.61

2

25

7.62

Sand

5.49

18

43

13.11

Clay

0.91

3

46

14.02

Sand

0.15

6

46

14.17

Clay, soft and light in colour

28.50

23

6

140

42.67

Red Sandstone, soft and dark.

5.08

16

6

156

6

Continued over leaf

GEOLOGICAL SURVEY AND MUSEUM,
SOUTH KENSINGTON,
LONDON, S.W.7.

Date received

Correspondence File No.

1" N.S. Map No.

1" O.S. Map No.

Site marked (use symbol) on 1" Map on 6" Map

2

Yield

360 gallons per hour at surface.
120 " " " at 24 ft. above surface.
7.32



BGS ID: 154030 : BGS Reference: SJ35NE1
British National Grid (27700) : 336730,358450

Contact BGS: ngdc@bgs.ac.uk

Contact BGS: ngdc@bgs.ac.uk



10-3.Tir 108/15

1063 Wt. 22438/0384 10m 7/45 (51) F.A.S.

RECORD OF WELL (SHAFT OR BORE)

(For Survey use only)

1-inch Map Registered No. **SJ35/10**
22 NW/1

At **Mr. H. Rogers, Broad Oak Farm.**
Town or Village **ROSSETT.**
County **Leicestershire.** Six-inch quarter sheet **22 NW**
For Mr. _____
Exact site of well **In farmyard about 30 ft. from house and 100 ft. from road.** { Attach a tracing from a map, or a sketch-map, if possible.
Level of ground surface above sea level (O.D.) _____ ft. If well-top is not at ground level, state how far ... { above; _____ ft. below; _____ ft.
SHAFT _____ ft.; diameter _____ ft. Details of headings _____
BORE **156 ft. 6 in.**; diameter of bore: at top **6** ins.; at bottom **2** ins. Lengths, diameters, perforations, etc., of lining tubes **12 ft. by 6 ins., 46 ft. by 4 ins., 59 ft. by 3 ins., 36 ft. by 2 ins..**
Water struck at depths below well top, of (feet) **23 ft. 6 ins., 46 ft. and 140 ft.**
Rest-level of water **4** ft. above well-top. Suction at _____ ft. Yield on _____ hours' pumping, _____ gal. per _____ with depression to _____ ft. below well-top. Capacity of pump _____ g.p.h. Recovery to rest level in _____ mins. Date of measurements _____ Date of well _____
Quality of water (attach copy of analysis if available) _____
Well made by **F.J. Ridgway, Harford Hill, Nr. Wrexham.**
Information from **F.J. Ridgway.**
Additional notes in space overleaf.

GEOLOGICAL CLASSIFICATION	NATURE OF STRATA	THICKNESS		DEPTH	
		Feet	Ins.	Feet	Ins.
River terrace Alluvium	Gravel	8		8	
	Clay	15		23	
	Gravel	2		25	
	Sand	18		43	
Boulder Clay	Clay	3		46	
	Sand		6	46	6
Triassic Lower Mottled Sandstone	Clay, soft and light in colour	23	6	140	
	Red Sandstone, soft and dark.	16	6	156	6
R. Addison 16.2.77					

Continued over leaf

GEOLOGICAL SURVEY AND MUSEUM, SOUTH KENSINGTON, LONDON, S.W.7.	Date received	Correspondence File No.	1" N.S. Map No.	1" O.S. Map No.	Site marked (use symbol on 1" Map on 6" Map)	
	13/1/46					

[illegible]



10-5-TIF

SJ35/10

WELSH NATIONAL WATER DEVELOPMENT AUTHORITY
DEE AND CLWYD RIVER DIVISION

DETAILED HYDROGEOLOGICAL RECORD SHEET : INDIVIDUAL SITE RECORD

D.C.R.D. REF. No. ~~35/45~~...

NAME BROAD OAK FARM, LAVISTER

N.G.R. 368 585

EXACT SITE KNOWN

YES/NO

LOCATION SKETCH

YES/NO

HEIGHT A.O.D.

13 METRES

ESTIMATED FROM

MAP/SURVEY/OTHER

REFERENCE POINT

NONE/DETAILS/SKETCH

LOG

YES/NO

LOCATION OF LOG

HERE/I.G.S.

SUMMARY OF LOG

i) THICKNESS OF DRIFT

42.7 METRES

ii) TOTAL DEPTH

47.5 METRES

iii) O.D. LEVEL OF ROCKHEAD

29.7 METRES

Bunker
(sandstone)

WATER QUALITY INFORMATION

YES/NO

WATER QUANTITY INFORMATION

ABSTRACTION

YES/NO/OCCASIONALLY/NOT KNOWN

LICENSED ABSTRACTION

LICENCE NO.

NONE

/HOUR

/DAY

/YEAR

WATER LEVEL INFORMATION

YES/NO

DETAILS :

ARTESIAN

PUMPING TEST

YES/NO

DATE

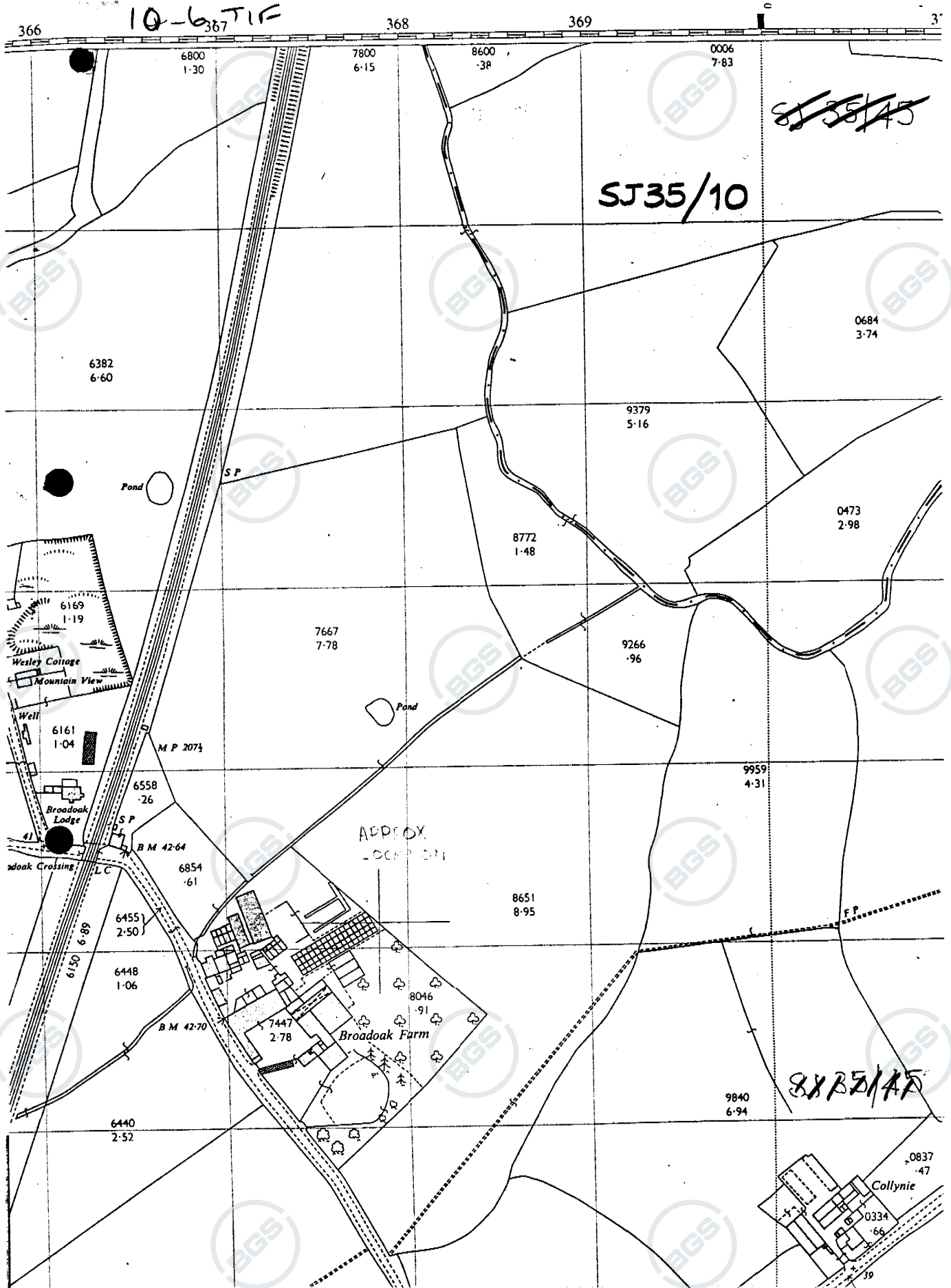
LOCATION OF DATA

WATER LEVELS RECORDED

NONE/ISOLATED READINGS/MONTHLY/AUTOGRAPHIC

LOCATION OF RECORDS

ACCESS



Appendix D Development Plan

Appendix E Trial Pit Location Plan & Photographic Record



Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise

LEGEND

● Trial Pit Locations

ton ∞ Ros

CLIENT:

Funky Furniture Hire (Properties) Ltd

www.waterco.co.uk

SCHEME:

Broad Oak Farm, Rossett

PLOT TITLE:

Trial Pit Location Plan

PLOT STATUS:		DATE:	
FINAL		07-05-2024	

DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
IT	MW	MW	1:600

PLOT NAME:	REVISION:
Trial _Pit_Location_Plan	-

Photo No.1	15923 – Broad Oak Farm, Rossett
Date: 23/04/2024 Description: TP1 (groundwater present).	

Photo No. 2	15923 – Broad Oak Farm, Rossett
Date: 23/04/2024 Description: The excavated materials / arising from TP1.	

Photo No.3	15923 – Broad Oak Farm, Rossett
Date: 23/04/2024 Description: Collapsed end of TP1 (abandoned).	

Photo No. 4	15923 – Broad Oak Farm, Rossett
Date: 23/04/2024 Description: Excavator used to dig TP1-TP3.	

Photo No.5	15923 – Broad Oak Farm, Rossett
Date: 23/04/2024	
Description: Water bowser used to fill TP 2 & 3.	

Photo No. 6	15923 – Broad Oak Farm, Rossett
Date: 23/04/2024	
Description: TP2 (groundwater present).	

Photo No.7	15923 – Broad Oak Farm, Rossett
Date: 23/04/2024 Description: The excavated materials / arising from TP2.	

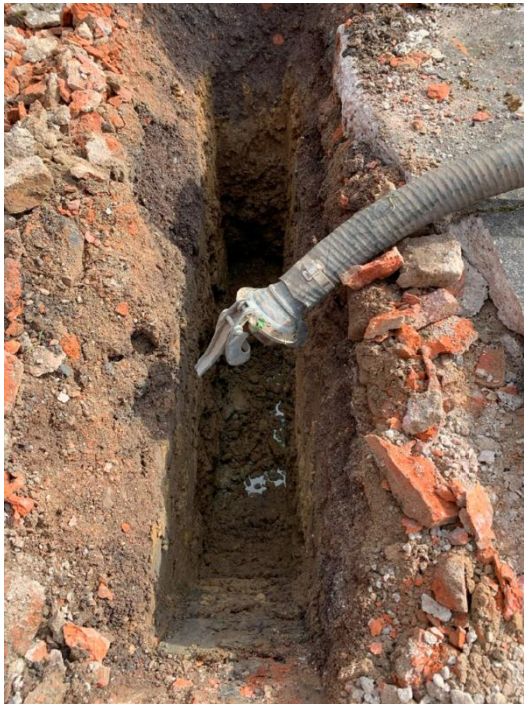
Photo No. 8	15923 – Broad Oak Farm, Rossett
Date: 23/04/2024 Description: TP3 prior to filling (groundwater present).	

Photo No.9	15923 – Broad Oak Farm, Rossett
Date: 23/04/2024 Description: TP3 filled with water.	

Photo No. 10	15923 – Broad Oak Farm, Rossett
Date: 23/04/2024 Description: The excavated materials / arising from TP3.	

Photo No.11	15923 – Broad Oak Farm, Rossett
Date: 23/04/2024	
Description: TP3 immediately after collapse.	

Photo No. 12	15923 – Broad Oak Farm, Rossett
Date: 23/04/2024	
Description: Llyndir Lane Culvert Inlet.	

Photo No.13	15923 – Broad Oak Farm, Rossett	
Date: 23/04/2024		
Description: Watercourse and Llyndir Lane culvert outlet.		

Photo No. 14	15923 – Broad Oak Farm, Rossett	
Date: 23/04/2024		
Description: Culvert inlet on the unnamed watercourse flowing adjacent to the site at approx NGR: 336706 , 358536.		

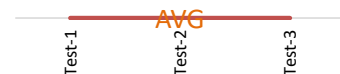
Appendix F Infiltration Test Results

Client :	Funky Furniture Hire (Properties) Ltd	Page 1 of 2	
Scheme :	15923 - Broad Oak Farm		
Section :	Infiltration Testing	Initials	Revision
		TP2	1
Prepared by:	Iwan Thomas (BSc Hons)	Date:	25/04/2024
Checked by:	Megan Williams BSc (Hons) MSc MCIWEM	Date:	02/05/2024
Approved by:	Aled Williams BSc (Hons) MCIWEM C.WEM	Date:	07/05/2024

Based on method described in BRE Digest 365

[illegible]

Infiltration rate results



Test pit details

Stone fill (% voids)	100		
Length (m)	2.20		
Width (m)	0.50		
Depth (m)	1.80		
Obs tube ht relative to GL (m)	0.00		

Infiltration rate calculations

Max Eff depth (m)	1.56		
25% Eff depth (m)	0.39	#VALUE!	#VALUE!
75% Eff depth (m)	1.17	#VALUE!	#VALUE!
Time 25% t_{25} (min)	#VALUE!	#VALUE!	#VALUE!
Time 75% t_{75} (min)	1.00	#VALUE!	#VALUE!
Time t_{p75-25} (sec)	#VALUE!	#VALUE!	#VALUE!
Drop H_{75-25} (m)	0.78	#VALUE!	#VALUE!
Volume V_{p75-25} (m ³)	0.86	#VALUE!	#VALUE!
Eff Area a_{p50} (m ²)	5.31	#VALUE!	#VALUE!
Infiltration rate (m/s)	#VALUE!	#VALUE!	#VALUE!

#VALUE!

Client : Funky Furniture Hire (Properties) Ltd

Scheme : 15923 - Broad Oak Farm

Section : Infiltration Testing

Page 2 of 2

Initials

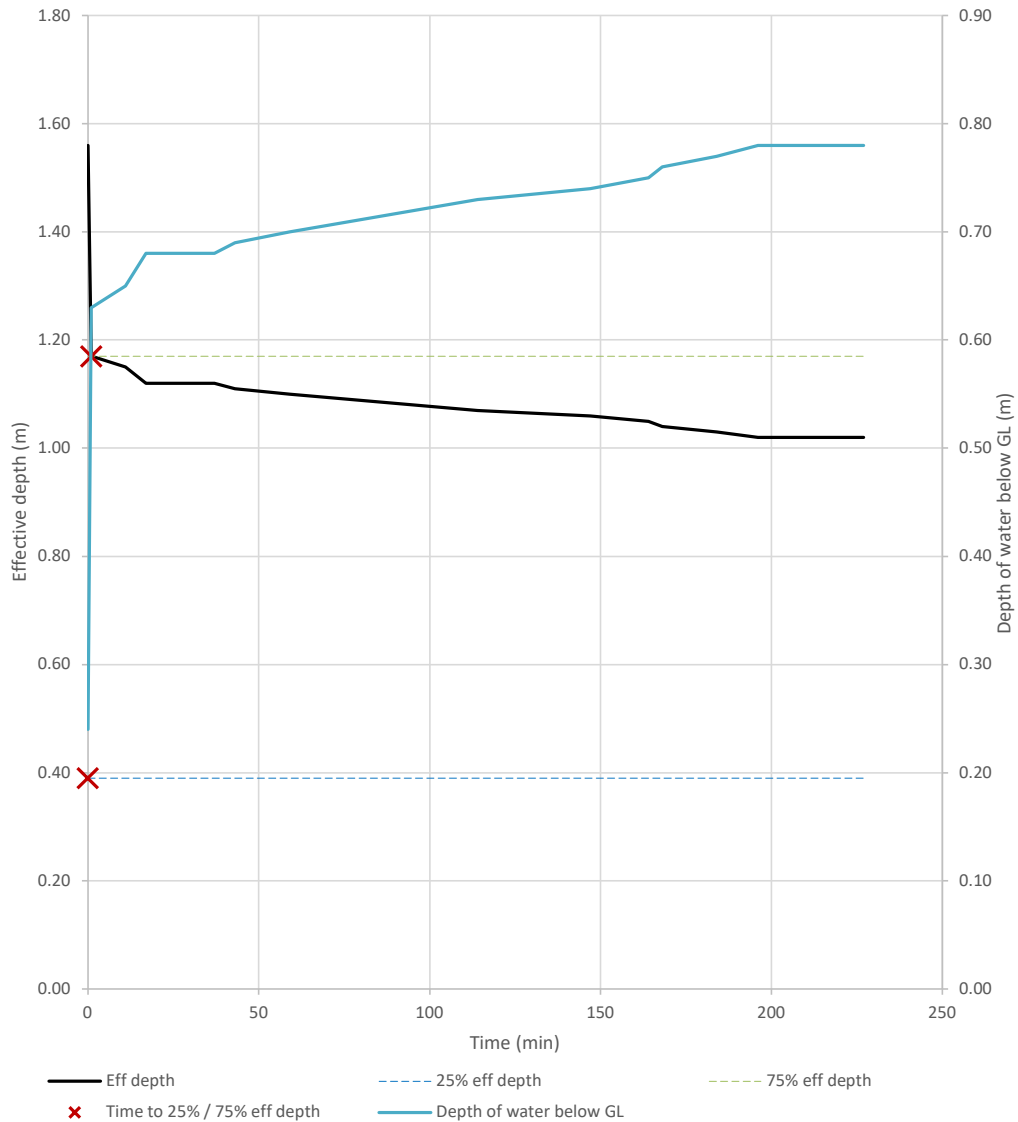
Revision

TP2

1

Based on method described in BRE Digest 365

Test 1



Calculations for pro-rata time to 25% & 75% depths

Time	Depth	Description
227	1.02	higher than 25% value
#VALUE!	0.39	pro-rata 25%
		lower than 25% value
1	1.17	higher than 75% value
1.00	1.17	pro-rata 75%
11	1.15	lower than 75% value

Client : Funky Furniture Hire (Properties) Ltd

Scheme : 15923 - Broad Oak Farm

Section : Infiltration Testing

Page 2 of 2

Initials

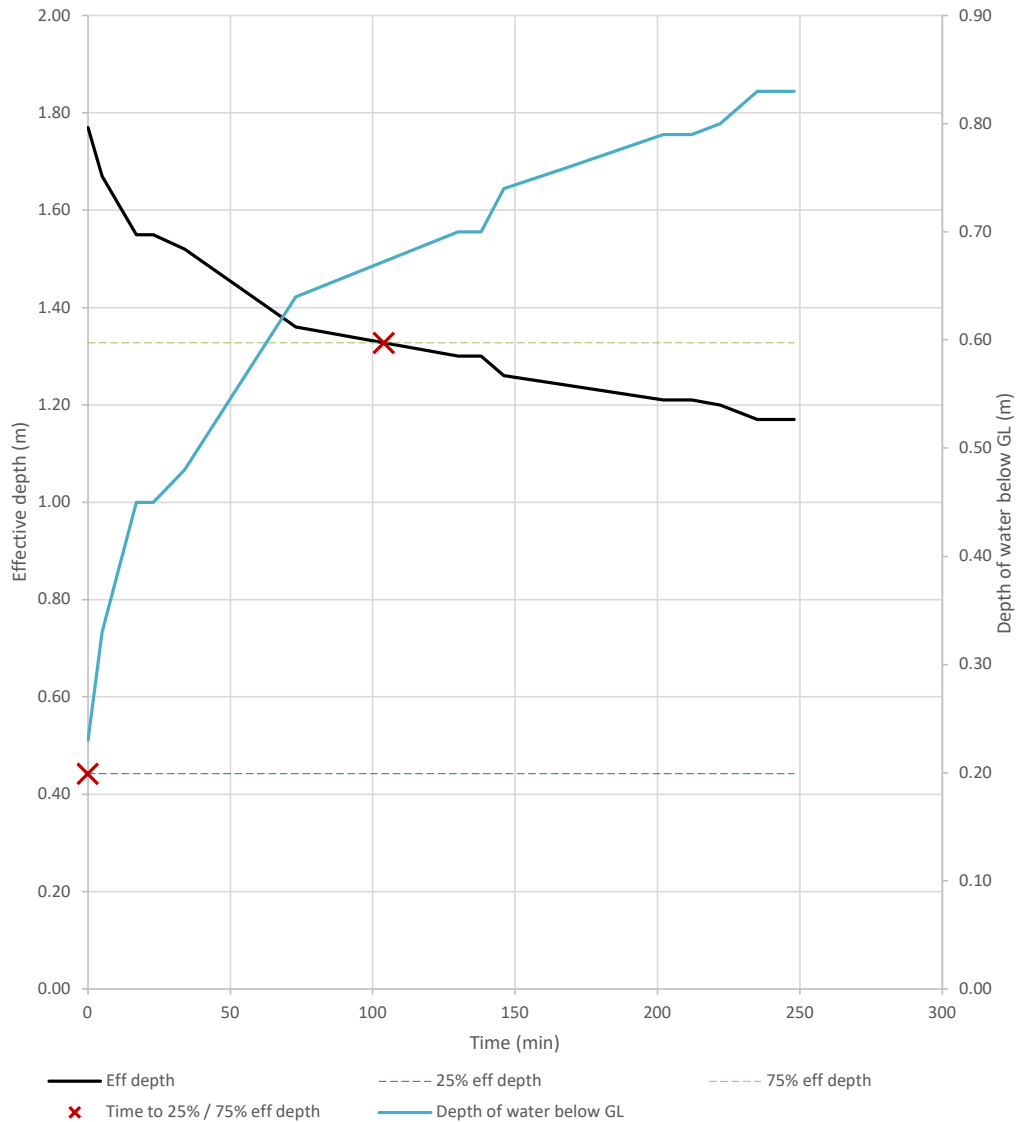
Revision

TP3

1

Based on method described in BRE Digest 365

Test 1



Calculations for pro-rata time to 25% & 75% depths

Time	Depth	Description
248	1.17	higher than 25% value
#VALUE!	0.44	pro-rata 25%
		lower than 25% value
73	1.36	higher than 75% value
103.88	1.33	pro-rata 75%
130	1.30	lower than 75% value