

Appendix 3E

Tip Stability Report

Your Ref:

Our Ref: JR.1964/1

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1st September 2015

E. & J. W. Glendinning Ltd.,
Glentor,
Ashburton,
Newton Abbot,
DEVON. TQ13 7LF

For the attention of Mr. Richard Webb

Dear Richard

Proposed Extension to Linhay Quarry

In accordance with your instructions on 13th – 14th July 2015 we carried out a trial pit investigation of the site of proposed new tips adjacent to Linhay Quarry. The new tips will be created as part of an extension to the existing quarry excavation. The site is located at National Grid Reference SX779718, immediately to the northeast of the current Linhay Quarry excavation, as shown in Figure 1. Eleven trial pits were excavated to depths of between 0.9m and 3.8m and were logged by an engineering geologist from Frederick Sherrell Limited. The purpose of the trial pits was to provide information on the ground conditions at the site in order to assist with design of the proposed new tips. The trial pit locations are indicated on the attached plan, Figure 2 and detailed logs are appended to this report.

Our comments in relation to the design of the proposed tips are set out below.

1. **THE SITE**

1 – 1. The proposed quarry extension area measures approximately 800m x 600m in total and extends parallel with the A38 dual carriageway almost to the hamlet of Caton. Within the site area the ground slopes very gently towards the southeast (ie towards the A38) at between 2 and 6 degrees to the horizontal, as illustrated in Photographs 1 and 2. Ground level varies between 115m above Ordnance Datum (AOD) at the southern edge of the proposed extension (next to the A38) and 149m AOD in the northeast corner.

1 – 2. The site is currently agricultural pasture. Old Ordnance Survey maps of the area do not

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show any change of use in the past 130 years. No surface water courses are indicated within the proposed extension area, although sinks and issues are indicated on Ordnance Survey maps at Alston and Caton near the northern and eastern edges of the proposed tip. Surface water ponding was visible between Alston and Trial Pit TP07 at the time of the investigation (see Photograph 2) and we understand from the farmer that this area generally remains wet throughout the year. Two small ponds are also visible in the field to the northeast of Lower Waye (see Figure 2).

1 – 3. The published geological map of the area (Sheet 338, Dartmoor Forest) indicates the presence beneath the site of the Chercombe Bridge Limestone Formation of Middle Devonian age. The map indicates that, to the north of the site, the limestone is thrust over slates of the Kate Brook Slate Formation (Upper Devonian age). The results of a recent site investigation by Sandybed Geological Services¹ indicate that, within the area of the proposed quarry extension, limestone bedrock is overlain by varying thicknesses of clayey overburden soils. The interpreted thickness of overburden soil ranged from 0.5 to 12.8m depth indicating the presence locally of sinkhole features derived from solution weathering of the limestone bedrock.

2. RESULTS OF THE TRIAL PIT INVESTIGATION

2 – 1. The trial pits identified the following sequence of soils and bedrock :

Strata	Depth to top of stratum (m bgl)	Proven Thickness (m)	Comments
Clayey TOPSOIL	G.L.	0.15 – 0.3	
Stiff to very stiff brown slightly sandy gravelly CLAY with cobbles and boulders of limestone.	0.15 - 0.3	2.1 – 3.4+	Not encountered in TP04. Base not proven in majority of pits.
Clayey COBBLES and BOULDERS of limestone.	2.3	0.4+	Only encountered in Trial Pit TP05. Base not proven.
Grey and orange-brown very clayey GRAVEL of slate.	2.3 – 3.1	1.0+	Only encountered in TP10 and TP11.
Strong grey LIMESTONE	0.3 – >3.8	0.3+	Only encountered in TP04.

¹ The Alston Extension to Linhay Quarry, Ashburton, Devon : Site Investigation and Design Report, March 2015.

The strata are briefly described in the following paragraphs but for more detail please refer to the appended trial pits logs.

2 – 2. Up to 0.3m thickness of soft brown clayey topsoil and turf was encountered in all of the trial pits.

2 – 3. Brown and orange-brown, locally dark grey and black, slightly sandy gravelly clay soil was encountered beneath the topsoil in all of the trial pits except TP04. Sub-angular cobbles and boulders of limestone up to 450mm in diameter were recorded within the clay in the majority of the trial pits. The clay was described as becoming very gravelly at some levels, grading to a very clayey gravel between 0.8 – 1.5m depth in Trial Pit TP01. At the time of the ground investigation the clay was typically described as stiff to very stiff (locally firm), although in Trial Pit TP10 the clay was described as soft between 1.6m and 2.3m depth. Insitu hand vane shear strength tests in the clays recorded undrained shear strengths between 76 and 100kN/m² in the top metre, although most of the time the clays were too gravelly and/or cobbly for successful tests.

2 – 4. In Trial Pit TP05 angular to sub-angular cobbles and boulders of limestone with a little clay matrix were recorded at 2.3m depth. It was not possible to extend the pit below 2.7m depth due to the difficulty of excavation.

2 – 5. Grey and orange-brown very clayey gravel of slate fragments was encountered beneath the stiff clay in Trial Pits TP10 and TP11, located in the northwestern part of the proposed extension area. The presence of slaty gravel in these trial pits suggests that this area is probably underlain by slate bedrock of the Kate Brook Slate Formation.

2 – 6. Strong grey limestone bedrock was encountered in Trial Pit TP04 at approximately 0.3m depth. The bedrock is broken by close to medium spaced discontinuities that give the rockmass a blocky structure. Bedding planes dip at 50 degrees to the horizontal towards the southeast; two orthogonal steeply dipping joint sets were also recorded (see Figure 2). Bedrock was not encountered in the other trial pits, although Trial Pit TP05 may possibly have refused on the limestone bedrock at 2.7m depth.

2 – 7. Seepages of groundwater were encountered within Trial Pits TP10 and TP11, located in the northwestern part of the site, at depths of 2.2m and 3.7m below ground level. The remaining trial pits were dry during the investigation. Higher groundwater levels are likely to exist during the winter months and following sustained heavy rainfall, especially in the northwestern parts of the site where the soils are underlain by slate bedrock.

3. RECOMMENDATIONS

3 – 1. Proposed Development

3 – 1.1. Tip development drawings prepared by Sandybed Geological Services are appended to this report and indicate that the proposed tips will have a maximum vertical height of approximately 15m. The drawings indicate that the proposed final slopes of the tips vary between 1:2 and 1:7 (vertical : horizontal). We understand that the tipped material will primarily comprise excavated overburden soil.

3 – 1.2. The main area of tipping will be in the northeastern part of the site, although significant tips/bunds will also be created alongside the A38 and to the northwest of the proposed excavation.

3 – 2. Engineering Considerations Relating to Tip Stability

3 – 2.1. The internal stability of the proposed tip will depend on the nature of the materials tipped, their method of placement, and the slope geometry. The materials tipped will primarily comprise clayey overburden excavated from the quarry extension area. An earlier report on the stability of slopes at the existing Linhay Quarry by Engineering Geology Limited² includes the results of laboratory shear box testing of samples of similar overburden soil. The test results are summarised as follows :

<u>Sample Type</u>	Angle of Friction ϕ' (°)	Effective Cohesion c' (kN/m ²)
Undisturbed (block)	30	15
	35	10
	27	10
	42	10
Remoulded	28	15
	24	15

Internal stability of the proposed tip has been analysed for an angle of friction of 28° and a cohesion of 0kN/m² using the computer program SLOPE (version 19.03.26). The analysis demonstrates a satisfactory Factor of Safety in excess of 1.7 for tip slopes not steeper than 1:3 (vertical:horizontal). However, a relatively low Factor of Safety of 1.09 is calculated for slopes of 1:2 (vertical:horizontal). In practice the stability of tip slopes will probably be enhanced by the presence of an element of cohesion

² Report on the Rock Slope Stability of Existing and Proposed Workings at Linhay Hill Quarry, Ashburton. Report No. 368/UK/0686, March 1987.

within the tip material, nonetheless final slopes should be designed on the basis of tip slope angles not steeper than 1:3 in order to avoid unravelling and/or shallow slippage. Tipped material should be placed in layers not greater than 1m in thickness and compacted in accordance with good engineering practice. Material forming the tip faces should not include organic matter, topsoil or other unsuitable material. Soft and/or saturated soils should be allowed to dry and increase in strength before incorporating into the centre of the tips only. During construction the surface of the tip should be graded to prevent ponding of surface water.

3 – 2.2. In the short term, temporary slope angles of up to 1:2 could be considered provided the following additional conditions are observed :

- a bench not less than 10m wide should be established between the toe of the tip and the crest of the quarry excavation or the site boundary in order to trap any shallow slides or unravelling of material
- 1:2 slopes should not be constructed along the southern boundary of the site, adjacent to the A38
- soft, organic and/or saturated soils should be excluded

3 – 2.3. The ground investigation has confirmed the presence of stiff to very stiff clayey soils beneath the footprint of the proposed tips. Construction of the tips on these soils is unlikely to result in deep-seated rotational failure of the tip foundation or basal sliding, provided that all topsoil and any soft or wet soils are removed from the foundation area prior to the start of tip construction.

3 – 3. Drainage

3 – 3.1. In addition to the foundation preparation measures outlined above it will also be necessary to implement drainage measures prior to construction to prevent the build-up of destabilising water pressures beneath the tips. Drainage measures should include the following :

- i) a drainage blanket not less than 500mm thick should be constructed at the base of the tips following the removal of the surface layer of topsoil and any soft soils, as indicated in Figure 3. The drainage blanket should comprise a layer of free-draining durable granular material such as Class 6B or 6C of the Highways Agency Specification for Highway Works and should be placed on a geotextile separator such as Terram 1000 to prevent migration of fines from the underlying soils. A second separator layer should be placed on top of the layer of granular material.
- ii) surface water cut-off drains should be installed around the perimeter of the tip area.

iii) horizontal drainage layers should be incorporated into the tips at no greater than 5m vertical spacing in order to prevent the build-up of hydrostatic pressures within the tip itself. The drainage layers should be not less than 300mm thick and should comprise durable crushed rock (non-argillaceous).

iv) if topsoil removal reveals the presence of locally high groundwater levels it may be necessary to install French drains locally to reduce hydrostatic pressures within the tip foundation.

3 – 4. Monitoring

3 – 4.1. Regular inspections of the tips should be carried out in accordance with the standard quarry operating procedures. If the nature of the materials tipped changes significantly then a geotechnical review of the tip design should be carried out.

We trust these notes are sufficient for your present purposes. If you have any queries or require any further information please do not hesitate to contact us.

Yours sincerely
for Frederick Sherrell Ltd



Jeremy Rickeard

Encl :

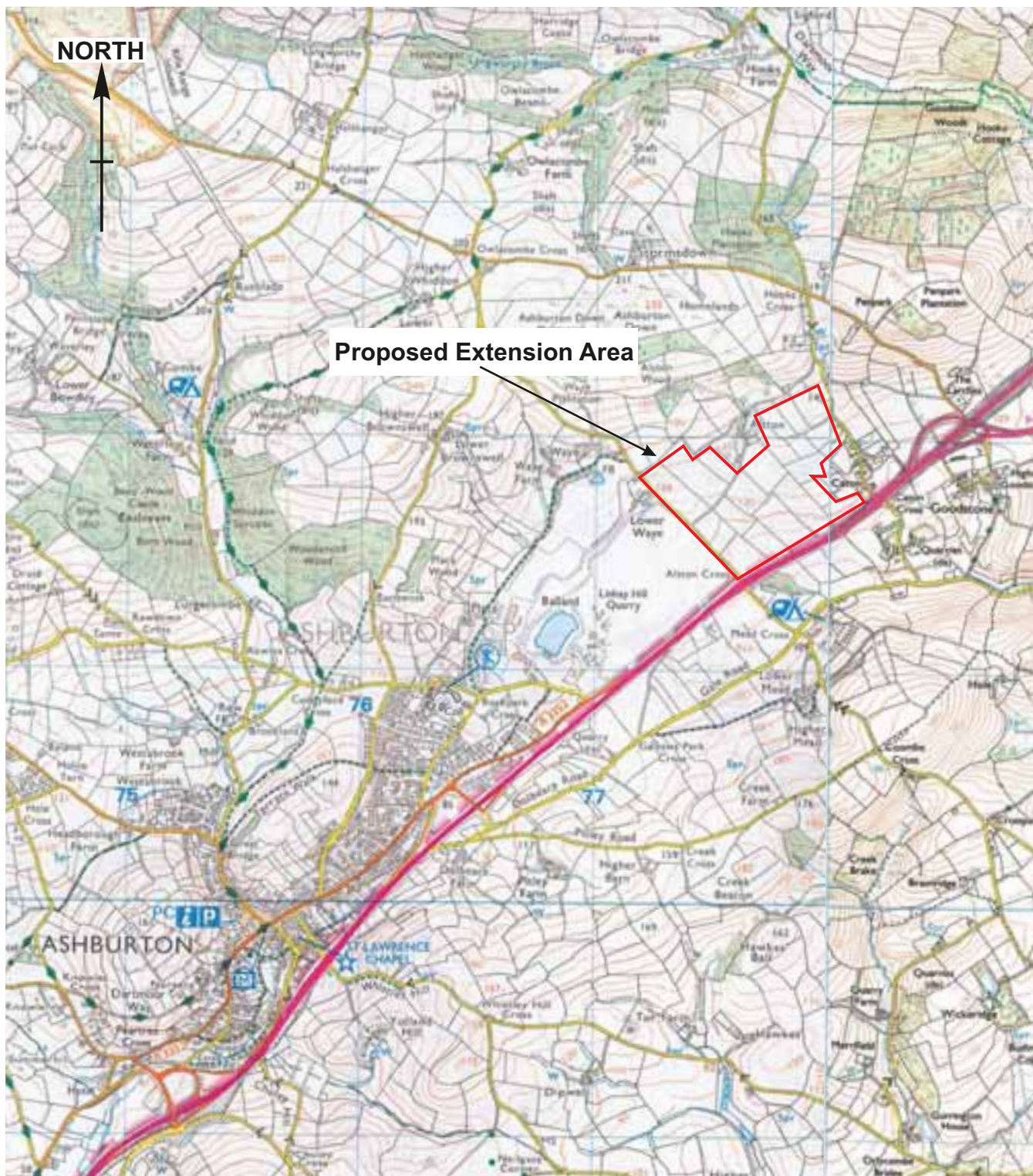
Figures 1 – 3

Photographs 1 – 7

Trial Pit Logs

Quarry Development Plans and Sections (prepared by Sandybed Geological Services)

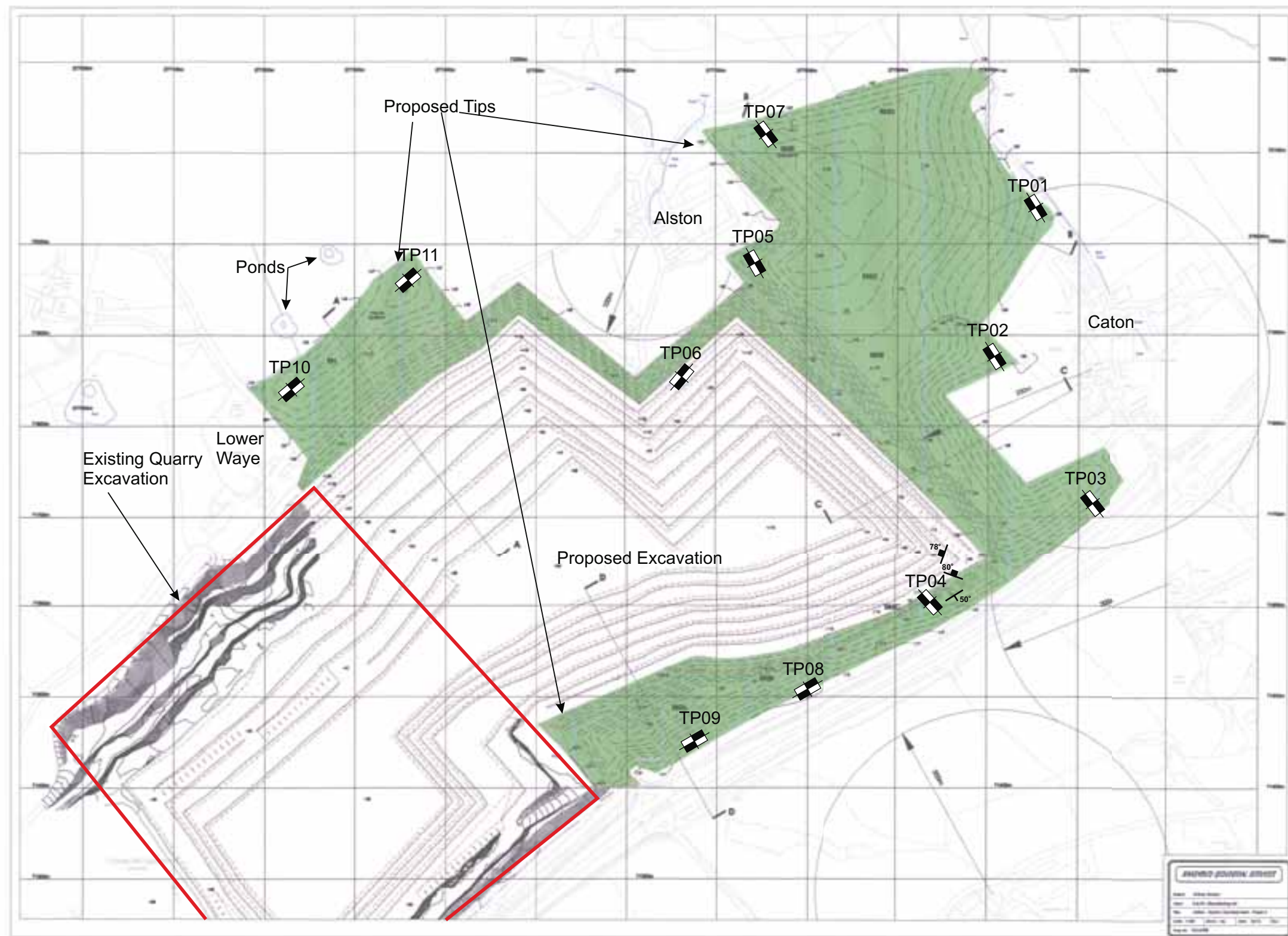
General Notes



Adapted from Ordnance Survey Explorer Map OZB 200b

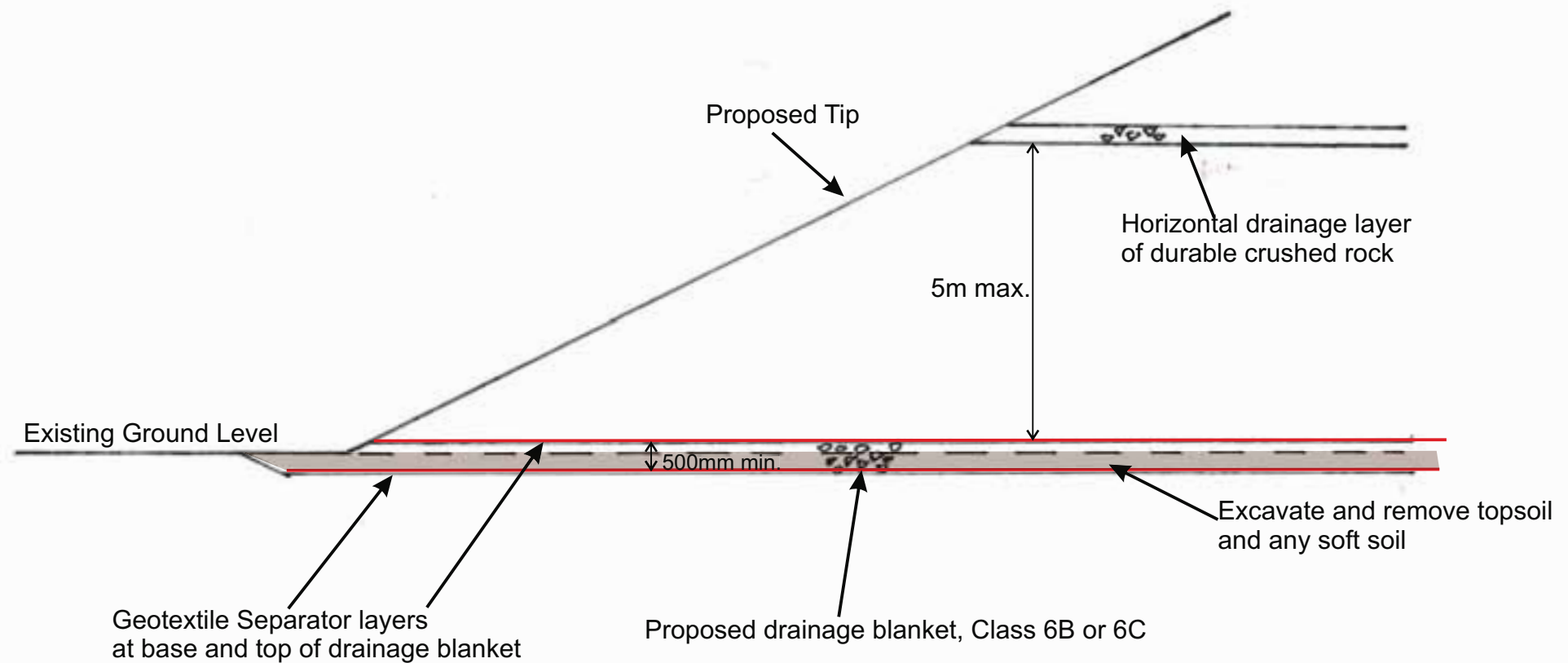
Ordnance Survey Map has been reproduced with the permission of The Controller of Her Majesty's Stationery Office, Crown Copyright Reserved. Licence No. AL 100002473

Title	<u>LINHAY QUARRY - PROPOSED EXTENSION</u>	Approximate Scale 1:25000@A4		Drawing No. FIGURE 1	
		Drawn JR	Checked RG	Date Aug. 2015	Job Ref. 1964/1
Client E. AND J.W. GLENDINNING LTD		FREDERICK SHERRELL LTD CONSULTING ENGINEERING GEOLOGISTS AND GEOTECHNICAL ENGINEERS			



Drawing based on Sandybed Geological Services Drawing No. G/A/008, reduced and annotated by Frederick Sherrell Limited.

Title	<u>LINHAY QUARRY - PROPOSED EXTENSION</u>			Approximate Scale 1:5000@A3		Drawing No. FIGURE 2	
	PROPOSED FINAL LAYOUT SHOWING TRIAL PIT LOCATIONS			Drawn HS	Checked JR	Date Aug. 2015	Job Ref. 1964/1
Client	E. AND J.W. GLENDINNING LTD			FREDERICK SHERRELL LTD CONSULTING ENGINEERING GEOLOGISTS AND GEOTECHNICAL ENGINEERS			



Title

LINHAY QUARRY - PROPOSED EXTENSION

**SKETCH SECTION ILLUSTRATING PROPOSED FOUNDATION
STRENGTHENING AND DRAINAGE MEASURES FOR NEW TIPS**

Approximate Scale
1:100@A4

Drawing No.

FIGURE 3

Drawn
JR

Checked
RG

Date
Aug. 2015

Job Ref.
1964/1

Client

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Photograph 1. View north across site area from Trial Pit TP09.



Photograph 2. View south from near Trial Pit TP07. Note surface water ponding in foreground.



Photograph 3. Excavated spoil, Trial Pit TP02.



Photograph 4. View
of Trial Pit TP02



Photograph 5. Limestone bedrock exposed in Trial Pit TP04



Photograph 6. Limestone cobbles and boulders (possible bedrock) exposed in base of Trial Pit TP05.

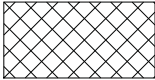
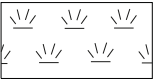
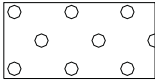
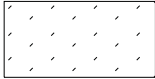
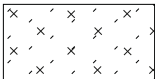


Photograph 7. Slatey gravel and groundwater seepage in Trial Pit TP10.

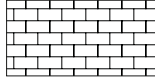
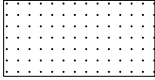
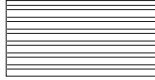
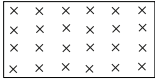
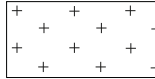
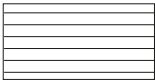
SYMBOLIC LEGEND & ABBREVIATIONS

Symbolic legends and abbreviations shown in the logs of exploratory holes are as follows:-

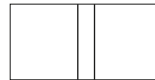
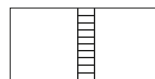
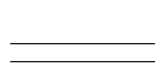
SOIL TYPES

	TOPSOIL		SILT
	MADE GROUND		CLAY
	COBBLES & BOULDERS		PEAT
	GRAVEL	Note : Composite soil or rock types are signified by combined symbols	
	SAND		
			e.g. SILTY SAND

ROCK TYPES

	BRECCIA		LIMESTONE
	SANDSTONE		SHALE
	SILTSTONE		COURSE GRAINED IGNEOUS ROCK
	MUDSTONE		FINE GRAINED IGNEOUS ROCK
	SLATE		

BACKFILL TYPES

	CONCRETE		PLAIN PIPE
	BENTONITE CEMENT		SLOTTED PIPE
	BENTONITE		CASING
	GRAVEL PACK		
	BACKFILL (ARISINGS)		

ABBREVIATIONS

HOLE TYPES:

IP	Inspection Pit
TP	Trial Pit
WLS	Windowless Sampler
WS	Window Sampler
DB	Drag Bit
DST	Driven Steel Tube
DTH	Down The Hole Hammer
RC	Rotary Coring

SAMPLE TYPES:

B	Bulk disturbed sample
D	Small disturbed sample
ES	Environmental sample (soil)
EV	Environmental Vile
EW	Environmental sample (water)
L	Windowless Sample liner
W	Water

INSITU TESTING:

CPT	Standard Penetration Test (solid cone)
SPT	Standard Penetration Test (split cone)
IVN	Insitu Vane Test
HV	Hand Vane Test
Cp	Penetrometer CBR
K	Soakaway Test

GROUNDWATER LEVELS

	WATER STRIKE
	WATER STANDING

Water levels are recorded on the logs of exploratory holes together with the depths of seepages and water inflows detected during the works. At the time of observation the exploratory hole water levels may not have equilibrated to the water table or phreatic surface. They may also be affected by the addition of water to facilitate progress.

Accurate groundwater levels may be obtained from standpipes and/or piezometers. However it should be noted that groundwater levels vary due to seasonal, climatic, tidal and man-made effects. Therefore water levels recorded during the investigation may no longer be appropriate.

Site/Project Name LINHAY QUARRY - PROPOSED EXTENSION		Grid Ref.		Ground Level		TRIAL PIT TP01	
Method MECHANICAL EXCAVATION		Machine JCB 3CX		Dimensions 3.2m x 1.0m x 3.0m		Orientation 148°	
Date 13/07/2015							

Symbolic Log	Description	Depth (m)	Level (m)	Sample Test	Depth (m) of Sample or Test	Water	Test Result
	Soft brown, slightly silty, sandy CLAY with frequent roots (TOPSOIL).	0.20		V	0.75		76KPa
	Stiff to very stiff orangish brown slightly silty, slightly sandy CLAY with occasional sub-angular gravel and occasional cobbles and boulders of limestone upto 350mm diameter.	0.80					
	Moderately compact brownish grey, sandy, very clayey, sub-angular, fine to coarse, GRAVEL with frequent cobbles and boulders and roots to 0.9m depth.	1.50					
	Firm pale orangish brown, mottled dark brown, slightly sandy, gravelly CLAY with some cobbles and boulders of limestone. 1.80m - Becoming stiff and very gravelly in lower levels.	3.00					
TRIAL PIT TERMINATED AT 3.00m DEPTH							
				Geological Structure			
		Depth (m)	Dip (degrees)	Dip Direction (degrees)	Description		

Sketch Plan/Elevations							
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Comments & Notes Ground slopes 5° East. No groundwater encountered. Pit sides unravelling above 1.5m. Excavation difficult.	U Undisturbed Sample (U100) B Bulk Disturbed Sample D Disturbed Sample ES Environmental Sample EV Environmental Vial CBR Undisturbed CBR Mould W Water Sample	V Hand Vane Shear Test Cp Penetrometer CBR ▽ Groundwater First Encountered ▽ Standing Water Level K Soakaway Test Pp Pocket Penetrometer Test * Excavated Sample	
	Logged by HS	Checked by JR	Scale 1:50
Client E & JW GLENDINNING LTD	FREDERICK SHERRELL LTD CONSULTING ENGINEERING GEOLOGISTS AND GEOTECHNICAL ENGINEERS		

Site/Project Name LINHAY QUARRY - PROPOSED EXTENSION		Grid Ref.		Ground Level		TRIAL PIT TP02	
Method MECHANICAL EXCAVATION		Machine JCB 3CX		Dimensions 3.2m x 1.0m x 3.5m		Orientation 148°	
Date 13/07/2015							
Symbolic Log	Description	Depth (m)	Level (m)	Sample Test	Depth (m) of Sample or Test	Water	Test Result
	Soft brown, slightly silty, sandy CLAY with frequent roots (TOPSOIL).	0.20		D	3.30		
	Very stiff brown mottled black, slightly silty, slightly sandy CLAY with occasional cobbles and boulders of limestone upto 450mm diameter.	2.30					
	Stiff pale brown mottled black slightly silty, slightly gravelly CLAY.						
	3.30m - Becoming firm pinkish brown slightly silty, slightly gravelly CLAY.	3.50					
TRIAL PIT TERMINATED AT 3.50m DEPTH							
Geological Structure							
Depth (m)	Dip (degrees)	Dip Direction (degrees)	Description				
Sketch Plan/Elevations							
Comments & Notes Ground slopes 2° East. No groundwater encountered. Pit sides stable. Excavation moderately easy.				U Undisturbed Sample (U100) B Bulk Disturbed Sample D Disturbed Sample ES Environmental Sample EV Environmental Vial CBR Undisturbed CBR Mould W Water Sample V Hand Vane Shear Test Cp Penetrometer CBR ▽ Groundwater First Encountered ▽ Standing Water Level K Soakaway Test Pp Pocket Penetrometer Test * Excavated Sample			
Logged by HS		Checked by JR		Scale 1:50		Job Ref. 1964	
Client E & JW GLENDINNING LTD				FREDERICK SHERRELL LTD CONSULTING ENGINEERING GEOLOGISTS AND GEOTECHNICAL ENGINEERS			

Site/Project Name LINHAY QUARRY - PROPOSED EXTENSION		Grid Ref.		Ground Level		TRIAL PIT TP03	
Method MECHANICAL EXCAVATION		Machine JCB 3CX		Dimensions 3.2m x 1.0m x 3.6m		Orientation 140°	
Date 13/07/2015							

Symbolic Log	Description	Depth (m)	Level (m)	Sample Test	Depth (m) of Sample or Test	Water	Test Result
	Soft brown, slightly gravelly, slightly sandy CLAY with frequent roots (TOPSOIL).	0.20					
	Firm brown slightly sandy, gravelly CLAY with some cobbles and boulders of limestone upto 350mm diameter.						
	1.20m - Becoming very stiff dark brown, slightly gravelly CLAY.						
	3.40m - Becoming more gravelly with little cobble content.	3.60					
<u>TRIAL PIT TERMINATED AT 3.60m DEPTH</u>							
				Geological Structure			
		Depth (m)	Dip (degrees)	Dip Direction (degrees)	Description		

Sketch Plan/Elevations							
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Comments & Notes Ground slopes 6° Southeast. No groundwater encountered. Pit sides stable. Excavation moderately difficult.				U Undisturbed Sample (U100) B Bulk Disturbed Sample D Disturbed Sample ES Environmental Sample EV Environmental Vial CBR Undisturbed CBR Mould W Water Sample	V Hand Vane Shear Test Cp Penetrometer CBR ▽ Groundwater First Encountered ▽ Standing Water Level K Soakaway Test Pp Pocket Penetrometer Test * Excavated Sample
Logged by HS		Checked by JR		Scale 1:50	Job Ref. 1964

Client E & JW GLENDINNING LTD	FREDERICK SHERRELL LTD CONSULTING ENGINEERING GEOLOGISTS AND GEOTECHNICAL ENGINEERS
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Site/Project Name LINHAY QUARRY - PROPOSED EXTENSION		Grid Ref.		Ground Level		TRIAL PIT TP04	
Method MECHANICAL EXCAVATION		Machine JCB 3CX		Dimensions 3.2m x 1.0m x 0.9m		Orientation 138°	
Date 13/07/2015							
Symbolic Log	Description	Depth (m)	Level (m)	Sample Test	Depth (m) of Sample or Test	Water	Test Result
	Soft brown, slightly silty, sandy CLAY with frequent roots (TOPSOIL).	0.30					
	Strong grey LIMESTONE. Slightly to moderately weathered. Recovered as angular cobbles and boulders with a little clayey gravel infill.	0.90					
	TRIAL PIT TERMINATED AT 0.90m DEPTH						
				Geological Structure			
				Depth (m)	Dip (degrees)	Dip Direction (degrees)	Description
Sketch Plan/Elevations				0.3	50°	152°	Bedding Joint Joint
				0.3	80°	20°	
				0.3	78°	290°	
Comments & Notes Ground slopes 3° Southwest. No groundwater encountered. Pit sides stable. Excavation difficult, refusal at 0.9m.				U Undisturbed Sample (U100) B Bulk Disturbed Sample D Disturbed Sample ES Environmental Sample EV Environmental Vial CBR Undisturbed CBR Mould W Water Sample V Hand Vane Shear Test Cp Penetrometer CBR ▽ Groundwater First Encountered ▽ Standing Water Level K Soakaway Test Pp Pocket Penetrometer Test * Excavated Sample			
Logged by HS		Checked by JR		Scale 1:50		Job Ref. 1964	
Client E & JW GLENDINNING LTD				FREDERICK SHERRELL LTD CONSULTING ENGINEERING GEOLOGISTS AND GEOTECHNICAL ENGINEERS			

Site/Project Name LINHAY QUARRY - PROPOSED EXTENSION		Grid Ref.		Ground Level		TRIAL PIT TP05	
Method MECHANICAL EXCAVATION		Machine JCB 3CX		Dimensions 3.2m x 1.0m x 2.7m		Orientation 148°	
Date 13/07/2015							

Symbolic Log	Description	Depth (m)	Level (m)	Sample Test	Depth (m) of Sample or Test	Water	Test Result
	Soft brown, slightly silty slightly gravelly CLAY with frequent roots (TOPSOIL).	0.20		B	1.00		
	Firm brown, slightly silty, slightly gravelly CLAY with occasional cobbles of limestone.						
	1.00m - Becoming stiff dark brown, slightly sandy, slightly gravelly CLAY with occasional cobbles of limestone.						
	Slightly clayey, angular to sub-angular COBBLES and BOULDERS of limestone.	2.30					
	TRIAL PIT TERMINATED AT 2.70m DEPTH	2.70					

Geological Structure			
Depth (m)	Dip (degrees)	Dip Direction (degrees)	Description

Sketch Plan/Elevations			

Comments & Notes Ground slopes 2° South. No groundwater encountered. Pit sides stable. Excavation moderately easy above 2.3m, refusal at 2.7m.				U Undisturbed Sample (U100) B Bulk Disturbed Sample D Disturbed Sample ES Environmental Sample EV Environmental Vial CBR Undisturbed CBR Mould W Water Sample				V Hand Vane Shear Test Cp Penetrometer CBR ▽ Groundwater First Encountered ▽ Standing Water Level K Soakaway Test Pp Pocket Penetrometer Test * Excavated Sample			
Logged by HS		Checked by JR		Scale 1:50		Job Ref. 1964					

Client E & JW GLENDINNING LTD	FREDERICK SHERRELL LTD CONSULTING ENGINEERING GEOLOGISTS AND GEOTECHNICAL ENGINEERS
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Site/Project Name LINHAY QUARRY - PROPOSED EXTENSION		Grid Ref.		Ground Level		TRIAL PIT TP06	
Method MECHANICAL EXCAVATION		Machine JCB 3CX		Dimensions 3.2m x 1.0m x 3.0m		Orientation 040°	
Date 13/07/2015							

Symbolic Log	Description	Depth (m)	Level (m)	Sample Test	Depth (m) of Sample or Test	Water	Test Result
	Soft brown, slightly silty, slightly gravelly CLAY with frequent roots (TOPSOIL).	0.20		V	0.30		85KPa
	Very stiff brown stained black, slightly gravelly CLAY with some cobbles of limestone.						
	1.70m - Becoming more gravelly.						
	2.30m - Becoming firm slightly gravelly CLAY.						
	TRIAL PIT TERMINATED AT 3.00m DEPTH	3.00					
				Geological Structure			
		Depth (m)	Dip (degrees)	Dip Direction (degrees)	Description		

Sketch Plan/Elevations							
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Comments & Notes Ground slopes 2° Southwest. No groundwater encountered. Pit sides stable. Excavation moderately difficult.				U Undisturbed Sample (U100) B Bulk Disturbed Sample D Disturbed Sample ES Environmental Sample EV Environmental Vial CBR Undisturbed CBR Mould W Water Sample				V Hand Vane Shear Test Cp Penetrometer CBR ▽ Groundwater First Encountered ▽ Standing Water Level K Soakaway Test Pp Pocket Penetrometer Test * Excavated Sample			
Logged by HS		Checked by JR		Scale 1:50		Job Ref. 1964					

Client E & JW GLENDINNING LTD	FREDERICK SHERRELL LTD CONSULTING ENGINEERING GEOLOGISTS AND GEOTECHNICAL ENGINEERS
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Site/Project Name LINHAY QUARRY - PROPOSED EXTENSION		Grid Ref.		Ground Level		TRIAL PIT TP07	
Method MECHANICAL EXCAVATION		Machine JCB 3CX		Dimensions 4.1m x 1.0m x 3.6m		Orientation 154°	
Date 14/07/215							

Symbolic Log	Description	Depth (m)	Level (m)	Sample Test	Depth (m) of Sample or Test	Water	Test Result
	Soft brown, slightly gravelly, silty CLAY with frequent roots (TOPSOIL).	0.20		V B D	0.40 0.70 3.20		>100KPa
	Very stiff brown, slightly gravelly, silty CLAY.	0.40					
	Very stiff orangish brown, gravelly CLAY. 0.80m - Becoming very stiff brown, slightly sandy, gravelly CLAY with occasional cobbles.						
	2.60m - With layers of stiff pale grey, slightly gravelly CLAY.						
TRIAL PIT TERMINATED AT 3.60m DEPTH		3.60					
				Geological Structure			
		Depth (m)	Dip (degrees)	Dip Direction (degrees)	Description		

Sketch Plan/Elevations							
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Comments & Notes Ground slopes 2° South. No groundwater encountered. Pit sides stable. Excavation moderately difficult below 2.0m.				U Undisturbed Sample (U100) B Bulk Disturbed Sample D Disturbed Sample ES Environmental Sample EV Environmental Vial CBR Undisturbed CBR Mould W Water Sample	V Hand Vane Shear Test Cp Penetrometer CBR ▽ Groundwater First Encountered ▼ Standing Water Level K Soakaway Test Pp Pocket Penetrometer Test * Excavated Sample
Logged by HS		Checked by JR		Scale 1:50	Job Ref. 1964

Client E & JW GLENDINNING LTD	FREDERICK SHERRELL LTD CONSULTING ENGINEERING GEOLOGISTS AND GEOTECHNICAL ENGINEERS
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Site/Project Name LINHAY QUARRY - PROPOSED EXTENSION		Grid Ref.		Ground Level		TRIAL PIT TP08	
Method MECHANICAL EXCAVATION		Machine JCB 3CX		Dimensions 3.5m x 1.0m x 3.2m		Orientation 040°	
Date 14/07/2015							

Symbolic Log	Description	Depth (m)	Level (m)	Sample Test	Depth (m) of Sample or Test	Water	Test Result
	Soft brown, slightly gravelly, silty CLAY with frequent roots (TOPSOIL).	0.20					
	Very stiff orangish brown, slightly silty, gravelly CLAY with some cobbles and frequent boulders of limestone upto 450mm diameter.						
	3.00m - Becoming very stiff, dark grey, gravelly CLAY.	3.20					
	<u>TRIAL PIT TERMINATED AT 3.20m DEPTH</u>						

Geological Structure			
Depth (m)	Dip (degrees)	Dip Direction (degrees)	Description

Sketch Plan/Elevations			

Comments & Notes Ground slopes 2° Southeast. No groundwater encountered. Pit sides unravelling above 1.8m. Excavation difficult below 2.6m.				U Undisturbed Sample (U100) B Bulk Disturbed Sample D Disturbed Sample ES Environmental Sample EV Environmental Vial CBR Undisturbed CBR Mould W Water Sample	V Hand Vane Shear Test Cp Penetrometer CBR ▽ Groundwater First Encountered ▽ Standing Water Level K Soakaway Test Pp Pocket Penetrometer Test * Excavated Sample
Logged by HS		Checked by JR	Scale 1:50	Job Ref. 1964	

Client E & JW GLENDINNING LTD	FREDERICK SHERRELL LTD CONSULTING ENGINEERING GEOLOGISTS AND GEOTECHNICAL ENGINEERS
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Site/Project Name LINHAY QUARRY - PROPOSED EXTENSION		Grid Ref.		Ground Level		TRIAL PIT TP09	
Method MECHANICAL EXCAVATION		Machine JCB 3CX		Dimensions 3.6m x 1.0m x 3.4m		Orientation 050°	
Date 14/07/2015							

Symbolic Log	Description	Depth (m)	Level (m)	Sample Test	Depth (m) of Sample or Test	Water	Test Result
	Soft brown, slightly gravelly, silty CLAY with frequent roots (TOPSOIL).	0.15		D	0.60		
	Very stiff orangish brown, slightly silty, slightly sandy, gravelly CLAY. 0.80m - Becoming very stiff dark grey, slightly gravelly CLAY.			D	1.80		
	TRIAL PIT TERMINATED AT 3.40m DEPTH	3.40					
				Geological Structure			
				Depth (m)	Dip (degrees)	Dip Direction (degrees)	Description

Sketch Plan/Elevations							
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Comments & Notes Ground slopes 2° Southeast. No groundwater encountered. Pit sides stable. Excavation easy.				U Undisturbed Sample (U100) B Bulk Disturbed Sample D Disturbed Sample ES Environmental Sample EV Environmental Vial CBR Undisturbed CBR Mould W Water Sample				V Hand Vane Shear Test Cp Penetrometer CBR ▽ Groundwater First Encountered ▽ Standing Water Level K Soakaway Test Pp Pocket Penetrometer Test * Excavated Sample			
Logged by HS		Checked by JR		Scale 1:50		Job Ref. 1964					

Client E & JW GLENDINNING LTD	FREDERICK SHERRELL LTD CONSULTING ENGINEERING GEOLOGISTS AND GEOTECHNICAL ENGINEERS		
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Site/Project Name LINHAY QUARRY - PROPOSED EXTENSION		Grid Ref.		Ground Level		TRIAL PIT TP10	
Method MECHANICAL EXCAVATION		Machine JCB 3CX		Dimensions 4.2m x 1.0m x 3.3m		Orientation 050°	
Date 14/07/2015							

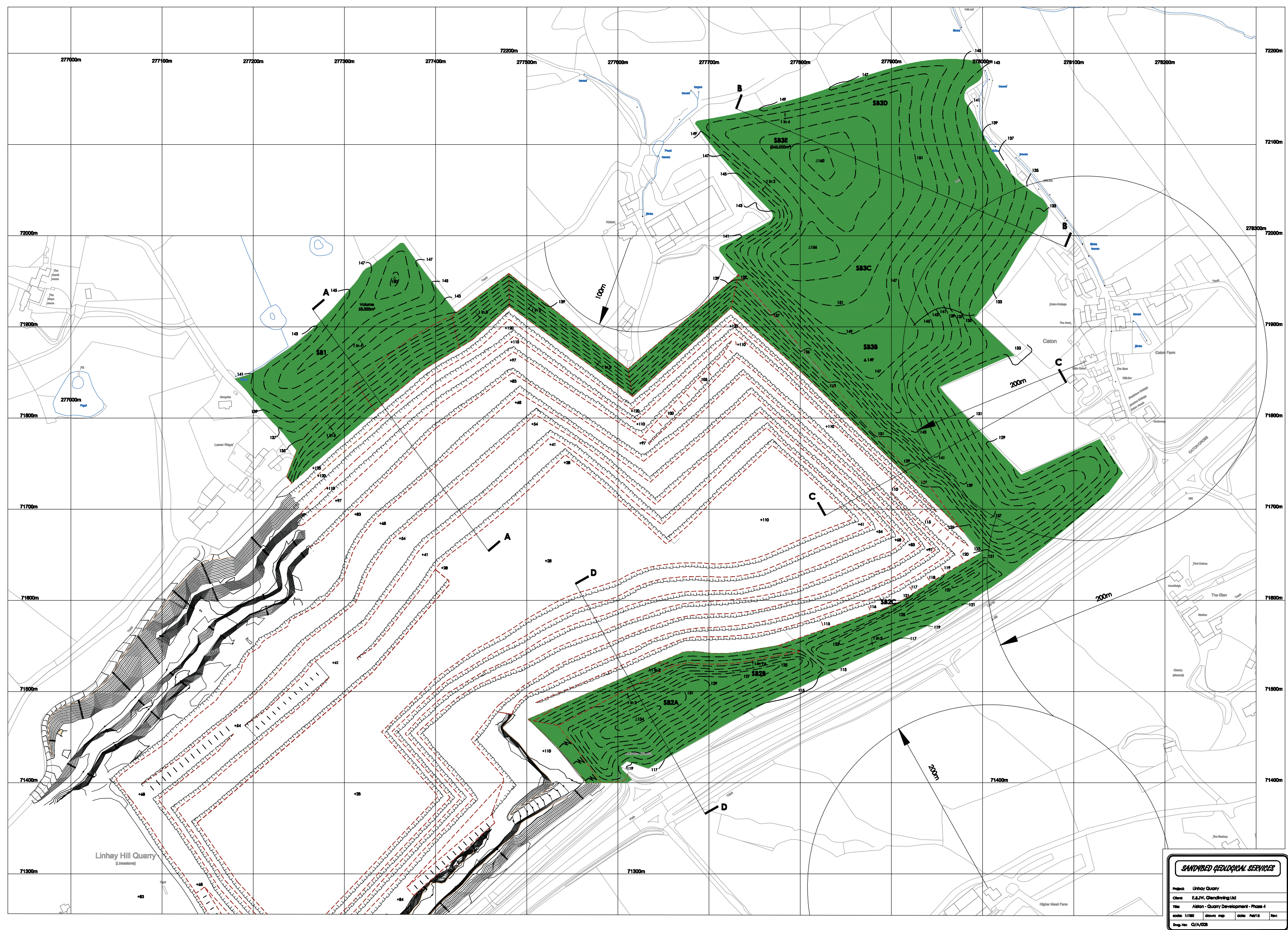
Symbolic Log	Description	Depth (m)	Level (m)	Sample Test	Depth (m) of Sample or Test	Water	Test Result
	Soft brown, slightly gravelly, silty CLAY with frequent roots (TOPSOIL).	0.20		D	2.30		
	Very stiff orangish brown slightly gravelly, slightly sandy CLAY with occasional cobbles of limestone.	1.60					
	Soft pale grey mottled orangish brown gravelly CLAY.	2.30					
	Pale grey stained orangish brown, very clayey, angular, fine to coarse GRAVEL of slate.	3.30					
TRIAL PIT TERMINATED AT 3.30m DEPTH							

Geological Structure			
Depth (m)	Dip (degrees)	Dip Direction (degrees)	Description

Sketch Plan/Elevations			

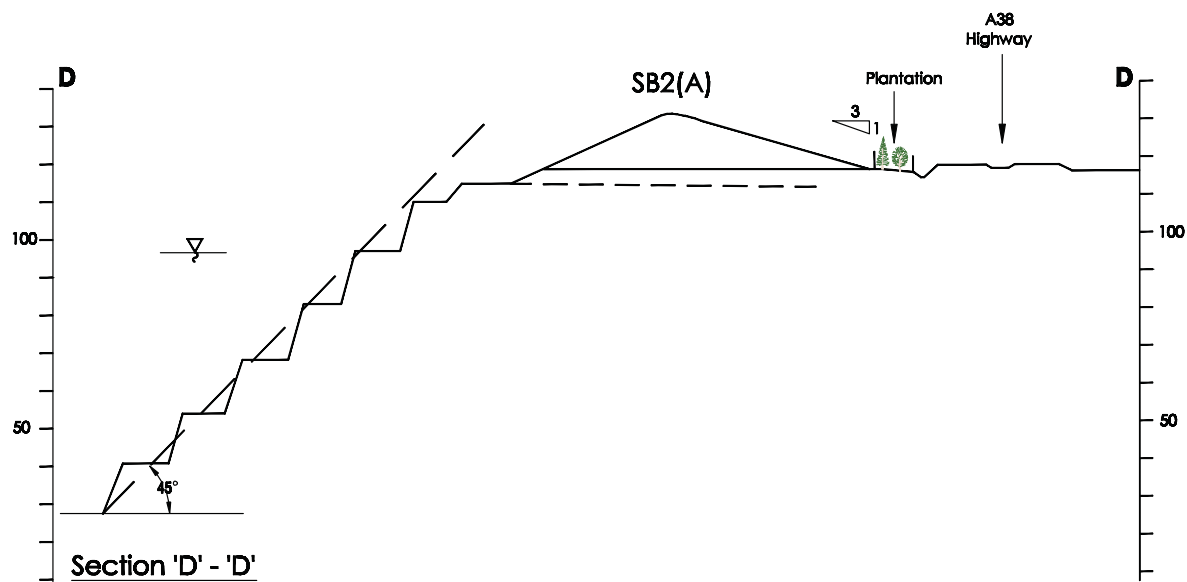
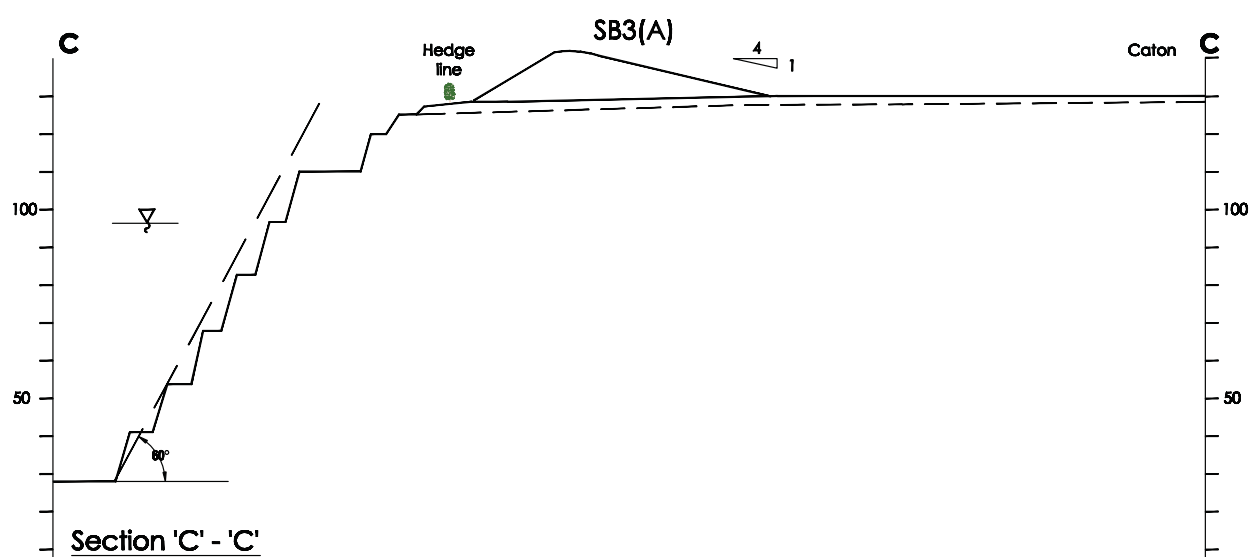
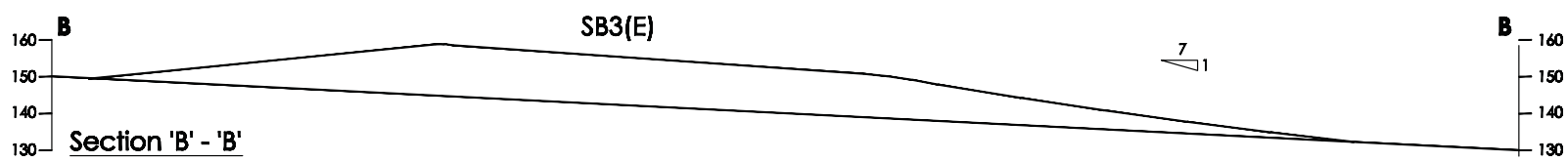
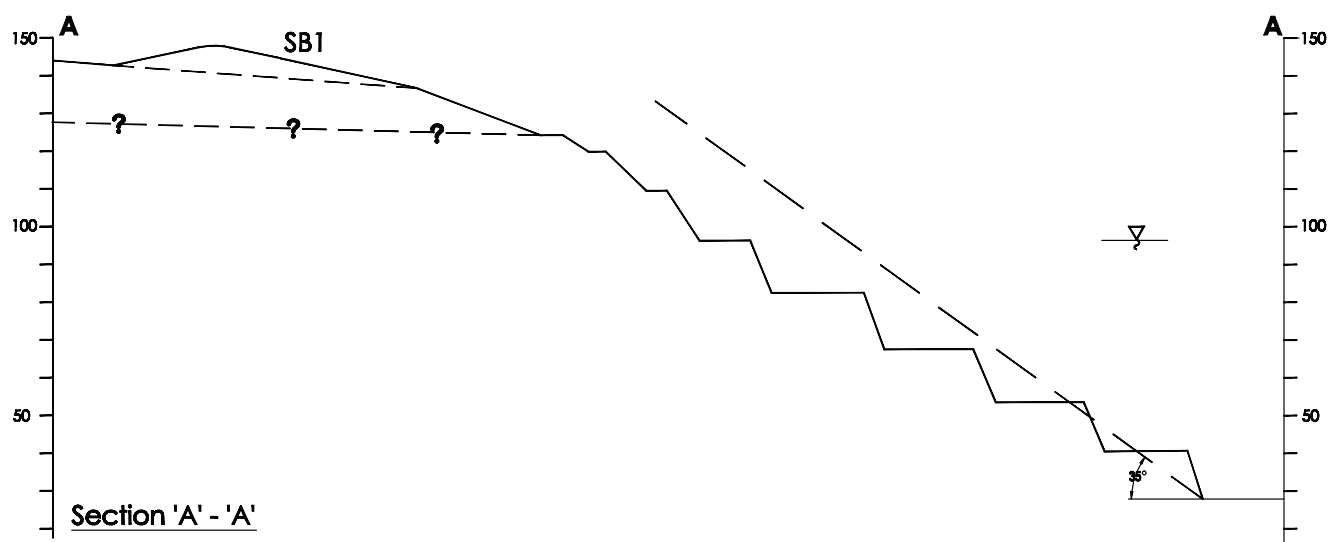
Comments & Notes Ground slopes 5° Southwest. Seepage of groundwater at 2.2m. Pit sides unravelling below 2.3m. Excavation difficult.				U Undisturbed Sample (U100) B Bulk Disturbed Sample D Disturbed Sample ES Environmental Sample EV Environmental Vial CBR Undisturbed CBR Mould W Water Sample				V Hand Vane Shear Test Cp Penetrometer CBR ▽ Groundwater First Encountered ▽ Standing Water Level K Soakaway Test Pp Pocket Penetrometer Test * Excavated Sample			
Logged by HS		Checked by JR		Scale 1:50		Job Ref. 1964					

Client E & JW GLENDINNING LTD	FREDERICK SHERRELL LTD CONSULTING ENGINEERING GEOLOGISTS AND GEOTECHNICAL ENGINEERS		
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SANDYBED GEOLOGICAL SERVICES

Project	Linhay Quarry		
Client	E.S.J.W. Glendinning Ltd		
Title	Aston - Quarry Development - Phase 4		
Scale	1:1130	drawn map	date
Drawn	Rev	date	Rev
Dwg. No: G/A/005			



SANDYBED GEOLOGICAL SERVICES

Project:	Linhay Quarry		
Client:	E.&J.W. Glendinning Ltd		
Title:	Alston - Quarry Development - Sections		
scale:	1:1000	drawn:	map
date:	Feb'15	Rev:	
Dwg. No:	G/A/009		

GENERAL NOTES

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Your Ref:

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Our Ref: JR.1964/1

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26th October 2015

E. & J. W. Glendinning Ltd.,
Glentor,
Ashburton,
Newton Abbot,
DEVON. TQ13 7LF

For the attention of Mr. Richard Webb

Dear Richard

Proposed Extension to Linhay Quarry

Further to our report of 1st September 2015 regarding proposed new tips adjacent to Linhay Quarry, we have reviewed the drainage requirements for the proposed tips. In our earlier report we recommended that a drainage blanket not less than 500mm thick should be constructed at the base of the tip following removal of topsoil and any soft soils. As an alternative consideration could be given to the installation of "herring-bone" drains at the base of the tip. The drains should be not less than 0.6m x 0.6m in cross-section and should comprise 150mm diameter perforated pipes with a surround of free-draining granular material such as "Type B" drainage material, as defined in Clause 505 of the Highways Agency Specification for Highway Works. The granular material should be fully wrapped in a geotextile separator such as Terram 1000. The principal carrier drains should be spaced not greater than 10m apart. The recommendations in our earlier report in relation to cut-off drains, horizontal drainage layers and the possible need for French drains locally remain.

We trust these notes are sufficient for your present purposes. If you have any queries or require any further information please do not hesitate to contact us.

Yours sincerely

for Frederick Sherrell Ltd



Jeremy Rickeard

Directors:

R.D.J. Gould, B.Sc., C.Geol., F.G.S.
J. Rickeard, B.Sc., A.R.S.M., C.Geol., F.G.S.