



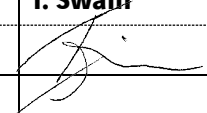
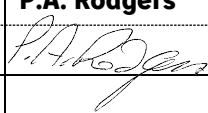
 **SOIL ENGINEERING**



REPORT QUALITY ASSURANCE SHEET

Title:

**REPORT ON A
 GROUND INVESTIGATION
 FOR
 NENTHEAD MINES PROPOSED MWTS, GI,
 NENTHEAD**

Report Status:	Description:	Date:	Compiled By:	Checked By:	Approved By:
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GROUND INVESTIGATION: NENTHEAD MINES PROPOSED MWTS, GI, NENTHEAD

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1.0 INTRODUCTION

In August 2019 Soil Engineering Geoservices Ltd were instructed by The Coal Authority (The Engineer and The Employer) to carry out a ground investigation at Nenthead and the adjacent scheduled ancient monument, a former metal mining site and museum. It is proposed to create a mine water treatment scheme at the site consisting of a pipeline, reedbeds and various treatment and pumping buildings. The investigation comprised the formation of cable percussion boreholes selectively extended by rotary drilling techniques together with trial pitting and dynamic sampling. An Archaeological watching brief was required throughout the works and PAS128 surveys were carried out at each location in advance of intrusive works.

This factual report presents the results of the fieldwork and laboratory testing undertaken together with information on the ground and groundwater conditions encountered. The fieldwork was carried out between 2nd and 20th September 2019.

2.0 PURPOSE, SCOPE AND REPORT FORMAT

2.1 Purpose

The purpose of this investigation was to determine the subsurface ground and groundwater conditions at the site of the proposed mine water treatment scheme. This information was obtained from a combination of intrusive investigation techniques and laboratory testing.

2.2 Scope of Work

The brief for this factual report comprised the following items:

1. To undertake a utilities scan at each exploratory hole position
2. To form exploratory holes on site.
3. To install gas and groundwater monitoring instruments.
4. To monitor on site installations.
5. To undertake laboratory tests on samples recovered from exploratory holes.

The sources of information used in the compilation of this report are detailed in the list of references on page 12.

2.3 Limitations

This report has been prepared in accordance with the project specification. Soil Engineering accepts no liability for any deficiencies in the report that arise from the specification's non-compliance with either European or British Standards. This particularly applies to exploratory hole spacings and depths and to the scope of laboratory testing.

It should be noted that the investigation data on which this report is based is only indicative of the actual ground, groundwater and ground gas conditions that exist at the locations of the exploratory holes and may not be representative of the conditions that exist on the site as a whole.

2.4 Report Format

This report is presented in the following format:

Factual information comprising: -

- Description of fieldwork
- Exploratory hole logs
- Laboratory test results
- Maps and plans
- Photographs
- Archaeological records

3.0 DESK STUDY INFORMATION

3.1 Scope of Study

A formal comprehensive (phase I) desk study was not requested by the Engineer for this investigation. The following sections however provide general details of site location and description, together with site geology as ascertained from published maps, papers, and memoirs together with details of any previous investigation carried out on the site.

3.2 Site Location and Description

The existing Mining Museum and scheduled ancient monument is located to the east north east of Nenthead in eastern Cumbria. The site is bounded to the north by the A689, to the south by the River Nent and to the east by Alston Moor. To the west of the site is the village of Nenthead

During the investigation, our engineer noted that the majority of the site comprised of hilly moorland terrain, comprising Alston Moor and the scheduled ancient monument of Nenthead Mine. The site rises from west to east. The terrain comprises of rough tracks and open moorland to the east and a carpark and mining museum with associated access to the west.

Site levels vary between approximately 577m AOD at the east end of the site and 437m AOD at the western end of the site.

The location of the site is indicated on Figure 1 in Section C of this report.

3.3 Geology

From the available information on the 1:50,000 scale Geological Survey map of the area¹ economic memoir² and detailed paper³ the site is shown to be underlain by the Stainmoore Member and the Alston Member of Carboniferous age with superficial deposits and peat being poorly mapped on the 1:50,000 scale mapping. All the beds are shown to be generally horizontal or shallowly dipping.

3.4 Previous Investigations

The Engineer has not made SEGL aware of any previous investigations on this site, however in April 2018 Soil Engineering carried out an investigation on this site consisting of four cable percussive boreholes. For further information reference should be made to the full report which is listed in the references of this report on page 13.

¹ Sheet 25: 1990, Solid and Drift edition for Alston

² North Pennine Orefield – Volume 1: Tyne to Stainmore. Memoire for sheets E19 and E25,

³ The Geology of NY74SE, Nenthead Cumbria S.M. Clarke

4.0 FIELDWORK

4.1 Scope of Fieldwork

The scope of the fieldwork was specified by the Engineer and was undertaken in general accordance with Eurocodes⁴ and, where there is no conflict, also with BS 5930⁵. Soil and rock logging has been undertaken in accordance with the relevant European Standards^{6,7,8} listed in the references for this report. In accordance with the specification and drawings provided by the Engineer, Soil Engineering were required to set out and survey the exploratory holes and to undertake the testing and sampling regime. Cable percussion boreholes selectively extended by rotary drilling were formed together with mechanically excavated trial pits and dynamically sampled boreholes. The exploratory hole locations are shown on the site plan presented in Section C of this report.

4.2 Ground Penetrating Radar Survey / Utility Detection

To allow the positive identification of any utilities or buried features on site prior to the formation of any exploratory hole, a category B PAS128 Survey was undertaken at each of the exploratory hole locations. These surveys were undertaken by Zetica Ltd, a specialist contractor. The survey comprised two types of non-intrusive geophysical mapping, Electromagnetic Ground conductivity (EM) and Ground Penetrating Radar (GPR). In addition, a desk top review, liaison with utility providers and site reconnaissance were also undertaken. The geophysical mapping covered a minimum 5m by 5m grid at each exploratory hole location.

A site sketch of each exploratory hole location was produced which indicated the location of any buried services encountered relative to the proposed exploratory hole location. Where buried services were located and found to obstruct the proposed exploratory hole, the position was relocated within the 5m by 5m grid.

4.3 Inspection Pits

In order to reduce the risk of damaging buried services, the location of each exploratory hole was scanned using a cable avoidance tool (CAT). As a further precaution, an inspection pit was hand excavated to a depth of 1.20m at each location, followed by a further scan of the base of each pit with the CAT.

4.4 Cable Percussion Boreholes

A total of five boreholes designated BH102R and BH103 to BH106 inclusive were formed to depths between 3.74m and 6.00m using conventional light cable percussion techniques together with 200mm and 150mm diameter temporary steel casings. The boreholes were all formed in order to obtain samples for laboratory testing and to provide geotechnical information for foundation design. Two of the boreholes were also used for the installation of gas monitoring wells and three for the installation of piezometers.

102mm nominal diameter open tube thin walled samples (UT100) were obtained at regular intervals throughout the boring operations where suitable cohesive materials were encountered. Where cohesive materials were found to be too stiff and / or had a high granular content, U100 sampling with an attendant reduction in sample quality was employed. All UT100 and U100 samples were sealed with wax to prevent moisture loss and were transported to the Leeds laboratory of Soil Engineering.

⁴ Eurocode 7 Part 2 (BS EN 1997-2: 2007)

⁵ BS 5930: 2015: Code of Practice for Site Investigation. British Standards Institution

⁶ BS EN ISO 14688-1: 2002: Geotechnical Investigation and testing – Identification and Classification of Soil – Part 1: Identification and Description.

⁷ BS EN ISO 14688-2: 2004 + A1: 2013: Geotechnical Investigation and testing – Identification and Classification of Soil – Part 2: Principles for a Classification

⁸ BS EN ISO 14689-1: 2003: Geotechnical Investigation and testing – Identification and Classification of Rock – Part 1: Identification and description.

In granular materials or where the presence of coarse material prevented the taking of open tube samples, Standard Penetration Tests⁹ were carried out using either a split spoon sampler or a solid 60° cone. The results of these tests are given as a Standard Penetration "N" value or as a blow count for a given penetration at the appropriate position on the borehole logs, where the use of either the sampler or cone is also recorded.

Representative disturbed samples of all materials encountered were obtained and these were placed in sealed containers for transport to the laboratory.

Where required, environmental samples were obtained for chemical testing.

The samples recovered from the boreholes were described by an Engineering Geologist, in accordance with the terminology presented in Appendix 1 of this report. A detailed description of all strata encountered, groundwater conditions and the position and type of samples taken are included on the borehole logs presented in Section A of this report.

4.5 Rotary Drilling

In order to obtain information on the solid geology beneath the site boreholes BH105 and BH107 inclusive were extended using rotary drilling techniques. These boreholes were extended to depths between 10.00m and 14.80m, using a PWF core barrel together with a protective semi rigid plastic liner and a Polycrystalline Diamond (PCD) core bit with water flush to produce cores of 92mm nominal diameter.

Details of the strata encountered are given on the borehole logs along with the Engineering Geologist's assessment of Total Core Recovery (TCR), Solid Core Recovery (SCR), and Rock Quality Designation (RQD) each expressed as a percentage of the individual core runs. Where applicable a fracture spacing (l_f) has also been determined and this information is given on the logs.

The symbols and abbreviations used on the rotary borehole logs are explained on the exploratory hole log legend and notation sheet presented in Section A of this report.

The core samples recovered were transported to the Leeds laboratory of Soil Engineering where they were photographed, sampled and described by an Engineering Geologist in accordance with the terminology presented in Appendix 1 of this report. The borehole logs are presented in Section A of this report and photographic records are presented in Section D of this report.

4.6 Dynamic Sampling

Sixteen dynamic sampling holes designated WS101 to WS109 inclusive WSBH101R, WSTP101, WSTP102, WSTP103, WSTP105, WSTP106 and WSTP107 were formed to depths between 1.50m and 4.10m using conventional equipment, which comprised 1.00m long steel cylinders with an internal plastic liner. The steel cylinders were repeatedly driven into the ground to progressive depths using rods connected to a handheld motor driven percussion hammer.

WSBH and WSTP holes were carried out with dynamic sampling equipment due to access restrictions or requirements to remain access past the location. This prevented the holes being completed by cable percussive (WSBH) or a tracked excavator (WSTP).

Disturbed representative samples of the strata being penetrated were recovered from the window sampler for geotechnical description and laboratory testing. The depths of the samples recovered are shown on the relevant exploratory hole logs presented in Section A of this report.

⁹ BS EN ISO 22476-3:2005 + A1: 2011: Geotechnical Investigation and Testing – Field Testing – Part 3: Standard Penetration Test.

4.7 Trial Pits

Twenty-two trial pits designated TP104 and TP108 to TP128 Inclusive were excavated using a 9T tracked excavator to depths between 0.50m and 3.00m. These trial pits were located around the site to provide a reasonable indication of the presence of any made ground and in particular to assess the mass soil fabric of the near surface natural deposits.

The trial pits were not shored and were logged from the surface by an Engineering Geologist. The Engineering Geologist provided a detailed description of the ground conditions encountered in each pit and also obtained disturbed soil samples at regular intervals for geotechnical and chemical analysis. The strata encountered in the trial pits are described on the trial pit logs presented in Section A of this report and the location of each of the trial pits is indicated on the site plan presented in Section C of this report. Trial pit photographs are included in Section D of this report

4.8 Installations

A slotted 50mm diameter UPVC tube was installed in each of boreholes BH102R, BH107, WS103, WS104 and WSBH101R. This tubing was slotted from the base of each borehole up to a depth of 0.50m with the slotted section being surrounded by pea gravel and the upper 0.50m being surrounded by a bentonite seal. A metal stopcock cover was concreted into place on each of the installations and a plastic cap with a gas valve was placed onto each tube to facilitate long-term groundwater and gas monitoring. A schematic of each installation is shown on the relevant borehole log presented in Section A of this report.

Casagrande type piezometers were installed in boreholes BH103, BH104 and BH106. These comprised a porous tip set within a sand cell of predetermined length. The sand cell or response zone was sealed with bentonite pellets and the piezometer tip was connected to ground level by a 19mm diameter UPVC tube. A metal stopcock cover was concreted into place at ground level to facilitate long term groundwater monitoring. A schematic of each installation is shown on the relevant borehole log presented in Section A of this report.

4.9 Groundwater and Gas Monitoring

In accordance with the Engineer's instruction monitoring of gas in boreholes BH102R, BH107, WS103, WS104 and WSBH101R and groundwater in boreholes BH103, BH104 and BH106 was carried out at weekly intervals for four weeks after completion of the site works. Monitoring for groundwater was carried out using a standard electronic dip meter and monitoring for methane, carbon dioxide, carbon monoxide, hydrogen sulphide and oxygen gases was carried out using a Geotechnical Instruments GA5000 gas analyser. Where practical, visits to site were made on days of low or falling barometric pressure in order to try to record the more onerous gas conditions. The results are presented in Section A of this report.

4.10 Archaeologists Report

AOC Archaeology Group was engaged as a subcontractor to Soil Engineering to undertake the role of Archaeological Clerk Of works, to investigate and produce a report on any evidence of Archaeological importance encountered during the siteworks. This involved a survey by the Archaeologist for evidence of historical remains as a watching brief during the removal of topsoil and the upper sections of superficial deposits in the trial pits and windowless samples. The AOC Archaeological report is included in Appendix 2 of this report.

5.0 LABORATORY TESTING

5.1 Scope of Testing

All geotechnical (soils) and chemical (environmental) testing was specified and scheduled by the Engineer. The scope of the testing was required to assist the Engineer in any geotechnical design to be made and in establishing any potential site contamination levels.

5.2 Geotechnical Soils Testing

The programme of laboratory testing was carried out in accordance with BS 1377¹⁰. The testing was carried out at the Leeds laboratory of Soil Engineering, a UKAS accredited testing laboratory No 1265.

Results are given on the summary sheets with individual test plots presented in Section B of this report.

In addition, chemical (sulfate and pH) testing was undertaken by DETS, a UKAS accredited testing laboratory No. 2139. Testing was undertaken in order to assess concrete requirements from BRE Special Digest No 1¹¹. Samples were prepared in general accordance with BS 1377, although final analysis of total sulfate was performed using ICP and aqueous extract using Ion Chromatography.

5.3 Environmental Testing

A programme of environmental testing was scheduled by the Engineer. Testing was carried out by DETS, a UKAS accredited testing laboratory No. 2139

Testing was carried out in accordance with the methods identified in the test reports.

The results of the environmental testing are presented in Section B of this report.

6.0 RESULTS OF THE INVESTIGATION

6.1 Scope of Commentary

The results of this investigation appear to broadly concur with the published geology summarised in Section 3.3 of this report and also with the information presented in the previous investigation carried out on this site and referenced in Section 3.4 of this report. The following sections are only intended to provide a summary of the ground conditions encountered during this investigation whilst the logs presented in Section A of this report give a detailed account of all the strata observed.

6.2 Made Ground

Made Ground was encountered in boreholes BH102R, BH104, and BH105 to depths between 1.00m and 4.60m and was comprised of clayey to very clayey sand and gravel or slightly sandy slightly gravelly clay. The sand and gravel was noted in BH102R located in the Nenthead mines carpark. The clay was noted on the open fells at the eastern end of the site.

Trial pits TP104, TP108, TP109 TP126, TP127, and TP128 located either in the Nenthead mines carpark and adjacent to access tracks located within the former historic mine areas encountered made ground between 0.50m and 2.05m in overall thickness. TP104 had the most significant thickness of made ground which comprised grey and brown very gravelly fine to coarse sand with high cobble content. Both the cobbles and gravel were noted to comprise wood, sandstone, and siltstone. Trial pit TP108 was terminated at 0.50m due to a possible feature associated with the historic mining activities carried out on the site.

Trial pits TP109 and TP127 both encountered a slightly sandy slightly gravelly clay to 1.90m and 1.30m

¹⁰ BS 1377: 1990: Parts 1 to 9: Methods of Test for Soils For Civil Engineering Purposes. British Standards Institution

¹¹ BRE Special Digest 1: 2005: Concrete in Aggressive Ground. BRE Construction Division.

respectively. Trial pits TP126 and TP128 encountered very gravelly and very clayey fine to coarse sand to depths between 0.45m and 0.55m respectively.

Window samples WS102, WS103, WS104, WS105, WSBH101R, WSTP102, WSTP103, WSTP105, WSTP106 and WSTP107 encountered made ground to depths between 0.50m and 3.10m, generally comprising a mixture of sands and gravels and clays associated with the historic activities on the site. In WSTP103, the remains of a wall were noted between 0.40m and 0.50m depth.

6.3 Superficial Deposits

Boreholes BH103 to BH106 inclusive encountered superficial deposits comprising soft to firm slightly sandy slightly gravelly clay to depths between 2.50m and 5.50m. BH103 encountered a layer of firm grey mottled brown slightly sandy slightly gravelly clay between ground level and 0.90m whilst from ground level in BH106 soft to firm slightly sandy slightly gravelly clay was found to 2.25m.

Below any made ground in the window samples, generally firm to stiff slightly sandy slightly gravelly clay was encountered. Where no made ground was present, soft to firm clay was noted. WS101 and WSTP101 both identified 0.50m and 0.85m respectively of clayey fine to coarse sand.

Trial pits TP110 to TP128 inclusive all encountered superficial deposits to depths between 0.90m and 3.00m and generally consisting of soft to firm becoming firm to stiff with depth slightly gravelly sandy clay. Trial pit TP125 found dark brownish grey very clayey very gravelly sand between ground level and 0.20m and trial pit TP126 found brown mottled orange very gravelly clayey fine to coarse sand between 0.45m and 1.25m.

6.4 Carboniferous Strata

Boreholes BH105 and BH107 were extended into rock. BH105 encountered medium strong thinly laminated light grey fine to coarse grained slightly sandy carbonaceous sandstone, underlain by a sequence of siltstones and mudstones to the base of each hole at depths of 14.80m and 10.00m respectively. In borehole BH105, a void was noted at depths between 11.20m and 13.30m.

6.5 Groundwater

Groundwater was encountered in WS101, WS106 and WS107 at various depths. A summary of exploratory hole groundwater inflows is given in Table 1 in Section A, whilst the logs presented in Section A of this report provide full details of all groundwater information.

6.6 Gas Monitoring

The results of the gas monitoring are presented in Section A of this report. The monitoring (which was carried out where possible during days of low or falling atmospheric pressure) produced no detectable methane, carbon dioxide levels were in the range 0.1% to 1.3% whilst oxygen levels were in the range 19.4% to 22.2%.

For and on behalf of
Soil Engineering Geoservices Ltd

M.P. Burton
Project Engineering Geologist

REPORT REFERENCES

1. BGS Sheet 25: 1990: 1:50,000 scale Alston. British Geological Survey.
2. BS EN 1997-2: 2007: Eurocode 7 – Geotechnical Design – Part 2: Ground Investigation and Testing
3. BS 5930: 2015: Code of Practice for Site Investigation. British Standards Institution
4. BS EN ISO 14688-1: 2002: Geotechnical Investigation and testing – Identification and Classification of Soil – Part 1: Identification and Description.
5. BS EN ISO 14688-2: 2004 + A1: 2013: Geotechnical Investigation and testing – Identification and Classification of Soil – Part 2: Principles for a Classification
6. BS EN ISO 14689-1: 2003: Geotechnical Investigation and testing – Identification and Classification of Rock – Part 1: Identification and description.
7. BS EN ISO 22476-3: 2005: + A1: 2011 Geotechnical Investigation and Testing – Field Testing – Part 3: Standard Penetration Test.
8. BS 1377: 1990: Parts 1 to 9: Methods of Test for Soils For Civil Engineering Purposes. British Standards Institution.
9. BRE Special Digest 1: 2005: Concrete in Aggressive Ground. BRE Construction Division.
10. ISRM 2007 The complete ISRM Suggested Methods for Rock Characterization, Testing and Monitoring: 1974-2006. Ulusay, R. and Hudson, J.A. (Eds).

Where any documents referenced above are subject to any amendment, then the latest version incorporating such amendment shall be deemed to apply, unless specifically stated otherwise.

For further information about the services provided by Soil Engineering Geoservices Limited, visit our website www.soil-engineering.co.uk

SUPPORTING FACTUAL DATA

SECTION A

Exploratory Hole Records and Field Data

EXPLORATORY HOLE LOG LEGEND AND NOTATION SHEET

SECTION A: EXPLORATORY HOLE LOG LEGENDS

CODE	DESCRIPTION	LEGEND	CODE	DESCRIPTION	LEGEND
101	Topsoil		806	Coal	
102	Made Ground		807	Breccia	
104	Concrete		808	Conglomerate	
201	Clay		809	Fine Grained Igneous	
301	Silt		810	Medium Grained Igneous	
401	Sand		811	Coarse Grained Igneous	
501	Gravel		812	Fine Grained Metamorphic	
601	Peat		813	Coarse / Medium Grained Metamorphic	
701	Cobbles		EVT	Evaporite	
730	Boulders		MWS	Mine Workings	
801	Mudstone		904	Grout	
802	Siltstone		905	Arisings	
803	Sandstone		BLK	Zone of No Recovery	
804	Limestone		WTR	Water	
805	Chalk				

Note: Most soils types comprise a mixture of particle sizes. These soil types are represented graphically on the exploratory hole logs by combining the legends shown on this sheet.

SECTION A: EXPLORATORY HOLE LOG LEGENDS

SAMPLING NOTATION

U	Undisturbed U100 or U38 sample (size given on log)
UT	Thin wall open drive tube sampler (size given on log)
P	Piston Sample
BLK	Block Sample
M	Mazier Sample
TW	Thin Walled Sample
L	Liner Sample obtained from windowless sampler
D	Small Disturbed Sample
B	Bulk Disturbed Sample
LB	Large Bulk Disturbed Sample
C	Core Sample
ES	Environmental Soil Sample
EW	Environmental Water Sample
W	Water Sample
UF	No Recovery in U Sample
UTF	No Recovery in UT Sample
PF	No Recovery in P Sample
TWF	No Recovery in TW Sample

IN SITU TEST NOTATION

SPT	Standard Penetration Test with a Split Spoon
SPT(C)	Standard Penetration Test with a Cone
C	Cone Penetration Test
NP	No Penetration for SPT or SPT(C)
V	Vane Test
HV	Hand Vane
HP	Hand Penetrometer
CBR	California Bearing Ratio Test
K	Permeability Test (test type not differentiated)
Pr	Pressuremeter Test

OTHER NOTATION

TCR	Total Core Recovery
SCR	Solid Core Recovery
RQD	Rock Quality Designation
FI	Fracture Index
If	Fracture Spacing
NI	Non Intact
NA	Data Not Applicable
NR	Data Not Recorded

GRAPHICS USED



Standing water level
Joining bar indicates level risen
Waterstrike level



SOIL engineering

SUPPORTING FACTUAL DATA

SECTION A

Exploratory Hole Records and Field Data

CABLE PERCUSSION AND ROTARY DRILLING RECORDS

Project Name Nenthead Mines - Proposed MWTS, GI	Exploratory Hole Log	Hole ID BH102R
Project No. TA8234		Sheet 1 of 1
Engineer Aecom		
Employer The Coal Authority		

Ground Level +437.97mOD	Coordinates 378120.33E, 543530.52N	Grid OSGB
Date Started 03/09/2019	Date Completed 03/09/2019	Inclination 90° from horizontal

Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit	Plant Used	Shoring Used	Pit Stability	Remarks
0.00	1.20	IP	03/09/2019 13:00	03/09/2019 13:40	BJ	MPB	NA	NA	Insulated Hand Tools	None used	Stable	0.50m x 0.50m x 1.20m
1.20	5.01	CP	03/09/2019 13:40	03/09/2019 17:30	BJ	MPB	NA	NA				

PROGRESS						WATER STRIKES						
Date Time	Depth	Depth Casing	Depth Water	Remarks		Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Time Elapsed	Remarks
03/09/2019 17:30	5.01	4.50	Dry	End of Hole								

CABLE PERCUSSION DETAILS						SPT DETAILS						
Depth Top	Depth Base	Time Start	Duration	Tool	Remarks	Depth Top	Test Type	Reported Result	Hammer Serial Number	Energy Ratio	Depth Casing	Depth Water
4.60	4.70	03/09/2019 09:45	01:00	Chisel	Chiselling	1.50	S	N=12 (2,3,2,3,4,3)	TS1	50	1.50	Dry
4.70	4.80	03/09/2019 10:45	01:00	Chisel	Chiselling	2.50	S	N=15 (5,4,3,3,4,5)	TS1	50	2.50	Dry
						3.50	S	N=10 (1,2,3,2,2,3)	TS1	50	3.00	Dry
						4.50	S	50/140mm (12,13/40,25,25/65)	TS1	50	4.50	Dry
						4.80	S	50/140mm (25/70,29,21/65)	TS1	50	4.50	Dry

ROTARY FLUSH DETAILS					
Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks

HOLE DIAMETER		CASING DIAMETER		DYNAMIC SAMPLING					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Diameter	Duration	Sample Recovery	Run Reference

INSTALLATION DETAILS						PIPE CONSTRUCTION						DEPTH RELATED REMARKS		
Distance	ID	Type	Response Top	Response Base	Pipe Ref	Pipe Ref	Top	Base	Diameter	Pipe Type	Depth Top	Depth Base	Remarks	
5.01	01	SP	1.00	5.01	01	01	0.00	1.00	50	PLAIN SLOTTED				
							1.00	5.00	50					

BACKFILL DETAILS				LOCATION DETAILS			
Depth Top	Depth Base	Description	Remarks	Remarks			
0.00	0.50	Concrete					
0.50	1.00	Bentonite					
1.00	5.01	Gravel backfill					

Project Name Nenthead Mines - Proposed MWTS, GI	Exploratory Hole Log	Hole ID BH103
Project No. TA8234		Sheet 1 of 1
Engineer Aecom		
Employer The Coal Authority		

Ground Level +491.95mOD	Coordinates 378680.48E, 543285.75N	Grid OSGB
Date Started 04/09/2019	Date Completed 04/09/2019	Inclination 90° from horizontal

Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit	Plant Used	Shoring Used	Pit Stability	Remarks
0.00	1.20	IP	04/09/2019 09:45	04/09/2019 10:00	BJ	MPB	NA	NA	Insulated Hand Tools	None used	Stable	0.50m x 0.50m x 1.20m
1.20	4.23	CP	04/09/2019 10:00	04/09/2019 14:15	BJ	MPB	NA	NA	Dando 2500			

PROGRESS						WATER STRIKES						
Date Time	Depth	Depth Casing	Depth Water	Remarks		Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Time Elapsed	Remarks
04/09/2019 14:15	4.23	4.10	Dry	End of Hole								

CABLE PERCUSSION DETAILS						SPT DETAILS								
Depth Top	Depth Base	Time Start	Duration	Tool	Remarks	Depth Top	Test Type	Reported Result			Hammer Serial Number	Energy Ratio	Depth Casing	Depth Water
4.10	4.20	04/09/2019 11:15	01:00	Chisel	Chiselling	2.50	S	N=20 (4,5,4,5,5,6)			TSI	50	2.50	Dry
						3.50	S	N=22 (4,7,6,6,5,5)			TSI	50	3.00	Dry
						4.10	S	50/20mm (25/20,50/20)			TSI	50	4.10	Dry
						4.20	S	50/20mm (25/10,50/20)			TSI	50	4.10	Dry

ROTARY FLUSH DETAILS					
Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks

HOLE DIAMETER		CASING DIAMETER		DYNAMIC SAMPLING					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Diameter	Duration	Sample Recovery	Run Reference
4.23	200	4.10	200						

INSTALLATION DETAILS						PIPE CONSTRUCTION					DEPTH RELATED REMARKS		
Distance	ID	Type	Response Top	Response Base	Pipe Ref	Pipe Ref	Top	Base	Diameter	Pipe Type	Depth Top	Depth Base	Remarks
4.10	01	SPIE	2.20	4.23	01	01	0.00	4.10	19	PLAIN			

BACKFILL DETAILS				LOCATION DETAILS			
Depth Top	Depth Base	Description	Remarks	Remarks			
0.00	0.50	Concrete					
0.50	2.20	Bentonite					
2.20	4.23	Sand backfill					

Project Name	Nenthead Mines - Proposed MWTS, GI		Exploratory Hole Log	Hole ID	BH103
Project No.	TA8234			Sheet 1 of 1	
Engineer	Aecom				
Employer	The Coal Authority				

Ground Level	+491.95mOD	Coordinates	378680.48E, 543285.75N	Grid	OSGB
Hole Type	IP+CP	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling		TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Installation
						Details	Dia.						
Firm grey mottled brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of sandstone, mudstone and siltstone.			(0.90)			ES 1 0.20							
Firm grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of sandstone, mudstone and siltstone.			0.90	491.05		ES 2 0.50 B 4 0.00-1.20							
from 2.50m firm sandy			(2.60)			ES 3 1.00							
						U 5 1.50-1.95	100	100	43			SPT(S) N=20 (4,5,4,5,5,6) 2.50	
						D 6 1.95-2.05 ES 7 2.00							
						D 8 2.25-2.50							
Extremely weak grey MUDSTONE. Recovered as grey subangular to subrounded fine to coarse gravel sized fragments.			3.50	488.45		D 9 2.50-2.95 B 10 2.50-3.00 ES 11 3.00						SPT(S) N=22 (4,7,6,6,5,5) 3.50	
			(0.60)			D 13 3.50-3.95 B 14 3.50-4.00							
Very hard yellow LIMESTONE. (Driller's description)			4.10	487.85		ES 15 4.00						SPT(S) 50/20mm (25/20,50/20) 4.10	
Complete at 4.23m. Termination Reason: Rockhead			4.23	487.72		D 16 4.10-4.20						SPT(S) 50/20mm (25/10,50/20) 4.20	

Project Name Nenthead Mines - Proposed MWTS, GI	Exploratory Hole Log	Hole ID BH104
Project No. TA8234		Sheet 1 of 1
Engineer Aecom		
Employer The Coal Authority		

Ground Level +502.77mOD	Coordinates 378788.32E, 543261.72N	Grid OSGB
Date Started 05/09/2019	Date Completed 05/09/2019	Inclination 90° from horizontal

Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit	Plant Used	Shoring Used	Pit Stability	Remarks
0.00	1.20	IP	05/09/2019 10:00	05/09/2019 10:10	BJ	MPB	NA	NA	Insulated Hand Tools	None used	Stable	0.50m x 0.50m x 1.20m
1.20	3.74	CP	05/09/2019 10:10	05/09/2019 14:20	BJ	MPB	NA	NA	Dando 2500			

PROGRESS						WATER STRIKES						
Date Time	Depth	Depth Casing	Depth Water	Remarks		Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Time Elapsed	Remarks
05/09/2019 14:20	3.74	3.50	Dry	End of Hole								

CABLE PERCUSSION DETAILS						SPT DETAILS								
Depth Top	Depth Base	Time Start	Duration	Tool	Remarks	Depth Top	Test Type	Reported Result			Hammer Serial Number	Energy Ratio	Depth Casing	Depth Water
3.20	3.50	05/09/2019 11:00	01:00	Chisel	Chiselling	2.50	S	N=40 (6,7,8,10,10,12)			TSI	50	2.50	Dry
						3.20	S	50/130mm (10,15/45,20,30/55)			TSI	50	3.20	Dry
						3.50	S	50/145mm (15,10/15,22,28/70)			TSI	50	3.20	Dry

ROTARY FLUSH DETAILS					
Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks

HOLE DIAMETER		CASING DIAMETER		DYNAMIC SAMPLING					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Diameter	Duration	Sample Recovery	Run Reference
3.74	200	3.50	200						

INSTALLATION DETAILS						PIPE CONSTRUCTION					DEPTH RELATED REMARKS		
Distance	ID	Type	Response Top	Response Base	Pipe Ref	Pipe Ref	Top	Base	Diameter	Pipe Type	Depth Top	Depth Base	Remarks
3.40	01	SPIE	1.50	3.74	01	01	0.00	3.40	19	PLAIN			

BACKFILL DETAILS				LOCATION DETAILS			
Depth Top	Depth Base	Description	Remarks	Remarks			
0.00	0.50	Concrete					
0.50	1.50	Bentonite					
1.50	3.74	Sand backfill					

Project Name	Nenthead Mines - Proposed MWTS, GI		Exploratory Hole Log	Hole ID	BH104
Project No.	TA8234			Sheet 1 of 1	
Engineer	Aecom				
Employer	The Coal Authority				

Ground Level	+502.77mOD	Coordinates	378788.32E, 543261.72N	Grid	OSGB
Hole Type	IP+CP	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling		TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Installation
						Details	Dia.						
MADE GROUND: Dark grey mottled orangish brown slightly sandy slightly gravelly clay. Sand sized fragments are fine to coarse. Gravel sized fragments are angular to subangular fine to coarse of sandstone and mudstone.			(1.00)			ES 1 0.20 D 3 0.50 ES 2 0.50 B 4 0.50-1.00							
Firm to stiff grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of sandstone, mudstone and siltstone.			1.00	501.77		ES 5 1.00							
Extremely weak thinly laminated grey mottled light brownish grey SILTSTONE. Recovered as grey slightly sandy slightly gravelly clay. Sand sized fragments are fine to coarse. Gravel sized fragments are angular to subangular fine to coarse.			(1.50)			U 6 1.50-1.95 B 7 1.50-2.00 ES 8 2.00 D 9 2.25	100	0	45				
			2.50	500.27		D 10 2.50-2.95 B 11 2.50-3.00 ES 12 3.00						SPT(S) N=40 (6,7,8,10,10,12) 2.50	
			(1.24)			D 13 3.20-3.45 D 14 3.50-3.74						SPT(S) 50/130mm (10,15/45,20,30/5 5) 3.20	
Complete at 3.74m. Termination Reason: Rockhead			3.74	499.03								SPT(S) 50/145mm (15,10/15,22,28/7 0) 3.50	

Project Name Nenthead Mines - Proposed MWTS, GI	Exploratory Hole Log	Hole ID BH105
Project No. TA8234		Sheet 1 of 1
Engineer Aecom		
Employer The Coal Authority		

Ground Level +505.48mOD	Coordinates 378804.35E, 543134.28N	Grid OSGB
Date Started 06/09/2019	Date Completed 16/09/2019	Inclination 90° from horizontal

Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit	Plant Used	Shoring Used	Pit Stability	Remarks
0.00	1.20	IP	06/09/2019 08:00	06/09/2019 09:00								
1.20	3.94	CP	06/09/2019 09:00	06/09/2019 12:45	BJ	MPB	NA	NA	Insulated Hand Tools	None used	Stable	
3.94	14.80	RC	12/09/2019 12:30	16/09/2019 11:00	BJ MW	MPB MO	NA PWF	NA PCD	Dando 2500 Comacchio 205-2			

PROGRESS						WATER STRIKES						
Date Time	Depth	Depth Casing	Depth Water	Remarks		Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Time Elapsed	Remarks
06/09/2019 12:45	3.94	3.40	Dry	End of Shift								
12/09/2019 12:30	3.94			Start of Shift								
12/09/2019 17:30	7.00	4.00	Dry	End of Shift								
13/09/2019 07:30	7.00	4.00	Dry	Start of Shift								
13/09/2019 16:30	11.20	4.00	Dry	End of Shift								
16/09/2019 07:30	11.20	4.00	Dry	Start of Shift								
16/09/2019 11:00	14.80	4.00	Dry	End of Hole								

CABLE PERCUSSION DETAILS						SPT DETAILS						
Depth Top	Depth Base	Time Start	Duration	Tool	Remarks	Depth Top	Test Type	Reported Result	Hammer Serial Number	Energy Ratio	Depth Casing	Depth Water
3.30	3.60	06/09/2019 10:20	01:00	Chisel	Chiselling	2.50	S	N=14 (2,3,3,4,4,3)	TSI	50	2.50	Dry
						3.30	S	50/150mm (11,14/65,25,25,0/0)	TSI	50	3.30	Dry
						3.60	C	100/150mm (25/40,50,50,0/0)	TSI	50	3.40	Dry

ROTARY FLUSH DETAILS					
Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks
3.60	14.80	WATER	0	NA	

HOLE DIAMETER		CASING DIAMETER		DYNAMIC SAMPLING					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Diameter	Duration	Sample Recovery	Run Reference
3.94	200	3.40	200						
14.80	101	14.80	140						

INSTALLATION DETAILS						PIPE CONSTRUCTION						DEPTH RELATED REMARKS		
Distance	ID	Type	Response Top	Response Base	Pipe Ref	Pipe Ref	Top	Base	Diameter	Pipe Type	Depth Top	Depth Base	Remarks	

BACKFILL DETAILS				LOCATION DETAILS			
Depth Top	Depth Base	Description	Remarks	Remarks			
0.00	14.80	Bentonite					



Ground Level +505.48mOD	Coordinates 378804.35E, 543134.28N	Grid OSGB
Hole Type IP+CP+RC	Inclination 90° from horizontal	

Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling		TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Installation
						Details	Dia.						
MADE GROUND: Brown slightly gravelly very sandy clay. Sand sized fragments are fine to coarse. Gravel sized fragments are subangular to subrounded fine to coarse of sandstone, limestone, siltstone and mudstone.			(1.95)			ES 1 0.20 ES 2 0.50 B 4 0.00-1.20 ES 3 1.00							
Brown very clayey fine to coarse SAND.			1.95	503.53		D 6 1.95-2.05 ES 7 2.00	100	100	56				
Firm brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of sandstone, mudstone and siltstone.			(0.55)	502.98		D 8 2.50-2.95 B 9 2.50-3.00 ES 10 3.00						SPT(S) N=14 (2,3,3,4,4,3) 2.50	
Strong fine grained pale grey SANDSTONE. Recovered as subangular fine to coarse gravel sized fragments.			(0.80)	502.18		D 11 3.30-3.59						SPT(S) 50/150mm (11,14/65,25,25,0/0) 3.30 SPT(C) 100/150mm (25/40,50,50,0/0) 3.60	
Strong light grey fine to coarse grained slightly sandy carbonaceous SANDSTONE with thin laminations of black mudstone. Discontinuities: 1) 0-10 degrees closely to medium spaced smooth undulating with orangish brown surface staining penetrating up to 20mm. Assumed zone of core loss. (Probable SANDSTONE).			(0.64)	501.54		C 1 3.60-5.00	101	55	26	25	NI 140 220		
Strong light grey fine to coarse grained slightly sandy carbonaceous SANDSTONE with thin laminations of black mudstone. Discontinuities: 1) 0-10 degrees closely spaced smooth undulating with orangish brown surface staining penetrating up to 20mm. Assumed zone of core loss. (Probable SANDSTONE).			(0.42)	501.12							NR		
Strong light grey fine to coarse grained slightly sandy carbonaceous SANDSTONE with thin laminations of black mudstone. Discontinuities: 1) 0-10 degrees closely spaced smooth undulating with orangish brown surface staining penetrating up to 20mm. Assumed zone of core loss. (Probable SANDSTONE).			(0.64)	500.48							NI 130		
Strong light grey fine to coarse grained slightly sandy carbonaceous SANDSTONE with thin laminations of black mudstone. Discontinuities: 1) 0-10 degrees closely spaced smooth undulating with orangish brown surface staining penetrating up to 20mm. Assumed zone of core loss. (Probable SANDSTONE).			(0.43)	500.05		C 2 5.00-6.00	101	43	7	0	NR		
Very weak thinly laminated black MUDSTONE. Discontinuities: 1) 0-15 degrees very closely to closely spaced rough undulating. from 6.00m to 6.25m extremely weak			(0.57)	499.48							NI 70 130		
from 6.80m to 7.00m assumed zone of core loss			(1.50)								NR		
from 7.00m to 7.45m non intact recovered as fine to coarse sand and gravel sized fragments											NI		
Weak dark grey brown fine to coarse grained SILTSTONE with thin laminations of black carbonaceous mudstone. Recovered as non intact fine to coarse sand, gravel and cobble sized fragments.			(0.75)	497.98		C 4 7.00-8.00	101	100	28	0	NI		
Medium strong brown fine to coarse grained SILTSTONE with thin laminations of black mudstone. Discontinuities: 1) 0-15 degrees closely spaced rough undulating with orangish brown surface staining. 2) 80-90 degrees closely spaced rough undulating with orange surface staining penetrating up to 50mm			(0.40)	497.23		C 5 8.00-9.00	101	86	6	0	NI 120 120		
Extremely weak thinly laminated dark grey MUDSTONE. Discontinuities: 1) 0-15 degrees very closely spaced rough undulating with brownish grey staining penetrating up to 30mm			(0.35)	496.83							NR		
from 8.90m to 9.00m assumed zone of core loss			(1.20)	496.48							NI 130 200		
Strong thinly light grey fine to coarse grained SILTSTONE with laminations of black mudstone. Discontinuities: 1) 0-15 degrees very closely to closely spaced smooth undulating with orangish brown staining. 2) 70-85 degrees very closely to closely spaced smooth						C 6 9.00-10.20	101	97	73	73			

Project Name	Nenthead Mines - Proposed MWTS, GI	Exploratory Hole Log	Hole ID
Project No.	TA8234		BH105
Engineer	Aecom		Sheet 2 of 2
Employer	The Coal Authority		

Ground Level	+505.48mOD	Coordinates	378804.35E, 543134.28N	Grid	OSGB
Hole Type	IP+CP+RC	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling				IF	In Situ Test Details	Installation											
						Details	Dia.	TCR/Sample Recovery %	SCR/Blows				RQD										
<p>Strong thinly light grey fine to coarse grained SILTSTONE with laminations of black mudstone. Discontinuities: 1) 0-15 degrees very closely to closely spaced smooth undulating with orangish brown staining. 2) 70-85 degrees very closely to closely spaced smooth undulating with orangish brown surface staining. from 9.70m to 9.85m recovered as soft orange to brown slightly sandy clay. Sand is fine to coarse (Highly weathered mudstone)</p> <p>Very weak dark grey fine to coarse grained SILTSTONE. Recovered as non intact fine to coarse sand, gravel and cobbles sized fragments.</p> <p>Extremely weak brown fine to coarse grained SANDSTONE. Recovered as non intact fine to coarse sand and gravel sized fragments.</p> <p>Extremely weak thinly laminated brown to dark grey MUDSTONE. Discontinuities: 1) 0-10 degrees closely spaced rough undulating. Assumed zone of core loss. (Probable MUDSTONE). VOID. (Possible Mine Workings)</p>			10.20	495.28		C 7 10.20-11.20	101	88	30	30													
			(0.30)																				
			10.50	494.98																			
			10.70	494.78																			
			10.90	494.58																			
			(0.30)																				
			11.20	494.28																			
			(2.10)																				
			13.30	492.18																			
			(0.70)																				
			14.00	491.48																			
			(0.80)																				
			14.80	490.68																			
Complete at 14.80m. Termination Reason: Achieved Scheduled Depth																							

Project Name Nenthead Mines - Proposed MWTS, GI										Exploratory Hole Log				Hole ID BH106	
Project No. TA8234															
Engineer Aecom															
Employer The Coal Authority														Sheet 1 of 1	
Ground Level +504.18mOD					Coordinates 378789.71E, 543077.10N					Grid OSGB					
Date Started 09/09/2019					Date Completed 09/09/2019					Inclination 90° from horizontal					
Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit	Plant Used	Shoring Used	Pit Stability	Remarks			
0.00 1.20	1.20 6.00	IP CP	09/09/2019 09:45 09/09/2019 10:00	09/09/2019 10:00 09/09/2019 12:30	BJ BJ	MPB MPB	NA NA	NA NA	Insulated Hand Tools Dando 2500	None used	Stable	0.50m x 0.50m x 1.20m			
PROGRESS							WATER STRIKES								
Date Time	Depth	Depth Casing	Depth Water	Remarks			Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Time Elapsed	Remarks		
09/09/2019 12:30	6.00	5.50	Dry	End of Hole											
CABLE PERCUSSION DETAILS							SPT DETAILS								
Depth Top	Depth Base	Time Start	Duration	Tool	Remarks		Depth Top	Test Type	Reported Result			Hammer Serial Number	Energy Ratio	Depth Casing	Depth Water
5.50	5.80	09/09/2019 11:20	01:00	Chisel	Chiselling		2.50 4.50 5.50 5.80	S S S C	N=15 (2,4,4,4,3) N=20 (4,5,4,4,5,7) 50/150mm (11,14,23,27,0/0) 50/135mm (25/60,28,22/60)			TSI TSI TSI TSI	50 50 50 50	2.50 4.50 5.50 5.50	Dry Dry Dry Dry
ROTARY FLUSH DETAILS															
Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks										
HOLE DIAMETER		CASING DIAMETER		DYNAMIC SAMPLING											
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Diameter	Duration	Sample Recovery	Run Reference						
6.00	150	5.50	150												
INSTALLATION DETAILS					PIPE CONSTRUCTION					DEPTH RELATED REMARKS					
Distance	ID	Type	Response Top	Response Base	Pipe Ref	Pipe Ref	Top	Base	Diameter	Pipe Type	Depth Top	Depth Base	Remarks		
5.70	01	SPIE	3.50	6.00	01	01	0.00	5.70	19	PLAIN					
BACKFILL DETAILS							LOCATION DETAILS								
Depth Top	Depth Base	Description			Remarks		Remarks								
0.00 0.50 3.50	0.50 3.50 6.00	Concrete Bentonite Sand backfill													
		Notes: All depth in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations see key.													
FINAL		Print date and time 17/01/2020 19:24					Log checked by MPB					SOIL ENGINEERING			
Form No. SIEXPHOLEHDR		Issue/Revision No. 2.02			Issue Date 22/06/2016					Part of the Bachy Soletanche Group					

Project Name	Nenthead Mines - Proposed MWTS, GI		Exploratory Hole Log	Hole ID	BH106
Project No.	TA8234			Sheet 1 of 1	
Engineer	Aecom				
Employer	The Coal Authority				

Ground Level	+504.18mOD	Coordinates	378789.71E, 543077.10N	Grid	OSGB
Hole Type	IP+CP	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling		TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Installation
						Details	Dia.						
Soft to firm brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of sandstone, mudstone and limestone. (Possible Reworked/Made Ground)			(2.25)			ES 2 0.20 ES 3 0.50 B 1 0.00-1.20 ES 4 1.00							
Firm greyish brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of sandstone, mudstone and limestone. from 2.50m with low cobble content. Cobbles are subangular to subrounded of limestone, sandstone and mudstone			2.25	501.93		D 8 2.25 D 9 2.50-2.95 B 10 2.50-3.00 ES 11 3.00 D 12 3.25		100	0	150		SPT(S) N=15 (2,4,4,4,3) 2.50	
Extremely weak to weak yellowish brown LIMESTONE. Recovered as subangular to subrounded fine to coarse gravel sized fragments.			(0.50)	498.68		D 16 4.25 D 17 4.50-4.95 B 18 4.50-5.00 ES 19 5.00		100	0	150		SPT(S) N=20 (4,5,4,4,5,7) 4.50	
Complete at 6.00m. Termination Reason: Rockhead			6.00	498.18		D 20 5.50-5.80						SPT(S) 50/150mm (11,14,23,27,0/0) 5.50 SPT(C) 50/135mm (25/60,28,22/60) 5.80	

Project Name Nenthead Mines - Proposed MWTS, GI	Exploratory Hole Log	Hole ID BH107
Project No. TA8234		Sheet 1 of 1
Engineer Aecom		
Employer The Coal Authority		

Ground Level +504.47mOD	Coordinates 378788.57E, 543110.99N	Grid OSGB
Date Started 16/09/2019	Date Completed 18/09/2019	Inclination 90° from horizontal

Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit	Plant Used	Shoring Used	Pit Stability	Remarks
0.00	4.50	RO	17/09/2019 08:00	17/09/2019 12:30	MW	MO	SWF		Comacchio 205-2			
4.50	10.00	RC	17/09/2019 12:30	18/09/2019 17:00	MW	MO	SWF		Comacchio 205-2			

PROGRESS						WATER STRIKES						
Date Time	Depth	Depth Casing	Depth Water	Remarks		Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Time Elapsed	Remarks
17/09/2019 16:30	6.50	5.00	Dry	End of Shift								
18/09/2019 12:30	6.50	5.00	Dry	Start of Shift								
25/09/2019 17:00	10.00	5.00	Dry	End of Hole								

CABLE PERCUSSION DETAILS						SPT DETAILS								
Depth Top	Depth Base	Time Start	Duration	Tool	Remarks	Depth Top	Test Type	Reported Result			Hammer Serial Number	Energy Ratio	Depth Casing	Depth Water

ROTARY FLUSH DETAILS					
Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks
4.50	10.00	WATER	0	NA	

HOLE DIAMETER		CASING DIAMETER		DYNAMIC SAMPLING					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Diameter	Duration	Sample Recovery	Run Reference

INSTALLATION DETAILS						PIPE CONSTRUCTION						DEPTH RELATED REMARKS		
Distance	ID	Type	Response Top	Response Base	Pipe Ref	Pipe Ref	Top	Base	Diameter	Pipe Type	Depth Top	Depth Base	Remarks	
4.00	01	SP	1.00	4.00	01	01	0.00	1.00	50	PLAIN SLOTTED				

BACKFILL DETAILS				LOCATION DETAILS			
Depth Top	Depth Base	Description	Remarks	Remarks			
0.00	1.00	Bentonite					
1.00	4.00	Gravel backfill					
4.00	10.00	Bentonite					

Project Name Nenthead Mines - Proposed MWTS, GI	Exploratory Hole Log	Hole ID BH107
Project No. TA8234		Sheet 2 of 2
Engineer Aecom		
Employer The Coal Authority		

Ground Level +504.47mOD	Coordinates 378788.57E, 543110.99N	Grid OSGB
Hole Type RO+RC	Inclination 90° from horizontal	

Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling		TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Installation
						Details	Dia.						
<p>Strong to extremely strong grey fine grained SANDSTONE. Discontinuities: 1) 0-10 degrees extremely closely to very closely spaced planar smooth. 2) 90 degrees extremely closely to closely spaced planar smooth from 9.70m to 9.80m extremely weak thinly laminated dark grey mudstone</p> <p>Extremely weak thinly laminated dark grey SILTSTONE. Discontinuities: 1) 0-10 degrees extremely closely to closely spaced planar smooth. from 9.86m to 9.98m recovered as non intact core (subangular to subrounded fine to coarse gravel sized fragments)</p> <p>Complete at 10.00m. Termination Reason: Achieved Scheduled Depth</p>													



SOIL engineering

SUPPORTING FACTUAL DATA

SECTION A

Exploratory Hole Records and Field Data

DYNAMIC SAMPLING RECORDS

Project Name Nenthead Mines - Proposed MWTS, GI	Exploratory Hole Log	Hole ID WS101
Project No. TA8234		Sheet 1 of 1
Engineer Aecom		
Employer The Coal Authority		

Ground Level +437.69mOD	Coordinates 37810961E, 54349652N	Grid OSGB
Date Started 09/09/2019	Date Completed 09/09/2019	Inclination 90° from horizontal

Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit	Plant Used	Shoring Used	Pit Stability	Remarks
0.00	1.20	IP	09/09/2019 13:30	09/09/2019 14:30	GC	MPB	NA	NA	Insulated Hand Tools	None used	Stable	0.50m x 0.50m x 1.20m
1.20	2.35	WLS	09/09/2019 14:30	09/09/2019 15:30	GC	MPB	NA	NA	Terrier			

PROGRESS						WATER STRIKES						
Date Time	Depth	Depth Casing	Depth Water	Remarks		Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Time Elapsed	Remarks
09/09/2019 15:30	2.35	0.00	1.50	End of Hole		16/09/2019 14:30	1.50	0.00		1.30	20	Not sealed

CABLE PERCUSSION DETAILS						SPT DETAILS								
Depth Top	Depth Base	Time Start	Duration	Tool	Remarks	Depth Top	Test Type	Reported Result			Hammer Serial Number	Energy Ratio	Depth Casing	Depth Water
						1.20	S	N=7 (2,2,2,2,1,2)			TDPS	58	0.00	Dry
						2.00	S	50/210mm (7,11,13,19,18/60)			TDPS	58	0.00	1.50

ROTARY FLUSH DETAILS					
Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks

HOLE DIAMETER		CASING DIAMETER		DYNAMIC SAMPLING					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Diameter	Duration	Sample Recovery	Run Reference
				1.20	2.00	90	00:10:00	20	1

INSTALLATION DETAILS						PIPE CONSTRUCTION					DEPTH RELATED REMARKS			
Distance	ID	Type	Response Top	Response Base	Pipe Ref	Pipe Ref	Top	Base	Diameter	Pipe Type	Depth Top	Depth Base	Remarks	

BACKFILL DETAILS				LOCATION DETAILS			
Depth Top	Depth Base	Description	Remarks	Remarks			
0.00	2.35	Bentonite					

Project Name	Nenthead Mines - Proposed MWTS, GI		Exploratory Hole Log	Hole ID	WS101
Project No.	TA8234			Sheet 1 of 1	
Engineer	Aecom				
Employer	The Coal Authority				

Ground Level	+437.69mOD	Coordinates	378109.61E, 543496.52N	Grid	OSGB
Hole Type	IP+WLS	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling		TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Installation
						Details	Dia.						
TOPSOIL.			0.05	437.64		D 1 0.10 ES 2 0.20							
Brown gravelly slightly clayey fine to coarse SAND. Gravel is subangular to subrounded fine to coarse of sandstone, mudstone and limestone.			(0.45)			B 3 0.20-0.50							
Firm to stiff brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of sandstone, mudstone and limestone.			0.50	437.19		D 5 0.50 ES 4 0.50							
Cobbles are subangular to subrounded fine to coarse of limestone and sandstone.			(0.40)			B 6 0.50-0.80							
Firm to stiff dark grey slightly sandy very gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mudstone.			0.90	436.79		D 7 0.90 ES 8 1.00							
Loose brown very clayey fine to coarse SAND and subangular to subrounded fine to coarse GRAVEL of sandstone.			(0.30)										
from 2.00m becomes dense			1.20	436.49	▼	D 10 1.20-1.65						SPT(S) N=7 (2,2,2,1,2) 1.20	
			(1.15)			B 9 1.00-2.20 L 11 1.20-2.00							
Complete at 2.35m. Termination Reason: Rockhead			2.35	435.34								SPT(S) 50/210mm (7,11,13,19,18/60) 2.00	

Project Name Nenthead Mines - Proposed MWTS, GI	Exploratory Hole Log	Hole ID WS102
Project No. TA8234		Sheet 1 of 1
Engineer Aecom		
Employer The Coal Authority		

Ground Level +437.79mOD	Coordinates 378114.54E, 543531.27N	Grid OSGB
Date Started 13/09/2019	Date Completed 13/09/2019	Inclination 90° from horizontal

Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit	Plant Used	Shoring Used	Pit Stability	Remarks
0.00	1.20	IP	13/09/2019 09:15	13/09/2019 10:15	GC	MO	NA	NA	Insulated Hand Tools	None used	Stable	
1.20	4.10	WLS	13/09/2019 10:30	13/09/2019 12:00	GC	MO	NA	NA	Terrier			

PROGRESS						WATER STRIKES						
Date Time	Depth	Depth Casing	Depth Water	Remarks		Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Time Elapsed	Remarks
13/09/2019 12:00	4.10	0.00	3.00	End of Hole								

CABLE PERCUSSION DETAILS						SPT DETAILS								
Depth Top	Depth Base	Time Start	Duration	Tool	Remarks	Depth Top	Test Type	Reported Result			Hammer Serial Number	Energy Ratio	Depth Casing	Depth Water
						1.20	S	N=5 (1,1,1,1,1,2)			TDPS	58	0.00	Dry
						2.00	S	N=7 (1,1,1,2,2,2)			TDPS	58	0.00	Dry
						3.00	S	N=34 (6,8,8,8,8,10)			TDPS	58	0.00	Dry
						3.90	S	50/125mm (25,0/0,27,23/50)			TDPS	58	0.00	Dry

ROTARY FLUSH DETAILS					
Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks

HOLE DIAMETER		CASING DIAMETER		DYNAMIC SAMPLING						
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Diameter	Duration	Sample Recovery	Run Reference	
				1.20	2.00	87	00:01:30	81	1	
				2.00	3.00	87	00:03:00	70	2	

INSTALLATION DETAILS						PIPE CONSTRUCTION					DEPTH RELATED REMARKS		
Distance	ID	Type	Response Top	Response Base	Pipe Ref	Pipe Ref	Top	Base	Diameter	Pipe Type	Depth Top	Depth Base	Remarks

BACKFILL DETAILS					LOCATION DETAILS						
Depth Top	Depth Base	Description			Remarks		Remarks				
0.00	4.10	Bentonite									

Project Name	Nenthead Mines - Proposed MWTS, GI		Exploratory Hole Log	Hole ID	WS102
Project No.	TA8234			Sheet 1 of 1	
Engineer	Aecom				
Employer	The Coal Authority				

Ground Level	+437.79mOD	Coordinates	378114.54E, 543531.27N	Grid	OSGB
Hole Type	IP+WLS	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling		TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Installation
						Details	Dia.						
MADE GROUND: Compacted stone (hardcore). (Driller's description)			0.10	437.69		D 1 0.10 ES 2 0.20 B 3 0.20-0.50 D 5 0.50 ES 4 0.50							
MADE GROUND: Dark grey slightly clayey fine to coarse sand sized fragments with high cobble content. Gravel sized fragments are angular to subrounded fine to coarse of limestone. Cobble sized fragments are angular to subrounded of limestone.			(0.95)										
Soft dark brown mottled light grey slightly gravelly sandy CLAY with high cobble and boulder content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of limestone and mudstone. Cobbles and boulders are angular to subangular of limestone.			1.05	436.74		ES 6 1.00 D 7 1.05 B 8 1.05-1.20 D 9 1.20-1.65 L 10 1.20-2.00						SPT(S) N=5 (1,1,1,1,1,2) 1.20	
			(1.45)			D 11 2.00-2.45						SPT(S) N=7 (1,1,1,2,2,2) 2.00	
Dense brown mottled orange and dark grey slightly clayey very gravelly fine to coarse SAND. Gravel is angular to subrounded fine to coarse of limestone. from 2.90m sand is medium to coarse			2.50	435.29		L 12 2.50-3.00						SPT(S) N=34 (6,8,8,8,8,10) 3.00	
			(1.60)			D 13 3.00-3.45 L 14 3.00-3.90							
from 3.90m to 4.10m limestone and siltstone cobbles present - angular to subrounded			4.10	433.69		D 15 3.90-4.10						SPT(S) 50/125mm (25,0/0,27,23/50) 3.90	
Complete at 4.10m. Termination Reason: Rockhead													

Project Name Nenthead Mines - Proposed MWTS, GI	Exploratory Hole Log	Hole ID WS103
Project No. TA8234		Sheet 1 of 1
Engineer Aecom		
Employer The Coal Authority		

Ground Level +490.58mOD	Coordinates 378663.61E, 543288.00N	Grid OSGB
Date Started 12/09/2019	Date Completed 12/09/2019	Inclination 90° from horizontal

Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit	Plant Used	Shoring Used	Pit Stability	Remarks
0.00	1.20	IP	12/09/2019 12:45	12/09/2019 13:30	GC	MO	NA	NA	Insulated Hand Tools	None used	Stable	0.50m x 0.50m x 1.20m
1.20	3.10	WLS	12/09/2019 13:45	12/09/2019 15:15	GC	MO	NA	NA	Terrier			

PROGRESS						WATER STRIKES						
Date Time	Depth	Depth Casing	Depth Water	Remarks		Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Time Elapsed	Remarks
12/09/2019 15:15	3.10	0.00	Dry	End of Hole								

CABLE PERCUSSION DETAILS						SPT DETAILS								
Depth Top	Depth Base	Time Start	Duration	Tool	Remarks	Depth Top	Test Type	Reported Result			Hammer Serial Number	Energy Ratio	Depth Casing	Depth Water
						1.20	S	N=11 (2,2,2,3,3,3)			TDPS	58	0.00	Dry
						2.00	S	N=25 (2,3,8,6,4,7)			TDPS	58	0.00	Dry
						2.80	S	50/150mm (7,8,16,34,0/0)			TDPS	58	0.00	Dry

ROTARY FLUSH DETAILS					
Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks

HOLE DIAMETER		CASING DIAMETER		DYNAMIC SAMPLING						
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Diameter	Duration	Sample Recovery	Run Reference	
				1.20	2.00	87	00:02:30	69	1	
				2.00	2.80	77	00:10:00	75	2	

INSTALLATION DETAILS						PIPE CONSTRUCTION					DEPTH RELATED REMARKS		
Distance	ID	Type	Response Top	Response Base	Pipe Ref	Pipe Ref	Top	Base	Diameter	Pipe Type	Depth Top	Depth Base	Remarks
2.80	01	SP	1.00	2.80	01	01	0.00	1.00	50	PLAIN SLOTTED			

BACKFILL DETAILS				LOCATION DETAILS			
Depth Top	Depth Base	Description	Remarks	Remarks			
0.00	0.50	Concrete					
0.50	1.00	Bentonite					
1.00	3.10	Gravel backfill					

Project Name Nenthead Mines - Proposed MWTS, GI	Exploratory Hole Log	Hole ID WS104
Project No. TA8234		Sheet 1 of 1
Engineer Aecom		
Employer The Coal Authority		

Ground Level +494.67mOD	Coordinates 378717.59E, 543276.30N	Grid OSGB
Date Started 12/09/2019	Date Completed 12/09/2019	Inclination 90° from horizontal

Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit	Plant Used	Shoring Used	Pit Stability	Remarks
0.00 1.20	1.20 3.25	IP WLS	12/09/2019 09:30 12/09/2019 10:30	20/09/2019 10:15 12/09/2019 12:00	GC GC	MO MO	NA NA	NA NA	Insulated Hand Tools Terrier	None used	Stable	0.50m x 0.50m x 1.20m

PROGRESS						WATER STRIKES						
Date Time	Depth	Depth Casing	Depth Water	Remarks		Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Time Elapsed	Remarks
12/09/2019 12:00	3.25	0.00	Dry	End of Hole								

CABLE PERCUSSION DETAILS						SPT DETAILS								
Depth Top	Depth Base	Time Start	Duration	Tool	Remarks	Depth Top	Test Type	Reported Result			Hammer Serial Number	Energy Ratio	Depth Casing	Depth Water
						1.20	S	N=18 (5,4,8,3,4,3)			TDPS	58	0.00	Dry
						1.70	S	N=15 (1,2,2,3,4,6)			TDPS	58	0.00	Dry
						2.40	S	N=22 (3,5,5,5,5,7)			TDPS	58	0.00	Dry
						3.20	S	50/10mm (25/40,50/10)			TDPS	58	0.00	Dry

ROTARY FLUSH DETAILS					
Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks

HOLE DIAMETER		CASING DIAMETER		DYNAMIC SAMPLING					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Diameter	Duration	Sample Recovery	Run Reference
				1.20	1.70	87	00:07:00	100	1
				1.70	2.40	87	00:07:00	93	2
				2.40	3.20	77	00:10:00	63	3

INSTALLATION DETAILS						PIPE CONSTRUCTION					DEPTH RELATED REMARKS		
Distance	ID	Type	Response Top	Response Base	Pipe Ref	Pipe Ref	Top	Base	Diameter	Pipe Type	Depth Top	Depth Base	Remarks
3.20	01	SP	1.00	3.20	01	01	0.00	1.00	50	PLAIN SLOTTED			

BACKFILL DETAILS				LOCATION DETAILS			
Depth Top	Depth Base	Description	Remarks	Remarks			
0.00	0.50	Concrete					
0.50	1.00	Bentonite					
1.00	3.25	Gravel backfill					

Ground Level +494.67mOD	Coordinates 378717.59E, 543276.30N	Grid OSGB
Hole Type IP+WLS	Inclination 90° from horizontal	

Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling		TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Installation
						Details	Dia.						
TOPSOIL			0.10	494.57		D 1 0.10 ES 2 0.20							
MADE GROUND: Light brown mottled dark grey and orange slightly gravelly sandy clay with high cobble content. Sand sized fragments are fine to coarse. Gravel sized fragments are angular to subrounded fine to coarse of limestone and sandstone. Cobble sized fragments are angular to subrounded of limestone and sandstone.			(0.40)			B 3 0.20-0.50 D 4 0.50 ES 5 0.50 B 6 0.50-0.80							
MADE GROUND: Dark grey mottled orangish brown slightly gravelly sandy clay with medium cobble content. Sand sized fragments are fine to coarse. Gravel sized fragments are angular to subrounded fine to coarse of limestone and sandstone. Cobble sized fragments are angular to subangular of limestone and sandstone.			(0.50)	494.17		D 7 1.00 ES 8 1.00							
Firm dark grey mottled dark orangish brown slightly gravelly sandy CLAY with medium cobble and boulder content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of limestone and sandstone. Cobbles and boulders are angular to subangular of sandstone and limestone.			1.00	493.67		D 9 1.20-1.65 L 10 1.20-1.70 D 11 1.20-2.15						SPT(S) N=18 (5,4,8,3,4,3) 1.20	
from 2.40m less orange mottling			(2.25)			L 12 1.70-2.40						SPT(S) N=15 (1,2,2,3,4,6) 1.70	
Complete at 3.25m. Termination Reason: Achieved Scheduled Depth			3.25	491.42		D 13 2.40-2.85 L 14 2.40-3.20						SPT(S) N=22 (3,5,5,5,5,7) 2.40	
						D 15 3.20-3.25						SPT(S) 50/10mm (25/40,50/10) 3.20	

Project Name Nenthead Mines - Proposed MWTS, GI	Exploratory Hole Log	Hole ID WS105
Project No. TA8234		Sheet 1 of 1
Engineer Aecom		
Employer The Coal Authority		

Ground Level +504.32mOD	Coordinates 378796.06E, 543191.49N	Grid OSGB
Date Started 11/09/2019	Date Completed 12/09/2019	Inclination 90° from horizontal

Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit	Plant Used	Shoring Used	Pit Stability	Remarks
0.00	1.20	IP	11/09/2019 16:15	11/09/2019 17:15	GC	MO	NA	NA	Insulated Hand Tools	None used	Stable	0.50m x 0.50m x 1.20m
1.20	3.40	WLS	12/09/2019 07:30	12/09/2019 09:15	GC	MO	NA	NA	Terrier			

PROGRESS						WATER STRIKES						
Date Time	Depth	Depth Casing	Depth Water	Remarks		Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Time Elapsed	Remarks
12/09/2019 09:15	3.40	0.00	0.10	End of Hole								

CABLE PERCUSSION DETAILS						SPT DETAILS						
Depth Top	Depth Base	Time Start	Duration	Tool	Remarks	Depth Top	Test Type	Reported Result	Hammer Serial Number	Energy Ratio	Depth Casing	Depth Water
						1.20	S	N=4 (1,1,1,1,1,1)	TDPS	58	0.00	0.10
						2.00	S	N=12 (2,1,2,2,3,5)	TDPS	58	0.00	0.10
						3.00	S	48/275mm (8,10,12,12,14,10/50)	TDPS	58	0.00	0.10

ROTARY FLUSH DETAILS					
Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks

HOLE DIAMETER		CASING DIAMETER		DYNAMIC SAMPLING					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Diameter	Duration	Sample Recovery	Run Reference
				1.20	2.00	87	00:02:00	60	1
				2.00	3.00	77	00:03:00		2



INSTALLATION DETAILS						PIPE CONSTRUCTION					DEPTH RELATED REMARKS		
Distance	ID	Type	Response Top	Response Base	Pipe Ref	Pipe Ref	Top	Base	Diameter	Pipe Type	Depth Top	Depth Base	Remarks

BACKFILL DETAILS				LOCATION DETAILS			
Depth Top	Depth Base	Description	Remarks	Remarks			
0.00	3.40	Bentonite					

Project Name	Nenthead Mines - Proposed MWTS, GI	Exploratory Hole Log	Hole ID
Project No.	TA8234		WS105
Engineer	Aecom		Sheet 1 of 1
Employer	The Coal Authority		

Ground Level	+504.32mOD	Coordinates	378796.06E, 543191.49N	Grid	OSGB
Hole Type	IP+WLS	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling		TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Installation
						Details	Dia.						
TOPSOIL			0.10	504.22		D 1 0.10 ES 2 0.20 B 3 0.20-0.50 ES 4 0.50							
MADE GROUND: Dark brown slightly gravelly sandy clay with low cobble content. Sand sized fragments are fine to coarse. Gravel sized fragments are angular to subrounded fine to coarse of limestone. Cobble sized fragments are angular to subrounded of limestone.			(1.10)										
Soft dark grey mottled orangish brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of limestone. from 1.65m less mottled			1.20	503.12		D 5 1.00 ES 6 1.00 D 7 1.20-1.65 L 8 1.20-2.00						SPT(S) N=4 (1,1,1,1,1) 1.20	
Firm dark grey mottled brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of limestone. from 3.00m to 3.40m very stiff			2.10	502.22		D 9 2.00-2.45 B 10 2.00-3.00						SPT(S) N=12 (2,1,2,2,3,5) 2.00	
			(1.30)										
Complete at 3.40m. Termination Reason: Achieved Scheduled Depth			3.40	500.92		D 11 3.00-3.40						SPT(S) 48/275mm (8,10,12,12,14,10/ 50) 3.00	

Project Name Nenthead Mines - Proposed MWTS, GI										Exploratory Hole Log			Hole ID WS106	
Project No. TA8234													Sheet 1 of 1	
Engineer Aecom														
Employer The Coal Authority														
Ground Level +504.91mOD					Coordinates 378797.19E, 543127.83N					Grid OSGB				
Date Started 11/09/2019					Date Completed 11/09/2019					Inclination 90° from horizontal				
Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit	Plant Used	Shoring Used	Pit Stability	Remarks		
0.00 1.20	1.20 3.05	IP WLS	11/09/2019 13:30 11/09/2019 14:30	11/09/2019 14:30 11/09/2019 15:45	GC GC	MO MO	NA NA	NA NA	Insulated Hand Tools Terrier	None used	Stable	0.50m x 0.50m x 1.20m		
PROGRESS						WATER STRIKES								
Date Time	Depth	Depth Casing	Depth Water	Remarks		Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Time Elapsed	Remarks		
11/09/2019 15:45	3.05	0.00	1.00	End of Hole		11/09/2019 14:30	1.20	0.00		1.00	20			
CABLE PERCUSSION DETAILS						SPT DETAILS								
Depth Top	Depth Base	Time Start	Duration	Tool	Remarks	Depth Top	Test Type	Reported Result			Hammer Serial Number	Energy Ratio	Depth Casing	Depth Water
						1.20	S	N=18 (2,2,2,4,6,6)			TDPS	58	0.00	1.00
						1.70	S	N=18 (8,5,3,4,5,6)			TDPS	58	0.00	1.00
						2.70	S	50/200mm (8,8,12,17,21/50)			TDPS	58	0.00	1.00
ROTARY FLUSH DETAILS														
Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks									
HOLE DIAMETER		CASING DIAMETER		DYNAMIC SAMPLING										
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Diameter	Duration	Sample Recovery	Run Reference					
				1.20	1.70	89	00:10:00	50	1					
				1.70	2.70	79	00:10:00	80	2					
INSTALLATION DETAILS				PIPE CONSTRUCTION						DEPTH RELATED REMARKS				
Distance	ID	Type	Response Top	Response Base	Pipe Ref	Pipe Ref	Top	Base	Diameter	Pipe Type	Depth Top	Depth Base	Remarks	
BACKFILL DETAILS						LOCATION DETAILS								
Depth Top	Depth Base	Description			Remarks		Remarks							
0.00	3.05	Bentonite												
 Notes: All depth in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations see key.												 SOIL ENGINEERING Part of the Bachy Soletanche Group		
FINAL				Print date and time 17/01/2020 19:25				Log checked by MPB						
Form No. SIEXPHOLEHDR				Issue/Revision No. 2.02				Issue Date 22/06/2016						

Project Name	Nenthead Mines - Proposed MWTS, GI		Exploratory Hole Log	Hole ID	WS106	
Project No.	TA8234	Engineer		Aecom	Employer	The Coal Authority
Sheet 1 of 1						

Ground Level	+504.91mOD	Coordinates	378797.19E, 543127.83N	Grid	OSGB
Hole Type	IP+WLS	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling		TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Installation
						Details	Dia.						
TOPSOIL Soft dark brown slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of limestone. Cobbles are angular to subangular of limestone.			0.10 (0.70)	504.81		D 1 0.10 ES 2 0.20 B 3 0.20-0.50 ES 4 0.50							
Soft to firm dark grey mottled orange slightly gravelly sandy CLAY with high cobble content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of limestone. Cobbles are angular to subangular of limestone.			0.80 (0.40)	504.11		D 5 0.80 B 6 0.80-1.20 ES 7 1.00						SPT(S) N=18 (2,2,2,4,6,6) 1.20	
Firm brown slightly gravelly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of limestone. Cobbles are angular to subangular of limestone. from 1.70m to 2.15m dark brown mottled black from 1.70m to 2.70m dark brown			1.20 (1.85)	503.71		D 8 1.20-1.65 L 9 1.20-1.70 D 10 1.70-2.15 L 11 1.70-2.70						SPT(S) N=18 (8,5,3,4,5,6) 1.70	
from 2.70m to 3.05m dark grey to dark brown mottled orange			3.05	501.86		D 12 2.70-3.05						SPT(S) 50/200mm (8,8,12,17,21/50) 2.70	
Complete at 3.05m. Termination Reason: Achieved Scheduled Depth													

Project Name Nenthead Mines - Proposed MWTS, GI	Exploratory Hole Log	Hole ID WS107
Project No. TA8234		Sheet 1 of 1
Engineer Aecom		
Employer The Coal Authority		

Ground Level +504.47mOD	Coordinates 378788.57E, 543110.99N	Grid OSGB
Date Started 11/09/2019	Date Completed 11/09/2019	Inclination 90° from horizontal

Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit	Plant Used	Shoring Used	Pit Stability	Remarks
0.00	1.20	IP	11/09/2019 10:45	11/09/2019 11:15	GC	MO	NA	NA	Insulated Hand Tools	None used	Stable	0.50m x 0.50m x 1.20m
1.20	3.40	WLS	11/09/2019 11:15	11/09/2019 13:00	GC	MO	NA	NA	Terrier			

PROGRESS						WATER STRIKES						
Date Time	Depth	Depth Casing	Depth Water	Remarks		Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Time Elapsed	Remarks
11/09/2019 13:00	3.40	0.00	0.80	End of Hole		11/09/2019 11:00	1.00	0.00		0.80	20	

CABLE PERCUSSION DETAILS						SPT DETAILS						
Depth Top	Depth Base	Time Start	Duration	Tool	Remarks	Depth Top	Test Type	Reported Result	Hammer Serial Number	Energy Ratio	Depth Casing	Depth Water
						1.20	S	N=10 (2,2,2,2,3,3)	TDPS	58	0.00	0.80
						2.00	S	N=31 (6,7,7,7,8,9)	TDPS	58	0.00	0.80
						3.00	S	58/290mm (6,7,8,15,17,18/65)	TDPS	58	0.00	0.80

ROTARY FLUSH DETAILS					
Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks

HOLE DIAMETER		CASING DIAMETER		DYNAMIC SAMPLING					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Diameter	Duration	Sample Recovery	Run Reference
				1.20	2.00	89	00:10:00	75	1
				2.00	3.00	79	00:10:00	15	2

INSTALLATION DETAILS						PIPE CONSTRUCTION						DEPTH RELATED REMARKS		
Distance	ID	Type	Response Top	Response Base	Pipe Ref	Pipe Ref	Top	Base	Diameter	Pipe Type	Depth Top	Depth Base	Remarks	

BACKFILL DETAILS				LOCATION DETAILS			
Depth Top	Depth Base	Description	Remarks	Remarks			
0.00	3.40	Bentonite					

Project Name Nenthead Mines - Proposed MWTS, GI	Exploratory Hole Log	Hole ID WS108
Project No. TA8234		Sheet 1 of 1
Engineer Aecom		
Employer The Coal Authority		

Ground Level +503.95mOD	Coordinates 378785.17E, 543089.31N	Grid OSGB
Date Started 10/09/2019	Date Completed 11/09/2019	Inclination 90° from horizontal

Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit	Plant Used	Shoring Used	Pit Stability	Remarks
0.00	1.20	IP	10/09/2019 16:30	03/09/2019 17:15	GC	MO	NA	NA	Insulated Hand Tools	None used	Stable	0.50m x 0.50m x 1.20m
1.20	3.10	WLS	11/09/2019 09:20	11/09/2019 10:30	GC	MO	NA	NA	Terrier			

PROGRESS						WATER STRIKES						
Date Time	Depth	Depth Casing	Depth Water	Remarks		Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Time Elapsed	Remarks
10/09/2019 17:15	1.20	0.00	0.00	End of Shift								
11/09/2019 09:20	1.20	0.00	0.00	Start of Shift								
11/09/2019 10:30	3.10	0.00	0.00	End of Hole								

CABLE PERCUSSION DETAILS						SPT DETAILS						
Depth Top	Depth Base	Time Start	Duration	Tool	Remarks	Depth Top	Test Type	Reported Result	Hammer Serial Number	Energy Ratio	Depth Casing	Depth Water
						1.20	S	N=6 (2,2,1,1,2,2)	TDPS	58	0.00	0.00
						2.00	S	N=26 (4,5,5,6,8,7)	TDPS	58	0.00	0.00
						2.70	S	50/265mm (8,10,12,14,16,8/40)	TDPS	58	0.00	0.00

ROTARY FLUSH DETAILS					
Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks

HOLE DIAMETER		CASING DIAMETER		DYNAMIC SAMPLING					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Diameter	Duration	Sample Recovery	Run Reference
				1.20	2.00	89	00:04:00	45	1
				2.00	2.70	79	00:08:00	70	2

INSTALLATION DETAILS						PIPE CONSTRUCTION						DEPTH RELATED REMARKS		
Distance	ID	Type	Response Top	Response Base	Pipe Ref	Pipe Ref	Top	Base	Diameter	Pipe Type	Depth Top	Depth Base	Remarks	

BACKFILL DETAILS				LOCATION DETAILS			
Depth Top	Depth Base	Description	Remarks	Remarks			
0.00	3.10	Bentonite					

Project Name	Nenthead Mines - Proposed MWTS, GI		Exploratory Hole Log	Hole ID	WS108
Project No.	TA8234			Sheet 1 of 1	
Engineer	Aecom				
Employer	The Coal Authority				

Ground Level	+503.95mOD	Coordinates	378785.17E, 543089.31N	Grid	OSGB
Hole Type	IP+WLS	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling		TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Installation
						Details	Dia.						
TOPSOIL			0.10	503.85		D 1 0.10 ES 2 0.20 B 3 0.20-0.50 ES 4 0.50							
Soft dark brown mottled orangish brown slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of sandstone. Cobbles are angular to subangular of limestone.			(0.65)										
Loose dark brown very clayey very gravelly fine to coarse SAND. Gravel is angular to subangular fine to coarse of limestone.			0.75	503.20		D 5 1.00 ES 6 1.00 B 7 1.00-1.20 D 8 1.20-1.65 L 9 1.20-2.00						SPT(S) N=6 (2,2,1,1,2,2) 1.20	
			(0.95)										
Stiff dark brown mottled grey slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of limestone.			1.70	502.25		D 10 2.00-2.45 L 11 2.00-2.70						SPT(S) N=26 (4,5,5,6,8,7) 2.00	
			(1.40)										
			3.10	500.85		D 12 2.70-3.10						SPT(S) 50/265mm (8,10,12,14,16,8/40) 2.70	
Complete at 3.10m. Termination Reason: Rockhead													

Project Name Nenthead Mines - Proposed MWTS, GI	Exploratory Hole Log	Hole ID WS109
Project No. TA8234		Sheet 1 of 1
Engineer Aecom		
Employer The Coal Authority		

Ground Level +502.52mOD	Coordinates 378777.40E, 543060.48N	Grid OSGB
Date Started 10/09/2019	Date Completed 11/09/2019	Inclination 90° from horizontal

Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit	Plant Used	Shoring Used	Pit Stability	Remarks
0.00	1.20	IP	10/09/2019 15:45	10/09/2019 16:30	GC	MO	NA	NA	Insulated Hand Tools	None used	Stable	0.50m x 0.50m x 1.20m
1.20	3.30	WLS	11/09/2019 07:30	11/09/2019 09:10	GC	MO	NA	NA	Terrier			

PROGRESS						WATER STRIKES						
Date Time	Depth	Depth Casing	Depth Water	Remarks		Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Time Elapsed	Remarks
10/09/2019 16:30	1.20	0.00	0.65	End of Shift								
11/09/2019 07:30	1.20	0.00	0.65	Start of Shift								
11/09/2019 09:10	3.30	0.00	1.50	End of Hole								

CABLE PERCUSSION DETAILS						SPT DETAILS						
Depth Top	Depth Base	Time Start	Duration	Tool	Remarks	Depth Top	Test Type	Reported Result	Hammer Serial Number	Energy Ratio	Depth Casing	Depth Water
						1.20	S	N=6 (1,0,1,1,2,2)	TDPS	58	0.00	0.65
						2.00	S	N=20 (2,2,3,2,8,7)	TDPS	58	0.00	0.70
						3.00	S	50/140mm (13,12/60,26,24/65)	TDPS	58	0.00	1.30

ROTARY FLUSH DETAILS					
Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks

HOLE DIAMETER		CASING DIAMETER		DYNAMIC SAMPLING					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Diameter	Duration	Sample Recovery	Run Reference
				1.20	2.00	89	00:05:00	60	1
				2.00	3.00	79	00:07:30	55	2

INSTALLATION DETAILS						PIPE CONSTRUCTION						DEPTH RELATED REMARKS		
Distance	ID	Type	Response Top	Response Base	Pipe Ref	Pipe Ref	Top	Base	Diameter	Pipe Type	Depth Top	Depth Base	Remarks	

BACKFILL DETAILS				LOCATION DETAILS			
Depth Top	Depth Base	Description	Remarks	Remarks			
0.00	3.30	Bentonite					

Project Name	Nenthead Mines - Proposed MWTS, GI		Exploratory Hole Log	Hole ID	WS109
Project No.	TA8234			Sheet 1 of 1	
Engineer	Aecom				
Employer	The Coal Authority				

Ground Level	+502.52mOD	Coordinates	378777.40E, 543060.48N	Grid	OSGB
Hole Type	IP+WLS	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling		TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Installation
						Details	Dia.						
TOPSOIL Soft dark grey mottled orangish brown slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of sandstone and limestone. Cobbles are angular to subangular of sandstone and limestone.			0.10 (1.00)	502.42		D 1 0.10 ES 2 0.20 B 3 0.20-0.50 D 4 0.50 ES 5 0.50							
Soft to firm dark brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of limestone.			1.10 (1.20)	501.42		D 7 1.00 ES 6 1.00 D 8 1.20-1.65 L 9 1.20-2.00						SPT(S) N=6 (1,0,1,1,2,2) 1.20	
Dark brown very gravelly very clayey fine to coarse SAND. Gravel is angular to subangular fine to coarse of limestone. from 3.00m mottled orange and light grey			2.30 (1.00)	500.22		D 10 2.00-2.45 L 11 2.00-3.00						SPT(S) N=20 (2,2,3,2,8,7) 2.00	
Complete at 3.30m. Termination Reason: Achieved Scheduled Depth			3.30	499.22		D 12 3.00-3.30						SPT(S) 50/140mm (13,12/60,26,24/65) 3.00	

Project Name Nenthead Mines - Proposed MWTS, GI	Exploratory Hole Log	Hole ID WSBH101R
Project No. TA8234		Sheet 1 of 1
Engineer Aecom		
Employer The Coal Authority		

Ground Level +437.92mOD	Coordinates 378108.75E, 543501.76N	Grid OSGB
Date Started 09/09/2019	Date Completed 09/09/2019	Inclination 90° from horizontal

Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit	Plant Used	Shoring Used	Pit Stability	Remarks
0.00	1.20	IP	09/09/2019 15:45	10/09/2019 08:30	GC	MO	NA	NA	Insulated Hand Tools	None used	Stable	0.50m x 0.50m x 1.20m
1.20	2.30	WLS	10/09/2019 09:20	10/09/2019 09:50	GC	MO	NA	NA	Terrier			

PROGRESS						WATER STRIKES						
Date Time	Depth	Depth Casing	Depth Water	Remarks		Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Time Elapsed	Remarks
09/09/2019 17:00	0.80	0.00	Dry	End of Shift								
10/09/2019 07:45	0.80	0.00	Dry	Start of Shift								
10/09/2019 09:50	2.30	0.00	Dry	End of Hole								

CABLE PERCUSSION DETAILS						SPT DETAILS							
Depth Top	Depth Base	Time Start	Duration	Tool	Remarks	Depth Top	Test Type	Reported Result		Hammer Serial Number	Energy Ratio	Depth Casing	Depth Water
						1.20	S	N=27 (6,7,6,8,7,6)		TDPS	58	0.00	Dry
						2.00	S	N=50 (4,12,12,12,14,12)		TDPS	58	0.00	Dry

ROTARY FLUSH DETAILS					
Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks

HOLE DIAMETER		CASING DIAMETER		DYNAMIC SAMPLING					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Diameter	Duration	Sample Recovery	Run Reference
				1.20	2.00		00:30:00	50	1

INSTALLATION DETAILS						PIPE CONSTRUCTION					DEPTH RELATED REMARKS		
Distance	ID	Type	Response Top	Response Base	Pipe Ref	Pipe Ref	Top	Base	Diameter	Pipe Type	Depth Top	Depth Base	Remarks
2.30	01	SP	1.00	2.30	01	01	0.00	1.00	50	PLAIN SLOTTED			

BACKFILL DETAILS				LOCATION DETAILS			
Depth Top	Depth Base	Description	Remarks	Remarks			
0.00	0.50	Concrete					
0.50	1.00	Bentonite					
1.00	2.30	Gravel backfill					

Project Name	Nenthead Mines - Proposed MWTS, GI	Exploratory Hole Log	Hole ID	WSBH101R
Project No.	TA8234		Sheet 1 of 1	
Engineer	Aecom			
Employer	The Coal Authority			

Ground Level	+437.92mOD	Coordinates	378108.75E, 543501.76N	Grid	OSGB
Hole Type	IP+WLS	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling		TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Installation
						Details	Dia.						
<p>TOPSOIL.</p> <p>MADE GROUND: Dark brown very sandy angular to subrounded fine to coarse gravel sized fragments of sandstone and siltstone with high cobble content. Sand sized fragments are fine to coarse. Cobble sized fragments are angular to subangular of sandstone and siltstone. from 0.35m to 0.50m clayey</p> <p>Firm dark brown mottled orange and light grey slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of sandstone. Cobbles are angular to subangular of sandstone.</p> <p>Large sandstone BOULDERS. (Driller's description)</p> <p>Medium dense clayey angular to subangular fine to coarse GRAVEL of sandstone, siltstone, limestone and mudstone.</p>			0.05 (0.45)	437.87		D 1 0.10 ES 2 0.20 B 3 0.20-0.50							
			0.50 (0.30)	437.42		D 4 0.50 ES 5 0.50 B 6 0.50-0.80							
			0.80	437.12		D 7 1.00 ES 8 1.00							
			1.00	436.92		D 9 1.20-1.65 ES 10 1.20-2.00						SPT(S) N=27 (6,7,6,8,7,6) 1.20	
			(1.30)			D 10 1.20-2.00							
			2.30	435.62		B 12 2.00-2.30 D 11 2.00-2.45						SPT(S) N=50 (4,12,12,12,14,12) 2.00	
Complete at 2.30m. Termination Reason: Rockhead													

Project Name Nenthead Mines - Proposed MWTS, GI	Exploratory Hole Log	Hole ID WSTP101
Project No. TA8234		Sheet 1 of 1
Engineer Aecom		
Employer The Coal Authority		

Ground Level +437.82mOD	Coordinates 378107.75E, 543505.69N	Grid OSGB
Date Started 10/09/2019	Date Completed 10/09/2019	Inclination 90° from horizontal

Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit	Plant Used	Shoring Used	Pit Stability	Remarks
0.00 1.20	1.20 2.00	IP WLS	10/09/2019 10:10 10/09/2019 11:10	10/09/2019 11:10 10/09/2019 12:30	GC GC	MPB MPB	NA NA	NA NA	Insulated Hand Tools Terrier	None used	Stable	0.50m x 0.50m x 1.20m

PROGRESS						WATER STRIKES						
Date Time	Depth	Depth Casing	Depth Water	Remarks		Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Time Elapsed	Remarks
10/09/2019 12:30	2.00	0.00	Dry	End of Hole								

CABLE PERCUSSION DETAILS						SPT DETAILS								
Depth Top	Depth Base	Time Start	Duration	Tool	Remarks	Depth Top	Test Type	Reported Result			Hammer Serial Number	Energy Ratio	Depth Casing	Depth Water
						1.20	S	N=26 (3,4,6,7,4,9)			TDPS	58	0.00	Dry
						1.75	S	50/165mm (12,13/50,22,23,5/15)			TDPS	58	0.00	Dry

ROTARY FLUSH DETAILS					
Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks

HOLE DIAMETER		CASING DIAMETER		DYNAMIC SAMPLING						
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Diameter	Duration	Sample Recovery	Run Reference	
				1.20	2.00	90	00:10:00	35	1	

INSTALLATION DETAILS						PIPE CONSTRUCTION					DEPTH RELATED REMARKS			
Distance	ID	Type	Response Top	Response Base	Pipe Ref	Pipe Ref	Top	Base	Diameter	Pipe Type	Depth Top	Depth Base	Remarks	

BACKFILL DETAILS					LOCATION DETAILS						
Depth Top	Depth Base	Description			Remarks		Remarks				
0.00	2.00	Bentonite									

Project Name Nenthead Mines - Proposed MWTS, GI	Exploratory Hole Log	Hole ID WSTP101
Project No. TA8234		Sheet 1 of 1
Engineer Aecom		
Employer The Coal Authority		

Ground Level +437.82mOD	Coordinates 378107.75E, 543505.69N	Grid OSGB
Hole Type IP+WLS	Inclination 90° from horizontal	

Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling		TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Installation
						Details	Dia.						
TOPSOIL. Brown clayey fine to coarse SAND and subangular to subrounded fine to coarse GRAVEL of sandstone, mudstone and siltstone.			0.05 (0.80)	437.77		D 1 0.10 ES 2 0.20 B 3 0.20-0.50 ES 4 0.50							
Stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of sandstone, mudstone, siltstone and limestone.			0.85 (1.15)	436.97		D 5 0.85 ES 7 1.00 B 6 0.85-1.20 D 8 1.20-1.65 L 9 1.20-1.75 D 10 1.75-2.00						SPT(S) N=26 (3,4,6,7,4,9) 1.20 SPT(S) 50/165mm (12,13/50,22,23,5/ 15) 1.75	
Complete at 2.00m. Termination Reason: Achieved Scheduled Depth			2.00	435.82									

Project Name Nenthead Mines - Proposed MWTS, GI	Exploratory Hole Log	Hole ID WSTP102
Project No. TA8234		Sheet 1 of 1
Engineer Aecom		
Employer The Coal Authority		

Ground Level +437.87mOD	Coordinates 378113.89E, 543514.44N	Grid OSGB
Date Started 10/09/2019	Date Completed 10/09/2019	Inclination 90° from horizontal

Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit	Plant Used	Shoring Used	Pit Stability	Remarks
0.00 1.20	1.20 2.95	IP WLS	10/09/2019 12:30 12/09/2019 13:30	10/09/2019 13:30 10/09/2019 14:40	GC GC	MPB MPB	NA NA	NA NA	Insulated Hand Tools Terrier	None used	Stable	0.50m x 0.50m x 1.20m

PROGRESS						WATER STRIKES						
Date Time	Depth	Depth Casing	Depth Water	Remarks		Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Time Elapsed	Remarks
10/09/2019 14:40	2.95	0.00	Dry	End of Hole								

CABLE PERCUSSION DETAILS						SPT DETAILS						
Depth Top	Depth Base	Time Start	Duration	Tool	Remarks	Depth Top	Test Type	Reported Result	Hammer Serial Number	Energy Ratio	Depth Casing	Depth Water
						1.20	S	N=19 (4,6,6,7,2,4)	TDPS	58	0.00	Dry
						2.00	S	N=9 (2,3,3,3,1,2)	TDPS	58	0.00	Dry
						2.70	S	50/125mm (14,11/50,25,25/50)	TDPS	58	0.00	Dry

ROTARY FLUSH DETAILS					
Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks

HOLE DIAMETER		CASING DIAMETER		DYNAMIC SAMPLING					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Diameter	Duration	Sample Recovery	Run Reference
				1.20	2.00	89	00:15:00	40	1
				2.00	2.70	89	00:15:00	55	2



INSTALLATION DETAILS						PIPE CONSTRUCTION					DEPTH RELATED REMARKS		
Distance	ID	Type	Response Top	Response Base	Pipe Ref	Pipe Ref	Top	Base	Diameter	Pipe Type	Depth Top	Depth Base	Remarks

BACKFILL DETAILS					LOCATION DETAILS		
Depth Top	Depth Base	Description	Remarks		Remarks		
0.00	2.95	Bentonite					

Project Name	Nenthead Mines - Proposed MWTS, GI	Exploratory Hole Log	Hole ID
Project No.	TA8234		WSTP102
Engineer	Aecom		Sheet 1 of 1
Employer	The Coal Authority		

Ground Level	+437.87mOD	Coordinates	378113.89E, 543514.44N	Grid	OSGB
Hole Type	IP+WLS	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling		TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Installation
						Details	Dia.						
TOPSOIL. MADE GROUND: Dark grey clayey gravelly fine to coarse sand sized fragments. Gravel sized fragments are subangular to subrounded fine to coarse of sandstone, mudstone, siltstone, ash and clinker.			0.10 (0.90)	437.77		D 1 0.10 ES 2 0.20 B 3 0.20-0.50 ES 4 0.50							
Firm brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of sandstone, mudstone, siltstone and limestone.			1.00 (0.56)	436.87		D 6 1.00 ES 5 1.00 B 7 1.00-1.20						SPT(S) N=19 (4,6,6,7,2,4) 1.20	
Assumed zone of no recovery.			1.56 (0.44)	436.31		D 8 1.20-1.65 L 9 1.20-2.00							
Firm brown to dark brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of sandstone and mudstone.			2.00 (0.45)	435.87		D 10 2.00-2.45 L 11 2.00-2.70						SPT(S) N=9 (2,3,3,3,1,2) 2.00	
Brown very clayey fine to coarse SAND and subangular to subrounded fine to coarse GRAVEL of limestone, mudstone, sandstone and siltstone.			2.45 (0.50)	435.42		D 12 2.70-2.95						SPT(S) 50/125mm (14,11/50,25,25/50) 2.70	
Complete at 2.95m. Termination Reason: Engineer's decision, refusal			2.95	434.92									

Project Name Nenthead Mines - Proposed MWTS, GI										Exploratory Hole Log			Hole ID WSTP103		
Project No. TA8234															
Engineer Aecom															
Employer The Coal Authority													Sheet 1 of 1		
Ground Level +437.84mOD					Coordinates 378104.71E, 543508.52N					Grid OSGB					
Date Started 12/09/2019					Date Completed 13/09/2019					Inclination 90° from horizontal					
Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit	Plant Used	Shoring Used	Pit Stability	Remarks			
0.00 1.20	1.20 2.00	IP WLS	12/09/2019 16:00 13/09/2019 07:30	12/09/2019 17:15 13/09/2019 09:00	GC GC	MO MO	NA NA	NA NA	Insulated Hand Tools Terrier	None used	Stable	1.00m x 0.50m x 1.20m			
PROGRESS						WATER STRIKES									
Date Time	Depth	Depth Casing	Depth Water	Remarks			Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Time Elapsed	Remarks		
12/09/2019 17:30 13/09/2019 09:00 13/10/2019 07:30	1.20 2.00 1.20	0.00 0.00 0.00	Dry Dry Dry	End of Shift End of Hole Start of Shift											
CABLE PERCUSSION DETAILS						SPT DETAILS									
Depth Top	Depth Base	Time Start	Duration	Tool	Remarks			Depth Top	Test Type	Reported Result	Hammer Serial Number	Energy Ratio	Depth Casing	Depth Water	
								1.20 1.80	S S	N=18 (3,5,5,5,3) 50/160mm (14,10/50,16,23,11/10)	TDPS TDPS	58 58	0.00 0.00	Dry Dry	
ROTARY FLUSH DETAILS															
Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks										
HOLE DIAMETER		CASING DIAMETER		DYNAMIC SAMPLING											
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Diameter	Duration	Sample Recovery	Run Reference						
				1.20	1.80	87	00:05:00	44	1						
INSTALLATION DETAILS				PIPE CONSTRUCTION						DEPTH RELATED REMARKS					
Distance	ID	Type	Response Top	Response Base	Pipe Ref	Pipe Ref	Top	Base	Diameter	Pipe Type	Depth Top	Depth Base	Remarks		
											0.00	0.50	Extended IP to avoid buried wall.		
BACKFILL DETAILS						LOCATION DETAILS									
Depth Top	Depth Base	Description			Remarks			Remarks							
0.00	2.00	Bentonite													
		Notes: All depth in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations see key.													
FINAL		Print date and time 17/01/2020 19:25				Log checked by MPB						SOIL ENGINEERING			
Form No. SIEXPHOLEHDR		Issue/Revision No. 2.02				Issue Date 22/06/2016						Part of the Bachy Soletanche Group			

Project Name Nenthead Mines - Proposed MWTS, GI	Exploratory Hole Log	Hole ID WSTP103
Project No. TA8234		
Engineer Aecom		
Employer The Coal Authority		Sheet 1 of 1

Ground Level +437.84mOD	Coordinates 378104.71E, 543508.52N	Grid OSGB
Hole Type IP+WLS	Inclination 90° from horizontal	

Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling		TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Installation
						Details	Dia.						
TOPSOIL.			0.10	437.74		D 1 0.10							
MADE GROUND: Dark brown slightly gravelly sandy clay with low cobble content. Sand sized fragments are fine to coarse. Gravel sized fragments are angular to subrounded fine to coarse of limestone and siltstone. Cobble sized fragments are angular to subrounded of limestone and sandstone.			(0.30)			ES 2 0.20							
			0.40	437.44		B 3 0.20-0.50							
MADE GROUND: Remains of wall. Driller's description)			0.50	437.34		D 4 0.50							
MADE GROUND: Dark brown mottled dark grey slightly gravelly sandy clay with medium cobble content. Sand sized fragments are fine to coarse. Gravel sized fragments are angular to subrounded fine to coarse of limestone and sandstone. Cobble sized fragments are angular to subangular of limestone and sandstone.			(1.30)			ES 5 0.50							
						B 6 0.50-0.80							
Firm dark brown sandy CLAY with high cobble content. Sand is fine to coarse. Cobbles are angular to subrounded of limestone.			1.80	436.04		D 7 1.00							
Complete at 2.00m. Termination Reason: Engineer's decision, refusal			2.00	435.84		ES 8 1.00							
						B 9 1.20							
						D 10 1.20-1.65							
						L 11 1.20-1.80							
						D 12 1.80-2.00							

Project Name Nenthead Mines - Proposed MWTS, GI	Exploratory Hole Log	Hole ID WSTP105
Project No. TA8234		Sheet 1 of 1
Engineer Aecom		
Employer The Coal Authority		

Ground Level +439.41mOD	Coordinates 378153.27E, 543470.02N	Grid OSGB
Date Started 13/09/2019	Date Completed 13/09/2019	Inclination 90° from horizontal

Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit	Plant Used	Shoring Used	Pit Stability	Remarks
0.00 1.20	1.20 2.10	IP WLS	13/09/2019 12:45 13/09/2019 14:00	13/09/2019 13:45 13/09/2019 15:30	GC GC	MO MO	NA NA	NA NA	Insulated Hand Tools Terrier	None used	Stable	0.50m x 0.50m x 1.20m

PROGRESS						WATER STRIKES						
Date Time	Depth	Depth Casing	Depth Water	Remarks		Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Time Elapsed	Remarks
13/09/2019 15:30	2.10	0.00	Dry	End of Hole								

CABLE PERCUSSION DETAILS						SPT DETAILS								
Depth Top	Depth Base	Time Start	Duration	Tool	Remarks	Depth Top	Test Type	Reported Result			Hammer Serial Number	Energy Ratio	Depth Casing	Depth Water
						1.20	S	N=7 (1,1,1,2,2,2)			TDPS	58	0.00	Dry
						1.80	S	50/205mm (18,7/35,18,18,14/55)			TDPS	58	0.00	Dry

ROTARY FLUSH DETAILS					
Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks

HOLE DIAMETER		CASING DIAMETER		DYNAMIC SAMPLING						
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Diameter	Duration	Sample Recovery	Run Reference	
				1.20	1.80	87	00:06:00	63	1	

INSTALLATION DETAILS						PIPE CONSTRUCTION					DEPTH RELATED REMARKS			
Distance	ID	Type	Response Top	Response Base	Pipe Ref	Pipe Ref	Top	Base	Diameter	Pipe Type	Depth Top	Depth Base	Remarks	

BACKFILL DETAILS					LOCATION DETAILS						
Depth Top	Depth Base	Description			Remarks		Remarks				
0.00	2.10	Bentonite									

Project Name	Nenthead Mines - Proposed MWTS, GI		Exploratory Hole Log	Hole ID	WSTP105
Project No.	TA8234			Sheet 1 of 1	
Engineer	Aecom				
Employer	The Coal Authority				

Ground Level	+439.41mOD	Coordinates	378153.27E, 543470.02N	Grid	OSGB
Hole Type	IP+WLS	Inclination	90° from horizontal		

Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling		TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Installation
						Details	Dia.						
<p>MADE GROUND: Dark brown very gravelly fine to coarse sand sized fragments with medium cobble content. Gravel sized fragments are angular to subrounded fine to coarse of siltstone and sandstone. Cobble sized fragments are angular to subangular of siltstone and sandstone.</p> <p>MADE GROUND: Dark brown very gravelly slightly clayey fine to coarse sand sized fragments with medium cobble content. Gravel sized fragments are angular to subrounded of siltstone and sandstone. Cobble sized fragments are angular to subangular of siltstone and sandstone.</p>			(0.40)	439.01		D 1 0.10							
			0.40			B 3 0.20-0.50							
			(1.70)			D 4 0.50						SPT(S) N=7 (1,1,1,2,2,2) 1.20	
			2.10	437.31		ES 5 0.50						SPT(S) 50/205mm (18,7/35,18,18,14/ 55) 1.80	
Complete at 2.10m. Termination Reason: Engineer's decision, refusal						B 6 0.50-0.80							
						D 7 1.00							
						ES 8 1.00							
						D 9 1.20-1.65							
						L 10 1.20-1.65							
						D 11 1.80-2.10							

Project Name Nenthead Mines - Proposed MWTS, GI	Exploratory Hole Log	Hole ID WSTP106
Project No. TA8234		Sheet 1 of 1
Engineer Aecom		
Employer The Coal Authority		

Ground Level +443.00mOD	Coordinates 378226.24E, 543407.29N	Grid OSGB
Date Started 16/09/2019	Date Completed 16/09/2019	Inclination 90° from horizontal

Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit	Plant Used	Shoring Used	Pit Stability	Remarks
0.00	1.20	IP	16/09/2019 08:15	16/09/2019 09:30	GC	MO	NA	NA	Insulated Hand Tools	None used	Stable	0.50m x 0.50m x 1.20m
1.20	1.50	WLS	16/09/2019 09:45	16/09/2019 11:00	GC	MO	NA	NA	Terrier			

PROGRESS						WATER STRIKES						
Date Time	Depth	Depth Casing	Depth Water	Remarks		Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Time Elapsed	Remarks
16/09/2019 11:00	1.50	0.00	Dry	End of Hole								

CABLE PERCUSSION DETAILS						SPT DETAILS								
Depth Top	Depth Base	Time Start	Duration	Tool	Remarks	Depth Top	Test Type	Reported Result			Hammer Serial Number	Energy Ratio	Depth Casing	Depth Water
						1.20	S	50/240mm (5,3,7,25,12,6/15)			TDPS	58	0.00	Dry

ROTARY FLUSH DETAILS					
Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks

HOLE DIAMETER		CASING DIAMETER		DYNAMIC SAMPLING					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Diameter	Duration	Sample Recovery	Run Reference
				1.20	1.50	87	00:10:00	20	1

INSTALLATION DETAILS						PIPE CONSTRUCTION					DEPTH RELATED REMARKS			
Distance	ID	Type	Response Top	Response Base	Pipe Ref	Pipe Ref	Top	Base	Diameter	Pipe Type	Depth Top	Depth Base	Remarks	

BACKFILL DETAILS					LOCATION DETAILS						
Depth Top	Depth Base	Description			Remarks		Remarks				
0.00	1.50	Bentonite									

Project Name Nenthead Mines - Proposed MWTS, GI	Exploratory Hole Log	Hole ID WSTP107
Project No. TA8234		Sheet 1 of 1
Engineer Aecom		
Employer The Coal Authority		

Ground Level +445.54mOD	Coordinates 378269.78E, 543368.91N	Grid OSGB
Date Started 16/09/2019	Date Completed 16/09/2019	Inclination 90° from horizontal

Top	Base	Type	Date Time Start	Date Time End	Rig Crew	Logger	Barrel Type	Drill Bit	Plant Used	Shoring Used	Pit Stability	Remarks
0.00	1.20	IP	16/09/2019 11:15	16/09/2019 12:15	GC	MO	NA	NA	Insulated Hand Tools	None used	Stable	0.50m x 0.50m x 1.20m
1.20	2.65	WLS	16/09/2019 12:15	16/09/2019 14:30	GC	MO	NA	NA	Terrier			

PROGRESS						WATER STRIKES						
Date Time	Depth	Depth Casing	Depth Water	Remarks		Date Time	Depth Strike	Depth Casing	Depth Sealed	Water Rose To	Time Elapsed	Remarks
16/09/2019 14:30	2.65	0.00	Dry	End of Hole								

CABLE PERCUSSION DETAILS						SPT DETAILS								
Depth Top	Depth Base	Time Start	Duration	Tool	Remarks	Depth Top	Test Type	Reported Result			Hammer Serial Number	Energy Ratio	Depth Casing	Depth Water
						1.20	S	N=41 (2,4,2,9,15,15)			TDPS	58	0.00	Dry
						2.00	S	N=47 (9,14,13,12,11,11)			TDPS	58	0.00	Dry
						2.60	S	50/25mm (25/25,50/25)			TDPS	58	0.00	Dry

ROTARY FLUSH DETAILS					
Depth Top	Depth Base	Flush Type	Flush Return	Flush Colour	Remarks

HOLE DIAMETER		CASING DIAMETER		DYNAMIC SAMPLING					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Diameter	Duration	Sample Recovery	Run Reference
				1.20	2.00	87	00:08:00	63	1
				2.00	2.60	65	00:06:00	58	2

INSTALLATION DETAILS						PIPE CONSTRUCTION					DEPTH RELATED REMARKS		
Distance	ID	Type	Response Top	Response Base	Pipe Ref	Pipe Ref	Top	Base	Diameter	Pipe Type	Depth Top	Depth Base	Remarks

BACKFILL DETAILS					LOCATION DETAILS				
Depth Top	Depth Base	Description			Remarks		Remarks		
0.00	2.65	Bentonite							

Project Name Nenthead Mines - Proposed MWTS, GI	Exploratory Hole Log	Hole ID WSTP107
Project No. TA8234		Sheet 1 of 1
Engineer Aecom		
Employer The Coal Authority		

Ground Level +445.54mOD	Coordinates 378269.78E, 543368.91N	Grid OSGB
Hole Type IP+WLS	Inclination 90° from horizontal	

Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling		TCR/Sample Recovery %	SCR/Blows	RQD	IF	In Situ Test Details	Installation
						Details	Dia.						
MADE GROUND: Compacted limestone surface. (Driller's description)			0.10	445.44		D 1 0.10 ES 2 0.20 B 3 0.20-0.50 ES 4 0.50							
MADE GROUND: Dark brown very gravelly fine to coarse sand sized fragments with medium cobble content. Gravel sized fragments are angular to subrounded fine to coarse of siltstone, mudstone and limestone. Cobble sized fragments are angular to subangular of siltstone, sandstone and limestone.			(1.40)			D 5 1.00 ES 6 1.00						SPT(S) N=41 (2,4,2,9,15,15) 1.20	
from 1.20m more clayey													
MADE GROUND: Dark brown slightly gravelly sandy clay with high cobble and boulder content. Sand sized fragments are fine to coarse. Gravel sized fragments are angular to subangular fine to coarse of limestone, sandstone, siltstone and slate. Cobble and boulder sized fragments are angular to subangular of limestone, sandstone and siltstone.			1.50	444.04		D 7 1.20-1.65 L 8 1.20-2.00						SPT(S) N=47 (9,14,13,12,11,11) 2.00	
			(1.15)										
Complete at 2.65m. Termination Reason: Engineer's decision, refusal			2.65	442.89		D 9 2.00-2.45 L 10 2.00-2.60						SPT(S) 50/25mm (25/25,50/25) 2.60	



SUPPORTING FACTUAL DATA

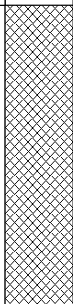
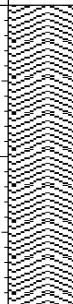
SECTION A

Exploratory Hole Records and Field Data

EXCAVATION RECORDS

Project Name Nenthead Mines - Proposed MWTS, GI	Excavation Log	Hole ID TP104
Project No. TA8234		Sheet 1 of 1
Engineer Aecom		
Employer The Coal Authority		

Ground Level +438.30mOD	Coordinates 378131.75E, 543499.61N	Grid OSGB
Hole Type TP	Method/Equipment 9T Tracked Excavator	
Date Started 04/09/2019	Date Completed 04/09/2019	Logged By MO

Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling Details	In Situ Test Details	Installation
MADE GROUND: Grey and brown silty very gravelly fine to coarse sand sized fragments with high cobble and boulder content. Gravel sized fragments are angular to subangular fine to coarse of wood, sandstone and siltstone. Cobble sized fragments are angular to subangular of wood, sandstone and siltstone. Boulder sized fragments are angular of siltstone.			(2.05)			B 1 0.50 B 4 1.00 D 3 1.00 ES 2 1.00 B 5 1.50		
End of excavation at 2.05m. Termination Reason: Too unstable to continue			2.05	436.25		D 7 2.00 ES 6 2.00		

Stability Unstable	Excavation Dimensions and Orientation
Shoring None used	Length (Sides A and C) 2.75m

DEPTH RELATED REMARKS		
Depth Top	Depth Base	Remarks
0.30	0.50	Large wood log.
0.30	2.05	Large siltstone blocks.
1.40	1.45	Water seepage (insufficient for sample).



WATER STRIKES					WATER STRIKES DETAIL	
Date Time	Depth Strike	Depth Sealed	Depth Water	Time Elapsed		

BACKFILL			
Depth Top	Depth Base	Description	Remarks
0.00	2.05	Arisings	

DEPTH RELATED EXPLORATORY HOLE REMARKS			GENERAL NOTES		
Depth Top	Depth Base	Remarks	Remarks		
			1. All sides similar. 2. Photographs taken of sides A, D and spoil. 3. No CBR - too gravelly.		

Project Name Nenthead Mines - Proposed MWTS, GI	Excavation Log	Hole ID TP108
Project No. TA8234		Sheet 1 of 1
Engineer Aecom		
Employer The Coal Authority		

Ground Level +462.11mOD	Coordinates 378458.80E, 543296.48N	Grid OSGB
Hole Type TP	Method/Equipment 9T Tracked Excavator	
Date Started 04/09/2019	Date Completed 04/09/2019	Logged By MO



Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling Details	In Situ Test Details	Installation
TOPSOIL. MADE GROUND: Mottled orange and dark grey brown slightly gravelly sandy clay with high cobble content. Sand sized fragments are fine to coarse. Gravel sized fragments are angular to subrounded fine to coarse of sandstone and siltstone. Cobble sized fragments are angular to subangular of siltstone and sandstone. End of excavation at 0.50m. Termination Reason: Stone Structure			0.10 (0.40) 0.50	462.01 461.61		B 1 0.45		

Stability All faces stable	Excavation Dimensions and Orientation
Shoring None used	Length (Sides A and C) 2.60m
	Length (Sides B and D) 1.40m
	Depth 0.50m
	Bearing along Side A toward Side B 311°

DEPTH RELATED REMARKS		
Depth Top	Depth Base	Remarks
0.20	0.25	Water seepage (insufficient for sample).

BACKFILL			
Depth Top	Depth Base	Description	Remarks
0.00	0.50	Arisings	

DEPTH RELATED EXPLORATORY HOLE REMARKS			GENERAL NOTES		
Depth Top	Depth Base	Remarks	Remarks		
			1. All sides similar. 2. Photographs taken of sides A, D and spoil.		

	Notes: All depth in metres, all soil strengths are average in kPa. For in situ test results, see accompanying records. All bearings given relate to magnetic North. For details of abbreviations, see key.	 SOIL ENGINEERING Part of the Bachy Soletanche Group
FINAL	Print date and time 17/01/2020 19:25	Log checked by MPB
Form No. SIEXPHOLETLOG	Issue/Revision No. 2.05	Issue Date 04/01/2019

Project Name Nenthead Mines - Proposed MWTS, GI	Excavation Log	Hole ID TP109
Project No. TA8234		Sheet 1 of 1
Engineer Aecom		
Employer The Coal Authority		

Ground Level +469.41mOD	Coordinates 378500.78E, 543262.58N	Grid OSGB
Hole Type TP	Method/Equipment 9T Tracked Excavator	
Date Started 04/09/2019	Date Completed 04/09/2019	Logged By MO

Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling Details	In Situ Test Details	Installation
TOPSOIL. MADE GROUND: Brown mottled light orange slightly sandy gravelly clay with high cobble and boulder content. Sand sized fragments are fine to coarse. Gravel sized fragments are angular to subangular fine to coarse of sandstone and siltstone. Cobble sized fragments are angular to subangular of siltstone and sandstone. Boulder sized fragments are angular to subangular of siltstone.		[Pattern]	0.10	469.31		B 1 0.50		[Pattern]
			(1.80)			D 3 1.00 ES 2 1.00		[Pattern]
End of excavation at 1.90m. Termination Reason: Too unstable to continue			1.90	467.51		B 4 1.50 W 5 1.80		[Pattern]

Stability Unstable	Excavation Dimensions and Orientation
Shoring None used	Length (Sides A and C) 2.55m
	Length (Sides B and D) 1.60m
	Depth 1.90m
	Bearing along Side A toward Side B 322°

DEPTH RELATED REMARKS		
Depth Top	Depth Base	Remarks
1.70	1.90	Water seepage (small sample taken).

BACKFILL				
Depth Top	Depth Base	Description	Remarks	
0.00	1.90	Arisings		

DEPTH RELATED EXPLORATORY HOLE REMARKS			GENERAL NOTES		
Depth Top	Depth Base	Remarks	Remarks		
			1. All sides similar. 2. Photographs taken of sides A, D and spoil. 3. No CBR - too gravelly.		

	Notes: All depth in metres, all soil strengths are average in kPa. For in situ test results, see accompanying records. All bearings given relate to magnetic North. For details of abbreviations, see key.	 Part of the Bachy Soletanche Group
FINAL	Print date and time 17/01/2020 19:25	Log checked by MPB
Form No. SIEXPHOLETLOG	Issue/Revision No. 2.05	Issue Date 04/01/2019

Project Name Nenthead Mines - Proposed MWTS, GI	Excavation Log	Hole ID TP110
Project No. TA8234		Sheet 1 of 1
Engineer Aecom		
Employer The Coal Authority		

Ground Level +491.33mOD	Coordinates 378670.90E, 543305.09N	Grid OSGB
Hole Type TP	Method/Equipment 9T Tracked Excavator	
Date Started 05/09/2019	Date Completed 05/09/2019	Logged By MO

Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling Details	In Situ Test Details	Installation
TOPSOIL Soft to firm grey mottled orange slightly gravelly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of sandstone, limestone and siltstone. Cobbles are angular to subangular of siltstone and limestone.			0.10	491.23		B 1 0.50		
Stiff grey mottled blueish black slightly gravelly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of siltstone and sandstone. Cobbles are angular to subangular of siltstone.			0.95	490.38		D 3 1.00 ES 2 1.00 B 4 1.50		
End of excavation at 3.00m. Termination Reason: Achieved Scheduled Depth			3.00	488.33		D 9 3.00 ES 8 3.00		

Stability All faces stable	Excavation Dimensions and Orientation
Shoring None used	Length (Sides A and C) 3.10m

DEPTH RELATED REMARKS		
Depth Top	Depth Base	Remarks

WATER STRIKES				WATER STRIKES DETAIL
Date Time	Depth Strike	Depth Sealed	Depth Water	Time Elapsed

BACKFILL				
Depth Top	Depth Base	Description	Remarks	
0.00	3.00	Arisings		

DEPTH RELATED EXPLORATORY HOLE REMARKS			GENERAL NOTES		
Depth Top	Depth Base	Remarks			
			1. All sides similar. 2. Photographs taken of sides A, D and spoil.		

	Notes: All depth in metres, all soil strengths are average in kPa. For in situ test results, see accompanying records. All bearings given relate to magnetic North. For details of abbreviations, see key.	
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Project Name	Nenthead Mines - Proposed MWTS, GI		Excavation Log	Hole ID	TP112	
Project No.	TA8234	Engineer		Aecom	Employer	The Coal Authority
Engineer	Aecom	Employer		The Coal Authority	Sheet 1 of 1	

Ground Level	+496.21mOD	Coordinates	378726.21E, 543338.28N	Grid	OSGB
Hole Type	TP	Method/Equipment	9T Tracked Excavator	Logged By	MO
Date Started	05/09/2019	Date Completed	05/09/2019		

Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling Details	In Situ Test Details	Installation
Soft to firm orangish brown sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of siltstone and sandstone. Cobbles are angular of siltstone and sandstone.			(0.95)			B 1 0.50		
Stiff black mottled blueish grey slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of siltstone and sandstone. Cobbles are angular to subrounded of siltstone.			0.95	495.26		D 3 1.00 ES 2 1.00 B 4 1.50		
			(2.05)			D 6 2.00 ES 5 2.00 B 7 2.50		
End of excavation at 3.00m. Termination Reason: Achieved Scheduled Depth			3.00	493.21		D 9 3.00 ES 8 3.00		

Stability	All faces stable	Excavation Dimensions and Orientation
Shoring	None used	

DEPTH RELATED REMARKS			Length (Sides A and C)	3.30m
			Length (Sides B and D)	1.55m
			Depth	3.00m
			Bearing along Side A toward Side B	63°

BACKFILL			WATER STRIKES		WATER STRIKES DETAIL
Depth Top	Depth Base	Remarks	Date Time	Depth Strike	Depth Sealed
0.00	3.00	Arisings			

DEPTH RELATED EXPLORATORY HOLE REMARKS			GENERAL NOTES		
Depth Top	Depth Base	Remarks	Remarks		
			1. All sides similar. 2. Photographs taken of sides A, D and spoil.		

			Notes: All depth in metres, all soil strengths are average in kPa. For in situ test results, see accompanying records. All bearings given relate to magnetic North. For details of abbreviations, see key.		
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Project Name	Nenthead Mines - Proposed MWTS, GI			Excavation Log		Hole ID		
Project No.	TA8234					TP113		
Engineer	Aecom					Sheet 1 of 1		
Employer	The Coal Authority			Grid		OSGB		
Ground Level	+493.48mOD	Coordinates	378701.95E, 543267.67N		Method/Equipment			9T Tracked Excavator
Hole Type	TP	Date Started	09/09/2019	Date Completed	09/09/2019	Logged By		MO

Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling Details	In Situ Test Details	Installation
TOPSOIL Firm to stiff dark blueish mottled dark grey organic slightly sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of sandstone. Cobbles are angular to subangular of sandstone.			0.10	493.38		B 1 0.50		
End of excavation at 1.10m. Termination Reason: Probable Boulder			(1.00)			D 3 1.00 ES 2 1.00		

Stability	All faces stable	Excavation Dimensions and Orientation	
Shoring	None used	Length (Sides A and C)	3.10m
		Length (Sides B and D)	1.60m
		Depth	1.10m
		Bearing along Side A toward Side B	189°

DEPTH RELATED REMARKS			
Depth Top	Depth Base	Remarks	

WATER STRIKES				WATER STRIKES DETAIL	
Date	Time	Depth Strike	Depth Sealed	Depth Water	Time Elapsed

BACKFILL			
Depth Top	Depth Base	Description	Remarks
0.00	1.10	Arisings	

DEPTH RELATED EXPLORATORY HOLE REMARKS			GENERAL NOTES		
Depth Top	Depth Base	Remarks	Remarks		
			1. All sides similar. 2. Photographs taken of sides A and spoil. 3. Too granular for CBR.		

Project Name	Nenthead Mines - Proposed MWTS, GI		Excavation Log	Hole ID	TP114	
Project No.	TA8234	Engineer		Aecom	Employer	The Coal Authority
				Sheet 1 of 1		

Ground Level	+493.62mOD	Coordinates	378702.54E, 543281.98N	Grid	OSGB
Hole Type	TP	Method/Equipment	9T Tracked Excavator	Logged By	MO
Date Started	05/09/2019	Date Completed	05/09/2019		

Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling Details	In Situ Test Details	Installation
TOPSOIL Soft to firm grey mottled orangish brown slightly gravelly sandy CLAY with high cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of limestone, sandstone and siltstone. Cobbles are angular of siltstone and sandstone.			0.10 (0.85)	493.52		B 1 0.50		
Firm dark blueish grey sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of limestone and sandstone. Cobbles are angular of limestone.			0.95 (0.70)	492.67		B 3 1.00 ES 2 1.00		
Soft to firm brown mottled yellowish brown slightly gravelly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of limestone and siltstone.			1.65 1.85	491.97 491.77		B 4 1.50 B 7 1.70 D 6 1.70 ES 5 1.70 D 9 1.90 ES 8 1.90 D 11 2.00 ES 10 2.00 B 12 2.50		
Stiff black mottled blue slightly gravelly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of siltstone and sandstone. Cobbles are angular of siltstone.			(1.15)					
End of excavation at 3.00m. Termination Reason: Achieved Scheduled Depth			3.00	490.62		B 13 3.00 D 14 3.00		

Stability	All faces stable	Excavation Dimensions and Orientation
Shoring	None used	

DEPTH RELATED REMARKS			Length (Sides A and C)	3.40m
			Length (Sides B and D)	1.60m
			Depth	3.00m
			Bearing along Side A toward Side B	14°

WATER STRIKES			WATER STRIKES DETAIL			
Date	Time	Depth	Strike	Depth Sealed	Depth Water	Time Elapsed

BACKFILL				
Depth Top	Depth Base	Description	Remarks	
0.00	3.00	Arisings		

DEPTH RELATED EXPLORATORY HOLE REMARKS			GENERAL NOTES		
Depth Top	Depth Base	Remarks	Remarks		
			1. All sides similar. 2. Photographs taken of sides C, D and spoil.		

	Notes: All depth in metres, all soil strengths are average in kPa. For in situ test results, see accompanying records.			
	All bearings given relate to magnetic North. For details of abbreviations, see key.			

Project Name	Nenthead Mines - Proposed MWTS, GI		Excavation Log	Hole ID	TP115
Project No.	TA8234			Sheet 1 of 1	
Engineer	Aecom				
Employer	The Coal Authority				

Ground Level	+496.37mOD	Coordinates	378734.10E, 543281.91N	Grid	OSGB
Hole Type	TP	Method/Equipment	9T Tracked Excavator		
Date Started	06/09/2019	Date Completed	06/09/2019	Logged By	MO

Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling Details	In Situ Test Details	Installation
TOPSOIL Firm brown mottled light grey and orange slightly gravelly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of sandstone, siltstone and limestone. Cobbles are angular to subrounded of sandstone and siltstone.			0.10 (1.05)	496.27		B 1 0.50		
Stiff dark blue mottled black slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of sandstone and siltstone. Cobbles are angular to subangular of sandstone and siltstone. (Possible Weathered Bedrock) End of excavation at 1.45m. Termination Reason: Probable Boulder			1.15 (0.30) 1.45	495.22 494.92		D 3 1.00 ES 2 1.00 D 5 1.20 ES 4 1.20	HV 1.00 HV 1.00 HV 1.00	

Stability	All faces stable	Excavation Dimensions and Orientation
Shoring	None used	

DEPTH RELATED REMARKS		
Depth Top	Depth Base	Remarks

WATER STRIKES		WATER STRIKES DETAIL		
Date Time	Depth Strike	Depth Sealed	Depth Water	Time Elapsed

BACKFILL				
Depth Top	Depth Base	Description	Remarks	
0.00	1.45	Arisings		

DEPTH RELATED EXPLORATORY HOLE REMARKS			GENERAL NOTES		
Depth Top	Depth Base	Remarks	Remarks		
			1. All sides similar. 2. Photographs taken of sides C, D and spoil.		

	Notes: All depth in metres, all soil strengths are average in kPa. For in situ test results, see accompanying records. All bearings given relate to magnetic North. For details of abbreviations, see key.	
	FINAL Print date and time 17/01/2020 19:25 Log checked by MPB Form No. SIEXPHOLETLOG Issue.Revision No. 2.05 Issue Date 04/01/2019 Part of the Bachy Soletanche Group	

Project Name Nenthead Mines - Proposed MWTS, GI	Excavation Log	Hole ID TP116
Project No. TA8234		Sheet 1 of 1
Engineer Aecom		
Employer The Coal Authority		

Ground Level +507.86mOD	Coordinates 378813.65E, 543186.89N	Grid OSGB
Hole Type TP	Method/Equipment 9T Tracked Excavator	
Date Started 10/09/2019	Date Completed 10/09/2019	Logged By MO

Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling Details	In Situ Test Details	Installation
TOPSOIL Soft to firm light brown mottled orange and grey slightly gravelly sandy CLAY with medium cobble and low boulder content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of sandstone, limestone and siltstone. Cobbles and boulders are angular to subangular of sandstone and siltstone.			0.10	507.76		B 1 0.50		
Stiff dark blue mottled orange and dark grey slightly gravelly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of sandstone. Cobbles are angular to subangular of sandstone. End of excavation at 1.10m. Termination Reason: Probable Boulder			1.00 1.10	506.86 506.76		D 3 1.00 ES 2 1.00		

Stability All faces stable	Excavation Dimensions and Orientation
Shoring None used	Length (Sides A and C) 3.70m
	Length (Sides B and D) 1.55m
	Depth 1.10m
	Bearing along Side A toward Side B 136°

DEPTH RELATED REMARKS			WATER STRIKES		WATER STRIKES DETAIL	
Depth Top	Depth Base	Remarks	Date Time	Depth Strike	Depth Sealed	Depth Water
0.40	0.60	Black clay lens in side C.				

BACKFILL			
Depth Top	Depth Base	Description	Remarks
0.00	1.10	Arisings	

DEPTH RELATED EXPLORATORY HOLE REMARKS		GENERAL NOTES	
Depth Top	Depth Base	Remarks	Remarks
			1. All sides similar. 2. Photographs taken of sides A, B and spoil.

	Notes: All depth in metres, all soil strengths are average in kPa. For in situ test results, see accompanying records. All bearings given relate to magnetic North. For details of abbreviations, see key.	
FINAL	Print date and time 17/01/2020 19:25	Log checked by MPB
Form No. SIEXPHOLETPLOG	Issue/Revision No. 2.05	Issue Date 04/01/2019
		Part of the Bachy Soletanche Group

Project Name	Nenthead Mines - Proposed MWTS, GI			Excavation Log	Hole ID	TP117
Project No.	TA8234				Sheet 1 of 1	
Engineer	Aecom					
Employer	The Coal Authority					

Ground Level	+504.43mOD	Coordinates	378790.99E, 543092.00N	Grid	OSGB
Hole Type	TP	Method/Equipment	9T Tracked Excavator		
Date Started	10/09/2019	Date Completed	10/09/2019	Logged By	MO

Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling Details	In Situ Test Details	Installation
TOPSOIL. Soft to firm dark grey mottled orange and blue slightly gravelly sandy CLAY with high cobble and low boulder content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of sandstone, siltstone and limestone. Cobbles and boulders are angular to subangular of sandstone, siltstone and limestone.			0.10 (1.10)	504.33		B 1 0.50 D 3 1.00 ES 2 1.00		
End of excavation at 1.20m. Termination Reason: Probable Boulder			1.20	503.23				

Stability	All faces stable	Excavation Dimensions and Orientation															
Shoring	None used	Length (Sides A and C)	330m														
DEPTH RELATED REMARKS <table border="1"> <thead> <tr> <th>Depth Top</th> <th>Depth Base</th> <th>Remarks</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> </tr> </tbody> </table>		Depth Top	Depth Base	Remarks				Length (Sides B and D)	160m								
		Depth Top	Depth Base	Remarks													
		Depth	120m														
		Bearing along Side A toward Side B	245°														
		WATER STRIKES <table border="1"> <thead> <tr> <th>Date Time</th> <th>Depth Strike</th> <th>Depth Sealed</th> <th>Depth Water</th> <th>Time Elapsed</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>		Date Time	Depth Strike	Depth Sealed	Depth Water	Time Elapsed									
Date Time	Depth Strike	Depth Sealed	Depth Water	Time Elapsed													
BACKFILL <table border="1"> <thead> <tr> <th>Depth Top</th> <th>Depth Base</th> <th>Description</th> <th>Remarks</th> </tr> </thead> <tbody> <tr> <td>0.00</td> <td>1.20</td> <td>Arisings</td> <td></td> </tr> </tbody> </table>		Depth Top	Depth Base	Description	Remarks	0.00	1.20	Arisings		GENERAL NOTES <table border="1"> <thead> <tr> <th>Depth Top</th> <th>Depth Base</th> <th>Remarks</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td>1. All sides similar. 2. Photographs taken of sides A, B and spoil.</td> </tr> </tbody> </table>		Depth Top	Depth Base	Remarks			1. All sides similar. 2. Photographs taken of sides A, B and spoil.
Depth Top	Depth Base	Description	Remarks														
0.00	1.20	Arisings															
Depth Top	Depth Base	Remarks															
		1. All sides similar. 2. Photographs taken of sides A, B and spoil.															

Project Name Nenthead Mines - Proposed MWTS, GI	Excavation Log	Hole ID TP118
Project No. TA8234		Sheet 1 of 1
Engineer Aecom		
Employer The Coal Authority		

Ground Level +500.65mOD	Coordinates 378761.78E, 543063.30N	Grid OSGB
Hole Type TP	Method/Equipment 9T Tracked Excavator	
Date Started 10/09/2019	Date Completed 10/09/2019	Logged By MO

Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling Details	In Situ Test Details	Installation
TOPSOIL Soft to firm brown mottled light grey and orange slightly gravelly sandy CLAY with high cobble and high boulder content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of siltstone and sandstone. Cobbles and boulders are angular to subangular of sandstone and siltstone.			0.10 (0.75)	500.55		B 1 0.50		
Stiff dark blue mottled orange and black slightly gravelly sandy CLAY with high cobble and boulder content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of sandstone and limestone. Cobbles and boulders are angular to subangular of sandstone and limestone.			0.85 (0.70)	499.80		D 3 1.00 ES 2 1.00		
End of excavation at 1.55m. Termination Reason: Probable Boulder			1.55	499.10		B 4 1.50		

Stability All faces stable	Excavation Dimensions and Orientation
Shoring None used	Length (Sides A and C) 3.60m
	Length (Sides B and D) 1.30m
	Depth 1.55m
	Bearing along Side A toward Side B 262°

DEPTH RELATED REMARKS			WATER STRIKES		WATER STRIKES DETAIL	
Depth Top	Depth Base	Remarks	Date Time	Depth Strike	Depth Sealed	Depth Water

BACKFILL			
Depth Top	Depth Base	Description	Remarks
0.00	1.55	Arisings	

DEPTH RELATED EXPLORATORY HOLE REMARKS			GENERAL NOTES		
Depth Top	Depth Base	Remarks	Remarks		
			1. All sides similar. 2. Photographs taken of sides A, B and spoil.		

	Notes: All depth in metres, all soil strengths are average in kPa. For in situ test results, see accompanying records. All bearings given relate to magnetic North. For details of abbreviations, see key.	
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Project Name Nenthead Mines - Proposed MWTS, GI	Excavation Log	Hole ID TP119
Project No. TA8234		Sheet 1 of 1
Engineer Aecom		
Employer The Coal Authority		

Ground Level +503.46mOD	Coordinates 378782.49E, 543115.12N	Grid OSGB
Hole Type TP	Method/Equipment 9T Tracked Excavator	
Date Started 10/09/2019	Date Completed 10/09/2019	Logged By MO

Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling Details	In Situ Test Details	Installation
TOPSOIL. Soft to firm black mottled orange slightly gravelly sandy CLAY with medium cobble and low boulder content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of sandstone. Cobbles are angular to subangular of sandstone. Boulders are angular to subrounded of sandstone.			0.10 (0.75)	503.36		B 1 0.50		
End of excavation at 0.85m. Termination Reason: Probable Boulder			0.85	502.61		D 3 0.80 ES 2 0.80		

Stability All faces stable	Excavation Dimensions and Orientation
Shoring None used	Length (Sides A and C) 3.50m
	Length (Sides B and D) 1.30m
	Depth 0.85m
	Bearing along Side A toward Side B 92°

DEPTH RELATED REMARKS			WATER STRIKES				WATER STRIKES DETAIL	
Depth Top	Depth Base	Remarks	Date Time	Depth Strike	Depth Sealed	Depth Water	Time Elapsed	

BACKFILL			
Depth Top	Depth Base	Description	Remarks
0.00	0.85	Arisings	

DEPTH RELATED EXPLORATORY HOLE REMARKS			GENERAL NOTES			
Depth Top	Depth Base	Remarks	Remarks			
			1. All sides similar. 2. Photographs taken of sides B, C and spoil.			

	Notes: All depth in metres, all soil strengths are average in kPa. For in situ test results, see accompanying records. All bearings given relate to magnetic North. For details of abbreviations, see key.	
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Project Name Nenthead Mines - Proposed MWTS, GI	Excavation Log	Hole ID TP120
Project No. TA8234		Sheet 1 of 1
Engineer Aecom		
Employer The Coal Authority		

Ground Level +503.97mOD	Coordinates 378792.77E, 543175.01N	Grid OSGB
Hole Type TP	Method/Equipment 9T Tracked Excavator	
Date Started 09/09/2019	Date Completed 09/09/2019	Logged By MO

Description of Strata	Weathering	Legend	Depth (Thick-ness)	Datum Level	Waterstrike	Sampling Details	In Situ Test Details	Install-ation
TOPSOIL. Soft to firm dark brown mottled orange slightly gravelly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of sandstone. Cobbles are angular to subangular of sandstone.			0.10	503.87		B 1 0.50 D 3 1.00 ES 2 1.00 D 5 1.20 ES 4 1.20		
			(1.05)					
			1.15	502.82				
Firm to stiff dark blue mottled dark grey and orange slightly gravelly sandy CLAY with high cobble and high boulder content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of sandstone. Cobbles and boulders are angular to subangular of sandstone. End of excavation at 1.30m. Termination Reason: Probable Boulder			1.30	502.67				

Stability All faces stable	Excavation Dimensions and Orientation
Shoring None used	Length (Sides A and C) 3.30m

DEPTH RELATED REMARKS		
Depth Top	Depth Base	Remarks
0.00	0.10	Stream flooded into pit from start - dammed.

WATER STRIKES				WATER STRIKES DETAIL	
Date Time	Depth Strike	Depth Sealed	Depth Water	Time Elapsed	

BACKFILL				
Depth Top	Depth Base	Description	Remarks	
0.00	1.30	Arisings		

DEPTH RELATED EXPLORATORY HOLE REMARKS			GENERAL NOTES		
Depth Top	Depth Base	Remarks	Remarks		
			1. All sides similar. 2. Photographs taken of sides B, C and spoil.		

	Notes: All depth in metres, all soil strengths are average in kPa. For in situ test results, see accompanying records. All bearings given relate to magnetic North. For details of abbreviations, see key.	
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Project Name Nenthead Mines - Proposed MWTS, GI	Excavation Log	Hole ID TP121
Project No. TA8234		Sheet 1 of 1
Engineer Aecom		
Employer The Coal Authority		


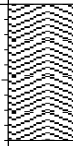
Ground Level +503.39mOD	Coordinates 378781.41E, 543078.69N	Grid OSGB
Hole Type TP	Method/Equipment 9T Tracked Excavator	
Date Started 10/09/2019	Date Completed 10/09/2019	Logged By MO

Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling Details	In Situ Test Details	Installation
TOPSOIL			(0.45)					
Soft to firm brown mottled black and orange slightly gravelly sandy CLAY with medium cobble and boulder content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of sandstone and limestone. Cobbles and boulders are angular to subangular of sandstone and limestone.			0.45	502.94		B 1 0.50		
Firm dark blue mottled orange slightly gravelly sandy CLAY with medium cobble and boulder content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of sandstone and limestone.			(0.30)	502.64				
Cobbles and boulders are angular to subangular of sandstone, limestone and mudstone.			0.75	502.49				
End of excavation at 0.90m. Termination Reason: Probable Boulder			0.90	502.49				

Stability All faces stable	Excavation Dimensions and Orientation
Shoring None used	Length (Sides A and C) 3.85m
	Length (Sides B and D) 1.50m
	Depth 0.90m
	Bearing along Side A toward Side B 288°
DEPTH RELATED REMARKS	WATER STRIKES
Depth Top Depth Base Remarks	Date Time Depth Strike Depth Sealed Depth Water Time Elapsed
BACKFILL	GENERAL NOTES
Depth Top Depth Base Description Remarks	Remarks
0.00 0.90 Arisings	1. All sides similar. 2. Photographs taken of sides A, B and spoil.
DEPTH RELATED EXPLORATORY HOLE REMARKS	
Depth Top Depth Base Remarks	

Project Name Nenthead Mines - Proposed MWTS, GI	Excavation Log	Hole ID TP122
Project No. TA8234		Sheet 1 of 1
Engineer Aecom		
Employer The Coal Authority		

Ground Level +504.36mOD	Coordinates 378792.28E, 543128.99N	Grid OSGB
Hole Type TP	Method/Equipment 9T Tracked Excavator	
Date Started 09/09/2019	Date Completed 09/09/2019	Logged By MO



Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling Details	In Situ Test Details	Installation
TOPSOIL Very soft to soft dark brown mottled orange and light grey slightly gravelly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of sandstone. Cobbles are angular to subangular of sandstone. Soft to firm dark blue mottled orange and light grey slightly gravelly sandy CLAY with high cobble and boulder content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of sandstone. Cobbles and boulders are angular to subangular of sandstone. End of excavation at 0.90m. Termination Reason: Probable Boulder			0.10 (0.35) 0.45 (0.45) 0.90	504.26 503.91 503.46		B 1 0.50 D 3 0.80 ES 2 0.80		

Stability All faces stable	Excavation Dimensions and Orientation
Shoring None used	Length (Sides A and C) 3.20m
	Length (Sides B and D) 1.60m
	Depth 0.90m
	Bearing along Side A toward Side B 273°

DEPTH RELATED REMARKS			WATER STRIKES		WATER STRIKES DETAIL	
Depth Top	Depth Base	Remarks	Date Time	Depth Strike	Depth Sealed	Depth Water

BACKFILL			
Depth Top	Depth Base	Description	Remarks
0.00	0.90	Arisings	

DEPTH RELATED EXPLORATORY HOLE REMARKS		GENERAL NOTES	
Depth Top	Depth Base	Remarks	Remarks
			1. All sides similar. 2. Photographs taken of sides B, C and spoil.

	Notes: All depth in metres, all soil strengths are average in kPa. For in situ test results, see accompanying records. All bearings given relate to magnetic North. For details of abbreviations, see key.	
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Project Name Nenthead Mines - Proposed MWTS, GI	Excavation Log	Hole ID TP123
Project No. TA8234		Sheet 1 of 1
Engineer Aecom		
Employer The Coal Authority		

Ground Level +503.02mOD	Coordinates 378789.34E, 543238.09N	Grid OSGB
Hole Type TP	Method/Equipment 9T Tracked Excavator	
Date Started 06/09/2019	Date Completed 06/09/2019	Logged By MO

Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling Details	In Situ Test Details	Installation
TOPSOIL			0.10	502.92				
Soft to firm dark brown mottled orange and black slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of siltstone, sandstone and limestone. Cobbles are angular to subrounded of sandstone, siltstone and limestone.			(0.45)					
Firm to stiff dark blue mottled orange and black slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of siltstone and sandstone. Cobbles are angular to subangular of sandstone and siltstone.			0.55	502.47		B 1 0.50 D 3 0.60 ES 2 0.60		
			(0.55)			B 6 1.00 D 5 1.00 ES 4 1.00		
End of excavation at 1.10m. Termination Reason: Probable Boulder			1.10	501.92				

Stability All faces stable	Excavation Dimensions and Orientation
Shoring None used	Length (Sides A and C) 3.60m

DEPTH RELATED REMARKS		
Depth Top	Depth Base	Remarks
0.25	0.45	Mudstone lens on side B tapering off into side C.

WATER STRIKES				WATER STRIKES DETAIL	
Date	Time	Depth Strike	Depth Sealed	Depth Water	Time Elapsed

BACKFILL				
Depth Top	Depth Base	Description	Remarks	
0.00	1.10	Arisings		

DEPTH RELATED EXPLORATORY HOLE REMARKS			GENERAL NOTES		
Depth Top	Depth Base	Remarks	Remarks		
			1. All sides similar. 2. Photographs taken of sides C, D and spoil.		

Project Name Nenthead Mines - Proposed MWTS, GI	Excavation Log	Hole ID TP124
Project No. TA8234		Sheet 1 of 1
Engineer Aecom		
Employer The Coal Authority		

Ground Level +479.37mOD	Coordinates 378551.32E, 543371.68N	Grid OSGB
Hole Type TP	Method/Equipment 9T Tracked Excavator	
Date Started 04/09/2019	Date Completed 04/09/2019	Logged By MO

Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling Details	In Situ Test Details	Installation
TOPSOIL Firm grey mottled light brown slightly sandy slightly gravelly CLAY with high cobble and boulder content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of sandstone, siltstone and limestone. Cobbles and boulders are angular to subangular of siltstone. from 1.50m mottled multicoloured			0.10	479.27		B 1 0.50		
			(2.45)			D 3 1.00 ES 2 1.00	HV 1.00 HV 1.00	
			2.55	476.82		B 4 1.50 D 6 2.00 ES 5 2.00	HV 1.00 HV 1.00	
End of excavation at 2.55m. Termination Reason: Reached bedrock / Possible Boulder						B 7 2.50		

Stability All faces stable	Excavation Dimensions and Orientation
Shoring None used	Length (Sides A and C) 3.00m

DEPTH RELATED REMARKS		
Depth Top	Depth Base	Remarks

WATER STRIKES				WATER STRIKES DETAIL	
Date	Time	Depth Strike	Depth Sealed	Depth Water	Time Elapsed

BACKFILL			
Depth Top	Depth Base	Description	Remarks
0.00	2.55	Arisings	

DEPTH RELATED EXPLORATORY HOLE REMARKS		GENERAL NOTES
Depth Top	Depth Base	Remarks
		1. All sides similar. 2. Photographs taken of sides A, D and spoil.

	Notes: All depth in metres, all soil strengths are average in kPa. For in situ test results, see accompanying records. All bearings given relate to magnetic North. For details of abbreviations, see key.	
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Project Name	Nenthead Mines - Proposed MWTS, GI		Excavation Log		Hole ID
Project No.	TA8234				TP125
Engineer	Aecom				
Employer	The Coal Authority				Sheet 1 of 1

Ground Level	+475.37mOD	Coordinates	378521.44E, 543308.71N	Grid	OSGB
Hole Type	TP	Method/Equipment	9T Tracked Excavator		
Date Started	04/09/2019	Date Completed	04/09/2019	Logged By	MO

Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling Details	In Situ Test Details	Installation
<p>TOPSOIL</p> <p>Dark brownish grey very clayey very gravelly SAND with medium cobble content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of sandstone, limestone and siltstone. Cobbles are angular to subrounded of siltstone.</p> <p>Firm to stiff light brown mottled orange slightly sandy gravelly CLAY with high cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of sandstone, limestone and siltstone. Cobbles are angular to subrounded of siltstone.</p> <p>at 2.00m black mottling present</p>			0.10 0.20	475.27 475.17		D 2 0.25 ES 1 0.25 B 3 0.30		
			(2.20)			D 5 1.00 ES 4 1.00 B 6 1.50	HV 0.70 HV 0.70 HV 0.70	
at 2.00m black mottling present			2.40	472.97		D 8 2.00 ES 7 2.00		
End of excavation at 2.40m. Termination Reason: Probable boulder								









Stability	Unstable	Excavation Dimensions and Orientation			
Shoring	None used	Length (Sides A and C)	2.10m		
		Length (Sides B and D)	1.50m		
		Depth	2.40m		
		Bearing along Side A toward Side B	75°		

DEPTH RELATED REMARKS				WATER STRIKES		WATER STRIKES DETAIL	
Depth Top	Depth Base	Remarks		Date Time	Depth Strike	Depth Sealed	Depth Water
BACKFILL							
Depth Top	Depth Base	Description	Remarks	Date Time	Depth Strike	Depth Sealed	Depth Water
0.00	2.40	Arisings					

DEPTH RELATED EXPLORATORY HOLE REMARKS				GENERAL NOTES			
Depth Top	Depth Base	Remarks		Remarks			
				1. All sides similar. 2. Photographs taken of sides A, D and spoil.			

Project Name Nenthead Mines - Proposed MWTS, GI	Excavation Log	Hole ID TP126
Project No. TA8234		Sheet 1 of 1
Engineer Aecom		
Employer The Coal Authority		

Ground Level +478.20mOD	Coordinates 378580.09E, 543180.69N	Grid OSGB
Hole Type TP	Method/Equipment 9T Tracked Excavator	
Date Started 06/09/2019	Date Completed 06/09/2019	Logged By MO

Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling Details	In Situ Test Details	Installation	
<p>MADE GROUND: Dark grey very gravelly fine to coarse sand sized fragments with high cobble and medium boulder content. Gravel sized fragments are angular to subrounded fine to coarse of sandstone, limestone and siltstone. Cobble and boulder sized fragments are angular to subrounded of sandstone, limestone and siltstone.</p> <p>Brown mottled orange very gravelly clayey fine to coarse SAND with high cobble and low boulder content. Gravel is angular to subrounded fine to coarse of sandstone and siltstone. Cobbles and boulders are angular to subangular of sandstone and siltstone.</p>			(0.45)						
				0.45	477.75		B 1 0.50		
				(1.40)			D 3 1.00 ES 2 1.00		
				1.85	476.35		B 4 1.50		
End of excavation at 1.85m. Termination Reason: Probable boulder									



Stability All faces stable	Excavation Dimensions and Orientation
Shoring None used	Length (Sides A and C) 3.70m
	Length (Sides B and D) 2.05m
	Depth 1.85m
	Bearing along Side A toward Side B 152°

DEPTH RELATED REMARKS		
Depth Top	Depth Base	Remarks
0.85	1.85	Clay lenses present.
1.40	1.85	Minor collapse of side a - on corner with side B.

WATER STRIKES					WATER STRIKES DETAIL	
Date	Time	Depth	Strike	Depth Sealed	Depth Water	Time Elapsed

BACKFILL			
Depth Top	Depth Base	Description	Remarks
0.00	1.85	Arisings	

DEPTH RELATED EXPLORATORY HOLE REMARKS		GENERAL NOTES
Depth Top	Depth Base	Remarks
		1. All sides similar. 2. Photographs taken of sides A, B and spoil.

	Notes: All depth in metres, all soil strengths are average in kPa. For in situ test results, see accompanying records. All bearings given relate to magnetic North. For details of abbreviations, see key.	 SOIL ENGINEERING Part of the Bachy Soletanche Group
FINAL	Print date and time 17/01/2020 19:25	Log checked by MPB
Form No. SIEXPHOLETLOG	Issue/Revision No. 2.05	Issue Date 04/01/2019

Project Name Nenthead Mines - Proposed MWTS, GI	Excavation Log	Hole ID TP127
Project No. TA8234		Sheet 1 of 1
Engineer Aecom		
Employer The Coal Authority		

Ground Level +487.71mOD	Coordinates 378656.86E, 543096.85N	Grid OSGB
Hole Type TP	Method/Equipment 9T Tracked Excavator	
Date Started 09/09/2019	Date Completed 09/09/2019	Logged By MO

Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling Details	In Situ Test Details	Installation
TOPSOIL MADE GROUND: Brown mottled dark grey and orange slightly gravelly sandy clay with high cobble and boulder content. Sand sized fragments are fine to coarse. Gravel sized fragments are angular to subrounded fine to coarse of sandstone. Cobble and boulder sized fragments are angular to subangular of sandstone.		[Cross-hatch pattern]	0.10 (1.20)	487.61		B 1 0.50		[Wavy pattern]
Soft to firm dark brown mottled light grey and orange slightly gravelly sandy CLAY with high cobble content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of sandstone. Cobbles are angular to subangular of sandstone.		[Dotted pattern]	1.30 (0.95)	486.41		D 3 1.00 ES 2 1.00 D 5 1.35 ES 4 1.35 B 6 1.50		[Wavy pattern]
End of excavation at 2.25m. Termination Reason: Probable Boulder			2.25	485.46		D 8 2.00 ES 7 2.00		[Wavy pattern]

Stability All faces stable	Excavation Dimensions and Orientation
Shoring None used	Length (Sides A and C) 3.60m
	Length (Sides B and D) 1.80m
	Depth 2.25m
	Bearing along Side A toward Side B 322°

DEPTH RELATED REMARKS		
Depth Top	Depth Base	Remarks
1.80	1.85	Seepage on side C. Collapse of corner on side A.
1.90	2.20	

WATER STRIKES				WATER STRIKES DETAIL	
Date	Time	Depth Strike	Depth Sealed	Depth Water	Time Elapsed

BACKFILL			
Depth Top	Depth Base	Description	Remarks
0.00	2.25	Arisings	

DEPTH RELATED EXPLORATORY HOLE REMARKS		GENERAL NOTES
Depth Top	Depth Base	Remarks
		1. All sides similar. 2. Photographs taken of sides A, D and spoil.

	Notes: All depth in metres, all soil strengths are average in kPa. For in situ test results, see accompanying records. All bearings given relate to magnetic North. For details of abbreviations, see key.	
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Project Name	Nenthead Mines - Proposed MWTS, GI		Excavation Log	Hole ID	TP128
Project No.	TA8234			Sheet 1 of 1	
Engineer	Aecom				
Employer	The Coal Authority				

Ground Level	+496.69mOD	Coordinates	378761.32E, 542992.53N	Grid	OSGB
Hole Type	TP	Method/Equipment	9T Tracked Excavator		
Date Started	09/09/2019	Date Completed	09/09/2019	Logged By	MO

Description of Strata	Weathering	Legend	Depth (Thickness)	Datum Level	Waterstrike	Sampling Details	In Situ Test Details	Installation
TOPSOIL MADE GROUND: Dark grey very gravelly clayey fine to coarse sand sized fragments with high cobble and medium boulder content. Gravel sized fragments are angular to subrounded fine to coarse of sandstone and siltstone. Cobble sized fragments are angular to subrounded of sandstone and siltstone. Boulder sized fragments are angular to subangular of sandstone and siltstone. Soft to firm dark brown mottled orange sandy gravelly organic CLAY with medium cobble and boulder content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of sandstone and mudstone. Cobbles and boulders are angular to subangular of sandstone and mudstone. Soft to firm light grey mottled reddish brown sandy gravelly organic CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of sandstone. Cobbles are angular to subangular of sandstone. Firm to stiff dark blue mottled dark grey sandy gravelly organic CLAY with low cobble and boulder content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of limestone. Cobbles and boulders are angular to subangular of limestone.			0.10 (0.45) 0.55 (0.40) 0.95 1.20 (1.05) 2.25	496.59 496.14 495.74 495.49 494.44		B 1 0.50 D 3 0.60 ES 2 0.60 D 5 1.00 ES 4 1.00 D 7 1.25 ES 6 1.25 B 8 1.50 D 10 1.65 ES 9 1.65 B 11 2.00		
End of excavation at 2.25m. Termination Reason: Probable boulder								

Stability	All faces stable	Excavation Dimensions and Orientation
Shoring	None used	

DEPTH RELATED REMARKS			Length (Sides A and C)	3.40m
DEPTH RELATED REMARKS			Length (Sides B and D)	1.90m
DEPTH RELATED REMARKS			Depth	2.25m
DEPTH RELATED REMARKS			Bearing along Side A toward Side B	257°

WATER STRIKES			WATER STRIKES DETAIL			
Date	Time	Depth	Strike	Depth Sealed	Depth Water	Time Elapsed

BACKFILL				
Depth Top	Depth Base	Description	Remarks	
0.00	2.25	Arisings		

DEPTH RELATED EXPLORATORY HOLE REMARKS			GENERAL NOTES		
Depth Top	Depth Base	Remarks	Remarks		
			1. All sides similar. 2. Photographs taken of sides A, D and spoil.		



SUPPORTING FACTUAL DATA


SECTION A

Exploratory Hole Records and Field Data

IN SITU TEST DATA


Project Name	Nenthead Mines - Proposed MWTS, GI	Photo Ionisation Results	Table No. 1
Project No.	TA8234		
Engineer	Aecom		
Client	The Coal Authority		

Hole ID	Sample Depth m	Sample Type	Sample Ref.	Test Number	Test Date yyyy-mm-dd	PID ppm	Temp. °C	Weather	Remarks	PID Device Type
BH102R	0.20	ES	1	1	2019-09-19	<0.1	16.0	Warm and dry		Mini-Rae Lite
BH102R	0.50	ES	2	1	2019-09-19	<0.1	16.0	Warm and dry		Mini-Rae Lite
BH102R	1.00	ES	3	1	2019-09-19	<0.1	16.0	Warm and dry		Mini-Rae Lite
BH102R	2.00	ES	6	1	2019-09-19	<0.1	16.0	Warm and dry		Mini-Rae Lite
BH102R	3.00	ES	10	1	2019-09-19	<0.1	16.0	Warm and dry		Mini-Rae Lite
BH102R	4.00	ES	14	1	2019-09-19	<0.1	16.0	Warm and dry		Mini-Rae Lite
BH103	0.00	ES	1	1	2019-09-05	<0.1	14.0	Cold and dry		Mini-Rae Lite
BH103	0.50	ES	2	1	2019-09-05	<0.1	14.0	Cold and dry		Mini-Rae Lite
BH103	1.00	ES	3	1	2019-09-05	<0.1	14.0	Cold and dry		Mini-Rae Lite
BH103	2.00	ES	7	1	2019-09-05	<0.1	14.0	Cold and dry		Mini-Rae Lite
BH103	3.00	ES	11	1	2019-09-05	<0.1	14.0	Cold and dry		Mini-Rae Lite
BH103	4.00	ES	15	1	2019-09-05	<0.1	14.0	Cold and dry		Mini-Rae Lite
BH104	0.20	ES	1	1	2019-09-19	1.0	16.0	Cold and dry		Mini-Rae Lite
BH104	0.50	ES	2	1	2019-09-19	<0.1	16.0	Cold and dry		Mini-Rae Lite
BH104	1.00	ES	5	1	2019-09-19	<0.1	16.0	Cold and dry		Mini-Rae Lite
BH104	2.00	ES	8	1	2019-09-19	<0.1	16.0	Cold and dry		Mini-Rae Lite
BH104	3.00	ES	12	1	2019-09-19	1.0	16.0	Cold and dry		Mini-Rae Lite
BH105	0.20	ES	1	1	2019-09-19	1.0	16.0	Cold and dry		Mini-Rae Lite
BH105	0.50	ES	2	1	2019-09-19	<0.1	16.0	Cold and dry		Mini-Rae Lite
BH105	1.00	ES	3	1	2019-09-19	<0.1	16.0	Cold and dry		Mini-Rae Lite
BH105	2.00	ES	7	1	2019-09-19	<0.1	16.0	Cold and dry		Mini-Rae Lite
BH105	3.00	ES	10	1	2019-09-19	1.0	16.0	Cold and dry		Mini-Rae Lite
BH106	0.20	ES	2	1	2019-09-19	1.0	16.0	Cold and dry		Mini-Rae Lite
BH106	0.50	ES	3	1	2019-09-19	<0.1	16.0	Cold and dry		Mini-Rae Lite
BH106	1.00	ES	4	1	2019-09-19	<0.1	16.0	Cold and dry		Mini-Rae Lite
BH106	2.00	ES	7	1	2019-09-19	1.0	16.0	Cold and dry		Mini-Rae Lite
BH106	3.00	ES	11	1	2019-09-19	1.0	16.0	Cold and dry		Mini-Rae Lite
BH106	4.00	ES	15	1	2019-09-05	<0.1	14.0	Cold and dry		Mini-Rae Lite
BH106	5.00	ES	19	1	2019-09-19	1.0	16.0	Cold and dry		Mini-Rae Lite
TP104	1.00	ES	2	1	2019-09-05	<0.1	14.0	Cold and dry		Mini-Rae Lite
TP104	2.00	ES	6	1	2019-09-05	<0.1	14.0	Cold and dry		Mini-Rae Lite
TP109	1.00	ES	2	1	2019-09-05	<0.1	14.0	Cold and dry		Mini-Rae Lite
TP110	1.00	ES	2	1	2019-09-19	1.0	16.0	Cold and dry		Mini-Rae Lite

Checked By: ian.swain		Approved By: ian.swain		 SOIL ENGINEERING Part of the Bachy Soletanche Group
Date: 17/01/2020		Date: 17/01/2020		
Form No. SE-EMS-F-001	Revision No. 2.00	Issue Date 19/02/2015		


Project Name	Nenthead Mines - Proposed MWTS, GI	Photo Ionisation Results	Table No. 1
Project No.	TA8234		
Engineer	Aecom		
Client	The Coal Authority		

Hole ID	Sample Depth m	Sample Type	Sample Ref.	Test Number	Test Date yyyy-mm-dd	PID ppm	Temp. °C	Weather	Remarks	PID Device Type
TP110	2.00	ES	5	1	2019-09-19	1.0	16.0	Cold and dry		Mini-Rae Lite
TP110	3.00	ES	8	1	2019-09-19	1.0	16.0	Cold and dry		Mini-Rae Lite
TP111	1.00	ES	2	1	2019-09-19	1.0	16.0	Cold and dry		Mini-Rae Lite
TP112	1.00	ES	2	1	2019-09-19	1.0	16.0	Cold and dry		Mini-Rae Lite
TP112	2.00	ES	5	1	2019-09-19	1.0	16.0	Cold and dry		Mini-Rae Lite
TP113	1.00	ES	2	1	2019-09-05	1.0	14.0	Cold and dry		Mini-Rae Lite
TP114	1.00	ES	2	1	2019-09-19	1.0	16.0	Cold and dry		Mini-Rae Lite
TP114	1.70	ES	5	1	2019-09-19	1.0	16.0	Cold and dry		Mini-Rae Lite
TP114	1.90	ES	8	1	2019-09-19	2.0	16.0	Cold and dry		Mini-Rae Lite
TP114	2.00	ES	10	1	2019-09-19	1.0	16.0	Cold and dry		Mini-Rae Lite
TP114	3.00	ES	13	1	2019-09-19	1.0	16.0	Cold and dry		Mini-Rae Lite
TP115	1.20	ES	4	1	2019-09-19	2.0	16.0	Cold and dry		Mini-Rae Lite
TP116	1.00	ES	2	1	2019-09-10	0.8	12.0	Cold and dry		Mini-Rae Lite
TP117	1.00	ES	2	1	2019-09-10	5.4	12.0	Cold and dry		Mini-Rae Lite
TP118	1.00	ES	2	1	2019-09-10	3.8	12.0	Cold and dry		Mini-Rae Lite
TP119	0.80	ES	2	1	2019-09-10	4.3	12.0	Cold and dry		Mini-Rae Lite
TP120	1.00	ES	2	1	2019-09-05	<0.1	14.0	Cold and dry		Mini-Rae Lite
TP120	1.20	ES	4	1	2019-09-05	<0.1	14.0	Cold and dry		Mini-Rae Lite
TP121	0.80	ES	2	1	2019-09-10	7.6	12.0	Cold and dry		Mini-Rae Lite
TP123	0.60	ES	2	1	2019-09-19	1.0	16.0	Cold and dry		Mini-Rae Lite
TP123	1.00	ES	4	1	2019-09-19	1.0	16.0	Cold and dry		Mini-Rae Lite
TP124	1.00	ES	2	1	2019-09-19	<0.1	16.0	Cold and dry		Mini-Rae Lite
TP124	2.00	ES	5	1	2019-09-19	<0.1	16.0	Cold and dry		Mini-Rae Lite
TP125	0.85	ES	1	1	2019-09-05	<0.1	14.0	Cold and dry		Mini-Rae Lite
TP125	1.00	ES	2	1	2019-09-05	<0.1	14.0	Cold and dry		Mini-Rae Lite
TP125	2.00	ES	4	1	2019-09-05	<0.1	14.0	Cold and dry		Mini-Rae Lite
TP126	1.00	ES	2	1	2019-09-19	1.0	16.0	Cold and dry		Mini-Rae Lite
TP127	1.00	ES	2	1	2019-09-05	<0.1	14.0	Cold and dry		Mini-Rae Lite
TP127	1.35	ES	4	1	2019-09-05	1.0	14.0	Cold and dry		Mini-Rae Lite
TP127	2.00	ES	7	1	2019-09-05	<0.1	14.0	Cold and dry		Mini-Rae Lite
TP128	1.00	ES	8	1	2019-09-05	<0.1	14.0	Cold and dry		Mini-Rae Lite
TP128	1.25	ES	6	1	2019-09-05	<0.1	14.0	Cold and dry		Mini-Rae Lite
TP128	1.65	ES	9	1	2019-09-05	<0.1	14.0	Cold and dry		Mini-Rae Lite

Checked By: ian.swain		Approved By: ian.swain		 SOIL ENGINEERING Part of the Bachy Soletanche Group
Date: 17/01/2020		Date: 17/01/2020		
Form No. SE-EMS-F-001	Revision No. 2.00	Issue Date 19/02/2015		

Project Name	Nenthead Mines - Proposed MWTS, GI	Photo Ionisation Results	Table No. 1
Project No.	TA8234		
Engineer	Aecom		
Client	The Coal Authority		

Hole ID	Sample Depth m	Sample Type	Sample Ref.	Test Number	Test Date yyyy-mm-dd	PID ppm	Temp. °C	Weather	Remarks	PID Device Type
WS101	0.20	ES		1	2019-09-05	1.0	14.0	Cold and dry		Mini-Rae Lite
WS101	0.50	ES	4	1	2019-09-05	1.0	14.0	Cold and dry		Mini-Rae Lite
WS101	1.00	ES	8	1	2019-09-05	1.0	14.0	Cold and dry		Mini-Rae Lite
WS102	0.20	ES	2	1	2019-09-13	3.5	14.0	Raining		Mini-Rae Lite
WS102	0.50	ES	4	1	2019-09-13	4.1	14.0	Raining		Mini-Rae Lite
WS102	1.00	ES	6	1	2019-09-13	2.0	14.0	Raining		Mini-Rae Lite
WS104	0.20	ES	2	1	2019-09-12	10.2	14.0	Raining		Mini-Rae Lite
WS104	0.50	ES	5	1	2019-09-12	7.8	14.0	Raining		Mini-Rae Lite
WS104	1.00	ES	8	1	2019-09-12	8.7	14.0	Raining		Mini-Rae Lite
WS105	0.20	ES	2	1	2019-09-11	4.0	13.0	Cold and dry		Mini-Rae Lite
WS105	0.50	ES	4	1	2019-09-11	6.9	13.0	Cold and dry		Mini-Rae Lite
WS105	1.00	ES	6	1	2019-09-11	4.5	13.0	Cold and dry		Mini-Rae Lite
WS106	0.20	ES	2	1	2019-09-11	11.1	13.0	Cold and dry		Mini-Rae Lite
WS106	0.50	ES	4	1	2019-09-11	3.2	13.0	Cold and dry		Mini-Rae Lite
WS106	1.00	ES	7	1	2019-09-11	5.7	13.0	Cold and dry		Mini-Rae Lite
WS107	0.20	ES	2	1	2019-09-11	0.7	13.0	Cold and dry		Mini-Rae Lite
WS107	0.50	ES	4	1	2019-09-11	4.9	13.0	Cold and dry		Mini-Rae Lite
WS107	1.00	ES	6	1	2019-09-11	5.4	13.0	Cold and dry		Mini-Rae Lite
WS108	0.20	ES	2	1	2019-09-10	4.5	12.0	Cold and dry		Mini-Rae Lite
WS108	1.00	ES	6	1	2019-09-10	7.9	12.0	Cold and dry		Mini-Rae Lite
WS109	0.20	ES	2	1	2019-09-10	17.4	12.0	Cold and dry		Mini-Rae Lite
WS109	0.50	ES	5	1	2019-09-10	1.8	12.0	Cold and dry		Mini-Rae Lite
WS109	1.00	ES	6	1	2019-09-10	16.7	12.0	Cold and dry		Mini-Rae Lite
WSBH101R	0.20	ES	2	1	2019-09-05	1.0	14.0	Cold and dry		Mini-Rae Lite
WSBH101R	0.50	ES	4	1	2019-09-05	1.0	14.0	Cold and dry		Mini-Rae Lite
WSBH101R	1.00	ES	8	1	2019-09-10	6.6	12.0	Cold and dry		Mini-Rae Lite
WSTP101	0.20	ES	2	1	2019-09-10	7.2	12.0	Cold and dry		Mini-Rae Lite
WSTP101	0.50	ES	4	1	2019-09-10	11.0	12.0	Cold and dry		Mini-Rae Lite
WSTP101	1.00	ES	7	1	2019-09-10	9.2	12.0	Cold and dry		Mini-Rae Lite
WSTP101	1.20-1.54	LES	9.1	1	2019-09-10	6.4	12.0	Cold and dry		Mini-Rae Lite
WSTP102	0.20	ES	2	1	2019-09-10	5.6	12.0	Cold and dry		Mini-Rae Lite
WSTP102	0.50	ES	4	1	2019-09-10	21.8	12.0	Cold and dry		Mini-Rae Lite
WSTP102	1.20-1.56	LES	9.1	1	2019-09-10	6.1	12.0	Cold and dry		Mini-Rae Lite


Checked By: ian.swain		Approved By: ian.swain		 SOIL ENGINEERING Part of the Bachy Soletanche Group
Date: 17/01/2020		Date: 17/01/2020		
Form No. SE-EMS-F-001	Revision No. 2.00	Issue Date 19/02/2015		

Project Name Nenthead Mines - Proposed MWTS, GI
 Project No. TA8234
 Engineer Aecom
 Client The Coal Authority

**Photo Ionisation
 Results**

Table No.
 1

Hole ID	Sample Depth m	Sample Type	Sample Ref.	Test Number	Test Date yyyy-mm-dd	PID ppm	Temp. °C	Weather	Remarks	PID Device Type
WSTP103	0.20	ES	2	1	2019-09-12	1.6	14.0	Raining		Mini-Rae Lite
WSTP103	0.50	ES	5	1	2019-09-12	2.1	14.0	Raining		Mini-Rae Lite
WSTP103	1.00	ES	8	1	2019-09-12	1.9	14.0	Raining		Mini-Rae Lite
WSTP104	1.00	ES	5	1	2019-09-10	9.6	12.0	Cold and dry		Mini-Rae Lite
WSTP105	0.20	ES	2	1	2019-09-13	1.5	14.0	Raining		Mini-Rae Lite
WSTP105	0.50	ES	5	1	2019-09-13	5.7	14.0	Raining		Mini-Rae Lite
WSTP105	1.00	ES	8	1	2019-09-13	3.8	14.0	Raining		Mini-Rae Lite
WSTP106	0.20	ES	2	1	2019-09-16	1.2	13.0	Sunny		Mini-Rae Lite
WSTP106	0.50	ES	4	1	2019-09-16	0.8	13.0	Sunny		Mini-Rae Lite
WSTP106	1.00	ES	6	1	2019-09-16	2.2	13.0	Sunny		Mini-Rae Lite
WSTP107	0.20	ES	2	1	2019-09-16	0.5	13.0	Sunny		Mini-Rae Lite
WSTP107	0.50	ES	4	1	2019-09-16	0.8	13.0	Sunny		Mini-Rae Lite
WSTP107	1.00	ES	6	1	2019-09-16	0.6	13.0	Sunny		Mini-Rae Lite
WSTP108	0.50	ES	4	1	2019-09-10	5.2	12.0	Cold and dry		Mini-Rae Lite

Checked By: ian.swain					Approved By: ian.swain					 SOIL ENGINEERING Part of the Bachy Soletanche Group
Date: 17/01/2020					Date: 17/01/2020					
Form No. SE-EMS-F-001		Revision No. 2.00			Issue Date 19/02/2015					

Project Name	Nenthead Mines - Proposed MWTS, GI	Vane and Penetrometer Results for Excavations	Hole ID
Project No.	TA8234		TP111
Engineer	Aecom		Table No.
Employer	The Coal Authority		1

Depth m	Test no.	Peak Vane kPa	Residual Vane kPa	Penetrometer kPa	Date	Remarks
1.00	1	>140	10		05/09/2019	
1.00	2	>140	68		05/09/2019	
1.00	3	>140	112		05/09/2019	

Project Name	Nenthead Mines - Proposed MWTS, GI	Vane and Penetrometer Results for Excavations	Hole ID	TP115
Project No.	TA8234		Table No.	
Engineer	Aecom		1	
Employer	The Coal Authority			

Depth m	Test no.	Peak Vane kPa	Residual Vane kPa	Penetrometer kPa	Date	Remarks
1.00	1	48	28		06/09/2019	
1.00	2	16	14		06/09/2019	
1.00	3	32	20		06/09/2019	

Project Name	Nenthead Mines - Proposed MWTS, GI	Vane and Penetrometer Results for Excavations	Hole ID	TP124
Project No.	TA8234		Table No.	
Engineer	Aecom		1	
Employer	The Coal Authority			

Depth m	Test no.	Peak Vane kPa	Residual Vane kPa	Penetrometer kPa	Date	Remarks
1.00	1	52	30		04/09/2019	
1.00	2	44	18		04/09/2019	
1.00	3	48	20		04/09/2019	

Project Name	Nenthead Mines - Proposed MWTS, GI	Vane and Penetrometer Results for Excavations	Hole ID
Project No.	TA8234		TP125
Engineer	Aecom		Table No.
Employer	The Coal Authority		1

Depth m	Test no.	Peak Vane kPa	Residual Vane kPa	Penetrometer kPa	Date	Remarks
0.70	1	40	26		04/09/2019	
0.70	2	54	16		04/09/2019	
0.70	3	48	26		04/09/2019	



SUPPORTING FACTUAL DATA

SECTION A

Exploratory Hole Records and Field Data

GROUNDWATER / GAS MONITORING RESULTS

Project Name	Nenthead Mines - Proposed MWTS, GI	Groundwater Readings For Installations	Table No.
Project No.	TA8234		
Engineer	Aecom		
Client	The Coal Authority		

NOTES: SPIE=Piezometer, SP=Standpipe
 For multiple installations at the same depth, use different Installation IDs. Otherwise, the field is optional.
 Monitoring point depth for piezometers = tip depth, for standpipes = base of response zone

COMMENTS


Exploratory Hole ID	Installation Details				Recorded Water Level								
	Type	Depth to base of pipe	Monitoring point depth	ID	Date	Time	Reading	Date	Time	Reading	Date	Time	Reading
		m			m	dd/mm/yyyy	hh:mm	m	dd/mm/yyyy	hh:mm	m	dd/mm/yyyy	hh:mm
BH102R	SP	5.00	5.01	01	20/09/2019	09:45	2.75	01/10/2019	12:20	2.61	09/10/2019	12:30	2.52
BH103	SPIE	4.10	4.10	01	20/09/2019	12:30	1.40	01/10/2019	10:59	2.20	09/10/2019	14:00	2.32
BH104	SPIE	3.40	3.40	01	20/09/2019	13:45	1.20	01/10/2019	11:17	1.08	09/10/2019	14:05	1.00
BH106	SPIE	5.70	5.70	01	20/09/2019	14:15	1.40	01/10/2019	11:40	1.07	09/10/2019	14:20	0.93
BH107	SP	4.00	4.00	01	20/09/2019	14:00	0.75	01/10/2019	11:30	0.66	09/10/2019	14:10	0.46
WS103	SP	2.80	2.80	01	20/09/2019	12:15	0.65	01/10/2019	10:37	1.37	09/10/2019	13:50	1.35
WS104	SP	3.20	3.20	01	20/09/2019	12:45	0.45	01/10/2019	11:06	0.33	09/10/2019	13:45	0.23
WSBH101R	SP	2.30	2.30	01	20/09/2019	09:30	1.85	01/10/2019	11:57	1.76	09/10/2019	12:40	1.69


Project Name	Nenthead Mines - Proposed MWTS, GI	Groundwater Readings For Installations	Table No.
Project No.	TA8234		
Engineer	Aecom		
Client	The Coal Authority		


NOTES: SPIE=Piezometer, SP=Standpipe
 For multiple installations at the same depth, use different Installation IDs. Otherwise, the field is optional.
 Monitoring point depth for piezometers = tip depth, for standpipes = base of response zone


COMMENTS


Exploratory Hole ID	Installation Details				Recorded Water Level								
	Type	Depth to base of pipe	Monitoring point depth	ID	Date	Time	Reading	Date	Time	Reading	Date	Time	Reading
		m			m	dd/mm/yyyy	hh:mm	m	dd/mm/yyyy	hh:mm	m	dd/mm/yyyy	hh:mm
BH102R	SP	5.00	5.01	01	17/10/2019	11:12	2.55	25/10/2019	11:10	2.61			
BH103	SPIE	4.10	4.10	01	17/10/2019	12:09	2.16	25/10/2019	12:10	2.30			
BH104	SPIE	3.40	3.40	01	17/10/2019	12:28	1.08	25/10/2019	11:50	1.00			
BH106	SPIE	5.70	5.70	01	17/10/2019	12:38	1.00	25/10/2019	11:30	1.00			
BH107	SP	4.00	4.00	01	17/10/2019	12:50	0.68	25/10/2019	11:40	0.70			
WS103	SP	2.80	2.80	01	17/10/2019	12:07	1.24	25/10/2019	12:20	1.47			
WS104	SP	3.20	3.20	01	17/10/2019	12:18	0.27	25/10/2019	12:00	0.34			
WSBH101R	SP	2.30	2.30	01	17/10/2019	11:23	1.82	25/10/2019	11:00	1.82			


Recorded by: Various	Checked by: Ian.Swain	Approved by: Ian Swain	 SOIL ENGINEERING Part of the Bachy Soletanche Group
Date: 30/09/2019	Date: 17/01/2020	Date: 17/01/2020	
Form No. SE-PGR-F-008	Issue.Revision No. 2.05	Issue Date 24/01/2014	

Project Name		Nenthead Mines - Proposed MWTS, GI		Record Of Gas Monitoring				Hole ID				
Project No.		TA8234						BH102R				
Engineer		Aecom						Table No.				
Client		The Coal Authority										
Notes												
Type of Sampling Point: GMP = Gas Monitoring Point, GMP+SP = Gas Monitoring Point and Standpipe, GMP+SPIE = Gas Monitoring Point and Standpipe Piezometer, GMP+GWMP = Gas Monitoring Point and Groundwater Monitoring Point												
For double gas valves, record valves separately, using separate Monitoring Point ID												
Distance to monitoring point		m	5.00		Monitoring Point ID				01			
Top of response zone		m	1.00		Base of response zone		m	5.01				
Well Type		SP		Initial base depth of installation		m	5.00					
Measured Parameter		Units	Detection Limit									
Monitoring round no.		N/A	N/A	1	2	3	4	5	6	7	8	
Date		dd/mm/yyyy	N/A	17/10/2019	25/10/2019							
Time of initial readings		hh:mm:ss	N/A	11:06:00	11:10:00							
Water Level		m	0.01	2.55	2.61							
Atmospheric pressure		mb	1	951	956							
Relative pressure		mb	1	<1	<1							
Base depth of installation at time of monitoring		m	0.01	5.00	4.44							
Time of 'Peak' readings		hh:mm:ss	N/A	11:08:00	11:11:00							
CH ₄ : (LEL) Peak		%	1	<1	<1							
CH ₄ : Peak		%v/v	0.1	<0.1	<0.1							
CO ₂ : Peak		%v/v	0.1	1.1	1.3							
O ₂ : Minimum		%v/v	0.1	20.0	20.1							
CO: Peak		ppm	1	1	1							
H ₂ S: Peak		ppm	1	<1	<1							
Time of Steady readings		hh:mm:ss	N/A	11:10:00	11:12:00							
CH ₄ : (LEL) Steady State		%	1	<1	<1							
CH ₄ : Steady State		%v/v	0.1	<0.1	<0.1							
CO ₂ : Steady State		%v/v	0.1	1.0	1.3							
O ₂ : Steady State		%v/v	0.1	20.0	20.1							
CO: Steady State		ppm	1	1	1							
H ₂ S: Steady State		ppm	1	<1	<1							
Gas Flow		l/hr	0.1	-0.1	0.1							
Weather Conditions:				Fine	Cloud							
Equipment Type			GA5000	GA5000								
Equipment Serial Number			G501004	G501004								
Equipment Last Calibrated			19/06/2019	19/06/2019								
Monitored By			CR	EB								
Comments												
												
Form No.		SE-EMS-F-002	Revision No.		2.06	Issue Date		27/01/2014	Part of the Bachy Soletanche Group			

Project Name	Nenthead Mines - Proposed MWTS, GI		Record Of Gas Monitoring				Hole ID				
Project No.	TA8234						BH107				
Engineer	Aecom						Table No.				
Client	The Coal Authority										
Notes	Type of Sampling Point: GMP = Gas Monitoring Point, GMP+SP = Gas Monitoring Point and Standpipe, GMP+SPIE = Gas Monitoring Point and Standpipe Piezometer, GMP+GWMP = Gas Monitoring Point and Groundwater Monitoring Point For double gas valves, record valves separately, using separate Monitoring Point ID										
Distance to monitoring point	m	4.00		Monitoring Point ID				1			
Top of response zone	m	1.00		Base of response zone		m	4.00				
Well Type	SP		Initial base depth of installation		m	4.00					
Measured Parameter	Units	Detection Limit									
Monitoring round no.	N/A	N/A	1	2	3	4	5	6	7	8	
Date	dd/mm/yyyy	N/A	17/10/2019	25/10/2019							
Time of initial readings	hh:mm:ss	N/A	12:34:00	11:40:00							
Water Level	m	0.01	0.68	0.70							
Atmospheric pressure	mb	1	954	956							
Relative pressure	mb	1	<1	<1							
Base depth of installation at time of monitoring	m	0.01	3.61	3.70							
Time of 'Peak' readings	hh:mm:ss	N/A	12:35:00	11:41:00							
CH ₄ : (LEL) Peak	%	1	<1	<1							
CH ₄ : Peak	%v/v	0.1	<0.1	<0.1							
CO ₂ : Peak	%v/v	0.1	0.1	0.1							
O ₂ : Minimum	%v/v	0.1	21.7	22.2							
CO: Peak	ppm	1	2	<1							
H ₂ S: Peak	ppm	1	<1	<1							
Time of Steady readings	hh:mm:ss	N/A	12:38:00	11:42:00							
CH ₄ : (LEL) Steady State	%	1	<1	<1							
CH ₄ : Steady State	%v/v	0.1	<0.1	<0.1							
CO ₂ : Steady State	%v/v	0.1	0.1	0.1							
O ₂ : Steady State	%v/v	0.1	21.7	22.2							
CO: Steady State	ppm	1	<1	<1							
H ₂ S: Steady State	ppm	1	<1	<1							
Gas Flow	l/hr	0.1	-0.1	0.1							
Weather Conditions:			Fine	Cloud							
Equipment Type			GA5000	GA5000							
Equipment Serial Number			G501004	G501004							
Equipment Last Calibrated			19/06/2019	19/06/2019							
Monitored By			CR	EB							
Comments											
 SOIL ENGINEERING Part of the Bachy Soletanche Group											
Form No.	SE-EMS-F-002	Revision No.	2.06	Issue Date	27/01/2014						

Project Name		Nenthead Mines - Proposed MWTS, GI		Record Of Gas Monitoring					Hole ID		
Project No.		TA8234							WS103		
Engineer		Aecom								Table No.	
Client		The Coal Authority									
Notes											
Type of Sampling Point: GMP = Gas Monitoring Point, GMP+SP = Gas Monitoring Point and Standpipe, GMP+SPIE = Gas Monitoring Point and Standpipe Piezometer, GMP+GWMP = Gas Monitoring Point and Groundwater Monitoring Point For double gas valves, record valves separately, using separate Monitoring Point ID											
Distance to monitoring point		m	2.80		Monitoring Point ID			01			
Top of response zone		m	1.00		Base of response zone		m	2.80			
Well Type		SP			Initial base depth of installation		m	2.80			
Measured Parameter		Units	Detection Limit								
Monitoring round no.		N/A	N/A	1	2	3	4	5	6	7	8
Date		dd/mm/yyyy	N/A	17/10/2019	25/10/2019						
Time of initial readings		hh:mm:ss	N/A	12:02:00	12:20:00						
Water Level		m	0.01	1.24	1.47						
Atmospheric pressure		mb	1	945	949						
Relative pressure		mb	1	-1	<1						
Base depth of installation at time of monitoring		m	0.01	2.80	2.80						
Time of 'Peak' readings		hh:mm:ss	N/A	12:03:00	12:21:00						
CH ₄ : (LEL) Peak		%	1	<1	<1						
CH ₄ : Peak		%v/v	0.1	<0.1	<0.1						
CO ₂ : Peak		%v/v	0.1	0.9	1.4						
O ₂ : Minimum		%v/v	0.1	19.9	19.4						
CO: Peak		ppm	1	<1	<1						
H ₂ S: Peak		ppm	1	<1	<1						
Time of Steady readings		hh:mm:ss	N/A	12:05:00	11:02:00						
CH ₄ : (LEL) Steady State		%	1	<1	<1						
CH ₄ : Steady State		%v/v	0.1	<0.1	<0.1						
CO ₂ : Steady State		%v/v	0.1	0.3	1.0						
O ₂ : Steady State		%v/v	0.1	19.9	19.6						
CO: Steady State		ppm	1	<1	<1						
H ₂ S: Steady State		ppm	1	<1	<1						
Gas Flow		l/hr	0.1	-0.5	2.8						
Weather Conditions:				Fine	Cloud						
Equipment Type				GA5000	GA5000						
Equipment Serial Number				G501004	G501004						
Equipment Last Calibrated				19/06/2019	19/06/2019						
Monitored By				CR	EB						
Comments											
 SOIL ENGINEERING											
Form No.		SE-EMS-F-002	Revision No.		2.06	Issue Date		27/01/2014	Part of the Bachy Soletanche Group		

Project Name		Nenthead Mines - Proposed MWTS, GI		Record Of Gas Monitoring				Hole ID			
Project No.		TA8234						WS104			
Engineer		Aecom						Table No.			
Client		The Coal Authority									
Notes											
Type of Sampling Point: GMP = Gas Monitoring Point, GMP+SP = Gas Monitoring Point and Standpipe, GMP+SPIE = Gas Monitoring Point and Standpipe Piezometer, GMP+GWMP = Gas Monitoring Point and Groundwater Monitoring Point											
For double gas valves, record valves separately, using separate Monitoring Point ID											
Distance to monitoring point		m	3.20		Monitoring Point ID				01		
Top of response zone		m	1.00		Base of response zone		m	3.20			
Well Type		SP		Initial base depth of installation		m	3.20				
Measured Parameter	Units	Detection Limit									
Monitoring round no.	N/A	N/A	1	2	3	4	5	6	7	8	
Date	dd/mm/yyyy	N/A	17/10/2019	25/10/2019							
Time of initial readings	hh:mm:ss	N/A	12:12:00	12:00:00							
Water Level	m	0.01	0.27	0.34							
Atmospheric pressure	mb	1	945	949							
Relative pressure	mb	1	<1	<1							
Base depth of installation at time of monitoring	m	0.01	3.25	3.15							
Time of 'Peak' readings	hh:mm:ss	N/A	12:14:00	12:01:00							
CH ₄ : (LEL) Peak	%	1	<1	<1							
CH ₄ : Peak	%v/v	0.1	<0.1	<0.1							
CO ₂ : Peak	%v/v	0.1	1.0	0.6							
O ₂ : Minimum	%v/v	0.1	21.2	22.2							
CO: Peak	ppm	1	<1	<1							
H ₂ S: Peak	ppm	1	<1	<1							
Time of Steady readings	hh:mm:ss	N/A	12:16:00	11:02:00							
CH ₄ : (LEL) Steady State	%	1	<1	<1							
CH ₄ : Steady State	%v/v	0.1	<0.1	<0.1							
CO ₂ : Steady State	%v/v	0.1	0.4	0.6							
O ₂ : Steady State	%v/v	0.1	21.2	22.2							
CO: Steady State	ppm	1	<1	<1							
H ₂ S: Steady State	ppm	1	<1	<1							
Gas Flow	l/hr	0.1	<0.1	0.3							
Weather Conditions:			Fine	Cloud							
Equipment Type			GA5000	GA5000							
Equipment Serial Number			G501004	G501004							
Equipment Last Calibrated			19/06/2019	19/06/2019							
Monitored By			CR	EB							
Comments											
											
Form No.	SE-EMS-F-002	Revision No.	2.06	Issue Date	27/01/2014						
Part of the Bachy Soletanche Group											

Project Name	Nenthead Mines - Proposed MWTS, GI		Record Of Gas Monitoring				Hole ID			
Project No.	TA8234						WSBH101R			
Engineer	Aecom						Table No.			
Client	The Coal Authority									
Notes	Type of Sampling Point: GMP = Gas Monitoring Point, GMP+SP = Gas Monitoring Point and Standpipe, GMP+SPIE = Gas Monitoring Point and Standpipe Piezometer, GMP+GWMP = Gas Monitoring Point and Groundwater Monitoring Point For double gas valves, record valves separately, using separate Monitoring Point ID									
Distance to monitoring point	m	2.30		Monitoring Point ID			01			
Top of response zone	m	1.00		Base of response zone	m	2.30				
Well Type	SP		Initial base depth of installation	m	2.30					
Measured Parameter	Units	Detection Limit								
Monitoring round no.	N/A	N/A	1	2	3	4	5	6	7	8
Date	dd/mm/yyyy	N/A	17/10/2019	25/10/2019						
Time of initial readings	hh:mm:ss	N/A	11:18:00	11:00:00						
Water Level	m	0.01	1.82	1.82						
Atmospheric pressure	mb	1	952	956						
Relative pressure	mb	1	<1	<1						
Base depth of installation at time of monitoring	m	0.01	2.30	2.30						
Time of 'Peak' readings	hh:mm:ss	N/A	11:20:00	11:01:00						
CH ₄ : (LEL) Peak	%	1	<1	<1						
CH ₄ : Peak	%v/v	0.1	<0.1	<0.1						
CO ₂ : Peak	%v/v	0.1	0.7	0.7						
O ₂ : Minimum	%v/v	0.1	20.3	20.5						
CO: Peak	ppm	1	<1	<1						
H ₂ S: Peak	ppm	1	<1	<1						
Time of Steady readings	hh:mm:ss	N/A	11:22:00	11:02:00						
CH ₄ : (LEL) Steady State	%	1	<1	<1						
CH ₄ : Steady State	%v/v	0.1	<0.1	<0.1						
CO ₂ : Steady State	%v/v	0.1	0.7	0.7						
O ₂ : Steady State	%v/v	0.1	20.3	20.5						
CO: Steady State	ppm	1	<1	<1						
H ₂ S: Steady State	ppm	1	<1	<1						
Gas Flow	l/hr	0.1	0.1	0.2						
Weather Conditions:			Fine	Cloud						
Equipment Type			GA5000	GA5000						
Equipment Serial Number			G501004	G501004						
Equipment Last Calibrated			19/06/2019	19/06/2019						
Monitored By			CR	EB						
Comments										
						 SOIL ENGINEERING				
Form No.	SE-EMS-F-002	Revision No.	2.06	Issue Date	27/01/2014	Part of the Bachy Soletanche Group				



SOIL engineering

SUPPORTING FACTUAL DATA

SECTION B

Laboratory Testing

KEY TO LABORATORY TEST RESULTS AND SUMMARY SHEETS

SECTION B: KEY TO LABORATORY TEST RESULTS AND SUMMARY SHEETS

FIELD IDENTIFICATION

Sample Type	U	Undisturbed sample	D	Small disturbed sample
	UT	Thin wall open drive tube sample	B	Bulk disturbed sample
	P	Piston sample	AMAL	Amalgamated sample
	TW	Thin walled sample	BLK	Block sample
	L	Liner sample	C	Core sample
Test status	Any result in italics indicates a test that is not within the scope of the UKAS accreditation for this laboratory.			

SUMMARY OF LABORATORY SOIL TESTS: INDEX / CLASSIFICATION TESTS

Particle density	p	Small pyknometer method	g	Gas jar method
Plastic index	N/P	Non plastic, although liquid limit will have been determined if requested		
Particle size (PSD)	1	Following value in silt column denotes combined clay and silt fraction		
	p	Following value in clay column denotes sedimentation by pipette, else sedimentation is by hydrometer.		

SUMMARY OF LABORATORY SOIL TESTS: STRENGTH AND PERMEABILITY TESTS

Triaxial	UU	Single stage unconsolidated quick undrained
	UUM	Multi stage unconsolidated quick undrained
	UU3	Set of 3 unconsolidated quick undrained
	CU	Single stage consolidated undrained
	CUM	Multi stage consolidated undrained
	CU3	Set of 3 consolidated undrained
	CD	Single stage consolidated drained
	CDM	Multi stage consolidated drained
	CD3	Set of 3 consolidated drained
		Note that single stage tests are reported assuming $\phi = 0$ for total stress
Consolidation	Oed	One-dimensional oedometer
	mv	Coefficient of compressibility quoted for range p_0 to $p_0 + 100\text{kPa}$, where determined
Permeability	C	Constant head permeability
Shearbox	SSB	Small shear box
	LSB	Large shear box
	p	Peak value
	r	Residual shear strength
	RS	Ring shear

SECTION B: KEY TO LABORATORY TEST RESULTS AND SUMMARY SHEETS

SUMMARY OF LABORATORY SOIL RE-USE TESTS

MCV	s	MCV value at natural or specified moisture content
	int	Intercept of calibration line in MCV calibration

SUMMARY OF LABORATORY ROCK STRENGTH TESTS

Point Load	Type (combination of)	D	Diametral	A	Axial
		I	Irregular lump	B	Block
		L	Test performed parallel to planes of weakness		
		P	Test performed perpendicular to planes of weakness		
		X	Invalid failure of point load (not broken between points of load application)		

SUMMARY OF LABORATORY ROCK MATERIALS TESTS

Ten% fines	w	Soaked test	d	Dry test
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Important note:

Summary sheets are provided for convenience and in no way replace individual test result sheets which shall, without exception, be regarded as the definitive result.

POINT LOAD INDEX RESULT

Point Load	Type (combination of)	D	Diametral	A	Axial
		I	Irregular lump	B	Block
		L	Test performed parallel to planes of weakness		
		P	Test performed perpendicular to planes of weakness		
		X	Invalid failure of point load (not broken between points of load application)		
Dimensions		W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump		
		D	Distance between platens when just in contact with specimen		
		D'	Distance between platens at point of failure		
		De	Equivalent core diameter	Is	P/De^2
		Is(50)	$F \times Is$	F	$(De/50)^{0.45}$
<p>Is(50) point load strength index corrected for a diametral test of core diameter 50mm For Axial/Lump tests $De^2 = (4/\pi) \times (W \times D')$ For Diametral tests $De^2 = D \times D'$</p>					



SOIL engineering

SUPPORTING FACTUAL DATA

SECTION B

Laboratory Testing

LABORATORY SOIL TEST SUMMARY SHEETS

Project Name Nenthead Mines - Proposed MWTS, GI						Classification Tests Summary										Particle size				
Project No. TA8234		Engineer Aecom		Employer The Coal Authority																
Hole ID	Sample depth m	Sample no.	Sample type	Specimen depth m	Specimen no.	Moisture Content	Bulk Density	Dry Density	Particle Density	Liquid Limit	Plastic Limit	Plastic Index	Passing 425µm	Linear Shrinkage	Clay	Silt	Sand	Gravel	Cobbles	
						%	Mg/m³			%	%	%	%	%	%	%	%	%	%	%
BH102R	1.50	4	D	1.50	1	14.8														
BH102R	2.50	9	B	2.50	1											11.1	7.8	19.8	61.3	
BH102R	3.00	11	D	3.00	3	12.5														
BH102R	3.00	11	D	3.00	4					40	25	15	42							
BH102R	4.00	13	D	4.00	3	17.3														
BH102R	4.00	13	D	4.00	4					33	20	13	80							
BH103	0.00	4	B	0.00	1										14.8	29.3	35.6	20.3	0.0	
BH103	1.95	6	D	1.95	3	18.3														
BH103	1.95	6	D	1.95	4					35	19	16	80							
BH103	3.25	12	D	3.25	3	16.4														
BH103	3.25	12	D	3.25	4					31	16	15	55							
BH104	0.50	3	D	0.50	1	21.7														
BH104	0.50	3	D	0.50	2					42	25	17	98							
BH104	0.50	4	B	0.50	1										19.7	29.6	35.0	15.7	0.0	
BH104	2.25	9	D	2.25	3	17.1														
BH104	2.25	9	D	2.25	4					38	19	19	73							
BH105	1.50	5	U	1.74	2					31	NP	NP	71							
BH106	0.00	1	B	0.00	3	30.6														
BH106	0.00	1	B	0.00	4					48	35	13	52							
BH106	3.50	14	B	3.50	2										4.7	24.0	41.8	18.4	11.1	
BH106	4.25	16	D	4.25	3	13.7														
BH106	4.25	16	D	4.25	4					32	16	16	52							
TP104	1.00	4	B	1.00	1										3.0	10.9	25.7	60.4	0.0	

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Leeds Laboratory

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SOIL ENGINEERING

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Part of the Bachy Soletanche Group

Project Name Nenthead Mines - Proposed MWTS, GI						Classification Tests Summary														
Project No. TA8234																				
Engineer Aecom																				
Employer The Coal Authority																				
Hole ID	Sample depth m	Sample no.	Sample type	Specimen depth m	Specimen no.	Moisture Content	Bulk Density	Dry Density	Particle Density	Liquid Limit	Plastic Limit	Plastic Index	Passing 425µm	Linear Shrinkage	Particle size					
						%	Mg/m ³			%	%	%	%	%	Clay	Silt	Sand	Gravel	Cobbles	
TP108	0.45	1	B	0.45	2										12.1	12.8	46.6	28.5	0.0	
TP109	1.00	3	D	1.00	3	27.9														
TP109	1.00	3	D	1.00	4				33	23	10	63								
TP109	1.50	4	B	1.50	1										9.1	21.6	29.2	26.1	14.0	
TP110	1.00	3	D	1.00	1	36.0														
TP110	2.00	6	D	2.00	3	15.8														
TP110	2.00	6	D	2.00	4				39	17	22	77								
TP110	3.00	9	D	3.00	1	17.3														
TP112	2.00	6	D	2.00	3	15.2														
TP112	2.00	6	D	2.00	4				41	18	23	75								
TP114	0.50	1	B	0.50	1	27.5														
TP114	1.00	3	B	1.00	3	20.7														
TP114	1.00	3	B	1.00	4				38	19	19	71								
TP114	1.70	6	D	1.70	3	20.5														
TP114	1.70	6	D	1.70	4				31	NP	NP	77								
TP114	2.00	11	D	2.00	3	15.5														
TP114	2.00	11	D	2.00	4				38	19	19	74								
TP115	1.00	3	D	1.00	1	46.4														
TP115	1.00	3	D	1.00	2				62	29	33	95								
TP116	1.00	3	D	1.00	3	18.7														
TP116	1.00	3	D	1.00	4				44	21	23	55								
TP120	1.20	5	D	1.20	3	17.0														
TP120	1.20	5	D	1.20	4				34	19	15	65								

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 Leeds Laboratory

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Project Name Nenthead Mines - Proposed MWTS, GI						Classification Tests Summary														
Project No. TA8234																				
Engineer Aecom																				
Employer The Coal Authority																				
Hole ID	Sample depth m	Sample no.	Sample type	Specimen depth m	Specimen no.	Moisture Content	Bulk Density	Dry Density	Particle Density	Liquid Limit	Plastic Limit	Plastic Index	Passing 425µm	Linear Shrinkage	Particle size					
						%	Mg/m ³			%	%	%	%	%	%	%	%	%	%	%
TP122	0.80	3	D	0.80	3	21.1														
TP122	0.80	3	D	0.80	4					45	22	23	77							
TP123	0.60	3	D	0.60	1	23.2														
TP123	1.00	5	D	1.00	1	17.8														
TP124	1.00	3	D	1.00	3	36.0														
TP124	1.00	3	D	1.00	4					45	24	21	98							
TP125	1.00	5	D	1.00	3	23.5														
TP125	1.00	5	D	1.00	4					45	25	20	81							
TP126	1.50	4	B	1.50	1											8.8	22.0	38.1	31.1	0.0
TP128	0.60	3	D	0.60	3	497														
TP128	0.60	3	D	0.60	4					692	366	326	100							
WS102	0.20	3	B	0.20	1												6.9'	14.3	37.3	41.5
WS102	1.20	10	L	1.20	1	20.6														
WS102	1.20	10	L	1.20	2					24	17	7	100							
WS102	3.00	14	L	3.00	1												10.2'	40.1	49.7	0.0
WS103	1.20	10	L	1.20	3	15.4														
WS103	1.20	10	L	1.20	4					38	17	21	67							
WS104	1.70	12	L	1.70	1	16.5														
WS104	1.70	12	L	1.70	2					32	18	14	97							
WS105	0.20	3	B	0.20	1											8.0	13.8	33.1	42.9	2.2
WS105	1.20	8	L	1.20	3	22.1														
WS105	1.20	8	L	1.20	4					37	19	18	61							
WS105	3.00	11	D	3.00	1	18.5														

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Leeds Laboratory

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Project Name	Nenthead Mines - Proposed Mine Water Treatment Scheme	Strength and Permeability Summary
Project No.	TA8234	
Engineer	Aecom	
Employer	The Coal Authority	

Hole ID	Sample depth m	Sample no.	Sample type	Specimen depth m	Specimen no.	Moisture Content		Triaxial			Consol		Permeability		Shearbox		
						%	Mg/m ³	Type	c kPa	Ø °	Type	m _v m ² /MN	Type	K m/s	Type	c kPa	Ø °
BH105	1.50	05	U	1.55	2	19	2.16	CUM	2	38.0							
								End									

Approved by:	Leeds Laboratory	 SOIL ENGINEERING
Kevin Walker		
Revision No.	3.04	Print date 08/11/2019
	Issue Date	24/11/2014
		Part of the Bachy Soletanche Group



SOIL engineering

SUPPORTING FACTUAL DATA


SECTION B

Laboratory Testing

LABORATORY SOIL TEST DATA SHEETS


Project Name	Nenthead Mines - Proposed MWTS, GI	Moisture Content
Project No.	TA8234	
Engineer	Aecom	
Employer	The Coal Authority	
		BS EN ISO 17892-1:2014

Hole ID	Sample depth m	Sample no.	Sample type	Specimen depth m	Specimen no.	Description	Remarks	Moisture Content %
BH102R	1.50	4	D	1.50	1	Dark grey slightly gravelly sandy CLAY.		14.8
BH102R	3.00	11	D	3.00	3	Dark brown sandy gravelly CLAY.		12.5
BH102R	4.00	13	D	4.00	3	Dark brown slightly gravelly sandy CLAY.		17.3
BH103	1.95	6	D	1.95	3	Brown slightly gravelly slightly sandy CLAY.		18.3
BH103	3.25	12	D	3.25	3	brown slightly gravelly sandy CLAY		16.4
BH104	0.50	3	D	0.50	1	Brown slightly gravelly slightly sandy CLAY.		21.7
BH104	2.25	9	D	2.25	3	Brown slightly gravelly slightly sandy CLAY.		17.1
BH106	0.00	1	B	0.00	3	Brown clayey gravelly SAND with some rootlets.		30.6
BH106	4.25	16	D	4.25	3	Brown slightly gravelly sandy CLAY.		13.7
TP109	1.00	3	D	1.00	3	Brown slightly gravelly sandy CLAY.		27.9
TP110	1.00	3	D	1.00	1	Grey and orangish brown slightly gravelly sandy CLAY.		36.0
TP110	2.00	6	D	2.00	3	Brown slightly gravelly sandy CLAY.		15.8
TP110	3.00	9	D	3.00	1	Brown gravelly sandy CLAY.		17.3
TP112	2.00	6	D	2.00	3	Grey slightly gravelly CLAY.		15.2
TP114	0.50	1	B	0.50	1	Brown gravelly sandy CLAY.		27.5
TP114	1.00	3	B	1.00	3	Brown gravelly sandy CLAY.		20.7
TP114	1.70	6	D	1.70	3	Brown gravelly sandy CLAY.		20.5
TP114	2.00	11	D	2.00	3	Brown slightly gravelly slightly sandy CLAY.		15.5

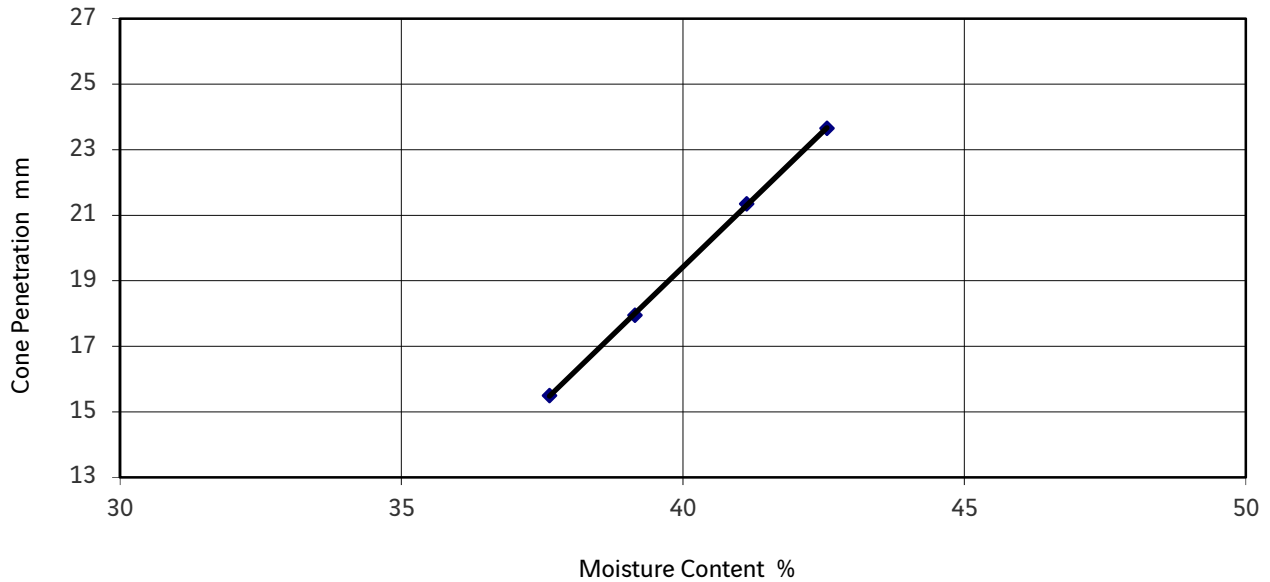
Approved by:	Leeds Laboratory	 SOIL ENGINEERING
Steve Harper	Print date 07/11/2019	
Revision No. 2.03	Issue Date 21/11/2012	Part of the Bachy Soletanche Group

Project Name	Nenthead Mines - Proposed MWTS, GI	Moisture Content
Project No.	TA8234	
Engineer	Aecom	
Employer	The Coal Authority	
		BS EN ISO 17892-1:2014

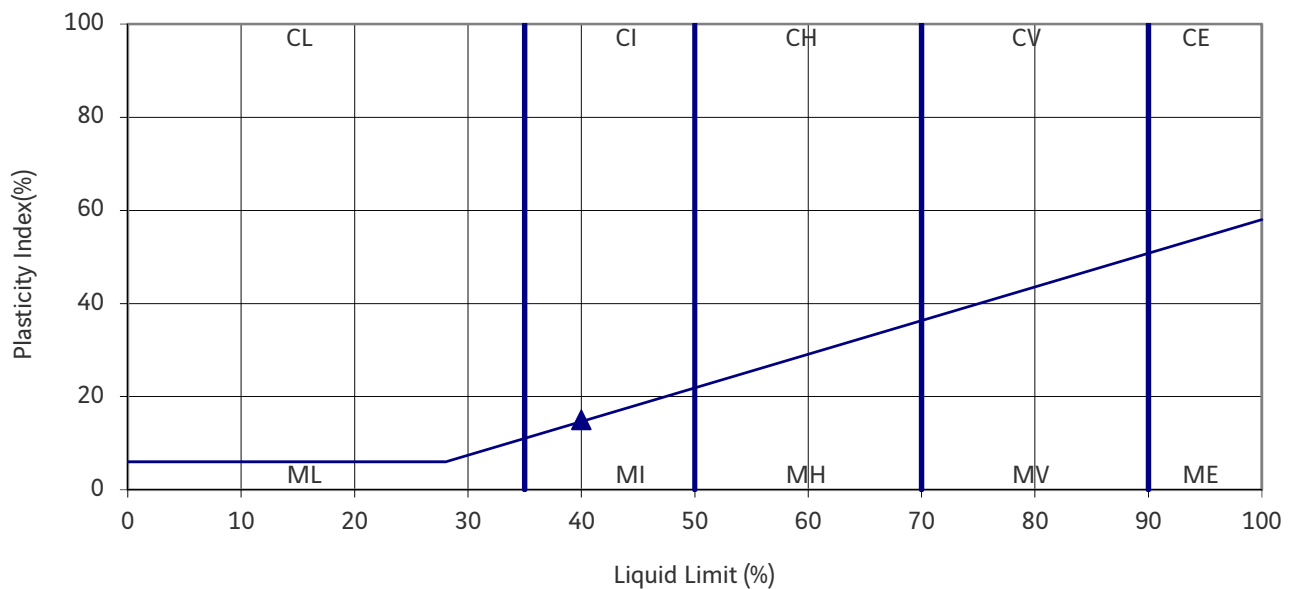
Hole ID	Sample depth m	Sample no.	Sample type	Specimen depth m	Specimen no.	Description	Remarks	Moisture Content %
TP115	1.00	3	D	1.00	1	Brown slightly gravelly slightly sandy CLAY.		46.4
TP116	1.00	3	D	1.00	3	Brown slightly gravelly sandy CLAY.		18.7
TP120	1.20	5	D	1.20	3	Brwon slightly gravelly sandy CLAY.		17.0
TP122	0.80	3	D	0.80	3	Brown slightly sandy slightly gravelly CLAY.		21.1
TP123	0.60	3	D	0.60	1	Brown slightly gravelly slightly sandy CLAY.		23.2
TP123	1.00	5	D	1.00	1	Brown slightly gravelly slightly sandy CLAY.		17.8
TP124	1.00	3	D	1.00	3	Brown slightly gravelly sandy CLAY.		36.0
TP125	1.00	5	D	1.00	3	Brown slightly gravelly sandy CLAY.		23.5
TP128	0.60	3	D	0.60	3	Dark grey PEAT.		497
WS102	1.20	10	L	1.20	1	Brown slightly gravelly clayey SAND.		20.6
WS103	1.20	10	L	1.20	3	Brown gravelly sandy CLAY.		15.4
WS104	1.70	12	L	1.70	1	Grey mottled brown slightly gravelly sandy CLAY.		16.5
WS105	1.20	8	L	1.20	3	Brown slightly gravelly clayey SAND.		22.1
WS105	3.00	11	D	3.00	1	Dark grey slightly gravelly slightly sandy CLAY.		18.5
WS107	1.00	5	D	1.00	1	Brown gravelly sandy CLAY.		13.9
WS107	2.00	10	L	2.00	3	Brown gravelly sandy CLAY.		14.8
WS108	2.00	11	L	2.00	3	Brown slightly gravelly sandy CLAY.		19.1
WSTP101	1.20	9	L	1.20	3	Brown sandy gravelly CLAY.		22.1


Approved by:	Leeds Laboratory	 SOIL ENGINEERING
Steve Harper	Print date 07/11/2019	
Revision No. 2.03	Issue Date 21/11/2012	Part of the Bachy Soletanche Group

Project Name	Nenthead Mines - Proposed MWTS, GI	Liquid And Plastic Limit Test	Hole ID BH102R
Project No.	TA8234		Sample Depth 3.00m
Engineer	Aecom		Sample Number 11
Employer	The Coal Authority		Sample Type D
Description		BS1377: Part 2: 1990: Clause 4.3 and 5 with Water Content to BS EN ISO 17892-1: 2014	Specimen Depth 3.00m
			Specimen Number 4

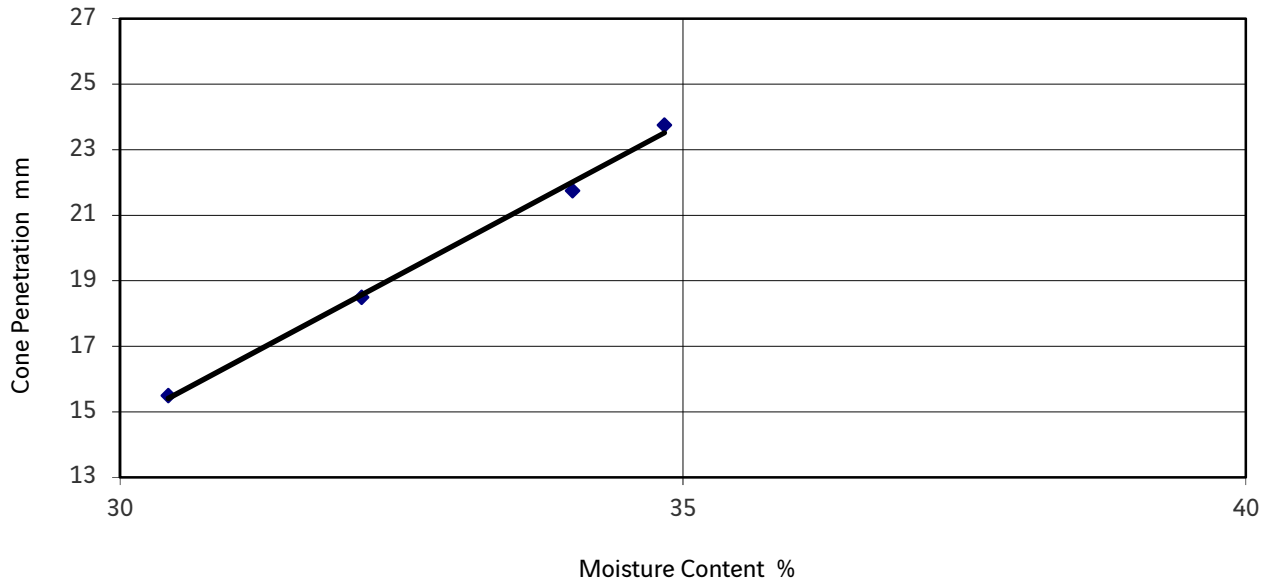


Natural moisture content:	12.5%	Percentage retained on 425µm sieve:	58%
Liquid limit:	40%	Preparation of sample:	Wet sieve
Plastic limit:	25%	Remarks:	
Plasticity index:	15%		
Moisture content of soil passing 425µm	29.5%		
Liquidity index:	0.303		

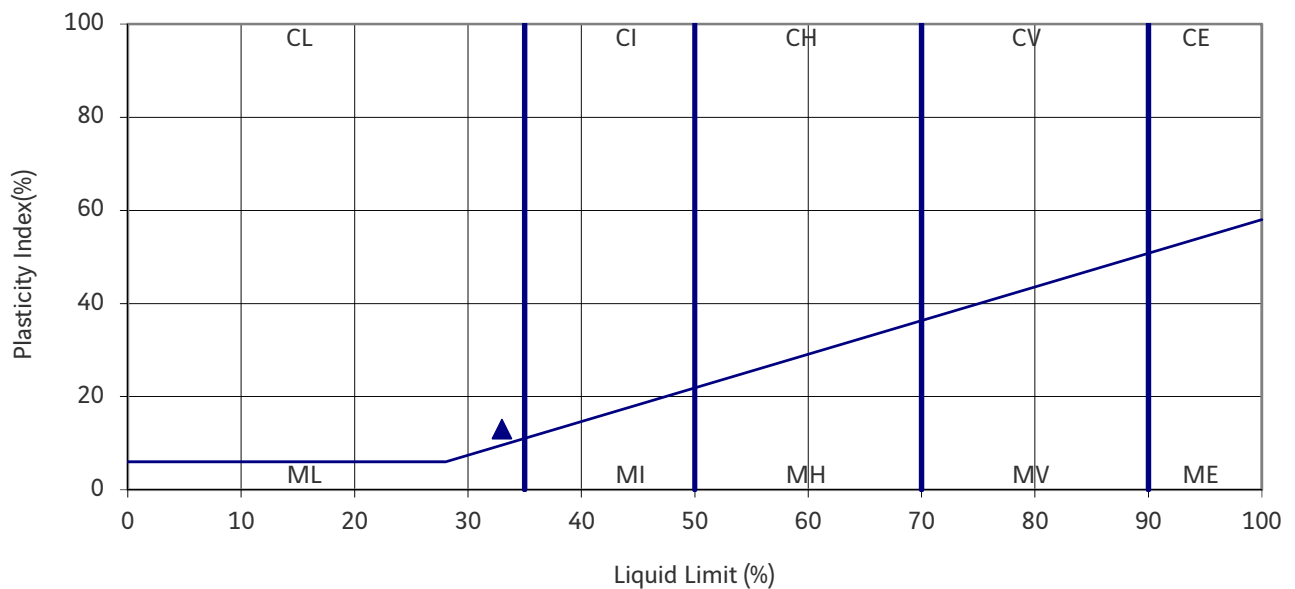



Approved by:	Leeds Laboratory	 SOIL ENGINEERING			
Steve Harper					
Revision No.	2.07	Issue Date	19/11/2012	Print date	07/11/2019
					Part of the Bachy Soletanche Group

Project Name	Nenthead Mines - Proposed MWTS, GI	Liquid And Plastic Limit Test	Hole ID BH102R
Project No.	TA8234		Sample Depth 4.00m
Engineer	Aecom		Sample Number 13
Employer	The Coal Authority		Sample Type D
Description	Dark brown slightly gravelly sandy CLAY.	BS1377: Part 2: 1990: Clause 4.3 and 5 with Water Content to BS EN ISO 17892-1: 2014	Specimen Depth 4.00m
			Specimen Number 4

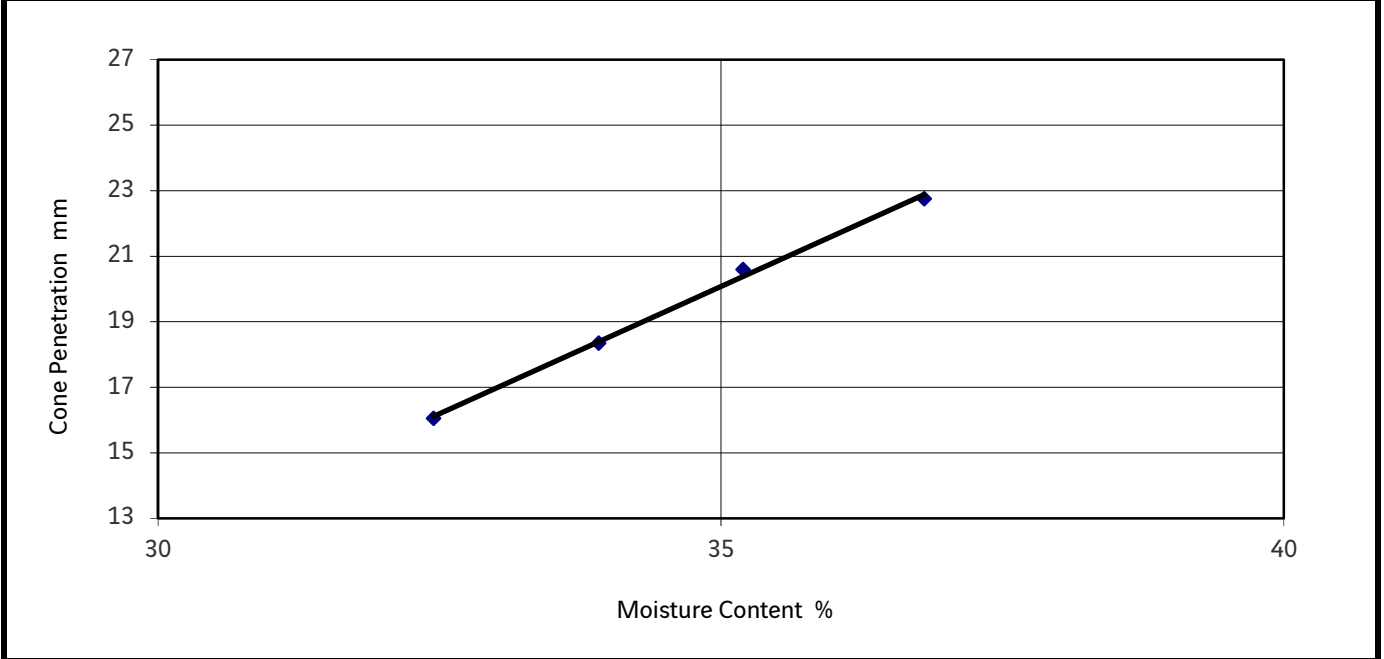


Natural moisture content:	17.3%	Percentage retained on 425µm sieve:	20%
Liquid limit:	33%	Preparation of sample: Wet sieve	
Plastic limit:	20%	Remarks:	
Plasticity index:	13%		
Moisture content of soil passing 425µm	21.6%		
Liquidity index:	0.121		

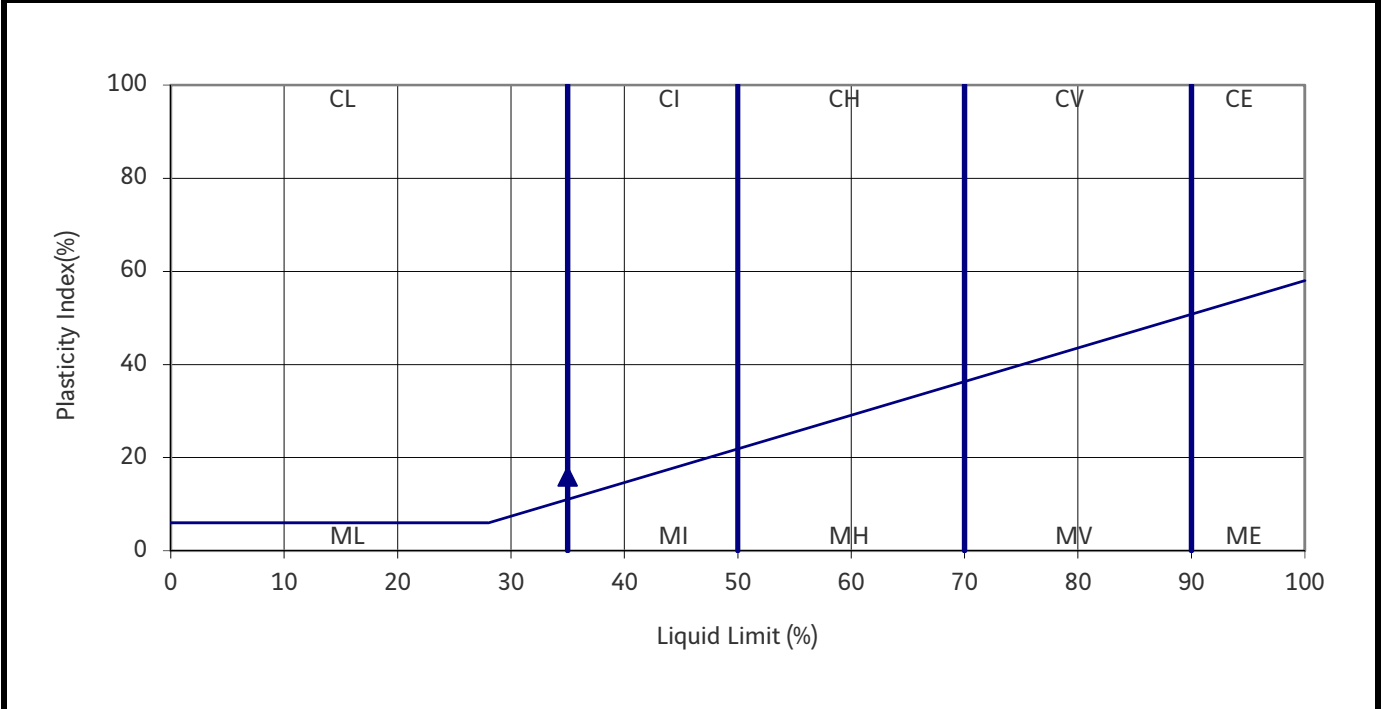



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Steve Harper						
Revision No.	2.07	Issue Date	19/11/2012	Print date	07/11/2019	Part of the Bachy Soletanche Group

Project Name	Nenthead Mines - Proposed MWTS, GI	Liquid And Plastic Limit Test	Hole ID	BH103
Project No.	TA8234		Sample Depth	1.95m
Engineer	Aecom		Sample Number	6
Employer	The Coal Authority		Sample Type	D
Description	Brown slightly gravelly slightly sandy CLAY.		Specimen Depth	1.95m
			Specimen Number	4

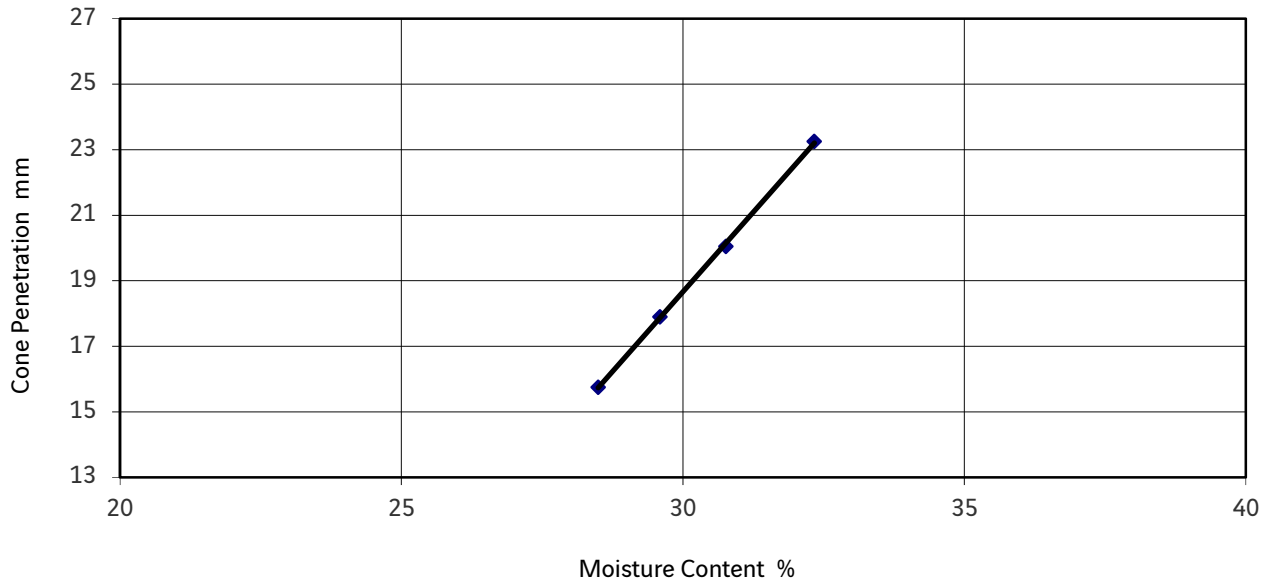


Natural moisture content:	18.3%	Percentage retained on 425µm sieve:	20%
Liquid limit:	35%	Preparation of sample:	Wet sieve
Plastic limit:	19%	Remarks:	
Plasticity index:	16%		
Moisture content of soil passing 425µm	22.8%		
Liquidity index:	0.237		

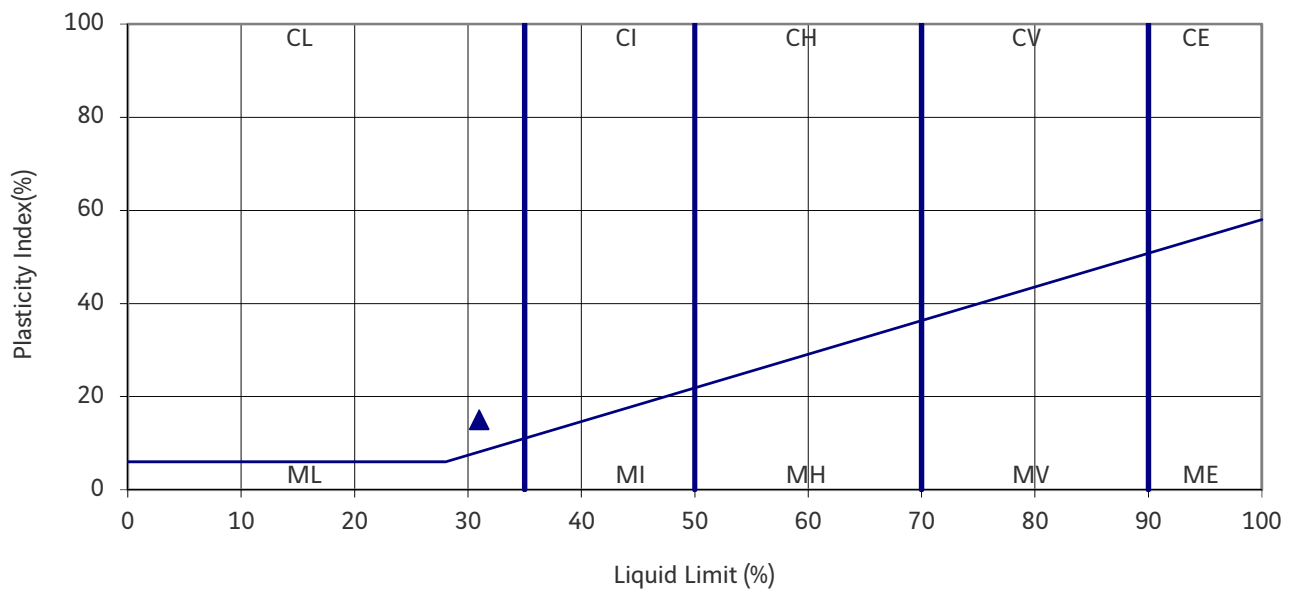



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Steve Harper					
Revision No.	2.07	Issue Date	19/11/2012	Print date	07/11/2019
					Part of the Bachy Soletanche Group

Project Name	Nenthead Mines - Proposed MWTS, GI	Liquid And Plastic Limit Test	Hole ID	BH103
Project No.	TA8234		Sample Depth	3.25m
Engineer	Aecom		Sample Number	12
Employer	The Coal Authority		Sample Type	D
Description		BS1377: Part 2: 1990: Clause 4.3 and 5 with Water Content to BS EN ISO 17892-1: 2014	Specimen Depth	3.25m
			Specimen Number	4

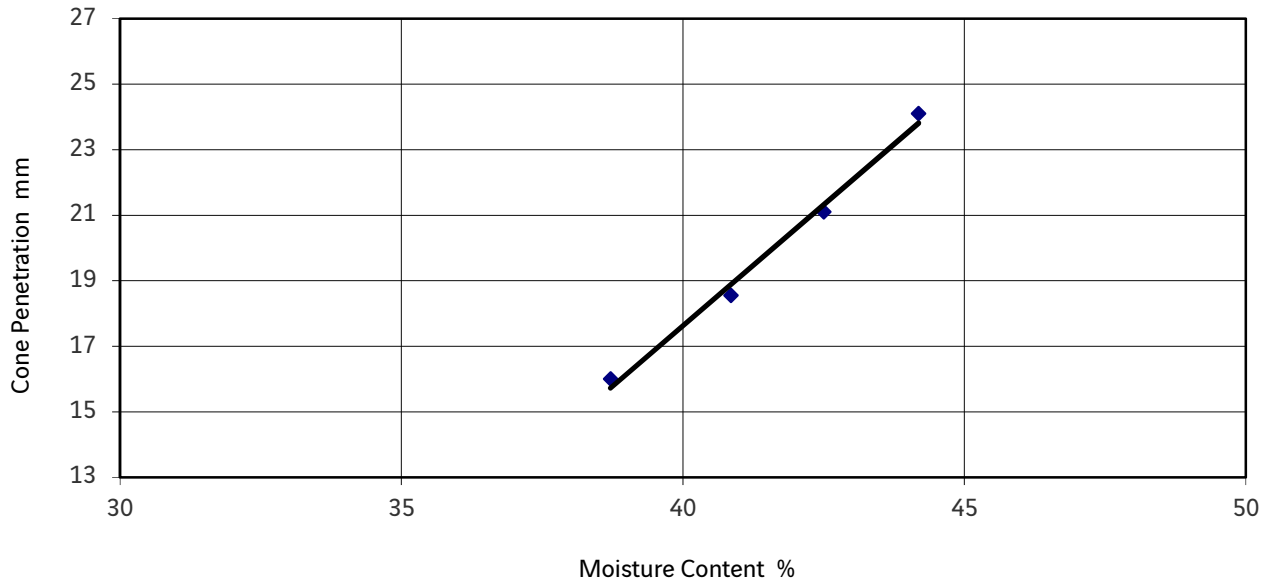


Natural moisture content:	16.4%	Percentage retained on 425µm sieve:	45%
Liquid limit:	31%	Preparation of sample:	Wet sieve
Plastic limit:	16%	Remarks:	
Plasticity index:	15%		
Moisture content of soil passing 425µm	29.9%		
Liquidity index:	0.924		

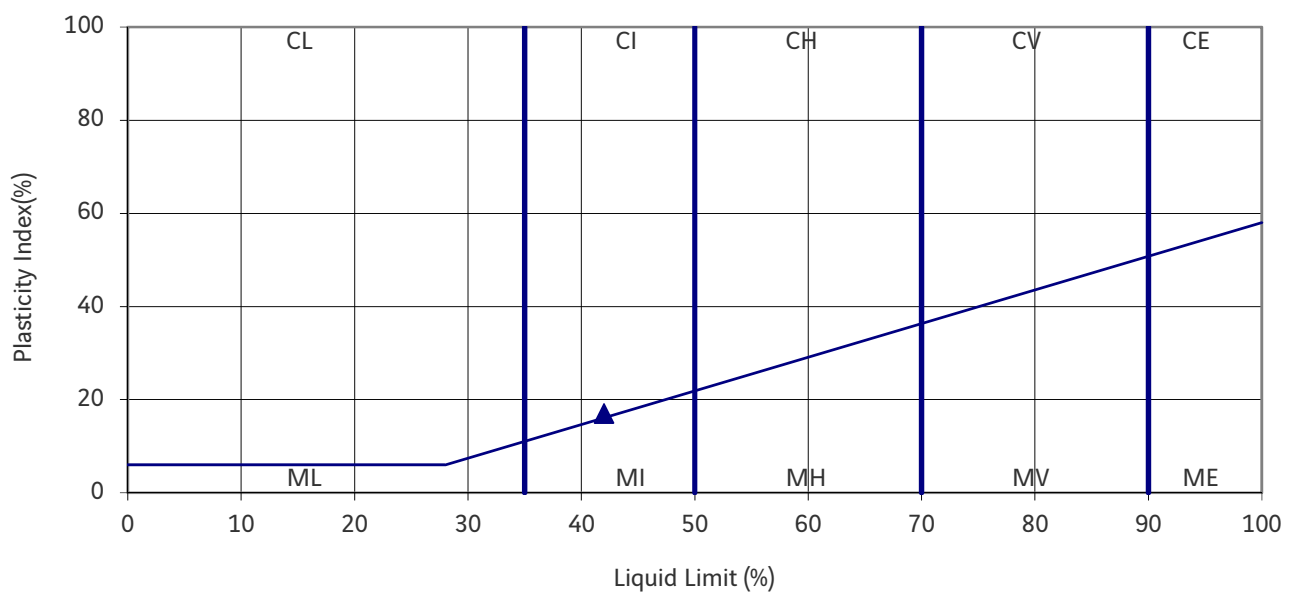



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Steve Harper		
Revision No.	2.07	Print date 07/11/2019
	Issue Date	19/11/2012
		Part of the Bachy Soletanche Group

Project Name	Nenthead Mines - Proposed MWTS, GI	Liquid And Plastic Limit Test	Hole ID	BH104
Project No.	TA8234		Sample Depth	0.50m
Engineer	Aecom		Sample Number	3
Employer	The Coal Authority		Sample Type	D
Description		BS1377: Part 2: 1990: Clause 4.3 and 5 with Water Content to BS EN ISO 17892-1: 2014	Specimen Depth	0.50m
			Specimen Number	2

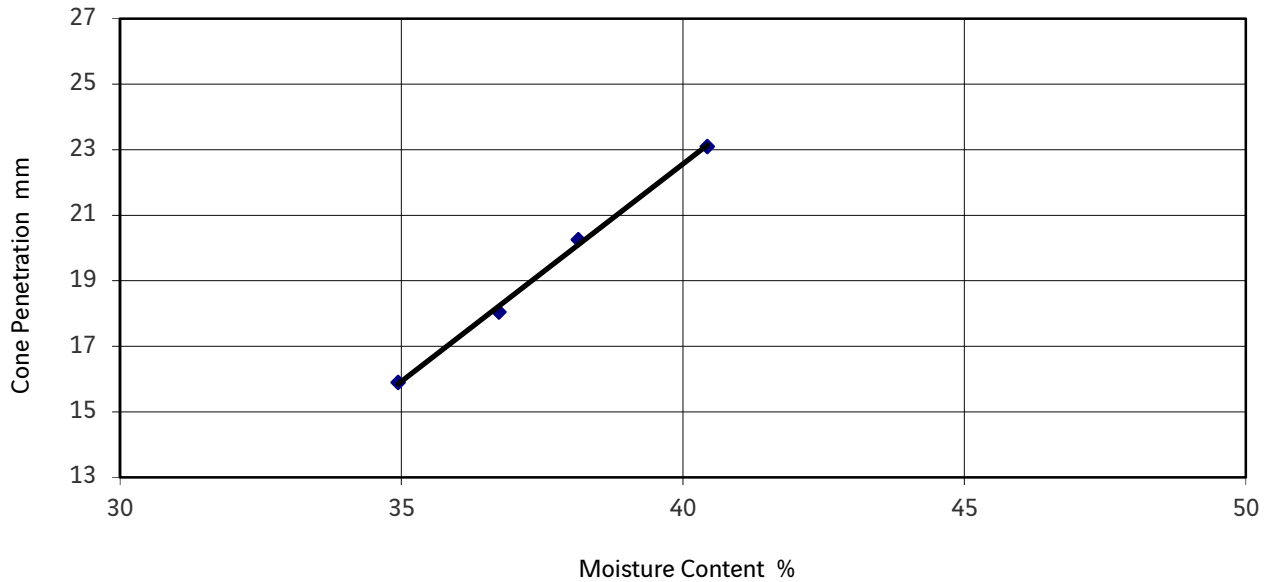


Natural moisture content:	21.7%	Estimated percentage retained on 425µm sieve:	2%
Liquid limit:	42%	Preparation of sample:	Natural
Plastic limit:	25%	Remarks:	
Plasticity index:	17%		
Moisture content of soil passing 425µm	22.1%		
Liquidity index:	-0.173		

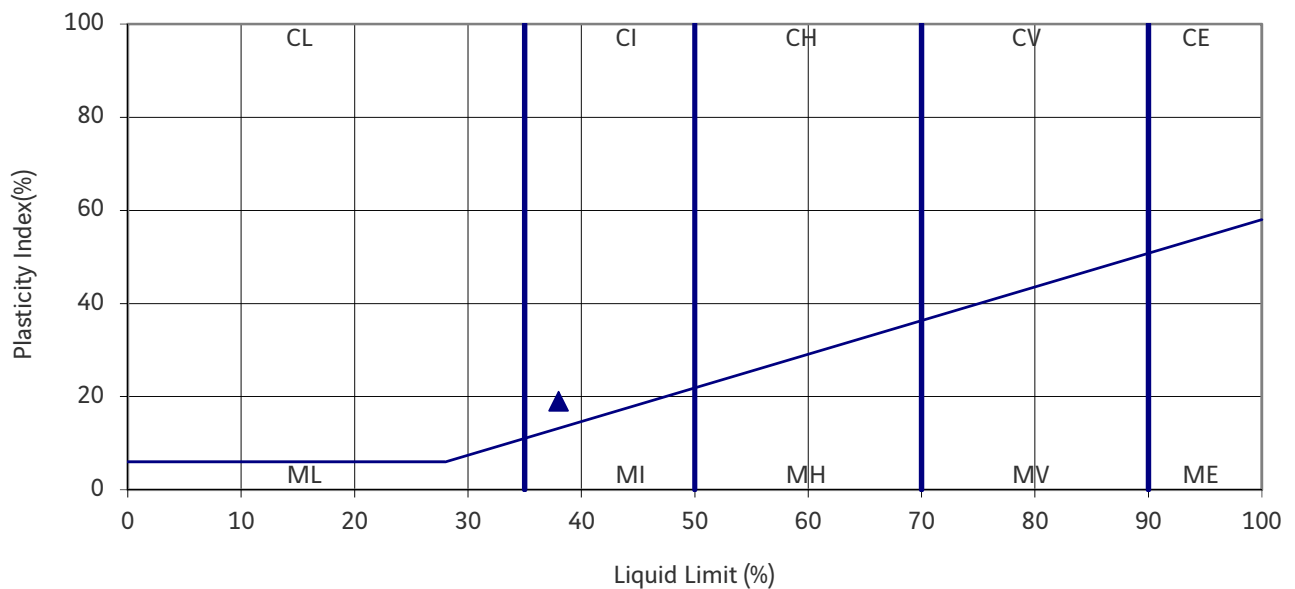



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Steve Harper					
Revision No.	2.07	Issue Date	19/11/2012	Print date	07/11/2019
					Part of the Bachy Soletanche Group

Project Name	Nenthead Mines - Proposed MWTS, GI	Liquid And Plastic Limit Test	Hole ID BH104
Project No.	TA8234		Sample Depth 2.25m
Engineer	Aecom		Sample Number 9
Employer	The Coal Authority		Sample Type D
Description		BS1377: Part 2: 1990: Clause 4.3 and 5 with Water Content to BS EN ISO 17892-1: 2014	Specimen Depth 2.25m
			Specimen Number 4

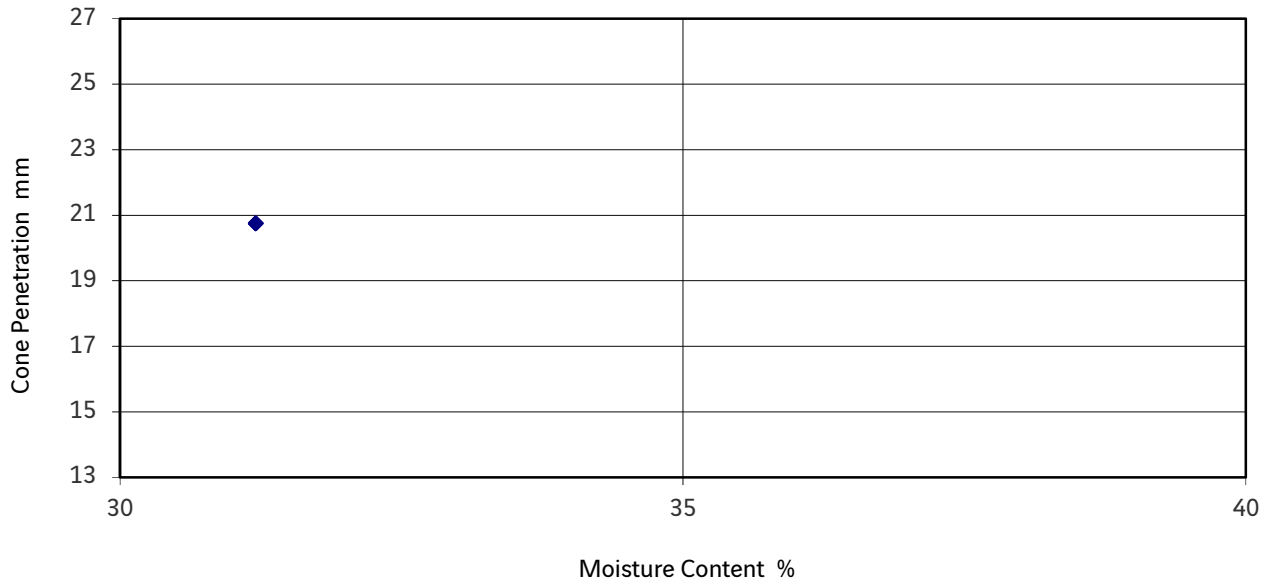


Natural moisture content:	17.1%	Percentage retained on 425µm sieve:	27%
Liquid limit:	38%	Preparation of sample:	Wet sieve
Plastic limit:	19%	Remarks:	
Plasticity index:	19%		
Moisture content of soil passing 425µm	23.4%		
Liquidity index:	0.23		

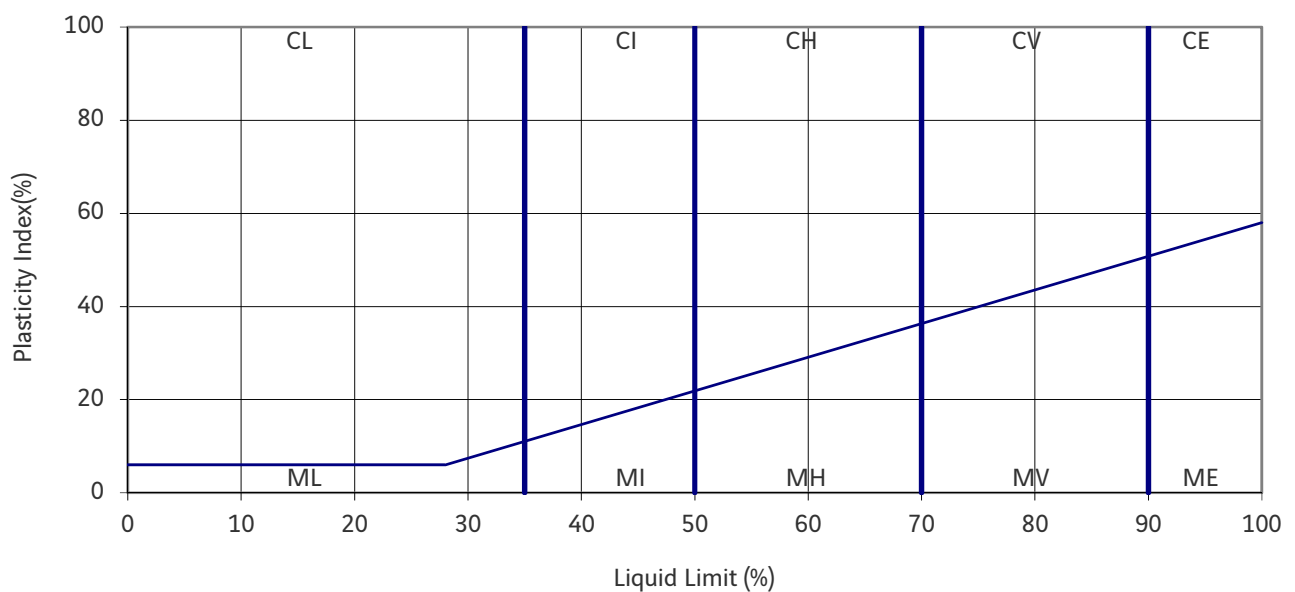



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Revision No.	2.07	Issue Date	19/11/2012	Print date	07/11/2019
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Project Name	Nenthead Mines - Proposed MWTS, GI	Liquid And Plastic Limit Test	Hole ID BH105
Project No.	TA8234		Sample Depth 1.50m
Engineer	Aecom		Sample Number 5
Employer	The Coal Authority		Sample Type U
Description		BS1377: Part 2: 1990: Clause 4.4 and 5 with Water Content to BS EN ISO 17892-1: 2014	Specimen Depth 1.74m
			Specimen Number 2

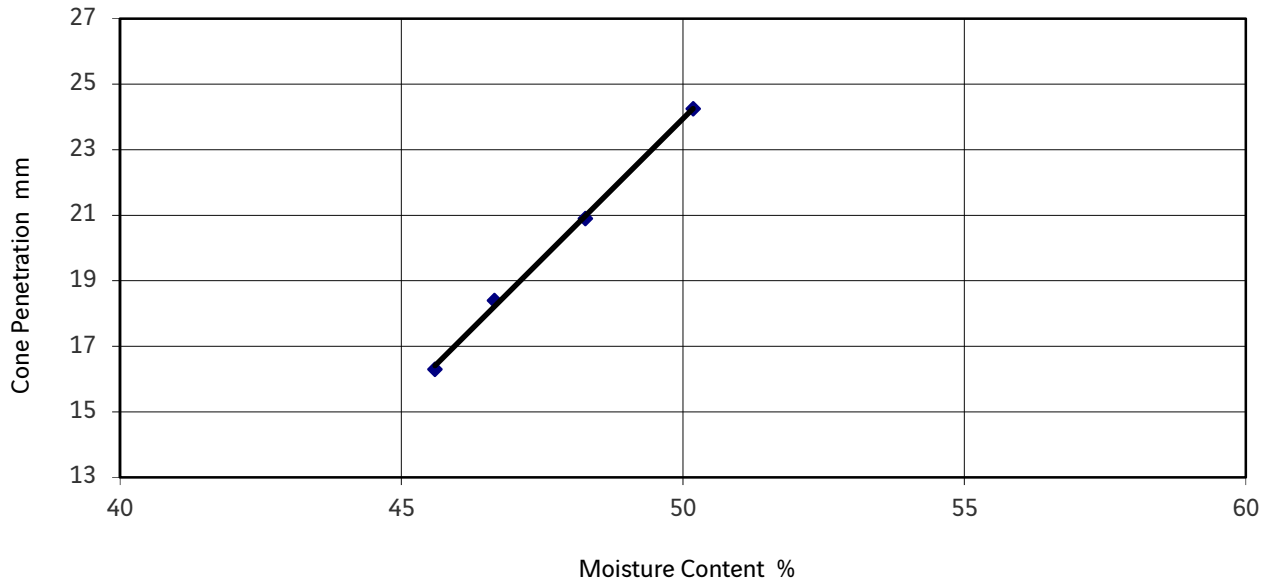


Natural moisture content:	19.1%	Estimated percentage retained on 425µm sieve:	29%
Liquid limit:	31%	Preparation of sample:	Natural
Plastic limit:	NP	Remarks:	Tested as 1 point Limit Liquid limit due to the sample being sand and/or silt and it is very difficult to get all four points on a line.
Plasticity index:			
Moisture content of soil passing 425µm	26.7%		
Liquidity index:			

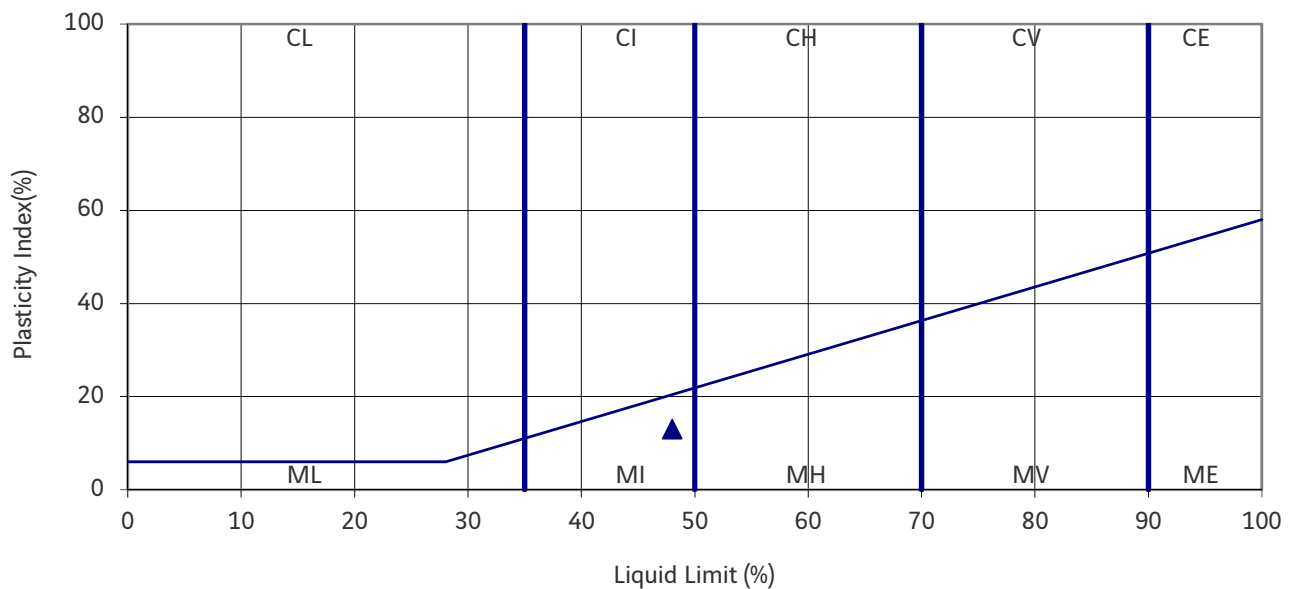



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	Issue Date	19/11/2012
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Project Name	Nenthead Mines - Proposed MWTS, GI	Liquid And Plastic Limit Test	Hole ID	BH106
Project No.	TA8234		Sample Depth	0.00m
Engineer	Aecom		Sample Number	1
Employer	The Coal Authority		Sample Type	B
Description	Brown clayey gravelly SAND with some rootlets.	BS1377: Part 2: 1990: Clause 4.3 and 5 with Water Content to BS EN ISO 17892-1: 2014	Specimen Depth	0.00m
			Specimen Number	4



Natural moisture content:	30.6%	Percentage retained on 425µm sieve:	48%
Liquid limit:	48%	Preparation of sample:	Wet sieve
Plastic limit:	35%	Remarks:	
Plasticity index:	13%		
Moisture content of soil passing 425µm	59.4%		
Liquidity index:	1.875		

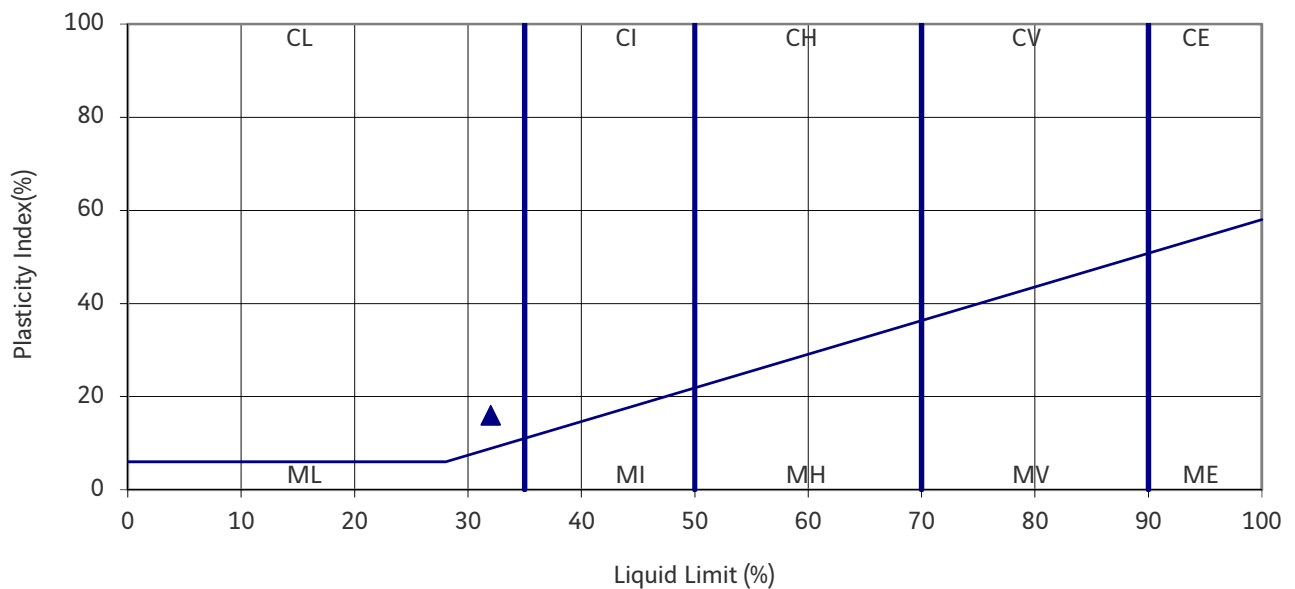



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Project Name	Nenthead Mines - Proposed MWTS, GI	Liquid And Plastic Limit Test	Hole ID	BH106
Project No.	TA8234		Sample Depth	4.25m
Engineer	Aecom		Sample Number	16
Employer	The Coal Authority		Sample Type	D
Description	Brown slightly gravelly sandy CLAY.	BS1377: Part 2: 1990: Clause 4.3 and 5 with Water Content to BS EN ISO 17892-1: 2014	Specimen Depth	4.25m
			Specimen Number	4

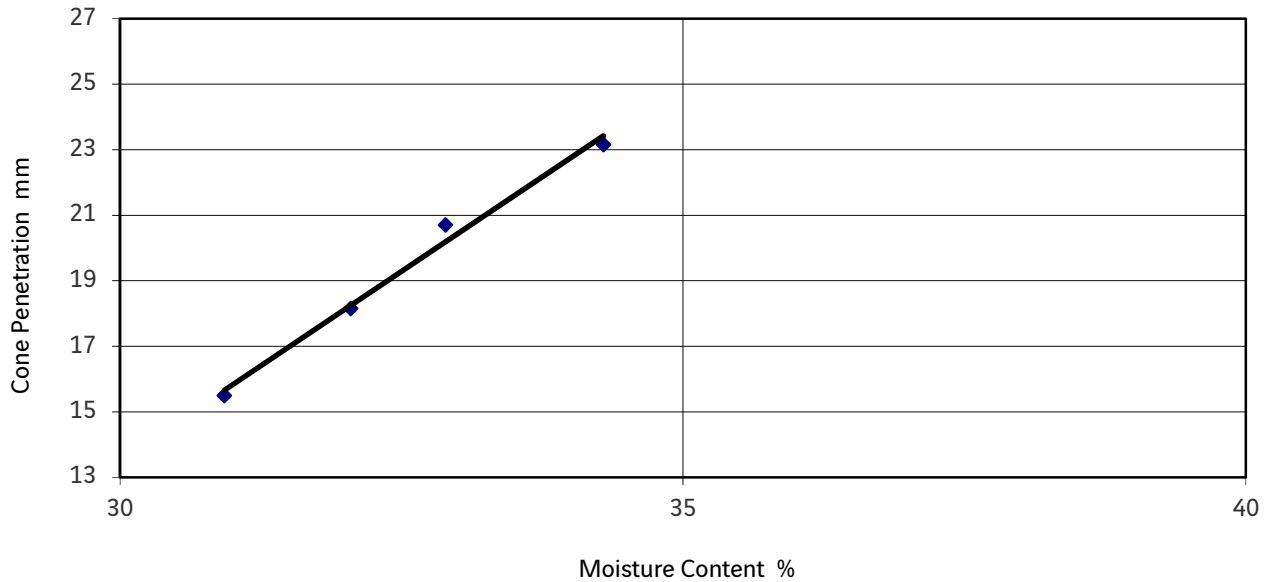


Natural moisture content:	13.7%	Percentage retained on 425µm sieve:	48%
Liquid limit:	32%	Preparation of sample:	Wet sieve
Plastic limit:	16%	Remarks:	
Plasticity index:	16%		
Moisture content of soil passing 425µm	26.3%		
Liquidity index:	0.642		

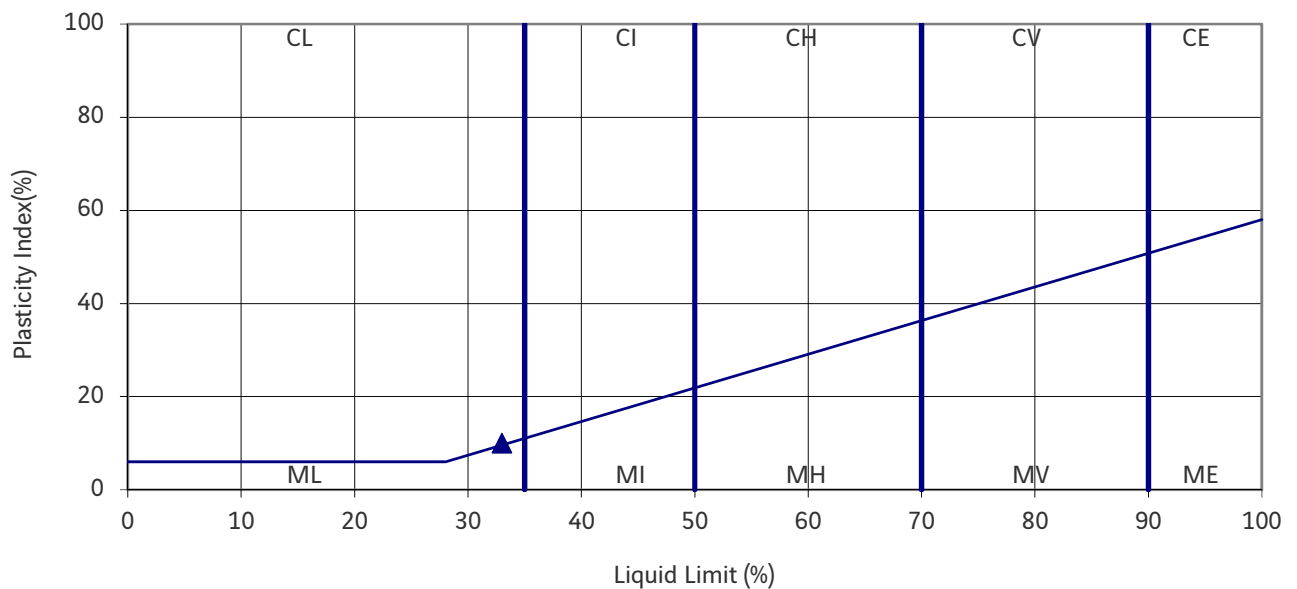



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Project Name	Nenthead Mines - Proposed MWTS, GI	Liquid And Plastic Limit Test	Hole ID	TP109
Project No.	TA8234		Sample Depth	1.00m
Engineer	Aecom		Sample Number	3
Employer	The Coal Authority		Sample Type	D
Description		BS1377: Part 2: 1990: Clause 4.3 and 5 with Water Content to BS EN ISO 17892-1: 2014	Specimen Depth	1.00m
			Specimen Number	4

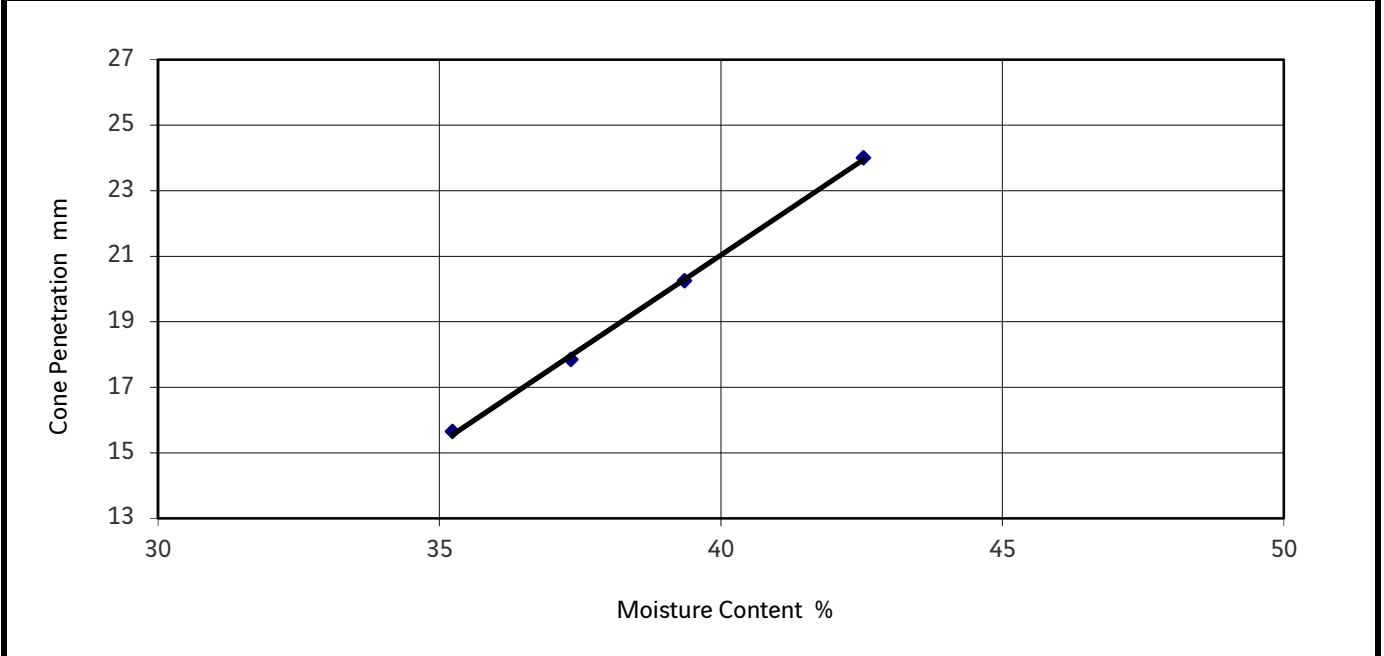


Natural moisture content:	27.9%	Percentage retained on 425µm sieve:	37%
Liquid limit:	33%	Preparation of sample:	Wet sieve
Plastic limit:	23%	Remarks:	
Plasticity index:	10%		
Moisture content of soil passing 425µm	44.0%		
Liquidity index:	2.1		

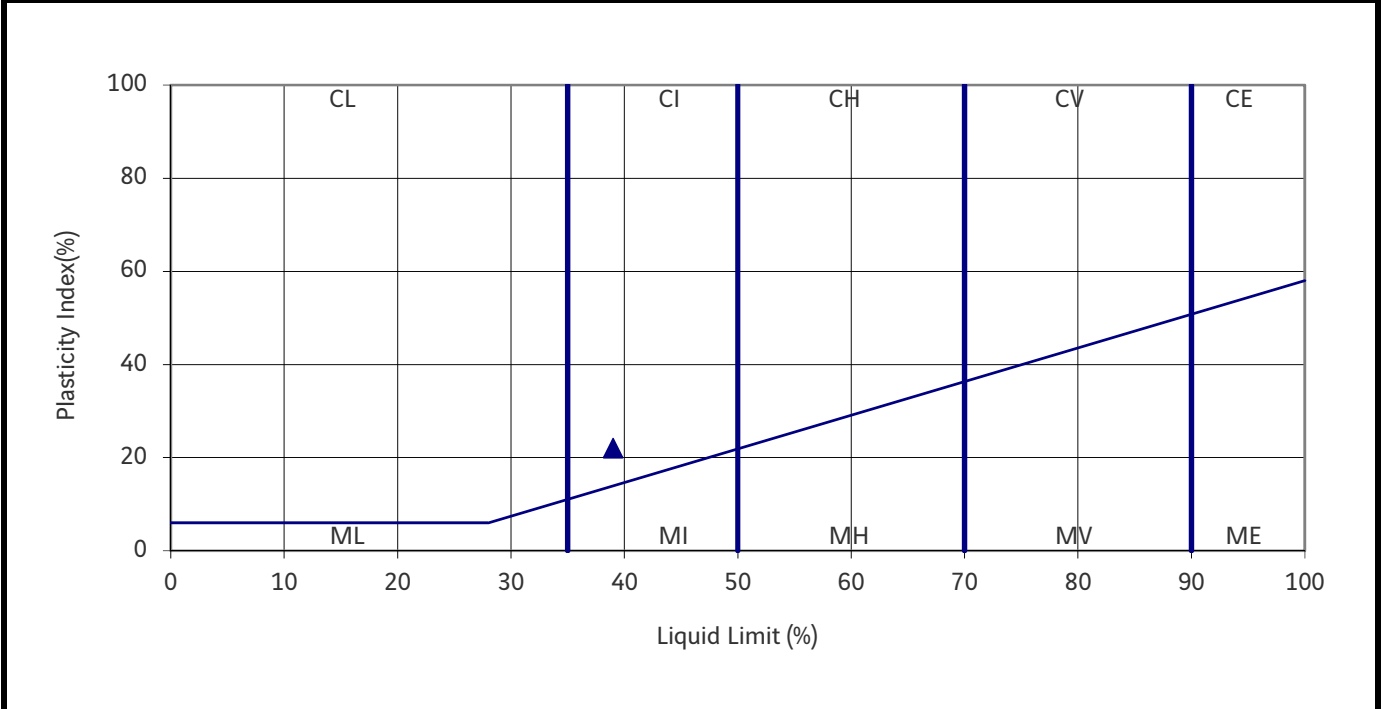



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Project Name	Nenthead Mines - Proposed MWTS, GI	Liquid And Plastic Limit Test	Hole ID	TP110
Project No.	TA8234		Sample Depth	2.00m
Engineer	Aecom		Sample Number	6
Employer	The Coal Authority		Sample Type	D
Description	Brown slightly gravelly sandy CLAY.		Specimen Depth	2.00m
			Specimen Number	4

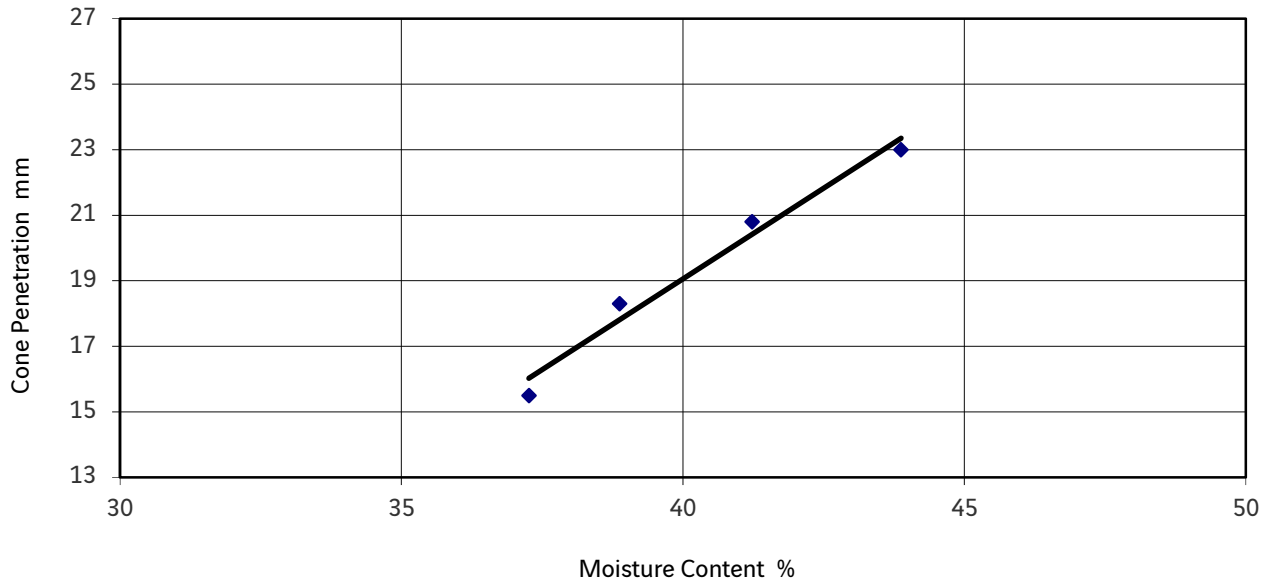


Natural moisture content:	15.8%	Percentage retained on 425µm sieve:	23%
Liquid limit:	39%	Preparation of sample:	Wet sieve
Plastic limit:	17%	Remarks:	
Plasticity index:	22%		
Moisture content of soil passing 425µm	20.6%		
Liquidity index:	0.162		

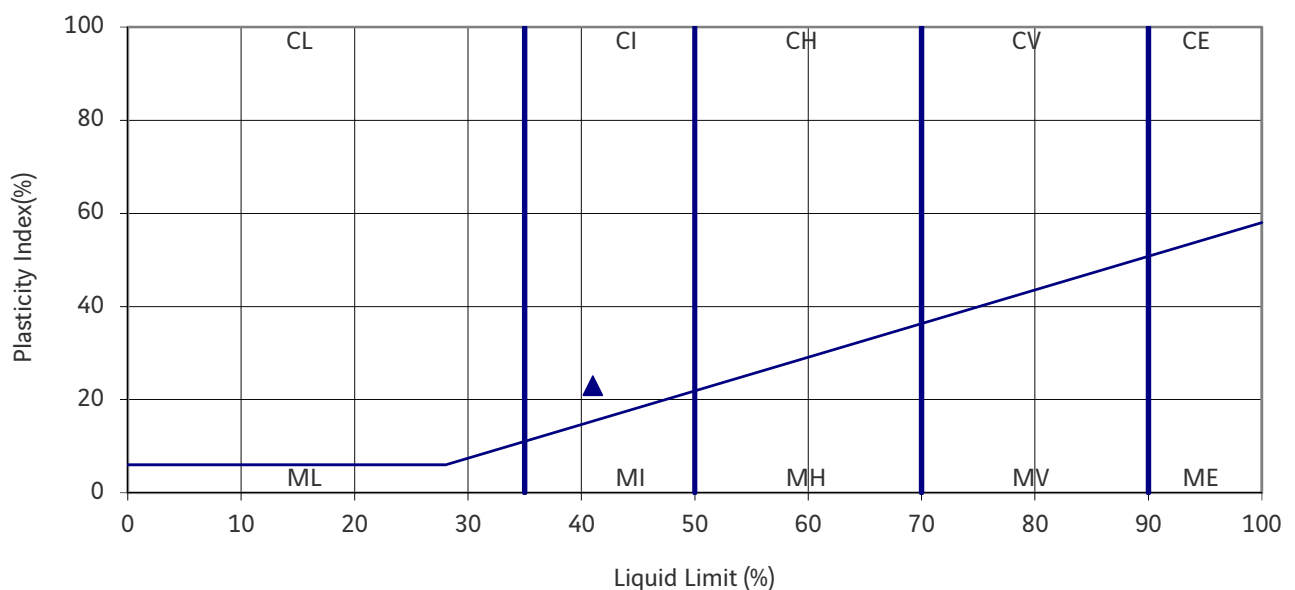



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Project Name	Nenthead Mines - Proposed MWTS, GI	Liquid And Plastic Limit Test	Hole ID	TP112
Project No.	TA8234		Sample Depth	2.00m
Engineer	Aecom		Sample Number	6
Employer	The Coal Authority		Sample Type	D
Description		BS1377: Part 2: 1990: Clause 4.3 and 5 with Water Content to BS EN ISO 17892-1: 2014	Specimen Depth	2.00m
			Specimen Number	4

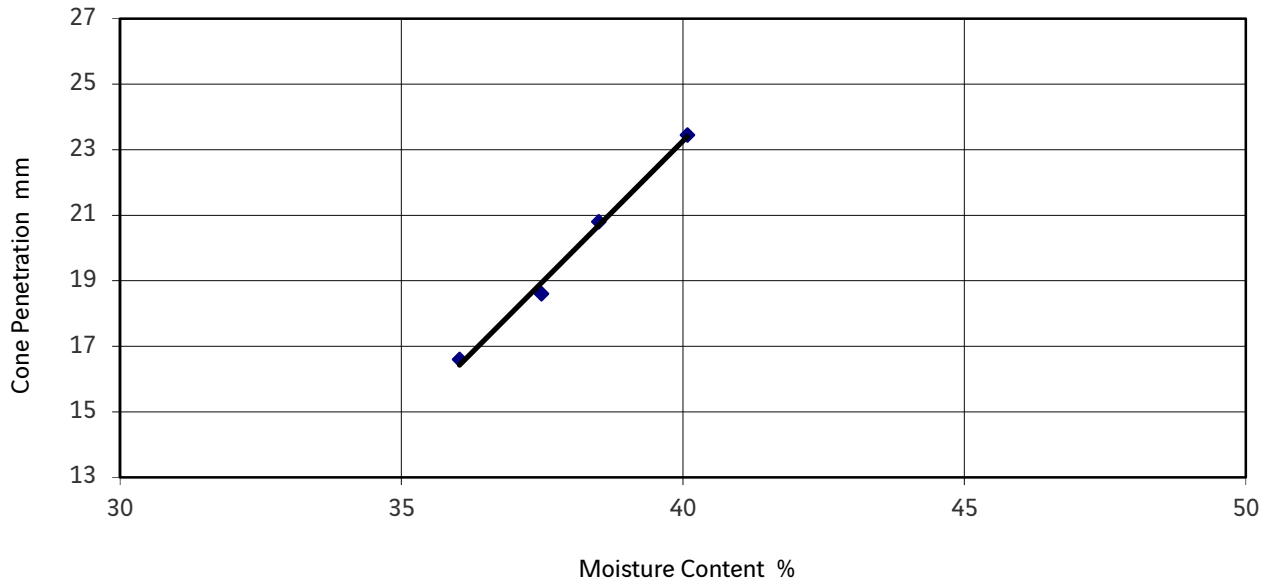


Natural moisture content:	15.2%	Percentage retained on 425µm sieve:	25%
Liquid limit:	41%	Preparation of sample:	Wet sieve
Plastic limit:	18%	Remarks:	
Plasticity index:	23%		
Moisture content of soil passing 425µm	20.2%		
Liquidity index:	0.097		

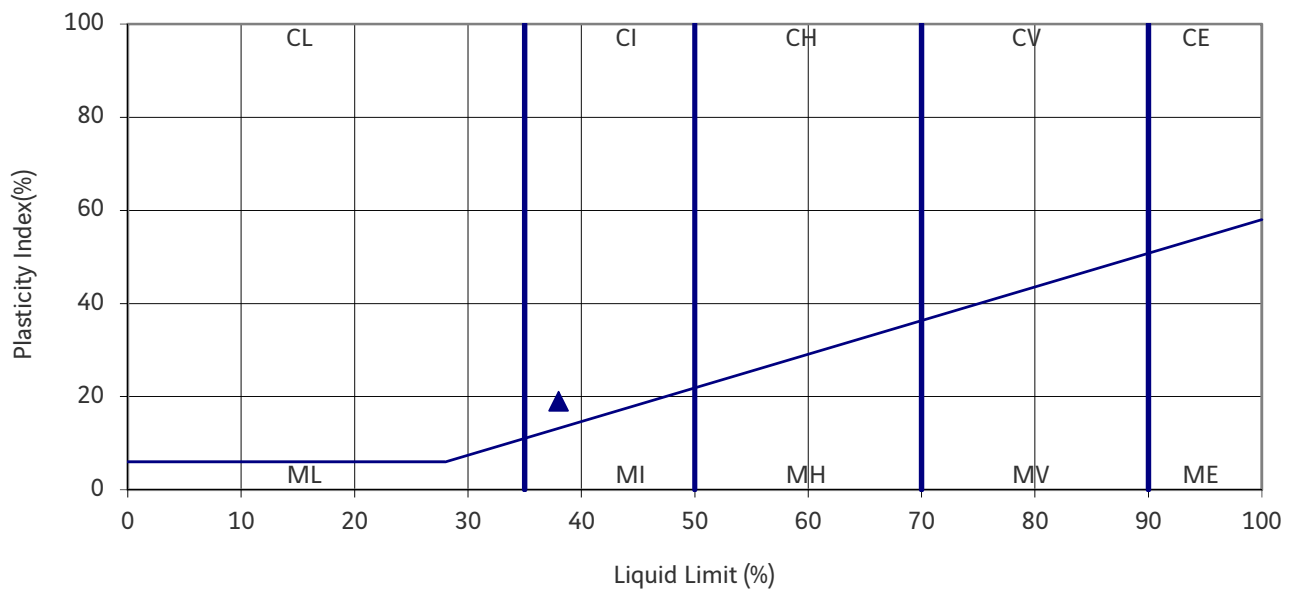



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Project Name	Nenthead Mines - Proposed MWTS, GI	Liquid And Plastic Limit Test	Hole ID	TP114
Project No.	TA8234		Sample Depth	1.00m
Engineer	Aecom		Sample Number	3
Employer	The Coal Authority		Sample Type	B
Description	Brwon gravelly sandy CLAY.	BS1377: Part 2: 1990: Clause 4.3 and 5 with Water Content to BS EN ISO 17892-1: 2014	Specimen Depth	1.00m
			Specimen Number	4

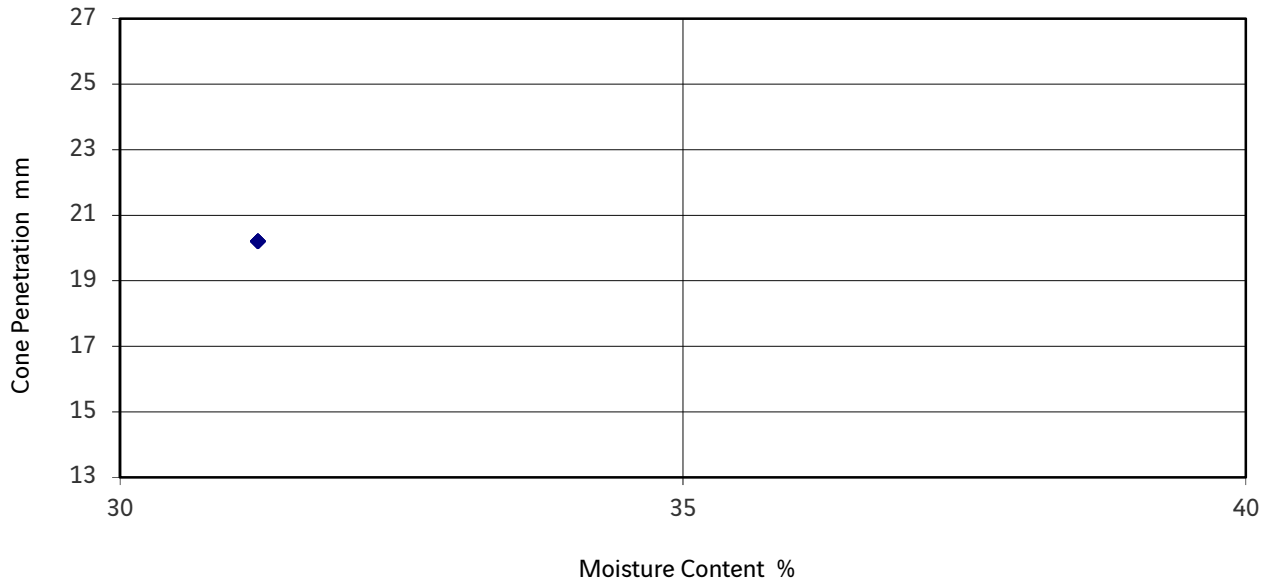


Natural moisture content:	20.7%	Percentage retained on 425µm sieve:	29%
Liquid limit:	38%	Preparation of sample:	Wet sieve
Plastic limit:	19%	Remarks:	
Plasticity index:	19%		
Moisture content of soil passing 425µm	29.3%		
Liquidity index:	0.542		

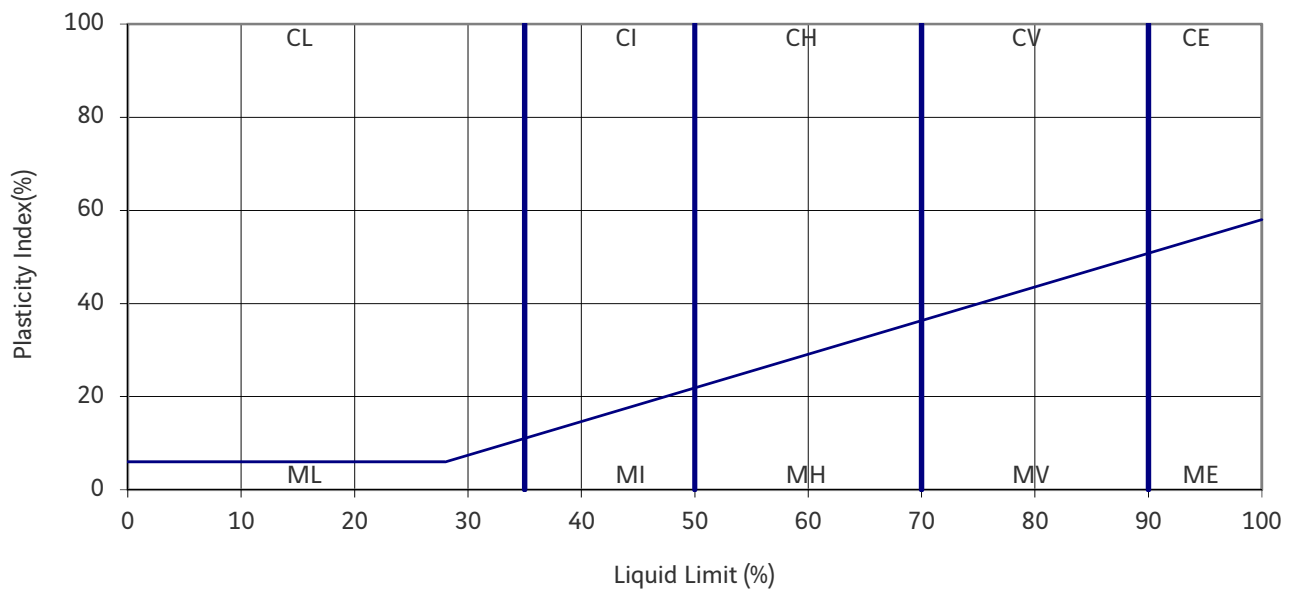



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Project Name	Nenthead Mines - Proposed MWTS, GI	Liquid And Plastic Limit Test	Hole ID	TP114
Project No.	TA8234		Sample Depth	1.70m
Engineer	Aecom		Sample Number	6
Employer	The Coal Authority		Sample Type	D
Description		BS1377: Part 2: 1990: Clause 4.4 and 5 with Water Content to BS EN ISO 17892-1: 2014	Specimen Depth	1.70m
			Specimen Number	4



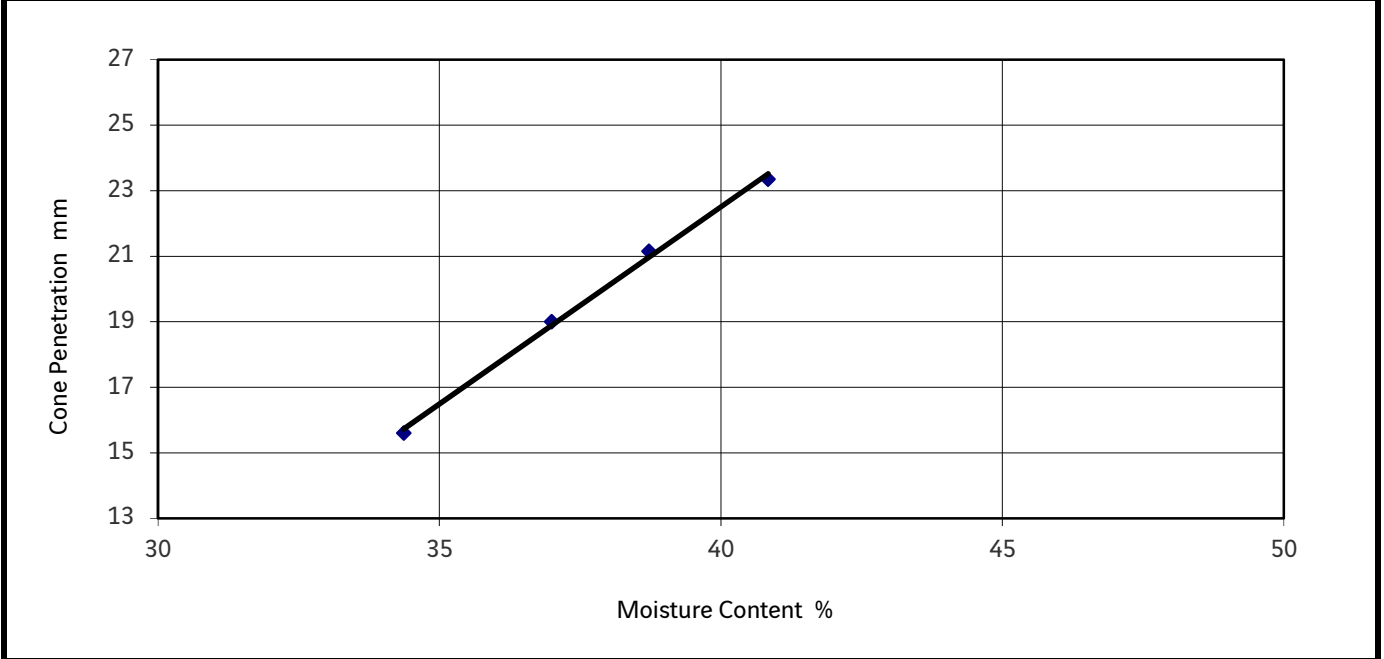
Natural moisture content:	20.5%	Percentage retained on 425µm sieve:	23%
Liquid limit:	31%	Preparation of sample:	Wet sieve
Plastic limit:	NP	Remarks:	Tested as 1 point Limit Liquid limit due to the sample being sand and/or silt and it is very difficult to get all four points on a line.
Plasticity index:			
Moisture content of soil passing 425µm	26.8%		
Liquidity index:			



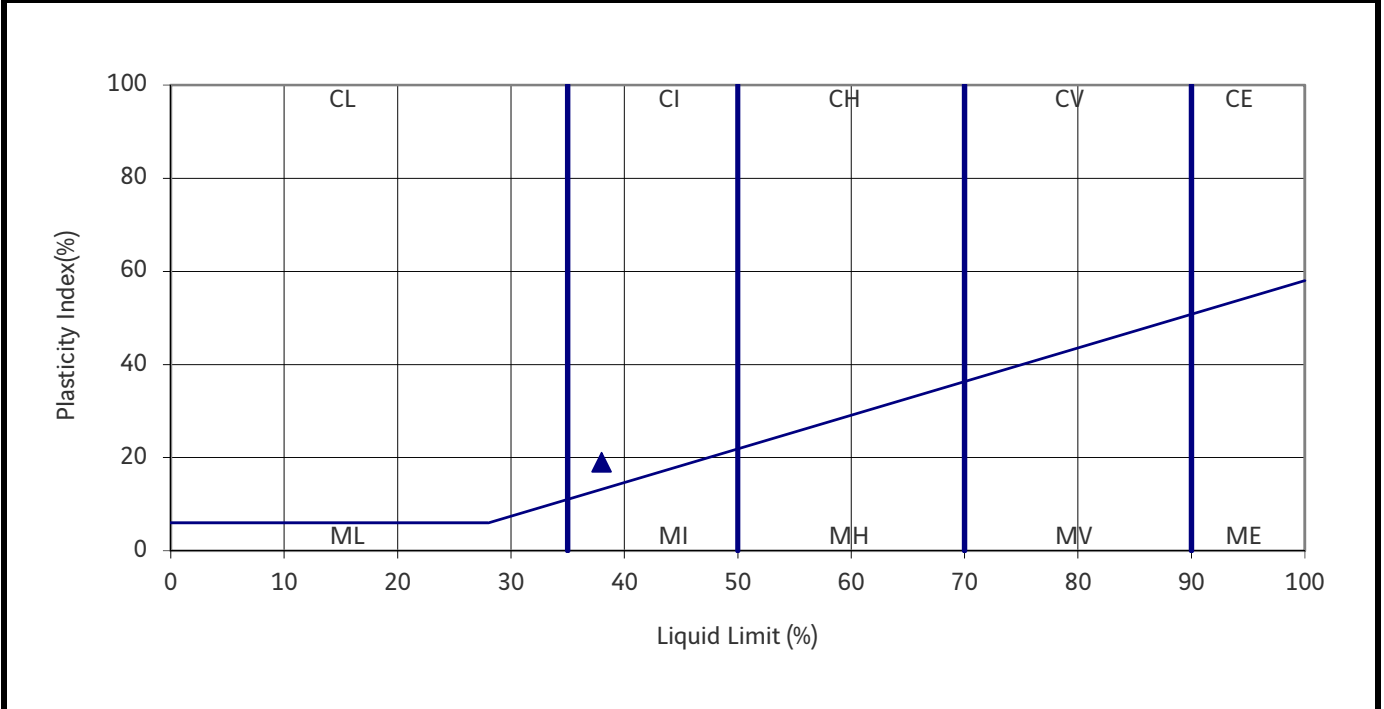
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Project Name	Nenthead Mines - Proposed MWTS, GI	Liquid And Plastic Limit Test	Hole ID	TP114
Project No.	TA8234		Sample Depth	2.00m
Engineer	Aecom		Sample Number	11
Employer	The Coal Authority		Sample Type	D
Description			Specimen Depth	2.00m
			Specimen Number	4

BS1377: Part 2: 1990: Clause 4.3 and 5
with Water Content to BS EN ISO
17892-1: 2014

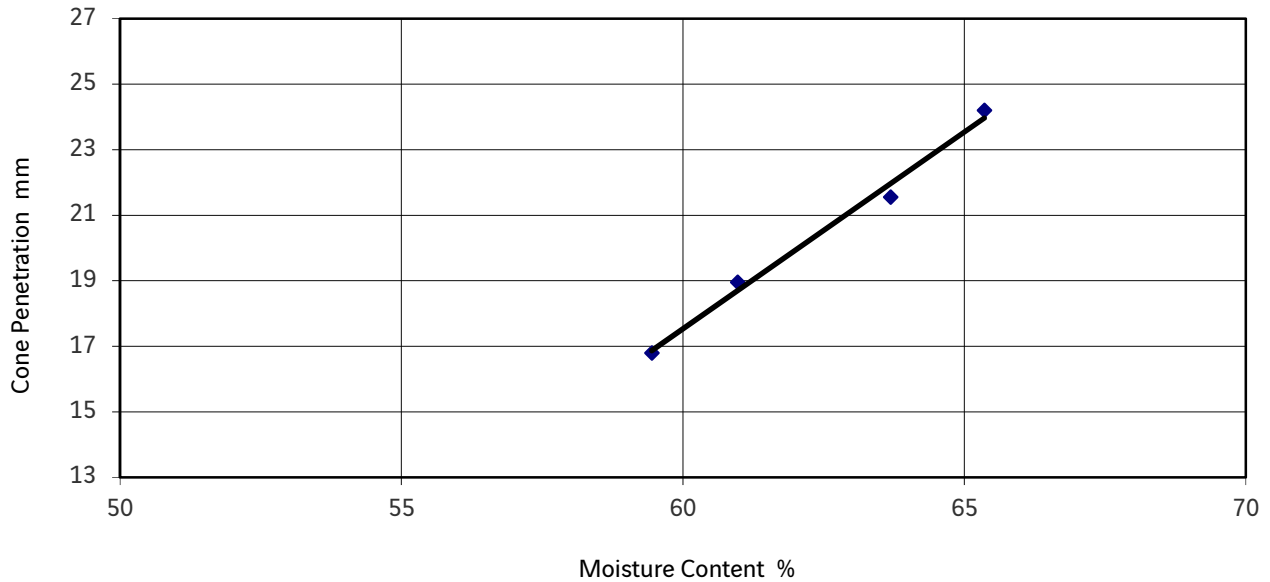


Natural moisture content:	15.5%	Percentage retained on 425µm sieve:	26%
Liquid limit:	38%	Preparation of sample:	Wet sieve
Plastic limit:	19%	Remarks:	
Plasticity index:	19%		
Moisture content of soil passing 425µm	21.0%		
Liquidity index:	0.103		

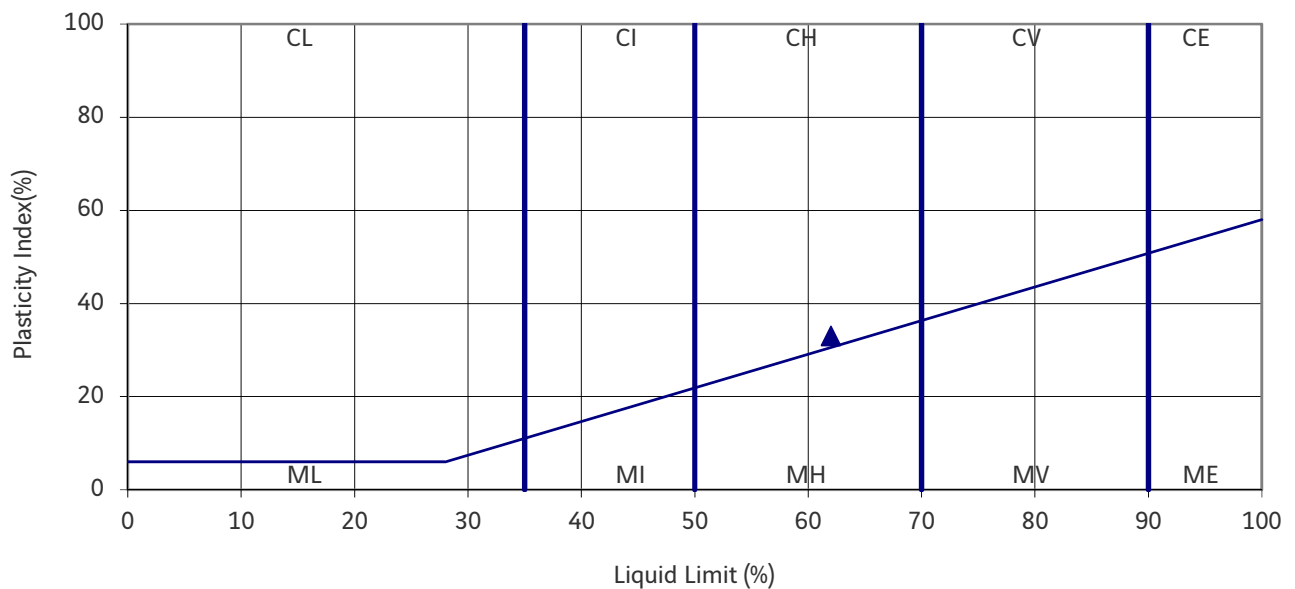



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Project Name	Nenthead Mines - Proposed MWTS, GI	Liquid And Plastic Limit Test	Hole ID	TP115
Project No.	TA8234		Sample Depth	1.00m
Engineer	Aecom		Sample Number	3
Employer	The Coal Authority		Sample Type	D
Description	Brown slightly gravelly slightly sandy CLAY.	BS1377: Part 2: 1990: Clause 4.3 and 5 with Water Content to BS EN ISO 17892-1: 2014	Specimen Depth	1.00m
			Specimen Number	2

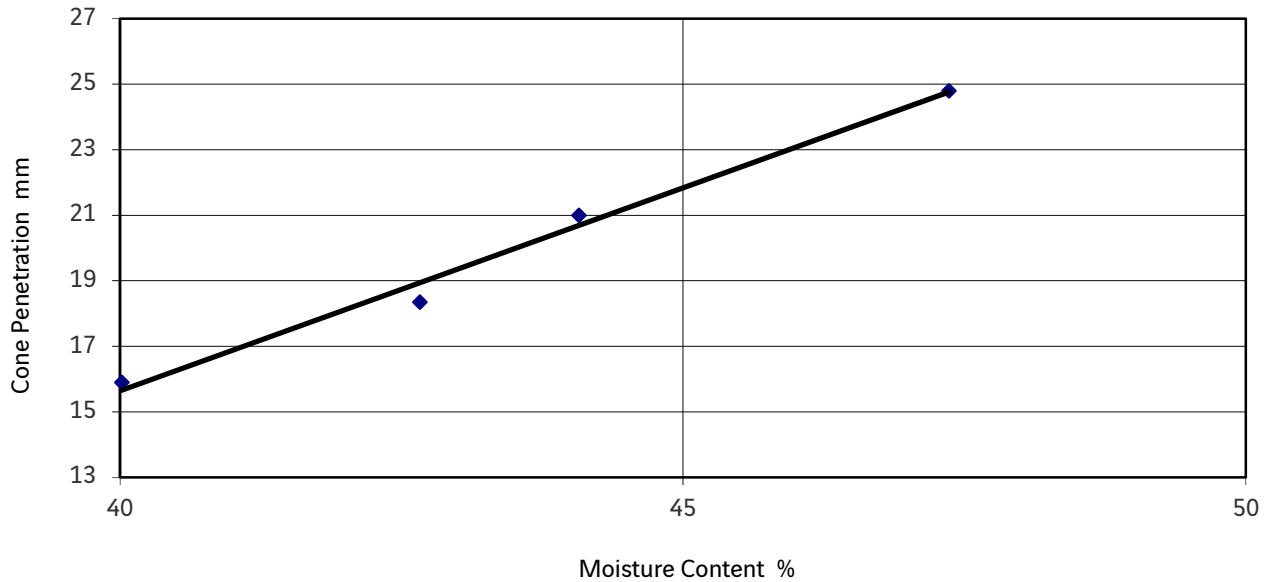


Natural moisture content:	46.4%	Estimated percentage retained on 425µm sieve:	5%
Liquid limit:	62%	Preparation of sample:	Natural
Plastic limit:	29%	Remarks:	
Plasticity index:	33%		
Moisture content of soil passing 425µm	48.7%		
Liquidity index:	0.598		

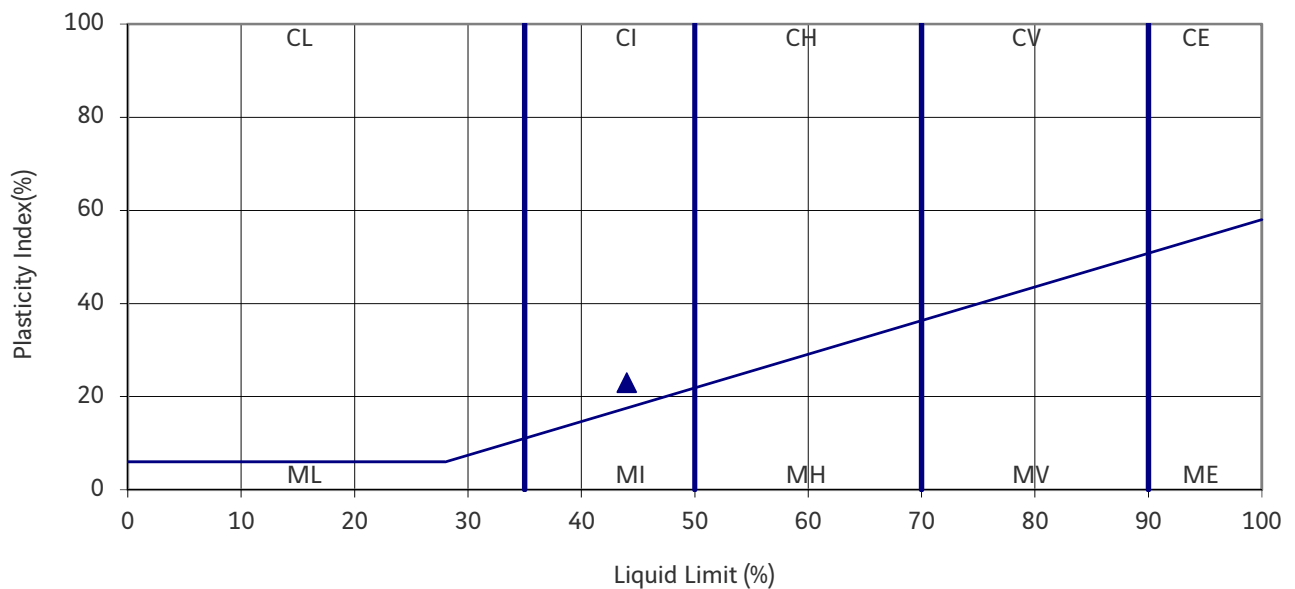



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Project Name	Nenthead Mines - Proposed MWTS, GI	Liquid And Plastic Limit Test	Hole ID	TP116
Project No.	TA8234		Sample Depth	1.00m
Engineer	Aecom		Sample Number	3
Employer	The Coal Authority		Sample Type	D
Description	Brown slightly gravelly sandy CLAY.	BS1377: Part 2: 1990: Clause 4.3 and 5 with Water Content to BS EN ISO 17892-1: 2014	Specimen Depth	1.00m
			Specimen Number	4



Natural moisture content:	18.7%	Percentage retained on 425µm sieve:	45%
Liquid limit:	44%	Preparation of sample:	Wet sieve
Plastic limit:	21%	Remarks:	
Plasticity index:	23%		
Moisture content of soil passing 425µm	34.0%		
Liquidity index:	0.564		

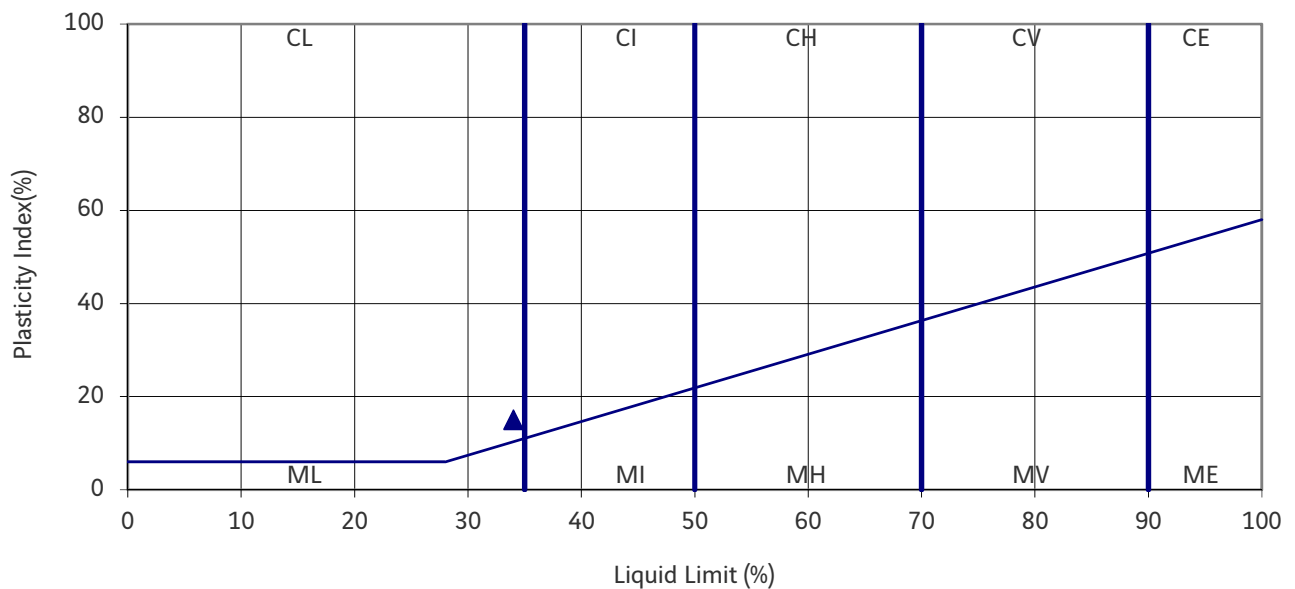



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Project Name	Nenthead Mines - Proposed MWTS, GI	Liquid And Plastic Limit Test	Hole ID	TP120
Project No.	TA8234		Sample Depth	1.20m
Engineer	Aecom		Sample Number	5
Employer	The Coal Authority		Sample Type	D
Description		BS1377: Part 2: 1990: Clause 4.3 and 5 with Water Content to BS EN ISO 17892-1: 2014	Specimen Depth	1.20m
			Specimen Number	4

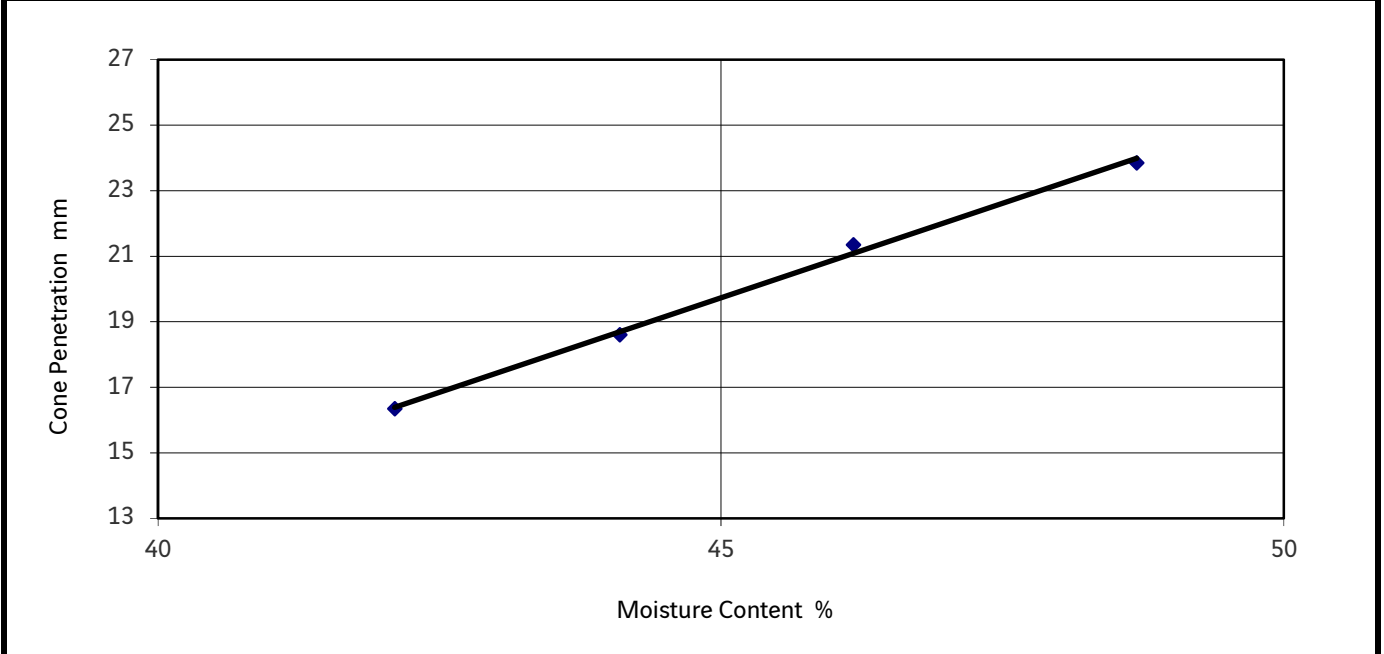


Natural moisture content:	17%	Percentage retained on 425µm sieve:	35%
Liquid limit:	34%	Preparation of sample:	Wet sieve
Plastic limit:	19%	Remarks:	
Plasticity index:	15%		
Moisture content of soil passing 425µm	26.3%		
Liquidity index:	0.486		

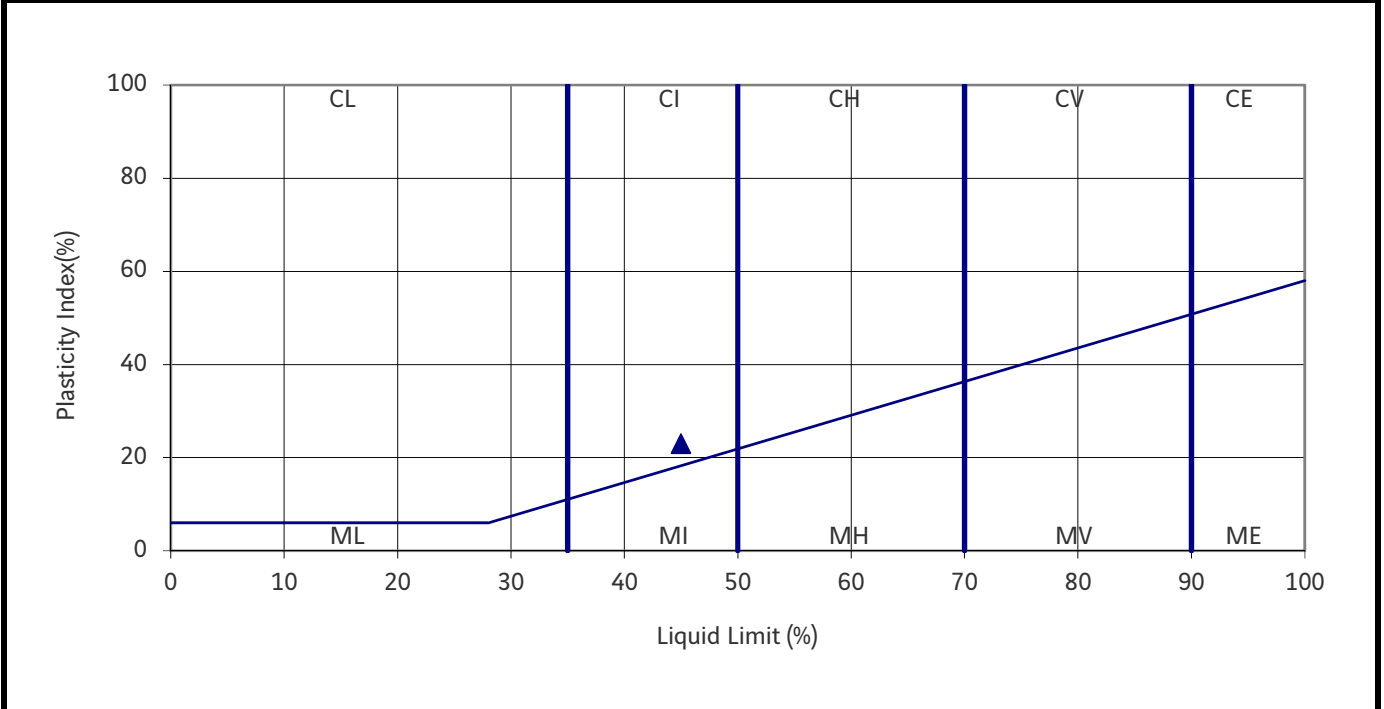



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Project Name	Nenthead Mines - Proposed MWTS, GI	Liquid And Plastic Limit Test	Hole ID	TP122
Project No.	TA8234		Sample Depth	0.80m
Engineer	Aecom		Sample Number	3
Employer	The Coal Authority		Sample Type	D
Description	Brown slightly sandy slightly gravelly CLAY.		Specimen Depth	0.80m
			Specimen Number	4

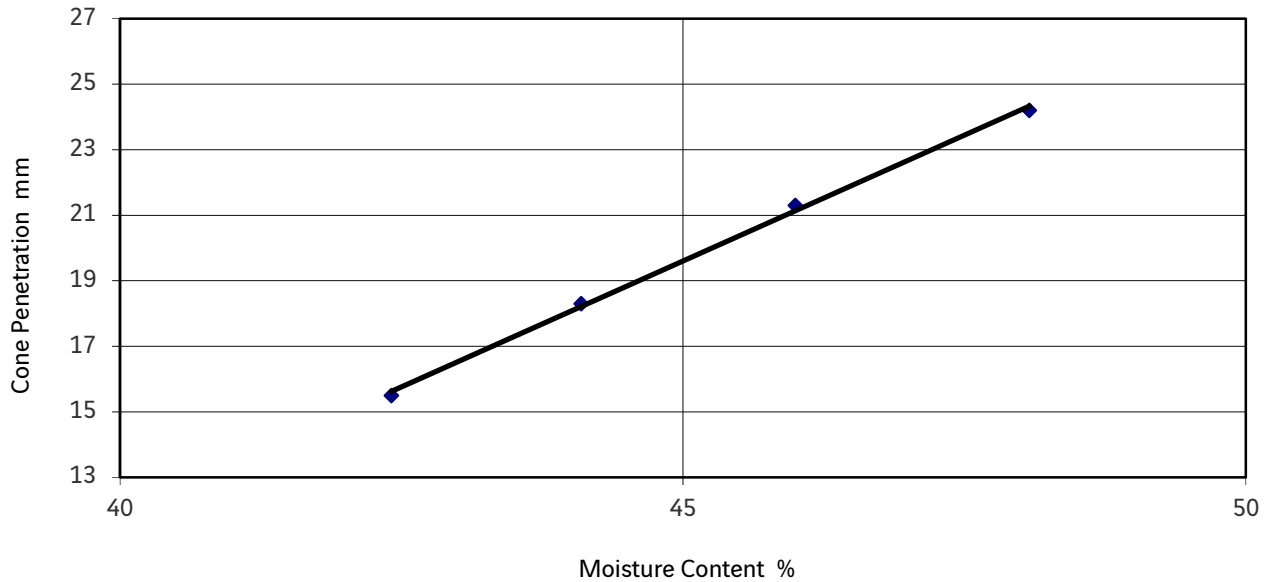


Natural moisture content:	21.1%	Percentage retained on 425µm sieve:	23%
Liquid limit:	45%	Preparation of sample:	Wet sieve
Plastic limit:	22%	Remarks:	
Plasticity index:	23%		
Moisture content of soil passing 425µm	27.3%		
Liquidity index:	0.229		

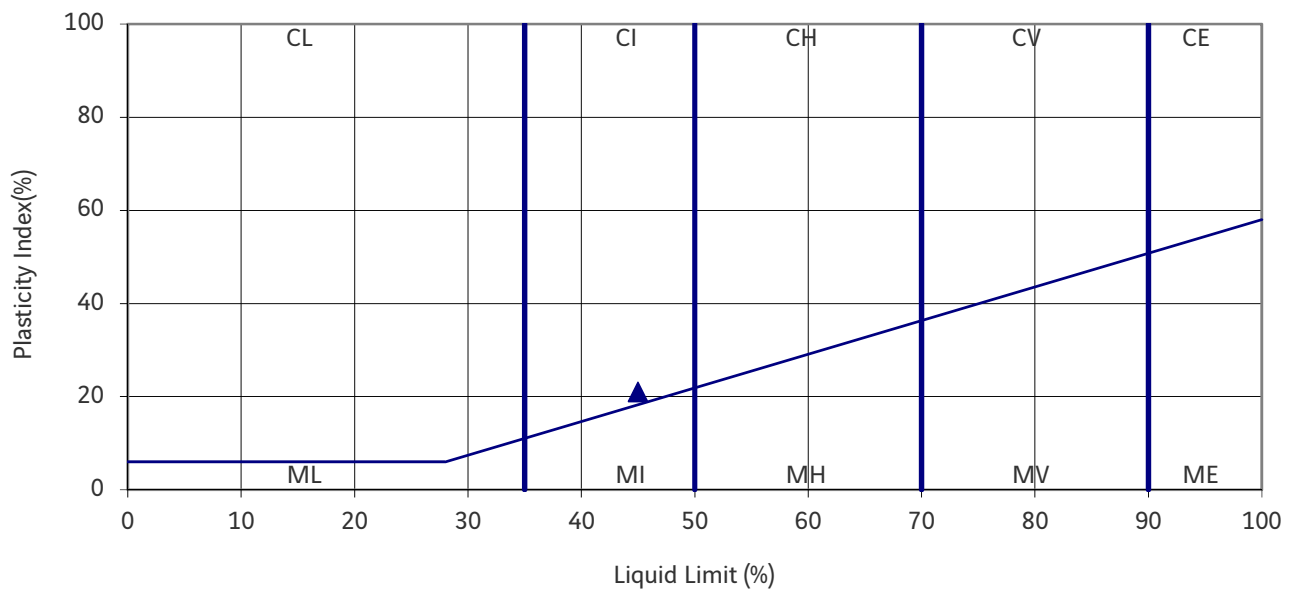



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Project Name	Nenthead Mines - Proposed MWTS, GI	Liquid And Plastic Limit Test	Hole ID	TP124
Project No.	TA8234		Sample Depth	1.00m
Engineer	Aecom		Sample Number	3
Employer	The Coal Authority		Sample Type	D
Description		BS1377: Part 2: 1990: Clause 4.3 and 5 with Water Content to BS EN ISO 17892-1: 2014	Specimen Depth	1.00m
			Specimen Number	4

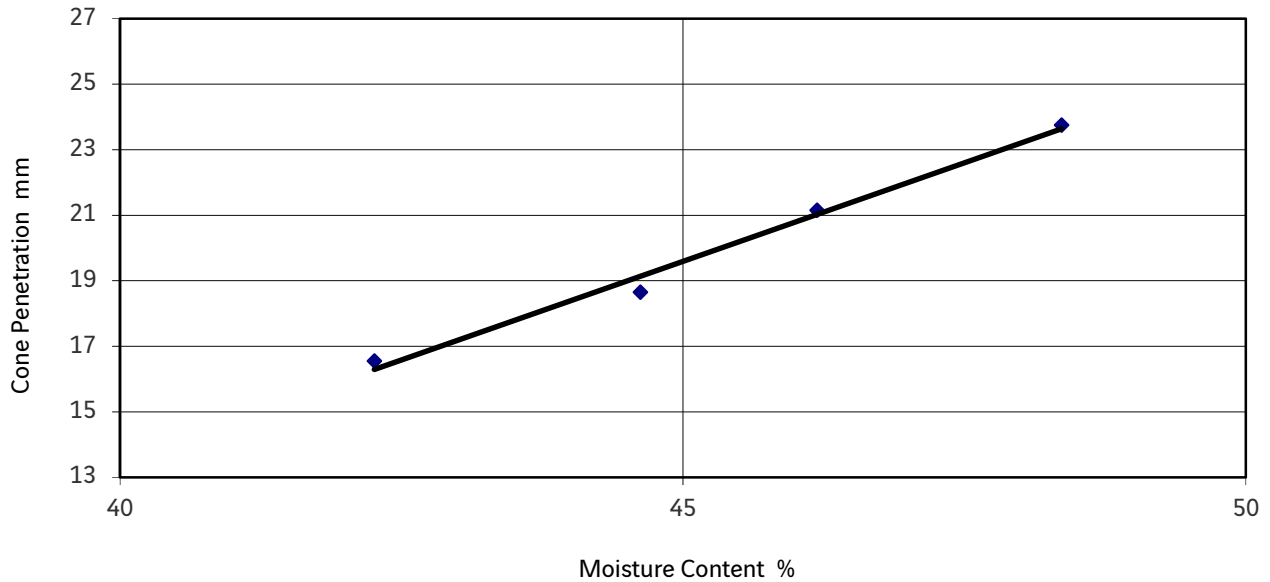


Natural moisture content:	36%	Estimated percentage retained on 425µm sieve:	2%
Liquid limit:	45%	Preparation of sample:	Natural
Plastic limit:	24%	Remarks:	
Plasticity index:	21%		
Moisture content of soil passing 425µm	36.8%		
Liquidity index:	0.608		

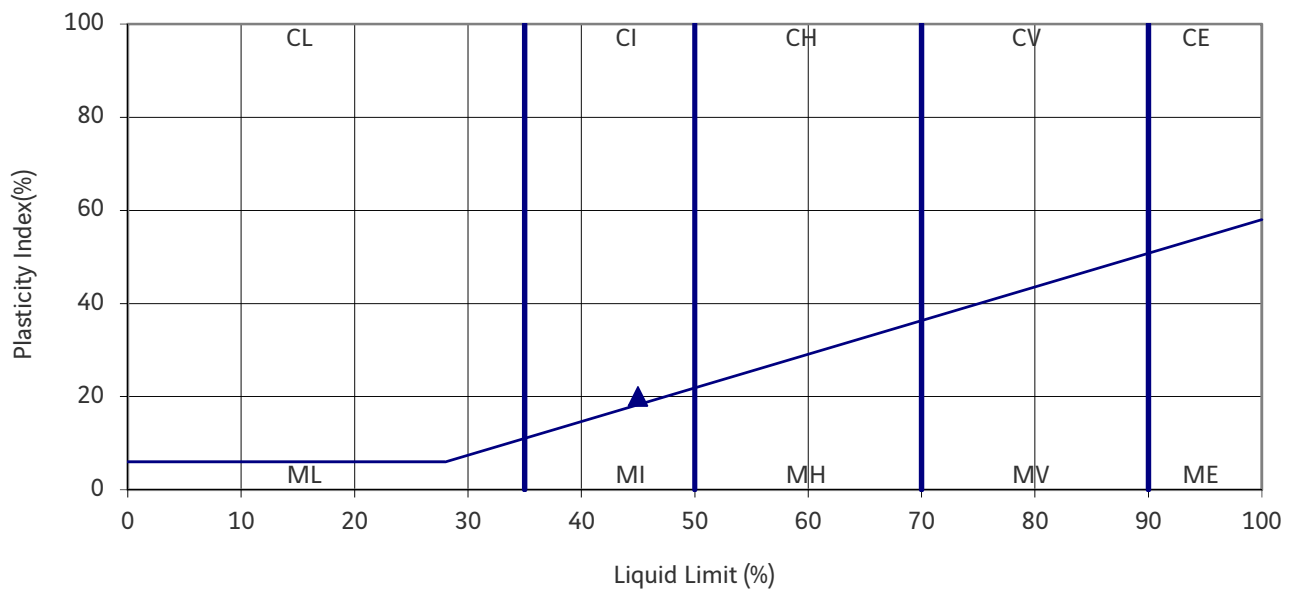



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Project Name	Nenthead Mines - Proposed MWTS, GI	Liquid And Plastic Limit Test	Hole ID	TP125
Project No.	TA8234		Sample Depth	1.00m
Engineer	Aecom		Sample Number	5
Employer	The Coal Authority		Sample Type	D
Description		BS1377: Part 2: 1990: Clause 4.3 and 5 with Water Content to BS EN ISO 17892-1: 2014	Specimen Depth	1.00m
			Specimen Number	4

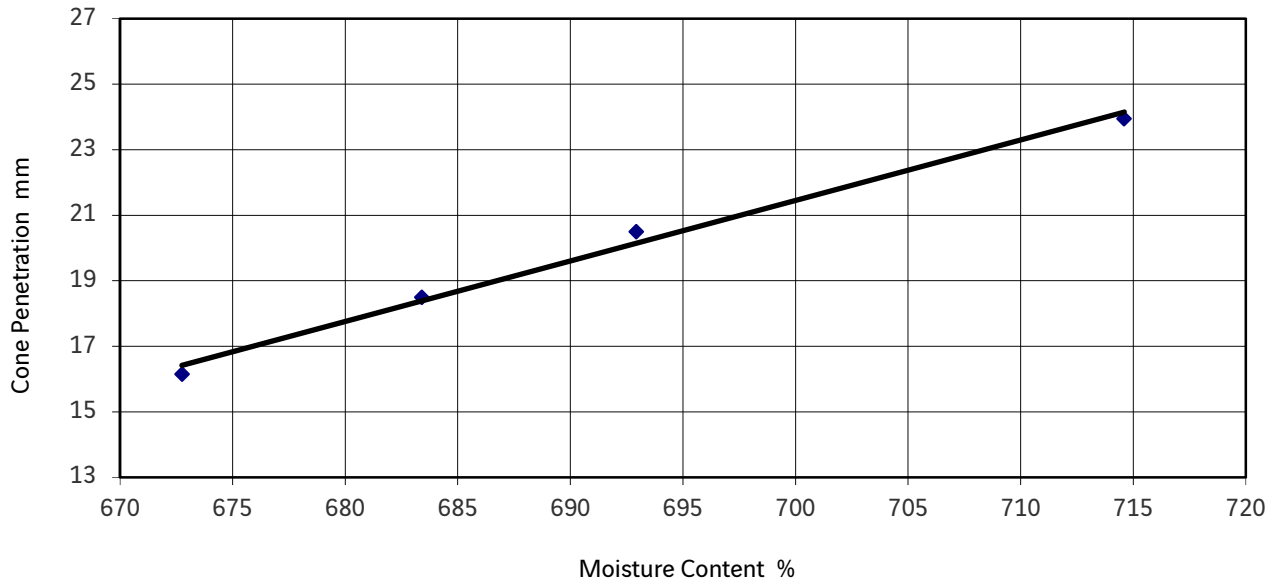


Natural moisture content:	23.5%	Percentage retained on 425µm sieve:	19%
Liquid limit:	45%	Preparation of sample:	Wet sieve
Plastic limit:	25%	Remarks:	
Plasticity index:	20%		
Moisture content of soil passing 425µm	29.0%		
Liquidity index:	0.199		

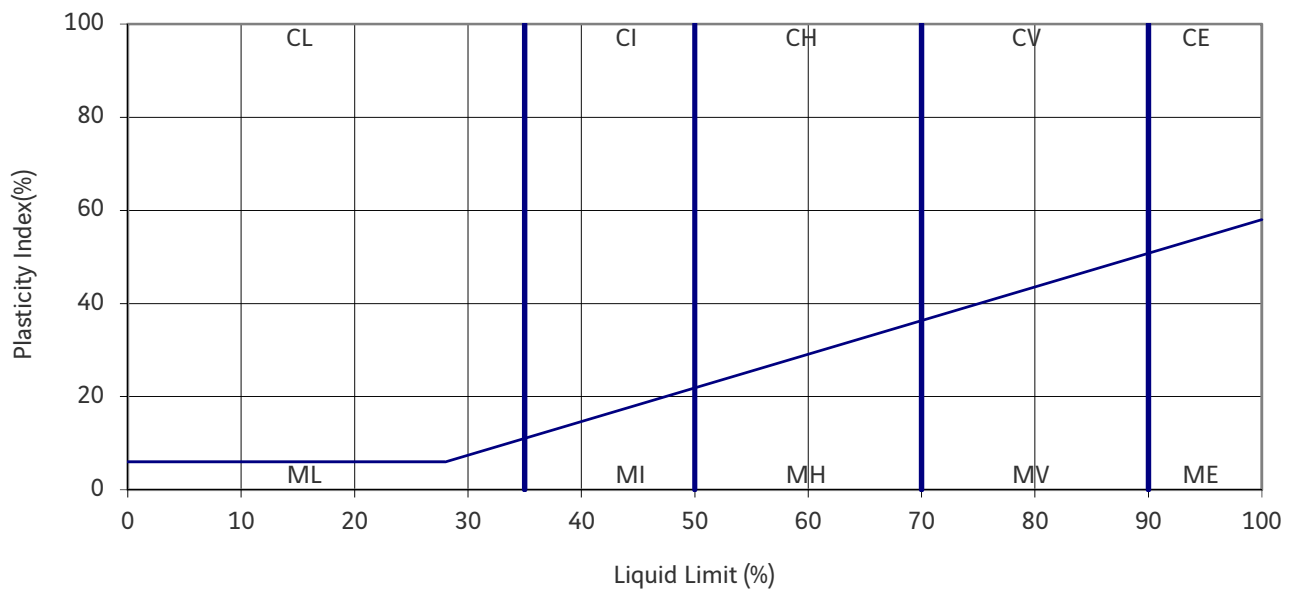



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Project Name	Nenthead Mines - Proposed MWTS, GI	Liquid And Plastic Limit Test	Hole ID	TP128
Project No.	TA8234		Sample Depth	0.60m
Engineer	Aecom		Sample Number	3
Employer	The Coal Authority		Sample Type	D
Description		BS1377: Part 2: 1990: Clause 4.3 and 5 with Water Content to BS EN ISO 17892-1: 2014	Specimen Depth	0.60m
			Specimen Number	4

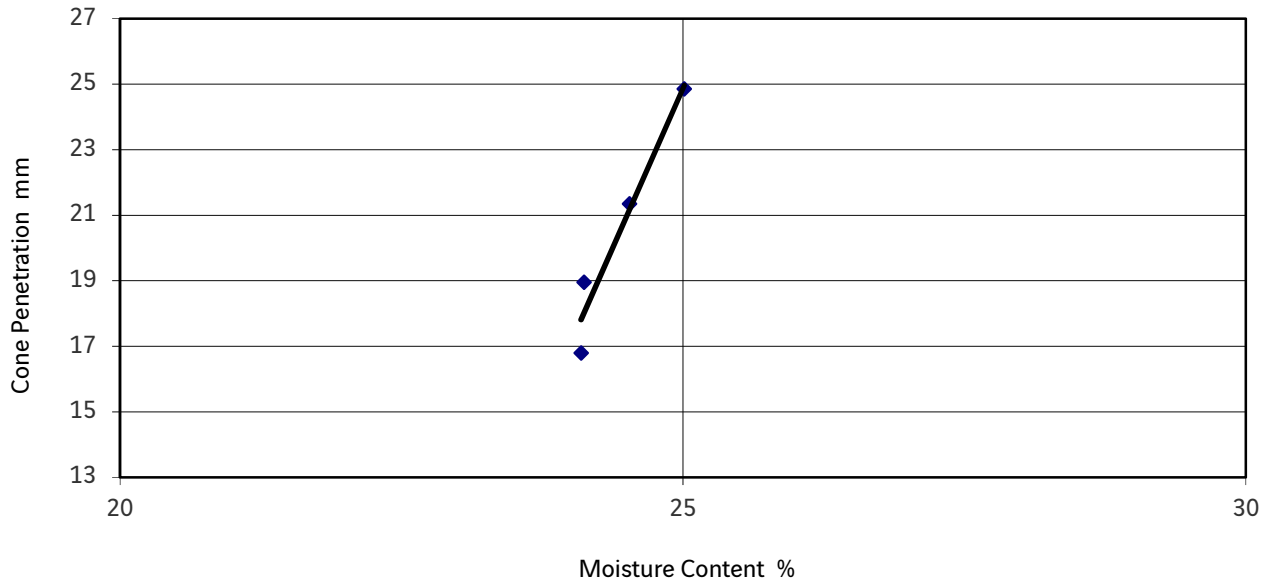


Natural moisture content:	497%	Estimated percentage retained on 425µm sieve:	0%
Liquid limit:	692%	Preparation of sample:	Natural
Plastic limit:	366%	Remarks:	Unable to obtain repeatable plastic limit test results. Value recorded is outside the BS test limits.
Plasticity index:	326%		
Moisture content of soil passing 425µm	497%		
Liquidity index:	0.402		

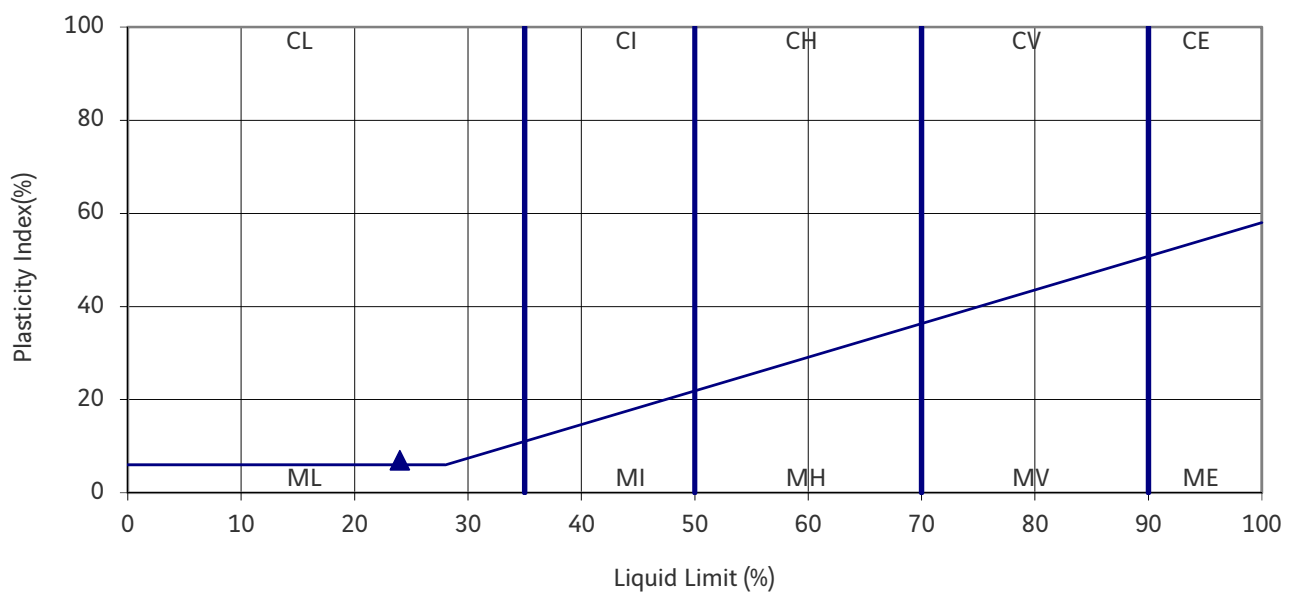



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Project Name	Nenthead Mines - Proposed MWTS, GI	Liquid And Plastic Limit Test	Hole ID	WS102
Project No.	TA8234		Sample Depth	1.20m
Engineer	Aecom		Sample Number	10
Employer	The Coal Authority		Sample Type	L
Description		BS1377: Part 2: 1990: Clause 4.3 and 5 with Water Content to BS EN ISO 17892-1: 2014	Specimen Depth	1.20m
			Specimen Number	2

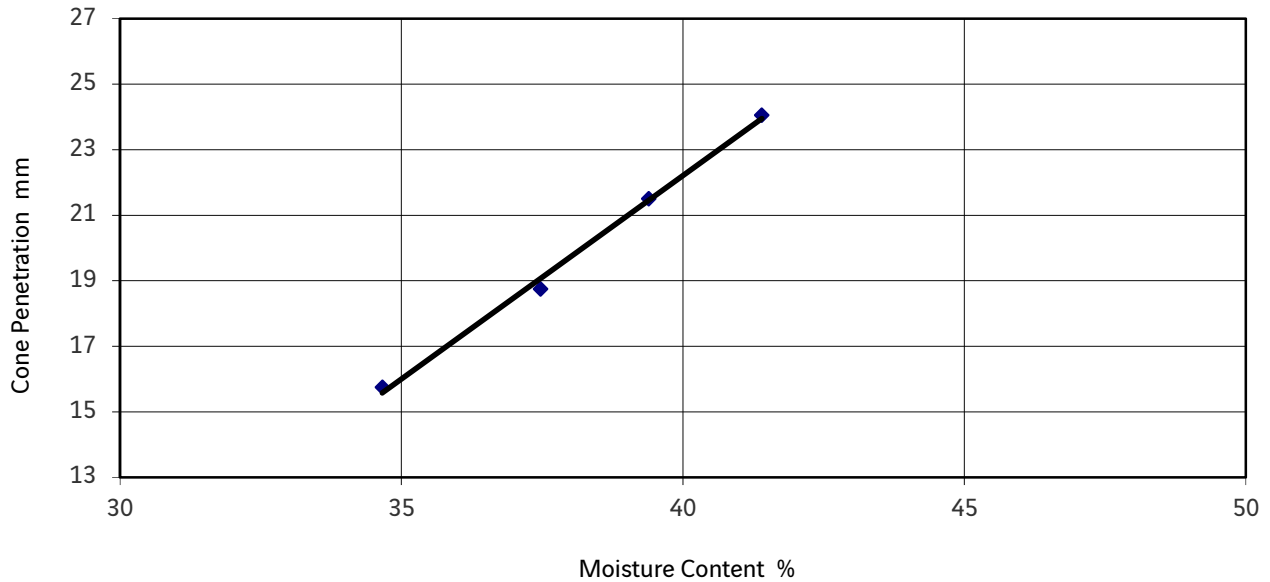


Natural moisture content:	20.6%	Estimated percentage retained on 425µm sieve:	0%
Liquid limit:	24%	Preparation of sample:	Natural
Plastic limit:	17%	Remarks:	
Plasticity index:	7%		
Moisture content of soil passing 425µm	20.6%		
Liquidity index:	0.514		

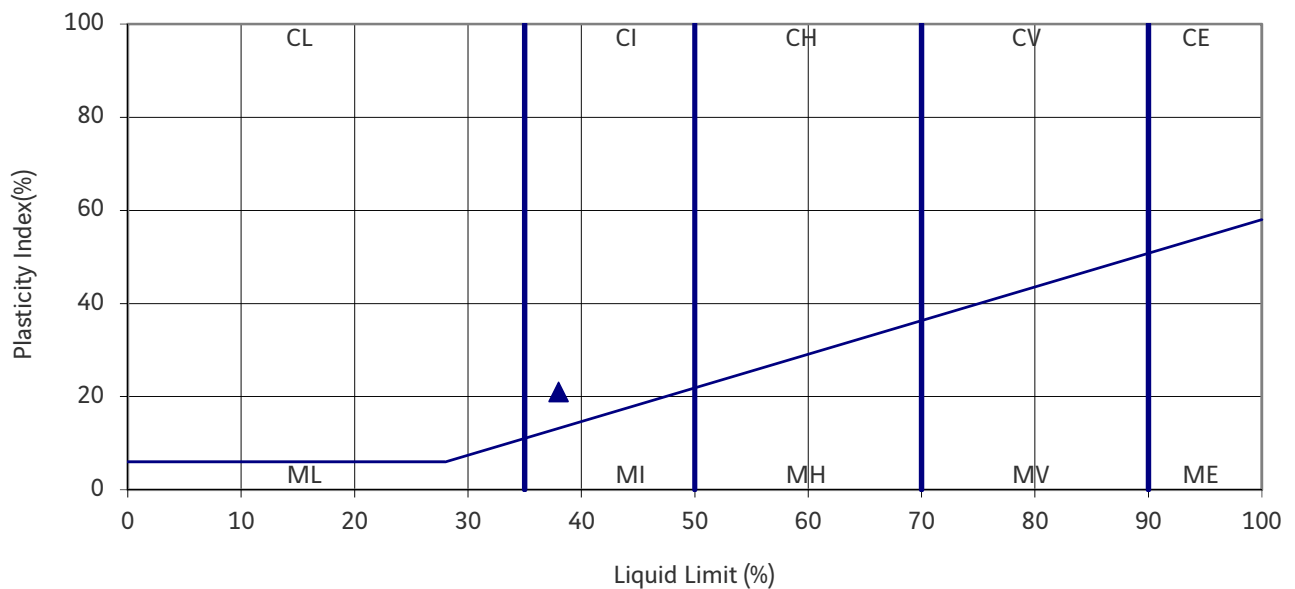



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Project Name	Nenthead Mines - Proposed MWTS, GI	Liquid And Plastic Limit Test	Hole ID	WS103
Project No.	TA8234		Sample Depth	1.20m
Engineer	Aecom		Sample Number	10
Employer	The Coal Authority		Sample Type	L
Description		BS1377: Part 2: 1990: Clause 4.3 and 5 with Water Content to BS EN ISO 17892-1: 2014	Specimen Depth	1.20m
			Specimen Number	4

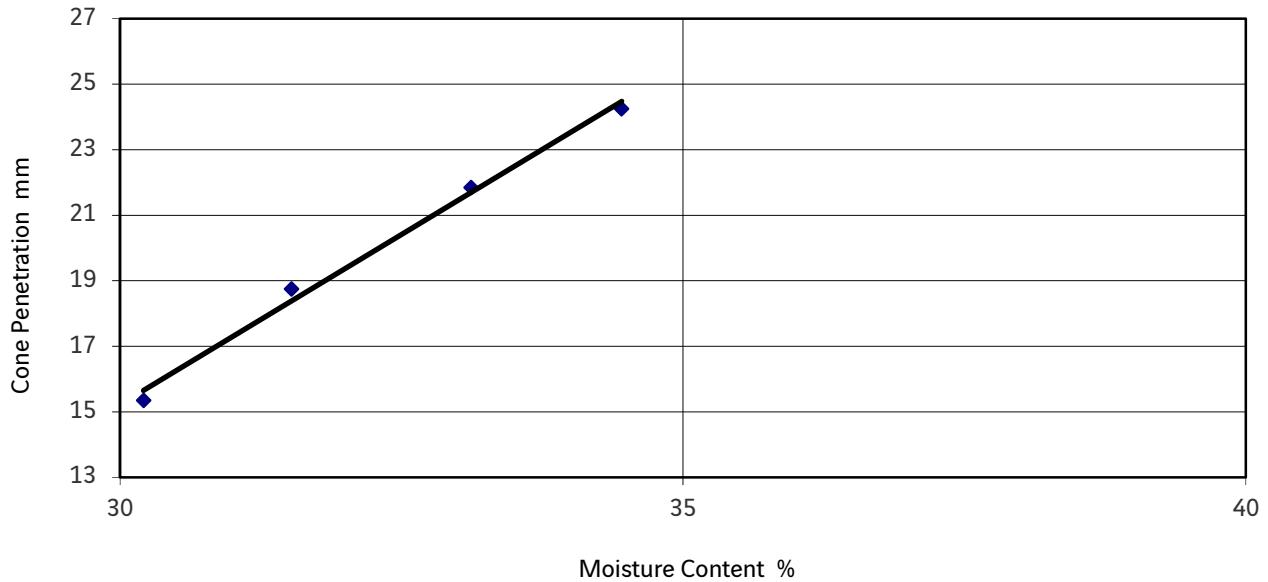


Natural moisture content:	15.4%	Percentage retained on 425µm sieve:	33%
Liquid limit:	38%	Preparation of sample:	Wet sieve
Plastic limit:	17%	Remarks:	
Plasticity index:	21%		
Moisture content of soil passing 425µm	22.8%		
Liquidity index:	0.278		

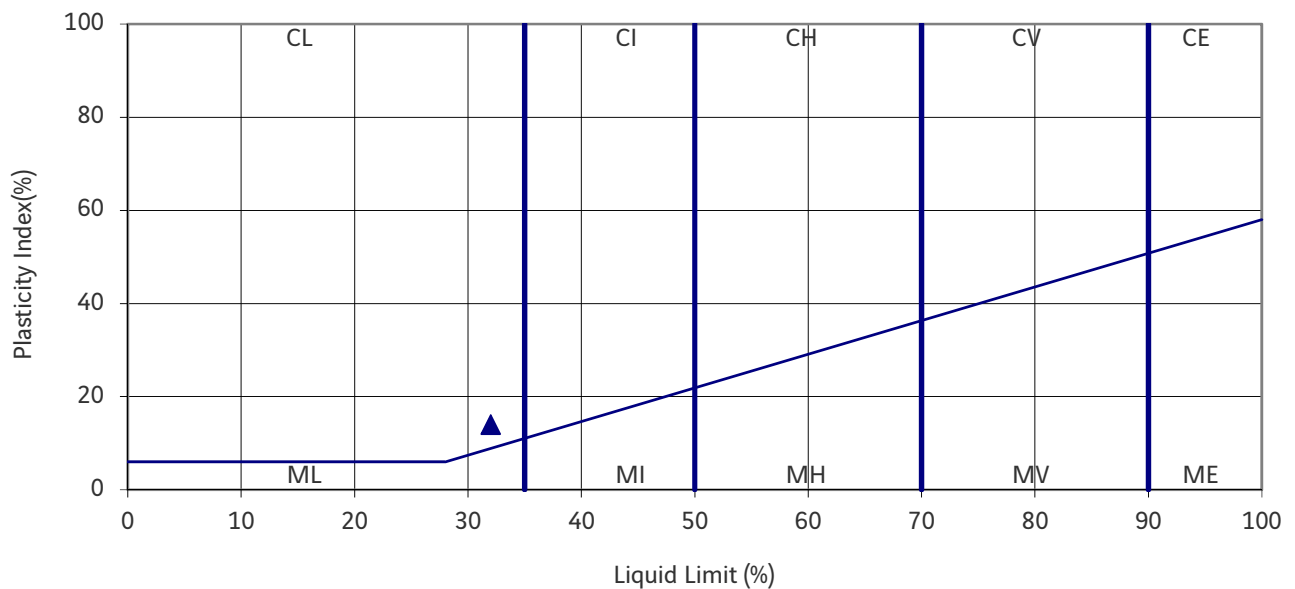



Approved by:	Leeds Laboratory	 SOIL ENGINEERING			
Steve Harper					
Revision No.	2.07	Issue Date	19/11/2012	Print date	07/11/2019
Part of the Bachy Soletanche Group					

Project Name	Nenthead Mines - Proposed MWTS, GI	Liquid And Plastic Limit Test	Hole ID	WS104
Project No.	TA8234		Sample Depth	1.70m
Engineer	Aecom		Sample Number	12
Employer	The Coal Authority		Sample Type	L
Description	Grey mottled brown slightly gravelly sandy CLAY.	BS1377: Part 2: 1990: Clause 4.3 and 5 with Water Content to BS EN ISO 17892-1: 2014	Specimen Depth	1.70m
			Specimen Number	2

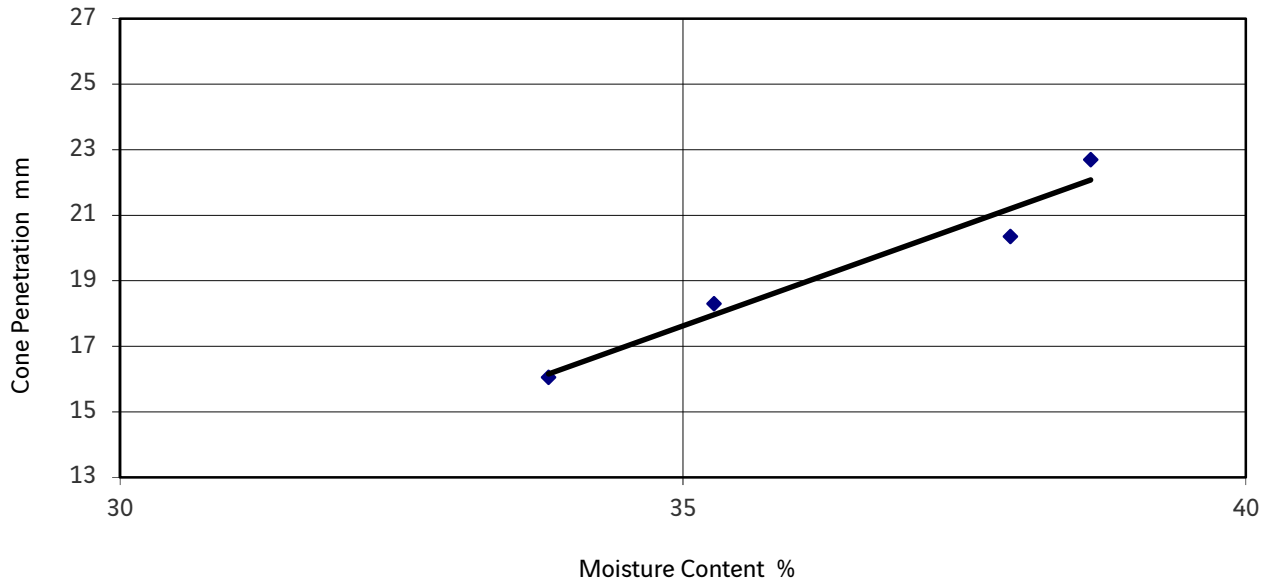


Natural moisture content:	16.5%	Estimated percentage retained on 425µm sieve:	3%
Liquid limit:	32%	Preparation of sample:	Natural
Plastic limit:	18%	Remarks:	
Plasticity index:	14%		
Moisture content of soil passing 425µm	17.0%		
Liquidity index:	-0.069		

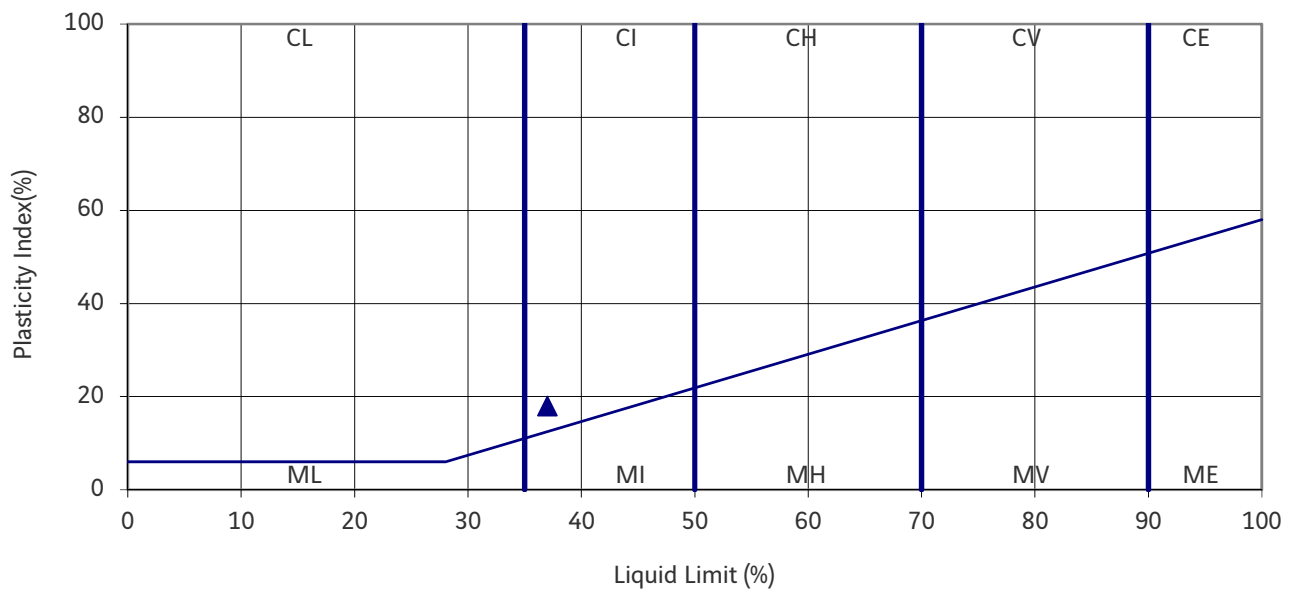



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Steve Harper		
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	Issue Date	19/11/2012
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Project Name	Nenthead Mines - Proposed MWTS, GI	Liquid And Plastic Limit Test	Hole ID	WS105
Project No.	TA8234		Sample Depth	1.20m
Engineer	Aecom		Sample Number	8
Employer	The Coal Authority		Sample Type	L
Description		BS1377: Part 2: 1990: Clause 4.3 and 5 with Water Content to BS EN ISO 17892-1: 2014	Specimen Depth	1.20m
			Specimen Number	4

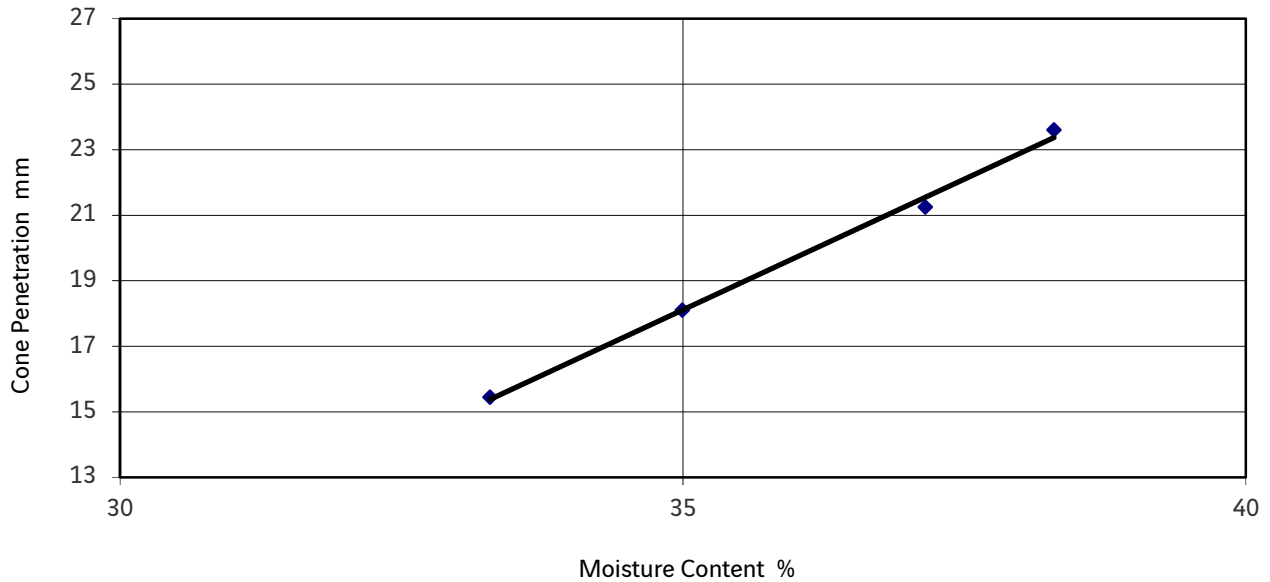


Natural moisture content:	22.1%	Percentage retained on 425µm sieve:	39%
Liquid limit:	37%	Preparation of sample:	Wet sieve
Plastic limit:	19%	Remarks:	
Plasticity index:	18%		
Moisture content of soil passing 425µm	36.0%		
Liquidity index:	0.947		

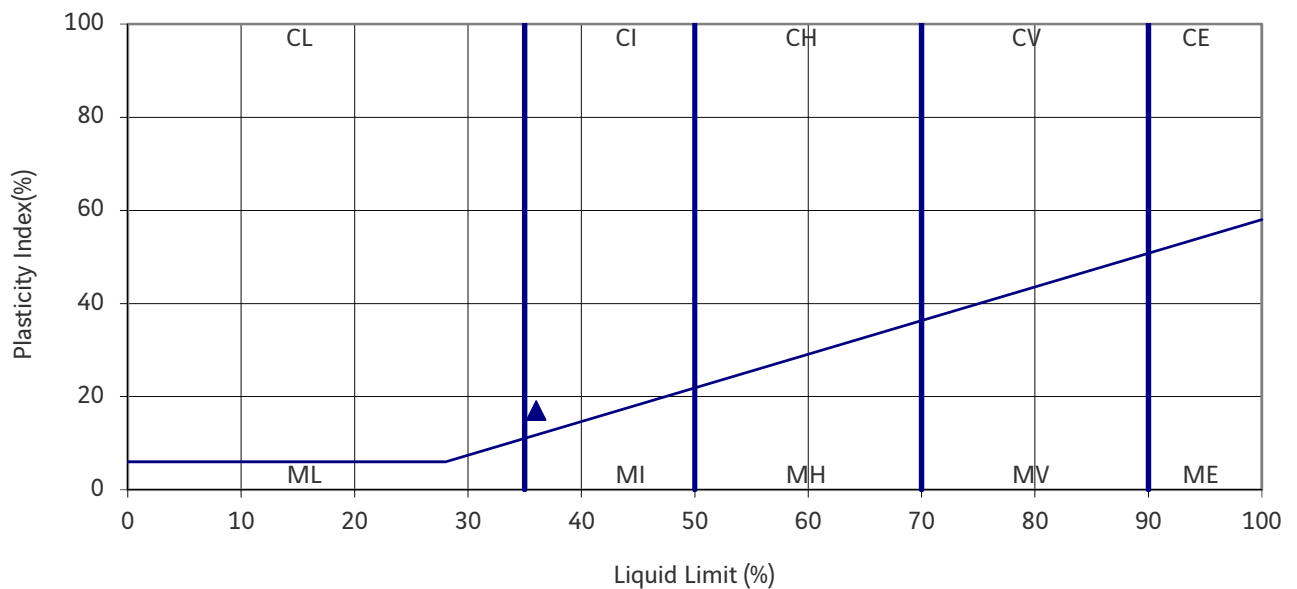



Approved by:	Leeds Laboratory	 SOIL ENGINEERING
Steve Harper		
Revision No.	2.07	Print date 07/11/2019
	Issue Date	19/11/2012
		Part of the Bachy Soletanche Group

Project Name	Nenthead Mines - Proposed MWTS, GI	Liquid And Plastic Limit Test	Hole ID	WS107
Project No.	TA8234		Sample Depth	2.00m
Engineer	Aecom		Sample Number	10
Employer	The Coal Authority		Sample Type	L
Description		BS1377: Part 2: 1990: Clause 4.3 and 5 with Water Content to BS EN ISO 17892-1: 2014	Specimen Depth	2.00m
			Specimen Number	4

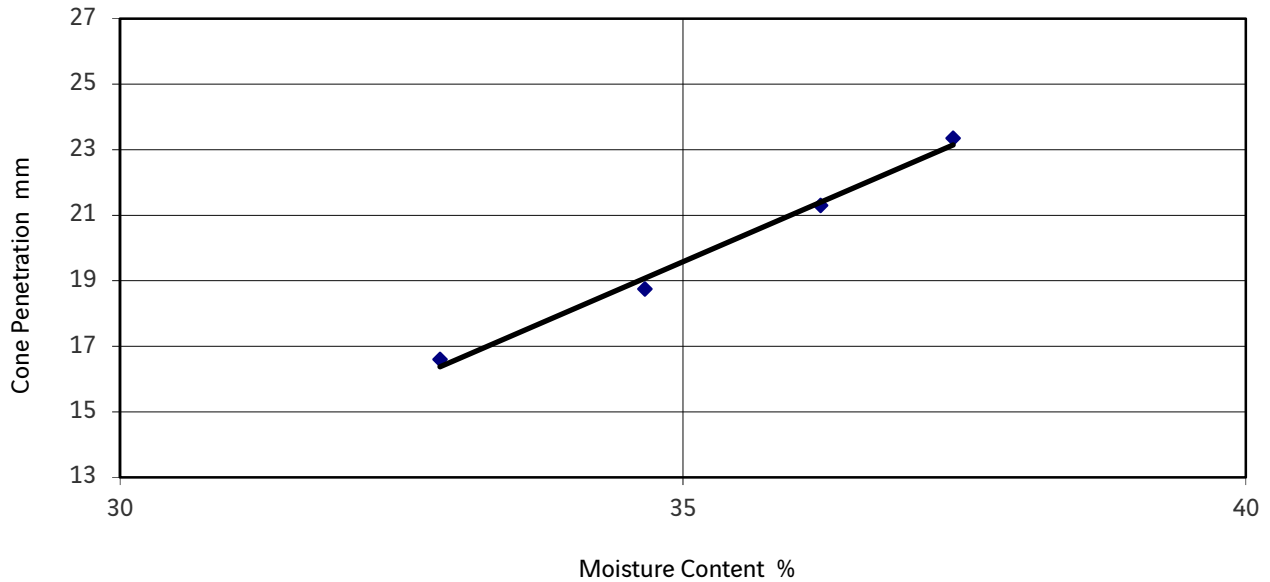


Natural moisture content:	14.8%	Percentage retained on 425µm sieve:	49%
Liquid limit:	36%	Preparation of sample:	Wet sieve
Plastic limit:	19%	Remarks:	
Plasticity index:	17%		
Moisture content of soil passing 425µm	29.2%		
Liquidity index:	0.598		

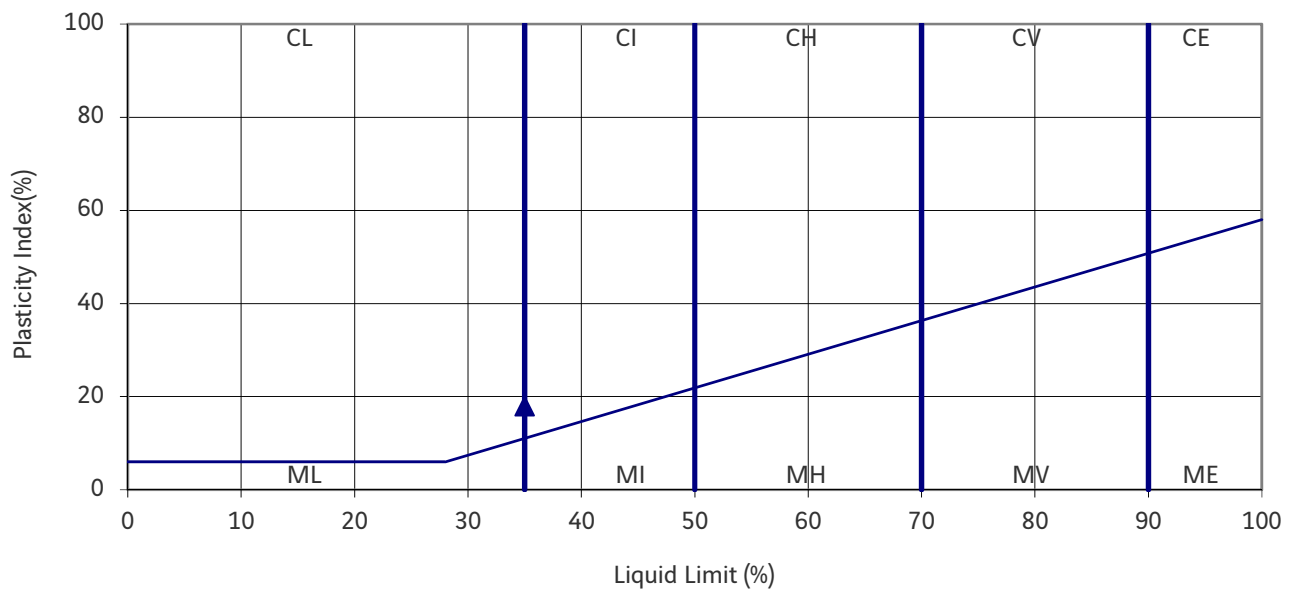



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Steve Harper					
Revision No.	2.07	Issue Date	19/11/2012	Print date	07/11/2019
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Project Name	Nenthead Mines - Proposed MWTS, GI	Liquid And Plastic Limit Test	Hole ID	WS108
Project No.	TA8234		Sample Depth	2.00m
Engineer	Aecom		Sample Number	11
Employer	The Coal Authority		Sample Type	L
Description		BS1377: Part 2: 1990: Clause 4.3 and 5 with Water Content to BS EN ISO 17892-1: 2014	Specimen Depth	2.00m
			Specimen Number	4

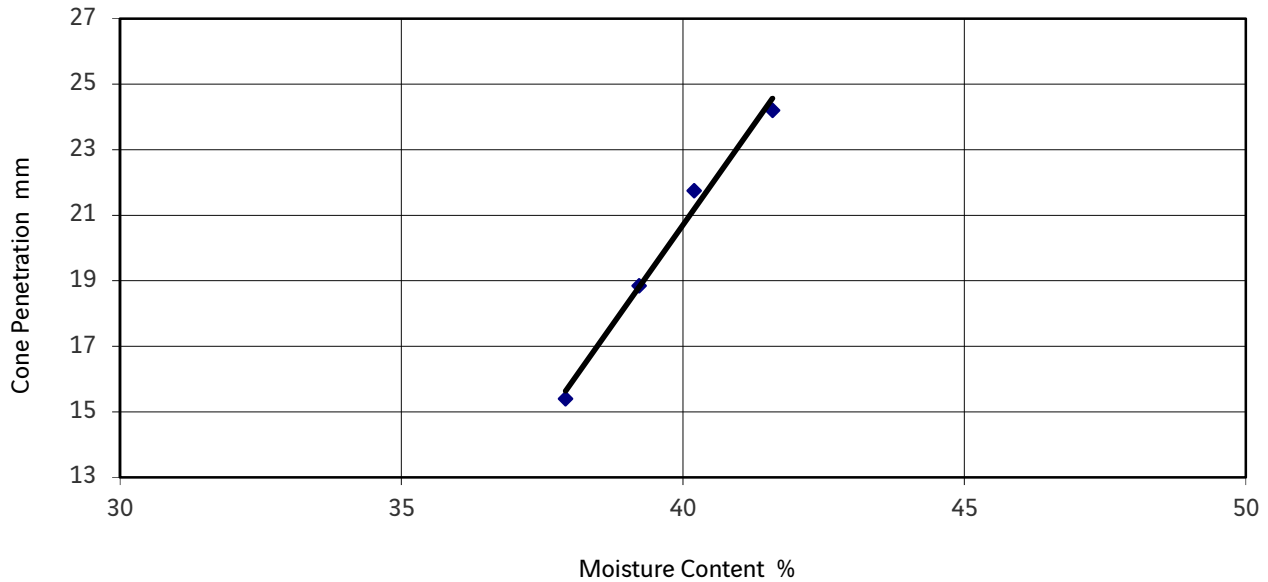


Natural moisture content:	19.1%	Percentage retained on 425µm sieve:	33%
Liquid limit:	35%	Preparation of sample:	Wet sieve
Plastic limit:	17%	Remarks:	
Plasticity index:	18%		
Moisture content of soil passing 425µm	28.5%		
Liquidity index:	0.639		

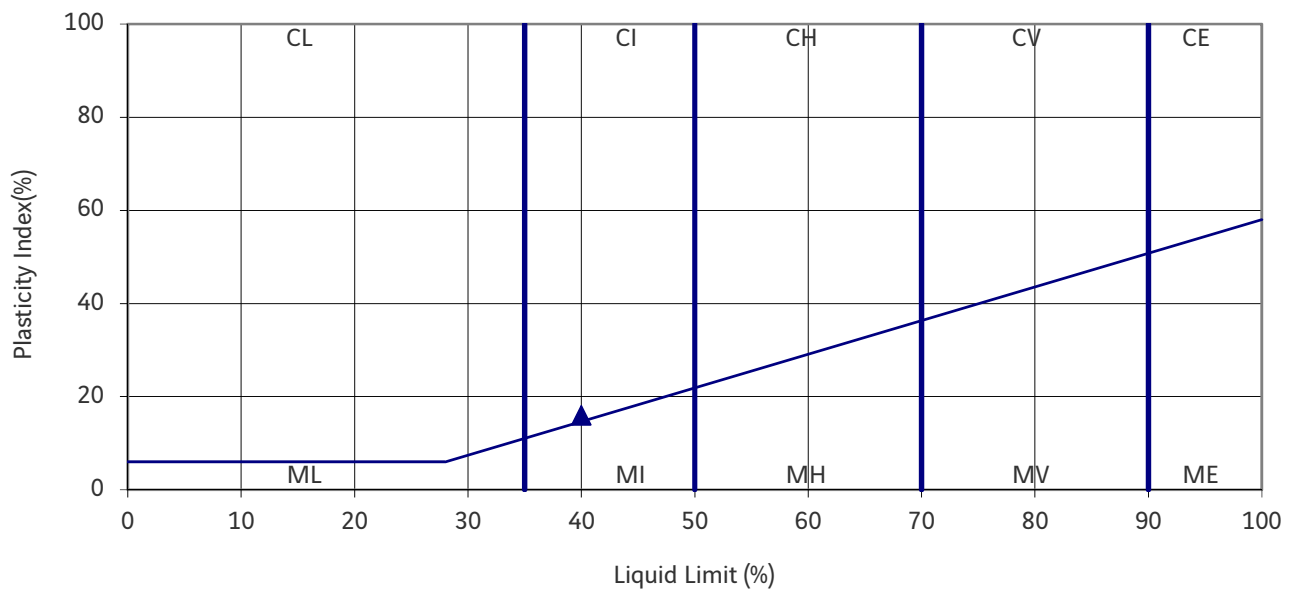



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Revision No.	2.07	Issue Date	19/11/2012	Print date	07/11/2019
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Project Name	Nenthead Mines - Proposed MWTS, GI	Liquid And Plastic Limit Test	Hole ID	WSTP101
Project No.	TA8234		Sample Depth	1.20m
Engineer	Aecom		Sample Number	9
Employer	The Coal Authority		Sample Type	L
Description		BS1377: Part 2: 1990: Clause 4.3 and 5 with Water Content to BS EN ISO 17892-1: 2014	Specimen Depth	1.20m
			Specimen Number	4

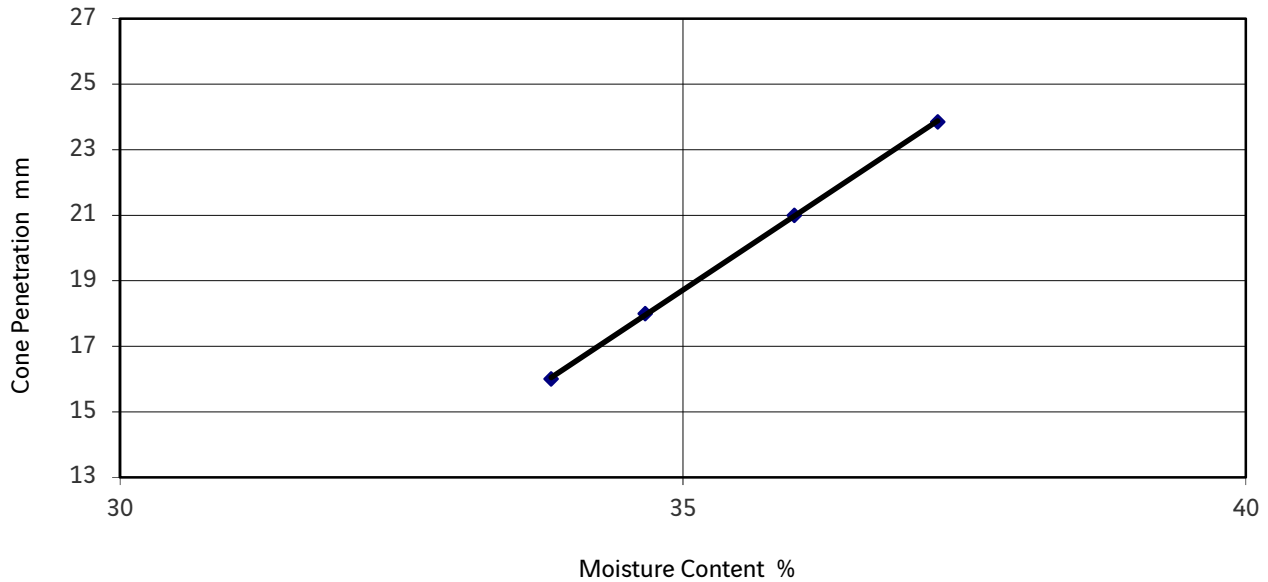


Natural moisture content:	22.1%	Percentage retained on 425µm sieve:	74%
Liquid limit:	40%	Preparation of sample:	Wet sieve
Plastic limit:	24%	Remarks:	
Plasticity index:	16%		
Moisture content of soil passing 425µm	86.5%		
Liquidity index:	3.908		

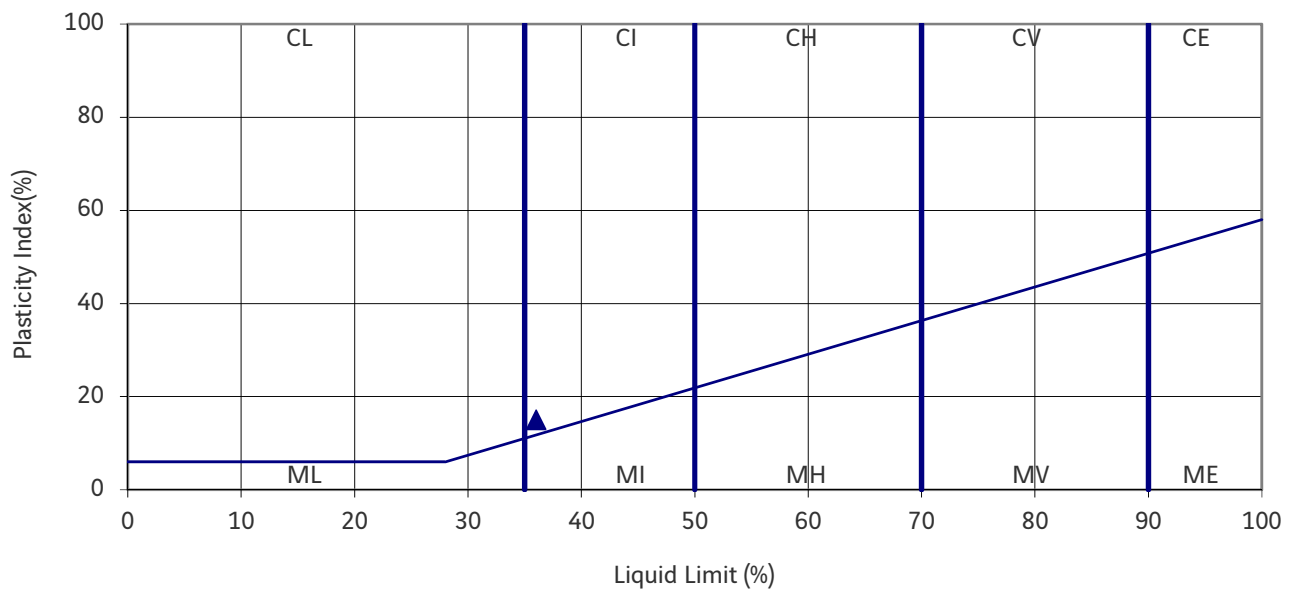



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Revision No.	2.07	Issue Date	19/11/2012	Print date	07/11/2019
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Project Name	Nenthead Mines - Proposed MWTS, GI	Liquid And Plastic Limit Test	Hole ID WSTP102
Project No.	TA8234		Sample Depth 1.00m
Engineer	Aecom		Sample Number 6
Employer	The Coal Authority		Sample Type D
Description		BS1377: Part 2: 1990: Clause 4.3 and 5 with Water Content to BS EN ISO 17892-1: 2014	Specimen Depth 1.00m
			Specimen Number 4

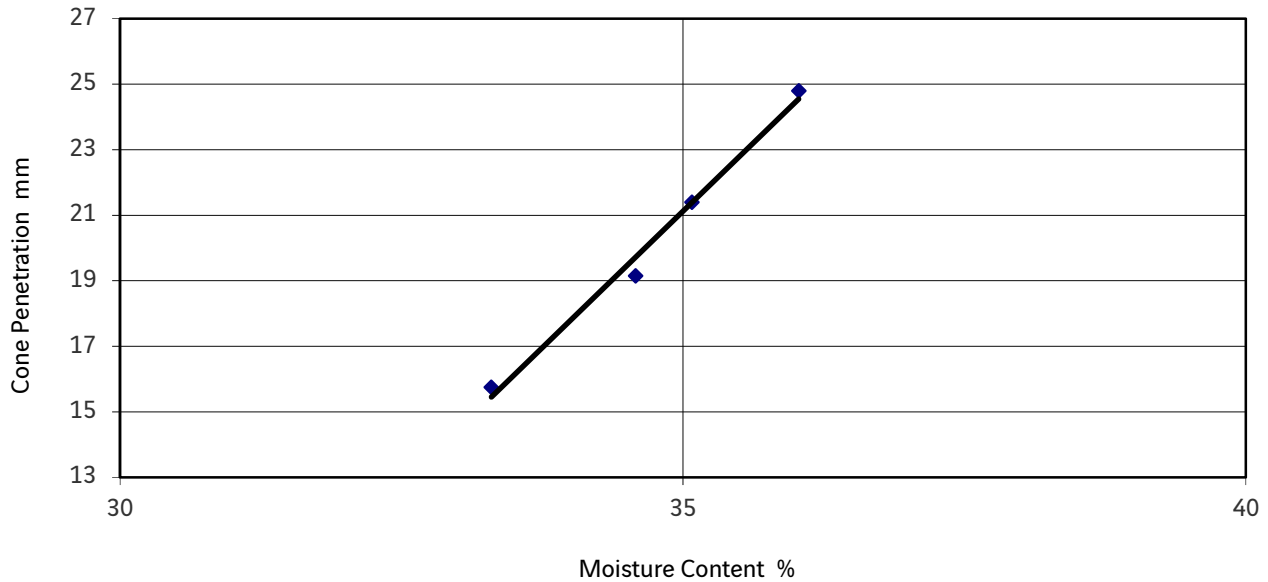


Natural moisture content:	15.4%	Percentage retained on 425µm sieve:	60%
Liquid limit:	36%	Preparation of sample:	Wet sieve
Plastic limit:	21%	Remarks:	
Plasticity index:	15%		
Moisture content of soil passing 425µm	39.0%		
Liquidity index:	1.199		

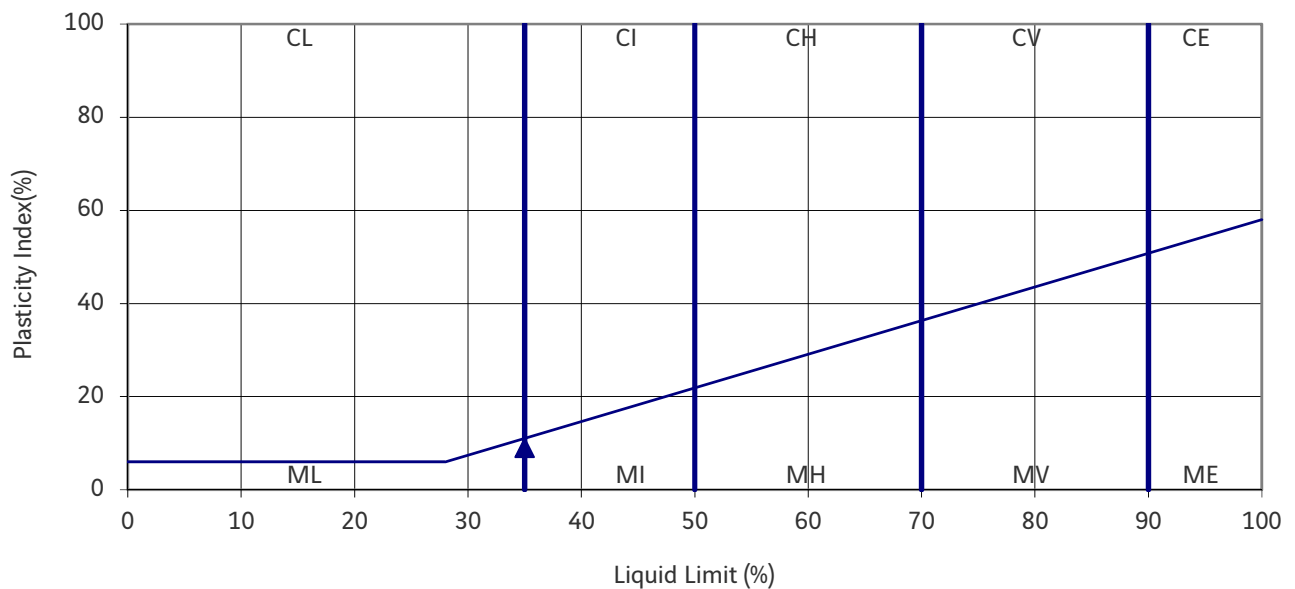



Approved by:	Leeds Laboratory	 SOIL ENGINEERING			
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Revision No.	2.07	Issue Date	19/11/2012	Print date	07/11/2019
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Project Name	Nenthead Mines - Proposed MWTS, GI	Liquid And Plastic Limit Test	Hole ID WSTP103
Project No.	TA8234		Sample Depth 0.50m
Engineer	Aecom		Sample Number 4
Employer	The Coal Authority		Sample Type D
Description		BS1377: Part 2: 1990: Clause 4.3 and 5 with Water Content to BS EN ISO 17892-1: 2014	Specimen Depth 0.50m
			Specimen Number 4

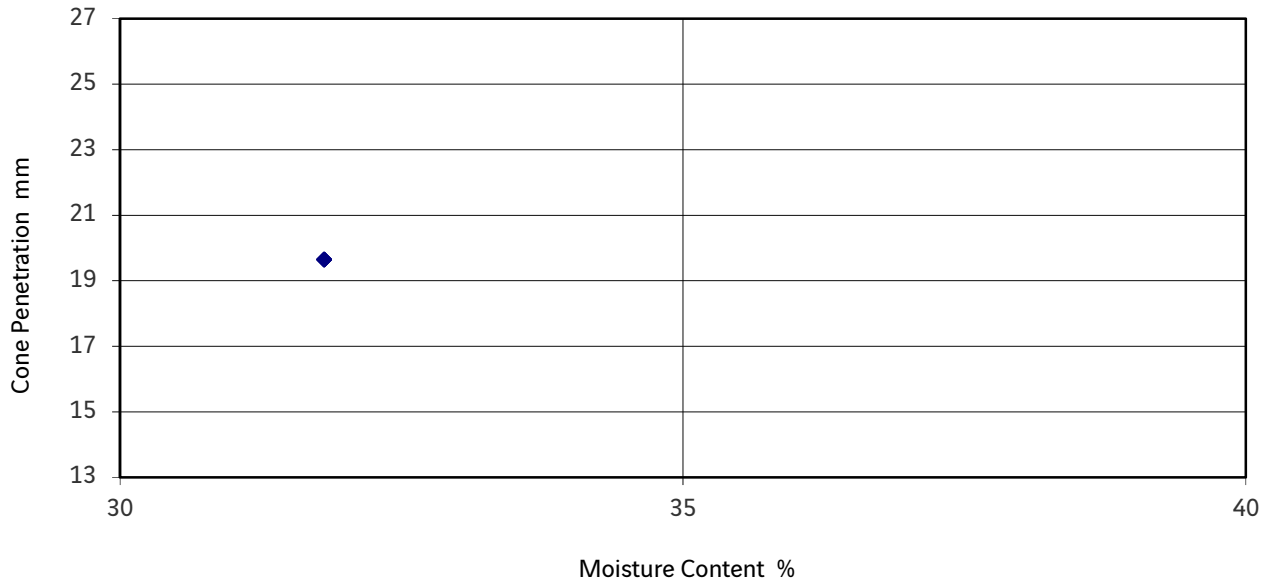


Natural moisture content:	13.6%	Percentage retained on 425µm sieve:	62%
Liquid limit:	35%	Preparation of sample:	Wet sieve
Plastic limit:	26%	Remarks:	
Plasticity index:	9%		
Moisture content of soil passing 425µm	36.1%		
Liquidity index:	1.123		

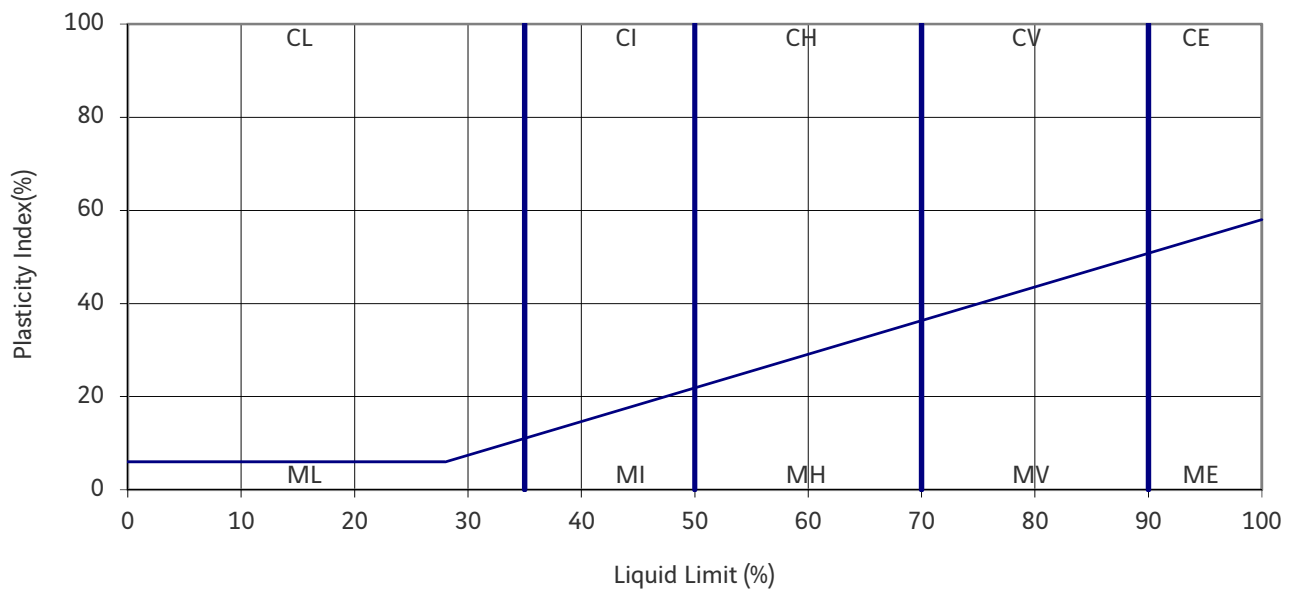



Approved by:	Leeds Laboratory	 SOIL ENGINEERING			
Steve Harper					
Revision No.	2.07	Issue Date	19/11/2012	Print date	07/11/2019
					Part of the Bachy Soletanche Group

Project Name	Nenthead Mines - Proposed MWTS, GI	Liquid And Plastic Limit Test	Hole ID WSTP107
Project No.	TA8234		Sample Depth 2.00m
Engineer	Aecom		Sample Number 10
Employer	The Coal Authority		Sample Type L
Description		BS1377: Part 2: 1990: Clause 4.4 and 5 with Water Content to BS EN ISO 17892-1: 2014	Specimen Depth 2.00m
			Specimen Number 4

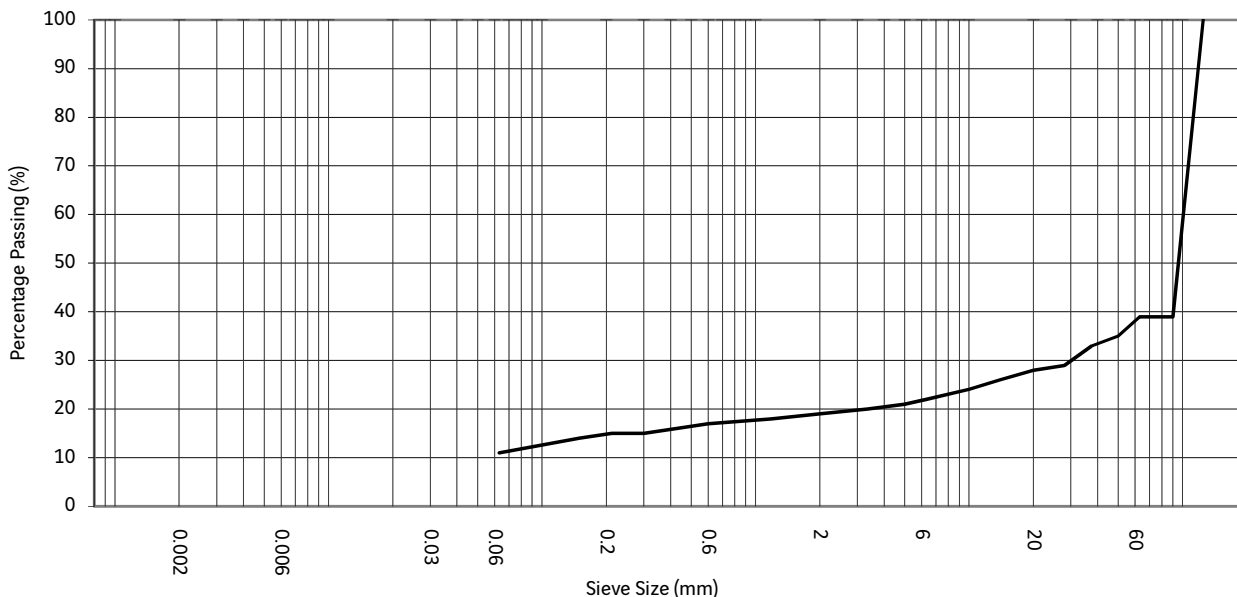


Natural moisture content:	9.4%	Percentage retained on 425µm sieve:	74%
Liquid limit:	32%	Preparation of sample:	Wet sieve
Plastic limit:	NP	Remarks:	Tested as 1 point Limit Liquid limit due to the sample being sand and/or silt and it is very difficult to get all four points on a line.
Plasticity index:			
Moisture content of soil passing 425µm	36.4%		
Liquidity index:			



Approved by:	Leeds Laboratory	 SOIL ENGINEERING
Steve Harper		
Revision No.	2.07	Print date 07/11/2019
	Issue Date	19/11/2012
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Project Name	Nenthead Mines - Proposed MWTS, GI	Particle Size Distribution	Hole ID BH102R
Project No.	TA8234		Sample Depth 2.50m
Engineer	Aecom		Sample Number 9
Employer	The Coal Authority		Sample type B
Description		Brown clayey very gravelly CLAY.	Specimen Depth 2.50m
			Specimen No. 1



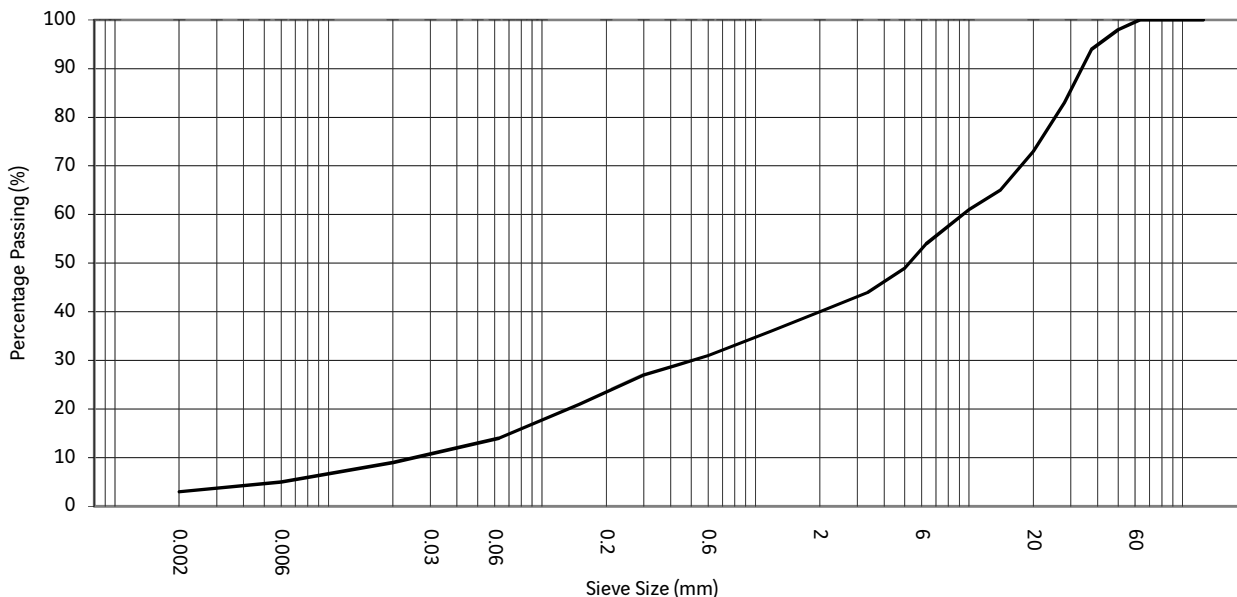
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks Sample size was insufficient to be representative of particle size
Silt and clay:	11.1	
Sand:	7.8	
Gravel:	19.8	
Cobbles:	61.3	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14	26
		10	24
		6.3	22
		5	21
125.0	100	3.35	20
90.0	39	2	19
75.0	39	1.18	18
63.0	39	0.6	17
50.0	35	0.425	16
37.5	33	0.3	15
28.0	29	0.212	15
20.0	28	0.15	14
		0.063	11

Approved by:		 SOIL ENGINEERING Part of the Bachy Soletanche Group
Steve Harper	Print date 07/11/2019	
Revision No. 3.04	Issue Date 24/07/2015	


Project Name	Nenthead Mines - Proposed MWTS, GI	Particle Size Distribution	Hole ID	TP104	
Project No.	TA8234		Sample Depth	1.00m	
Engineer	Aecom		Sample Number	4	
Employer	The Coal Authority		Sample type	B	
Description		Brown very gravelly sandy CLAY.		Specimen Depth	1.00m
				Specimen No.	1



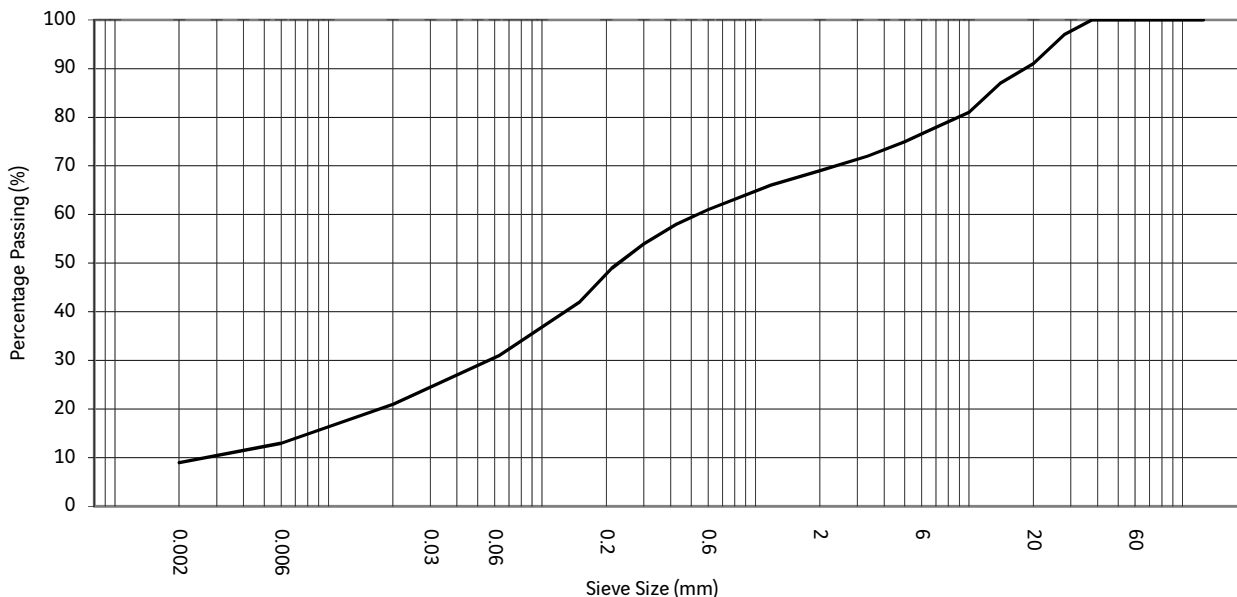
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Clay:	3.0	
Silt:	10.9	
Sand:	25.7	
Gravel:	60.4	
Cobbles:	0.0	

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14	65		
		10	61	0.020100	9
		6.3	54	0.006000	5
125.0	100	5	49	0.002000	3
90.0	100	3.35	44		
75.0	100	2	40		
63.0	100	1.18	36		
50.0	98	0.6	31		
37.5	94	0.425	29		
28.0	83	0.3	27		
20.0	73	0.212	24		
		0.15	21		
		0.063	14		

Approved by:				 SOIL ENGINEERING Part of the Bachy Soletanche Group
Steve Harper			Print date 07/11/2019	
Revision No.	3.04	Issue Date	24/07/2015	


Project Name	Nenthead Mines - Proposed MWTS, GI	Particle Size Distribution	Hole ID	TP126	
Project No.	TA8234		Sample Depth	1.50m	
Engineer	Aecom		Sample Number	4	
Employer	The Coal Authority		Sample type	B	
Description		Brown gravelly sandy CLAY.	Specimen Depth	1.50m	
				Specimen No.	1



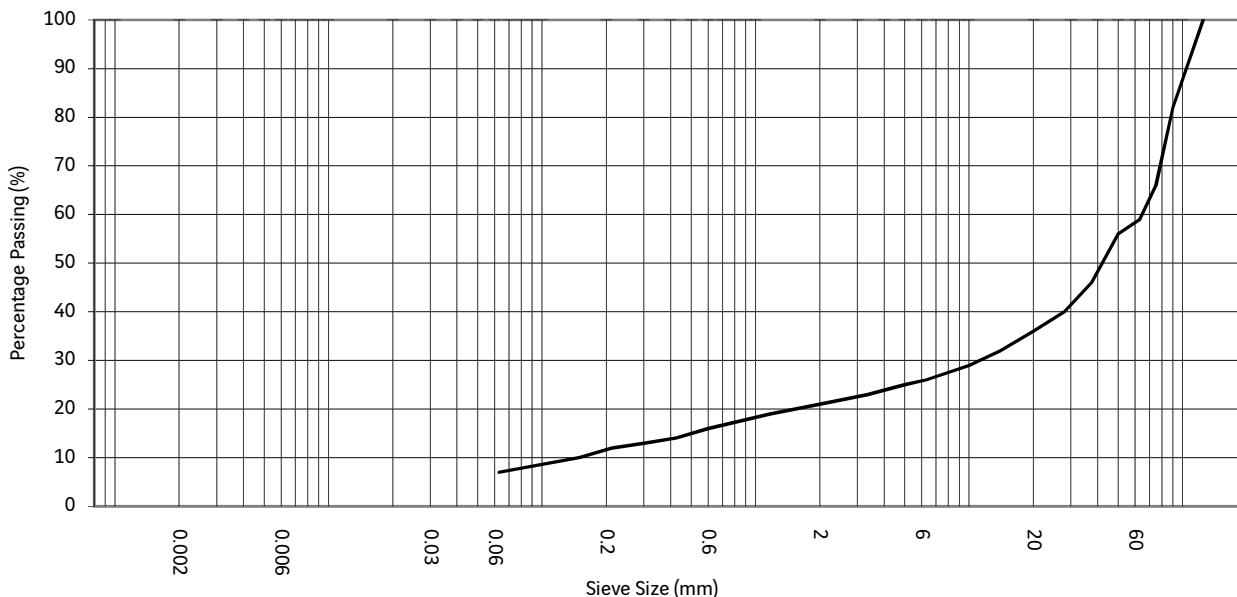
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE		%	General remarks
Clay:	8.8		
Silt:	22.0		
Sand:	38.1		
Gravel:	31.1		
Cobbles:	0.0		

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14	87		
		10	81	0.020100	21
		6.3	77	0.006000	13
125.0	100	5	75	0.002000	9
90.0	100	3.35	72		
75.0	100	2	69		
63.0	100	1.18	66		
50.0	100	0.6	61		
37.5	100	0.425	58		
28.0	97	0.3	54		
20.0	91	0.212	49		
		0.15	42		
		0.063	31		

Approved by:				 SOIL ENGINEERING Part of the Bachy Soletanche Group
Steve Harper			Print date 07/11/2019	
Revision No.	3.04	Issue Date	24/07/2015	


Project Name	Nenthead Mines - Proposed MWTS, GI	Particle Size Distribution	Hole ID	WS102	
Project No.	TA8234		Sample Depth	0.20m	
Engineer	Aecom		Sample Number	3	
Employer	The Coal Authority		Sample type	B	
Description			Dark brown very gravelly sandy CLAY with medium cobble content.	Specimen Depth	0.20m
				Specimen No.	1



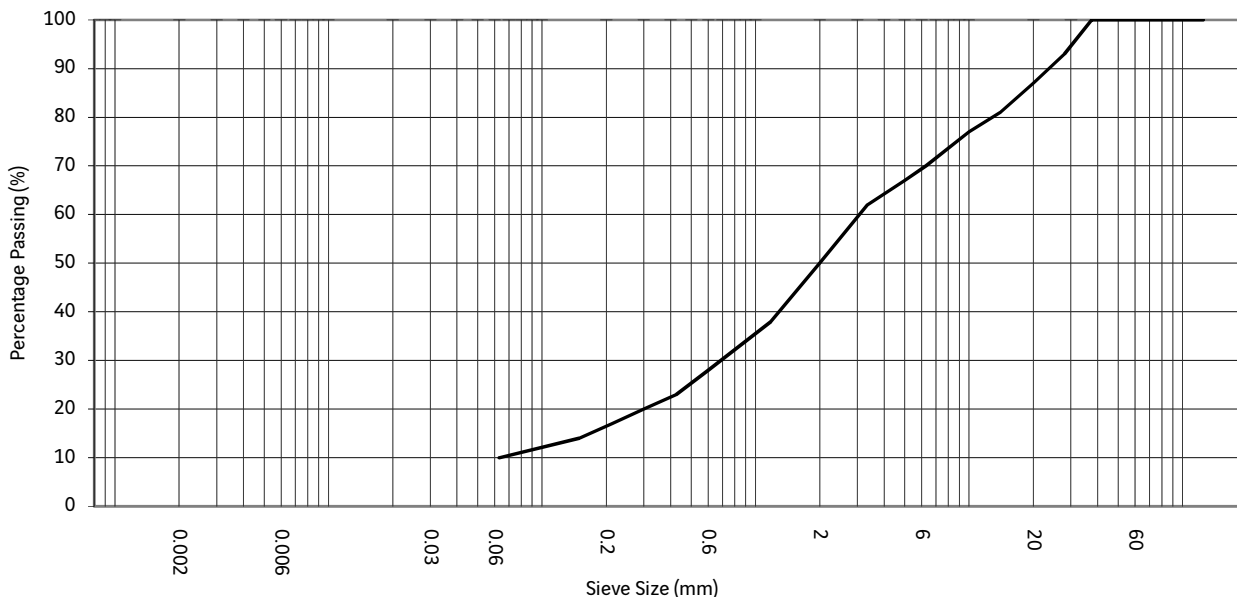
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	6.9	Sample size was insufficient to be representative of particle size
Sand:	14.3	
Gravel:	37.3	
Cobbles:	41.5	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14	32
		10	29
		6.3	26
125.0	100	5	25
90.0	82	3.35	23
75.0	66	2	21
63.0	59	1.18	19
50.0	56	0.6	16
37.5	46	0.425	14
28.0	40	0.3	13
20.0	36	0.212	12
		0.15	10
		0.063	7

Approved by:			 SOIL ENGINEERING Part of the Bachy Soletanche Group
Steve Harper		Print date 07/11/2019	
Revision No.	3.04	Issue Date	24/07/2015


Project Name	Nenthead Mines - Proposed MWTS, GI	Particle Size Distribution	Hole ID	WS102	
Project No.	TA8234		Sample Depth	3.00m	
Engineer	Aecom		Sample Number	14	
Employer	The Coal Authority		Sample type	L	
Description			Brown clayey gravelly SAND.	Specimen Depth	3.00m
				Specimen No.	1



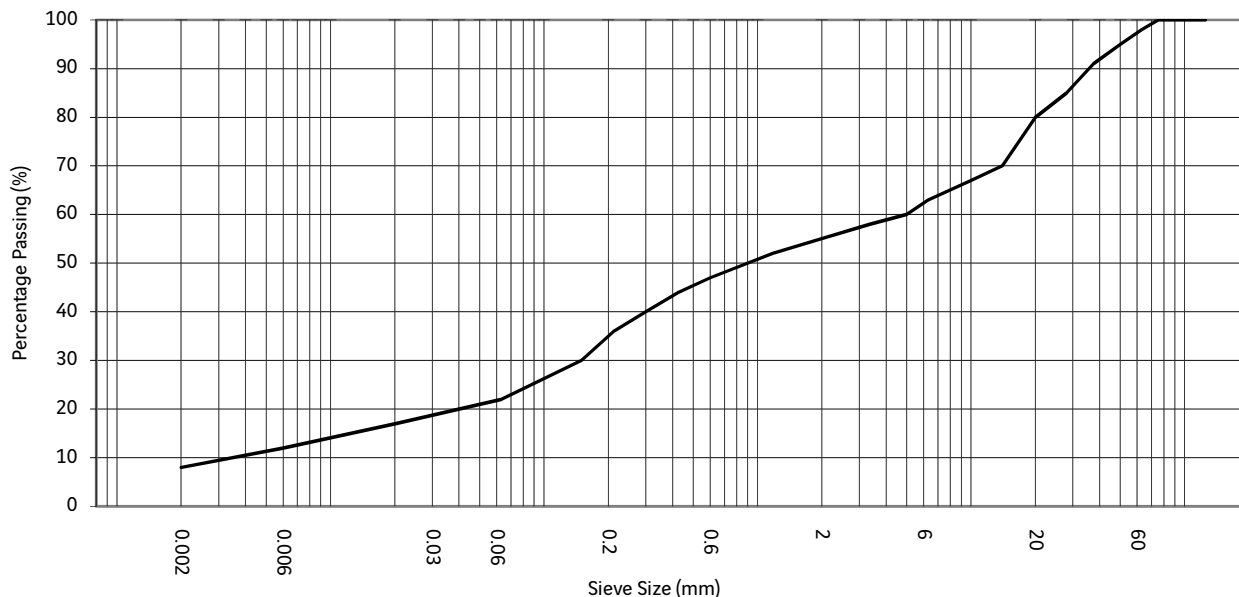
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	10.2	
Sand:	40.1	
Gravel:	49.7	
Cobbles:	0.0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14	81
		10	77
		6.3	70
125.0	100	5	67
90.0	100	3.35	62
75.0	100	2	50
63.0	100	1.18	38
50.0	100	0.6	28
37.5	100	0.425	23
28.0	93	0.3	20
20.0	87	0.212	17
		0.15	14
		0.063	10

Approved by:			 SOIL ENGINEERING Part of the Bachy Soletanche Group
Steve Harper		Print date 07/11/2019	
Revision No.	3.04	Issue Date	24/07/2015

Project Name	Nenthead Mines - Proposed MWTS, GI	Particle Size Distribution	Hole ID WS105
Project No.	TA8234		Sample Depth 0.20m
Engineer	Aecom		Sample Number 3
Employer	The Coal Authority		Sample type B
Description	Brown sandy gravelly CLAY with some rootlets.	BS 1377: Part 2: 1990: 9.2 and 9.4	Specimen Depth 0.20m
			Specimen No. 1



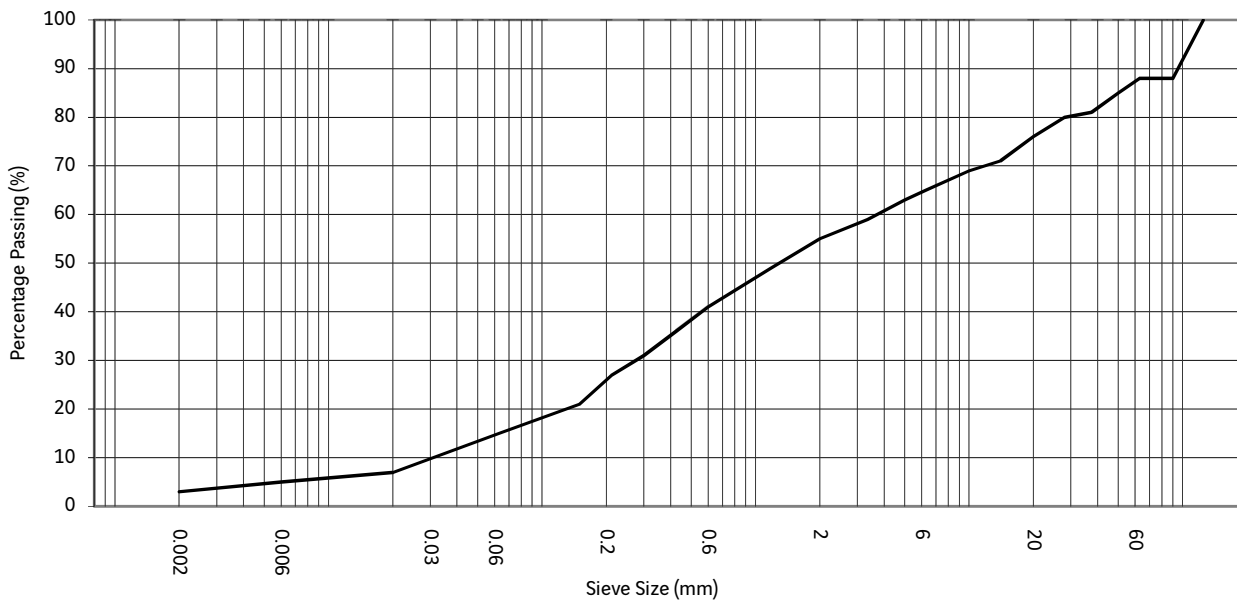
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

<table style="width: 100%;"> <tr> <td>PARTICLE SIZE</td> <td style="text-align: right;">%</td> </tr> <tr> <td>Clay:</td> <td style="text-align: right;">8.0</td> </tr> <tr> <td>Silt:</td> <td style="text-align: right;">13.8</td> </tr> <tr> <td>Sand:</td> <td style="text-align: right;">33.1</td> </tr> <tr> <td>Gravel:</td> <td style="text-align: right;">42.9</td> </tr> <tr> <td>Cobbles:</td> <td style="text-align: right;">2.2</td> </tr> </table>	PARTICLE SIZE	%	Clay:	8.0	Silt:	13.8	Sand:	33.1	Gravel:	42.9	Cobbles:	2.2	General remarks
PARTICLE SIZE	%												
Clay:	8.0												
Silt:	13.8												
Sand:	33.1												
Gravel:	42.9												
Cobbles:	2.2												

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14	70		
		10	67	0.020100	17
		6.3	63	0.006000	12
125.0	100	5	60	0.002000	8
90.0	100	3.35	58		
75.0	100	2	55		
63.0	98	1.18	52		
50.0	95	0.6	47		
37.5	91	0.425	44		
28.0	85	0.3	40		
20.0	80	0.212	36		
		0.15	30		
		0.063	22		

Approved by: Steve Harper			SOIL ENGINEERING <small>Part of the Bachy Soletanche Group</small>
Revision No.	3.04	Issue Date	24/07/2015
		<small>Print date</small>	07/11/2019


Project Name	Nenthead Mines - Proposed MWTS, GI	Particle Size Distribution	Hole ID	WS108	
Project No.	TA8234		Sample Depth	1.00m	
Engineer	Aecom		Sample Number	7	
Employer	The Coal Authority		Sample type	B	
Description		Brown clayey gravelly SAND.		Specimen Depth	1.00m
				Specimen No.	1



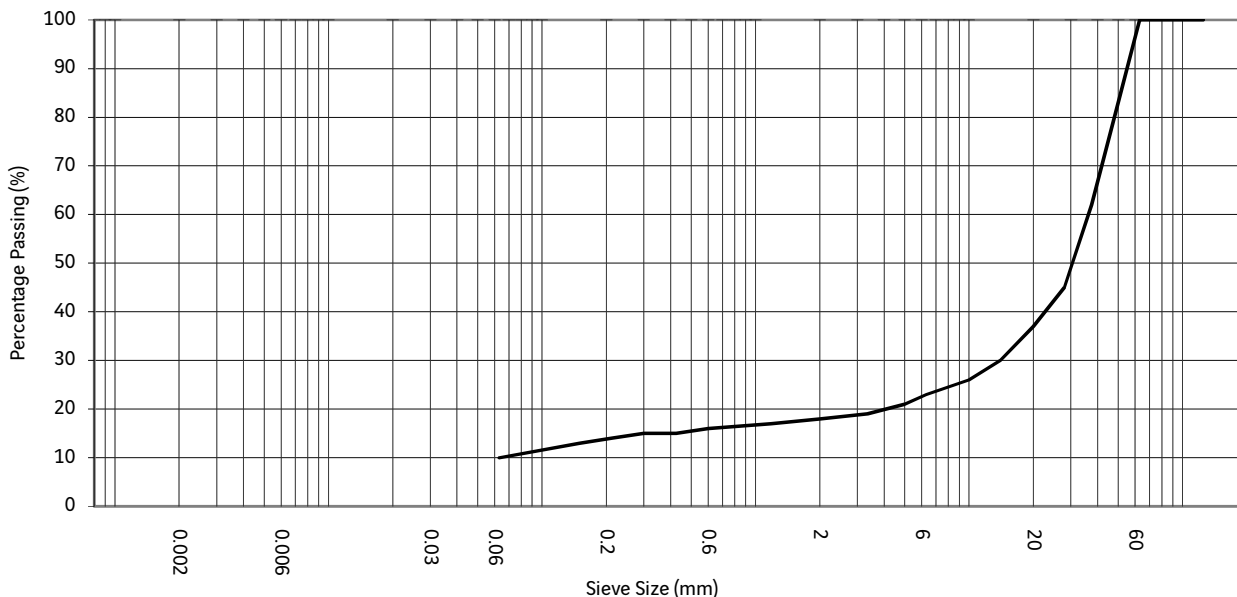
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE % Clay: 2.9 Silt: 12.3 Sand: 39.7 Gravel: 33.3 Cobbles: 11.8		General remarks Sample size was insufficient to be representative of particle size
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WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14	71		
		10	69	0.020100	7
		6.3	65	0.006000	5
125.0	100	5	63	0.002000	3
90.0	88	3.35	59		
75.0	88	2	55		
63.0	88	1.18	49		
50.0	85	0.6	41		
37.5	81	0.425	36		
28.0	80	0.3	31		
20.0	76	0.212	27		
		0.15	21		
		0.063	15		

Approved by:				 SOIL ENGINEERING Part of the Bachy Soletanche Group
Steve Harper			Print date 07/11/2019	
Revision No.	3.04	Issue Date	24/07/2015	


Project Name	Nenthead Mines - Proposed MWTS, GI	Particle Size Distribution	Hole ID	WSBH101R
Project No.	TA8234		Sample Depth	2.00m
Engineer	Aecom		Sample Number	12
Employer	The Coal Authority		Sample type	B
Description		Brown very gravelly CLAY.	Specimen Depth	2.00m
			Specimen No.	1



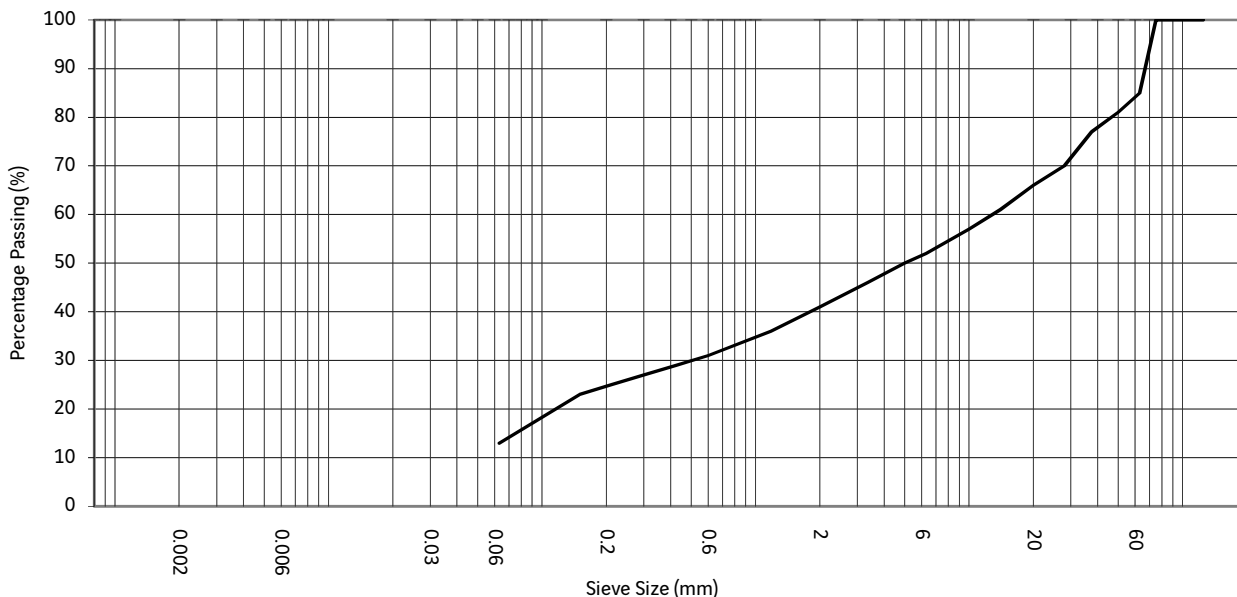
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	9.6	Sample size was insufficient to be representative of particle size
Sand:	8.1	
Gravel:	82.3	
Cobbles:	0.0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14	30
		10	26
		6.3	23
125.0	100	5	21
90.0	100	3.35	19
75.0	100	2	18
63.0	100	1.18	17
50.0	83	0.6	16
37.5	62	0.425	15
28.0	45	0.3	15
20.0	37	0.212	14
		0.15	13
		0.063	10

Approved by:			 SOIL ENGINEERING Part of the Bachy Soletanche Group
Steve Harper		Print date 07/11/2019	
Revision No.	3.04	Issue Date	24/07/2015


Project Name	Nenthead Mines - Proposed MWTS, GI	Particle Size Distribution	Hole ID	WSTP101
Project No.	TA8234		Sample Depth	0.20m
Engineer	Aecom		Sample Number	3
Employer	The Coal Authority		Sample type	B
Description	MADE GROUND: Brown clayey gravelly sand with some brick and concrete fragments.	BS 1377: Part 2: 1990: 9.2	Specimen Depth	0.20m
			Specimen No.	1



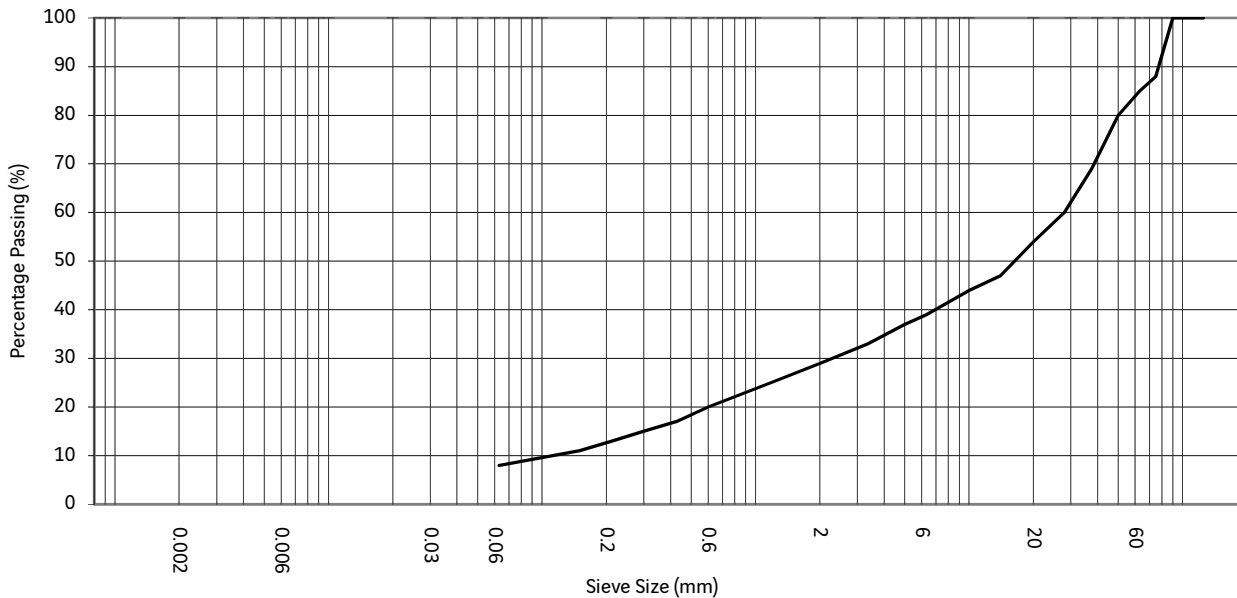
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks Sample size was insufficient to be representative of particle size
Silt and clay:	12.9	
Sand:	28.3	
Gravel:	43.6	
Cobbles:	15.2	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14	61
		10	57
		6.3	52
		5	50
125.0	100	3.35	46
90.0	100	2	41
75.0	100	1.18	36
63.0	85	0.6	31
50.0	81	0.425	29
37.5	77	0.3	27
28.0	70	0.212	25
20.0	66	0.15	23
		0.063	13

Approved by:			 SOIL ENGINEERING Part of the Bachy Soletanche Group
Steve Harper		Print date 07/11/2019	
Revision No.	3.04	Issue Date	24/07/2015


Project Name	Nenthead Mines - Proposed MWTS, GI	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID	WSTP105	
Project No.	TA8234		Sample Depth	0.50m	
Engineer	Aecom		Sample Number	6	
Employer	The Coal Authority		Sample type	B	
Description	Brown clayey very gravelly SAND.	Specimen Depth	0.50m	Specimen No.	1



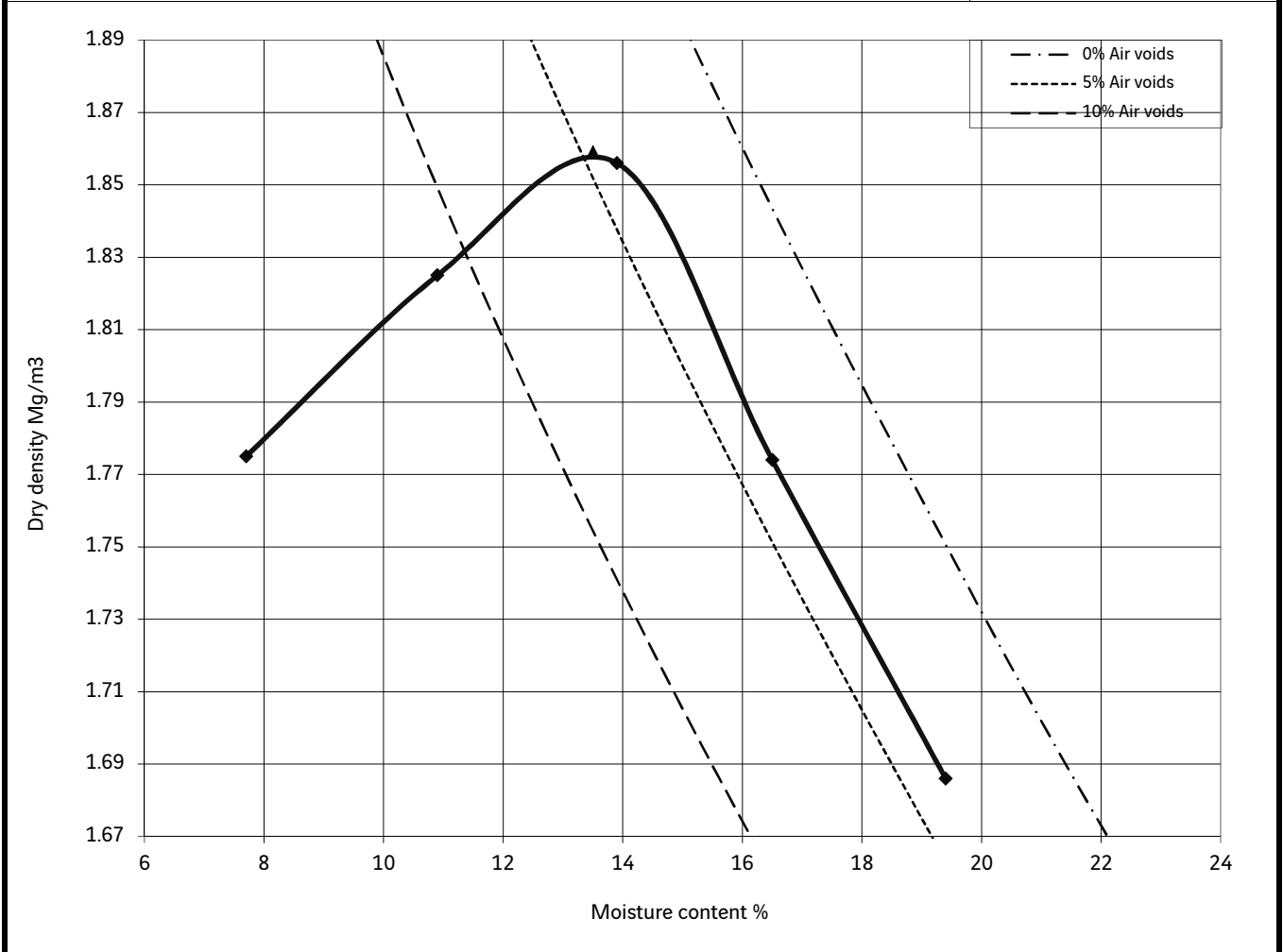
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks Sample size was insufficient to be representative of particle size
Silt and clay:	8.0	
Sand:	21.4	
Gravel:	56.0	
Cobbles:	14.6	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14	47
		10	44
		6.3	39
		5	37
125.0	100	3.35	33
90.0	100	2	29
75.0	88	1.18	25
63.0	85	0.6	20
50.0	80	0.425	17
37.5	69	0.3	15
28.0	60	0.212	13
20.0	54	0.15	11
		0.063	8


Approved by:			 SOIL ENGINEERING Part of the Bachy Soletanche Group
Steve Harper		Print date 07/11/2019	
Revision No.	3.04	Issue Date	24/07/2015

Project Name	Nenthead Mines - Proposed MWTS, GI	Dry Density / Moisture Content Relationship	Hole ID BH106
Project No.	TA8234		Sample Depth
Engineer	Aecom		Sample Number 1
Employer	The Coal Authority		Sample Type AMAL
Description		Brown gravelly CLAY.	Specimen Depth
Amalgamation:		BH106 1.50m 6 B +BH106 0.00m 1 B	Specimen Number 1

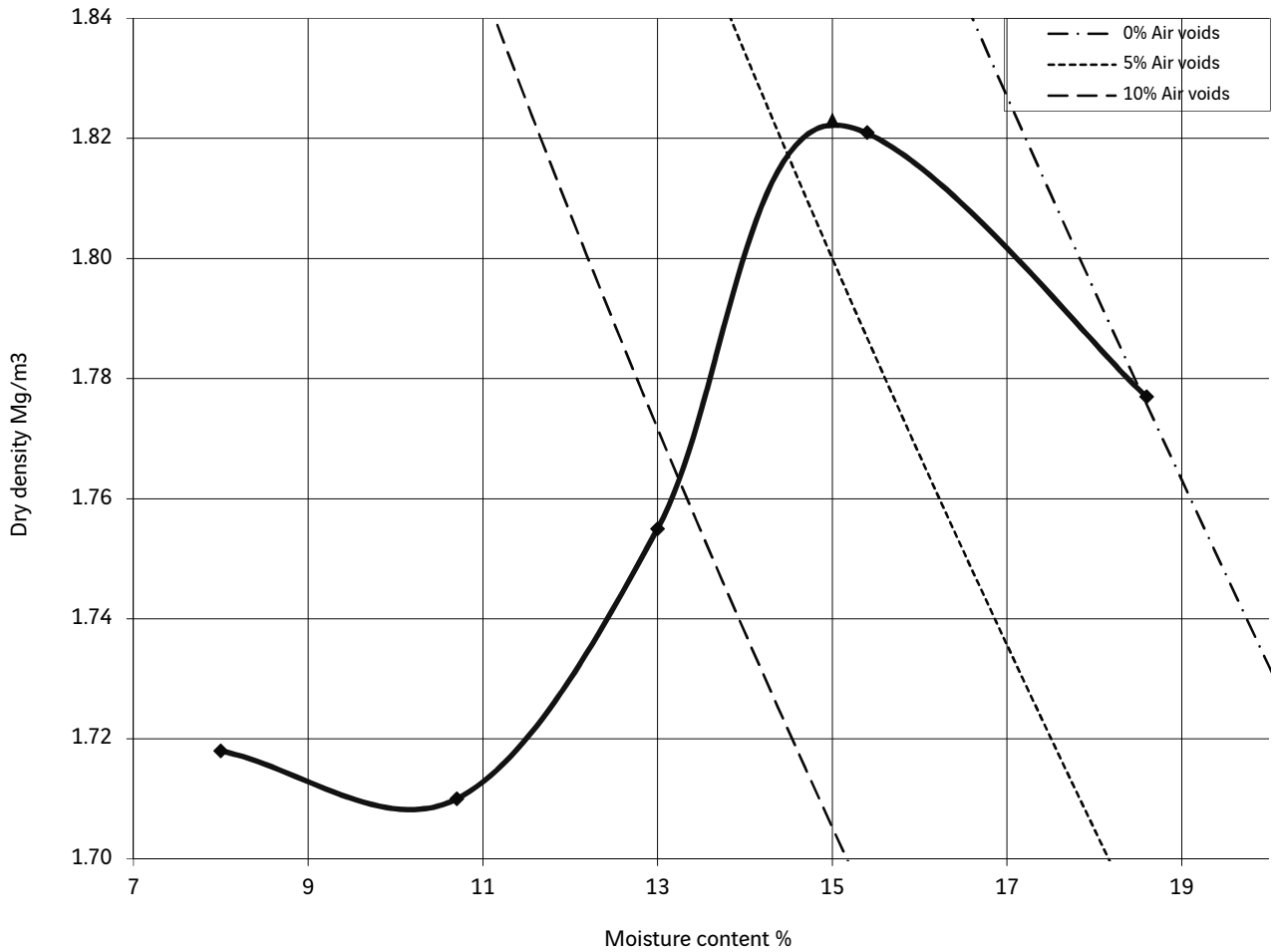


Maximum dry density	1.86Mg/m³	Experimental points			
Optimum moisture content	14%			Moisture content %	Dry Density Mg/m³
Corrected maximum dry density for removal of gravel	1.9Mg/m³			7.7	1.78
Method of compaction	2.5KG	10.9	1.83		
Batches tested	Separate batches tested.	13.9	1.86		
Particle density	Assumed 2.65Mg/m³	16.5	1.77		
Gravel retained on 20mm sieve	7%	19.4	1.69		
Gravel retained on 37.5mm sieve	3%				

General remarks: Test performed on specimen unsuitable due to gravel content.


Approved by:			 SOIL ENGINEERING
Steve Harper		Print date 07/11/2019	
Revision No.	2.03	Issue Date	21/11/2012

Project Name	Nenthead Mines - Proposed MWTS, GI	Dry Density / Moisture Content Relationship	Hole ID TP112
Project No.	TA8234		Sample Depth 1.50m
Engineer	Aecom		Sample Number 4
Employer	The Coal Authority		Sample Type B
Description		BS1377: Part 4: 1990: 3.3	Specimen Depth 1.50m
			Specimen Number 2

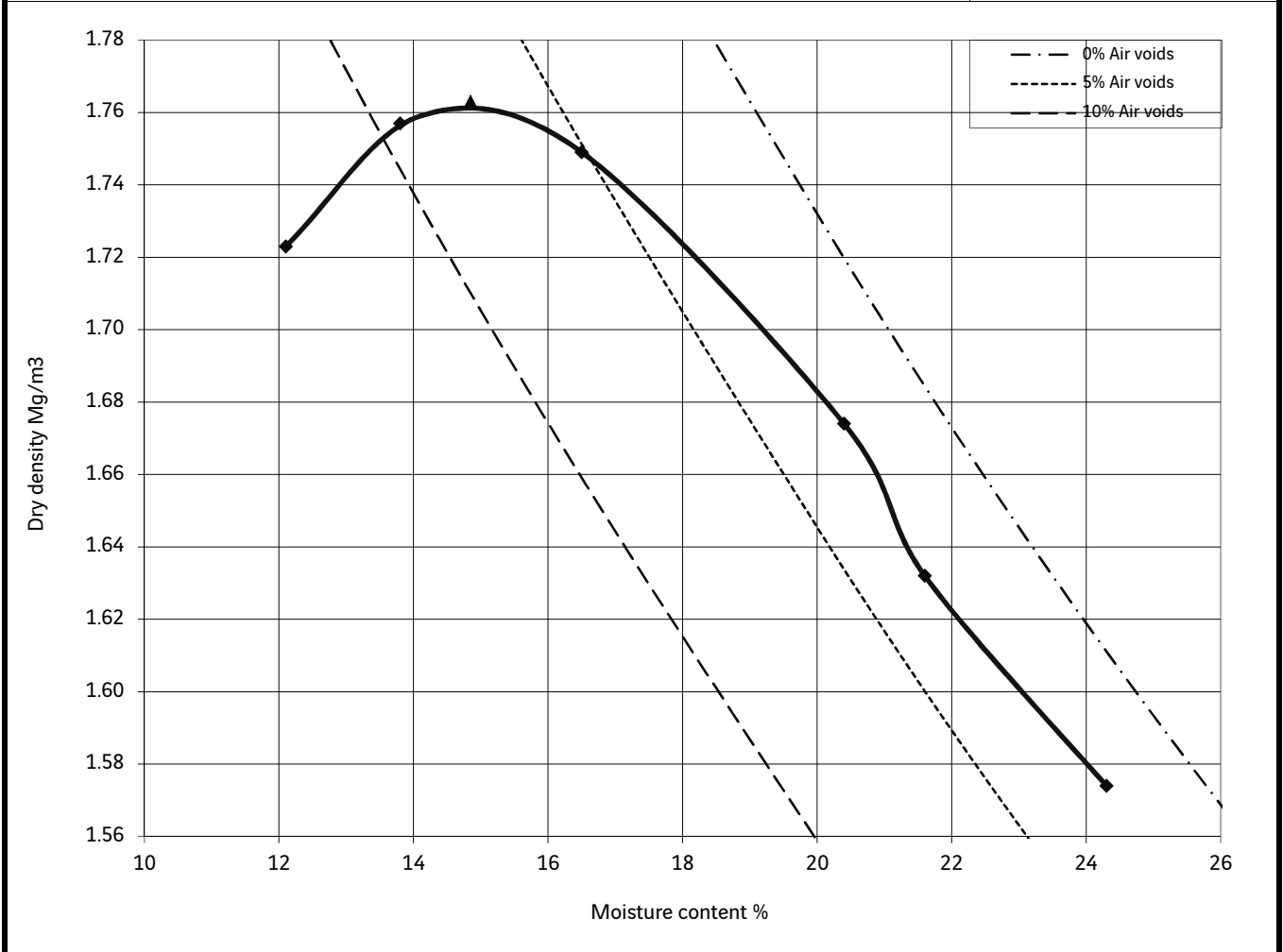


Maximum dry density	1.82Mg/m³	Experimental points			
Optimum moisture content	15%			Moisture content %	Dry Density Mg/m³
Corrected maximum dry density for removal of gravel	1.82Mg/m³			8.0	1.72
Method of compaction	2.5KG	Nat	10.7	1.71	
Batches tested	Separate batches tested.		13.0	1.76	
Particle density	Assumed 2.65Mg/m³		15.4	1.82	
Gravel retained on 20mm sieve	1%		18.6	1.78	
Gravel retained on 37.5mm sieve	0%				

General remarks

Approved by:			 SOIL ENGINEERING
Steve Harper		Print date 07/11/2019	
Revision No.	2.03	Issue Date	21/11/2012
			Part of the Bachy Soletanche Group

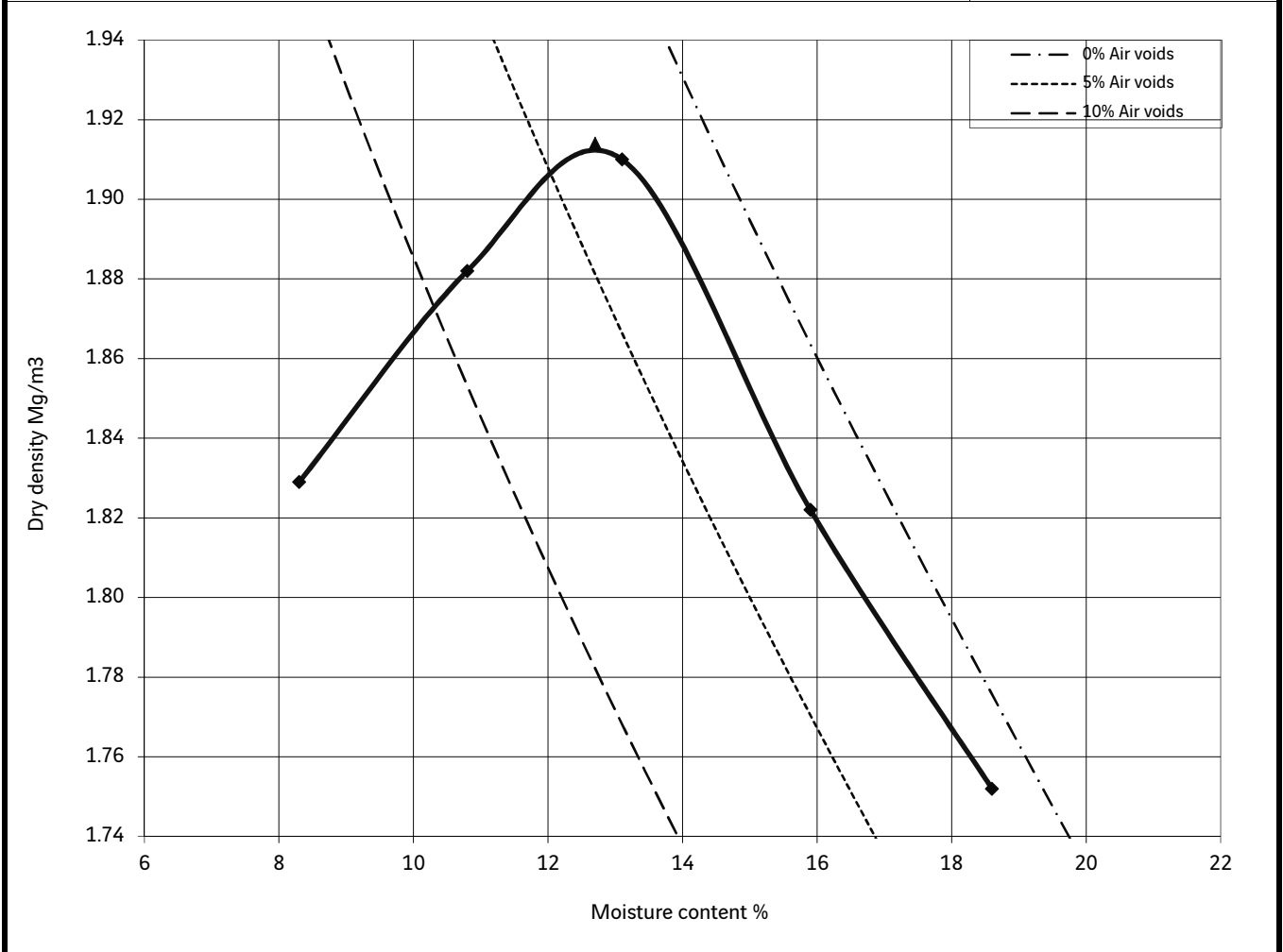
Project Name	Nenthead Mines - Proposed MWTS, GI	Dry Density / Moisture Content Relationship	Hole ID TP113
Project No.	TA8234		Sample Depth 0.50m
Engineer	Aecom		Sample Number 1
Employer	The Coal Authority		Sample Type B
Description		Brown gravelly sandy CLAY.	Specimen Depth 0.50m
			Specimen Number 2



Maximum dry density	1.76Mg/m³	Experimental points			
Optimum moisture content	15%			Moisture content %	Dry Density Mg/m³
Corrected maximum dry density for removal of gravel	1.89Mg/m³			12.1	1.72
Method of compaction	2.5KG	13.8	1.76		
Batches tested	Single specimen.	16.5	1.75		
Particle density	Assumed 2.65Mg/m³	20.4	1.67		
Gravel retained on 20mm sieve	20%	21.6	1.63		
Gravel retained on 37.5mm sieve	15%	Nat 24.3	1.57		


General remarks: Test performed on specimen unsuitable due to gravel content.

Project Name	Nenthead Mines - Proposed MWTS, GI	Dry Density / Moisture Content Relationship	Hole ID TP120
Project No.	TA8234		Sample Depth 0.50m
Engineer	Aecom		Sample Number 1
Employer	The Coal Authority		Sample Type B
Description		Dark brown gravelly sandy CLAY.	Specimen Depth 0.50m
			Specimen Number 2

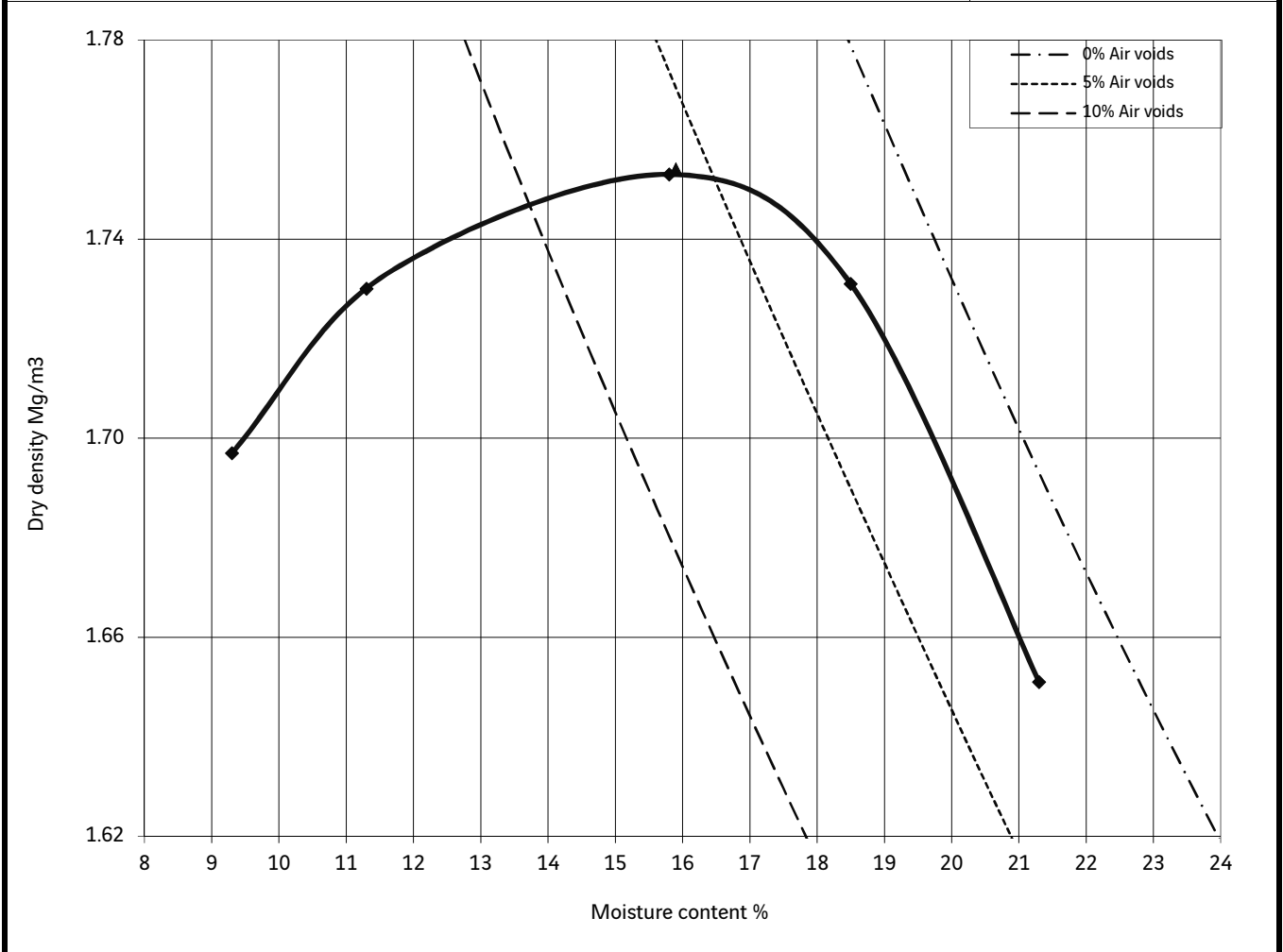


Maximum dry density	1.91Mg/m ³	Experimental points	
Optimum moisture content	13%		
Corrected maximum dry density for removal of gravel	2.05Mg/m ³	Moisture content %	Dry Density Mg/m ³
Method of compaction	2.5KG	8.3	1.83
Batches tested	Separate batches tested.	10.8	1.88
Particle density	Assumed 2.65Mg/m ³	13.1	1.91
Gravel retained on 20mm sieve	24%	15.9	1.82
Gravel retained on 37.5mm sieve	12%	18.6	1.75

General remarks: Test performed on specimen unsuitable due to gravel content.

Approved by:			 SOIL ENGINEERING
Steve Harper		Print date 07/11/2019	
Revision No.	2.03	Issue Date	21/11/2012

Project Name	Nenthead Mines - Proposed MWTS, GI	Dry Density / Moisture Content Relationship	Hole ID WS107
Project No.	TA8234		Sample Depth 0.20m
Engineer	Aecom		Sample Number 3
Employer	The Coal Authority		Sample Type B
Description		Brown gravelly sandy CLAY with some rootlets.	Specimen Depth 0.20m
			Specimen Number 1

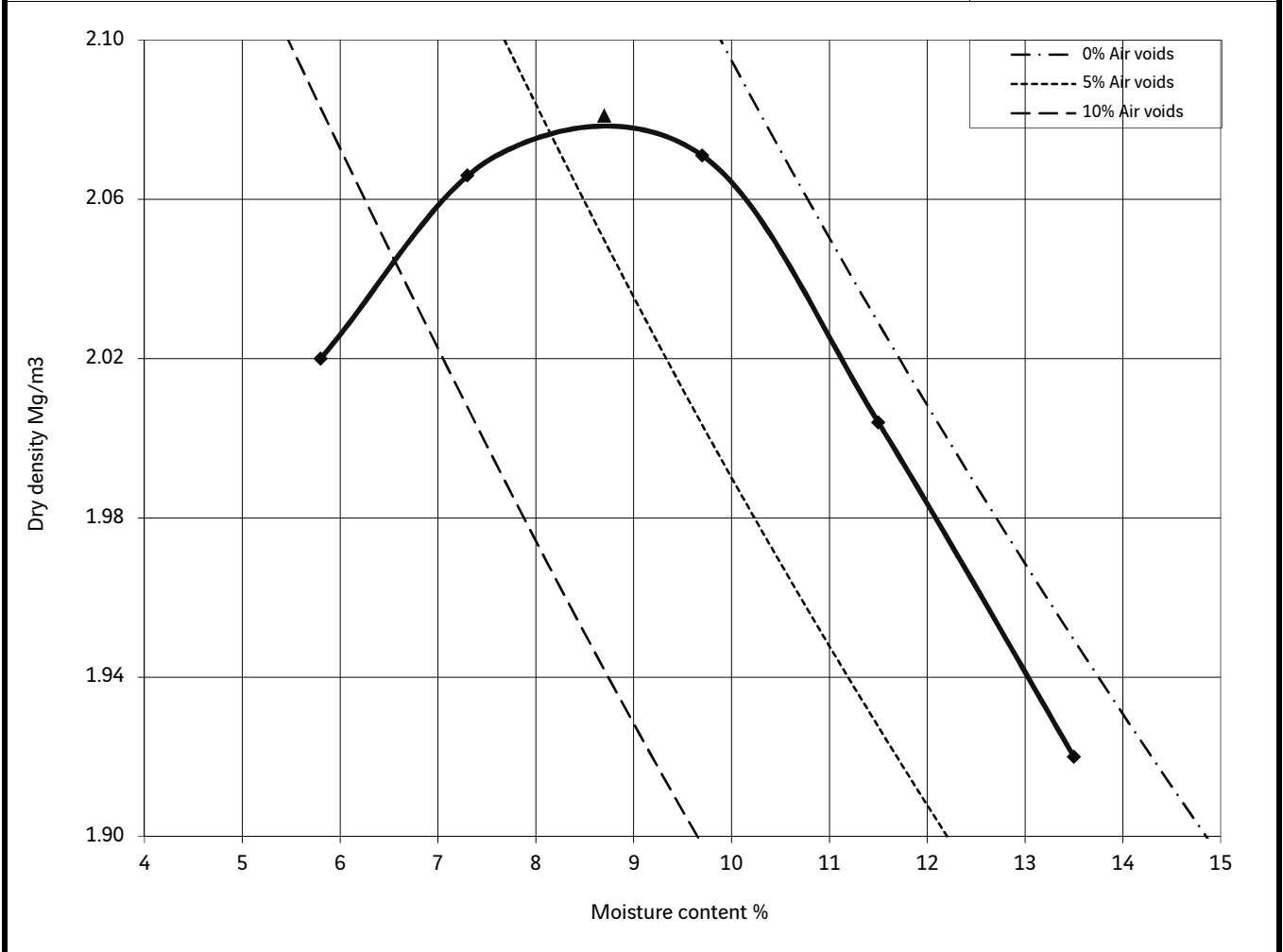


Maximum dry density	1.75Mg/m ³	Experimental points	
Optimum moisture content	16%		
Corrected maximum dry density for removal of gravel	1.79Mg/m ³		
Method of compaction	2.5KG	Moisture content %	Dry Density Mg/m ³
Batches tested	Separate batches tested.	9.3	1.70
Particle density	Assumed 2.65Mg/m ³	11.3	1.73
Gravel retained on 20mm sieve	6%	15.8	1.75
Gravel retained on 37.5mm sieve	2%	18.5	1.73
		21.3	1.65

General remarks: Test performed on specimen unsuitable due to gravel content.


Approved by:			
Steve Harper		Print date	07/11/2019
Revision No.	2.03	Issue Date	21/11/2012

Project Name	Nenthead Mines - Proposed MWTS, GI	Dry Density / Moisture Content Relationship	Hole ID TP118
Project No.	TA8234		Sample Depth 1.50m
Engineer	Aecom		Sample Number 4
Employer	The Coal Authority		Sample Type B
Description		Brown slightly sandy slightly gravelly CLAY.	Specimen Depth 1.50m
			Specimen Number 2

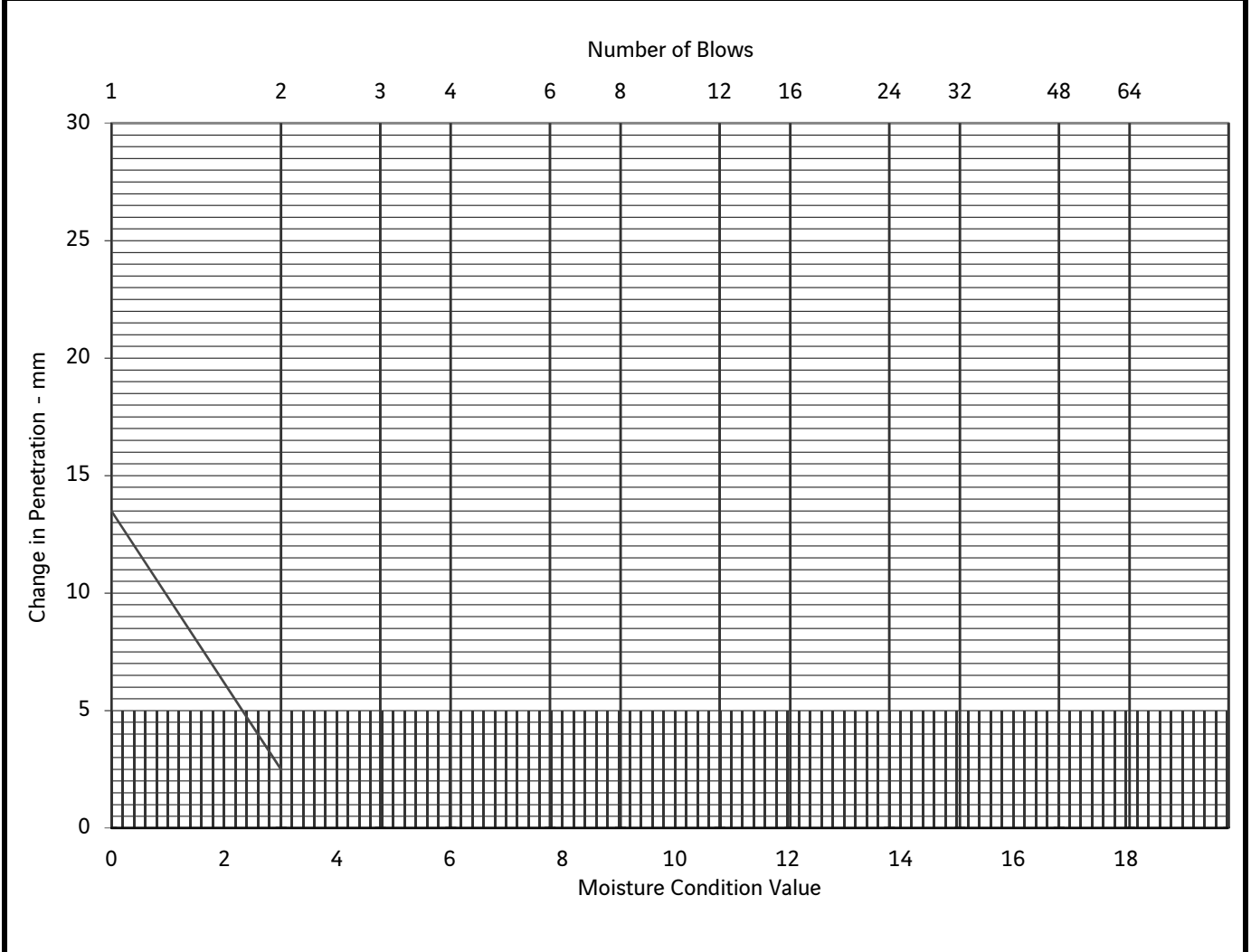


Maximum dry density	2.08Mg/m ³	Experimental points	
Optimum moisture content	8.70%		
Corrected maximum dry density for removal of gravel	2.12Mg/m ³		
Method of compaction	4.5KG	Moisture content %	Dry Density Mg/m ³
Batches tested	Separate batches tested.	5.8	2.02
Particle density	Assumed 2.65Mg/m ³	7.3	2.07
Gravel retained on 20mm sieve	8%	9.7	2.07
Gravel retained on 37.5mm sieve	2%	11.5	2.00
		13.5	1.92

General remarks: Test performed on specimen unsuitable due to gravel content.

Approved by:			 SOIL ENGINEERING
Steve Harper		Print date 07/11/2019	
Revision No.	2.03	Issue Date	21/11/2012
			Part of the Bachy Soletanche Group

Project Name	Nenthead Mines - Proposed MWTS, GI	Moisture Condition Value	Hole ID	BH104
Project No.	TA8234		Sample Depth	1.50m
Engineer	Aecom		Sample Number	7
Employer	The Coal Authority		Sample Type	B
Description			Dark grey slightly gravelly slightly sandy CLAY.	
			Specimen Depth	1.50m
			Specimen Number	1



Specimen number		Nat
Moisture condition value	MCV	2.3
Moisture content	%	24
Number of blows until seepage		5
Method of determining MCV		Steepest fit line
Bulk density after compaction #	Mg/m ³	1.98
Dry density after compaction #	Mg/m ³	1.60
Hand vane strength after compaction #	kPa	
Gravel retained on 20mm sieve	%	0.0

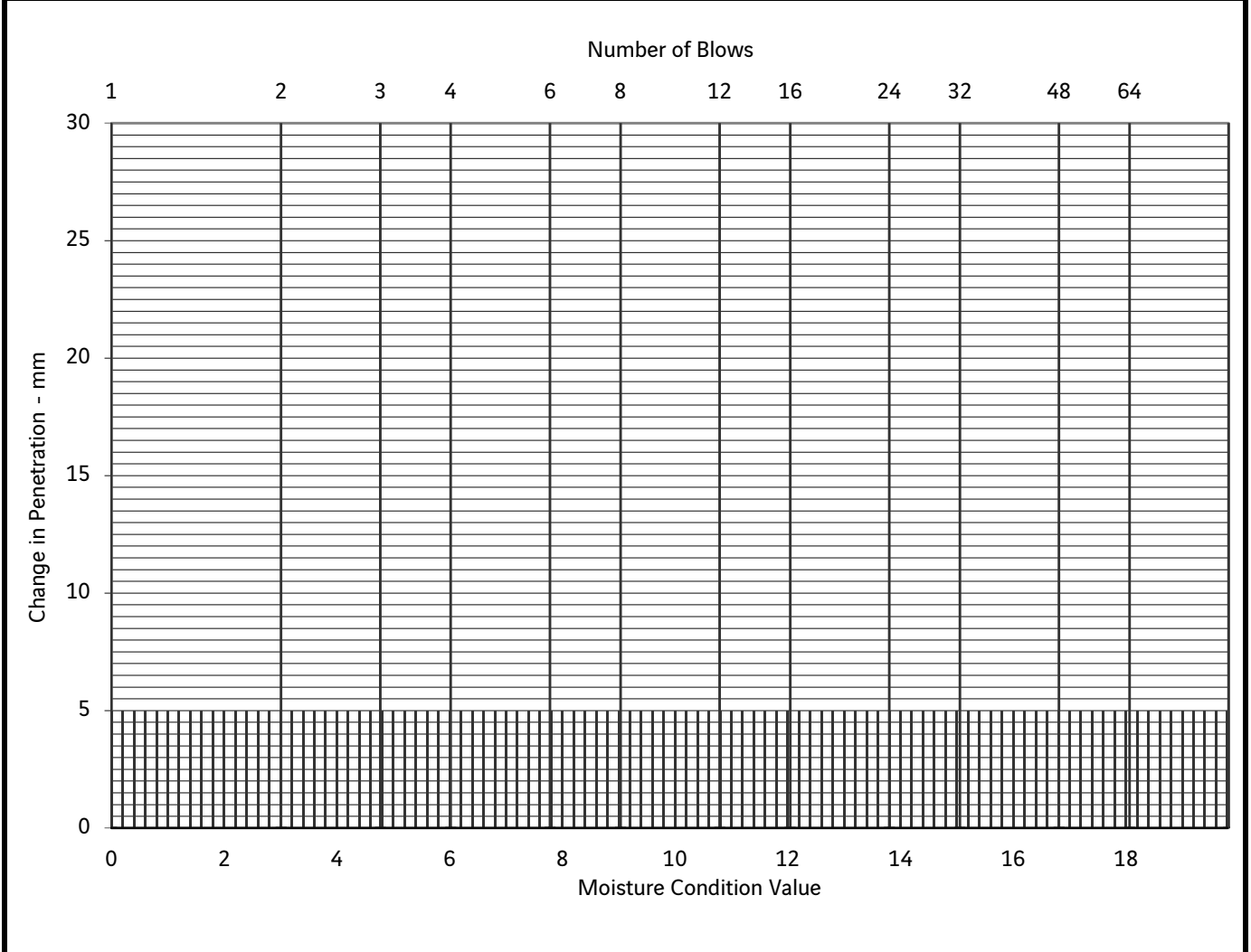
Remarks: Single sample tested. Test performed in the Laboratory

not part of test method

Approved by:			
Steve Harper			Print date 07/11/2019
Revision No.	2.04	Issue Date	21/11/2012




Project Name	Nenthead Mines - Proposed MWTS, GI	Moisture Condition Value	Hole ID BH105
Project No.	TA8234		Sample Depth 0.00m
Engineer	Aecom		Sample Number 4
Employer	The Coal Authority		Sample Type B
Description		Brown gravelly sandy CLAY.	Specimen Depth 0.00m
			Specimen Number 1



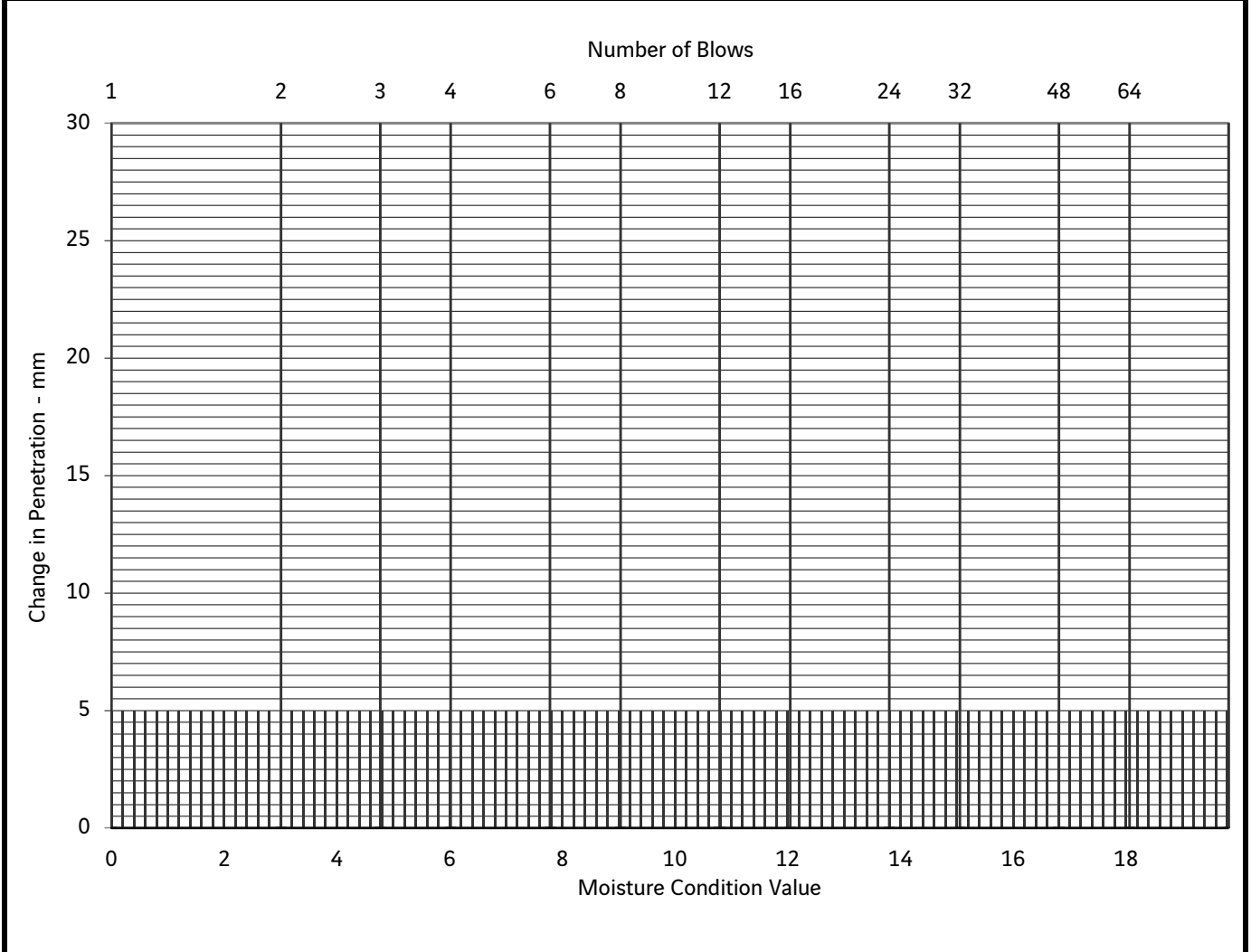
Specimen number		Nat
Moisture condition value	MCV	
Moisture content	%	8.2
Number of blows until seepage		1
Method of determining MCV		
Bulk density after compaction #	Mg/m ³	1.91
Dry density after compaction #	Mg/m ³	1.77
Hand vane strength after compaction #	kPa	
Gravel retained on 20mm sieve	%	8.2

Remarks Single sample tested. Test performed in the Laboratory
 MCV result of 0.0 indicates a test where a change in penetration of 5mm or less has occurred after 4 blows.

not part of test method

Approved by:			 SOIL ENGINEERING
Kevin Walker	Not UKAS	Print date	
Revision No.	2.04	Issue Date	21/11/2012
			Part of the Bachy Soletanche Group

Project Name	Nenthead Mines - Proposed MWTS, GI	Moisture Condition Value	Hole ID BH105
Project No.	TA8234		Sample Depth 2.50m
Engineer	Aecom		Sample Number 9
Employer	The Coal Authority		Sample Type B
Description		Brown gravelly sandy CLAY.	Specimen Depth 2.50m
			Specimen Number 1



Specimen number		Nat
Moisture condition value	MCV	
Moisture content	%	30
Number of blows until seepage		1
Method of determining MCV		
Bulk density after compaction #	Mg/m ³	1.92
Dry density after compaction #	Mg/m ³	1.47
Hand vane strength after compaction #	kPa	
Gravel retained on 20mm sieve	%	9.9

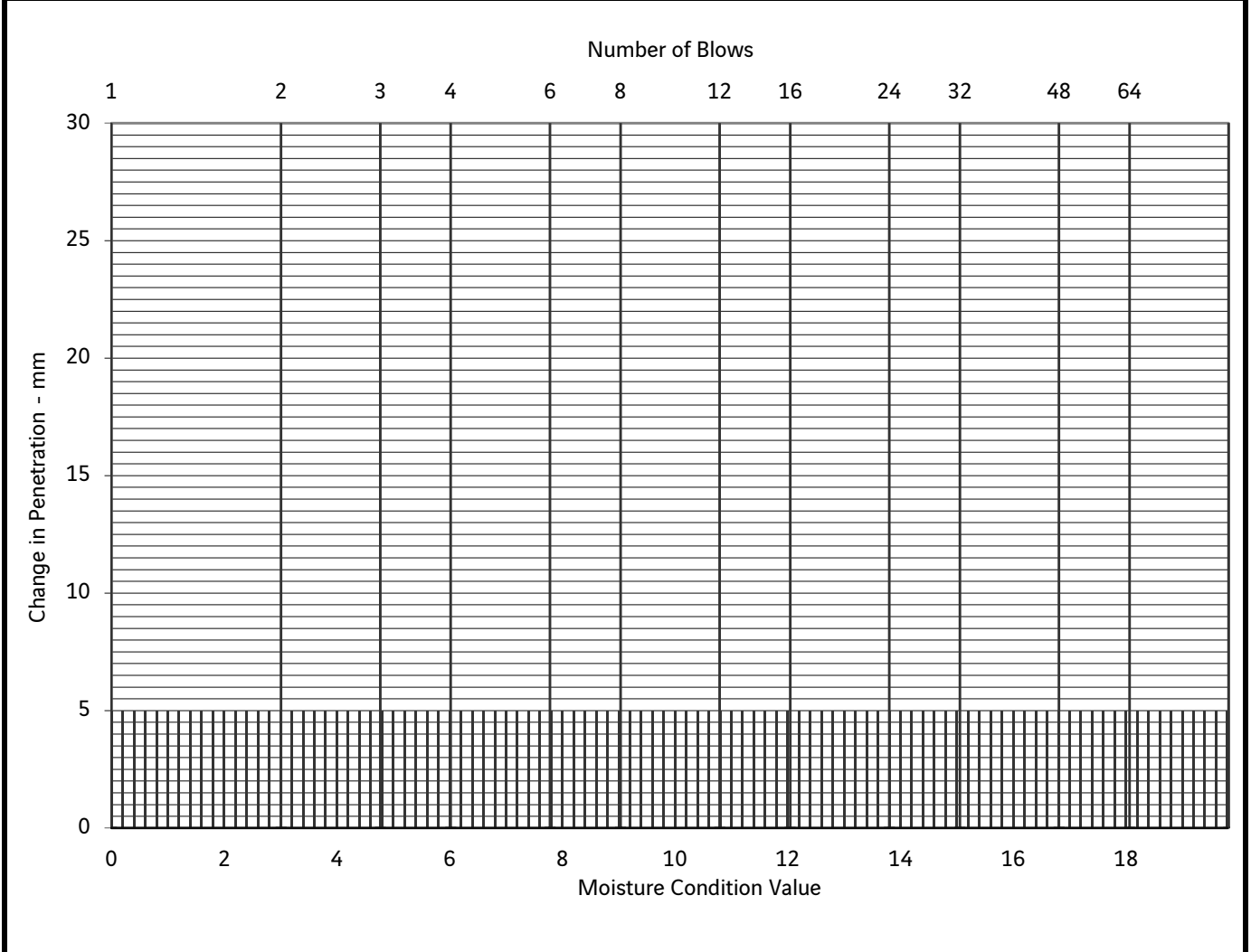
Remarks Single sample tested. Test performed in the Laboratory
 MCV result of 0.0 indicates a test where a change in penetration of 5mm or less has occurred after 4 blows.

not part of test method

Approved by:			
Steve Harper			Print date 07/11/2019
Revision No.	2.04	Issue Date	21/11/2012




Project Name	Nenthead Mines - Proposed MWTS, GI	Moisture Condition Value	Hole ID	BH106
Project No.	TA8234		Sample Depth	2.50m
Engineer	Aecom		Sample Number	10
Employer	The Coal Authority		Sample Type	B
			BS1377 : Part 4 : 1990 : Clause 5.4	
Description	Brown gravelly sandy CLAY.		Specimen Depth	2.50m
			Specimen Number	1



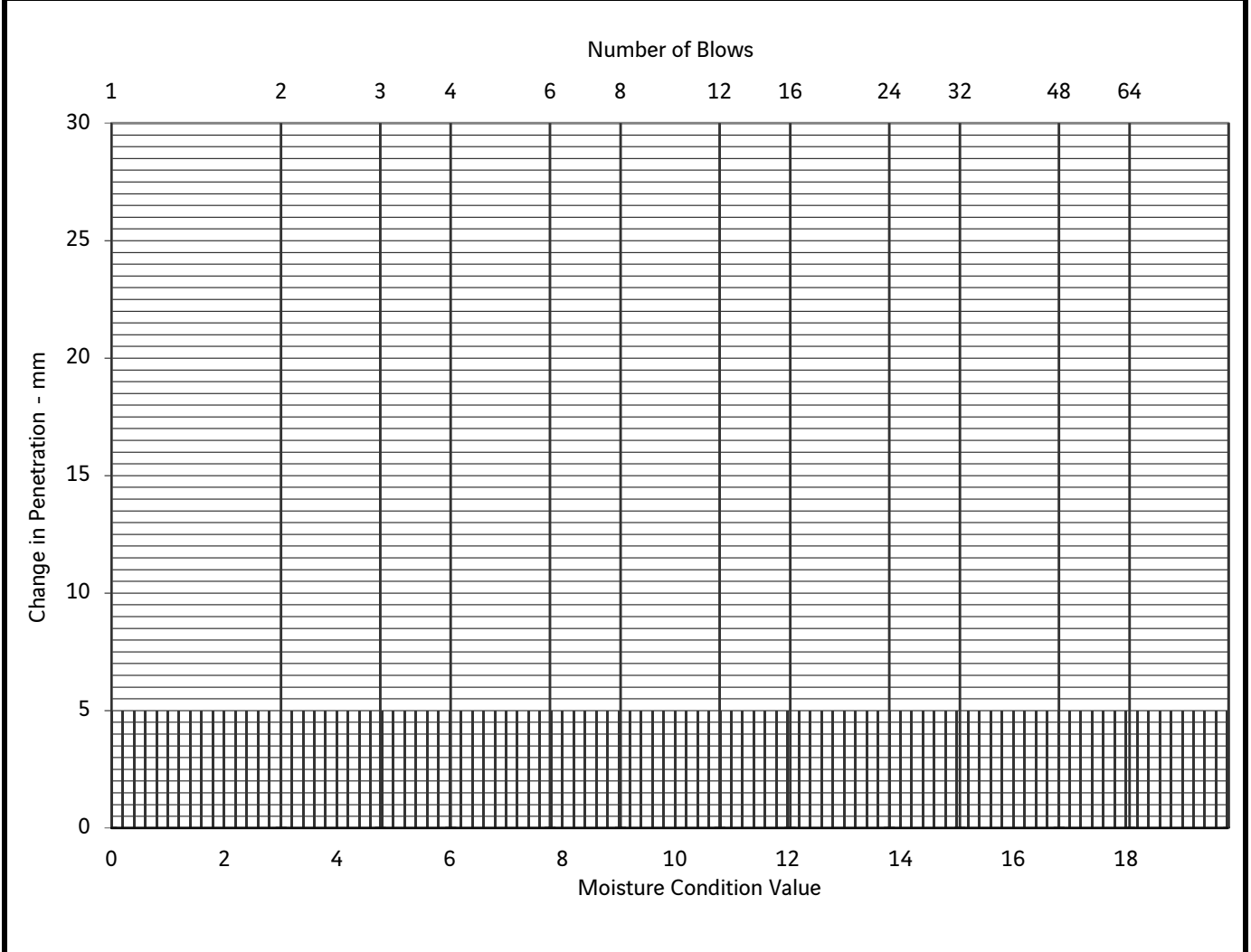
Specimen number	Nat	
Moisture condition value	MCV	
Moisture content	%	16
Number of blows until seepage	No seepage	
Method of determining MCV		
Bulk density after compaction #	Mg/m ³	2.07
Dry density after compaction #	Mg/m ³	1.78
Hand vane strength after compaction #	kPa	
Gravel retained on 20mm sieve	%	12.7

Remarks Single sample tested. Test performed in the Laboratory
 MCV result of 0.0 indicates a test where a change in penetration of 5mm or less has occurred after 4 blows.

not part of test method

Approved by:			 SOIL ENGINEERING
Steve Harper		Print date 07/11/2019	
Revision No.	2.04	Issue Date	21/11/2012
			Part of the Bachy Soletanche Group

Project Name	Nenthead Mines - Proposed MWTS, GI	Moisture Condition Value	Hole ID BH106
Project No.	TA8234		Sample Depth 4.50m
Engineer	Aecom		Sample Number 18
Employer	The Coal Authority		Sample Type B
Description		BS1377 : Part 4 : 1990 : Clause 5.4	Specimen Depth 4.50m
			Specimen Number 1



Specimen number		Nat
Moisture condition value	MCV	
Moisture content	%	21
Number of blows until seepage		1
Method of determining MCV		
Bulk density after compaction #	Mg/m ³	2.03
Dry density after compaction #	Mg/m ³	1.68
Hand vane strength after compaction #	kPa	
Gravel retained on 20mm sieve	%	12.8

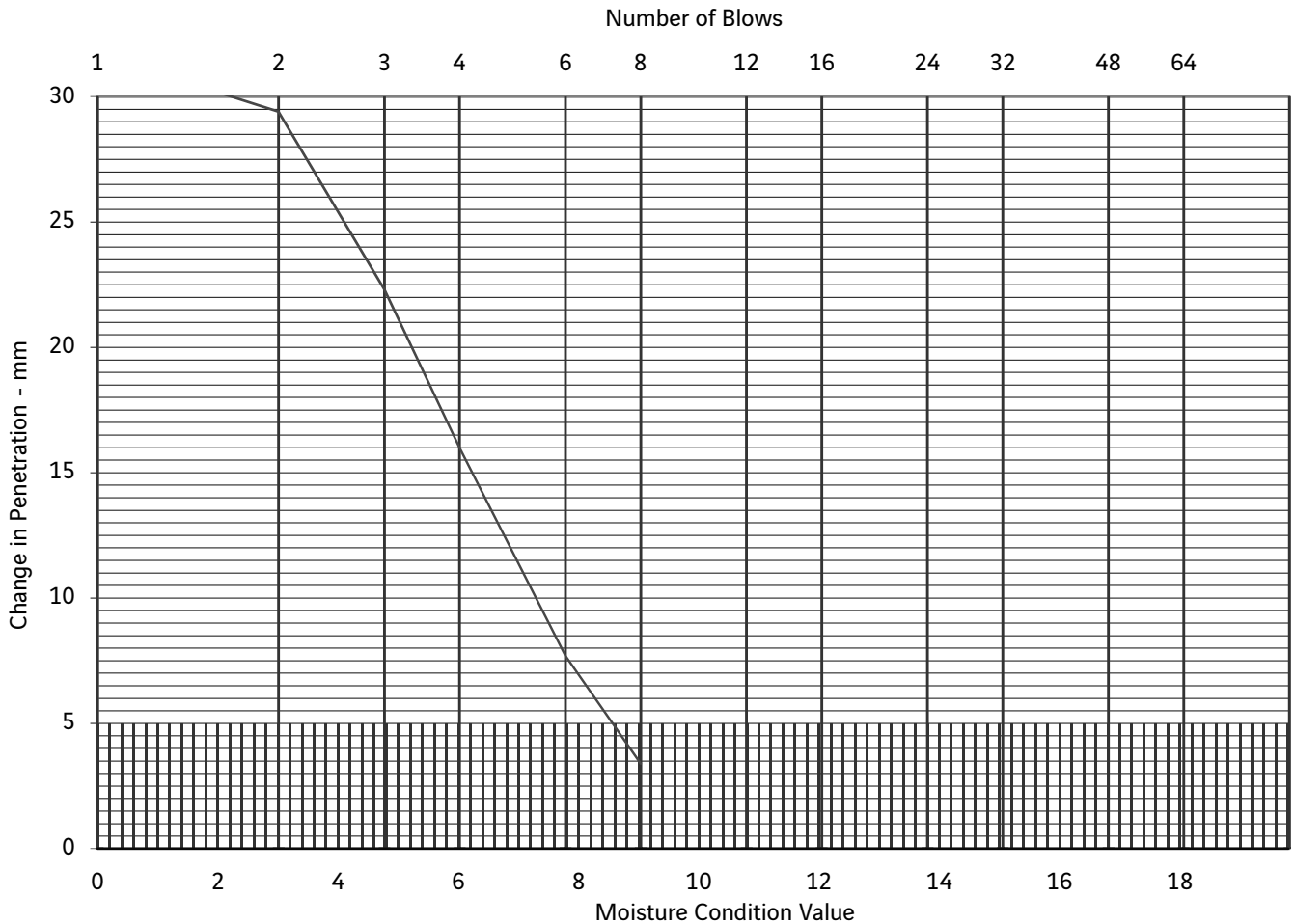
Remarks Single sample tested. Test performed in the Laboratory
 MCV result of 0.0 indicates a test where a change in penetration of 5mm or less has occurred after 4 blows.

not part of test method

Approved by:			
Steve Harper			Print date 07/11/2019
Revision No.	2.04	Issue Date	21/11/2012



Project Name	Nenthead Mines - Proposed MWTS, GI	Moisture Condition Value BS1377 : Part 4 : 1990 : Clause 5.4	Hole ID TP114
Project No.	TA8234		Sample Depth 2.50m
Engineer	Aecom		Sample Number 12
Employer	The Coal Authority		Sample Type B
Description	Dark grey slightly gravelly slightly sandy CLAY.		Specimen Depth 2.50m
			Specimen Number 1



Specimen number		Nat
Moisture condition value MCV		8.2
Moisture content	%	16
Number of blows until seepage		17
Method of determining MCV		Steepest fit line
Bulk density after compaction #	Mg/m ³	2.18
Dry density after compaction #	Mg/m ³	1.88
Hand vane strength after compaction #	kPa	
Gravel retained on 20mm sieve	%	0.0

Remarks Single sample tested. Test performed in the Laboratory

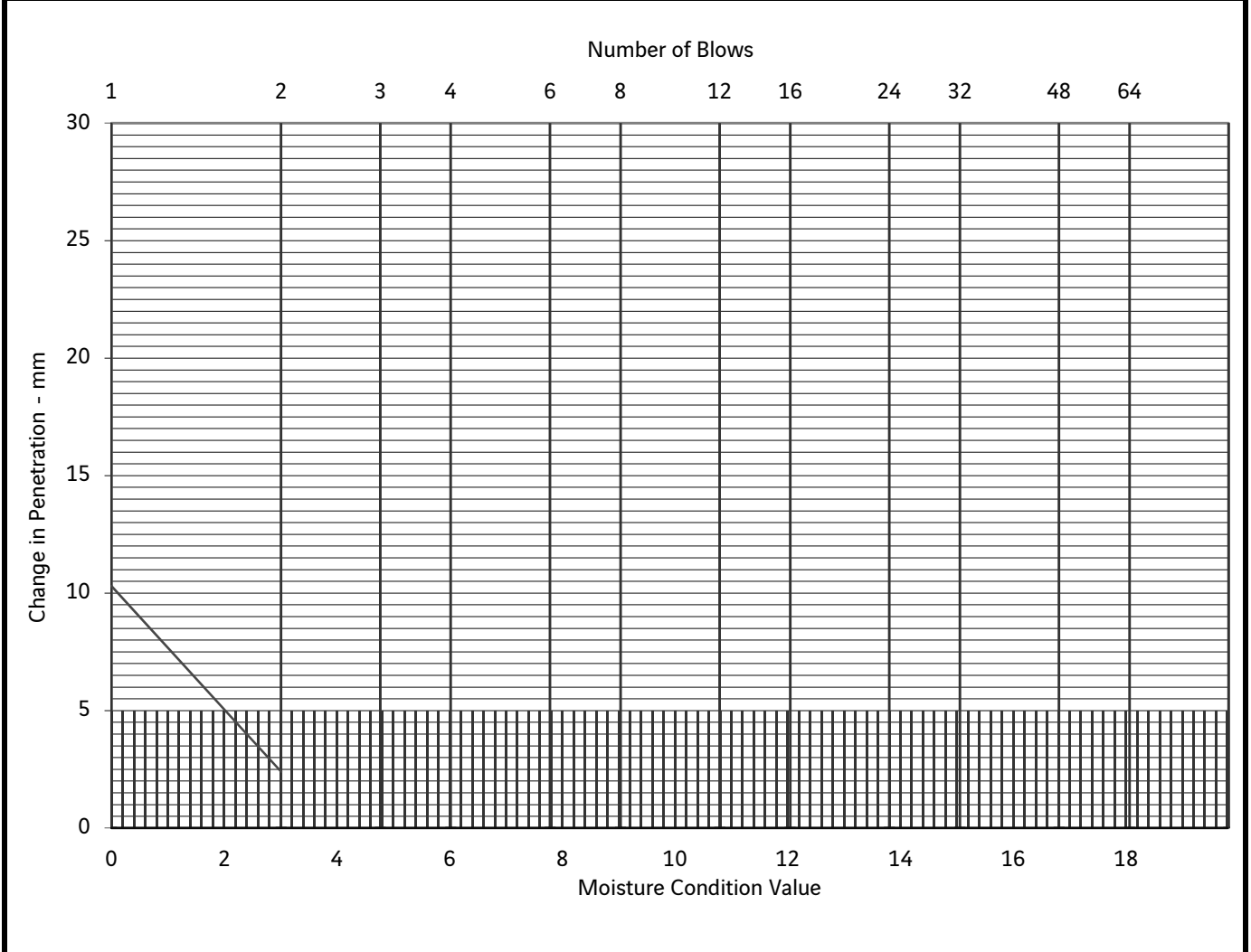
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Approved by:			
Steve Harper			Print date 07/11/2019
Revision No.	2.04	Issue Date	21/11/2012



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Project Name	Nenthead Mines - Proposed MWTS, GI	Moisture Condition Value	Hole ID TP122
Project No.	TA8234		Sample Depth 0.50m
Engineer	Aecom		Sample Number 1
Employer	The Coal Authority		Sample Type B
Description		BS1377 : Part 4 : 1990 : Clause 5.4	Specimen Depth 0.50m
			Specimen Number 1



Specimen number		Nat
Moisture condition value	MCV	2
Moisture content	%	30
Number of blows until seepage		2
Method of determining MCV		Steepest fit line
Bulk density after compaction #	Mg/m ³	1.93
Dry density after compaction #	Mg/m ³	1.48
Hand vane strength after compaction #	kPa	
Gravel retained on 20mm sieve	%	26.6

Remarks Single sample tested. Test performed in the Laboratory

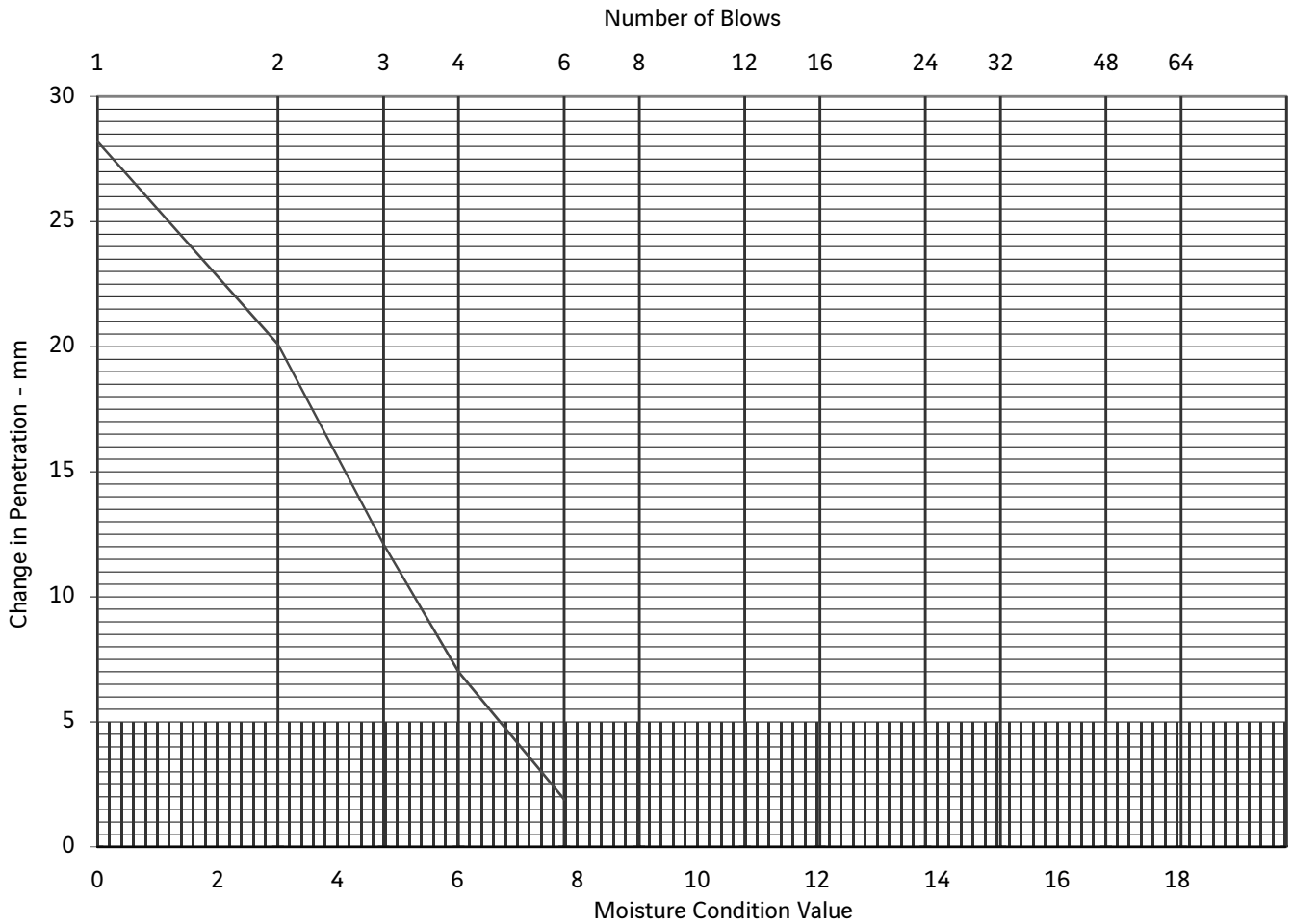
not part of test method

Approved by:			
Steve Harper			Print date 07/11/2019
Revision No.	2.04	Issue Date	21/11/2012



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Project Name	Nenthead Mines - Proposed MWTS, GI	Moisture Condition Value	Hole ID TP123
Project No.	TA8234		Sample Depth 1.00m
Engineer	Aecom		Sample Number 6
Employer	The Coal Authority		Sample Type B
Description		BS1377 : Part 4 : 1990 : Clause 5.4	Specimen Depth 1.00m
			Specimen Number 1



Specimen number		Nat
Moisture condition value	MCV	6.3
Moisture content	%	19
Number of blows until seepage		14
Method of determining MCV		Steepest fit line
Bulk density after compaction #	Mg/m ³	2.09
Dry density after compaction #	Mg/m ³	1.75
Hand vane strength after compaction #	kPa	
Gravel retained on 20mm sieve	%	1.9

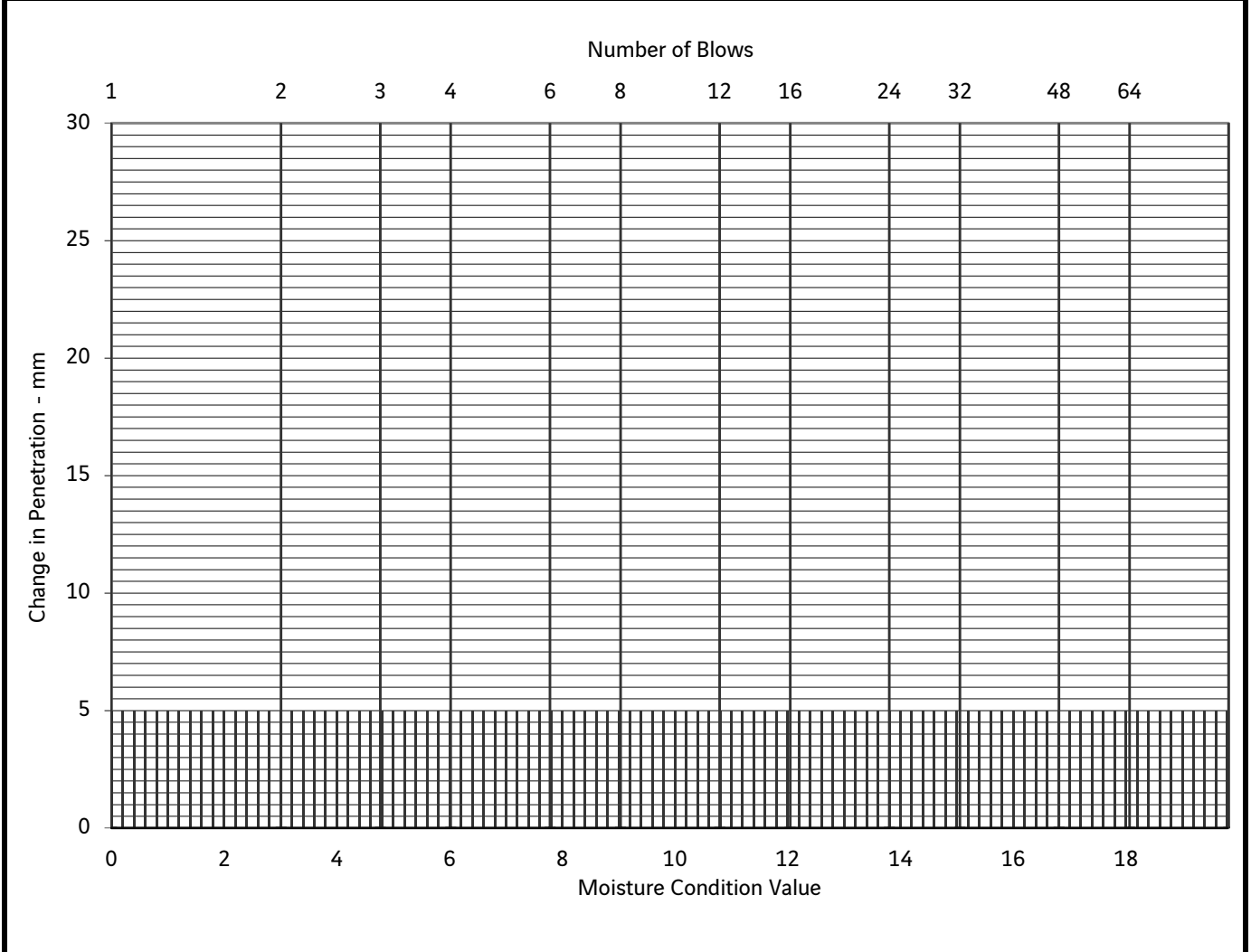
Remarks: Single sample tested. Test performed in the Laboratory

not part of test method

Approved by:			
Steve Harper			Print date 07/11/2019
Revision No.	2.04	Issue Date	21/11/2012



Project Name	Nenthead Mines - Proposed MWTS, GI	Moisture Condition Value BS1377 : Part 4 : 1990 : Clause 5.4	Hole ID WS105
Project No.	TA8234		Sample Depth 2.00m
Engineer	Aecom		Sample Number 10
Employer	The Coal Authority		Sample Type B
Description	Brown clayey slightly gravelly SAND.		Specimen Depth 2.00m
			Specimen Number 1



Specimen number		Nat
Moisture condition value	MCV	
Moisture content	%	29
Number of blows until seepage		1
Method of determining MCV		
Bulk density after compaction #	Mg/m ³	1.93
Dry density after compaction #	Mg/m ³	1.50
Hand vane strength after compaction #	kPa	
Gravel retained on 20mm sieve	%	2.5

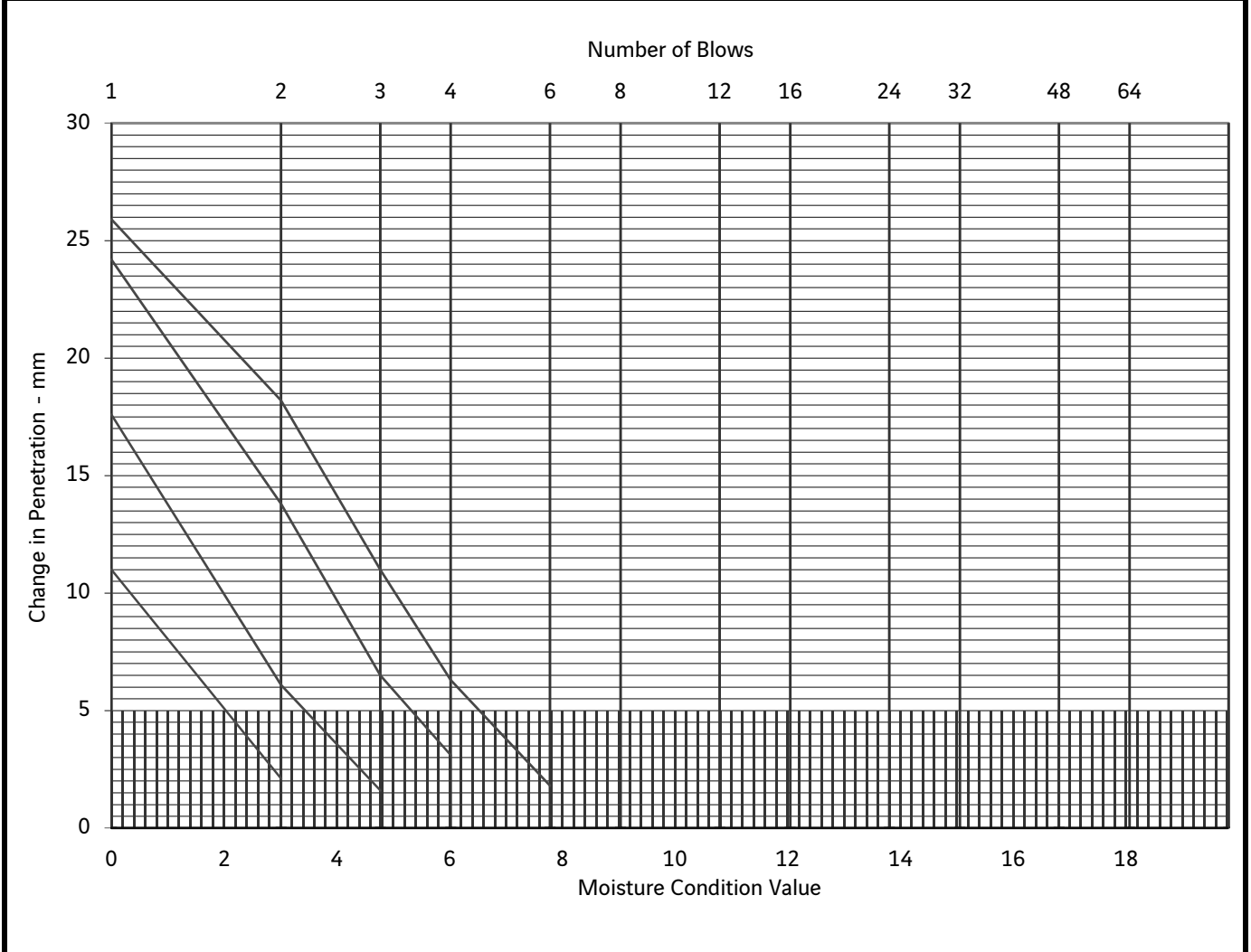
Remarks: Single sample tested. Test performed in the Laboratory
 MCV result of 0.0 indicates a test where a change in penetration of 5mm or less has occurred after 4 blows.

not part of test method

Approved by:			
Steve Harper			Print date 07/11/2019
Revision No.	2.04	Issue Date	21/11/2012



Project Name	Nenthead Mines - Proposed MWTS, GI	Moisture Condition Value	Hole ID TP121
Project No.	TA8234		Sample Depth 0.50m
Engineer	Aecom		Sample Number 1
Employer	The Coal Authority		Sample Type B
Description		Brown clayey gravelly SAND.	Specimen Depth 0.50m
			Specimen Number 4



Specimen number		1	2	3	4
Moisture condition value MCV		2	5.1	6.2	3.3
Moisture content	%	27	25	22	26
Number of blows until seepage		7	No seepage	22	10
Method of determining MCV		Steepest fit line Steepest fit line Steepest fit line Steepest fit line			
Bulk density after compaction #	Mg/m ³	1.84	1.93	1.96	1.91
Dry density after compaction #	Mg/m ³	1.45	1.54	1.60	1.52
Hand vane strength after compaction #	kPa				
Gravel retained on 20mm sieve	%	17.8			

Remarks Separate batches tested Test performed in the Laboratory

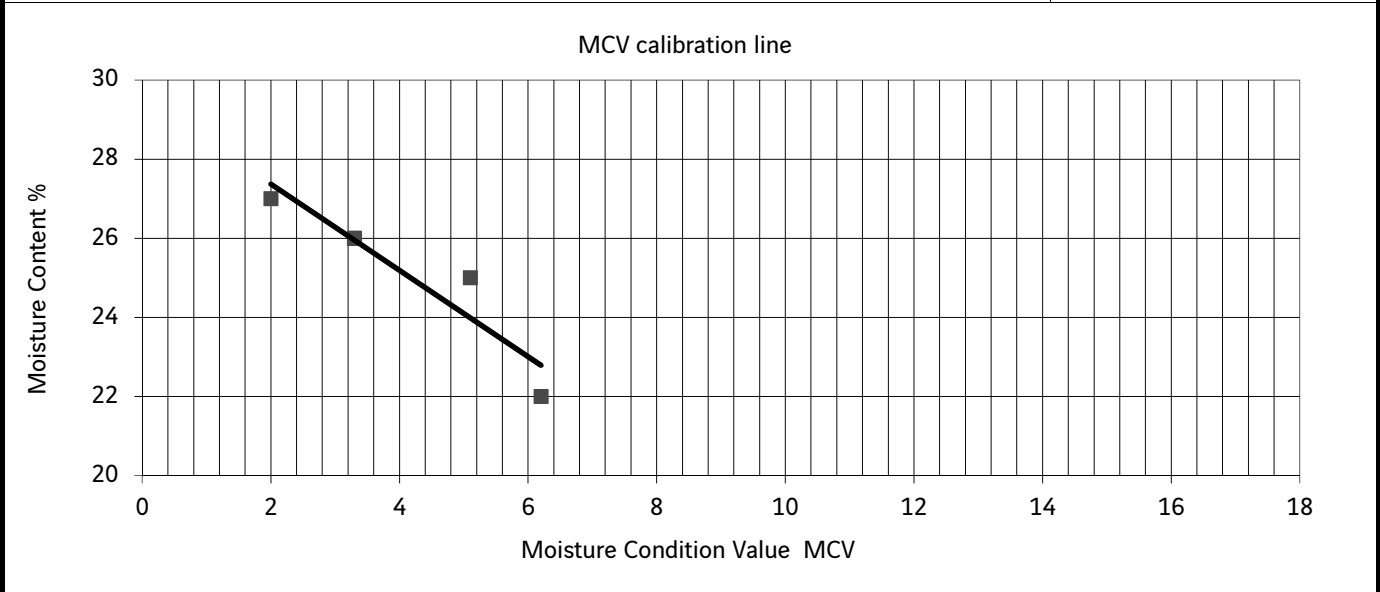
not part of test method

Approved by:			
Steve Harper			Print date 07/11/2019
Revision No.	2.04	Issue Date	21/11/2012

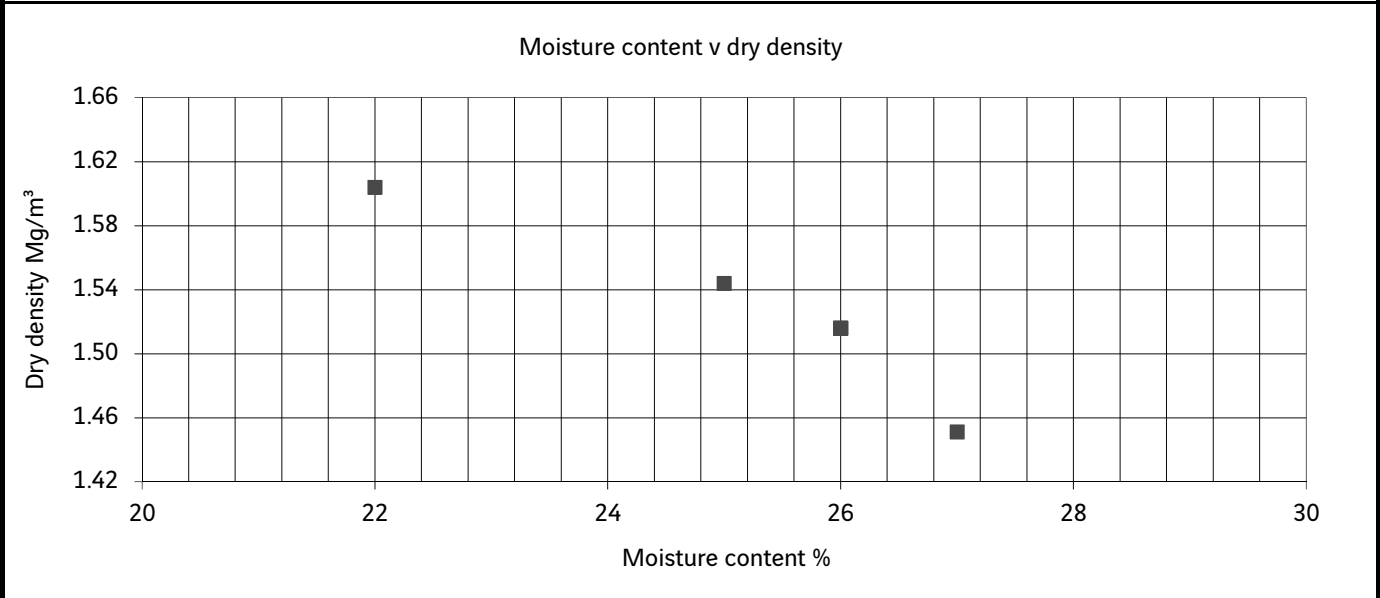


Project Name	Nenthead Mines - Proposed MWTS, GI	Moisture Condition Value	Hole ID	TP121
Project No.	TA8234		Sample Depth	0.50m
Engineer	Aecom		Sample Number	1
Employer	The Coal Authority		Sample Type	B
Description		Brown clayey gravelly SAND.	Specimen Depth	0.50m
			Specimen Number	4

BS1377 : Part 4 : 1990 : Clause 5.5

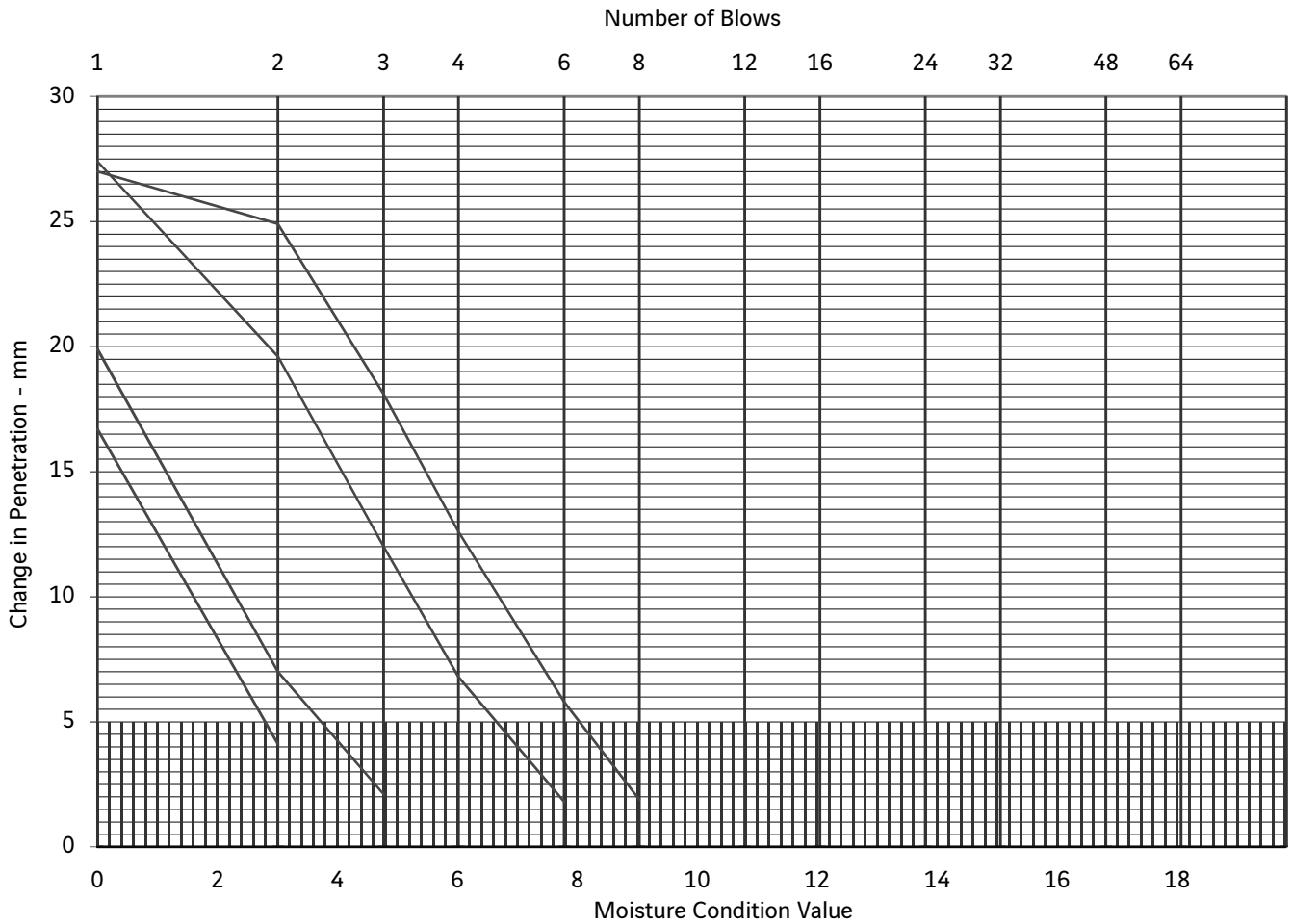


Characteristics of calibration line	determined using linear regression	
Intercept	29.2	
Slope	-1.001	
Sensitivity	0.999	MCV per MC%
Correlation	-0.931	



Remarks: Separate batches tested Test performed in the Laboratory

Project Name	Nenthead Mines - Proposed MWTS, GI	Moisture Condition Value	Hole ID TP123
Project No.	TA8234		Sample Depth 0.50m
Engineer	Aecom		Sample Number 1
Employer	The Coal Authority		Sample Type B
Description		BS1377 : Part 4 : 1990 : Clause 5.5	Specimen Depth 0.50m
			Specimen Number 2



Specimen number		1	2	3	4
Moisture condition value MCV		2.8	3.5	6.4	7.7
Moisture content	%	26	24	22	20
Number of blows until seepage		6	8	18	30
Method of determining MCV		Steepest fit line Steepest fit line Steepest fit line Steepest fit line			
Bulk density after compaction #	Mg/m ³	1.89	1.94	2.00	2.04
Dry density after compaction #	Mg/m ³	1.50	1.56	1.64	1.70
Hand vane strength after compaction #	kPa				
Gravel retained on 20mm sieve	%	15.6			

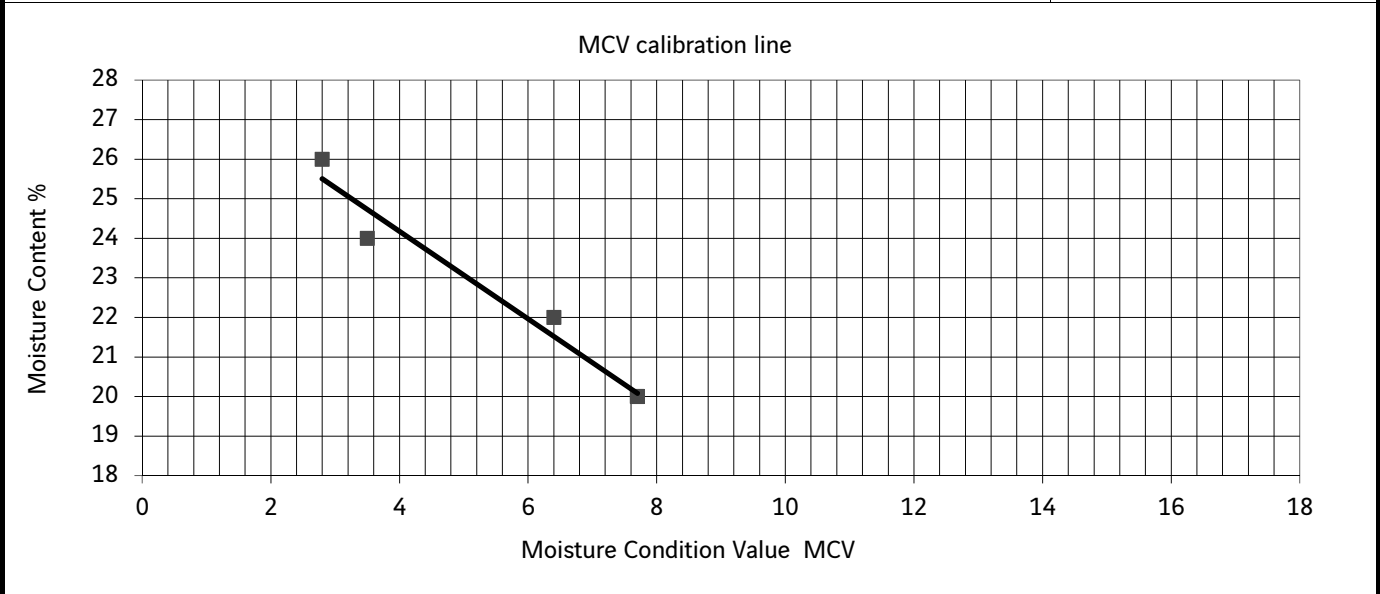
Remarks Separate batches tested Test performed in the Laboratory

not part of test method

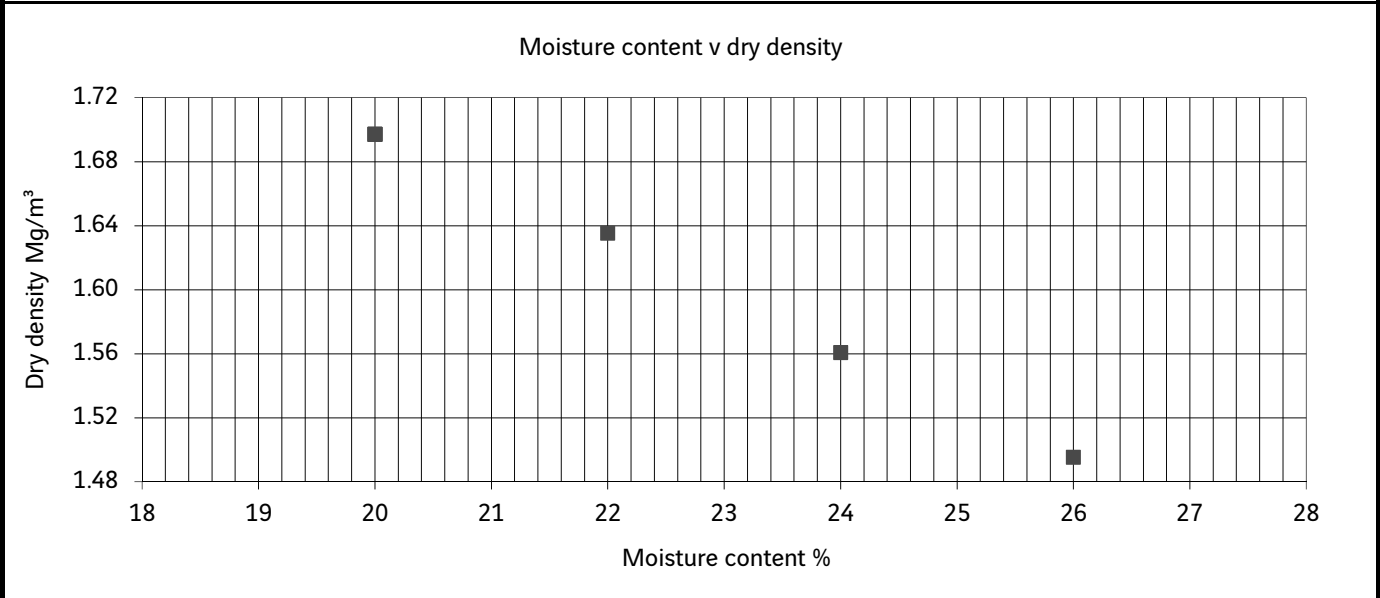
Approved by:			
Steve Harper			Print date 07/11/2019
Revision No.	2.04	Issue Date	21/11/2012



Project Name	Nenthead Mines - Proposed MWTS, GI	Moisture Condition Value	Hole ID	TP123
Project No.	TA8234		Sample Depth	0.50m
Engineer	Aecom		Sample Number	1
Employer	The Coal Authority		Sample Type	B
Description		Brown sandy gravelly CLAY.	Specimen Depth	0.50m
			Specimen Number	2



Characteristics of calibration line	determined using linear regression	
Intercept	29.0	
Slope	-1.110	
Sensitivity	0.901	MCV per MC%
Correlation	-0.973	

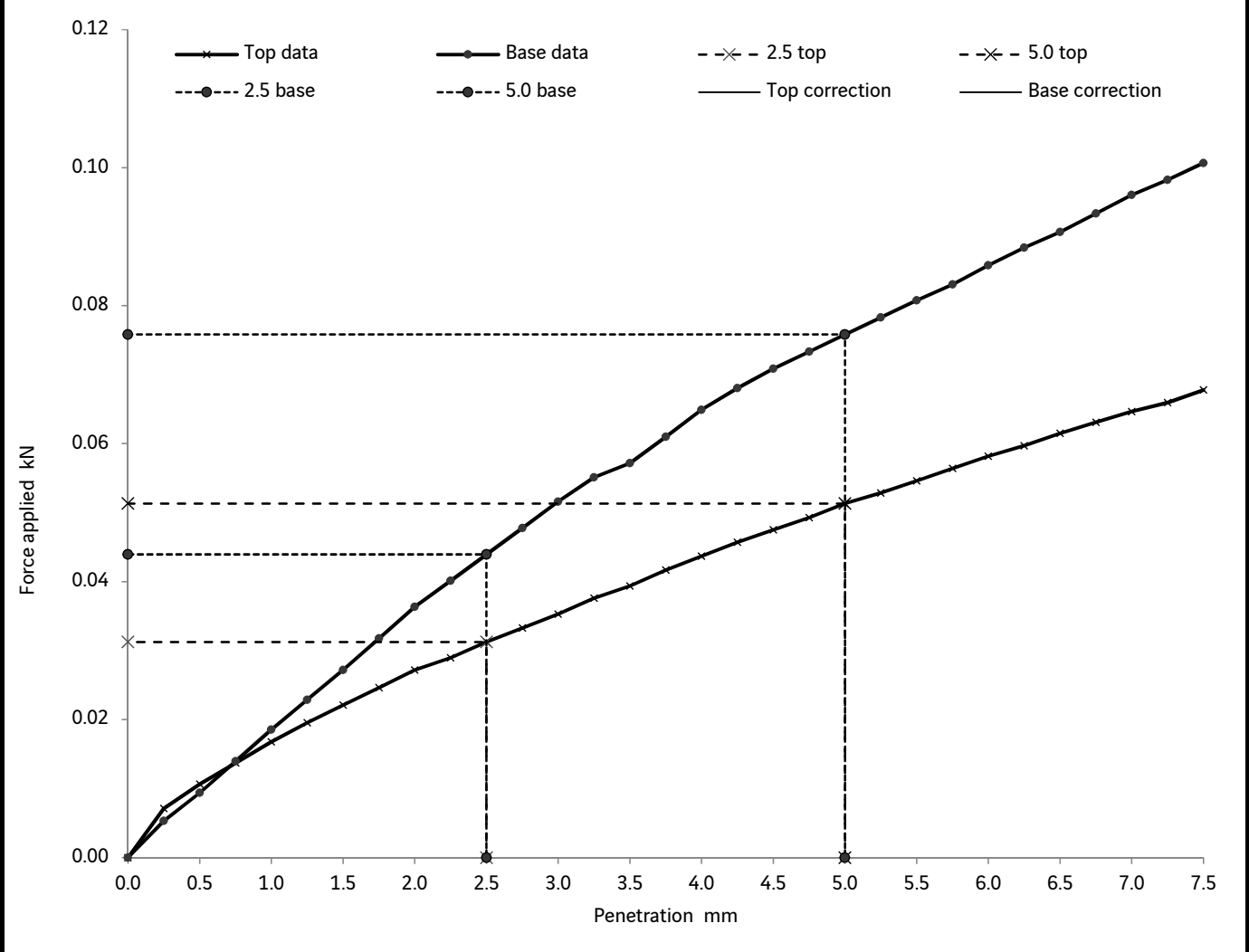


Remarks Separate batches tested Test performed in the Laboratory

Project Name	Nenthead Mines - Proposed MWTS, GI	California Bearing Ratio Test	Hole ID	TP109
Project No.	TA8234		Sample Depth	0.50m
Engineer	Aecom		Sample Number	1
Employer	The Coal Authority		Sample Type	B
Description			Brown slightly sandy slightly gravelly CLAY.	

BS1377: Part 4: 1990: 7.2.4 2.5kg compactive effort

Specimen Depth
0.50m
Specimen Number
1



Penetration	CBR values %			As received moisture content	22	%
	Top	Base	Accepted CBR	Moisture content - top	23	%
2.50 mm	0.24	0.33	N/A	Moisture content - base	22	%
5.00 mm	0.26	0.38		Bulk density	2.01	Mg/m ³
Curve correction				Dry density	1.64	Mg/m ³

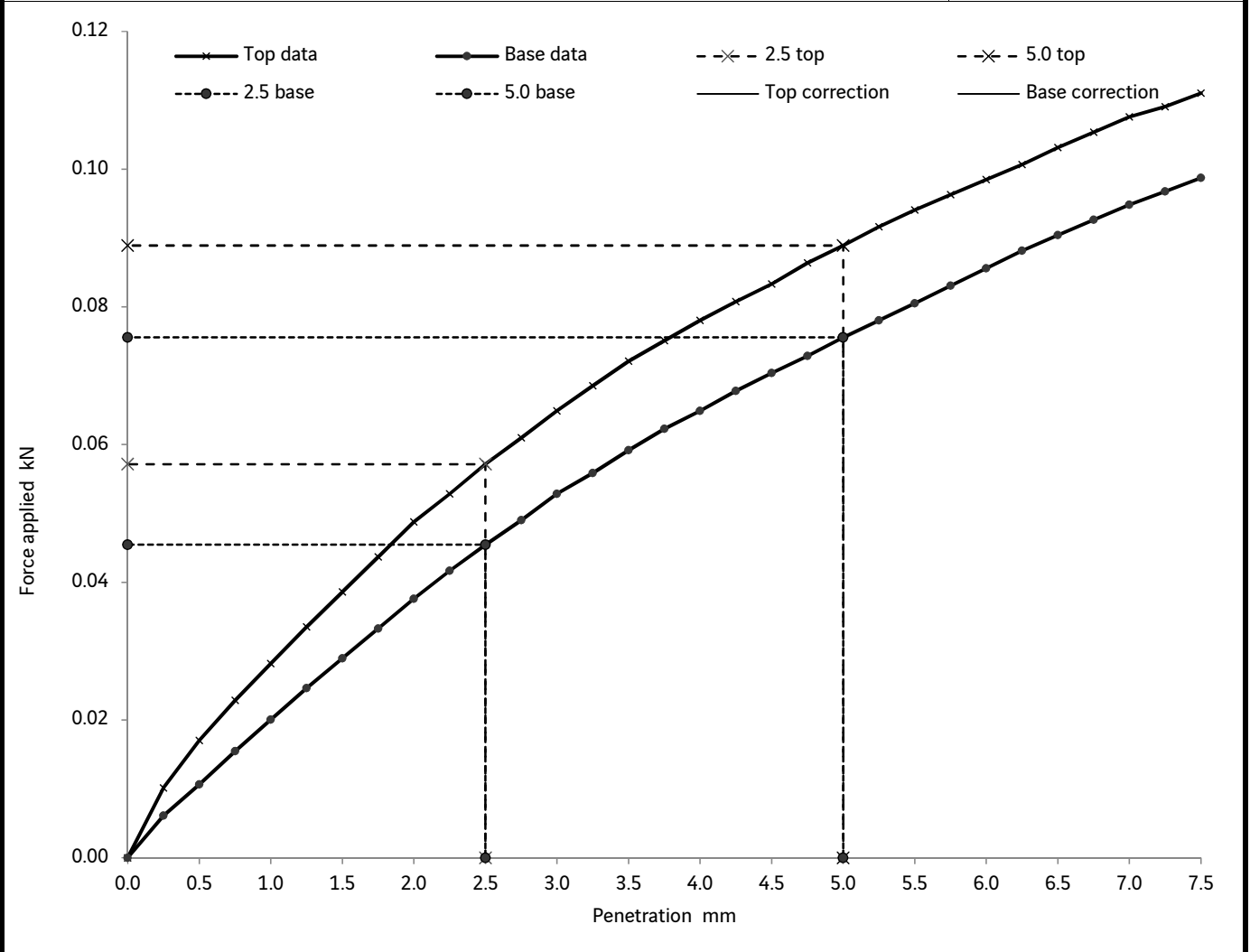
Seating load - top	10	N	Method of compaction	2.5kg rammer
Seating load - base	10	N		
Surcharge	5.2	kg		
Gravel retained on 20mm sieve	12	%		
Gravel retained on 37.5mm sieve	3.2	%		

General remarks Unsoaked, Surcharge 5.182kg.

Approved by:				
Steve Harper			Print date 07/11/2019	
Revision No.	2.03	Issue Date	20/11/2012	Part of the Bachy Soletanche Group

Project Name	Nenthead Mines - Proposed MWTS, GI	California Bearing Ratio Test	Hole ID	TP110
Project No.	TA8234		Sample Depth	0.50m
Engineer	Aecom		Sample Number	1
Employer	The Coal Authority		Sample Type	B
			BS1377: Part 4: 1990: 7.2.4 4.5kg compactive effort	

Description	Brown sandy CLAY.	Specimen Depth	0.50m
		Specimen Number	2



Penetration	CBR values %			As received moisture content	38	%	
	Top	Base	Accepted CBR	Moisture content - top	38	%	
	2.50 mm	0.43	0.34	0.41	Moisture content - base	38	%
	5.00 mm	0.44	0.38		Bulk density	1.78	Mg/m ³
Curve correction				Dry density	1.29	Mg/m ³	

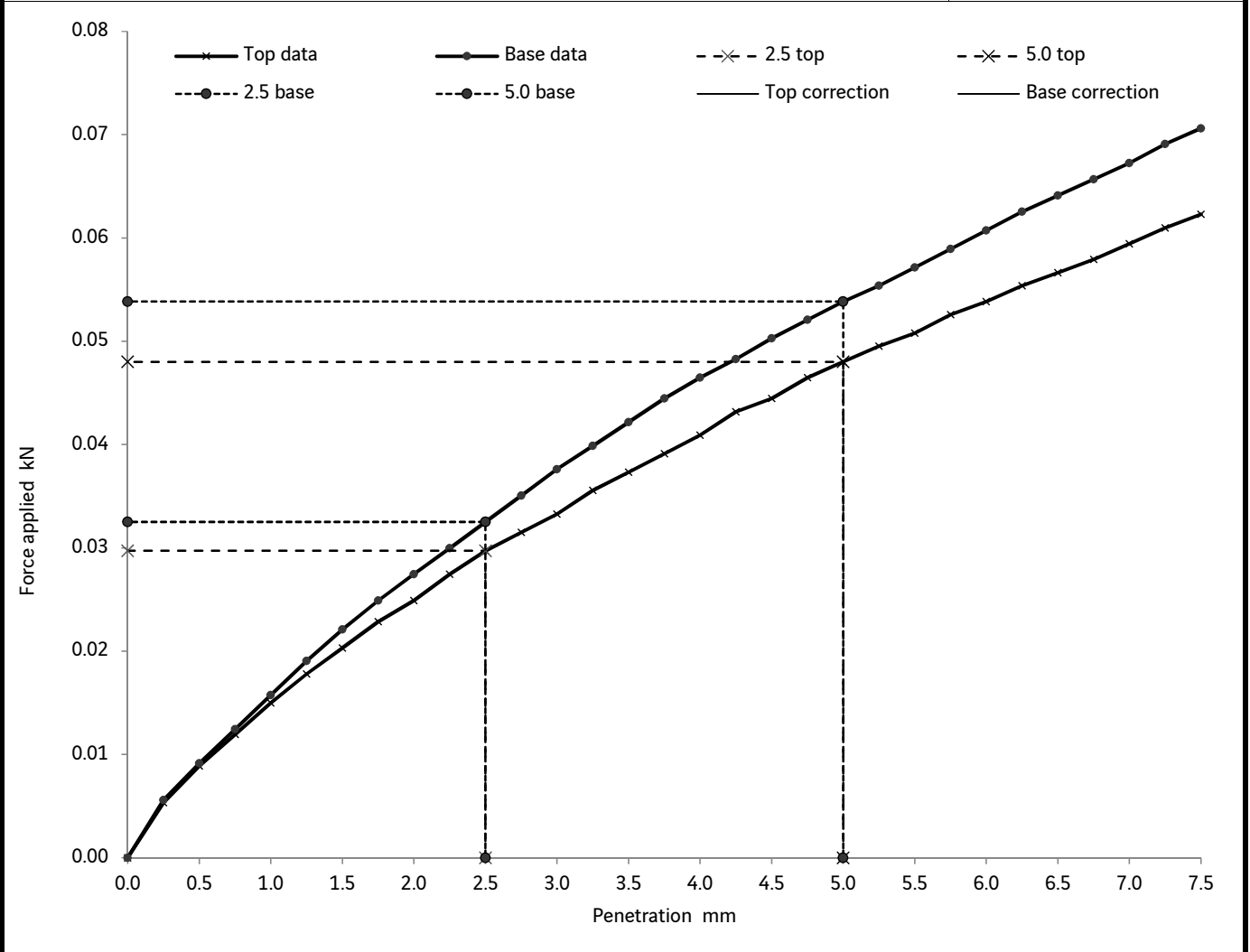
Seating load - top	10	N	Method of compaction	4.5kg rammer
Seating load - base	10	N		
Surcharge	4.2	kg		
Gravel retained on 20mm sieve	0	%		
Gravel retained on 37.5mm sieve	0	%		

General remarks Unsoaked, Surcharge 4.183kg.

Approved by:				
Steve Harper			Print date 07/11/2019	
Revision No.	2.03	Issue Date	20/11/2012	Part of the Bachy Soletanche Group

Project Name	Nenthead Mines - Proposed MWTS, GI	California Bearing Ratio Test	Hole ID	TP112
Project No.	TA8234		Sample Depth	0.50m
Engineer	Aecom		Sample Number	1
Employer	The Coal Authority		Sample Type	B
			BS1377: Part 4: 1990: 7.2.4 2.5kg compactive effort	


Description	Brown slightly sandy slightly gravelly CLAY with rootlets.	Specimen Depth	0.50m
		Specimen Number	1



Penetration	CBR values %			As received moisture content	35	%
	Top	Base	Accepted CBR	Moisture content - top	34	%
2.50 mm	0.23	0.25	0.26	Moisture content - base	34	%
5.00 mm	0.24	0.27		Bulk density	1.81	Mg/m ³
Curve correction				Dry density	1.35	Mg/m ³

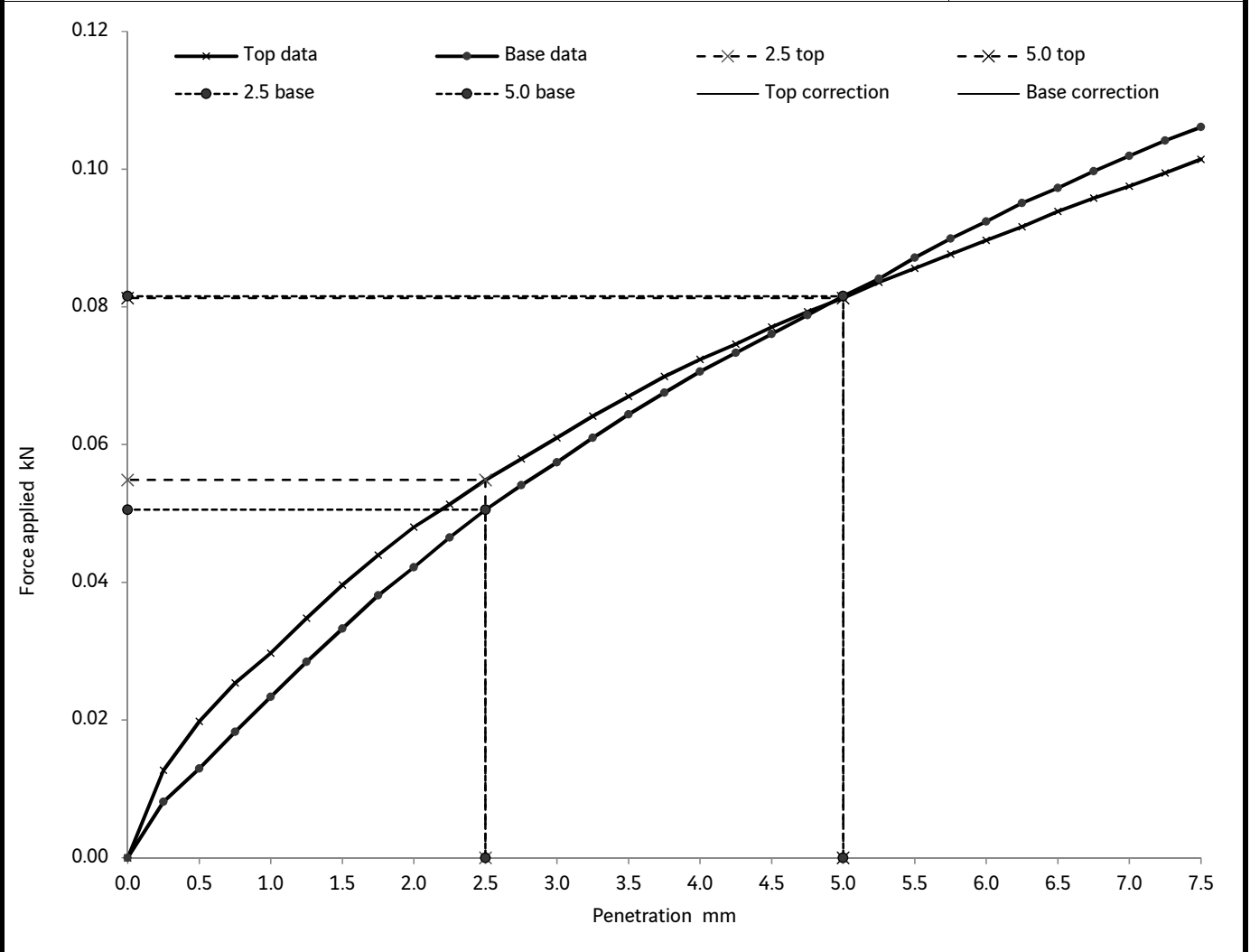
Seating load - top	10	N	Method of compaction	2.5kg rammer
Seating load - base	10	N		
Surcharge	5.2	kg		
Gravel retained on 20mm sieve	4.1	%		
Gravel retained on 37.5mm sieve	2	%		

General remarks Unsoaked, Surcharge 5.188kg.

Approved by:				 SOIL ENGINEERING
Steve Harper			Print date 07/11/2019	
Revision No.	2.03	Issue Date	20/11/2012	Part of the Bachy Soletanche Group

Project Name	Nenthead Mines - Proposed MWTS, GI	California Bearing Ratio Test	Hole ID	TP115
Project No.	TA8234		Sample Depth	0.50m
Engineer	Aecom		Sample Number	1
Employer	The Coal Authority		Sample Type	B
			BS1377: Part 4: 1990: 7.2.4 2.5kg compactive effort	


Description	Brown slightly gravelly sandy CLAY with some rootlets.	Specimen Depth	0.50m
		Specimen Number	1



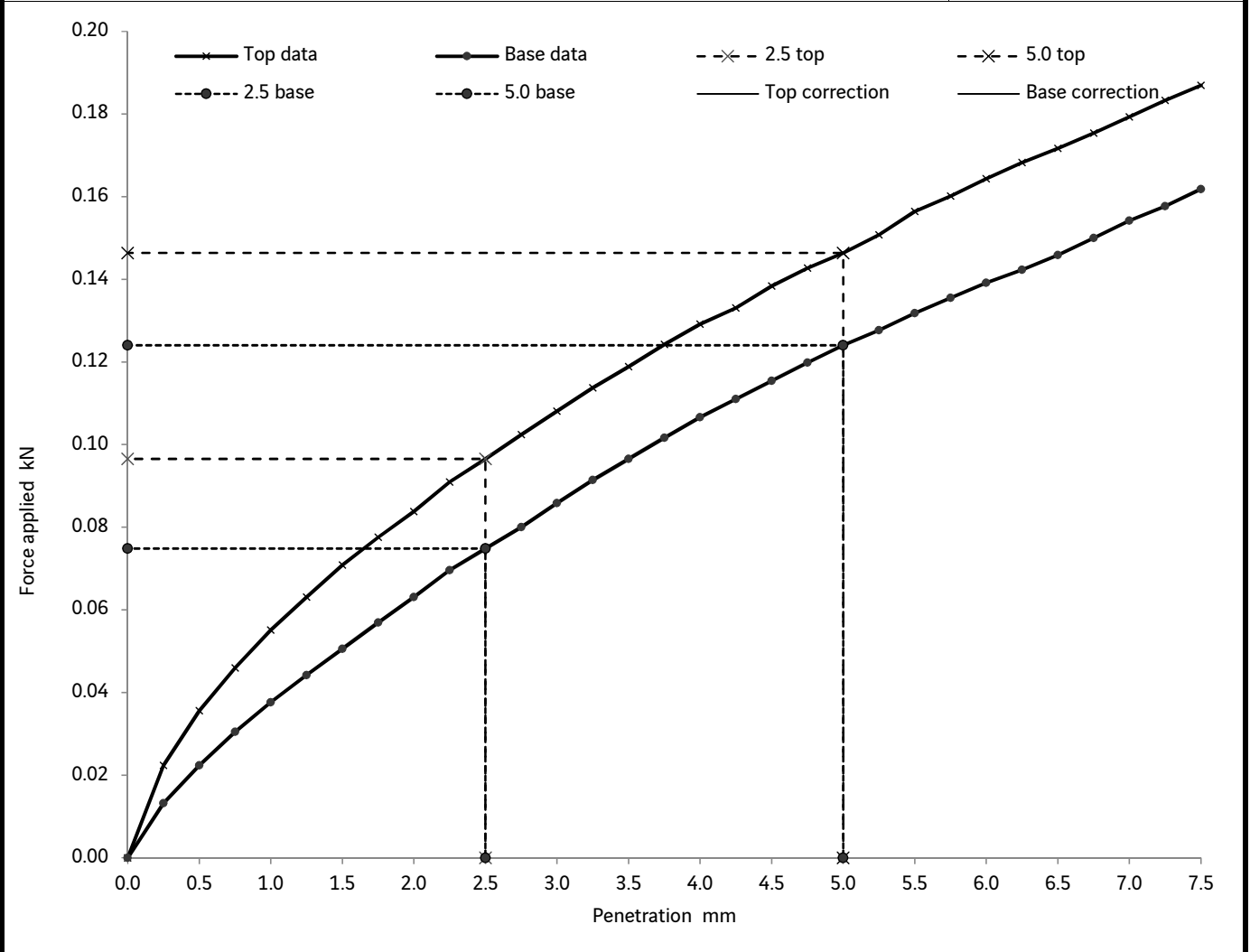
Penetration	CBR values %			As received moisture content	32	%
	Top	Base	Accepted CBR	Moisture content - top	32	%
2.50 mm	0.42	0.38	0.42	Moisture content - base	32	%
5.00 mm	0.41	0.41		Bulk density	1.86	Mg/m ³
Curve correction				Dry density	1.41	Mg/m ³

Seating load - top	10	N	Method of compaction	2.5kg rammer
Seating load - base	10	N	Curing period	3 Days
Surcharge	5.5	kg	Soaking period	4 Days
Gravel retained on 20mm sieve	0	%	Amount of swell	-0.31 mm
Gravel retained on 37.5mm sieve	0	%		

General remarks Soaked, Surcharge 5.451kg.

Approved by:			 SOIL ENGINEERING
Steve Harper		Print date 07/11/2019	
Revision No.	2.03	Issue Date	20/11/2012
			Part of the Bachy Soletanche Group

Project Name	Nenthead Mines - Proposed MWTS, GI	California Bearing Ratio Test	Hole ID TP119
Project No.	TA8234		Sample Depth 0.50m
Engineer	Aecom		Sample Number 1
Employer	The Coal Authority		Sample Type B
Description		Brown clayey gravelly SAND.	Specimen Depth 0.50m
			Specimen Number 2



Penetration	CBR values %			As received moisture content	30	%
	Top	Base	Accepted CBR	Moisture content - top	29	%
	2.50 mm	0.73	0.57	0.68		
5.00 mm	0.73	0.62		Moisture content - base	29	%
Curve correction				Bulk density	1.91	Mg/m ³
				Dry density	1.47	Mg/m ³

Seating load - top	10	N	Method of compaction	2.5kg rammer
Seating load - base	10	N		
Surcharge	5.5	kg	Curing period	3 Days
Gravel retained on 20mm sieve	11.4	%	Soaking period	4 Days
Gravel retained on 37.5mm sieve	4.7	%	Amount of swell	0.12 mm

General remarks Soaked, Surcharge 5.496kg.

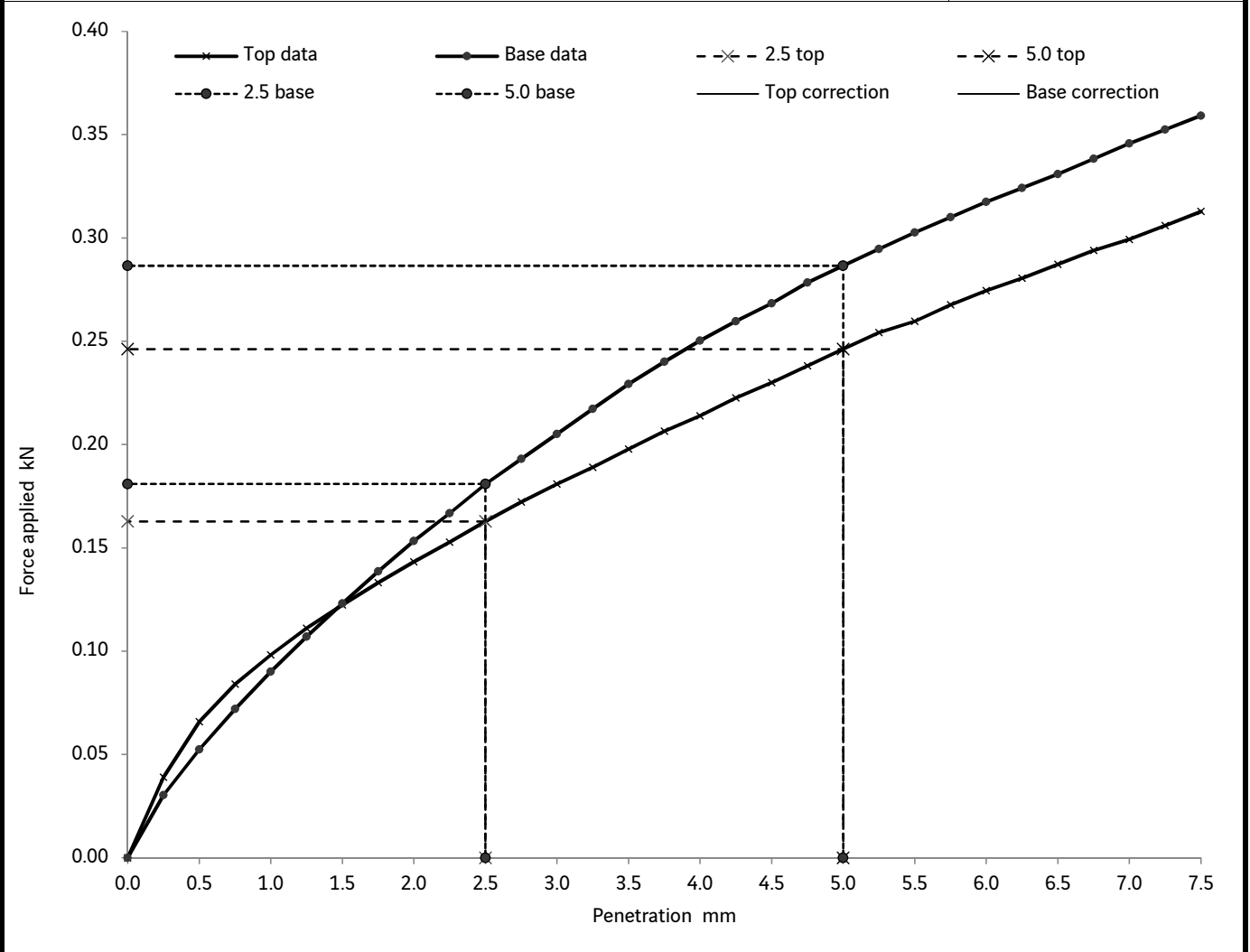
Approved by:			
Steve Harper			Print date 07/11/2019
Revision No.	2.03	Issue Date	20/11/2012
			Part of the Bachy Soletanche Group



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Project Name	Nenthead Mines - Proposed MWTS, GI	California Bearing Ratio Test	Hole ID	TP124
Project No.	TA8234		Sample Depth	0.50m
Engineer	Aecom		Sample Number	1
Employer	The Coal Authority		Sample Type	B
		BS1377: Part 4: 1990: 7.2.4 2.5kg compactive effort		

Description	Brown gravelly sandy CLAY.	Specimen Depth	0.50m
		Specimen Number	1



Penetration	CBR values %			As received moisture content	31	%
	Top	Base	Accepted CBR	Moisture content - top	30	%
2.50 mm	1.2	1.4	1.3	Moisture content - base	30	%
5.00 mm	1.2	1.4		Bulk density	1.90	Mg/m ³
Curve correction				Dry density	1.45	Mg/m ³

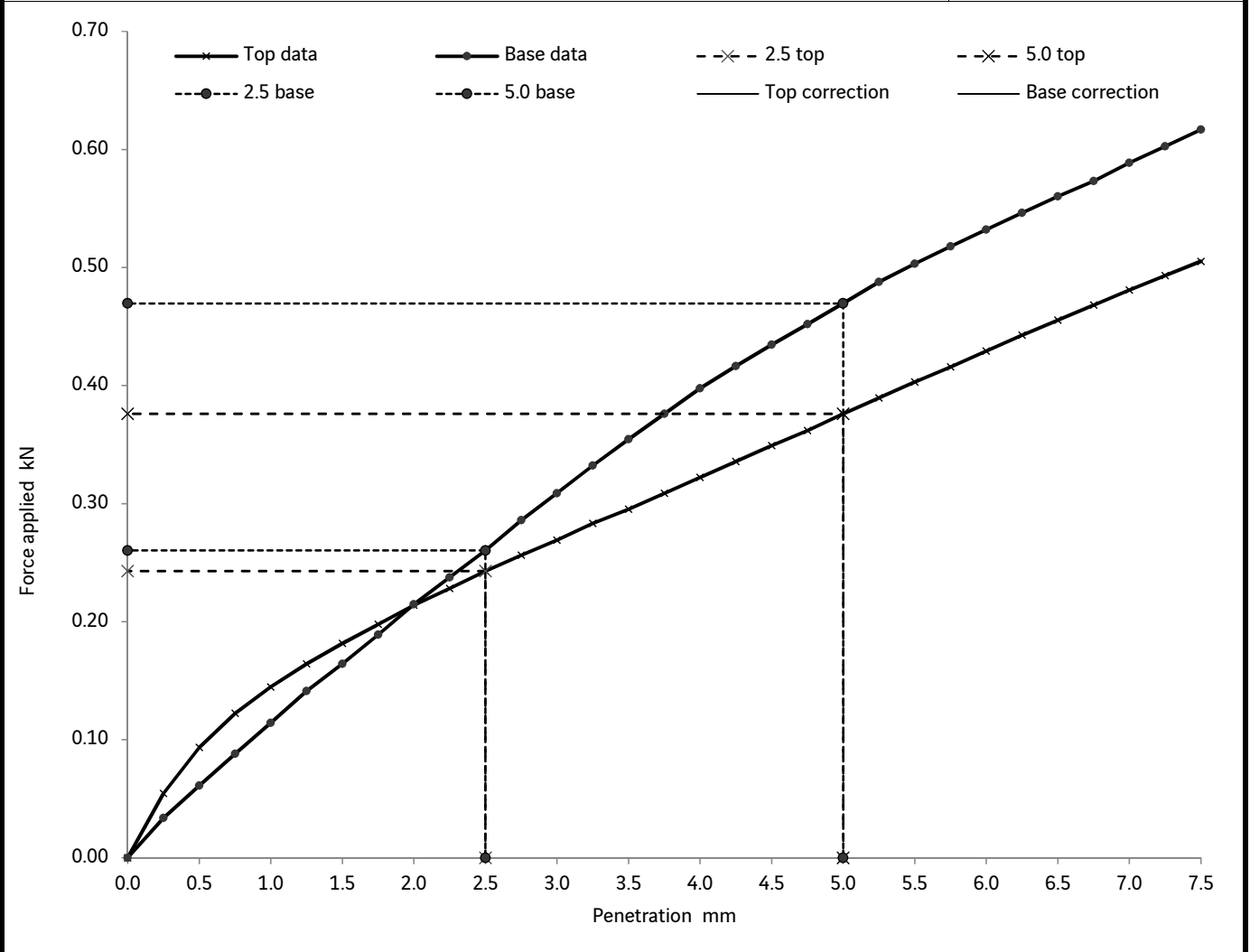
Seating load - top	10	N	Method of compaction	2.5kg rammer
Seating load - base	10	N	Curing period	3 Days
Surcharge	5.4	kg	Soaking period	4 Days
Gravel retained on 20mm sieve	8.1	%	Amount of swell	0.02 mm
Gravel retained on 37.5mm sieve	5.3	%		

General remarks Soaked, Surcharge 5.425kg.

Approved by:			
Steve Harper			Print date 07/11/2019
Revision No.	2.03	Issue Date	20/11/2012
			SOIL ENGINEERING Part of the Bachy Soletanche Group

Project Name	Nenthead Mines - Proposed MWTS, GI	California Bearing Ratio Test	Hole ID	TP125
Project No.	TA8234		Sample Depth	0.30m
Engineer	Aecom		Sample Number	3
Employer	The Coal Authority		Sample Type	B
			BS1377: Part 4: 1990: 7.2.4 2.5kg compactive effort	


Description	Brown sandy gravelly CLAY.	Specimen Depth	0.30m
		Specimen Number	2



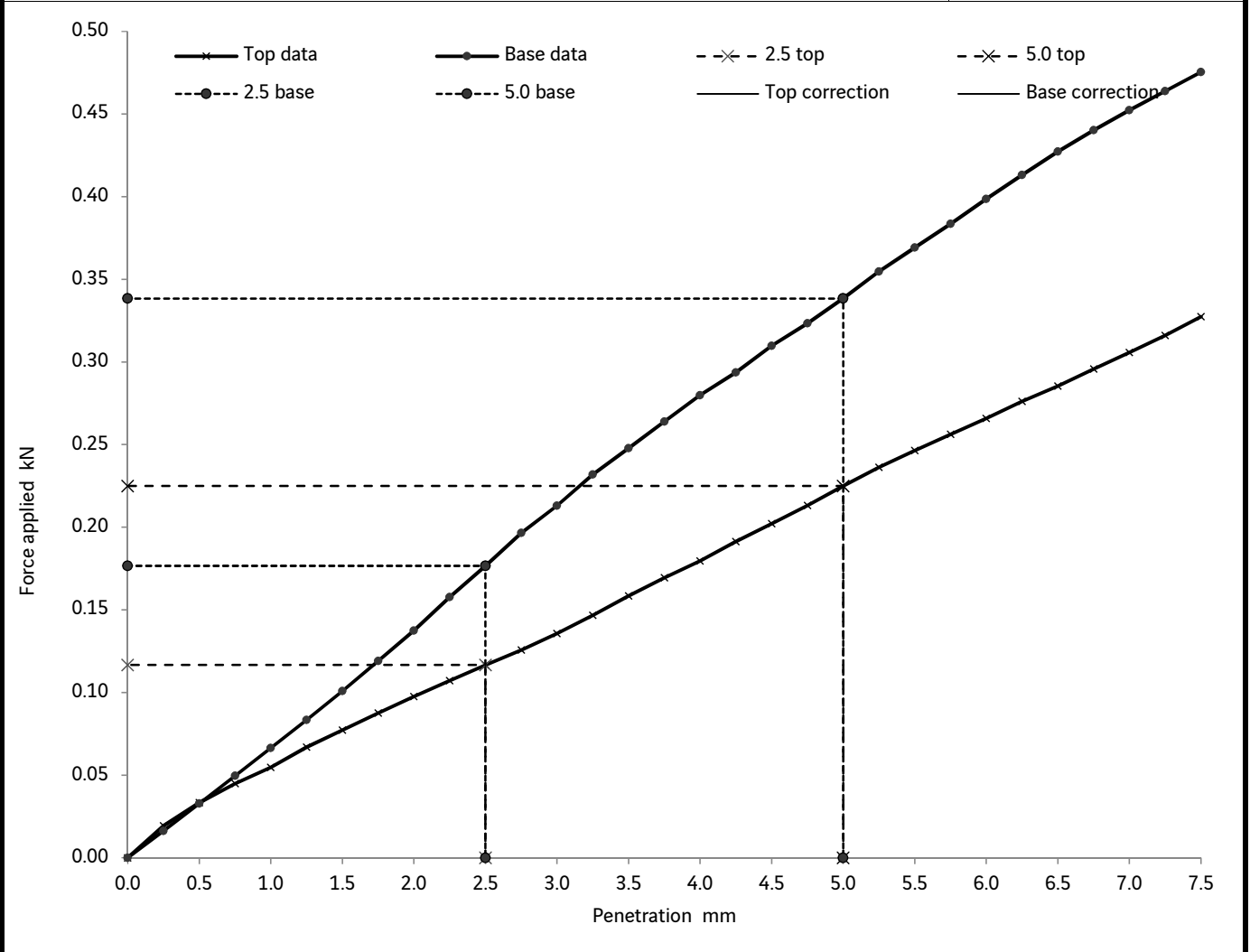
	CBR values %			As received moisture content	21	%
Penetration	Top	Base	Accepted CBR	Moisture content - top	20	%
2.50 mm	1.8	2	2.1	Moisture content - base	21	%
5.00 mm	1.9	2.3		Bulk density	2.05	Mg/m ³
Curve correction				Dry density	1.70	Mg/m ³

Seating load - top	10	N	Method of compaction	2.5kg rammer
Seating load - base	10	N	Curing period	3 Days
Surcharge	5.4	kg	Soaking period	4 Days
Gravel retained on 20mm sieve	14.6	%	Amount of swell	-0.03 mm
Gravel retained on 37.5mm sieve	12.2	%		

General remarks Soaked, Surcharge 5.393kg. Test performed on specimen unsuitable due to gravel content.

Approved by:			 SOIL ENGINEERING
Steve Harper		Print date 07/11/2019	
Revision No.	2.03	Issue Date	20/11/2012
			Part of the Bachy Soletanche Group

Project Name	Nenthead Mines - Proposed MWTS, GI	California Bearing Ratio Test	Hole ID	TP126
Project No.	TA8234		Sample Depth	0.50m
Engineer	Aecom		Sample Number	1
Employer	The Coal Authority		Sample Type	B
Description		Brown sandy gravelly CLAY.	Specimen Depth	0.50m
			Specimen Number	1



	CBR values %			As received moisture content	26	%
Penetration	Top	Base	Accepted CBR	Moisture content - top	25	%
2.50 mm	0.88	1.3	N/A	Moisture content - base	24	%
5.00 mm	1.1	1.7		Bulk density	2.00	Mg/m ³
Curve correction				Dry density	1.60	Mg/m ³

Seating load - top	10	N	Method of compaction	2.5kg rammer
Seating load - base	10	N		
Surcharge	5.2	kg		
Gravel retained on 20mm sieve	11	%		
Gravel retained on 37.5mm sieve	4.1	%		

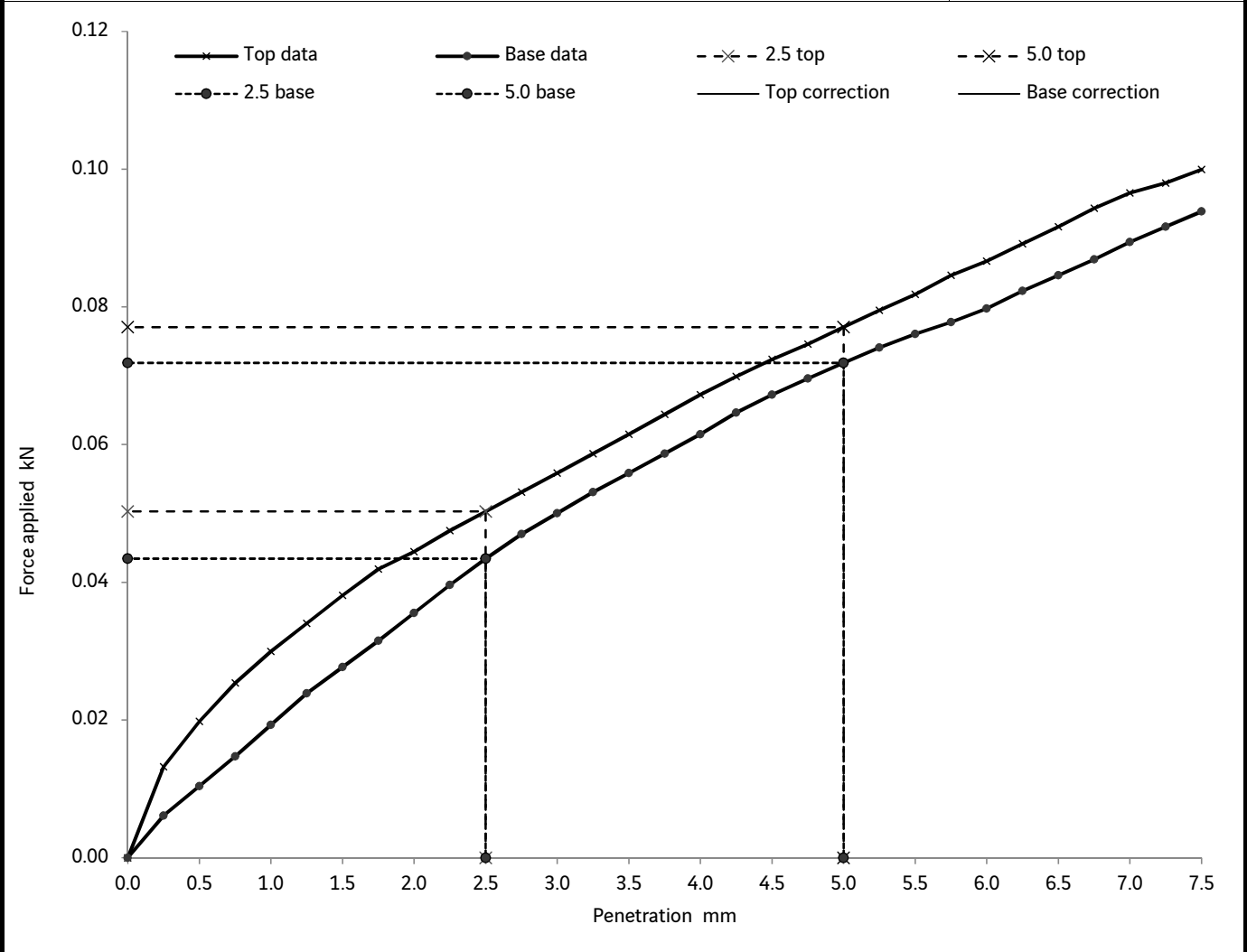
General remarks Unsoaked, Surcharge 5.182kg.

Approved by:				
Steve Harper			Print date	
Revision No.	2.03	Issue Date	20/11/2012	
				Part of the Bachy Soletanche Group

Project Name	Nenthead Mines - Proposed MWTS, GI	California Bearing Ratio Test	Hole ID	TP127
Project No.	TA8234		Sample Depth	0.50m
Engineer	Aecom		Sample Number	1
Employer	The Coal Authority		Sample Type	B
Description			Brown slightly sandy gravelly CLAY with medium cobble cntent.	

BS1377: Part 4: 1990: 7.2.4 4.5kg compactive effort

Description		Specimen Depth	0.50m
		Specimen Number	2



Penetration	CBR values %			As received moisture content	26	%
	Top	Base	Accepted CBR	Moisture content - top	26	%
2.50 mm	0.38	0.33	0.38	Moisture content - base	26	%
5.00 mm	0.39	0.36		Bulk density	1.96	Mg/m ³
Curve correction				Dry density	1.56	Mg/m ³

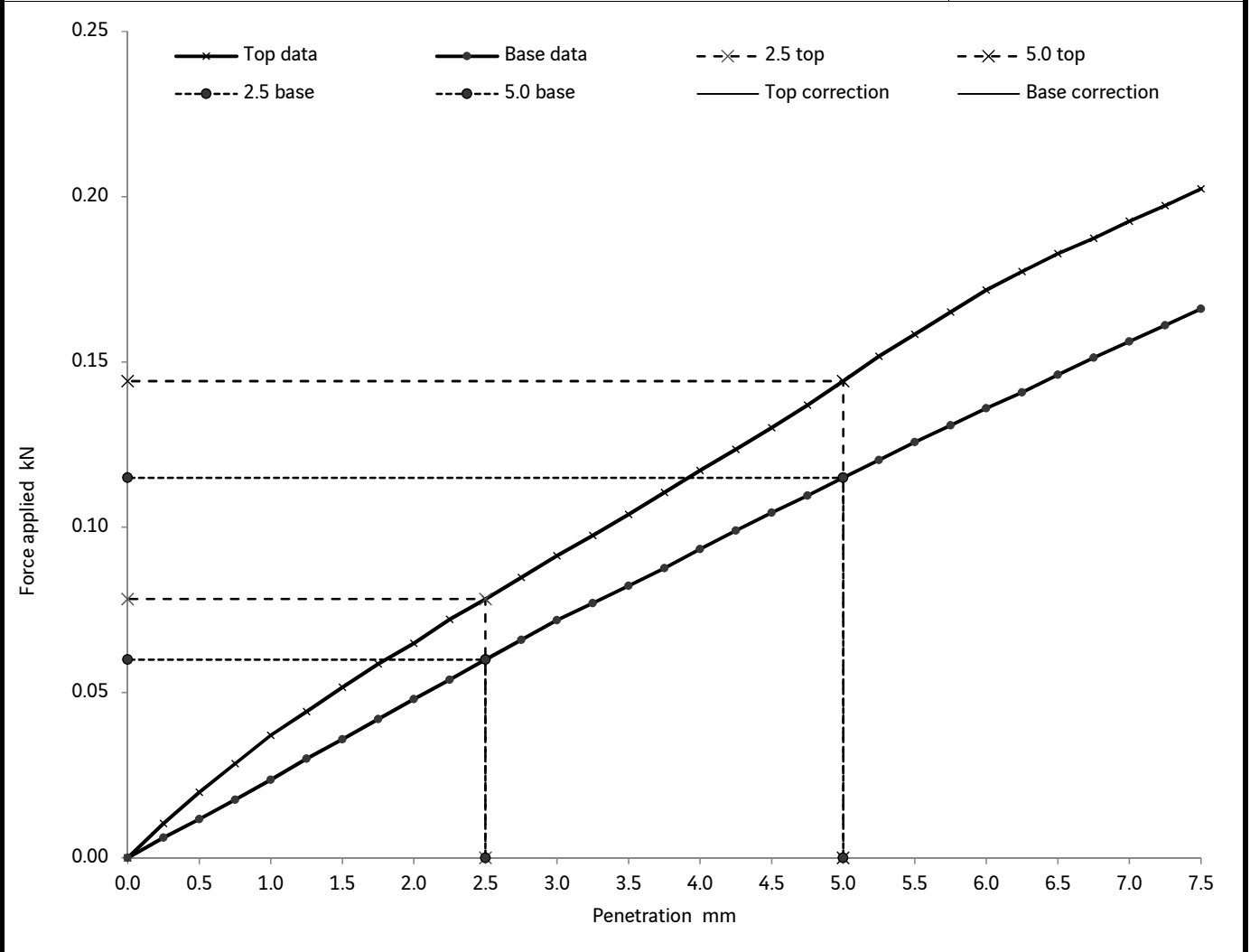
Seating load - top	10	N	Method of compaction	4.5kg rammer
Seating load - base	10	N		
Surcharge	5.2	kg		
Gravel retained on 20mm sieve	40.8	%		
Gravel retained on 37.5mm sieve	33.1	%		

General remarks Unsoaked, Surcharge 5.188kg. Test performed on specimen unsuitable due to gravel content.

Approved by:			
Steve Harper		Print date 07/11/2019	
Revision No.	2.03	Issue Date	20/11/2012
			Part of the Bachy Soletanche Group

Project Name	Nenthead Mines - Proposed MWTS, GI	California Bearing Ratio Test	Hole ID	TP128
Project No.	TA8234		Sample Depth	0.50m
Engineer	Aecom		Sample Number	1
Employer	The Coal Authority		Sample Type	B
		BS1377: Part 4: 1990: 7.2.4 2.5kg compactive effort		


Description	Brown gravelly slightly sandy CLAY.	Specimen Depth	0.50m
		Specimen Number	2



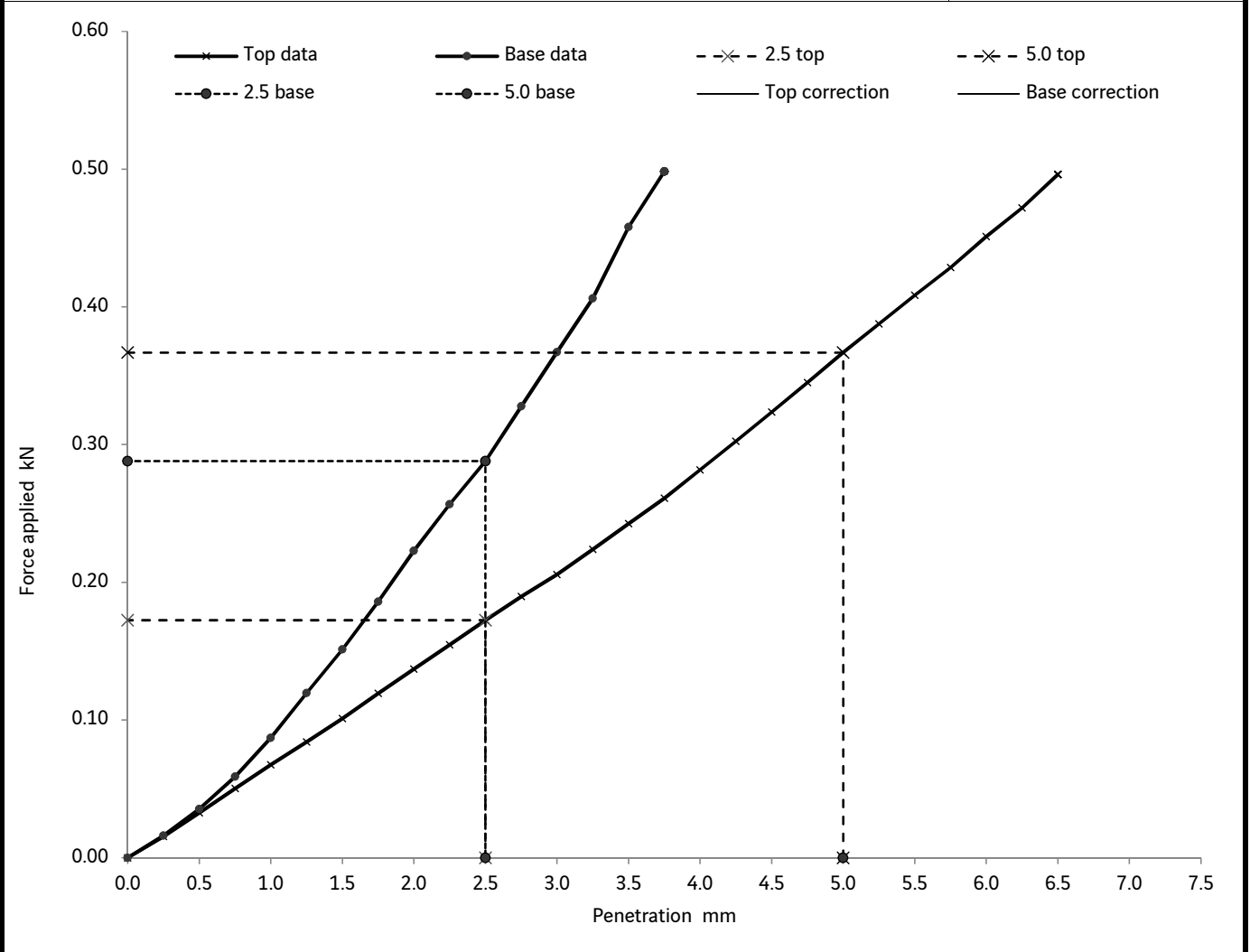
	CBR values %			As received moisture content	31	%
Penetration	Top	Base	Accepted CBR	Moisture content - top	33	%
2.50 mm	0.59	0.45	N/A	Moisture content - base	31	%
5.00 mm	0.72	0.57		Bulk density	1.84	Mg/m ³
Curve correction				Dry density	1.40	Mg/m ³

Seating load - top	10	N	Method of compaction	2.5kg rammer
Seating load - base	10	N		
Surcharge	4.2	kg		
Gravel retained on 20mm sieve	33.8	%		
Gravel retained on 37.5mm sieve	22	%		

General remarks Unsoaked, Surcharge 4.183kg. Test performed on specimen unsuitable due to gravel content.

Approved by:			 SOIL ENGINEERING
Steve Harper		Print date	
Revision No.	2.03	Issue Date	20/11/2012
			Part of the Bachy Soletanche Group

Project Name	Nenthead Mines - Proposed MWTS, GI	California Bearing Ratio Test	Hole ID	WSTP105
Project No.	TA8234		Sample Depth	0.20m
Engineer	Aecom		Sample Number	3
Employer	The Coal Authority		Sample Type	B
Description		Brown clayey gravelly SAND.	Specimen Depth	0.20m
			Specimen Number	1



Penetration	CBR values %			As received moisture content	11	%
	Top	Base	Accepted CBR	Moisture content - top	12	%
	2.50 mm	1.3	2.2	N/A		
5.00 mm	1.8			Moisture content - base	11	%
Curve correction				Bulk density	2.29	Mg/m ³
				Dry density	2.06	Mg/m ³
Seating load - top		10	N	Method of compaction	4.5kg rammer	
Seating load - base		10	N	Curing period	3 Days	
Surcharge		5.4	kg	Soaking period	4 Days	
Gravel retained on 20mm sieve		27.3	%	Amount of swell	-0.24 mm	
Gravel retained on 37.5mm sieve		17.2	%			

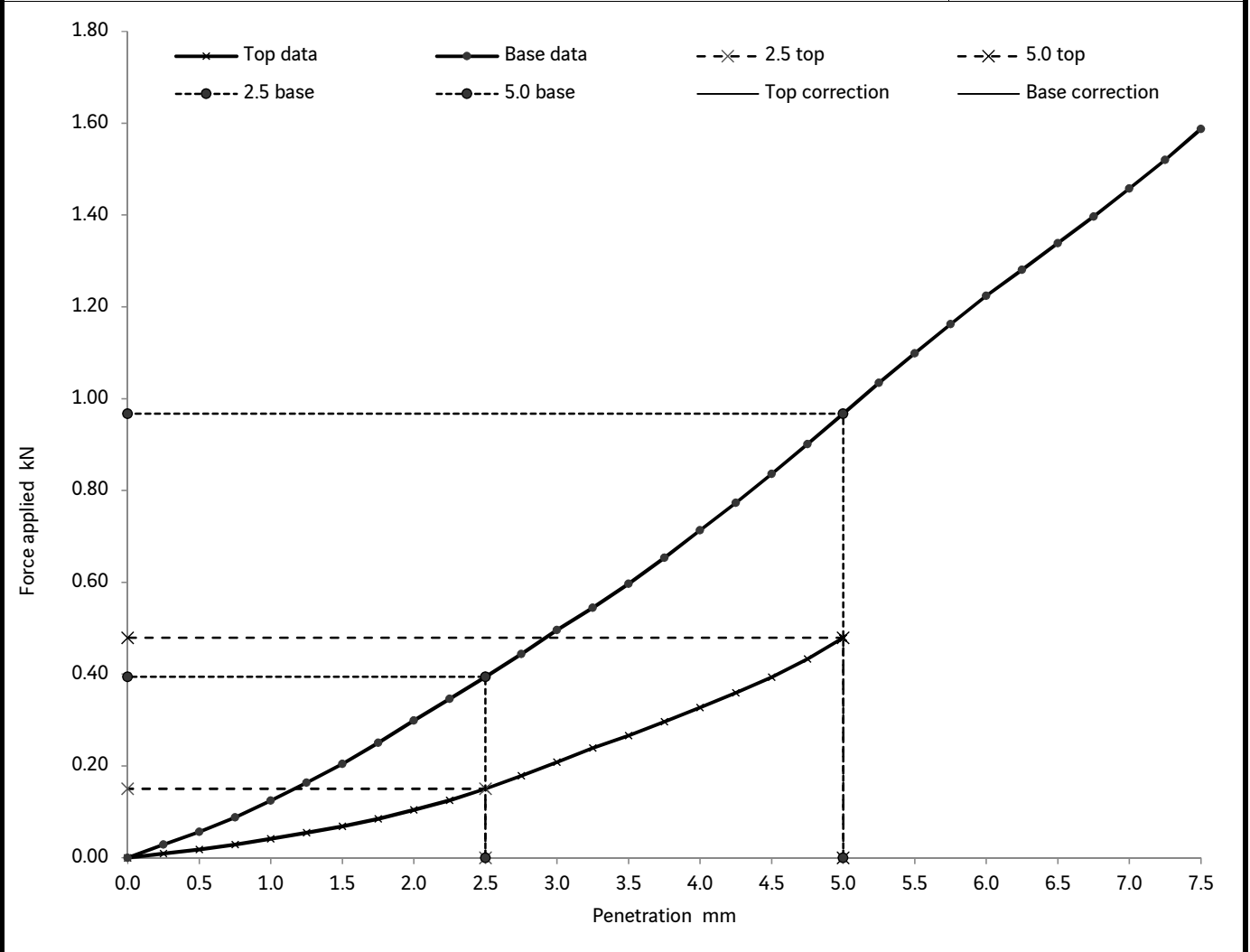
General remarks Soaked, Surcharge 5.436kg. Test performed on specimen unsuitable due to gravel content.

Approved by:			
Steve Harper			Print date 07/11/2019
Revision No.	2.03	Issue Date	20/11/2012
			Part of the Bachy Soletanche Group



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Project Name	Nenthead Mines - Proposed MWTS, GI	California Bearing Ratio Test	Hole ID	WSTP107
Project No.	TA8234		Sample Depth	0.20m
Engineer	Aecom		Sample Number	3
Employer	The Coal Authority		Sample Type	B
Description		Brown clayey gravelly SAND.	Specimen Depth	0.20m
			Specimen Number	1



	CBR values %			As received moisture content	13	%
Penetration	Top	Base	Accepted CBR	Moisture content - top	13	%
2.50 mm	1.1	3	N/A	Moisture content - base	13	%
5.00 mm	2.4	4.8		Bulk density	2.29	Mg/m ³
Curve correction				Dry density	2.02	Mg/m ³

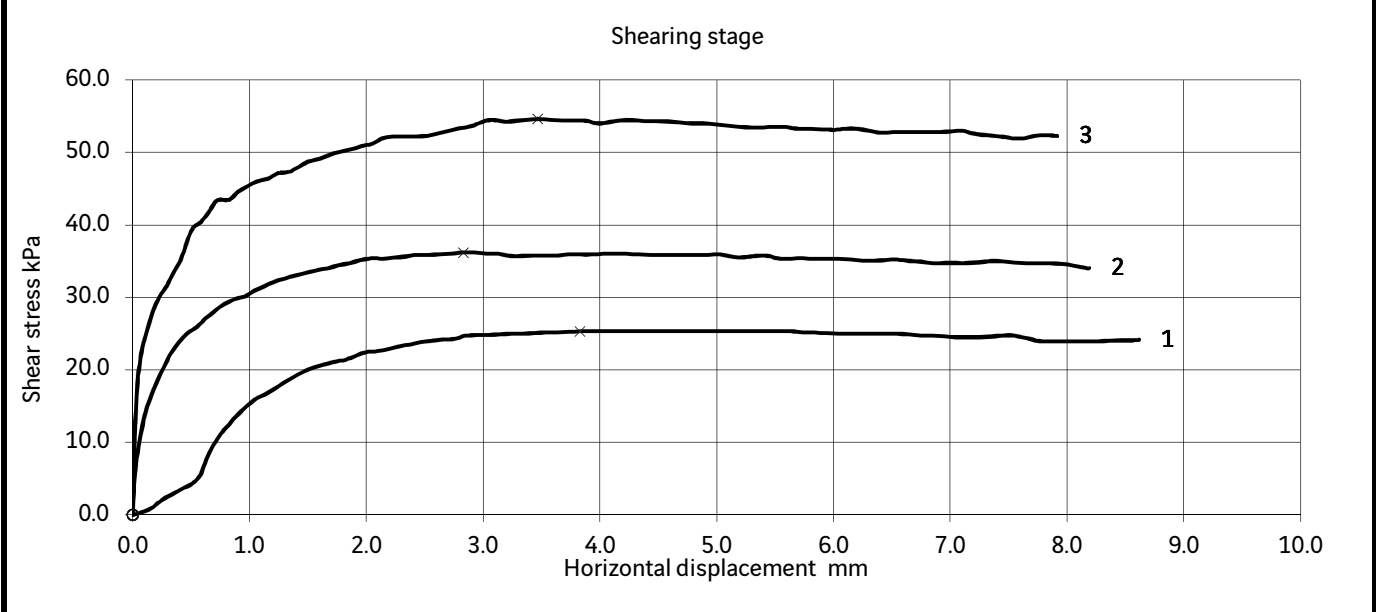
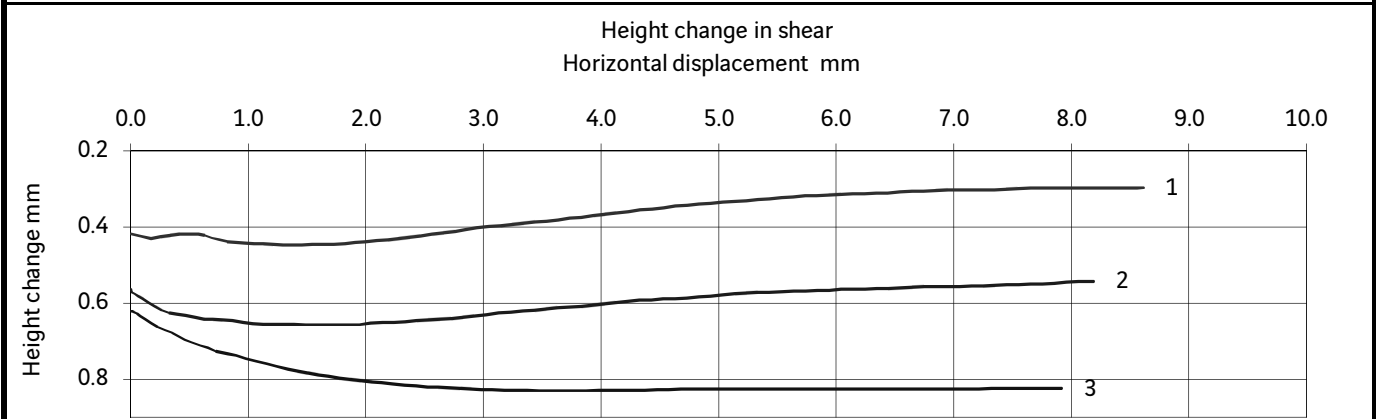
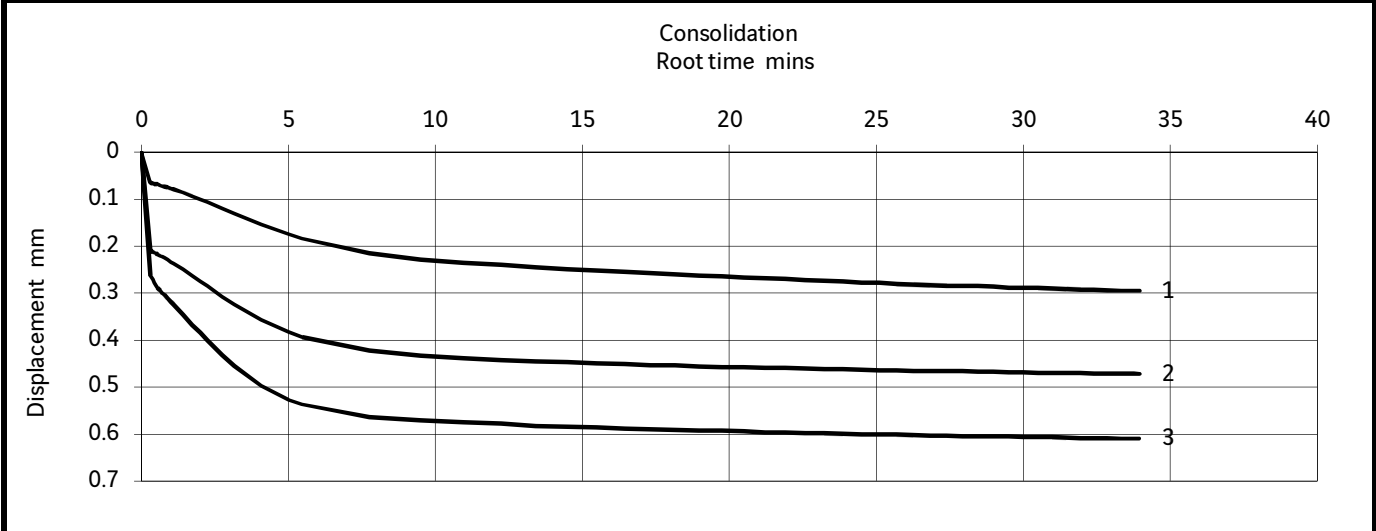
Seating load - top	10	N	Method of compaction	2.5kg rammer
Seating load - base	10	N		
Surcharge	5.2	kg		
Gravel retained on 20mm sieve	9.5	%		
Gravel retained on 37.5mm sieve	0	%		


General remarks Unsoaked, Surcharge 5.182kg.

Approved by:				 SOIL ENGINEERING
Steve Harper			Print date 07/11/2019	
Revision No.	2.03	Issue Date	20/11/2012	Part of the Bachy Soletanche Group

Project Name	Nenthead Mines - Proposed MWTS, GI	Shear Strength Using The Small Shearbox	Hole ID BH106
Project No.	TA8234		Sample Depth 2.50m
Engineer	Aecom		Sample Number 10
Employer	The Coal Authority		Sample Type B
Description		Brown gravelly sandy CLAY.	Specimen Depth 2.50m
			Specimen Number 2

BS1377: Part 7: 1990: Clause 4



Approved by:	Leeds Laboratory		 SOIL ENGINEERING
Steve Harper		Print date 07/11/2019	
Revision No.	3.02	Issue Date	21/11/2012
			Part of the Bachy Soletanche Group

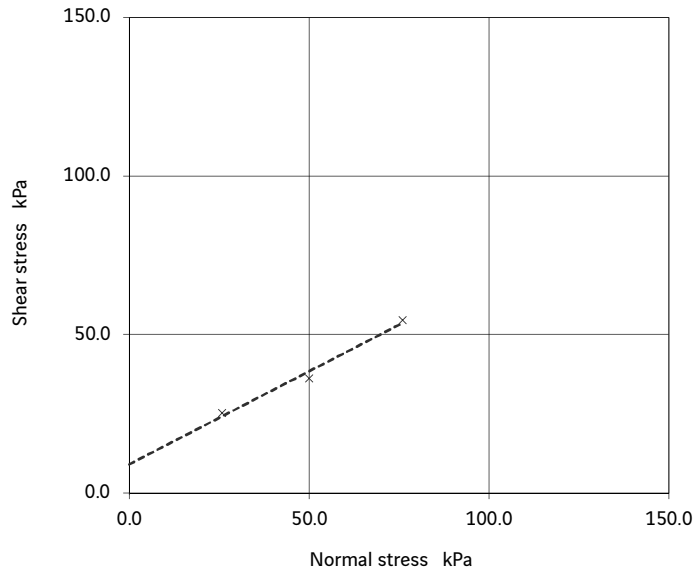
Project Name	Nenthead Mines - Proposed MWTS, GI	Shear Strength Using The Small Shearbox	Hole ID BH106
Project No.	TA8234		Sample Depth 2.50m
Engineer	Aecom		Sample Number 10
Employer	The Coal Authority		Sample Type B
Description		Brown gravelly sandy CLAY.	Specimen Depth 2.50m
			Specimen Number 2

BS1377: Part 7: 1990: Clause 4

Coulomb envelope

Peak

c' 9 kPa
φ' 30 1/2 °




× Peak shear strength

○ Residual shear strength

Test run number		1	2	3
Normal stress	kPa	25.8	50.0	75.9
Particle density	Assumed Mg/m ³	2.65	2.65	2.65
Trimings moisture content	%	18.4	18.4	18.4
Moisture content of specimen before test	%	19	19	19
Moisture content of specimen after test	%	18	17	17
Specimen dimensions				
Side 1	mm	59.98	60.04	60.02
Side 2	mm	59.96	60.02	59.98
Height	mm	22.28	21.80	22.08
Bulk density	Mg/m ³	2.13	2.17	2.15
Dry density	Mg/m ³	1.79	1.83	1.81
Saturation	%	106.8	111.1	107.4
Initial voids ratio		0.48	0.45	0.47
Voids ratio after consolidation		0.46	0.42	0.42
Voids ratio after shear		0.46	0.41	0.41
Rate of displacement	mm/min	0.024	0.024	0.024
Displacement at peak	mm	3.8	2.8	3.5
Shear strength at peak	kPa	25.3	36.2	54.6
Displacement at residual	mm			
Shear strength at residual	kPa			
Final displacement	mm	8.6	8.2	7.9

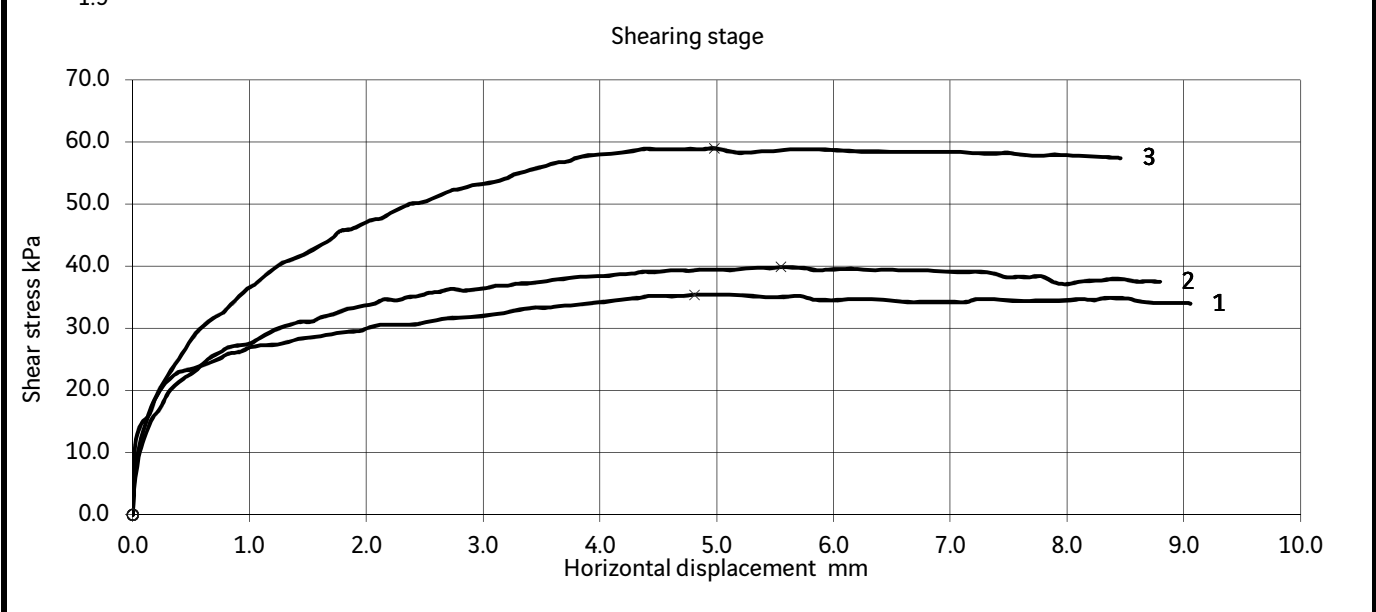
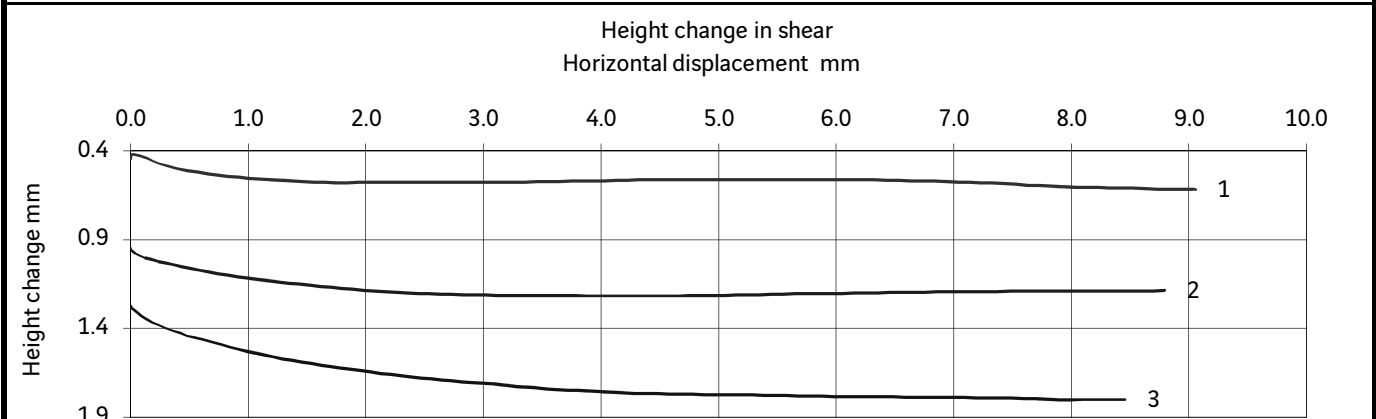
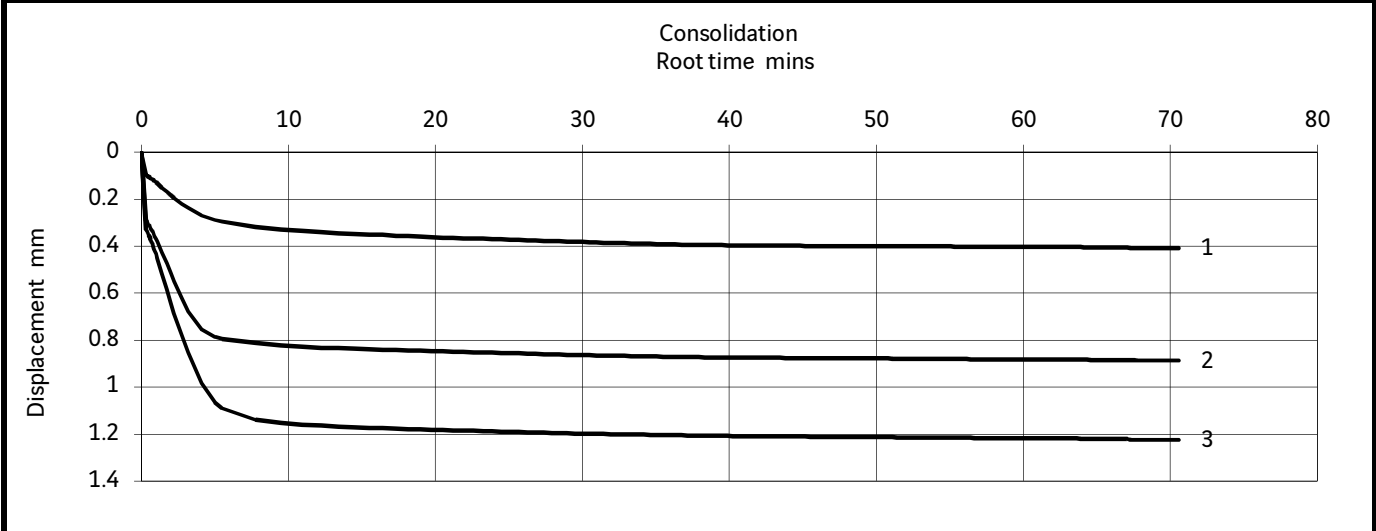
Method of reversal Peak only


Remarks Specimen tested submerged.
Specimen lightly tamped into shearbox.

Approved by:	Leeds Laboratory		 SOIL ENGINEERING
Steve Harper		Print date 07/11/2019	
Revision No.	3.02	Issue Date	21/11/2012
			Part of the Bachy Soletanche Group

Project Name	Nenthead Mines - Proposed MWTS, GI	Shear Strength Using The Small Shearbox	Hole ID TP116
Project No.	TA8234		Sample Depth 0.50m
Engineer	Aecom		Sample Number 1
Employer	The Coal Authority		Sample Type B
Description		Brown gravelly sandy CLAY.	Specimen Depth 0.50m
			Specimen Number 1

BS1377: Part 7: 1990: Clause 4



Approved by:	Leeds Laboratory		 SOIL ENGINEERING
Steve Harper		Print date 07/11/2019	
Revision No.	3.02	Issue Date	21/11/2012
			Part of the Bachy Soletanche Group

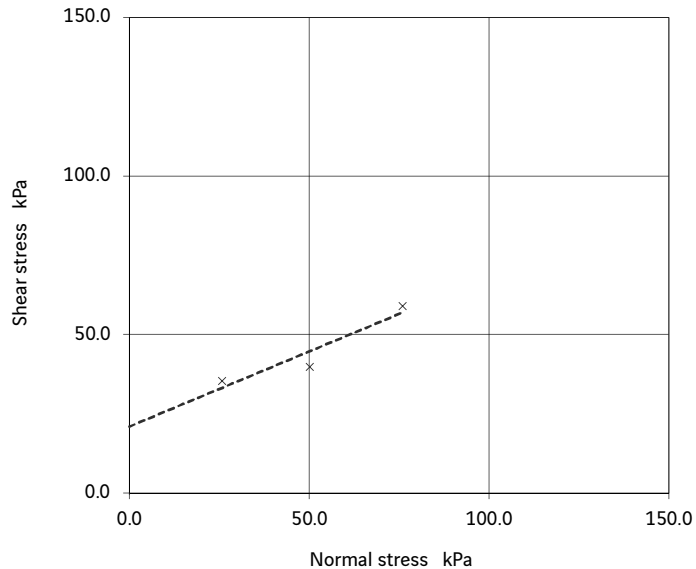
Project Name	Nenthead Mines - Proposed MWTS, GI	Shear Strength Using The Small Shearbox	Hole ID	TP116
Project No.	TA8234		Sample Depth	0.50m
Engineer	Aecom		Sample Number	1
Employer	The Coal Authority		Sample Type	B
Description		Brown gravelly sandy CLAY.	Specimen Depth	0.50m
			Specimen Number	1

BS1377: Part 7: 1990: Clause 4

Coulomb envelope

Peak

c' 21 kPa
φ' 25 1/2 °




× Peak shear strength

○ Residual shear strength

Test run number		1	2	3
Normal stress	kPa	25.8	50.1	76.0
Particle density	Assumed Mg/m ³	2.65	2.65	2.65
Trimings moisture content	%	33	33.2	33
Moisture content of specimen before test	%	35	34	34
Moisture content of specimen after test	%	31	30	28
Specimen dimensions				
Side 1	mm	59.98	59.94	59.96
Side 2	mm	59.98	59.98	60.02
Height	mm	24.16	24.36	24.22
Bulk density	Mg/m ³	1.91	1.89	1.90
Dry density	Mg/m ³	1.41	1.41	1.41
Saturation	%	105.3	102.4	103.6
Initial voids ratio		0.87	0.88	0.88
Voids ratio after consolidation		0.84	0.81	0.78
Voids ratio after shear		0.83	0.79	0.74
Rate of displacement	mm/min	0.024	0.024	0.024
Displacement at peak	mm	4.8	5.6	5.0
Shear strength at peak	kPa	35.4	39.9	59.0
Displacement at residual	mm			
Shear strength at residual	kPa			
Final displacement	mm	9.1	8.8	8.5

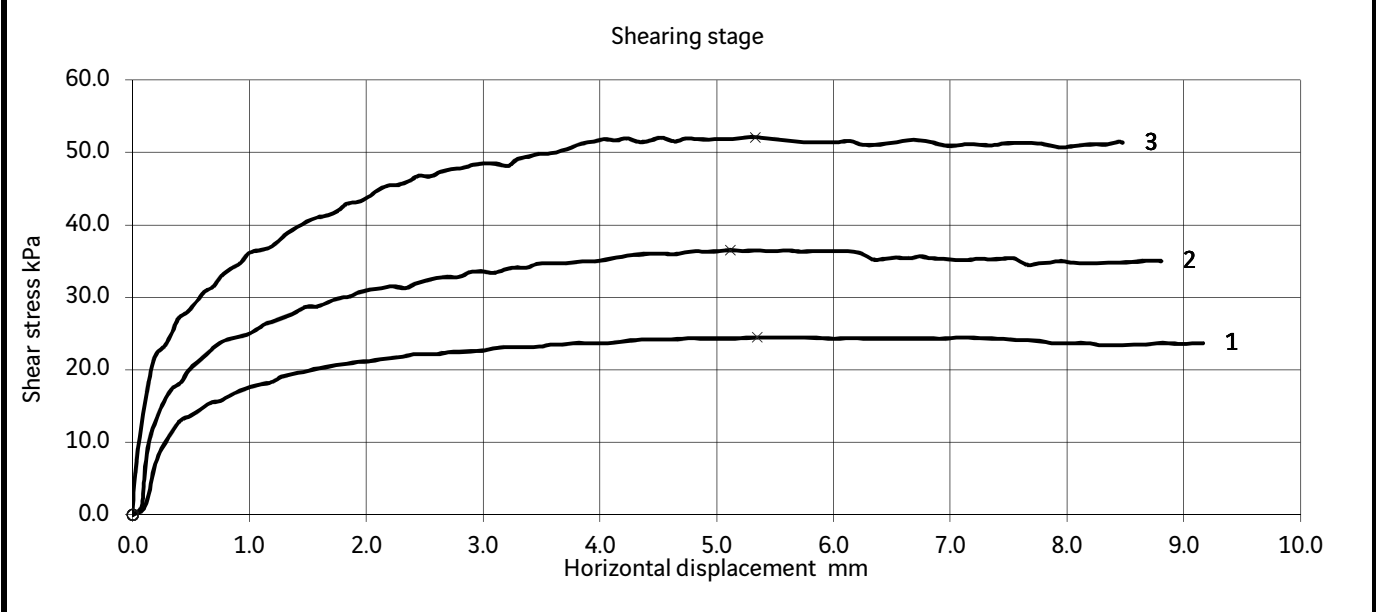
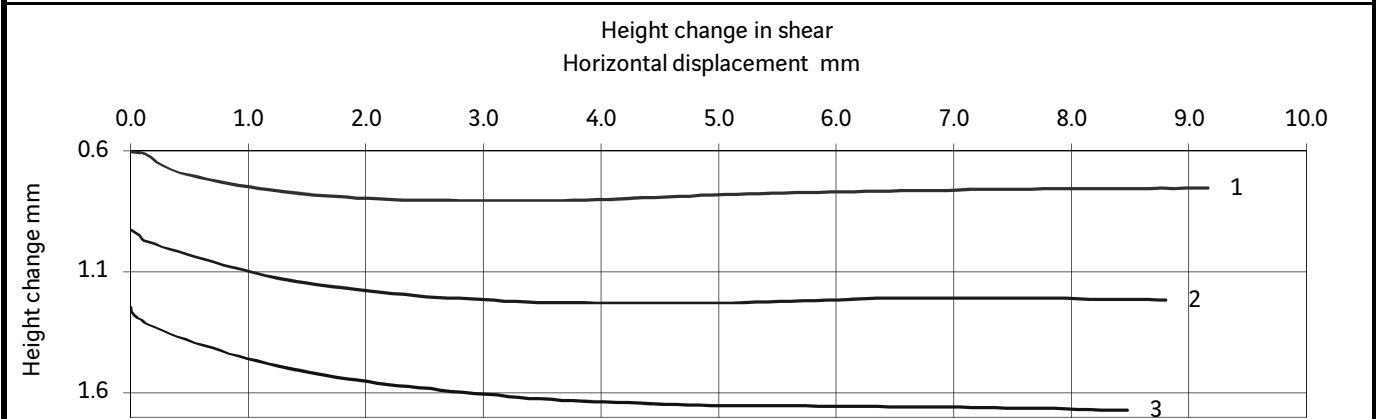
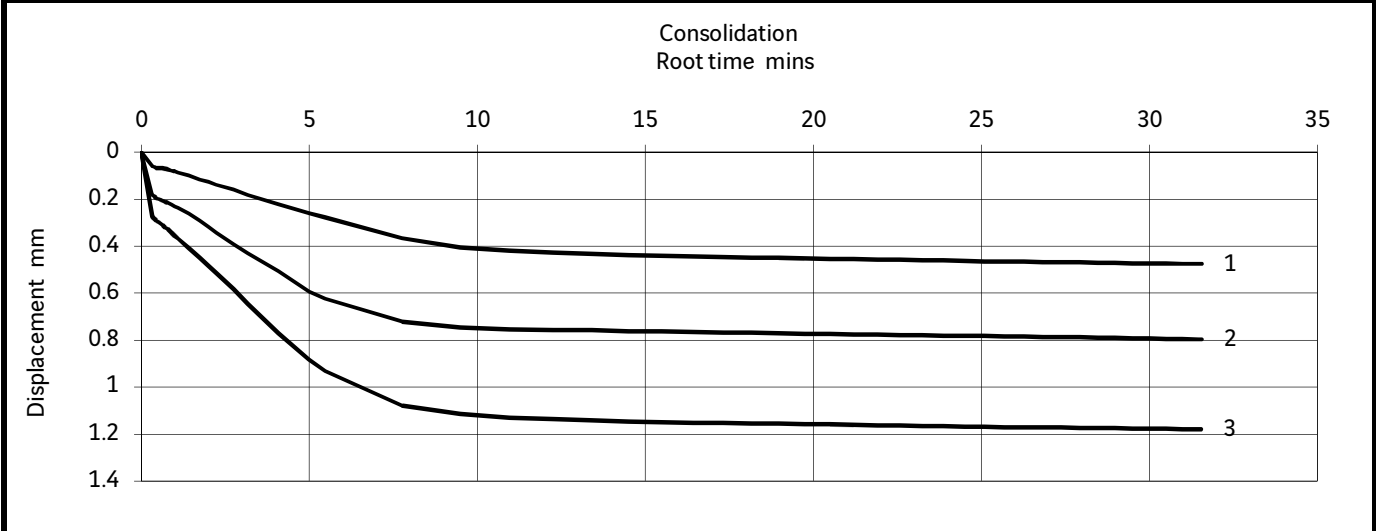
Method of reversal Peak only


Remarks Specimen tested submerged.
Specimen lightly tamped into shearbox.

Approved by:	Leeds Laboratory		 SOIL ENGINEERING
Steve Harper		Print date 07/11/2019	
Revision No.	3.02	Issue Date	21/11/2012
			Part of the Bachy Soletanche Group

Project Name	Nenthead Mines - Proposed MWTS, GI	Shear Strength Using The Small Shearbox	Hole ID TP117
Project No.	TA8234		Sample Depth 0.50m
Engineer	Aecom		Sample Number 1
Employer	The Coal Authority		Sample Type B
Description		Brown gravelly sandy CLAY.	Specimen Depth 0.50m
			Specimen Number 1

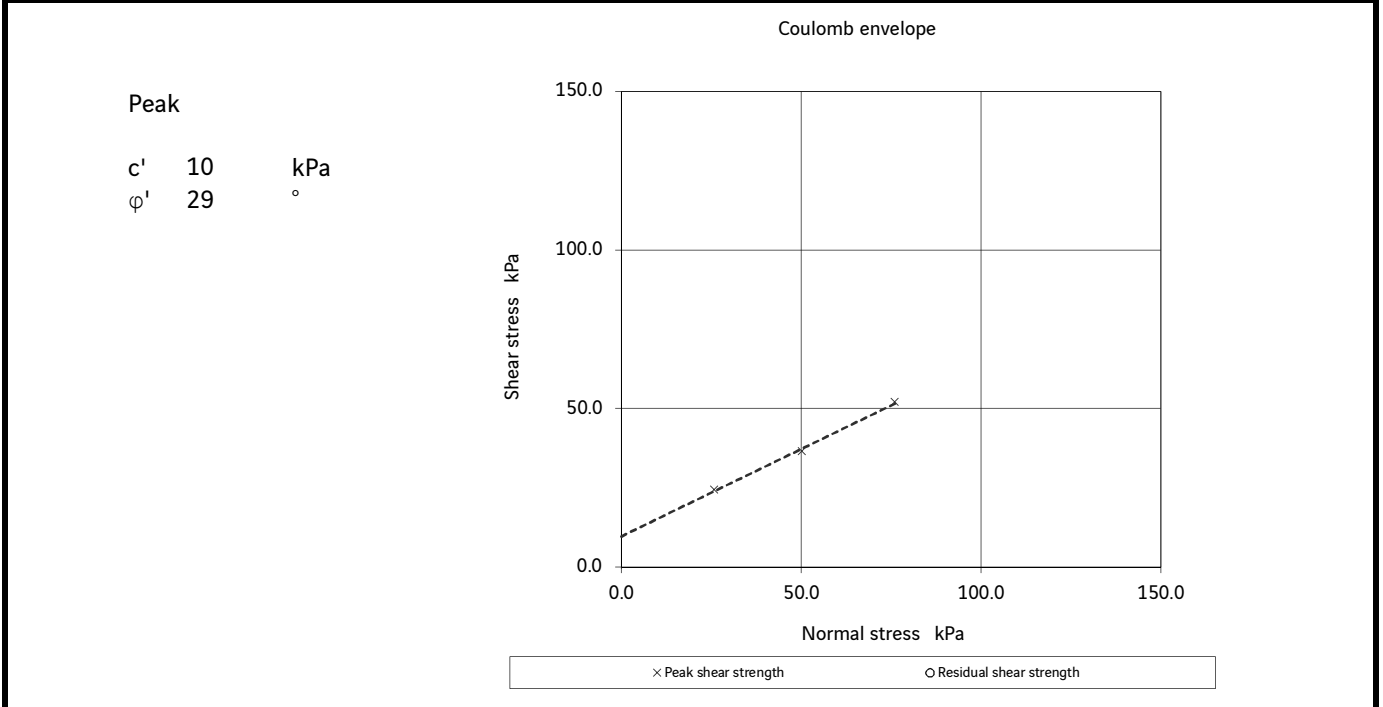
BS1377: Part 7: 1990: Clause 4



Approved by:	Leeds Laboratory		 SOIL ENGINEERING
Steve Harper		Print date 07/11/2019	
Revision No.	3.02	Issue Date	21/11/2012
			Part of the Bachy Soletanche Group


Project Name	Nenthead Mines - Proposed MWTS, GI	Shear Strength Using The Small Shearbox	Hole ID TP117
Project No.	TA8234		Sample Depth 0.50m
Engineer	Aecom		Sample Number 1
Employer	The Coal Authority		Sample Type B
Description		Brown gravelly sandy CLAY.	Specimen Depth 0.50m
			Specimen Number 1

BS1377: Part 7: 1990: Clause 4



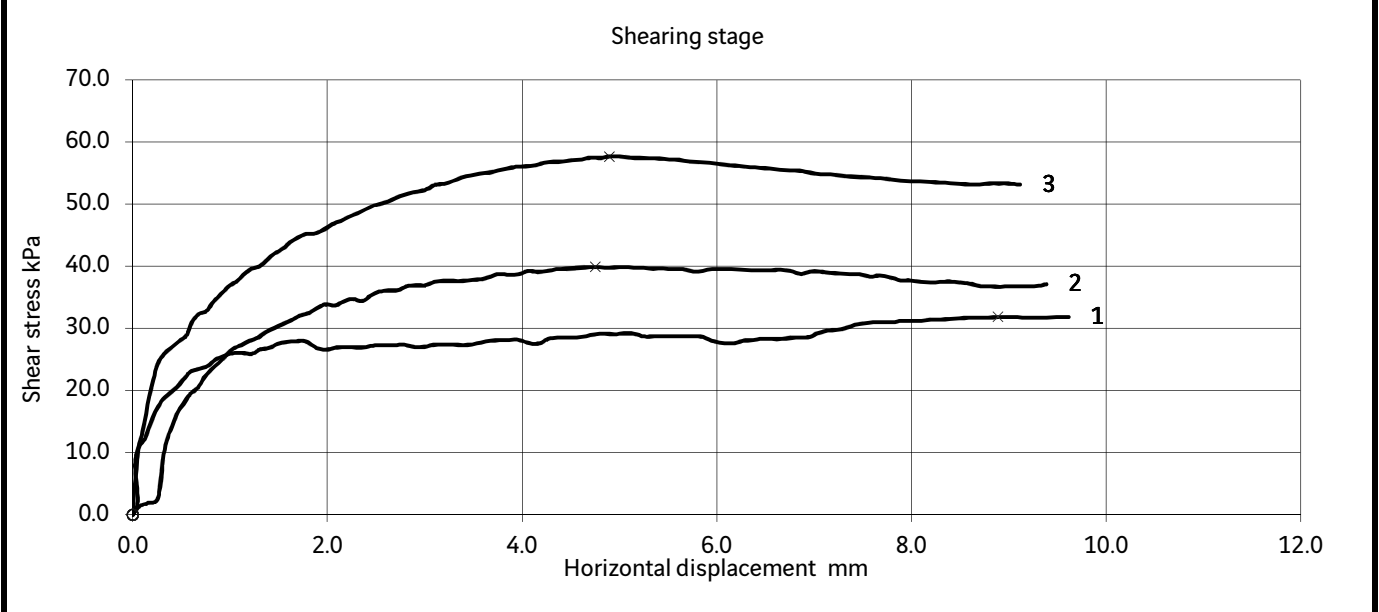
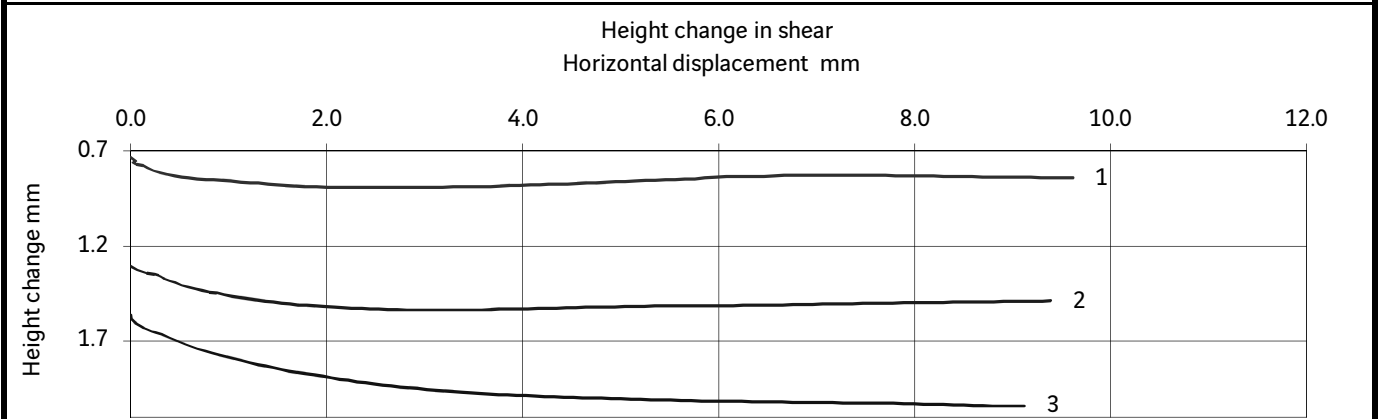
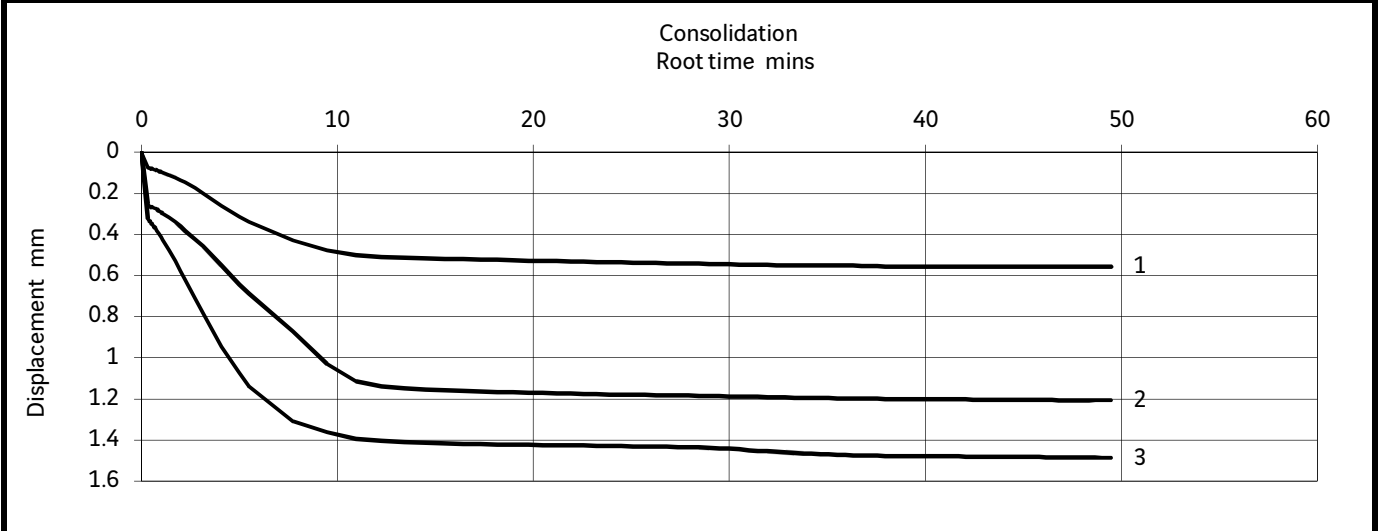
Test run number		1	2	3
Normal stress	kPa	25.8	50.1	76.0
Particle density	Assumed Mg/m ³	2.65	2.65	2.65
Trimings moisture content	%	27.2	27.2	27.2
Moisture content of specimen before test	%	29	29	28
Moisture content of specimen after test	%	27	25	24
Specimen dimensions				
Side 1	mm	59.98	59.94	59.96
Side 2	mm	59.98	59.98	60.02
Height	mm	23.76	23.64	23.70
Bulk density	Mg/m ³	1.94	1.95	1.95
Dry density	Mg/m ³	1.50	1.52	1.52
Saturation	%	100.7	101.7	99.1
Initial voids ratio		0.77	0.75	0.74
Voids ratio after consolidation		0.73	0.69	0.65
Voids ratio after shear		0.71	0.66	0.62
Rate of displacement	mm/min	0.024	0.024	0.024
Displacement at peak	mm	5.4	5.1	5.3
Shear strength at peak	kPa	24.5	36.5	52.1
Displacement at residual	mm			
Shear strength at residual	kPa			
Final displacement	mm	9.2	8.8	8.5
Method of reversal				Peak only


Remarks Specimen tested submerged.
Specimen lightly tamped into shearbox.

Approved by:	Leeds Laboratory		 SOIL ENGINEERING	
Steve Harper		Print date 07/11/2019		
Revision No.	3.02	Issue Date	21/11/2012	Part of the Bachy Soletanche Group

Project Name	Nenthead Mines - Proposed MWTS, GI	Shear Strength Using The Small Shearbox	Hole ID TP118
Project No.	TA8234		Sample Depth 0.50m
Engineer	Aecom		Sample Number 1
Employer	The Coal Authority		Sample Type B
Description		Brown gravelly sandy CLAY.	Specimen Depth 0.50m
			Specimen Number 1

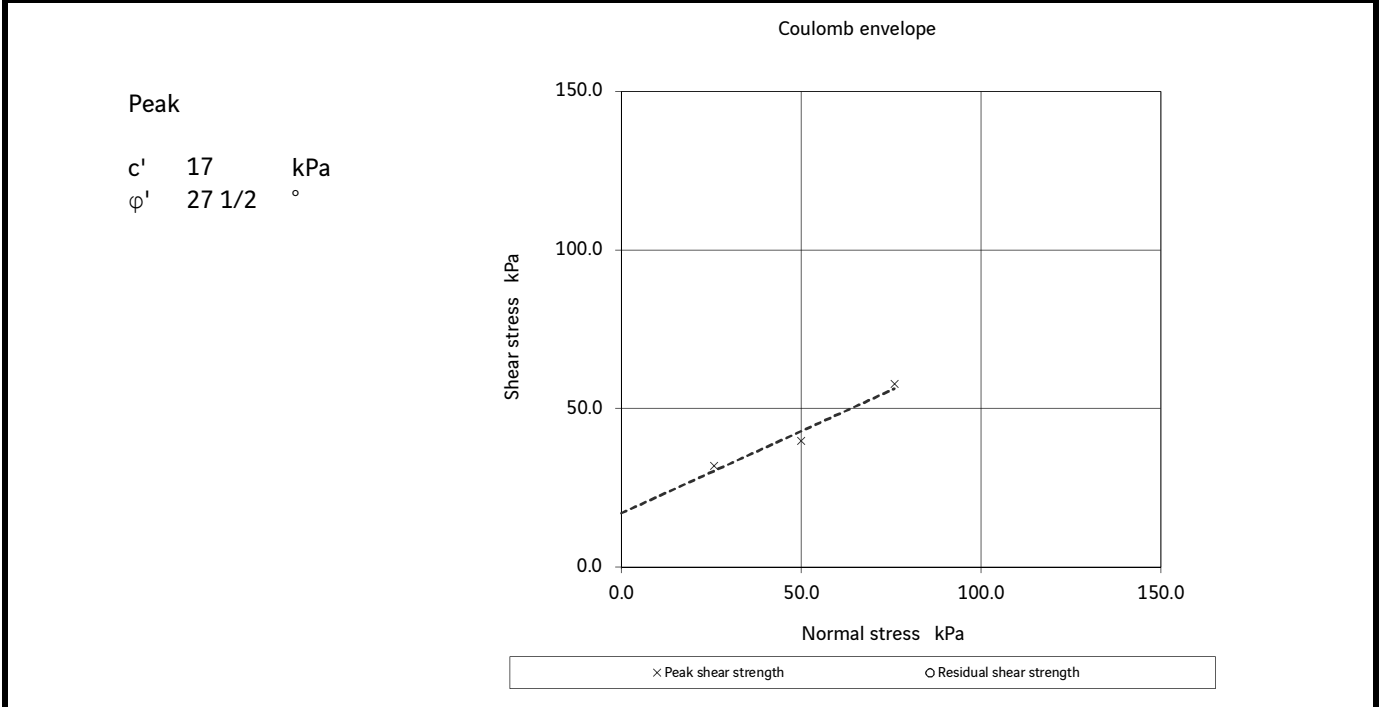
BS1377: Part 7: 1990: Clause 4



Approved by:	Leeds Laboratory		 SOIL ENGINEERING
Steve Harper		Print date 07/11/2019	
Revision No.	3.02	Issue Date	21/11/2012
			Part of the Bachy Soletanche Group


Project Name	Nenthead Mines - Proposed MWTS, GI	Shear Strength Using The Small Shearbox	Hole ID TP118
Project No.	TA8234		Sample Depth 0.50m
Engineer	Aecom		Sample Number 1
Employer	The Coal Authority		Sample Type B
Description		Brown gravelly sandy CLAY.	Specimen Depth 0.50m
			Specimen Number 1

BS1377: Part 7: 1990: Clause 4

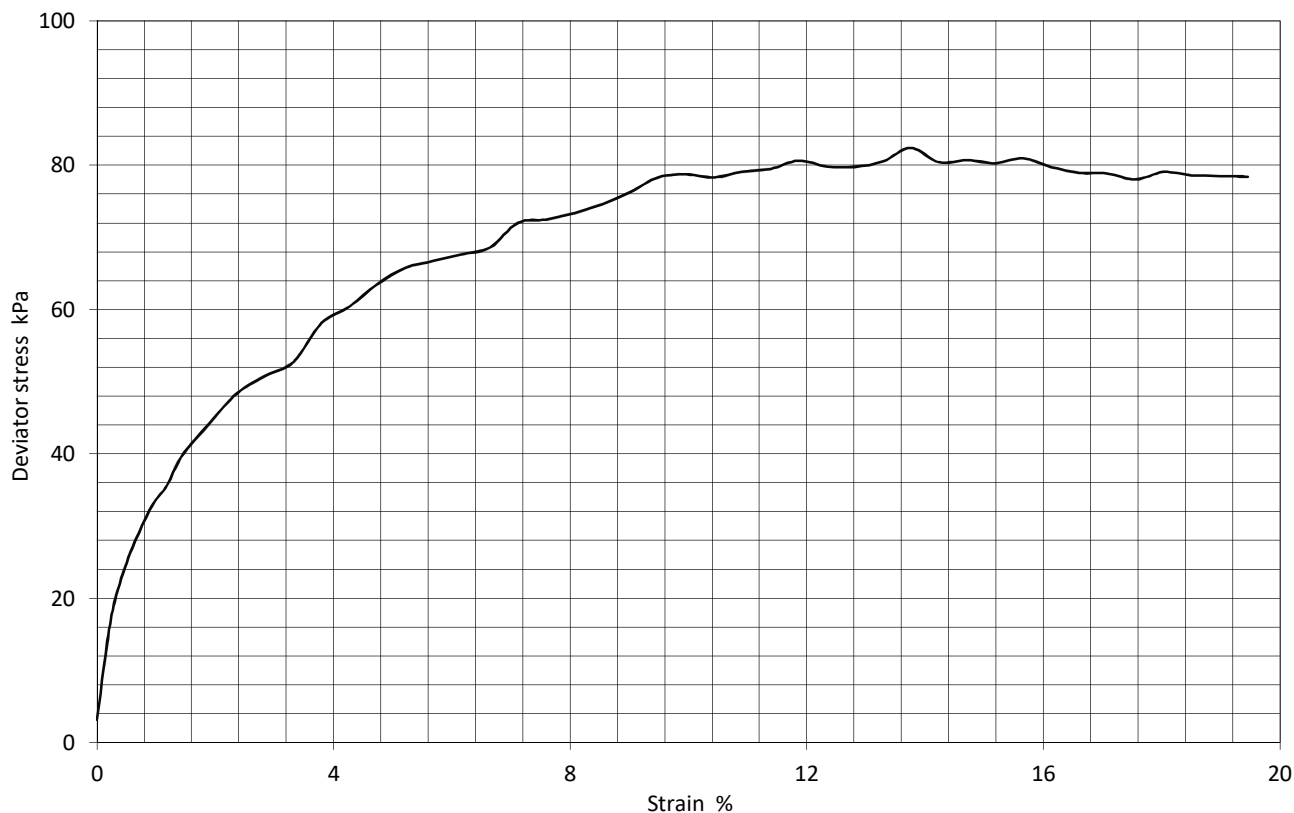


Test run number		1	2	3
Normal stress	kPa	25.8	50.0	75.9
Particle density	Assumed Mg/m ³	2.65	2.65	2.65
Trimings moisture content	%	28.9	29.1	30.2
Moisture content of specimen before test	%	30	31	31
Moisture content of specimen after test	%	27	26	25
Specimen dimensions				
Side 1	mm	59.98	60.02	60.02
Side 2	mm	59.98	60.04	59.98
Height	mm	23.76	23.52	23.28
Bulk density	Mg/m ³	1.94	1.96	1.98
Dry density	Mg/m ³	1.50	1.49	1.51
Saturation	%	102.3	105.9	108.5
Initial voids ratio		0.77	0.77	0.75
Voids ratio after consolidation		0.73	0.68	0.64
Voids ratio after shear		0.71	0.66	0.60
Rate of displacement	mm/min	0.024	0.024	0.024
Displacement at peak	mm	8.9	4.8	4.9
Shear strength at peak	kPa	31.9	39.9	57.7
Displacement at residual	mm			
Shear strength at residual	kPa			
Final displacement	mm	9.6	9.4	9.1
Method of reversal			Peak only	

Remarks Specimen tested submerged.
Specimen lightly tamped into shearbox.

Approved by:	Leeds Laboratory		 SOIL ENGINEERING	
Steve Harper		Print date 07/11/2019		
Revision No.	3.02	Issue Date	21/11/2012	Part of the Bachy Soletanche Group


Project Name	Nenthead Mines - Proposed MWTS, GI	Undrained Triaxial Compression Without Measurement Of Pore Pressure (Multistage Method) BS1377: Part 7: 1990: 9	Hole ID BH103
Project No.	TA8234		Sample Depth 1.50m
Engineer	Aecom		Sample Number 5
Employer	The Coal Authority		Sample Type U
Description	Dark brown very sandy very gravelly CLAY.		Specimen Depth 1.54m
			Specimen Number 1



Shear strength parameters c 14 kPa ϕ 11.9 ° Apparent c 33 kPa

Test type	UNDISTURBED	Multi stage	
Test number	1	2	3
Cell pressure	kPa 30	60	90
Deviator stress	kPa 50.80	67.67	82.41
Corrected deviator stress	kPa 50	67	81
Membrane correction	kPa 0.31	0.61	1.13
Membrane thickness	mm 0.392		
Moisture content	% 15		
Bulk density	Mg/m ³ 2.14		
Dry density	Mg/m ³ 1.86		
Diameter	mm 99.97		
Length	mm 210.73		
Failure strain	% 2.8	6.2	13.8
Cu	kPa 25	34	41
Rate of strain	%/min 0.47		
Mode of failure	Compound		

High density rubber latex membrane used. Specimen cut with longest axis in a vertical orientation.
Remarks

Approved by:			 SOIL ENGINEERING Part of the Bachy Soletanche Group
Steve Harper		Print date 07/11/2019	
Revision No.	2.05	Issue Date	22/08/2018

Project Name	Nenthead Mines - Proposed Mine Water Treatment Scheme	Consolidated Undrained Triaxial Compression With Pore Water Pressure Measurement	Hole ID	BH105
Project No.	TA8234		Sample Depth	1.50m
Engineer	Aecom		Sample Number	05
Employer	The Coal Authority		Sample Type	U
In-House Method based on K H Head: Manual of Soils Testing, Vol 3				

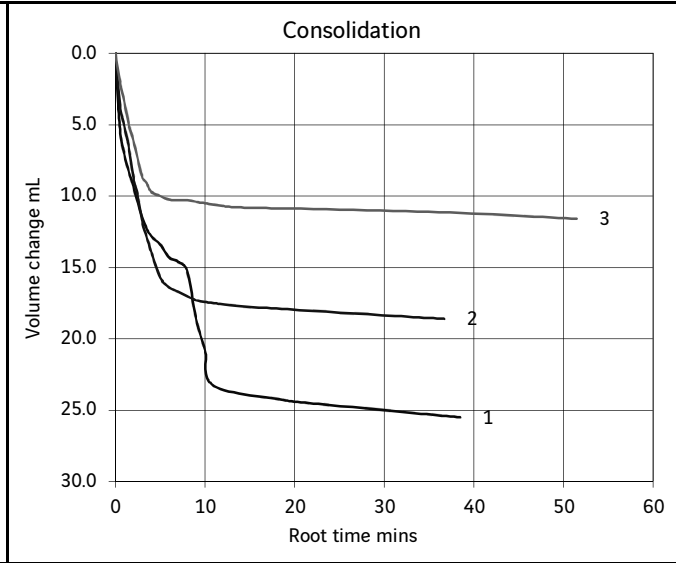
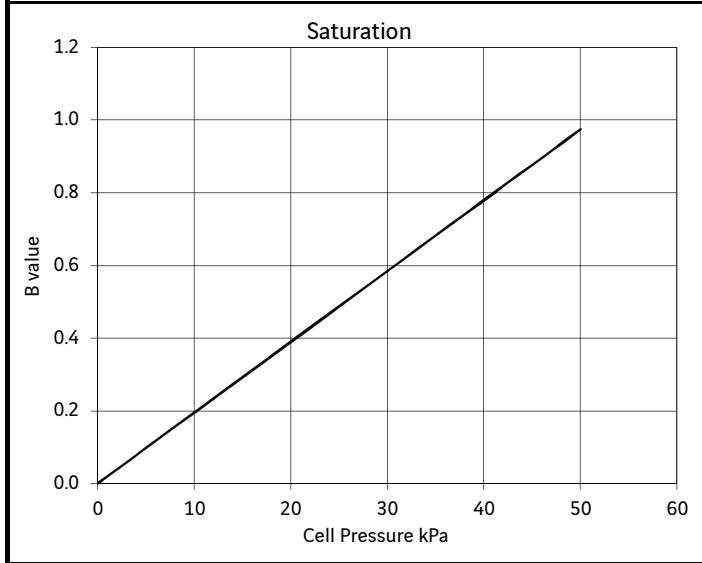
Description	Dark brown gravelly sandy CLAY with rare cobbles.	Specimen Depth	1.55m
		Specimen Number	2

SPECIMEN INITIAL DIMENSIONS		1	2	3
Test number				
Specimen diameter	mm	105.32	107.37	108.50
Specimen length	mm	172.27	162.93	158.01
Density	Mg/m ³	2.16	2.18	2.19
Moisture content	%	19	18	17
Dry density	Mg/m ³	1.81	1.85	1.87

SATURATION STAGE		1	2	3
Initial pore water pressure	kPa	1.2		
Saturated pore water pressure	kPa	49.9		
Final cell pressure	kPa	50		
B value		0.974		

CONSOLIDATION STAGE		1	2	3
Cell pressure	kPa	330	360	390
Back pressure	kPa	300	300	300
Effective cell pressure	kPa	30	60	90
Initial pore water pressure	kPa	328.2	349.6	365
Final pore water pressure	kPa	300.3	299.5	302.7
Pore pressure dissipation	%	98.9	101.0	95.8
c _{vi}	m ² /year	55.89	172.12	372.98
m _{vi}	m ² /MN	0.61	0.25	0.13

SPECIMEN AFTER CONSOLIDATION		1	2	3
Density	Mg/m ³	2.18	2.19	2.20
Moisture content	%	18	17	17
Dry density	Mg/m ³	1.85	1.87	1.88

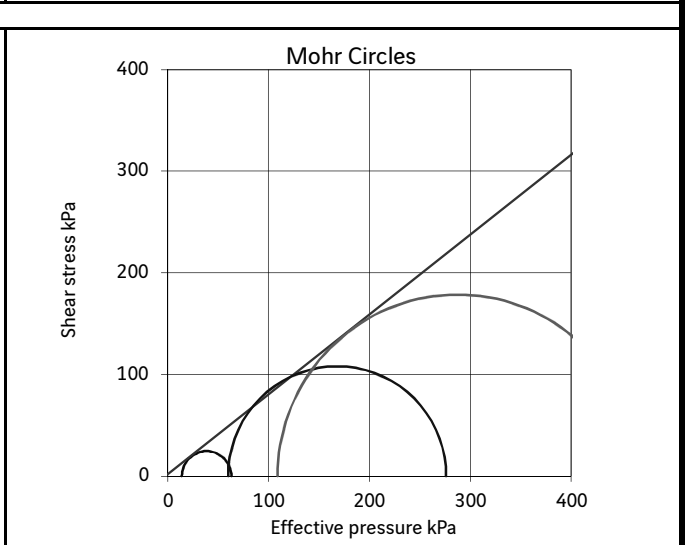
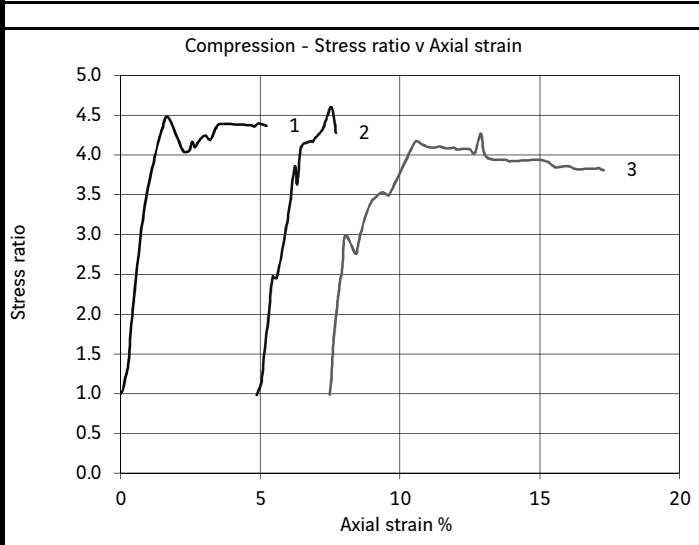
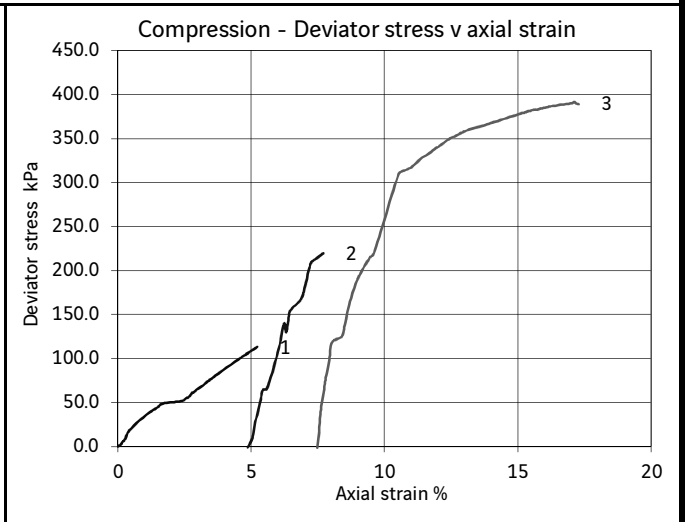
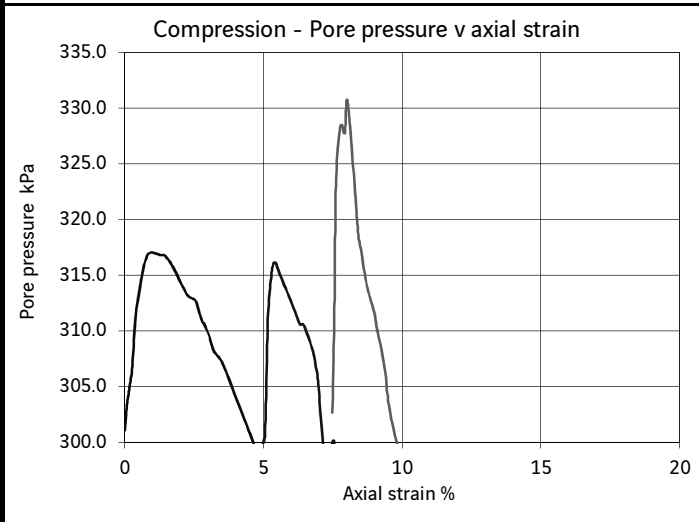


Remarks: Specimen orientation Vertical
Specimen condition for test Undisturbed
Saturation with 50kPa increments with a differential pressure of 10kPa
Drainage from both ends

Project Name	Nenthead Mines - Proposed Mine Water Treatment Scheme	Consolidated Undrained Triaxial Compression With Pore Water Pressure Measurement <small>In-House Method based on K H Head: Manual of Soils Testing, Vol 3</small>	Hole ID BH105
Project No.	TA8234		Sample Depth 1.50m
Engineer	Aecom		Sample Number 05
Employer	The Coal Authority		Sample Type U
Description	Dark brown gravelly sandy CLAY with rare cobbles.		Specimen Depth 1.55m
			Specimen Number 2


COMPRESSION STAGE		1	2	3
Test number				
Cell pressure	kPa	330	360	390
Initial pore water pressure	kPa	301	299	303
Initial effective pressure	kPa	30	60	90
Failure conditions at		Maximum stress ratio		
Axial strain at failure	%	1.7	7.6	12.9
Maximum deviator stress	$\sigma_1 - \sigma_3$ kPa	49	216	357
Pore water pressure at failure	σ kPa	316	300	281
Effective major principal stress	σ_1' kPa	63.11	276.10	465.56
Effective minor principal stress	σ_3' kPa	14.10	60.00	109.00
Effective principal stress ratio		4.48	4.60	4.27
Membrane correction	kPa	0.33	1.24	1.87
Filter drain correction not applicable	kPa	0.0	0.0	0.0
Pore pressure coefficient		0.32	0.00	-0.06

SHEAR STRENGTH PARAMETERS c' 2 kPa ϕ' 38.0°



Project Name	Nenthead Mines - Proposed Mine Water Treatment Scheme	Consolidated Undrained Triaxial Compression With Pore Water Pressure Measurement <small>In-House Method based on K H Head: Manual of Soils Testing, Vol 3</small>	Hole ID	BH105
Project No.	TA8234		Sample Depth	1.50m
Engineer	Aecom		Sample Number	05
Employer	The Coal Authority		Sample Type	U
Description	Dark brown gravelly sandy CLAY with rare cobbles.		Specimen Depth	1.55m
			Specimen Number	2

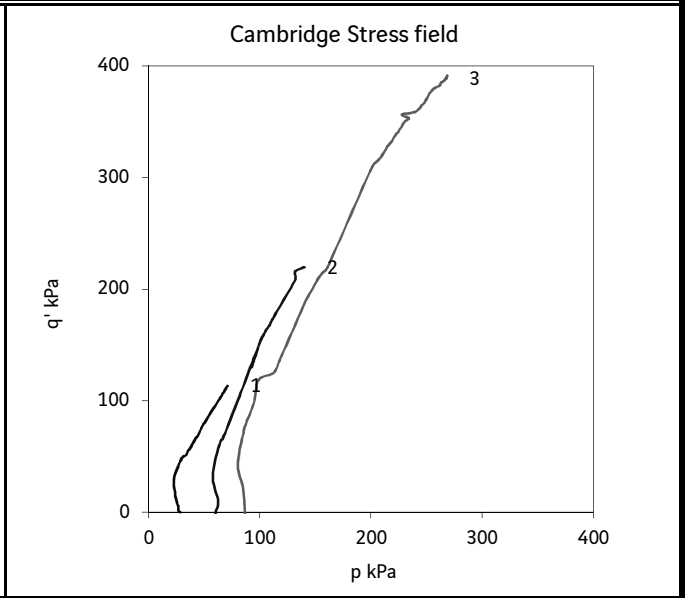
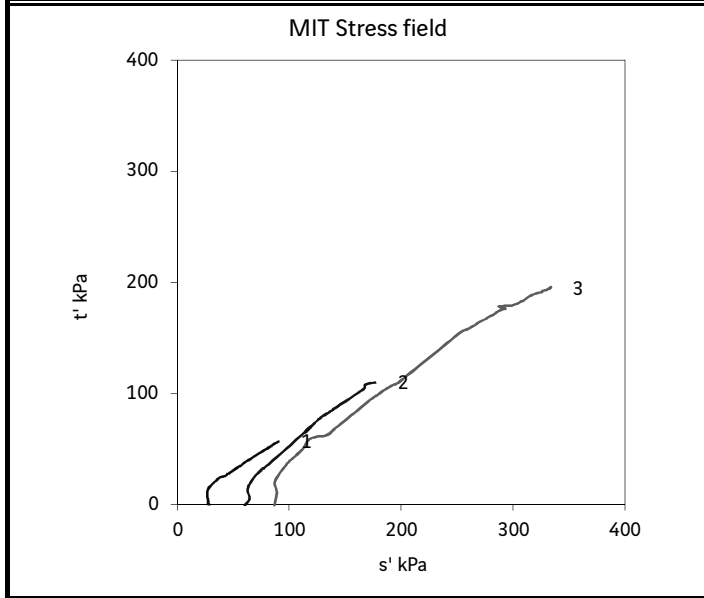
SPECIMEN AFTER TEST

Test number	1		
Mode of failure	Compound		

Final moisture content	%	18	17	17
Final bulk density	Mg/m ³	2.18	2.19	2.20
Final dry density	Mg/m ³	1.85	1.87	1.88

ADDITIONAL SPECIMEN DETAILS

Rate of strain	%/hour	0.25	0.25	0.25
Failure criterion	Maximum stress ratio			



REMARKS



SOIL ENGINEERING

SUPPORTING FACTUAL DATA

SECTION B

Laboratory Testing

LABORATORY ROCK TEST SUMMARY SHEETS



SOIL ENGINEERING

SUPPORTING FACTUAL DATA


SECTION B

Laboratory Testing

LABORATORY ROCK TEST DATA SHEETS

Project Name	Nenthead Mines - Proposed MWTS, GI	Water Content of Rock
Project No.	TA8234	
Engineer	Aecom	
Employer	The Coal Authority	
		ISRM: Suggested method for determining water content.

Hole ID	Sample depth m	Sample no.	Sample type	Specimen depth m	Specimen no.	Description	Remarks	% Water Content
BH105R	5.00	02	C	5.00	01	Grey SANDSTONE.		0.9
BH105R	5.00	02	C	5.10	02	Grey SANDSTONE.		1
BH105R	5.00	02	C	5.23	03	Grey SANDSTONE.		0.8
BH105R	6.00	03	C	6.00	01	Thinly laminated dark grey MUDSTONE.		10.8
BH105R	6.00	03	C	6.40	02	Thinly laminated dark grey MUDSTONE.		10.7
BH105R	6.00	03	C	6.70	03	Thinly laminated dark grey MUDSTONE.		8.9
BH105R	9.00	06	C	9.15	01	Interlaminated grey and black SILTSTONE.		4.7
BH105R	9.00	06	C	9.60	02	Interlaminated grey and black SILTSTONE.		1.5
BH105R	9.00	06	C	10.10	03	Interlaminated grey and black SILTSTONE.		2.3
BH107	9.00	04	C	9.15	01	Grey SANDSTONE.		5.7
BH107	9.00	04	C	9.60	02	Grey SANDSTONE.		1.6
BH107	9.00	04	C	9.95	03	Thinly laminated grey SILTSTONE.		2.8

Approved by:	Leeds Laboratory	 SOIL ENGINEERING
Kevin Walker	Print date 22/11/2019	
Revision No. 2.03	Issue Date 20/11/2012	Part of the Bachy Soletanche Group



SOIL engineering

SUPPORTING FACTUAL DATA

SECTION B

Laboratory Testing

ENVIRONMENTAL AND CHEMICAL RESULTS



DETS

Certificate of Analysis

Certificate Number 19-19167

03-Oct-19

Client Soil Engineering
Parkside Lane
Leeds
West Yorkshire
LS11 5SX

Our Reference 19-19167

Client Reference TA8234

Order No (not supplied)

Contract Title Nenthead Mines - Proposed MWTS, GI

Description 13 Soil samples, 3 Leachate samples.

Date Received 26-Sep-19

Date Started 26-Sep-19

Date Completed 03-Oct-19

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By



Adam Fenwick
Contracts Manager



Summary of Chemical Analysis

Soil Samples

Our Ref 19-19167

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1570306	1570307	1570308	1570309	1570310	1570311
Sample ID	BH103	BH103	TP104	TP109	TP110	TP110
Depth	0.20	1.00	1.00	1.00	1.00	2.00
Other ID	1	3	2	2	2	5
Sample Type	ES	ES	ES	ES	ES	ES
Sampling Date	04/09/19	04/09/19	n/s	n/s	n/s	n/s
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	8.8	11	12	11	6.4	12
Barium	DETSC 2301#	1.5	mg/kg	190	280	210	130	120	390
Beryllium	DETSC 2301#	0.2	mg/kg	1.9	1.7	1.8	1.4	1.7	1.8
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	< 0.2	< 0.2	0.2	< 0.2	< 0.2	< 0.2
Cadmium	DETSC 2301#	0.1	mg/kg	0.4	0.8	1.1	6.2	0.1	0.3
Chromium	DETSC 2301#	0.15	mg/kg	14	12	13	7.3	13	13
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	20	20	27	18	17	20
Lead	DETSC 2301#	0.3	mg/kg	130	220	730	900	64	110
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Nickel	DETSC 2301#	1	mg/kg	32	30	19	26	11	32
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	2.8	< 0.5	< 0.5
Vanadium	DETSC 2301#	0.8	mg/kg	18	16	15	13	16	17
Zinc	DETSC 2301#	1	mg/kg	130	270	390	2100	65	90
Inorganics									
pH	DETSC 2008#		pH	6.1	5.3	5.4	8.0	5.2	5.2
Cyanide, Total	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Cyanide, Free	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
FOC	DETSC 2084#	0.001		0.013	0.011	0.021	0.008	0.014	0.014
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	29	13	17	< 10	15	< 10
Sulphide	DETSC 2024*	10	mg/kg	48	44	72	< 10	12	16
Sulphur as S, Total	DETSC 2320	0.01	%	0.02	0.03	0.05	0.03	0.02	0.02
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10



Summary of Chemical Analysis

Soil Samples

Our Ref 19-19167

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1570306	1570307	1570308	1570309	1570310	1570311
Sample ID	BH103	BH103	TP104	TP109	TP110	TP110
Depth	0.20	1.00	1.00	1.00	1.00	2.00
Other ID	1	3	2	2	2	5
Sample Type	ES	ES	ES	ES	ES	ES
Sampling Date	04/09/19	04/09/19	n/s	n/s	n/s	n/s
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
Benzene	DETSC 3321#	0.01	mg/kg		< 0.01				< 0.01
Ethylbenzene	DETSC 3321#	0.01	mg/kg		< 0.01				< 0.01
Toluene	DETSC 3321#	0.01	mg/kg		< 0.01				< 0.01
Xylene	DETSC 3321#	0.01	mg/kg		< 0.01				< 0.01
PAHs									
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Chrysene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Coronene	DETSC 3301*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PAH Total	DETSC 3301	1.6	mg/kg	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3

Summary of Chemical Analysis

Soil Samples

Our Ref 19-19167

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1570312	1570313	1570314	1570315	1570316	1570317
Sample ID	TP110	TP111	TP112	TP114	TP124	TP125
Depth	3.00	1.00	1.00	1.00	1.00	0.25
Other ID	8	2	2	2	2	1
Sample Type	ES	ES	ES	ES	ES	ES
Sampling Date	n/s	n/s	n/s	n/s	n/s	n/s
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	16	11	20	12	26	12
Barium	DETSC 2301#	1.5	mg/kg	420	250	150	170	180	33
Beryllium	DETSC 2301#	0.2	mg/kg	2.0	1.5	2.5	1.6	4.4	0.6
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Cadmium	DETSC 2301#	0.1	mg/kg	0.1	< 0.1	7.2	< 0.1	1.5	1.8
Chromium	DETSC 2301#	0.15	mg/kg	12	12	11	12	10	14
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	34	19	23	21	27	13
Lead	DETSC 2301#	0.3	mg/kg	240	41	100	47	170	730
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	< 0.05	0.05	< 0.05	0.07	< 0.05
Nickel	DETSC 2301#	1	mg/kg	31	27	30	21	43	12
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	1.0
Vanadium	DETSC 2301#	0.8	mg/kg	16	14	13	14	14	17
Zinc	DETSC 2301#	1	mg/kg	92	65	840	44	540	260
Inorganics									
pH	DETSC 2008#		pH	5.1	5.5	5.4	5.1	4.9	6.2
Cyanide, Total	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Cyanide, Free	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
FOC	DETSC 2084#	0.001		0.019	0.016	0.035	0.014	0.020	0.011
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	11	16	52	< 10	40	< 10
Sulphide	DETSC 2024*	10	mg/kg	28	12	96	12	< 10	< 10
Sulphur as S, Total	DETSC 2320	0.01	%	0.06	0.02	0.34	0.01	0.03	0.01
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10



Summary of Chemical Analysis

Soil Samples

Our Ref 19-19167

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1570312	1570313	1570314	1570315	1570316	1570317
Sample ID	TP110	TP111	TP112	TP114	TP124	TP125
Depth	3.00	1.00	1.00	1.00	1.00	0.25
Other ID	8	2	2	2	2	1
Sample Type	ES	ES	ES	ES	ES	ES
Sampling Date	n/s	n/s	n/s	n/s	n/s	n/s
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
Benzene	DETSC 3321#	0.01	mg/kg						
Ethylbenzene	DETSC 3321#	0.01	mg/kg						
Toluene	DETSC 3321#	0.01	mg/kg						
Xylene	DETSC 3321#	0.01	mg/kg						
PAHs									
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Chrysene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Coronene	DETSC 3301*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PAH Total	DETSC 3301	1.6	mg/kg	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3

Summary of Chemical Analysis

Soil Samples

Our Ref 19-19167

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1570318
Sample ID	TP125
Depth	2.00
Other ID	7
Sample Type	ES
Sampling Date	n/s
Sampling Time	n/s

Test	Method	LOD	Units	
Metals				
Arsenic	DETSC 2301#	0.2	mg/kg	18
Barium	DETSC 2301#	1.5	mg/kg	140
Beryllium	DETSC 2301#	0.2	mg/kg	2.7
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	< 0.2
Cadmium	DETSC 2301#	0.1	mg/kg	1.9
Chromium	DETSC 2301#	0.15	mg/kg	14
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	31
Lead	DETSC 2301#	0.3	mg/kg	5300
Mercury	DETSC 2325#	0.05	mg/kg	0.12
Nickel	DETSC 2301#	1	mg/kg	32
Selenium	DETSC 2301#	0.5	mg/kg	4.9
Vanadium	DETSC 2301#	0.8	mg/kg	20
Zinc	DETSC 2301#	1	mg/kg	1400
Inorganics				
pH	DETSC 2008#		pH	5.3
Cyanide, Total	DETSC 2130#	0.1	mg/kg	< 0.1
Cyanide, Free	DETSC 2130#	0.1	mg/kg	< 0.1
FOC	DETSC 2084#	0.001		0.011
Sulphate Aqueous Extract as SO ₄	DETSC 2076#	10	mg/l	22
Sulphide	DETSC 2024*	10	mg/kg	< 10
Sulphur as S, Total	DETSC 2320	0.01	%	0.04
Petroleum Hydrocarbons				
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10

Summary of Chemical Analysis

Soil Samples

Our Ref 19-19167

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1570318
Sample ID	TP125
Depth	2.00
Other ID	7
Sample Type	ES
Sampling Date	n/s
Sampling Time	n/s

Test	Method	LOD	Units	
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg	< 10
Benzene	DETSC 3321#	0.01	mg/kg	< 0.01
Ethylbenzene	DETSC 3321#	0.01	mg/kg	< 0.01
Toluene	DETSC 3321#	0.01	mg/kg	< 0.01
Xylene	DETSC 3321#	0.01	mg/kg	< 0.01
PAHs				
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	< 0.1
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1
Pyrene	DETSC 3301	0.1	mg/kg	< 0.1
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	< 0.1
Chrysene	DETSC 3301	0.1	mg/kg	< 0.1
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	< 0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1
Coronene	DETSC 3301*	0.1	mg/kg	< 0.1
PAH Total	DETSC 3301	1.6	mg/kg	< 1.6
Phenols				
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3

Summary of Chemical Analysis Soil VOC/SVOC Samples

Our Ref 19-19167

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1570307	1570311	1570318
Sample ID	BH103	TP110	TP125
Depth	1.00	2.00	2.00
Other ID	3	5	7
Sample Type	ES	ES	ES
Sampling Date	04/09/19	n/s	n/s
Sampling Time	n/s	n/s	n/s

Test	Method	LOD	Units			
VOCs						
Vinyl Chloride	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,1 Dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Trans-1,2-dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,1-dichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Cis-1,2-dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
2,2-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Bromochloromethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Chloroform	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,1,1-trichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,1-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Carbon tetrachloride	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Benzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,2-dichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Trichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,2-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Dibromomethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Bromodichloromethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
cis-1,3-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Toluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
trans-1,3-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,1,2-trichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Tetrachloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,3-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Dibromochloromethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,2-dibromoethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Chlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,1,1,2-tetrachloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Ethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
m+p-Xylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
o-Xylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Styrene	DETSC 3431*	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Bromoform	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Isopropylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Bromobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,2,3-trichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
n-propylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
2-chlorotoluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,3,5-trimethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
4-chlorotoluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Tert-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01

Summary of Chemical Analysis

Soil VOC/SVOC Samples

Our Ref 19-19167

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1570307	1570311	1570318
Sample ID	BH103	TP110	TP125
Depth	1.00	2.00	2.00
Other ID	3	5	7
Sample Type	ES	ES	ES
Sampling Date	04/09/19	n/s	n/s
Sampling Time	n/s	n/s	n/s

Test	Method	LOD	Units			
1,2,4-trimethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
sec-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
p-isopropyltoluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,3-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,4-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
n-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,2-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,2-dibromo-3-chloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,2,4-trichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Hexachlorobutadiene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,2,3-trichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
MTBE	DETSC 3431*	0.01	mg/kg	< 0.01	< 0.01	< 0.01
SVOCs						
Phenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Aniline	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1
2-Chlorophenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Benzyl Alcohol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
2-Methylphenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Bis(2-chloroisopropyl)ether	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
3&4-Methylphenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
2,4-Dimethylphenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Bis-(dichloroethoxy)methane	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
2,4-Dichlorophenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
1,2,4-Trichlorobenzene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
4-Chloro-3-methylphenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
2-Methylnaphthalene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Hexachlorocyclopentadiene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1
2,4,6-Trichlorophenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
2,4,5-Trichlorophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1
2-Chloronaphthalene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
2-Nitroaniline	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1
2,4-Dinitrotoluene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1
3-Nitroaniline	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1
4-Nitrophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Dibenzofuran	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
2,6-Dinitrotoluene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
2,3,4,6-Tetrachlorophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Diethylphthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
4-Chlorophenylphenylether	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1
4-Nitroaniline	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1

Summary of Chemical Analysis Soil VOC/SVOC Samples

Our Ref 19-19167

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1570307	1570311	1570318
Sample ID	BH103	TP110	TP125
Depth	1.00	2.00	2.00
Other ID	3	5	7
Sample Type	ES	ES	ES
Sampling Date	04/09/19	n/s	n/s
Sampling Time	n/s	n/s	n/s

Test	Method	LOD	Units			
2-Methyl-4,6-Dinitrophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Diphenylamine	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
4-Bromophenylphenylether	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Hexachlorobenzene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Pentachlorophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Di-n-butylphthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Butylbenzylphthalate	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Bis(2-ethylhexyl)phthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Di-n-octylphthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
1,4-Dinitrobenzene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Dimethylphthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
1,3-Dinitrobenzene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1
1,2-Dinitrobenzene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1
2,3,5,6-Tetrachlorophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Azobenzene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Carbazole	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1

Summary of Chemical Analysis

Leachate Samples

Our Ref 19-19167

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1570319	1570320	1570321
Sample ID	BH103	TP110	TP125
Depth	1.00	2.00	2.00
Other ID	3	5	7
Sample Type	ES	ES	ES
Sampling Date	04/09/19	n/s	n/s
Sampling Time	n/s	n/s	n/s

Test	Method	LOD	Units			
Preparation						
Leachate 2:1 250g Non-WAC	DETSC 1009*			Y	Y	Y
Metals						
Arsenic, Dissolved	DETSC 2306	0.16	ug/l	0.46	0.26	0.25
Barium, Dissolved	DETSC 2306	0.26	ug/l	3.7	3.5	8.2
Beryllium, Dissolved	DETSC 2306*	0.1	ug/l	< 0.1	< 0.1	< 0.1
Boron, Dissolved	DETSC 2306*	12	ug/l	< 12	< 12	< 12
Cadmium, Dissolved	DETSC 2306	0.03	ug/l	< 0.03	< 0.03	< 0.03
Chromium, Dissolved	DETSC 2306	0.25	ug/l	< 0.25	< 0.25	< 0.25
Chromium, Hexavalent	DETSC 2203	0.007	mg/l	< 0.007	< 0.007	< 0.007
Copper, Dissolved	DETSC 2306	0.4	ug/l	< 0.4	< 0.4	< 0.4
Lead, Dissolved	DETSC 2306	0.09	ug/l	0.45	0.22	0.15
Mercury, Dissolved	DETSC 2306	0.01	ug/l	< 0.01	< 0.01	< 0.01
Nickel, Dissolved	DETSC 2306	0.5	ug/l	0.6	< 0.5	< 0.5
Selenium, Dissolved	DETSC 2306	0.25	ug/l	< 0.25	< 0.25	< 0.25
Vanadium, Dissolved	DETSC 2306	0.6	ug/l	< 0.6	< 0.6	< 0.6
Zinc, Dissolved	DETSC 2306	1.3	ug/l	16	8.4	6.1
Inorganics						
Conductivity	DETSC 2009	1	uS/cm	9.9	11.3	17.1
pH	DETSC 2008		pH	7.5	7.2	7.0
Cyanide, Total	DETSC 2130	40	ug/l	< 40	< 40	< 40
Cyanide, Free	DETSC 2130	0.02	mg/l	< 0.02	< 0.02	< 0.02
Ammoniacal Nitrogen as N	DETSC 2207	0.015	mg/l	0.11	0.068	0.096
Chloride	DETSC 2055	0.1	mg/l	1.1	1.2	1.6
Nitrate as N	*	0.1	mg/l	0.44	0.15	0.15
Sulphate as SO4	DETSC 2055	0.1	mg/l	0.96	1.4	2.8
Sulphide	DETSC 2208	10	ug/l	< 10	< 10	< 10
Sulphur as S, Total	DETSC 2320*	10	mg/l	< 10	< 10	< 10
Petroleum Hydrocarbons						
Aliphatic C5-C6	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1
Aliphatic C6-C8	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1
Aliphatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1
Aliphatic C10-C12	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0
Aliphatic C12-C16	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0
Aliphatic C16-C21	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0
Aliphatic C21-C35	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0
Aliphatic C5-C35	DETSC 3072*	10	ug/l	< 10	< 10	< 10
Aromatic C5-C7	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1
Aromatic C7-C8	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1
Aromatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1

Summary of Chemical Analysis

Leachate Samples

Our Ref 19-19167

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1570319	1570320	1570321
Sample ID	BH103	TP110	TP125
Depth	1.00	2.00	2.00
Other ID	3	5	7
Sample Type	ES	ES	ES
Sampling Date	04/09/19	n/s	n/s
Sampling Time	n/s	n/s	n/s

Test	Method	LOD	Units			
Aromatic C10-C12	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0
Aromatic C12-C16	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0
Aromatic C16-C21	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0
Aromatic C21-C35	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0
Aromatic C5-C35	DETSC 3072*	10	ug/l	< 10	< 10	< 10
TPH Ali/Aro Total	DETSC 3072*	10	ug/l	< 10	< 10	< 10
PAHs						
Naphthalene	DETSC 3304	0.05	ug/l	< 0.05	< 0.05	< 0.05
Acenaphthylene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01
Acenaphthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01
Fluorene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01
Phenanthrene	DETSC 3304	0.01	ug/l	0.02	0.02	< 0.01
Anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01
Fluoranthene	DETSC 3304	0.01	ug/l	0.02	0.03	< 0.01
Pyrene	DETSC 3304	0.01	ug/l	0.01	0.02	< 0.01
Benzo(a)anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01
Chrysene	DETSC 3304	0.01	ug/l	< 0.01	0.01	< 0.01
Benzo(b)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01
Benzo(k)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01
Benzo(a)pyrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01
Indeno(1,2,3-c,d)pyrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01
Dibenzo(a,h)anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01
Benzo(g,h,i)perylene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01
Coronene	DETSC 3304*	0.01	ug/l	< 0.01	< 0.01	< 0.01
PAH Total	DETSC 3304	0.2	ug/l	< 0.20	< 0.20	< 0.20
Phenols						
Phenol - Monohydric	DETSC 2130	0.1	mg/l	< 0.1	< 0.1	< 0.1

Summary of Asbestos Analysis

Soil Samples

Our Ref 19-19167

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
1570306	BH103 1 0.20	SOIL	NAD	none	Jordan Eadington
1570307	BH103 3 1.00	SOIL	NAD	none	Jordan Eadington
1570308	TP104 2 1.00	SOIL	NAD	none	Jordan Eadington
1570309	TP109 2 1.00	SOIL	NAD	none	Jordan Eadington
1570310	TP110 2 1.00	SOIL	NAD	none	Jordan Eadington
1570311	TP110 5 2.00	SOIL	NAD	none	Jordan Eadington
1570312	TP110 8 3.00	SOIL	NAD	none	Jordan Eadington
1570313	TP111 2 1.00	SOIL	NAD	none	Jordan Eadington
1570314	TP112 2 1.00	SOIL	NAD	none	Jordan Eadington
1570315	TP114 2 1.00	SOIL	NAD	none	Jordan Eadington
1570316	TP124 2 1.00	SOIL	NAD	none	Jordan Eadington
1570317	TP125 1 0.25	SOIL	NAD	none	Jordan Eadington
1570318	TP125 7 2.00	SOIL	NAD	none	Jordan Eadington

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * - not included in laboratory scope of accreditation.

Information in Support of the Analytical Results

Our Ref 19-19167
 Client Ref TA8234
 Contract Nenthead Mines - Proposed MWTS, GI

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1570306	BH103 0.20 SOIL	04/09/19	GJ 250ml, GJ 60ml, PT 1L		
1570307	BH103 1.00 SOIL	04/09/19	GJ 250ml, GJ 60ml, PT 1L		
1570308	TP104 1.00 SOIL		GJ 250ml, GJ 60ml, PT 1L		
1570309	TP109 1.00 SOIL		GJ 250ml, GJ 60ml, PT 1L		
1570310	TP110 1.00 SOIL		GJ 250ml, GJ 60ml, PT 1L		
1570311	TP110 2.00 SOIL		GJ 250ml, GJ 60ml, PT 1L		
1570312	TP110 3.00 SOIL		GJ 250ml, GJ 60ml, PT 1L		
1570313	TP111 1.00 SOIL		GJ 250ml, GJ 60ml, PT 1L		
1570314	TP112 1.00 SOIL		GJ 250ml, GJ 60ml, PT 1L		
1570315	TP114 1.00 SOIL		GJ 250ml, GJ 60ml, PT 1L		
1570316	TP124 1.00 SOIL		GJ 250ml, GJ 60ml, PT 1L		
1570317	TP125 0.25 SOIL		GJ 250ml, GJ 60ml, PT 1L		
1570318	TP125 2.00 SOIL		GJ 250ml, GJ 60ml, PT 1L		
1570319	BH103 1.00 LEACHATE	04/09/19	GJ 250ml, GJ 60ml, PT 1L		
1570320	TP110 2.00 LEACHATE		GJ 250ml, GJ 60ml, PT 1L		
1570321	TP125 2.00 LEACHATE		GJ 250ml, GJ 60ml, PT 1L		

Key: G-Glass P-Plastic J-Jar T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.
 Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.
 The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-
 Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months



DETS

Certificate of Analysis

Certificate Number 19-19242-1

13-Dec-19

Client Soil Engineering
Parkside Lane
Leeds
West Yorkshire
LS11 5SX

Our Reference 19-19242-1

Client Reference TA8234

Order No (not supplied)

Contract Title Nenthead Mines - Proposed MWTS, GI

Description 44 Soil samples, 16 Leachate samples.

Date Received 27-Sep-19

Date Started 27-Sep-19

Date Completed 13-Dec-19

Test Procedures Identified by prefix DETSn (details on request).

Notes **This report supersedes 19-19242, extra testing added**

Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By



Adam Fenwick
Contracts Manager



Summary of Chemical Analysis

Soil Samples

Our Ref 19-19242-1

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1571208	1571209	1571210	1571211	1571212	1571213
Sample ID	BH104	BH104	BH104	BH105	BH105	BH105
Depth	0.50	2.00	3.00	1.00	2.00	3.00
Other ID	2	8	12	3	7	10
Sample Type	ES	ES	ES	ES	ES	ES
Sampling Date	05/09/19	05/09/19	05/09/19	06/09/19	06/09/19	06/09/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	10	11	16	12	11	19
Barium	DETSC 2301#	1.5	mg/kg	230	240	160	380	440	400
Beryllium	DETSC 2301#	0.2	mg/kg	2.2	1.8	2.6	3.6	3.3	3.9
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	0.4	0.2	0.3	0.3	0.3	< 0.2
Cadmium	DETSC 2301#	0.1	mg/kg	0.5	0.1	< 0.1	1.4	1.6	1.0
Chromium	DETSC 2301#	0.15	mg/kg	13	13	12	10	7.6	9.4
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	35	23	22	23	20	20
Lead	DETSC 2301#	0.3	mg/kg	110	180	25	430	110	76
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	< 0.05	< 0.05	0.06	< 0.05	< 0.05
Nickel	DETSC 2301#	1	mg/kg	14	23	37	57	57	110
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	1.8	< 0.5	< 0.5	5.4
Vanadium	DETSC 2301#	0.8	mg/kg	17	17	19	15	11	16
Zinc	DETSC 2301#	1	mg/kg	150	68	22	740	860	1200
Inorganics									
pH	DETSC 2008#		pH	5.0	5.7	6.5	5.7	5.9	6.3
Cyanide, Total	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Cyanide, Free	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
FOC	DETSC 2084#	0.001		0.024	0.017	0.023	0.010	0.008	0.011
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	34	15	270	27	23	54
Sulphide	DETSC 2024*	10	mg/kg	< 10	< 10	31	< 10	< 10	32
Sulphur as S, Total	DETSC 2320	0.01	%	0.03	0.03	1.4	0.04	0.04	0.18
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10



Summary of Chemical Analysis

Soil Samples

Our Ref 19-19242-1

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1571208	1571209	1571210	1571211	1571212	1571213
Sample ID	BH104	BH104	BH104	BH105	BH105	BH105
Depth	0.50	2.00	3.00	1.00	2.00	3.00
Other ID	2	8	12	3	7	10
Sample Type	ES	ES	ES	ES	ES	ES
Sampling Date	05/09/19	05/09/19	05/09/19	06/09/19	06/09/19	06/09/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
Benzene	DETSC 3321#	0.01	mg/kg	< 0.01		< 0.01	< 0.01		
Ethylbenzene	DETSC 3321#	0.01	mg/kg	< 0.01		< 0.01	< 0.01		
Toluene	DETSC 3321#	0.01	mg/kg	< 0.01		< 0.01	< 0.01		
Xylene	DETSC 3321#	0.01	mg/kg	< 0.01		< 0.01	< 0.01		
PAHs									
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Chrysene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Coronene	DETSC 3301*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PAH Total	DETSC 3301	1.6	mg/kg	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	1.0	0.9	0.5	0.4	0.4	< 0.3

Summary of Chemical Analysis

Soil Samples

Our Ref 19-19242-1

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1571214	1571215	1571216	1571217	1571218	1571219
Sample ID	BH106	BH106	BH106	TP113	TP115	TP115
Depth	1.00	2.00	3.00	1.00	1.00	1.20
Other ID	4	7	11	2	2	4
Sample Type	ES	ES	ES	ES	ES	ES
Sampling Date	09/09/19	09/09/19	09/09/19	09/09/19	06/09/19	06/09/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	16	11	9.9	11	16	16
Barium	DETSC 2301#	1.5	mg/kg	200	630	470	96	130	140
Beryllium	DETSC 2301#	0.2	mg/kg	1.5	1.7	1.3	1.1	2.0	3.5
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	0.3	0.3	0.3	< 0.2	0.2	< 0.2
Cadmium	DETSC 2301#	0.1	mg/kg	0.3	0.2	< 0.1	< 0.1	0.3	0.2
Chromium	DETSC 2301#	0.15	mg/kg	11	13	11	8.1	10	12
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	20	21	17	13	19	16
Lead	DETSC 2301#	0.3	mg/kg	1100	100	100	31	76	30
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05
Nickel	DETSC 2301#	1	mg/kg	30	36	19	14	11	18
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	0.5	< 0.5	< 0.5	< 0.5	< 0.5
Vanadium	DETSC 2301#	0.8	mg/kg	13	16	12	9.9	13	12
Zinc	DETSC 2301#	1	mg/kg	190	150	45	82	180	380
Inorganics									
pH	DETSC 2008#		pH	5.1	6.6	6.9	6.9	6.2	5.2
Cyanide, Total	DETSC 2130#	0.1	mg/kg	0.2	< 0.1	< 0.1	0.1	< 0.1	< 0.1
Cyanide, Free	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
FOC	DETSC 2084#	0.001		0.019	0.014	0.011	0.018	0.020	0.035
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	50	38	28	16	17	14
Sulphide	DETSC 2024*	10	mg/kg	48	< 10	36	< 10	12	< 10
Sulphur as S, Total	DETSC 2320	0.01	%	0.06	0.05	0.03	0.02	0.02	0.02
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10



Summary of Chemical Analysis

Soil Samples

Our Ref 19-19242-1

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1571214	1571215	1571216	1571217	1571218	1571219
Sample ID	BH106	BH106	BH106	TP113	TP115	TP115
Depth	1.00	2.00	3.00	1.00	1.00	1.20
Other ID	4	7	11	2	2	4
Sample Type	ES	ES	ES	ES	ES	ES
Sampling Date	09/09/19	09/09/19	09/09/19	09/09/19	06/09/19	06/09/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
Benzene	DETSC 3321#	0.01	mg/kg	< 0.01	< 0.01			< 0.01	
Ethylbenzene	DETSC 3321#	0.01	mg/kg	< 0.01	< 0.01			< 0.01	
Toluene	DETSC 3321#	0.01	mg/kg	< 0.01	< 0.01			< 0.01	
Xylene	DETSC 3321#	0.01	mg/kg	< 0.01	< 0.01			< 0.01	
PAHs									
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Chrysene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Coronene	DETSC 3301*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PAH Total	DETSC 3301	1.6	mg/kg	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3	0.3	< 0.3

Summary of Chemical Analysis

Soil Samples

Our Ref 19-19242-1

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1571220	1571221	1571222	1571223	1571224	1571225
Sample ID	TP116	TP117	TP118	TP119	TP120	TP122
Depth	1.00	1.00	1.00	0.80	1.00	0.80
Other ID	2	2	2	2	2	2
Sample Type	ES	ES	ES	ES	ES	ES
Sampling Date	10/09/19	10/09/19	10/09/19	10/09/19	09/09/19	09/09/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	10	8.5	8.0	8.6	4.5	17
Barium	DETSC 2301#	1.5	mg/kg	390	230	260	440	190	390
Beryllium	DETSC 2301#	0.2	mg/kg	1.8	1.5	1.4	1.2	1.4	1.7
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	< 0.2	0.2	0.2	0.2	0.2	< 0.2
Cadmium	DETSC 2301#	0.1	mg/kg	< 0.1	0.4	< 0.1	0.6	0.5	0.2
Chromium	DETSC 2301#	0.15	mg/kg	14	8.7	11	8.0	10	13
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	21	17	19	15	19	23
Lead	DETSC 2301#	0.3	mg/kg	61	51	25	180	40	61
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Nickel	DETSC 2301#	1	mg/kg	21	20	19	15	27	25
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.6
Vanadium	DETSC 2301#	0.8	mg/kg	15	10	13	9.5	12	15
Zinc	DETSC 2301#	1	mg/kg	54	230	38	220	450	140
Inorganics									
pH	DETSC 2008#		pH	5.3	5.4	5.3	5.9	5.9	5.1
Cyanide, Total	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Cyanide, Free	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
FOC	DETSC 2084#	0.001		0.014	0.013	0.014	0.028	0.013	0.016
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	< 10	23	12	16	16	12
Sulphide	DETSC 2024*	10	mg/kg	< 10	52	< 10	< 10	< 10	< 10
Sulphur as S, Total	DETSC 2320	0.01	%	0.01	0.03	0.01	0.02	0.01	0.02
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10



Summary of Chemical Analysis

Soil Samples

Our Ref 19-19242-1

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1571220	1571221	1571222	1571223	1571224	1571225
Sample ID	TP116	TP117	TP118	TP119	TP120	TP122
Depth	1.00	1.00	1.00	0.80	1.00	0.80
Other ID	2	2	2	2	2	2
Sample Type	ES	ES	ES	ES	ES	ES
Sampling Date	10/09/19	10/09/19	10/09/19	10/09/19	09/09/19	09/09/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
Benzene	DETSC 3321#	0.01	mg/kg			< 0.01			
Ethylbenzene	DETSC 3321#	0.01	mg/kg			< 0.01			
Toluene	DETSC 3321#	0.01	mg/kg			< 0.01			
Xylene	DETSC 3321#	0.01	mg/kg			< 0.01			
PAHs									
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Chrysene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Coronene	DETSC 3301*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PAH Total	DETSC 3301	1.6	mg/kg	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	0.3	< 0.3	< 0.3	< 0.3	< 0.3

Summary of Chemical Analysis

Soil Samples

Our Ref 19-19242-1

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1571226	1571227	1571228	1571229	1571230	1571231
Sample ID	TP123	TP126	TP127	TP128	TP128	WS101
Depth	0.60	1.00	1.00	0.60	1.00	0.20
Other ID	2	2	2	2	4	2
Sample Type	ES	ES	ES	ES	ES	ES
Sampling Date	06/09/19	06/09/19	09/09/19	09/09/19	09/09/19	09/09/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	14	22	13	64	4.8	85
Barium	DETSC 2301#	1.5	mg/kg	280	270	320	1000	340	98
Beryllium	DETSC 2301#	0.2	mg/kg	2.2	1.6	2.2	6.2	1.1	1.3
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	0.4	< 0.2	0.2	< 0.2	< 0.2	< 0.2
Cadmium	DETSC 2301#	0.1	mg/kg	0.2	4.9	0.2	11	1.3	51
Chromium	DETSC 2301#	0.15	mg/kg	9.7	12	9.1	49	13	5.4
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	21	22	21	110	13	150
Lead	DETSC 2301#	0.3	mg/kg	270	1000	71	2800	99	10000
Mercury	DETSC 2325#	0.05	mg/kg	0.07	0.09	< 0.05	0.06	0.17	0.90
Nickel	DETSC 2301#	1	mg/kg	21	27	35	95	11	53
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	2.2	< 0.5	9.3	1.1	1.7
Vanadium	DETSC 2301#	0.8	mg/kg	13	17	13	67	10	9.6
Zinc	DETSC 2301#	1	mg/kg	190	2000	91	4600	490	U/S
Inorganics									
pH	DETSC 2008#		pH	5.0	7.1	6.3	6.5	6.8	7.4
Cyanide, Total	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1	< 0.1	0.3	0.3	0.2
Cyanide, Free	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
FOC	DETSC 2084#	0.001		0.028	0.008	0.016	0.13	0.091	0.018
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	27	170	24	100	66	48
Sulphide	DETSC 2024*	10	mg/kg	< 10	< 10	< 10	110	100	380
Sulphur as S, Total	DETSC 2320	0.01	%	0.04	0.14	0.01	1.7	0.13	0.45
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10



Summary of Chemical Analysis

Soil Samples

Our Ref 19-19242-1

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1571226	1571227	1571228	1571229	1571230	1571231
Sample ID	TP123	TP126	TP127	TP128	TP128	WS101
Depth	0.60	1.00	1.00	0.60	1.00	0.20
Other ID	2	2	2	2	4	2
Sample Type	ES	ES	ES	ES	ES	ES
Sampling Date	06/09/19	06/09/19	09/09/19	09/09/19	09/09/19	09/09/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
Benzene	DETSC 3321#	0.01	mg/kg		< 0.01			< 0.01	
Ethylbenzene	DETSC 3321#	0.01	mg/kg		< 0.01			< 0.01	
Toluene	DETSC 3321#	0.01	mg/kg		< 0.01			< 0.01	
Xylene	DETSC 3321#	0.01	mg/kg		< 0.01			< 0.01	
PAHs									
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	0.3	< 0.1	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	0.3	< 0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	0.8	< 0.1	0.2
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	0.3	< 0.1	< 0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	0.6	< 0.1	0.1
Pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	1.3	< 0.1	0.1
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	0.3	< 0.1	< 0.1
Chrysene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	0.3	< 0.1	< 0.1
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Coronene	DETSC 3301*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PAH Total	DETSC 3301	1.6	mg/kg	< 1.6	< 1.6	< 1.6	4.5	< 1.6	< 1.6
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3	1.1	0.4	< 0.3

Summary of Chemical Analysis

Soil Samples

Our Ref 19-19242-1

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1571232	1571233	1571234	1571235	1571236	1571237
Sample ID	WS101	WS102	WS102	WS103	WS104	WS105
Depth	1.00	0.50	1.00	0.50	1.00	0.50
Other ID	8	4	6	5	8	4
Sample Type	ES	ES	ES	ES	ES	ES
Sampling Date	09/09/19	13/09/19	13/09/19	12/09/19	12/09/19	11/09/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	29	49	37	12	13	15
Barium	DETSC 2301#	1.5	mg/kg	120	350	71	210	130	160
Beryllium	DETSC 2301#	0.2	mg/kg	6.1	2.2	3.8	1.8	3.2	2.1
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	< 0.2	< 0.2	0.3	< 0.2	0.2	< 0.2
Cadmium	DETSC 2301#	0.1	mg/kg	11	30	14	4.9	1.0	0.8
Chromium	DETSC 2301#	0.15	mg/kg	5.9	7.7	8.2	11	14	8.9
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	38	87	35	27	24	21
Lead	DETSC 2301#	0.3	mg/kg	1400	5300	850	890	160	550
Mercury	DETSC 2325#	0.05	mg/kg	0.15	0.72	0.31	0.11	< 0.05	< 0.05
Nickel	DETSC 2301#	1	mg/kg	64	34	32	20	18	25
Selenium	DETSC 2301#	0.5	mg/kg	0.7	1.3	0.7	< 0.5	< 0.5	< 0.5
Vanadium	DETSC 2301#	0.8	mg/kg	7.7	12	11	15	15	11
Zinc	DETSC 2301#	1	mg/kg	5100	U/S	U/S	1900	350	360
Inorganics									
pH	DETSC 2008#		pH	7.1	7.4	7.1	6.1	5.1	6.5
Cyanide, Total	DETSC 2130#	0.1	mg/kg	0.1	0.2	0.1	0.1	< 0.1	< 0.1
Cyanide, Free	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
FOC	DETSC 2084#	0.001		0.028	0.030	0.033	0.012	0.012	0.011
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	50	56	120	44	19	27
Sulphide	DETSC 2024*	10	mg/kg	130	180	320	80	< 10	44
Sulphur as S, Total	DETSC 2320	0.01	%	0.48	0.36	1.3	0.06	0.08	0.02
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10



Summary of Chemical Analysis

Soil Samples

Our Ref 19-19242-1

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1571232	1571233	1571234	1571235	1571236	1571237
Sample ID	WS101	WS102	WS102	WS103	WS104	WS105
Depth	1.00	0.50	1.00	0.50	1.00	0.50
Other ID	8	4	6	5	8	4
Sample Type	ES	ES	ES	ES	ES	ES
Sampling Date	09/09/19	13/09/19	13/09/19	12/09/19	12/09/19	11/09/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
Benzene	DETSC 3321#	0.01	mg/kg		< 0.01		< 0.01		
Ethylbenzene	DETSC 3321#	0.01	mg/kg		< 0.01		< 0.01		
Toluene	DETSC 3321#	0.01	mg/kg		< 0.01		< 0.01		
Xylene	DETSC 3321#	0.01	mg/kg		< 0.01		< 0.01		
PAHs									
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Pyrene	DETSC 3301	0.1	mg/kg	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Chrysene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Coronene	DETSC 3301*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PAH Total	DETSC 3301	1.6	mg/kg	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3

Summary of Chemical Analysis

Soil Samples

Our Ref 19-19242-1

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1571238	1571239	1571240	1571241	1571242	1571243
Sample ID	WS106	WS107	WS108	WS108	WS109	WSBH101
Depth	1.00	0.50	0.50	1.00	0.20	0.20
Other ID	7	4	4	6	2	2
Sample Type	ES	ES	ES	ES	ES	ES
Sampling Date	11/09/19	11/09/19	10/09/19	10/09/19	10/09/19	09/09/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	8.6	11	2.6	7.6	54	97
Barium	DETSC 2301#	1.5	mg/kg	290	530	130	450	930	130
Beryllium	DETSC 2301#	0.2	mg/kg	2.1	1.5	0.5	1.9	3.1	1.1
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	0.3	0.2	< 0.2	0.3	< 0.2	< 0.2
Cadmium	DETSC 2301#	0.1	mg/kg	0.5	0.4	0.4	0.2	18	U/S
Chromium	DETSC 2301#	0.15	mg/kg	12	11	4.3	11	12	3.9
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	24	18	7.1	21	14	60
Lead	DETSC 2301#	0.3	mg/kg	68	230	130	130	970	U/S
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	0.20	1.0
Nickel	DETSC 2301#	1	mg/kg	27	22	9.0	28	42	54
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	1.1	< 0.5	< 0.5	2.4	3.0
Vanadium	DETSC 2301#	0.8	mg/kg	14	13	6.1	14	16	7.8
Zinc	DETSC 2301#	1	mg/kg	280	180	100	160	4700	U/S
Inorganics									
pH	DETSC 2008#		pH	5.6	5.7	5.4	5.6	6.8	7.5
Cyanide, Total	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1	0.1	0.1	0.2	0.1
Cyanide, Free	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
FOC	DETSC 2084#	0.001		0.017	0.012	0.005	0.012	0.021	0.038
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	16	21	39	22	24	31
Sulphide	DETSC 2024*	10	mg/kg	< 10	< 10	< 10	20	< 10	< 10
Sulphur as S, Total	DETSC 2320	0.01	%	0.02	0.02	0.01	0.04	0.08	0.10
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10



Summary of Chemical Analysis

Soil Samples

Our Ref 19-19242-1

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1571238	1571239	1571240	1571241	1571242	1571243
Sample ID	WS106	WS107	WS108	WS108	WS109	WSBH101
Depth	1.00	0.50	0.50	1.00	0.20	0.20
Other ID	7	4	4	6	2	2
Sample Type	ES	ES	ES	ES	ES	ES
Sampling Date	11/09/19	11/09/19	10/09/19	10/09/19	10/09/19	09/09/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
Benzene	DETSC 3321#	0.01	mg/kg			< 0.01		< 0.01	< 0.01
Ethylbenzene	DETSC 3321#	0.01	mg/kg			< 0.01		< 0.01	< 0.01
Toluene	DETSC 3321#	0.01	mg/kg			< 0.01		< 0.01	< 0.01
Xylene	DETSC 3321#	0.01	mg/kg			< 0.01		< 0.01	< 0.01
PAHs									
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.3
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.3
Pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.3
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.1
Chrysene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.1
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.2
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Coronene	DETSC 3301*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PAH Total	DETSC 3301	1.6	mg/kg	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3

Summary of Chemical Analysis

Soil Samples

Our Ref 19-19242-1

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1571244	1571245	1571246	1571247	1571248	1571314
Sample ID	WSBH101	WSTP101	WSTP102	WSTP102	WSTP103	WSTP105
Depth	0.50	1.20-1.56	0.50	1.20-1.56	0.50	0.50
Other ID	5	9.1	4	9.1	5	5
Sample Type	ES	ES	ES	ES	ES	ES
Sampling Date	09/09/19	10/09/19	10/09/19	10/09/19	12/09/19	13/09/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	83	250	64	110	72	
Barium	DETSC 2301#	1.5	mg/kg	89	130	200	80	75	
Beryllium	DETSC 2301#	0.2	mg/kg	1.3	2.9	3.3	1.4	1.0	
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Cadmium	DETSC 2301#	0.1	mg/kg	54	80	16	12	48	
Chromium	DETSC 2301#	0.15	mg/kg	3.3	6.2	2.9	5.2	4.8	
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	110	800	34	240	100	
Lead	DETSC 2301#	0.3	mg/kg	U/S	8700	960	9800	U/S	
Mercury	DETSC 2325#	0.05	mg/kg	1.9	1.0	1.2	1.2	1.1	1.0
Nickel	DETSC 2301#	1	mg/kg	39	120	67	68	33	
Selenium	DETSC 2301#	0.5	mg/kg	2.6	3.3	0.8	2.5	1.6	
Vanadium	DETSC 2301#	0.8	mg/kg	5.5	11	4.1	9.1	8.2	
Zinc	DETSC 2301#	1	mg/kg	U/S	U/S	U/S	U/S	U/S	
Inorganics									
pH	DETSC 2008#		pH	7.2	7.5	7.8	7.7	7.9	7.8
Cyanide, Total	DETSC 2130#	0.1	mg/kg	0.1	0.1	< 0.1	< 0.1	0.1	0.2
Cyanide, Free	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
FOC	DETSC 2084#	0.001		0.007	0.008	0.017	0.002	0.027	0.009
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	180	45	32	48	96	180
Sulphide	DETSC 2024*	10	mg/kg	< 10	< 10	210	< 10	320	500
Sulphur as S, Total	DETSC 2320	0.01	%	0.89	0.17	0.49	0.09	1.8	0.66
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10



Summary of Chemical Analysis

Soil Samples

Our Ref 19-19242-1

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1571244	1571245	1571246	1571247	1571248	1573134
Sample ID	WSBH101	WSTP101	WSTP102	WSTP102	WSTP103	WSTP105
Depth	0.50	1.20-1.56	0.50	1.20-1.56	0.50	0.50
Other ID	5	9.1	4	9.1	5	5
Sample Type	ES	ES	ES	ES	ES	ES
Sampling Date	09/09/19	10/09/19	10/09/19	10/09/19	12/09/19	13/09/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
Benzene	DETSC 3321#	0.01	mg/kg						
Ethylbenzene	DETSC 3321#	0.01	mg/kg						
Toluene	DETSC 3321#	0.01	mg/kg						
Xylene	DETSC 3321#	0.01	mg/kg						
PAHs									
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Chrysene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Coronene	DETSC 3301*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PAH Total	DETSC 3301	1.6	mg/kg	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3

Summary of Chemical Analysis

Soil Samples

Our Ref 19-19242-1

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1573135	1573136
Sample ID	WSTP106	WSTP107
Depth	0.50	1.00
Other ID	4	6
Sample Type	ES	ES
Sampling Date	16/09/19	16/09/19
Sampling Time	n/s	n/s

Test	Method	LOD	Units		
Metals					
Arsenic	DETSC 2301#	0.2	mg/kg		
Barium	DETSC 2301#	1.5	mg/kg		
Beryllium	DETSC 2301#	0.2	mg/kg		
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	< 0.2	0.2
Cadmium	DETSC 2301#	0.1	mg/kg		
Chromium	DETSC 2301#	0.15	mg/kg		
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg		
Lead	DETSC 2301#	0.3	mg/kg		
Mercury	DETSC 2325#	0.05	mg/kg	0.38	1.4
Nickel	DETSC 2301#	1	mg/kg		
Selenium	DETSC 2301#	0.5	mg/kg		
Vanadium	DETSC 2301#	0.8	mg/kg		
Zinc	DETSC 2301#	1	mg/kg		
Inorganics					
pH	DETSC 2008#		pH	7.9	7.9
Cyanide, Total	DETSC 2130#	0.1	mg/kg	0.2	0.1
Cyanide, Free	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1
FOC	DETSC 2084#	0.001		0.007	0.014
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	440	190
Sulphide	DETSC 2024*	10	mg/kg	12	760
Sulphur as S, Total	DETSC 2320	0.01	%	0.39	1.3
Petroleum Hydrocarbons					
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10

Summary of Chemical Analysis

Soil Samples

Our Ref 19-19242-1

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1573135	1573136
Sample ID	WSTP106	WSTP107
Depth	0.50	1.00
Other ID	4	6
Sample Type	ES	ES
Sampling Date	16/09/19	16/09/19
Sampling Time	n/s	n/s

Test	Method	LOD	Units		
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg	< 10	< 10
Benzene	DETSC 3321#	0.01	mg/kg	< 0.01	< 0.01
Ethylbenzene	DETSC 3321#	0.01	mg/kg	< 0.01	< 0.01
Toluene	DETSC 3321#	0.01	mg/kg	< 0.01	< 0.01
Xylene	DETSC 3321#	0.01	mg/kg	< 0.01	< 0.01
PAHs					
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Pyrene	DETSC 3301	0.1	mg/kg	< 0.1	0.2
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Chrysene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Coronene	DETSC 3301*	0.1	mg/kg	< 0.1	< 0.1
PAH Total	DETSC 3301	1.6	mg/kg	< 1.6	< 1.6
Phenols					
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3

Summary of Chemical Analysis

Soil VOC/SVOC Samples

Our Ref 19-19242-1

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1571208	1571210	1571211	1571214	1571215	1571218
Sample ID	BH104	BH104	BH105	BH106	BH106	TP115
Depth	0.50	3.00	1.00	1.00	2.00	1.00
Other ID	2	12	3	4	7	2
Sample Type	ES	ES	ES	ES	ES	ES
Sampling Date	05/09/19	05/09/19	06/09/19	09/09/19	09/09/19	06/09/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
VOCs									
Vinyl Chloride	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,1 Dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Trans-1,2-dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,1-dichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Cis-1,2-dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
2,2-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Bromochloromethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Chloroform	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,1,1-trichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,1-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Carbon tetrachloride	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,2-dichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Trichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,2-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Dibromomethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Bromodichloromethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
cis-1,3-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Toluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
trans-1,3-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,1,2-trichloroethane	DETSC 3431	0.01	mg/kg	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Tetrachloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,3-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Dibromochloromethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,2-dibromoethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Chlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,1,1,2-tetrachloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Ethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
m+p-Xylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
o-Xylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Styrene	DETSC 3431*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Bromoform	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Isopropylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Bromobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,2,3-trichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	0.01	< 0.01	< 0.01	0.01
n-propylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
2-chlorotoluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,3,5-trimethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
4-chlorotoluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Tert-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Summary of Chemical Analysis

Soil VOC/SVOC Samples

Our Ref 19-19242-1

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1571208	1571210	1571211	1571214	1571215	1571218
Sample ID	BH104	BH104	BH105	BH106	BH106	TP115
Depth	0.50	3.00	1.00	1.00	2.00	1.00
Other ID	2	12	3	4	7	2
Sample Type	ES	ES	ES	ES	ES	ES
Sampling Date	05/09/19	05/09/19	06/09/19	09/09/19	09/09/19	06/09/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
1,2,4-trimethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
sec-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
p-isopropyltoluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,3-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,4-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
n-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,2-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,2-dibromo-3-chloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,2,4-trichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Hexachlorobutadiene	DETSC 3431	0.01	mg/kg	0.01	0.01	0.01	0.01	< 0.01	0.01
1,2,3-trichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
MTBE	DETSC 3431*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
SVOCs									
Phenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aniline	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2-Chlorophenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzyl Alcohol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2-Methylphenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Bis(2-chloroisopropyl)ether	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
3&4-Methylphenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2,4-Dimethylphenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Bis-(dichloroethoxy)methane	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2,4-Dichlorophenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
1,2,4-Trichlorobenzene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
4-Chloro-3-methylphenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2-Methylnaphthalene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Hexachlorocyclopentadiene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2,4,6-Trichlorophenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2,4,5-Trichlorophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2-Chloronaphthalene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2-Nitroaniline	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2,4-Dinitrotoluene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
3-Nitroaniline	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
4-Nitrophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dibenzofuran	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2,6-Dinitrotoluene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2,3,4,6-Tetrachlorophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Diethylphthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
4-Chlorophenylphenylether	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
4-Nitroaniline	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

Summary of Chemical Analysis Soil VOC/SVOC Samples

Our Ref 19-19242-1

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1571208	1571210	1571211	1571214	1571215	1571218
Sample ID	BH104	BH104	BH105	BH106	BH106	TP115
Depth	0.50	3.00	1.00	1.00	2.00	1.00
Other ID	2	12	3	4	7	2
Sample Type	ES	ES	ES	ES	ES	ES
Sampling Date	05/09/19	05/09/19	06/09/19	09/09/19	09/09/19	06/09/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
2-Methyl-4,6-Dinitrophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Diphenylamine	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
4-Bromophenylphenylether	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Hexachlorobenzene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Pentachlorophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Di-n-butylphthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Butylbenzylphthalate	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Bis(2-ethylhexyl)phthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Di-n-octylphthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
1,4-Dinitrobenzene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dimethylphthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
1,3-Dinitrobenzene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
1,2-Dinitrobenzene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2,3,5,6-Tetrachlorophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Azobenzene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Carbazole	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

Summary of Chemical Analysis

Soil VOC/SVOC Samples

Our Ref 19-19242-1

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1571222	1571227	1571230	1571233	1571235	1571240
Sample ID	TP118	TP126	TP128	WS102	WS103	WS108
Depth	1.00	1.00	1.00	0.50	0.50	0.50
Other ID	2	2	4	4	5	4
Sample Type	ES	ES	ES	ES	ES	ES
Sampling Date	10/09/19	06/09/19	09/09/19	13/09/19	12/09/19	10/09/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
VOCs									
Vinyl Chloride	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,1 Dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Trans-1,2-dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,1-dichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Cis-1,2-dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
2,2-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Bromochloromethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Chloroform	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,1,1-trichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,1-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Carbon tetrachloride	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,2-dichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Trichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,2-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Dibromomethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Bromodichloromethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
cis-1,3-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Toluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
trans-1,3-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,1,2-trichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Tetrachloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,3-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Dibromochloromethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,2-dibromoethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Chlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,1,1,2-tetrachloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Ethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
m+p-Xylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
o-Xylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Styrene	DETSC 3431*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Bromoform	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Isopropylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Bromobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,2,3-trichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
n-propylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
2-chlorotoluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,3,5-trimethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
4-chlorotoluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Tert-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Summary of Chemical Analysis

Soil VOC/SVOC Samples

Our Ref 19-19242-1

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1571222	1571227	1571230	1571233	1571235	1571240
Sample ID	TP118	TP126	TP128	WS102	WS103	WS108
Depth	1.00	1.00	1.00	0.50	0.50	0.50
Other ID	2	2	4	4	5	4
Sample Type	ES	ES	ES	ES	ES	ES
Sampling Date	10/09/19	06/09/19	09/09/19	13/09/19	12/09/19	10/09/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
1,2,4-trimethylbenzene	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
sec-butylbenzene	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
p-isopropyltoluene	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,3-dichlorobenzene	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,4-dichlorobenzene	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
n-butylbenzene	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,2-dichlorobenzene	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,2-dibromo-3-chloropropane	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,2,4-trichlorobenzene	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Hexachlorobutadiene	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	0.01	< 0.01	< 0.01	0.01
1,2,3-trichlorobenzene	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
MTBE	DETS 3431*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
SVOCs									
Phenol	DETS 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aniline	DETS 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2-Chlorophenol	DETS 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzyl Alcohol	DETS 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2-Methylphenol	DETS 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Bis(2-chloroisopropyl)ether	DETS 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
3&4-Methylphenol	DETS 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2,4-Dimethylphenol	DETS 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Bis-(dichloroethoxy)methane	DETS 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2,4-Dichlorophenol	DETS 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
1,2,4-Trichlorobenzene	DETS 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
4-Chloro-3-methylphenol	DETS 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2-Methylnaphthalene	DETS 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Hexachlorocyclopentadiene	DETS 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2,4,6-Trichlorophenol	DETS 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2,4,5-Trichlorophenol	DETS 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2-Chloronaphthalene	DETS 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2-Nitroaniline	DETS 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2,4-Dinitrotoluene	DETS 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
3-Nitroaniline	DETS 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
4-Nitrophenol	DETS 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dibenzofuran	DETS 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2,6-Dinitrotoluene	DETS 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2,3,4,6-Tetrachlorophenol	DETS 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Diethylphthalate	DETS 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
4-Chlorophenylphenylether	DETS 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
4-Nitroaniline	DETS 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

Summary of Chemical Analysis Soil VOC/SVOC Samples

Our Ref 19-19242-1

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1571222	1571227	1571230	1571233	1571235	1571240
Sample ID	TP118	TP126	TP128	WS102	WS103	WS108
Depth	1.00	1.00	1.00	0.50	0.50	0.50
Other ID	2	2	4	4	5	4
Sample Type	ES	ES	ES	ES	ES	ES
Sampling Date	10/09/19	06/09/19	09/09/19	13/09/19	12/09/19	10/09/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
2-Methyl-4,6-Dinitrophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Diphenylamine	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
4-Bromophenylphenylether	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Hexachlorobenzene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Pentachlorophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Di-n-butylphthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Butylbenzylphthalate	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Bis(2-ethylhexyl)phthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Di-n-octylphthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
1,4-Dinitrobenzene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dimethylphthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
1,3-Dinitrobenzene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
1,2-Dinitrobenzene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2,3,5,6-Tetrachlorophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Azobenzene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Carbazole	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

Summary of Chemical Analysis

Soil VOC/SVOC Samples

Our Ref 19-19242-1

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1571242	1571243	1573135	1573136
Sample ID	WS109	WSBH10	WSTP106	WSTP107
Depth	0.20	0.20	0.50	1.00
Other ID	2	2	4	6
Sample Type	ES	ES	ES	ES
Sampling Date	10/09/19	09/09/19	16/09/19	16/09/19
Sampling Time	n/s	n/s	n/s	n/s

Test	Method	LOD	Units				
VOCs							
Vinyl Chloride	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
1,1 Dichloroethylene	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Trans-1,2-dichloroethylene	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
1,1-dichloroethane	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Cis-1,2-dichloroethylene	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
2,2-dichloropropane	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Bromochloromethane	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Chloroform	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
1,1,1-trichloroethane	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
1,1-dichloropropene	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Carbon tetrachloride	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Benzene	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
1,2-dichloroethane	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Trichloroethylene	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
1,2-dichloropropane	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Dibromomethane	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Bromodichloromethane	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
cis-1,3-dichloropropene	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Toluene	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
trans-1,3-dichloropropene	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
1,1,2-trichloroethane	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Tetrachloroethylene	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
1,3-dichloropropane	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Dibromochloromethane	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
1,2-dibromoethane	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Chlorobenzene	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
1,1,1,2-tetrachloroethane	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Ethylbenzene	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
m+p-Xylene	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
o-Xylene	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Styrene	DETS 3431*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Bromoform	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Isopropylbenzene	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Bromobenzene	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
1,2,3-trichloropropane	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
n-propylbenzene	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
2-chlorotoluene	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
1,3,5-trimethylbenzene	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
4-chlorotoluene	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Tert-butylbenzene	DETS 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01

Summary of Chemical Analysis

Soil VOC/SVOC Samples

Our Ref 19-19242-1

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1571242	1571243	1573135	1573136
Sample ID	WS109	WSBH10	WSTP106	WSTP107
Depth	0.20	0.20	0.50	1.00
Other ID	2	2	4	6
Sample Type	ES	ES	ES	ES
Sampling Date	10/09/19	09/09/19	16/09/19	16/09/19
Sampling Time	n/s	n/s	n/s	n/s

Test	Method	LOD	Units				
1,2,4-trimethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
sec-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
p-isopropyltoluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
1,3-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
1,4-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
n-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
1,2-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
1,2-dibromo-3-chloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
1,2,4-trichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
Hexachlorobutadiene	DETSC 3431	0.01	mg/kg	0.01	< 0.01	< 0.01	< 0.01
1,2,3-trichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
MTBE	DETSC 3431*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01
SVOCs							
Phenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Aniline	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
2-Chlorophenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Benzyl Alcohol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
2-Methylphenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Bis(2-chloroisopropyl)ether	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
3&4-Methylphenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
2,4-Dimethylphenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Bis-(dichloroethoxy)methane	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
2,4-Dichlorophenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
1,2,4-Trichlorobenzene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
4-Chloro-3-methylphenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
2-Methylnaphthalene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Hexachlorocyclopentadiene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
2,4,6-Trichlorophenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
2,4,5-Trichlorophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
2-Chloronaphthalene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
2-Nitroaniline	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
2,4-Dinitrotoluene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
3-Nitroaniline	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
4-Nitrophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Dibenzofuran	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
2,6-Dinitrotoluene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
2,3,4,6-Tetrachlorophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Diethylphthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
4-Chlorophenylphenylether	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
4-Nitroaniline	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1

Summary of Chemical Analysis

Soil VOC/SVOC Samples

Our Ref 19-19242-1

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1571242	1571243	1573135	1573136
Sample ID	WS109	WSBH10	WSTP106	WSTP107
Depth	0.20	0.20	0.50	1.00
Other ID	2	2	4	6
Sample Type	ES	ES	ES	ES
Sampling Date	10/09/19	09/09/19	16/09/19	16/09/19
Sampling Time	n/s	n/s	n/s	n/s

Test	Method	LOD	Units				
2-Methyl-4,6-Dinitrophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Diphenylamine	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
4-Bromophenylphenylether	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Hexachlorobenzene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Pentachlorophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Di-n-butylphthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Butylbenzylphthalate	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Bis(2-ethylhexyl)phthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Di-n-octylphthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
1,4-Dinitrobenzene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Dimethylphthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
1,3-Dinitrobenzene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
1,2-Dinitrobenzene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
2,3,5,6-Tetrachlorophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Azobenzene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Carbazole	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1

Summary of Chemical Analysis

Leachate Samples

Our Ref 19-19242-1

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1571249	1571250	1571251	1571252	1571253	1571254
Sample ID	BH104	BH104	BH105	BH106	BH106	TP115
Depth	0.50	3.00	1.00	1.00	2.00	1.00
Other ID	2	12	3	4	7	2
Sample Type	ES	ES	ES	ES	ES	ES
Sampling Date	05/09/19	05/09/19	06/09/19	09/09/19	09/09/19	06/09/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Preparation									
Leachate 2:1 250g Non-WAC	DETSC 1009*			Y	Y	Y	Y	Y	Y
Metals									
Arsenic, Dissolved	DETSC 2306	0.16	ug/l	< 0.16	0.20	< 0.16	0.20	0.20	< 0.16
Barium, Dissolved	DETSC 2306	0.26	ug/l	6.7	11	2.5	3.3	2.9	1.6
Beryllium, Dissolved	DETSC 2306*	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Boron, Dissolved	DETSC 2306*	12	ug/l	< 12	< 12	< 12	< 12	< 12	< 12
Cadmium, Dissolved	DETSC 2306	0.03	ug/l	< 0.03	0.07	< 0.03	< 0.03	< 0.03	< 0.03
Chromium, Dissolved	DETSC 2306	0.25	ug/l	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25
Chromium, Hexavalent	DETSC 2203	0.007	mg/l	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007
Copper, Dissolved	DETSC 2306	0.4	ug/l	< 0.4	0.8	< 0.4	0.5	0.4	< 0.4
Lead, Dissolved	DETSC 2306	0.09	ug/l	< 0.09	< 0.09	0.10	2.2	1.0	0.50
Mercury, Dissolved	DETSC 2306	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Nickel, Dissolved	DETSC 2306	0.5	ug/l	< 0.5	6.3	0.8	1.3	< 0.5	< 0.5
Selenium, Dissolved	DETSC 2306	0.25	ug/l	< 0.25	2.0	< 0.25	< 0.25	< 0.25	< 0.25
Vanadium, Dissolved	DETSC 2306	0.6	ug/l	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
Zinc, Dissolved	DETSC 2306	1.3	ug/l	5.7	15	12	12	5.1	5.2
Inorganics									
Conductivity	DETSC 2009	1	uS/cm	13.4	76.2	10.7	10.9	10.9	7.7
pH	DETSC 2008		pH	7.1	6.2	6.3	5.8	7.4	7.1
Cyanide, Total	DETSC 2130	40	ug/l	< 40	< 40	< 40	< 40	< 40	< 40
Cyanide, Free	DETSC 2130	0.02	mg/l	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Ammoniacal Nitrogen as N	DETSC 2207	0.015	mg/l	< 0.015	0.018	< 0.015	< 0.015	< 0.015	< 0.015
Chloride	DETSC 2055	0.1	mg/l	1.3	1.3	1.2	1.4	1.3	1.2
Nitrate as N	*	0.1	mg/l	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Sulphate as SO4	DETSC 2055	0.1	mg/l	1.4	25	1.1	2.5	1.6	1.1
Sulphide	DETSC 2208	10	ug/l	< 10	< 10	< 10	< 10	< 10	< 10
Sulphur as S, Total	DETSC 2320*	10	mg/l	< 10	12	< 10	< 10	< 10	< 10
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C6-C8	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C10-C12	DETSC 3072*	1	ug/l	< 1.0	< 1.0	2.2	< 1.0	< 1.0	< 1.0
Aliphatic C12-C16	DETSC 3072*	1	ug/l	< 1.0	< 1.0	4.7	< 1.0	< 1.0	< 1.0
Aliphatic C16-C21	DETSC 3072*	1	ug/l	5.7	< 1.0	7.2	< 1.0	< 1.0	5.4
Aliphatic C21-C35	DETSC 3072*	1	ug/l	1.3	8.6	14	< 1.0	< 1.0	< 1.0
Aliphatic C5-C35	DETSC 3072*	10	ug/l	< 10	< 10	28	< 10	< 10	< 10
Aromatic C5-C7	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C7-C8	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

Summary of Chemical Analysis

Leachate Samples

Our Ref 19-19242-1

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1571249	1571250	1571251	1571252	1571253	1571254
Sample ID	BH104	BH104	BH105	BH106	BH106	TP115
Depth	0.50	3.00	1.00	1.00	2.00	1.00
Other ID	2	12	3	4	7	2
Sample Type	ES	ES	ES	ES	ES	ES
Sampling Date	05/09/19	05/09/19	06/09/19	09/09/19	09/09/19	06/09/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Aromatic C10-C12	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C12-C16	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C16-C21	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C21-C35	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C5-C35	DETSC 3072*	10	ug/l	< 10	< 10	< 10	< 10	< 10	< 10
TPH Ali/Aro Total	DETSC 3072*	10	ug/l	< 10	< 10	28	< 10	< 10	< 10

PAHs									
Naphthalene	DETSC 3304	0.05	ug/l	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthene	DETSC 3304	0.01	ug/l	< 0.01	0.01	< 0.01	< 0.01	< 0.01	< 0.01
Fluorene	DETSC 3304	0.01	ug/l	< 0.01	0.02	< 0.01	< 0.01	< 0.01	< 0.01
Phenanthrene	DETSC 3304	0.01	ug/l	0.02	0.03	0.01	0.05	0.03	< 0.01
Anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Fluoranthene	DETSC 3304	0.01	ug/l	0.02	0.01	< 0.01	0.03	0.03	0.01
Pyrene	DETSC 3304	0.01	ug/l	0.01	< 0.01	< 0.01	0.02	0.02	< 0.01
Benzo(a)anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	0.01	< 0.01	< 0.01
Chrysene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	0.01	< 0.01	< 0.01
Benzo(b)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	0.02	0.01	< 0.01
Benzo(k)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)pyrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Indeno(1,2,3-c,d)pyrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Dibenzo(a,h)anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(g,h,i)perylene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Coronene	DETSC 3304*	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
PAH Total	DETSC 3304	0.2	ug/l	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20

Phenols									
Phenol - Monohydric	DETSC 2130	0.1	mg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

Summary of Chemical Analysis

Leachate Samples

Our Ref 19-19242-1

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1571255	1571256	1571257	1571258	1571259	1571260
Sample ID	TP118	TP126	TP128	WS102	WS103	WS108
Depth	1.00	1.00	1.00	0.50	0.50	0.50
Other ID	2	2	4	4	5	4
Sample Type	ES	ES	ES	ES	ES	ES
Sampling Date	10/09/19	06/09/19	09/09/19	13/09/19	12/09/19	10/09/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Preparation									
Leachate 2:1 250g Non-WAC	DETS 1009*			Y	Y	Y	Y	Y	Y
Metals									
Arsenic, Dissolved	DETS 2306	0.16	ug/l	< 0.16	< 0.16	0.90	0.40	< 0.16	0.30
Barium, Dissolved	DETS 2306	0.26	ug/l	1.8	5.2	17	46	7.7	7.5
Beryllium, Dissolved	DETS 2306*	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Boron, Dissolved	DETS 2306*	12	ug/l	< 12	< 12	< 12	< 12	< 12	< 12
Cadmium, Dissolved	DETS 2306	0.03	ug/l	< 0.03	< 0.03	< 0.03	0.60	< 0.03	< 0.03
Chromium, Dissolved	DETS 2306	0.25	ug/l	< 0.25	0.90	0.80	0.30	< 0.25	0.40
Chromium, Hexavalent	DETS 2203	0.007	mg/l	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007
Copper, Dissolved	DETS 2306	0.4	ug/l	< 0.4	0.6	2.1	1.5	< 0.4	1.4
Lead, Dissolved	DETS 2306	0.09	ug/l	0.20	0.10	0.90	3.6	2.1	6.8
Mercury, Dissolved	DETS 2306	0.01	ug/l	< 0.01	< 0.01	< 0.01	0.02	< 0.01	< 0.01
Nickel, Dissolved	DETS 2306	0.5	ug/l	< 0.5	< 0.5	1.0	< 0.5	0.5	1.6
Selenium, Dissolved	DETS 2306	0.25	ug/l	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25
Vanadium, Dissolved	DETS 2306	0.6	ug/l	< 0.6	< 0.6	1.4	< 0.6	< 0.6	0.6
Zinc, Dissolved	DETS 2306	1.3	ug/l	5.1	10	16	140	37	23
Inorganics									
Conductivity	DETS 2009	1	uS/cm	8.5	90.8	47.8	141	13.5	9.0
pH	DETS 2008		pH	6.7	6.4	7.0	6.9	7.1	6.9
Cyanide, Total	DETS 2130	40	ug/l	< 40	< 40	< 40	< 40	< 40	< 40
Cyanide, Free	DETS 2130	0.02	mg/l	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Ammoniacal Nitrogen as N	DETS 2207	0.015	mg/l	< 0.015	< 0.015	0.090	0.060	0.040	0.030
Chloride	DETS 2055	0.1	mg/l	1.4	2.5	1.7	13	1.3	1.3
Nitrate as N	*	0.1	mg/l	0.17	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Sulphate as SO4	DETS 2055	0.1	mg/l	1.4	30	12	14	1.9	1.9
Sulphide	DETS 2208	10	ug/l	< 10	< 10	< 10	< 10	< 10	< 10
Sulphur as S, Total	DETS 2320*	10	mg/l	< 10	11	< 10	< 10	< 10	< 10
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETS 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C6-C8	DETS 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C8-C10	DETS 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C10-C12	DETS 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C12-C16	DETS 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C16-C21	DETS 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C21-C35	DETS 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C5-C35	DETS 3072*	10	ug/l	< 10	< 10	< 10	< 10	< 10	< 10
Aromatic C5-C7	DETS 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C7-C8	DETS 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C8-C10	DETS 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

Summary of Chemical Analysis

Leachate Samples

Our Ref 19-19242-1

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1571255	1571256	1571257	1571258	1571259	1571260
Sample ID	TP118	TP126	TP128	WS102	WS103	WS108
Depth	1.00	1.00	1.00	0.50	0.50	0.50
Other ID	2	2	4	4	5	4
Sample Type	ES	ES	ES	ES	ES	ES
Sampling Date	10/09/19	06/09/19	09/09/19	13/09/19	12/09/19	10/09/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Aromatic C10-C12	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C12-C16	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C16-C21	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C21-C35	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C5-C35	DETSC 3072*	10	ug/l	< 10	< 10	< 10	< 10	< 10	< 10
TPH Ali/Aro Total	DETSC 3072*	10	ug/l	< 10	< 10	< 10	< 10	< 10	< 10
PAHs									
Naphthalene	DETSC 3304	0.05	ug/l	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.02
Fluorene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.02
Phenanthrene	DETSC 3304	0.01	ug/l	0.02	0.02	< 0.01	0.05	0.03	0.05
Anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	0.02	< 0.01	0.02
Fluoranthene	DETSC 3304	0.01	ug/l	0.02	< 0.01	0.02	0.03	0.05	0.05
Pyrene	DETSC 3304	0.01	ug/l	0.01	< 0.01	0.02	0.02	0.04	0.03
Benzo(a)anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	0.01	0.01	< 0.01
Chrysene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	0.01	0.03	0.02	0.02
Benzo(b)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	0.02	0.05	0.02	0.02
Benzo(k)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	0.02	< 0.01	< 0.01
Benzo(a)pyrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	0.02	< 0.01	< 0.01
Indeno(1,2,3-c,d)pyrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	0.02	< 0.01	< 0.01
Dibenzo(a,h)anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(g,h,i)perylene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	0.01	0.03	0.01	0.01
Coronene	DETSC 3304*	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
PAH Total	DETSC 3304	0.2	ug/l	< 0.20	< 0.20	< 0.20	0.31	< 0.20	0.27
Phenols									
Phenol - Monohydric	DETSC 2130	0.1	mg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

Summary of Chemical Analysis

Leachate Samples

Our Ref 19-19242-1

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1571261	1571262	1573137	1573138
Sample ID	WS109	WSBH10	WSTP106	WSTP107
Depth	0.20	0.20	0.50	1.00
Other ID	2	2	4	6
Sample Type	ES	ES	ES	ES
Sampling Date	10/09/19	09/09/19	16/09/19	16/09/19
Sampling Time	n/s	n/s	n/s	n/s

Test	Method	LOD	Units				
Preparation							
Leachate 2:1 250g Non-WAC	DETSC 1009*			Y	Y	Y	Y
Metals							
Arsenic, Dissolved	DETSC 2306	0.16	ug/l	1.2	0.20	< 0.16	< 0.16
Barium, Dissolved	DETSC 2306	0.26	ug/l	13	21	20	19
Beryllium, Dissolved	DETSC 2306*	0.1	ug/l	0.1	< 0.1	< 0.1	< 0.1
Boron, Dissolved	DETSC 2306*	12	ug/l	< 12	< 12	< 12	< 12
Cadmium, Dissolved	DETSC 2306	0.03	ug/l	0.30	1.3	3.1	2.2
Chromium, Dissolved	DETSC 2306	0.25	ug/l	0.30	< 0.25	< 0.25	< 0.25
Chromium, Hexavalent	DETSC 2203	0.007	mg/l	< 0.007	< 0.007	< 0.007	< 0.007
Copper, Dissolved	DETSC 2306	0.4	ug/l	1.1	1.1	1.2	0.9
Lead, Dissolved	DETSC 2306	0.09	ug/l	10	7.0	7.2	3.1
Mercury, Dissolved	DETSC 2306	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01
Nickel, Dissolved	DETSC 2306	0.5	ug/l	0.8	1.2	0.6	< 0.5
Selenium, Dissolved	DETSC 2306	0.25	ug/l	< 0.25	< 0.25	< 0.25	< 0.25
Vanadium, Dissolved	DETSC 2306	0.6	ug/l	< 0.6	< 0.6	1.9	0.8
Zinc, Dissolved	DETSC 2306	1.3	ug/l	230	440	320	310
Inorganics							
Conductivity	DETSC 2009	1	uS/cm	33.8	55.2	314	83.3
pH	DETSC 2008		pH	6.5	7.5	6.3	6.6
Cyanide, Total	DETSC 2130	40	ug/l	< 40	< 40	< 40	< 40
Cyanide, Free	DETSC 2130	0.02	mg/l	< 0.02	< 0.02	< 0.02	< 0.02
Ammoniacal Nitrogen as N	DETSC 2207	0.015	mg/l	0.040	0.050	0.35	0.33
Chloride	DETSC 2055	0.1	mg/l	1.7	1.4	0.92	1.2
Nitrate as N	*	0.1	mg/l	< 0.10	< 0.10	0.13	0.19
Sulphate as SO4	DETSC 2055	0.1	mg/l	3.6	5.7	140	20
Sulphide	DETSC 2208	10	ug/l	< 10	< 10	< 10	< 10
Sulphur as S, Total	DETSC 2320*	10	mg/l	< 10	< 10	51	11
Petroleum Hydrocarbons							
Aliphatic C5-C6	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C6-C8	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C10-C12	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C12-C16	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C16-C21	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C21-C35	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C5-C35	DETSC 3072*	10	ug/l	< 10	< 10	< 10	< 10
Aromatic C5-C7	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C7-C8	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1

Summary of Chemical Analysis

Leachate Samples

Our Ref 19-19242-1

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	1571261	1571262	1573137	1573138
Sample ID	WS109	WSBH10	WSTP106	WSTP107
Depth	0.20	0.20	0.50	1.00
Other ID	2	2	4	6
Sample Type	ES	ES	ES	ES
Sampling Date	10/09/19	09/09/19	16/09/19	16/09/19
Sampling Time	n/s	n/s	n/s	n/s

Test	Method	LOD	Units				
Aromatic C10-C12	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C12-C16	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C16-C21	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C21-C35	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C5-C35	DETSC 3072*	10	ug/l	< 10	< 10	< 10	< 10
TPH Ali/Aro Total	DETSC 3072*	10	ug/l	< 10	< 10	< 10	< 10
PAHs							
Naphthalene	DETSC 3304	0.05	ug/l	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01
Fluorene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01
Phenanthrene	DETSC 3304	0.01	ug/l	0.02	0.07	< 0.01	0.02
Anthracene	DETSC 3304	0.01	ug/l	< 0.01	0.02	< 0.01	< 0.01
Fluoranthene	DETSC 3304	0.01	ug/l	0.02	0.06	< 0.01	0.03
Pyrene	DETSC 3304	0.01	ug/l	< 0.01	0.04	< 0.01	0.03
Benzo(a)anthracene	DETSC 3304	0.01	ug/l	< 0.01	0.02	< 0.01	< 0.01
Chrysene	DETSC 3304	0.01	ug/l	< 0.01	0.05	< 0.01	0.01
Benzo(b)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	0.06	< 0.01	< 0.01
Benzo(k)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	0.02	< 0.01	< 0.01
Benzo(a)pyrene	DETSC 3304	0.01	ug/l	< 0.01	0.01	< 0.01	< 0.01
Indeno(1,2,3-c,d)pyrene	DETSC 3304	0.01	ug/l	< 0.01	0.02	< 0.01	< 0.01
Dibenzo(a,h)anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(g,h,i)perylene	DETSC 3304	0.01	ug/l	< 0.01	0.03	< 0.01	< 0.01
Coronene	DETSC 3304*	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01
PAH Total	DETSC 3304	0.2	ug/l	< 0.20	0.44	< 0.20	< 0.20
Phenols							
Phenol - Monohydric	DETSC 2130	0.1	mg/l	< 0.1	< 0.1	< 0.1	< 0.1

Summary of Asbestos Analysis

Soil Samples

Our Ref 19-19242-1

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
1571208	BH104 2 0.50	SOIL	NAD	none	Colin Patrick
1571209	BH104 8 2.00	SOIL	NAD	none	Colin Patrick
1571210	BH104 12 3.00	SOIL	NAD	none	Colin Patrick
1571211	BH105 3 1.00	SOIL	NAD	none	Colin Patrick
1571212	BH105 7 2.00	SOIL	NAD	none	Colin Patrick
1571213	BH105 10 3.00	SOIL	NAD	none	Colin Patrick
1571214	BH106 4 1.00	SOIL	NAD	none	Colin Patrick
1571215	BH106 7 2.00	SOIL	NAD	none	Colin Patrick
1571216	BH106 11 3.00	SOIL	NAD	none	Colin Patrick
1571217	TP113 2 1.00	SOIL	NAD	none	Colin Patrick
1571218	TP115 2 1.00	SOIL	NAD	none	Colin Patrick
1571219	TP115 4 1.20	SOIL	NAD	none	Colin Patrick
1571220	TP116 2 1.00	SOIL	NAD	none	Colin Patrick
1571221	TP117 2 1.00	SOIL	NAD	none	Colin Patrick
1571222	TP118 2 1.00	SOIL	NAD	none	Colin Patrick
1571223	TP119 2 0.80	SOIL	NAD	none	Colin Patrick
1571224	TP120 2 1.00	SOIL	NAD	none	Colin Patrick
1571225	TP122 2 0.80	SOIL	NAD	none	Colin Patrick
1571226	TP123 2 0.60	SOIL	NAD	none	Colin Patrick
1571227	TP126 2 1.00	SOIL	NAD	none	Colin Patrick
1571228	TP127 2 1.00	SOIL	NAD	none	Colin Patrick
1571229	TP128 2 0.60	SOIL	NAD	none	Colin Patrick
1571230	TP128 4 1.00	SOIL	NAD	none	Colin Patrick
1571231	WS101 2 0.20	SOIL	NAD	none	Colin Patrick
1571232	WS101 8 1.00	SOIL	NAD	none	Colin Patrick
1571233	WS102 4 0.50	SOIL	NAD	none	Colin Patrick
1571234	WS102 6 1.00	SOIL	NAD	none	Colin Patrick
1571235	WS103 5 0.50	SOIL	NAD	none	Colin Patrick
1571236	WS104 8 1.00	SOIL	NAD	none	Colin Patrick
1571237	WS105 4 0.50	SOIL	NAD	none	Colin Patrick
1571238	WS106 7 1.00	SOIL	NAD	none	Colin Patrick
1571239	WS107 4 0.50	SOIL	NAD	none	Colin Patrick
1571240	WS108 4 0.50	SOIL	NAD	none	Colin Patrick
1571241	WS108 6 1.00	SOIL	NAD	none	Colin Patrick
1571242	WS109 2 0.20	SOIL	NAD	none	Colin Patrick
1571243	WSBH101R 2 0.20	SOIL	NAD	none	Colin Patrick
1571244	WSBH101R 5 0.50	SOIL	NAD	none	Colin Patrick
1571245	WSTP101 9.1 1.20-1.56	SOIL	NAD	none	Colin Patrick
1571246	WSTP102 4 0.50	SOIL	NAD	none	Colin Patrick
1571247	WSTP102 9.1 1.20-1.56	SOIL	NAD	none	Colin Patrick
1571248	WSTP103 5 0.50	SOIL	NAD	none	Colin Patrick
1573134	WSTP105 5 0.50	SOIL	NAD	none	Colin Patrick
1573135	WSTP106 4 0.50	SOIL	NAD	none	Colin Patrick
1573136	WSTP107 6 1.00	SOIL	NAD	none	Colin Patrick

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos.

Summary of Asbestos Analysis

Soil Samples

Our Ref 19-19242-1

Client Ref TA8234

Contract Title Nenthead Mines - Proposed MWTS, GI

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
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Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * - not included in laboratory scope of accreditation.					
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Information in Support of the Analytical Results

Our Ref 19-19242-1

Client Ref TA8234

Contract Nenthead Mines - Proposed MWTS, GI

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1571208	BH104 0.50 SOIL	05/09/19	GJ 250ml, GJ 60ml x2, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days), SVOC (14 days)	
1571209	BH104 2.00 SOIL	05/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days)	
1571210	BH104 3.00 SOIL	05/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days), SVOC (14 days)	
1571211	BH105 1.00 SOIL	06/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days), SVOC (14 days)	
1571212	BH105 2.00 SOIL	06/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days)	
1571213	BH105 3.00 SOIL	06/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days)	
1571214	BH106 1.00 SOIL	09/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days), SVOC (14 days)	
1571215	BH106 2.00 SOIL	09/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days), SVOC (14 days)	
1571216	BH106 3.00 SOIL	09/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days)	
1571217	TP113 1.00 SOIL	09/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days)	
1571218	TP115 1.00 SOIL	06/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days), SVOC (14 days)	
1571219	TP115 1.20 SOIL	06/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days)	

Information in Support of the Analytical Results

Our Ref 19-19242-1

Client Ref TA8234

Contract Nenthead Mines - Proposed MWTS, GI

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1571220	TP116 1.00 SOIL	10/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days)	
1571221	TP117 1.00 SOIL	10/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days)	
1571222	TP118 1.00 SOIL	10/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days), SVOC (14 days)	
1571223	TP119 0.80 SOIL	10/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days)	
1571224	TP120 1.00 SOIL	09/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days)	
1571225	TP122 0.80 SOIL	09/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days)	
1571226	TP123 0.60 SOIL	06/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days)	
1571227	TP126 1.00 SOIL	06/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days), SVOC (14 days)	
1571228	TP127 1.00 SOIL	09/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days)	
1571229	TP128 0.60 SOIL	09/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days)	
1571230	TP128 1.00 SOIL	09/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days), SVOC (14 days)	
1571231	WS101 0.20 SOIL	09/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days)	
1571232	WS101 1.00 SOIL	09/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days)	
1571233	WS102 0.50 SOIL	13/09/19	GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days), VOC (7 days)	

Information in Support of the Analytical Results

Our Ref 19-19242-1

Client Ref TA8234

Contract Nenthead Mines - Proposed MWTS, GI

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1571234	WS102 1.00 SOIL	13/09/19	GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
1571235	WS103 0.50 SOIL	12/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days), SVOC (14 days)	
1571236	WS104 1.00 SOIL	12/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days)	
1571237	WS105 0.50 SOIL	11/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days)	
1571238	WS106 1.00 SOIL	11/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days)	
1571239	WS107 0.50 SOIL	11/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days)	
1571240	WS108 0.50 SOIL	10/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days), SVOC (14 days)	
1571241	WS108 1.00 SOIL	10/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days)	
1571242	WS109 0.20 SOIL	10/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days), SVOC (14 days)	
1571243	WSBH101R 0.20 SOIL	09/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days), SVOC (14 days)	
1571244	WSBH101R 0.50 SOIL	09/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days)	
1571245	WSTP101 1.20-1.56 SOIL	10/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days)	
1571246	WSTP102 0.50 SOIL	10/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days)	
1571247	WSTP102 1.20-1.56 SOIL	10/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days)	

Information in Support of the Analytical Results

Our Ref 19-19242-1

Client Ref TA8234

Contract Nenthead Mines - Proposed MWTS, GI

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1571248	WSTP103 0.50 SOIL	12/09/19	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days)	
1571249	BH104 0.50 LEACHATE	05/09/19	GJ 250ml, GJ 60ml x2, PT 1L		
1571250	BH104 3.00 LEACHATE	05/09/19	GJ 250ml, GJ 60ml, PT 1L		
1571251	BH105 1.00 LEACHATE	06/09/19	GJ 250ml, GJ 60ml, PT 1L		
1571252	BH106 1.00 LEACHATE	09/09/19	GJ 250ml, GJ 60ml, PT 1L		
1571253	BH106 2.00 LEACHATE	09/09/19	GJ 250ml, GJ 60ml, PT 1L		
1571254	TP115 1.00 LEACHATE	06/09/19	GJ 250ml, GJ 60ml, PT 1L		
1571255	TP118 1.00 LEACHATE	10/09/19	GJ 250ml, GJ 60ml, PT 1L		
1571256	TP126 1.00 LEACHATE	06/09/19	GJ 250ml, GJ 60ml, PT 1L		
1571257	TP128 1.00 LEACHATE	09/09/19	GJ 250ml, GJ 60ml, PT 1L		
1571258	WS102 0.50 LEACHATE	13/09/19	GJ 250ml, GJ 60ml, PT 1L		
1571259	WS103 0.50 LEACHATE	12/09/19	GJ 250ml, GJ 60ml, PT 1L		
1571260	WS108 0.50 LEACHATE	10/09/19	GJ 250ml, GJ 60ml, PT 1L		
1571261	WS109 0.20 LEACHATE	10/09/19	GJ 250ml, GJ 60ml, PT 1L		
1571262	WSBH101R 0.20 LEACHATE	09/09/19	GJ 250ml, GJ 60ml, PT 1L		
1573134	WSTP105 0.50 SOIL	13/09/19	GJ 250ml, GJ 60ml, PT 1L		
1573135	WSTP106 0.50 SOIL	16/09/19	GJ 250ml, GJ 60ml, PT 1L		
1573136	WSTP107 1.00 SOIL	16/09/19	GJ 250ml, GJ 60ml, PT 1L		
1573137	WSTP106 0.50 LEACHATE	16/09/19	GJ 250ml, GJ 60ml, PT 1L		
1573138	WSTP107 1.00 LEACHATE	16/09/19	GJ 250ml, GJ 60ml, PT 1L		

Key: G-Glass P-Plastic J-Jar T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months



Certificate of Analysis

Certificate Number 19-19852

23-Oct-19

Client Soil Engineering
Parkside Lane
Leeds
West Yorkshire
LS11 5SX

Our Reference 19-19852

Client Reference TA8234

Order No (not supplied)

Contract Title NENTHEAD MINE - PROPOSED MWTS, GI

Description 5 Water samples.

Date Received 04-Oct-19

Date Started 04-Oct-19

Date Completed 23-Oct-19

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

A handwritten signature in black ink, appearing to read "A. Fenwick".

Adam Fenwick
Contracts Manager



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Summary of Chemical Analysis Water Samples

Our Ref 19-19852

Client Ref TA8234

Contract Title NENTHEAD MINE - PROPOSED MWTS, GI

Lab No	1575836	1575837	1575838	1575839	1575840
Sample ID	BH102R	BH104	WS103	WS104	WSBH101
Depth	2.61	1.08	1.37	0.33	1.76
Other ID	MW1	MW1	MW1	MW1	MW1
Sample Type	EW	EW	EW	EW	EW
Sampling Date	01/10/19	01/10/19	01/10/19	01/10/19	01/10/19
Sampling Time	1220	1117	1037	1106	1157

Test	Method	LOD	Units	1575836	1575837	1575838	1575839	1575840
Metals								
Arsenic, Dissolved	DETSC 2306	0.16	ug/l	0.28	0.36	16	5.9	0.35
Barium, Dissolved	DETSC 2306	0.26	ug/l	93	98	830	98	88
Beryllium, Dissolved	DETSC 2306*	0.1	ug/l	< 0.1	< 0.1	8.8	0.8	< 0.1
Boron, Dissolved	DETSC 2306*	12	ug/l	14	65	33	35	< 12
Cadmium, Dissolved	DETSC 2306	0.03	ug/l	3.5	< 0.03	1.7	0.14	2.5
Calcium, Dissolved	DETSC 2306	0.09	mg/l	44	47	100	20	42
Chromium, Dissolved	DETSC 2306	0.25	ug/l	< 0.25	< 0.25	21	3.3	0.30
Chromium, Hexavalent	DETSC 2203	0.007	mg/l	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007
Copper, Dissolved	DETSC 2306	0.4	ug/l	3.5	1.1	210	28	4.3
Lead, Dissolved	DETSC 2306	0.09	ug/l	26	0.40	660	20	19
Magnesium, Dissolved	DETSC 2306	0.02	mg/l	3.6	6.2	16	4.6	3.5
Mercury, Dissolved	DETSC 2306	0.01	ug/l	< 0.01	< 0.01	< 0.01	0.05	< 0.01
Nickel, Dissolved	DETSC 2306	0.5	ug/l	7.8	1.0	150	23	7.0
Potassium, Dissolved	DETSC 2306	0.08	mg/l	1.1	4.5	7.1	3.9	1.6
Selenium, Dissolved	DETSC 2306	0.25	ug/l	3.7	1.8	11	8.6	11
Sodium, Dissolved	DETSC 2306	0.07	mg/l	13	50	84	100	30
Vanadium, Dissolved	DETSC 2306	0.6	ug/l	< 0.6	< 0.6	91	12	< 0.6
Zinc, Dissolved	DETSC 2306	1.3	ug/l	1900	3.3	420	33	680
Inorganics								
Conductivity	DETSC 2009	1	uS/cm	285	526	503	560	365
pH	DETSC 2008		pH	7.2	7.1	9.4	8.2	7.6
Cyanide, Total	DETSC 2130	40	ug/l	< 40	< 40	< 40	< 40	< 40
Cyanide, Free	DETSC 2130	0.02	mg/l	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Hardness	DETSC 2303	0.1	mg/l	125	143	316	68.3	119
Ammoniacal Nitrogen as N	DETSC 2207	0.015	mg/l	0.047	0.035	0.038	0.15	0.91
Chloride	DETSC 2055	0.1	mg/l	7.2	8.1	5.8	5.7	6.3
Nitrate as NO3	DETSC 2055	0.1	mg/l	1.9	< 0.10			0.87
Nitrate as N	*	0.1	mg/l	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Sulphate as SO4	DETSC 2055	0.1	mg/l	27	89	96	62	42
Sulphide	DETSC 2208	10	ug/l	< 10	< 10	93	< 10	< 10
Sulphur as S, Total	DETSC 2320*	10	mg/l	< 10	30	20	20	11
Petroleum Hydrocarbons								
Aliphatic C5-C6	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C6-C8	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C10-C12	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C12-C16	DETSC 3072*	1	ug/l	< 1.0	1.4	< 1.0	< 1.0	< 1.0
Aliphatic C16-C21	DETSC 3072*	1	ug/l	< 1.0	170	110	< 1.0	< 1.0
Aliphatic C21-C35	DETSC 3072*	1	ug/l	< 1.0	370	400	< 1.0	< 1.0
Aliphatic C5-C35	DETSC 3072*	10	ug/l	< 10	540	510	< 10	< 10
Aromatic C5-C7	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1



Summary of Chemical Analysis Water Samples

Our Ref 19-19852

Client Ref TA8234

Contract Title NENTHEAD MINE - PROPOSED MWTS, GI

Lab No	1575836	1575837	1575838	1575839	1575840
Sample ID	BH102R	BH104	WS103	WS104	WSBH101
Depth	2.61	1.08	1.37	0.33	1.76
Other ID	MW1	MW1	MW1	MW1	MW1
Sample Type	EW	EW	EW	EW	EW
Sampling Date	01/10/19	01/10/19	01/10/19	01/10/19	01/10/19
Sampling Time	1220	1117	1037	1106	1157

Test	Method	LOD	Units	1575836	1575837	1575838	1575839	1575840	
Aromatic C7-C8	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	
Aromatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	
Aromatic C10-C12	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
Aromatic C12-C16	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
Aromatic C16-C21	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
Aromatic C21-C35	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
Aromatic C5-C35	DETSC 3072*	10	ug/l	< 10	< 10	< 10	< 10	< 10	
TPH Ali/Aro Total	DETSC 3072*	10	ug/l	< 10	540	510	< 10	< 10	
Benzene	DETSC 3322	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
Toluene	DETSC 3322	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
Ethylbenzene	DETSC 3322	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
Xylene	DETSC 3322	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
PAHs									
Naphthalene	DETSC 3304	0.05	ug/l	< 0.05	< 0.05	0.22	0.18	< 0.05	
Acenaphthylene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.10	< 0.10	< 0.01	
Acenaphthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.10	< 0.10	< 0.01	
Fluorene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	0.22	< 0.10	< 0.01	
Phenanthrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	1.4	0.18	0.01	
Anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	2.1	< 0.10	< 0.01	
Fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	0.41	< 0.10	< 0.01	
Pyrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	0.44	< 0.10	< 0.01	
Benzo(a)anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	0.19	< 0.10	< 0.01	
Chrysene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	0.98	< 0.10	< 0.01	
Benzo(b)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	0.71	< 0.10	< 0.01	
Benzo(k)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	0.16	< 0.10	< 0.01	
Benzo(a)pyrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.10	< 0.10	< 0.01	
Indeno(1,2,3-c,d)pyrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	0.10	< 0.10	< 0.01	
Dibenzo(a,h)anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.10	< 0.10	< 0.01	
Benzo(g,h,i)perylene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	0.20	< 0.10	< 0.01	
PAH Total	DETSC 3304	0.2	ug/l	< 0.20	< 0.20	7.0	< 1.60	< 0.20	
Phenols									
Phenol - Monohydric	DETSC 2130	0.1	mg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	



Summary of Chemical Analysis Water Samples

Our Ref 19-19852

Client Ref TA8234

Contract Title NENTHEAD MINE - PROPOSED MWTS, GI

Lab No	1575836	1575837	1575838	1575839	1575840
Sample ID	BH102R	BH104	WS103	WS104	WSBH101
Depth	2.61	1.08	1.37	0.33	1.76
Other ID	MW1	MW1	MW1	MW1	MW1
Sample Type	EW	EW	EW	EW	EW
Sampling Date	01/10/19	01/10/19	01/10/19	01/10/19	01/10/19
Sampling Time	1220	1117	1037	1106	1157

Test	Method	LOD	Units	1575836	1575837	1575838	1575839	1575840
VOCs								
Dichlorodifluoromethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Chloromethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Vinyl Chloride	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Bromomethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Chloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Trichlorofluoromethane	DETSC 3432*	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,1-dichloroethylene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Methylene Chloride	DETSC 3432*	27	ug/l	< 27	< 27	< 27	< 27	< 27
Trans-1,2-dichloroethylene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,1-dichloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Cis-1,2-dichloroethylene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
2,2-dichloropropane	DETSC 3432	2	ug/l	< 2	< 2	< 2	< 2	< 2
Bromochloromethane	DETSC 3432	4	ug/l	< 4	< 4	< 4	< 4	< 4
Chloroform	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,1,1-trichloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,1-dichloropropene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Carbon tetrachloride	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Benzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,2-dichloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Trichloroethylene	DETSC 3432*	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,2-dichloropropane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Dibromomethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Bromodichloromethane	DETSC 3432	4	ug/l	< 4	< 4	< 4	< 4	< 4
cis-1,3-dichloropropene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Toluene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
trans-1,3-dichloropropene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,1,2-trichloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Tetrachloroethylene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,3-dichloropropane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Dibromochloromethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,2-dibromoethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Chlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,1,1,2-tetrachloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Ethylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
m+p-Xylene	DETSC 3432	2	ug/l	< 2	< 2	< 2	< 2	< 2
o-Xylene	DETSC 3432	1	ug/l	< 1	< 1	< 1	1	< 1
Styrene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Bromoform	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Isopropylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1



Summary of Chemical Analysis Water Samples

Our Ref 19-19852

Client Ref TA8234

Contract Title NENTHEAD MINE - PROPOSED MWTS, GI

Lab No	1575836	1575837	1575838	1575839	1575840
Sample ID	BH102R	BH104	WS103	WS104	WSBH101
Depth	2.61	1.08	1.37	0.33	1.76
Other ID	MW1	MW1	MW1	MW1	MW1
Sample Type	EW	EW	EW	EW	EW
Sampling Date	01/10/19	01/10/19	01/10/19	01/10/19	01/10/19
Sampling Time	1220	1117	1037	1106	1157

Test	Method	LOD	Units	1575836	1575837	1575838	1575839	1575840
1,1,2,2-tetrachloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Bromobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,2,3-trichloropropane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
n-propylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
2-chlorotoluene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,3,5-trimethylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	2	< 1
4-chlorotoluene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Tert-butylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,2,4-trimethylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
sec-butylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
p-isopropyltoluene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,3-dichlorobenzene	DETSC 3432	2	ug/l	< 2	< 2	< 2	< 2	< 2
1,4-dichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
n-butylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,2-dichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,2-dibromo-3-chloropropane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,2,4-trichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Hexachlorobutadiene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,2,3-trichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
MTBE	DETSC 3432*	1	ug/l	< 1	< 1	< 1	< 1	< 1
SVOCs								
Phenol	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
Aniline	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
2-Chlorophenol	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
Benzyl Alcohol	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
2-Methylphenol	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
Bis(2-chloroisopropyl)ether	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
3&4-Methylphenol	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
Bis(2-chloroethoxy)methane	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
2,4-Dimethylphenol	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
2,4-Dichlorophenol	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
1,2,4-Trichlorobenzene	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
4-Chloro-3-methylphenol	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
2-Methylnaphthalene	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
Hexachlorocyclopentadiene	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
2,4,6-Trichlorophenol	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
2,4,5-Trichlorophenol	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
2-Chloronaphthalene	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
2-Nitroaniline	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
2,4-Dinitrotoluene	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0



Summary of Chemical Analysis Water Samples

Our Ref 19-19852

Client Ref TA8234

Contract Title NENTHEAD MINE - PROPOSED MWTS, GI

Lab No	1575836	1575837	1575838	1575839	1575840
Sample ID	BH102R	BH104	WS103	WS104	WSBH101
Depth	2.61	1.08	1.37	0.33	1.76
Other ID	MW1	MW1	MW1	MW1	MW1
Sample Type	EW	EW	EW	EW	EW
Sampling Date	01/10/19	01/10/19	01/10/19	01/10/19	01/10/19
Sampling Time	1220	1117	1037	1106	1157

Test	Method	LOD	Units	1575836	1575837	1575838	1575839	1575840
3-Nitroaniline	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
4-Nitrophenol	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
Dibenzofuran	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
2,6-Dinitrotoluene	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
2,3,4,6-Tetrachlorophenol	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
Diethylphthalate	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
4-Chlorophenylphenylether	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
4-Nitroaniline	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
Diphenylamine	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
4-Bromophenylphenylether	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
Hexachlorobenzene	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
Bis(2-ethylhexyl)ester	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
Pentachlorophenol	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
Di-n-butylphthalate	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	12	< 2.0
Butylbenzylphthalate	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
Bis(2-ethylhexyl)phthalate	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
Di-n-octylphthalate	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
1,4-Dinitrobenzene	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
Dimethylphthalate	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
1,3-Dinitrobenzene	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
2,3,5,6-Tetrachlorophenol	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
Azobenzene	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
Carbazole	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0
1-Methylnaphthalene	DETSC 3434*	1	ug/l	< 1.0	< 2.0	< 10.0	< 10.0	< 2.0

Information in Support of the Analytical Results

Our Ref 19-19852

Client Ref TA8234

Contract NENTHEAD MINE - PROPOSED MWTS, GI

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1575836	BH102R 2.61 WATER	01/10/19	GJ 250ml x4, GJ 60ml x2, PB 1L	pH/Cond/TDS (1 days)	VOC
1575837	BH104 1.08 WATER	01/10/19	GJ 250ml x4, GJ 60ml x2, PB 1L	pH/Cond/TDS (1 days)	VOC
1575838	WS103 1.37 WATER	01/10/19	GJ 250ml x4, GJ 60ml x2, PB 1L	pH/Cond/TDS (1 days)	VOC
1575839	WS104 0.33 WATER	01/10/19	GJ 250ml x4, GJ 60ml, PB 1L	pH/Cond/TDS (1 days)	VOC
1575840	WSBH101R 1.76 WATER	01/10/19	GJ 250ml x4, GJ 60ml x2, PB 1L	pH/Cond/TDS (1 days)	VOC

Key: G-Glass P-Plastic J-Jar B-Bottle

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months



DETS

Certificate of Analysis

Certificate Number 19-21000

04-Nov-19

Client Soil Engineering
Southern Office
Foundation Court
Riverside Way
Watchmoor Park
Camberley
GU15 3RG

Our Reference 19-21000

Client Reference TA8234

Order No (not supplied)

Contract Title Nenthead Mines GI

Description 9 Soil samples.

Date Received 18-Oct-19

Date Started 18-Oct-19

Date Completed 04-Nov-19

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By



Adam Fenwick
Contracts Manager



2139

Summary of Chemical Analysis Soil Samples

Our Ref 19-21000

Client Ref TA8234

Contract Title Nenthead Mines GI

Lab No	1583986	1583987	1583988	1583989	1583990	1583991	1583992	1583993	1583994
Sample ID	BH102R	TP104	TP112	WSBH101 R	WSBH101 R	WSTP101	WSTP101	WSTP102	WSTP103
Depth	1.75	1.00	1.00	0.10	1.00	0.85	1.20	0.10	1.00
Other ID	7	3	3	1	7	5	8	1	7
Sample Type	D	D	D	D	D	D	D	D	D
Sampling Date	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units									
Inorganics												
pH	DETSC 2008#		pH	7.9	7.6	6.5	7.8	7.6	7.9	7.7	7.8	8.0
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	190	37	260	57	54	61	40	26	71
Sulphur as S, Total	DETSC 2320	0.01	%	0.59	0.26	0.50	0.12	0.15	0.61	0.18	0.44	0.27
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.23	0.14	0.27	0.16	0.22	0.26	0.13	0.19	0.21

Information in Support of the Analytical Results

Our Ref 19-21000
 Client Ref TA8234
 Contract Nenthead Mines GI

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1583986	BH102R 1.75 SOIL		PT 1L	Sample date not supplied, Anions 2:1 (365 days), Total Sulphur ICP (365 days), Total Sulphate ICP (730 days), Metals ICP Prep (365 days), pH + Conductivity (7 days)	
1583987	TP104 1.00 SOIL		PT 1L	Sample date not supplied, Anions 2:1 (365 days), Total Sulphur ICP (365 days), Total Sulphate ICP (730 days), Metals ICP Prep (365 days), pH + Conductivity (7 days)	
1583988	TP112 1.00 SOIL		PT 1L	Sample date not supplied, Anions 2:1 (365 days), Total Sulphur ICP (365 days), Total Sulphate ICP (730 days), Metals ICP Prep (365 days), pH + Conductivity (7 days)	
1583989	WSBH101R 0.10 SOIL		PT 1L	Sample date not supplied, Anions 2:1 (365 days), Total Sulphur ICP (365 days), Total Sulphate ICP (730 days), Metals ICP Prep (365 days), pH + Conductivity (7 days)	
1583990	WSBH101R 1.00 SOIL		PT 1L	Sample date not supplied, Anions 2:1 (365 days), Total Sulphur ICP (365 days), Total Sulphate ICP (730 days), Metals ICP Prep (365 days), pH + Conductivity (7 days)	
1583991	WSTP101 0.85 SOIL		PT 1L	Sample date not supplied, Anions 2:1 (365 days), Total Sulphur ICP (365 days), Total Sulphate ICP (730 days), Metals ICP Prep (365 days), pH + Conductivity (7 days)	
1583992	WSTP101 1.20 SOIL		PT 1L	Sample date not supplied, Anions 2:1 (365 days), Total Sulphur ICP (365 days), Total Sulphate ICP (730 days), Metals ICP Prep (365 days), pH + Conductivity (7 days)	
1583993	WSTP102 0.10 SOIL		PT 1L	Sample date not supplied, Anions 2:1 (365 days), Total Sulphur ICP (365 days), Total Sulphate ICP (730 days), Metals ICP Prep (365 days), pH + Conductivity (7 days)	
1583994	WSTP103 1.00 SOIL		PT 1L	Sample date not supplied, Anions 2:1 (365 days), Total Sulphur ICP (365 days), Total Sulphate ICP (730 days), Metals ICP Prep (365 days), pH + Conductivity (7 days)	

Key: P-Plastic T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Information in Support of the Analytical Results

Our Ref 19-21000
Client Ref TA8234
Contract Nenthead Mines GI

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425 μ m sieve, in accordance with BS1377.
Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.
The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-
Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months



SUPPORTING FACTUAL DATA

SECTION C

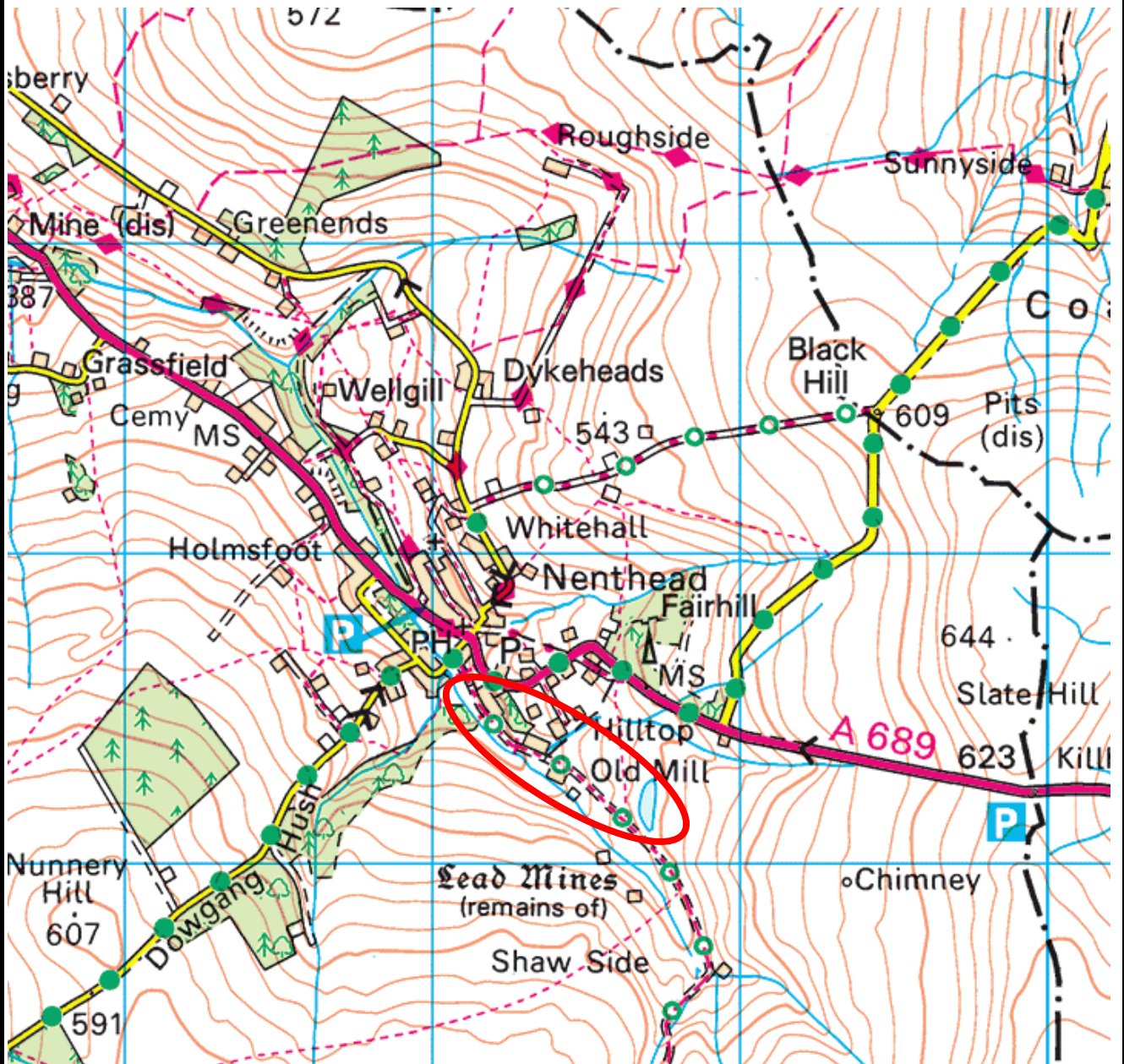
Plans and Drawings

SITE LOCATION PLAN

Project Name Nenthead Mines - Proposed MWTS, GI
 Project No. TA8234
 Engineer Aecom
 Employer The Coal Authority

Site Location Plan

Scale
 1:50,000
 Figure No.



○ Denotes Site Location

Reproduced from Ordnance Survey's 1:50,000 map number 87
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Recorded By: MPB	Checked By: paul.rogers	Approved By: paul.rogers
Date: 28/10/2019	Date: 11/11/2019	Date: 11/11/2019
Form No. SE-GOA-F-011	IssueNo.RevisionNo 2.04	Issue Date 17/08/2016



SOIL ENGINEERING
 Part of the Bachy Soletanche Group



SOIL engineering

SUPPORTING FACTUAL DATA

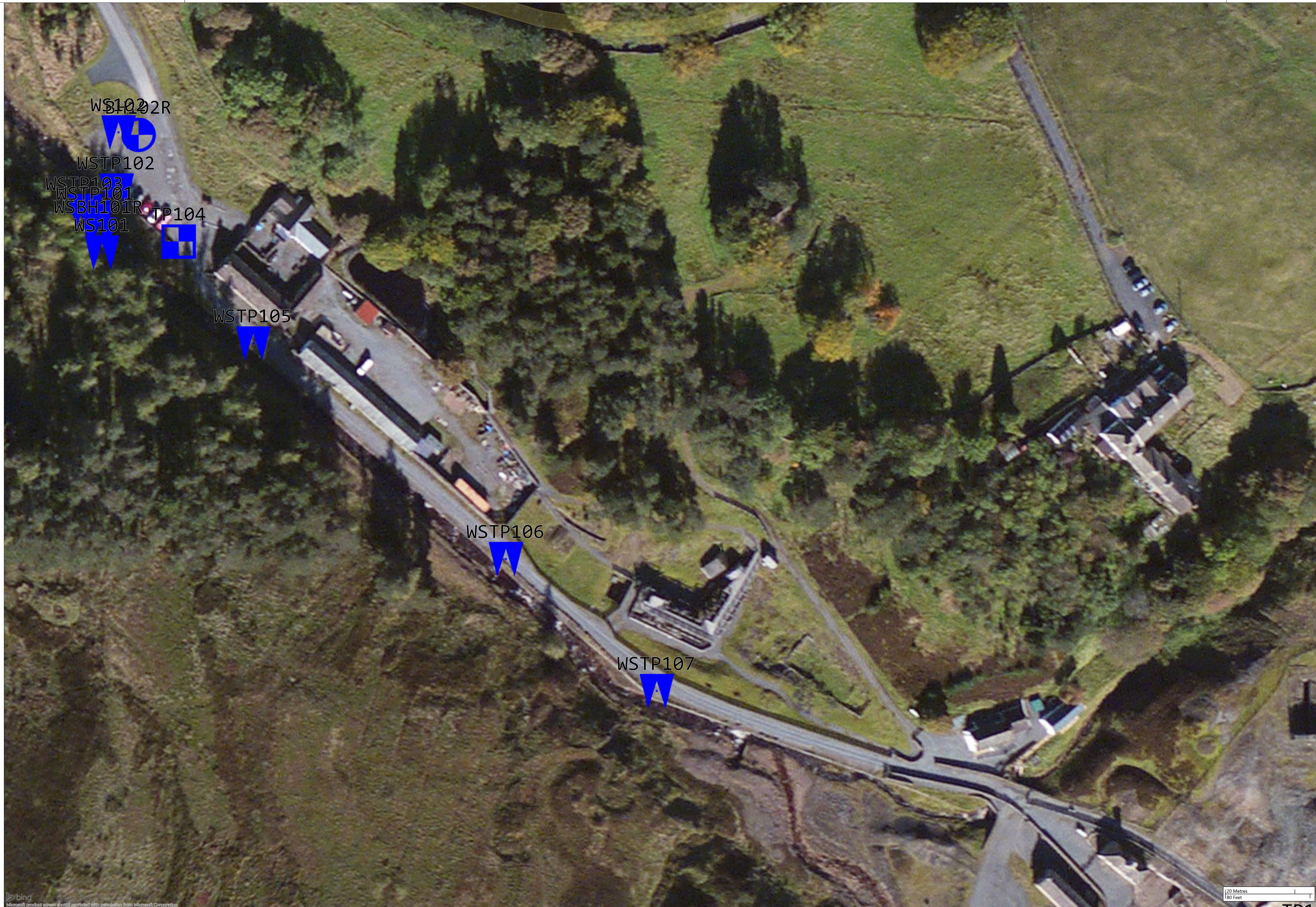
SECTION C

Plans and Drawings

EXPLORATORY HOLE LOCATION PLAN

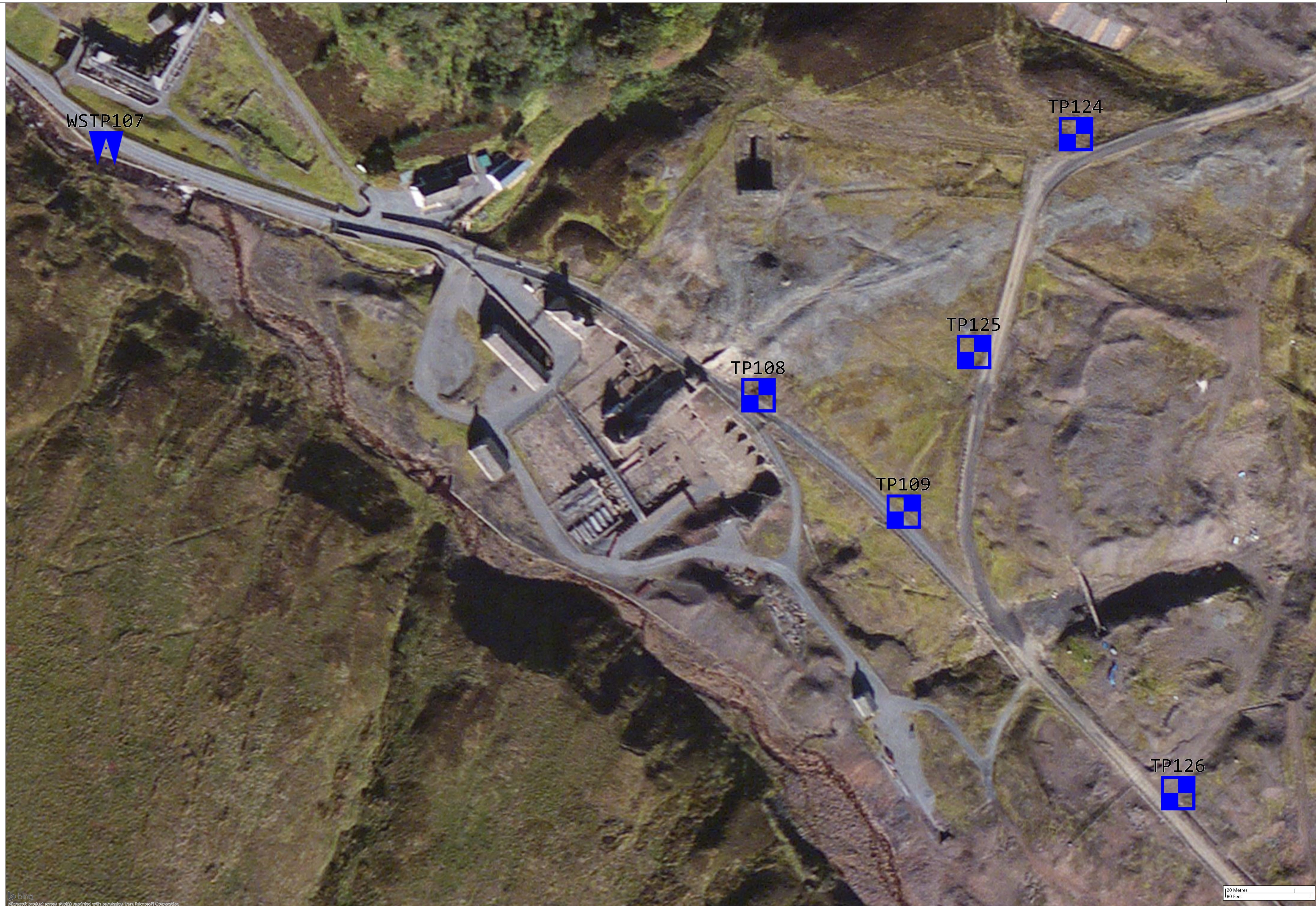
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- ⊗ Locations By Type...
- ▼ Locations By Type...
- ⊙ Locations By Type...
- ⊠ Locations By Type...

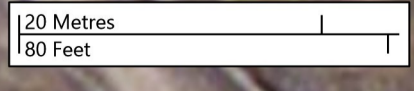


Legend Key

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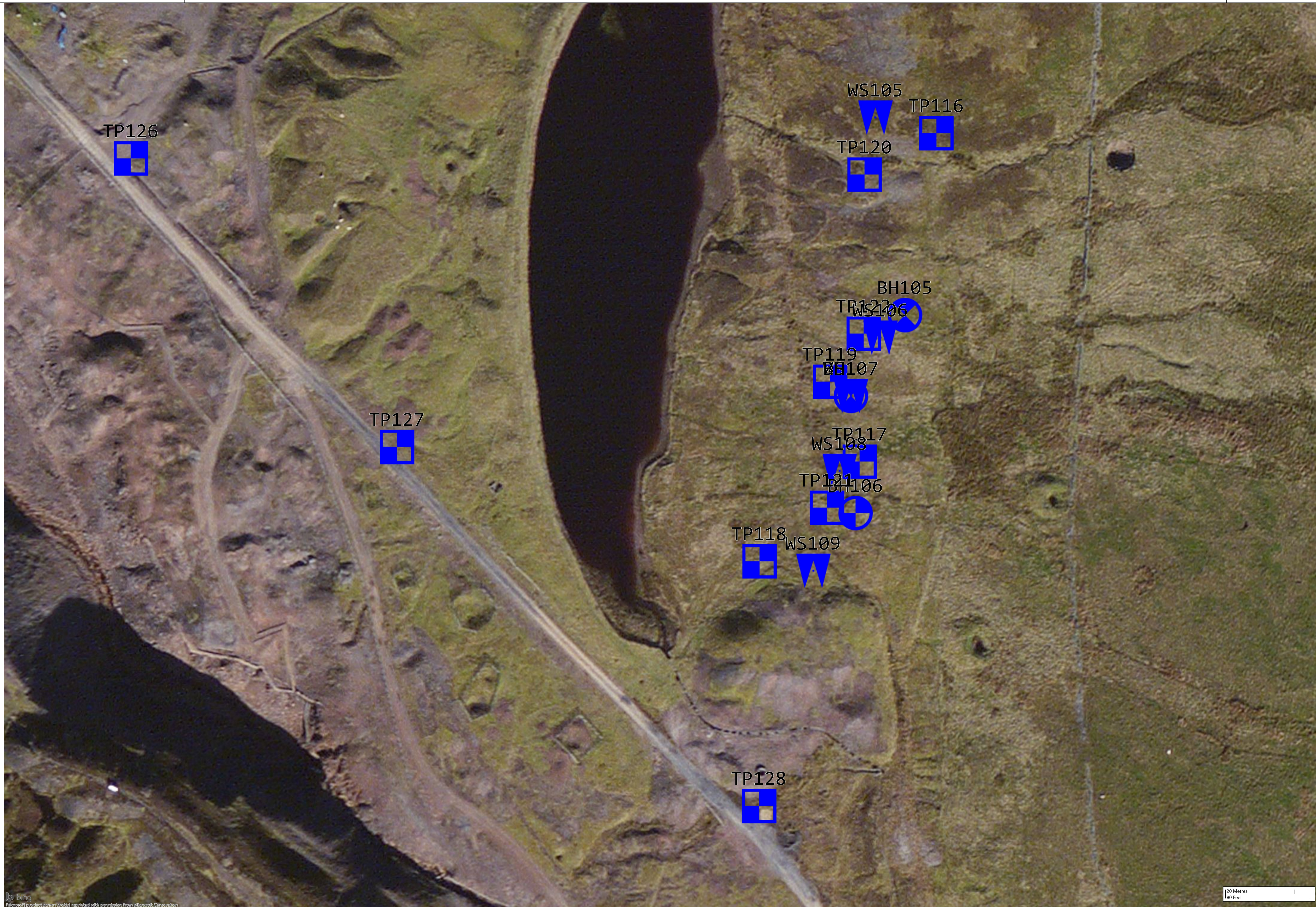
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Legend Key

- Locations
- By Type...
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- ⊗ Locations
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- By Type...





SOIL engineering

SUPPORTING FACTUAL DATA

SECTION D
Photographs

**SOIL SAMPLE / ROCK CORE /
CONCRETE CORE PHOTOGRAPHS**


Project Name	Nenthead Mines - Proposed MWTS, GI	Photographic Record	Hole ID
Project No.	TA8234		BH105
Engineer	Aecom		Plate No.
Employer	The Coal Authority		01



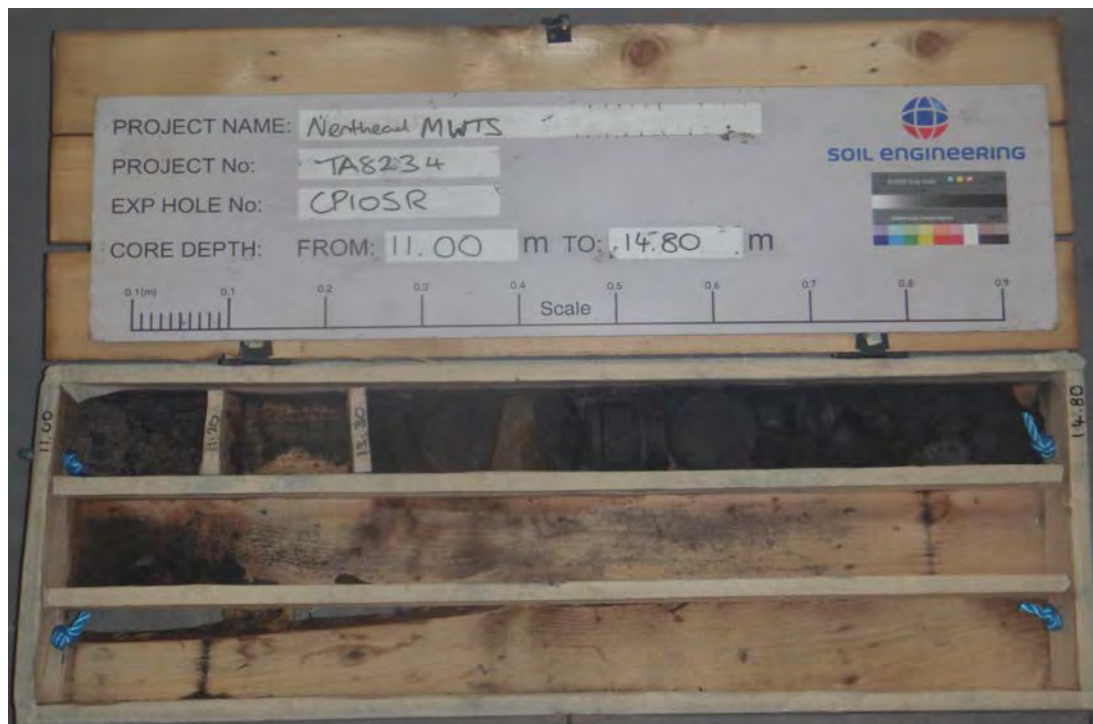
3.60 to 8.00m




8.00m to 11.00m

Photographed by	Date photographed	TA8234_3.60-8.00_2	 SOIL ENGINEERING Part of the Bachy Soletanche Group
Lee Winning	23/09/2019	TA8234_8.00-11.00_4	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	

Project Name	Nenthead Mines - Proposed MWTS, GI	Photographic Record	Hole ID
Project No.	TA8234		BH105
Engineer	Aecom		Plate No.
Employer	The Coal Authority		02



11.00m to 14.80m

Photographed by	Date photographed	TA8234_11.00-14.80_4	 SOIL ENGINEERING
Lee Winning	23/09/2019		
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group


Project Name	Nenthead Mines - Proposed MWTS, GI	Photographic Record	Hole ID
Project No.	TA8234		BH107
Engineer	Aecom		Plate No.
Employer	The Coal Authority		01



4.50m to 7.50m



7.50m to 10.00m

Photographed by	Date photographed	TA8234_WS07_4.50-7.50_3	 SOIL ENGINEERING
Lee Winning	23/09/2019	TA8234_WS07_7.50-10.00_3	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group



SOIL engineering

SUPPORTING FACTUAL DATA

SECTION D
Photographs

EXCAVATION PHOTOGRAPHS


Project Name	Nenthead Mines - Proposed MWTS, GI	Photographic Record	Hole ID
Project No.	TA8234		TP104
Engineer	Aecom		Plate No.
Employer	The Coal Authority		01



Photograph of Side A - 2.05m



Photograph of Side D - 2.05m

Photographed by	Date photographed	Side A_2	
Matthew Olley	04/09/2019	Side D_2	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group


Project Name	Nenthead Mines - Proposed MWTS, GI	Photographic Record	Hole ID
Project No.	TA8234		TP108
Engineer	Aecom		Plate No.
Employer	The Coal Authority		01



Photograph of Side A - 0.75m




Photograph of Side D - 0.75m

Photographed by	Date photographed	Side A_2	
Matthew Olley	04/09/2019	Side D_4	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Nenthead Mines - Proposed MWTS, GI	Photographic Record	Hole ID
Project No.	TA8234		TP108
Engineer	Aecom		Plate No.
Employer	The Coal Authority		02



Photograph of Spoil - 0.75m

Photographed by	Date photographed	Spoil_2	
Matthew Olley	04/09/2019		
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group


Project Name	Nenthead Mines - Proposed MWTS, GI	Photographic Record	Hole ID
Project No.	TA8234		TP109
Engineer	Aecom		Plate No.
Employer	The Coal Authority		01



Photograph of Side A - 1.90m



Photograph of Side D - 1.90m

Photographed by	Date photographed	Side A_3	 SOIL ENGINEERING
Matthew Olley	04/09/2019	Side D_1	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group


Project Name	Nenthead Mines - Proposed MWTS, GI	Photographic Record	Hole ID
Project No.	TA8234		TP110
Engineer	Aecom		Plate No.
Employer	The Coal Authority		01



Photograph of Side A - 3.00m




Photograph of Side D - 3.00m

Photographed by	Date photographed	Side A_2	
Matthew Olley	05/09/2019	Side D_2	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Nenthead Mines - Proposed MWTS, GI	Photographic Record	Hole ID
Project No.	TA8234		TP111
Engineer	Aecom		Plate No.
Employer	The Coal Authority		02



Photograph of Spoil

Photographed by	Date photographed	Spoil_2	
Matthew Olley	05/09/2019		
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group


Project Name	Nenthead Mines - Proposed MWTS, GI	Photographic Record	Hole ID
Project No.	TA8234		TP112
Engineer	Aecom		Plate No.
Employer	The Coal Authority		01



Photograph of Side A - 3.00m



Photograph of Side D - 3.00m

Photographed by	Date photographed	Side A_2	
Matthew Olley	05/09/2019	Side D_2	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group


Project Name	Nenthead Mines - Proposed MWTS, GI	Photographic Record	Hole ID
Project No.	TA8234		TP113
Engineer	Aecom		Plate No.
Employer	The Coal Authority		01



Photograph of Side A - 1.10m




Photograph of Spoil

Photographed by	Date photographed	Side A_1	
Matthew Olley	09/09/2019	Spoil_2	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Nenthead Mines - Proposed MWTS, GI	Photographic Record	Hole ID
Project No.	TA8234		TP114
Engineer	Aecom		Plate No.
Employer	The Coal Authority		02




Photograph of Spoil

Photographed by	Date photographed	Spoil_1	 SOIL ENGINEERING
Matthew Olley	05/09/2019		
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Nenthead Mines - Proposed MWTS, GI	Photographic Record	Hole ID
Project No.	TA8234		TP115
Engineer	Aecom		Plate No.
Employer	The Coal Authority		02




Photograph of Spoil

Photographed by	Date photographed	Spoil_1	
Matthew Olley	06/09/2019		
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Nenthead Mines - Proposed MWTS, GI	Photographic Record	Hole ID
Project No.	TA8234		TP116
Engineer	Aecom		Plate No.
Employer	The Coal Authority		02




Photograph of Spoil

Photographed by	Date photographed	Sppil_2	 SOIL ENGINEERING
Matthew Olley	10/09/2019		
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Nenthead Mines - Proposed MWTS, GI	Photographic Record	Hole ID
Project No.	TA8234		TP117
Engineer	Aecom		Plate No.
Employer	The Coal Authority		02




Photograph of Spoil

Photographed by	Date photographed	Spoil_1	 SOIL ENGINEERING
Matthew Olley	10/09/2019		
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Nenthead Mines - Proposed MWTS, GI	Photographic Record	Hole ID
Project No.	TA8234		TP118
Engineer	Aecom		Plate No.
Employer	The Coal Authority		02



Photograph of Spoil

Photographed by	Date photographed	Spoil_1	 SOIL ENGINEERING
Matthew Olley	10/09/2019		
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group


Project Name	Nenthead Mines - Proposed MWTS, GI	Photographic Record	Hole ID
Project No.	TA8234		TP119
Engineer	Aecom		Plate No.
Employer	The Coal Authority		01



Photograph of Side B - 0.85m



Photograph of Side C - 0.85m

Photographed by	Date photographed	Side B_1	 SOIL ENGINEERING Part of the Bachy Soletanche Group
Matthew Olley	10/09/2019	Side C_1	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	


Project Name	Nenthead Mines - Proposed MWTS, GI	Photographic Record	Hole ID
Project No.	TA8234		TP120
Engineer	Aecom		Plate No.
Employer	The Coal Authority		01



Photograph of Side B - 1.30m



Photograph of Side C - 1.30m

Photographed by	Date photographed	Side B_1	 SOIL ENGINEERING
Matthew Olley	09/09/2019	Side C_1	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group


Project Name	Nenthead Mines - Proposed MWTS, GI	Photographic Record	Hole ID
Project No.	TA8234		TP121
Engineer	Aecom		Plate No.
Employer	The Coal Authority		01



Photograph of Side A - 0.90m




Photograph of Side B - 0.90m

Photographed by	Date photographed	Side A_2	
Matthew olley	10/09/2019	Side B_1	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Nenthead Mines - Proposed MWTS, GI	Photographic Record	Hole ID
Project No.	TA8234		TP122
Engineer	Aecom		Plate No.
Employer	The Coal Authority		02



Photograph of Spoil

Photographed by	Date photographed	Spoil_1	
Matthew Olley	09/09/2019		
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group


Project Name	Nenthead Mines - Proposed MWTS, GI	Photographic Record	Hole ID
Project No.	TA8234		TP123
Engineer	Aecom		Plate No.
Employer	The Coal Authority		01



Photograph of Side C - 1.10m




Photograph of Side D - 1.10m

Photographed by	Date photographed	Side C_1	 SOIL ENGINEERING Part of the Bachy Soletanche Group
Matthew Olley	06/09/2019	Side D_1	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	

Project Name	Nenthead Mines - Proposed MWTS, GI	Photographic Record	Hole ID
Project No.	TA8234		TP124
Engineer	Aecom		Plate No.
Employer	The Coal Authority		02



Photograph of spoil

Photographed by	Date photographed	Spoil_2	 SOIL ENGINEERING
Matthew Olley	04/09/2019		
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group


Project Name	Nenthead Mines - Proposed MWTS, GI	Photographic Record	Hole ID
Project No.	TA8234		TP125
Engineer	Aecom		Plate No.
Employer	The Coal Authority		01



Photograph of Side A - 2.40m




Photograph of Side D - 2.40m

Photographed by	Date photographed	Side A_1	 SOIL ENGINEERING
Matthew Olley	04/09/2019	Side B_1	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group

Project Name	Nenthead Mines - Proposed MWTS, GI	Photographic Record	Hole ID
Project No.	TA8234		TP126
Engineer	Aecom		Plate No.
Employer	The Coal Authority		02



Photograph of Spoil

Photographed by	Date photographed	Spoil_2	 SOIL ENGINEERING
Matthew Olley	06/09/2019		
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group


Project Name	Nenthead Mines - Proposed MWTS, GI	Photographic Record	Hole ID
Project No.	TA8234		TP127
Engineer	Aecom		Plate No.
Employer	The Coal Authority		01



Photograph of Side A - 2.25m



Photograph of Side D - 2.25m

Photographed by	Date photographed	Side A_2	
Matthew Olley	09/09/2019	Side D_1	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group


Project Name	Nenthead Mines - Proposed MWTS, GI	Photographic Record	Hole ID
Project No.	TA8234		TP128
Engineer	Aecom		Plate No.
Employer	The Coal Authority		01



Photograph of Side A - 2.25m



Photograph of Side D - 2.25m

Photographed by	Date photographed	Side A_2	 SOIL ENGINEERING
Matthew Olley	09/09/2019	Side D_1	
Form No. SE-SDP-F-005	IssueNo.RevisionNo 2.04	Issue Date 05/11/2012	Part of the Bachy Soletanche Group



SOIL engineering

SUPPORTING FACTUAL DATA

APPENDIX 1

Explanatory Notes on Fieldwork, Logging
and Laboratory Testing

FIELDWORK PROCEDURES

APPENDIX 1: FIELDWORK PROCEDURES

1.0 CABLE PERCUSSION BORING TECHNIQUES

Unless otherwise stated the light cable percussion technique of 'soft ground' boring has been employed in the formation of boreholes for this contract. In cohesive soils a clay cutter has been used to advance the boreholes whilst in granular deposits a shell has been employed. The combination of clay cutter and shell bring up disturbed material which is generally sufficiently representative to permit identification of the strata. Whilst these particular techniques allow the maximum data to be obtained on strata conditions, a degree of mixing of some layered soils (e.g. thin layers of coarse and fine granular material) is inevitable.

2.0 DYNAMIC SAMPLING

As an alternative to cable percussion boring, Soil Engineering employs a number of techniques for the sampling of soils. The most common alternative techniques comprise some form of dynamic sampling system which involves sampling tubes being driven into the ground by means of a sliding weight.

'Window sampling' techniques form the most common type of dynamic sampling and typically comprise 1.0m long steel cylinders with elongated windows. These are driven to the required depth by the use of a percussive hammer. In the 'windowless' mode a plastic liner can be placed in the steel cylinders such that effectively continuous sampling can be undertaken. This method of sampling only produces Quality Class 3 or 4 samples which are not suitable for any form of laboratory machine testing.

3.0 ROUTINE SAMPLING

In the UK "undisturbed" samples of predominantly cohesive soils have historically generally been obtained in a 102mm diameter open drive sampler as described in the British Standard Code of Practice BS 5930: 1999 (ref 01). These samplers are known as U100 and historically are of two types; a metal tube or a plastic liner. BS EN ISO 22475-1: 2006 (ref 03) however makes it clear that such samplers will not produce a quality class 1 sample. It is this class of sample that is required for laboratory machine testing.

Alternative methods of sampling which will produce a class 1 sample are available and these include piston samplers, Shelby tubes and the UT100. The latter is a modification of the U100 and classifies as a thin wall sampler and as such is capable of obtaining class 1 samples. It should be noted however that this type of sampler is only suitable for certain ground conditions and cannot be used in very stiff to hard cohesive soils or in very granular cohesive soils. Equally other thin walled samplers such as the piston sampler are more appropriate for very soft and soft cohesive soils.

Soil Engineering recognise that in certain soil types, there will not be a single solution to sampling and it will be necessary to utilise a variety of sampling techniques in order to obtain the best quality samples possible. Such techniques may include rotary coring and this is described in section 4.0. For some 'difficult' soil types it may not be possible to obtain truly undisturbed samples, and engineering judgement will be required if such samples are to be used for geotechnical laboratory testing. Where such challenging soil types have been encountered and alternative sampling techniques used, this is discussed in the report text.

APPENDIX 1: FIELDWORK PROCEDURES

In granular deposits and mixed cohesive granular deposits where it is not possible to recover undisturbed samples, either large or small disturbed samples are normally obtained. The size of these samples are in accordance with the requirements of BS 5930: 1999 whilst the frequency of sampling is unique to this contract.

It is important to note that the number of blows taken to drive any kind of sampling tube is not necessarily indicative of the strength of the material being sampled. For this reason Soil Engineering recommends that no attempt is made to correlate such blows with the strength of cohesive strata.

4.0 ROTARY DRILLING

Where rotary open hole drilling techniques have been employed it is important to note that descriptions of the strata encountered are generally solely based on the lead drillers observations of cuttings and drill flush returns. Whilst such techniques can provide useful information in certain ground conditions it should be recognised that an accurate determination of subsurface rock strata can only be obtained by rotary coring techniques.

An examination of rock cores obtained by rotary drilling generally enables bedding planes, fissuring and consistency to be observed but does not necessarily reveal the presence of vertical fissures or joints. Where an appropriate core diameter and flushing medium have been used, sub-sampling of the core immediately following removal from the core barrel can produce quality Class 1 samples. Such samples require to be sealed and waxed in order to prevent moisture loss.

Details of the strata encountered are given on the borehole log along with the geologist's assessment of Total Core Recovery (TCR), Solid Core Recovery (SCR) and Rock Quality Designation (RQD) each expressed as a percentage of the individual core runs. When appropriate the Fracture Index (FI) or Fracture Spacing (If) is also given on the logs and represents respectively the number of natural fractures per metre run of core for core that has a similar intensity of fracturing, or the minimum, average and maximum spacing of such natural fractures over an arbitrary length of core of similar intensity of fracturing.

The symbols and abbreviations used on the rotary borehole logs are explained on the exploratory hole legend and notation sheet that precedes the exploratory hole records. It is considered however that the meaning of the abbreviations NI and NA needs further clarification. NI denotes material recovered non intact and applies to material that has numerous fractures or incipient fractures and which is either naturally broken up or which becomes broken up by drilling activities. The result in both cases is that the core is recovered in a highly fragmented state, generally as a gravel. The term NA is the abbreviation for not applicable and refers to any materials to which determination of a fracture index would be inappropriate, i.e. for clay bands.

Where significant core loss (>300mm) has occurred, it is Soil Engineering general policy to insert a separate 'stratum' on the log to coincide with the inferred zone of core loss. Unless there is good evidence as to the rock (or soil) type that has been lost, the legend column is left blank. For zones of inferred mine workings, an appropriate legend is used and this together with all the legends used on the logs is shown on the log notation sheet that precedes the exploratory logs in the report.

A summary of logging methodology for rock strata and core measurements is given in Appendix 1: Terminology used in the Description and Classification of Rocks.

APPENDIX 1: FIELDWORK PROCEDURES

5.0 IN SITU DYNAMIC PENETRATION TESTS

The Standard Penetration Test using either a split spoon (SPT) or a solid cone (SPT(C)), is generally employed where undisturbed samples cannot be obtained e.g. in granular soils, fill and rock etc, in order to obtain an indication of the in situ density, compaction or hardness. It can also be used as an alternative to undisturbed sampling in cohesive deposits. Inherent difficulties are present in obtaining true SPT or SPT(C) "N" values in water bearing fine grained granular deposits and careful consideration of the test technique and groundwater conditions are necessary before test results are used for design purposes.

The full procedure for carrying out the Standard Penetration Test (SPT) is given in BS EN ISO 22476-3: 2005 (ref 02). For fine to medium granular deposits and in clays the test consists of driving a 50mm external diameter split barrel sampler into the soil using a 63.5kg hammer dropping 760mm. In coarse granular soils or in rock, the split barrel may be replaced by a solid cone. The penetration resistance is expressed as the number of blows required to obtain 300mm penetration below an initial seating drive of 150mm through any disturbed ground at the bottom of the borehole. The number of blows for the 300mm test drive penetration is recorded on the borehole logs as the "N" value. A full record of the number of blows required to drive the sampler at 75mm intervals throughout the total 450mm drive is also tabulated along with the groundwater level at the time of test. Where full 450mm penetration is not achieved, it is important to distinguish how the blow count relates to the penetration of the sampler and this may be achieved in the following manner:

- (i) Where the test drive is terminated before full (300mm) penetration the number of blows for the partial test drive (usually 50) and the penetration of the sampler within the test drive are recorded. An approximate "N" value may be obtained by linear extrapolation of the number of blows recorded for the partial test drive.
- (ii) If the total seating drive penetration is equal to or less than 150mm then the number of blows (usually 25) and the depth of penetration within the initial seating penetration are recorded on the borehole logs.

The "N" value obtained from the Standard Penetration Test may be used to assess the relative density of sands and gravels in accordance with Clause 41.3.2 of BS 5930: 1999 (ref 01), as shown in table 1.

It should be noted that the "N" values reported on the logs are uncorrected, as specified in section 7.1.2 of BS EN ISO 22476-3:2005.

SPT's performed by Soil Engineering are carried out using automatic trip hammers that have been calibrated in accordance with BS EN ISO 22476-3:2005. The hammer ID and energy ratio are recorded on the 'header page' of each log and calibration certificates for the hammers used on the project are contained in the Appendix Section of the report, as required by BS EN ISO 22476-3:2005.

TABLE 1: DETERMINATION OF RELATIVE DENSITY FROM PENETRATION TESTS (from BS 5930)

Term	SPT N-Value: Blows/300mm Penetration
Very Loose	0-4
Loose	4-10
Medium Dense	10-30
Dense	30-50
Very Dense	Over 50

APPENDIX 1: FIELDWORK PROCEDURES

It should be noted that it is a requirement of BS EN ISO 22476-3: 2005 that all test hammers are calibrated. Soil Engineering routinely calibrate all their test hammers and the results of the calibration are expressed as an Energy Ratio (Er) on the exploratory hole logs. The Er value is required for design purposes and should be applied to the recorded test N value in the manner described in BS EN ISO 22476-3: 2005.

Standard Penetration Testing may also be performed in very stiff/hard clays in which it would be difficult to obtain undisturbed samples. In such cases the SPT "N" values may be used for design purposes based on correlations between "N" value and various soil parameters such as those proposed by Stroud and Butler (1975) (ref 04) and by Stroud (1989) (ref 05).

6.0 GROUNDWATER

The groundwater conditions entered on the exploratory hole records are those encountered at the time of the investigation. These however, may not represent the actual conditions or those which may apply in large excavations. The normal rate of boring does not always permit the recording of an equilibrium water level for any one water strike, particularly because the entry of water into a borehole may be reduced or even eliminated due to casing off a water bearing layer or due to a skin being formed on the borehole wall by the drilling tools. It should also be noted that groundwater conditions may vary seasonally and/or tidally and that the water levels as shown at the time of investigation should not necessarily be taken as being constant because they may be subject to such fluctuations.

More accurate information on groundwater conditions can be obtained from exploratory hole installations such as piezometers and standpipes. Normally a minimum of three or four monitoring visits are required at the site to provide this information.

References

- 01) BS 5930: 1999: Code of Practice for Site Investigation. British Standards Institution.
- 02) BS EN ISO 22476-3: 2005: Geotechnical Investigation and Testing - Field Testing - Part 3: Standard Penetration Test.
- 03) BS EN ISO 22475-1: 2006: Geotechnical Investigation and Testing - Sampling Methods and Groundwater measurements - Part 1: Technical Principles for Execution.
- 04) Stroud, M.A, Butler, F.G April 1975: 'The Standard Penetration Test and the Engineering Properties of Glacial Materials'. The Engineering Behaviour of Glacial Materials Proc. of Symp.
- 05) Stroud, M.A. 1989: 'The Standard Penetration Test - Its Application and Interpretation. Thomas Telford, London.



SOIL engineering

SUPPORTING FACTUAL DATA

APPENDIX 1

Explanatory Notes on Fieldwork, Logging
and Laboratory Testing

TERMINOLOGY USED IN SOIL DESCRIPTIONS

APPENDIX 1: TERMINOLOGY USED IN SOIL DESCRIPTIONS

1.0 GENERAL PROCEDURES

Soil descriptions contained in this report have been produced in accordance with the procedures and principles given in BS EN ISO 14688-1: 2002 (ref 01), BS EN ISO 14688-2: 2004 (ref 02) and also where there is no conflict with the European standards, in accordance with BS 5930: 1999 (ref 03).

For a soil description the main soil characteristics should be given in a standard word order although the word order can be adjusted to enhance and clarify if appropriate. The main soil characteristics can be divided as follows:-

- | | |
|---|--|
| 1 Mass Characteristics
comprising state and structure | 2 Material Characteristics
comprising nature and state |
| 1a Density and Field Strength | 2a Colour |
| 1b Discontinuities | 2b Composite Soil Types: particle grading and composition, shape and size |
| 1c Bedding | 2c Principal Soil Type, name in capitals eg CLAY |
| 3 Stratum Name (optional) | |
| 3a Geological group or Formation | |

The basic soil categories may be broadly summarised as follows, with categories i to iii covered by these notes and categories iv and v by separate notes.

- (i) Very coarse soils: greater than 63mm in diameter, ie cobbles and boulders.
- (ii) Coarse soils: 0.063mm to 63mm in diameter, ie sands and gravels.
- (iii) Fine soils: less than 0.063mm in diameter, ie clays and silts.
- (iv) Organic soils.
- (v) Man made "soils".

2.0 MASS CHARACTERISTICS OF SOILS

2.1 Cohesive Soils

For cohesive material determination of consistency is made in accordance with Table 1. The undrained shear strength of clays is determined by laboratory or field testing and is made in accordance with the terms given in Table 2.

TABLE 1: CONSISTENCY GUIDE FOR COHESIVE MATERIAL (from BS EN ISO 14688-1: 2002)

Term	Field Identification
Very Soft	Exudes between fingers when squeezed in the hand
Soft	Can be moulded by light finger pressure
Firm	Cannot be moulded, but can be rolled into 3mm thick thread
Stiff	Crumbles when rolled into 3mm thick thread
Very Stiff	Cannot be moulded and crumbles under pressure. Indented by thumbnail

APPENDIX 1: TERMINOLOGY USED IN SOIL DESCRIPTIONS

TABLE 2: STRENGTH TERMS OF FINE SOILS (from BS EN ISO 14688-2: 2004)

Strength Term	Undrained shear strength (Cu) kPa
Extremely Low	<10
Very Low	10 to 20
Low	20 to 40
Medium	40 to 75
High	75 to 150
Very High	150 to 300
Extremely High ¹	>300

¹ Materials with shear strengths greater than 300kPa may behave as weak rocks and should be described in accordance with BS EN ISO 14689-1

2.2 Granular Soils

For granular deposits relative density may only be determined by the Standard Penetration Test (SPT). The following table provides a scale of terms related to SPT 'N' values from BS 5930: 1999 (ref 03).

TABLE 3: ASSESSMENT OF RELATIVE DENSITY FOR GRANULAR SOILS (from BS 5930: 1999)

Term	Field Identification (generally in trial pits)	SPT 'N' Values (blows for 300mm penetration)
Very loose	Can be excavated with a spade	0-4
Loose	and 50mm wooden peg can be easily driven	4-10
Medium dense	-	10-30
Dense	Requires pick for excavation	30-50
Very dense	and 50mm wooden peg is hard to drive	over 50

N.B: The field identification terms for very loose/loose material and dense/very dense material are very subjective and should be treated with caution.

2.3 Discontinuities

The type of discontinuity should be described eg fissures, faults and shear planes together with their spacing as given in Table 4. Discontinuity openness, and surface texture eg rough, smooth, polished and striated are recorded although these may not always be added to the borehole log if the required level of detail is low.

2.4 Bedding

Bedding spacing is assessed using the thickness terms given in Table 4.

APPENDIX 1: TERMINOLOGY USED IN SOIL DESCRIPTIONS

TABLE 4: DESCRIPTIONS FOR DISCONTINUITIES AND BEDDING (from BS 5930: 1999)

DISCONTINUITIES		BEDDING	
Scale of SpacingTerm	Mean Spacing mm	Scale of BeddingTerm	Mean Thickness mm
Very widely	>2000	Very thickly bedded	>2000
Widely	2000-600	Thickly bedded	2000-600
Medium	600-200	Medium bedded	600-200
Closely	200-60	Thinly bedded	200-60
Very closely	60-20	Very thinly bedded	60-20
Extremely closely	<20	Thickly laminated	20-6
		Thinly laminated	<6

N.B: Spacing terms are also used for describing the distance between partings, isolated beds, laminae or roots etc.
Interbedded/interlaminated: alternating layers of different material type. These terms are given a thickness if material is present in equal proportions.
Otherwise the thickness of and spacing between subordinate layers are defined.

3.0 MATERIAL CHARACTERISTICS OF SOIL

An examination of insitu soil deposits, disturbed or undisturbed samples allows the material characteristics to be recorded. These characteristics include colour, particle shape, particle grading and particle composition.

3.1 Colour

The recorded colour is based on the logger's general impression of the overall colour. For material with more than three colours the term multicoloured may be used. The term mottled is applied to soils which exhibit two colours, one of which is subordinate to the other.

White, cream, grey, black, yellow, orange, red, brown, green and blue etc may be used but supplemented as necessary with: light, dark, mottled and reddish brownish etc. All colouration associated with chemical changes is noted ie grey gleying on fissures.

3.2 Soil Types (Including Composite Soils)

3.2.1 Very Coarse Soils (Boulders and Cobbles)

Where the soil sample is considered large enough to be representative, material is described as shown in Table 5.

TABLE 5: DESCRIPTORS FOR VERY COARSE SOILS (from BS 5930: 1999)

Main Name	Estimated Boulder/Cobble Content of Very Coarse Fraction
BOULDERS	Over 50% is of boulder size (>200mm)
COBBLES	Over 50% is of cobble size (200mm to 63mm)

Mixtures of very coarse and finer materials are described by combining terms for the very coarse constituents with those for the finer constituents as shown in Table 6.

APPENDIX 1: TERMINOLOGY USED IN SOIL DESCRIPTIONS

TABLE 6: DESCRIPTORS FOR MIXTURES OF VERY COARSE AND FINER SOILS (from BS 5930: 1999)

Term	Composition (Approx %)
BOULDERS (or COBBLES) with a little finer material ⁽¹⁾	Up to 5% finer material
BOULDERS (or COBBLES) with some finer material ⁽¹⁾	5% to 20% finer material
BOULDERS (or COBBLES) with much finer material ⁽¹⁾	20% to 50% finer material
FINER MATERIAL with low boulder content	<5% boulders
FINER MATERIAL with low cobble content	<10% cobbles
FINER MATERIAL with medium boulder content	5% to 20% boulders
FINER MATERIAL with medium cobble content	10% to 20% cobbles
FINER MATERIAL with high boulder content (or cobbles)	>20% boulders or cobbles

(1) The description of "finer material" is made in accordance with BS 5930: 1999 ignoring the very coarse fraction; the principal soil type name of the finer material may also be given in capital letters, e.g. sandy GRAVEL with low boulder content; COBBLES with some sandy CLAY.

3.2.2 Coarse Soils (Gravel and Sand)

A coarse soil (omitting any cobbles and boulders) contains 65% or more of SAND or GRAVEL. The terms given in Table 7 are used to describe the coarse fraction.

TABLE 7: DESCRIPTORS FOR MIXTURES OF COARSE SOILS (from BS 5930: 1999)

Term	Principal Soil Type	Approximate Proportion of Secondary Constituent
Slightly sandy or gravelly	SAND	<5%
Sandy or gravelly	or	5% to 20%
Very sandy or gravelly	GRAVEL	>20%
-	SAND and GRAVEL	About equal proportions

3.2.3 Fine Soils and Mixtures of Fine and Coarse Soils

Fine soil should be described as either a SILT or a CLAY. The use of silty CLAY or clayey SILT is however permitted, where the presence of the secondary constituent is considered important.

For deposits that contain a mixture of soil types the descriptors given in Table 8 are used. The dominant secondary fraction is placed immediately before the principal soil type. It should also be noted that the terms silty and clayey are mutually exclusive in a coarse soil. The use of the terms sandy and gravelly are however permitted.

APPENDIX 1: TERMINOLOGY USED IN SOIL DESCRIPTIONS

TABLE 8: DESCRIPTORS FOR FINE SOILS AND COMPOSITE SOIL TYPES (from BS 5930: 1999)

Term	Principal Soil Type	Approximate Proportion of Secondary Constituent Coarse Soil	Approximate Proportion of Secondary Constituent Coarse and/or Fine Soil
Slightly clayey or silty and/or sandy or gravelly	SAND and/or		<5%
Clayey or silty and/or sandy or gravelly	GRAVEL		5% - 20% *
Very clayey or silty and/or sandy or gravelly			>20% *
Very sandy or gravelly	SILT or	>65% +	
Sandy and/or gravelly	CLAY	35% - 65%	
Slightly sandy and/or gravelly		<35%	

* or described as fine soil depending on assessed engineering behaviour

+ or described as coarse soil depending on assessed engineering behaviour

3.3 Particle Shape and Grading

For coarser granular deposits (gravel and cobbles) the particle shape is described as shown in Table 9. A schematic of angularity and form terms is given in Figure 1.

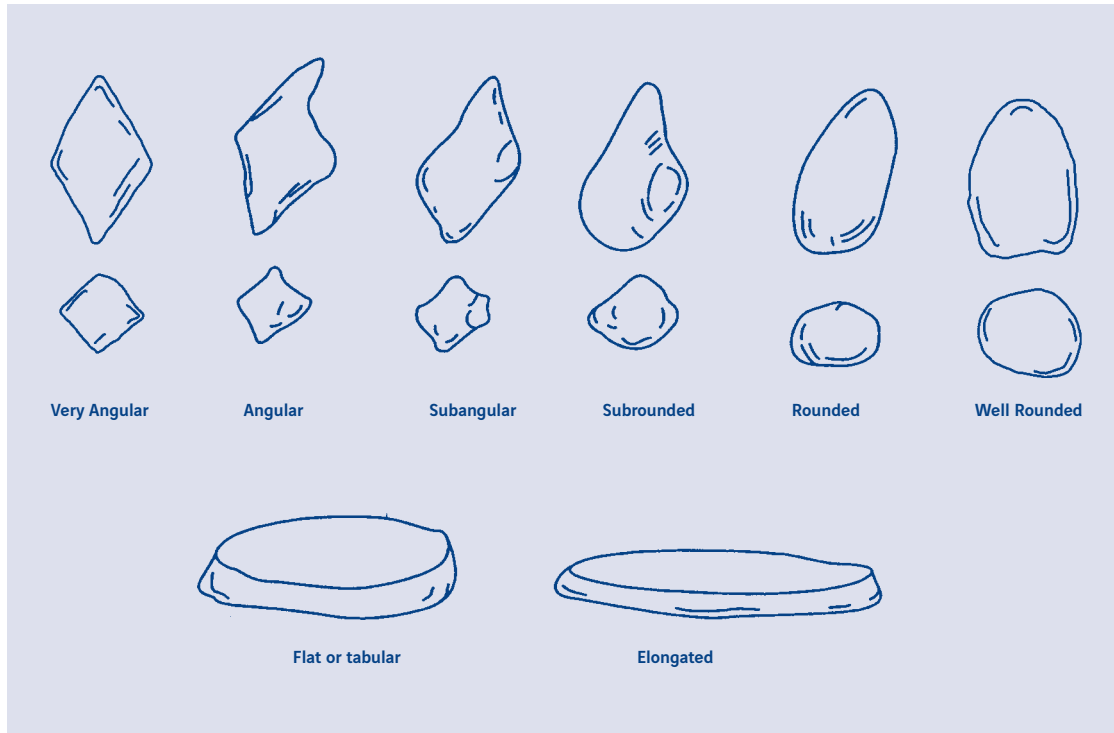
TABLE 9: DESCRIPTORS FOR PARTICLE SHAPE (from BS EN ISO 14688-1: 2002)

Angularity	Form	Surface Texture
Very Angular	Cubic	
Angular	Flat	Rough
Subangular	Elongated	Smooth
Subrounded		
Rounded		
Well Rounded		

The distribution of particle sizes within sands and gravels is described stating the predominant size fraction present eg fine to medium SAND.

APPENDIX 1: TERMINOLOGY USED IN SOIL DESCRIPTIONS

FIGURE 1: PARTICLE ANGULARITY AND FORM TERMS (from BS 5930: 1999 and Soil Engineering)



References

- 01) BS EN ISO 14688-1: 2002: Geotechnical Investigation and Testing - Identification and Classification of Soil Part 1: Identification and Description.
- 02) BS EN ISO 14688-2: 2004: Geotechnical Investigation and Testing - Identification and Classification of Soil Part 2: Principles for a Classification.
- 03) BS 5930: 1999: Code of Practice for Site Investigation. British Standards Institution.



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APPENDIX 1

Explanatory Notes on Fieldwork, Logging
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TERMINOLOGY USED IN THE DESCRIPTION OF MADE GROUND

APPENDIX 1: TERMINOLOGY USED IN THE DESCRIPTION OF MADE GROUND

1.0 GENERAL DEFINITIONS

Man made soils may be defined as those materials that have not been laid down by geomorphological processes. Under the heading of 'man made soils' two distinct material types can be identified as follows:-

TABLE 1: DEFINITIONS FOR MAN MADE SOILS

Term	Description
NATURAL SOILS (Reworked)	Use terminology outlined for soils in BS EN ISO 14688-1: 2002 (ref 01), BS EN ISO 14688-2: 2004 (ref 02) and BS 5930: 1999 (ref 03). Can be described using normal approach for soils. Can be tested in accordance with BS1377: 1990.
MAN MADE MATERIALS	Can also frequently be described using normal approach and terminology as above, and tested geotechnically. Includes materials that defy description in any standard manner and includes a range of exotic materials and artifacts. Often not testable in the field or in the laboratory. For example it is not possible to measure strength of a bicycle frame or liquid limit of plastic.

There is also a distinction between the terms "Fill" and "Made Ground" as follows:

FILL = Material placed under engineering control

MADE GROUND = Material placed without any kind of control, ie non engineered

2.0 IDENTIFICATION OF MAN MADE SOILS

Some common examples of man made soils are given in Table 2 on page 2. The table illustrates that the heading of 'man made' soils can cover a wide variety of materials, some of which may not readily appear to be anything other than natural.

Natural soils re-laid by man may be difficult to identify as such and so it is necessary to look for evidence in the form of artifacts or relic structure in the material.

For example as few as one or two artifacts may be diagnostic (rare brick fragments or car body at base of trial pit). Lenses or pockets of clay that are laminated etc help to indicate natural material that has been relaid. However be aware of the following:

Contamination by driller (Clinker from around rig, green grass from 15m...).

Contamination during trial pitting (brick rubble can fall from the upper layers in a pit and then get pushed in to natural deposits by the action of the excavator bucket).

APPENDIX 1: TERMINOLOGY USED IN THE DESCRIPTION OF MADE GROUND

TABLE 2: DEFINITIONS FOR MAN MADE SOILS

CATEGORY	EXAMPLE
Natural Soils re-laid by man	Embankment Fill Colliery Spoil (Coarse Discard) Drainage Layer e.g Gravel
Man Made Materials that can be described and which are testable geotechnically	Abutment backfill e.g Crushed rock Colliery Spoil (Fine Discard) Mine Tailings from non-coal mines Crushed Concrete Pulverised Fuel Ash (PFA) Chalk whiting (slurry from cement manufacture)
Man Made Materials that are NOT readily describable and which are not testable geotechnically	Landfill Demolition rubble (including frames, slates etc) Fly tipped materials Bury (glass work waste)

3.0 DESCRIPTION OF MAN MADE SOILS

Information that is be reported to define the material includes the following:-

Origin of materials, if known from desk study.

Layers and their inclination to inform on mode of tipping, whether ponded, end tipped, spread or stockpiled.

Large objects, obstructions such as concrete, masonry walls, old cars.

Presence of hollow objects, compressible/collapsible objects or voids such as oil drums, cellars, tanks.

Chemical wastes and dangerous or hazardous substances such as creosote, hospital wastes, unlabelled drums, asbestos.

Decomposable materials with note on degree of decomposition such as garden waste, paper.

Smell such as organic, phenolic, sulphurous, petrol.

Striking colours

Any dating possible such as type of bottles, newspapers, papers.

Signs of heat or combustion such as steam, smoke, burnt shale.

NOTES

Because of the variability of the constituents of man made soils, strength or in situ density descriptors are not generally assigned to made ground. Where describing fill as opposed to made ground it may be possible to use the descriptors that are used for natural soils.

Large or hollow objects cannot be sampled so the description is the sole information on condition and character of the features.

The constituents of made ground are grouped together under the above categories and it is usual to give volumetric percentages where possible.

Granular made ground may be given a particle size, although the following description methodology is employed.

MADE GROUND: Grey fine to coarse gravel sized fragments of brick and concrete.

OR

MADE GROUND: Grey gravelly clay with occasional subangular cobble sized fragments of brick. Gravel sized fragments are angular to subangular, fine, medium and coarse of brick.

APPENDIX 1: TERMINOLOGY USED IN THE DESCRIPTION OF MADE GROUND

In these two examples, note the use of term 'sized fragments' to describe the granular content. Because the material is man made we do not use the terms sand, gravel or cobbles etc in the same context as for natural soils. In other words it would be incorrect to use the following:

MADE GROUND: Grey gravelly clay with occasional cobbles. Gravel is angular coarse of brick, cobbles are rounded of brick.

The use of sand, gravel or cobble prior to 'sized fragments' is only intended to define a size range to the granular made ground material.

Similar grain size indicators are also used to describe the size of other man made materials such as concrete, bituminous road surfacing etc. In addition the terms can also be used to describe natural material that has been modified by man, such as wood that may be present in the form of railway sleepers etc. Where whole man made items are identified they should be described as follows:

'with numerous wooden railway sleepers'

For such materials it is necessary to add size measurements, since no other quantifying terms are used.

4.0 DEFINITIONS OF SOME MAN MADE SOILS

There is generally a lack of national guidance on the meaning of common terms used in made ground. This applies particularly to man made materials. For this reason descriptions of man made soils within this report aim to provide as much information as possible on the material being logged, whilst staying within the guidance provided in these notes.

For some sites a set of definitions for the likely range of made ground to be encountered may have been determined and where this is the case it is identified within the report text.

Some terms for one group of commonly encountered made ground are given below.

COMBUSTION PRODUCTS, often physically unstable and usually containing concentrations of metals and poly-aromatic hydrocarbons. The definitions below are workable compromises.

ASH: Sand or silt size by definition, so do not need but can use "ash sand", and cannot have "gravel size ash" although cinders can be gravel size but readily crush down. Can include unburnt coal.

CLINKER: Gravel size or larger by definition so do not need but can use "clinker gravel", and cannot have "sand size clinker".

SLAG: Materials fused or poured as liquid or scum or froth, of any size or shape, and will be at least strong. If in blocks or layers, can present difficulties for borehole or trial pit penetration. Slag is often pelletised, expanded or crushed for reuse in construction.

APPENDIX 1: TERMINOLOGY USED IN THE DESCRIPTION OF MADE GROUND

References

- 01) BS EN ISO 14688-1: 2002: Geotechnical Investigation and Testing - Identification and Classification of Soil Part 1: Identification and Description.
- 02) BS EN ISO 14688-2: 2004: Geotechnical Investigation and Testing - Identification and Classification of Soil Part 2: Principles for a Classification.
- 03) BS 5930: 1999: Code of Practice for Site Investigation. British Standards Institution.



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TERMINOLOGY USED IN PEAT AND ORGANIC SOIL DESCRIPTIONS

APPENDIX 1: TERMINOLOGY USED IN PEAT AND ORGANIC SOIL DESCRIPTIONS

The basic designation for soils consisting principally of organic matter is summarised in Table 1.

TABLE 1: IDENTIFICATION AND DESCRIPTION OF ORGANIC SOIL

Term	Description
Fibrous Peat	Fibrous structure, easily recognisable plant structure, retains some strength
Pseudo-fibrous Peat	Recognisable plant structure, no strength of apparent plant material
Amorphous Peat	No visible plant structure, mushy consistency
Gyttja	Decomposed plant and animal remains, may contain inorganic constituents
Humus	Plant remains, living organisms and their excretions together with inorganic constituents, from the topsoil

If a soil contains organic material in identifiable fragments these are individually described using the "occasional, some and much" terms as appropriate. Any smells or odours should be noted. Where the organic materials are disseminated throughout the soil the term "organic" should be given prior to the soil type.

eg: Soft grey organic CLAY

Where the soil is composed of natural organic material a peat description may be more appropriate. Peats are normally described after BS EN ISO 14688-1: 2002 (ref 01), although as the descriptive scheme in that standard is very limited, the additional terms summarised by Hobbs (ref 02) may be used if required.

Peats can be identified as shown in Table 2. The word order is as for other natural soils, however different terms are used to describe the consistency of the peat and the soil type is preceded by an additional term (Fibrous or Amorphous).

No guidance is given in either BS EN ISO 14688-1: 2002 or 14688-2: 2004 or BS 5930: 1999 as to how to deal (in terms of description) with peat soils that contain other materials such as clay or gravel. If the peat has a coarse soil fraction the proportions given in Terminology Used in Soil Descriptions, Table 6 (Descriptors for Mixtures of Very Coarse and Finer Soils) are used. It is difficult to assess visually what proportion of the fine soil is mineral and what proportion is organic therefore the terms "clayey" or "silty" are used with caution if at all.

eg: Firm black fibrous PEAT (H3)
Plastic brown amorphous PEAT (H8)
Spongy black slightly sandy fibrous PEAT (H4)

References

- 01) BS EN ISO 14688-1: 2002: Geotechnical Investigation and Testing - Identification and Classification of Soil Part 1: Identification and Description.
- 02) Hobbs, N.B. 1986: 'Mire morphology and the properties and behaviour of some British and foreign peats.' Q.J. Engng Geol. 19, No 1, 7-80.
- 03) BS 5930: 1999: Code of Practice for Site Investigation. British Standards Institution.
- 04) BS EN ISO 14688-2: 2004 Geotechnical Investigation and Testing - Identification and Classification of Soil Part 2: Principles for a Classification.

APPENDIX 1: TERMINOLOGY USED IN PEAT AND ORGANIC SOIL DESCRIPTIONS

TABLE 2: GUIDANCE ON THE IDENTIFICATION AND DESCRIPTION OF PEAT (AFTER BS 5930 AND HOBBS)

CONSISTENCY	SOIL TYPE	DEGREE OF HUMIFICATION	DECOMPOSITION	DESCRIPTION	MATERIAL EXTRUDED BETWEEN FINGERS	RESIDUE IN HAND
Firm or Spongy	Fibrous PEAT	H1	None	Entirely unconverted mud-free peat	Clear, colourless water	Not pasty
		H2	Insignificant	Almost entirely unconverted mud-free peat	Yellowish water	
		H3	Very slight	Very slightly converted or very slightly muddy peat	Brown, muddy water, no peat	Somewhat pasty
		H4	Slight	Slightly converted or somewhat muddy peat	Dark brown muddy water, no peat	
		H5	Moderate	Fairly converted or rather muddy peat, plant structure still quite evident	Muddy water and some peat	
		H6	Moderately strong	Fairly converted or rather muddy peat, plant structure indistinct but more obvious after squeezing	Above one third of peat squeezed out; water dark brown	Thick, pasty
		H7	Strong	Fairly well converted or markedly muddy peat; plant extract still discernible	About one half of peat squeezed out, consistency like porridge; any water is very dark brown	Very thick paste
Plastic	Amorphous PEAT	H8	Very strong	Well converted or very muddy peat, very indistinct plant structure	About two thirds of peat squeezed out, also some pasty water	Plant roots and fibre which resist decomposition
		H9	Nearly complete	Almost completely converted or mud-like peat, plant structure almost not recognisable	Nearly all the peat squeezed out as a fairly uniform paste	
		H10	Complete	Completely converted or entirely muddy peat, no plant structure visible	All the peat passes between the fingers, no free water visible	



SOIL engineering

SUPPORTING FACTUAL DATA

APPENDIX 1

Explanatory Notes on Fieldwork, Logging
and Laboratory Testing

TERMINOLOGY USED IN THE DESCRIPTION AND CLASSIFICATION OF ROCKS

APPENDIX 1: TERMINOLOGY USED IN THE DESCRIPTION AND CLASSIFICATION OF ROCKS

1.0 GENERAL PROCEDURES

Rock descriptions contained in this report have been produced in accordance with the procedure and principles given in BS EN ISO 14689-1: 2003 (ref 01) and where there is no conflict with the European standards in accordance with BS 5930: 1999: Section 6 (ref 02). For rock descriptions the main rock characteristics should be given in a standard word order. The description and classification is therefore based on the following:-

1	Material Characteristics	2	General Information
1a	Strength	2a	Minor Constituents
1b	Structure	2b	Geological Formation
1c	Colour		
1d	Texture		
1e	Grain size		
1f	Weathering and alteration effects		
1g	Rock name (in capitals e.g. SANDSTONE)		
3	Mass Characteristics		
3a	State of weathering		
3b	Fracture state		
3c	Discontinuities		

2.0 MATERIAL CHARACTERISTICS OF ROCK

2.1 Strength

The descriptors given in Table 1 are used to assess rock strength.

TABLE 1: DESCRIPTORS AND FIELD IDENTIFICATION FOR ROCK STRENGTH

Term	FIELD IDENTIFICATION	UNCONFINED COMPRESSIVE STRENGTH (MPa)
Extremely weak ¹	Indented by thumbnail	<1
Very weak	Crumbles under firm blows with point of geological hammer, can be peeled by pocket knife	1 to 5
Weak	Can be peeled by pocket knife with difficulty, shallow indentations can be made by firm blow with point of geological hammer	5 to 25
Medium strong	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with a single firm blow of geological hammer	25 to 50
Strong	Specimen requires more than one blow of geological hammer to fracture it	50 to 100
Very strong	Specimen requires many blows of geological hammer to fracture it	100 to 250
Extremely strong	Specimen can only be chipped with geological hammer	>250

¹ Some extremely weak rocks will behave as soils and should be described as soils in accordance with BS EN ISO 14688-1

APPENDIX 1: TERMINOLOGY USED IN THE DESCRIPTION AND CLASSIFICATION OF ROCKS

2.2 Structure

The descriptive terms for structure cover the inter-relationship of lithology and textural features in the rock. Terms include: bedding, laminated, foliated and banded. The thicknesses of these structures are described by the terms given in table 2 which also apply to the spacing of discontinuities (see section 4.3).

TABLE 2: DESCRIPTIVE TERMS FOR STRUCTURE AND DISCONTINUITY SPACING (from BS EN ISO 14689-1: 2003)

STRUCTURE (EG BEDDING, CLEAVAGE)	DISCONTINUITY (EG JOINT, FISSURE)	SPACING
Very thickly (bedded)	Very widely (jointed)	> 2m
Thickly (bedded)	Widely (jointed)	0.6m-2m
Medium (bedded)	Medium (jointed)	0.2m-0.6m
Thinly (bedded)	Closely (jointed)	60mm-200mm
Very thinly (bedded)	Very closely (jointed)	20mm-60mm
Laminated	Extremely closely (jointed)	6mm-20mm
Thinly laminated	-	< 6mm

2.3 Colour

Colour is described according to the scheme given in BS EN ISO 14689-1.

2.4 Texture

A description of rock texture is not normally required but when used refers to the arrangement of individual grains in the rock. Terms which may be used include: porphyritic, crystalline, amorphous and vitreous. For further guidance refer to BS 5930: 1999: section 44.2.4 (ref 02).

2.5 Grain Size

The descriptive scheme given in Table 14 of BS 5930: 1999 (ref 02) is used together with the accompanying notes in section 44.2.5.

2.6 Weathering and Alteration Effects

The results of weathering or alteration of the rock material are described in accordance with the principals given for rock mass in section 4.0.

2.7 Rock Name

An aid to the identification of rock type is given in Table A1 of BS EN ISO 14689-1:2003 (ref 01).

3.0 GENERAL INFORMATION

3.1 Minor/Other Characteristics

Information can include minor constituents as for soils (see Terminology used in Soil Descriptions) and can include abnormal mineralogy, presence of vugs etc.

3.2 Geological Formation

The geological formation, age and type of deposit are only given where this can be done with confidence and where no conjecture is involved.

4.0 MASS CHARACTERISTICS

4.1 Description of Weathering for the Rock Mass

Approach 1 in BS 5930 1999, provides guidance on the factual description of weathering effects at the material and mass scales. This factual description is mandatory and requires the following indicators of weathering to be described:

- Changes in colour
- Changes in fracture state
- Reduction in strength
- Presence, character & extent of weathering products

When further classification is required, use is made of Approach 4 in Figure 19 of BS 5930 and this table is reproduced as Table 3. Approach 4 is used for many specific formations in the UK, such as London Clay, Lias Clay and Mercia Mudstone. Chalk however is classified under Approach 5 as a special case.

It should be noted that Tables 2 and 13 in BS EN ISO 14689-1 are not relevant to the majority of rocks in the UK and are not reproduced in these notes.

TABLE 3: CLASSIFICATION OF WEATHERING INCORPORATING MATERIAL AND MASS FEATURES (Approach 4 in BS 5930 1999)

CLASS	CLASSIFIER	TYPICAL CHARACTERISTICS
A	Unweathered	Original strength, colour and fracture spacing
B	Partially Weathered	Slightly reduced strength, slightly closer fracture spacing, weathering penetrating in from fractures. Brown oxidation
C	Distinctly Weathered	Further weakened, much closer fracture spacing, grey reduction
D	Destructured	Greatly weakened, mottled, ordered lithorelics in matrix becoming weakened and disordered
E	Residual or reworked	Matrix with occasional altered random lithorelics, bedding destroyed. Classed as reworked if with foreign inclusions

4.2 Fracture State

For the purposes of logging and the recording of mechanical properties, fractures include: Joints (a discontinuity in the body of the rock along which there has been no visible displacement), Faults (a fracture along which there has been visible displacement), Bedding Fracture (a fracture along the bedding) and Cleavage Fracture (a fracture along a cleavage).

Fracture state is recorded in accordance with the terms detailed in BS EN ISO 22475-1: 2006 (ref 03) as follows:

Solid core

Core with at least one full diameter (but not necessarily a full circumference) between two natural fractures. By this definition core that has a single set of inclined fractures would have a solid core recovery of 100%. Where there are two or more sets of non parallel fractures only sections of the core in which the fractures actually intersect are excluded from the assessment of solid core.

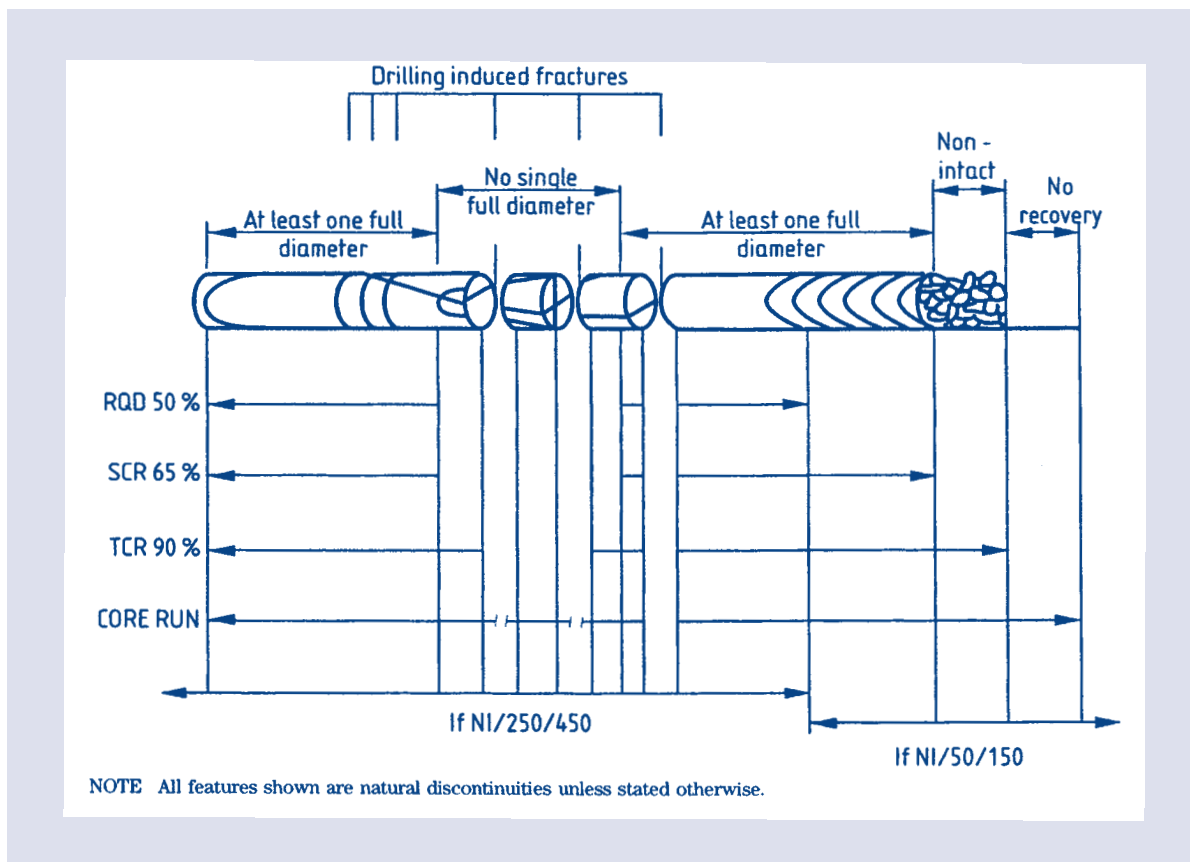
Based on these definitions the terms in Table 4 are defined and these are shown schematically in Figure 1.

APPENDIX 1: TERMINOLOGY USED IN THE DESCRIPTION AND CLASSIFICATION OF ROCKS

TABLE 4: DESCRIPTORS FOR THE MECHANICAL LOGGING OF ROCK CORE

TERM	ABBREVIATION	DEFINITION
Total Core Recovery	TCR (%)	The percentage ratio of core recovered (both solid and non-intact) to the total length of core run
Solid Core Recovery	SCR (%)	The percentage of solid core recovered to total length of core run
Rock Quality Designation	RQD(%)	The total length of solid core pieces greater than 100mm between natural fractures expressed as a percentage of total length of core run
Fracture Index	FI	The number of natural fractures contained within a metre of core of similar intensity of fracturing. This need not correspond to core runs. (NI) is used to denote non intact fragmented core.
Fracture Spacing	If min ave max	The minimum, average & maximum spacing of natural fractures within core of similar intensity of fracturing. This need not correspond to core runs. (NI) is used to denote non intact fragmented core.

FIGURE 1: ILLUSTRATION OF FRACTURE LOGGING TERMS



APPENDIX 1: TERMINOLOGY USED IN THE DESCRIPTION AND CLASSIFICATION OF ROCKS

4.3 Discontinuities

Discontinuities are breaks in the rock mass and when observed in rock cores are described as:

Joint, Fissure, Fault, Induced Fracture, Incipient Fracture, Bedding Fracture and Vein. Descriptive terms for discontinuities are given below in the correct order:

Spacing:	Described in accordance with Table 1
Persistence:	Discontinuous or Continuous
Roughness:	See Table 5
Aperture:	See Table 6
Infill:	See Table 7

TABLE 5: DESCRIPTORS FOR DISCONTINUITY ROUGHNESS (After BS EN ISO 14689-1: 2003)

MEDIUM SCALE DESCRIPTORS	SMALL SCALE DESCRIPTORS	
	Rough (irregular)	Smooth
Stepped	Stepped rough	Stepped smooth
Undulating	Undulating rough	Undulating smooth
Planar	Planar rough	Planar smooth

Note: The large scale terms: wavy, curved and straight are only seen at the mass scale and are not observed in rock cores.

TABLE 6: DESCRIPTORS FOR DISCONTINUITY APERTURE (After BS EN ISO 14689-1: 2003)

APERTURE SIZE TERM	APERTURE
Very Tight	<0.1mm
Tight	0.1mm to 0.25mm
Partly Open	0.25mm to 0.5mm
Open	0.5mm to to 2.5mm
Moderately Wide	2.5mm to 10mm
Wide	1cm to 10cm
Very Wide	10cm to 100cm
Extremely Wide	>1.0m

TABLE 7: DESCRIPTORS FOR DISCONTINUITY INFILL

INFILL	INFILL DESCRIPTION DEFINITION
Clean	No fracture infill material
Stained	Colouration on rock only. No recognisable infill material
Filled or partially filled	Discontinuity filled with recognisable infill material which should be described, eg clay, gypsum etc, together with its thickness.

APPENDIX 1: TERMINOLOGY USED IN THE DESCRIPTION AND CLASSIFICATION OF ROCKS

References

- 01) BS EN ISO 14689-1: 2003: Geotechnical Investigation and Testing - Identification and Classification of Rock Part 1: Identification and Description.
- 02) BS 5930: 1999: Code of Practice for Site Investigation. British Standards Institution.
- 03) BS EN ISO 22475-1: 2006: Geotechnical Investigation and Testing - Sampling Methods and Groundwater Measurements - Part 1: Technical Principles for Execution.

SUPPORTING FACTUAL DATA

APPENDIX 1

Explanatory Notes on Fieldwork, Logging
and Laboratory Testing

ASSESSMENT OF AGGRESSIVE GROUND AND GROUNDWATER CONDITIONS

APPENDIX 1: ASSESSMENT OF AGGRESSIVE GROUND AND GROUNDWATER CONDITIONS

Certain ground and groundwater conditions may be described as aggressive depending on their chemical composition which is related to previous industrial use. Where foundations are proposed to be constructed on industrial sites or on landfill sites in which the ground or groundwater may be contaminated with chemical waste, detailed consideration needs to be given to both the method of investigation and the severity of ground and groundwater conditions with respect to construction materials. For such sites it will usually be necessary to undertake a full chemical analysis in order to identify the potentially aggressive compounds.

On sites where new concrete foundations are to be constructed in natural ground it is usually only necessary to examine the sulfate content and pH level of the ground. The sulfate content of soils varies widely and can range from being virtually absent to extremely high concentrations in crystals such as gypsum. In between these two extremes sulfate may be disseminated throughout a soil or may be present in discrete bands or lenses. Because of this wide variation in the sulfate content of soils, the most reliable indication of possible aggressive conditions can be obtained by testing representative samples of groundwater. In order to take account of natural variations in the distribution of sulfates in the ground, samples should be taken at a number of locations that are well spaced across the site and at different depths.

The methods for the determination of total sulfate of soil and the sulfate content of groundwater and 2:1 aqueous soil extracts are given in various specifications including BS 1377 1990: Part 3: Section 5 (ref 01). The results of tests performed in accordance with BS 1377 yield results which are expressed as percentage of dry weight retained or grammes/litre SO_3 . Tests performed in accordance with other specifications however, tend to express results as SO_4 .

The classification of natural sulfate conditions is based on BRE Special Digest 1 2005 (ref 02). This digest makes most use of sulfate values expressed as milligrammes/litre SO_4 . In order to convert the results expressed as SO_3 (BS 1377) to SO_4 (BRE Special Digest 1) it is necessary to apply a multiplication factor of 1.2. In the following discussion of sulfate conditions values given in the tables are expressed in terms of SO_4 . The current approach to the classification of aggressive ground conditions given in BRE Special Digest 1 is based on the Aggressive Chemical Environment for Concrete (ACEC). This takes into account the type of site, sulfate concentration and groundwater acidity and mobility. Different site assessment procedures are used for natural ground, for brownfield sites that contain industrial waste and pyritic ground. The reactions of sulfates in the presence of other ions, notably carbonate and magnesium are also taken into account.

In general when the results of sulfate determinations are assessed, emphasis must be given to the samples which fall in the higher classes. Therefore if eight out of ten samples are found to be non aggressive and fall within Class DS1 and the remainder fall within Class DS2 it will be necessary to adopt the precautions appropriate to Class DS2 conditions for the whole site. The current digest differentiates between 'natural ground locations' and 'brownfield locations'.

Table 1 on page 2 is reproduced from the digest and deals with natural ground locations.

APPENDIX 1: ASSESSMENT OF AGGRESSIVE GROUND AND GROUNDWATER CONDITIONS

TABLE 1: AGGRESSIVE CHEMICAL ENVIRONMENT FOR CONCRETE (ACEC) CLASSIFICATION FOR NATURAL GROUND LOCATIONS (a) (From BRE Special Digest 1)

SULFATE				GROUNDWATER		
DESIGN SULFATE CLASS FOR LOCATION	2:1 WATER/SOIL EXTRACT ^(b)	GROUNDWATER	TOTAL POTENTIAL SULFATE ^(c)	STATIC WATER	MOBILE WATER	ACEC CLASS FOR LOCATION
1	2 (SO ₄ mg/l)	3 (SO ₄ mg/l)	4 (SO ₄ %)	5 (pH)	6 (pH)	7
DS-1	<500	<400	<0.24	>2.5	>5.5 ^(d) 2.5-5.5	AC-1s AC-1 ^(d) AC-2z
DS-2	500-1500	400-1400	0.24-0.6	>3.5 2.5-3.5	>5.5 2.5-5.5	AC-1s AC-2 AC-2s AC-3z
DS-3	1600-3000	1500-3000	0.7-1.2	>3.5 2.5-3.5	>5.5 2.5-5.5	AC-2s AC-3 AC-3s AC-4
DS-4	3100-6000	3100-6000	1.3-2.4	>3.5 2.5-3.5	>5.5 2.5-5.5	AC-3s AC-4 AC-4s AC-5
DS-5	>6000	>6000	>2.4	>3.5 2.5-3.5	>2.5	AC-4s AC-5

NOTES

- a) Applies to locations on sites that comprise either undisturbed ground that is in its natural state or clean fill derived from such ground.
b) The limits of Design Sulfate Classes based on 2:1 water/soil extracts have been lowered relative to previous digests.
c) Applies only to locations where concrete will be exposed to sulphate ions (SO₄) which may result from the oxidation of sulfides (eg pyrite) following ground disturbance.
d) For flowing water that is potentially aggressive to concrete owing to high purity or an aggressive carbon dioxide level greater than 15mg/l, increase the ACEC Class to AC-2z.

Explanation of suffix symbols to ACEC Class

Suffix 's' indicates that the water has been classified as static

Concrete placed in a ACEC Class that includes the suffix 'z' primarily have to resist acid conditions and may be made with any of the cements listed in Table D2 in the Digest.

Additional testing is required for those natural sites that contain pyrite. In particular it is essential to take account of the total potential sulfate content which might result from oxidation following ground disturbance. On such sites it is necessary to determine total sulfate content (AS% SO₄), total sulfur (TS%S). The total potential sulfate is then determined from $TPS\%SO_4 = 3.0 \times TS\%S$. Finally the amount of oxidisable sulfides (OS as %SO₄) is determined by subtracting the acid soluble sulfates (AS%SO₄) from the total potential sulfate content: $OS\%SO_4 = TPS\%SO_4 - AS\%SO_4$. It is important to note that this testing is in addition to and not instead of the standard sulfate determination testing.

Unless the site can be demonstrated to comprise natural ground, Table 2 for brownfield locations must be used in all assessments for the design of concrete. It should be noted that the effects of the magnesium ion become relevant to concrete design for certain Design Sulfate Classes.

APPENDIX 1: ASSESSMENT OF AGGRESSIVE GROUND AND GROUNDWATER CONDITIONS

TABLE 2: AGGRESSIVE CHEMICAL ENVIRONMENT FOR CONCRETE (ACEC) CLASSIFICATION FOR BROWNFIELD LOCATIONS (a) (From BRE Special Digest 1)

SULFATE AND MAGNESIUM					STATIC POTENTIAL SULFATE (c)	GROUNDWATER		
DESIGN SULFATE CLASS FOR LOCATION	2:1 WATER/SOIL GROUNDWATER EXTRACT (b)		TOTAL			MOBILE WATER	ACEC WATER	CLASS FOR LOCATION
1	2 (SO ₄ mg/l)	3 (Mg mg/l)	4 (SO ₄ mg/l)	5 (Mg mg/l)	6 (SO ₄ %)	7 (pH) (d)	8 (pH) (d)	9
DS-1	<500	-	<400	-	<0.24	>2.5	>6.5 (d) 5.5-6.5 4.5-5.5 2.5-4.5	AC-1s AC-1 AC-2z AC-3z AC-4z
DS-2	500-1500	-	400-1400	-	0.24-0.6	>5.5 2.5-3.5	>6.5 5.5-6.5 4.5-5.5 2.5-4.5	AC-1s AC-2 AC-2s AC-3z AC-4z AC-5z
DS-3	1600-3000	-	1500-3000	-	0.7-1.2	>5.5 2.5-5.5	>6.5 5.5-6.5 2.5-5.5	AC-2s AC-3 AC-3s AC-4 AC-5
DS-4	3100-6000	<1200	3100-6000	<1000	1.3-2.4	>5.5 2.5-3.5	>6.5 2.5-6.5	AC-3s AC-4 AC-4s AC-5
DS-4m	3100-6000	>1200 (e)	3100-6000	>1000 (e)	1.3-2.4	>5.5 2.5-5.5	>6.5 2.5-6.5	AC-3s AC-4m AC-4ms AC-5m
DS-5	>6000	<1200	>6000	<1000	>2.4	>5.5 2.5-3.5	>2.5	AC-4s AC-5
DS-5m	>6000	>1200 (e)	>6000	>1000 (e)	>2.4	>5.5 2.5-5.5	>2.5	AC-4ms AC-5m

NOTES

- a) Brownfield locations are those sites or parts of sites that might contain chemical residues produced by industrial processes.
- b) The limits of Design Sulfate Classes based on 2:1 water/soil extracts have been lowered relative to previous digests.
- c) Applies only to locations where concrete will be exposed to sulfate ions (SO₄) which may result from the oxidation of sulfides (eg pyrite) following ground disturbance.
- d) An additional account is taken of hydrochloric and nitric acids by adjustment to sulfate content
- e) The limit on water soluble magnesium does not apply to brackish groundwater (chloride content between 12000mg/l and 17000mg/l). This allows 'm' to be omitted from the relevant ACEC classification. Sea water (chloride about 18000mg/l) and stronger brines are not covered by this table.

Explanation of suffix symbols to ACEC Class

Suffix 's' indicates that the water has been classified as static

Concrete placed in ACEC Classes that include the suffix 'z' primarily have to resist acid conditions cements listed in Table D2 in the Digest.

Suffix 'm' relates to the higher levels of magnesium in Design Sulfate Classes 4 and 5.

APPENDIX 1: ASSESSMENT OF AGGRESSIVE GROUND AND GROUNDWATER CONDITIONS

The pH value of groundwater provides a crude measure of the potential aggressiveness due to the presence of organic acids. The standard procedure for measuring the acidity of soils and groundwater is the electrometric method using a pH meter and is described in BS 1377: 1990: Part 3: Section 5. The pH value of pure water is 7.0 and the presence of acid substances will yield results with values less than 7. It should be noted however that the pH of most natural waters depends mainly on the dissolved carbon dioxide content and therefore lies between pH values of 6.5 and 8.5. It is generally accepted that soils or groundwater with pH values in the range 6 to 9 may be classified as near neutral. It should be noted that the pH value of soil and groundwater can change with time and it is therefore necessary to carry out testing on fresh samples of soil or water.

The pH value of the soil or groundwater also needs to be taken into consideration when the recorded sulfate content is borderline between two classes or approaches the upper limit of a given class. In these circumstances both the pH value and the mobility of the groundwater needs to be assessed and where doubt exists, the sample should be placed in the more severe class of the sulfate classification. This general approach may be justified on the grounds that the acids present will tend to break down the concrete surface and therefore make it more susceptible to sulfate attack. This will be especially so if the sample contains large amounts of sulfides since these can be converted to sulfuric acid.

Organic acids are often found in peaty or marshy soils in which the pH value is below 6.0. In such soils it will be necessary to take specific precautions to protect any concrete which would be exposed to organic acids. The recommended precautionary measures outlined in Tomlinson 2001 (ref 03) could be followed. In all cases where mineral acids are present the groundwater is likely to be aggressive with regard to foundation concrete and in these circumstances the recommendations given in BRE Special Digest 1 Part C will need to be followed.

Apart from acid groundwater, the effects of static and mobile groundwater tables are taken into account in BRE Special Digest 1 in 'Box C9' and the incremental rules in this table need to be viewed in relation to Tables C1 and C2 in the Digest.

Alkaline groundwater is not generally considered aggressive to concrete unless present in high concentrations. Unless the aggregate used in foundation concrete is of a reactive type, pH values of groundwater up to pH = 14 need not be considered as problematic.

References

- 01) BS 1377: 1990: Methods of Test for Soils for Civil Engineering Purposes. Part 3: Chemical Electrochemical Tests, British Standards Institution.
- 02) Building Research Establishment 2005: Concrete in Aggressive Ground. BRE Special Digest 1. Building Research Station, Garston
- 03) Tomlinson M.J 2001: Foundation Design and Construction. 7th Edition, Pearson, Prentice Hall.



SOIL engineering

SUPPORTING FACTUAL DATA

APPENDIX 2

SUBCONTRACT REPORTS

AOC Archaeology Watching Brief Report

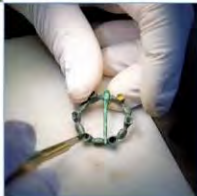
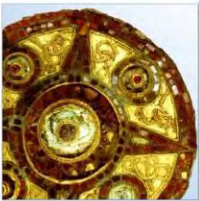
Nenthead (Caplecleugh), Mine Water Treatment

Archaeological Watching Brief Report

National Grid Reference Number: NY 78430 43298

AOC Project No: 52055

Date: November 2019



ARCHAEOLOGY

| HERITAGE

| CONSERVATION

Nenthead (Caplecleugh) Mine Water Treatment Archaeological Watching Brief Report

On Behalf of:	The Coal Authority 200 Lichfield Lane Mansfield Nottinghamshire NG18 4RG United Kingdom
National Grid Reference (NGR):	NY 78430 43298
AOC Project No:	52055
Fieldwork undertaken by:	Stuart Wilson and Matt Walker
Fieldwork undertaken:	02 – 16 September 2019
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Figure 2: Plan of Trial Pit and Window Sample locations

Plates

Plate 1: Trial Pit 103a showing structure TP3001a, viewed from the southeast.

Plate 2: Trial Pit 103b showing structure TP3002b, viewed from the southeast.

Plate 3: Trial Pit 104, viewed from the SSE.

Plate 4: Trial Pit 109, viewed from the southwest.

Plate 5: Trial Pit 113, viewed from the west.

Plate 6: Trial Pit 115, viewed from the north.

Plate 7: Trial Pit 116, viewed from the north.

Plate 8: Trial Pit 118, viewed from the north.

Plate 9: Trial Pit 120, viewed from the northwest.

Plate 10: Trail Pit 124, viewed from the ESE.

Plate 11: Trial Pit 125, viewed from the southeast.

Plate 12: Trail Pit 126, viewed from the southwest.

Plate 13: Trial Pit 128, viewed from the north.

Non-Technical Summary

AOC Archaeology Group was commissioned by The Coal Authority through their agents AECOM to monitor a series of groundwork investigations at the Nenthead Mine, Cumbria, for a Mine Water Treatment Scheme.

Twenty-eight trial pits and nine window samples were excavated. Made ground deposits were encountered in the trial pits on the northwestern part of the site and these are thought to represent redeposited mining waste. The trial pits on the main body of the site revealed more conventional soil profiles (topsoil/subsoil/natural). Three potential structures were also encountered, at least one of which is thought to relate to the historic mine complex.

1 Introduction

- 1.1 AOC Archaeology Group was commissioned by The Coal Authority through their agents AECOM to undertake an archaeological watching brief during geotechnical investigations in advance of the construction of a Mine Water Treatment Scheme for the Nenthead Mine, Cumbria. The works fall partly within the boundaries of a scheduled monument encompassing historic lead mines, ore works and a smelthill at Nenthead (NHLE 1015858).
- 1.2 The archaeological evaluation was undertaken in accordance with a Written Scheme of Investigation (WSI) prepared by AECOM Limited and approved by Cumbria County Council's Historic Environment Officer (AECOM 2019). The work also met the requirements of nationally recognised guidance for archaeological excavations, including the professional standards published by the Chartered Institute for Archaeologists (specifically, the *Standard and Guidance for an Archaeological Watching Brief* (CIfA, 2014a)).
- 1.3 The archaeological work was managed to the standards laid down in the Historic England guideline publication *Management of Research Projects in the Historic Environment (MoRPHE): Project Managers Guide* (2006a), and the *MoRPHE: Project Planning Note 3: Archaeological Excavation (PPN3)* (2008). It also met the requirements of the National Planning Policy Framework (NPPF; Chapter 16: 'Conserving and enhancing the historic environment'; DCLG 2019).

2 Site Location and Description

- 2.1 The proposed development site is situated on the south side of the A689 adjacent to the village of Nenthead, within the scheduled monument of Nenthead Mine (Figure 1). The site occupies mainly vacant land consisting of mining waste heaps, ruined mining facilities, rocky outcrops, and low vegetated hills on the north side of the River Nent. It is bounded to the south by the River Nent and to the north by the A689, and is centred at NGR: NY78430 43298 (Figure 2). The western edge of the site slopes steeply down towards the mining museum in the northwest, whilst there is open countryside to the east. The topography of the site varies but much lies at approximately 457m above Ordnance Datum (aOD).
- 2.2 The solid geology of the area consists of limestone and sandstone of the Alston Formation and limestone of the Stainmore Formation. The bedrock geology is overlain by superficial deposits of clay, sand and gravel (River Terrace Deposits) (BGS 2019). The local soils are acid upland soils with a peaty texture and generally impeded drainage (Soilscapes 2019).

3 Summary of Proposed Development Plans

- 3.1 The current development proposal comprises three compost based treatment ponds (CBTPs), one balancing pond, one wetland, a single storey stone clad building, welfare facilities, access and maintenance tracks, a mine water capture structure, a pumping station, transfer pipelines and a new outfall to the River Nent.

4 Archaeological and Historical Background

- 4.1 Extensive prehistoric, Roman and medieval activity was identified in the landscape surrounding Alston as part of Historic England's North Pennines National Mapping Programme. A possible Roman/Iron Age settlement has also been identified through LiDAR about 920m NNE of the eastern entrance to the development site, near to the Bloomsberry Lead Mine. Although exploitation of natural resources, including lead and silver, can be traced back to Roman times in the region, the first documented mining activity on Alston Moor dates from the 12th century; this activity is likely to have been small-scale and

intermittent. Larger-scale ore extraction at Nenthead is thought to have begun in the late 17th century when the Rampgill Vein was discovered in 1690. Nenthead had become one of the main mining areas of the London Lead Company by the mid-18th century, and the existing village of Nenthead grew out this process of industrialisation, beginning as accommodation and services for workers and their families. During the 19th century, the focus of mining shifted towards zinc extraction, and the mine continued to operate into the 20th century until production ceased in 1963. The mine complex is now a scheduled monument and is regarded as the most intact mining landscape within the North Pennines (NHLE 1015858). The list entry for the mine notes:

- 4.2 *“The main importance of the site lies in the unusually high level of preservation not only of the obvious features such as the buildings and dams, but also the network of roadways built by the London Lead Company. The wide range of mining features provide an important resource for the study of the developments in mining technology in the 18th and 19th centuries, particularly the development of deep mining based on long adits (levels). The monument also preserves a good example of the inter-relationships between the mining features, buildings and water managements system.”*

5 Aims and Objectives

- 5.1 The aim of the archaeological watching brief was to gather sufficient information to establish the presence/absence, character, extent, state of preservation and date of any archaeological remains within the areas to be impacted by the development, and to inform further archaeological mitigation strategies should they be necessary.
- 5.2 The specific objectives of the archaeological fieldwork were to:
- Locate, record, characterise, and determine the extent of any surviving sub-surface archaeological remains
 - Excavate and record identified archaeological features and deposits to a level appropriate to their extent and significance
 - Report the results of the fieldwork and place them within their local and national context
 - Produce a comprehensive site archive and a descriptive and interpretive report
- 5.3 The specific research objectives of the archaeological fieldwork were:
- Where possible, to determine the presence and date of unknown surviving features associated with historic mining and smelting activities at Nenthead, particularly those that relate to the scheduled remains of 18th to 19th century lead mining.
 - To assess the degree to which deposits have been disturbed or truncated by the later mining operations and 20th century developments;
 - To confirm the presence or absence of any other surviving archaeological remains within the Site; and
 - To preserve by record the sequence, thickness and elevation of the stratigraphic units and archaeological horizons which survive between the current ground surface and underlying bedrock.

6 Methodology

- 6.1 The archaeological watching brief involved monitoring the excavation of twenty-eight GI trial pits (TP's 101-128), and nine window samples (WS 101-109) (see Figure 2).

- 6.2 The trial pits were excavated using a back acting excavator fitted with a smooth bladed bucket, whilst the window samples were carried out using a drilling rig operated by the GI technicians. These groundworks were carried out under direct archaeological supervision.
- 6.3 Where archaeology was judged to be present during the watching brief the methodology employed was as follows (see AECOM 2019, 8-9):
- limited hand cleaning of archaeological sections and surfaces sufficient to establish the stratigraphic sequence exposed;
 - the collection of dating evidence from *in situ* deposits and visual scanning of spoil heaps for dateable artefacts;
 - a scaled drawn record of representative exposed sections and surfaces;
 - photographs of exposed deposits within the trial pits, with an appropriate scale, and sufficient further photographs to establish the setting of the groundworks undertaken; and
 - a record of the datum levels of the archaeological deposits.
- 6.4 Where no archaeological remains were encountered, a photographic record was taken of the test pit and a written description with sketch section recorded.
- 6.5 A full written, drawn and photographic record was made of all features revealed during the archaeological watching brief. Plans were completed at a scale of 1:50 or 1:20 (as appropriate), with section drawings at a scale of 1:10 or 1:20 as appropriate. All recording was undertaken to meet the standards and requirements of the *Archaeological Field Manual* (MOLAS 1994).
- 6.6 All areas of ground disturbance were recorded on a suitable base map, even if no archaeological remains were present.
- 6.7 Digital photography was employed using a camera with a resolution of at least 10 megapixels.
- 6.8 All identified finds and artefacts were collected and retained. Finds were bagged according to their context, and significant finds were allocated a recorded finds number and their positions surveyed individually. Finds were exposed, lifted, cleaned, conserved, marked, bagged and stored in accordance with the guidelines set out in the United Kingdom Institute for Conservation's *Conservation Guidelines No. 2* and the ClfA guidelines *Standard and Guidance for the collection, documentation, conservation and research of archaeological materials* (2014b). Where required, conservation was undertaken by approved conservators in line with the *First Aid for Finds* guidelines (Watkinson and Neal 1998).
- 6.9 The paleoenvironmental sampling strategy comprised the removal of a bulk sample from securely sealed, hand-excavated contexts, excepting those with excessive levels of residuality or those with minimal 'soil' content (such as building rubble). Bulk samples comprised a representative 40 litre sample, or, from small features, the maximum amount of material that it was practicable to collect.

Variations to the methodology

- 6.10 Archaeological visibility was occasionally limited by heavy rainfall, particularly when water drained from the higher ground to the lower, eroding the sides of some test pits.
- 6.11 The excavation of Trial Pit 101 was not observed due to the simultaneous excavation of WS 104 across site.
- 6.12 Trial Pit 108 was abandoned due to an obstruction that could not be removed.

7 Results

Natural deposits

- 7.1 Natural subsoil was encountered in most of the trial pits (TPs 102, 104, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, and 128). The excavation of Trial Pits 103a, 103b, 105, 106, 107, and 108 ceased before natural subsoil was reached. All of the window samples exposed natural deposits.
- 7.2 The natural subsoil can be divided into two main categories across site. Most trial pits contained mixed dark grey and orange clays. Other natural deposits encountered in Trial Pits 102, 109, and 125, and Window Sample 109 consisted of mid-brown clay.

Trial Pits

Trial Pit 102

Table of Stratigraphic Sequence

Context No	Type	Description	Depth
TP2000	Topsoil	Dark grey clay loam with sub-angular stone inclusions throughout	0.00m-0.10m
TP2001	Made Ground	Grey clay with frequent sub-angular stone inclusions throughout	0.10m-1.11m
TP2002	Natural	Red brown clay	1.11m-1.12m+

- 7.3 Trial Pit 102 was located at the western limit of the site and was excavated to a depth of 1.12m. The lower of the three deposits identified within the pit comprised a 0.01m+ deep deposit of red brown clay (TP2002) which appeared to be natural material and contained no finds. This was sealed by a 1.01m deep deposit of grey clay with frequent sub-angular stone inclusions throughout (TP2001) which had possibly been dumped during mining works.

Trial Pit 103a (Plate 1)

Table of Stratigraphic Sequence

Context No	Type	Description	Depth
TP3000a	Topsoil	Mid-brown clay loam	0.00m-0.30m
TP3001a	Structure	Truncated sandstone structure, composed of sub-angular blocks, no bonding material	-

- 7.4 Trial Pit 103a was located at the western limit of the site, immediately north-east of TP102. The trial pit measured 0.44 by 0.46m and was excavated to a depth of 0.3m. At this depth a sandstone structure or surface was encountered (TP3001a). It consisted of angular sandstone fragments and extended across the base of the trial pit and beyond the limit of excavation in all directions. Excavation ceased at this level and a new trial pit was excavated 1m to the northeast. It is unclear whether the structure encountered in Trial Pit 103a is part of a wall or a rough stone surface.

Trial Pit 103b (Plate 2)**Table of Stratigraphic Sequence**

Context No	Type	Description	Depth
TP3000b	Topsoil	Mid-brown clay loam	0.00m-0.30m
TP3001b	Made Ground	Deposit of firmly compacted demolition material, slag, metal, and crushed sandstone	0.30m-1.12m+
TP3002b	Structure	Sandstone structure, composed of sub-angular blocks, no bonding material	0.3m-1.12m+

- 7.5 Trial Pit 103b was located towards the western limit of the site, 1.00m northeast of TP103a. It was excavated to a depth of 1.12m. On the northeastern side of the pit the edge of a substantial stone structure was partially exposed which was constructed from angular sandstone blocks (TP3002b). It was possible to continue to excavate the trial pit to the southwest of the structure which demonstrated that the structure continued beyond the base of the pit (it was greater than 0.82m in depth/height). It was abutted by a deposit of firmly compacted demolition material (TP3001b) which contained inclusions of slag, metal and crushed sandstone. This deposit was sealed by 0.30m of clay loam topsoil.

Trial Pit 104 (Plate 3)**Table of Stratigraphic Sequence**

Context No	Type	Description	Depth
TP4000	Made Ground	Type 1	0.00m-0.32m
TP4001	Made Ground	Friable ashy deposit with medium sub-angular stones	0.32m-0.73m
TP4002	Made Ground	Friable grey sandy clay with large angular stones and timber fragments	0.73m-2.05m+

- 7.6 Trial Pit 104 lay close to the western limit of the site, to the east of TP102, and was excavated to a depth of 2.05m. It was orientated NNW-SSE and was 2.8m long by 0.8m wide. The lowest deposit identified was a friable grey sandy clay (TP4002) which contained wood fragments and continued to the limit of excavation (2.05m). Water was encountered at a depth of 1.40m. Deposit (TP4002) was sealed by 0.41m of made ground consisting of a mixed ashy soil with large sub-angular stone inclusions (TP4001). The upper 0.32m of the pit contained modern type 1 material forming the ground surface.

Trial Pit 105**Table of Stratigraphic Sequence**

Context No	Type	Description	Depth
TP5000	Made Ground	Compacted type 1	0.00m-0.30m
TP5001	Made Ground	Firmly compacted crushed sandstone	0.30m-1.00m+

- 7.7 Trial Pit 105 lay in the western part of the site along the western access road and was excavated to a depth of 1.00m. The lowest deposit consisted of compacted crushed sandstone (TP5001), which was sealed by compacted type 1 (0.30m thick) (TP5000). These materials represent raised made ground for the road surface.

Trial Pit 106

Table of Stratigraphic Sequence

Context No	Type	Description	Depth
TP6000	Made Ground	Compacted type 1	0.00m-0.20m
TP6001	Made Ground	Firmly compacted crushed sandstone	0.20m-0.45m
TP6002	Made Ground	Soft dark brown grey sandy clay with occasional stone inclusions	0.45m-1.20m+

- 7.8 Trial Pit 106 lay in the western part of the site, along the western access road, south-east of TP105, and was excavated to a depth of 1.20m. The lowest deposit consisted of dark brown grey sandy clay with occasional stone inclusions (TP6002) which is interpreted as made ground (>0.75m deep). The upper two deposits in the pit both represented made ground and comprised (TP6001), a 0.25m deep crushed sandstone deposit, and (TP6000), a 0.20m deep compacted type 1 deposit (the road surface).

Trial Pit 107

Table of Stratigraphic Sequence

Context No	Type	Description	Depth
TP7000	Made Ground	Type 1	0.00m-0.27m
TP7001	Redeposited Natural	Angular and sub-angular limestone fragments	0.27m-0.57m
TP7002	Made Ground/Mine Waste	Dark brown grey sandy silt with frequent small stone inclusions	0.57m-1.20m+

- 7.9 Trial Pit 107 was located in the western part of the site, along the western access road, outside the historic mine buildings, and was excavated to a depth of 1.20m. The lowest deposit (TP7002) recorded at the base of the pit was a dark brown-grey sandy silt with frequent small stone inclusions from which no finds were recovered. This is interpreted as levelling for the road possibly consisting of waste from the mines. This was sealed by a 0.30m deep deposit (TP7001) that contained angular and sub-angular limestone fragments representing redeposited natural bedrock. The upper deposit comprised a 0.27m deep made ground deposit of type 1 stone (TP 7000).

Trial Pit 108**Table of Stratigraphic Sequence**

Context No	Type	Description	Depth
TP8000	Made Ground	Mid-blackish brown clay	0.00m-0.58m
TP8001	Structure	Possible structure	-

- 7.10 Trial Pit 108 was located to the west of the centre of the site, along the western access road. The trial pit was orientated NW-SE and was 2.40m long by 0.72m wide. The uppermost deposit encountered comprised mid blackish brown clay which is interpreted as made ground; this extended to a depth of 0.58m. At this depth an obstruction was encountered and excavation was abandoned. The pit also rapidly filled with water due to the prevailing weather conditions, preventing further archaeological recording.

Trial Pit 109 (Plate 4)**Table of Stratigraphic Sequence**

Context No	Type	Description	Depth
TP9000	Topsoil	Dark brown silty clay	0.00m-0.10m
TP9001	Natural	Light brown sandy clay with large rounded boulders throughout	0.10m-1.90m+

- 7.11 Trial Pit 109 was located in the centre of the site, along the edge of the western access road and was excavated to a depth of 1.90m. The trench was orientated NW-SE and was 2.30m long and 1.60m wide. The lower deposit encountered comprised light brown sandy clay natural with large rounded boulders throughout (TP9001). This was sealed by a topsoil deposit (TP9000).

Trial Pit 110**Table of Stratigraphic Sequence**

Context No	Type	Description	Depth
TP110000	Topsoil	Dark grey peat/clay	0.00m-0.10m
TP110001	Natural	Mid-grey and patchy orange clay	0.10m-3.00m+

- 7.12 Trial Pit 110 was located in the central eastern part of the site, immediately to the east of the proposed reed bed, along the proposed access track; it was excavated to a depth of 3.00m. The trial pit was orientated NE-SW and was 3.00m long and 1.6m wide. The lowest deposit encountered was a 2.90m+ deep clay natural (TP11001) from which no finds were recovered; this was sealed by 0.10m of peaty clay topsoil (TP11000).

Trial Pit 111**Table of Stratigraphic Sequence**

Context No	Type	Description	Depth
TP111000	Topsoil	Dark silty clay	0.00m-0.10m
TP111001	Natural	Mid-grey clay with orange patches and occasional sub-angular stones throughout	0.10m-2.25m+

- 7.13 Trial Pit 111 was located in the central northern part of the site, along the intended route for the mains pipe, to the north of TP110, and was excavated to a depth of 2.25m. The lowest deposit encountered was 2.15m+ in depth and comprised mid-grey clay with orange patches and occasional angular stones (TP111001). This deposit was sealed by topsoil (TP111000) that occupied the upper 0.10m of the pit.

Trial Pit 112**Table of Stratigraphic Sequence**

Context No	Type	Description	Depth
TP120000	Topsoil	Black silty clay topsoil	0.00m-0.12m
TP120001	Natural	Mixed grey and orange clay	0.12m-3.00m+

- 7.14 Trail pit 112 was located close to the north-east boundary of the site, along the intended route for the mains pipe, and was excavated to a depth of 3.00m. The trial pit was orientated ENE-WSW and was 2.30m long by 1.70m wide. The lowest deposit encountered (TP112001) was a mixed grey and orange clay natural (2.88m+ deep) which contained no finds. This deposit was sealed by 0.10m of black silty clay topsoil (TP112000).

Trial Pit 113 (Plate 5)**Table of Stratigraphic Sequence**

Context No	Type	Description	Depth
TP130000	Topsoil	Dark grey/black clayey peat	0.00m-0.10m
TP130001	Natural	Mid-grey sandy clay with orange flecks	0.10m-1.10m+

- 7.15 Trial Pit 113 was located in the eastern central part of the site, along the proposed access track to the south of the proposed reed bed; it was excavated to a depth of 1.10m. The trial pit was orientated N-S and was 3.10m long by 1.50m wide. The lowest deposit encountered (TP113001) was a mid-grey sandy clay with orange flecks (0.90m+ deep) which contained no finds. This deposit was sealed by 0.10m of dark grey clayey peat (TP113000).

Trial Pit 114**Table of Stratigraphic Sequence**

Context No	Type	Description	Depth
TP114000	Topsoil	Dark grey/black clayey peat	0.00m-0.09m
TP114001	Natural	Mid-grey clay with patches of orange and occasional sub-angular stones	0.09m-3.00m+

- 7.16 Trial Pit 114 was located in the eastern central part of the site, in the centre of the proposed reed bed and was excavated to a depth of 3.00m. The trial pit was orientated N-S and was 3.00m long by 1.53m wide. The lowest deposit encountered (TP114001) was a mid-grey clay with patches of orange and occasional sub-angular stones (2.91m+ deep) which contained no finds. This deposit was sealed by 0.09m of dark grey clayey peat (TP114000).

Trial Pit 115 (Plate 6)**Table of Stratigraphic Sequence**

Context No	Type	Description	Depth
TP115000	Topsoil	Dark grey clayey peat	0.00m-0.12m
TP115001	Natural	Mixture of yellow and orange clay	0.12m-1.54m+

- 7.17 Trial Pit 115 was located in the eastern central part of the site, along the proposed access track to the south of the proposed reed bed; it was excavated to a depth of 1.54m. The trial pit was orientated W-E and was 3.30m long by 1.03m wide. The lowest deposit encountered (TP115001) was a mixed yellow and orange clay (1.42m+ deep) which contained no finds. This deposit was sealed by 0.12m of dark grey clayey peat (TP115000).

Trial Pit 116 (Plate 7)**Table of Stratigraphic Sequence**

Context No	Type	Description	Depth
TP116000	Topsoil	Dark grey peat/clay	0.00m-0.08m
TP116001	Subsoil	Mid-grey clay with orange patches and occasional medium sized sub-angular inclusions	0.08m-0.80m+
TP116002	Natural	Dark grey clay with occasional medium sized sub-angular stone inclusions throughout	0.80-1.06m+

- 7.18 Trial Pit 116 was located in the north-eastern part of the site, to the east of the northernmost proposed pond, and was excavated to a depth of 1.06m. The trial pit was orientated E-W and was 3.70m long by 1.56m wide. The lowest deposit encountered (TP116002) was a dark grey clay with occasional medium sized sub-angular stone inclusions (0.08m deep) which contained no finds. This deposit was sealed by 0.72m of mid-grey clay with orange patches and occasional medium sized sub-angular stones (TP116001). This in turn was sealed by topsoil comprising dark grey peat/clay (TP116000).

Trial Pit 117**Table of Stratigraphic Sequence**

Context No	Type	Description	Depth
TP117000	Topsoil	Dark grey/black peat	0.00m-0.31m
TP117001	Natural	Mid-grey clay with orange patches and occasional small and medium sized sub-angular stones	0.31m-1.13m
TP117002	Bedrock	Limestone	1.13m-1.20m+

- 7.19 Trial Pit 117 was located in the south-eastern part of the site, to the east of the southernmost proposed pond, and was excavated to a depth of 1.20m. The trial pit was orientated SE-NW and was 3.30m long by 1.53m wide. The lowest deposit encountered (TP117002) comprised limestone bedrock (0.07m+ deep). This deposit was sealed by 0.82m of mid-grey clay with orange patches and occasional small and medium sized sub-angular stones (TP117001); this, in turn, was sealed by 0.31m of dark grey/black peat topsoil (TP117000).

Trial Pit 118 (Plate 8)**Table of Stratigraphic Sequence**

Context No	Type	Description	Depth
TP118000	Topsoil	Dark grey clay/peat	0.00m-0.27m
TP118001	Subsoil	Mid-orange clay with small sub-angular stone inclusions	0.27m-0.52m
TP118002	Natural	Mid-grey clay with occasional sub-angular stone inclusions	0.52m-1.55m
TP118003	Bedrock	Limestone	1.55m+

- 7.20 Trial Pit 118 was located in the south-eastern part of the site, to the south-west of the southernmost proposed pond, and was excavated to a depth of 1.55m. The trial pit was orientated W-E and was 3.30m long by 1.70m wide. The lowest deposit encountered (TP118003) comprised limestone bedrock at the limit of the excavation. This deposit was sealed by 1.03m of mid-grey clay with occasional sub-angular stone inclusions (TP118002). Above this lay 0.25m of mid-orange clay with small sub-angular stone inclusions (TP118001). The topsoil consisted of dark grey clay/peat 0.27m deep (TP118000).

Trial Pit 119**Table of Stratigraphic Sequence**

Context No	Type	Description	Depth
TP119000	Topsoil	Dark grey clay/peat	0.00m-0.06m
TP119001	Subsoil	Mid-orange clay with few sub-angular stone inclusions	0.06m-0.11m
TP119002	Natural	Dark grey clay with orange flecks and few sub-angular stone inclusions	0.11m-0.25m
TP119003	Bedrock	Limestone	0.25m-0.9m+

- 7.21 Trial Pit 119 was located in the eastern part of the site, to the west of the central proposed pond, and was excavated to a depth of 0.90m. The trial pit was orientated SE-NW and was 3.30m long by 1.53m wide. The lowest deposit encountered (TP119003) comprised limestone bedrock (0.65m+). This deposit was sealed by 0.14m of dark grey clay with orange flecks and few sub-angular stone inclusions (TP119002). Above this lay 0.05m of mid-orange clay with few sub-angular stone inclusions (TP119001). The topsoil consisted of dark grey clay/peat 0.06m deep (TP119000).

Trial Pit 120 (Plate 9)**Table of Stratigraphic Sequence**

Context No	Type	Description	Depth
TP120000	Topsoil	Dark grey clayey peat with occasional medium sized sub-angular stones	0.00m-0.14m
TP120001	Made ground	Mixed orange/grey clay with very occasional small sub-angular stones	0.14m-0.65m
TP120002	Natural	Mudstone	0.65m-1.30m

- 7.22 Trial Pit 120 was located in the eastern part of the site, to the south-west of the northernmost proposed pond, and was excavated to a depth of 1.30m. The trial pit was orientated NE-SW and was 1.65m long by 3.10m wide. The lowest deposit encountered (TP120002) consisted of natural mudstone (0.65m+). This layer was sealed by a made ground deposit of mixed orange/grey clay with very occasional small sub-angular stones (TP120001; 0.51m deep). This was sealed by a thin 0.14m layer of dark grey clayey peat with occasional medium sized sub-angular stones (TP120000).

Trial Pit 121**Table of Stratigraphic Sequence**

Context No	Type	Description	Depth
TP121000	Topsoil	Dark grey peat	0.00m-0.26m
TP121001	Subsoil	Mid-orange clay	0.26m-0.46m
TP121002	Subsoil	Dark grey clay with occasional sub-angular stone inclusions	0.46m-0.86m
TP121003	Bedrock	Limestone	0.86m-0.90m+

- 7.24 Trial Pit 121 was located in the south-eastern part of the site, in the centre of the southernmost proposed pond, and was excavated to a depth of 0.90m. The trial pit was orientated SW-NE and was 3.74m long by 1.51m wide. The lowest deposit encountered (TP121003) comprised limestone bedrock (0.04m+). This layer was sealed by 0.40m of subsoil which consisted of dark grey clay with occasional sub-angular stone inclusions (TP121002). This was sealed by 0.20m of mid-orange clay (TP121001) which, in turn, was sealed by 0.26m of dark grey peat topsoil (121000).

Trial Pit 122**Table of Stratigraphic Sequence**

Context No	Type	Description	Depth
TP122000	Topsoil	Mid-brown peat	0.00m-0.16m
TP122001	Subsoil	Mid-orange clay with grey patches	0.16m-0.38m
TP122002	Subsoil	Mid-grey clay with orange patches	0.38m-0.90m
TP122003	Bedrock	Limestone	0.90m+

- 7.25 Trial Pit 122 was located in the eastern part of the site, in the north portion of the central proposed pond, and was excavated to a depth of 0.90m. The trial pit was orientated NW-SE and was 3.2m long by 1.56m wide. The lowest deposit encountered (TP122003) consisted of limestone bedrock at a depth of 0.90m. Overlying the bedrock was 0.62m of mid-grey clay subsoil with orange patches (TP122002). This was sealed by 0.22m of mid-orange clay with grey patches (TP122001) which, in turn, was sealed by 0.16m of mid-brown peat topsoil (122000).

Trial Pit 123**Table of Stratigraphic Sequence**

Context No	Type	Description	Depth
TP123000	Topsoil	Mid-brown peat	0.00m-0.10m
TP123001	Subsoil	Mid-orange clay with grey patches	0.10m-1.00m
TP123002	Bedrock	Limestone	1.00m-1.10m+

7.26 Trial Pit 123 was located in the north-eastern part of the site, in the north portion of the northernmost proposed pond, and was excavated to a depth of 1.10m. The trial pit was orientated E-W and was 3.5m long by 1.15m wide. The lowest deposit encountered (TP123002) consisted of limestone bedrock at a depth of 1.00m. Overlying the bedrock was 0.90m of mid-orange clay with grey patches (TP123001), consistent with that found in TP121 and TP122. This was sealed by 0.10m of mid-brown peat topsoil (123000).

Trial Pit 124 (Plate 10)**Table of Stratigraphic Sequence**

Context No	Type	Description	Depth
TP124000	Topsoil	Dark grey silty clay	0.00m-0.04m
TP124001	Subsoil	Mid-grey clay with patches of orange and very occasional sub-angular large stones	0.04m-2.50m+

7.27 Trial Pit 124 was located in the north part of the site along the proposed route for the mains pipe, and was excavated to a depth of 2.50m. The trial pit was orientated WSW-ENE and was 1.76m long by 1.50m wide. The lowest deposit encountered (TP123001) comprised mid grey clay which contained patches of orange clay and occasional sub-angular stones (2.46m+ deep). This was sealed by a thin layer of dark grey silty clay topsoil (124000) (0.04m deep).

Trial Pit 125 (Plate 11)**Table of Stratigraphic Sequence**

Context No	Type	Description	Depth
TP125000	Topsoil	Dark-grey/black silty clay	0.00m-0.19m
TP125001	Natural	Mid-orange/brown clay with small angular stone inclusions	0.19m-2.40m+

7.28 Trial Pit 125 was located in the central northern part of the site along the proposed mains route, and was excavated to a depth of 2.40m. The trial pit was orientated NE-SW and was 2.00m long by 1.50m wide. The lowest deposit encountered (TP125001) comprised natural mid-orange/brown clay with small angular stone inclusions. Overlying this was 0.19m of dark-grey/black silty clay topsoil (TP125000).

Trial Pit 126 (Plate 12)**Table of Stratigraphic Sequence**

Context No	Type	Description	Depth
TP126000	Made Ground	Pea gravel	0.00m-0.51m
TP126001	Subsoil	Orange/yellow clay with occasional sub-angular stones	0.51m-1.85m+

- 7.29 Trial Pit 126 was located in the south-central part of the site, along the NW-SE access road, and was excavated to a depth of 1.85m. The trial pit was orientated SE-NW and was 3.5m long by 1.15m wide. The lowest deposit encountered (TP126001) comprised orange/yellow clay natural with occasional sub-angular stones. This was sealed by 0.51m of pea gravel forming the road surface (126000).

Trial Pit 127**Table of Stratigraphic Sequence**

Context No	Type	Description	Depth
TP127000	Topsoil	Dark grey clayey peat	0.00m-0.20m
TP127001	Subsoil	Mixed mid-grey/orange clay with medium sized sub-angular stones	0.20m-2.25m+

- 7.30 Trial Pit 127 was located in the south-eastern part of the site, along the NW-SE access road, and was excavated to a depth of 2.25m. The trial pit was orientated NE-SW and was 3.5m long by 1.55m wide. The lowest deposit encountered comprised 2.05m of mixed mid-grey/orange clay with medium sized sub-angular stones (TP127001). This was sealed by 0.20m of dark grey clayey peat topsoil (127000).
- 7.31 A possible construction pile was encountered in SW edge of the pit; this was left *in situ*.

Trial Pit 128 (Plate 13)**Table of Stratigraphic Sequence**

Context No	Type	Description	Depth
TP128000	Made Ground	Mid-grey sandy clay with medium sized sub-angular stones throughout	0.00m-0.60m
TP128001	Subsoil	Dark brown peat with wood throughout	0.60m-1.10m
TP128002	Subsoil	Grey clay	1.10m-2.25m
TP128003	Bedrock	Limestone	2.25m+

- 7.32 Trial Pit 128 was located in the south-eastern part of the site, along the NW-SE access road, and was excavated to a depth of 2.25m. The trial pit was orientated E-W and was 3.4m long by 1.90m wide. The lowest deposit encountered (TP128003) comprised limestone bedrock at a depth of 2.25m. Sealing the bedrock was 1.15m of grey clay (TP128002) which, in turn, was sealed by 0.50m of peat (TP128001). This was sealed by 0.60m of mid-grey sandy clay with medium sized sub-angular stones throughout (128000); this deposit formed the road surface.

Window Samples

Window Sample 101

- 7.23 Window Sample 101 measured 0.8m by 0.5m and was excavated to a depth of 1.14m. Natural mid brown clay was encountered at the base of the pit (WS101002). This was sealed by a made ground deposit which comprised dark grey clay with frequent small sub-angular stones (WS101001; 0.9m deep). This, in turn, was sealed by dark grey sandy loam topsoil (WS101/000; 0.13m deep).

Window Sample 102

- 7.24 Window Sample 102 measured 0.58m by 0.55m and was excavated to a depth of 1.3m. A dark brown sandy clay was encountered at the base of the pit (WS102002). This was sealed by a deep made ground deposit which comprised crushed sandstone and demolition rubble (WS102001; 1.2m deep).

Window Sample 103

- 7.25 Window Sample 103 measured 0.45m by 0.4m and was excavated to a depth of 1.05m. Bedrock was encountered at the base of the pit (WS103002). This was sealed by a subsoil deposit which comprised mid grey clay with orange flecks and occasional sub-angular stone inclusions (WS103001; 0.87m deep). This, in turn, was sealed by dark grey peat-rich topsoil (WS103/000; 0.18m deep).

Window Sample 104

- 7.26 Window Sample 104 measured 0.6m by 0.4m and was excavated to a depth of 1.09m. Bedrock was encountered at the base of the pit (WS104002). This was sealed by a subsoil deposit which comprised mid grey clay with orange flecks and occasional sub-angular stone inclusions (WS104001; 0.95m deep). This, in turn, was sealed by dark grey peat-rich topsoil (WS104/000; 0.14m deep).

Window Sample 105

- 7.27 Window Sample 105 measured 0.65m by 0.35m and was excavated to a depth of 1.10m. Bedrock was encountered at the base of the pit (WS105002). This was sealed by a subsoil deposit which comprised mid grey and orange clay which contained occasional sub-angular stone inclusions (WS105001; 0.9m deep). This, in turn, was sealed by dark brown peat-rich topsoil (WS105/000; 0.10m deep).

Window Sample 106

- 7.28 Window Sample 106 measured 0.55m by 0.4m and was excavated to a depth of 1m. Bedrock was encountered at the base of the pit (WS106002). This was sealed by a subsoil deposit which comprised mid grey clay with orange flecks and occasional sub-angular stone inclusions (WS106001; 0.86 deep). This, in turn, was sealed by dark brown peat-rich topsoil (WS106/000; 0.14m deep).

Window Sample 107

- 7.29 Window Sample 107 measured 0.58m by 0.47m and was excavated to a depth of 0.85m. Bedrock was encountered at the base of the pit (WS107002). This was sealed by a subsoil deposit which comprised dark grey clay with orange flecks (WS107001; 0.72 deep). This, in turn, was sealed by dark grey peat-rich topsoil (WS107000; 0.13m deep).

Window Sample 108

- 7.30 Window Sample 108 measured 0.52m by 0.45m and was excavated to a depth of 0.8m. The earliest deposit encountered comprised mid orange/grey clay which contained occasional sub-angular stones (WS108001; 0.7 deep). This was sealed by dark grey peat-rich topsoil (WS108/000; 0.1m deep).

Window Sample 109

- 7.31 Window Sample 109 measured 0.5m by 0.3m and was excavated to a depth of 0.87m. Bedrock was encountered at the base of the pit (WS109002). This was sealed by a subsoil deposit which comprised mid brown clay which contained occasional sub-angular stones (WS109001; 0.74 deep). This, in turn, was sealed by dark grey peat-rich topsoil (WS109000; 0.13m deep).

8 Conclusion

- 8.1 The trial pits excavated on the northwestern part of the site, in the vicinity of the mining museum, revealed varying depths of made ground, most of which is likely to represent redeposited mining waste. In contrast, the trial pits on the main body of the site generally revealed topsoil/subsoil/natural profiles, only a few of the pits revealing isolated deposits of made ground (Trial Pits 120, 126 and 128).
- 8.2 At the northwestern extent of the development area, in Trial pits 103a and 103b, two stone structures were encountered. The structure in Trial Pit 103a appeared to be fairly rudimentary and could represent the remains of a drystone wall or a rough stone surface or area of hardstanding. The structure in Trial Pit 103b was much more substantial and is likely to be related to the historic mine complex. However, it should be noted that only small portions of each structure were exposed which limits interpretation.
- 8.3 A third stone obstruction was encountered in Trial Pit 108 on the proposed course of the rising main but its depth and flooding prevented it from being investigated.
- 8.4 With regard to the research objectives of the project, the following comments can be made:
- Potential structures were located in Trial Pits 103a, 103b and 108. The structure in Trial Pit 103b is likely to be associated with the historic mining complex. It was abutted by a made ground deposit which contained crushed sandstone and slag, which may represent mining waste dumped in this area once the structure fell out of use. However, no secure dating evidence was recovered for any of the encountered structures.
 - The results of the watching brief suggest widespread deposition of potential mining waste on the northwestern part of the site (Trial Pits 102 to 108). There appears to have been less disturbance on the main body of the development site.
 - No archaeological features were encountered which might shed light on earlier periods of human activity in the area.

9 Archiving

- 9.1 A full site archive will be produced which will contain all the data collected during the archaeological works, including the finds (if required by the receiving institution). The archive will be quantified, ordered, indexed and internally consistent, and will be deposited at the appropriate local museum.
- 9.2 The archive will be assembled in line with the recommendations provided in Historic England's *MoRPHE Project Planning Note 3: Archaeological Excavation (PPN3)* (2008), and in accordance with the *Guidelines for the preparation of Excavation Archives for long-term storage* (United Kingdom Institute for Conservation, 1990) and *Standards in the museum care of archaeological collections* (Museums and Galleries Commission 1994).
- 9.3 An OASIS form has been completed and uploaded for this project and a copy of this is provided in Appendix 2.

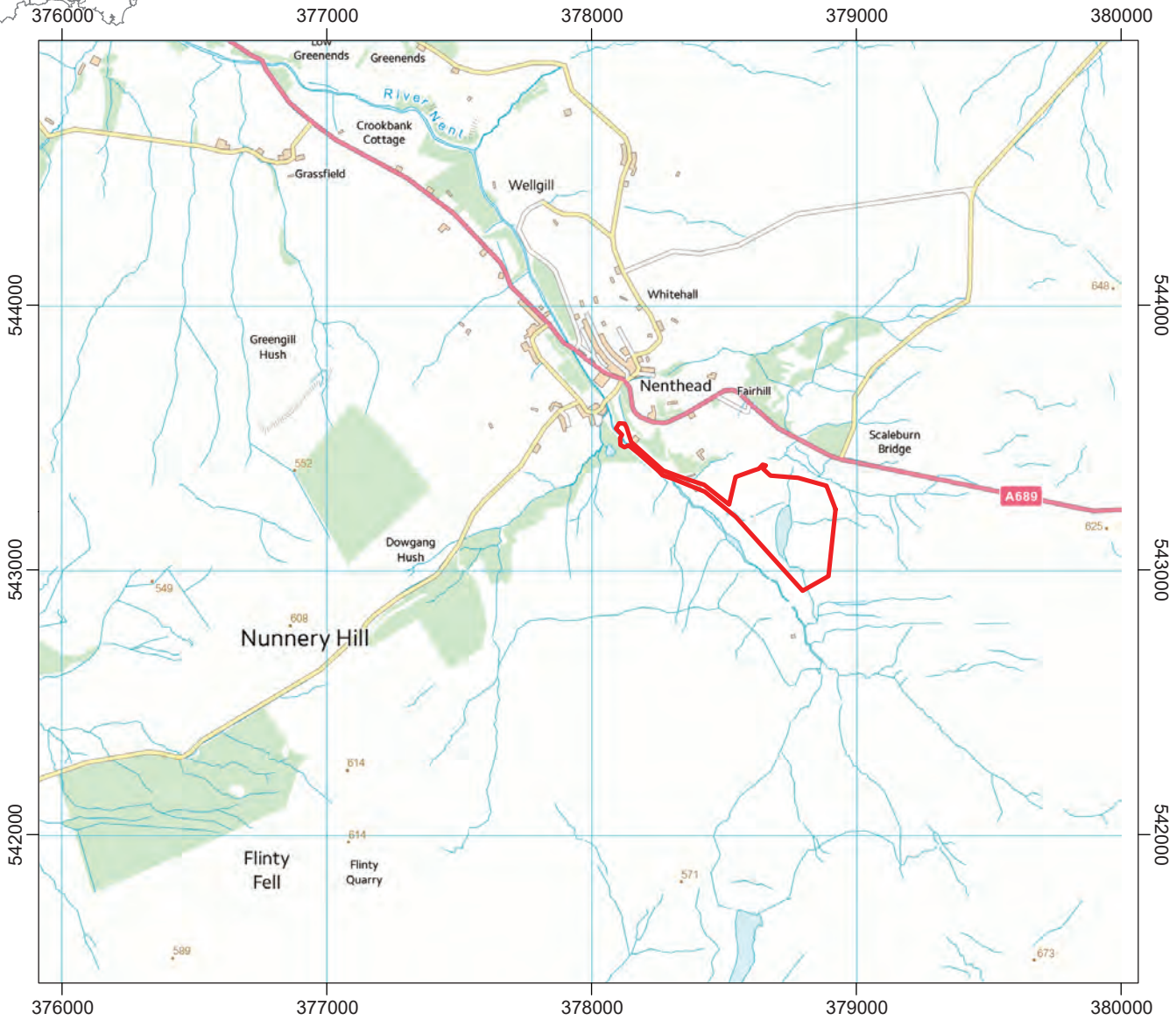
10 Bibliography

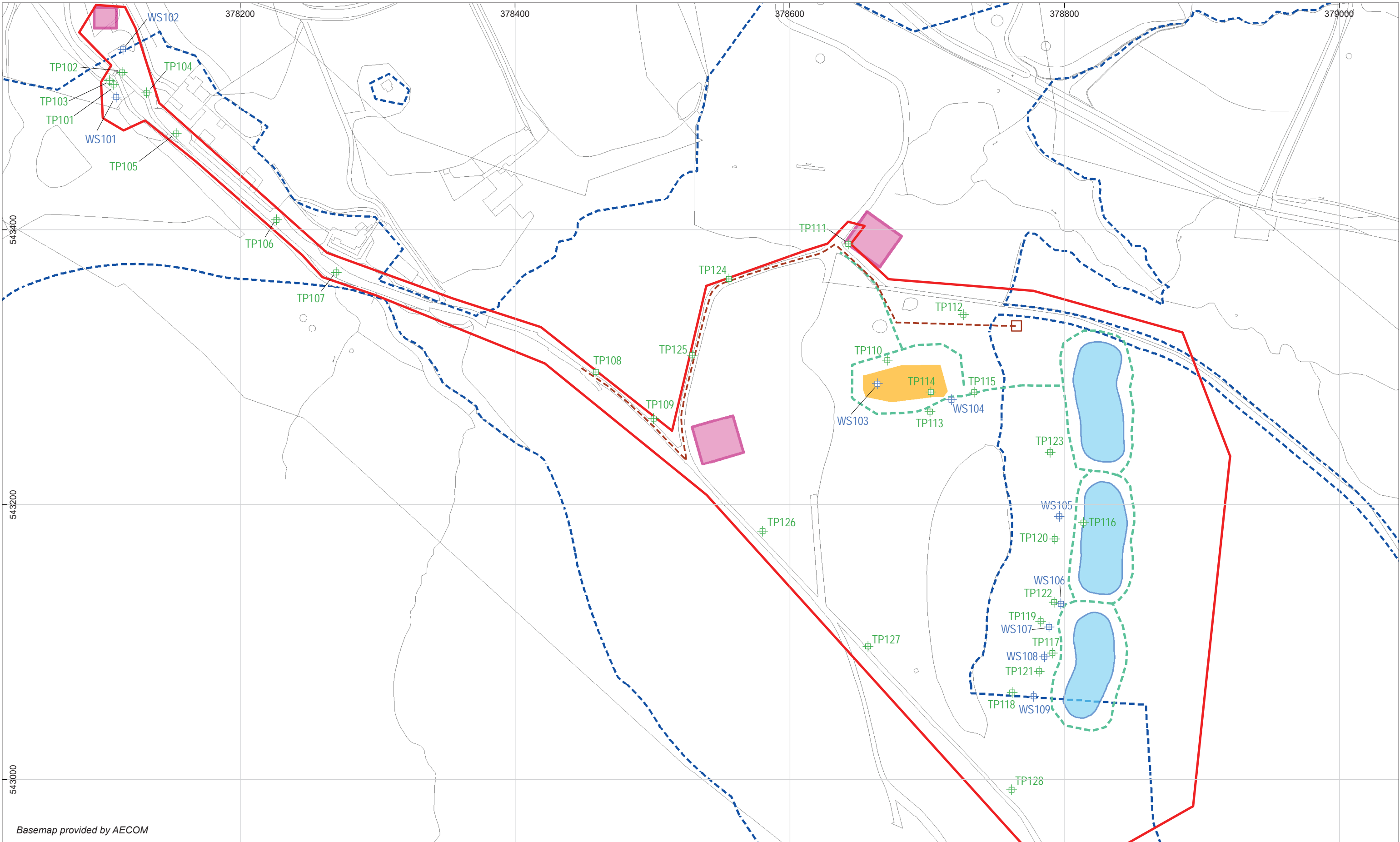
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- United Kingdom Institute for Conservation, 1990 Guidelines for the preparation of Excavation Archives for long-term storage.
- Watkinson, D. And Neal, V., 1998 First Aid for Finds.

Figures



Figure 1	
Site location	
 1:25,000 at A4	
<small>Based on data provided by the Ordnance Survey with the permission of the Controller of Her Majesty's Stationery Office. © Crown Copyright. Licence no. AL 100016114</small>	





Basemap provided by AECOM

Plan of Trial Pit and Window Sample locations

Figure 2		Site boundary	Suggested route of rising main and outfall chamber	Proposed contractor compound	Proposed mine water treatment pond	Trial Pit
		Scheduled Monument boundary	Proposed access track	Proposed reed bed	Window sample borehole	<p>1:2500 at A3</p>

Plates



Plate 1: Trial Pit 103a showing structure TP3001a, viewed from the southeast.



Plate 2: Trial Pit 103b showing structure TP3002b, viewed from the southeast.



Plate 3: Trial Pit 104, viewed from the SSE.



Plate 4: Trial Pit 109, viewed from the southwest.

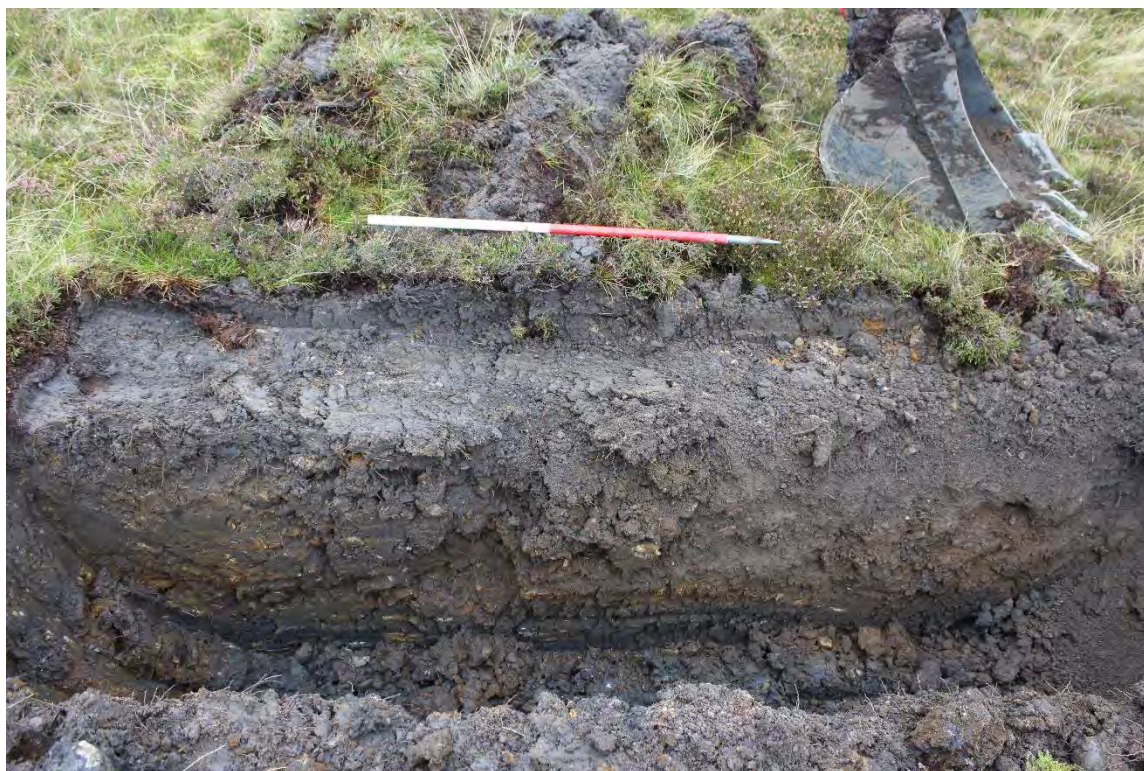


Plate 5: Trial Pit 113, viewed from the west.



Plate 6: Trial Pit 115, viewed from the north.



Plate 7: Trial Pit 116, viewed from the north.



Plate 8: Trial Pit 118, viewed from the north.



Plate 9: Trial Pit 120, viewed from the northwest.



Plate 10: Trail Pit 124, viewed from the ESE.



Plate 11: Trial Pit 125, viewed from the southeast.



Plate 12: Trail Pit 126, viewed from the southwest.



Plate 13: Trial Pit 128, viewed from the north.

Appendix 1

Context No	Type	Description	Length	Width	Depth
TP2000	Deposit	Topsoil	-	-	0.1m
TP2001	Deposit	Made Ground	-	-	1.01mm
TP2002	Deposit	Natural	-	-	>0.01m
TP3000a	Deposit	Topsoil	-	-	0.30m
TP3001a	Structure	Sandstone structure	-	-	-
TP3000b	Deposit	Topsoil	-	-	0.30m
TP3001b	Deposit	Made Ground	-	-	>0.82m
TP3001c	Structure	Sandstone wall	-	-	>0.82m
TP4000	Deposit	Made Ground	-	-	0.32m
TP4001	Deposit	Made Ground	-	-	0.41m
TP4002	Deposit	Made Ground	-	-	>1.32m
TP5000	Deposit	Made Ground	-	-	0.30m
TP5001	Deposit	Made Ground	-	-	>0.70m
TP6000	Deposit	Made Ground	-	-	0.20m
TP6001	Deposit	Made Ground	-	-	0.25m
TP6002	Deposit	Made Ground	-	-	>0.75m
TP7000	Deposit	Made Ground	-	-	0.27m
TP7001	Deposit	Redeposited Natural	-	-	0.30m
TP7002	Deposit	Made Ground/ Mine Waste	-	-	>0.63m
TP8000	Deposit	Made Ground	-	-	0.58m
TP8001	Structure	Structure	-	-	-
TP9000	Deposit	Topsoil	-	-	0.10m
TP9001	Deposit	Natural	-	-	>1.80m

TP11000	Deposit	Topsoil	-	-	0.10m
TP11001	Deposit	Natural	-	-	>2.90m
TP111000	Deposit	Topsoil	-	-	0.10m
TP111001	Deposit	Natural	-	-	>2.15m
TP120000	Deposit	Topsoil	-	-	0.12m
TP120001	Deposit	Natural	-	-	>2.88m
TP130000	Deposit	Topsoil	-	-	0.10m
TP130001	Deposit	Natural	-	-	>1.00m
TP114000	Deposit	Topsoil	-	-	0.09m
TP114001	Deposit	Natural	-	-	>2.91m
TP115000	Deposit	Topsoil	-	-	0.12m
TP115001	Deposit	Natural	-	-	>1.42m
TP116000	Deposit	Topsoil	-	-	0.08m
TP116001	Deposit	Subsoil	-	-	0.72m
TP116002	Deposit	Natural	-	-	>0.26m
TP117000	Deposit	Topsoil	-	-	0.31m
TP117001	Deposit	Natural	-	-	0.82m
TP117002	Deposit	Bedrock	-	-	>0.07m
TP118000	Deposit	Topsoil	-	-	0.27m
TP118001	Deposit	Subsoil	-	-	0.25m
TP118002	Deposit	Natural	-	-	1.03m
TP118003	Deposit	Bedrock	-	-	-
TP119000	Deposit	Topsoil	-	-	0.06m
TP119001	Deposit	Subsoil	-	-	0.05m

TP119002	Deposit	Natural	-	-	0.14m
TP119003	Deposit	Bedrock	-	-	>0.65m
TP120000	Deposit	Topsoil	-	-	0.14m
TP120001	Deposit	Subsoil	-	-	0.51m
TP120002	Deposit	Natural	-	-	>0.65m
TP121000	Deposit	Topsoil	-	-	0.26m
TP121001	Deposit	Subsoil	-	-	0.20m
TP121002	Deposit	Subsoil	-	-	0.40m
TP121003	Deposit	Bedrock	-	-	>0.04m
TP122000	Deposit	Topsoil	-	-	0.16m
TP122001	Deposit	Subsoil	-	-	0.22m
TP122002	Deposit	Subsoil	-	-	0.52m
TP122003	Deposit	Bedrock	-	-	-
TP123000	Deposit	Topsoil	-	-	0.10m
TP123001	Deposit	Subsoil	-	-	0.90m
TP123002	Deposit	Bedrock	-	-	>0.10m
TP124000	Deposit	Topsoil	-	-	0.04m
TP124001	Deposit	Natural	-	-	>2.46m
TP125000	Deposit	Topsoil	-	-	0.19m
TP125001	Deposit	Natural	-	-	>2.21m
TP126000	Deposit	Topsoil	-	-	0.51m
TP126001	Deposit	Natural	-	-	>1.34m
TP127000	Deposit	Topsoil	-	-	0.20m
TP127001	Deposit	Natural	-	-	>2.05m

TP128000	Deposit	Made Ground	-	-	0.60m
TP128001	Deposit	Subsoil	-	-	0.50m
TP128002	Deposit	Subsoil	-	-	1.15m
TP128003	Deposit	Subsoil	-	-	-
WS101000	Deposit	Topsoil	-	-	0.13m
WS101001	Deposit	Subsoil	-	-	0.90m
WS101002	Deposit	Natural	-	-	-
WS102001	Deposit	Made Ground	-	-	1.20m
WS102002	Deposit	Natural	-	-	-
WS103000	Deposit	Topsoil	-	-	0.18m
WS103001	Deposit	Subsoil	-	-	>0.87m
WS103002	Deposit	Bedrock	-	-	-
WS104000	Deposit	Topsoil	-	-	0.14m
WS104001	Deposit	Subsoil	-	-	0.95m
WS104002	Deposit	Bedrock	-	-	-
WS105000	Deposit	Topsoil	-	-	0.10m
WS105001	Deposit	Subsoil	-	-	0.90m
WS105002	Deposit	Bedrock	-	-	-
WS106000	Deposit	Topsoil	-	-	0.14m
WS16001	Deposit	Subsoil	-	-	0.86m
WS106002	Deposit	Bedrock	-	-	-
WS107000	Deposit	Topsoil	-	-	0.13m
WS107001	Deposit	Subsoil	-	-	0.72m
WS107002	Deposit	Bedrock	-	-	-

WS108000	Deposit	Topsoil	-	-	0.10m
WS108001	Deposit	Subsoil	-	-	0.70m
WS109000	Deposit	Topsoil	-	-	0.13m
WS109002	Deposit	Subsoil	-	-	0.74m
WS109003	Deposit	Bedrock	-	-	0.74m

Appendix 2

OASIS Form

OASIS DATA COLLECTION FORM: England

[List of Projects](#) | [Manage Projects](#) | [Search Projects](#) | [New project](#) | [Change your details](#) | [HER coverage](#) | [Change country](#) | [Log out](#)

Printable version

OASIS ID: aocarcha1-372820

Project details

Project name	Nenthead (Caplecleugh) Mine Water Treatment: Archaeological Watching Brief
Short description of the project	AOC Archaeology Group was commissioned to monitor a series of groundwater investigations at the Nenthead Mine, Cumbria, for a Mine Water Treatment Scheme. Twenty-eight trial pits and nine window samples were excavated. Made ground deposits were encountered in the trial pits on the northwestern part of the site and these are thought to represent redeposited mining waste. The trial pits on the main body of the site revealed more conventional soil profiles (topsoil/subsoil/natural). Three potential structures were also encountered, at least one of which is thought to relate to the historic mine complex.
Project dates	Start: 02-09-2019 End: 16-09-2019
Previous/future work	Not known / Not known
Any associated project reference codes	52055 - Contracting Unit No.
Type of project	Recording project
Site status	Scheduled Monument (SM)
Current Land use	Other 8 - Land dedicated to the display of a monument
Monument type	WALL Post Medieval
Significant Finds	NONE None
Investigation type	"Watching Brief"
Prompt	National Planning Policy Framework - NPPF

Project location

Country	England
Site location	CUMBRIA EDEN ALSTON MOOR Nenthead (Caplecleugh) Mine Water Treatment
Postcode	CA9 3PB
Study area	0 Square metres
Site coordinates	NY 78430 43298 54.784022489733 -2.335430928125 54 47 02 N 002 20 07 W Point

Project creators

Name of Organisation	AOC Archaeology Group
Project brief originator	No formal brief issued

Project design originator	AECOM
Project director/manager	Stephen Potten
Project supervisor	Stuart Wilson
Project supervisor	Matthew Walker
Type of sponsor/funding body	Developer
Name of sponsor/funding body	The Coal Authority

Project archives

Physical Archive Exists?	No
Digital Archive recipient	To be confirmed
Digital Contents	"Survey","other"
Digital Media available	"Images raster / digital photography","Survey"
Paper Archive recipient	To be confirmed
Paper Contents	"Stratigraphic","other"
Paper Media available	"Context sheet","Notebook - Excavation"," Research"," General Notes","Plan","Report"

Project bibliography 1

Publication type	Grey literature (unpublished document/manuscript)
Title	Nenthead (Caplecleugh) Mine Water Treatment: Archaeological Watching Brief Report
Author(s)/Editor(s)	Davis, B.
Date	2019
Issuer or publisher	AOC Archaeology Group
Place of issue or publication	York
Description	A4 bound report
Entered by	Stephen Potten (stephen.potten@aocarchaeology.com)
Entered on	6 November 2019

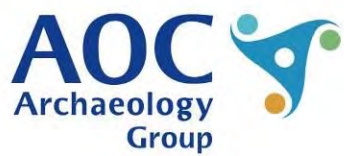
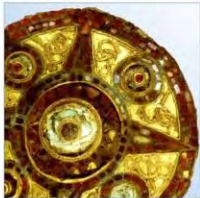
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SUPPORTING FACTUAL DATA

APPENDIX 2

SUBCONTRACT REPORTS

Zetica PAS128 Survey Report



Client: The Coal Authority
Reference: P8560-19-R1-B
Site: Nenthead Mines, Cumbria
Date: 30th October 2019

utilitysurveys

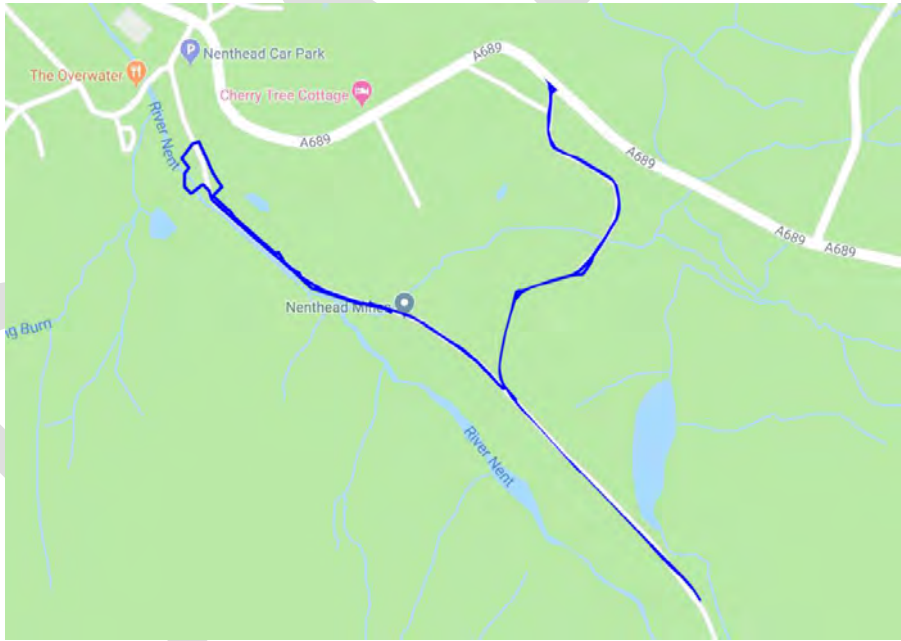


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SUMMARY REPORT

Location: Nenthead Mines, Nenthead, Cumbria
 Client: The Coal Authority
 Reference: P8560-19-R1-B

1. INTRODUCTION

Scope	<p>Zetica were commissioned by The Coal Authority (the Client) to carry out a utility services survey for a ~1.5ha area within the Nenthead Mines Scheduled Monument immediately south of Nenthead, Cumbria.</p> <p>The utility services survey was required to map detectable in-ground utility services including electric, gas, telecommunications, water and foul and surface water drains.</p> <p>The utility services survey was carried out in accordance with the PAS 128:2014 standard (specification for underground utility detection, verification and location).</p> <p>The survey was undertaken between 2nd and the 11th of September 2019.</p>	
Site	<p>The Site is ~1.5ha area within the Nenthead Mines Scheduled Monument immediately south of Nenthead Cumbria as shown in Figure 1. The Client requested:</p> <ol style="list-style-type: none"> 1) Utility survey of the access road shown below (Figure 1). 2) Utility clearance of 50No. exploratory locations. <p>The access road construction was gravel track. The exploratory holes were located along the access track and to the North and East of the reservoir. The ground conditions around the reservoir were moorland.</p>	
	 <p style="font-size: small;">Source: Google Earth</p>	 North  Survey extents
	Figure 1: Survey extents	Scale: NTS

2. METHODOLOGY	
Summary of techniques	<p>The utility survey utilised a combination of techniques and was carried out in accordance with the PAS 128:2014 standard. This PAS sets out the accuracy to which the data are captured, the quality expected of these data and a means which to assess and indicate the confidence that can be placed in such data.</p> <p>A key feature of PAS 128:2014 is the inclusion of quality levels for detected utility services. Zetica has produced an interpretation of the quality level for detected utility services across the Site. The results of this interpretation are shown on drawing P8560-19-DWG01-A.</p> <p>Each utility service was assigned a quality level ranging from B4 (inferred location) to A (verification). Utility services that have been located from visual inspection and/or traced within manhole chambers have been given a PAS quality level A.</p> <p>Zetica conducted a Type B M2P utility services detection survey utilising the following techniques:</p> <ul style="list-style-type: none"> • Full visual inspection of manholes and ID of services (including recording to provide a detailed manhole schedule including photographs and CAD schematic). See Zetica Drawing P8560-19-DWG01-A. • Tracing utility services using radio frequency location (RFL) system. • Area scans in passive mode to locate active cables. • Ground penetrating radar survey of the client's key targeted accessible areas fully post-processed. • Topography survey to pick up mapped services and manholes. • 2D CAD drawing with PAS 128:2014 quality level annotation for each individual service. <p>Factual report (this document).</p>
Useful Links	https://www.zetica.com/resources/method/

Summary of survey design	Technique	Configuration	Line Spacing	Station interval	Depth Accuracy
	GPR	Dual-channel - 250MHz antenna. 700MHz antenna.	Exploratory Locations - 1m x 1m orthogonal grid Access Track - 2m x 2m orthogonal grid.	0.01m	+/-15% of recorded depth
	RFL	Passive and Active mode.	N/A	N/A	+/-10% of recorded depth
Limitations	<p>The following clarifies some of the limitations relevant to the survey:</p> <ul style="list-style-type: none"> • Factors such as multiple utility services or conductive sub-surface conditions (such as water retentive soils) can reduce the detectability of utility services. • Depths of interpreted features were indicated where possible and were measured relative to the ground surface. These are based on data modelling and may not necessarily indicate the exact depth. • The detectability depth for potential features depends on target size and site-specific signal to noise ratios. Large diameter features will be detectable at greater burial depth than small diameter features in the same environment. • GPR depth of detection is strongly dependent on the material properties of the ground. GPR signals can be attenuated by conductive soils and scattered by in-ground targets (clutter) resulting in reduced detection depths. • RFL depths are derived from an induced signal that is centred on the utility service. The diameter of the utility service has not been considered. • The results of electro-detection techniques are not infallible. Whilst all reasonable efforts are made, the completeness of the utility services information cannot be guaranteed. • Inaccessible areas of the Site are shown on Zetica drawing P8560-19-DWG01-A. 				

PAS 128:2014 Quality Levels

In line with PAS 128:2014 the following quality levels were achieved. Each utility service is annotated with a PAS quality level to display the accuracy achieved at the time of the survey.

Quality Level	Post Processing	Horizontal Accuracy	Vertical Accuracy	Supporting Data
A	-	±50 mm	±25 mm	Visual inspection
B1P	Yes	±150 mm	±15% of detected depth	Two techniques with post-processing
B1	-	±150 mm	±15% of detected depth	Two techniques no post-processing
B2P	Yes	±250 mm	±40% of detected depth	One technique with post-processing
B2	-	±250 mm	±40% of detected depth	One technique no post-processing
B3P	Yes	±500 mm	Undefined	One technique with post-processing
B3	-	±500 mm	Undefined	One technique no post-processing
B4	-	Undefined	Undefined	Inferred location

3. DATA	
Data Presentation	
<p>The utility survey results are presented as an interpretative CAD drawing. An example plot of the geophysical data is provided as Figures 2-4. These are referenced below.</p>	
Figure Reference	Title
Figure 1	Site Location: Survey area outlined in blue
Figure 2	Example GPR vertical radargram (linear feature)
Zetica Drawing Reference	Title
P8560-19-DWG01-A	Utility Services Plan
Data Quality	
<p>GPR dual channel antenna data quality was good with the maximum signal penetration depth across the Site estimated as 1.25m with an average TWTT to the 'noise floor' of 26.3ns and an estimated average signal velocity through the near-surface materials of 95mm/ns. The signal velocity was determined using the hyperbolic curve-fitting method applied to selected anomalies observed within the data.</p> <p>The dual channel antenna based GPR system produces a 2D vertical profile of data. Figure 2 comprise grey-scale plots of the GPR data from a slice through this volume in a vertical direction, which is referred to as a 'radargram'. The colours of the radargram represent the measured GPR signal amplitude within that specific slice. Mid-tones (grey) represents low amplitude, white represents high positive amplitudes and black represent high negative amplitudes.</p> <p>A typical reflection from an object is comprised of an alternating negative - positive - negative cycle of amplitudes, as seen in a vertical radargram slice. It is not generally possible to determine the type of utility service from GPR data alone so features without corresponding detected utilities are included with a dedicated 'GPR' linetype in Zetica Drawing P8560-19-DWG01-A.</p>	
Detectability & Accuracies	
<p>The detection of utility services across the Site was good with numerous services being mapped between surface level and a modelled depth of -1.20m. Most of the mapped utility services produced coincident results with multiple methods providing a good level of detection confidence.</p> <p>GPR was deployed where accessibility was possible within the site, with the resulting detection depth of approximately 1.75m bgl. Areas inaccessible to GPR are shown on Zetica drawing P8560-19-DWG01-A (Combined Utility Services Plan).</p> <p>The RFL survey was undertaken across the entire accessible Site areas. The majority of the mapped utility services were located <1m bgl. and the detection of the deepest utility service found on Site was 2.49m. The horizontal accuracy for RFL detected utility services is estimated to be better than 0.15m.</p> <p>For both GPR and RFL an approximate modelled depth of a utility service has been provided. The accuracy of these modelled depths is estimated to be ±15% and ±10% of the stated depth for the GPR and RFL respectively.</p>	

4. DISCUSSION

Interpretation

The interpretation of a feature in GPR data depends on the characteristics of the received response. The following sections provide examples of the response to features observed on Site with associated interpretations.

Linear feature

Figure 2 provide examples of the GPR response to a linear feature. This is characterised by a continuous high amplitude hyperbola response across multiple swaths. These are interpreted as utility services or trenches associated with construction features.

Example radargram showing the GPR response to linear utility services in cross section (blue circles). Depth axis shows modelled depth.

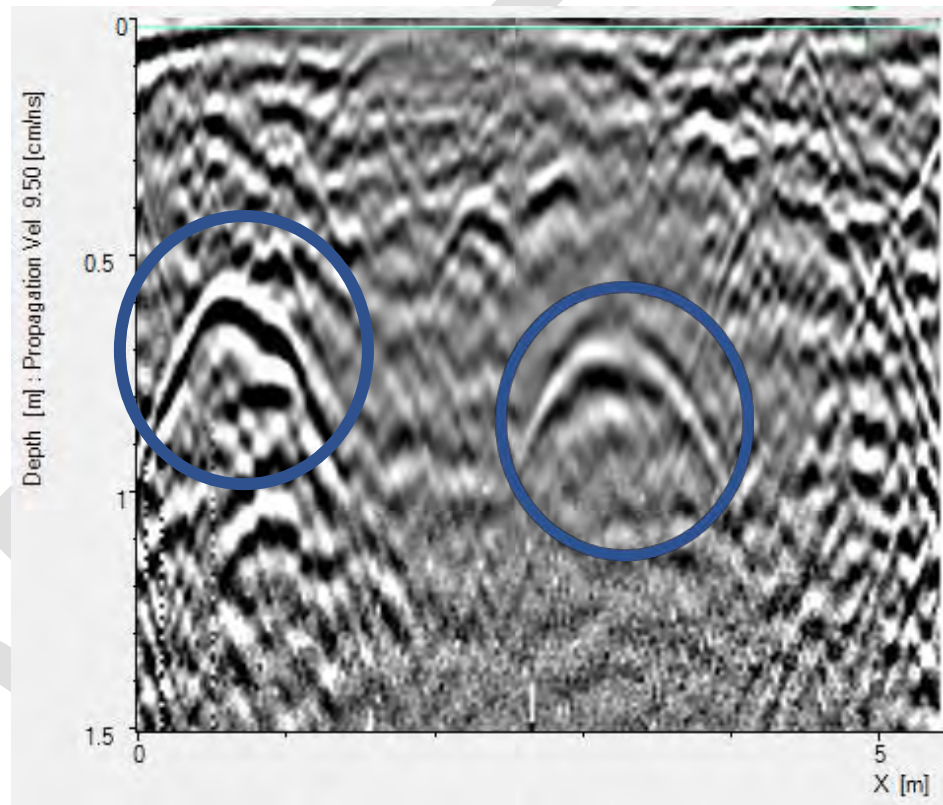


Figure 2: Example radargram (linear feature)

5. RESULTS

The table below provides a summary of identified buried features detected on the Site. This table should be read in conjunction with Zetica drawing P8560-19-DWG01-A (Utility Services Plan).

Feature	No.	Estimated Depth Range (m)	Comments
Electricity Cables	3	0.00 - 1.25	-
Surface Water Sewer	4	0.00 - 0.65	-
Foul Water Sewer	6	0.40 - 1.38	-
Combined Drainage	1	0.50 - 0.70	-
Water	7	0.00 - 2.20	4No. water pipes could not be traced due to polyethylene construction.
Unknown	3	0.10 - 1.85	3No. utility services were traced on Site which could not be assigned to a service type.
GPR Linear	10	0.20 - 2.20	Linear features mapped are assumed to relate to utility services or trenches associated with construction features.

6. SUMMARY


Summary	<p>44No. exploratory locations were surveyed. 8No. locations contained a feature potentially linked to utility services.</p> <p>The utility survey has mapped numerous utility services including electricity, surface water, foul water, water supply and other unknown services.</p> <p>The survey results are summarised on Zetica Drawing P8560-19-DWG01-A.</p>
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DRAFT

Appendix 1

<p>General Notes</p>	<ol style="list-style-type: none"> 1. This report has been prepared in relation to the specific requirement of the contract or commission. The report should not be used by third parties without prior consultation with Zetica Ltd. Any advice, recommendations, or statements within the report should be addressed only in the context of the report as a whole. 2. The copyright for this report remains with Zetica Ltd. No part of this report may be reproduced, published or amended without prior written consent from Zetica Ltd. 3. The report refers to the conditions of the Property at the time of investigation. Zetica Ltd cannot accept liability for subsequent changes of Property conditions. 4. Zetica Ltd may have relied on externally provided information. Under no circumstances does Zetica Ltd accept responsibility for the accuracy of such information or data supplied. 5. It should be noted that the detection performance is dependent on a measurable physical contrast between the item for detection and host materials. Where significant noise is present sufficient detection may not be possible. 6. Interpretation relies largely on experience of similar conditions. Site-specific conditions can create variations that may not be detectable by non-intrusive investigation techniques. It should be noted that the detail of an interpretation might vary from that identified by later intrusive investigation, although the general identification of a feature should not vary. 7. The report has been written in line with relevant guidance and legislation in use at the time of report compilation. Subsequent improvement in techniques, changes in legislation, or changes in site conditions, may render parts of this report obsolete. If the report is used after such changes have occurred, or at a time in excess of 1 year of the issue date, it would be prudent to contact Zetica Ltd to reassess the report under a new contract.
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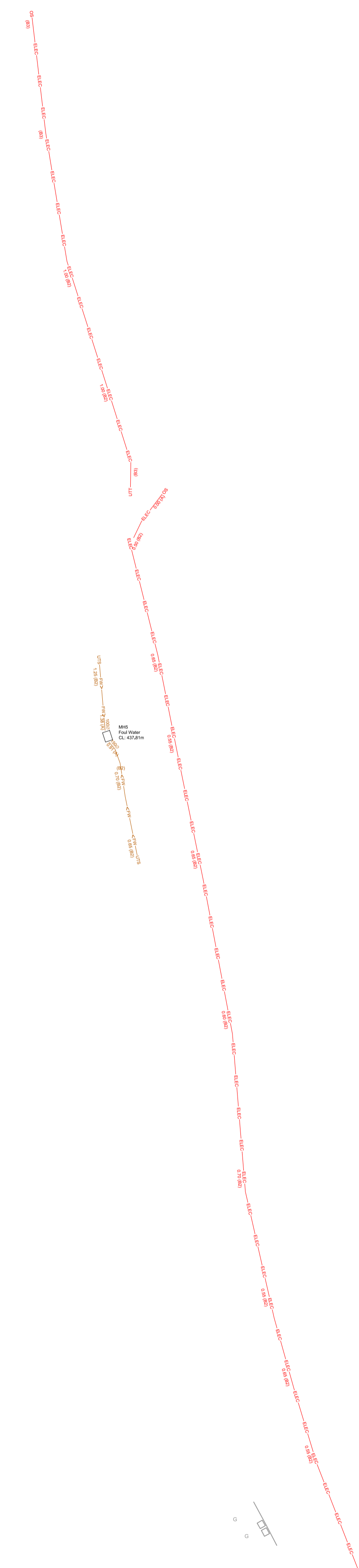
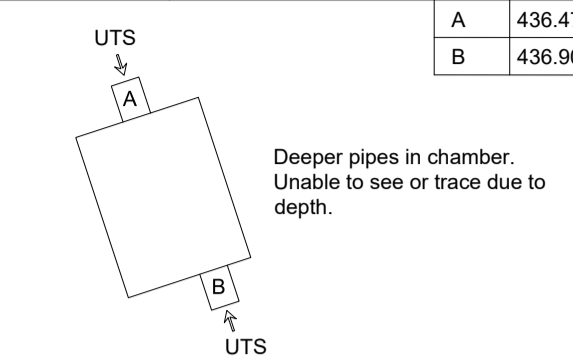
Established for over 28 **years**, **Zetica's services include**

-  Desk studies
-  Unexploded ordnance risk assessments and risk mitigation
-  Utility services detection
-  Archaeological geophysics
-  Environmental and engineering geophysical surveys
-  Transport infrastructure surveys
-  Pipeline & cable route surveys
-  Intrusive ground investigations

More details are available at
www.zetica.com



Reference:	MH5	Cover Level:	437.81m	Pipe	SL (m) Ø (mm)	Notes:	Foul Water
				A	436.47 100	MH Cover	
				B	436.90 150	MH Chamber	



Notes			
A	Base map provided by the Client.		
B	Limitations imposed by site conditions and current technologies mean that there can be no guarantee of detection for utility services. It is the responsibility of the user to satisfy themselves as to the location of site services prior to undertaking any excavation.		
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E	Factors such as multiple utility services can reduce the detectability of utility services.		
F	Survey conducted to PAS 128:2014 M3P.		
G	Where PAS128 utility detection and location quality levels could be determined the level is shown in brackets alongside the apparatus. The table below shows the correlating accuracies for each quality level.		
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A	±25 mm	±25 mm	Visual inspection
B1P	±150 mm or ±15% of detected depth, whichever is greater	±15% of detected depth	Two techniques with post-processing
B1	±150 mm or ±15% of detected depth, whichever is greater	±15% of detected depth	Two techniques no post-processing
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B2	±250 mm or ±40% of detected depth, whichever is greater	±40% of detected depth	One technique no post-processing
B3P	±500 mm	Undefined	One technique with post-processing
B3	±500 mm	Undefined	One technique no post-processing
B4	Undefined	Undefined	Inferred location
H	Drawing should be read in conjunction with report P8560-19-R1-B.		

Legend

Utility Services

- Drainage
 - Arrow indicates flow direction
 - Drainage - Combined water
 - Drainage - Surface water
 - Drainage - Foul water
- Electricity Cables
 - Electricity cables
- Water Pipes
 - Water pipe
- Unknown Utility
 - Unknown
- GPR Feature
 - GPR linear feature

Other

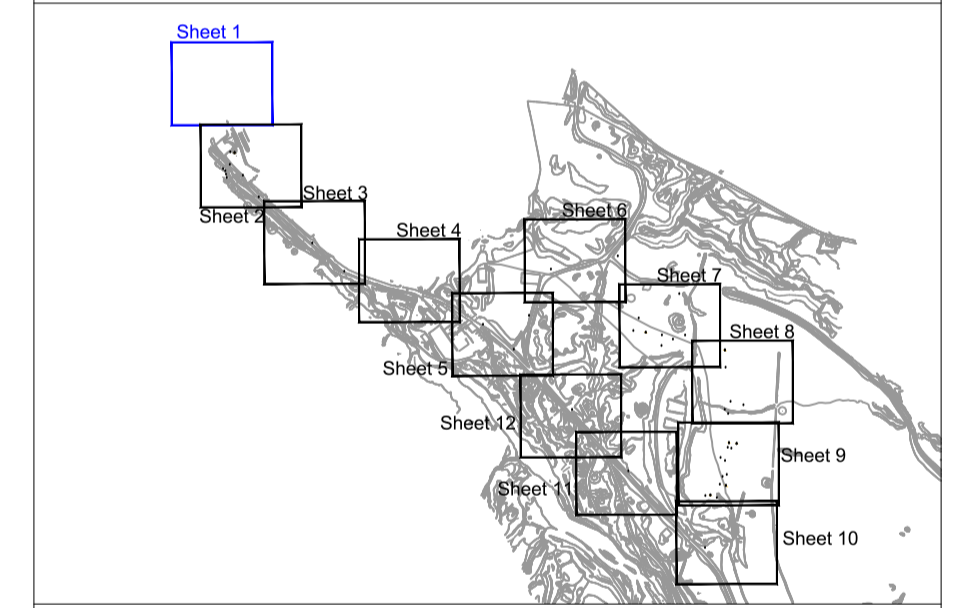
- Site Boundary - Utility survey
- Site Boundary - Exploratory locations
- Inaccessible

Client Exploratory Locations

- Cable percussion borehole
- Trial pit
- Windowless sampling

Abbreviations and annotations

- UTL Unable to Lift
- UTT Unable to Trace
- UTS Unable to See
- OS Service runs Off Site
- MH Manhole



Draft
User to check for latest issue

Client
The Coal Authority

Project
Nenthead Mines

Location
Nenthead, Cumbria

Title
Utility Services Plan

Drawn by T. Carroll	Checked by R. Grant
Horizontal Scale (A1) 1:200	Date of Survey 02/09/2019-11/09/2019
Project Code P8560-19	Issue Date 31/10/2019
Drawing No. DWG01	Sheet 1 of 12
	Issue B

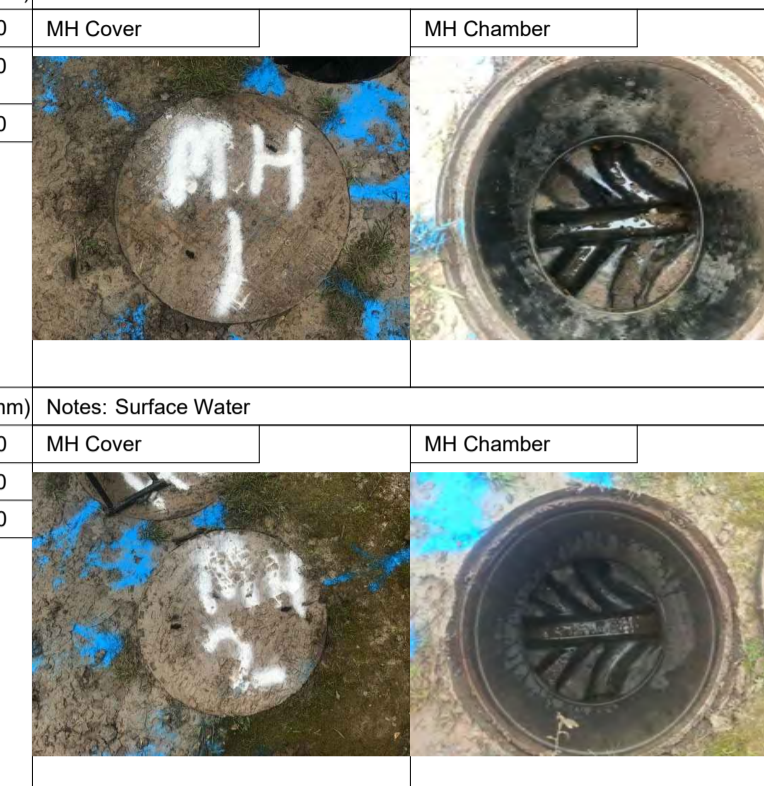
Issue	Remarks	Drawn	Checked	Date
A	Draft issue, for comment	TC	RG	20/09/2019
B	Draft issue, for comment	TC	RG	31/10/2019
-	-	-	-	-
-	-	-	-	-

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www.zetica.com



Reference:	Cover Level:	Pipe	SL (m)	Ø (mm)	Notes:
MH1	439.68m	A, D	439.18	100	Surface Water
		B, C, F	439.23	100	
		E	439.26	100	

Reference:	Cover Level:	Pipe	SL (m)	Ø (mm)	Notes:
MH2	439.70m	A, D	439.17	100	Surface Water
		B, F	439.22	100	
		C, E	439.23	100	



Notes

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 - Water pipe
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 - Unknown
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Other

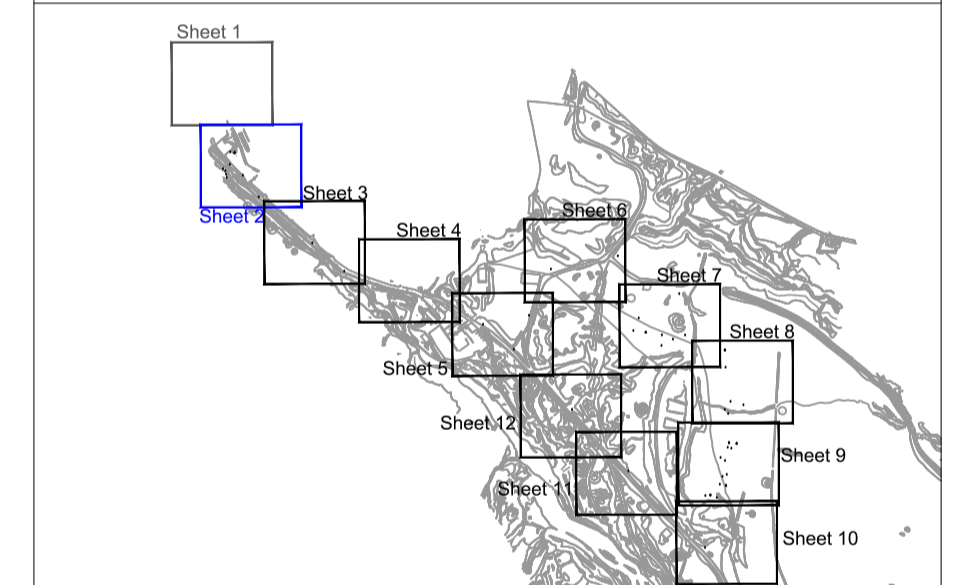
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Abbreviations and annotations

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Client
 The Coal Authority

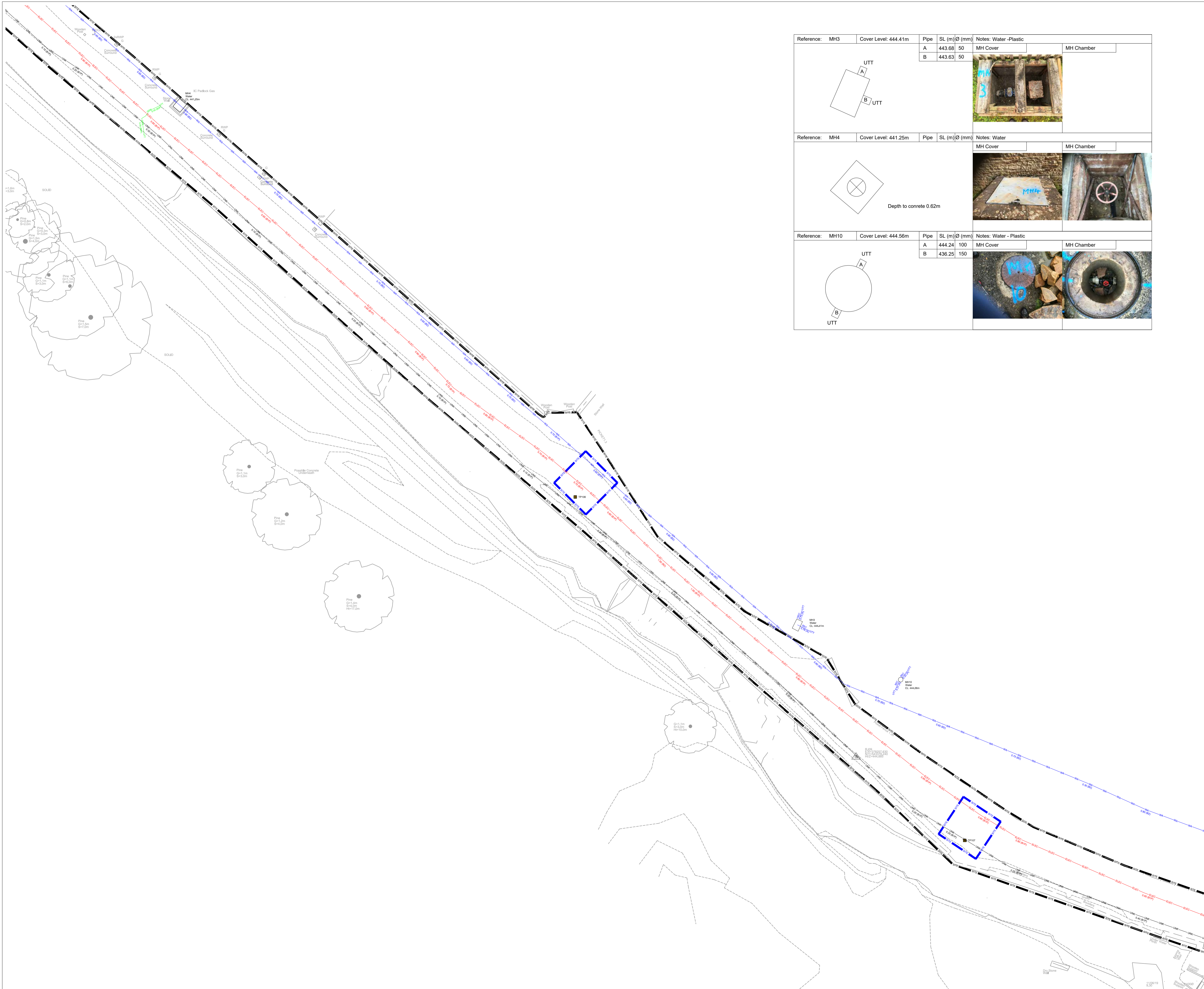
Project
 Nenthead Mines

Location
 Nenthead, Cumbria

Title
 Utility Services Plan

Drawn by T. Carroll	Checked by R. Grant
Horizontal Scale (A1) 1:200	Date of Survey 02/09/2019-11/09/2019
Project Code P8560-19	Issue Date 31/10/2019
Drawing No. DWG01	Sheet 2 of 12
	Issue B

Issue	Remarks	Drawn	Checked	Date
A	Draft issue, for comment	TC	RG	20/09/2019
B	Draft issue, for comment	TC	RG	31/10/2019
-	-	-	-	-
-	-	-	-	-



Reference: MH3	Cover Level: 444.41m	Pipe	SL (m) Ø (mm)	Notes: Water - Plastic	MH Cover	MH Chamber
		A	443.68 50			
		B	443.63 50			
Reference: MH4	Cover Level: 441.25m	Pipe	SL (m) Ø (mm)	Notes: Water	MH Cover	MH Chamber
<p>Depth to concrete 0.62m</p>						
Reference: MH10	Cover Level: 444.56m	Pipe	SL (m) Ø (mm)	Notes: Water - Plastic	MH Cover	MH Chamber
		A	444.24 100			
		B	436.25 150			

Notes

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B3	±500 mm	Undefined	One technique no post-processing
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Legend

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 - Water pipe
- Unknown Utility
 - Unknown
- GPR Feature
 - GPR linear feature

Other

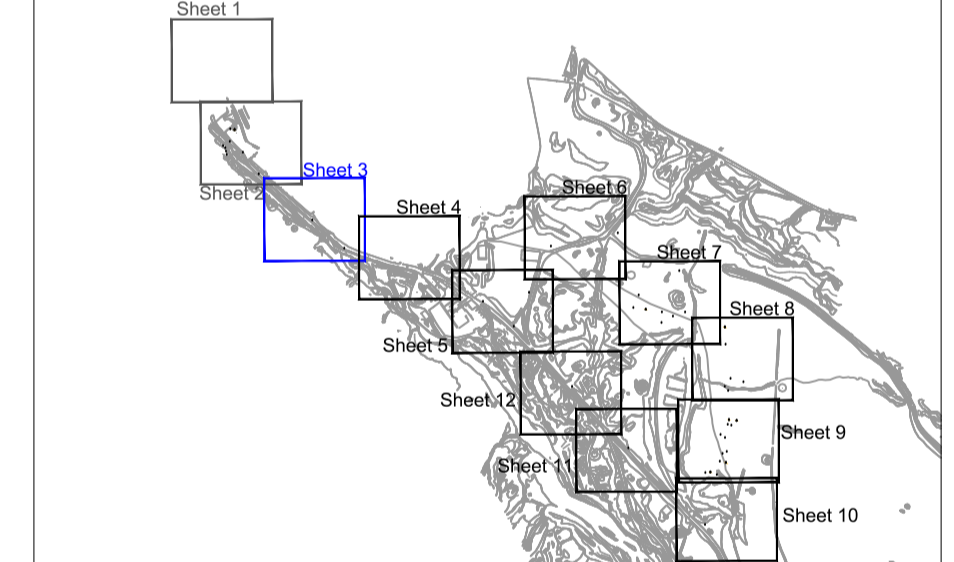
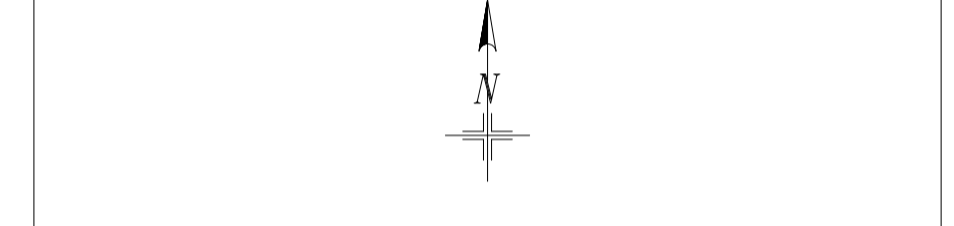
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- Windowless sampling



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Client
The Coal Authority

Project
Nenthead Mines

Location
Nenthead, Cumbria

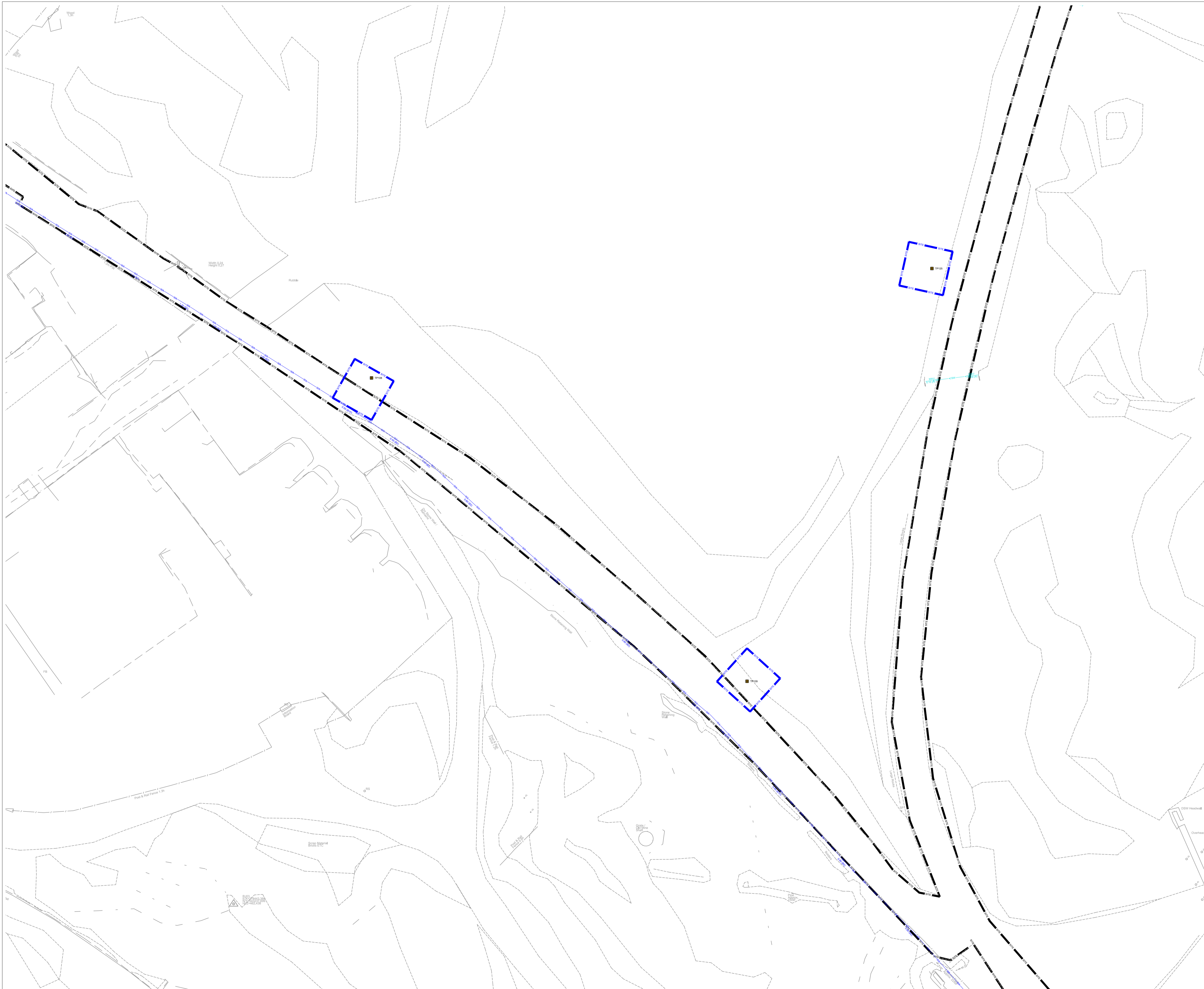
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Utility Services Plan

Drawn by T. Carroll	Checked by R. Grant
Horizontal Scale (A1) 1:200	Date of Survey 02/09/2019-11/09/2019
Project Code P8560-19	Issue Date 31/10/2019
Drawing No. DWG01	Sheet 3 of 12
	Issue B

Issue	Remarks	Drawn	Checked	Date
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Legend

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 - Water pipe
- Unknown Utility
 - Unknown
- GPR Feature
 - GPR linear feature

Other

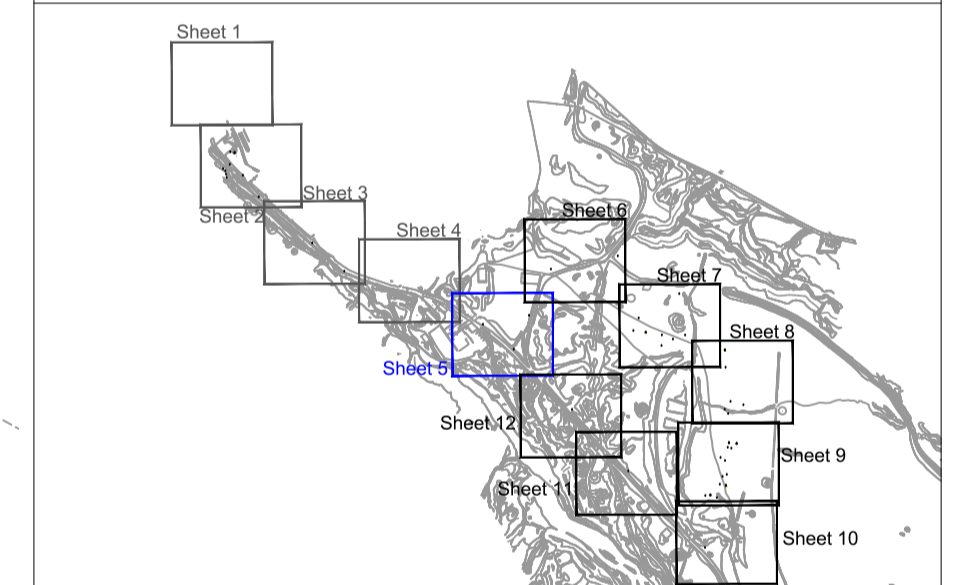
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Abbreviations and annotations

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Client
The Coal Authority

Project
Nenthead Mines

Location
Nenthead, Cumbria

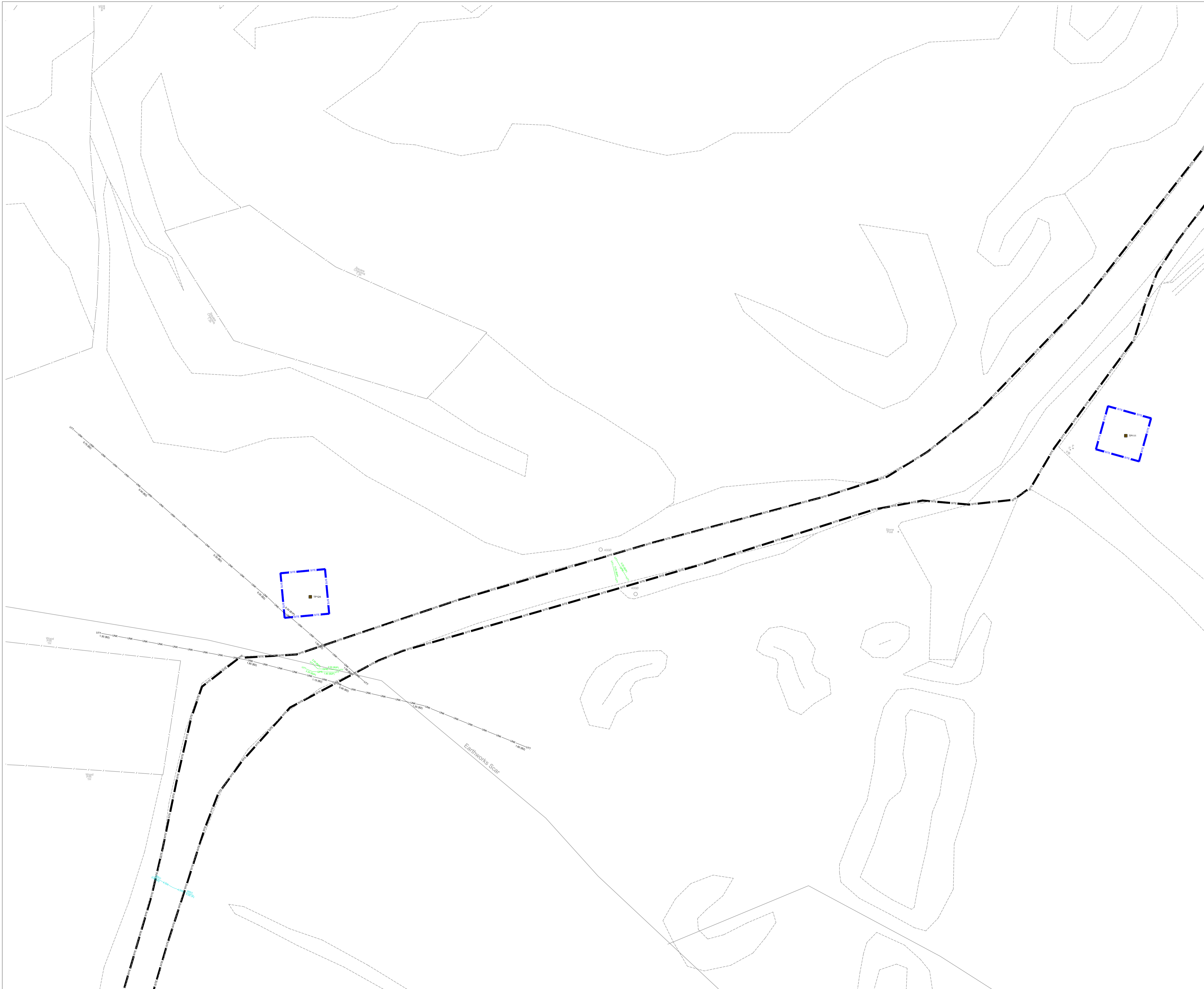
Title
Utility Services Plan

Drawn by T. Carroll	Checked by R. Grant
Horizontal Scale (A1) 1:200	Date of Survey 02/09/2019-11/09/2019
Project Code P8560-19	Drawing No. DWG01
Issue Date 31/10/2019	Sheet 5 of 12
	Issue B

Issue	Remarks	Drawn	Checked	Date
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B	Draft issue, for comment	TC	RG	31/10/2019
-	-	-	-	-
-	-	-	-	-

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Legend

Utility Services

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Other

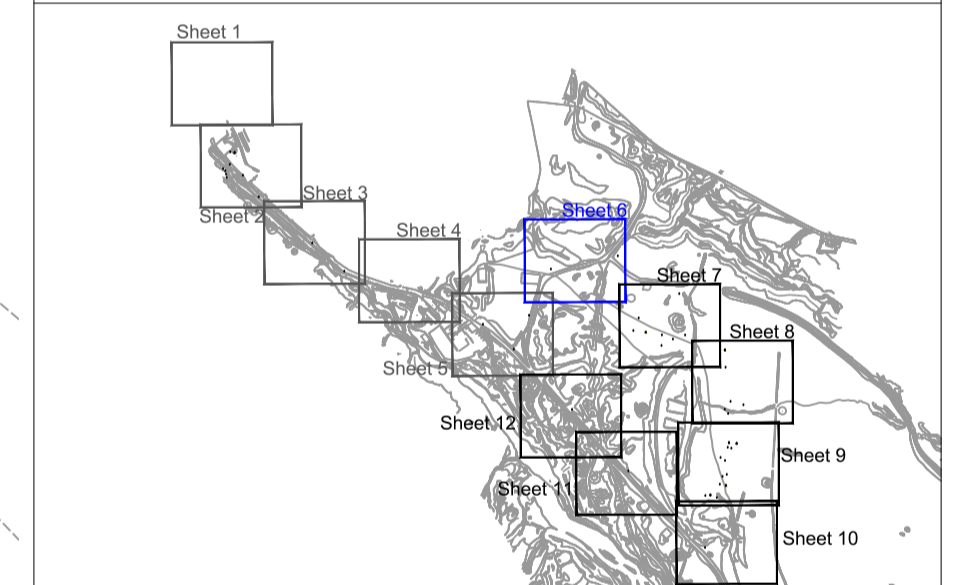
- Site Boundary - Utility survey
- Site Boundary - Exploratory locations
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Client Exploratory Locations

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- Trial pit
- Windowless sampling

Abbreviations and annotations

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 UTT Unable to Trace
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 OS Service runs Off Site
 MH Manhole



Draft
 User to check for latest issue

Client
The Coal Authority

Project
Nenthead Mines

Location
Nenthead, Cumbria

Title
Utility Services Plan

Drawn by T. Carroll	Checked by R. Grant
Horizontal Scale (A1) 1:200	Date of Survey 02/09/2019-11/09/2019
Issue Date 31/10/2019	
Project Code P8560-19	Drawing No. DWG01
Sheet 6 of 12	Issue B

Issue	Remarks	Drawn	Checked	Date
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B	Draft issue, for comment	TC	RG	31/10/2019
-	-	-	-	-
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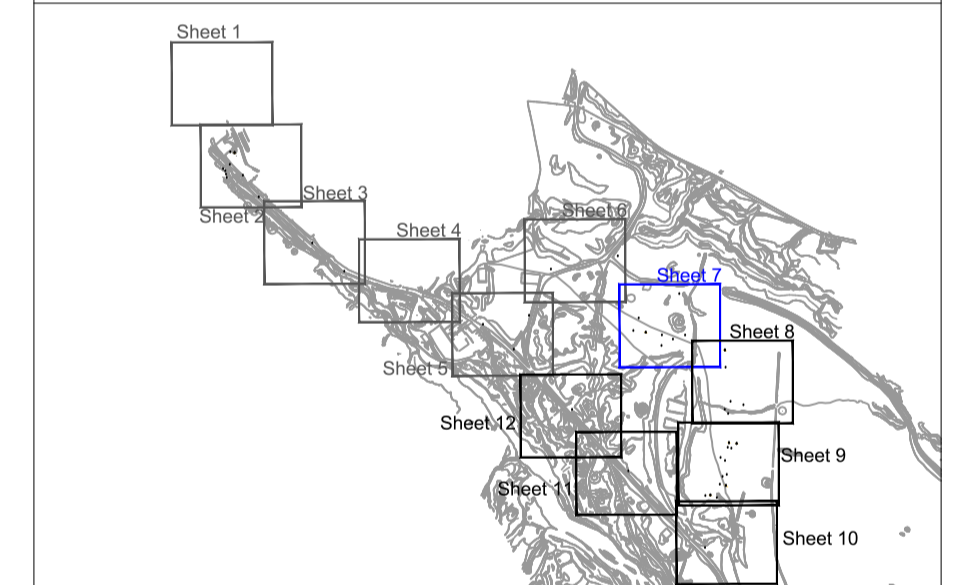
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Draft
User to check for latest issue

Client	The Coal Authority
Project	Nenthead Mines
Location	Nenthead, Cumbria
Title	Utility Services Plan

Drawn by	T. Carroll	Checked by	R. Grant
Horizontal Scale (A1)	1:200	Date of Survey	02/09/2019-11/09/2019
Project Code	P8560-19	Issue Date	31/10/2019
Drawing No.	DWG01	Sheet	7 of 12
		Issue	B

Issue	Remarks	Drawn	Checked	Date
A	Draft issue, for comment	TC	RG	20/09/2019
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Legend

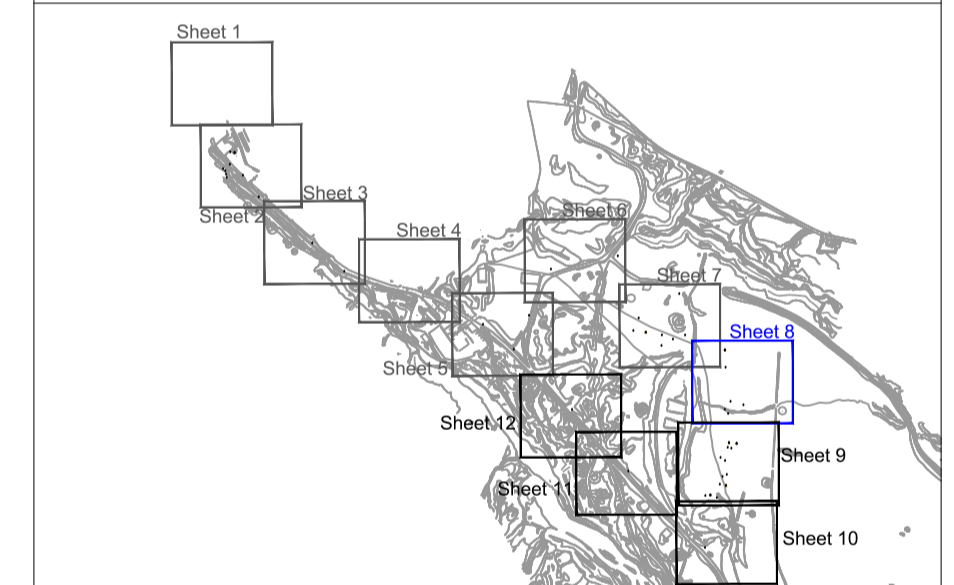
<p>Utility Services</p> <p>Drainage</p> <ul style="list-style-type: none"> Arrow indicates flow direction Drainage - Combined water Drainage - Surface water Drainage - Foul water <p>Electricity Cables</p> <ul style="list-style-type: none"> Electricity cables <p>Water Pipes</p> <ul style="list-style-type: none"> Water pipe <p>Unknown Utility</p> <ul style="list-style-type: none"> Unknown <p>GPR Feature</p> <ul style="list-style-type: none"> GPR linear feature 	<p>Client Exploratory Locations</p> <ul style="list-style-type: none"> Cable percussion borehole Trial pit Windowless sampling
--	---

Other

<ul style="list-style-type: none"> Site Boundary - Utility survey Site Boundary - Exploratory locations Inaccessible

Abbreviations and annotations

UTL	Unable to Lift
UTT	Unable to Trace
UTS	Unable to Sound
OS	Service runs Off Site
MH	Manhole



Draft
User to check for latest issue

Client	The Coal Authority
Project	Nenthead Mines
Location	Nenthead, Cumbria
Title	Utility Services Plan

Drawn by	T. Carroll	Checked by	R. Grant
Horizontal Scale (A1)	1:200	Date of Survey	02/09/2019-11/09/2019
Project Code	P8560-19	Issue Date	31/10/2019
Drawing No.	DWG01	Sheet	8 of 12
		Issue	B

Issue	Remarks	Drawn	Checked	Date
A	Draft issue, for comment	TC	RG	20/09/2019
B	Draft issue, for comment	TC	RG	31/10/2019
-	-	-	-	-
-	-	-	-	-

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www.zetica.com



Notes

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B3P	±500 mm	Undefined	One technique with post-processing
B3	±500 mm	Undefined	One technique no post-processing
B4	Undefined	Undefined	Inferred location

H Drawing should be read in conjunction with report P8560-19-R1-B.

Legend

Utility Services

Drainage
 Arrow indicates flow direction
 Drainage - Combined water
 Drainage - Surface water
 Drainage - Foul water

Electricity Cables
 Electricity cables

Water Pipes
 Water pipe
 Unknown Utility
 Unknown

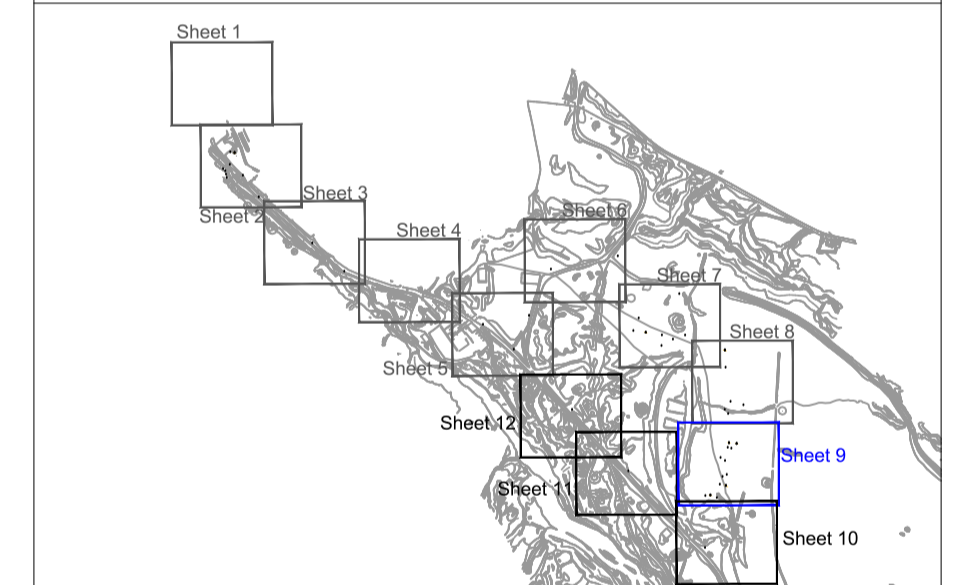
GPR Feature
 GPR linear feature

Other
 Site Boundary - Utility survey
 Site Boundary - Exploratory locations
 Inaccessible

Client Exploratory Locations
 Cable percussion borehole
 Trial pit
 Windowless sampling

Abbreviations and annotations

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 User to check for latest issue

Client
The Coal Authority

Project
Nenthead Mines

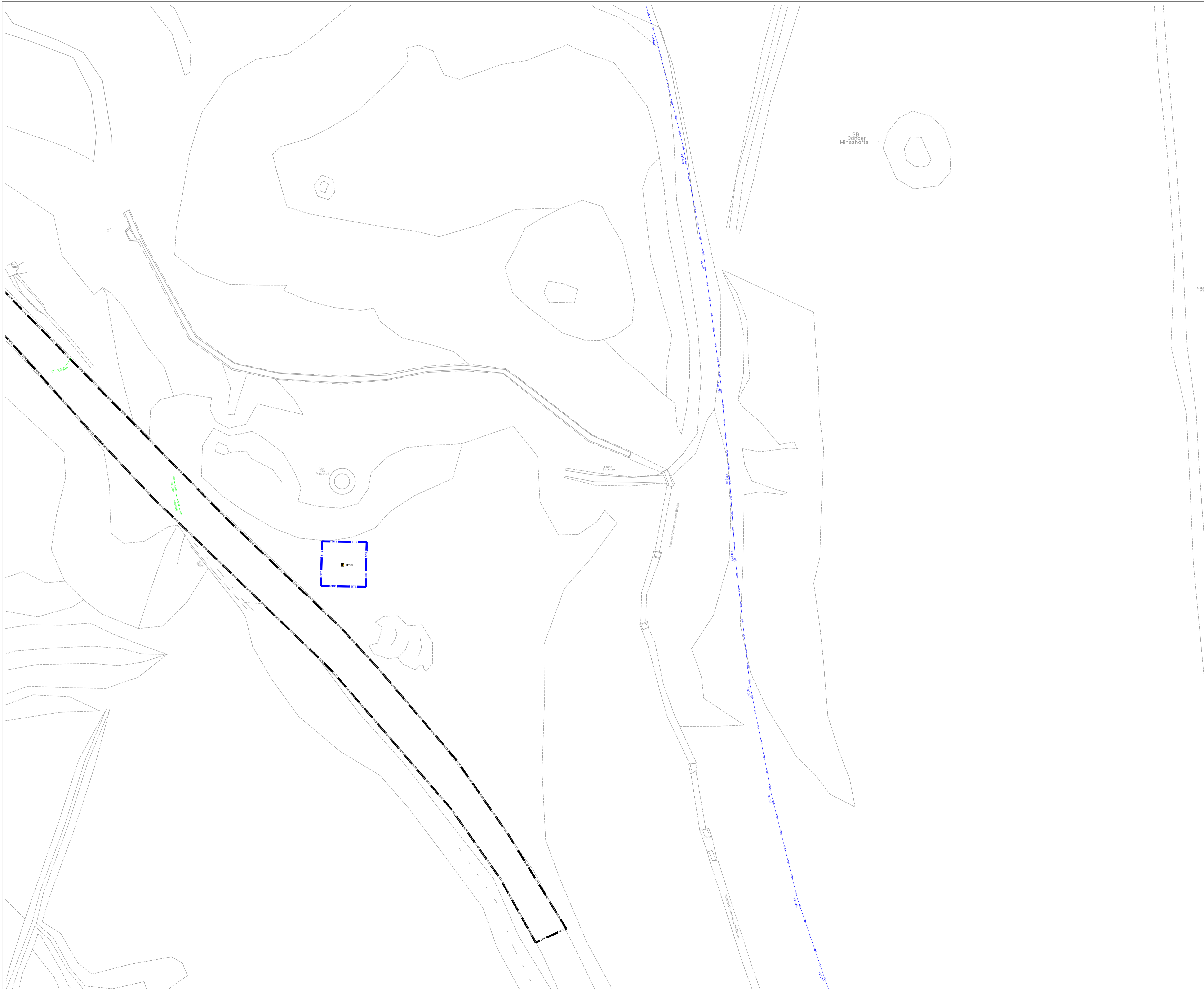
Location
Nenthead, Cumbria

Title
Utility Services Plan

Drawn by T. Carroll	Checked by R. Grant
Horizontal Scale (A1) 1:200	Date of Survey 02/09/2019-11/09/2019
Issue Date 31/10/2019	
Project Code P8560-19	Drawing No. DWG01
Sheet 9 of 12	Issue B

Issue	Remarks	Drawn	Checked	Date
A	Draft issue, for comment	TC	RG	20/09/2019
B	Draft issue, for comment	TC	RG	31/10/2019
-	-	-	-	-
-	-	-	-	-

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Legend

Utility Services

- Drainage
 - Arrow indicates flow direction
 - Drainage - Combined water
 - Drainage - Surface water
 - Drainage - Foul water
- Electricity Cables
 - Electricity cables
- Water Pipes
 - Water pipe
- Unknown Utility
 - Unknown
- GPR Feature
 - GPR linear feature

Other

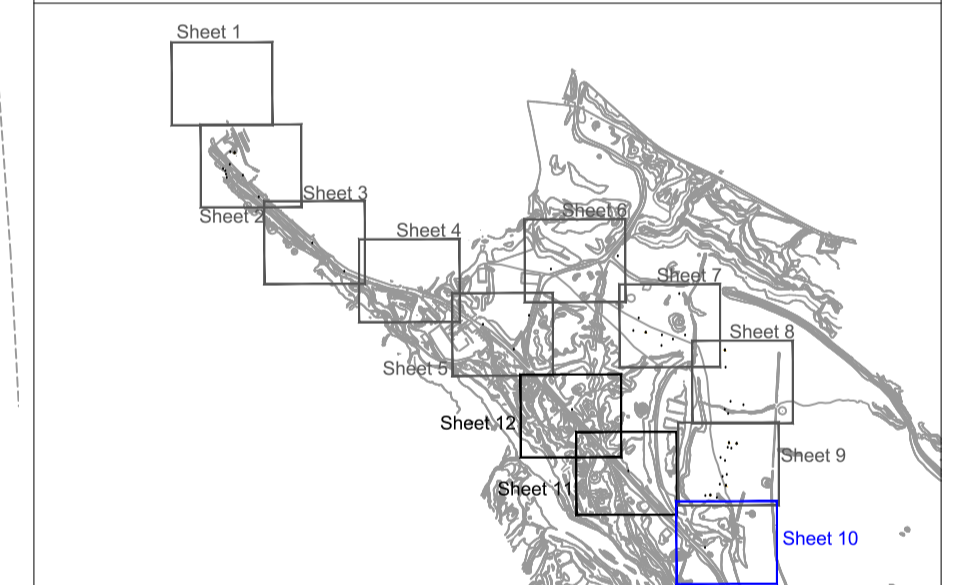
- Site Boundary - Utility survey
- Site Boundary - Exploratory locations
- Inaccessible

Client Exploratory Locations

- Cable percussion borehole
- Trial pit
- Windowless sampling

Abbreviations and annotations

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Draft
 User to check for latest issue

Client
 The Coal Authority

Project
 Nenthead Mines

Location
 Nenthead, Cumbria

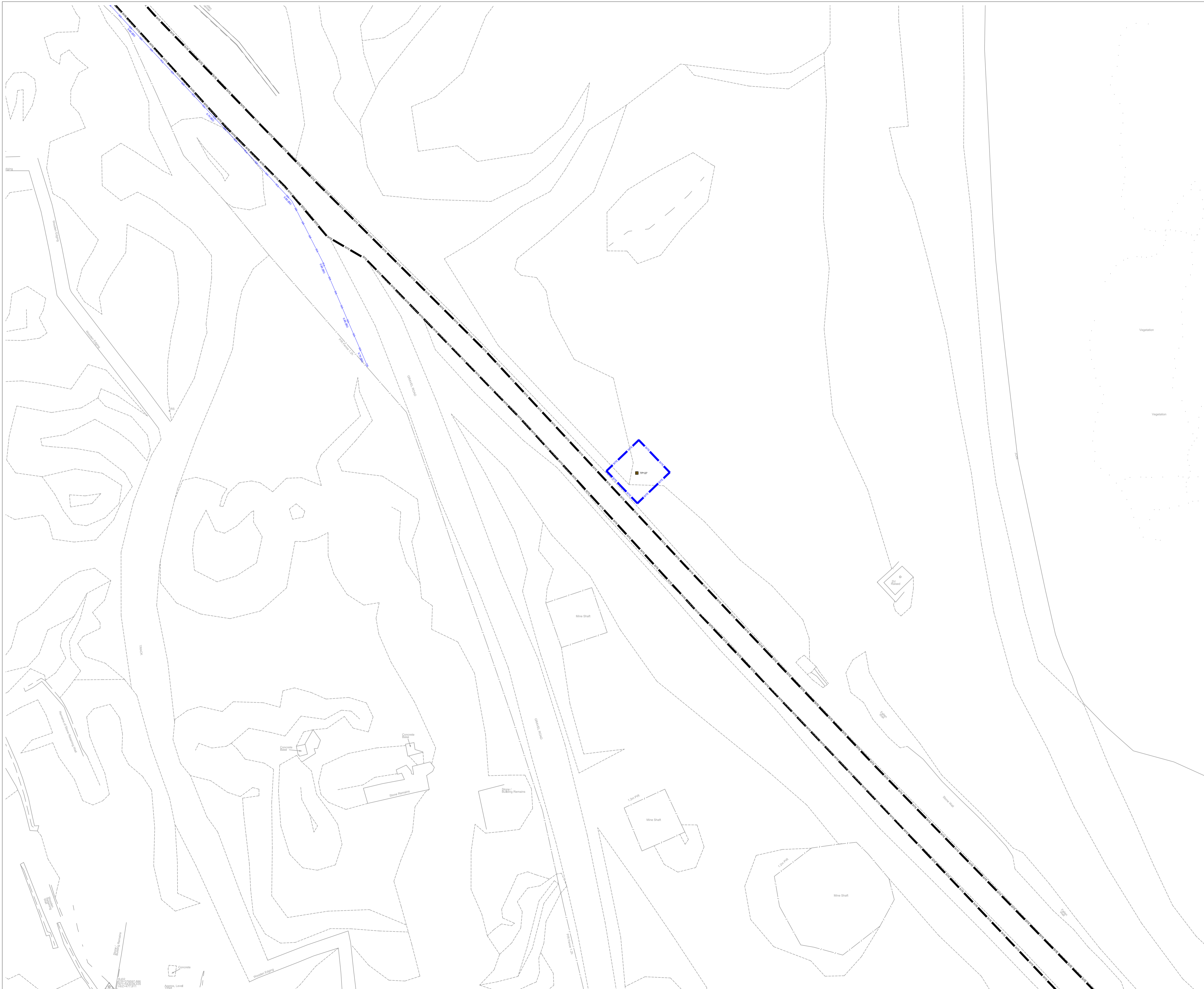
Title
 Utility Services Plan

Drawn by T. Carroll	Checked by R. Grant
Horizontal Scale (A1) 1:200	Date of Survey 02/09/2019-11/09/2019
Project Code P8560-19	Issue Date 31/10/2019
Drawing No. DWG01	Sheet 10 of 12
	Issue B

Issue	Remarks	Drawn	Checked	Date
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-	-	-	-	-
-	-	-	-	-

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Legend

Utility Services

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- Water Pipes
 - Water pipe
- Unknown Utility
 - Unknown
- GPR Feature
 - GPR linear feature

Other

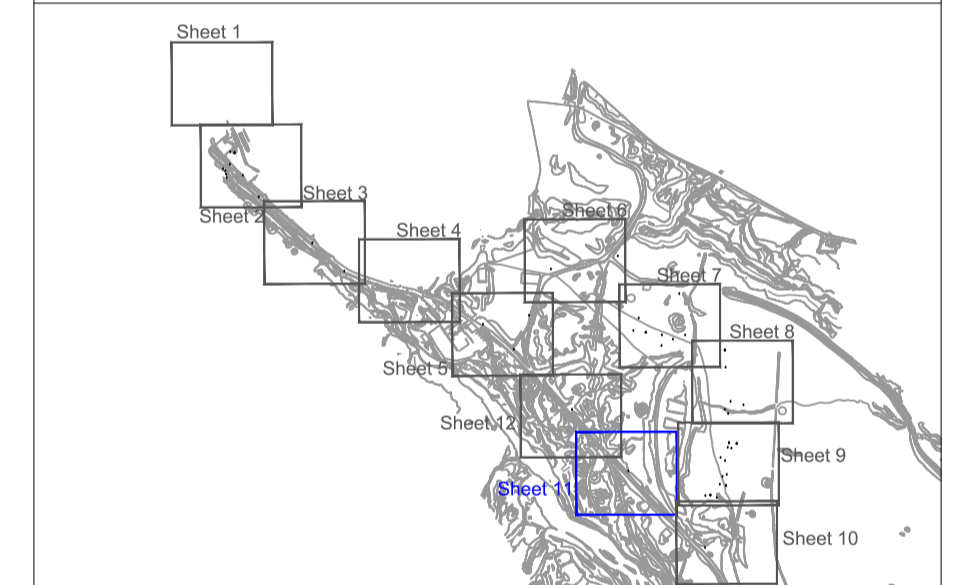
- Site Boundary - Utility survey
- Site Boundary - Exploratory locations
- Inaccessible

Client Exploratory Locations

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Abbreviations and annotations

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Draft
 User to check for latest issue

Client
The Coal Authority

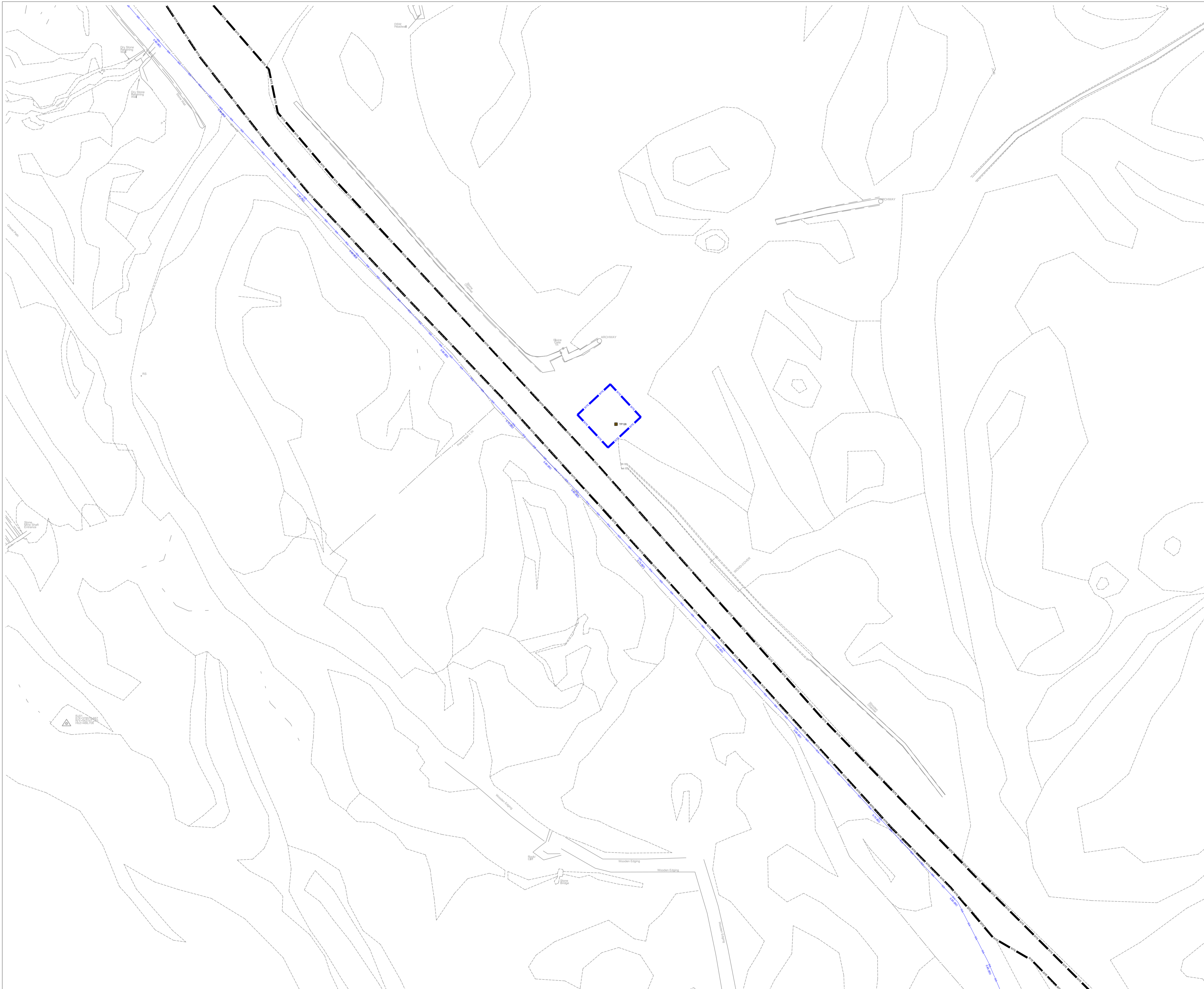
Project
Nenthead Mines

Location
Nenthead, Cumbria

Title
Utility Services Plan

Drawn by T. Carroll	Checked by R. Grant
Horizontal Scale (A1) 1:200	Date of Survey 02/09/2019-11/09/2019
Project Code P8560-19	Drawing No. DWG01
Issue B	Sheet 11 of 12
Issue B	Issue B

Issue	Remarks	Drawn	Checked	Date
A	Draft issue, for comment	TC	RG	20/09/2019
B	Draft issue, for comment	TC	RG	31/10/2019
-	-	-	-	-
-	-	-	-	-



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Other

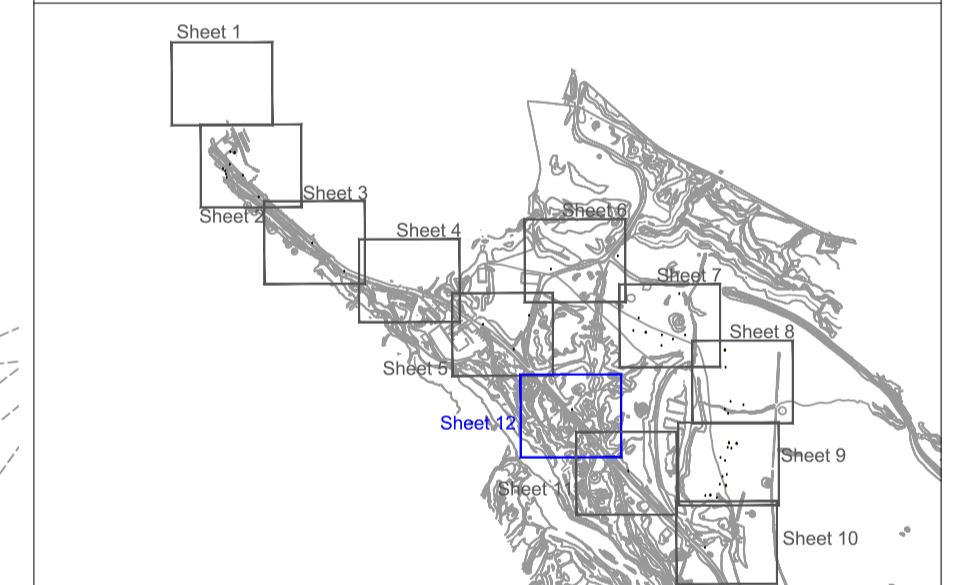
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- Site Boundary - Exploratory locations
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Client Exploratory Locations

- Cable percussion borehole
- Trial pit
- Windowless sampling

Abbreviations and annotations

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Draft
User to check for latest issue

Client
The Coal Authority

Project
Nenthead Mines

Location
Nenthead, Cumbria

Title
Utility Services Plan

Drawn by T. Carroll	Checked by R. Grant
Horizontal Scale (A1) 1:200	Date of Survey 02/09/2019-11/09/2019
Project Code P8560-19	Drawing No. DWG01
Issue Date 31/10/2019	Sheet / Issue 12 of 12 / B

Issue	Remarks	Drawn	Checked	Date
A	Draft issue, for comment	TC	RG	20/09/2019
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-	-	-	-	-
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SOIL ENGINEERING

SUPPORTING FACTUAL DATA

APPENDIX 3

A-Line Plot

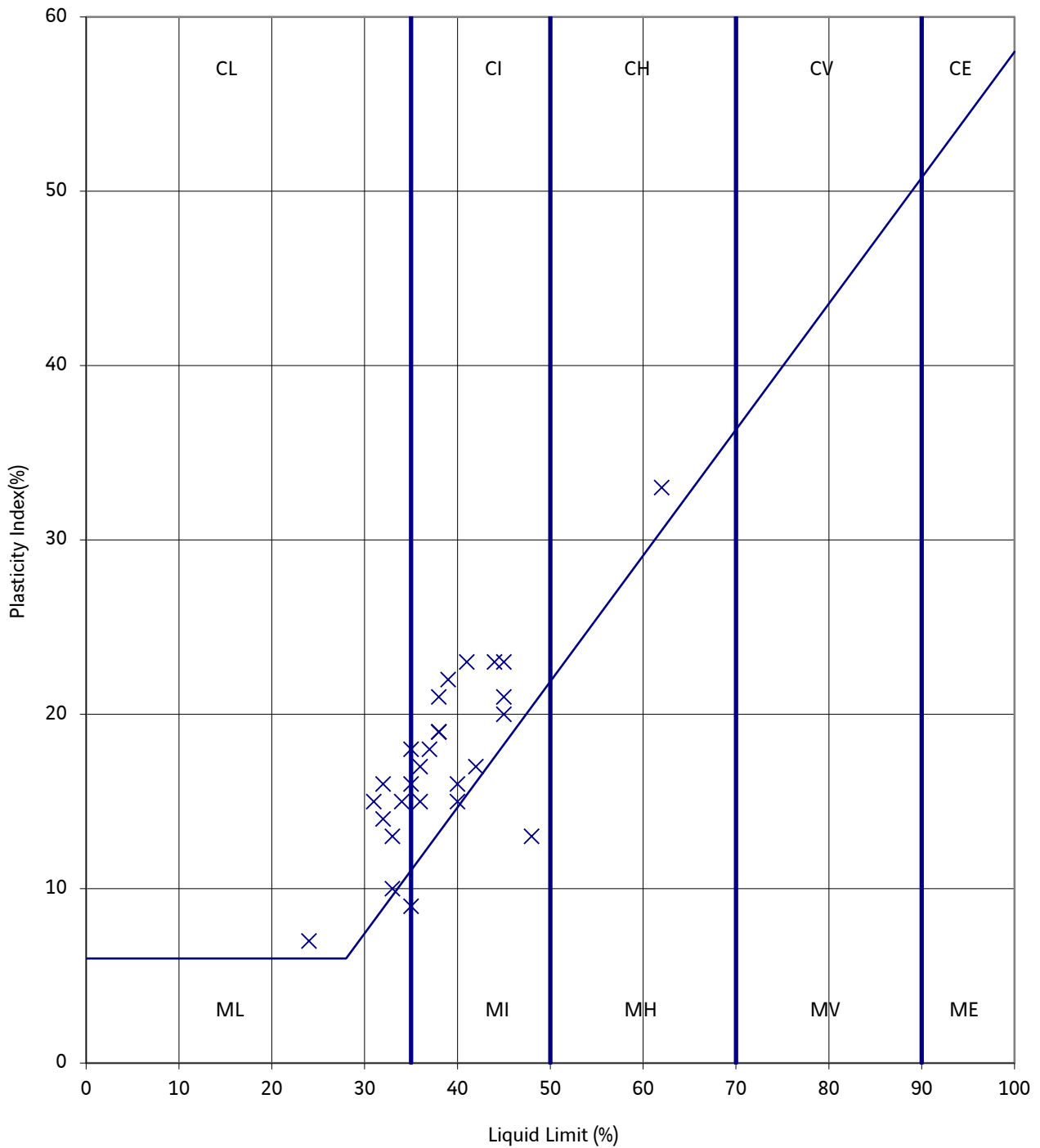
Project Name Nenthead Mines - Proposed MWTS, GI

A-Line Plot Summary

Project No. TA8234

Engineer Aecom

Employer The Coal Authority



Recorded By:

Checked By:

Approved By:

Date:

Date:

Date:

Form No. SE-HBW-F-015

IssueNo.RevisionNo 1.03

Issue Date 02/01/2014



Part of the Bachy Soletanche Group



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