GEO Environmental Engineering

Jordan Tyson
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Rural Enterprise Centre
Redhills, Penrith
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CA11 0DT

Date: 16.02.2023
Project No: GEO2023-5701
Project Title: Uldale View, Egremont – Soil Infiltration Test Report

Dear Jordan,

Geo Environmental Engineering Ltd (GEO) were commissioned by the Client, Gleeson Regeneration Ltd to carry out soil infiltration tests to aid the drainage design for the proposed residential development at Uldale View in Egremont, Cumbria.

GEO have previously completed a Desk Top Study and Ground Investigation for the site and it is recommended that these documents are read in conjunction with this test report.

The previous ground investigation encountered topsoil overlying variable drift deposits including firm and stiff sandy gravelly clay, silty sandy gravel, silty sand and occasional sandy gravelly silt. The recent soil infiltration tests were targeted in the areas where the granular soils had previously been encountered.

The soil infiltration tests were completed over two days commencing on the 6th February 2023. The works comprised 7 No. trial pits (TP-A to TP-F) to depths of between c.1.45m and c.2.00m bgl.

The trial pits encountered a mixture of sandy gravelly clay, silty sandy gravel with occasional cobbles and silty gravelly sand. Trial pit TP-C encountered mostly clay with only a thin band of sand, therefore the trial pit was abandoned, and another trial pit (TP-C1) excavated nearby which encountered silty gravelly sand throughout.

Groundwater was encountered in trial pits TP-A, B and C at depths of between c.1.45m and c.1.80m bgl. The ingress was noted as slight and moderate which resulted in a thin layer of water at the base of the pits upon completion. Trial pits TP-C1, D, E and F were recorded as dry throughout (these pits all encountered sand deposits).

The trial pits were partially filled with water from a mobile agricultural bowser. The water level was monitored over a period of between 267 and 327 minutes (c.4.5 to c.5.5 hours). During this time the water levels dropped between 320mm and 730mm. Calculation sheets for each test are attached to this report. The results indicate infiltration rates of between 1.0×10^{-05} m/s and 1.7×10^{-05} m/s. Due to the rate of infiltration, there was insufficient time to complete additional tests at each trial pit location.

The water level was noted to fall quickest where sand deposits were encountered. The overall results suggest a 'Good Drainage Characteristic' and a 'Low and Medium Permeability Classification'. It is likely that the silt content within the granular deposits significantly reduces the infiltration potential. It should be borne in mind that the pore spaces within the granular deposits could silt up further over time and therefore reduce the infiltration rate.

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The results should be adopted by the Civil Engineer as the maximum achievable infiltration rate for design purposes to determine if soak-away drainage is suitable for the proposed development.

Consideration must be made for variations to occur in the ground conditions between the exploratory hole locations for which GEO holds no responsibility. It is therefore recommended that a "watching brief" be applied to ensure that if ground conditions vary from those identified during this investigation, then advice should be sought from a suitably qualified and experienced Geo-Environmental Engineer.

The recommendations and opinions expressed in this report are based on the ground conditions observed. Consequently, GEO takes no responsibility for conditions that have not been revealed or which occur between them.

The conclusions and recommendations presented within this report are considered reasonable based on the available information. However, these cannot be guaranteed to gain regulatory approval. Therefore, the report should be passed to the appropriate regulatory authorities and/ or other key stakeholders, including warranty providers in order to seek their approval of the findings prior to undertaking any site works or development on site.

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If there are any queries, please do not hesitate to contact Geo-Environmental Engineering Ltd.

Yours Faithfully

……
James Brock *BSc (Hons), MSc*
Associate - Geo Environmental Engineering Ltd

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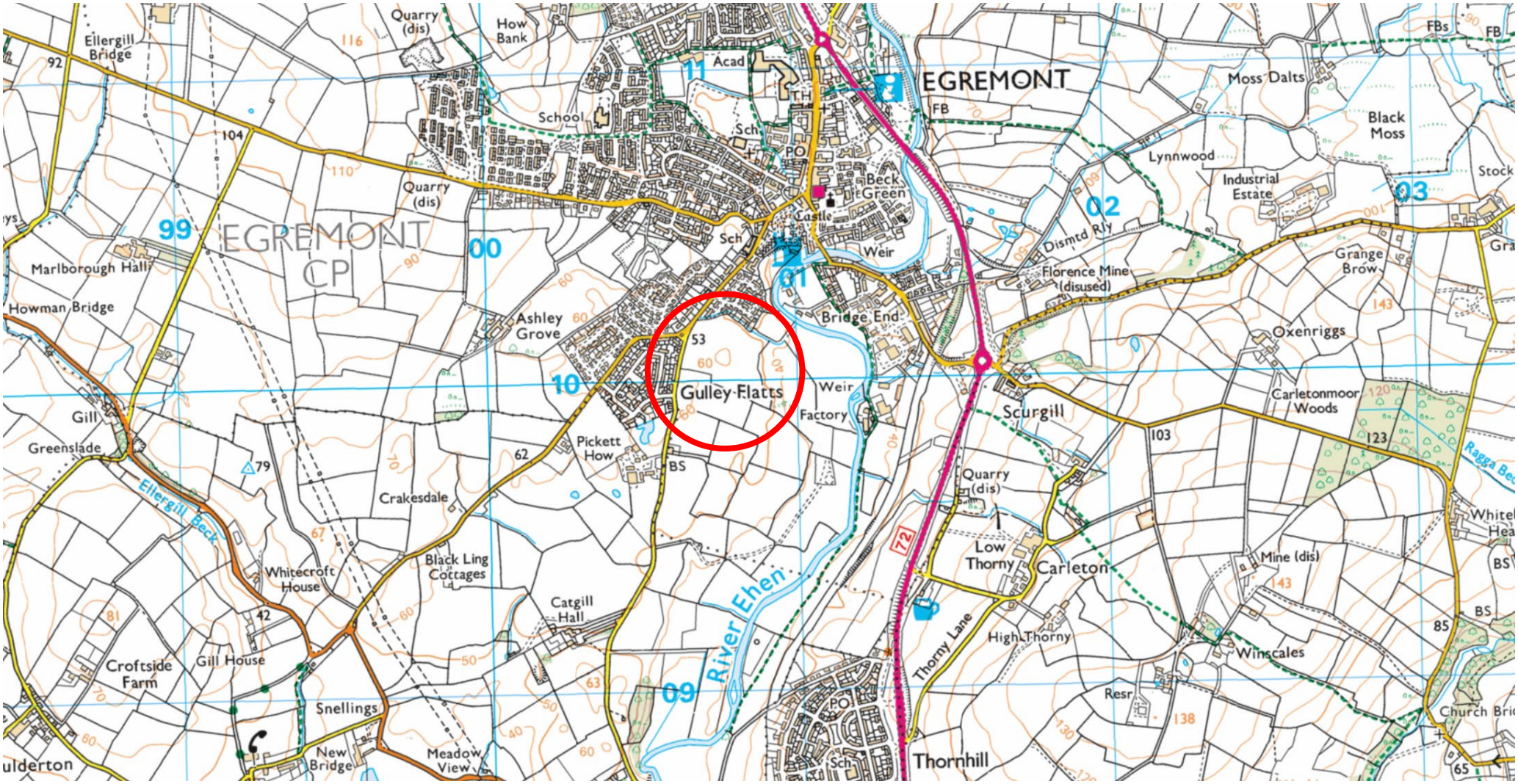
GEO2023-5701: Uldale View, Egremont, Cumbria – Site Location



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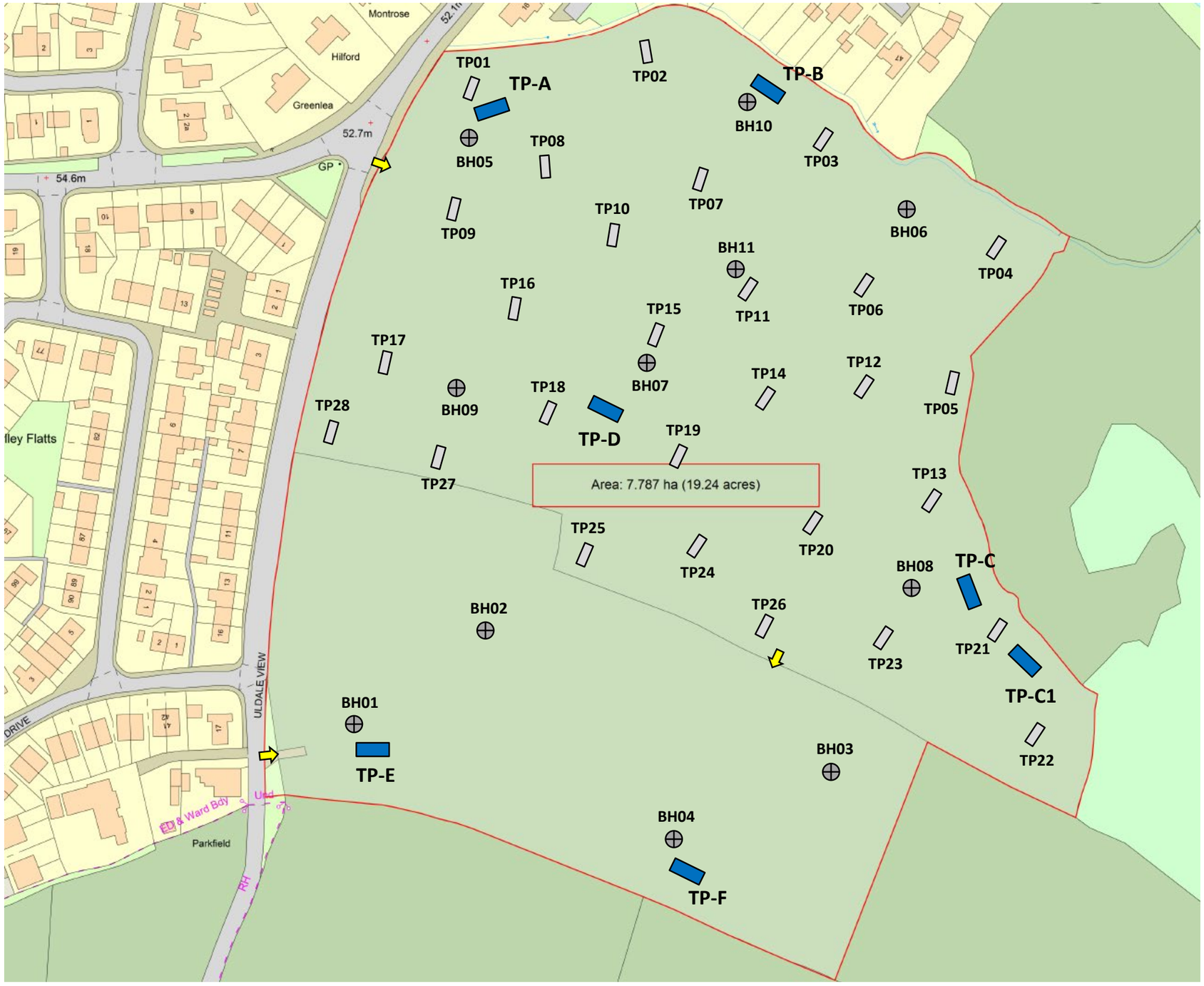
GEO2023-5701: Uldale View, Egremont, Cumbria – Exploratory Hole Location Plan



KEY:

- Soil Infiltration Test Locations*
- Previous Trial Pit Locations*
- Previous Borehole Locations*
- Access Points (Gates)

* - Locations are Approximate

N

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GEO2023-5701: Uldale View, Egremont – TP-A

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.30	TOPSOIL: Dark grey brown silty sandy gravelly LOAM.		
0.30	0.65	Orangey brown silty very sandy fine to coarse GRAVEL with occasional cobbles and lenses of gravelly sand.		
0.65	1.50	Dark red brown silty very sandy GRAVEL and COBBLES.		
		End of trial hole at 1.50m bgl – Soil Infiltration Test Completed. Slight groundwater ingress at c.1.45m bgl. Trial hole backfilled with arisings on completion.		

Engineer: J.Brock
Site Works Date: 06/02/2023
Plant: Tracked 360 Excavator
Dimensions: 2.60m x 0.65m

Log Notes:
HSV = Hand Shear Vane (kN/m^2)
LP = Limited Penetration (HSV/CBR)
B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub

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GEO2023-5701: Uldale View, Egremont – TP-B

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.28	TOPSOIL: Dark grey brown silty sandy gravelly LOAM.		
0.28	1.60	Brown slightly silty very sandy GRAVEL with occasional sub-rounded cobbles.		
		End of trial hole at 1.60m bgl – Soil Infiltration Test Completed. Moderate groundwater ingress at c.1.45m bgl. Trial hole backfilled with arisings on completion.		

Engineer: J.Brock
Site Works Date: 06/02/2023
Plant: Tracked 360 Excavator
Dimensions: 2.50m x 0.65m

Log Notes:
HSV = Hand Shear Vane (kN/m^2)
LP = Limited Penetration (HSV/CBR)
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GEO2023-5701: Uldale View, Egremont – TP-C

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.30	TOPSOIL: Dark grey brown silty sandy gravelly LOAM.		
0.30	1.45	Stiff dark red brown slightly sandy gravelly CLAY.		
1.45	1.80	Dark brown very silty gravelly SAND.		
1.80	2.00	Stiff dark red brown slightly sandy gravelly CLAY.		
		End of trial hole at 2.00m bgl. Slight groundwater ingress at c.1.80m bgl. Trial hole backfilled with arisings on completion.		

Engineer: J.Brock
Site Works Date: 06/02/2023
Plant: Tracked 360 Excavator

Log Notes:
HSV = Hand Shear Vane (kN/m^2)
LP = Limited Penetration (HSV/CBR)
B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub

No Photo

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GEO2023-5701: Uldale View, Egremont – TP-C1

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.33	TOPSOIL: Dark grey brown silty sandy gravelly LOAM.		
0.33	1.45	Dark red brown silty very gravelly SAND with occasional cobbles and lenses of sandy gravel.		
		End of trial hole at 1.60m bgl – soil infiltration test completed. Trial pit dry on completion. Trial hole backfilled with arisings on completion.		

Engineer: J.Brock
Site Works Date: 06/02/2023
Plant: Tracked 360 Excavator
Dimensions: 2.50m x 0.65m

Log Notes:
HSV = Hand Shear Vane (kN/m^2)
LP = Limited Penetration (HSV/CBR)
B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub

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GEO2023-5701: Uldale View, Egremont – TP-D

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.31	TOPSOIL: Dark grey brown silty sandy gravelly LOAM.		
0.31	1.60	Brown slightly silty fine to medium SAND. Becoming medium sand with depth.		
		End of trial hole at 1.60m bgl – soil infiltration test completed. Trial pit dry on completion. Trial hole backfilled with arisings on completion.		

Engineer: J.Brock
Site Works Date: 06/02/2023
Plant: Tracked 360 Excavator
Dimensions: 2.40m x 0.65m

Log Notes:
HSV = Hand Shear Vane (kN/m^2)
LP = Limited Penetration (HSV/CBR)
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GEO2023-5701: Uldale View, Egremont – TP-E

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.28	TOPSOIL: Dark grey brown silty sandy gravelly LOAM.		
0.28	1.30	Firm to stiff dark brown slightly sandy gravelly CLAY with occasional cobbles.		
1.30	2.00	Brown slightly silty fine to medium SAND with occasional cobbles and boulders. Occasional lenses of sandy gravelly clay and sandy sub-rounded gravel.		
		End of trial hole at 2.00m bgl – soil infiltration test completed. Trial pit dry on completion. Trial hole backfilled with arisings on completion.		

Engineer: J.Brock
Site Works Date: 07/02/2023
Plant: Tracked 360 Excavator
Dimensions: 2.60m x 0.65m

Log Notes:
HSV = Hand Shear Vane (kN/m^2)
LP = Limited Penetration (HSV/CBR)
B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub

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GEO2023-5701: Uldale View, Egremont – TP-F

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.28	TOPSOIL: Dark grey brown silty sandy gravelly LOAM.		
0.28	1.30	Dark brown very silty fine to coarse angular to sub-rounded GRAVEL with occasional cobbles and boulders. Occasional lenses of very gravelly clay.		
1.30	2.00	Brown slightly silty very gravelly SAND.		
		End of trial hole at 2.00m bgl – soil infiltration test completed. Trial pit dry on completion. Trial hole backfilled with arisings on completion.		

Engineer: J.Brock
Site Works Date: 07/02/2023
Plant: Tracked 360 Excavator
Dimensions: 2.60m x 0.65m

Log Notes:
HSV = Hand Shear Vane (kN/m^2)
LP = Limited Penetration (HSV/CBR)
B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub

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GEO2023-5701: Uldale View, Egremont – Soil Infiltration Test Results

Soil Infiltration Test Results – TP-A	
Duration (mins)	**Water Level (m bgl)**
0	0.49
16	0.54
69	0.62
128	0.69
225	0.76
327	0.81

Soil Infiltration Test Results – TP-B	
Duration (mins)	**Water Level (m bgl)**
0	0.56
56	0.71
115	0.78
213	0.86
314	0.93

Soil Infiltration Test Results – TP-C1	
Duration (mins)	**Water Level (m bgl)**
0	0.50
22	0.66
81	0.80
179	0.96
281	1.09

Soil Infiltration Test Results – TP-D	
Duration (mins)	**Water Level (m bgl)**
0	0.64
10	0.76
68	0.98
166	1.16
267	1.26

Soil Infiltration Test Results – TP-E	
Duration (mins)	**Water Level (m bgl)**
0	0.81
76	0.98
150	1.15
230	1.34
305	1.51

Soil Infiltration Test Results – TP-F	
Duration (mins)	**Water Level (m bgl)**
0	0.74
69	1.01
242	1.29
320	1.47

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SOIL INFILTRATION TEST CALCULATION SHEET

SITE:	**Uldale View, Egremont**
JOB NO:	**2023-5701**
DATE:	**06.02.2023**
TRIAL PIT:	**TP-A**
TEST NO.:	**1**

GROUND CONDITIONS: See Trial Pit Logs for Details

TEST HOLE SIZE:

Width	**650**	mm
Length	**2600**	mm
Depth of hole	**1500**	mm
Change Water Level	**320**	mm

MONITORING RESULTS:

Recorded Time			Total Time	Depth of water
Hours	Minutes	Seconds	(secs)	(mm)
0	0	0	0	490
0	16	0	960	540
0	69	0	4140	620
0	128	0	7680	690
0	225	0	13500	760
0	327	0	19620	810

PERCOLATION TEST RESULTS AND SOIL INFILTRATION ASSESSMENT

TEST NO.: **1**

SOIL INFILTRATION RATE ASSESSMENT:

Vol. Outflowing between 75% and 25% effective depth:

V_{p75-25} = **0.2704** m^3

Mean surface area (pit sides to 50% effective depth + base of pit):

A_{p50} = **2.73** m^2

Time for the outflow between 75% and 25% effective depth:

t_{p75-25} = **9810** secs

Soil Infiltration rate:

f = **1.0E-05** m/s

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SOIL INFILTRATION TEST CALCULATION SHEET

SITE:	**Uldale View, Egremont**
JOB NO:	**2023-5701**
DATE:	**06.02.2023**
TRIAL PIT:	**TP-B**
TEST NO.:	**1**

GROUND CONDITIONS: See Trial Pit Logs for Details

TEST HOLE SIZE:

Width	**650**	mm
Length	**2500**	mm
Depth of hole	**1600**	mm
Change Water Level	**370**	mm

MONITORING RESULTS:

Recorded Time			Total Time	Depth of water
Hours	Minutes	Seconds	(secs)	(mm)
0	0	0	0	560
0	56	0	3360	710
0	115	0	6900	780
0	213	0	12780	860
0	314	0	18840	930

PERCOLATION TEST RESULTS AND SOIL INFILTRATION ASSESSMENT

TEST NO.: **1**

SOIL INFILTRATION RATE ASSESSMENT:

Vol. Outflowing between 75% and 25% effective depth:

V_{p75-25} = **0.300625** m^3

Mean surface area (pit sides to 50% effective depth + base of pit):

A_{p50} = **2.7905** m^2

Time for the outflow between 75% and 25% effective depth:

t_{p75-25} = **9420** secs

Soil Infiltration rate:

f = **1.1E-05** m/s

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SOIL INFILTRATION TEST CALCULATION SHEET

SITE:	**Uldale View, Egremont**
JOB NO:	**2023-5701**
DATE:	**06.02.2023**
TRIAL PIT:	**TP-C1**
TEST NO.:	**1**

GROUND CONDITIONS: See Trial Pit Logs for Details

TEST HOLE SIZE:

Width	**650**	mm
Length	**2500**	mm
Depth of hole	**1450**	mm
Change Water Level	**590**	mm

MONITORING RESULTS:

Recorded Time			Total Time	Depth of water
Hours	Minutes	Seconds	(secs)	(mm)
0	0	0	0	500
0	22	0	1320	660
0	81	0	4860	800
0	179	0	10740	960
0	281	0	16860	1090

PERCOLATION TEST RESULTS AND SOIL INFILTRATION ASSESSMENT

TEST NO.: **1**

SOIL INFILTRATION RATE ASSESSMENT:

Vol. Outflowing between 75% and 25% effective depth:

V_{p75-25} = **0.479375** m^3

Mean surface area (pit sides to 50% effective depth + base of pit):

A_{p50} = **3.4835** m^2

Time for the outflow between 75% and 25% effective depth:

t_{p75-25} = **8430** secs

Soil Infiltration rate:

f = **1.6E-05** m/s

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SOIL INFILTRATION TEST CALCULATION SHEET

SITE:	**Uldale View, Egremont**
JOB NO:	**2023-5701**
DATE:	**06.02.2023**
TRIAL PIT:	**TP-D**
TEST NO.:	**1**

GROUND CONDITIONS: See Trial Pit Logs for Details

TEST HOLE SIZE:

Width	**650**	mm
Length	**2400**	mm
Depth of hole	**1600**	mm
Change Water Level	**620**	mm

MONITORING RESULTS:

Recorded Time			Total Time	Depth of water
Hours	Minutes	Seconds	(secs)	(mm)
0	0	0	0	640
0	10	0	600	760
0	68	0	4080	980
0	166	0	9960	1160
0	267	0	16020	1260

PERCOLATION TEST RESULTS AND SOIL INFILTRATION ASSESSMENT

TEST NO.: **1**

SOIL INFILTRATION RATE ASSESSMENT:

Vol. Outflowing between 75% and 25% effective depth:

V_{p75-25} = **0.4836** m^3

Mean surface area (pit sides to 50% effective depth + base of pit):

A_{p50} = **3.451** m^2

Time for the outflow between 75% and 25% effective depth:

t_{p75-25} = **8010** secs

Soil Infiltration rate:

f = **1.7E-05** m/s

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SOIL INFILTRATION TEST CALCULATION SHEET

SITE:	**Uldale View, Egremont**
JOB NO:	**2023-5701**
DATE:	**06.02.2023**
TRIAL PIT:	**TP-E**
TEST NO.:	**1**

GROUND CONDITIONS: See Trial Pit Logs for Details

TEST HOLE SIZE:

Width	**650**	mm
Length	**2600**	mm
Depth of hole	**2000**	mm
Change Water Level	**700**	mm

MONITORING RESULTS:

Recorded Time			Total Time	Depth of water
Hours	Minutes	Seconds	(secs)	(mm)
0	0	0	0	810
0	76	0	4560	980
0	150	0	9000	1150
0	230	0	13800	1340
0	305	0	18300	1510

PERCOLATION TEST RESULTS AND SOIL INFILTRATION ASSESSMENT

TEST NO.: **1**

SOIL INFILTRATION RATE ASSESSMENT:

Vol. Outflowing between 75% and 25% effective depth:

V_{p75-25} = **0.5915** m^3

Mean surface area (pit sides to 50% effective depth + base of pit):

A_{p50} = **3.965** m^2

Time for the outflow between 75% and 25% effective depth:

t_{p75-25} = **9150** secs

Soil Infiltration rate:

f = **1.6E-05** m/s

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SOIL INFILTRATION TEST CALCULATION SHEET

SITE:	**Uldale View, Egremont**
JOB NO:	**2023-5701**
DATE:	**06.02.2023**
TRIAL PIT:	**TP-F**
TEST NO.:	**1**

GROUND CONDITIONS: See Trial Pit Logs for Details

TEST HOLE SIZE:

Width	**650**	mm
Length	**2600**	mm
Depth of hole	**2000**	mm
Change Water Level	**730**	mm

MONITORING RESULTS:

Recorded Time			Total Time	Depth of water
Hours	Minutes	Seconds	(secs)	(mm)
0	0	0	0	740
0	69	0	4140	1010
0	242	0	14520	1290
0	320	0	19200	1470

PERCOLATION TEST RESULTS AND SOIL INFILTRATION ASSESSMENT

TEST NO.: **1**

SOIL INFILTRATION RATE ASSESSMENT:

Vol. Outflowing between 75% and 25% effective depth:

V_{p75-25} = **0.61685** m^3

Mean surface area (pit sides to 50% effective depth + base of pit):

A_{p50} = **4.0625** m^2

Time for the outflow between 75% and 25% effective depth:

t_{p75-25} = **9600** secs

Soil Infiltration rate:

f = **1.6E-05** m/s

GEO Environmental Engineering Ltd

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&
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