By Email

Thomas Milburn (Properties) Limited
Seacote Park
St Bees
Cumbria
CA27 0ET

Our ref 2328/HB/L001

Date 17/07/2023

RE: Hensingham Housing Development, Egremont Road, CA28 8QB

Infiltration Testing Letter Report

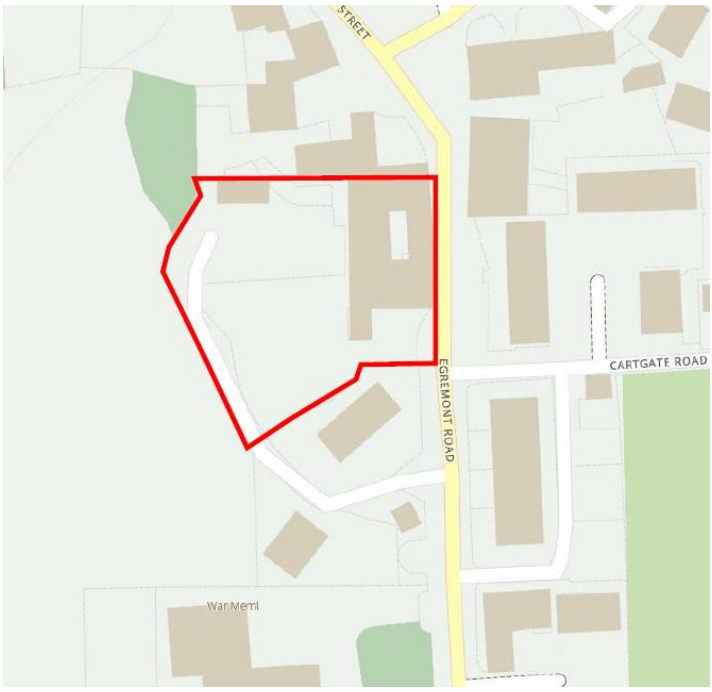
Dear Tom

This letter summarises the findings of the infiltration testing which was carried out on 12/07/2023 to inform the drainage design as part of the proposed residential development at Hensingham House.

1 Location

The Hensingham Housing Development site is accessed from Egremont Road near postcode CA28 8QB. It is understood that the Phase 1 development proposal consists of construction of 4 new houses and conversion of 5 houses. The whole development would comprise approximately 30 houses although these would be later phases.

The infiltration testing was carried out in 2 test locations, which were selected by the Client; one towards the south of the site near the corner of the existing footprint of Hensingham House and one further north towards the area of hardstanding on the site. The Phase 1 site is shown below with an approximate red line boundary marked.



2 Infiltration Testing

Infiltration testing was carried out in general accordance with best practice guidance as detailed within BRE Digest 365 Soakaway Design via excavation of a trial hole and filling this with a sufficient depth of water followed by measurement of water level changes. The guide recommends 3 infiltration tests per test location, unless the tests show that the ground conditions are unsuitable.

Testing locations were confirmed on site by the client prior to undertaking the works. All GI locations were also scanned with a Cable Avoidance Tool (CAT) prior to working to check for buried services prior to excavation.

Excavations and the infiltration testing were supervised and undertaken by Westlakes Engineering.

A Soakaway Testing Location Plan, Trial Pit Logs and Photographs of the encountered ground conditions are enclosed.

3 Ground Conditions

3.1. Geology Maps and Historic Records

Reference to British Geological Survey (BGS) mapping records indicates the site to be underlain by superficial deposits consisting of Till (typically clays but may include sand and gravel layers), over mudstone, siltstone and sandstone bedrock of the Stainmore Formation.

Three historic BGS borehole logs have been obtained from the BGS. The logs record the encountered ground conditions on the site and in the close vicinity and are provided for background information only.

The location of each historic log is shown on the plan below and the historic logs are enclosed.

The historic logs are summarised below. For further detail refer to the logs themselves.

Ref Number	Ground Conditions Simplified Summary (m bgl)	Groundwater (m bgl)
BGS: NX91 NE101 (Also known as BH 8)	Surface Topsoil to 0.45m, over Firm Clay to 2.35m, over Siltstone to 2.60m	Strike at 2.35m Resting at 2.50m
BGS: NX91 NE127 (Also known as TP 12)	Surface Topsoil to 0.30m, over Soft to firm Clay to 1.05m, over Soft to firm orange-brown Clay to 1.80m, over Stiff to very stiff Clay to 2.60m, where BH terminated	None encountered

BGS: SJ97 NW79 (Also known as BH28)	Surface Topsoil over subsoil to 0.90m, over Firm Clay to 1.80m, over Stiff olive-brown Clay to 2.50m, over Dark grey fissured Mudstone to 3.45m, where BH terminated	None encountered

3.2. Encountered Ground Conditions

The following ground conditions were encountered during the infiltration testing investigation:

- Made Ground. Both test locations encountered Made Ground at surface level, which was found to extend to between 0.40m and 0.50m below ground level (bgl). This was typically dark brown clayey gravelly sand topsoil locally overlying black medium to coarse gravel to 0.50m bgl (SA01). The gravels included brick, concrete, ash, charcoal and natural stones. The black gravel consisted solely of ash, charcoal and mudstone.
- Concrete. Concrete cobbles and a concrete block were encountered in both locations from 0.10m to 0.25m bgl within the Made Ground. Concrete cobbles were angular.
- Clay. The natural ground was encountered in both trial pit locations, beneath the Made Ground, at depths of 0.40m (SA02) and 0.50m (SA01) bgl. The natural ground comprised soft to firm slightly gravelly clay with variable sand content, which was found to extend to a maximum depth of 1.30m bgl (SA02). Local bands of fine to medium sand were recorded within the clay from 0.85m to 1.20m bgl (SA01).
- Sand. Granular natural soils were recorded in both locations. In SA01, granular soil was recorded underlying natural clay from 0.85m to 1.0m bgl. In SA02, the granular soil was underlying Made Ground at 0.40m bgl to a depth of 1.10m bgl. In both locations, soils comprised clayey slightly gravelly sand. Clay content increased below 0.95m bgl. Sand was underlain by firm sandy slightly gravelly clay as described above.
- Groundwater. No groundwater was encountered as part of the investigation.

No visual or olfactory evidence of contamination was observed during the excavation except from local black ash and charcoal gravel encountered in SA01 from 0.40m to 0.50m bgl.

Ground conditions between, beyond or below excavation and sampling points may vary from those stated due to the unpredictable nature of ground and groundwater conditions. All distances, measurements and locations given are approximate.

4 Infiltration Test Results

Two soakaway infiltration tests were undertaken, one test within each test pit. The ground conditions were slightly different. SA01 encountered only thin bands of sand within the natural soils to 1.20m bgl. SA02 encountered sand below the Made Ground to 1.10m bgl overlying firm clay to 1.30m bgl.

The tests were carried out in accordance with BRE365, in order to determine the infiltration rate of the natural granular and cohesive Glacial Till deposits. The SA01 test failed due to the water level remaining at 0.64m bgl for the duration of the 3 hour test. SA02 recorded a water level drop of 35mm over the duration of the 3 hour test which also resulted in a failed test.

As such, in accordance with BRE365, neither test could be used to calculate an infiltration rate.

The results therefore suggest that soakaway drainage would not be suitable at this site.

5 Conclusion

The infiltration testing was completed on 12/07/2023 consisting of 2 trial pits and 1 infiltration test undertaken in each trial pit. Ground conditions comprised Made Ground from surface level to a maximum depth of 0.50m bgl onto natural soft to firm clay or clayey sand overlying firm clay. Bedrock was not encountered. The maximum depth of excavation was to 1.30m bgl.

Infiltration testing indicates that the shallow natural superficial soils exhibit very low permeability and the tests undertaken in both locations failed in accordance with BRE Digest 365 Soakaway Design, as the water failed to infiltrate sufficiently. Infiltration rates could not be calculated due to the test failures and as such values are assumed to be very low.

It is considered that soakaway drainage is not suitable at the site as part of the Phase 1 developed. Alternative means will therefore be required to disposal of surface waters generated by the development. Consideration could be given to discharge to a nearby watercourse or discharge to the public drainage system, both of which require attenuation to an agreed discharge rate with the associated authorities. This should be considered further as part of the future site drainage design.

If you have any queries, please do not hesitate to contact us.

Yours sincerely

Helen Brown

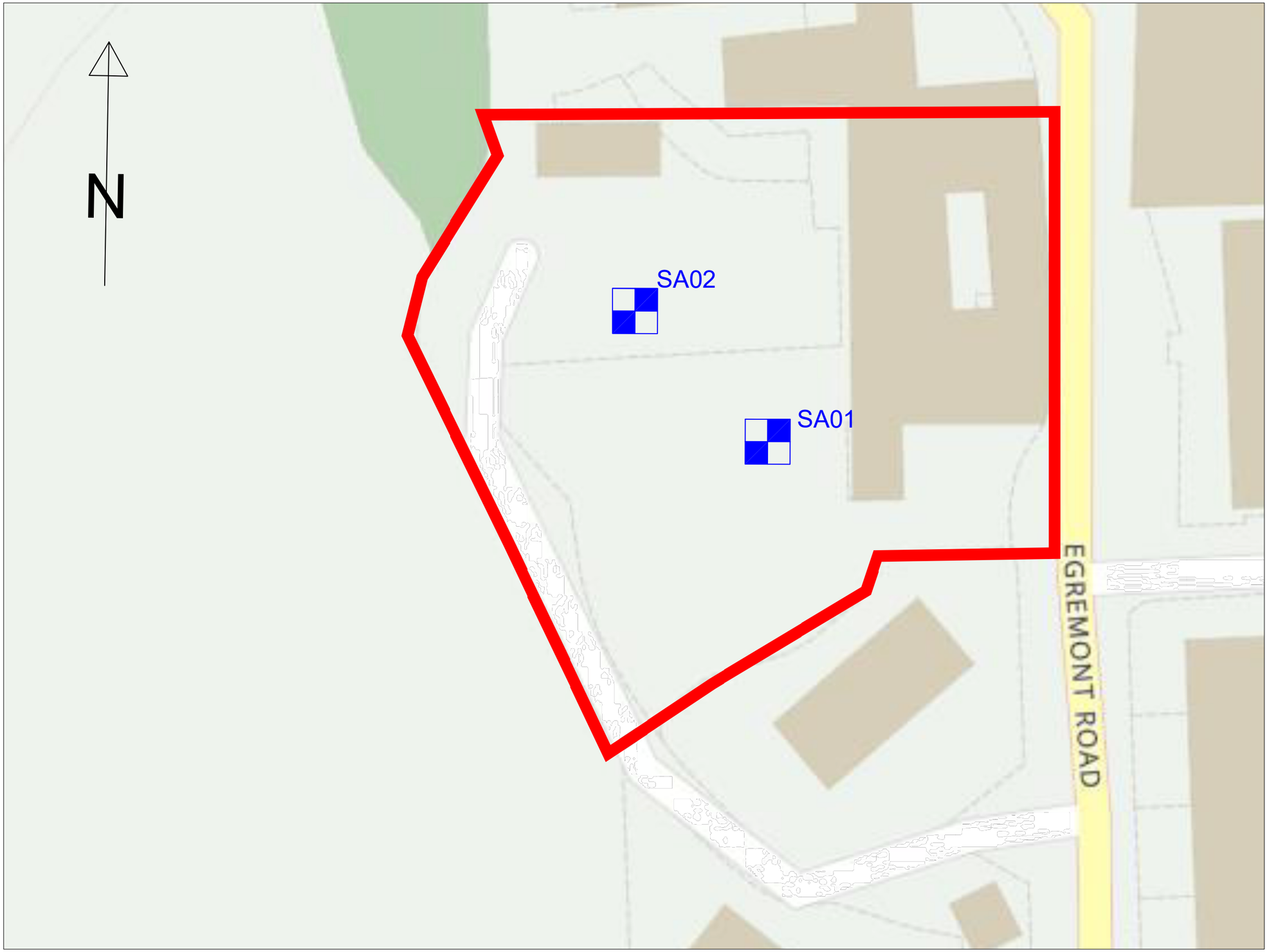
Principal Engineering Geologist

Enc
1. Soakaway Testing Location Plan
2. Trial Pit Logs
3. Site Photographs
4. Historic BGS Borehole Logs
5. Soakaway Infiltration Calculation Sheets

1. Soakaway Testing Location Plan

GENERAL NOTES

1. ALL LEVELS ARE IN METRES, RELATIVE TO ORDNANCE DATUM SURVEY.
2. ALL DIMENSIONS TO BE CHECKED ON SITE BY THE CONTRACTOR PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. ANY DISCREPANCIES SHOULD BE REPORTED TO THE ENGINEER IMMEDIATELY.
3. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS AND SPECIALISTS DRAWINGS TOGETHER WITH THEIR SPECIFICATIONS.
4. DO NOT SCALE FROM THIS DRAWING, ONLY WRITTEN OR CALCULATED DIMENSIONS TO BE USED.
5. BASE PLAN EXTRACTED FROM ORDNANCE SURVEY MAPPING FROM 13/07/2023.



SA01-SA02

SOAKAWAY INFILTRATION TEST PIT LOCATIONS UP TO 1.30M BGL UNDERTAKEN ON 12/07/2023

APPROXIMATE SITE BOUNDARY AS NOTED ON THE DEVELOPMENT PLAN ISSUED BY TOM MILBURN ON 26/06/2023

Rev.	Date	Revision Details	By	Chkd	Appd
P1	13/07/23	ISSUED FOR PRELIMINARY INFORMATION	TW	HB	HB

Westlakes Engineering

Client: TOM MILBURN PROPERTY LTD

Project: HENSINGHAM HOUSING DEVELOPMENT
HENSINGHAM

Title: SOAKAWAY INFILTRATION TEST

LOCATION PLAN

Drawing No.	Revision
WL_2328_SK01	P1

Scale	NOT TO SCALE	Date	JULY 2023		
Drawn	TW	Chk	HB	App	HB

Unit 2.1, 20 Dale Street,
Manchester.
M1 1EZ
Tel. 0161 236 8203

2. Trial Pit Logs

Trial Pit Log

Westlakes Environmental

TrialPit No: SA01
Sheet 1 of 1

Project Name:	Hensingham Housing Development	Project No. 2328	Co-ords: - Level:	Date 12/07/2023
Location:	Hensingham House, Hensingham, Whitehaven	Dimensions (m): 0.90 × 0.40 Depth 1.20		Scale 1:25
Client:	Tom Milburn Property Ltd			Logged TW

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
				0.20			MADE GROUND: Grass over dark brown, clayey gravelly sand. Sand is fine to medium. Gravel is fine to coarse, subangular to subrounded brick, charcoal, sandstone, mudstone and quartzite. (TOPSOIL)
				0.40			MADE GROUND: Concrete block.
				0.50			MADE GROUND: Black, fine to coarse gravel. Gravel is angular ash, charcoal and mudstone.
				0.85			Soft, orangish brown, gravelly CLAY. Gravel is fine to coarse, subangular to subrounded sandstone, mudstone and quartzite.
				1.00			Orangish brown, clayey slightly gravelly SAND. Sand is fine to medium. Gravel is fine to coarse, subangular to subrounded sandstone, mudstone and quartzite.
				1.20			Firm, orangish brown, sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is fine to coarse, subangular to subrounded sandstone, mudstone and quartzite. *Local bands of fine to medium sand within clay from 1.0m to 1.20m bgl.*
							End of Pit at 1.200m

Remarks: Position of soakaway test pit confirmed by client on site. Position checked for underground services using CAT4 scanner. Test pit excavated through Made Ground into natural superficial sand and clay to 1.20m bgl. 1 soakaway test conducted within the pit. Test failed after 3 hours. Test pit backfilled with arisings.

Stability: Stable

AGS

Trial Pit Log

Westlakes Environmental

TrialPit No: SA02
Sheet 1 of 1

Project Name:	Hensingham Housing Development	Project No. 2328	Co-ords: - Level:	Date 12/07/2023
Location:	Hensingham House, Hensingham, Whitehaven	Dimensions (m): 0.90 × 0.40 Depth 1.30		Scale 1:25
Client:	Tom Milburn Property Ltd			Logged TW

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
				0.10			MADE GROUND: Grass over dark brown, clayey gravelly sand. Sand is fine to medium. Gravel is fine to coarse, subangular to subrounded brick, charcoal, sandstone, mudstone and quartzite. (TOPSOIL)
				0.25			MADE GROUND: Concrete cobbles.
				0.40			MADE GROUND: Brown, slightly clayey gravelly sand. Sand is fine to medium. Gravel is fine to coarse, subangular to subrounded brick, charcoal, sandstone, mudstone and quartzite.
							Orangish brown, clayey slightly gravelly SAND. Sand is fine to medium. Gravel is fine to coarse, subangular to subrounded sandstone, mudstone and quartzite.
							Becoming very clayey from 0.95m to 1.10m bgl.
				1.10			Firm, orangish brown, sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is fine to coarse, subangular to subrounded sandstone, mudstone and quartzite.
				1.30			End of Pit at 1.300m

Remarks: Position of soakaway test pit confirmed by client on site. Position checked for underground services using CAT4 scanner. Test pit excavated through Made Ground into natural superficial clay to 1.30m bgl. 1 soakaway test conducted within the pit. Test failed after 3 hours. Test pit backfilled with arisings.

Stability: Stable

AGS

3. Site Photographs

Photo 1: SA01 on completion

Photo 2: SA01 concrete block

Photo 3: SA01 arisings

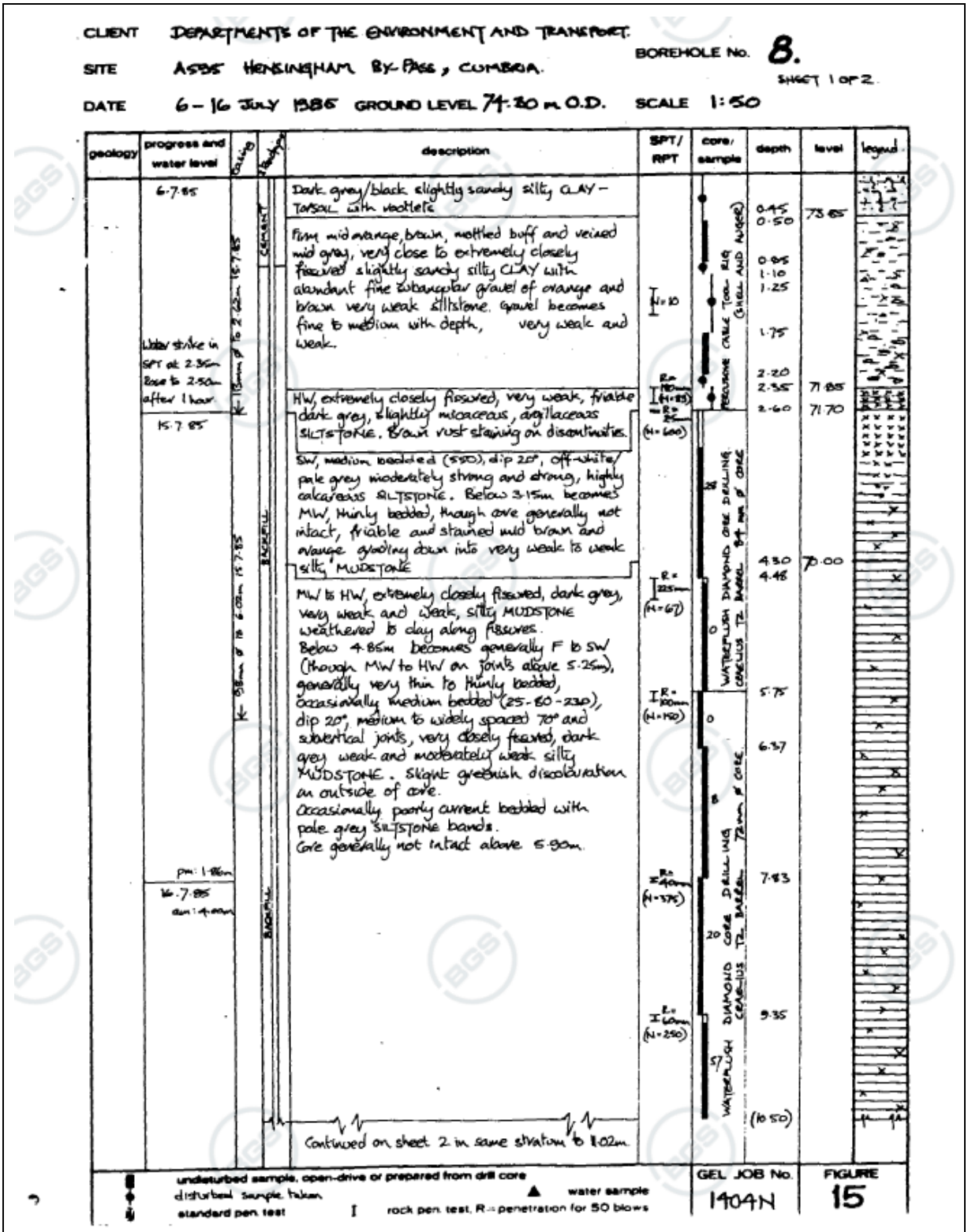
Photo 4: SA01 backfilled

Photo 5: SA02 on completion

Photo 6: SA02 arisings

Photo 7: SA02 backfilled

4. Historic BGS Borehole Logs



BGS: NX91 NE101. (Also known as BH 8)

CLIENT DEPARTMENT OF THE ENVIRONMENT AND TRANSPORT.

SITE A595 HENSINGHAM BY-PASS, CUMBRIA. BOREHOLE No. 19.

DATE 29 JULY 1985 GROUND LEVEL 76.05 m OD SCALE 1:50

geology	progress and water level	description	SPT/ RPT	core/ sample	depth	level	legend
	29.7.85	Dark brown, clayey, silty, fine grained SAND - TOPSOIL and ORGANIC SUBSOIL with rootlets. Little fine subangular to rounded gravel.			0.30	75.75	
		Firm, mid to dark orange-brown slightly sandy silty CLAY with little fine, occasionally medium gravel including coal.	N=8*	DISTURBED SAMPLE 90mm DIAMETER. ENTIRELY DRY DRILLING PRODUCING FRAGMENTS	1.15		
		Stiff, dark olive-brown, mottled orange and banded dark grey in parts, silty CLAY some fine to medium subangular gravel of mudstone, siltstone and sandstone becoming more frequent with depth.	N=18		1.80	74.25	
		HW, extremely closely fissured, shaley, dark grey though generally stained rusty orange-brown, very weak silty MUDSTONE. CW is hard, friable silty clay along fissures.	R* 29blows		2.15		
			(N=52)		2.50	73.55	
		END OF BOREHOLE AT 3.45m.			3.00		
		Borehole backfilled on completion.			3.45	72.60	

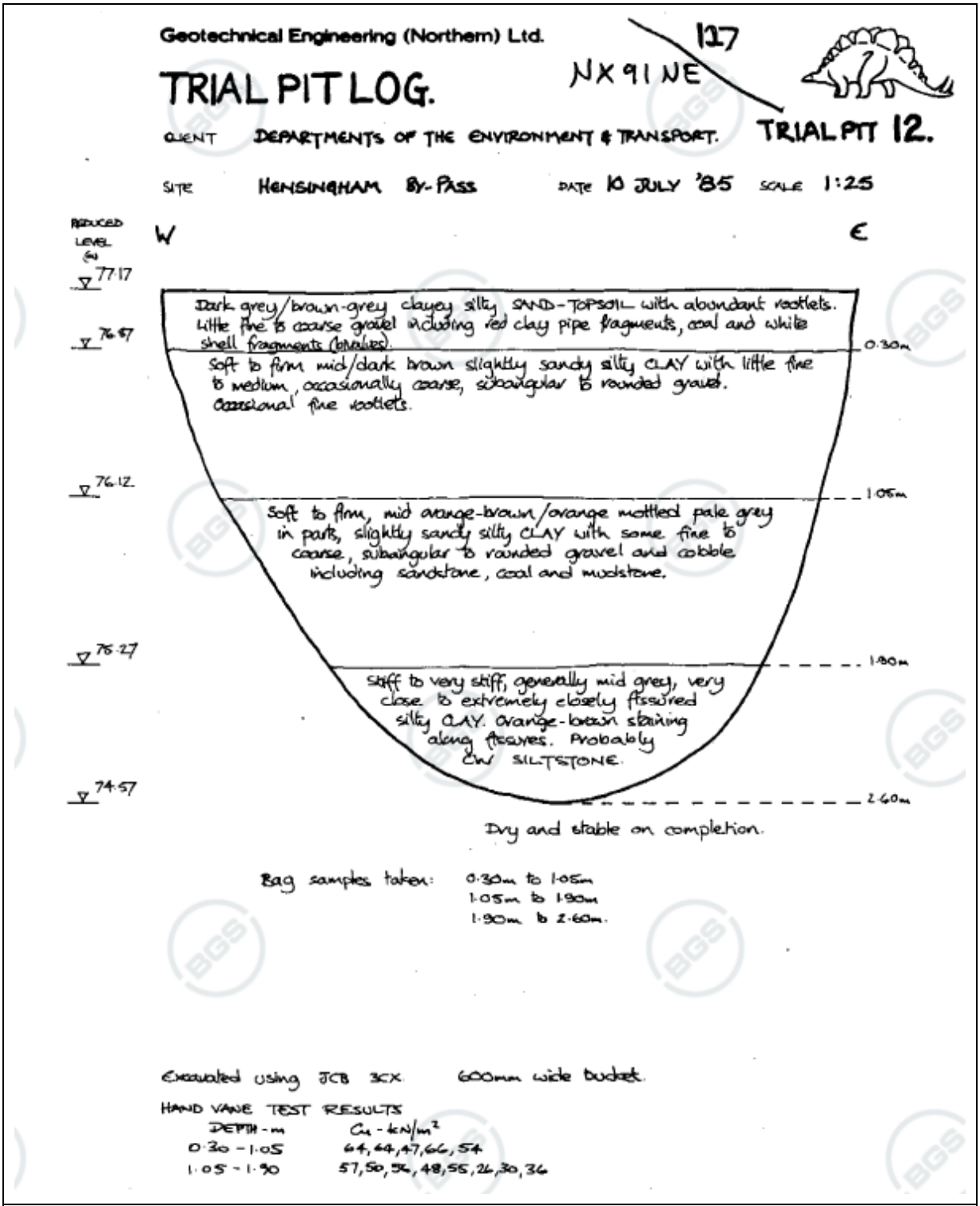
R* extrapolated from SPT at 3.00m:- 10/15/14/12/15 for 300mm penetration.

■ undisturbed sample, open-drive or prepared from drill core ▲ water sample

standard pen. test I rock pen. test, R – penetration for 50 blows

GEL JOB No. 1404N FIGURE 32

BGS: NX91 NE112. (Also known as BH 19)



Geotechnical Engineering (Northern) Ltd.

127

NX91 NE

TRIAL PIT LOG.

TRIAL PIT 12.

CLIENT DEPARTMENTS OF THE ENVIRONMENT & TRANSPORT.

SITE HENSINGHAM BY-PASS DATE 10 JULY '85 SCALE 1:25

REDUCED LEVEL (m)

W E

77.17

Dark grey/brown-grey clayey silty SAND - TOPSOIL with abundant rootlets. Little fine to coarse gravel including red clay pipe fragments, coal and white shell fragments (bivalves).

76.87

0.30m

Soft to firm mid/dark brown slightly sandy silty CLAY with little fine to medium, occasionally coarse, subangular to rounded gravel. Occasional fine rootlets.

76.12

1.05m

Soft to firm, mid orange-brown/orange mottled pale grey in parts, slightly sandy silty CLAY with some fine to coarse, subangular to rounded gravel and cobble including sandstone, coal and mudstone.

76.27

1.80m

Stiff to very stiff, generally mid grey, very close to extremely closely fissured silty CLAY. Orange-brown staining along fissures. Probably CW SILTSTONE.

74.57

2.60m

Dry and stable on completion.

Bag samples taken: 0.30m to 1.05m
1.05m to 1.80m
1.80m to 2.60m.

Excavated using JCB 3CX 600mm wide bucket.

HAND VANE TEST RESULTS

DEPTH - m	C_u - kN/m²
0.30 - 1.05	64, 64, 47, 66, 54
1.05 - 1.90	57, 50, 34, 48, 55, 26, 30, 36

BGS: NX91 NE127. (Also known as TP 12)

5. Soakaway Infiltration Calculation Sheets

Westlakes Engineering

westlakes.co.uk

engineering with integrity

Ref BRE365

Soakaway Testing

Hensingham Housing Development

12/07/2023. Weather: Raining.

TEST 1 **SA01**

Pit length	0.9	m
Pit width	0.4	m
Pit depth	1.2	m

conditions: Soft to firm, sandy gravelly CLAY with local sand bands. Made

Time taken to fill pit with water 1 minute

Depth to top of water	0.64	m
Depth to bottom of pit	1.2	m
Depth of water	0.560	m

Volume of water at start of test 0.202 m^3

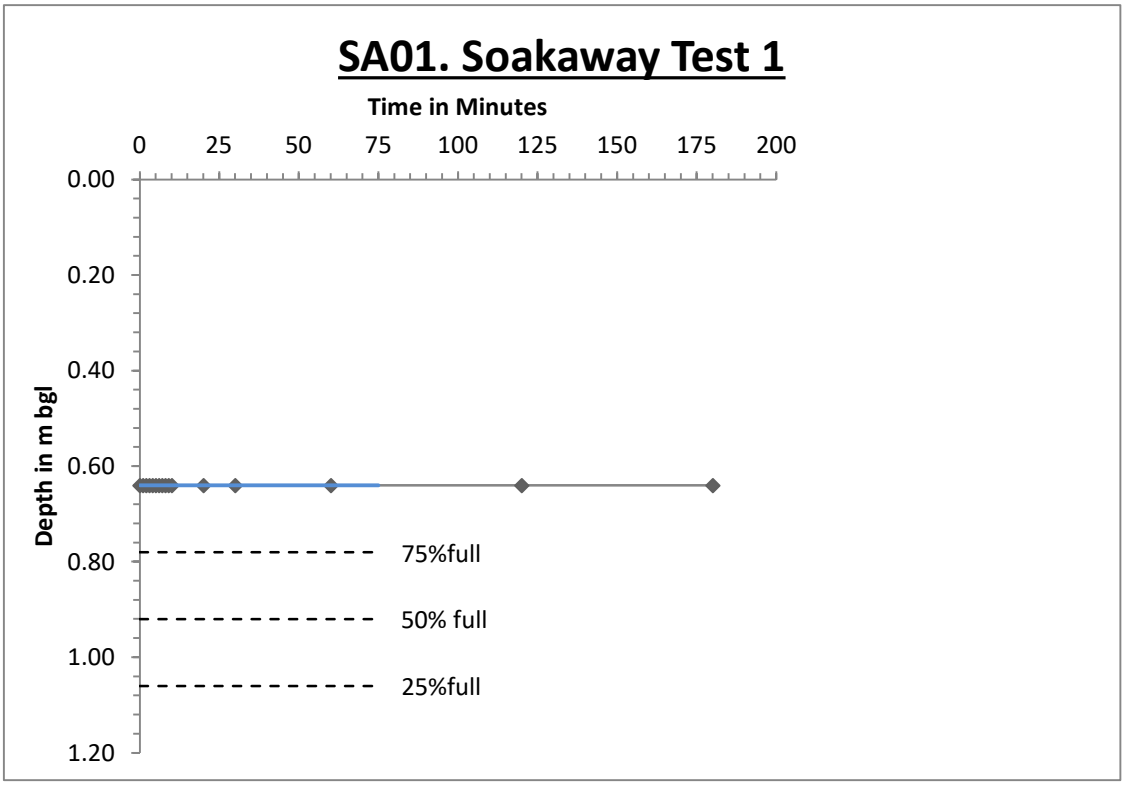
Time minutes	Depth to water m bgl	Head of water	
0	0.64	0.560	m
1	0.64	0.560	m
2	0.64	0.560	m
3	0.64	0.560	m
4	0.64	0.560	m
5	0.64	0.560	m
6	0.64	0.560	m
7	0.64	0.560	m
8	0.64	0.560	m
9	0.64	0.560	m
10	0.64	0.560	m
20	0.64	0.560	m
30	0.64	0.560	m
60	0.64	0.560	m
120	0.64	0.560	m
180	0.64	0.560	m

75% full	0.78	0.420	m after	minutes
50% full	0.92	0.280	m	
25% full	1.06	0.140	m after	minutes

Infiltration Rate

Infiltration rate **N/A** **m/s**

TEST FAILED



Westlakes Engineering

westlakes.co.uk

engineering with integrity

Ref BRE365

Soakaway Testing

Hensingham Housing Development

12/07/2023. Weather: Raining.

TEST 1 **SA02**

Pit length	0.9	m
Pit width	0.4	m
Pit depth	1.3	m

conditions: Made: Soft to firm, clayey gravelly SAND overlying firm, sandy gravelly CLAY with local sand bands

Time taken to fill pit with water 1 minute

Depth to top of water	0.73	m
Depth to bottom of pit	1.3	m
Depth of water	0.570	m

Volume of water at start of test 0.205 m^3

Time minutes	Depth to water m	Head of water	
0	0.73	0.570	m
1	0.73	0.570	m
2	0.73	0.570	m
3	0.73	0.570	m
4	0.73	0.570	m
5	0.73	0.570	m
6	0.73	0.570	m
7	0.73	0.570	m
8	0.73	0.570	m
9	0.73	0.570	m
10	0.73	0.570	m
15	0.73	0.570	m
30	0.75	0.550	m
60	0.76	0.545	m
120	0.76	0.540	m
180	0.77	0.535	m

75% full	0.873	0.428 m	after	minutes
50% full	1.015	0.285 m		
25% full	1.158	0.143 m	after	minutes

Infiltration Rate

Infiltration rate **N/A** **m/s**

TEST FAILED