



GEO

Environmental Engineering



PHASE II: GROUND INVESTIGATION REPORT

**PROPOSED RESIDENTIAL DEVELOPMENT OF
LAND AT HARRAS DYKE FARM, HARRAS MOOR
WHITEHAVEN, CUMBRIA**

FOR:

GENR8 NORTH LTD

GEO Environmental Engineering

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1.0 Introduction

1.1 Brief

GEO Environmental Engineering Ltd (GEO) was commissioned by Genr8 North Ltd, herein referred to as the “Client”, to carry out a ground investigation on land at Harras Dyke Farm in Harras Moor near Whitehaven, Cumbria as indicated on the site location plan included in appendix I.

The investigation was carried out to determine ground conditions across the site to aid the design of foundations, roads and drainage and to assess the risk to human health and environmental receptors from possible contamination and ground gas.

Details of previous investigations completed for the site are included in Section 2.

1.2 Site Location and Description

The site, occupying an area of c.5.6ha is located in the eastern part of Whitehaven, c.1.2km north east of the town centre as indicated on the site location plan included in Appendix I. Access to the site is from Harras Road to the south.

- National Grid Reference: 298861, 518389
- Post Code: CA28 6SJ (approximate only)

The site comprises two agricultural fields surfaced with coarse unkempt grass and occasional scrub vegetation (rough grazing farmland). The site is delineated by a post and wire fence and dry-stone walls with roads to the east and west. The surrounding land is predominantly residential or agricultural with no potentially contaminative land uses identified.

The site undulates gently with the highest area in the north at c.146m AOD. The land falls gently to the lowest area in the south east at c.140m AOD. Topographical survey data has been included on the exploratory hole location plan included in Appendix I.

1.3 Proposed Development

It is understood that the Client plans to develop the site for residential end use. A proposed site layout plan of the site has not been provided at this stage, however, it is anticipated that the development will comprise conventional houses with private gardens, soft landscaping, access roads, car parking and other associated infrastructure.

The Client is also considering the use of a soak-away drainage system if the ground conditions prove suitable.

2.0 Previous Reports / Studies

2.1 Previous Reports/Studies

The following reports/studies have previously been completed for the site:

- Phase I Desk Top Study (Preliminary Environmental Risk Assessment) by Geo Environmental Engineering Ltd, ref: 2015-1558, dated: 23rd July 2015.
- Coal Mining Risk Assessment Report by Elliott Environmental Surveyors Ltd, ref: EES15-174, dated 6th June 2016.

In addition to the previous reports/studies, GEO were also provided with ground investigation data (borehole and trial pit logs) that were produced by Sirius Geotechnical Ltd in October 2018. Further details are provided below in Section 2.2.3.

At the time of writing, GEO were undertaking Maintained Load Tests on the site to determine potential settlement values for the deep backfill material in the former opencast area. GEO had issued the following preliminary draft report for the tests and a copy is included in Appendix V:

- Preliminary Maintained Load Test Report by Geo Environmental Engineering Ltd, ref: 2019-3889, dated: 8th June 2020.

The following section includes a summary of the previous investigation data. It is recommended that the previous reports/studies are read in conjunction with this report.

2.2 Summary of Previous Findings

2.2.1 Desk Top Study (Preliminary Environmental Risk Assessment)

The Desk Top Study / Preliminary Environmental Risk Assessment (DTS/PERA) was completed by Geo Environmental Engineering Ltd in July 2015. The report identified that the site had previously been part of a large opencast coal mine which had subsequently been restored. As such, the report concluded that the geotechnical risk to the proposed residential development was very high.

Geological data indicated that the site is underlain glacial till overlying solid strata (bedrock) of the Middle Coal Measures Formation. The report identifies coal seams that are conjectured as potentially sub-cropping on site including the Unnamed F, Unnamed E and The Brassy. The report also indicated that other coal seams sub-crop to the east and may potentially pass beneath the site.

Given the presence of possible shallow coal seams beneath the site, the report identified a potential for shallow unrecorded mine workings beneath areas of the site which have not been excavated during the opencast coal mining operations on site. The report indicated that areas adjacent to the roads and housing are unlikely to have been worked by opencast methods and could, therefore still be affected by shallow unrecorded coal mine workings.

The Coal Authority Coal Mining Report indicated that the site is within the likely zone of influence of workings in two seams of coal at depths of between 130m and 200m bgl, with the latest date of workings being 1961. These workings were not considered to pose a significant risk to the proposed development.

The Coal Authority identified a former mine shaft in the eastern part of the site which is also identified on historical and current map extracts. A concrete marker post was noted at this location during the site walkover.

Due to the former opencast mine, the report noted a potential for deep and extensive made ground on site. It was not known if the material had been restored to an engineered specification or what the nature of the backfill material was.

The report indicated a low risk of ground contamination and a very low risk of ground gas due to the site history and the potential for significant made ground. The risk to the controlled waters and surrounding land was considered negligible as significant contamination sources were not encountered.

The DTS recommended further enquiries to The Coal Authority with respect to the former opencast coal mine workings and intrusive ground investigation works to fully assess the site prior to development.

2.2.2 Coal Mining Risk Assessment (CMRA) Report

The Coal Mining Risk Assessment (CMRA) was completed by Elliott Environmental Surveyors in June 2016 and included a review of Coal Mine Abandonment Plans for the Moresby and Keekle Opencast and intrusive ground investigation works (trenching) to identify the extents of the former opencast coal mine. The CMRA report also includes a combined mining plan showing the position of the sub-cropping coal seams along with other geological and coal mining information.

The report indicates that four seams of coal were worked within the opencast including the Unnamed G, Unnamed E, Brassy and Unnamed C coal seams. The Black Metal to the Six Quarter coal seams were unworked by opencast methods but may have been worked by underground mining methods. The worked seams were recorded as being between c.0.20m and c.0.85m thick.

The report indicates that the seams sub-crop on site and are still likely to be present beyond the areas of opencast excavation. The report indicated that the preliminary risk assessment for mine related issues was high.

The intrusive ground investigation works comprised 5 No. trenches (TP1 to TP5) along the western and southern boundaries of the former opencast to identify the location of the highwall. The excavations encountered unworked natural ground comprising stiff to very stiff gravelly clay in the areas outside of the opencast and made ground of compact stiff gravelly clay with occasional bricks, cobbles and boulders within the opencast. This was underlain by made ground comprising broken sandstone and shale with some clay. The highwall was identified within the trenches and the locations indicated on the exploratory hole location plan.

2.2.3 Ground Investigation by Sirius Geotechnical Ltd (Sirius)

The Ground Investigation by Sirius was completed in October 2018 and GEO have been provided with copies of the exploratory hole records and the exploratory hole location plan, copies of which are included in Appendix II.

The previous ground investigation by Sirius comprised 10 No. trial pits, 7 No. trenches, 3 No. cable percussive boreholes to depths of between c.14.4m and c.16.55 and 6 No. rotary openhole boreholes to depths of between c.30m and c.51m bgl. The logs and the exploratory hole location plan have been provided to GEO to aid this investigation.

Outside of the former opencast area, the investigation encountered topsoil overlying firm to stiff and stiff orangey brown mottled grey sandy gravelly clay. This was underlain by red brown and grey very sandy gravelly clay and clayey very gravelly sand (destructured sandstone). Weathered sandstone bedrock comprising weak red brown silty fine to coarse sandstone was encountered from between c.1.50m and c.3.10m bgl. Occasional shallow thin coal seams were also encountered in the trial pits in the east of the site.

Within the area of the former opencast, the investigation encountered topsoil made ground comprising firm to stiff orangey brown sandy gravelly clay with occasional brick. This was underlain by grey clayey very sandy gravel and cobbles of sandstone and mudstone which were proved to the base of the exploratory holes. Borehole CPR02 was drilled by cable percussive and rotary techniques to a depth of c.45m bgl within the former opencast. The borehole encountered colliery backfill to a depth of c.22m bgl overlying solid mudstone bedrock. No coal seams or evidence of deeper underground coal mine workings were encountered beneath the base of the former opencast coal mine.

The trenches were located across the site to further delineate the extents of the former opencast and improve the accuracy of the high wall location. The locations were surveyed and are included on the exploratory hole location plan. The grid coordinates are provided in Section 5.3.

Rotary drilling outside of the former opencast encountered numerous coals seams beneath the site at depths of between c.3.0m and c.40.0m bgl. The seams varied in thickness between c.0.20m and c.0.90m. The seams were all intact with no evidence of mine workings or loss of flush.

2.2.4 Maintained Load tests (Geo Ltd)

Maintained Load Tests have been carried out on the site to determine potential settlement values for the deep backfill material in the area of the former opencast. The tests commenced on the 9th March and the results have been issued in a separate report. At the time of writing, the most up to date version (v3) was issued on the 2nd October 2020.

The tests comprised placing large concrete blocks directly onto the backfill material at depths of between c.1.05m and c.1.30m bgl and surveying the top corners at regular intervals to determine settlement values. The ground pressures were increased from 28.3kN/m² to 56.7kN/m² in three phases and settlement values of between 31mm and 38mm were recorded over duration of the test (136 days / 20 weeks).

3.0 Ground Investigation Report

3.1 Ground Investigation Aims and Objectives

The overall objective of this Ground Investigation is to provide information relating to the geotechnical and environmental properties of the ground and groundwater across the development area in order to facilitate foundation and drainage design and determine any risks to human health or the surrounding environment. Works were also completed to further delineate the edge of the former opencast coal mine.

3.2 Guidelines, Codes of Practice and Third Part Accreditations

This report contains information relating to the geotechnical properties of the soils encountered on site to aid foundation and highway design by a Structural Engineer. The report also incorporates a Level 1 Ground Contamination and Ground Gas Risk Assessment for Human Health (Generic Quantitative Risk Assessment – GQRA).

The laboratory testing (geotechnical and ground contamination) was completed by UKAS and MCERTS accredited laboratories with details given in Sections 6, with copies of the test reports contained within Appendix III.

This Ground Investigation Report has generally been completed in accordance with the following documents:

- CLR11: Model Procedures for the Management of Land Contamination. DEFRA/EA, 2004.
- BS10175: 2011: Code of Practice for the Investigation of Potentially Contaminated Sites.
- BS5930: 2015: Code of Practice for Site Investigations.
- BS1377: 1990: Methods of test for soils for civil engineering purposes.
- BS8485: 2015: Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings.
- BS8576: 2013: Guidance on Ground Gas Investigations.
- CIRIA Report C665: 2015.
- Eurocode 7 – Geotechnical Design (Part 1: General Rules and; Part 2: Ground Investigation and Testing).
- UK Specification for Ground Investigation, 2nd Edition. Site Investigation Steering Group, 2011.
- Effective Site Investigation. Site Investigation Steering Group, 2013.
- SP1010 Development of Category 4 Screening Levels Main Report, 2014.
- The LQM/CIEH S4UL's for Human Health Risk Assessment, 2015.

All depths included in the report are in metres below ground level (m bgl), unless stated otherwise

3.3 Ground Investigation Limitations of Use

Although every effort is made to ensure a full and comprehensive investigation has been completed, it should always be borne in mind that ground conditions have the potential to vary between exploratory hole locations and it is recommended that a prudent developer adopt a “watching brief” during the redevelopment works, to ensure that any potential variations encountered are identified and dealt with in an appropriate manner.

In addition, this Ground Investigation Report and its contents are limited to the boundaries of the site, as indicated on the Plans in Appendix I. No reliance, copying or use of this report (in part or whole) by any Third Party is permitted without prior written approval from Geo Environmental Engineering Ltd, with intellectual copyright remaining the sole property of the author. Reliance on the report and its associated

information is strictly in accordance with Geo Environmental Engineering Ltd Terms and Conditions, copies of which are available on request.

3.4 Consideration for Residential End Use

It is understood that the site will be developed for residential end use with houses, gardens, car parking, access roads, and other associated infrastructure. Consequently, when considering the intended development, the site is considered suitable for assessment using a Level 1 Generic Quantitative Risk Assessment (GQRA).

A GQRA provides details of potential future risks to Human Health (proposed end users) from any contamination which may be identified on site in made ground or natural soils. For the Human Health Risk Assessment, it is considered that the future residents will be subjected to the greatest exposure periods and consequently the most risk. Therefore, in accordance with current guidance and legislation a CLEA end use classification of *residential* has been considered most appropriate.

4.0 Ground Investigation Fieldwork

4.1 Intrusive Investigation Fieldworks Summary

The ground investigation works were completed between the 14th and the 19th October 2019. Additional site works were completed in April 2020 to locate the eastern edge of the opencast mine. The exploratory holes were located across the site to provide general site coverage taking into consideration the locations of the former opencast coal mine, buried utilities, areas of ponding, saturated ground and surface obstructions.

The ground investigation works comprised:

- 5 No Mechanically Excavated Trenches (TT201 to TT205) to depths of between c.2.00m and c.3.80m bgl. The trenches were located along the boundary of the former opencast coal mine to further delineate the highwall.
- 23 No. Dynamic (Windowless) Sampling Boreholes (BH201 to BH223) to depths of between c.0.80m and c.5.00m bgl. Gas and groundwater monitoring wells were installed in every borehole.
 - Boreholes BH201 to BH210 were sunk outside of the former opencast.
 - Boreholes BH211 to BH223 were sunk within the former opencast.
- 20 No. Mechanically Excavated Trial Pits (TP201 to TP219) to depths of between c.1.45m and c.3.30m bgl.
 - Trial pits TP201 to TP209 were excavated outside of the former opencast.
 - Trial pits TP210 to TP219 were excavated within the former opencast.
- 11 No. Mechanically Excavated Trial pits (TP301 to TP311) to locate the eastern edge of the open cast mine (High Wall) and investigate the ground either side of the mine shaft cap.
- 9 No Plate Load Tests (PLT01 to PLT09).
 - Plate Load Tests PLT01 to PLT04 were located outside of the former opencast.
 - Plate Load Tests PLT05 to PLT09 were located within the former opencast.
- 5 No. Dynamic Probe Super Heavy Tests (DP01 to DP05) to depths of between c.2.10m and c.10m bgl. All of the Dynamic Probes were located within the former opencast.
- 14 No Dynamic Cone Penetrometer Tests located adjacent to the trial pits.
 - 7 No DCP tests were located outside of the former opencast and 7 were located within.
- 2 No. Cable Percussive boreholes (CP201 and CP202) to a depth of c.10m bgl within the former opencast.
- 5 No. Rotary open-holed boreholes (R201 to R205) to depths of c.30m bgl. The rotary boreholes were located outside of the former opencast.
- 2 No. In-situ Soil Infiltration tests (TP218 and TP219).
- Gas and groundwater monitoring (12 visits completed).
- In-situ geotechnical testing (Standard Penetration Tests (SPT)).
- In-situ hand shear vane tests in the trial pits.
- Site supervision by a suitably qualified and experienced Geo-Environmental Engineer.
- Laboratory geotechnical testing and chemical screening.
- Level 1 Generic Quantitative Risk Assessment (GQRA) to determine potential ground contamination and ground gas risks to the proposed end users.

The investigation fieldworks were undertaken in accordance with BS5930:1999, BS1377:1990 and Eurocode 7 (Part I and II).

At each exploratory hole location, the surfacing type, made ground, natural ground and groundwater conditions were observed, with in-situ testing undertaken and samples recovered. Details of the ground conditions are included on the exploratory hole logs which are included in Appendix II together with other relevant ground investigation data (Gas and Groundwater Monitoring results).

The exploratory hole location plan is provided in Appendix I. Exploratory hole logs, in-situ test results and the gas monitoring sheets are included in Appendix II. The results of the geotechnical and chemical laboratory test results are provided in Appendix III. The exploratory hole locations were surveyed following the site works and all location coordinates are provided in Appendix I.

During the supplementary investigations in April 2020, the location of the head wall was successfully identified in the south eastern part of the site, however, to the north of this much of the high wall runs beneath the route of a United Utilities water main and it was not possible to accurately determine the location on the high wall where the wayleave prevented excavation.

5.0 Ground and Groundwater Conditions

5.1 Ground Conditions Outside of the Former Opencast

The following section provides a summary of the ground conditions encountered outside of the former opencast area. The summary is based on information obtained as part of this ground investigation and utilises information obtained during the previous ground investigation by Sirius Geotechnical Ltd in October 2018.

During the investigation, the area to the east of the opencast was not investigated due to a buried water main and associated wayleave. Sirius have previously completed ground investigation works in this area which included 2 No. trial pits (TP07 and TP09) and 2 No. rotary boreholes (R01 and R03).

Section 5.2 provides details of the ground conditions within the former opencast area.

Reference should be made to the exploratory hole logs included in Appendix II for detailed descriptions of the strata and groundwater conditions.

5.1.1 Made Ground and Topsoil

Topsoil was encountered in every exploratory hole location to depths of between c.0.20m and c.0.40m bgl (typically c.0.30m deep). The topsoil was described as dark grey brown clayey sandy very gravelly loam with occasional small flecks of coal.

Made ground was encountered to depths of between c.1.50m and c.1.80m bgl in trial pits TP203 and TP204 and borehole BH203, all of which were located in the south western part of the site and is likely to be a result of opencast capping material extending beyond the highwall. The made ground was described as stiff brown slightly sandy very gravelly clay with many sub-rounded cobbles. The material appeared as a reworked natural deposit with occasional rare fragments of brick.

With the exception of trial pit TP09, the previous investigation by Sirius did not record any made ground outside of the opencast. The made ground in trial pit TP09 to the east of the former opencast comprised reworked firm brown sandy clay to a depth of c.0.90m bgl.

Made ground was also encountered in trial pit TP208 in the south east of the site associated with a buried pipe at c.2.20mbgl. This was initially recorded as an unrecorded utility, however, this may be associated with the drainage pipe connecting the field drains which cross the site. A copy of the plan indicating the layout of the field drains is included in the EES report. The fill material overlying the pipe was described as firm brown sandy gravelly clay over red brown silty sandy angular gravels and cobbles of siltstone and sandstone. The material was noted as very unstable and the sides walls collapsed on several occasions.

Localised shallow made ground associated with buried field drains was also encountered at depths of between c.0.70m and c.0.80m bgl.

During the investigation, GEO did not identify any visual or olfactory evidence of fuel/oil type contamination (no staining, odour or free product) or any landfill type waste such as potentially biodegradable, decomposable or putrescible materials.

5.1.2 Natural Drift Deposits

Natural drift deposits typically comprised firm and stiff brown sandy very gravelly clay over stiff dark red brown slightly sandy gravelly clay (glacial till). Many cobbles and occasional boulders were encountered throughout the natural drift deposits.

Previous investigations by Sirius indicated that the natural ground to the east of the former opencast comprised stiff (medium to high strength) brown mottled grey, and red brown sandy gravelly clay to depths of between c.2.30m and c.2.90m bgl where bedrock was encountered.

Hand shear vane tests were completed in the natural sandy gravelly clay at depths of between c.0.70m and c.1.20m bgl where safe and appropriate to do so. The tests indicated undrained shear strengths of between 80kN/m² and in excess of 120kN/m².

In-situ Standard Penetration Tests (SPTs) were completed in the boreholes at depths of between c.1.00m and c.3.00m bgl. The tests gave 'N' values in the natural drift deposits of between 8 and 35 (typically 10 to 35) indicative of clays of medium to very high strength. N values in excess of 50 blows for a limited penetration were recorded at the base of the dynamic sampling boreholes indicating refusal (further penetration not possible). This was probably due to encountering bedrock, large cobbles or a boulder.

5.1.3 Bedrock

Outside of the former opencast, weathered bedrock was encountered in the trial pits and boreholes at depths of between c.0.80m and c.3.20m bgl. The weathered bedrock comprised very sandy angular gravels/cobbles of sandstone or siltstone. The bedrock was occasionally noted as 'destructured' and comprised a gravelly fine to medium sand. The weathered bedrock typically became competent with depth, becoming less friable and difficult to excavate.

A seam of coal was encountered in trial pit TP08 and borehole BH210 at a depth of c.1.20m bgl. The seam was c.0.70m thick (vertically) and was excavated as a silty coarse angular gravel of coal and carbonaceous siltstone.

Within the rotary boreholes, bedrock was encountered at depths of between c.1.70m and c.2.60m bgl. The bedrock comprised interbedded siltstone and sandstone with occasional thin coal seams. The coal seams were encountered at depths of between c.2.30m and c.26.00m bgl and varied between c.0.10m and c.0.40m in thickness. No evidence of mine workings (voids or broken ground) or loss of flush was encountered. No coal seams were recorded in rotary borehole R204.

The rotary boreholes sunk during the previous investigation by Sirius to depths of between c.30m and c.51m bgl encountered rock at depths of between c.2.00 and c.3.10m bgl. The rock was noted as sandstone, siltstone and mudstone with several coal seams noted at depths of between 3.00m and 48.00m bgl. A coal seam was also encountered in trial pit TP07 to the east of the former opencast at a depth of c.2.30m bgl (c.0.10m thick). The seams were noted to be between c.0.10m and c.1.10m thick. No evidence of mine workings or loss of flush was encountered.

5.1.4 Groundwater

The exploratory holes were typically dry except for occasional ingress from field drains and a minor seepages from the made ground at a depth of c.1.60m bgl in trial pit TP207B.

Groundwater monitoring of installations placed in the boreholes has been carried out on three occasions between November and December 2019. Standing groundwater levels have been recorded between c.0.10m and c.2.20m bgl. However, given the ground conditions (stiff clay), it is

likely that the water has resulted from surface ingress which has been trapped/perched within the boreholes rather than representing a continuous groundwater table.

Based on the results of the ground investigation, significant groundwater ingress is not anticipated outside of the former opencast. However, it is recommended that allowance be made for some groundwater control measures (i.e. pumping equipment) particularly during wetter periods of the year, as the materials encountered may deteriorate following exposure to surface water.

5.2 Ground Conditions Within the Former Opencast

The following section provides a summary of the ground conditions encountered within the area of the former opencast. The summary is based on information obtained as part of this ground investigation and during the previous ground investigation by Sirius Geotechnical Ltd in October 2018.

Reference should be made to the exploratory hole logs included in Appendix II for detailed descriptions of the strata and groundwater conditions.

5.2.1 Made Ground and Topsoil

Topsoil was encountered in every exploratory hole location within the former opencast to depths of between c.0.20m and c.0.46m bgl (typically c.0.30m deep). The topsoil was described as dark grey brown clayey sandy very gravelly loam with occasional small flecks of coal.

Made ground was encountered to the base of every exploratory holes within the former opencast which typically comprised a cap of stiff brown slightly sandy very gravelly clay with many sub-rounded cobbles overlying clay bound gravel, cobbles and boulders of siltstone and sandstone or stiff to very stiff dark grey sandy very gravelly clay with many angular cobbles and boulders of siltstone and sandstone.

The cap material was generally encountered to depths of between c.1.00m and c.1.90m bgl. The material appeared very similar to the natural drift deposits encountered outside of the former opencast area and comprised reworked natural drift deposits (possibly overburden that was scrapped off prior to the opencast operations). It is likely that the capping materials may extend beyond the extent of the former opencast and this has been noted by Sirius. However, as the capping material appeared almost identical to the natural deposits encountered elsewhere, delineating the made ground would prove very difficult.

The clay matrix bounding the gravel, cobbles and boulders was typically stiff or very stiff, however, localised soft or firm deposits were also noted. The made ground was generally stable, however, occasional mirror collapses were noted within the made ground.

Occasional plastic field drains were noted between c.0.70m and c.0.80m bgl and evidence of a ceramic field drain was noted at a depth of c.1.40m bgl.

It was not possible to recover any undisturbed (U100) samples during the cable percussive drilling due to the high granular content of the fill materials (i.e. cobbles and boulders).

Hand shear vane tests were completed in the cohesive made ground at depths of between c.0.80m and c.1.50m bgl where safe and appropriate to do so. The tests indicated undrained shear strengths of between 60kN/m² and in excess of 120kN/m².

In-situ Standard Penetration Tests (SPTs) were completed in the dynamic boreholes and cable percussive at depths of between c.1.00m and c.10.00m bgl. The tests gave variable 'N' values in the made ground of between 7 and >50, but typically between 10 and 29, indicative of medium and high

strength clay deposits. Occasionally, N values in excess of 50 blows were recorded at the base of the dynamic sampling boreholes, indicating refusal (further penetration not possible) due to encountering a large cobble or boulder. Chiselling was occasionally required to progress the cable percussive boreholes to the target depth of c.10.00m bgl.

5 No. in-situ Dynamic Probe tests were completed across the area of former opencast. The tests were completed from ground level and recorded variable N100 values of between 0 and 48 in the upper 2.5m. These results correlate to N300 values of between 0 and 59. However, below 2.5m bgl, the probe results were generally more consistent, providing N300 values which were typically between 7 and 30. Further details regarding the Dynamic Probe tests are provided in Section 6.4.

Based on a review of mine abandonment plans provided in the EES report, the deepest area of coal appears to have been extracted at c.96m AOD. Therefore, based on current topography survey data, the opencast backfill may be up to 48m deep.

During the investigation, GEO did not identify any visual or olfactory evidence of fuel/oil type contamination (no staining, odour or free product) or any biodegradable, decomposable or putrescible materials.

The ground investigation data from Sirius generally concurs with the findings of this investigation. Cable percussive/rotary borehole CPR02 encountered opencast fill materials to a depth of c.22m bgl overlying solid mudstone bedrock to a depth of c.45m bgl. No coal seams or evidence of deeper underground coal mine workings were encountered beneath the former opencast coal mine.

The Sirius cable percussive boreholes encountered predominantly granular opencast backfill material comprising very clayey gravel and cobbles of sandstone and mudstone. SPT tests in the cable percussive boreholes by Sirius indicated 'N' values in the opencast backfill of between 10 and 51 indicating medium dense and dense deposits.

5.2.2 Natural Drift Deposits

Natural drift deposits were not encountered within the former opencast area during this ground investigation.

5.2.3 Solid Geological Deposits (Bedrock)

Bedrock was not encountered within the former opencast area during this ground investigation.

Sirius have previously encountered solid mudstone bedrock at a depth of c.22m bgl in cable percussive/rotary boreholes CPR02 in the north eastern part of the site.

Based on abandonment mining plans included within the EES report, it is possible that the base of the workings and, therefore, solid strata is present at depths of up to c.48m bgl.

5.2.4 Groundwater

The exploratory holes were typically dry except for a minor seepages noted in trial pits TP212 to TP215 in the east of the site at depths of between c.1.50m and c.2.00m bgl.

Groundwater monitoring of installations placed in the boreholes has been carried out on 3 No. occasions between November and December 2019. Standing groundwater levels have been recorded between c.0.25m and c.3.62m bgl. The water level is likely to be a results of surface ingress being trapped/perched within the borehole rather than a continuous water table.

During the investigation by Sirius, occasional minor seepages were encountered at depths of between c.1.40m and c.1.90m bgl, however, the majority of the exploratory holes were recorded as dry.

It is recommended that allowance be made for some groundwater control measures (i.e. pumping equipment) during excavation in the made ground, particularly during wetter periods of the year, as the materials encountered may deteriorate following exposure to surface water.

5.3 Location of Mine Shaft and Opencast Highwall

5.3.1 Location of Mine Shaft Cap

Supplementary ground investigation works were completed in April 2020 to locate the high wall along the eastern edge of the opencast and to confirm the location of the mine shaft cap. During the works, the vegetation covering the shaft cap was scraped off to expose the concrete and the corners of the cap were accurately surveyed as indicated below in Table 1.

Trial pits TP310 and TP311 were located either side of the cap to determine the ground conditions. The trial pits encountered reworked stiff dark brown sandy gravelly clay to suspected weathered siltstone bedrock at a depth of c.1.50m bgl. The cap was noted to be 0.50m thick and appeared to be structurally sound (i.e. no significant spalling or cracking was noted).

Mine Shaft Corner	Mine Shaft Cap Corner Co-ordinates	Mine Shaft Cap Elevation (m AOD)
North East	298965.99, 518410.34	143.553
North West	298960.15, 518411.37	143.582
South West	298959.15, 518405.35	143.542
South East	298965.00, 518404.15	143.575

Table 1: Mine Shaft Cap Location.

5.3.2 Extent of the Opencast Highwall

The location of the highwall was originally identified by Elliott Environmental Surveyors Ltd (EES) in 2016 as part of the Coal Mining Risk Assessment. EES excavated 5 No. trenches (TP1 to TP5) along the western and southern boundaries of the former opencast to identify the highwall position. The locations where EES identified the highwall are indicated in the EES report and are also included on the exploratory hole location plan included in Appendix I.

As part of the previous investigation by Sirius, the opencast high wall was identified to the south and west in 3 No. trenches (TT01, TT05 and TT07). Sirius attempted to locate the highwall along its eastern edge, however, due to the position of a water main and associated wayleave, they were unable to confirm the exact location of the highwall. The locations where the highwall was successfully recorded were surveyed accurately and the coordinates are included below in Table 2. The locations are also indicated on the exploratory hole location plan included in Appendix I.

As part of this investigation, trenches TT201 to TT205 were excavated along the southern and western boundaries of the former opencast to provide additional information to delineate the location of the highwall with more accuracy.

Supplementary ground investigation works were completed in April 2020 to locate the eastern edge of the high wall. Trial Pits TP301 to TP309 were excavated along the suspected route of the highwall and it was successfully located in the south eastern part of the site. However, to the north of this

much of the high wall runs beneath the route of a buried water main and the associated wayleave and it was not possible to accurately determine the location on the high wall in this area.

The trenches were initially excavated outside of the former opencast in the natural ground and then extended into the former opencast. The location at which the edge of the bedrock and the deeper made ground was encountered was recorded as the highwall (edge of the opencast). The location at which the highwall crossed the trench was marked with a stake to allow the position to be surveyed accurately. The coordinates for the highwall are included in Table 2 below and the location is indicated on the exploratory hole location plan included in Appendix I.

Two logs have been produced per trench, one for each end of the excavation to confirm the ground conditions either side of the highwall.

Company	Exploratory Hole Ref:	Highwall location (National Grid Reference)
Sirius	TT01	293795, 518488
Sirius	TT05	298817, 518348
Sirius	TT07	298905, 518275
GEO	TT201	298888, 518283
GEO	TT202	298854, 518317
GEO	TT203	298798, 518369
GEO	TT204	298795, 518405
GEO	TT205	298796, 518465
GEO	TP303	298933, 518263
GEO	TP304	298913, 518262
GEO	TP305	298929, 518250

Table 2: Locations at which the Opencast Highwall has been identified.

6.0 Exploratory Hole Testing

In-situ site testing and monitoring was generally undertaken in accordance with BS5930:1999, BS1377:1990 and Eurocode 7 (Part I and II).

6.1 Standard Penetration Tests

6.1.1 Standard Penetration Test Methodology

To determine the relative density and strength of the underlying soils, Standard Penetration Tests (SPT's) were completed within the boreholes. The test uses a "split spoon" sample tube (external diameter of c.50mm, internal diameter of c.35mm and a length of around c.650mm) driven from the base of the borehole as it is progressed, usually at c.1.00m spacing's/intervals.

The sample tube is driven by blows of a slide hammer with a weight of c.63.5kg falling over a c.760mm drop. The sample tube is driven c.150mm into the ground (seating blows) and then the number of blows needed for the tube to penetrate each c.75mm increment up to a depth of c.450mm is recorded.

The number of blows for the final c.300mm of penetration is referred to as the "standard penetration resistance" or "N" value, which are presented on the exploratory hole logs adjacent to each sample depth. Where 50 blows are insufficient to advance the test through a c.75mm interval the amount of penetration after 50 blows is recorded and the test is referred to as a "refusal".

6.1.2 Standard Penetration Test Results

In-situ Standard Penetration Tests (SPTs) were completed in the made ground deposits within the former opencast in boreholes BH211 to BH223 and cable percussive boreholes CP201 and CP202. The tests were completed at depths of between c.1.00m and c.10.00m bgl. The tests gave variable 'N' values of between 7 and >50, but typically between 10 and 29, indicative of medium and high strength clay deposits. Occasionally, N values in excess of 50 blows were recorded at the base of the boreholes indicating refusal (further penetration not possible) due to encountering a large cobble or boulder. Chiselling was required to progress cable percussive borehole CP202.

In-situ Standard Penetration Tests (SPTs) were completed in the natural drift deposits in boreholes BH201 to BH210 at depths of between c.1.00m and c.3.00m bgl. The tests gave 'N' values of between 8 and 35 (typically 10 to 35) indicative of clays of medium to very high strength. N values in excess of 50 blows for a limited penetration were recorded at the base of most of the dynamic sampling boreholes indicating refusal (further penetration not possible). This was probably due to encountering bedrock or a large cobble or boulder.

The results of the standard penetration tests are presented on the borehole logs which are included in Appendix II.

6.2 Hand Shear Vane Tests

Hand shear vane tests were completed in the cohesive made ground at depths of between c.0.80m and c.1.50m bgl where safe and appropriate to do so. The tests indicated undrained shear strengths of between 60kN/m² and in excess of 120kN/m².

Hand shear vane tests were completed in the natural sandy gravelly clay at depths of between c.0.70m and c.1.20m bgl where safe and appropriate to do so. The tests indicated undrained shear strengths of between 80kN/m² and in excess of 120kN/m².

The results of the hand shear vane tests are presented on the trial pit logs which are included in Appendix II.

6.3 Dynamic Cone Penetrometer Tests (DCP)

The Dynamic Cone Penetration (DCP) Test provides a measure of a material's in-situ resistance to penetration. The test is performed by driving a metal cone into the ground by repeated striking it with an 8kg weight dropped from a distance of 575 mm. The penetration of the cone is measured after each blow and is recorded to provide a continuous measure of shearing resistance up to c.0.85m below the ground surface. Test results can be correlated to California Bearing Ratio to aid pavement design by a Civil Engineer.

The results of the Dynamic Cone Penetrometer tests and the calculations of the equivalent CBR values are included in Appendix II (Dynamic Cone Penetrometer Calculation Sheet).

It should be borne in mind that the results of the Dynamic Cone Penetrometer tests can be influenced by the coarse granular content (gravel, cobbles, boulders, etc...) within the materials tested, therefore, it is always recommended that the appropriate CBR value is confirmed by way of plate load testing at formation level.

6.4 In-situ Dynamic Probe

6.4.1 In-situ Dynamic Probe Test Methodology

The Dynamic Probe test is used to determine the resistance of soils in-situ to the intermittent penetration of a cone, driven dynamically in a standard manner and in accordance to B.S. 1377: Part 9. The equipment consists of a 90° cone which may be sacrificial or retained for recovery, a series of extension or driving rods, a torque wrench and a driving device.

There are two types of test: Heavy Dynamic Probing (DPH) and Super Heavy Dynamic Probing (DPSH). The dimensions of the cone and the mass and drop height of the driving weight differ between the two tests.

The extension rods used in the test are either 0.5-metre-long (for top of the hole) or 1-metre-long, manufactured from 35mm diameter heat-treated alloy steel, with graduations marked every 100mm along their length. The rods are flush-coupled and designed such that rod ends butt-up fully against each other when driving, forming a continuous jointed series with a straight axis. The driving device may be an Automatic Trip Hammer as part of a Dynamic Sampling drilling rig or a purpose-designed Probing Rig with characteristics conforming to BS 1377: Part 9.

The blow count is recorded for every 100mm of driving (N100) and the results presented as a plot of blow count against depth. Where the DPSH is utilised the sum total of three N100 increments (c.300mm penetration – N300 value) correlates to an equivalent SPT "N" value. Both N100 and N300 values are presented on the In-situ Dynamic Probe Record Sheet which is presented in Appendix II.

It should be noted that no samples are recovered during the probing, therefore a record of the strata is not possible. However, a basic correlation is possible when the probe is located adjacent to other exploratory holes.

6.4.2 In-situ Dynamic Probe Test Results

Where possible, the Dynamic Probe Super Heavy (DPSH) tests were located adjacent to trial pits as indicated on the exploratory hole location plan.

5 No. in-situ Dynamic Probe tests were completed across the area of former opencast. The tests were completed from ground level and recorded variable N100 values of between 0 and 48 in the upper 2.5m. These results correlate to N300 values of between 0 and 59. However, below 2.5m bgl, the probe results were generally more consistent, providing N300 values which were typically between 7 and 30.

6.5 Plate Load Tests

3 No plate load tests were completed in the area outside of the former opencast and 6 No tests were completed within the former opencast. The tests were completed using a 13-ton tracked excavator as kentledge.

Prior to each test, the topsoil was scrapped off and the underlying sub-soil leveled and flattened using the back of the excavator bucket. In the area outside of the former opencast, the tests were completed with a 610mm plate, whereas, within the opencast, the tests were completed with a 900mm plate.

The plate load tests completed in the area outside of the former opencast at trial pits TP202, 204 and 206 recorded CBR values of between 1.3% and 4.5%. Maximum settlements of between 7.48mm and 13.64mm at 171kN/m² were recorded.

The tests completed within the opencast at trial pits TP209, 210, 214, 215, 216 and 217 recorded CBR values of between 1.4% and 7.8%. Maximum settlements of between 3.60mm and 6.34mm at 97kN/m² were recorded.

The values can be used to aid the design of pavements, roads and areas of hard standing.

6.6 Soil Infiltration Tests

It is understood that the Client is considering the use of soak-away drainage as part of the proposed development if ground conditions prove favorable. In order to facilitate the soak-away design, soil infiltration tests were completed in trial pits TP218 and TP219.

The ground conditions at these locations were noted as topsoil overlying made ground comprising firm to stiff slightly sandy, very gravelly clay and very stiff, very gravelly clay. The trial pits were excavated to c.1.50m bgl and partially filled with water. The water level was monitored over a period of between 6 and 7 hours, during which time, the water level did not fall at all.

As the water level did not drop at all, the ground infiltration rate is considered too low to be suitable for soak-away drainage (as would be expected with firm and stiff clays). As such, soak away drainage is not considered suitable for the proposed development and an alternative solution is required.

6.7 Ground Gas Monitoring

To assess the on-site potential for hazardous ground gases, 23 No. ground gas monitoring wells were installed in boreholes BH201 to BH223.

The boreholes were installed to the terminal depths of the boreholes ranging between c.0.80m and c.4.00m bgl with a 50mm diameter HDPE standpipe with a bentonite seal for the upper section and a gravel surround for the remainder of the pipe, finished with a plastic end cap and rubber gas bung. The installation details presented on each borehole log in Appendix II.

The monitoring and assessment has been completed in accordance with BS8485: 2007: Code of practice for the characterisation and remediation from ground gas affected developments, CIRIA Report C665, November 2007 and the NHBC Document; Guidance on the evaluation of development proposals on site where methane and carbon dioxide are present, March 2007.

As it is the intention of the Client to develop the site for Residential end use, the monitoring of ground gas monitoring must comprise at least 6 No. site visits over a minimum period of three months. However, due to the presence of a former opencast coal mine and possible deep mine workings beneath the site, a minimum monitoring period of six months is recommended with at least 12 gas monitoring visits.

To date, the wells have been monitored on 12 No. occasions between November 2019 and June 2020 in general accordance with CIRIA C665 (Table 5.5a and 5.5b) using a GA2000 Ground Gas Analyser with external flow pod.

The results of monitoring are included on the Ground Gas Monitoring Record Sheets included in Appendix II. The ground gas risk assessment is presented in Section 11.4 of this report.

6.8 Maintained Load Tests

As previously stated in Section 2.2.4, Maintained Load Tests have been carried out on the site to determine potential settlement values for the deep backfill material in the area of the former opencast. The tests commenced on the 9th March and the results have been issued in a separate report. At the time of writing, the most up to date version (v3) was issued on the 2nd October 2020.

The tests comprised placing large concrete blocks directly onto the backfill material at depths of between c.1.05m and c.1.30m bgl and surveying the top corners at regular intervals to determine settlement values. The ground pressures were increased from 28.3kN/m² to 56.7kN/m² in three phases and settlement values of between 31mm and 38mm were recorded over duration of the test (136 days / 20 weeks).

7.0 Laboratory Testing

7.1 Geotechnical Testing

Geotechnical testing was completed generally in accordance with BS1377:1990: Part 1 to 4 by the following UKAS and MCERTS accredited laboratory:

- Professional Soil Laboratories (PSL) of Doncaster, Yorkshire.

The following tests were completed to aid the design of foundations, roads and retaining structures.

- 17 No. samples at depths of between c.0.70m to c.14.00m bgl were scheduled to Atterberg Tests to determine the natural moisture content, plastic and liquid limits.
- 1 No. sample of suspected coal recovered from trial pit TP208 at c.1.30m bgl scheduled to loss on ignition and calorific value test.

It was not possible to recover any undisturbed samples from the cable percussive boreholes in the opencast fill material due to the coarse material content (i.e. gravel, cobbles and boulders).

7.2 Chemical Screening

7.2.1 Determination of pH and Water-Soluble Sulphate

In order to determine the correct concrete classification for buried structures (foundations), laboratory testing was undertaken for pH and water-soluble sulphate (SO_4). The tests were completed on the following samples:

- 22 No. samples of topsoil recovered at a depth of c.0.20m bgl.
- 15 No. samples of made ground from depths of between c.0.90m and c.10m bgl.
- 7 No. samples of the natural cohesive soils from depths of between c.0.70m and c.1.50m bgl.
- 1 No. sample of coal recovered from trial pit TP0208 at a depth of c.1.30m bgl.
- 2 No. samples of weathered rock recovered from depths of between c.1.70m and c.2.00m bgl.

The testing was completed generally in accordance with BS1377:1990: Part 1 to 4 by the following UKAS and MCERTS accredited laboratory:

- Chemtech Environmental Testing of Stanley, County Durham.
- Derwentside Environmental Testing Services (DETS) Limited of Consett, County Durham.

The results of the testing are summarised in section 9 and presented in the Chemtech report (ref: 82011 and 82349) and DETS report (19-21848), contained in Appendix III.

7.2.2 Contamination Testing for Human Health

To enable the completion of a Level 1 Generic Quantitative Risk Assessment (GQRA) for Human Health, 22 No. samples of topsoil from across the site were subjected to analysis at the following UKAS and MCERTS accredited laboratory:

- Chemtech Environmental Testing of Stanley, County Durham.

Potential Contaminants of Concern (PCOC's) have been determined for the development area based on the descriptions of the materials encountered within the exploratory holes.

Relevant samples of the topsoil from across the site was subjected to contamination testing for the determinants detailed below.

- **Inorganic Soil Suite (Human Health Risk Assessment):** Metal (Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium and Zinc), Cyanide, Asbestos and Total Organic Carbon.
- **Organic Soil Suite (Human Health Risk Assessment):** Speciated Polycyclic Aromatic Hydrocarbons (PAH – USEPA 16).

The full catalogue of soil screening results and test detection limits can be seen in the Chemtech report (ref: 82011) contained in Appendix III.

8.0 Geotechnical Analysis

8.1 Atterberg Tests (Moisture Content, Liquid and Plastic Limits)

17 No. samples of the natural drift deposits recovered from the exploratory holes at depths of between c.0.7m and c.14m bgl were scheduled for Atterberg tests to determine the moisture content, liquid and plastic limits. The results of the testing are contained in the PSL report (ref: PSL19/6452) presented in Appendix III and summarised below.

Natural moisture contents of between 11% and 27% were observed, with liquid limits of between 33% and 65% and plasticity indices of between 16% and 36% being recorded. The results indicate clays of low, intermediate and high plasticity, but typically of intermediate plasticity and a medium volume change potential.

8.2 loss on ignition and calorific value

1 No sample of suspected coal recovered at a depth of c.1.30m bgl from trial pit TP208 in the south eastern part of the site was scheduled to a loss on ignition and calorific value test to assess the risk of combustion.

The tests indicated a loss of 81% on ignition and a calorific value of 22.7MJ/kg.

A loss of 81% on ignition indicates a significant mass of the material tested is potentially combustible.

It is understood that a material with a calorific value of less than 2MJ/kg is unlikely to smoulder and a material with a value of more than 10MJ/kg is almost certainly able to smoulder with right conditions present. Therefore, a calorific value of 22.7MJ/kg indicates a significant potential for the material to smoulder and potentially combust if sufficient oxygen and heat are present.

The results indicate a potential for combustion (potentially spontaneous) wherever coal seams are present at or near to the surface where there is a heat source such as utility trenches (i.e. electrical cables) or buildings. There is also a potential for spontaneous combustion where sufficient oxygen is present. Therefore, it would be prudent to remove any significant deposits of coal present at shallow depth or in the corridor of the proposed utility trenches or beneath proposed buildings unless suitable protection measures are installed.

The tests are presented in the DETS report (ref: 19-21848) in Appendix III.

9.0 Generic Quantitative Risk Assessment (GQRA)

9.1 Methodology for Assessing Risks to Human Health

Within the UK, the current framework for assessing potential ground contamination is utilising the Contaminated Land Exposure Assessment (CLEA) model as set out by the Department of the Environment, Farming and Rural Affairs (DEFRA) and comprises of the established pollutant linkage model of *Source – Pathway – Receptor*. For a risk to be present to the proposed end user (*Receptor*) there must be an identified *Source* and a plausible *Pathway*. Where one or more of the links are missing then risk is negated. In order for the land to be classified as contaminated under Part IIa of the Environmental Protection Act (EPA) 1990 all three elements of the pollutant linkage must be present.

A human health risk assessment can be completed using the contamination levels recorded in the soils by comparing the values against published Generic Assessment Criteria (GAC), such as CLEA Soil Guideline Values (SGV's), Category 4 Screening Levels (C4SLs), Land Quality Management (LQM), Chartered Institute of Environmental Health (CIEH) S4UL Values and Atkins ATRISK^{SOIL} Soil Screening Values (SSV's). The guidelines are generally based on three main land uses as outlined below:

- *Residential*
(with or without plant uptake)
- *Allotments*
- *Commercial*

Where these land uses are not deemed appropriate, other land use values can be considered with the DEFRA C4SLs, LQM S4UL's values and the ATRISK^{SOIL} SSV's (i.e. parks/playing fields/Public Open Space). Alternatively, it is possible to determine site specific intervention values as part of a Detailed Quantitative Risk Assessment (DQRA).

It is anticipated that the proposed development will incorporate a residential development with private gardens. Therefore, for the purposes of this basic Human Health ground contamination risk assessment, the maximum site recorded values for the soil samples have been compared to GAC for a CLEA end use classification of: *Residential with plant uptake end use* to determine if a potential risk is present to the proposed end users.

Contaminant Analysis Sheets that include the results of the relevant Human Health Risk Assessment and the Generic Assessment Criteria (GAC) values are presented in Appendix IV.

9.2 Human Health Risk Assessment – Comparison with Guidance Levels

9.2.1 Generic Contaminants – Soil

The maximum concentration values for each inorganic analyte have been compared to the most relevant published Generic Assessment Criteria (GAC) as part of the Maximum Value Test. The GAC have been selected using the following guidance documents:

- LQM CIEH S4UL 2014 (Residential with Plant Uptake End Use).
- Defra Category 4 Screening Levels C4SL (Residential with Plant Uptake End Use).
- Atkins ATRISK Soil Screening Values (Residential with Plant Uptake End Use)

As discussed in section 9.1, the contaminant concentrations have been assessed against GAC for a residential with plant uptake end use as it is anticipated that the proposed development will incorporate private gardens.

Based on the results of the contaminant analysis sheet contained in Appendix IV none of the inorganic contaminant concentrations exceed the assessment criteria and as such do not pose a risk to human health.

In addition, phytotoxic elements (copper, nickel and zinc) are within the acceptable limits for topsoil (BS3882: Specification for Topsoil, 2015).

9.2.2 Organic Contaminants – Soil

The maximum concentration values for the organic analytes tested for (i.e. Speciated PAH) have been compared to the most relevant and appropriate published guidance values (generic assessment criteria) as part of the Maximum Value Test. The GAC have been selected using the following guidance documents:

- LQM CIEH S4UL 2014 (Residential with Plant Uptake End Use).

Taking in to account the average TOC of the soils on the site, this assessment has been completed utilising a 2.5% SOM.

Based on the results of the contaminant analysis sheet contained in Appendix IV it can be seen that none of the organic contaminant concentrations exceed the assessment criteria and as such do not pose a risk to human health.

9.2.3 Asbestos Containing Materials (ACM's) – Soil

22 No. samples of the topsoil have been subjected to laboratory microscopic analysis to determine the presence or not of Asbestos Containing Materials (ACM's) in accordance with the methodology within HSG 248.

Of the samples tested, all returned a negative result for ACM's and were recorded as NAD (no asbestos detected), i.e. no asbestos was encountered.

9.2.4 Human Health Risk Assessment – Summary for Whole Site

The following is a summary of the Human Health risk assessment based on a *Residential End Use with Consumption of Home Produce*:

- **Generic Contamination:** None.
- **Organic Contamination:** None.
- **Other Contamination:** None.

Based on the Human Health risk assessment above, none of the contaminants have been identified as posing a potential risk to human health with respect to a residential end use with plant uptake.

As such, the topsoil is not considered to pose a risk to human health and remediation is not required at this stage.

The topsoil materials noted on site are considered suitable for re use in a residential context in accordance with BS3882: Specification for Topsoil, 2015.

9.3 Ground Gas Risk Assessment

As indicated in section 6.7, gas and groundwater monitoring wells have been installed in all 23 No. dynamic sampling boreholes and monitoring has been completed on 3 No. occasions between November and December 2019.

During the monitoring, atmospheric air pressures varied between 970mb and 1015mb during both rising and falling pressure trends.

A maximum Carbon Dioxide (CO₂) concentration of 26.3%v/v has been recorded and a maximum Methane (CH₄) concentration of 3.0%v/v has been recorded. The minimum Oxygen (O₂) concentration was 0.0% (zero) and the maximum flow value was recorded as + 7.2l/hr. A negative flow value of 9.4l/hr was also recorded.

In accordance with CIRIA C665 the maximum recorded CO₂ concentration has been converted to a Gas Screening Value (GSV), summarised as follows.

In this instance, the CO₂ GSV is:

- **CO₂ GSV = (Max CO₂ (%) / 100) x Max Flow (l/hr),**
- **Therefore; (26.3 / 100) x 9.4 = 2.4 l/hr GSV**

In this instance, the CH₄ GSV is:

- **CH₄ GSV = (Max CH₄ (%) / 100) x Max Flow (l/hr),**
- **Therefore; (3.0 / 100) x 9.4 = 0.28 l/hr GSV**

Therefore, in accordance with CIRIA C665 Table 8.5, taking into consideration the GSV and the maximum gas concentrations observed within this dataset, the site falls into Characteristic Situation 3 (CS3) or the Amber 2 Classification when utilising the NHBC Characterisation System. This indicates that gas precautions are required. Further details are included in Section 11.5.

Significantly depleted Oxygen (O₂) levels have also been noted. Whilst these levels are unlikely to pose a risk to above ground structures, they may potentially pose a risk to the construction workforce for any below ground works (i.e. installing utilities etc.). As a result of this, the information presented in this report

should be passed to the Principal Contractor (PC) as a Workforce Health and Safety risk assessment lies out-with the scope of this report.

9.4 Determination of pH and Water-Soluble Sulphate

As indicated in Section 7.2, selected samples of topsoil and natural soil have been screened to determine their pH and soluble sulphate potential to aid the design of buried concrete. The results of the chemical screening are presented in the Chemtech reports (ref: 82011 and 82349) and DETS report (19-21848) contained in Appendix III.

From the results of the testing on the topsoil, the following observations can be seen:

- pH values in the soils ranged from 5.5 to 6.3 (slightly acidic).
- Water Soluble Sulphate (SO₄) levels were recorded as ranging from <10mg/l to 35mg/l.

From the results of the testing on the made ground, natural clays and bedrock, the following observations can be seen:

- pH values in the soils ranged from 4.7 to 7.4 (acidic to neutral).
- Water Soluble Sulphate (SO₄) levels were recorded as ranging from <10mg/l to 533mg/l.

The, the results recorded have been assessed in accordance with BRE Special Digest 1: 2005. As more than 10 values were available, the average of the highest or lowest 10% were assessed. The results equate to a Design Sulphate classification of DS-1. With respect to the pH levels, the results indicate a potentially acidic environment which may be aggressive with respect to concrete. In view of this, an (ACEC) classification of AC-4z should be adopted (for mobile groundwater on brownfield land).

In summary, the ground equates to **DS-1, AC-4z**.

10.0 Construction Related Excavations and Off-Site Disposal

During the construction works it is likely that materials will be excavated on site (i.e. future foundations and buried utilities, etc.) that will not be able to be accommodated on site during to space and level constraints, ultimately requiring removal off site.

During the construction works different materials should be kept separate, as it may be the case that uncontaminated natural materials can be classified as Inert and transferred to an Inert Landfill site. A separate assessment will be required for any topsoil (naturally occurring organic materials) that may be encountered as they cannot be classified as inert due to their natural organic content.

Where made ground materials or disturbed natural strata is to be removed, the results of the soil testing undertaken within this report can be used as a preliminary assessment and the anticipated waste disposal facility should be provided with a copy of the results for review. It may be the case that the waste facility requires additional contamination screening to aid the characterisation of the made ground for off-site disposal (i.e. Waste Acceptance Criteria – WAC) and it is recommended that this be confirmed by the design team prior to commencing on site.

During the construction phase, it may be the case that WAC screening is required to aid classification for disposal and it is recommended that all materials are classified prior to excavation and disposal off site.

Conversely, if materials are required to be brought to site to raise site levels or as part of a clean cover system then certification and/or soil testing results should be reviewed by a suitably experienced and qualified geo-environmental engineer to ensure that potentially contaminated materials are not being brought to site.

Any material movements may require a Material Management Plan (MMP) in accordance with CL:AIRE.

11.0 Discussion and Recommendations

Given the history of opencast mining on the site, it has been separated into two separate areas which have very different ground conditions and will require different foundation solutions.

Areas outside of the former opencast include a corridor along the south, east and west of the site. These areas are likely to have remained free of excavation due to their proximity to the roads and residential housing.

It appears that the eastern extent of the opencast lies below a buried water main and an associated wayleave, therefore, the exact location could not be determined for the most part. However, investigations have proven the location of the highwall in the south eastern part of the site.

A mine entrance (shaft) is present in the eastern part of the site which has been marked by a concrete plinth.

The area of the former opencast includes much of the central and northern parts of the site. An inspection of the historical mine abandonments plans suggest that the opencast may have been up to 48m deep but has been infilled to near original levels to an unknown specification.

11.1 Ground and Groundwater Conditions Summary

11.1.1 Ground Condition Summary - Area Outside of Former Opencast

Areas outside of the former opencast typically comprised topsoil overlying firm and stiff glacial clays. Bedrock of sandstone or siltstone/mudstone was encountered at depths of between c.0.80m and c.3.20m bgl. Occasional made ground was encountered to depths of between c.0.70m and c.2.20m bgl which was typically associated with overlapping capping materials (firm and stiff sandy gravelly clays) related to the remediation of the former opencast or localised made ground associated with buried field drains/pipes.

Shallow coal seams were noted in the trial pits and rotary boreholes in the south east and eastern parts of the site from depths of c.1.20m bgl. Additional coal seams were encountered in the rotary boreholes at depths of between 2.30m and c.48.00m bgl which varied between c.0.10m and c.1.10m in thickness. In total, 10 No. rotary boreholes have been sunk in the area outside of the former opencast and no evidence of mine workings or loss of flush was encountered.

Significant groundwater ingress is not anticipated other than minor pockets of perched water. However, it is recommended that allowance be made for some groundwater control measures particularly during wetter periods of the year, as the materials encountered may deteriorate following exposure to surface water.

11.1.2 Ground Condition Summary - Area within Former Opencast

This area is underlain by made ground comprising topsoil over a cap of stiff brown slightly sandy very gravelly clay with many cobbles and boulders to depths of between c.1.00m and c.1.90m bgl. This was underlain by opencast backfill materials including clay bound gravel, cobbles and boulders of siltstone and sandstone or stiff to very stiff dark grey sandy very gravelly clay with angular cobbles and boulders of siltstone and sandstone.

There are no records to indicate if the fill materials have been engineered or to what specification they were placed. However, based on visual inspection of the materials within the trial pits and

boreholes, it would appear that they have been very well compacted with no evidence of voids or unsuitable materials.

Natural drift deposits were not encountered, and bedrock was only encountered in one borehole at a depth of c.22m bgl during the previous investigation by Sirius. An inspection of abandonment plans indicates that bedrock may be up to 48m deep within the former opencast. No evidence of coal seams or mine workings were encountered beneath the opencast during the previous investigation by Sirius.

In-situ testing indicates variable strengths in the top 2.5m however, values typically increase below this indicating medium dense and dense granular deposits and medium to high shear strengths for the cohesive fraction.

Significant groundwater ingress is not anticipated other than minor pockets of perched water. However, it is recommended that allowance be made for some groundwater control measures particularly during wetter periods of the year, as the materials encountered may deteriorate following exposure to surface water.

During the investigation, GEO did not identify any visual or olfactory evidence of fuel/oil type contamination (no staining, odour or free product) or any potentially biodegradable, decomposable or putrescible materials within the former opencast or in the area beyond.

Ground permeability tests indicate that the ground conditions (reworked firm to stiff and stiff clays) are not suitable for a soak-away drainage system.

11.2 Coal Mining Risk Assessment

The investigation has confirmed the presence of deep made ground within the central and northern parts of the site associated with a former opencast coal mine. The mine has since been backfilled and any shallow unrecorded underground mine workings which were present within this area will have been removed. Abandonment plans indicate some shallow workings close to the central part of the site within the Unnamed G coal seam at a level of c.140m bgl. However, subsequent excavations to extract deeper seams will have removed the workings at these locations.

There exists a potential for shallow unrecorded mine workings outside of the former opencast coal mine. However, 10 No. rotary boreholes have been sunk within this area to depths of between c.30m and c.51m bgl and no evidence of workings (voids, broken ground, loss of flush, etc...) has been encountered. The seams varied between c.0.10m and c.1.10m thick and were encountered from depths of between c.1.70m bgl. However, the coal encountered in trial pit TP208 was of poor quality, comprising silty angular gravel of coal and carbonaceous siltstone. Laboratory testing of the coal indicated a loss on ignition of 81%.

Based on the information above, the risk of shallow unrecorded mine workings existing within influencing depth outside of the former opencast is considered very low and further assessment is not considered necessary at this stage. However, during development, it would be prudent to maintain a watching brief to ensure that any evidence of ground disturbance or other evidence of mine workings is fully investigated and potentially dealt with in accordance with good practice.

Deep boreholes located within the area of the former opencast proved made ground to a depth of c.22m bgl overlying solid bedrock with no evidence of coal seams or workings. As such, the risk to the proposed development from mine workings beneath the former opencast are considered negligible.

A historical mine shaft is present in the north eastern part of the site. This is marked with a concrete plinth, however, details regarding the treatment or capping are unavailable. Therefore, further

investigation and possible treatment of the shaft may be required. Alternatively, consideration could be given to sterilisation of this part of the site.

11.3 Future Foundations, Pavements and Buried Structures

It is understood that the proposed development will incorporate residential housing.

11.3.1 Future Foundations, etc. - Area Outside of Former Opencast

Based on the results of the ground investigation, conventional strip foundations are considered appropriate for the area outside of the former opencast. To avoid the potential for differential settlement, none of the proposed developments should straddle the highwall. It would also be prudent to avoid placing foundations with the influencing zone of the highwall (i.e., within a 45-degree zone from the highwall threshold).

Foundations should extend through the topsoil and into the firm to stiff and/or stiff sandy gravelly clay (glacial till), or onto the shallow weathered bedrock where it is present at shallow depth. In accordance with NHBC Standards the top of the foundations should be at a depth not less than 750mm below the finished level when founding in the natural glacial clay deposits.

To avoid differential movement, close inspection of the formation is recommended to ensure that foundations do not transition between drift and the weathered bedrock. Any foundations that do transition, should be over deepened using trench fill techniques so that all of the foundation is placed on the rock.

A bearing resistance of 100kPa may be used in design for foundations in the firm to stiff and stiff sandy gravelly clays.

With respect to buried structures (concrete), the pH levels and soluble sulphate concentrations in the soils equate to a Design Sulphate classification of DS-1 and an ACEC classification of AC-4z (BRE Special Digest 1: 2005).

Based on the ground conditions, the plate load tests and the results of the DCP tests, conventional road and pavement construction techniques should be suitable although a capping layer will be required where lower CBR values of less than 5% were recorded. It is always recommended that the appropriate CBR value is confirmed by way of plate load testing at formation level prior to construction.

11.3.2 Future Foundations, etc. - Area within Former Opencast

When taking into consideration the ground conditions identified within the former opencast, conventional shallow strip footings are not considered suitable. The Structural Engineer will therefore need to design an appropriate foundation that will safeguard the proposed residential structures. Potential foundations options could comprise the following, subject to confirmation by the Structural Engineer:

- Stiff rafted foundation.
- Ground improvement techniques, for example vibro-stone columns, deep soil mixing, material excavation and replacement under an engineered specification (recourse should be made to the relevant specialists for their advice).
- Pile foundations, although given the nature and depth of the man-made deposits, conventional deep driven and/or bored-cast-in place pile types may not be practical. The presence of large obstructions could deflect driven types causing failure and prevent the advancement of bore-cast-in place piles (recourse should be made to the relevant specialists for their advice).
- The Structural Engineer may wish to consider use of a lightly loaded, reinforced, widened strip footing, which would need appropriate measures to safeguard against potential settlement.

- The developer should consider additional boreholes in the former opencast (i.e. one per plot) to confirm no soft spots are present within influencing depth of the proposed foundation option.

11.4 Ground Contamination

During the ground investigation, no visual or olfactory evidence of contamination was encountered.

Following the results of the contamination assessment it can be seen that none of the contaminant concentrations in the topsoil from anywhere on site exceed the assessment criteria for a residential development with plant uptake and asbestos fibres have not been detected. As such, the topsoil on the site does not pose a risk to human health and is suitable for re-use in areas of private gardens and soft landscaping. In addition, phytotoxic elements (copper, nickel and zinc) are within the acceptable limits for topsoil.

In view of the above, remediation is not considered necessary in order to develop the site for residential end use.

Given the results of the chemical screening, standard water supply pipes are likely to be suitable. However, it is recommended that the relevant utility suppliers are contacted in this respect, as a site-specific risk assessment may be required.

11.5 Ground Gas

The results of the preliminary ground gas monitoring indicate elevated concentrations of methane and carbon dioxide with moderate flow rates. Based on the maximum gas concentrations and the results of the gas screening values (GSV) for both methane and carbon dioxide, gas protection measures are considered necessary at this stage.

The gas protection measures should be in accordance with CIRIA C665 Characteristic Situation 3 or the Amber 2 Classification when utilising the NHBC Characterisation System.

The following comment is taken from the CIRIA C665 document and describes the minimum protection measures required for Amber 2:

“Intermediate to high gas regime identified, which requires high-level gas protection measures, comprising a membrane and ventilated sub-floor void to create a permeability contrast to prevent the ingress of gas into buildings. Gas protection measures should be as prescribed in BRE Report 414 (Johnson, 2001). Membranes should always be fitted by a specialist contractor. As with amber 1, ventilation of the sub-floor void should facilitate a minimum of one complete volume change per 24 hours. Certification that these passive protection measures have been installed correctly should be provided.”

As indicated above, gas protection measures in line with CS3 or Amber 2 classification should be installed by a specialist contractor. Therefore, the site will require a Ground Gas Verification Plan (Ground Gas Remediation Strategy) to detail the proposed remedial measures to be incorporated into the proposed foundation and floor slab design. The Ground Gas Verification Plan will require acceptance by the Planning Authority prior to commencing on site and third party independent verification/validation of the protection measures will be required during construction, with appropriate Verification Reporting.

Highly depleted Oxygen (O₂) levels have also been noted which could pose a risk to the construction workforce during any below ground works (i.e. installing utilities etc.).

The previously completed desk-based assessment indicates that Radon protection measures are not considered necessary at this time. However, it may be prudent for the design team to purchase an up to date Radon report to ensure the site setting has not been reassessed recently.

11.6 General Comments

Consideration must be made for variations to occur in the ground conditions between the exploratory hole locations for which GEO holds no responsibility and areas where limited access was available. It is therefore recommended that a “watching brief” and “observational technique” be applied to this site to ensure that if ground conditions appear to vary from those identified within this investigation report then advice should be sought from a suitably qualified and experienced Engineering Geologist, Geotechnical or Geo-Environmental Engineer.

The recommendations and opinions expressed in this report are based on the strata observed within the exploratory holes in addition to the results of the site and laboratory tests commissioned by GEO. Consequently, GEO takes no responsibility for conditions that have not been revealed or which occur between them. GEO takes no responsibility for the accuracy of third party information provided by sub-contract drillers or laboratories.

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

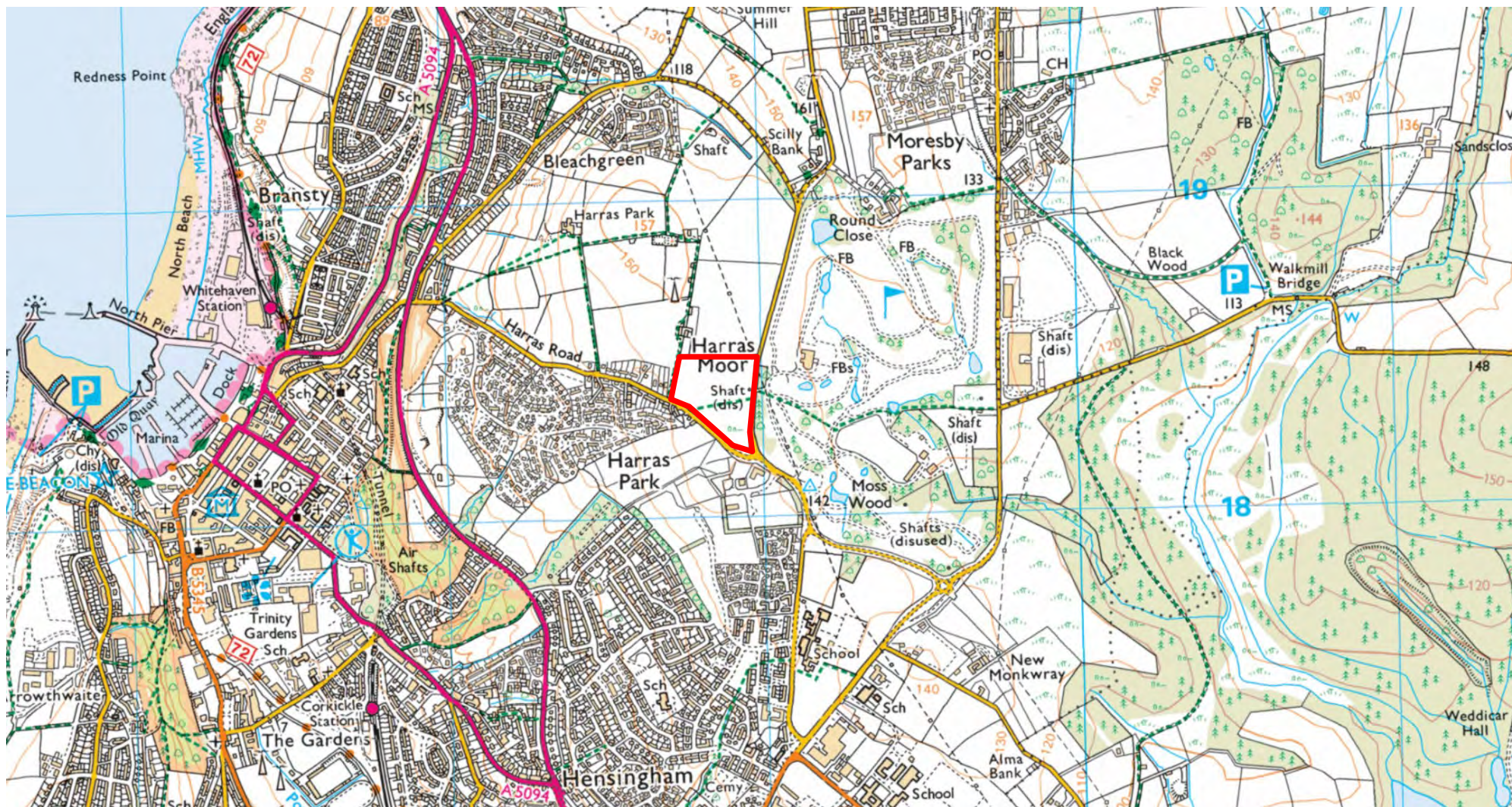
Any items not specifically mentioned cannot be assumed to be covered.

End of Report

Appendix I

- Site Location Plan
- Exploratory Hole Location Plan
- Exploratory Hole Coordinates

GEO2019-3889: Harras Dyke Farm, Whitehaven – Site Location



Website: www.geoenvironmentalengineering.com

Email: info@geoenvironmentalengineering.com

Telephone: 08456 768 895 / 07883 440 186

Harras Dyke Farm, Harras Road, Whitehaven, Cumbria

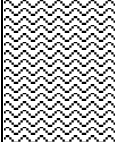
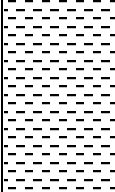
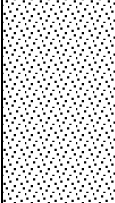
Exploratory Hole Location Co-ordinates

Exploratory Hole	Note	Eastings	Northings	Elevation
TP201	Centre of Pit	298773.512	518502.524	143.695
TP202	Centre of Pit	298747.419	518471.563	142.606
TP203	Centre of Pit	298786.074	518436.671	143.811
TP204	Centre of Pit	298748.998	518398.033	142.592
TP205	Centre of Pit	298787.092	518384.020	143.235
TP206	Centre of Pit	298820.943	518315.603	143.571
TP207B	Centre of Pit	298893.589	518257.048	141.706
TP208	Centre of Pit	298924.653	518237.023	140.859
TP209	Centre of Pit	298846.895	518365.033	143.997
TP210	Centre of Pit	298887.796	518323.385	143.328
TP211	Centre of Pit	298850.999	518401.518	144.560
TP212	Centre of Pit	298911.210	518391.548	144.016
TP213	Centre of Pit	298905.902	518441.507	145.003
TP214	Centre of Pit	298882.110	518377.530	144.072
TP215	Centre of Pit	298882.388	518419.213	145.133
TP216	Centre of Pit	298915.942	518477.385	145.057
TP217	Centre of Pit	298857.473	518452.471	145.936
TP218	Centre of Pit	298903.882	518356.523	143.306
TP219	Centre of Pit	298828.102	518396.933	143.540
TT201	Edge of Opencast	298887.514	518283.103	142.489
TT202	Edge of Opencast	298853.976	518316.622	143.518
TT203	Edge of Opencast	298797.853	518369.222	143.168
TT204	Edge of Opencast	298795.065	518405.239	143.383
BH201	Gas Monitoring Well	298786.784	518468.920	144.137
BH202	Gas Monitoring Well	298739.659	518448.760	142.271
BH203	Gas Monitoring Well	298776.548	518419.723	143.605
BH204	Gas Monitoring Well	298771.104	518383.478	143.143
BH205	Gas Monitoring Well	298728.925	518390.140	141.415
BH206	Gas Monitoring Well	298800.401	518340.761	143.560
BH207	Gas Monitoring Well	298836.143	518311.138	143.706
BH208	Gas Monitoring Well	298863.126	518287.602	143.114
BH209	Gas Monitoring Well	298890.223	518263.090	142.176
BH210	Gas Monitoring Well	298920.303	518242.521	141.248
BH211	Gas Monitoring Well	298902.998	518309.395	143.093
BH212	Gas Monitoring Well	298863.853	518349.650	144.228
BH213	Gas Monitoring Well	298830.682	518376.026	143.980
BH214	Gas Monitoring Well	298839.650	518421.759	144.724
BH215	Gas Monitoring Well	298875.724	518403.999	145.459
BH216	Gas Monitoring Well	298898.867	518367.596	143.914
BH217	Gas Monitoring Well	298927.607	518397.917	144.436
BH218	Gas Monitoring Well	298924.323	518433.648	144.636
BH219	Gas Monitoring Well	298883.420	518437.570	145.845
BH220	Gas Monitoring Well	298831.758	518477.488	144.783
BH221	Gas Monitoring Well	298859.609	518499.815	146.662
BH222	Gas Monitoring Well	298889.186	518485.906	146.229
BH223	Gas Monitoring Well	298930.588	518490.755	145.207
R201	Borehole Location	298907.499	518245.383	141.204
R202	Borehole Location	298874.434	518270.464	142.458
R203	Borehole Location	298829.264	518308.569	143.418
R204	Borehole Location	298750.418	518387.485	142.734
R205	Borehole Location	298771.999	518483.591	143.094
CP201	Borehole Location	298854.898	518386.026	144.424
CP202	Borehole Location	298914.685	518397.935	144.177

Appendix II

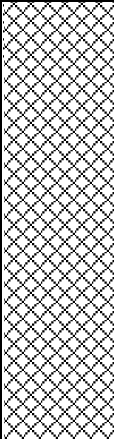
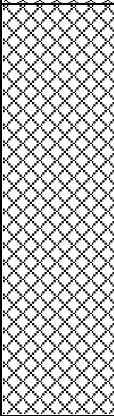
- Exploratory Hole Logs and In-situ Test Data
- DCP Calculation Sheets
- Plate Load Test Results
- Ground Gas Monitoring Sheets
- Ground Investigation Data by Sirius Geotechnical Ltd

GEO2019-3889: Harras Dyke Farm, Whitehaven – TT201 (Southern End)

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.46	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		0.3 - J
0.46	1.10	Stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles.		0.7 HSV = >120 1.0 - T
1.10	1.80	Dark red brown very silty, very gravelly fine to medium sand with many angular cobbles of sandstone (possible completely weathered bedrock).		
1.80	2.00	SUSPECTED WEATHERED SANDSTONE BEDROCK. Recovered as dark red brown very sandy fine to coarse angular GRAVEL and COBBLES of sandstone.		
		Edge of Opencast noted at NGR: XXXX Trial hole remained open and dry on completion. Trial hole backfilled with arisings on completion.		
Site: Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 14/10/2019 Plant: Tracked 360 Excavator			Log Notes: HSV = Hand Shear Vane (kN/m ²) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	



GEO2019-3889: Harras Dyke Farm, Whitehaven – TT201 (Northern End)

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.34	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		
0.34	1.80	MADE GROUND: Stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles. 0.8 – Field drain at c.0.80m bgl.		
1.80	3.40	MADE GROUND: Brown sandy clay bound GRAVEL, COBBLES and BOULDERS of siltstone and sandstone. Occasional coal. Clay is generally stiff.		
		Edge of Opencast noted at NGR: XXXX Excavated as Trench (8.20m long). Trial hole remained open and dry on completion. Trial hole backfilled with arisings on completion.		

Site: Harras Dyke Farm, Whitehaven

Engineer: J.Brock

Site Works Date: 14/10/2019

Plant: Tracked 360 Excavator

Log Notes:

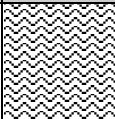
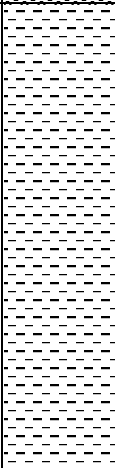
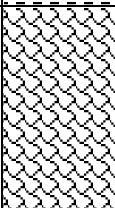
HSV = Hand Shear Vane (kN/m²)

NP = No penetration (HSV/CBR)

B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub



GEO2019-3889: Harras Dyke Farm, Whitehaven – TT202 (Southern End)

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.40	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		0.2 – J
0.40	2.18	Stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles.		1.0 HSV = >120 1.5 - T
1.80	2.70	SUSPECTED WEATHERED SILTSTONE BEDROCK. Recovered as dark grey fine to coarse angular GRAVEL of weak to moderately weak SILTSTONE.		
		Edge of Opencast noted at NGR: XXXX Trial hole remained open and dry on completion. Trial hole backfilled with arisings on completion.		

Site: Harras Dyke Farm, Whitehaven

Engineer: J.Brock

Site Works Date: 14/10/2019

Plant: Tracked 360 Excavator

Log Notes:

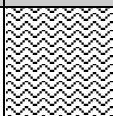
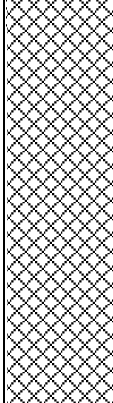
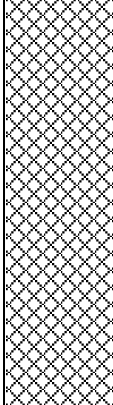
HSV = Hand Shear Vane (kN/m²)

NP = No penetration (HSV/CBR)

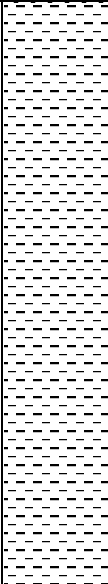
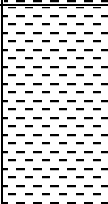
B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub



GEO2019-3889: Harras Dyke Farm, Whitehaven – TT202 (Northern End)

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.40* *varies	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		
0.40	1.80	MADE GROUND: Stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles.		
1.80	3.80	MADE GROUND: Brown sandy clay bound GRAVEL, COBBLES and BOULDERS of siltstone and sandstone. Occasional coal. Clay is generally stiff.		
		Edge of Opencast noted at NGR: XXXX Excavated as Trench (8.00m long). Trial hole remained open and dry on completion. Trial hole backfilled with arisings on completion.		No samples retained.
Site: Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 14/10/2019 Plant: Tracked 360 Excavator			Log Notes: HSV = Hand Shear Vane (kN/m²) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	
				

GEO2019-3889: Harras Dyke Farm, Whitehaven – TT203 (Southern End)

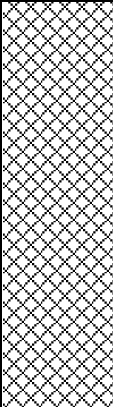
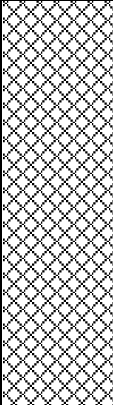
Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.32	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		0.2 - J
0.32	2.40	Stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles.		1.0 - T
2.40	3.20	Very stiff dark grey very gravelly CLAY.		
		Edge of Opencast noted at NGR: XXXX Excavated as trench (5.00m long). Trial hole remained open and dry on completion. Trial hole backfilled with arisings on completion.		

Site: Harras Dyke Farm, Whitehaven
Engineer: J.Brock
Site Works Date: 14/10/2019
Plant: Tracked 360 Excavator

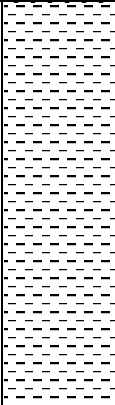
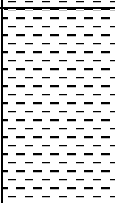
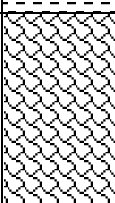
Log Notes:
 HSV = Hand Shear Vane (kN/m²)
 NP = No penetration (HSV/CBR)
 B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub



GEO2019-3889: Harras Dyke Farm, Whitehaven – TT203 (Northern End)

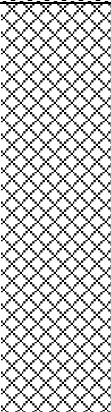
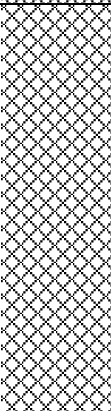
Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.37	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		
0.37	1.90	MADE GROUND: Stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles.		
1.90	3.60	MADE GROUND: Brown sandy clay bound GRAVEL, COBBLES and BOULDERS of siltstone and sandstone. Occasional coal. Clay is generally stiff. Note: Fill material was unstable with occasional collapse of side walls.		
		Edge of Opencast noted at NGR: XXXX Excavated as Trench (5.00m long). Slight groundwater ingress at c.1.0m bgl. Trial hole backfilled with arisings on completion.		No samples retained.
Site: Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 14/10/2019 Plant: Tracked 360 Excavator			Log Notes: HSV = Hand Shear Vane (kN/m ²) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	
				

GEO2019-3889: Harras Dyke Farm, Whitehaven – TT204 (Western End)

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.32	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal and fragments of brick.		
0.32	1.80	Stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles.		
1.80	2.60	Very stiff dark brown very gravelly CLAY with many sub-rounded cobbles.		
2.60	3.40	SUSPECTED WEATHERED SILTSTONE BEDROCK. Recovered as dark grey fine to coarse angular GRAVEL of weak to moderately weak SILTSTONE.		
		Edge of Opencast noted at NGR: XXXX Excavated as trench (4.00m long). Trial hole remained open and dry on completion. Trial hole backfilled with arisings on completion.		No samples retained.
Site: Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 14/10/2019 Plant: Tracked 360 Excavator			Log Notes: HSV = Hand Shear Vane (kN/m ²) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	



GEO2019-3889: Harras Dyke Farm, Whitehaven – TT204 (Eastern End)

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.34	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		
0.34	2.30	MADE GROUND: Firm to stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles.		
2.30	3.50	MADE GROUND: Brown sandy clay bound GRAVEL, COBBLES and BOULDERS of siltstone and sandstone. Occasional coal. Clay is generally stiff.		
		Edge of Opencast noted at NGR: XXXX Excavated as Trench (4.00m long). Trial pit was dry and stable on completion. Trial hole backfilled with arisings on completion.		No samples retained.
Site: Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 14/10/2019 Plant: Tracked 360 Excavator		Log Notes: HSV = Hand Shear Vane (kN/m²) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub		
				

GEO2019-3889: Harras Dyke Farm, Whitehaven – TT205 (Western End)

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.20	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		0.1 - J
0.20	2.10	Stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles.		
2.10	3.20	Very stiff dark grey brown very gravelly CLAY with many sub-rounded cobbles. Occasional sandstone boulders.		
3.20	3.50	SUSPECTED WEATHERED SILTSTONE BEDROCK. Recovered as dark grey fine to coarse angular GRAVEL of weak to moderately weak SILTSTONE.		
		Edge of Opencast noted at NGR: XXXX Excavated as trench (8.00m long). Trial hole remained open and dry on completion. Trial hole backfilled with arisings on completion.		

Site: Harras Dyke Farm, Whitehaven

Engineer: J.Brock

Site Works Date: 14/10/2019

Plant: Tracked 360 Excavator

Log Notes:

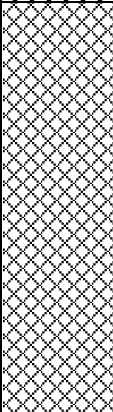
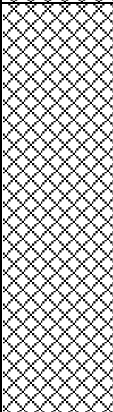
HSV = Hand Shear Vane (kN/m²)

NP = No penetration (HSV/CBR)

B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub



GEO2019-3889: Harras Dyke Farm, Whitehaven – TT205 (Eastern End)

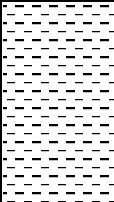
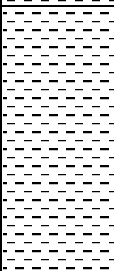
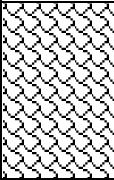
Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.20	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		
0.20	2.10	MADE GROUND: Firm to stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles.		
2.10	4.10	MADE GROUND: Brown sandy clay bound GRAVEL, COBBLES and BOULDERS of siltstone and sandstone. Occasional coal. Clay is generally stiff.		
		Edge of Opencast noted at NGR: XXXX Excavated as Trench (8.00m long). Trial pit was dry and stable on completion. Trial hole backfilled with arisings on completion.		No samples retained.
Site: Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 14/10/2019 Plant: Tracked 360 Excavator			Log Notes: HSV = Hand Shear Vane (kN/m²) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	
				

GEO2019-3889: Harras Dyke Farm, Whitehaven – TP201

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.24	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal and occasional glass.		0.2 - J
0.24	0.90	Stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles.		
0.90	1.40	Stiff dark brown very gravelly CLAY with occasional thin veins of fine to medium sand.		1.3 - T
1.40	1.60	SUSPECTED WEATHERED SANDSTONE BEDROCK. Recovered as dark brown very sandy fine to coarse angular GRAVEL and COBBLES of sandstone.		
		End of trial hole at 1.60m – Engineer Instruction. Trial hole remained open and dry on completion. Trial hole backfilled with arisings on completion.		
Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 15/10/2019 Plant: Tracked 360 Excavator NGR: XXX			Log Notes: HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	

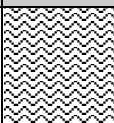
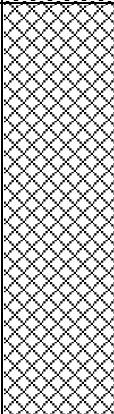
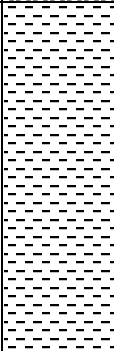


GEO2019-3889: Harras Dyke Farm, Whitehaven – TP202

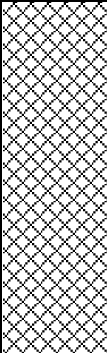
Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.27	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal and occasional glass.		0.1 - J
0.27	0.90	Stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles.		0.7 - T
0.90	1.80	Stiff dark brown very gravelly CLAY with occasional thin veins of fine to medium sand.		
1.80	2.40	SUSPECTED WEATHERED SILTSTONE BEDROCK. Recovered as dark grey brown very silty fine to coarse angular GRAVEL and COBBLES of siltstone.		2.0 - T
		End of trial hole at 2.40m – Engineer Instruction. Trial hole remained open and dry on completion. Trial hole backfilled with arisings on completion.		
Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 15/10/2019 Plant: Tracked 360 Excavator NGR: XXX			Log Notes: HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	



GEO2019-3889: Harras Dyke Farm, Whitehaven – TP203

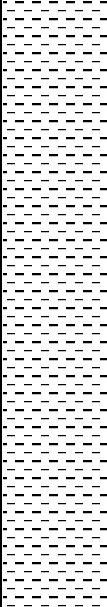
Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.36	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal and occasional glass.		0.2 - J
0.36	1.80	MADE GROUND: Stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles. 0.8 – Field drain at 0.80m bgl. 1.6 – Fragments of brick at 1.60m bgl.		0.8 HSV = >120 1.2 HSV = 80 1.5 - T
1.80	3.00	Very stiff to hard dark brown very gravelly CLAY with occasional cobbles.		
		End of trial hole at 3.00m – Engineer Instruction. Trial hole remained open and dry on completion. Trial hole backfilled with arisings on completion.		
Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 15/10/2019 Plant: Tracked 360 Excavator NGR: XXX			Log Notes: HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	
				

GEO2019-3889: Harras Dyke Farm, Whitehaven – TP204

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.32	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		0.2 - J
0.32	1.50	POSSIBLE MADE GROUND: Stiff to very stiff brown mottled grey slightly sandy very gravelly CLAY with many sub-rounded cobbles (appears reworked). 0.7 – Field drain at 0.70m bgl.		
1.50	1.90	SUSPECTED WEATHERED SANDSTONE BEDROCK. Recovered as dark grey brown very sandy fine to coarse angular GRAVEL and COBBLES of sandstone.		1.7 - T
		End of trial hole at 1.90m – Engineer Instruction. Groundwater ingress from field drain at 0.70m bgl. Trial hole backfilled with arisings on completion.		
Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 15/10/2019 Plant: Tracked 360 Excavator NGR: XXX			Log Notes: HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	



GEO2019-3889: Harras Dyke Farm, Whitehaven – TP205

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.30	TOPSOIL: Dark grey brown very clayey, slightly sandy very gravelly LOAM with occasional small flecks of coal.		0.2 - J
0.30	2.50	Stiff dark brown slightly sandy very gravelly CLAY with many sub-rounded cobbles.		0.9 - T
		End of trial hole at 1.90m – Engineer Instruction. Groundwater ingress from field drain at 0.70m bgl. Trial hole backfilled with arisings on completion.		
Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 15/10/2019 Plant: Tracked 360 Excavator NGR: XXX			Log Notes: HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	



GEO2019-3889: Harras Dyke Farm, Whitehaven – TP206

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.29	TOPSOIL: Dark grey sandy very gravelly LOAM with occasional small flecks of coal.		0.2 - J
0.29	1.12	Stiff light brown mottled grey slightly sandy very gravelly CLAY with many sub-rounded cobbles. 0.8 – Field drain at 0.80m bgl.		1.0 - T
1.12	2.04	Stiff dark brown mottled dark grey very gravelly CLAY with occasional cobbles of sandstone and siltstone.		1.2 HSV = >120
2.04	2.30	SUSPECTED WEATHERED SANDSTONE BEDROCK. Recovered as dark red brown very sandy fine to coarse angular GRAVEL and COBBLES of sandstone.		
		End of trial hole at 1.90m – Engineer Instruction. Trial pit dry and stable on completion. Trial hole backfilled with arisings on completion.		
Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 15/10/2019 Plant: Tracked 360 Excavator NGR: XXX			Log Notes: HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	

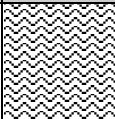
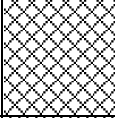
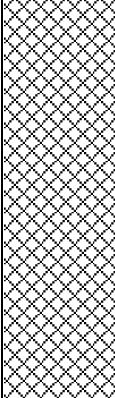


GEO2019-3889: Harras Dyke Farm, Whitehaven – TP207

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.39	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		0.2 - J
0.39	1.50	Stiff brown mottled grey slightly sandy very gravelly CLAY with many sub-rounded cobbles. 0.7 – Field drain at 0.70m bgl.		
1.50	2.20	SUSPECTED WEATHERED SILTSTONE BEDROCK. Recovered as grey brown very sandy fine to coarse angular GRAVEL and COBBLES of siltstone. 2.0 – Dark grey from 2.0m bgl.		1.7 - T
		End of trial hole at 2.20m – Engineer Instruction. Trial pit dry and stable on completion. Trial hole backfilled with arisings on completion.		
Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 15/10/2019 Plant: Tracked 360 Excavator NGR: XXX			Log Notes: HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	



GEO2019-3889: Harras Dyke Farm, Whitehaven – TP207B

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.40	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		
0.40	0.80	MADE GROUND: Firm brown mottled grey slightly sandy very gravelly CLAY with many sub-rounded cobbles.		
0.80	2.20	LOCALISED MADE GROUND: Red brown silty sandy fine to coarse angular GRAVEL and COBBLES of siltstone and sandstone (very loose/soft). Material is very unstable.		
2.20		Pipe (Not recorded on utility plans – trending NE - SW)		
		End of trial hole at 2.20m – Pipe Encountered. Pipe encountered at NGR: XXX (See EHLP). Slight groundwater ingress at c.1.60m bgl. Trial hole backfilled with arisings on completion.		No samples retained.
Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 15/10/2019 Plant: Tracked 360 Excavator NGR: XXX			Log Notes: HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	

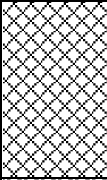
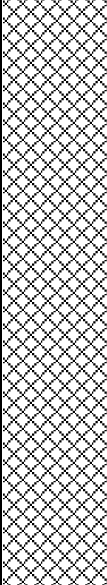


GEO2019-3889: Harras Dyke Farm, Whitehaven – TP208

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.30	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		0.2 - J
0.30	1.20	Firm to stiff brown mottled grey slightly sandy very gravelly CLAY with many sub-rounded cobbles and occasional timber. Many cobbles and boulders at base. 0.7 – Field drain at 0.70m bgl.		
1.20	1.90	SUSPECTED WEATHERED COAL SEAM. Recovered as black silty fine to coarse angular GRAVEL of coal and carbonaceous siltstone.		1.3 – T (coal)
1.90	2.30	SUSPECTED WEATHERED SILTSTONE BEDROCK. Recovered as dark grey brown very sandy fine to coarse angular GRAVEL and COBBLES of siltstone.		
		End of trial hole at 2.20m – Engineer Instruction. Trial pit dry and stable on completion. Trial hole backfilled with arisings on completion.		
Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 15/10/2019 Plant: Tracked 360 Excavator NGR: XXX			Log Notes: HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	



GEO2019-3889: Harras Dyke Farm, Whitehaven – TP209

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.28	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		0.2 - J
0.28	0.90	MADE GROUND: Firm brown mottled grey slightly sandy very gravelly CLAY with many sub-rounded cobbles.		
0.90	3.10	MADE GROUND: Stiff to very stiff dark grey sandy very gravelly CLAY with many angular cobbles and boulders of siltstone and sandstone. Locally clay bound gravel, cobbles and boulders.		1.8 - T
		End of trial hole at 3.10m – Engineer Instruction. Trial pit dry and stable on completion. Trial hole backfilled with arisings on completion.		

Harras Dyke Farm, Whitehaven

Engineer: J.Brock

Site Works Date: 16/10/2019

Plant: Tracked 360 Excavator

NGR: XXX

Log Notes:

HSV = Hand Shear Vane (kN/m²)

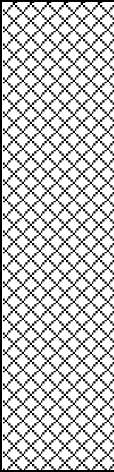
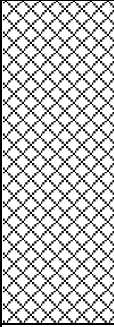
LP = Limited Penetration (HSV/CBR)

NP = No penetration (HSV/CBR)

B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub

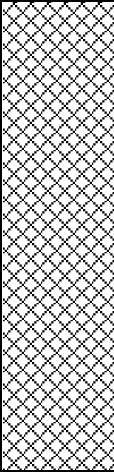
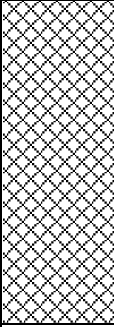


GEO2019-3889: Harras Dyke Farm, Whitehaven – TP210

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.32	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		0.2 - J
0.32	1.90	MADE GROUND: Stiff dark brown slightly sandy very gravelly CLAY with many sub-rounded cobbles of sandstone and siltstone. 1.40 – Fragments of ceramic pipe at c.1.40m bgl.		1.2 - T
1.90	3.00	MADE GROUND: Very stiff to hard dark grey sandy very gravelly CLAY with many angular cobbles and boulders of siltstone and sandstone. Locally clay bound gravel, cobbles and boulders.		
		End of trial hole at 3.10m – Engineer Instruction. Plate Load Test (PLT05) completed at 0.35m bgl. Trial pit dry and stable on completion. Trial hole backfilled with arisings on completion.		
Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 16/10/2019 Plant: Tracked 360 Excavator NGR: XXX			Log Notes: HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	

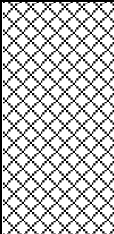
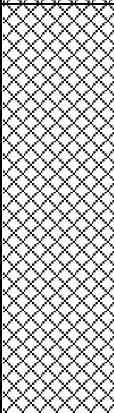


GEO2019-3889: Harras Dyke Farm, Whitehaven – TP210

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.32	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		0.2 - J
0.32	1.90	MADE GROUND: Stiff dark brown slightly sandy very gravelly CLAY with many sub-rounded cobbles of sandstone and siltstone. 1.40 – Fragments of ceramic pipe at c.1.40m bgl.		1.2 - T
1.90	3.00	MADE GROUND: Very stiff to hard dark grey sandy very gravelly CLAY with many angular cobbles and boulders of siltstone and sandstone. Locally clay bound gravel, cobbles and boulders.		
		End of trial hole at 3.10m – Engineer Instruction. Plate Load Test (PLT05) completed at 0.35m bgl. Trial pit dry and stable on completion. Trial hole backfilled with arisings on completion.		
Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 16/10/2019 Plant: Tracked 360 Excavator NGR: XXX			Log Notes: HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	



GEO2019-3889: Harras Dyke Farm, Whitehaven – TP211

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.38	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		0.2 - J
0.38	1.20	MADE GROUND: Stiff brown mottled grey slightly sandy very gravelly CLAY with many sub-rounded cobbles of sandstone and siltstone.		0.9 HSV = 90 0.9 - T
1.20	2.60	MADE GROUND: Very stiff dark grey sandy very gravelly CLAY with many angular cobbles and boulders of siltstone. Locally clay bound gravel, cobbles and boulders.		1.5 HSV = >120 1.5 - T
		End of trial hole at 2.60m – Engineer Instruction. Trial pit dry and stable on completion. Trial hole backfilled with arisings on completion.		

Harras Dyke Farm, Whitehaven

Engineer: J.Brock

Site Works Date: 17/10/2019

Plant: Tracked 360 Excavator

NGR: XXX

Log Notes:

HSV = Hand Shear Vane (kN/m²)

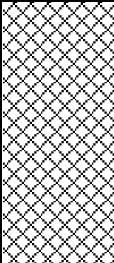
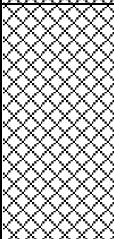
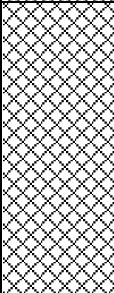
LP = Limited Penetration (HSV/CBR)

NP = No penetration (HSV/CBR)

B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub



GEO2019-3889: Harras Dyke Farm, Whitehaven – TP212

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.30	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		0.2 - J
0.30	1.20	MADE GROUND: Firm brown mottled grey slightly sandy very gravelly CLAY with many sub-rounded cobbles of sandstone and siltstone.		0.9 HSV = 60
1.20	2.00	MADE GROUND: Stiff to very stiff, locally firm dark grey sandy very gravelly CLAY with many angular cobbles and boulders of siltstone. Locally soft clay bound gravel, cobbles and boulders near base.		1.8 - T
2.00	3.00	MADE GROUND: Stiff dark grey sandy very gravelly CLAY with many angular cobbles and boulders of siltstone. Occasionally clay bound gravel, cobbles and boulders.		2.5 - T
		End of trial hole at 3.00m – Engineer Instruction. Slight groundwater ingress at 1.80m bgl. Trial hole backfilled with arisings on completion.		

Harras Dyke Farm, Whitehaven

Engineer: J.Brock

Site Works Date: 17/10/2019

Plant: Tracked 360 Excavator

NGR: XXX

Log Notes:

HSV = Hand Shear Vane (kN/m²)

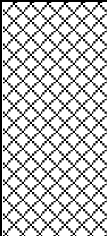
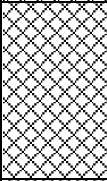
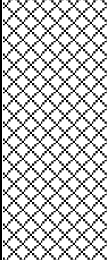
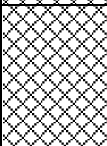
LP = Limited Penetration (HSV/CBR)

NP = No penetration (HSV/CBR)

B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub

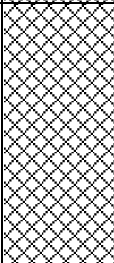
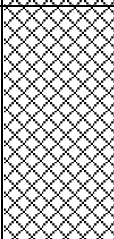
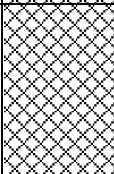


GEO2019-3889: Harras Dyke Farm, Whitehaven – TP213

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.30	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		0.2 - J
0.30	1.10	MADE GROUND: Stiff brown mottled grey slightly sandy very gravelly CLAY with many sub-rounded cobbles of sandstone and siltstone.		0.8 HSV = 80 1.0 HSV = >120 1.0 – T
1.10	1.70	MADE GROUND: Stiff, locally firm to stiff brown mottled grey sandy very gravelly CLAY with many angular cobbles and boulders of siltstone.		1.5 - T
1.70	2.70	MADE GROUND: Fine to medium angular GRAVEL, COBBLES and BOULDERS within a matrix of soft to firm sandy gravelly clay. Poor stability – side walls collapsing.		2.0 - T
2.70	3.30	MADE GROUND: Stiff dark grey sandy very gravelly CLAY with many angular cobbles and boulders of siltstone. Occasionally clay bound gravel, cobbles and boulders.		
		End of trial hole at 3.00m – Engineer Instruction. Slight groundwater ingress at 2.30m bgl. Trial hole backfilled with arisings on completion.		
Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 17/10/2019 Plant: Tracked 360 Excavator NGR: XXX			Log Notes: HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	



GEO2019-3889: Harras Dyke Farm, Whitehaven – TP214

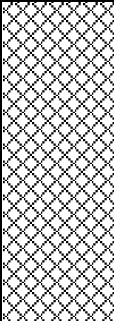
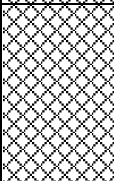
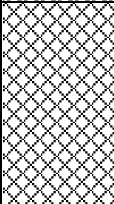
Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.30	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		0.2 - J
0.30	1.20	MADE GROUND: Stiff brown mottled grey slightly sandy very gravelly CLAY with many sub-rounded cobbles of sandstone and siltstone.		1.0 HSV = 110 1.0 - T
1.20	2.00	MADE GROUND: Grey sandy very clayey fine to coarse angular GRAVEL, COBBLES and BOULDERS of siltstone. Poor stability.		1.5 - T
2.00	2.60	MADE GROUND: Stiff dark grey sandy very gravelly CLAY with many angular cobbles and boulders of siltstone. Occasionally clay bound gravel, cobbles and boulders.		
		End of trial hole at 2.60m – Engineer Instruction. Plate Load Test - PLT09 completed at 0.30m bgl. Slight groundwater ingress at 1.50m bgl. Trial hole backfilled with arisings on completion.		
Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 17/10/2019 Plant: Tracked 360 Excavator NGR: XXX			Log Notes: HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	
				

GEO2019-3889: Harras Dyke Farm, Whitehaven – TP215

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.30	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		
0.30	1.00	MADE GROUND: Stiff brown mottled grey slightly sandy very gravelly CLAY with many sub-rounded cobbles of sandstone and siltstone.		0.8 HSV = >120
1.00	2.10	MADE GROUND: Grey sandy very clayey fine to coarse angular GRAVEL, COBBLES and BOULDERS of siltstone (clay bound). Poor stability.		1.5 - T
2.10	3.00	MADE GROUND: Stiff dark grey sandy very gravelly CLAY with many angular cobbles and boulders of siltstone. Occasionally clay bound gravel, cobbles and boulders.		
		End of trial hole at 2.60m – Engineer Instruction. Plate Load Test - PLT06 completed at 0.30m bgl. Slight groundwater ingress at 2.00m bgl. Trial hole backfilled with arisings on completion.		
Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 17/10/2019 Plant: Tracked 360 Excavator NGR: XXX			Log Notes: HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	



GEO2019-3889: Harras Dyke Farm, Whitehaven – TP216

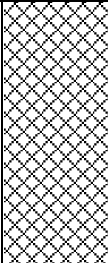
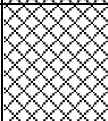
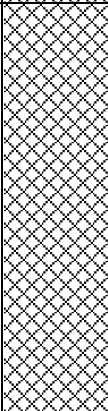
Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.24	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		0.2 - J
0.24	1.30	MADE GROUND: Firm to stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles of sandstone and siltstone. 0.8 – Field drain at c.0.80m bgl.		
1.30	1.90	MADE GROUND: Grey sandy very clayey fine to coarse angular GRAVEL, COBBLES and BOULDERS of siltstone and sandstone (clay bound).		1.8 - T
1.90	2.60	MADE GROUND: Stiff dark grey sandy very gravelly CLAY with many angular cobbles and boulders of siltstone. Occasionally clay bound gravel, cobbles and boulders.		
		End of trial hole at 2.60m – Engineer Instruction. Plate Load Test - PLT07 completed at 0.30m bgl. Slight groundwater ingress from field drain at c.0.80m bgl. Trial hole backfilled with arisings on completion.		

Harras Dyke Farm, Whitehaven
Engineer: J.Brock
Site Works Date: 17/10/2019
Plant: Tracked 360 Excavator
NGR: XXX

Log Notes:
 HSV = Hand Shear Vane (kN/m²)
 LP = Limited Penetration (HSV/CBR)
 NP = No penetration (HSV/CBR)
 B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub



GEO2019-3889: Harras Dyke Farm, Whitehaven – TP217

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.34	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		0.2
0.34	1.20	MADE GROUND: Firm to stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles of sandstone and siltstone. 0.8 – Field drain at c.0.80m bgl.		1.0 - T
1.20	1.60	MADE GROUND: Grey sandy very clayey fine to coarse angular GRAVEL, COBBLES and BOULDERS of siltstone and sandstone (clay bound). Poor Stability.		
1.60	3.00	MADE GROUND: Stiff dark grey sandy very gravelly CLAY with many angular cobbles and boulders of siltstone. Occasionally clay bound gravel, cobbles and boulders.		2.0 - T
		End of trial hole at 3.00m – Engineer Instruction. Plate Load Test - PLT08 completed at 0.30m bgl. Slight groundwater ingress from field drain at c.0.80m bgl. Trial hole backfilled with arisings on completion.		

Harras Dyke Farm, Whitehaven

Engineer: J.Brock

Site Works Date: 17/10/2019

Plant: Tracked 360 Excavator

NGR: XXX

Log Notes:

HSV = Hand Shear Vane (kN/m²)

LP = Limited Penetration (HSV/CBR)

NP = No penetration (HSV/CBR)

B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub



GEO2019-3889: Harras Dyke Farm, Whitehaven – TP301

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.40	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		
0.40	2.00	MADE GROUND: Firm to stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles of sandstone and siltstone.		
2.00	4.90	MADE GROUND: Stiff, locally firm dark grey brown sandy very gravelly CLAY with many angular cobbles and boulders of siltstone. Pockets of very sandy gravel. Cont/d...		
		End of trial hole at 4.90m – Maximum reach. Trial pit remained dry. Trial hole backfilled with arisings on completion.		

Engineer: J.Brock

Site Works Date: 17/04/2020

Plant: Tracked 360 Excavator

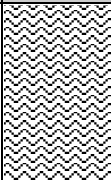
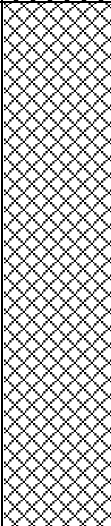
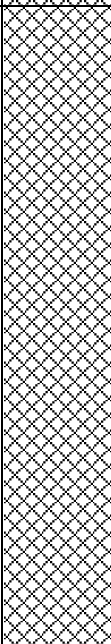
Log Notes:

HSV = Hand Shear Vane (kN/m²)

B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub



GEO2019-3889: Harras Dyke Farm, Whitehaven – TP302

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.56	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		
0.56	2.40	MADE GROUND: Soft to firm, locally soft brown slightly sandy very gravelly CLAY with many sub-rounded cobbles of sandstone and siltstone. Occasional pockets of organic rich material.		
2.40	4.60	MADE GROUND: Stiff, locally firm dark grey brown sandy very gravelly CLAY with many angular cobbles and boulders of siltstone. Pockets of very sandy gravel.		
		End of trial hole at 4.60m – Maximum reach. Trial pit remained dry. Trial hole backfilled with arisings on completion.		
Engineer: J.Brock Site Works Date: 17/04/2020 Plant: Tracked 360 Excavator			Log Notes: HSV = Hand Shear Vane (kN/m ²) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	
No Photo				

GEO2019-3889: Harras Dyke Farm, Whitehaven – TP303 (Eastern End of Pit)

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.45	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		
0.45	1.60	POSSIBLE MADE GROUND (CAPPING MATERIAL): Stiff dark brown slightly sandy very gravelly CLAY with many sub-rounded cobbles. Plastic Field Drain encountered at c.1.20m bgl. Ceramic Field Drain encountered at c.1.60m bgl.		
1.60	3.55	SUSPECTED WEATHERED SILTSTONE: Recovered as grey sandy silty GRAVEL of weak siltstone. Becoming orangey brown with depth. 3.0m bgl - Becoming grey and very shaley.		
3.55	~	SUSPECTED SOLID BEDROCK. Unable to excavate.		

Engineer: J.Brock

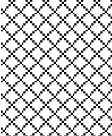
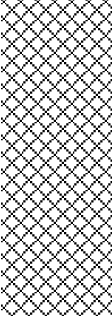
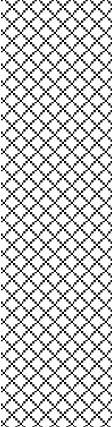
Site Works Date: 17/04/2020

Log Notes:

B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub



GEO2019-3889: Harras Dyke Farm, Whitehaven – TP303 (Western End of Pit)

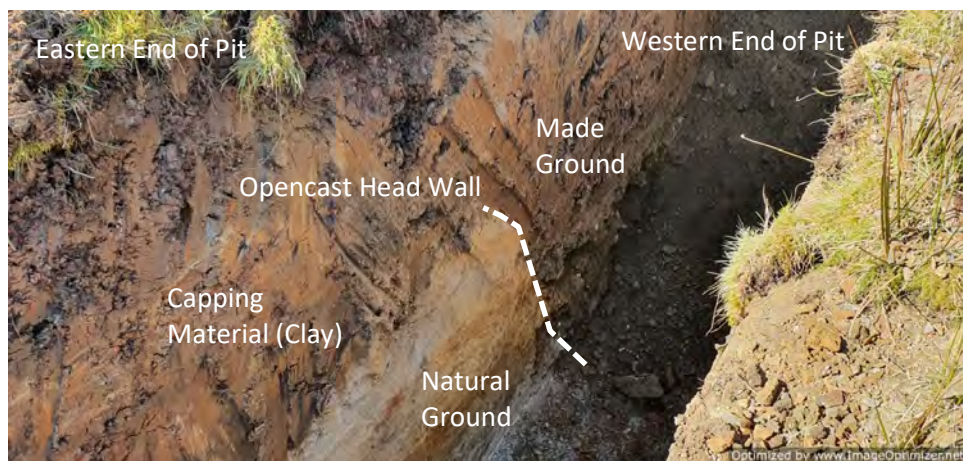
Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.40	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		
0.40	0.90	MADE GROUND: Firm dark grey brown sandy gravelly CLAY with much brick, coal and siltstone.		
0.90	2.00	MADE GROUND: Firm to stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles of sandstone and siltstone.		
2.00	4.70	MADE GROUND: Stiff dark grey brown sandy very gravelly CLAY with many angular cobbles and boulders of siltstone. Pockets of very sandy gravel.		
		Cont/d...		
		End of trial hole at 4.70m – Maximum reach. Trial pit remained dry.		

Engineer: J.Brock

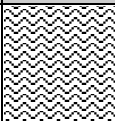
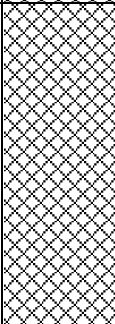
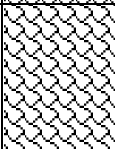
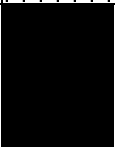
Site Works Date: 17/04/2020

Log Notes:

B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub

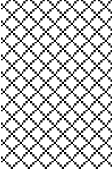
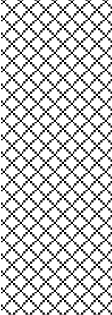
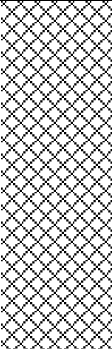


GEO2019-3889: Harras Dyke Farm, Whitehaven – TP304 (Southern End of Pit)

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.40	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		
0.40	1.60	POSSIBLE MADE GROUND (CAPPING MATERIAL): Stiff dark brown slightly sandy very gravelly CLAY with many sub-rounded cobbles.		
1.60	2.00	SUSPECTED WEATHERED SILTSTONE: Recovered as grey sandy silty GRAVEL of weak siltstone.		
2.00	2.40	SUSPECTED WEATHERED COAL SEAM. Recovered as dark grey to black silty fine to coarse angular GRAVEL of coal and carbonaceous siltstone.		
Engineer: J.Brock Site Works Date: 17/04/2020			Log Notes: B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	



GEO2019-3889: Harras Dyke Farm, Whitehaven – TP304 (Northern End of Pit)

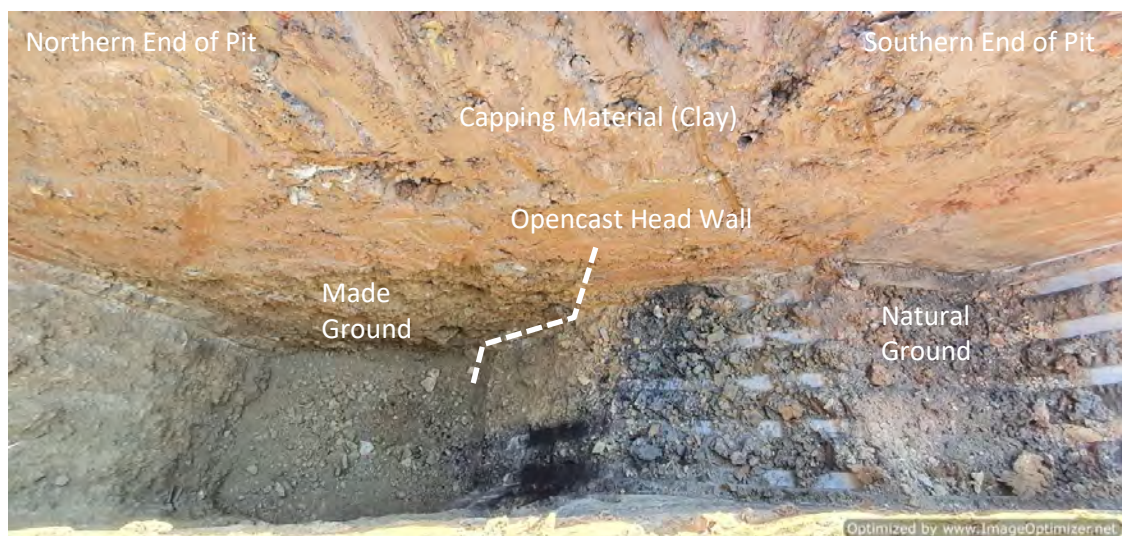
Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.30	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		
0.30	0.90	MADE GROUND: Firm dark grey brown sandy gravelly CLAY with occasional brick, coal and siltstone.		
0.90	2.00	MADE GROUND: Firm to stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles of sandstone and siltstone.		
2.00	4.00	MADE GROUND: Stiff dark grey brown sandy very gravelly CLAY with many angular cobbles and boulders of siltstone. Pockets of very sandy gravel.		
		Cont/d...		
		End of trial hole at 4.00m. Trial pit remained dry.		

Engineer: J.Brock

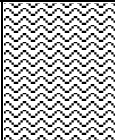
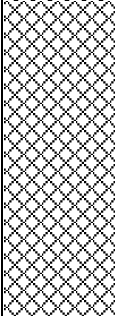
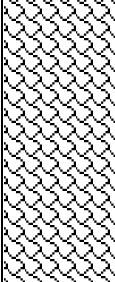
Site Works Date: 17/04/2020

Log Notes:

B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub



GEO2019-3889: Harras Dyke Farm, Whitehaven – TP305 (South-Eastern End of Pit)

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.46	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		
0.46	1.60	POSSIBLE MADE GROUND (CAPPING MATERIAL): Stiff dark brown slightly sandy very gravelly CLAY with many sub-rounded cobbles.		
1.60	2.60	SUSPECTED WEATHERED SILTSTONE: Recovered as grey sandy silty GRAVEL of weak siltstone.		
2.60	2.90	SUSPECTED WEATHERED COAL SEAM. Recovered as dark grey to black silty fine to coarse angular GRAVEL of coal and carbonaceous siltstone.		
2.90	3.10	SUSPECTED WEATHERED SILTSTONE: Recovered as grey sandy silty GRAVEL of weak siltstone.		
Engineer: J.Brock Site Works Date: 17/04/2020			Log Notes: B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	



GEO2019-3889: Harras Dyke Farm, Whitehaven – TP305 (North-Western End of Pit)

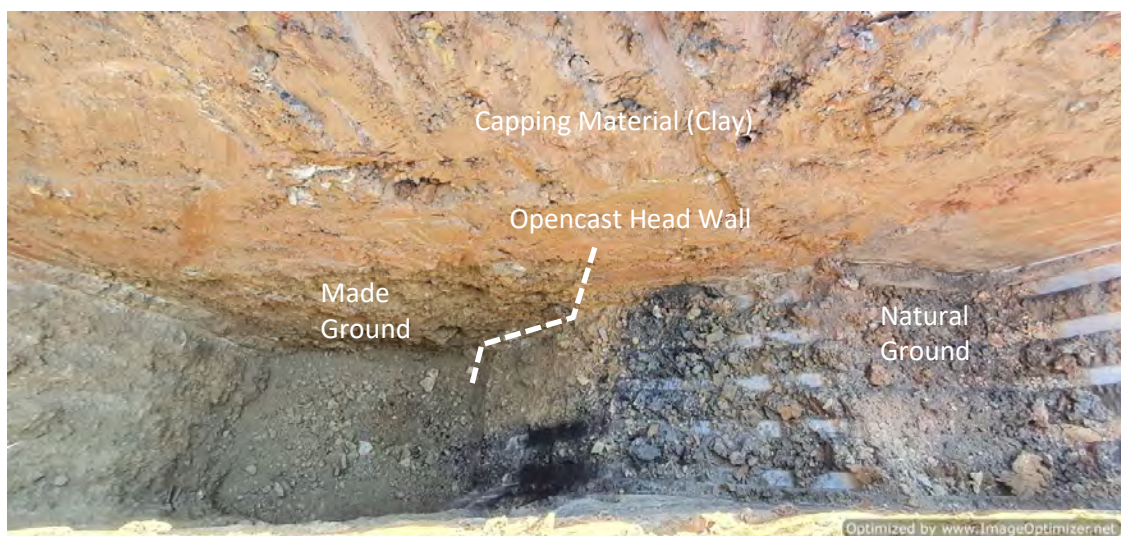
Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.30	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		
0.30	0.80	MADE GROUND: Firm dark grey brown sandy gravelly CLAY with occasional brick, coal and siltstone.		
0.80	2.40	MADE GROUND: Firm to stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles of sandstone and siltstone.		
2.40	3.20	MADE GROUND: Stiff dark grey brown sandy very gravelly CLAY with many angular cobbles and boulders of siltstone. Pockets of very sandy gravel.		
		Cont/d...		
		End of trial hole at 3.20m. Trial pit remained dry.		

Engineer: J.Brock

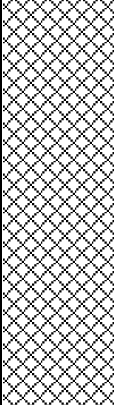
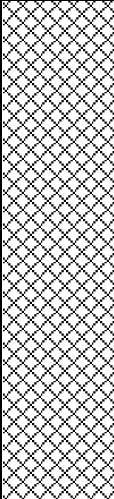
Site Works Date: 17/04/2020

Log Notes:

B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub



GEO2019-3889: Harras Dyke Farm, Whitehaven – TP306

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.40	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		
0.40	1.80	MADE GROUND: Stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles of sandstone and siltstone.		
1.80	3.50	MADE GROUND: Stiff dark grey sandy very gravelly CLAY with many angular cobbles and boulders of siltstone. Pockets of very sandy gravel and cobbles.		
		End of trial hole at 3.50m. Trial pit remained dry.		

Engineer: J.Brock

Site Works Date: 17/04/2020

Plant: Tracked 360 Excavator

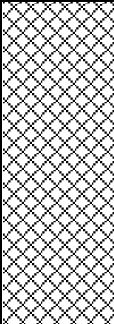
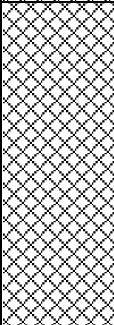
Log Notes:

HSV = Hand Shear Vane (kN/m²)

B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub



GEO2019-3889: Harras Dyke Farm, Whitehaven – TP307

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.37	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		
0.37	1.50	MADE GROUND: Stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles of sandstone and siltstone.		
1.50	2.50	MADE GROUND: Stiff dark grey sandy very gravelly CLAY with many angular cobbles and boulders of siltstone. Pockets of very sandy gravel and cobbles.		
		End of trial hole at 2.50m. Trial pit remained dry.		

Engineer: J.Brock

Site Works Date: 17/04/2020

Plant: Tracked 360 Excavator

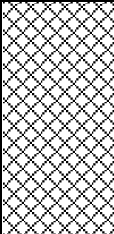
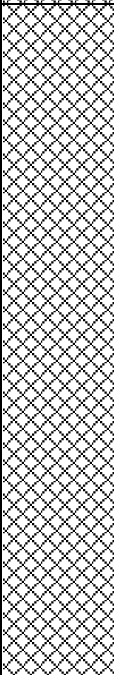
Log Notes:

HSV = Hand Shear Vane (kN/m²)

B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub



GEO2019-3889: Harras Dyke Farm, Whitehaven – TP308

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.37	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		
0.37	1.20	MADE GROUND: Stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles of sandstone and siltstone.		
1.20	3.50	MADE GROUND: Stiff dark grey sandy very gravelly CLAY with many angular cobbles and boulders of siltstone. Pockets of very sandy gravel and cobbles.		
		End of trial hole at 2.50m. Trial pit remained dry.		

Engineer: J.Brock

Site Works Date: 17/04/2020

Plant: Tracked 360 Excavator

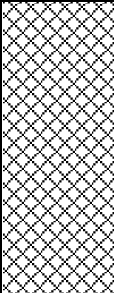
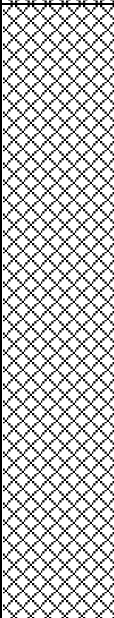
Log Notes:

HSV = Hand Shear Vane (kN/m²)

B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub



GEO2019-3889: Harras Dyke Farm, Whitehaven – TP309

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.30	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		
0.30	1.30	MADE GROUND: Stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles of sandstone and siltstone.		
1.30	3.50	MADE GROUND: Stiff dark grey sandy very gravelly CLAY with many angular cobbles and boulders of siltstone. Pockets of very sandy gravel and cobbles.		
		End of trial hole at 3.50m. Trial pit remained dry.		

Engineer: J.Brock

Site Works Date: 17/04/2020

Plant: Tracked 360 Excavator

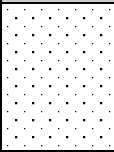
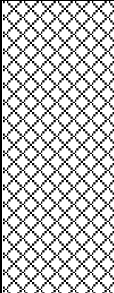
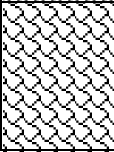
Log Notes:

HSV = Hand Shear Vane (kN/m²)

B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub

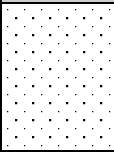
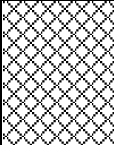


GEO2019-3889: Harras Dyke Farm, Whitehaven – TP310

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.50	CONCRETE (Edge of Mine Shaft cap).		
0.50	1.50	POSSIBLE MADE GROUND (CAPPING MATERIAL): Stiff dark brown slightly sandy very gravelly CLAY with many sub-rounded cobbles.		
1.50	2.00	SUSPECTED WEATHERED SILTSTONE: Recovered as grey sandy silty GRAVEL of weak siltstone.		
Engineer: J.Brock Site Works Date: 17/04/2020			Log Notes: B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	



GEO2019-3889: Harras Dyke Farm, Whitehaven – TP311

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.50	CONCRETE (Edge of Mine Shaft cap).		
0.50	1.00	POSSIBLE MADE GROUND (CAPPING MATERIAL): Stiff dark brown slightly sandy very gravelly CLAY with many sub-rounded cobbles.		

Engineer: J.Brock

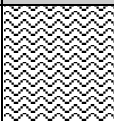
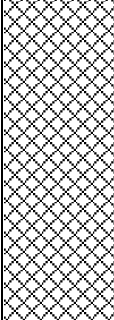
Site Works Date: 17/04/2020

Log Notes:

B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub

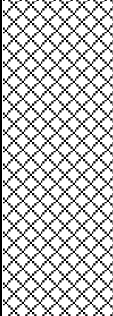


GEO2019-3889: Harras Dyke Farm, Whitehaven – TP218

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.36	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		
0.36	1.45	MADE GROUND: Firm to stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles of sandstone and siltstone.		
		End of trial hole at 1.45m – Engineer Instruction. Soil Infiltration test completed at c.1.45m bgl – See table below. Trial pit dry and stable on completion. Trial hole backfilled with arisings on completion.		
Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 18/10/2019 Plant: Tracked 360 Excavator NGR: XXX		Log Notes: HSV = Hand Shear Vane (kN/m²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub		
No Photo				

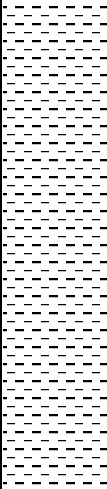
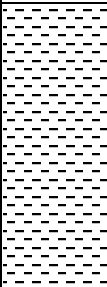
Soil Infiltration Test	
Trial Pit Dimensions – 1.80m long, 0.70m wide	
Duration (mins)	Water Level (m bgl)
0	0.65
30	0.66
75	0.66
155	0.66
200	0.66
320	0.66
420	0.66

GEO2019-3889: Harras Dyke Farm, Whitehaven – TP219

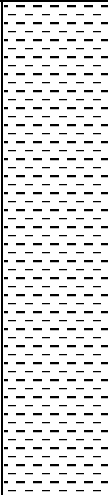
Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.36	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		
0.36	1.45	MADE GROUND: Firm to stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles of sandstone and siltstone.		
1.45	1.55	MADE GROUND: Very stiff to hard dark brown very gravelly CLAY with occasional cobbles.		
		End of trial hole at 1.55m – Engineer Instruction. Soil Infiltration test completed at c.1.55m bgl – See table below. Trial pit dry and stable on completion. Trial hole backfilled with arisings on completion.		
Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 18/10/2019 Plant: Tracked 360 Excavator NGR: XXX			Log Notes: HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	
No Photo				

Soil Infiltration Test	
Trial Pit Dimensions – 1.90m long, 0.70m wide	
Duration (mins)	Water Level (m bgl)
0	1.06
25	1.06
120	1.06
175	1.06
220	1.06
350	1.06
380	1.06

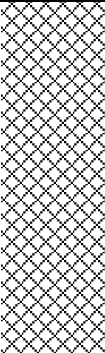
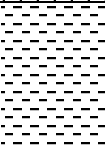
GEO2019-3889: Harras Dyke Farm, Whitehaven – BH201

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.32	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		0.2 - J
0.32	1.90	Stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles.		1.0 SPT = N8
1.90	3.00	Very stiff dark grey brown very gravelly CLAY with many sub-rounded cobbles. Occasional sandstone boulders.		2.0 SPT = N25 3.0 SPT = N>50
		End of borehole at 3.00m due to sample tube and SPT refusal. Borehole remained open and dry on completion. Borehole installed: GL to 1m - plain pipe and bentonite seal 1m to 3m - slotted pipe and gravel filter		Hand dug to 1.00m
Site: Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 15/10/2019 Plant: Archway Competitor C130 Superheavy			Log Notes: SPT = Standard Penetration test (N value) HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	

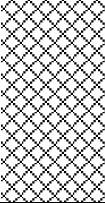
GEO2019-3889: Harras Dyke Farm, Whitehaven – BH202

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.30	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		0.2 - J
0.30	2.00	Stiff dark red brown very sandy gravelly CLAY with lenses of silty very sandy fine to coarse angular gravel of sandstone.		1.0 SPT = N20 2.0 SPT = N>50
		End of borehole at 2.00m due to sample tube and SPT refusal. Borehole remained open and dry on completion. Borehole installed: GL to 1m - plain pipe and bentonite seal 1m to 1.85m - slotted pipe and gravel filter		Hand dug to 1.00m
Site: Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 15/10/2019 Plant: Archway Competitor C130 Superheavy			Log Notes: SPT = Standard Penetration test (N value) HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	

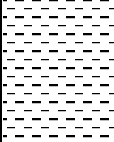
GEO2019-3889: Harras Dyke Farm, Whitehaven – BH203

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.30	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		0.2 - J
0.30	1.50	MADE GROUND: Stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles. Fragments of brick at c.1.20m bgl.		1.0 SPT = N10
1.50	2.00	Stiff to very stiff dark grey brown very gravelly CLAY with many sub-rounded cobbles. Occasional sandstone boulders.		2.0 SPT = N>50
		End of borehole at 2.00m due to sample tube and SPT refusal. Borehole remained open and dry on completion. Borehole installed: GL to 1m - plain pipe and bentonite seal 1m to 1.80m - slotted pipe and gravel filter		Hand dug to 1.00m
		Site: Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 15/10/2019 Plant: Archway Competitor C130 Superheavy	Log Notes: SPT = Standard Penetration test (N value) HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	

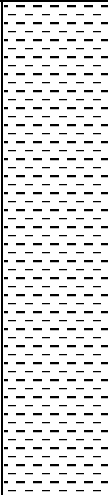
GEO2019-3889: Harras Dyke Farm, Whitehaven – BH204

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.32	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		0.2 - J
0.32	1.00	POSSIBLE MADE GROUND: Stiff dark brown slightly sandy very gravelly CLAY with many sub-rounded cobbles.		1.0 SPT = N>50
		End of borehole at 1.00m due to sample tube and SPT refusal. Borehole remained open and dry on completion. Borehole installed: GL to 0.5m - plain pipe and bentonite seal 0.5m to 1.2m - slotted pipe and gravel filter		Hand dug to 1.00m
Site: Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 15/10/2019 Plant: Archway Competitor C130 Superheavy			Log Notes: SPT = Standard Penetration test (N value) HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	

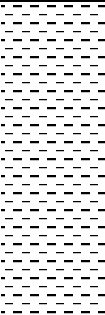
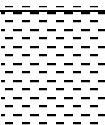
GEO2019-3889: Harras Dyke Farm, Whitehaven – BH205

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.30	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		0.2 - J
0.30	0.80	Stiff dark red brown very sandy very gravelly CLAY with many sub-rounded cobbles.		
0.80		Suspected sandstone bedrock		
		End of borehole at 0.80m due to sample tube and SPT refusal. Borehole remained open and dry on completion. Borehole installed: GL to 0.5m - plain pipe and bentonite seal 0.5m to 0.8m - slotted pipe and gravel filter		Hand dug to 0.80m
Site: Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 15/10/2019 Plant: Archway Competitor C130 Superheavy			Log Notes: SPT = Standard Penetration test (N value) HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	

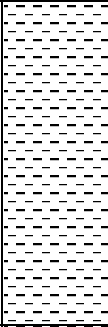
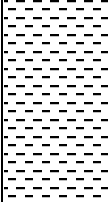
GEO2019-3889: Harras Dyke Farm, Whitehaven – BH206

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.32	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		0.2 - J
0.32	2.00	Stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles.		1.0 SPT = N16 2.0 SPT = N>50
		End of borehole at 2.00m due to sample tube and SPT refusal. Borehole remained open and dry on completion. Borehole installed: GL to 1m - plain pipe and bentonite seal 1m to 2m - slotted pipe and gravel filter		Hand dug to 1.00m
Site: Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 16/10/2019 Plant: Archway Competitor C130 Superheavy			Log Notes: SPT = Standard Penetration test (N value) HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	

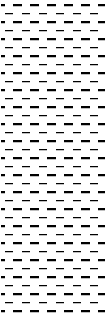
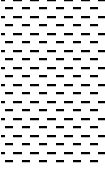
GEO2019-3889: Harras Dyke Farm, Whitehaven – BH207

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.28	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		0.2 - J
0.28	1.40	Stiff to very stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles.		1.0 SPT = N35
1.40	1.80	Stiff dark grey brown very gravelly CLAY with many sub-rounded cobbles of sandstone.		1.80 SPT = N>50
		End of borehole at 1.80m due to sample tube and SPT refusal. Borehole remained open and dry on completion. Borehole installed: GL to 1m - plain pipe and bentonite seal 1m to 1.8m - slotted pipe and gravel filter		Hand dug to 1.00m
Site: Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 16/10/2019 Plant: Archway Competitor C130 Superheavy			Log Notes: SPT = Standard Penetration test (N value) HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	

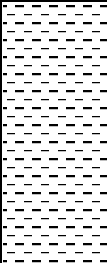
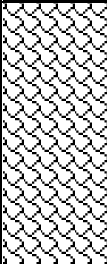
GEO2019-3889: Harras Dyke Farm, Whitehaven – BH208

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.32	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		0.2 - J
0.32	1.20	Stiff to very stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles.		1.0 SPT = N30
1.20	1.85	Stiff dark grey brown very gravelly CLAY with many sub-rounded cobbles of sandstone.		1.60 SPT = N>50
		End of borehole at 1.85m due to sample tube and SPT refusal. Borehole remained open and dry on completion. Borehole installed: GL to 1m - plain pipe and bentonite seal 1m to 1.85m - slotted pipe and gravel filter		Hand dug to 1.00m
Site: Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 16/10/2019 Plant: Archway Competitor C130 Superheavy			Log Notes: SPT = Standard Penetration test (N value) HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	

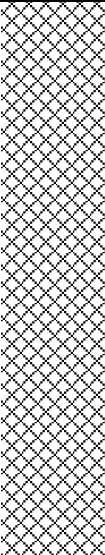
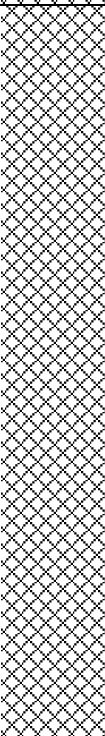
GEO2019-3889: Harras Dyke Farm, Whitehaven – BH209

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.43	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		0.2 - J
0.43	1.20	Firm dark grey brown slightly sandy very gravelly CLAY with many sub-rounded cobbles.		1.0 SPT = N18
1.20	1.80	Stiff dark grey brown very gravelly CLAY with many sub-rounded cobbles of sandstone.		1.80 SPT = N>50
1.80	2.00	SUSPECTED WEATHERED SANDSTONE BEDROCK: Recovered as dark grey brown silty sandy angular GRAVEL of weak sandstone.		
		End of borehole at 2.00m due to sample tube and SPT refusal. Borehole remained open and dry on completion. Borehole installed: GL to 1m - plain pipe and bentonite seal 1m to 2m - slotted pipe and gravel filter		Hand dug to 1.00m
Site: Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 16/10/2019 Plant: Archway Competitor C130 Superheavy			Log Notes: SPT = Standard Penetration test (N value) HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	

GEO2019-3889: Harras Dyke Farm, Whitehaven – BH210

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.34	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		0.2 - J
0.34	1.20	Firm dark grey brown slightly sandy very gravelly CLAY with many sub-rounded cobbles.		1.0 SPT = N11
1.20	1.90	SUSPECTED WEATHERED COAL SEAM. Recovered as black silty fine to coarse angular GRAVEL of coal and carbonaceous siltstone.		
1.90	2.80	SUSPECTED WEATHERED SILTSTONE BEDROCK. Recovered as dark grey brown very sandy fine to coarse angular GRAVEL and COBBLES of weak siltstone.		2.0 SPT = N16 2.8 SPT = N>50
		End of borehole at 2.00m due to sample tube and SPT refusal. Borehole remained open and dry on completion. Borehole installed: GL to 1m - plain pipe and bentonite seal 1m to 2m - slotted pipe and gravel filter		Hand dug to 1.00m
Site: Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 16/10/2019 Plant: Archway Competitor C130 Superheavy			Log Notes: SPT = Standard Penetration test (N value) HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	

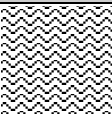
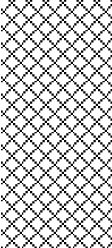
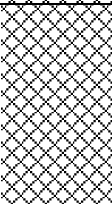
GEO2019-3889: Harras Dyke Farm, Whitehaven – BH211

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.30	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		0.2 - J
0.30	2.00	MADE GROUND: Firm dark grey brown slightly sandy very gravelly CLAY with many sub-rounded cobbles.		1.0 SPT = N18 2.0 SPT = N>50
2.30	5.00	MADE GROUND: Stiff, locally firm dark grey brown very gravelly CLAY with many sub-rounded cobbles.		3.0 SPT = N37 4.0 SPT = N17 5.0 SPT = N8
		End of borehole at 5.00m. Borehole remained open and dry on completion. Borehole installed: GL to 1m - plain pipe and bentonite seal 1m to 4m - slotted pipe and gravel filter		Hand dug to 1.00m
Site: Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 17/10/2019 Plant: Archway Competitor C130 Superheavy			Log Notes: SPT = Standard Penetration test (N value) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	

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Environmental Engineering

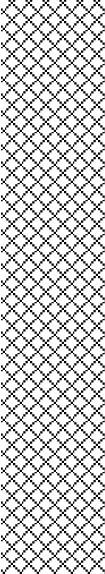
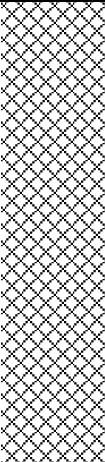
GEO2019-3889: Harras Dyke Farm, Whitehaven – BH213

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.40	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		0.2 - J
0.40	1.30	MADE GROUND: Stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles.		1.0 SPT = N16
1.30	2.00	Stiff, locally firm dark grey brown very gravelly CLAY with many sub-rounded cobbles.		2.0 SPT = N>50
		End of borehole at 2.00m due to sample tube and SPT refusal. Borehole remained open and dry on completion. Borehole installed: GL to 1m - plain pipe and bentonite seal 1m to 1.8m - slotted pipe and gravel filter		Hand dug to 1.00m
Site: Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 17/10/2019 Plant: Archway Competitor C130 Superheavy			Log Notes: SPT = Standard Penetration test (N value) HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	

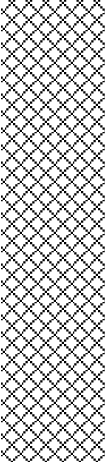
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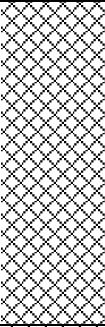
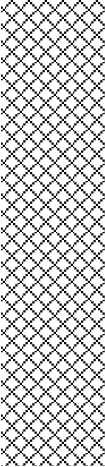
GEO2019-3889: Harras Dyke Farm, Whitehaven – BH215

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.38	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		0.2 - J
0.38	2.40	MADE GROUND: Stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles.		1.0 SPT = N17 2.0 SPT = N18
2.40	4.00	Stiff, locally firm dark grey brown very gravelly CLAY with many sub-rounded cobbles.		3.0 SPT = N18 4.0 SPT = N16
		End of borehole at 4.00m. Arisings damp between c.1.40m and c.1.90m bgl. Borehole installed: GL to 1m - plain pipe and bentonite seal 1m to 3.5m - slotted pipe and gravel filter		Hand dug to 1.00m
Site: Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 17/10/2019 Plant: Archway Competitor C130 Superheavy			Log Notes: SPT = Standard Penetration test (N value) HSV = Hand Shear Vane (kN/m2) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	

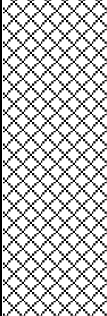
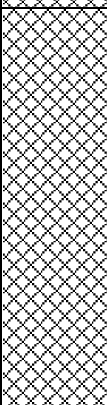
GEO2019-3889: Harras Dyke Farm, Whitehaven – BH216

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.37	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		0.2 - J
0.37	2.00	MADE GROUND: Firm to stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles.		1.0 SPT = N22 2.0 SPT = N>50
		End of borehole at 2.00m due to sample tube and SPT refusal. Borehole remained open and dry on completion. Borehole installed: GL to 1m - plain pipe and bentonite seal 1m to 1.8m - slotted pipe and gravel filter		Hand dug to 1.00m
Site: Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 17/10/2019 Plant: Archway Competitor C130 Superheavy			Log Notes: SPT = Standard Penetration test (N value) HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	

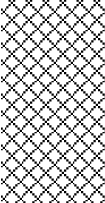
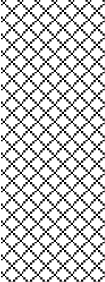
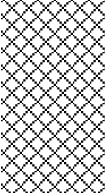
GEO2019-3889: Harras Dyke Farm, Whitehaven – BH217

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.32	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		0.2 - J
0.32	1.40	MADE GROUND: Stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles.		1.0 SPT = N8
1.40	3.00	Stiff, locally firm dark grey brown very gravelly CLAY with many sub-rounded cobbles.		2.0 SPT = N18 3.00 SPT N>50
		End of borehole at 3.00m due to sample tube and SPT refusal.. Borehole remained open and dry on completion. Borehole installed: GL to 1m - plain pipe and bentonite seal 1m to 1.80m - slotted pipe and gravel filter		Hand dug to 1.00m
Site: Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 17/10/2019 Plant: Archway Competitor C130 Superheavy		Log Notes: SPT = Standard Penetration test (N value) HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub		

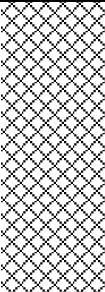
GEO2019-3889: Harras Dyke Farm, Whitehaven – BH218

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.32	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		0.2 - J
0.32	1.40	MADE GROUND: Stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles.		1.0 SPT = N9
1.40	2.80	Stiff, locally firm dark grey brown very gravelly CLAY with many sub-rounded cobbles.		2.0 SPT = N42 2.8 SPT N>50
		End of borehole at 2.80m due to sample tube and SPT refusal. Borehole remained open and dry on completion. Borehole installed: GL to 1m - plain pipe and bentonite seal 1m to 2.2m - slotted pipe and gravel filter		Hand dug to 1.00m
Site: Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 18/10/2019 Plant: Archway Competitor C130 Superheavy			Log Notes: SPT = Standard Penetration test (N value) HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	

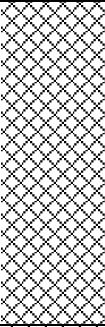
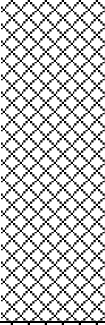
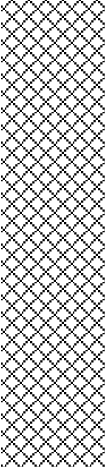
GEO2019-3889: Harras Dyke Farm, Whitehaven – BH219

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.38	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		0.2 - J
0.38	1.10	MADE GROUND: Stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles.		1.0 SPT = N19
1.10	2.10	Stiff, locally firm dark grey brown very gravelly CLAY with many sub-rounded cobbles.		2.0 SPT = N5
2.10	2.80	Soft to firm dark grey silty sandy very gravelly CLAY.		
2.80	3.00	Stiff, locally firm dark grey brown very gravelly CLAY with many sub-rounded cobbles.		3.0 SPT = N>50
		End of borehole at 3.00m due to sample tube and SPT refusal. Borehole remained open and dry on completion. Borehole installed: GL to 1m - plain pipe and bentonite seal 1m to 3m - slotted pipe and gravel filter		Hand dug to 1.00m
Site: Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 17/10/2019 Plant: Archway Competitor C130 Superheavy			Log Notes: SPT = Standard Penetration test (N value) HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	

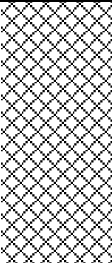
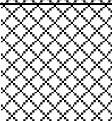
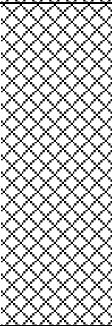
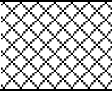
GEO2019-3889: Harras Dyke Farm, Whitehaven – BH220

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.32	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		0.2 - J
0.32	1.30	MADE GROUND: Stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles.		1.0 SPT = N18
1.30	1.50	Stiff, locally firm dark grey brown very gravelly CLAY with many sub-rounded cobbles.		1.5 SPT = N>50
		End of borehole at 1.50m due to sample tube and SPT refusal. Borehole remained open and dry on completion. Borehole installed: GL to 1m - plain pipe and bentonite seal 1m to 1.5m - slotted pipe and gravel filter		Hand dug to 1.00m
Site: Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 17/10/2019 Plant: Archway Competitor C130 Superheavy			Log Notes: SPT = Standard Penetration test (N value) HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	

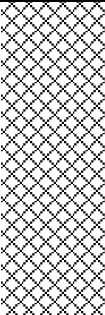
GEO2019-3889: Harras Dyke Farm, Whitehaven – BH221

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.29	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		0.2 - J
0.29	1.30	MADE GROUND: Stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles.		1.0 SPT = N22
1.30	2.40	Grey brown clay bound GRAVEL, COBBLES and BOULDERS of siltstone. Clay is firm.		2.0 SPT = N4
2.40	4.00	Stiff, locally firm dark grey brown very gravelly CLAY with many sub-rounded cobbles.		3.0 SPT = N7 4.0 SPT = N35
		End of borehole at 4.00m. Borehole remained open and dry on completion. Borehole installed: GL to 1m - plain pipe and bentonite seal 1m to 3.8m - slotted pipe and gravel filter		Hand dug to 1.00m
Site: Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 17/10/2019 Plant: Archway Competitor C130 Superheavy			Log Notes: SPT = Standard Penetration test (N value) HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	

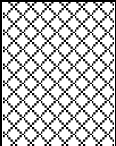
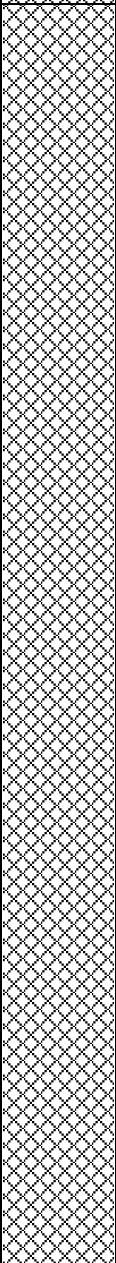
GEO2019-3889: Harras Dyke Farm, Whitehaven – BH222

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.32	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		0.2 - J
0.32	1.20	MADE GROUND: Stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles.		1.0 SPT = N12
1.20	1.60	Grey brown clay bound GRAVEL, COBBLES and BOULDERS of siltstone. Clay is soft to firm.		
1.60	2.70	MADE GROUND: Firm brown sandy very gravelly CLAY.		2.0 SPT = N7
2.70	3.00	Stiff, locally firm dark grey brown very gravelly CLAY with many sub-rounded cobbles.		3.0 SPT = N>50
		End of borehole at 3.00m due to sample tube and SPT refusal. Borehole remained open and dry on completion. Borehole installed: GL to 1m - plain pipe and bentonite seal 1m to 2.5m - slotted pipe and gravel filter		Hand dug to 1.00m
Site: Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 17/10/2019 Plant: Archway Competitor C130 Superheavy			Log Notes: SPT = Standard Penetration test (N value) HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	

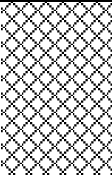
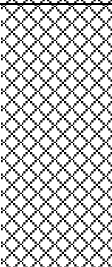
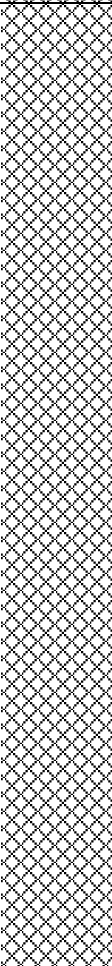
GEO2019-3889: Harras Dyke Farm, Whitehaven – BH223

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.32	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		0.2 - J
0.32	1.50	MADE GROUND: Stiff brown slightly sandy very gravelly CLAY with many sub-rounded cobbles.		1.0 SPT = N>50
		End of borehole at 1.30m due to sample tube and SPT refusal. Borehole remained open and dry on completion. Borehole installed: GL to 1m - plain pipe and bentonite seal 1m to 1.5m - slotted pipe and gravel filter		Hand dug to 1.00m
Site: Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 18/10/2019 Plant: Archway Competitor C130 Superheavy		Log Notes: SPT = Standard Penetration test (N value) HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub		

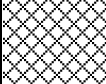
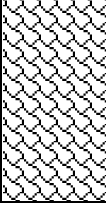
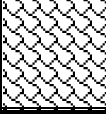
GEO2019-3889: Harras Dyke Farm, Whitehaven – CP201

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.40	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		
0.40	1.40	MADE GROUND: Firm dark grey brown slightly sandy very gravelly CLAY with many sub-rounded cobbles.		1.0 - D
1.40	10.00	MADE GROUND: Stiff to very stiff reworked dark grey very gravelly CLAY with mang cobbles and boulders of siltstone and sandstone. Gravel is fine to coarse sub-angular to angular siltstone. Occasional cobbles/boulders.		1.5 SPT = N24 2.0 – D 3.0 – D 3.0 SPT = N14 4.0 – D 4.5 SPT = N19 5.0 – D/B 6.0 – D 6.0 SPT = N20 7.0 – D 7.5 SPT = N23 8.0 – D 9.0 – D/B 9.0 SPT = N17 10.0 – D 10 SPT = N19
		Borehole remained dry on completion. Borehole installed: backfilled with arisings		Hand dug to 1.00m
Engineer: J. Brock Site Works Date: 18.10.2019 Plant: Dando 2000 Cable Percussive Drill Rig			Log Notes: SPT = Standard Penetration test (N value) – samples recovered B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	

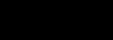
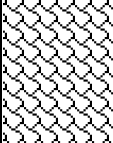
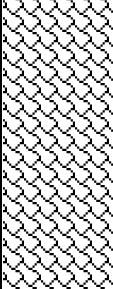
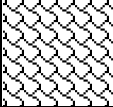
GEO2019-3889: Harras Dyke Farm, Whitehaven – CP202

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.30	TOPSOIL: Dark grey brown clayey sandy very gravelly LOAM with occasional small flecks of coal.		
0.30	1.70	MADE GROUND: Firm dark grey brown slightly sandy very gravelly CLAY with many sub-rounded cobbles of siltstone. Occasional brick fragments.		1.0 – D 1.5 SPT = N18
1.70	3.50	MADE GROUND: Stiff to very stiff reworked dark grey, occasionally mottled dark grey brown, very gravelly CLAY with many cobbles and boulders of siltstone. Gravel is fine to coarse sub-angular to angular siltstone. Many cobbles/boulders of siltstone. 2.00 to 2.50m – Chiselling (30 mins)		2.0 – D 3.0 – D/B 3.0 SPT = N27
3.50	10.00	MADE GROUND: Clay bound GRAVEL, COBBLES and BOULDERS. Clay is stiff to very stiff dark grey, occasionally mottled dark grey brown and very gravelly. 5.50 – 6.00 – Chiselling (30 mins)		4.0 – D 4.5 SPT = N21 5.0 – D 6.0 – D/B 6.0 SPT = N29 7.0 – D 7.5 SPT = N21 8.0 – D 9.0 – D/B 9.0 SPT = N23 10.0 – D 10 SPT = N>50
		Borehole remained dry on completion. Borehole installed: backfilled with arisings		Hand dug to 1.00m
Engineer: J. Brock Site Works Date: 18.10.2019 Plant: Dando 2000 Cable Percussive Drill Rig			Log Notes: SPT = Standard Penetration test (N value) – samples recovered B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	

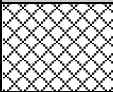
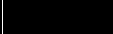
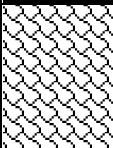
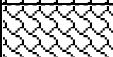
GEO2019-3889: Harras Dyke Farm, Whitehaven – R201

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	2.80	TOPSOIL over brown mottled grey CLAY.		
2.80	6.50	Dark grey SILTSTONE. - Light grey from 4.50m bgl.		
6.50	9.50	Interbedded light brown SILTSTONE and dark red SANDSTONE.		
9.50	12.40	Interbedded light grey and dark grey SILTSTONE.		
12.40	19.00	Light Grey SILTSTONE		
19.0	19.3	COAL. Intact.		
19.3	23.4	Light grey SILTSTONE.		
23.4	24.5	COAL. Intact.		
24.5	30.0	Interbedded light grey SILTSTONE and SANDSTONE.		
		Borehole terminated at 30m bgl. Borehole drilled with air/water mist flush. 100% flush throughout. No evidence of mine workings identified. Borehole installed: backfilled with bentonite and arisings.		Hand dug to 1.00m
Site: Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 18.10.2019 Plant: Beretta T41 Rotary Drilling Rig			Log Notes: SPT = Standard Penetration test (N value) HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	

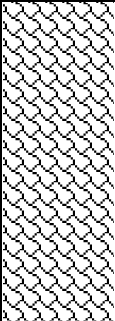
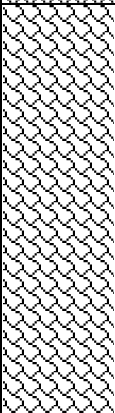
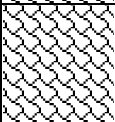
GEO2019-3889: Harras Dyke Farm, Whitehaven – R202

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	2.00	TOPSOIL over brown mottled grey CLAY.		
2.00	2.30	Light grey SILTSTONE.		
2.30	2.50	COAL. Intact.		
2.50	3.00	Light grey SILTSTONE.		
3.00	9.40	Interbedded Brown SILTSTONE and red brown SANDSTONE.		
9.40	10.30	Light Grey SILTSTONE		
10.30	10.70	COAL. Intact.		
10.70	16.00	Interbedded red brown SILTSTONE and light grey SANDSTONE.		
16.00	26.00	Interbedded light grey SANDSTONE and dark grey SILTSTONE.		
26.00	26.40	COAL. Intact.		
26.40	30.00	Interbedded light grey and dark grey SILTSTONE.		
		Borehole terminated at 30m bgl. Borehole drilled with air/water mist flush. 100% flush throughout. No evidence of mine workings identified. Borehole installed: backfilled with bentonite and arisings.		Hand dug to 1.00m
Site: Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 18.10.2019 Plant: Beretta T41 Rotary Drilling Rig			Log Notes: SPT = Standard Penetration test (N value) HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	

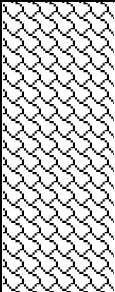
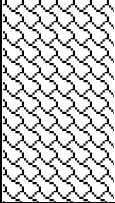
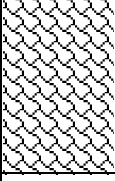
GEO2019-3889: Harras Dyke Farm, Whitehaven – R203

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	2.60	TOPSOIL over brown mottled grey CLAY.		
2.60	8.50	Interbedded red brown SILTSTONE and SANDSTONE and Light Grey SILTSTONE.		
8.50	9.90	Light grey SILTSTONE.		
9.90	10.00	COAL. Intact.		
10.00	15.00	Red brown SANDSTONE.		
15.00	17.50	Light grey SILTSTONE.		
17.50	18.00	COAL. Intact.		
18.00	25.50	Interbedded light grey and dark grey SILTSTONE.		
25.50	25.90	COAL. Intact.		
25.90	30.00	Interbedded light grey and dark grey SILTSTONE.		
		Borehole terminated at 30m bgl. Borehole drilled with air/water mist flush. 100% flush throughout. No evidence of mine workings identified. Borehole installed: backfilled with bentonite and arisings.		Hand dug to 1.00m
Site: Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 18.10.2019 Plant: Beretta T41 Rotary Drilling Rig			Log Notes: SPT = Standard Penetration test (N value) HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	

GEO2019-3889: Harras Dyke Farm, Whitehaven – R204

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	2.00	TOPSOIL over brown mottled grey CLAY.		
2.00	12.30	Interbedded red brown SILTSTONE and dark grey SANDSTONE.		
12.30	27.10	Brown and light grey SILTSTONE with thin bands of light grey SANDSTONE.		
27.10	30.00	Light grey SILTSTONE.		
		Borehole terminated at 30m bgl. Borehole drilled with air/water mist flush. 100% flush throughout. No evidence of mine workings identified. Borehole installed: backfilled with bentonite and arisings.		Hand dug to 1.00m
Site: Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 19.10.2019 Plant: Beretta T41 Rotary Drilling Rig			Log Notes: SPT = Standard Penetration test (N value) HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	

GEO2019-3889: Harras Dyke Farm, Whitehaven – R205

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	1.70	TOPSOIL over brown mottled grey CLAY.		
1.70	12.20	Interbedded red brown SILTSTONE and dark grey SILTSTONE and SANDSTONE.		
12.20	13.00	Light grey SILTSTONE.		
13.00	13.30	COAL. Intact.		
13.30	20.40	Brown and grey SILTSTONE with thin bands of grey SANDSTONE.		
20.40	23.00	Light grey SILTSTONE.		
23.00	23.80	COAL. Intact.		
23.80	30.00	Light grey SILTSTONE.		
		Borehole terminated at 30m bgl. Borehole drilled with air/water mist flush. 100% flush throughout. No evidence of mine workings identified. Borehole installed: backfilled with bentonite and arisings.		Hand dug to 1.00m
Site: Harras Dyke Farm, Whitehaven Engineer: J.Brock Site Works Date: 19.10.2019 Plant: Beretta T41 Rotary Drilling Rig			Log Notes: SPT = Standard Penetration test (N value) HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	

In-Situ Dynamic Probe Record Sheet - Super Heavy DPSH

Site Location: Harras Dyke Farm, Whitehaven
 Project Ref: 2019-3889
 Driller: SG
 Engineer: JB
 Fieldworks Date: 18.10.2019
 Fieldworks Notes: N/A
 Standard: BS1377 Part 9 DPSH



The Dynamic Probe test is used to determine the resistance of soils in-situ to the intermittent penetration of a cone, driven dynamically in a standard manner and in accordance to B.S. 1377: Part 9. The equipment consists of a 90° cone which may be sacrificial or retained for recovery, a series of extension or driving rods, a torque wrench and a driving device.

There are two types of test: Heavy Dynamic Probing (DPH) and Super Heavy Dynamic Probing (DPSH). The dimensions of the cone and the mass and drop height of the driving weight differ between the two tests. The extension rods used in the test are either 0.5-metre-long (for top of the hole) or 1-metre-long, manufactured from 35mm diameter heat-treated alloy steel, with graduations marked every 100mm along their length. The rods are flush-coupled and designed such that rod ends butt-up fully against each other when driving, forming a continuous jointed series with a straight axis. The driving device may be an Automatic Trip Hammer as part of a Dynamic Sampling drilling rig or a purpose-designed Probing Rig with characteristics conforming to BS 1377: Part 9.

The blow count is recorded for every 100mm of driving (N100) and the results presented as a plot of blow count against depth. Where the DPSH is utilised the sum total of three N100 increments (c.300mm penetration – N300 value) correlates to an equivalent SPT “N” value.

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 Notes:

Probe Location:	DP01		DP02		DP03		DP04		DP05	
Depth (m bgl):	N100	N300	N100	N300	N100	N300	N100	N300	N100	N300
0.1	0		0		0		0		0	
0.2	0	1	0	0	0	0	0	0	0	2
0.3	1		0		0		0		2	
0.4	1		1		1		0		1	
0.5	2	5	2	4	0	2	2	4	0	2
0.6	2		1		1		2		1	
0.7	2		2		2		1		0	
0.8	2	6	1	5	2	6	2	5	0	2
0.9	2		2		2		2		2	
1	2		2		1		1		2	
1.1	2	5	4	10	1	2	17	32	1	5
1.2	1		4		0		14		2	
1.3	3		4		3		7		1	
1.4	3	9	4	13	2	7	4	15	1	5
1.5	3		5		2		4		3	
1.6	2		3		2		23		3	
1.7	2	6	5	56	2	6	14	44	3	9
1.8	2		48		2		7		3	
1.9	3		>50		4		8		2	
2	1	4		>50	7	29	12	33	4	16
2.1	0				8		13		10	
2.2	0				10		10		7	
2.3	0	0			6	22	25	49	7	23
2.4	0				6		14		9	
2.5	1				10		7		6	
2.6	1	5			8	33	6	20	7	17
2.7	3				15		7		4	
2.8	6				12		7		5	
2.9	8	21			5	24	5	17	3	13
3	8				7		5		5	
3.1	8				5		6		5	
3.2	7	20			4	13	3	11	6	14
3.3	5				4		2		3	
3.4	3				4		3		3	
3.5	5	11			3	11	2	8	2	7
3.6	3				4		3		2	
3.7	17				2		2		2	
3.8	24	59			2	8	1	6	2	5
3.9	18				4		3		1	
4	10				4		3		2	
4.1	3	18			3	13	2	7	10	15
4.2	5				6		2		3	
4.3	2				4		3		3	
4.4	2	6			3	9	3	9	4	10
4.5	2				2		3		3	
4.6	3				4		2		2	
4.7	2	7			3	9	3	8	3	7
4.8	2				2		3		2	
4.9	3				3		2		3	
5	4	10			3	8	2	6	2	12
5.1	3				2		2		7	
5.2	3				2		3		5	
5.3	3	8			3	7	2	7	5	13
5.4	2				2		2		3	
5.5	2				2		6		3	
5.6	3	7			3	8	5	14	3	9
5.7	2				3		3		3	
5.8	1				2		3		4	
5.9	2	5			2	6	3	9	4	19
6	2				2		3		11	
6.1	2				7		3		8	
6.2	19	33			2	14	2	7	5	17
6.3	12				5		2		4	
6.4	10				36	>50	13		3	
6.5	6	24			>50		8	24	5	12
6.6	8						3		4	
6.7	10						3		3	
6.8	4	26					2	8	3	8
6.9	12						3		2	
7	3						3		2	
7.1	2	8					4	9	4	9
7.2	3						2		3	
7.3	3						3		3	
7.4	3	9					3	8	3	10
7.5	3						2		4	
7.6	4						4		12	
7.7	5	15					5	23	12	29
7.8	6						14		5	
7.9	5						11		4	
8	5	17					4	20	4	12
8.1	7						5		4	
8.2	5						4		7	
8.3	4	13					7	18	6	20
8.4	4						7		7	
8.5	4						7		7	
8.6	4	14					4	15	5	17
8.7	6						4		5	
8.8	6						4		4	
8.9	6	22					4	14	7	16
9	10						6		5	
9.1	7						5		5	
9.2	10	27					7	19	5	14
9.3	10						7		4	
9.4	5						4		6	
9.5	5	16					4	15	7	20
9.6	6						7		7	
9.7	10						4		6	
9.8	5	22					5	14	7	19
9.9	7						5		6	



Zero Blow Reading: 80

[illegible]

1 - TRRL Equation, $\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057\text{Log}_{10}(\text{mm/blow})$



Zero Blow Reading: 80

Zero Blow Reading: 80

1 - TRRL Equation, $\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057\text{Log}_{10}(\text{mm/blow})$

[illegible][illegible]

1 - TRRL Equation, $\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057\text{Log}_{10}(\text{mm/blow})$



Zero Blow Reading: 70

[illegible]

1 - TRRL Equation, $\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057\text{Log}_{10}(\text{mm/blow})$

[illegible][illegible]

1 - TRRL Equation, $\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057\text{Log}_{10}(\text{mm/blow})$

[illegible][illegible]

1 - TRRL Equation, $\log_{10}(\text{CBR}) = 2.48 - 1.057\log_{10}(\text{mm/blow})$



Zero Blow Reading: 80

Zero Blow Reading: 90

1 - TRRL Equation, $\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057\text{Log}_{10}(\text{mm/blow})$

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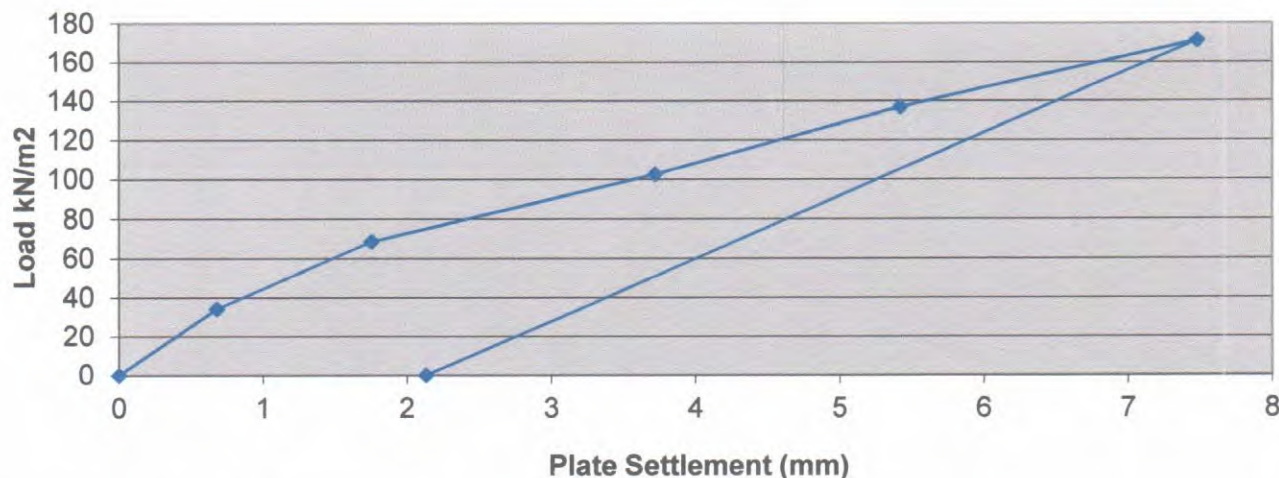


2714

TEST CERTIFICATE PLATE BEARING TEST BS 1377:PART 9:1990:INCREMENTAL LOADING

Client	Geo Environmental		Job No	8901
Site	Harras Moor, Whitehaven		GRN	16457/1
Location	Plate 1 (-400mm)		Date Tested	16/10/19
Material	Light Brown Silty CLAY with fine to coarse gravel			
Clients Ref	1			
Plate (mm)	610			
Pressure in bar	Load in kN	kN/m ²	Settlement (mm)	
N/A	0	0	0	
N/A	10	34	0.68	
N/A	20	68	1.75	
N/A	30	103	3.72	
N/A	40	137	5.42	
N/A	50	171	7.48	
N/A	0	0.0	2.13	

Plate Bearing Test



Comments: CBR at 1.25mm estimated value
Maximum Plate Settlement at
Load Applied Maximum Load
kN/m² mm
Plate Test result 171 7.48
K762 Factor 34620 kN/M²/M
CBR @ 1.25mm 4.5
Plate factor 0.8165
Note: Plate factor and CBR calculated by IAN ;

3) method

Authorised Signature:

J McGuigan
Laboratory Manager

Jds
Managing Director

Date: 20/10/19

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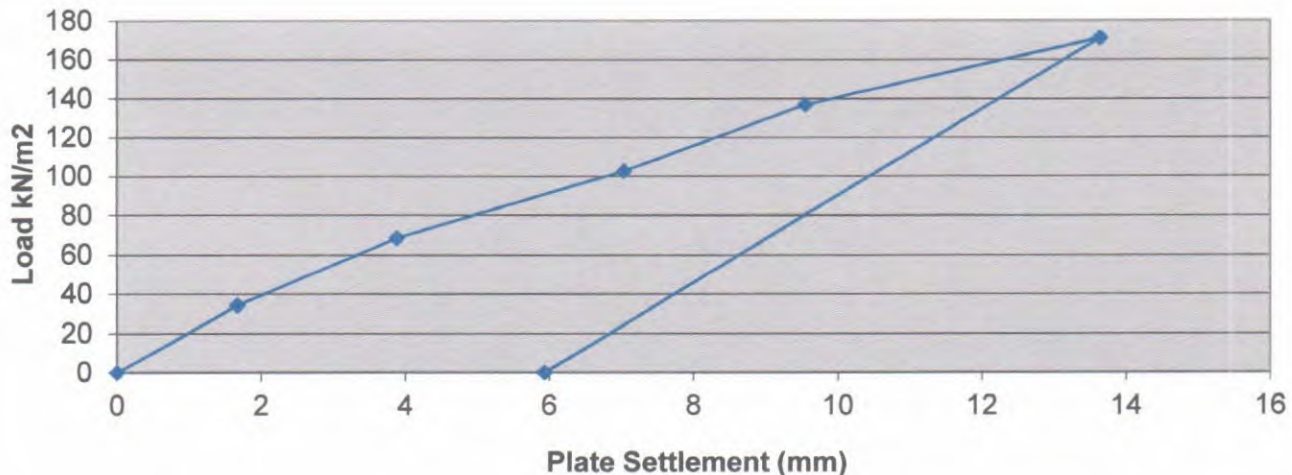


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TEST CERTIFICATE PLATE BEARING TEST BS 1377:PART 9:1990:INCREMENTAL LOADING

Client	Geo Environmental		Job No	8901
Site	Harras Moor, Whitehaven		GRN	16457/2
Location	Plate 2 (-400mm)		Date Tested	16/10/19
Material	Light Brown Silty CLAY with fine to coarse gravel			
Clients Ref	2			
Plate (mm)	610			
Pressure in bar	Load in kN	kN/m ²	Settlement (mm)	
N/A	0	0	0	
N/A	10	34	1.67	
N/A	20	68	3.88	
N/A	30	103	7.03	
N/A	40	137	9.55	
N/A	50	171	13.64	
N/A	0	0.0	5.93	

Plate Bearing Test



Comments: CBR at 1.25mm estimated value
Maximum Plate Settlement at
Load Applied Maximum Load
kN/m² mm
Plate Test result 171 13.64
K762 Factor 16983 kN/M²/M
CBR @ 1.25mm 1.3
Plate factor 0.8165

Note: Plate factor and CBR calculated by IAN 73

Authorised Signature:

J McGuigan
Laboratory Manager

R. Woods
Managing Director

Date: 20/10/19

Construction Materials Testing Limited

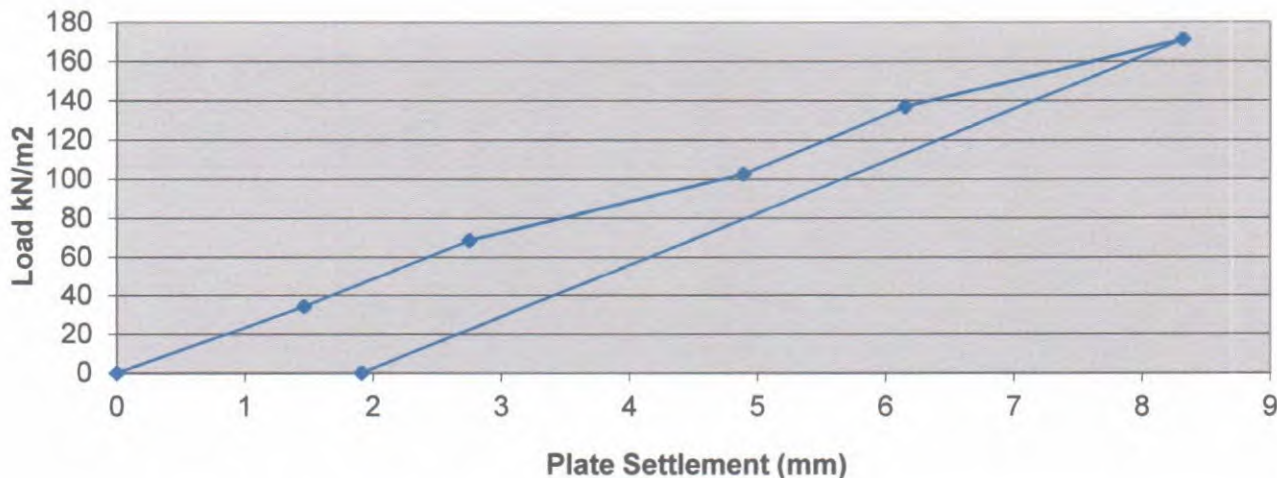
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TEST CERTIFICATE PLATE BEARING TEST BS 1377:PART 9:1990:INCREMENTAL LOADING

Client	Geo Environmental		Job No	8901
Site	Harras Moor, Whitehaven		GRN	16457/3
Location	Plate 3 (-400mm)		Date Tested	16/10/19
Material	Light Brown Silty CLAY with fine to coarse gravel			
Clients Ref	3			
Plate (mm)	610			
Pressure in bar	Load in kN	kN/m ²	Settlement (mm)	
N/A	0	0	0	
N/A	10	34	1.46	
N/A	20	68	2.75	
N/A	30	103	4.89	
N/A	40	137	6.15	
N/A	50	171	8.32	
N/A	0	0.0	1.91	

Plate Bearing Test



Comments: CBR at 1.25mm estimated value
Maximum Plate Settlement at
Load Applied Maximum Load
kN/m² mm

Plate Test result 171 8.32
K762 Factor 18943 kN/M²/M
CBR @ 1.25mm 1.6
Plate factor 0.8165

Note: Plate factor and CBR calculated by IAN' Rev 1 (2009) method

Authorised Signature:

J McGuigan
Laboratory Manager

R.Woods
Managing Director

Date: 20/10/19

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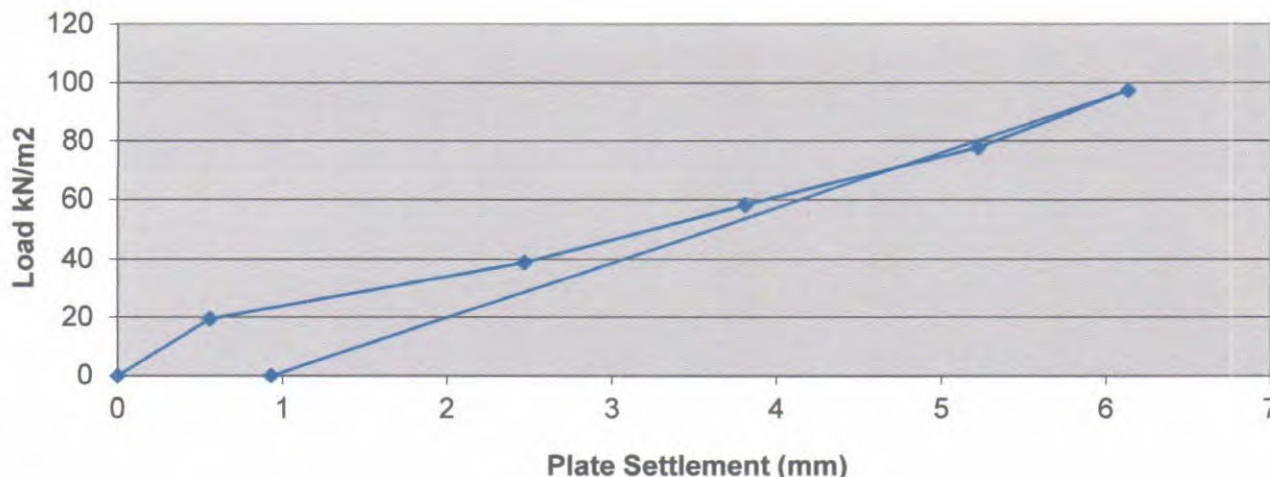


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TEST CERTIFICATE PLATE BEARING TEST BS 1377:PART 9:1990:INCREMENTAL LOADING

Client	Geo Environmental		Job No	8901
Site	Harras Moor, Whithaven		GRN	16457/4
Location	Plate 4 (-400mm)		Date Tested	16/10/19
Material	Light Brown silty sandy CLAY wth fine to coarse gravel			
Clients Ref	4			
Plate (mm)	900			
Pressure in bar	Load in kN	kN/m ²	Settlement (mm)	
N/A	0	0	0	
N/A	10	19	0.56	
N/A	20	39	2.47	
N/A	30	58	3.81	
N/A	40	78	5.22	
N/A	50	97	6.13	
N/A	0	0.0	0.93	

Plate Bearing Test



Comments: CBR at 1.25mm estimated value
Maximum Load Applied Plate Settlement at Maximum Load

	kN/m ²	mm
Plate Test result	97	6.13
K762 Factor	23342	kN/M ² /M
CBR @ 1.25mm	2.3	
Plate factor	1.1671	

Note: Plate factor and CBR calculated by IAN 73/1 (2009) method

Authorised Signature:

J McGuigan ☐
Laboratory Manager

R.Woods ☐
Managing Director

Date: 20/10/19

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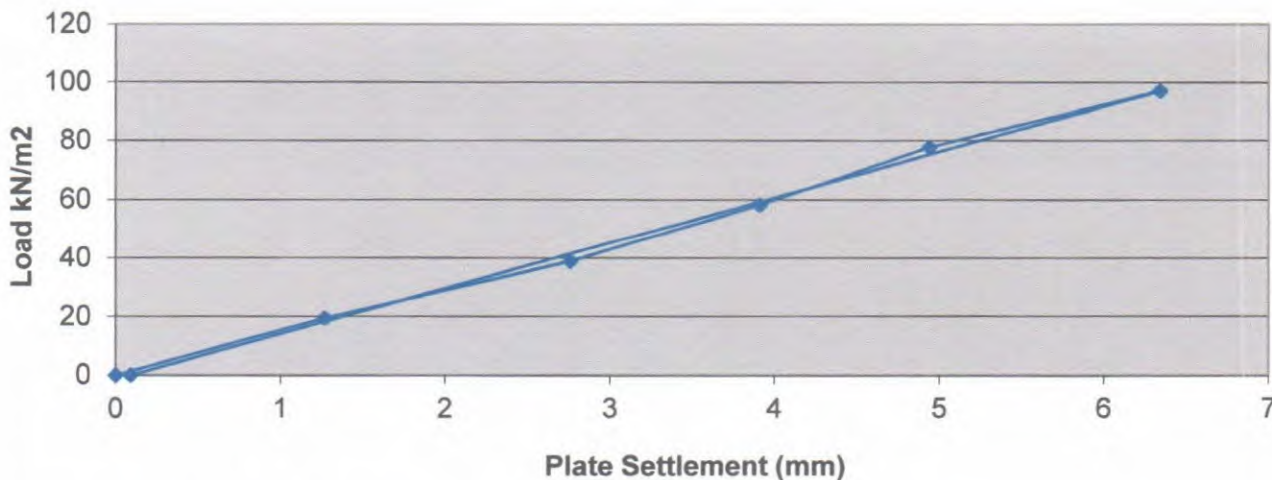


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TEST CERTIFICATE PLATE BEARING TEST BS 1377:PART 9:1990:INCREMENTAL LOADING

Client	Geo Environmental		Job No	8901
Site	Harras Moor, Whithaven		GRN	16457/5
Location	Plate 5 (-400mm)		Date Tested	16/10/19
Material	Light Brown silty sandy CLAY wth fine to coarse gravel			
Clients Ref	5			
Plate (mm)	900			
Pressure in bar	Load in kN	kN/m ²	Settlement (mm)	
N/A	0	0	0	
N/A	10	19	1.27	
N/A	20	39	2.76	
N/A	30	58	3.91	
N/A	40	78	4.94	
N/A	50	97	6.34	
N/A	0	0.0	0.09	

Plate Bearing Test



Comments: CBR at 1.25mm estimated value
Maximum Plate Settlement at
Load Applied Maximum Load
kN/m² mm
Plate Test result 97 6.34
K762 Factor 17740 kN/M²/M
CBR @ 1.25mm 1.4
Plate factor 1.1671
Note: Plate factor and CBR calculated by IAN

Authorised Signature:

J McGuigan ☐
Laboratory Manager

☒
Managing Director

Date: 20/10/19

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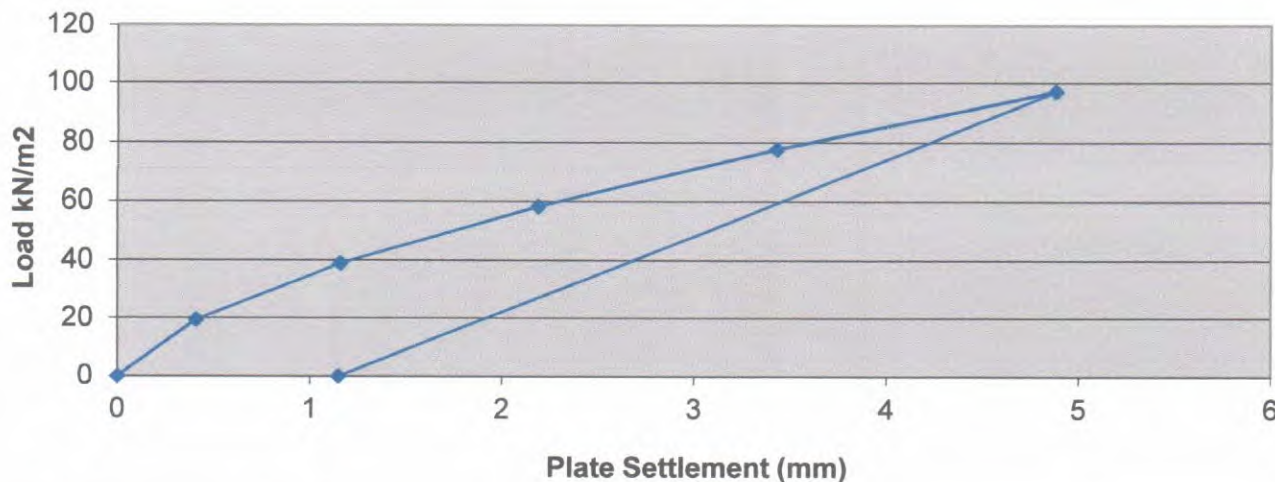


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TEST CERTIFICATE PLATE BEARING TEST BS 1377:PART 9:1990:INCREMENTAL LOADING

Client	Geo Environmental		Job No	8901
Site	Harras Moor, Whithaven		GRN	16463/1
Location	Plate 6 (-400mm)		Date Tested	17/10/19
Material	Light Brown silty sandy CLAY wth fine to coarse gravel			
Clients Ref	1			
Plate (mm)	900			
Pressure in bar	Load in kN	kN/m ²	Settlement (mm)	
N/A	0	0	0	
N/A	10	19	0.41	
N/A	20	39	1.16	
N/A	30	58	2.19	
N/A	40	78	3.43	
N/A	50	97	4.88	
N/A	0	0.0	1.15	

Plate Bearing Test



Comments: CBR at 1.25mm estimated value
Maximum Plate Settlement at
Load Applied Maximum Load
kN/m² mm

Plate Test result 97 4.88
K762 Factor 38281 kN/M²/M
CBR @ 1.25mm 5.3
Plate factor 1.1671

Note: Plate factor and CBR calculated by IAN 73/06 (2009) method,

Authorised Signature:

J McGuigan ☐
Laboratory Manager

R. V. V. ☐
Managing Director

Date: 20/10/19

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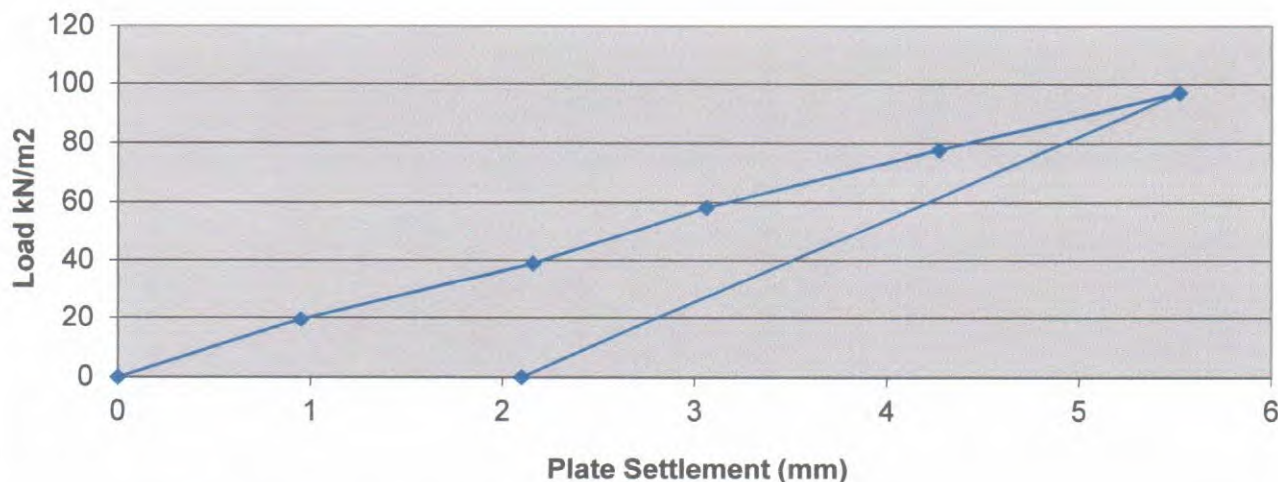


2714

TEST CERTIFICATE PLATE BEARING TEST BS 1377:PART 9:1990:INCREMENTAL LOADING

Client	Geo Environmental		Job No	8901
Site	Harras Moor, Whithaven		GRN	16463/2
Location	Plate 7 (-400mm)		Date Tested	17/10/19
Material	Light Brown silty sandy CLAY wth fine to coarse gravel			
Clients Ref	2			
Plate (mm)	900			
Pressure in bar	Load in kN	kN/m ²	Settlement (mm)	
N/A	0	0	0	
N/A	10	19	0.95	
N/A	20	39	2.16	
N/A	30	58	3.06	
N/A	40	78	4.27	
N/A	50	97	5.52	
N/A	0	0.0	2.10	

Plate Bearing Test



Comments: CBR at 1.25mm estimated value
Maximum Plate Settlement at
Load Applied Maximum Load
kN/m² mm
Plate Test result 97 5.52
K762 Factor 21475 kN/M²/M
CBR @ 1.25mm 2.0
Plate factor 1.1671

Note: Plate factor and CBR calculated by IAN 75

Authorised Signature:

J McGuigan ☐
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R.Woods ☐
Managing Director

Date: 20/10/19

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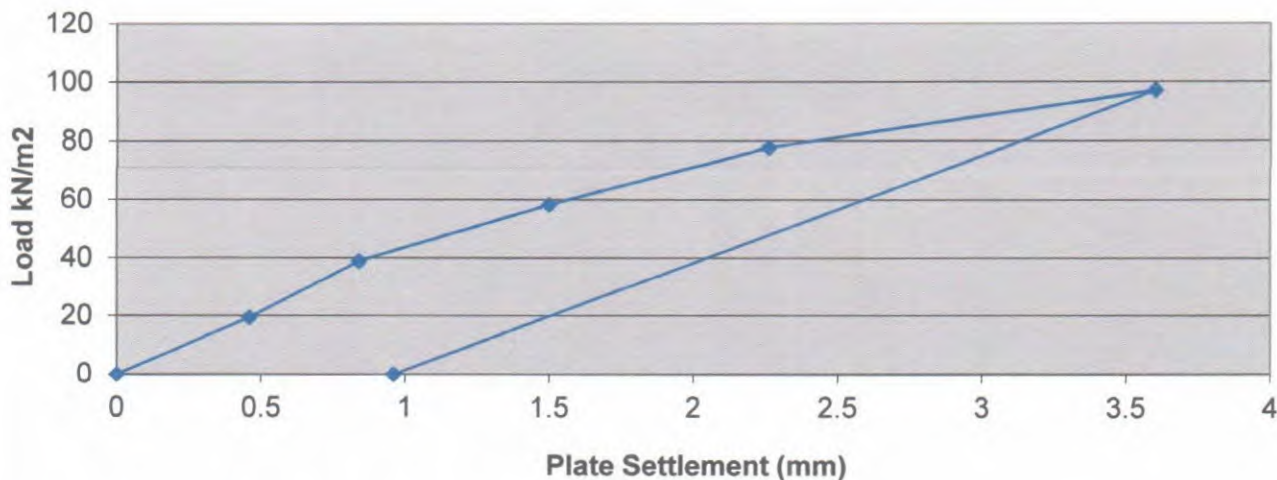


2714

TEST CERTIFICATE PLATE BEARING TEST BS 1377:PART 9:1990:INCREMENTAL LOADING

Client	Geo Environmental		Job No	8901
Site	Harras Moor, Whithaven		GRN	16463/3
Location	Plate 8 (-400mm)		Date Tested	17/10/19
Material	Light Brown silty sandy CLAY wth fine to coarse gravel			
Clients Ref	3			
Plate (mm)	900			
Pressure in bar	Load in kN	kN/m ²	Settlement (mm)	
N/A	0	0	0	
N/A	10	19	0.46	
N/A	20	39	0.84	
N/A	30	58	1.50	
N/A	40	78	2.26	
N/A	50	97	3.60	
N/A	0	0.0	0.96	

Plate Bearing Test



Comments: CBR at 1.25mm estimated value
Maximum Plate Settlement at
Load Applied Maximum Load
kN/m² mm

Plate Test result 97 3.60
K762 Factor 47618 kN/M²/M
CBR @ 1.25mm 7.8
Plate factor 1.1671

Note: Plate factor and CBR calculated by IAN 73/L * (2009) method

Authorised Signature:

J McGuigan
Laboratory Manager

...woods
Managing Director

Date: 20/10/19

Construction Materials Testing Limited

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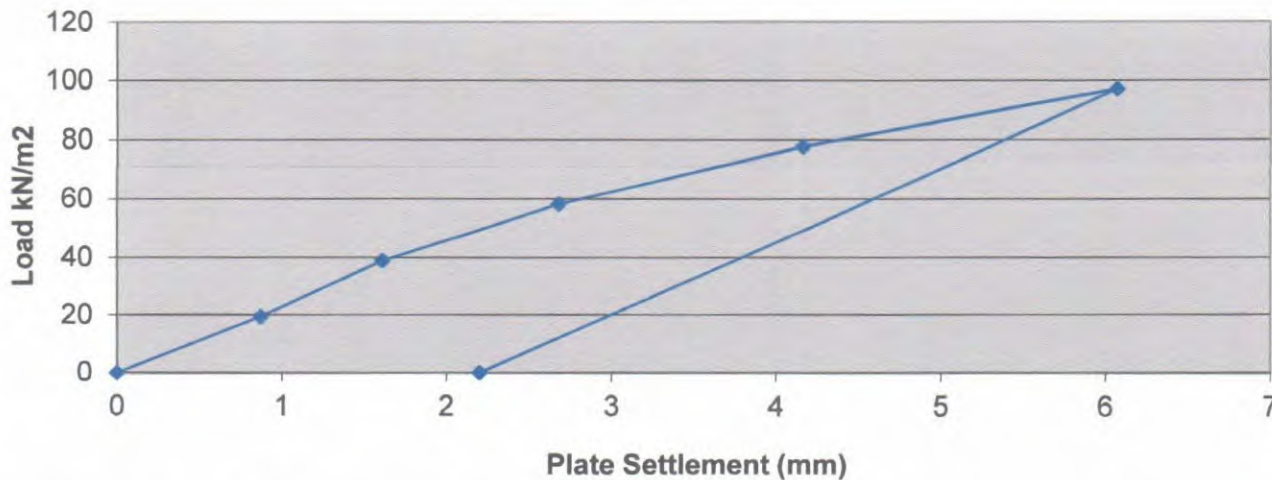


2714

TEST CERTIFICATE PLATE BEARING TEST BS 1377:PART 9:1990:INCREMENTAL LOADING

Client	Geo Environmental		Job No	8901
Site	Harras Moor, Whithaven		GRN	16463/4
Location	Plate 9 (-400mm)		Date Tested	17/10/19
Material	Light Brown silty sandy CLAY wth fine to coarse gravel			
Clients Ref	4			
Plate (mm)	900			
Pressure in bar	Load in kN	kN/m ²	Settlement (mm)	
N/A	0	0	0	
N/A	10	19	0.87	
N/A	20	39	1.61	
N/A	30	58	2.68	
N/A	40	78	4.16	
N/A	50	97	6.07	
N/A	0	0.0	2.20	

Plate Bearing Test



Comments: CBR at 1.25mm estimated value
Maximum Plate Settlement at
Load Applied Maximum Load
kN/m² mm

Plate Test result 97 6.07
K762 Factor 26143 kN/M²/M
CBR @ 1.25mm 2.8
Plate factor 1.1671

Note: Plate factor and CBR calculated by IAN 73/ rev 1 (2009) method

Authorised Signature:

J McGuigan
Laboratory Manager

K. Woods
Managing Director

Date: 20/10/19

Ground Gas & Groundwater Monitoring Record Sheet 01

Site: Harras Dyke Farm, Whitehaven

Project No: 2019-3889

Date: 04/11/2019

Borehole	Pressure (mb)	Methane Initial (% v/v)	Methane Residual (% v/v)	Carbon Dioxide Initial (% v/v)	Carbon Dioxide Residual (% v/v)	Oxygen Initial (% v/v)	Oxygen Residual (% v/v)	Flow Rate (l/h)	Water Level (m)	Depth of base (m)	Water Sample Recovered?
BH201	970 R	0	0	9.1	3.4	16.4	18.1	0	2.22	3.00	-
BH202	970 R	0	0	3.9	4.0	18.2	17.6	0	0.79	1.85	-
BH203	970 R	0	0	0.9	0.9	20.0	20.0	0	0.38	1.80	-
BH204	970 R	0	0	5.3	4.1	15.1	14.6	0	DRY	1.20	-
BH205	970 R	0	0	8.3	7.5	13.3	13.5	0	DRY	0.80	-
BH206	970 R	0	0	2.5	2.6	19.5	19.4	0	1.02	2.00	-
BH207	970 R	0	0	10.1	10.2	11.1	10.7	0	1.37	1.80	-
BH208	970 R	0	0	4.9	4.9	19.4	19.4	0	0.20	1.80	-
BH209	970 R	0	0	6.0	6.0	12.0	10.3	0	1.27	2.00	-
BH210	970 R	0	0	8.6	8.7	13.9	13.4	0	1.06	2.00	-
BH211	970 R	2.9	3.0	5.7	5.7	3.4	0.5	0	3.32	4.00	-
BH212	970 R	0	0	0.8	0.8	20.1	20.1	-2.8	DRY	3.50	-
BH213	970 R	0	0	8.4	8.5	13.0	12.4	0	DRY	1.80	-
BH214	970 R	0	0	5.2	5.6	17.7	17.2	-3.1	DRY	3.80	-
BH215	970 R	0	0	19.7	20.7	0.7	0.2	-2.9	DRY	3.50	-
BH216	970 R	0	0	0.3	0.3	20.6	20.6	0	1.35	1.80	-
BH217	970 R	0	0	4.8	4.9	19.2	19.0	0	1.07	1.80	-
BH218	970 R	0.6	0.6	14.1	14.1	0.4	0.4	7.2	1.65	2.20	-
BH219	970 R	0	0	0.5	0.5	19.8	19.9	-0.3	2.45	3.00	-
BH220	970 R	0	0	11.9	11.7	7.8	7.2	0	DRY	1.50	-
BH221	970 R	0	0	23.4	23.9	1.4	0.3	0	DRY	3.80	-
BH222	970 R	0	0	6.9	7.0	12.8	12.4	0	2.27	2.50	-
BH223	970 R	0	0	5.7	5.7	12.0	12.0	0	DRY	1.50	-

Notes:
 Initial Value = First recorded concentration taken immediately upon opening the gas valve; Residual Value = Constant or "steady" reading following peak.
 Monitoring undertaken for a minimum of three minutes. Where high concentrations are initially noted then the monitoring should be increased to five minutes.
 F = Falling Atmospheric Pressure, R = Rising Atmospheric Pressure, S = Steady Atmospheric Pressure

Monitoring Completed By: JB

Equipment Used: GA2000 Gas Analyser with External Flow Pod. Geotechnical Instruments Dipmeter.

Weather Conditions: Dry.

Temperature 12.0°C.

Ground Gas & Groundwater Monitoring Record Sheet 02

Site: Harras Dyke Farm, Whitehaven

Project No: 2019-3889

Date: 19/11/2019

Borehole	Pressure (mb)	Methane Initial (% v/v)	Methane Residual (% v/v)	Carbon Dioxide Initial (% v/v)	Carbon Dioxide Residual (% v/v)	Oxygen Initial (% v/v)	Oxygen Residual (% v/v)	Flow Rate (l/h)	Water Level (m)	Depth of base (m)	Water Sample Recovered?
BH201	1015 F	0	0	10.1	10.1	16.3	17.5	0	2.11	3.00	-
BH202	1015 F	0	0	3.9	3.8	13.6	13.6	0	0.82	1.85	-
BH203	1015 F	0	0	2.3	2.6	19.5	19.5	0	0.41	1.80	-
BH204	1015 F	0	0	6.3	3.4	12.3	12.3	0	DRY	1.20	-
BH205	1015 F	0	0	8.5	8.4	14.7	14.8	0	DRY	0.80	-
BH206	1015 F	0	0	2.6	2.6	19.3	19.4	0	1.54	2.00	-
BH207	1015 F	0	0	12.1	11.9	11.1	10.7	0	1.48	1.80	-
BH208	1015 F	0	0	5.6	5.6	19.4	19.4	0	0.21	1.80	-
BH209	1015 F	0	0	6.1	6.1	15.0	15.1	0	1.25	2.00	-
BH210	1015 F	0	0	8.8	8.8	10.2	10.6	0	1.15	2.00	-
BH211	1015 F	2.5	2.6	5.8	5.8	2.3	1.8	0	2.78	4.00	-
BH212	1015 F	0	0	0.9	0.9	20.0	20.1	-2.9	DRY	3.50	-
BH213	1015 F	0	0	10.2	10.2	10.6	11.5	0	DRY	1.80	-
BH214	1015 F	0	0	8.5	8.6	14.5	14.6	-3.2	DRY	3.80	-
BH215	1015 F	0	0	19.5	19.6	5.2	4.9	-2.5	DRY	3.50	-
BH216	1015 F	0	0	3.2	3.2	19.6	19.7	0	1.35	1.80	-
BH217	1015 F	0	0	4.9	5.3	19.0	19.1	0	1.12	1.80	-
BH218	1015 F	0.8	0.8	14.2	14.1	2.1	1.9	4.2	1.70	2.20	-
BH219	1015 F	0	0	0.3	0.4	19.9	19.9	0	2.47	3.00	-
BH220	1015 F	0	0	12.3	12.2	7.9	7.7	0	DRY	1.50	-
BH221	1015 F	0	0	15.6	16.5	8.9	8.2	0	DRY	3.80	-
BH222	1015 F	0	0	7.5	7.6	7.2	6.8	0	2.27	2.50	-
BH223	1015 F	0	0	6.2	6.2	11.5	11.2	0	DRY	1.50	-

Notes:
 Initial Value = First recorded concentration taken immediately upon opening the gas valve; Residual Value = Constant or "steady" reading following peak.
 Monitoring undertaken for a minimum of three minutes. Where high concentrations are initially noted then the monitoring should be increased to five minutes.
 F = Falling Atmospheric Pressure, R = Rising Atmospheric Pressure, S = Steady Atmospheric Pressure

Monitoring Completed By: JB

Equipment Used: GA2000 Gas Analyser with External Flow Pod. Geotechnical Instruments Dipmeter.

Weather Conditions: Dry.

Temperature 7.0°C.

Ground Gas & Groundwater Monitoring Record Sheet 03

Site: Harras Dyke Farm, Whitehaven

Project No: 2019-3889

Date: 29/11/2019

Borehole	Pressure (mb)	Methane Initial (% v/v)	Methane Residual (% v/v)	Carbon Dioxide Initial (% v/v)	Carbon Dioxide Residual (% v/v)	Oxygen Initial (% v/v)	Oxygen Residual (% v/v)	Flow Rate (l/h)	Water Level (m)	Depth of base (m)	Water Sample Recovered?
BH201	1002 R	0	0	10.8	10.5	16.0	15.6	<0.1	2.01	3.00	-
BH202	1002 R	0	0	3.3	3.3	11.3	10.3	<0.1	0.90	1.85	-
BH203	1002 R	0	0	4.3	5.1	18.3	18.1	<0.1	0.65	1.80	-
BH204	1002 R	0	0	9.7	9.7	11.8	8.9	<0.1	DRY	1.20	-
BH205	1002 R	0	0	6.9	6.6	15.3	14.6	<0.1	DRY	0.80	-
BH206	1002 R	0	0	2.7	2.8	19.5	19.3	<0.1	1.83	2.00	-
BH207	1002 R	0	0	14.4	14.7	8.3	7.5	<0.1	1.58	1.80	-
BH208	1002 R	0	0	6.5	6.7	19.0	18.5	<0.1	0.22	1.80	-
BH209	1002 R	0	0	5.7	5.8	17.0	16.0	<0.1	1.25	2.00	-
BH210	1002 R	0	0	8.8	9.6	12.0	7.8	<0.1	1.25	2.00	-
BH211	1002 R	1.2	1.2	5.9	6.0	1.6	0.9	<0.1	2.30	4.00	-
BH212	1002 R	0	0	1.0	1.1	19.6	19.6	-3.4	DRY	3.50	-
BH213	1002 R	0	0	12.3	12.4	7.1	7.0	<0.1	DRY	1.80	-
BH214	1002 R	0	0	9.6	9.7	13.5	12.9	-3.4	DRY	3.80	-
BH215	1002 R	0.1	0	15.5	16.6	12.2	7.3	-2.8	DRY	3.50	-
BH216	1002 R	0	0	6.2	6.6	18.3	17.3	-1.9	1.35	1.80	-
BH217	1002 R	0	0	5.8	7.5	18.1	17.4	<0.1	1.17	1.80	-
BH218	1002 R	0.5	0	14.2	14.4	4.4	1.1	+3.1	1.78	2.20	-
BH219	1002 R	0	0	0.3	0.3	20.2	20.2	<0.1	2.48	3.00	-
BH220	1002 R	0	0	12.0	12.4	7.5	5.5	<0.1	DRY	1.50	-
BH221	1002 R	0	0	10.1	10.6	15.7	13.7	-1.0	DRY	3.80	-
BH222	1002 R	0	0	8.4	8.6	12.5	6.5	<0.1	1.95	2.50	-
BH223	1002 R	0	0	7.8	8.3	11.6	7.4	<0.1	DRY	1.50	-

Notes:
 Initial Value = First recorded concentration taken immediately upon opening the gas valve; Residual Value = Constant or "steady" reading following peak.
 Monitoring undertaken for a minimum of three minutes. Where high concentrations are initially noted then the monitoring should be increased to five minutes.
 F = Falling Atmospheric Pressure, R = Rising Atmospheric Pressure, S = Steady Atmospheric Pressure

Monitoring Completed By: JB

Equipment Used: GA2000 Gas Analyser with External Flow Pod. Geotechnical Instruments Dipmeter.

Weather Conditions: Dry.

Temperature 1.0°C.

Ground Gas & Groundwater Monitoring Record Sheet 04

Site: Harras Dyke Farm, Whitehaven

Project No: 2019-3889

Date: 09/12/2019

Borehole	Pressure (mb)	Methane Initial (% v/v)	Methane Residual (% v/v)	Carbon Dioxide Initial (% v/v)	Carbon Dioxide Residual (% v/v)	Oxygen Initial (% v/v)	Oxygen Residual (% v/v)	Flow Rate (l/h)	Water Level (m)	Depth of base (m)	Water Sample Recovered?
BH201	995 R	0	0	12.3	12.4	15.2	15.3	<0.1	1.92	3.00	-
BH202	995 R	0	0	3.8	3.8	10.2	8.5	+0.2	0.92	1.85	-
BH203	995 R	0	0	2.3	2.2	18.6	18.6	<0.1	0.63	1.80	-
BH204	995 R	0	0	10.0	10.0	12.3	8.4	<0.1	DRY	1.20	-
BH205	995 R	0	0	6.2	6.0	16.2	16.0	<0.1	DRY	0.80	-
BH206	995 R	0	0	1.8	1.8	16.8	17.6	<0.1	1.82	2.00	-
BH207	995 R	0	0	14.9	15.0	9.5	10.2	<0.1	1.57	1.80	-
BH208	995 R	0	0	4.6	4.6	19.2	19.5	<0.1	0.18	1.80	-
BH209	995 R	0	0	5.0	5.5	16.2	16.0	<0.1	1.25	2.00	-
BH210	995 R	0	0	9.0	9.1	14.5	12.6	<0.1	1.11	2.00	-
BH211	995 R	1.9	1.9	5.5	5.5	2.3	6.5	<0.1	2.20	4.00	-
BH212	995 R	0	0	4.5	4.5	17.8	18.2	-0.6	DRY	3.50	-
BH213	995 R	0	0	12.8	12.8	8.5	7.9	<0.1	DRY	1.80	-
BH214	995 R	0	0	8.3	8.4	12.3	14.5	-1.2	DRY	3.80	-
BH215	995 R	0.2	0	17.5	19.2	11.8	8.5	-0.9	DRY	3.50	-
BH216	995 R	0	0	10.5	10.5	14.5	15.6	-1.9	1.35	1.80	-
BH217	995 R	0	0	6.5	6.4	13.5	14.5	+1.2	0.80	1.80	-
BH218	995 R	0.3	0.3	15.2	15.2	0.5	0.1	+4.5	1.50	2.20	-
BH219	995 R	0	0	0.35	0.32	20.1	20.2	<0.1	2.40	3.00	-
BH220	995 R	0	0	12.3	12.4	5.6	5.6	<0.1	DRY	1.50	-
BH221	995 R	0	0	10.1	10.6	15.7	13.7	-1.0	DRY	3.80	-
BH222	995 R	0	0	12.3	12.3	8.9	9.3	<0.1	2.35	2.50	-
BH223	995 R	0	0	8.5	8.6	12.5	10.2	<0.1	DRY	1.50	-

Notes:
 Initial Value = First recorded concentration taken immediately upon opening the gas valve; Residual Value = Constant or "steady" reading following peak.
 Monitoring undertaken for a minimum of three minutes. Where high concentrations are initially noted then the monitoring should be increased to five minutes.
 F = Falling Atmospheric Pressure, R = Rising Atmospheric Pressure, S = Steady Atmospheric Pressure

Monitoring Completed By: JB

Equipment Used: GA2000 Gas Analyser with External Flow Pod. Geotechnical Instruments Dipmeter.

Weather Conditions: Dry.

Temperature 6.0°C.

Ground Gas & Groundwater Monitoring Record Sheet 05

Site: Harras Dyke Farm, Whitehaven

Project No: 2019-3889

Date: 17/12/2019

Borehole	Pressure (mb)	Methane Initial (% v/v)	Methane Residual (% v/v)	Carbon Dioxide Initial (% v/v)	Carbon Dioxide Residual (% v/v)	Oxygen Initial (% v/v)	Oxygen Residual (% v/v)	Flow Rate (l/h)	Water Level (m)	Depth of base (m)	Water Sample Recovered?
BH201	981 R	0	0	15.2	13.8	13.9	15.0	<0.1	1.87	3.00	-
BH202	981 R	0	0	4.5	4.6	11.0	9.4	+2.6	0.94	1.85	-
BH203	981 R	0	0	1.9	1.7	19.7	19.7	<0.1	0.57	1.80	-
BH204	981 R	0	0	10.3	10.8	11.3	7.3	-0.3	DRY	1.20	-
BH205	981 R	0	0	6.1	5.7	17.0	15.4	<0.1	DRY	0.80	-
BH206	981 R	0	0	3.9	3.9	17.6	16.5	<0.1	1.82	2.00	-
BH207	981 R	0	0	15.2	15.9	11.1	6.9	<0.1	1.54	1.80	-
BH208	981 R	0	0	1.9	1.9	20.4	20.4	-0.2	0.1	1.80	-
BH209	981 R	0	0	5.0	5.2	15.6	12.2	<0.1	1.27	2.00	-
BH210	981 R	0	0	9.1	9.3	15.8	10.4	<0.1	1.11	2.00	-
BH211	981 R	2.1	2.2	5.1	5.2	6.4	18.0	<0.1	2.15	4.00	-
BH212	981 R	0	0	5.7	5.8	16.9	15.1	-2.1	DRY	3.50	-
BH213	981 R	0	0	13.2	14.2	10.5	6.6	0.2	DRY	1.80	-
BH214	981 R	0	0	8.2	10.2	18.5	12.7	-2.1	DRY	3.80	-
BH215	981 R	0	0	18.0	21.6	12.6	5.4	-1.5	DRY	3.50	-
BH216	981 R	0	0	11.0	11.0	13.2	13.2	-1.9	1.36	1.80	-
BH217	981 R	0	0	5.8	5.8	14.4	14.4	6.8	0.25	1.80	-
BH218	981 R	0.5	0.5	14.2	14.2	0.6	0.0	7.1	1.36	2.20	-
BH219	981 R	0	0	0.3	0.3	20.4	20.4	<0.1	2.39	3.00	-
BH220	981 R	0	0	12.9	13.1	6.7	3.2	<0.1	1.59	1.50	-
BH221	981 R	0	0	19.6	21.0	9.5	5.5	<0.1	DRY	3.80	-
BH222	981 R	0	0	9.9	10.4	10.7	2.1	-0.3	2.14	2.50	-
BH223	981 R	0	0	7.8	9.1	14.3	9.4	<0.1	1.48	1.50	-

Notes:
 Initial Value = First recorded concentration taken immediately upon opening the gas valve; Residual Value = Constant or "steady" reading following peak.
 Monitoring undertaken for a minimum of three minutes. Where high concentrations are initially noted then the monitoring should be increased to five minutes.
 F = Falling Atmospheric Pressure, R = Rising Atmospheric Pressure, S = Steady Atmospheric Pressure

Monitoring Completed By: JB

Equipment Used: GA2000 Gas Analyser with External Flow Pod. Geotechnical Instruments Dipmeter.

Weather Conditions: Dry.

Temperature 6.0°C.

Ground Gas & Groundwater Monitoring Record Sheet 06

Site: Harras Dyke Farm, Whitehaven

Project No: 2019-3889

Date: 15.01.2020

Borehole	Pressure (mb)	Methane Initial (% v/v)	Methane Residual (% v/v)	Carbon Dioxide Initial (% v/v)	Carbon Dioxide Residual (% v/v)	Oxygen Initial (% v/v)	Oxygen Residual (% v/v)	Flow Rate (l/h)	Water Level (m)	Depth of base (m)	Water Sample Recovered?
BH201	999 R	0	0	13.2	13.2	13.5	14.2	<0.1	1.75	3.00	-
BH202	999 R	0	0	6.9	6.8	13.2	8.5	+0.5	0.92	1.85	-
BH203	999 R	0	0	2.6	2.7	19.4	19.4	<0.1	0.52	1.80	-
BH204	999 R	0	0	9.8	10.2	13.4	9.8	<0.1	DRY	1.20	-
BH205	999 R	0	0	5.3	4.8	14.9	15.6	<0.1	DRY	0.80	-
BH206	999 R	0	0	3.9	3.9	17.6	16.5	<0.1	1.82	2.00	-
BH207	999 R	0	0	12.5	13.2	11.4	9.5	<0.1	1.50	1.80	-
BH208	999 R	0	0	2.9	2.9	20.2	20.2	<0.1	0.30	1.80	-
BH209	999 R	0	0	4.5	4.6	16.5	16.7	<0.1	1.28	2.00	-
BH210	999 R	0	0	9.0	9.1	12.3	11.5	<0.1	1.20	2.00	-
BH211	999 R	2.0	2.1	3.6	3.4	5.6	3.0	<0.1	2.10	4.00	-
BH212	999 R	0	0	4.1	3.9	18.7	18.2	-1.2	DRY	3.50	-
BH213	999 R	0	0	13.2	13.5	12.3	12.9	<0.1	1.60	1.80	-
BH214	999 R	0	0	8.2	8.2	17.5	14.2	-1.5	DRY	3.80	-
BH215	999 R	0.1	0	17.6	18.2	11.4	9.5	-1.1	DRY	3.50	-
BH216	999 R	0	0	12.5	12.5	14.2	12.5	<0.1	1.36	1.80	-
BH217	999 R	0	0	4.3	4.5	15.2	15.2	3.2	0.24	1.80	-
BH218	999 R	0.3	0.3	8.6	7.6	4.5	3.2	2.3	1.20	2.20	-
BH219	999 R	0	0	0.2	0.3	20.2	20.0	<0.1	2.34	3.00	-
BH220	999 R	0	0	14.2	12.5	12.2	8.5	<0.1	1.55	1.50	-
BH221	999 R	0	0	22.3	22.2	5.6	5.2	<0.1	DRY	3.80	-
BH222	999 R	0	0	6.5	6.2	17.4	17.2	<0.1	2.30	2.50	-
BH223	999 R	0	0	8.5	8.5	12.2	11.5	<0.1	1.45	1.50	-

Notes:
 Initial Value = First recorded concentration taken immediately upon opening the gas valve; Residual Value = Constant or "steady" reading following peak.
 Monitoring undertaken for a minimum of three minutes. Where high concentrations are initially noted then the monitoring should be increased to five minutes.
 F = Falling Atmospheric Pressure, R = Rising Atmospheric Pressure, S = Steady Atmospheric Pressure

Monitoring Completed By: JB

Equipment Used: GA2000 Gas Analyser with External Flow Pod. Geotechnical Instruments Dipmeter.

Weather Conditions: Dry.

Temperature 10.0°C.

Ground Gas & Groundwater Monitoring Record Sheet 07

Site: Harras Dyke Farm, Whitehaven

Project No: 2019-3889

Date: 29.01.2020

Borehole	Pressure (mb)	Methane Initial (% v/v)	Methane Residual (% v/v)	Carbon Dioxide Initial (% v/v)	Carbon Dioxide Residual (% v/v)	Oxygen Initial (% v/v)	Oxygen Residual (% v/v)	Flow Rate (l/h)	Water Level (m)	Depth of base (m)	Water Sample Recovered?
BH201	987 F	0	0	12.4	12.4	14.0	14.1	+0.2	1.69	3.00	-
BH202	987 F	0	0	7.6	7.6	12.0	9.1	-1.2	0.92	1.85	-
BH203	987 F	0	0	3.4	3.4	18.1	18.1	<0.1	0.48	1.80	-
BH204	987 F	0	0	10.7	11.0	14.1	6.9	+0.2	DRY	1.20	-
BH205	987 F	0	0	5.1	4.7	15.7	15.1	<0.1	DRY	0.80	-
BH206	987 F	0	0	7.2	7.2	11.6	9.5	<0.1	1.58	2.00	-
BH207	987 F	0	0	15.4	17.0	10.4	6.1	<0.1	1.46	1.80	-
BH208	987 F	0	0	3.0	3.1	19.2	19.2	<0.1	0.38	1.80	-
BH209	987 F	0	0	3.4	3.6	17.2	14.0	<0.1	1.28	2.00	-
BH210	987 F	0	0	9.3	9.4	9.9	5.8	+0.4	1.39	2.00	-
BH211	987 F	2.1	2.1	4.6	4.6	6.9	3.0	+2.7	1.52	4.00	-
BH212	987 F	0	0	0.3	0.3	19.5	19.5	-1.6	DRY	3.50	-
BH213	987 F	0	0	14.1	15.1	14.0	3.3	<0.1	1.45	1.80	-
BH214	987 F	0	0	8.3	9.0	18.1	15.0	-2.4	3.7	3.80	-
BH215	987 F	0.1	0.1	18.6	20.5	15.2	6.7	-1.3	3.45	3.50	-
BH216	987 F	0	0	13.0	13.3	11.9	9.1	<0.1	1.35	1.80	-
BH217	987 F	0	0	3.8	4.4	16.3	14.9	-2.9	0.23	1.80	-
BH218	987 F	0	0	9.2	10.5	13.7	9.8	-2.1	1.14	2.20	-
BH219	987 F	0	0	0.3	0.3	19.7	19.7	<0.1	2.35	3.00	-
BH220	987 F	0	0	12.1	13.1	13.8	2.1	<0.1	1.51	1.50	-
BH221	987 F	0	0	24.6	24.6	3.2	0.8	0.2	DRY	3.80	-
BH222	987 F	0	0	7.6	9.2	16.1	3.2	<0.1	2.44	2.50	-
BH223	987 F	0	0	10.7	10.7	8.9	2.2	<0.1	1.43	1.50	-

Notes:
Initial Value = First recorded concentration taken immediately upon opening the gas valve; Residual Value = Constant or "steady" reading following peak.
Monitoring undertaken for a minimum of three minutes. Where high concentrations are initially noted then the monitoring should be increased to five minutes.
F = Falling Atmospheric Pressure, R = Rising Atmospheric Pressure, S = Steady Atmospheric Pressure

Monitoring Completed By: JB

Equipment Used: GA2000 Gas Analyser with External Flow Pod. Geotechnical Instruments Dipmeter.

Weather Conditions: Dry.

Temperature 5.0°C.

Ground Gas & Groundwater Monitoring Record Sheet 08

Site: Harras Dyke Farm, Whitehaven

Project No: 2019-3889

Date: 10.02.2020

Borehole	Pressure (mb)	Methane Initial (% v/v)	Methane Residual (% v/v)	Carbon Dioxide Initial (% v/v)	Carbon Dioxide Residual (% v/v)	Oxygen Initial (% v/v)	Oxygen Residual (% v/v)	Flow Rate (l/h)	Water Level (m)	Depth of base (m)	Water Sample Recovered?
BH201	1002 R	0	0	10.2	10.5	15.6	15.8	<0.1	1.70	3.00	-
BH202	1002 R	0	0	7.0	7.1	12.8	12.0	<0.1	0.90	1.85	-
BH203	1002 R	0	0	3.8	3.8	17.5	17.6	<0.1	0.50	1.80	-
BH204	1002 R	0	0	10.2	10.8	11.5	8.4	<0.1	DRY	1.20	-
BH205	1002 R	0	0	5.0	5.0	15.2	15.2	<0.1	DRY	0.80	-
BH206	1002 R	0	0	8.4	8.6	12.2	7.5	<0.1	1.61	2.00	-
BH207	1002 R	0	0	16.3	16.8	12.3	9.6	<0.1	1.54	1.80	-
BH208	1002 R	0	0	2.5	2.3	19.0	19.1	<0.1	0.43	1.80	-
BH209	1002 R	0	0	4.5	4.6	16.5	16.4	<0.1	1.35	2.00	-
BH210	1002 R	0	0	5.6	5.6	12.5	13.5	1.2	1.42	2.00	-
BH211	1002 R	2.3	2.3	4.0	4.1	8.5	4.6	-0.5	1.62	4.00	-
BH212	1002 R	0	0	6.5	7.2	16.5	17.4	0.6	DRY	3.50	-
BH213	1002 R	0	0	13.5	14.2	13.2	9.5	<0.1	1.26	1.80	-
BH214	1002 R	0	0	21.0	21.3	3.2	1.7	1.2	3.85	3.80	-
BH215	1002 R	0.3	0.4	20.3	21.0	6.5	1.2	0.8	3.51	3.50	-
BH216	1002 R	0	0	12.3	12.3	12.6	12.6	<0.1	1.38	1.80	-
BH217	1002 R	0	0	8.7	9.2	8.5	8.7	0.5	0.25	1.80	-
BH218	1002 R	0	0	8.5	9.2	12.5	8.7	-0.5	1.32	2.20	-
BH219	1002 R	0	0	0.7	0.7	19.8	19.7	<0.1	2.34	3.00	-
BH220	1002 R	0	0	13.0	13.0	8.2	6.9	<0.1	DRY	1.50	-
BH221	1002 R	0	0	24.5	24.5	5.0	3.1	0.2	DRY	3.80	-
BH222	1002 R	0	0	6.5	6.0	17.5	8.5	<0.1	2.46	2.50	-
BH223	1002 R	0	0	11.0	12.3	9.5	4.5	<0.1	1.40	1.50	-

Notes:
 Initial Value = First recorded concentration taken immediately upon opening the gas valve; Residual Value = Constant or "steady" reading following peak.
 Monitoring undertaken for a minimum of three minutes. Where high concentrations are initially noted then the monitoring should be increased to five minutes.
 F = Falling Atmospheric Pressure, R = Rising Atmospheric Pressure, S = Steady Atmospheric Pressure

Monitoring Completed By: JB

Equipment Used: GA2000 Gas Analyser with External Flow Pod. Geotechnical Instruments Dipmeter.

Weather Conditions: Dry.

Temperature 6.0°C.

Ground Gas & Groundwater Monitoring Record Sheet 09

Site: Harras Dyke Farm, Whitehaven

Project No: 2019-3889

Date: 09.03.2020

Borehole	Pressure (mb)	Methane Initial (% v/v)	Methane Residual (% v/v)	Carbon Dioxide Initial (% v/v)	Carbon Dioxide Residual (% v/v)	Oxygen Initial (% v/v)	Oxygen Residual (% v/v)	Flow Rate (l/h)	Water Level (m)	Depth of base (m)	Water Sample Recovered?
BH201	990 F	0	0	8.5	7.4	16.6	16.6	<0.1	1.69	nm	-
BH202	990 F	0	0	6.8	6.9	13.9	11.4	<0.1	0.92	nm	-
BH203	990 F	0	0	3.5	3.6	18.7	17.7	<0.1	0.48	nm	-
BH204	990 F	0	0	10.6	11.2	11.8	7.8	<0.1	DRY	nm	-
BH205	990 F	0	0	4.9	5.0	14.2	10.2	<0.1	DRY	nm	-
BH206	990 F	0	0	9.4	9.7	13.4	6.5	<0.1	1.58	nm	-
BH207	990 F	0	0	16.1	16.6	13.4	5.8	<0.1	1.46	nm	-
BH208	990 F	0	0	0.5	0.5	19.9	20.1	<0.1	0.38	nm	-
BH209	990 F	0	0	5.6	5.8	17.8	15.6	<0.1	1.28	nm	-
BH210	990 F	0	0	1.1	1.1	19.4	19.0	-3.9	1.39	nm	-
BH211	990 F	1.8	2.0	3.8	3.9	9.4	5.3	-2.4	1.52	nm	-
BH212	990 F	0	0	10.7	11.1	12.3	2.7	+0.9	DRY	nm	-
BH213	990 F	0	0	14.4	14.7	12.7	6.4	<0.1	1.45	nm	-
BH214	990 F	0	0	25.9	26.3	4.4	1.4	+0.8	3.7	nm	-
BH215	990 F	0.4	0.4	21.5	22.7	8.5	2.6	+0.7	3.45	nm	-
BH216	990 F	0	0	11.0	12.0	15.2	10.4	<0.1	1.35	nm	-
BH217	990 F	0	0	11.7	12.0	6.6	3.4	<0.1	0.23	nm	-
BH218	990 F	0	0	10.2	10.8	14.1	10.6	-0.7	1.14	nm	-
BH219	990 F	0	0	1.4	1.4	18.7	19.1	<0.1	2.35	nm	-
BH220	990 F	0	0	13.2	13.4	5.3	1.5	<0.1	1.51	nm	-
BH221	990 F	0	0	25.3	25.3	5.3	2.2	<0.1	DRY	nm	-
BH222	990 F	0	0	8.9	9.3	10.2	5.6	<0.1	2.44	nm	-
BH223	990 F	0	0	10.9	10.9	4.3	3.1	<0.1	1.43	nm	-

Notes:
 Initial Value = First recorded concentration taken immediately upon opening the gas valve; Residual Value = Constant or "steady" reading following peak.
 Monitoring undertaken for a minimum of three minutes. Where high concentrations are initially noted then the monitoring should be increased to five minutes.
 F = Falling Atmospheric Pressure, R = Rising Atmospheric Pressure, S = Steady Atmospheric Pressure
 Nm = not monitored

Monitoring Completed By: JB

Equipment Used: GA2000 Gas Analyser with External Flow Pod. Geotechnical Instruments Dipmeter.

Weather Conditions: Dry.

Temperature 7.0°C.

Ground Gas & Groundwater Monitoring Record Sheet 10

Site: Harras Dyke Farm, Whitehaven

Project No: 2019-3889

Date: 16.04.2020

Borehole	Pressure (mb)	Methane Initial (% v/v)	Methane Residual (% v/v)	Carbon Dioxide Initial (% v/v)	Carbon Dioxide Residual (% v/v)	Oxygen Initial (% v/v)	Oxygen Residual (% v/v)	Flow Rate (l/h)	Water Level (m)	Depth of base (m)	Water Sample Recovered?
BH201	1002 F	0	0	5.6	4.1	18.3	18.4	<0.1	1.81	nm	-
BH202	1002 F	0	0	9.1	9.4	10.6	8.1	<0.1	1.29	nm	-
BH203	1002 F	0	0	12.3	12.6	9.4	6.6	<0.1	1.82	nm	-
BH204	1002 F	0	0	10.5	10.7	7.7	6.9	<0.1	DRY	nm	-
BH205	1002 F	0	0	8.2	8.5	6.8	2.4	<0.1	DRY	nm	-
BH206	1002 F	0	0	10.4	11.1	6.5	4.1	<0.1	1.93	nm	-
BH207	1002 F	0	0	15.8	16.7	5.0	3.0	+0.5	1.40	nm	-
BH208	1002 F	0	0	6.0	6.1	17.2	16.6	<0.1	0.94	nm	-
BH209	1002 F	0	0	6.4	6.4	13.5	13.1	<0.1	DRY	nm	-
BH210	1002 F	0.2	0.2	8.1	8.5	4.0	0.7	<0.1	1.52	nm	-
BH211	1002 F	1.3	1.5	4.5	4.6	2.6	0.0	<0.1	DRY	nm	-
BH212	1002 F	0	0	2.7	2.8	18.6	18.7	<0.1	DRY	nm	-
BH213	1002 F	0	0	15.0	15.0	2.5	2.5	<0.1	1.41	nm	-
BH214	1002 F	0	0	20.6	24.0	6.8	3.0	<0.1	DRY	nm	-
BH215	1002 F	0	0	14.3	14.8	11.6	11.1	<0.1	DRY	nm	-
BH216	1002 F	0	0	13.8	13.9	5.6	5.2	<0.1	1.66	nm	-
BH217	1002 F	0	0	8.6	8.7	6.4	5.8	<0.1	1.60	nm	-
BH218	1002 F	0	0	3.6	4.2	16.4	14.6	-9.4	1.20	nm	-
BH219	1002 F	0	0	0.2	0.2	19.6	19.6	<0.1	2.49	nm	-
BH220	1002 F	0	0	10.4	10.4	9.0	7.9	<0.1	1.47	nm	-
BH221	1002 F	0	0	6.9	7.2	17.2	17.2	<0.1	DRY	nm	-
BH222	1002 F	0	0	10.9	10.9	3.0	3.0	<0.1	2.56	nm	-
BH223	1002 F	0	0	10.7	11.4	8.1	1.6	<0.1	1.36	nm	-

Notes:
 Initial Value = First recorded concentration taken immediately upon opening the gas valve; Residual Value = Constant or "steady" reading following peak.
 Monitoring undertaken for a minimum of three minutes. Where high concentrations are initially noted then the monitoring should be increased to five minutes.
 F = Falling Atmospheric Pressure, R = Rising Atmospheric Pressure, S = Steady Atmospheric Pressure
 Nm = not monitored

Monitoring Completed By: JB

Equipment Used: GA2000 Gas Analyser with External Flow Pod. Geotechnical Instruments Dipmeter.

Weather Conditions: Dry, Sunny.

Temperature 15.5°C.

Ground Gas & Groundwater Monitoring Record Sheet 11

Site: Harras Dyke Farm, Whitehaven

Project No: 2019-3889

Date: 05.06.2020

Borehole	Pressure (mb)	Methane Initial (% v/v)	Methane Residual (% v/v)	Carbon Dioxide Initial (% v/v)	Carbon Dioxide Residual (% v/v)	Oxygen Initial (% v/v)	Oxygen Residual (% v/v)	Flow Rate (l/h)	Water Level (m)	Depth of base (m)	Water Sample Recovered?
BH201	990 F	0	0	11.2	11.6	16.5	15.9	<0.1	Nm	nm	-
BH202	990 F	0	0	8.4	8.4	15.6	14.5	<0.1	Nm	nm	-
BH203	990 F	0	0	3.2	3.1	12.5	13.5	<0.1	Nm	nm	-
BH204	990 F	0	0	9.8	9.5	7.8	7.9	<0.1	Nm	nm	-
BH205	990 F	0	0	6.3	6.3	12.9	13.1	<0.1	Nm	nm	-
BH206	990 F	0	0	5.6	6.3	12.6	11.8	<0.1	Nm	nm	-
BH207	990 F	0	0	12.6	12.4	9.6	10.2	+0.2	Nm	nm	-
BH208	990 F	0	0	4.2	4.4	18.9	18.9	<0.1	Nm	nm	-
BH209	990 F	0	0	5.1	5.1	16.5	16.4	<0.1	Nm	nm	-
BH210	990 F	0	0	8.8	8.5	15.6	15.5	<0.1	Nm	nm	-
BH211	990 F	1.8	1.8	5.2	5.6	4.6	3.1	<0.1	Nm	nm	-
BH212	990 F	0	0	1.8	1.8	18.9	18.9	<0.1	Nm	nm	-
BH213	990 F	0	0	13.2	13.2	6.5	6.9	<0.1	Nm	nm	-
BH214	990 F	0	0	12.6	13.1	7.2	7.5	<0.1	Nm	nm	-
BH215	990 F	0	0	18.5	18.5	7.8	8.2	<0.1	Nm	nm	-
BH216	990 F	0	0	6.5	6.5	7.8	8.6	<0.1	Nm	nm	-
BH217	990 F	0	0	6.5	5.9	12.3	12.4	<0.1	Nm	nm	-
BH218	990 F	0.1	0.1	9.2	10.1	11.1	10.5	+1.2	Nm	nm	-
BH219	990 F	0	0	0.3	0.3	19.8	19.8	<0.1	Nm	nm	-
BH220	990 F	0	0	11.9	12.3	8.2	7.6	<0.1	Nm	nm	-
BH221	990 F	0	0	13.5	13.6	8.6	8.4	<0.1	Nm	nm	-
BH222	990 F	0	0	9.7	9.8	12.3	12.3	<0.1	Nm	nm	-
BH223	990 F	0	0	11.5	11.6	7.6	2.3	<0.1	Nm	nm	-

Notes:
Initial Value = First recorded concentration taken immediately upon opening the gas valve; Residual Value = Constant or "steady" reading following peak.
Monitoring undertaken for a minimum of three minutes. Where high concentrations are initially noted then the monitoring should be increased to five minutes.
F = Falling Atmospheric Pressure, R = Rising Atmospheric Pressure, S = Steady Atmospheric Pressure
Nm = not monitored

Monitoring Completed By: JB

Equipment Used: GA2000 Gas Analyser with External Flow Pod. Geotechnical Instruments Dipmeter.

Weather Conditions: Dry.

Temperature: 16°C.

Ground Gas & Groundwater Monitoring Record Sheet 12

Site: Harras Dyke Farm, Whitehaven

Project No: 2019-3889

Date: 09.06.2020

Borehole	Pressure (mb)	Methane Initial (% v/v)	Methane Residual (% v/v)	Carbon Dioxide Initial (% v/v)	Carbon Dioxide Residual (% v/v)	Oxygen Initial (% v/v)	Oxygen Residual (% v/v)	Flow Rate (l/h)	Water Level (m)	Depth of base (m)	Water Sample Recovered?
BH201	1005 F	0	0	6.6	6.3	17.7	17.7	<0.1	Nm	Nm	-
BH202	1005 F	0	0	8.7	8.6	12.3	13.6	<0.1	Nm	Nm	-
BH203	1005 F	0	0	10.3	11.2	12.3	11.2	<0.1	Nm	Nm	-
BH204	1005 F	0	0	12.1	11.9	6.5	6.9	<0.1	Nm	Nm	-
BH205	1005 F	0	0	2.4	3.5	8.5	8.6	<0.1	Nm	Nm	-
BH206	1005 F	0	0	9.8	10.3	5.6	3.7	<0.1	Nm	Nm	-
BH207	1005 F	0	0	17.7	17.8	3.7	3.4	+0.4	Nm	Nm	-
BH208	1005 F	0	0	6.0	6.1	17.2	16.6	<0.1	Nm	Nm	-
BH209	1005 F	0	0	1.5	3.2	19.6	19.5	<0.1	Nm	Nm	-
BH210	1005 F	0.1	0.1	7.4	7.9	3.6	1.2	<0.1	Nm	Nm	-
BH211	1005 F	0.7	0.5	3.7	3.8	5.6	4.8	0.4	Nm	Nm	-
BH212	1005 F	0	0	3.6	3.5	5.6	5.7	<0.1	Nm	Nm	-
BH213	1005 F	0	0	14.6	14.7	3.5	2.9	<0.1	Nm	Nm	-
BH214	1005 F	0	0	14.3	14.0	7.8	6.8	<0.1	Nm	Nm	-
BH215	1005 F	0	0	6.5	6.4	8.2	8.3	<0.1	Nm	Nm	-
BH216	1005 F	0	0	5.6	5.6	2.3	3.6	<0.1	Nm	Nm	-
BH217	1005 F	0	0	5.6	5.6	8.4	6.5	<0.1	Nm	Nm	-
BH218	1005 F	0	0	7.8	7.8	16.2	16.2	-1.2	Nm	Nm	-
BH219	1005 F	0	0	1.6	1.6	19.0	19.0	<0.1	Nm	Nm	-
BH220	1005 F	Nm	Nm	Nm	Nm	Nm	Nm	Nm	Nm	Nm	-
BH221	1005 F	0	0	3.2	3.2	16.8	17.6	<0.1	Nm	Nm	-
BH222	1005 F	0	0	8.5	8.4	6.8	6.8	<0.1	Nm	Nm	-
BH223	1005 F	0	0	10.5	10.5	6.3	3.5	<0.1	Nm	Nm	-

Notes:
 Initial Value = First recorded concentration taken immediately upon opening the gas valve; Residual Value = Constant or "steady" reading following peak.
 Monitoring undertaken for a minimum of three minutes. Where high concentrations are initially noted then the monitoring should be increased to five minutes.
 F = Falling Atmospheric Pressure, R = Rising Atmospheric Pressure, S = Steady Atmospheric Pressure
 Nm = not monitored

Monitoring Completed By: JB

Equipment Used: GA2000 Gas Analyser with External Flow Pod. Geotechnical Instruments Dipmeter.

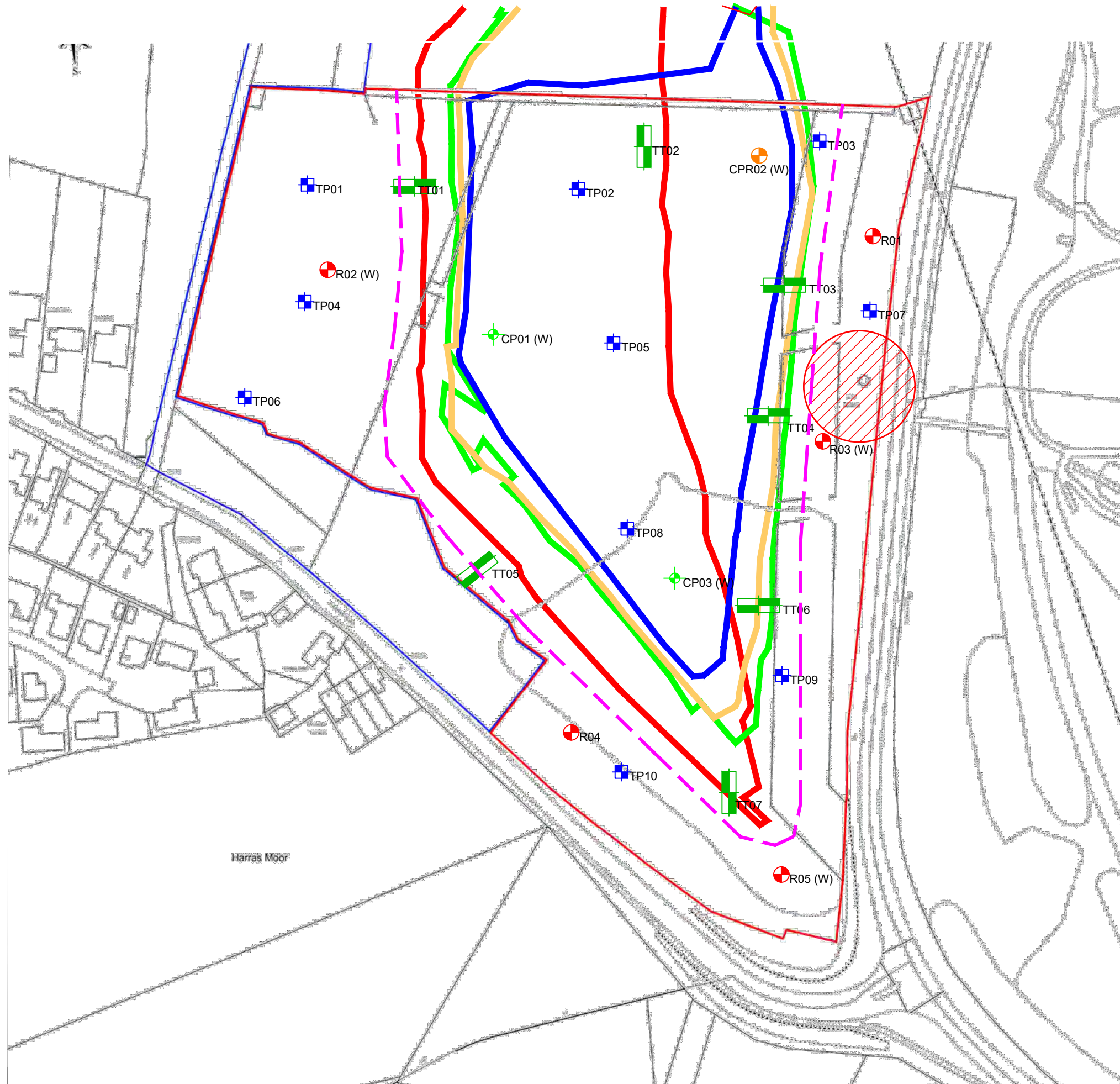
Weather Conditions: Dry, Sunny.

Temperature 17.0°C.



APPENDIX A

FIGURES AND DRAWINGS

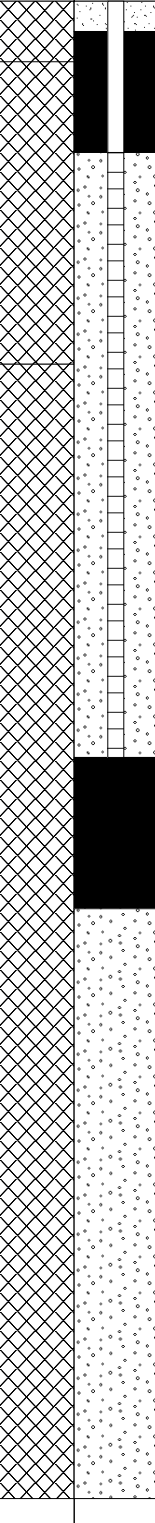


NOTES			
 Approximate Site Boundary			
 Rotary open hole borehole			
 Cable percussion borehole with rotary open follow on			
 Cable percussion borehole			
(W) Borehole with gas/groundwater monitoring well			
 Trial Trench Location			
 Mine shaft and overhead cable 15m offsets			
 Trial Pit Location			
 Conjectured batter plane of high wall			
 Opencast made ground			
Seams Worked by Opencast Based on Coal Authority abandonment plan NW1454 11/08/2015			
 Unnamed G			
 Unnamed E			
 Brassy			
 Unnamed C			
REVISION		BY	DATE
0	For Information	MF	10/01/19
A	>>	>>	>>
B	>>	>>	>>
C	>>	>>	>>
D	>>	>>	>>
SIRIUS GEOTECHNICAL LTD Russel House, Mill Lane, Langley Moor, Durham DH7 8HJ www.thesiriusgroup.com TEL: 0191 378 9972 FAX: 0191 378 1537			
CLIENT			
Michael Little			
SITE			
Harras Moor, Whitehaven			
DRAWING TITLE			
Extents of Opencast Made Ground			
DRAWING NO. C7728/05		REVISION NO. 0	
DRAWN BY MF		APPROVED BY GA	
DATE January 2019	SCALE 1:1500	PAPER SIZE A3	

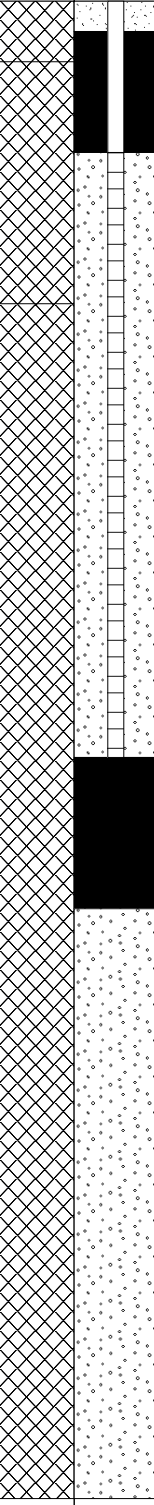


APPENDIX C

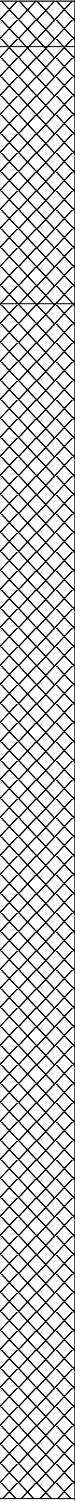
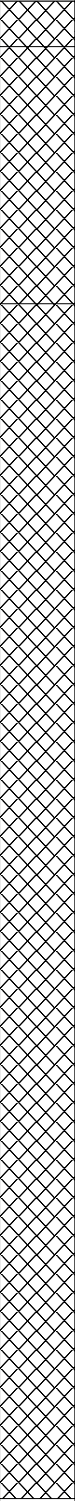
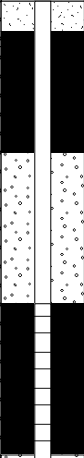
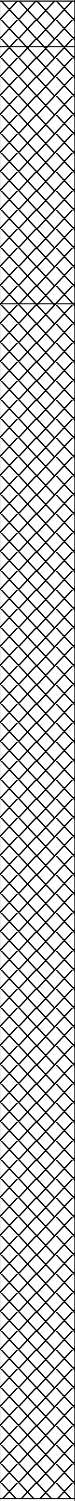
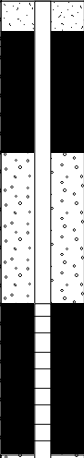
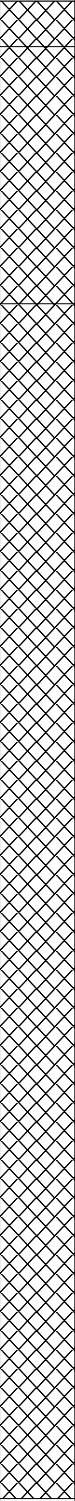
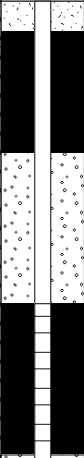
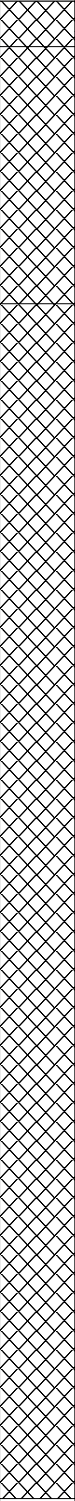
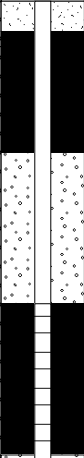
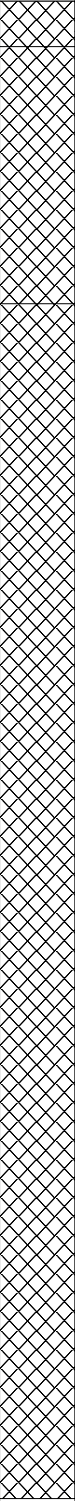
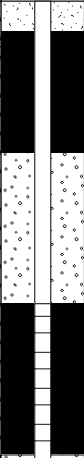
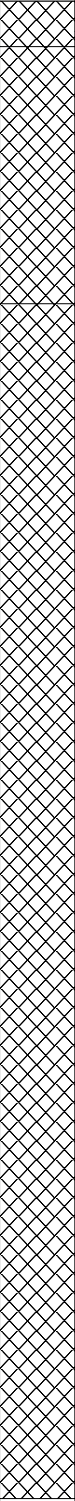
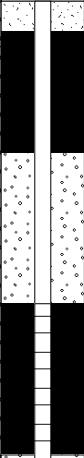
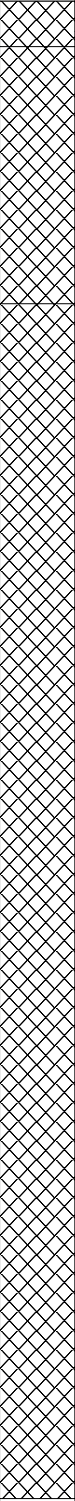
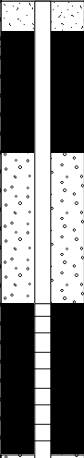
EXPLORATORY HOLE LOGS AND FIELD TEST RESULTS

				BOREHOLE RECORD		BH No. CP01 Sheet 1 of 2	
				Site: Harras Moor, Whitehaven		Contract No: C7728	
				Client: Michael Little		Date(s): 02/10/2018 - 03/10/2018	
				Method: Hole advanced with a Dando 2000 cable percussion drilling rig using 200mm tools.		Scale: 1:50	
SAMPLE DETAILS				STRATA RECORD		Logged By: DG Checked By: CR Driller: Infosoil Ltd.	
Type	Depth From - To(m)	SPT (N), (ppm), (Cu Peak), Vane Result (kN/m2)	Ground -water	Description	Depth (m)	Level (m AOD)	Legend 
D ES D	1.00 1.00 1.00 - 1.45	N=13 (3,3/3,3,4,3)	1	MADE GROUND: Firm brown sandy gravelly clay (Topsoil). Gravel is sub angular to rounded fine to coarse sandstone and occasional coal.	0.40		
D ES D	2.00 2.00 2.00 - 2.45	N=51 (8,16/17,10,13, 11)	2	MADE GROUND: Firm to stiff orange brown sandy gravelly clay. Gravel is angular to rounded fine to coarse sandstone, mudstone, coal and occasional brick. Low cobble content of angular and sub angular sandstone.	2.40		
D ES	3.00 3.00		3	MADE GROUND: Medium dense (occasionally dense) grey very clayey very sandy gravel and cobbles of angular and sub angular fine to coarse mudstone and sandstone. High content of cobbles and boulders of sandstone and mudstone.			
D ES D	4.00 4.00 4.00 - 4.45	N=11 (2,3/2,3,3,3)	4				
D ES D	5.00 5.00 5.00 - 5.45	N=23 (3,4/7,4,5,7)	5				
D D	6.00 6.00 - 6.45	N=25 (4,5/6,6,7,6)	6				
D	7.00		7				
D D	7.50 - 7.95 8.00	35 (4,11/35 for 170mm)	8				
D	9.00 - 9.45	N=21 (5,5/5,6,5,5)	9				
				Continued next sheet			
Remarks and Groundwater Observations: 1. Groundwater not encountered.					GL (mAOD)		Fig No. CP01
					Easting:		
					298820.00		
					Northing:		
					518436.00		

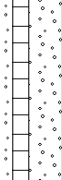
				BOREHOLE RECORD		BH No. CP01 Sheet 2 of 2		
				Site: Harras Moor, Whitehaven		Contract No: C7728		
				Client: Michael Little		Date(s): 02/10/2018 - 03/10/2018		
				Method: Hole advanced with a Dando 2000 cable percussion drilling rig using 200mm tools.		Scale: 1:50		
SAMPLE DETAILS				STRATA RECORD		Logged By: DG Checked By: CR		
				Driller: Infosoil Ltd.				
Type	Depth From - To(m)	SPT (N), (ppm), (Cu Peak), Vane Result (kN/m2)	Ground -water	Description	Depth (m)	Level (m AOD)	Legend	Well
D	10.00	N=21 (3,3/4,5,7,5)	10	MADE GROUND: Medium dense (occasionally dense) grey very clayey very sandy gravel and cobbles of angular and sub angular fine to coarse mudstone and sandstone. High content of cobbles and boulders of sandstone and mudstone.				
D	10.50 - 10.95		11					
D	11.50		12					
		N=43 (5,4/8,11,10,14)		<i>From 12.0m to 14.4m: Becomes very dense, and with numerous cobbles and boulders.</i>				
D	12.45 - 12.95		13					
B	13.00 - 13.50		14					
D	13.50 - 13.70	50 (25 for 110mm/50 for 295mm) 50 (50 for 0mm/50 for 0mm) 50 (50 for 0mm/50 for 0mm)		End of Borehole at 14.40m	14.40			
D	14.00		15					
D	14.20		16					
D	14.40		17					
			18					
			19					
Remarks and Groundwater Observations:					GL (mAOD)		Fig No.	
1. Groundwater not encountered.					Easting:		CP01	
					298820.00			
					Northing:			
					518436.00			

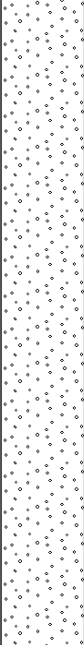
				BOREHOLE RECORD		BH No. CP03 Sheet 1 of 2	
				Site: Harras Moor, Whitehaven		Contract No: C7728	
				Client: Michael Little		Date(s): 03/10/2018 - 04/10/2018	
				Method: Hole advanced with a Dando 2000 cable percussion drilling rig using 200mm tools.		Scale: 1:50	
SAMPLE DETAILS				STRATA RECORD		Logged By: DG Checked By: CR Driller: Infosoil Ltd.	
Type	Depth From - To(m)	SPT (N), (ppm), (Cu Peak), Vane Result (kN/m2)	Ground -water	Description	Depth (m)	Level (m AOD)	Legend 
B	0.00 - 0.50			MADE GROUND: Firm brown sandy gravelly clay (Topsoil). Gravel is sub angular to rounded fine to coarse sandstone and occasional coal.	0.40		
D	1.00	N=12	1	MADE GROUND: Firm to stiff orange brown sandy gravelly clay. Gravel is angular to rounded fine to coarse sandstone, mudstone, coal and occasional brick. Low cobble content of angular and sub angular sandstone.			
ES	1.00	(2,3/3,3,3,3)					
D	1.00 - 1.45						
D	2.00	N=12	2	MADE GROUND: Medium dense grey very clayey very sandy gravel and cobbles of angular and sub angular fine to coarse mudstone and sandstone. High content of cobbles and boulders of sandstone and mudstone.	2.00		
ES	2.00	(3,4/3,2,4,3)					
D	2.00 - 2.45						
D	3.00	N=10	3				
ES	3.00	(1,2/2,3,2,3)					
D	3.00 - 3.45						
D	4.00	N=15	4				
ES	4.00	(3,4/4,3,4,4)					
D	4.00 - 4.45						
D	5.00	N=13	5				
ES	5.00	(2,4/2,4,3,4)					
D	5.00 - 5.45						
B	5.00 - 6.00						
D	6.00 - 6.45	N=14	6				
		(2,3/3,4,5,2)					
			7				
D	7.50 - 7.95	N=13	8				
		(3,3/3,3,4,3)					
D	8.50						
D	9.00 - 9.45	N=19	9				
		(4,4/3,5,5,6)					
				Continued next sheet			
Remarks and Groundwater Observations: 1. Groundwater not encountered.					GL (mAOD)		Fig No. CP03
					Easting: 298885.00		
					Northing: 518349.00		

				BOREHOLE RECORD		BH No. CP03 Sheet 2 of 2		
				Site: Harras Moor, Whitehaven		Contract No: C7728		
				Client: Michael Little		Date(s): 03/10/2018 - 04/10/2018		
				Method: Hole advanced with a Dando 2000 cable percussion drilling rig using 200mm tools.		Scale: 1:50		
SAMPLE DETAILS				STRATA RECORD		Logged By: DG Checked By: CR Driller: Infosoil Ltd.		
Type	Depth From - To(m)	SPT (N), (ppm), (Cu Peak), Vane Result (kN/m2)	Ground -water	Description	Depth (m)	Level (m AOD)	Legend	Well
D	10.00		10	MADE GROUND: Medium dense grey very clayey very sandy gravel and cobbles of angular and sub angular fine to coarse mudstone and sandstone. High content of cobbles and boulders of sandstone and mudstone. <i>From 12.0m to 16.55m: Becomes very dense and dense, and with numerous cobbles and boulders.</i>				
D	10.50 - 10.95	N=19 (4,5/3,7,4,5)	11					
B	11.00 - 12.00							
D	12.00 - 12.13	50 (25 for 1mm/50 for 305mm)	12					
D	13.00		13					
D	13.50 - 13.95	N=33 (21,9/8,11,7,7)	14					
D	14.50							
D	15.00 - 15.45	N=44 (6,7/5,12,11,16)	15					
B	15.90 - 16.35		16					
D	16.35 - 16.45	50 (25 for 0mm/50 for 20mm)						
D	16.55	50 (50 for 0mm/50 for 0mm)		End of Borehole at 16.55m	16.55			
Remarks and Groundwater Observations: 1. Groundwater not encountered.					GL (mAOD)		Fig No. CP03	
					Easting: 298885.00			
					Northing: 518349.00			

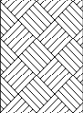
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				Site: Harras Moor, Whitehaven		Contract No: C7728			
				Client: Michael Little		Date(s): 03/10/2018			
				Method: Hole advanced with a Dando 2000 cable percussion drilling rig using 200mm tools, and a tracked rotary drilling rig.		Scale: 1:50			
SAMPLE DETAILS				STRATA RECORD		Logged By: DG Checked By: CR			
				Driller: Infosoil Ltd.					
Type	Depth From - To(m)	SPT (N), (ppm), (Cu Peak), Vane Result (kN/m2)	Ground -water	Description		Depth (m)	Level (m AOD)	Legend	Well
D ES D	1.00 1.00 1.00 - 1.45	N=17 (3,4/4,4,5,4)	1	MADE GROUND: Topsoil		0.30			
	MADE GROUND: Firm to stiff orange brown sandy gravelly clay. Gravel is angular to rounded fine to coarse sandstone, mudstone, coal and occasional brick. Low cobble content of angular and sub angular sandstone.								
D ES D	2.00 2.00 2.00 - 2.45	N=25 (5,5/6,6,7,6)	2	MADE GROUND: Medium dense and dense grey very clayey sandy gravel and cobbles of sandstone and occasional mudstone. High content of cobbles and boulders of sandstone and mudstone.		2.00			
D ES D	3.00 3.00 3.00 - 3.45	N=12 (3,6/3,3,3,3)	3						
D ES D	4.00 4.00 4.00 - 4.45	N=28 (4,6/7,8,6,7)	4						
D ES D	5.00 5.00 5.00 - 5.45	N=29 (3,4/5,8,9,7)	5						
D D	6.00 6.00 - 6.45	N=12 (2,2/3,3,3,3)	6						
D D	7.00 7.50 - 7.95	N=38 (4,4/6,11,11,10)	7						
B D	8.00 - 9.00 9.00 - 9.45	N=6 (1,1/1,2,2,1)	9	From 9.0m to 10.0m: Becomes loose.					
				Continued next sheet					
Remarks and Groundwater Observations: 1. Groundwater not encountered. 2. Cable percussion drilling to 15.8m, rotary open hole drilling thereafter.						GL (mAOD)		Fig No. CPR02	
						Easting: 298915.00			
						Northing: 518500.00			

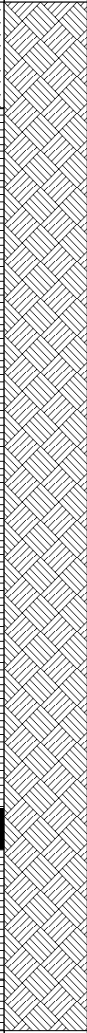
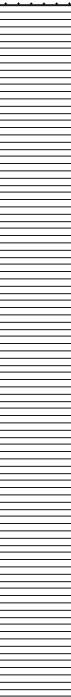
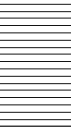
				BOREHOLE RECORD		BH No. CPR02 Sheet 2 of 5			
				Site: Harras Moor, Whitehaven		Contract No: C7728			
				Client: Michael Little		Date(s): 03/10/2018			
				Method: Hole advanced with a Dando 2000 cable percussion drilling rig using 200mm tools, and a tracked rotary drilling rig.		Scale: 1:50			
SAMPLE DETAILS				STRATA RECORD		Logged By: DG Checked By: CR			
				Driller: Infosoil Ltd.					
Type	Depth From - To(m)	SPT (N), (ppm), (Cu Peak), Vane Result (kN/m2)	Ground -water	Description		Depth (m)	Level (m AOD)	Legend	Well
D	10.50	N=23	10	MADE GROUND: Medium dense and dense grey very clayey sandy gravel and cobbles of sandstone and occasional mudstone. High content of cobbles and boulders of sandstone and mudstone.					
D	10.50 - 10.95	(3,8/7,4,8,4)							
D	11.50		11						
D	12.00 - 12.45	N=28 (4,8/8,7,6,7)	12						
B	13.00 - 13.50		13						
D	13.50 - 13.95	N=43 (6,11/11,10,12,10)	14	From 13.5m to 15.0m: Becomes very dense.					
D	14.50		15						
		28 (5,7/28 for 5mm)							
		50 (25 for 30mm/50 for 30mm)							
		50 (25 for 0mm/50 for 0mm)							
			16	MADE GROUND: Grey colliery backfill, numerous boulders.		15.80			
			17						
			18						
			19						
				Continued next sheet					
Remarks and Groundwater Observations: 1. Groundwater not encountered. 2. Cable percussion drilling to 15.8m, rotary open hole drilling thereafter.						GL (mAOD)		Fig No. CPR02	
						Easting: 298915.00			
						Northing: 518500.00			

				BOREHOLE RECORD		BH No. CPR02 Sheet 3 of 5		
				Site: Harras Moor, Whitehaven		Contract No: C7728		
				Client: Michael Little		Date(s): 03/10/2018		
				Method: Hole advanced with a Dando 2000 cable percussion drilling rig using 200mm tools, and a tracked rotary drilling rig.		Scale: 1:50		
SAMPLE DETAILS				STRATA RECORD		Logged By: DG Checked By: CR		
				Driller: Infosoil Ltd.				
Type	Depth From - To(m)	SPT (N), (ppm), (Cu Peak), Vane Result (kN/m2)	Ground -water	Description	Depth (m)	Level (m AOD)	Legend	Well
			20	MADE GROUND: Grey colliery backfill, numerous boulders.	22.00			
			21					
			22	Grey silty MUDSTONE.				
			23					
			24					
			25					
			26					
			27					
			28					
			29					
				Continued next sheet				
Remarks and Groundwater Observations: 1. Groundwater not encountered. 2. Cable percussion drilling to 15.8m, rotary open hole drilling thereafter.					GL (mAOD)		Fig No. CPR02	
					Easting: 298915.00			
					Northing: 518500.00			

				BOREHOLE RECORD		BH No. CPR02 Sheet 4 of 5		
				Site: Harras Moor, Whitehaven		Contract No: C7728		
				Client: Michael Little		Date(s): 03/10/2018		
				Method: Hole advanced with a Dando 2000 cable percussion drilling rig using 200mm tools, and a tracked rotary drilling rig.		Scale: 1:50		
SAMPLE DETAILS				STRATA RECORD		Logged By: DG Checked By: CR		
				Driller: Infosoil Ltd.				
Type	Depth From - To(m)	SPT (N), (ppm), (Cu Peak), Vane Result (kN/m2)	Ground -water	Description	Depth (m)	Level (m AOD)	Legend	Well
			30	Grey silty MUDSTONE.	34.00			
			31					
			32					
			33					
			34	Dark grey MUDSTONE.				
			35					
			36					
			37					
			38	Grey MUDSTONE.	37.50			
			39					
				Continued next sheet				
Remarks and Groundwater Observations: 1. Groundwater not encountered. 2. Cable percussion drilling to 15.8m, rotary open hole drilling thereafter.					GL (mAOD)		Fig No. CPR02	
					Easting: 298915.00			
					Northing: 518500.00			

				BOREHOLE RECORD		BH No. CPR02 Sheet 5 of 5		
				Site: Harras Moor, Whitehaven		Contract No: C7728		
				Client: Michael Little		Date(s): 03/10/2018		
				Method: Hole advanced with a Dando 2000 cable percussion drilling rig using 200mm tools, and a tracked rotary drilling rig.		Scale: 1:50		
SAMPLE DETAILS				STRATA RECORD		Logged By: DG Checked By: CR		
						Driller: Infosoil Ltd.		
Type	Depth From - To(m)	SPT (N), (ppm), (Cu Peak), Vane Result (kN/m2)	Ground -water	Description	Depth (m)	Level (m AOD)	Legend	Well
			40	Grey MUDSTONE.				
			41					
			42	Solid - no returns.	42.00			
			43					
			44					
			45	End of Borehole at 45.00m	45.00			
			46					
			47					
			48					
			49					
Remarks and Groundwater Observations: 1. Groundwater not encountered. 2. Cable percussion drilling to 15.8m, rotary open hole drilling thereafter.					GL (mAOD)		Fig No. CPR02	
					Easting: 298915.00			
					Northing: 518500.00			

						BOREHOLE RECORD		BH No. R01 Sheet 1 of 2		
						Site: Harras Moor, Whitehaven		Contract No: C7728		
						Client: Michael Little		Date(s): 04/10/2018		
						Method: Hole advanced with a Beratta T44 rotary drilling rig, using air flush.		Scale: 1:150		
SAMPLE DETAILS						STRATA RECORD		Logged By: DG Checked By: CR		
						Driller: Info Soil Ltd.				
Depth From - To(m)	TCR	SCR	RQD	FI	Ground -water	Description	Depth (m)	Level (m AOD)	Legend	Well
						1 TOPSOIL. Brown sandy gravelly CLAY.	0.30			
						2 Grey brown MUDSTONE.	2.00			
						3 COAL.	3.00			
						4 Grey SILTSTONE.	3.30			
						5				
						6 COAL.	6.20			
						7 Grey MUDSTONE.	6.60			
						8				
						9 COAL.	8.30			
						9 Grey MUDSTONE.	8.60			
						10				
						11				
						12				
						13				
						14				
						15				
						16				
						17				
						18				
						19				
						20				
						21				
						22				
						23				
						24 Dark grey MUDSTONE.	24.00			
						25				
						26				
						27 COAL.	27.30			
						28 Grey MUDSTONE.	27.60			
						29 Grey SANDSTONE.	29.00			
						30				
	TCR	SCR	RQD	FI						
Remarks and Groundwater Observations: 1. Groundwater not encountered.							GL (m AOD)		Fig No. R01	
							Eastings: 298954.00			
							Northings: 518473.00			

						BOREHOLE RECORD		BH No. R01 Sheet 2 of 2		
						Site: Harras Moor, Whitehaven		Contract No: C7728		
						Client: Michael Little		Date(s): 04/10/2018		
						Method: Hole advanced with a Beratta T44 rotary drilling rig, using air flush.		Scale: 1:150		
SAMPLE DETAILS						STRATA RECORD		Logged By: DG Checked By: CR Driller: Infosoil Ltd.		
Depth From - To(m)	TCR	SCR	RQD	FI	Ground -water	Description	Depth (m)	Level (m AOD)	Legend	Well
					31	Grey SANDSTONE.				
					32					
					33	Grey MUDSTONE.	32.70			
					34					
					35					
					36					
					37					
					38					
					39					
					40					
					41					
					42					
					43					
					44					
					45					
					46					
					47	COAL.	46.60			
					48	Grey MUDSTONE.	47.40			
					49					
					50	Dark grey MUDSTONE.	50.00			
					51	End of Borehole at 51.00m	51.00			
					52					
					53					
					54					
					55					
					56					
					57					
					58					
					59					
					60					
					61					
Remarks and Groundwater Observations: 1. Groundwater not encountered.						GL (m AOD)		Fig No. R01		
						Eastings:				
						Northings:				
						298954.00 518473.00				

						BOREHOLE RECORD		BH No. R02 Sheet 1 of 1		
						Site: Harras Moor, Whitehaven		Contract No: C7728		
						Client: Michael Little		Date(s): 05/10/2018		
						Method: Hole advanced with a Beratta T44 rotary drilling rig, using air flush.		Scale: 1:150		
SAMPLE DETAILS						STRATA RECORD		Logged By: DG Checked By: CR		
						Driller: Info Soil Ltd.				
Depth From - To(m)	TCR	SCR	RQD	FI	Ground -water	Description	Depth (m)	Level (m AOD)	Legend	Well
						TOPSOIL.	0.30			
						1 Soft brown sandy gravelly CLAY.				
						2				
						Pink grey MUDSTONE.	2.20			
						3				
						4				
						5				
						6				
						7				
						8				
						9				
						10				
						11				
						12				
						13				
						14				
						15				
						16				
						17				
						18				
						19				
						20				
						21				
						22				
						23 COAL.	22.60			
						24 Grey MUDSTONE with occasional sandstone bands.	23.40			
						25				
						26				
						27				
						28				
						29				
						30 End of Borehole at 30.00m	30.00			
Remarks and Groundwater Observations: 1. Groundwater not encountered.							GL (m AOD)		Fig No. R02	
							Eastings: 298760.00			
							Northings: 518459.00			

						BOREHOLE RECORD		BH No. R03 Sheet 1 of 2		
						Site: Harras Moor, Whitehaven		Contract No: C7728		
						Client: Michael Little		Date(s): 04/10/2018		
						Method: Hole advanced with a Beratta T44 rotary drilling rig, using air flush.		Scale: 1:150		
SAMPLE DETAILS						STRATA RECORD		Logged By: DG Checked By: CR Driller: Infosoil Ltd.		
Depth From - To(m)	TCR	SCR	RQD	FI	Ground -water	Description	Depth (m)	Level (m AOD)	Legend	Well
						TOPSOIL. Brown sandy gravelly CLAY.	0.30			
						Grey MUDSTONE.	3.00			
						COAL.	6.70			
						Grey MUDSTONE.	7.00			
						COAL.	9.40			
						Grey MUDSTONE.	9.70			
						COAL.	16.80			
						Grey MUDSTONE.	17.10			
						Dark grey MUDSTONE.	24.00			
						COAL.	28.10			
						Grey MUDSTONE.	28.90			
Remarks and Groundwater Observations: 1. Groundwater not encountered.							GL (m AOD)		Fig No. R03	
							Eastings:			
							298938.00			
							Northings:			
518398.00										

						BOREHOLE RECORD		BH No. R03 Sheet 2 of 2		
						Site: Harras Moor, Whitehaven		Contract No: C7728		
						Client: Michael Little		Date(s): 04/10/2018		
						Method: Hole advanced with a Beratta T44 rotary drilling rig, using air flush.		Scale: 1:150		
SAMPLE DETAILS						STRATA RECORD		Logged By: DG Checked By: CR		
						Driller: Infosoil Ltd.				
Depth From - To(m)	TCR	SCR	RQD	FI	Ground -water	Description	Depth (m)	Level (m AOD)	Legend	Well
					31	Grey MUDSTONE.				
					32					
					33					
					34					
					35					
					36					
					37					
					38					
					39					
					40					
					41					
					42					
					43					
					44					
					45					
					46					
					47					
					48	COAL.	48.00			
					49	Grey MUDSTONE.	48.90			
					50					
					51	End of Borehole at 51.00m	51.00			
					52					
					53					
					54					
					55					
					56					
					57					
					58					
					59					
					60					
					61					
Remarks and Groundwater Observations: 1. Groundwater not encountered.							GL (m AOD)		Fig No. R03	
							Eastings:			
							298938.00			
							Northings:			
							518398.00			



BOREHOLE RECORD

BH No. **R04**
Sheet 1 of 2

Site: Harras Moor, Whitehaven

Contract No: C7728

Client: Michael Little

Date(s): 03/10/2018

Method: Hole advanced with a Beratta T44 rotary drilling rig, using air flush.

Scale: 1:150

SAMPLE DETAILS

STRATA RECORD

Logged By: DG

Checked By: CR

Driller: Infosoil Ltd.

Depth From - To(m)	TCR	SCR	RQD	FI	Ground -water	Description	Depth (m)	Level (m AOD)	Legend	Well
						TOPSOIL.	0.30			
					1	Brown sandy gravelly CLAY.				
					2	Grey silty MUDSTONE.	2.00			
					3					
					4					
					5					
					6	COAL	5.50			
						Grey MUDSTONE.	5.90			
					7					
					8					
					9					
					10					
					11					
					12					
					13	COAL.	13.20			
					14	Grey SILTSTONE.	13.90			
					15					
					16					
					17					
					18					
					19					
					20	Dark grey MUDSTONE.	20.00			
					21					
					22					
					23					
					24					
					25					
					26					
					27					
					28					
					29					
					30	COAL.	29.50			
							29.80			

Remarks and Groundwater Observations:

1. Groundwater not encountered.

GL (m AOD)

Eastings: 298844.86

Northings: 518291.94

Fig No.

R04

BOREHOLE RECORD

BH No.

R04

Sheet 2 of 2

Site: Harras Moor, Whitehaven

Contract No: C7728

Client: Michael Little

Date(s):	03/10/2018
----------	------------

Method:	Hole advanced with a Beratta T44 rotary drilling rig, using air flush.
---------	--

Scale: 1:150

SAMPLE DETAILS

STRATA RECORD

Logged By: DG

DG

Checked By: CR

Driller: Infosoil Ltd.

Infosoil Ltd.

Depth

TCR

SCR

RQD

FI

Ground

Description

Depth
(cm)

Level

Legenc

Well

Grey SILTSTONE.

COAL.

Grey MUDSTONE.

COAL.

Dark grey MUDSTONE.

Grey MUDSTONE.

Dark grey MUDSTONE.

End of Borehole at 51.00m

Remarks and Groundwater Observations:	
---------------------------------------	--

1. Groundwater not encountered.

GL (m AOD)	
------------	--

Easting:	298844.86
-----------------	-----------

Northings:
518291.94

Fig No.

R04



BOREHOLE RECORD

Site: Harras Moor, Whitehaven

Client: Michael Little

Method: Hole advanced with a Beratta T44 rotary drilling rig, using air flush.

BH No. **R05**
Sheet 1 of 1

Contract No: C7728

Date(s): 05/10/2018

Scale: 1:150

SAMPLE DETAILS

Depth From - To(m)

TCR

SCR

RQD

FI

Ground -water

STRATA RECORD

Description

Depth (m)

Level (m AOD)

Legend

Well

TOPSOIL.

0.30

Brown sandy gravelly CLAY.

3.10

Pink grey MUDSTONE.

6.50

Dark grey MUDSTONE.

13.60

COAL.

14.30

Grey MUDSTONE.

17.00

COAL.

17.50

Grey MUDSTONE.

19.10

COAL.

19.50

Grey MUDSTONE.

24.00

Dark grey MUDSTONE.

26.50

Grey MUDSTONE.

30.00

End of Borehole at 30.00m

Remarks and Groundwater Observations:

1. Groundwater not encountered.

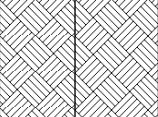
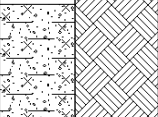
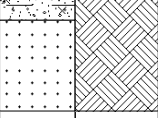
GL (m AOD)

Eastings: 298923.86

Northings: 518242.66

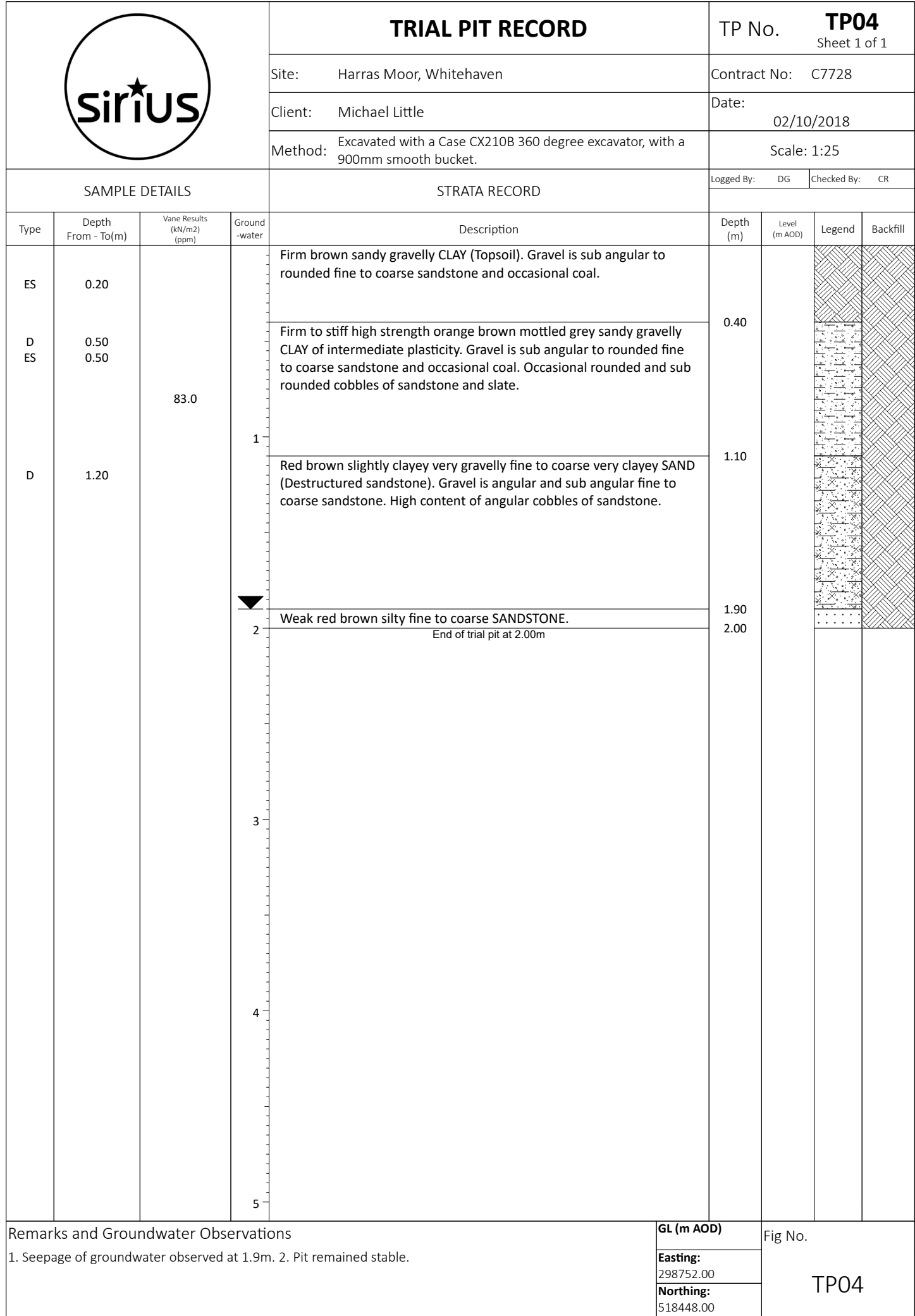
Fig No.

R05

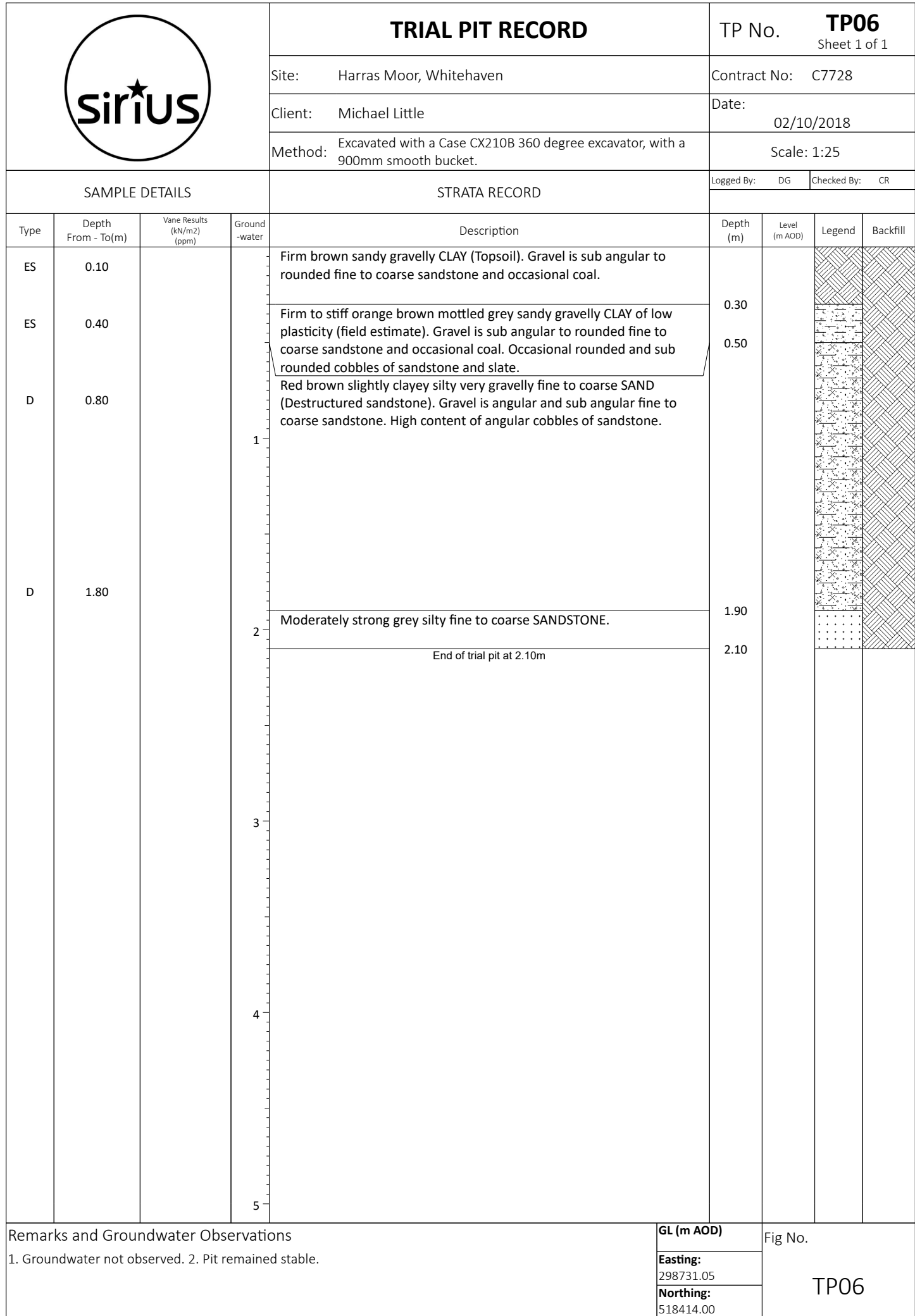
				TRIAL PIT RECORD		TP No. TP01 Sheet 1 of 1			
				Site: Harras Moor, Whitehaven		Contract No: C7728			
				Client: Michael Little		Date: 02/10/2018			
				Method: Excavated with a Case CX210B 360 degree excavator, with a 900mm smooth bucket.		Scale: 1:25			
SAMPLE DETAILS				STRATA RECORD		Logged By: DG Checked By: CR			
Type	Depth From - To(m)	Vane Results (kN/m2) (ppm)	Ground -water	Description	Depth (m)	Level (m AOD)	Legend	Backfill	
ES	0.10	75.0	1	Firm brown sandy gravelly CLAY (Topsoil). Gravel is sub angular to rounded fine to coarse sandstone and occasional coal.	0.40				
B D	0.70 0.70			Firm to stiff medium to high strength orange brown mottled grey sandy gravelly CLAY of intermediate plasticity. Gravel is sub angular to rounded fine to coarse sandstone and occasional coal. Occasional rounded and sub rounded cobbles of sandstone and slate.					
D	1.40			Red brown slightly clayey silty very gravelly fine to coarse SAND (Destructured sandstone). Gravel is angular and sub angular fine to coarse sandstone. High content of angular cobbles of sandstone.	1.20				
D	2.40			Weak red brown silty fine to coarse SANDSTONE.	2.40				
				End of trial pit at 2.70m	2.70				
			3						
			4						
			5						
Remarks and Groundwater Observations 1. Groundwater not observed. 2. Pit remained stable.					GL (m AOD)		Fig No. TP01		
					Easting:				
					Northing:				
					518490.32				

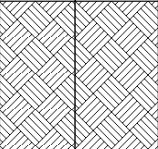
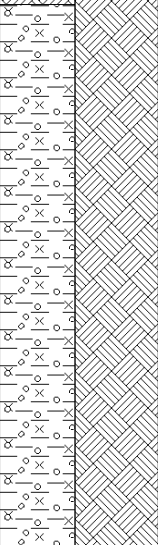
				TRIAL PIT RECORD		TP No. TP02 Sheet 1 of 1		
				Site: Harras Moor, Whitehaven		Contract No: C7728		
				Client: Michael Little		Date: 02/10/2018		
				Method: Excavated with a Case CX210B 360 degree excavator, with a 900mm smooth bucket.		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: DG Checked By: CR		
Type	Depth From - To(m)	Vane Results (kN/m2) (ppm)	Ground -water	Description	Depth (m)	Level (m AOD)	Legend	Backfill
ES	0.20			MADE GROUND: Firm brown sandy very gravelly CLAY (Topsoil). Gravel is sub angular to rounded fine to coarse sandstone and occasional coal.	0.30			
D ES	0.50 0.60			MADE GROUND: Firm to stiff orange brown sandy gravelly clay. Gravel is angular to rounded fine to coarse sandstone, mudstone, coal and occasional brick. Low cobble content of angular and sub angular sandstone.				
D	1.50			MADE GROUND: Grey clayey very sandy gravel and cobbles of angular and sub angular fine to coarse sandstone and occasional mudstone. High content of angular and sub angular cobbles and boulders of sandstone and mudstone.	1.20			
				From 2.0m to 2.6m: Approximately 50% of the material is cobbles and boulders.	2.60			
				End of trial pit at 2.60m				
Remarks and Groundwater Observations					GL (m AOD)		Fig No.	
1. Groundwater not observed. 2. Pit remained stable.					Easting: 298850.88		TP02	
					Northing: 518488.78			

				TRIAL PIT RECORD		TP No. TP03 Sheet 1 of 1		
				Site: Harras Moor, Whitehaven		Contract No: C7728		
				Client: Michael Little		Date: 02/10/2018		
				Method: Excavated with a Case CX210B 360 degree excavator, with a 900mm smooth bucket.		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: DG Checked By: CR		
Type	Depth From - To(m)	Vane Results (kN/m2) (ppm)	Ground -water	Description	Depth (m)	Level (m AOD)	Legend	Backfill
ES	0.10			MADE GROUND: Firm brown sandy gravelly clay (Topsoil). Gravel is sub angular to rounded fine to coarse sandstone and occasional coal.	0.30			
				MADE GROUND: Firm to stiff orange brown sandy gravelly clay. Gravel is angular to rounded fine to coarse sandstone, mudstone, coal and occasional brick. Low cobble content of angular and sub angular sandstone.				
D	0.90		1					
D	1.50			MADE GROUND: Grey clayey very sandy gravel and cobbles of angular and sub angular fine to coarse sandstone and occasional mudstone. High content of angular and sub angular cobbles and boulders of sandstone and mudstone.	1.40			
D	2.00		2		2.30			
				End of trial pit at 2.30m				
			3					
			4					
			5					
Remarks and Groundwater Observations 1. Groundwater not observed. 2. Pit remained stable.					GL (m AOD)		Fig No. TP03	
					Easting:			
					298942.00			
					Northing:			
		518488.00						

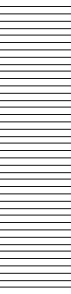


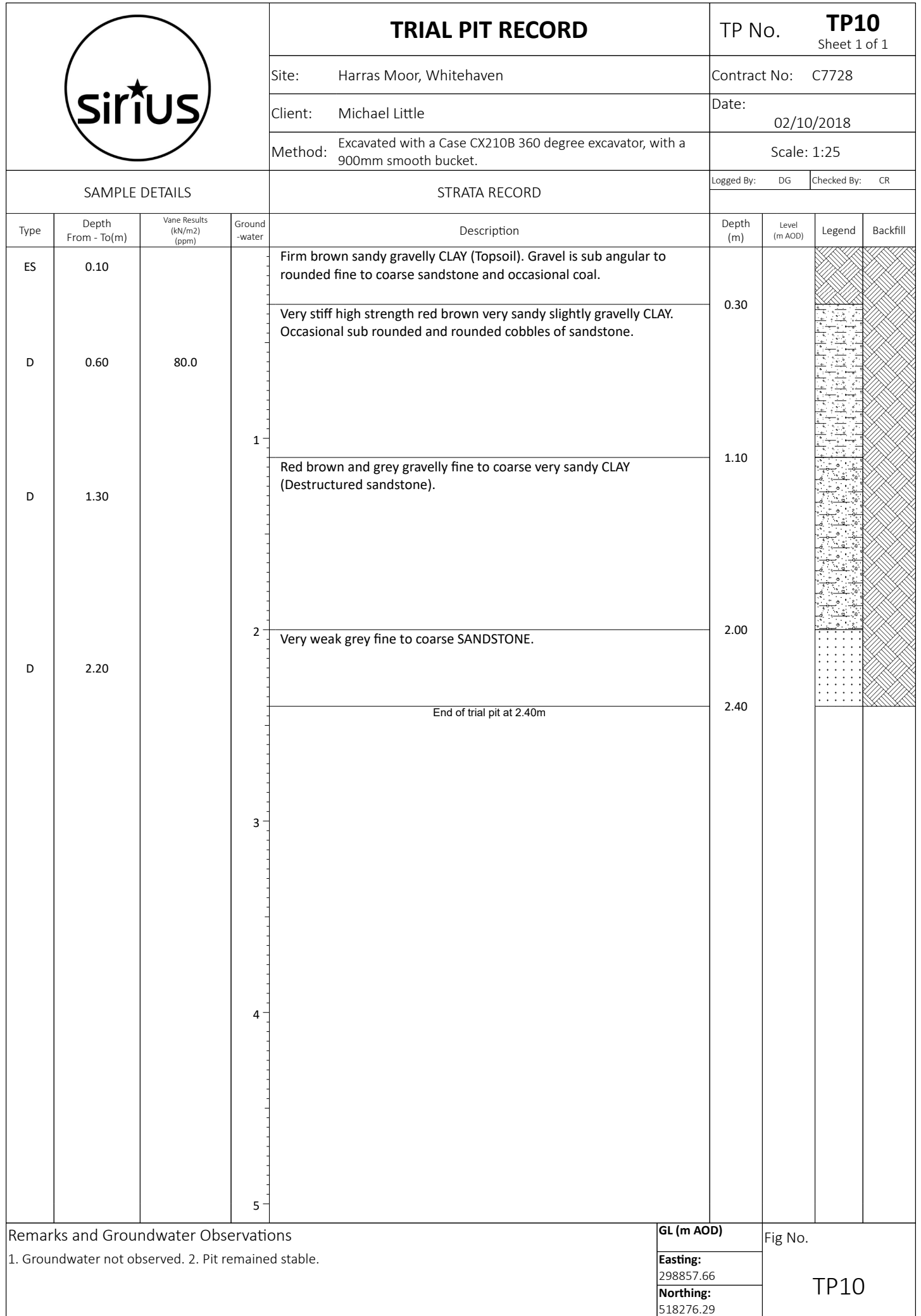
				TRIAL PIT RECORD		TP No. TP05 Sheet 1 of 1		
				Site: Harras Moor, Whitehaven		Contract No: C7728		
				Client: Michael Little		Date: 02/10/2018		
				Method: Excavated with a Case CX210B 360 degree excavator, with a 900mm smooth bucket.		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: DG Checked By: CR		
Type	Depth From - To(m)	Vane Results (kN/m2) (ppm)	Ground -water	Description	Depth (m)	Level (m AOD)	Legend	Backfill
ES	0.10			MADE GROUND: Firm brown sandy very gravelly clay (Topsoil). Gravel is sub angular to rounded fine to coarse sandstone and occasional coal.	0.30			
ES ES	0.50 0.50			MADE GROUND: Firm to stiff orange brown sandy gravelly clay. Gravel is angular to rounded fine to coarse sandstone, mudstone, coal and occasional brick. Low cobble content of angular and sub angular sandstone.				
D	1.20		1	MADE GROUND: Grey clayey very sandy gravel and cobbles of angular and sub angular fine to coarse sandstone and occasional mudstone. High content of angular and sub angular cobbles and boulders of sandstone and mudstone.				
D	2.40			From 2.5m to 3.1m: Approximately 50% of the material is cobbles and boulders. End of trial pit at 3.10m	3.10			
Remarks and Groundwater Observations					GL (m AOD)		Fig No.	
1. Groundwater not observed. 2. Pit remained stable.					Easting:		TP05	
					298863.54			
					Northing:			
					518433.54			

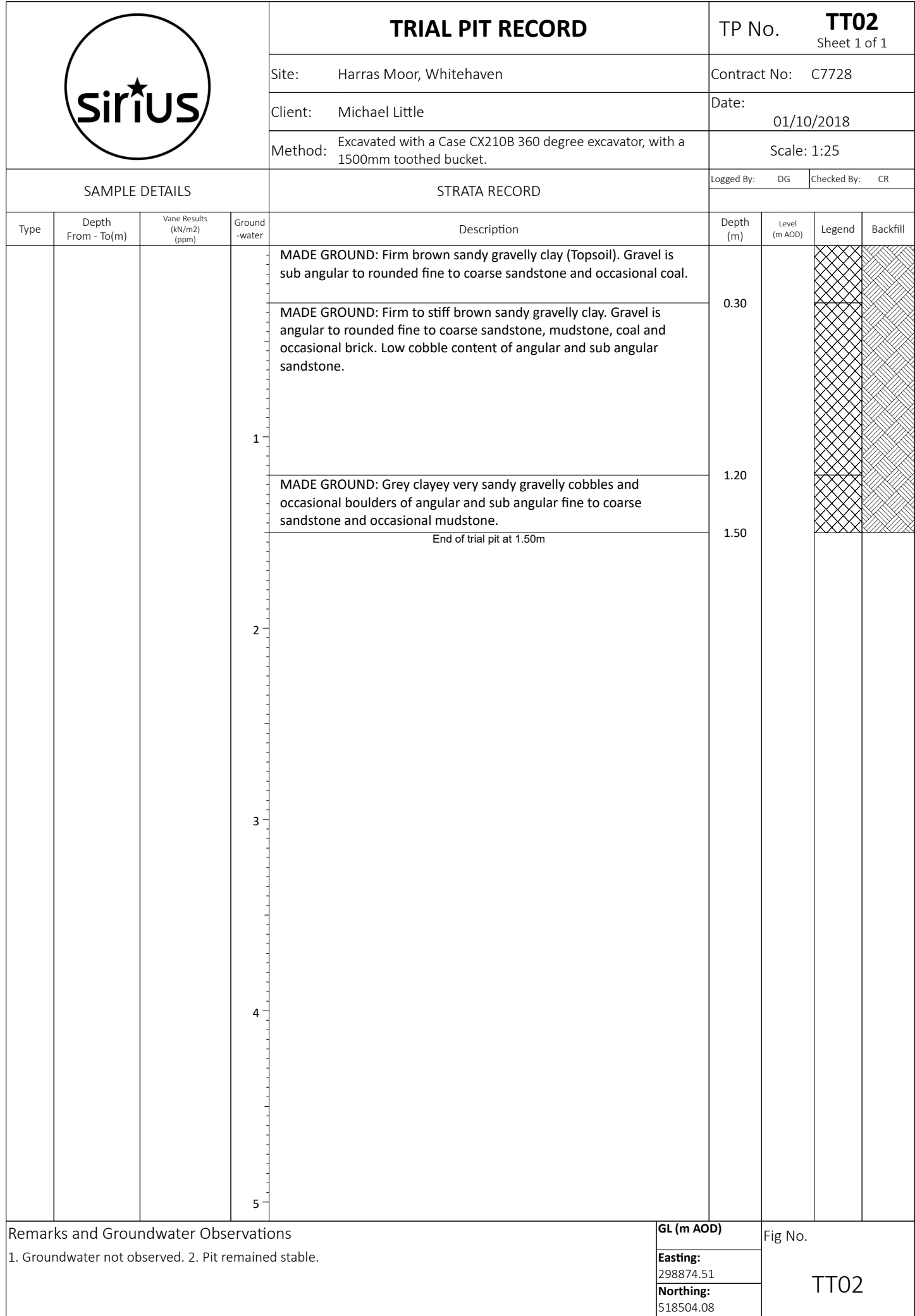


				TRIAL PIT RECORD		TP No. TP07 Sheet 1 of 1				
				Site: Harras Moor, Whitehaven		Contract No: C7728				
				Client: Michael Little		Date: 02/10/2018				
				Method: Excavated with a Case CX210B 360 degree excavator, with a 900mm smooth bucket.		Scale: 1:25				
SAMPLE DETAILS				STRATA RECORD		Logged By: DG Checked By: CR				
Type	Depth From - To(m)	Vane Results (kN/m2) (ppm)	Ground -water	Description	Depth (m)	Level (m AOD)	Legend	Backfill		
ES	0.20	73.0	1 2 3 4 5	Firm brown sandy gravelly CLAY (Topsoil). Gravel is sub angular to rounded fine to coarse sandstone and occasional coal.	0.50					
				Stiff medium strength brown mottled grey sandy CLAY of intermediate plasticity.						
D	0.90									
D	1.50									
					2.30					
				COAL						
				Very weak grey distinctly weathered MUDSTONE.	2.40					
D	2.50				2.70					
				End of trial pit at 2.70m						
Remarks and Groundwater Observations					GL (m AOD)		Fig No.			
1. Groundwater not observed. 2. Pit remained stable.					Easting: 298949.00		TP07			
					Northing: 518440.00					

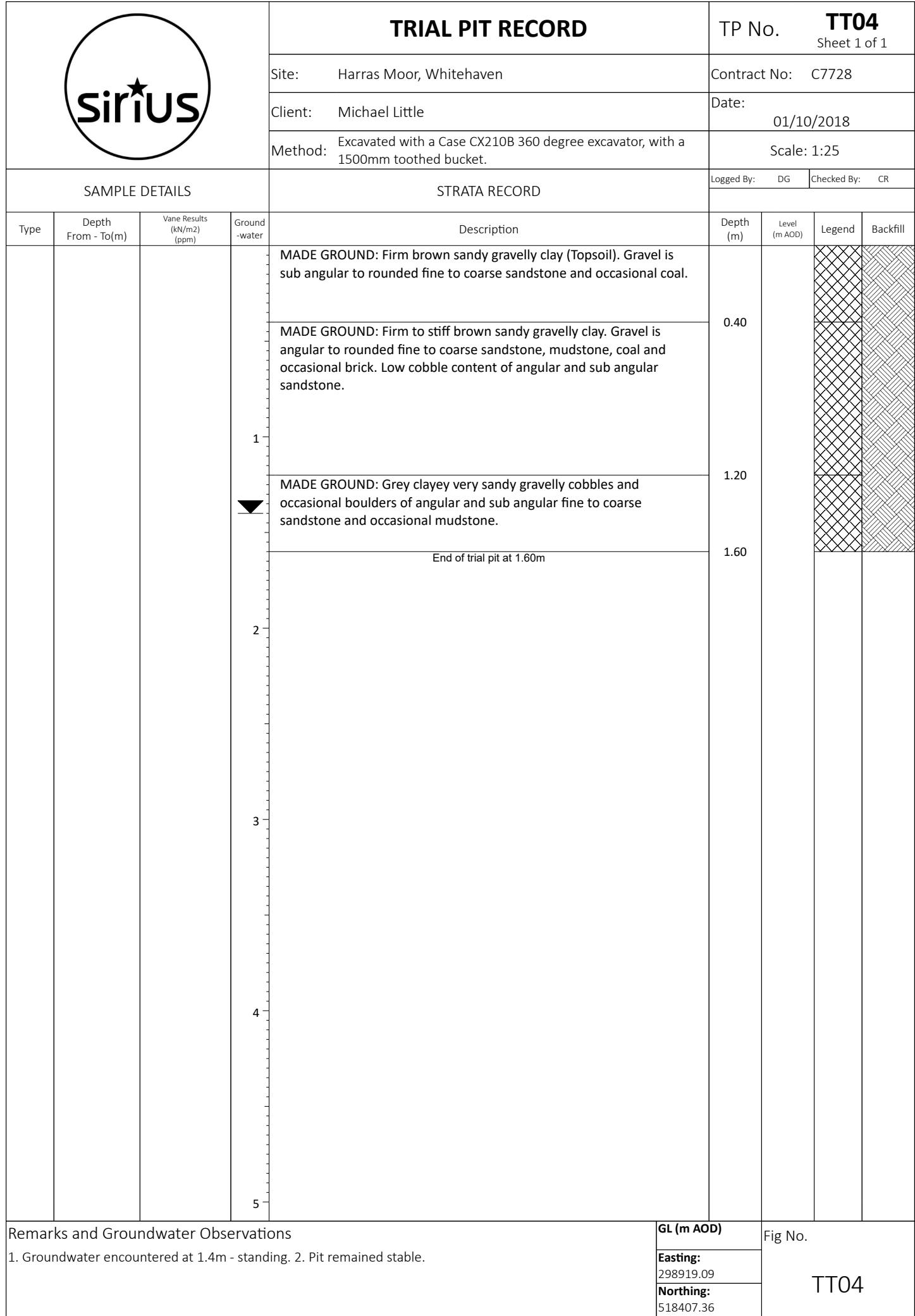
				TRIAL PIT RECORD		TP No. TP08 Sheet 1 of 1		
				Site: Harras Moor, Whitehaven		Contract No: C7728		
				Client: Michael Little		Date: 02/10/2018		
				Method: Excavated with a Case CX210B 360 degree excavator, with a 900mm smooth bucket.		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: DG Checked By: CR		
Type	Depth From - To(m)	Vane Results (kN/m2) (ppm)	Ground -water	Description	Depth (m)	Level (m AOD)	Legend	Backfill
ES	0.10			MADE GROUND: Firm brown sandy very gravelly clay (Topsoil). Gravel is sub angular to rounded fine to coarse sandstone and occasional coal.	0.40			
ES	0.40			MADE GROUND: Firm to stiff orange brown sandy gravelly clay. Gravel is angular to rounded fine to coarse sandstone, mudstone, coal and occasional brick. Low cobble content of angular and sub angular sandstone.				
D	0.60							
			1					
				MADE GROUND: Grey clayey very sandy gravelly cobbles and boulders of angular and sub angular fine to coarse sandstone and occasional mudstone.	1.30			
D	1.50							
			2					
B	2.00			End of trial pit at 2.20m	2.20			
			3					
			4					
			5					
Remarks and Groundwater Observations 1. Groundwater not observed. 2. Pit remained stable.					GL (m AOD)		Fig No. TP08	
					Easting:			
					298868.47			
					Northing:			
					518366.79			

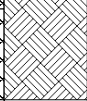
				TRIAL PIT RECORD		TP No. TP09 Sheet 1 of 1		
				Site: Harras Moor, Whitehaven		Contract No: C7728		
				Client: Michael Little		Date: 02/10/2018		
				Method: Excavated with a Case CX210B 360 degree excavator, with a 900mm smooth bucket.		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: DG Checked By: CR		
Type	Depth From - To(m)	Vane Results (kN/m2) (ppm)	Ground -water	Description	Depth (m)	Level (m AOD)	Legend	Backfill
ES	0.10	78.0	1	MADE GROUND: Firm brown sandy gravelly clay (Topsoil). Gravel is sub angular to rounded fine to coarse sandstone and occasional coal.	0.30			
ES	0.60			MADE GROUND: Firm dark brown sandy gravelly clay. Gravel is angular to rounded fine to coarse sandstone and occasional mudstone and coal. Occasional cobbles of sandstone and mudstone.				
D	1.00			Stiff high strength brown mottled grey sandy gravelly CLAY of intermediate plasticity. Gravel is sub angular to rounded fine to coarse sandstone, coal and slate.	0.90			
D	2.00			Stiff high strength red brown sandy gravelly CLAY of intermediate plasticity (Destructured mudstone). Gravel is sub angular fine to coarse mudstone.	1.70			
D	2.80			Very weak grey distinctly weathered MUDSTONE.	2.50			
			3	End of trial pit at 3.50m	3.50			
			4					
			5					
Remarks and Groundwater Observations 1. Groundwater not observed. 2. Pit remained stable.					GL (m AOD)		Fig No. TP09	
					Easting:			
					298931.47			
					Northing:			
		518313.70						



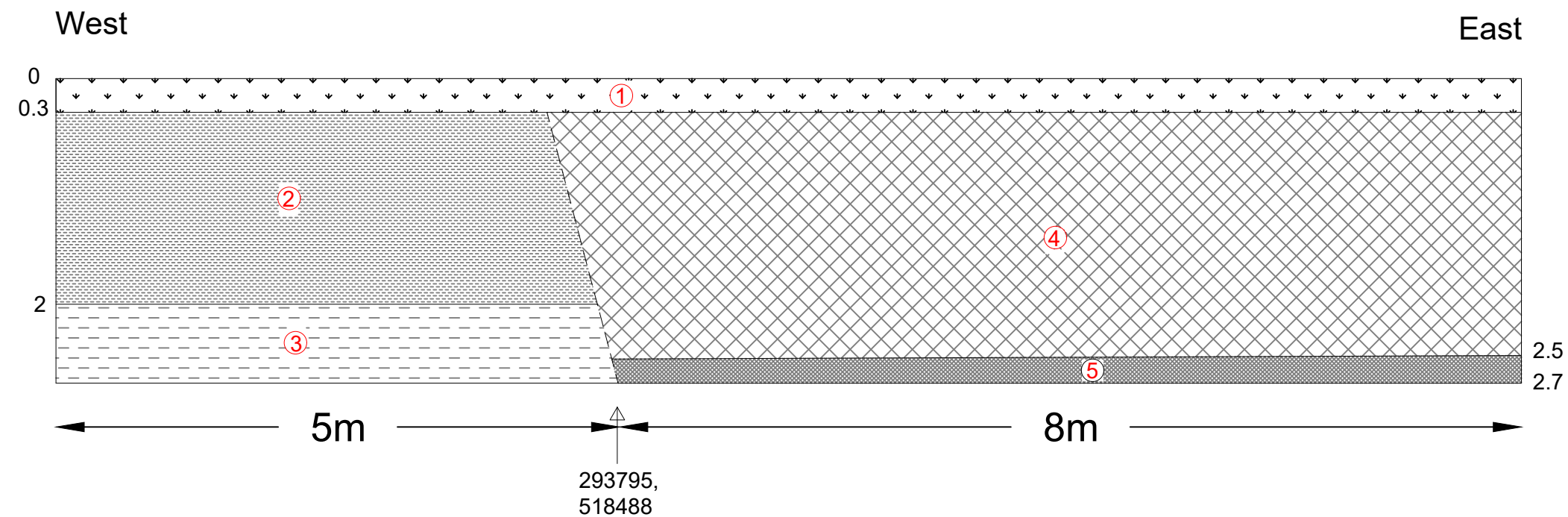


				TRIAL PIT RECORD		TP No. TT03 Sheet 1 of 1		
				Site: Harras Moor, Whitehaven		Contract No: C7728		
				Client: Michael Little		Date: 01/10/2018		
				Method: Excavated with a Case CX210B 360 degree excavator, with a 1500mm toothed bucket.		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: DG Checked By: CR		
Type	Depth From - To(m)	Vane Results (kN/m2) (ppm)	Ground -water	Description	Depth (m)	Level (m AOD)	Legend	Backfill
			1 2 3 4 5	MADE GROUND: Firm brown sandy gravelly clay (Topsoil). Gravel is sub angular to rounded fine to coarse sandstone and occasional coal.	0.40			
				MADE GROUND: Firm to stiff brown sandy gravelly clay. Gravel is angular to rounded fine to coarse sandstone, mudstone, coal and occasional brick. Low cobble content of angular and sub angular sandstone.				
				At 0.9m: 100mm ceramic field drain.	1.40			
				MADE GROUND: Grey clayey very sandy gravelly cobbles and occasional boulders of angular and sub angular fine to coarse sandstone and occasional mudstone. End of trial pit at 1.60m	1.60			
Remarks and Groundwater Observations					GL (m AOD)		Fig No.	
1. Groundwater not observed. 2. Pit remained stable.					Easting:		TT03	
					298925.02			
					Northing:			
					518454.25			



				TRIAL PIT RECORD		TP No. TT06 Sheet 1 of 1		
				Site: Harras Moor, Whitehaven		Contract No: C7728		
				Client: Michael Little		Date: 01/10/2018		
				Method: Excavated with a Case CX210B 360 degree excavator, with a 1500mm toothed bucket.		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: DG Checked By: CR		
Type	Depth From - To(m)	Vane Results (kN/m2) (ppm)	Ground -water	Description	Depth (m)	Level (m AOD)	Legend	Backfill
			1 2 3 4 5	MADE GROUND: Firm brown sandy gravelly clay (Topsoil). Gravel is sub angular to rounded fine to coarse sandstone and occasional coal.	0.50			
				MADE GROUND: Firm to stiff brown sandy gravelly clay. Gravel is angular to rounded fine to coarse sandstone, mudstone, coal and occasional brick. Low cobble content of angular and sub angular sandstone.				
				At 0.9m: 100mm ceramic field drain.				
				MADE GROUND: Grey clayey very sandy gravelly cobbles and occasional boulders of angular and sub angular fine to coarse sandstone and occasional mudstone.	1.90			
				End of trial pit at 2.20m	2.20			
Remarks and Groundwater Observations					GL (m AOD)		Fig No.	
1. Groundwater not observed. 2. Pit remained stable.					Easting:		TT06	
					298915.64			
					Northing:			
					518339.24			

TT01



- ① Topsoil: Brown sandy slightly gravelly CLAY.
- ② Firm to stiff orange, brown and brown sandy gravelly CLAY.
- ③ Stiff to very stiff red, brown sandy gravelly CLAY (weathered mudstone)
- ④ MADE GROUND: Firm to stiff brown, sandy, gravelly clay.
- ⑤ MADE GROUND; Grey, very clayey, sandy, gravel and COBBLES of mudstone and sandstone.

NOTES

REVISION		BY	DATE
0	For Information	MF	17/10/18
A	>>	>>	>>
B	>>	>>	>>
C	>>	>>	>>
D	>>	>>	>>

SIRIUS GEOTECHNICAL
& ENVIRONMENTAL
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TEL: 0113 264 9960
FAX: 0113 264 9962



CLIENT

Michael Little

SITE

**Harras Moor,
Whitehaven**

DRAWING TITLE

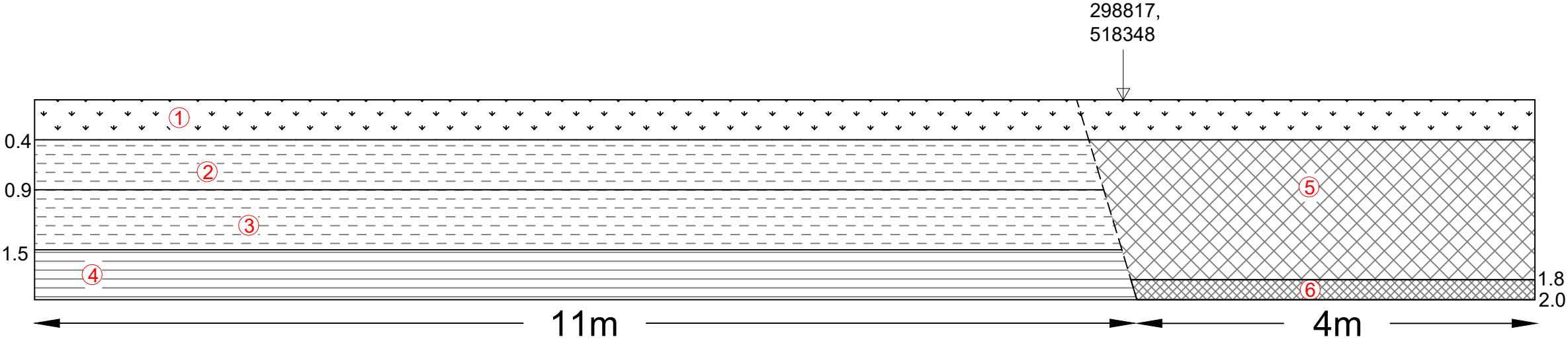
TT01

DRAWING NO. C7728/TT01		REVISION NO. 0	
DRAWN BY MF		APPROVED BY DG	
DATE October 2018	SCALE 1:50	PAPER SIZE A3	

TT05

South West

North East



- ① Topsoil: Brown sandy slightly gravelly CLAY.
② Firm to stiff orange, brown, mottled, grey, sandy, gravelly CLAY.
③ Stiff red, brown, sandy, gravelly, friable CLAY.
④ Grey, brown weathered SILTSTONE.
⑤ MADE GROUND: Firm to stiff brown, sandy, gravelly clay.
⑥ MADE GROUND; Grey, very clayey, sandy, GRAVEL and COBBLES of mudstone and sandstone.

NOTES

REVISION		BY	DATE
0	For Information	MF	17/10/18
A	>>	>>	>>
B	>>	>>	>>
C	>>	>>	>>
D	>>	>>	>>

SIRIUS
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Russel House,
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CLIENT

Michael Little

SITE

**Harras Moor,
Whitehaven**

DRAWING TITLE

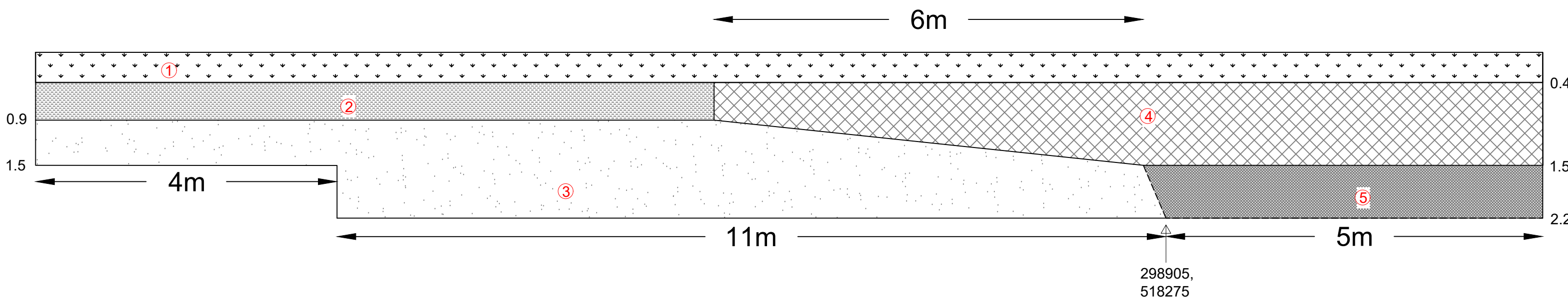
TT05

DRAWING NO. C7728/TT05		REVISION NO. 0	
DRAWN BY MF		APPROVED BY DG	
DATE October 2018	SCALE 1:50	PAPER SIZE A3	

TT07

South

North



- ① Topsoil: Brown sandy slightly gravelly CLAY.
- ② Firm to stiff orange, brown and brown sandy gravelly CLAY.
- ③ Destructured red, brown silty sandstone
- ④ MADE GROUND: Firm to stiff brown, sandy, gravelly clay.
- ⑤ MADE GROUND; Grey, very clayey, sandy, gravel and COBBLES of mudstone and sandstone.

REVISION		BY	DATE
0	For Information	MF	17/10/18
A	>>	>>	>>
B	>>	>>	>>
C	>>	>>	>>
D	>>	>>	>>

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TT07

DRAWING NO. C7728/TT07		REVISION NO. 0	
DRAWN BY MF		APPROVED BY DG	
DATE October 2018	SCALE 1:50	PAPER SIZE A2	

Appendix III

■ Laboratory Test Results



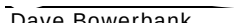
ANALYTICAL TEST REPORT

Contract no: 82011
Contract name: Harras Dyke, Whitehaven
Client reference: GEO2019-3889
Clients name: Geo Environmental Engineering
Clients address: 4 Culgarth Avenue
Cockermouth
Cumbria
CA13 9PL

Samples received: 23 October 2019
Analysis started: 23 October 2019
Analysis completed: 30 October 2019
Report issued: 30 October 2019

Notes: Opinions and interpretations expressed herein are outside the UKAS accreditation scope.
Unless otherwise stated, Chemtech Environmental Ltd was not responsible for sampling.
All testing carried out at Unit 6 Parkhead, Stanley, DH9 7YB, except for subcontracted testing.
Methods, procedures and performance data are available on request.
Results reported herein relate only to the material supplied to the laboratory.
This report shall not be reproduced except in full, without prior written approval.
Samples will be disposed of 6 weeks from initial receipt unless otherwise instructed.

Key: U UKAS accredited test
M MCERTS & UKAS accredited test
\$ Test carried out by an approved subcontractor
I/S Insufficient sample to carry out test
N/S Sample not suitable for testing
NAD No Asbestos Detected

Approved by: 
Dave Bowerbank
Customer Support Hero

Chemtech Environmental Limited

SAMPLE INFORMATION

MCERTS (Soils):

Soil descriptions are only intended to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions. MCERTS accreditation applies for sand, clay and loam/topsoil, or combinations of these whether these are derived from naturally occurring soils or from made ground, as long as these materials constitute the major part of the sample. Other materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

All results are reported on a dry basis. Samples dried at no more than 30°C in a drying cabinet.

Analytical results are inclusive of stones.

Lab ref	Sample id	Depth (m)	Sample description	Material removed	% Removed	% Moisture
82011-1	BH204	0.20	Sandy Clay with Gravel	-	-	17.2
82011-2	BH206	0.20	Sandy Clay with Gravel & Roots	-	-	27.0
82011-3	BH216	0.20	Sandy Clay with Gravel & Roots	-	-	25.0
82011-4	BH218	0.20	Sandy Clay with Gravel & Roots	-	-	23.8
82011-5	BH221	0.10	Sandy Clay with Gravel & Roots	-	-	29.6
82011-6	BH222	0.20	Sandy Clay with Gravel & Roots	-	-	23.7
82011-7	TP201	0.20	Sandy Clay with Gravel & Roots	-	-	26.0
82011-8	TP202	0.10	Sandy Clay with Gravel & Roots	-	-	31.5
82011-9	TP203	0.20	Sandy Clay with Gravel & Roots	-	-	21.1
82011-10	TP204	0.20	Clay with Gravel	-	-	18.7
82011-11	TP205	0.20	Clay with Gravel & Roots	-	-	22.8
82011-12	TP206	0.20	Clay with Gravel & Roots	-	-	23.8
82011-13	TP207	0.20	Clay with Gravel & Roots	-	-	21.7
82011-14	TP208	0.20	Clay with Gravel & Roots	-	-	23.6
82011-15	TP209	0.20	Clay with Gravel & Roots	-	-	31.1
82011-16	TP210	0.20	Clay with Gravel & Roots	-	-	35.7
82011-17	TP211	0.20	Clay with Gravel & Roots	-	-	34.8
82011-18	TP212	0.20	Clay with Gravel & Roots	-	-	23.4
82011-19	TP213	0.20	Clay with Gravel & Roots	-	-	23.7
82011-20	TP217	0.20	Clay with Gravel	-	-	21.2
82011-21	TT201 (S)	0.30	Clay with Gravel & Roots	-	-	26.7
82011-22	TT202 (S)	0.20	Clay with Gravel & Roots	-	-	41.8

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SOILS

Lab number			82011-1	82011-2	82011-3	82011-4	82011-5	82011-6
Sample id			BH204	BH206	BH216	BH218	BH221	BH222
Depth (m)			0.20	0.20	0.20	0.20	0.10	0.20
Date sampled			22/10/2019	22/10/2019	22/10/2019	22/10/2019	22/10/2019	22/10/2019
Test	Method	Units						
Arsenic (total)	CE127 ^M	mg/kg As	11	13	7.0	10	15	11
Cadmium (total)	CE127 ^M	mg/kg Cd	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Chromium (total)	CE127 ^M	mg/kg Cr	43	46	32	40	47	42
Chromium (III)	-	mg/kg CrIII	43	46	32	40	47	42
Chromium (VI)	CE146	mg/kg CrVI	<1	<1	<1	<1	<1	<1
Copper (total)	CE127 ^M	mg/kg Cu	15	21	13	17	34	21
Lead (total)	CE127 ^M	mg/kg Pb	23	38	17	23	38	21
Mercury (total)	CE127 ^M	mg/kg Hg	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Nickel (total)	CE127 ^M	mg/kg Ni	8.8	14	11	14	30	15
Selenium (total)	CE127 ^M	mg/kg Se	1.2	0.9	0.7	0.8	1.0	1.0
Zinc (total)	CE127 ^M	mg/kg Zn	22	37	23	27	35	29
pH	CE004 ^M	units	5.5	5.5	5.8	6.0	5.7	6.1
Sulphate (2:1 water soluble)	CE061 ^M	mg/l SO ₄	32	14	17	15	19	12
Cyanide (total)	CE077	mg/kg CN	<1	<1	<1	<1	<1	<1
Total Organic Carbon (TOC)	CE072 ^M	% w/w C	2.2	5.2	3.5	2.7	5.1	2.6
PAH								
Naphthalene	CE087 ^M	mg/kg	<0.02	<0.02	0.03	<0.02	0.14	<0.02
Acenaphthylene	CE087 ^M	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthene	CE087 ^M	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluorene	CE087 ^U	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Phenanthrene	CE087 ^M	mg/kg	0.04	0.10	0.11	0.07	0.33	0.07
Anthracene	CE087 ^U	mg/kg	<0.02	<0.02	<0.02	<0.02	0.06	<0.02
Fluoranthene	CE087 ^M	mg/kg	0.03	0.16	0.10	0.05	0.45	0.08
Pyrene	CE087 ^M	mg/kg	0.02	0.12	0.08	0.04	0.34	0.07
Benzo(a)anthracene	CE087 ^U	mg/kg	<0.02	0.09	0.05	0.04	0.27	0.05
Chrysene	CE087 ^M	mg/kg	<0.03	0.10	0.08	0.05	0.28	0.06
Benzo(b)fluoranthene	CE087 ^M	mg/kg	0.02	0.10	0.06	0.04	0.27	0.06
Benzo(k)fluoranthene	CE087 ^M	mg/kg	<0.03	0.04	<0.03	<0.03	0.10	<0.03
Benzo(a)pyrene	CE087 ^U	mg/kg	<0.02	0.07	0.04	0.02	0.18	0.04
Indeno(123cd)pyrene	CE087 ^M	mg/kg	<0.02	0.06	0.04	0.02	0.14	0.03
Dibenz(ah)anthracene	CE087 ^M	mg/kg	<0.02	<0.02	<0.02	<0.02	0.03	<0.02
Benzo(ghi)perylene	CE087 ^M	mg/kg	<0.02	0.05	0.04	0.02	0.11	0.03
PAH (total of USEPA 16)	CE087	mg/kg	<0.34	0.90	0.63	0.37	2.70	0.48
Subcontracted analysis								
Asbestos (qualitative)	\$	-	NAD	NAD	NAD	NAD	NAD	NAD

Chemtech Environmental Limited

SOILS

Lab number			82011-7	82011-8	82011-9	82011-10	82011-11	82011-12
Sample id			TP201	TP202	TP203	TP204	TP205	TP206
Depth (m)			0.20	0.10	0.20	0.20	0.20	0.20
Date sampled			22/10/2019	22/10/2019	22/10/2019	22/10/2019	22/10/2019	22/10/2019
Test	Method	Units						
Arsenic (total)	CE127 ^M	mg/kg As	12	9.2	10	9.3	8.0	10
Cadmium (total)	CE127 ^M	mg/kg Cd	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Chromium (total)	CE127 ^M	mg/kg Cr	38	32	33	36	34	30
Chromium (III)	-	mg/kg CrIII	38	32	33	36	34	30
Chromium (VI)	CE146	mg/kg CrVI	<1	<1	<1	<1	<1	<1
Copper (total)	CE127 ^M	mg/kg Cu	18	22	18	20	19	14
Lead (total)	CE127 ^M	mg/kg Pb	38	60	24	17	17	26
Mercury (total)	CE127 ^M	mg/kg Hg	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Nickel (total)	CE127 ^M	mg/kg Ni	12	8.3	9.7	13	16	12
Selenium (total)	CE127 ^M	mg/kg Se	1.0	0.7	0.9	1.1	1.0	0.9
Zinc (total)	CE127 ^M	mg/kg Zn	37	25	24	27	35	21
pH	CE004 ^M	units	5.9	5.8	5.9	6.2	6.1	6.0
Sulphate (2:1 water soluble)	CE061 ^M	mg/l SO ₄	20	22	<10	<10	<10	15
Cyanide (total)	CE077	mg/kg CN	<1	<1	<1	<1	<1	<1
Total Organic Carbon (TOC)	CE072 ^M	% w/w C	3.7	5.4	1.9	1.6	1.9	9.0
PAH								
Naphthalene	CE087 ^M	mg/kg	<0.02	<0.02	<0.02	<0.02	0.03	0.21
Acenaphthylene	CE087 ^M	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthene	CE087 ^M	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluorene	CE087 ^U	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Phenanthrene	CE087 ^M	mg/kg	0.11	0.11	0.08	0.04	0.11	0.32
Anthracene	CE087 ^U	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	0.03
Fluoranthene	CE087 ^M	mg/kg	0.12	0.14	0.10	0.02	0.10	0.18
Pyrene	CE087 ^M	mg/kg	0.10	0.11	0.09	0.02	0.08	0.14
Benzo(a)anthracene	CE087 ^U	mg/kg	0.07	0.08	0.07	<0.02	0.06	0.10
Chrysene	CE087 ^M	mg/kg	0.09	0.10	0.08	<0.03	0.07	0.14
Benzo(b)fluoranthene	CE087 ^M	mg/kg	0.09	0.09	0.07	0.02	0.06	0.11
Benzo(k)fluoranthene	CE087 ^M	mg/kg	0.03	0.04	<0.03	<0.03	<0.03	0.03
Benzo(a)pyrene	CE087 ^U	mg/kg	0.05	0.06	0.05	<0.02	0.04	0.07
Indeno(123cd)pyrene	CE087 ^M	mg/kg	0.05	0.05	0.04	<0.02	0.03	0.05
Dibenz(ah)anthracene	CE087 ^M	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(ghi)perylene	CE087 ^M	mg/kg	0.04	0.04	0.03	<0.02	0.03	0.07
PAH (total of USEPA 16)	CE087	mg/kg	0.75	0.83	0.61	<0.34	0.63	1.44
Subcontracted analysis								
Asbestos (qualitative)	\$	-	NAD	NAD	NAD	NAD	NAD	NAD

Chemtech Environmental Limited

SOILS

Lab number			82011-13	82011-14	82011-15	82011-16	82011-17	82011-18
Sample id			TP207	TP208	TP209	TP210	TP211	TP212
Depth (m)			0.20	0.20	0.20	0.20	0.20	0.20
Date sampled			22/10/2019	22/10/2019	22/10/2019	22/10/2019	22/10/2019	22/10/2019
Test	Method	Units						
Arsenic (total)	CE127 ^M	mg/kg As	6.4	7.3	8.5	6.9	11	13
Cadmium (total)	CE127 ^M	mg/kg Cd	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Chromium (total)	CE127 ^M	mg/kg Cr	36	30	34	34	33	32
Chromium (III)	-	mg/kg CrIII	36	30	34	34	33	32
Chromium (VI)	CE146	mg/kg CrVI	<1	<1	<1	<1	<1	<1
Copper (total)	CE127 ^M	mg/kg Cu	9.5	12	12	13	17	19
Lead (total)	CE127 ^M	mg/kg Pb	16	17	40	26	28	27
Mercury (total)	CE127 ^M	mg/kg Hg	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Nickel (total)	CE127 ^M	mg/kg Ni	10	9.3	9.8	9.7	12	17
Selenium (total)	CE127 ^M	mg/kg Se	0.9	0.6	0.7	0.7	0.8	0.9
Zinc (total)	CE127 ^M	mg/kg Zn	22	21	25	26	33	34
pH	CE004 ^M	units	6.3	6.2	6.0	6.7	6.1	6.1
Sulphate (2:1 water soluble)	CE061 ^M	mg/l SO ₄	25	14	35	27	22	18
Cyanide (total)	CE077	mg/kg CN	<1	<1	<1	<1	<1	<1
Total Organic Carbon (TOC)	CE072 ^M	% w/w C	2.5	3.2	4.9	4.0	4.4	3.1
PAH								
Naphthalene	CE087 ^M	mg/kg	<0.02	0.03	0.04	0.03	0.04	0.06
Acenaphthylene	CE087 ^M	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthene	CE087 ^M	mg/kg	0.04	<0.02	<0.02	0.03	<0.02	<0.02
Fluorene	CE087 ^U	mg/kg	0.04	<0.02	0.02	0.04	<0.02	<0.02
Phenanthrene	CE087 ^M	mg/kg	0.49	0.12	0.34	0.46	0.15	0.18
Anthracene	CE087 ^U	mg/kg	0.10	<0.02	0.06	0.08	<0.02	0.02
Fluoranthene	CE087 ^M	mg/kg	0.73	0.10	0.54	0.99	0.18	0.13
Pyrene	CE087 ^M	mg/kg	0.56	0.08	0.43	0.77	0.15	0.10
Benzo(a)anthracene	CE087 ^U	mg/kg	0.31	0.07	0.26	0.49	0.12	0.08
Chrysene	CE087 ^M	mg/kg	0.32	0.09	0.33	0.56	0.13	0.11
Benzo(b)fluoranthene	CE087 ^M	mg/kg	0.30	0.08	0.34	0.62	0.14	0.10
Benzo(k)fluoranthene	CE087 ^M	mg/kg	0.11	<0.03	0.12	0.23	0.05	0.03
Benzo(a)pyrene	CE087 ^U	mg/kg	0.21	0.06	0.24	0.43	0.10	0.06
Indeno(123cd)pyrene	CE087 ^M	mg/kg	0.16	0.04	0.19	0.35	0.08	0.05
Dibenz(ah)anthracene	CE087 ^M	mg/kg	0.03	<0.02	0.03	0.07	<0.02	<0.02
Benzo(ghi)perylene	CE087 ^M	mg/kg	0.13	0.04	0.16	0.27	0.07	0.05
PAH (total of USEPA 16)	CE087	mg/kg	3.53	0.72	3.10	5.41	1.20	0.97
Subcontracted analysis								
Asbestos (qualitative)	\$	-	NAD	NAD	NAD	NAD	NAD	NAD

Chemtech Environmental Limited

SOILS

Lab number			82011-19	82011-20	82011-21	82011-22
Sample id			TP213	TP217	TT201 (S)	TT202 (S)
Depth (m)			0.20	0.20	0.30	0.20
Date sampled			22/10/2019	22/10/2019	22/10/2019	22/10/2019
Test	Method	Units				
Arsenic (total)	CE127 ^M	mg/kg As	8.0	14	7.4	3.5
Cadmium (total)	CE127 ^M	mg/kg Cd	<0.2	<0.2	<0.2	<0.2
Chromium (total)	CE127 ^M	mg/kg Cr	32	35	27	36
Chromium (III)	-	mg/kg CrIII	32	35	27	36
Chromium (VI)	CE146	mg/kg CrVI	<1	<1	<1	<1
Copper (total)	CE127 ^M	mg/kg Cu	12	20	12	9.0
Lead (total)	CE127 ^M	mg/kg Pb	21	37	22	12
Mercury (total)	CE127 ^M	mg/kg Hg	<0.5	<0.5	<0.5	<0.5
Nickel (total)	CE127 ^M	mg/kg Ni	9.5	14	9.4	5.1
Selenium (total)	CE127 ^M	mg/kg Se	0.6	1.0	0.6	0.4
Zinc (total)	CE127 ^M	mg/kg Zn	23	35	21	14
pH	CE004 ^M	units	5.8	6.1	6.2	5.6
Sulphate (2:1 water soluble)	CE061 ^M	mg/l SO ₄	16	18	16	16
Cyanide (total)	CE077	mg/kg CN	<1	<1	<1	<1
Total Organic Carbon (TOC)	CE072 ^M	% w/w C	2.9	4.9	3.6	5.5
PAH						
Naphthalene	CE087 ^M	mg/kg	<0.02	<0.02	<0.02	<0.02
Acenaphthylene	CE087 ^M	mg/kg	<0.02	<0.02	<0.02	<0.02
Acenaphthene	CE087 ^M	mg/kg	<0.02	<0.02	<0.02	<0.02
Fluorene	CE087 ^U	mg/kg	<0.02	<0.02	<0.02	<0.02
Phenanthrene	CE087 ^M	mg/kg	0.03	0.13	0.06	0.02
Anthracene	CE087 ^U	mg/kg	<0.02	<0.02	<0.02	<0.02
Fluoranthene	CE087 ^M	mg/kg	0.07	0.21	0.10	0.04
Pyrene	CE087 ^M	mg/kg	0.06	0.18	0.08	0.04
Benzo(a)anthracene	CE087 ^U	mg/kg	0.04	0.11	0.06	0.04
Chrysene	CE087 ^M	mg/kg	0.05	0.13	0.06	<0.03
Benzo(b)fluoranthene	CE087 ^M	mg/kg	0.05	0.15	0.07	0.03
Benzo(k)fluoranthene	CE087 ^M	mg/kg	<0.03	0.06	<0.03	<0.03
Benzo(a)pyrene	CE087 ^U	mg/kg	0.04	0.10	0.04	0.02
Indeno(123cd)pyrene	CE087 ^M	mg/kg	0.03	0.08	0.04	<0.02
Dibenz(ah)anthracene	CE087 ^M	mg/kg	<0.02	0.02	<0.02	<0.02
Benzo(ghi)perylene	CE087 ^M	mg/kg	0.02	0.07	0.03	<0.02
PAH (total of USEPA 16)	CE087	mg/kg	0.40	1.25	0.54	<0.34
Subcontracted analysis						
Asbestos (qualitative)	\$	-	NAD	NAD	NAD	NAD

Chemtech Environmental Limited

METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE127	Arsenic (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg As
CE127	Cadmium (total)	Aqua regia digest, ICP-MS	Dry	M	0.2	mg/kg Cd
CE127	Chromium (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Cr
-	Chromium (III)	Calculation: Cr (total) - Cr (VI)	Dry		1	mg/kg CrIII
CE146	Chromium (VI)	Acid extraction, Colorimetry	Dry		1	mg/kg CrVI
CE127	Copper (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Cu
CE127	Lead (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Pb
CE127	Mercury (total)	Aqua regia digest, ICP-MS	Dry	M	0.5	mg/kg Hg
CE127	Nickel (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Ni
CE127	Selenium (total)	Aqua regia digest, ICP-MS	Dry	M	0.3	mg/kg Se
CE127	Zinc (total)	Aqua regia digest, ICP-MS	Dry	M	5	mg/kg Zn
CE004	pH	Based on BS 1377, pH Meter	As received	M	-	units
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	M	10	mg/l SO ₄
CE077	Cyanide (total)	Extraction, Continuous Flow Colorimetry	As received		1	mg/kg CN
CE072	Total Organic Carbon (TOC)	Removal of IC by acidification, Carbon Analyser	Dry	M	0.1	% w/w C
CE087	Naphthalene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Acenaphthylene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Acenaphthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Fluorene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Phenanthrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Anthracene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Fluoranthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Pyrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(a)anthracene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Chrysene	Solvent extraction, GC-MS	As received	M	0.03	mg/kg
CE087	Benzo(b)fluoranthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(k)fluoranthene	Solvent extraction, GC-MS	As received	M	0.03	mg/kg
CE087	Benzo(a)pyrene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Indeno(123cd)pyrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Dibenz(ah)anthracene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(ghi)perylene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	PAH (total of USEPA 16)	Solvent extraction, GC-MS	As received		0.34	mg/kg
\$	Asbestos (qualitative)	HSG 248, Microscopy	Dry	U	-	-

Chemtech Environmental Limited

DEVIATING SAMPLE INFORMATION

Comments

Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.

For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.

Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

Key

N	No (not deviating sample)
Y	Yes (deviating sample)
NSD	Sampling date not provided
NST	Sampling time not provided (waters only)
EHT	Sample exceeded holding time(s)
IC	Sample not received in appropriate containers
HP	Headspace present in sample container
NCF	Sample not chemically fixed (where appropriate)
OR	Other (specify)

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
82011-1	BH204	0.20	N	
82011-2	BH206	0.20	N	
82011-3	BH216	0.20	N	
82011-4	BH218	0.20	N	
82011-5	BH221	0.10	N	
82011-6	BH222	0.20	N	
82011-7	TP201	0.20	N	
82011-8	TP202	0.10	N	
82011-9	TP203	0.20	N	
82011-10	TP204	0.20	N	
82011-11	TP205	0.20	N	
82011-12	TP206	0.20	N	
82011-13	TP207	0.20	N	
82011-14	TP208	0.20	N	
82011-15	TP209	0.20	N	
82011-16	TP210	0.20	N	
82011-17	TP211	0.20	N	
82011-18	TP212	0.20	N	
82011-19	TP213	0.20	N	
82011-20	TP217	0.20	N	
82011-21	TT201 (S)	0.30	N	
82011-22	TT202 (S)	0.20	N	



ANALYTICAL TEST REPORT

Contract no: 82349
Contract name: Harras Dyke Farm
Client reference: GEO2019-3889
Clients name: Geo Environmental Engineering
Clients address: 4 Culgarth Avenue
Cockermouth
Cumbria
CA13 9PL

Samples received: 11 November 2019

Analysis started: 11 November 2019

Analysis completed: 18 November 2019

Report issued: 18 November 2019

Notes: Opinions and interpretations expressed herein are outside the UKAS accreditation scope.
Unless otherwise stated, Chemtech Environmental Ltd was not responsible for sampling.
All testing carried out at Unit 6 Parkhead, Stanley, DH9 7YB, except for subcontracted testing.
Methods, procedures and performance data are available on request.
Results reported herein relate only to the material supplied to the laboratory.
This report shall not be reproduced except in full, without prior written approval.
Samples will be disposed of 6 weeks from initial receipt unless otherwise instructed.

Key: U UKAS accredited test
M MCERTS & UKAS accredited test
\$ Test carried out by an approved subcontractor
I/S Insufficient sample to carry out test
N/S Sample not suitable for testing

Approved by: _____
Dave Bowerbank
Customer Support Hero

Chemtech Environmental Limited

SAMPLE INFORMATION

MCERTS (Soils):

Soil descriptions are only intended to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions. MCERTS accreditation applies for sand, clay and loam/topsoil, or combinations of these whether these are derived from naturally occurring soils or from made ground, as long as these materials constitute the major part of the sample. Other materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

All results are reported on a dry basis. Samples dried at no more than 30°C in a drying cabinet.

Analytical results are inclusive of stones.

Lab ref	Sample id	Depth (m)	Sample description	Material removed	% Removed	% Moisture
82349-1	CP01	4.00	Sand with Gravel	-	-	6.9
82349-2	CP01	7.00	Sand with Gravel	-	-	10.2
82349-3	CP01	10.00	Clay with Gravel	-	-	9.2
82349-4	CP02	5.00	Clay with Gravel	-	-	11.6
82349-5	CP02	8.00	Clay with Gravel	-	-	9.2

Chemtech Environmental Limited

SOILS

Lab number			82349-1	82349-2	82349-3	82349-4	82349-5
Sample id			CP01	CP01	CP01	CP02	CP02
Depth (m)			4.00	7.00	10.00	5.00	8.00
Date sampled			18/10/2019	18/10/2019	18/10/2019	18/10/2019	18/10/2019
Test	Method	Units					
pH	CE004 ^M	units	6.6	6.3	6.5	6.5	4.7
Sulphate (2:1 water soluble)	CE061 ^M	mg/l SO ₄	131	232	277	376	533

Chemtech Environmental Limited

METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE004	pH	Based on BS 1377, pH Meter	As received	M	-	units
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	M	10	mg/l SO ₄

Chemtech Environmental Limited

DEVIATING SAMPLE INFORMATION

Comments

Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.

For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.

Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

Key

N	No (not deviating sample)
Y	Yes (deviating sample)
NSD	Sampling date not provided
NST	Sampling time not provided (waters only)
EHT	Sample exceeded holding time(s)
IC	Sample not received in appropriate containers
HP	Headspace present in sample container
NCF	Sample not chemically fixed (where appropriate)
OR	Other (specify)

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
82349-1	CP01	4.00	N	
82349-2	CP01	7.00	N	
82349-3	CP01	10.00	N	
82349-4	CP02	5.00	N	
82349-5	CP02	8.00	N	



LABORATORY REPORT



4043

Contract Number: PSL19/6452

Report Date: 29 October 2019
Client's Reference: 2019-3889
Client Name: Geo Environmental Engineering
4 Culgarth Avenue
Cockermouth
Cumbria
CA13 9PL

For the attention of: James Brock

Contract Title: Harras Dyke, Whitehaven
Date Received: 24/10/2019
Date Commenced: 24/10/2019
Date Completed: 29/10/2019

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. 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 other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

R Gunson
(Director)

A Watkins
(Director)

R Berriman
(Quality Manager)

L Knight
(Senior Technician)

S Eyre
(Senior Technician)

S Royle
(Laboratory Manager)

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Page 1 of

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
TT201		TUB	14.00		Brown slightly gravelly very sandy CLAY.
TT202		TUB	1.50		Brown mottled grey slightly gravelly slightly sandy CLAY.
TP201		TUB	1.30		Brown mottled grey slightly gravelly sandy CLAY.
TP202		TUB	0.70		Brown mottled grey slightly gravelly sandy CLAY.
TP205		TUB	0.90		Brown slightly gravelly very sandy CLAY.
TP206		TUB	1.00		Brown slightly gravelly sandy CLAY.
TP207		TUB	1.00		Brown slightly gravelly sandy CLAY.
TP209		TUB	1.80		Brown slightly gravelly sandy CLAY.
TP210		TUB	1.20		Brown slightly gravelly sandy CLAY.
TP211		TUB	0.90		Brown slightly gravelly sandy CLAY.
TP211		TUB	1.50		Brown COBBLE.
TP212		TUB	1.80		Brown slightly gravelly very sandy CLAY.
TP212		TUB	2.50		Grey slightly gravelly very sandy CLAY.
TP213		TUB	1.50		Brown slightly gravelly sandy CLAY.
TP213		TUB	2.00		Brown highly weathered MUDSTONE.
TP217		TUB	1.00		Brown slightly gravelly sandy CLAY.
TP217		TUB	2.00		Brown highly weathered MUDSTONE.



Harras Dyke, Whitehaven

Contract No:

PSL19/6452

Client Ref:

GEO2019-3889

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m ³ Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
TT201		TUB	14.00		15			37	18	19	92	Intermediate plasticity CI.
TT202		TUB	1.50		24			65	29	36	95	High plasticity CH.
TP201		TUB	1.30		16			42	20	22	96	Intermediate plasticity CI.
TP202		TUB	0.70		27			48	23	25	97	Intermediate plasticity CI.
TP205		TUB	0.90		15			31	16	15	92	Low plasticity CL.
TP206		TUB	1.00		19			44	21	23	93	Intermediate plasticity CI.
TP207		TUB	1.00		26			46	22	24	97	Intermediate plasticity CI.
TP209		TUB	1.80		13			39	19	20	97	Intermediate plasticity CI.
TP210		TUB	1.20		21			42	21	21	93	Intermediate plasticity CI.
TP211		TUB	0.90		20			43	20	23	96	Intermediate plasticity CI.
TP211		TUB	1.50		4.2				NP			
TP212		TUB	1.80		20			33	17	16	92	Low plasticity CL.
TP212		TUB	2.50		11			35	18	17	91	Intermediate plasticity CI.
TP213		TUB	1.50		17			39	21	18	93	Intermediate plasticity CI.
TP213		TUB	2.00		18			37	19	18	78	Intermediate plasticity CI.
TP217		TUB	1.00		21			40	20	20	97	Intermediate plasticity CI.
TP217		TUB	2.00		12			38	21	17	89	Intermediate plasticity CI.

SYMBOLS : NP : Non Plastic

* : Liquid Limit and Plastic Limit Wet Sieved.



PSL
Professional Soils Laboratory

Harras Dyke, Whitehaven

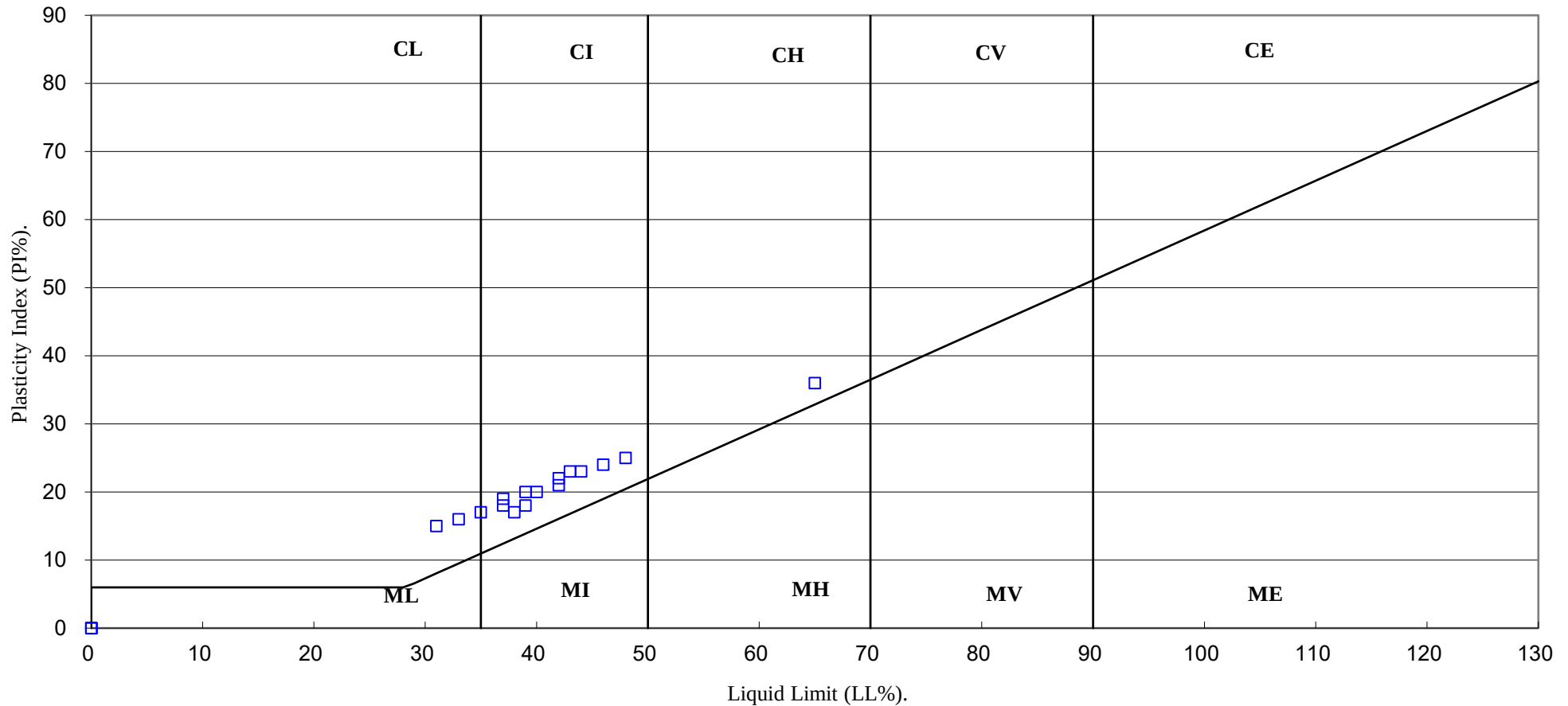
Contract No:

PSL19/6452

Client Ref:

GEO2019-3889

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



4043

PSL
Professional Soils Laboratory

Harras Dyke, Whitehaven

Contract No:

PSL19/6452

Client Ref:

GEO2019-3889



Certificate of Analysis

Certificate Number 19-21848

04-Nov-19

Client Professional Soils Laboratory Ltd
5/7 Hexthorpe Road
Hexthorpe
DN4 0AR

Our Reference 19-21848

Client Reference PSL19/6452

Order No (not supplied)

Contract Title Harras Dyke, Whitehaven

Description 20 Soil samples.

Date Received 29-Oct-19

Date Started 29-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



Summary of Chemical Analysis

Soil Samples

Our Ref 19-21848

Client Ref PSL19/6452

Contract Title Harras Dyke, Whitehaven

Lab No	1589410	1589411	1589412	1589413	1589414	1589415	1589416	1589417	1589418	1589419	1589420
Sample ID	TT201	TT202	TP201	TP202	TP205	TP206	TP207	TP208	TP209	TP210	TP211
Depth	1.00	1.50	1.30	0.70	0.90	1.00	1.00	1.30	1.80	1.20	0.90
Other ID											
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	25/10/19	25/10/19	25/10/19	25/10/19	25/10/19	25/10/19	25/10/19	25/10/19	25/10/19	25/10/19	25/10/19
Sampling Time	n/s	n/s	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	6.6	5.3	5.2	5.1	6.4	6.5	5.0	4.9	5.4	7.3	5.2
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	24	51	11	14	11	12	25	16	39	20	21

Summary of Chemical Analysis

Soil Samples

Our Ref 19-21848

Client Ref PSL19/6452

Contract Title Harras Dyke, Whitehaven

Lab No	1589421	1589422	1589423	1589424	1589425	1589426	1589427	1589428	1589429
Sample ID	TP211	TP212	TP212	TP213	TP213	TP217	TP217	TP202	TP207
Depth	1.50	1.80	2.50	1.50	2.00	1.00	2.00	2.00	1.70
Other ID									
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	25/10/19	25/10/19	25/10/19	25/10/19	25/10/19	25/10/19	25/10/19	25/10/19	25/10/19
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	7.0	6.1	6.5	5.7	6.1	6.0	7.4	4.9	5.5
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	26	16	28	22	21	12	23	< 10	15

Information in Support of the Analytical Results

Our Ref 19-21848
 Client Ref PSL19/6452
 Contract Harras Dyke, Whitehaven

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1589410	TT201 1.00 SOIL	25/10/19	PT 500ml		
1589411	TT202 1.50 SOIL	25/10/19	PT 500ml		
1589412	TP201 1.30 SOIL	25/10/19	PT 500ml		
1589413	TP202 0.70 SOIL	25/10/19	PT 500ml		
1589414	TP205 0.90 SOIL	25/10/19	PT 500ml		
1589415	TP206 1.00 SOIL	25/10/19	PT 500ml		
1589416	TP207 1.00 SOIL	25/10/19	PT 500ml		
1589417	TP208 1.30 SOIL	25/10/19	PT 500ml		
1589418	TP209 1.80 SOIL	25/10/19	PT 500ml		
1589419	TP210 1.20 SOIL	25/10/19	PT 500ml		
1589420	TP211 0.90 SOIL	25/10/19	PT 500ml		
1589421	TP211 1.50 SOIL	25/10/19	PT 500ml		
1589422	TP212 1.80 SOIL	25/10/19	PT 500ml		
1589423	TP212 2.50 SOIL	25/10/19	PT 500ml		
1589424	TP213 1.50 SOIL	25/10/19	PT 500ml		
1589425	TP213 2.00 SOIL	25/10/19	PT 500ml		
1589426	TP217 1.00 SOIL	25/10/19	PT 500ml		
1589427	TP217 2.00 SOIL	25/10/19	PT 500ml		
1589428	TP202 2.00 SOIL	25/10/19	GJ 250ml		
1589429	TP207 1.70 SOIL	25/10/19	GJ 250ml		

Key: P-Plastic T-Tub G-Glass J-Jar

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

Appendix IV

- GEO Chemical Assessment Sheet

Geo Environmental Engineering Ltd

Chemical Assessment Sheet - Soils

Lab number			82011-1	82011-2	82011-3	82011-4	82011-5	82011-6	82011-7	82011-8	82011-9	82011-10	82011-11	82011-12	82011-13	82011-14	82011-15	82011-16	82011-17	82011-18	82011-19	82011-20	82011-21	82011-22	Generic Assessment Criteria Residential With Plant Uptake 2.5% SOM		
Sample id			BH204	BH206	BH216	BH218	BH221	BH222	TP201	TP202	TP203	TP204	TP205	TP206	TP207	TP208	TP209	TP210	TP211	TP212	TP213	TP217	TT201 (S)	TT202 (S)	GAC	GAC Exceeded?	GAC Ref:
Depth (m)			0.20	0.20	0.20	0.20	0.10	0.20	0.20	0.10	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.30	0.20				
Date sampled			22/10/2019	22/10/2019	22/10/2019	22/10/2019	22/10/2019	22/10/2019	22/10/2019	22/10/2019	22/10/2019	22/10/2019	22/10/2019	22/10/2019	22/10/2019	22/10/2019	22/10/2019	22/10/2019	22/10/2019	22/10/2019	22/10/2019	22/10/2019	22/10/2019	22/10/2019			
Test	Method	Units																									
Arsenic (total)	CE127 ^M	mg/kg As	11	13	7.0	10	15	11	12	9.2	10	9.3	8.0	10	6.4	7.3	8.5	6.9	11	13	8.0	14	7.4	3.5	37	No	LQM S4UL
Cadmium (total)	CE127 ^M	mg/kg Cd	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	11	No	LQM S4UL
Chromium (III)	-	mg/kg CrIII	43	46	32	40	47	42	38	32	33	36	34	30	36	30	34	34	33	32	32	35	27	36	910	No	LQM S4UL
Chromium (VI)	CE146	mg/kg CrVI	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	6	No	LQM S4UL
Copper (total)	CE127 ^M	mg/kg Cu	15	21	13	17	34	21	18	22	18	20	19	14	9.5	12	12	13	17	19	12	20	12	9.0	2400	No	LQM S4UL
Lead (total)	CE127 ^M	mg/kg Pb	23	38	17	23	38	21	38	60	24	17	17	26	16	17	40	26	28	27	21	37	22	12	200	No	DEFRA C4SL
Mercury (total)	CE127 ^M	mg/kg Hg	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	40	No	LQM S4UL
Nickel (total)	CE127 ^M	mg/kg Ni	8.8	14	11	14	30	15	12	8.3	9.7	13	16	12	10	9.3	9.8	9.7	12	17	9.5	14	9.4	5.1	130	No	LQM S4UL
Selenium (total)	CE127 ^M	mg/kg Se	1.2	0.9	0.7	0.8	1.0	1.0	1.0	0.7	0.9	1.1	1.0	0.9	0.9	0.6	0.7	0.7	0.8	0.9	0.6	1.0	0.6	0.4	250	No	LQM S4UL
Zinc (total)	CE127 ^M	mg/kg Zn	22	37	23	27	35	29	37	25	24	27	35	21	22	21	25	26	33	34	23	35	21	14	3700	No	LQM S4UL
pH	CE004 ^M	units	5.5	5.5	5.8	6.0	5.7	6.1	5.9	5.8	5.9	6.2	6.1	6.0	6.3	6.2	6.0	6.7	6.1	6.1	5.8	6.1	6.2	5.6	N/A	N/A	N/A
Sulphate (2:1 water soluble)	CE061 ^M	mg/l SO ₄	32	14	17	15	19	12	20	22	<10	<10	<10	15	25	14	35	27	22	18	16	18	16	16	N/A	N/A	N/A
Cyanide (total)	CE077	mg/kg CN	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	34	No	ATRISK SSV
Total Organic Carbon (TOC)	CE072 ^M	% w/w C	2.2	5.2	3.5	2.7	5.1	2.6	3.7	5.4	1.9	1.6	1.9	9.0	2.5	3.2	4.9	4.0	4.4	3.1	2.9	4.9	3.6	5.5	-	-	-
PAH																											
Naphthalene	CE087 ^M	mg/kg	<0.02	<0.02	0.03	<0.02	0.14	<0.02	<0.02	<0.02	<0.02	<0.02	0.03	0.21	<0.02	0.03	0.04	0.03	0.04	0.06	<0.02	<0.02	<0.02	<0.02	5.6	No	LQM S4UL
Acenaphthylene	CE087 ^M	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	420	No	LQM S4UL
Acenaphthene	CE087 ^M	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.04	<0.02	<0.02	0.03	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	510	No	LQM S4UL
Fluorene	CE087 ^U	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.04	<0.02	0.02	0.04	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	400	No	LQM S4UL
Phenanthrene	CE087 ^M	mg/kg	0.04	0.10	0.11	0.07	0.33	0.07	0.11	0.11	0.08	0.04	0.11	0.32	0.49	0.12	0.34	0.46	0.15	0.18	0.03	0.13	0.06	0.02	220	No	LQM S4UL
Anthracene	CE087 ^U	mg/kg	<0.02	<0.02	<0.02	<0.02	0.06	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.03	0.10	<0.02	0.06	0.08	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	5400	No	LQM S4UL
Fluoranthene	CE087 ^M	mg/kg	0.03	0.16	0.10	0.05	0.45	0.08	0.12	0.14	0.10	0.02	0.10	0.18	0.73	0.10	0.54	0.99	0.18	0.13	0.07	0.21	0.10	0.04	560	No	LQM S4UL
Pyrene	CE087 ^M	mg/kg	0.02	0.12	0.08	0.04	0.34	0.07	0.10	0.11	0.09	0.02	0.08	0.14	0.56	0.08	0.43	0.77	0.15	0.10	0.06	0.18	0.08	0.04	1200	No	LQM S4UL
Benzo(a)anthracene	CE087 ^U	mg/kg	<0.02	0.09	0.05	0.04	0.27	0.05	0.07	0.08	0.07	<0.02	0.06	0.10	0.31	0.07	0.26	0.49	0.12	0.08	0.04	0.11	0.06	0.04	11	No	LQM S4UL
Chrysene	CE087 ^M	mg/kg	<0.03	0.10	0.08	0.05	0.28	0.06	0.09	0.10	0.08	<0.03	0.07	0.14	0.32	0.09	0.33	0.56	0.13	0.11	0.05	0.13	0.06	<0.03	22	No	LQM S4UL
Benzo(b)fluoranthene	CE087 ^M	mg/kg	0.02	0.10	0.06	0.04	0.27	0.06	0.09	0.09	0.07	0.02	0.06	0.11	0.30	0.08	0.34	0.62	0.14	0.10	0.05	0.15	0.07	0.03	3.3	No	LQM S4UL
Benzo(k)fluoranthene	CE087 ^M	mg/kg	<0.03	0.04	<0.03	<0.03	0.10	<0.03	0.03	0.04	<0.03	<0.03	<0.03	0.03	0.11	<0.03	0.12	0.23	0.05	0.03	<0.03	0.06	<0.03	<0.03	93	No	LQM S4UL
Benzo(a)pyrene	CE087 ^U	mg/kg	<0.02	0.07	0.04	0.02	0.18	0.04	0.05	0.06	0.05	<0.02	0.04	0.07	0.21	0.06	0.24	0.43	0.10	0.06	0.04	0.10	0.04	0.02	2.7	No	LQM S4UL
Indeno(123cd)pyrene	CE087 ^M	mg/kg	<0.02	0.06	0.04	0.02	0.14	0.03	0.05	0.05	0.04	<0.02	0.03	0.05	0.16	0.04	0.19	0.35	0.08	0.05	0.03	0.08	0.04	<0.02	36	No	LQM S4UL
Dibenz(ah)anthracene	CE087 ^M	mg/kg	<0.02	<0.02	<0.02	<0.02	0.03	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.03	<0.02	0.03	0.07	<0.02	<0.02	<0.02	0.02	<0.02	<0.02	0.28	No	LQM S4UL
Benzo(ghi)perylene	CE087 ^M	mg/kg	<0.02	0.05	0.04	0.02	0.11	0.03	0.04	0.04	0.03	<0.02	0.03	0.07	0.13	0.04	0.16	0.27	0.07	0.05	0.02	0.07	0.03	<0.02	340	No	LQM S4UL
PAH (total of USEPA 16)	CE087	mg/kg	<0.34	0.90	0.63	0.37	2.70	0.48	0.75	0.83	0.61	<0.34	0.63	1.44	3.53	0.72	3.10	5.41	1.20	0.97	0.40	1.25	0.54	<0.34	-	-	-
Subcontracted analysis																											
Asbestos (qualitative)	\$	-	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	Present	No	Presence

Notes:
GAC = Generic Assessment Criteria
YES = GAC Exceeded
Defra C4SL = Defra Category 4 Screening Levels
LQM S4UL = LQM/CIEH 'Suitable 4 Use Levels' S4ULs (Residential End Use based on 2.5% SOM)
CL:AIRE GAC (2010) = EIC/AGS/CL:AIRE GAC 2010 (Residential End Use based on 2.5% SOM)
ATRISK SSV = Atkins Soil Screening Values (Residential End Use based on 2.5% SOM)

Appendix IV

Maintained Load Tests



GEO
Environmental Engineering



PRELIMINARY MAINTAINED LOAD TEST REPORT

**PROPOSED RESIDENTIAL DEVELOPMENT OF
LAND AT HARRAS DYKE FARM
WHITEHAVEN, CUMBRIA**

FOR:

GENR8 NORTH LTD

GEO Environmental Engineering

DOCUMENT CONTROL SHEET

Report Ref: 2019-3889

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02.10.2020 – Draft Report v3 Issued with Corrections
24.11.2020 – Draft Report v4 Issued following Client correspondence

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Consultant: ~

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1.0 Introduction

1.1 Brief

GEO Environmental Engineering Ltd (GEO) were commissioned by Genr8 North Ltd, herein referred to as the “Client”, to carry out Maintained Load Tests (MLTs) on land at Harras Dyke Farm near Whitehaven in Cumbria as indicated on the site location plan included in Appendix I.

The tests were carried out to investigate potential settlement of the fill material within the backfilled opencast mine that is present beneath the site.

The tests have been completed to aid the design of foundations by a Structural Engineer. The selection or design of foundations is beyond the scope of this report.

1.2 Site Location and Description

The site, occupying an area of c.5.59ha is located c.1km north east of Whitehaven town centre in Cumbria as indicated on the site location plan included in Appendix I. Access to the site is from Harras Road which runs parallel to the southern boundary.

- National Grid Reference: 298861, 518389

The site comprises large agricultural fields covered with grass and scrub vegetation. The fields are delineated by post and wire fences with a mixture of agricultural land, residential development and golf course in the surrounding area.

The ground undulates with an overall fall in level to the south east. Topographical data indicates that the lowest area in the south east is at an elevation of c.140m AOD. The highest area in the north is at an elevation of 146m AOD.

1.3 Proposed Development

It is understood that the Client plans to develop the site for residential end use. The results of this report will form part of the feasibility assessment that will determine the site layout. It is anticipated that the development will comprise conventional houses with private gardens, soft landscaping, access roads, car parking and other associated infrastructure.

1.4 Other Reports/Studies

GEO have completed previous investigations of the site, details of which are included below. It is recommended that these documents are read in conjunction with this report.

- Phase I Desk Top Study, ref: 2015-1558, dated: 23.07.2020.
- Phase II Ground Investigation Report, ref: 2019-3889, dated: 17.12.2019.

The Phase II Ground Investigation Report by GEO incorporated data completed by others, details of which are included below:

- Coal Mining Risk Assessment Report by Elliott Environmental Surveyors Ltd, ref: EES15-174, dated 6th June 2016.
- GEO were also provided with ground investigation data (borehole and trial pit logs) that were produced by Sirius Geotechnical Ltd in October 2018.

2.0 Preamble

2.1 Previous Findings

The previous studies and intrusive ground investigations identified a large area of deep made ground across the central part of the site associated with the backfilling of a former opencast coal mine.

The investigation typically encountered topsoil overlying a capping material of firm and stiff brown slightly sandy very gravelly clay with many sub-rounded cobbles (reworked drift). This was typically encountered to depths of between c.1.00m and c.2.30m bgl and appeared to extend beyond the extents of the former opencast.

This was underlain by clay bound gravel, cobbles and boulders of siltstone and sandstone or stiff to very stiff dark grey sandy very gravelly clay with many angular cobbles and boulders of siltstone and sandstone (backfill material). This backfill material was proved to a maximum depth of 10m bgl during the investigation by GEO, however, historical topographical data suggests that the fill may be up to c.48m deep. Although it is unclear if the fill material was compacted to an Engineered Specification, the material appeared well compacted with no voids encountered. SPT tests were completed at 1m intervals throughout the backfill material to a maximum depth of 5.00m bgl. SPT 'N' values within the backfill material varied between 5 and 37, but were typically between 10 and 20.

Detailed descriptions of the ground conditions encountered within the former opencast area are provided in the previous ground investigation report by GEO, details of which are included in Section 1.4.

2.2 Objectives

The overall objective of the Maintained Load Test (MLT) is to provide information relating to the geotechnical properties of the backfill material within the former opencast mine to aid the design of foundations by a Structural Engineer.

The tests were completed in general accordance with BS1377: Part 9, 1990, Soils for civil Engineering Purposes, In-situ tests.

The following paragraph is taken from BS13377:

'This method [Maintained Load Test] covers the determination of the settlement characteristics of soil in-situ by a test in which a constant load is applied to the ground for a period of several weeks through a pad located at shallow depth. The test is suitable for estimating the settlement caused by structures with lightly loaded shallow foundations built on filled ground and on some types of soft natural soils where the weakest ground in the profile is immediately beneath the test pad.'

2.3 Guidelines, Codes of Practice and Third Part Accreditations

This report contains information relating to the geotechnical properties of the soils encountered to aid foundation and highway design by a Structural Engineer.

This testing has been completed in general accordance with the following documents:

- BS5930: 2015: Code of Practice for Site Investigations.
- BS1377: 1990: Methods of test for soils for civil engineering purposes.
- Eurocode 7 – Geotechnical Design (Part 1: General Rules and; Part 2: Ground Investigation and Testing).

- UK Specification for Ground Investigation, 2nd Edition. Site Investigation Steering Group, 2011.
- Effective Site Investigation. Site Investigation Steering Group, 2013.
- BS1377: Part 9 1990. Soils for civil Engineering Purposes, In-situ tests.

2.4 Limitations of Use

Although every effort is made to ensure a full, comprehensive and accurate data has been obtained, it should always be borne in mind that ground conditions have the potential to vary between exploratory hole locations and it is recommended that a “watching brief” is adopted during the development works to ensure that any potential variations encountered are identified and dealt with in an appropriate manner.

In addition, this Ground Investigation Report and its contents are limited to the boundaries of the site, as indicated on the Plans in Appendix I. No reliance, copying or use of this report (in part or whole) by any Third Party is permitted without prior written approval from Geo Environmental Engineering Ltd, with intellectual copyright remaining the sole property of the author. Reliance on the report and its associated information is strictly in accordance with Geo Environmental Engineering Ltd Terms and Conditions, copies of which are available on request.

3.0 In-situ Tests

3.1 Maintained Load Test (MLT) Methodology

The tests were completed in general accordance with BS1377: Part 9, 1990, Soils for Civil Engineering Purposes, In-situ tests.

5 No. locations were chosen for the tests as indicated on the exploratory hole location plan included in Appendix I. The locations were all positioned within the former opencast area and were within the area of proposed development.

The tests commenced on the 9th March 2020 and were completed on the 23rd July 2020. At each test location, a pit was excavated to a depth of between c.1.05m and c.1.30m bgl under the supervision of a suitably qualified and experienced Geo-Environmental Engineer. The pits were excavated through the capping material to expose the stiff dark grey backfill material. At each test location, the ground and groundwater conditions were observed, and details of the ground conditions are included on the exploratory hole logs which are included in Appendix II.

The base of the pits was scraped flat and level and the kentledge (interlocking concrete blocks) were placed directly onto the backfill material (See Figure 1). The arisings from the excavations were used to backfill the pits to ground level, leaving the top of the kentledge blocks standing proud of the ground (See Figure 2).

Each concrete block had the following dimensions:

- Length: c.1.50m
- Width: c.0.60m
- Height: c.0.60m
- Mass: c.1300kg per block.



Figure 1: Blocks stacked directly on backfill



Figure 2: Arisings backfilled around blocks.

The test was split into three phases that were defined by the number of concrete blocks at each test location. Phase 1 spanned weeks 1 and 2 and included 2 blocks at each test location. During phase 1, the blocks were surveyed daily.

Phase 2 spanned weeks 2 to 9 and included three blocks at each test location. Initially in week 3, the blocks were surveyed daily, however, this was reduced to weekly survey visits from week 4. Maintained Load Test 2 (MLT 2) was terminated at the end of Phase 2 in week 9, the concrete blocks were removed, and the test pit was backfilled.

Phase 3 spanned weeks 10 to 12 and included four blocks at MLT 3, 4 and 5, however, three blocks remained at MLT 1. The blocks were surveyed weekly.

The blocks were surveyed at regular intervals as indicated on Table 1 below:

Table 1 - Survey Frequency and Number of Blocks						
Phase	Week and Frequency of Surveys	MLT 1	MLT 2	MLT 3	MLT 4	MLT 5
Phase 1 (10 Days)	1 - Daily	2 Blocks	2 Blocks	2 Blocks	2 Blocks	2 Blocks
	2 - Daily					
Phase 2 (49 Days)	3 - Daily	3 Blocks	3 Blocks	3 Blocks	3 Blocks	3 Blocks
	4 - Weekly					
	5 - Weekly					
	6 - Weekly					
	7 - Weekly					
	8 - Weekly					
	9 - Weekly					
Phase 3 (14 Days)	10 - Weekly	3 Blocks	End of Test Week 9	4 Blocks	4 Blocks	4 Blocks
	11 - Weekly					
	12 - Weekly					
	16 - Monthly					
	20 - Monthly					

Table 1 – Survey Frequency and Number of Blocks

This report has been issued following week 20. Although some settlement is still occurring, the rate of settlement has slowed significantly to a negligible ‘creep’ and further testing is not considered necessary.

The raw survey data including the survey dates and the number of blocks at each test location is presented in Appendix III.

4.0 Test Results

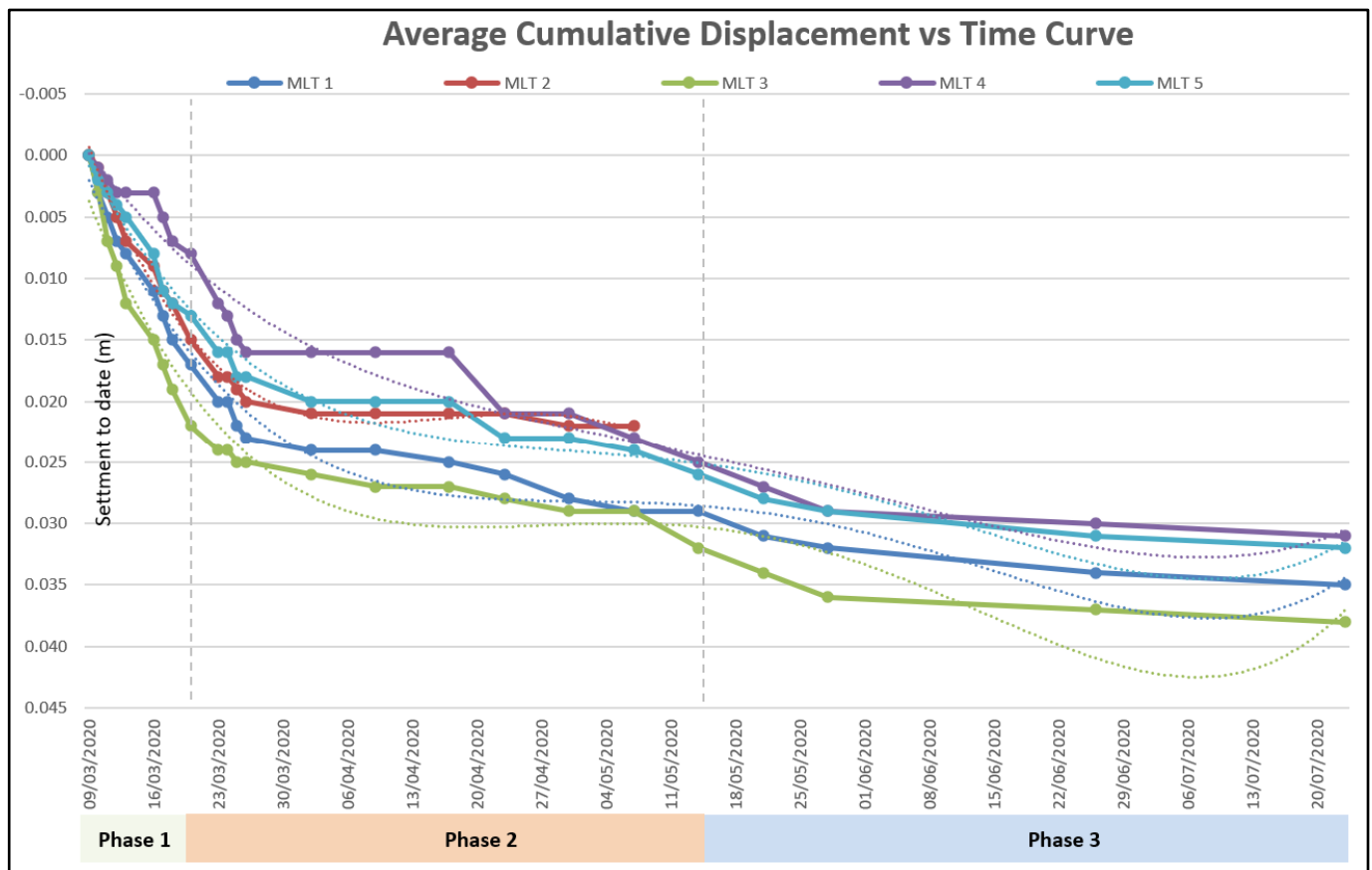
The following section provides a summary the test results obtained up to week 20.

4.1 Maintained Load Test (MLT) Parameters

- Each block has a base area of 1.50m x 0.60m = 0.90m².
- Each block has a mass of c.1300kg, a force of 12.75kN.
- This equates to a pressure of 1444kg/m² per block (14kN/m²).
- With two blocks, the pressure at the base of the stack is 2889kg/m² (28.3kN/m²).
- With three blocks, the pressure at the base of the stack is 4333kg/m² (42.5kN/m²).
- With four blocks, the pressure at the base of the stack is 5777kg/m² (56.66kN/m²).

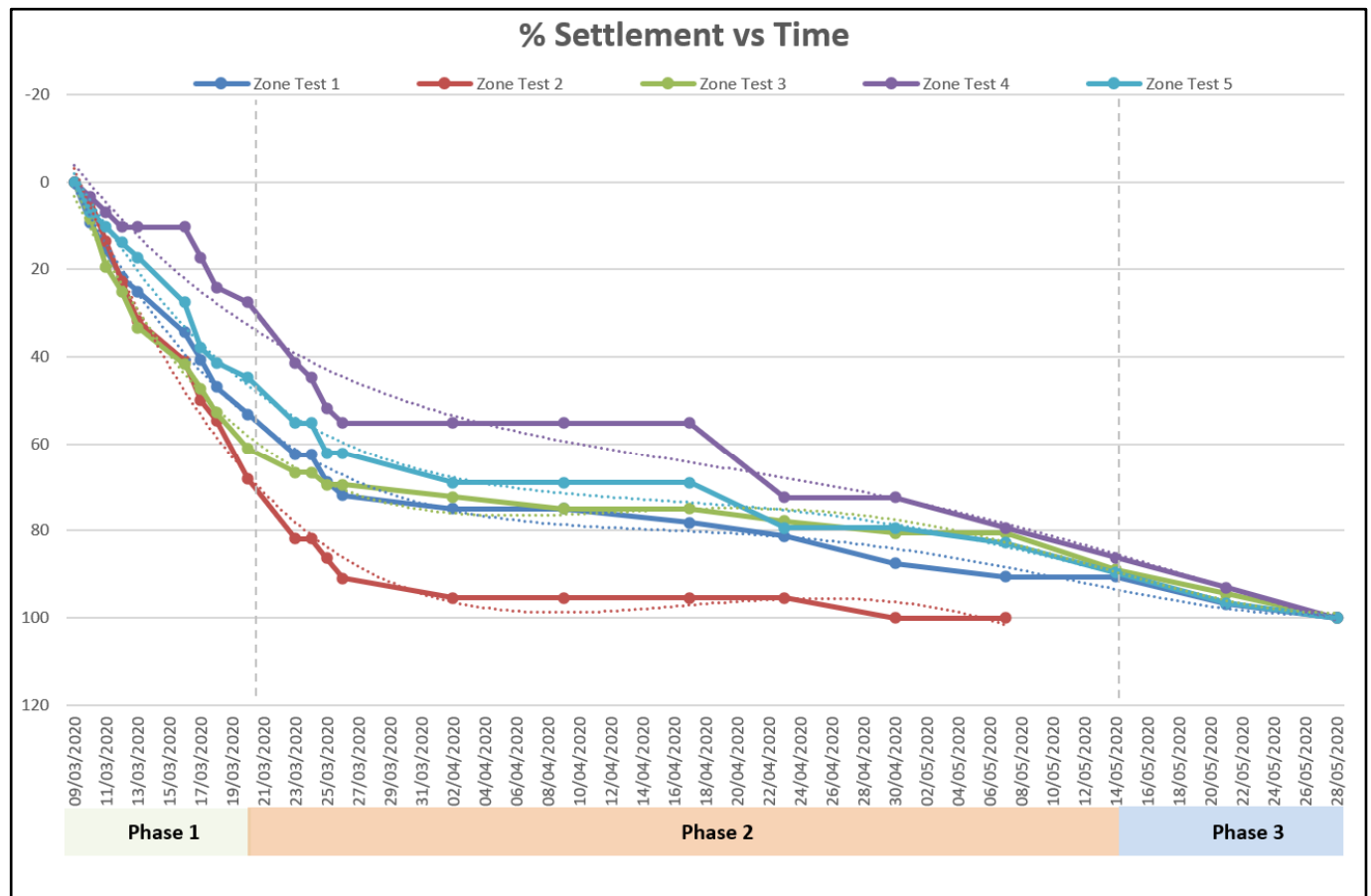
4.1 Maintained Load Test (MLT) Results

The raw survey data, and analysis of the numerical data is presented in Appendix III. A graph of the cumulative displacement at each test location is presented in Appendix III and a copy is included in Graph 1 below.



Graph 1: Average Cumulative Displacement Graph for each Test Location.

The percentage of settlement that has occurred to date has been presented in Graph 2 below.



Graph 2: Percentage of Settlement to date at each Test Location.

Settlement values of between 0.031m (31mm) and 0.038m (38mm) have been recorded for MLT01, 03, 04 and 05, with 50% of settlement to date occurring within 8 to 16 days and 80% occurring within 66 days.

During Phase 1 with two blocks at each test location, a rapid rate of settlement was noted with cumulative displacement values of between 0.007m (7mm) and 0.015m (15mm) and between 23% and 55% of the settlement occurring. This equates to a settlement of between 0.0007m/day (0.7mm) and 0.0015m/day (1.5mm/day).

During the second phase, the rate of settlement reduced significantly, and the cumulative settlement varied between 0.007m (7mm) and 0.015m (15mm) over a period of c.49 days which equates to between 18% and 48% of settlement to date. This equates to a settlement of between 0.00014m/day (0.14mm/day) and 0.0003m/day (0.3mm/day) during Phase 2. Cumulative displacement values of between 0.022m (22mm) and 0.029m (29mm) were recorded since the tests began which equates to between 74% and 83% of the overall settlement. Some minor variations are noted in the data that are likely to be attributed to survey errors.

Phase 3 saw a significant reduction in the settlement rate with cumulative values of 0.006m (6mm) over a period of 77 days which equates to between 16% and 19% of the settlement to date. This equates to an average cumulative settlement of 0.00008m/day (0.08mm/day) during Phase 3. Cumulative displacement values of between 0.031m (31mm) and 0.038m (38mm) were recorded since the tests began, i.e. over 20 weeks.

Average Cumulative Displacement Values									
Week	No. of Blocks	Survey Date	Elapsed Time (Days)	MLT 1	MLT 2	MLT 3	MLT 4	MLT 5	
Week 1	Phase 1: 2 Blocks	09/03/2020	0	0	0	0	0	0	
		10/03/2020	1	0.003	0.001	0.003	0.001	0.002	
		11/03/2020	2	0.005	0.003	0.007	0.002	0.003	
		12/03/2020	3	0.007	0.005	0.009	0.003	0.004	
		13/03/2020	4	0.008	0.007	0.012	0.003	0.005	
Week 2		16/03/2020	7	0.011	0.009	0.015	0.003	0.008	
		17/03/2020	8	0.013	0.011	0.017	0.005	0.011	
		18/03/2020	9	0.015	0.012	0.019	0.007	0.012	
Week 3		Phase 2: 3 Blocks	20/03/2020	11	0.017	0.015	0.022	0.008	0.013
			23/03/2020	14	0.020	0.018	0.024	0.012	0.016
			24/03/2020	15	0.020	0.018	0.024	0.013	0.016
			25/03/2020	16	0.022	0.019	0.025	0.015	0.018
			26/03/2020	17	0.023	0.020	0.025	0.016	0.018
Week 4	02/04/2020		24	0.024	0.021	0.026	0.016	0.020	
Week 5	09/04/2020		31	0.024	0.021	0.027	0.016	0.020	
Week 6	17/04/2020		39	0.025	0.021	0.027	0.016	0.020	
Week 7	23/04/2020		45	0.026	0.021	0.028	0.021	0.023	
Week 8	30/04/2020		52	0.028	0.022	0.029	0.021	0.023	
Week 9	07/05/2020		59	0.029	0.022	0.029	0.023	0.024	
Week 10	Phase 3: 4 Blocks on Tests 3,4 and 5. 3 Blocks on Test 1. Test 2 Terminated.		14/05/2020	66	0.029	N/A	0.032	0.025	0.026
Week 11			21/05/2020	73	0.031	N/A	0.034	0.027	0.028
Week 12		28/05/2020	80	0.032	N/A	0.036	0.029	0.029	
Week 16		26/06/2020	109	0.034	N/A	0.037	0.030	0.031	
Week 20		23/07/2020	136	0.035	N/A	0.038	0.031	0.032	

Table 2 - Average Cumulative Displacement Values for each Test Location

5.0 Conclusion and Discussion

5.1 Conclusion and Discussion

When taking into consideration the ground conditions identified within the former opencast, conventional shallow strip footings are not considered suitable. The Structural Engineer will therefore need to design an appropriate foundation that will safeguard the proposed residential structures. Potential foundations options could comprise the following, subject to confirmation by the Structural Engineer:

- Stiff rafted foundation.
- Ground improvement techniques, for example vibro-stone columns, deep soil mixing, material excavation and replacement under an engineered specification (recourse should be made to the relevant specialists for their advice).
- Pile foundations, although given the nature and depth of the man-made deposits, conventional deep driven and/or bored-cast-in place pile types may not be practical. The presence of large obstructions could deflect driven types causing failure and prevent the advancement of bore-cast-in place piles (recourse should be made to the relevant specialists for their advice).
- The Structural Engineer may wish to consider use of a lightly loaded, reinforced, widened strip footing, which would need appropriate measures to safeguard against potential settlement.
- The developer should consider additional boreholes in the former opencast (i.e. one per plot) to confirm no soft spots are present within influencing depth of the proposed foundation option.

5.2 General Comments

Consideration must be made for variations to occur in the ground conditions between the exploratory hole locations for which GEO holds no responsibility and areas where limited access was available. It is therefore recommended that a “watching brief” and “observational technique” be applied to this site to ensure that if ground conditions appear to vary from those identified within this investigation then advice should be sought from a suitably qualified and experienced Engineering Geologist, Geotechnical or Geo-Environmental Engineer.

The recommendations and opinions expressed in this report are based on the strata observed within the exploratory holes in addition to the results of the site and laboratory tests commissioned by GEO. Consequently, GEO takes no responsibility for conditions that have not been revealed or which occur between them. GEO takes no responsibility for the accuracy of third-party information provided by sub-contract drillers or laboratories.

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

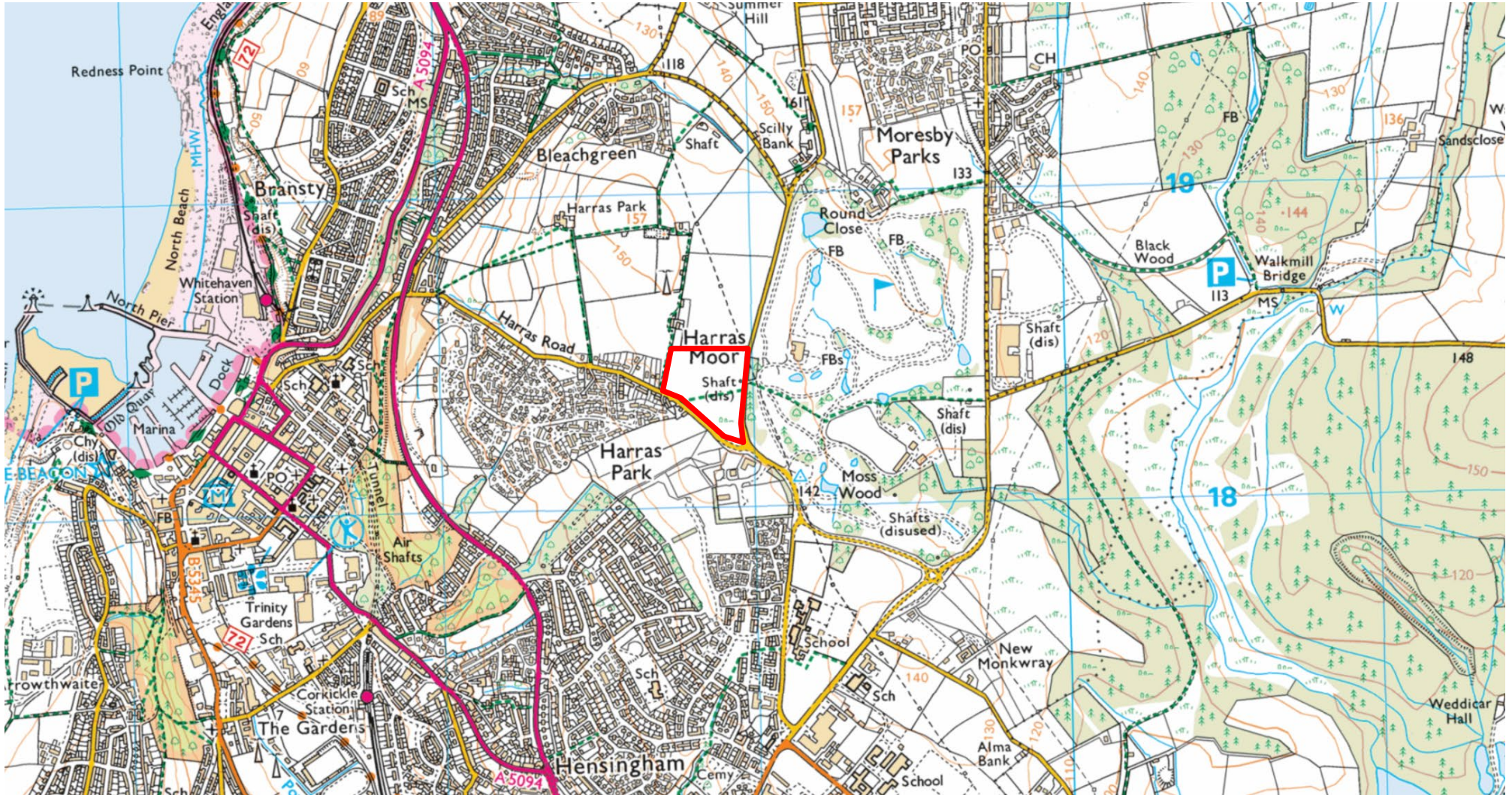
Any items not specifically mentioned cannot be assumed to be covered.

End of Report

Appendix I

- Site Location Plan
- Test Location Plan

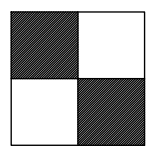
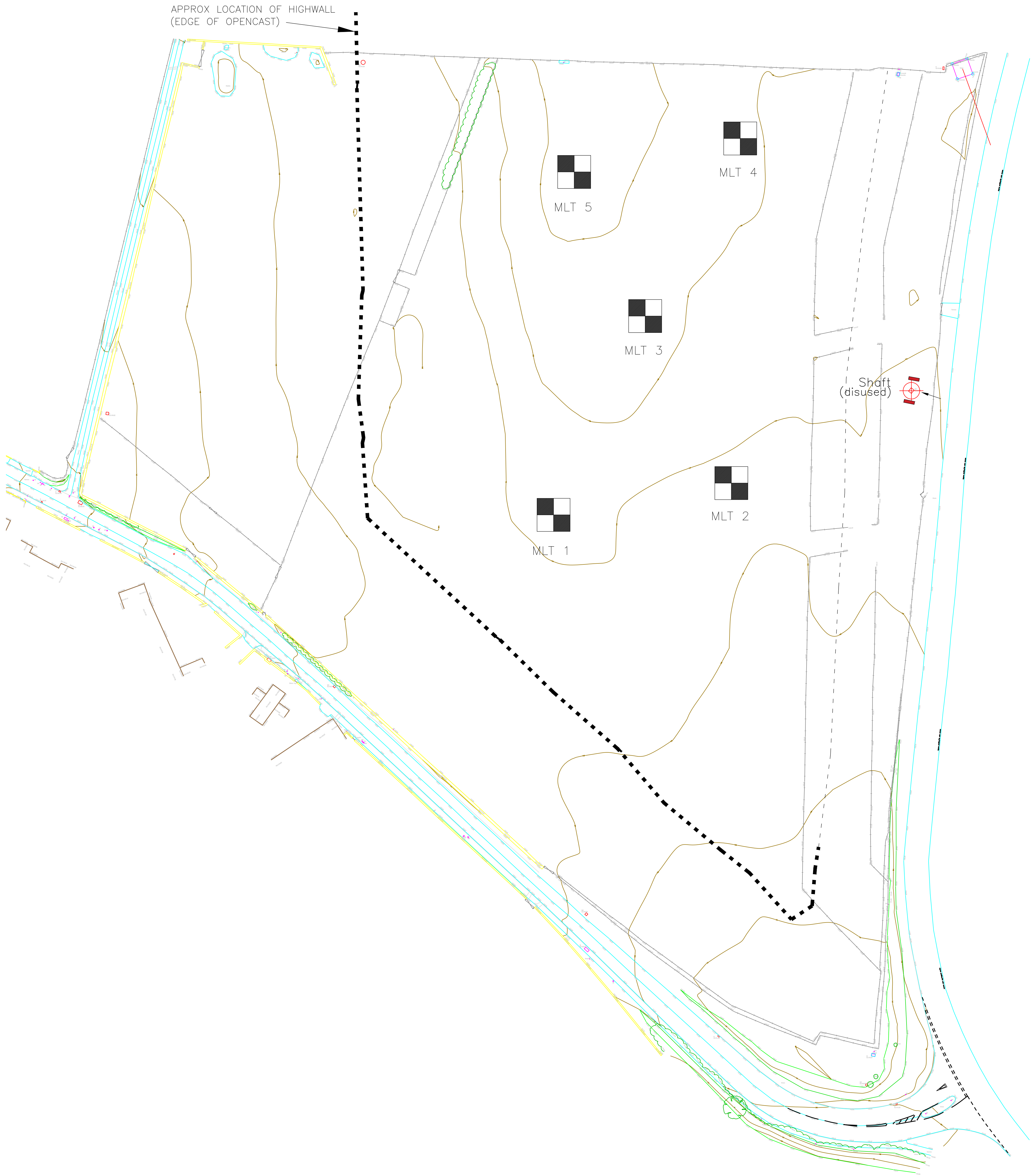
GEO2019-3889: Harras Dyke Farm, Whitehaven – Site Location



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Email: info@geoenvironmentalengineering.com

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MAINTAINED LOAD TEST (MLT) LOCATION

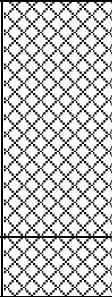
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- MLT 2 – 298907.9, 518379.8
- MLT 3 – 298881.8, 518430.3
- MLT 4 – 298910.6, 518484.0
- MLT 5 – 298860.3, 518473.9

A					
REV	DATE	BY	CHKD	APP	DETAILS
CHANGES					
GeoEnvironmental Engineering Ltd 4 Culpinville Avenue, Cockermouth, Cumbria, CA13 9PL 01900 826 027					
PROJECT		HARRAS DYKE FARM			
TITLE		MAINTAINED LOAD TEST (MLT) LOCATION PLAN			
SCALE	NTS	STATUS	APPROVAL		
DRAWN BY	JB	CHECKED	CE	APPROVED	CE
DATE	03.06.2020	DATE	03.06.2020	DATE	03.06.2020
DRAWING NUMBER		2019-3889-MLT			REVISION
FILE NAME		C:\Users\jones\Dropbox\GEO Ltd - PRIVATE\Project Files\2019 Projects\3889_Zone Testing\			A

Appendix II

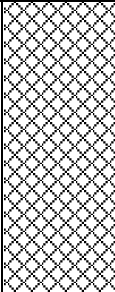
- Test Pit Logs and Photographs

GEO2019-3889: Harras Dyke Farm, Whitehaven, Cumbria – Test Location 1

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.23	TOPSOIL: Dark brown sandy gravelly LOAM		
0.23	1.03	MADE GROUND: Firm to stiff dark brown slight sandy very gravelly CLAY with many sub-rounded cobbles.		
1.03	1.10	Stiff to very stiff dark grey very gravelly CLAY with many angular cobbles of siltstone.		
		Maintained Load test 1 2 x concrete blocks (1.5 x 0.60 x 0.60m) positioned in pit. Pit dry on completion. Pit backfilled around concrete blocks.		No samples retained.
Site: Harras Dyke Farm, Whitehaven, Cumbria Engineer: J. Brock Site Works Date: 09.03.2020 Plant: Tracked 360 Excavator			Log Notes: HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	

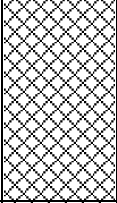


GEO2019-3889: Harras Dyke Farm, Whitehaven, Cumbria – Test Location 2

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.24	TOPSOIL: Dark brown sandy gravelly LOAM		
0.24	1.23	MADE GROUND: Firm to stiff dark brown slight sandy very gravelly CLAY with many sub-rounded cobbles.		
1.23	1.30	Stiff to very stiff dark grey very gravelly CLAY with many angular cobbles of siltstone.		
		Maintained Load test 2 2 x concrete blocks (1.5 x 0.60 x 0.60m) positioned in pit. Pit dry on completion. Pit backfilled around concrete blocks.		No samples retained.
Site: Harras Dyke Farm, Whitehaven, Cumbria Engineer: J. Brock Site Works Date: 09.03.2020 Plant: Tracked 360 Excavator			Log Notes: HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	

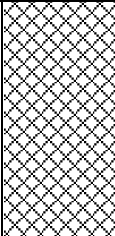


GEO2019-3889: Harras Dyke Farm, Whitehaven, Cumbria – Test Location 3

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.33	TOPSOIL: Dark brown sandy gravelly LOAM		
0.33	0.97	MADE GROUND: Firm to stiff dark brown slight sandy very gravelly CLAY with many sub-rounded cobbles.		
0.97	1.05	Stiff to very stiff dark grey very gravelly CLAY with many angular cobbles of siltstone.		
		Maintained Load test 3 2 x concrete blocks (1.5 x 0.60 x 0.60m) positioned in pit. Pit dry on completion. Pit backfilled around concrete blocks.		No samples retained.
Site: Harras Dyke Farm, Whitehaven, Cumbria Engineer: J. Brock Site Works Date: 09.03.2020 Plant: Tracked 360 Excavator			Log Notes: HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	

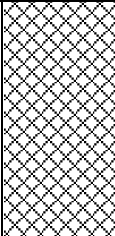


GEO2019-3889: Harras Dyke Farm, Whitehaven, Cumbria – Test Location 4

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.26	TOPSOIL: Dark brown sandy gravelly LOAM		
0.26	1.13	MADE GROUND: Firm to stiff dark brown slight sandy very gravelly CLAY with many sub-rounded cobbles.		
1.13	1.20	Stiff to very stiff dark grey very gravelly CLAY with many angular cobbles of siltstone.		
		Maintained Load test 4 2 x concrete blocks (1.5 x 0.60 x 0.60m) positioned in pit. Pit dry on completion. Pit backfilled around concrete blocks.		No samples retained.
Site: Harras Dyke Farm, Whitehaven, Cumbria Engineer: J. Brock Site Works Date: 09.03.2020 Plant: Tracked 360 Excavator			Log Notes: HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	



GEO2019-3889: Harras Dyke Farm, Whitehaven, Cumbria – Test Location 5

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.27	TOPSOIL: Dark brown sandy gravelly LOAM		
0.27	1.10	MADE GROUND: Firm to stiff dark brown slight sandy very gravelly CLAY with many sub-rounded cobbles. - Field drain at 0.30m bgl.		
1.10	1.20	Stiff to very stiff dark grey very gravelly CLAY and angular COBBLES of siltstone.		
		Maintained Load test 5 2 x concrete blocks (1.5 x 0.60 x 0.60m) positioned in pit. Pit dry on completion. Pit backfilled around concrete blocks.		No samples retained.
Site: Harras Dyke Farm, Whitehaven, Cumbria Engineer: J. Brock Site Works Date: 09.03.2020 Plant: Tracked 360 Excavator			Log Notes: HSV = Hand Shear Vane (kN/m ²) LP = Limited Penetration (HSV/CBR) NP = No penetration (HSV/CBR) B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub	





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Appendix III

- Raw Survey Data
- Data Analysis Sheet and Graphs

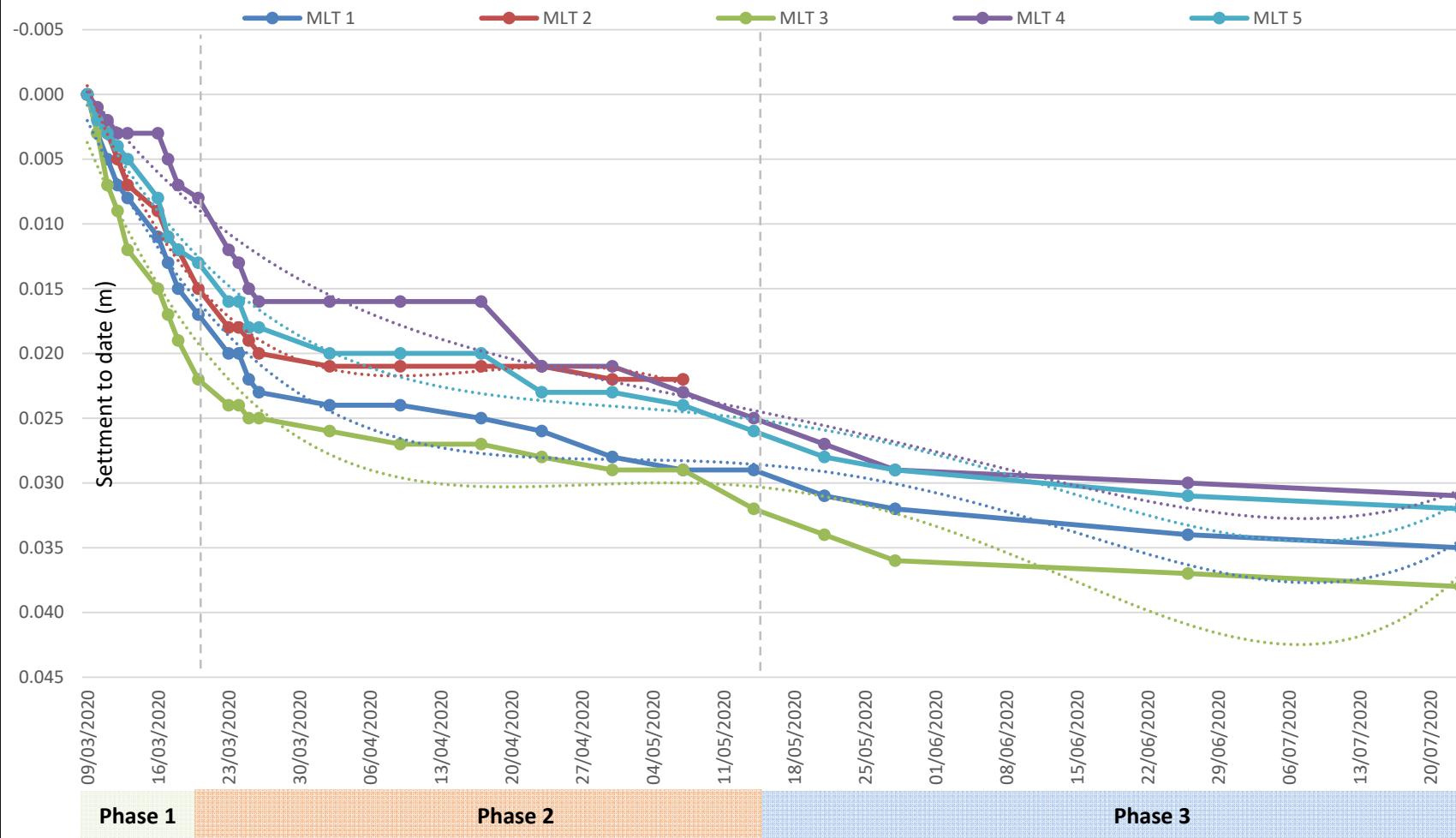
HARRAS DYKE FARM
MAINTAINED LOAD TESTS
RAW SURVEY DATA

Test Location	Easting	Northing	09/03/2020	10/03/2020	11/03/2020	12/03/2020	13/03/2020	16/03/2020	17/03/2020	18/03/2020	ADDITIONAL BLOCK ADDED TO ALL TEST LOCATIONS (3 BLOCKS AT EACH LOCATION))	19/03/2020	20/03/2020	23/03/2020	24/03/2020	25/03/2020	26/03/2020	02/04'2020	09/04/2020	17/04/2020	23/04/2020	30/04/2020	07/05/2020	ADDITIONAL BLOCK ADDED TO TESTS 3, 4 AND 5. TEST 1 CONTINUED WITHmAOD 3 BLOCKS.	07/05/2020	Height of Additional Block	14/05/2020	21/05/2020	28/05/2020	26/06/2020	23/07/2020		
			Phase 1									Phase 2													Phase 3								
			Height (m AOD)									Height (m AOD)													Height (m AOD)								
MLT01.1	298854.1	518370.2	144.48	144.478	144.476	144.473	144.471	144.468	144.467	144.466		145.075	145.074	145.074	145.073	145.07	145.069	145.067	145.067	145.066	145.065	145.064	145.064		145.064	145.064	0	145.064	145.061	145.059	145.057	145.055	
MLT01.2	298852.9	518370.8	144.508	144.505	144.503	144.5	144.497	144.494	144.492	144.49		145.052	145.051	145.047	145.047	145.045	145.044	145.043	145.043	145.041	145.041	145.038	145.038		145.038	145.038	0	145.038	145.037	145.037	145.035	145.035	
MLT01.3	298853.1	518371.2	144.489	144.486	144.483	144.481	144.48	144.478	144.475	144.472		145.071	145.066	145.062	145.062	145.061	145.061	145.06	145.059	145.059	145.059	145.055	145.054		145.054	145.054	0	145.053	145.053	145.051	145.049	145.048	
MLT01.4	298854.3	518370.6	144.458	144.455	144.454	144.453	144.453	144.45	144.449	144.448		145.097	145.094	145.09	145.09	145.09	145.089	145.087	145.087	145.087	145.085	145.084	145.083		145.083	145.083	0	145.081	145.079	145.078	145.077	145.075	
MLT02.1	298907.9	518379.8	143.617	143.615	143.613	143.612	143.61	143.607	143.606	143.603		144.214	144.214	144.21	144.21	144.209	144.208	144.205	144.205	144.205	144.205	144.205	144.205		144.205	144.205							
MLT02.2	298908	518380.3	143.626	143.624	143.622	143.621	143.619	143.616	143.614	143.613		144.243	144.241	144.235	144.235	144.234	144.234	144.233	144.233	144.233	144.233	144.233	144.233		144.233	144.233							
MLT02.3	298906.7	518380.7	143.652	143.65	143.647	143.645	143.642	143.639	143.635	143.635		144.247	144.242	144.242	144.242	144.239	144.237	144.236	144.236	144.236	144.236	144.236	144.236		144.236	144.236							
MLT02.4	298906.6	518380.2	143.644	143.644	143.643	143.641	143.641	143.639	143.639	143.638		144.224	144.222	144.22	144.22	144.22	144.219	144.219	144.219	144.218	144.218	144.217	144.217		144.217	144.217							
MLT03.1	298881.8	518430.3	145.67	145.667	145.664	145.662	145.659	145.657	145.655	145.653		146.279	146.278	146.271	146.271	146.27	146.269	146.269	146.269	146.268	146.268	146.268	146.268		146.268	146.268	146.88	0.612	146.878	146.876	146.875	146.874	146.874
MLT03.2	298881.3	518430.4	145.689	145.686	145.683	145.679	145.675	145.671	145.668	145.666		146.262	146.26	146.257	146.257	146.256	146.256	146.255	146.255	146.255	146.253	146.251	146.25		146.25	146.25	146.892	0.642	146.89	146.888	146.884	146.882	146.88
MLT03.3	298881.5	518431.8	145.705	145.702	145.698	145.696	145.694	145.692	145.691	145.69		146.279	146.275	146.275	146.275	146.274	146.274	146.273	146.273	146.272	146.271	146.271	146.27		146.27	146.27	146.878	0.608	146.875	146.872	146.87	146.869	146.867
MLT03.4	298882	518431.7	145.687	145.683	145.68	145.677	145.675	145.671	145.669	145.668		146.298	146.293	146.293	146.293	146.293	146.292	146.292	146.289	146.289	146.289	146.287	146.286		146.286	146.286	146.862	0.576	146.859	146.859	146.858	146.856	146.855
MLT04.1	298910.6	518484	145.337	145.337	145.337	145.337	145.337	145.335	145.333	145.332		145.944	145.941	145.939	145.939	145.934	145.933	145.933	145.933	145.933	145.929	145.929	145.927		145.927	145.927	146.533	0.606	146.531	146.528	146.526	146.526	146.525
MLT04.2	298910.8	518485.4	145.352	145.35	145.35	145.349	145.348	145.346	145.346	145.345		145.951	145.951	145.949	145.949	145.949	145.949	145.948	145.948	145.948	145.936	145.936	145.934		145.934	145.934	146.529	0.595	146.528	146.527	146.525	146.523	146.52
MLT04.3	298910.3	518485.5	145.366	145.366	145.366	145.366	145.366	145.365	145.362	145.36		145.945	145.941	145.937	145.935	145.932	145.93	145.929	145.929	145.929	145.929	145.928	145.925		145.925	145.925	146.54	0.615	146.538	146.535	146.535	146.535	146.534
MLT04.4	298910.1	518484.1	145.352	145.352	145.348	145.345	145.349	145.347	145.345	145.343		145.932	145.932	145.925	145.925	145.924	145.924	145.924	145.924	145.924	145.922	145.92	145.919		145.919	145.919	146.552	0.633	146.55	146.548	146.547	146.545	146.545
MLT05.1	298860.3	518473.9	146.381	146.379	146.378	146.377	146.376	146.375	146.374	146.373		146.971	146.971	146.965	146.965	146.965	146.964	146.963	146.963	146.961	146.961	146.959	146.959		146.959	146.959	147.581	0.622	147.579	147.575	147.574	147.569	147.567
MLT05.2	298861.7	518473.6	146.421	146.419	146.418	146.416	146.415	146.412	146.41	146.41		147.015	147.012	147.011	147.01	147.005	147.004	147.003	147.003	147.003	147.003	147.003	147.003		147.003	147.003	147.61	0.607	147.607	147.604	147.602	147.601	147.601
MLT05.3	298861.6	518473.2	146.395	146.393	146.391	146.391	146.389	146.388	146.383	146.38		146.983	146.982	146.979	146.979	146.979	146.978	146.977	146.976	146.976	146.973	146.972	146.971		146.971	146.971	147.563	0.592	147.56	147.56	147.56	147.559	147.556
MLT05.4	298860.3	518473.4	146.355	146.353	146.353	146.351	146.351	146.346	146.342	146.34		146.938	146.937	146.937	146.936	146.936	146.936	146.934	146.934	146.934	146.928	146.928	146.928		146.928	146.928	147.532	0.604	147.531	147.53	147.529	147.528	147.527

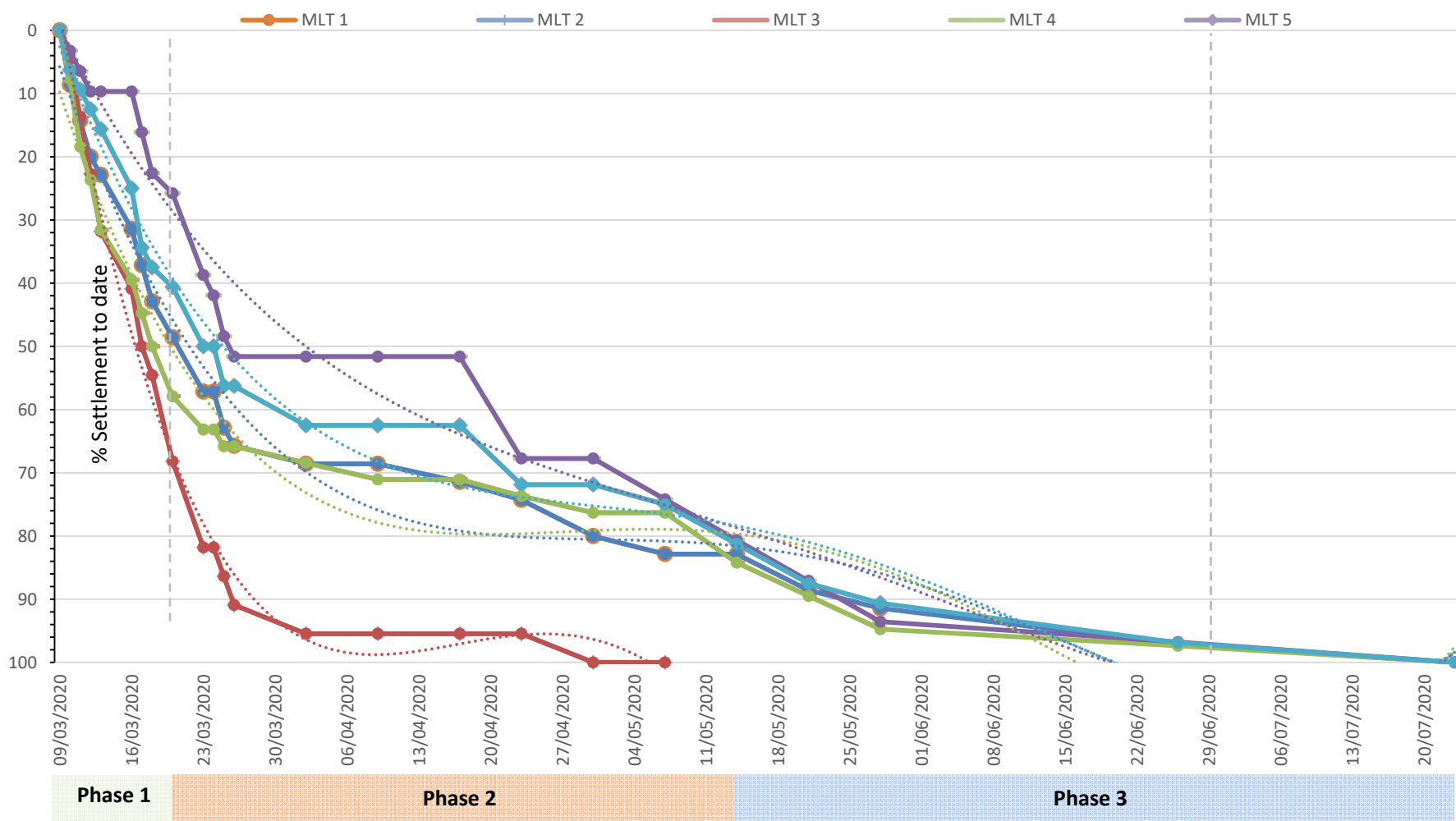
	CUMULATIVE DISPLACEMENT VALUES																										
	09.03.20	10.03.20	11.03.20	12.03.20	13.03.20	16.03.22	17.03.22	18.03.23	19.03.20	20.03.20	23.03.20	24.03.20	25.03.20	26.03.20	02.04.20	09.04.20	17.04.20	23.04.20	30.04.20	07.05.20	14.05.20	14.05.20	21.05.20	28.05.20	26.06.2020	23.07.2020	
		PHASE 1 - TWO BLOCKS								ADDITIONAL BLOCK ADDED TO ALL TEST LOCATIONS (3 BLOCKS AT EACH LOCATION)	PHASE 2 - THREE BLOCKS										ADDITIONAL BLOCK ADDED TO TESTS 3, 4 AND 5. TEST 1 CONTINUED WITH 3 BLOCKS. TEST 2 TERMINATED.	PHASE 3 3 & 4 BLOCKS					
MLT 1	0.000	0.002	0.004	0.007	0.009	0.012	0.013	0.014	0.001		0.001	0.002	0.005	0.006	0.008	0.008	0.009	0.010	0.011	0.011		0.000	0.003	0.005	0.007	0.009	
	0.000	0.003	0.005	0.008	0.011	0.014	0.016	0.018	0.001		0.005	0.005	0.007	0.008	0.009	0.009	0.011	0.011	0.014	0.014		0.000	0.001	0.001	0.003	0.003	
	0.000	0.003	0.006	0.008	0.009	0.011	0.014	0.017	0.005		0.009	0.009	0.010	0.010	0.011	0.012	0.012	0.012	0.016	0.017		0.001	0.001	0.003	0.005	0.006	
	0.000	0.003	0.004	0.005	0.005	0.008	0.009	0.010	0.003		0.007	0.007	0.007	0.008	0.010	0.010	0.010	0.012	0.013	0.014		0.002	0.004	0.005	0.006	0.008	
AVERAGE SETTLEMENT	0.000	0.003	0.005	0.007	0.008	0.011	0.013	0.015	0.002		0.005	0.006	0.007	0.008	0.009	0.010	0.011	0.011	0.013	0.014		0.001	0.002	0.004	0.005	0.007	
CUMULATIVE SETTLEMENT	0.000	0.003	0.005	0.007	0.008	0.011	0.013	0.015	0.017		0.020	0.020	0.022	0.023	0.024	0.024	0.025	0.026	0.028	0.029		0.029	0.031	0.032	0.034	0.035	
MLT 2	0.000	0.002	0.004	0.005	0.007	0.010	0.011	0.014	0.000		0.004	0.004	0.005	0.006	0.009	0.009	0.009	0.009	0.009	0.009		0.009	N/A*	N/A*	N/A*	N/A*	N/A*
	0.000	0.002	0.004	0.005	0.007	0.010	0.012	0.013	0.002		0.008	0.008	0.009	0.009	0.010	0.010	0.010	0.010	0.010	0.010		N/A*	N/A*	N/A*	N/A*	N/A*	
	0.000	0.002	0.005	0.007	0.010	0.013	0.017	0.017	0.005		0.005	0.005	0.008	0.010	0.011	0.011	0.011	0.011	0.012	0.013		N/A*	N/A*	N/A*	N/A*	N/A*	
	0.000	0.000	0.001	0.003	0.003	0.005	0.005	0.006	0.002		0.004	0.004	0.004	0.005	0.005	0.005	0.006	0.006	0.007	0.007		N/A*	N/A*	N/A*	N/A*	N/A*	
AVERAGE SETTLEMENT	0.000	0.001	0.003	0.005	0.007	0.009	0.011	0.012	0.002		0.005	0.005	0.006	0.008	0.009	0.009	0.009	0.009	0.009	0.010		N/A*	N/A*	N/A*	N/A*	N/A*	
CUMULATIVE SETTLEMENT	0.000	0.001	0.003	0.005	0.007	0.009	0.011	0.012	0.015		0.018	0.018	0.019	0.020	0.021	0.021	0.021	0.021	0.022	0.022		N/A*	N/A*	N/A*	N/A*	N/A*	
MLT 3	0.000	0.003	0.006	0.008	0.011	0.013	0.015	0.017	0.001		0.008	0.008	0.009	0.010	0.010	0.010	0.011	0.011	0.011	0.011		0.011	0.002	0.004	0.005	0.006	0.006
	0.000	0.003	0.006	0.010	0.014	0.018	0.021	0.023	0.002		0.005	0.005	0.006	0.006	0.007	0.007	0.007	0.009	0.011	0.012		0.002	0.004	0.008	0.010	0.012	
	0.000	0.003	0.007	0.009	0.011	0.013	0.014	0.015	0.004		0.004	0.004	0.005	0.005	0.006	0.006	0.007	0.008	0.008	0.009		0.003	0.006	0.008	0.009	0.011	
	0.000	0.004	0.007	0.010	0.012	0.016	0.018	0.019	0.005		0.005	0.005	0.005	0.006	0.006	0.009	0.009	0.009	0.011	0.012		0.003	0.003	0.004	0.006	0.007	
AVERAGE SETTLEMENT	0.000	0.003	0.007	0.009	0.012	0.015	0.017	0.019	0.003		0.005	0.005	0.006	0.007	0.007	0.008	0.009	0.009	0.010	0.011		0.002	0.004	0.006	0.008	0.009	
CUMULATIVE SETTLEMENT	0.000	0.003	0.007	0.009	0.012	0.015	0.017	0.019	0.022		0.024	0.024	0.025	0.025	0.026	0.027	0.027	0.028	0.029	0.029		0.032	0.034	0.036	0.037	0.038	
MLT 4	0.000	0.000	0.000	0.000	0.000	0.002	0.004	0.005	0.003		0.005	0.005	0.010	0.011	0.011	0.011	0.011	0.015	0.015	0.017		0.002	0.005	0.007	0.007	0.008	
	0.000	0.002	0.002	0.003	0.004	0.006	0.006	0.007	0.000		0.002	0.002	0.002	0.002	0.003	0.003	0.003	0.015	0.015	0.017		0.001	0.002	0.004	0.006	0.009	
	0.000	0.000	0.000	0.000	0.000	0.001	0.004	0.006	0.004		0.008	0.010	0.013	0.015	0.016	0.016	0.016	0.016	0.017	0.020		0.002	0.005	0.005	0.005	0.006	
	0.000	0.000	0.004	0.007	0.003	0.005	0.007	0.009	0.000		0.007	0.007	0.008	0.008	0.008	0.008	0.008	0.010	0.012	0.013		0.002	0.004	0.005	0.007	0.007	
AVERAGE SETTLEMENT	0.000	0.001	0.002	0.003	0.002	0.003	0.005	0.007	0.002		0.005	0.006	0.008	0.009	0.009	0.009	0.009	0.014	0.015	0.017		0.002	0.004	0.005	0.006	0.007	
CUMULATIVE SETTLEMENT	0.000	0.001	0.002	0.003	0.003	0.003	0.005	0.007	0.008		0.012	0.013	0.015	0.016	0.016	0.016	0.016	0.021	0.021	0.023		0.025	0.027	0.029	0.030	0.031	
MLT 5	0.000	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.000		0.006	0.006	0.006	0.007	0.008	0.008	0.010	0.010	0.012	0.012		0.012	0.002	0.006	0.007	0.012	0.014
	0.000	0.002	0.003	0.005	0.006	0.009	0.011	0.011	0.003		0.004	0.005	0.010	0.011	0.012	0.012	0.012	0.012	0.012	0.012		0.003	0.006	0.008	0.009	0.009	
	0.000	0.002	0.004	0.004	0.006	0.007	0.012	0.015	0.001		0.004	0.004	0.004	0.005	0.006	0.007	0.007	0.010	0.011	0.012		0.003	0.003	0.003	0.004	0.007	
	0.000	0.002	0.002	0.004	0.004	0.009	0.013	0.015	0.001		0.001	0.002	0.002	0.002	0.004	0.004	0.004	0.010	0.010	0.010		0.001	0.002	0.003	0.004	0.005	
AVERAGE SETTLEMENT	0.000	0.002	0.003	0.004	0.005	0.008	0.011	0.012	0.001		0.004	0.004	0.005	0.006	0.008	0.008	0.008	0.010	0.011	0.011		0.002	0.004	0.005	0.007	0.009	
CUMULATIVE SETTLEMENT	0.000	0.002	0.003	0.004	0.005	0.008	0.011	0.012	0.013		0.016	0.016	0.018	0.018	0.020	0.020	0.020	0.023	0.023	0.024		0.026	0.028	0.029	0.031	0.032	

[illegible]

Average Cumulative Displacement vs Time Curve



% Settlement vs Time





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