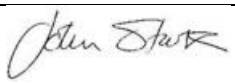
GROUND AND MINING INVESTIGATION AT THE PROPOSED GLYNCOED PRIMARY SCHOOL, EBBW VALE

Ground Investigation Interpretative Report

Report No. Q0215/IR September 2020

DOCUMENT CONTROL	
Contract Name:	**Proposed Glyncoed Primary School, Ebbw Vale**
Contract Reference:	**Q0215**
Report Type:	**Ground Investigation Interpretative Report**
Report Reference:	**Q0215/GIR**
Date of Report Production:	**September 2020**
Client:	**Blaenau Gwent County Borough Council**

Version:	Date:	Prepared by:	Checked by:	Approved by:
Second Issue	17/09/20	P. Darby	R. McDermott	J. Stark
				
		Senior Engineering Geologist B.Sc.(Hons.),M.Sc., C.Geol., F.G.S.	Company Manager B.Sc.(Hons.),M.Sc., C.Geol., F.G.S.	Technical Manager *B.Sc.(Hons.), C.Geol., F.G.S.*

Quantum Geotechnic Ltd, Plas Newydd Farm, Llanedi, Pontarddulais SA4 0FQ T: 01554 744880 E: enquiries@quantumgeotech.co.uk

CONTENTS

APPENDICES

EXECUTIVE SUMMARY

Upon the instruction of Blaenau Gwent County Borough Council (Client), Quantum Geotechnic Limited (QGL) were instructed to carry out a ground investigation at the site of the proposed Glyncoed Primary School, Ebbw Vale.

The purpose of the Ground Investigation as set out by the Specification provided by the client is to establish the ground conditions to satisfy Planning and SAB requirements and to determine what ground engineering works and foundation solutions are required.

A summary of the fieldworks undertaken is outlined below;

- 9 No. Cable Percussion Boreholes to refusal with Rotary Percussive Open Hole 'Follow On'
- 9 No. Machine Excavated Trial Pits; with 4 No to facilitate in-situ Soakaway Testing
- Geotechnical and Environmental Soil Sampling
- Logging of all samples retrieved
- California Bearing Ratio (CBR) and Plate Bearing Tests
- Installation of ground gas and water monitoring pipes

The table below provides a summary of the ground conditions encountered:

General Strata Description	Depth of base of Strata mbgl								
	TP01	TP02	TP03	TP04	TP05	TP06	TP07	TP08	TP09
Made Ground									
Topsoil	--	--	0.4	--	--	0.2	--	--	0.3
Made Ground – Demolition Material	1.0	0.4	--	0.6	0.5	--	--	0.3	--
Made Ground – Reworked Natural Ground	--	--	--	1.9	2.4	1.0	1.2	--	--
Concrete	--	--	--	1.9+	2.4+	--	--	--	--
Glacial Deposits									
Glacial Till	2.0+	3.0+	2.5+	--	--	3.0	3.0+	3.2+	2.7+
General Strata Description	**Depth of base of Strata mbgl**								
	BH01	**BH02**	**BH03**	**BH04**	**BH05**	**BH06**	**BH07**	**BH08**	**BH09**
Made Ground									
Topsoil	--	--	--	0.2	--	--	--	--	--
Made Ground – Demolition Material	1.0	1.0	1.0	--	0.8	1.1	1.2	0.8	0.6
Made Ground – Reworked Natural Ground	--	3.2	1.8	1.2	1.2	--	--	--	1.5
Concrete	--	3.3	--	--	--	--	--	--	--
Glacial Deposits									
Glacial Till	3.0	--	4.8	4.7	3.2	3.3	2.7	3.3	3.3
Boulders	3.3	--	--	--	3.4	3.4	3.5	3.7	3.4
Lower Coal Measures									
Weak / Weathered Mudstone	17.9	18.7	17.1	18.7	26.7	20.8	21.0	19.2	24.6
Mudstone	22.4	24.2	24.2	25.1	--	24.1	24.7	27.8	28.6
Coal – Garw Seam?	23.6	25.3	25.0	26.0	27.6	25.2	25.8	28.4	29.6
Mudstone	--	28.0	--	--	--	--	26.8	--	31.0
Sandstone	33.0	37.0	32.7	35.0	38.5	34.2	34.1	37.5	37.0
Mudstone / Siltstone	45.0+	45.0+	45.0+	45.0+	45.0+	45.0+	45.0+	45.0+	45.0+

A summary of ground water encountered during the intrusive investigation is summarised in the table below:

Exploratory Hole ID	Groundwater summary
BH02	2.9mbgl – Slow groundwater inflow
BH03	22.3mbgl – Slow groundwater inflow
BH04	36.0mbgl – Slow groundwater inflow
BH05	31.6mbgl – Slow groundwater inflow
TP05	1.0mbgl – Rapid groundwater inflow

The relatively shallow groundwater was only encountered in the central area of the site, possibly perched above a buried structure below the area of the former school building, with the water encountered at a depth of 1.0mbgl. In addition, post fieldwork groundwater monitoring measured groundwater at 0.75mbgl at the location of BH06.

Coal Mining Risk Assessment Conclusion

The intrusive investigation identified no evidence of historic mine workings within the Garw Coal Seam, or any other seam or ironstone bands or pins, at shallow depths below the site. Based on the findings of the investigation, the risk to the proposed development from shallow mine workings is considered to be negligible. It is recommended any excavations in the north eastern area of the site are carefully supervised to ensure no anomalies, areas of soft ground or backfilling associated with potential crop workings of the Garw coal seam are present.

Foundation Recommendations

The Made Ground is not considered suitable for founding significant structures due to its potential heterogeneity and uncompacted nature and therefore potential for differential settlements. The underlying Glacial Deposits are likely to provide a suitable founding stratum and should provide an allowable bearing capacity of 65kN/m^2 at 1.2mbgl (where present) and in excess of 125kN/m^2 at 2.0mbgl (where present). The developer must ensure the founding strata is proof rolled and any soft spots excavated and replaced with suitable fill.

The Made Ground below the proposed main school building in the central area of the site has been proven to extend to depths in excess of 3.0mbgl, with potential buried structures (concrete) identified locally. Due to the depth and nature of the Made Ground, the use of shallow trench fill, pad or strip foundations is not considered suitable for large sections of the proposed main school building. In addition, the possible buried structures would act as a 'hard spot', potentially causing excessive magnitudes of differential settlement in structures founded above. The full extent of the possible concrete is not fully known. It is recommended further investigation is undertaken to assess the presence and full extents of any buried structures / concrete.

It is recommended that consideration be given to the following options which would provide suitable founding methods for the main school building where the deeper Made Ground is known to be present:

- A raft foundation or reinforced strip foundation in conjunction with excavation/replacement ground improvement; i.e. excavation of the existing poor ground and buried structures, and replacement with an engineered fill. Alternatively, it may be possible to re-use the existing material following a selection/screening/treatment process, followed by placement in accordance with an appropriate earthworks engineering specification, which would require further earthworks specific testing on specific strata.

- A piled foundation system with suspended floor slab. Piles should be designed by an experienced and competent specialist piling contractor who should select appropriate design parameters and guarantee safe working loads together with maximum total and differential settlements, which should be within acceptable tolerances for the proposed structures. The choice of piling technique should be agreed with the contractor and should take into account the potential presence of buried structure and boulders. Soil parameters for the strata to be penetrated will depend on the piling technique selected and the precise method of working. Driven piles should only be considered if vibrations and environmental constraints can be maintained within acceptable limits. If a piled foundation solution is the preferred option, it is recommended further detailed investigation is undertaken to determine the characteristics and competency of the bedrock deposits and allow suitable pile design.

Once the extent of the possible buried structure / concrete and deeper Made Ground are determined, it may be possible to combine the above options with shallow foundations placed within the Glacial Deposits however, the potential magnitudes of differential settlement that may occur should then be considered.

The Made Ground below the footprint of the proposed Childcare Building, located in the western area of the site, was identified to be less than 2.0m in thickness and to be directly underlain by the Glacial Deposits. Based on current ground levels, trench fill or pad foundations extending through the Made Ground to found on competent Glacial Deposits, in conjunction with a suspended floor slab, should provide a suitable founding solution.

Foundation Concrete Class Designation

The Design Sulphate (DS) class for the site is DS-1, and the Aggressive Chemical Environment for Concrete (ACEC) site classification is AC-1, assuming ‘mobile’ groundwater conditions in a ‘Brownfield’ situation.

Pavement Design

CBR testing has been undertaken within the shallow Made Ground across the footprint of the proposed MUGA, in the north eastern area of the site. CBR values between 3% and 7% were measured.

Human Health Risk of Site End Users

The concentration of Benzo(b)fluoranthene, Benzo(a)pyrene and Dibenzo(a,h)anthracene within the samples of Made Ground within Trial Pit TP07 and TP01 were measured above the relevant assessment criteria for Residential End Use with Plant Uptake. The Dibenzo(a,h)anthracene concentration measured within the sample of Demolition material within BH02 was also above the relevant assessment criteria for Residential End Use with Plant Uptake.

The potential contaminants identified within the Made Ground within TP01 and TP07 may pose a risk to future site users. As TP01 and TP07 are located in areas of proposed soft landscaping, a pathway may exist between the Made Ground (potential contaminant source), and future site users (receptor). Although no statistical analysis has been undertaken, given the test results and visual assessment of the Made Ground across the site, these pockets of Made Ground differ from all other areas of the site and may be considered a potential contamination ‘hotspot’. If this Made Ground is to remain in-situ as part of the development, the following remedial options may be considered suitable to reduce the risk to future site users:

- The installation of a suitable designed capping layer above the potentially contaminated material to remove the potential contamination pathway.
- Excavation of the potentially contaminated material and disposal off site or placement below a capping layer / hardstanding in another area of the development.
- Further accessibility testing and a site-specific assessment to further assess the risk posed to future

site users.

The potential contamination identified within the Made Ground within BH02, if it is to remain in-situ, will be capped by hardstanding as part of the proposed development and at the concentrations measured, a contamination pathway is unlikely to exist and therefore the potential contamination is unlikely to pose a significant risk to site users.

Asbestos fibres within the Made Ground in TP05 was measured at quantities that may pose risk to future site users. This Made Ground is fill material above possible buried structures. TP05 is located below the proposed main school building footprint and within the vicinity of proposed hardstanding area and as such, a pathway between this material and future site users is unlikely to exist and therefore this risk to future site users is considered low. Based on the findings of the investigation, the buried structures possibly identified are not expected to extend below areas of soft landscaping proposed to the south of the main school building however, if alternative sources of information indicate buried structures are present below proposed areas of soft landscaping, further investigation in these areas is recommended to establish the nature of the fill material and if further remediation will be required.

Human Health Risks during Construction

The geo-environmental laboratory testing showed raised potential contamination concentrations within the Made Ground deposits, therefore a risk to construction operatives from chemical contaminants from the shallow ground may exist.

In addition, given the Made Ground associated with fill material above an anticipated buried structure was found to contain Asbestos at quantities that may pose a risk to human health, a risk to construction workers and neighboring site users will exists from air borne migration when undertaking excavations within the area of TP05.

Operatives working with, or likely to come into contact with made ground with the potential to harness raised concentrations of contaminants, should observe particular precautions concerning personal hygiene. They should be issued with the appropriate personal protective equipment and should be instructed in safe working methods.

The presence of Asbestos fibres suggests there is a potential risk, particularly during any groundworks, including post construction if the Made Ground is to remain on site, in the area of TP05. It is recommended that the guidelines given in CIRIA Report C733 'asbestos in soil and made ground: a guide to understanding and managing risks' (2014) is consulted as regards risks to workers from ACM.

In addition, instructions should be issued in the recognition of potentially hazardous materials including oily and odorous soil and water and also any discoloured or fibrous substances for example. Operatives should be warned to avoid contact between hands and mouth before washing. The consumption of food must be confined to designated clean areas with suitable welfare including washing facilities should be provided.

Risk to the Environment and Controlled Waters

Leachate testing of selected soil samples and testing on groundwater samples did not identify any potentially significantly raised contamination concentrations within the soil leachate. Therefore, the risk to controlled waters from potentially mobile contaminants at the site is considered low.

Ground Gas Risk Assessment

The maximum flow recorded in any of the boreholes was 1.2 litre/hour in borehole BH06 with a maximum gas concentration of 6.7% CO_2 recorded in Borehole BH09. The resulting GSV is 0.08. This places the site within Characteristic Situation 2, indicating a low risk classification.

Given the proposed end use of the site is a school, protective measures suitable for use within a residential development are recommended. Typical protective measures recommended in accordance with CIRIA C665 are therefore:

- Reinforced concrete cast in-situ floor slab (suspended, non-suspended or raft) with at least 1200g DPM^2 and underfloor venting
- Beam and block or pre-cast concrete and 2000g DPM/reinforced gas membrane and underfloor venting
- All joints and penetrations sealed

Monitoring of land-gas concentrations being emitted from the installed standpipes have been carried out on single return visit. The results to date indicate the site to be Characteristic Situation 1, indicating a very low risk classification; no special protective measures are considered necessary.

0.0 FOREWORD

The following Conditions and Notes on Site Investigation Procedures should be read in conjunction with this report.

General

Recommendations made and opinions expressed in the report are based on the strata observed in the excavations, together with the results of site and laboratory tests. No responsibility can be held for conditions which have not been revealed by the Exploratory Holes or which occur between Exploratory Holes. Whilst the report may suggest the likely configuration of strata, both between Exploratory Holes and below the maximum depth of investigation, this is only indicative and liability cannot be accepted for its accuracy.

Unless specifically stated, no account has been taken of possible subsidence due to mineral extraction below or close to the site.

Investigation Procedures

Cable Percussive Boreholes, Rotary open holes and Machine Excavated Trial Pit techniques for ground investigation have been employed within the project. All Exploratory Hole operations, sampling and logging of soils, rocks and in-situ testing complies with the recommendations of the British Code of Practice BS 5930: 2015 'Site Investigations', British Code of Practice BS 10175: 2011 +A1:2013 'Investigation of Potentially Contaminated Sites' and BS 1377: 1990, 'Methods of Test for Soils for Engineering Purposes'.

Routine Sampling

Representative bulk, disturbed and environmental samples of the different strata are taken following completion of logging. These samples are sealed and labelled in clear plastic bags and 2kg plastic tubs. Soil samples obtained for environmental testing are sampled and sealed in borosilicate amber jars or in specialist vessels where required. All samples are returned from site to QGL's laboratory for controlled storage within 24 hours of sampling to await test scheduling/requirements.

In-Situ Testing, Surveying & Instrumentation

In-situ testing comprised:

- Soakaway Testing in accordance with BRE Digest 365
- Plate Bearing Tests in accordance with BS1377
- California Bearing Ratio tests in accordance with BS1377
- Standard Penetration Tests

Groundwater

Where possible, the depth of entry of any influx of groundwater is recorded during the course of excavation or boring operations. The rate of inflow into the excavation or borehole is monitored during the course of the excavation or during boring procedures. Upon encountering any water strikes, work is temporarily halted and the water levels monitored for a standard twenty minute period recording the change in water level at the end of the twenty minutes.

Groundwater conditions observed in the excavations are those appertaining to the period of investigation. It should be noted, however, that groundwater levels are subject to diurnal, seasonal and climatic variations and can also be affected by drainage conditions or other causes.

Retention of Samples

After satisfactory completion of all the scheduled laboratory tests on any sample, the remaining material is discarded. Unless otherwise instructed or detailed within the Contract, all soil and/or rock samples not tested will be discarded 28 days after submission of the approved final report.

1.0 INTRODUCTION

1.1 General

Upon the instruction of Blaenau Gwent County Borough Council (Client), Quantum Geotechnic Limited (QGL) were instructed to carry out a ground investigation at the site of the proposed Glyncoed Primary School, Ebbw Vale.

The Client is proposing to build a two-storey primary school across the site. The main school building will have a building footprint of approximately 2500m^2 located in the central area of the site, whilst a second smaller building that is proposed will be a childcare facility will have an approximate footprint of 800m^2 and be located in the western area of the site. The development will incorporate areas of hardstanding, car parks and soft landscaping. Access to the site is proposed off Badminton Road. The proposed development layout is presented in Appendix I.

In this interpretative report, a factual account of the fieldwork, the strata encountered including contamination and groundwater observations are detailed. Guidance and recommendations on geotechnical matters and contamination issues are provided along with details on any remedial or mitigative measures deemed necessary.

1.2 Purpose of Ground Investigation

The purpose of the Ground Investigation as set out by the Specification provided by the client is to establish the ground conditions to satisfy Planning and SAB requirements and to determine what ground engineering works and foundation solutions are required.

1.3 Scope of Works

Although an initial scope was set out in the specification, freedom was delegated to QGL (as project engineer) to amend the scope as deemed required so that sufficient data was obtained to allow the ground model to be developed.

The agreed scope of works are as follows:

- 9 no. Cable Percussive boreholes with Rotary Percussive (open hole) follow on
- 9 no. Trial Pits
- In-situ testing regime (including SPTs, soakaway testing, CBR's and Plate Load Tests)

<u>General</u>

- Installation and monitoring of gas and groundwater standpipes
- Soil sampling and classification
- Laboratory soil testing

The intrusive investigation covers the proposed site area, with the boreholes focused across the proposed building footprints.

2.0 SITE OVERVIEW

2.1 Site Description

The site is located off Badminton Road in the residential area of Glyncoed. Ebbw Vale.

The central area of the site is relatively flat with a covering of demolition material and asphalt hardstanding. The south western and south eastern areas of the site have significant areas of grassland with several mature trees. The south western area of the site slopes down to the main site area. The north eastern area of the site is grassed and slopes down to the north eastern site boundary.

To the northwest of the site is a large building occupied by a bowls club along with the associated car parking area. The site is bounded to the south west by Badminton Road and residential housing, and to the north east by Allotment Road with several industrial buildings beyond. The existing Glyncoed Primary School bounds the site to the south east and residential housing is present immediately to the north west of the site. The Afon Ebwy flows approximately 180m to the northwest.

The site is centred on National Grid Reference 316435, 211245.

A Site Location Plan is presented as Figure 1 in Appendix I.

2.2 Site History

The site is shown as being undeveloped prior to 1959 on historical maps. The historical map resource *old-maps.co.uk* shows the presence and development of Glyncoed School on the 1938 mapping. An extension of the school is mapped from the 1984 edition survey.

In the surrounding area, residential expansion is first shown on the 1938 mapping. In the extended area there are numerous mining related features mapped, but none are mapped in the immediate vicinity of the site.

2.3 Published Geology

The geology of the site is depicted on the British Geological Survey (BGS) geological map 232 'Abergavenny' at 1:50,000 scale, and sheet SO 11 SE at 1:10,560 scale, as well as the BGS's online resource Geology of Britain Viewer.

The superficial deposits are mapped as Glacial Till described on Sheet 232 as 'Boulder Clay or Glacial Till'.

Bedrock beneath the site is shown to be the South Wales Lower Coal Measures. The BGS online database describes this as 'Grey, (productive) coal bearing mudstone/siltstones, with seatearths and minor sandstone', typically comprising Mudstone, Siltstone and Sandstone with workable coal seams. The solid geology in the area is mapped to dip to the south south west at an angle of 6˚.

A number of coal seams are mapped in the region with the Garw seam inferred to outcrop on or close to the northern site boundary and the Five Feet Gellideg seam inferred to crop approximately 100m to the south of the site. Given the dip of the strata, the Garw seam is likely to underlie the site. Numerous coal seams are inferred to crop to the south of the Five Feet Gellideg seam however, based on the anticipated dip of the strata, the Five Feet Gellideg and all seams cropping to the south of this seam will not underlie the site.

In terms of mining related features, the geological mapping identifies the 'No. 4 Pit' approximately 400m to the south west and a north easterly orientated adit approximately 400m to the north east, possibly associated with the Five Feet Gellideg.

2.4 Coal Authority Mining Report

A Coal Authority Mining Report (Ref: 51002194683001, dated 13/11/19) has been provided by the Client for the site and is presented in Appendix II.

The Report states that the property is not within a surface area that could be affected by any past recorded underground coal mining. However the property is in an area where the Coal Authority believes there is coal at or close to the surface. This coal may have been worked at some time in the past. The potential presence of coal workings at or close to the surface should be considered, particularly prior to any site works or future development activity, as ground movement could still be a risk.

The Report also states that there are no recorded coal mine entries known to the Coal Authority within, or within 20 metres, of the boundary of the property.

3.0 FIELDWORK

3.1 General

The fieldworks were carried out between the 1st and 16th June. Full-time on-site supervision and attendance by an Engineering Geologist from Quantum was undertaken on all aspects of the site works and subsequent reinstatement works of all exploratory hole locations.

All works were conducted within safe working practices set out by QGL's Risk Assessed Method Statement including CAT scanning and service inspection hand excavated pits to 1.2mbgl in all exploratory hole locations. All inductions and daily site briefings were carried out by QGL's Engineering Geologist with regular toolbox talks and site meetings with the Investigation Supervisor. No incidents or near misses were recorded during the fieldworks, with the works being incident free. No deviations from the Standards and Procedures adopted for the works were recorded.

A summary of the fieldworks is outlined below;

- 9 No. Cable Percussion Boreholes to refusal with Rotary Percussive Open Hole 'Follow On'
- 9 No. Machine Excavated Trial Pits; with 4 No to facilitate in-situ Soakaway Testing
- Geotechnical and Environmental Soil Sampling
- Logging of all samples retrieved
- California Bearing Ratio (CBR) and Plate Bearing Tests
- Installation of ground gas and water monitoring pipes

3.2 Exploratory Hole Locations

The exploratory hole locations were set out by a QGL Engineering Geologist to obtain general coverage of the site whilst focusing on critical areas within the proposed development and were agreed with the Client prior to commencing the investigation. The positions of the investigation holes were surveyed using GPS equipment, with National Grid References and ground levels to Ordnance Datum presented on the Logs.

An Exploratory Hole Location Plan is presented as Figure 2 in Appendix I.

3.3 Cable Percussive Boreholes with Rotary Percussive Open Hole 'Follow On'

A Dando 200 cable percussive rig was used to progress the boreholes through the overlying Made Ground and superficial deposits. With a winch capacity of 1 to 2 tonnes, a wire rope is controlled via the clutch of a diesel engine which generates the percussive action used in this drilling method. Various drill tools connected to the end of the winch are used to recover samples (clay cutter and shell) or break up rock and obstructions (chisel). Steel casing keeps the borehole open and prevent collapse as it progresses which is removed on completion of each borehole.

Representative bulk disturbed and small disturbed samples were recovered from each cable percussive borehole for geotechnical characterisation of the underlying ground conditions. Environmental samples were taken at regular intervals for subsequent laboratory contamination testing.

The Cable Percussive Borehole terminated upon refusal at relatively shallow depths of between 2.7 and 4.8mbgl.

A Comacchio MC450P track-mounted rotary drilling rig was used to progress the boreholes using rotary percussive open-hole drilling techniques from the base of the Cable Percussive Boreholes to target depths of 45.0mbgl.

115mm diameter casing was drilled through the overlying superficial deposits (ODEX system) to keep the hole open and a 4-inch hammer used to break through obstructions and progress (probe) through rock. A combined air/mist flush was used to clear the hole of returns and debris through the superficial deposits within each of the boreholes. Water flush was used whilst drilling within the bedrock.

Upon completion of the rotary boreholes, BH03, BH04, BH06 and BH09 were installed with gas/groundwater monitoring standpipes (see section 3.6.). All remaining holes were backfilled and sealed with bentonite pellets.

A summary of each borehole, including termination details, are presented in Table 1. A complete set of the Engineering Geologist's borehole logs are presented within Appendix III.

Table 1: Borehole Summary

Exploratory Hole ID	Drilling Method	Termination Depth (mbgl)	Remarks
BH01	Cable Percussive	2.70	Refusal on obstruction / Weathered Bedrock
	Rotary	45.0	Scheduled Depth
BH02	Cable Percussive	3.2	Refusal on Concrete
	Rotary	45.0	Scheduled Depth
BH03	Cable Percussive	4.8	Refusal on obstruction / Weathered Bedrock
	Rotary	45.0	Scheduled Depth
BH04	Cable Percussive	4.7	Refusal on obstruction / Weathered Bedrock
	Rotary	45.0	Scheduled Depth
BH05	Cable Percussive	3.2	Refusal on obstruction / Possible Boulders
	Rotary	45.0	Scheduled Depth
BH06	Cable Percussive	3.3	Refusal on obstruction / Possible Boulders
	Rotary	45.0	Scheduled Depth
BH07	Cable Percussive	2.7	Refusal on obstruction / Possible Boulders
	Rotary	45.0	Scheduled Depth
BH08	Cable Percussive	3.3	Refusal on obstruction / Possible Boulders
	Rotary	45.0	Scheduled Depth
BH09	Cable Percussive	3.3	Refusal on obstruction / Possible Boulders
	Rotary	45.0	Scheduled Depth

3.4 Machine Excavated Trial Pits

9 No. Trial Pits were excavated across the site using a 13 Tonne tracked excavator. The Trial Pit positions are shown on the exploratory hole location plan in Appendix I.

This method of investigation allows direct sampling of the near surface deposits for identification purposes, as well as assessment of any salient features and Made Ground or disturbed ground. The trial pits were logged in accordance with BS5930:2015+A1:2020; BS EN ISO 14688-1:2018 and BS EN ISO 14688-2:2018, and supervised at all times by an Engineering Geologist from QGL. All of the trial pits were backfilled with compacted layers of arisings upon completion of soakaway testing with suitable surface reinstatement where required.

Soakaway testing was performed within Trial Pits TP01, TP02, TP06 and TP07, in accordance with BRE Digest 365 guidelines. The Soakaway test records are presented in Appendix V.

A complete set of Engineering Geologist Trial Pit logs and corresponding Soakaway Test Certificates are presented within Appendix IV.

Details of the Trial Pits including final depths in metres below ground level (mbgl) are provided below in Table 2.

Table 2: Trial Pit Detail

Exploratory Hole ID	Terminated Depth (mbgl)	Reason for Termination
TP01	2	To undertake in-situ Soakaway Test
TP02	3	Clay too stiff to progress
TP03	2.5	To undertake in-situ Soakaway Test
TP04	1.9	Unable to penetrate Concrete / Boulder
TP05	2.4	Unable to penetrate Concrete Slab
TP06	3	To undertake in-situ Soakaway Test
TP07	3	To undertake in-situ Soakaway Test
TP08	3.2	Target Depth
TP09	2.7	Unable to penetrate through cobbles and boulders

3.5 Land Gas & Groundwater Borehole Installations

50mm (internal) diameter standpipes were installed in boreholes BH03, BH04, BH06 and BH09 for the purposes of land gas and groundwater monitoring. The pipes are sealed from above and below from the use of bentonite pellets which ‘go off’ and make a water-tight seal. Plain pipe connects the well to the ground surface where lockable flush covers are cemented in. Details of the pipe installations are presented in Table 3.

Table 3: Borehole Installation Details

Exploratory Hole ID	Depth to base (mbgl)	Response Zone depth (mbgl)
BH03	9.0	50mm: 1.0 – 9.0
BH04	12.5	50mm: 3.5 – 12.5
BH06	10.0	50mm: 1.0 – 10.0
BH09	30.0	50mm: 10.5 – 30.0

Borehole Monitoring results are presented within Appendix VI.

3.6 In-Situ Testing

3.6.1 Standard Penetration Testing

Standard penetration tests (SPTs) were undertaken at 1m intervals within the Cable Percussive Boreholes. Tests are conducted in superficial deposits (Made Ground and Glacial Till) to give an indication of their relative density / strength.

This is a dynamic test as described in BS1377:1990 - Part 9 and is a measure of the density of the soil or rock. Within fine grained or cohesive soils, the test incorporates a small diameter tube (650mm length, 50mm external diameter and 35mm internal diameter) with a cutting shoe known as the 'split barrel sampler'. The sampler is forced into the soil dynamically using blows from a 63.5kg hammer dropped through 760mm. The sampler is initially advanced 150mm into the soil with seating blows, then the number of blows required to advance the sampler each 75mm increment up to a depth of 300mm is recorded. This cumulative total number of blows over the 300mm test is referred to as the "N" value. For coarse gravels and bedrock the split barrel is replaced by a 60° cone.

SPT results can be found on the corresponding borehole logs in Appendix III.

3.6.2 Plate Bearing Tests

Plate bearing tests were undertaken at depths of 0.4mbgl across the areas of the proposed building footprint to provide an indication of the bearing capacity of the shallow soils across the site. The test locations are shown on the exploratory hole location plan in Appendix I.

The tests were undertaken in accordance with BS1377:1990 – Part 9 and involves using a 13t tracked excavator as Kentledge and a jack to apply a known pressure on a circular plate. The settlement of the plate is measured at various pressures.

Plate Bearing Test results are presented in Appendix VII.

3.6.3 California Bearing Ratio

California Bearing Ratio (CBR) tests were undertaken within areas of proposed hardstanding. The test locations are shown on the exploratory hole location plan in Appendix I.

Where access allowed the tests were using a 13t tracked excavator as Kentledge and a jack to apply a known pressure on a circular plate in accordance with BS1377:1990 – Part 9. The settlement of the plate is measured at various pressures. The CBR value is interpreted from the test load at 1.25mm penetration, in accordance with Specification for Highway Works IAN73/06 Rev.1.

CBR Test results are presented in Appendix VIII.

3.7 Sampling - General

Geotechnical bulk and disturbed samples were taken where required within the superficial deposits for strata identification and laboratory testing purposes. In addition, environmental samples were taken for laboratory testing. All environmental samples were sent to the laboratory within 24-36 hours of having been obtained, whilst geotechnical samples were returned from site to QGL's laboratory for controlled storage to await test scheduling/requirements. For specific details of laboratory testing see Section 4.0. Sample type and sample depth are recorded on the Engineering Geologist's Exploratory Hole Logs found within Appendices II to IV.

4.0 LABORATORY TESTING

4.1 General

The laboratory testing was scheduled by QGL and comprised a number of geotechnical and environmental tests on selected soil and soil leachate samples obtained during the investigation.

4.2 Geotechnical Laboratory Testing

All the geotechnical soil testing work was carried out in accordance with the procedures stipulated in the various sections of BS 1377:1990 Parts 1 - 9 Methods of test for soils for civil engineering purposes. Table 4 details the tests undertaken.

Table 4: Geotechnical Tests Undertaken

Type of Test	No of Tests
Moisture Content	15
4 Point Liquid and Plastic Limit (Atterberg)	14
Particle Size Distribution by Wet Sieve	13
Sedimentation by Pipette carried out with Wet Sieve	3
Dry Density / Moisture Content Relationship using 2.5kg rammer	3
BRE Digest Suite D	7

Note: 4 no. Dry Density / Moisture Content Relationship tests were initially scheduled however a single sample of Made Ground from BH06 between 0.5 and 1.0mbgl was too granular to undertake the test.

A full set of geotechnical laboratory test certificates are provided within Appendix IX.

4.3 Geo-Environmental Laboratory Testing

Geo-Environmental testing was carried out on selected soil and soil-leachate samples gained from the ground investigation. The purpose of the testing is to gain a holistic view of any raised levels of contaminants that may exist on site and any risks they may pose to future site users but more prominently the construction workers during the construction phase. Table 5 details Geo-Environmental tests undertaken on selected soil samples, with Table 5A detailing the leachate test undertaken on selected soil samples and Table 5B detailing the testing undertaken on water samples obtained from post fieldwork monitoring / groundwater sampling of the monitoring installations.

Table 5: Geo-environmental tests undertaken on soil samples

Analytical Parameter (Soil Analysis)	Accreditation Status	No of Tests	Analytical Parameter (Soil Analysis)	Accreditation Status	No of Tests
Asbestos	ISO 17025	18	**Heavy Metals / Metalloids**		
General			Arsenic (aqua regia extractable)	MCERTS	18
pH - Automated	MCERTS	18	Boron (water soluble)	MCERTS	18
Total Cyanide	MCERTS	18	Cadmium (aqua regia extractable)	MCERTS	18
Water Sol. Sulphate as SO_4	MCERTS	18	Chromium (aqua regia extractable)	MCERTS	18
Organic Matter	MCERTS	18	Copper (aqua regia extractable)	MCERTS	18
Total Sulphate as SO_4	MCERTS	18	Lead (aqua regia extractable)	MCERTS	18
Total Sulphur	MCERTS	18	Mercury (aqua regia extractable)	MCERTS	18
Water Sol. Chloride	MCERTS	18	Nickel (aqua regia extractable)	MCERTS	18
Total Phenols			Zinc (aqua regia extractable)	MCERTS	18
Total Phenols (monohydric)	MCERTS	18	Magnesium (Water Sol.)		18
Speciated PAHs			Magnesium (Leachate)		18
Naphthalene	MCERTS	18	**Petroleum Hydrocarbons**		
Acenaphthylene	MCERTS	18	TPH-CWG - Aliphatic >EC5 - EC6	MCERTS	18
Acenaphthene	MCERTS	18	TPH-CWG - Aliphatic >EC6 - EC8	MCERTS	18
Fluorene	MCERTS	18	TPH-CWG - Aliphatic >EC8 - EC10	MCERTS	18
Phenanthrene	MCERTS	18	TPH-CWG - Aliphatic >EC10 - EC12	MCERTS	18
Anthracene	MCERTS	18	TPH-CWG - Aliphatic >EC12 - EC16	MCERTS	18
Fluoranthene	MCERTS	18	TPH-CWG - Aliphatic >EC16 - EC21	MCERTS	18
Pyrene	MCERTS	18	3TPH-CWG - Aliphatic >EC21 - C35	MCERTS	18
Benzo(a)anthracene	MCERTS	18	TPH-CWG - Aliphatic (EC5 - EC35)	MCERTS	18
Chrysene	MCERTS	18	TPH-CWG - Aromatic >EC5 - EC7	MCERTS	18
Benzo(b)fluoranthene	MCERTS	18	TPH-CWG - Aromatic >EC7 - EC8	MCERTS	18
Benzo(k)fluoranthene	MCERTS	18	TPH-CWG - Aromatic >EC8 - EC10	MCERTS	18
Benzo(a)pyrene	MCERTS	18	TPH-CWG - Aromatic >EC10 - EC12	MCERTS	18
Indeno(1,2,3-cd)pyrene	MCERTS	18	TPH-CWG - Aromatic >EC12 - EC16	MCERTS	18
Dibenz(a,h)anthracene	MCERTS	18	TPH-CWG - Aromatic >EC16 - EC21	MCERTS	18
Benzo(ghi)perylene	MCERTS	18	TPH-CWG - Aromatic >EC21 - EC35	MCERTS	18
Total PAH			**Monoaromatics & Oxygenates**		
Speciated Total EPA-16 PAHs	MCERTS	18	Benzene	MCERTS	18
			Toluene	MCERTS	18
			Ethylbenzene	MCERTS	18
			p & m-xylene	MCERTS	18
			o-xylene	MCERTS	18
			MTBE (Methyl Tertiary Butyl Ether)	MCERTS	18

Table 5A: Geo-environmental tests undertaken on soil leachate samples

Analytical Parameter (Soil Leachate Analysis)	Accreditation Status	No of Tests	Analytical Parameter (Soil Leachate Analysis)	Accreditation Status	No of Tests
Petroleum Hydrocarbons			**Heavy Metals / Metalloids**		
TPH C10 – C40	IOS 17025	7	Arsenic (dissolved)	ISO 17025	7
Speciated PAHs			Lead (dissolved)	ISO 17025	7
Naphthalene	ISO 17025	7	Cadmium (dissolved)	ISO 17025	7
Acenaphthylene	ISO 17025	7	Chromium (dissolved)	ISO 17025	7
Acenaphthene	ISO 17025	7	Copper (dissolved)	ISO 17025	7
Fluorene	ISO 17025	**7**	ISO 17025	ISO 17025	7
Phenanthrene	ISO 17025	7	Mercury (dissolved)	ISO 17025	7
Anthracene	ISO 17025	7	Nickel (dissolved)	ISO 17025	7
Fluoranthene	ISO 17025	7	Zinc (dissolved)	ISO 17025	7
Pyrene	ISO 17025	7	**General Inorganics**		
Benzo(a)anthracene	ISO 17025	7	pH	ISO 17025	7
Chrysene	ISO 17025	7	Total Cyanide	ISO 17025	7
Benzo(b)fluoranthene	ISO 17025	7	Sulphate as SO_4	ISO 17025	7
Benzo(k)fluoranthene	ISO 17025	7	**Phenols**		
Benzo(a)pyrene	ISO 17025	7	Total Phenols	ISO 17025	7
Indeno(1,2,3-cd)pyrene	None	7			
Dibenz(a,h)anthracene	None	7			
Benzo(ghi)perylene	None	7			

Table 5B: Geo-environmental tests undertaken on groundwater samples

Analytical Parameter (Soil Leachate Analysis)	Accreditation Status	No of Tests	Analytical Parameter (Soil Leachate Analysis)	Accreditation Status	No of Tests
Petroleum Hydrocarbons			**Heavy Metals / Metalloids**		
TPH C10 – C40	IOS 17025	1	Arsenic (dissolved)	ISO 17025	1
Speciated PAHs			Lead (dissolved)	ISO 17025	1
Naphthalene	ISO 17025	1	Cadmium (dissolved)	ISO 17025	1
Acenaphthylene	ISO 17025	1	Chromium (dissolved)	ISO 17025	1
Acenaphthene	ISO 17025	1	Copper (dissolved)	ISO 17025	1
Fluorene	ISO 17025	**1**	ISO 17025	ISO 17025	1
Phenanthrene	ISO 17025	1	Mercury (dissolved)	ISO 17025	1
Anthracene	ISO 17025	1	Nickel (dissolved)	ISO 17025	1
Fluoranthene	ISO 17025	1	Zinc (dissolved)	ISO 17025	1
Pyrene	ISO 17025	1	**General Inorganics**		
Benzo(a)anthracene	ISO 17025	1	pH	ISO 17025	1
Chrysene	ISO 17025	1	Total Cyanide	ISO 17025	1
Benzo(b)fluoranthene	ISO 17025	1	Sulphate as SO_4	ISO 17025	1
Benzo(k)fluoranthene	ISO 17025	1	**Phenols**		
Benzo(a)pyrene	ISO 17025	1	Total Phenols	ISO 17025	1
Indeno(1,2,3-cd)pyrene	None	1			
Dibenz(a,h)anthracene	None	1			
Benzo(ghi)perylene	None	1			

A full set of Geo-Environmental laboratory test certificates are provided within Appendix X.

5.0 GROUND CONDITIONS ENCOUNTERED

5.1 General

The sequence of deposits encountered during the investigation is detailed within the Engineering Geologist's logs presented within Appendices III and IV. The following sections summarise the findings of the exploratory holes.

5.2 Ground Conditions

5.2.1 Overview of Strata Encountered

Table 6 summarises the findings of the exploratory holes.

Table 6: Summary of Strata encountered in exploratory holes

General Strata Description	Depth of base of Strata mbgl								
	TP01	TP02	TP03	TP04	TP05	TP06	TP07	TP08	TP09
Made Ground									
Topsoil	--	--	0.4	--	--	0.2	--	--	0.3
Made Ground – Demolition Material	1.0	0.4	--	0.6	0.5	--	--	0.3	--
Made Ground – Reworked Natural Ground	--	--	--	1.9	2.4	1.0	1.2	--	--
Concrete	--	--	--	1.9+	2.4+	--	--	--	--
Glacial Deposits									
Glacial Till	2.0+	3.0+	2.5+	--	--	3.0	3.0+	3.2+	2.7+
General Strata Description	**Depth of base of Strata mbgl**								
	BH01	**BH02**	**BH03**	**BH04**	**BH05**	**BH06**	**BH07**	**BH08**	**BH09**
Made Ground									
Topsoil	--	--	--	0.2	--	--	--	--	--
Made Ground – Demolition Material	1.0	1.0	1.0	--	0.8	1.1	1.2	0.8	0.6
Made Ground – Reworked Natural Ground	--	3.2	1.8	1.2	1.2	--	--	--	1.5
Concrete	--	3.3	--	--	--	--	--	--	--
Glacial Deposits									
Glacial Till	3.0	--	4.8	4.7	3.2	3.3	2.7	3.3	3.3
Boulders	3.3	--	--	--	3.4	3.4	3.5	3.7	3.4
Lower Coal Measures									
Weak / Weathered Mudstone	17.9	18.7	17.1	18.7	26.7	20.8	21.0	19.2	24.6
Mudstone	22.4	24.2	24.2	25.1	--	24.1	24.7	27.8	28.6
Coal – Garw Seam?	23.6	25.3	25.0	26.0	27.6	25.2	25.8	28.4	29.6
Mudstone	--	28.0	--	--	--	--	26.8	--	31.0
Sandstone	33.0	37.0	32.7	35.0	38.5	34.2	34.1	37.5	37.0
Mudstone / Siltstone	45.0+	45.0+	45.0+	45.0+	45.0+	45.0+	45.0+	45.0+	45.0+

+ Depth of strata not proven
-- Strata not encountered

Made Ground

Made Ground was found to be variable across the site and was encountered within each of the exploratory holes undertaken, to depths of between 0.2 and 3.3mbgl.

The various Made Ground deposits are described below and over page.

Topsoil was encountered at Ground Level in the eastern and western areas of the site, within Borehole BH04

and Trial Pits TP03, TP06 and TP09, to depths of between 0.2 and 0.4mbgl. The Topsoil was generally described as dark brown sandy slightly gravelly SILT with many rootlets.

Made Ground interpreted to be predominately demolition material was encountered from Ground Level to depths of between 0.3 and 1.2mbgl within exploratory holes TP01, TP02, TP04, TP05, TP08, BH01, BH02, BH03, BH05, BH06, BH07, BH08 and BH09, generally located in the central area of the site.

Localised areas of Made Ground interpreted to predominately be Reworked Natural Ground were encountered in the central and west areas of the site to depths of between 1.2 and 3.2mbgl. Within TP05 the predominately Reworked Natural Ground was found to include a large proportion of demolition material such as concrete, re-bar and brick.

Within BH02, TP04 and TP05 the Reworked Natural Ground was found to overly concrete at depths of between 1.9 and 3.2mbgl. The concrete was proven to be approximately 0.1m thick within BH02.

Within Trial Pit TP07, the Made Ground between Ground Level and 1.2mbgl was found to be black gravelly silty Clay with the gravel constituent comprising slag and brick.

Within Trial Pit TP01, the Made Ground between Ground Level and 1.0mbgl was found to be dark grey to black slightly silty slightly sandy Gravel with the gravel constituent comprising concrete, brick and sandstone.

Glacial Deposits

Beneath the Made Ground, natural superficial deposits interpreted to be Glacial Till were encountered to depths of between 3.4 and 3.7mbgl. The strata was typically described as firm to stiff dark grey and brown gravelly Clay with low to high cobble content. The gravel and cobble content were found to be predominately Sandstone and Quarzitic Sandstone.

Boulders were found at the base of the Glacial Deposits within BH01, BH05, BH06, BH07, BH08 and BH09. It should be noted, given the locations and depths of the strata interpreted to be boulders, and the drilling method that identified the boulders, it is possible the boulders could in fact be concrete as identified in other borehole at similar depths.

Lower Coal Measures

Bedrock of the Lower Coal Measures was identified below the Glacial Deposits with rockhead identified at depths of between 3.3 and 3.7mbgl within each of the Boreholes.

The general sequence of the Lower Coal Measures proven comprised Mudstone to depths of between 22.4 to 28.6 over a relatively thin (0.6 to 1.2 thick) Coal Seam, interpreted to be the Garw Seam, over Sandstone to depths of between 32.7 and 38.5mbgl overlying Mudstone, proven to depths of 45.0mbgl.

Full details are included within Engineer Logs in appendix III.

5.2.2 Groundwater Conditions

Groundwater was encountered locally during the investigation. A summary of the groundwater encountered is summarised in Table 7.

Table 7: Summary of Groundwater Encountered

Exploratory Hole ID	Groundwater summary
BH02	2.9mbgl – Slow groundwater inflow
BH03	22.3mbgl – Slow groundwater inflow
BH04	36.0mbgl – Slow groundwater inflow
BH05	31.6mbgl – Slow groundwater inflow
TP05	1.0mbgl – Rapid groundwater inflow

Please Note: The groundwater conditions observed in these exploratory holes are those appertaining to the period of the investigation and monitoring. However, it should be noted that groundwater levels are subject to diurnal, seasonal and climatic conditions or may vary due to other causes.

5.2.3 Visual & Olfactory Evidence of Soil Contamination

Although a mantle of Made Ground was encountered across the site, no visual or olfactory evidence of contamination was observed, however the potential exists for the demolition material to contain Asbestos containing material (ACM) and slag was encountered in the Made Ground within Trial Pit TP07.

5.2.4 Visual & Olfactory Evidence of Groundwater & Surface Water Contamination

No visual or olfactory evidence of any groundwater contamination or surface water contamination during the investigation works was observed/ recorded.

6.0 COAL MINING RISK ASSESSMENT

6.1 Background

As part of the investigation, rotary boreholes have been drilled across the footprint of the proposed buildings to inform as to the mining legacy risk to the site, in particular the potential for unrecorded mine workings within near surface coal seams potentially present at shallow depths below the site, as identified within Coal Authority Mining Report 51002194683001.

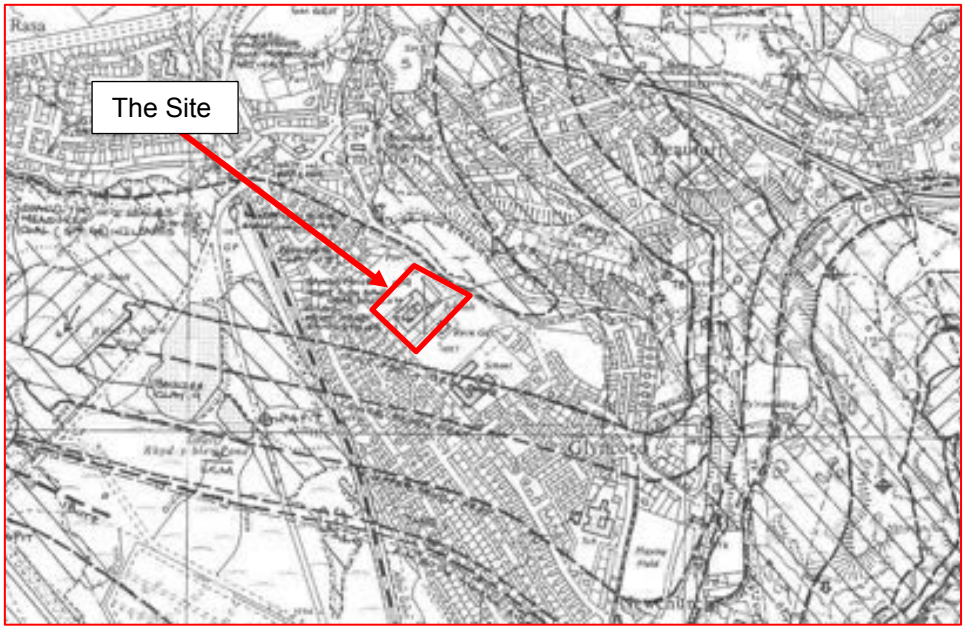
6.2 Mining Geology

As stated in Section 2.3, a number of coal seams are mapped in the region with the Garw seam inferred to outcrop on or close to the northern site boundary and the Five Feet Gellideg seam inferred to crop approximately 100m to the south of the site. Given the dip of the strata (6˚to the south south west), the Garw seam is likely to underlie the site. Numerous coal seams are inferred to crop to the south of the Five Feet Gellideg seam however, based on the dip of the strata, the Five Feet Gellideg and all seams cropping to the south of this seam, will not underlie the site.

In terms of mining related features, the geological mapping identifies the No.4 Pit approximately 400m to the south west and a north easterly orientated adit approximately 400m to the north east, possibly associated with the Five Feet Gellideg.

An extract of the geological map of the site area is presented below.

Figure 1: Extract from BGS Sheet SO11SE (British Geological Survey ©NERC)
Not to Scale



6.3 Mining History

As discussed in Section 2.2, historic mapping of the area shows evidence of mining related features across extensive areas of Ebbw Vale, however no mining related features are mapped within the vicinity of the site.

The Coal Authority on-line resource (http://mapapps2.bgs.ac.uk/coalauthority/home.html) presents summaries of seam outcrops, underground seam levels and contours as well as extents of recorded underground workings in coal seams. The coal seam outcrops presented therein correlate well to the geological mapping. The Coal Authority on-line resource references coal seams by specific numbers rather than seam names. As such it is not always possible to correlate the coal seams on-line to those on geological maps.

The on-line resource shows the following:

- No mine entries are recorded on the site.
- No underground workings or probable underground workings area identified below the site.

A coal seam is mapped as cropping along the north site boundary, referenced 'SW010l', which is considered likely to be the Garw Coal Seam identified on the geological mapping.

6.4 Mining Investigation

In order to quantify the risk to the development from unrecorded shallow mine workings beneath the site, rotary boreholes have been drilled across the footprints of the proposed buildings. .

The locations of the boreholes are indicated on Figure 2 in Appendix I. In summary, a Coal Seam, anticipated to be the Garw Seam, was encountered within each of the boreholes and proven to be at depths of between 22.4 and 28.6mbgl, between 0.6 and 1.2m in thickness and dipping to the south south east. No broken ground or voids were encountered.

6.5 Coal Mining Risk Assessment Conclusion

From desk-based sources, shallow coal seams have been shown to potentially underlie the site. No recorded workings have been noted from on-line records at shallow depth below the site however as coal seams are anticipated to be present at shallow depths below the site, the potential for unrecorded workings within these seams could not be discounted without undertaking an intrusive investigation. No mine entries are recorded or have been revealed on the site from our extended searches.

The intrusive investigation identified no evidence of historic mine workings within the Garw Coal Seam, or any other seam or ironstone bands or pins, at shallow depths below the site. Based on the findings of the investigation, the risk to the proposed development from shallow mine workings is considered to be negligible. It is recommended any excavations in the north eastern area of the site are carefully supervised to ensure no anomalies, areas of soft ground or backfilling associated with potential crop workings of the Garw coal seam are present.

7.0 GEOTECHNICAL ENGINEERING APPRAISAL

7.1 General

The purpose of this Ground Investigation and subsequent reporting is to determine and assess the existing ground conditions on site in preparation for the proposed school development.

The main aims of the geotechnical investigation are to provide an assessment of the ground conditions to inform initial design of the foundations.

7.2 Engineering Properties of Strata

The soils at the site comprised variable Made Ground and locally buried structures, overlying Glacial Till and the South Wales Lower Coal Measures. A range of geotechnical in-situ and laboratory tests were carried out as part of the ground investigation to gain an understanding of their engineering properties.

7.2.1 Geotechnical Testing

A summary of the test results is presented in Table 8.

Table 8: Classification laboratory test result summary

Made Ground Deposits		**Range**	**Average**	**No. Tests**
Moisture Content	**(%)**	17 - 25	21	3
Atterberg Limits	Liquid Limit (%)	33 – 43	40	3
	Plastic Limit (%)	14 – 21	18	
	Plasticity Index (%)	19 – 25	22	
Particle Size Distribution	Cobbles (%)	0 - 45	19	5
	Gravel (%)	16 - 47	29	
	Sand (%)	10 - 20	14	
	Silt/Clay (%)	3 – 60	32	
	Silt (%)	14	14	
	Clay (%)	58	58	
Water Soluble Sulphate as SO_4	mg/l	30 – 40		3
pH	NA	7.18 – 7.57		3
Maximum Dry Density	Mg/m^3	1.62	1.62	1
Optimum Moisture Content	%	18	18	1
SPT 'N' Value		16 - 50+	31	6
Glacial Till Deposits		**Range**	**Average**	**No. Tests**
Particle Size Distribution	Cobbles (%)	0 – 57	8	7
	Gravel (%)	11 – 39	21	
	Sand (%)	9 – 24	17	
	Silt/Clay (%)	38 – 71	59	
	Silt (%)	10 – 18	14	
	Clay (%)	12 – 42	27	
Moisture Content	(%)	18 – 45	27	11
Atterberg Limits	Liquid Limit (%)	37 – 61	48	11

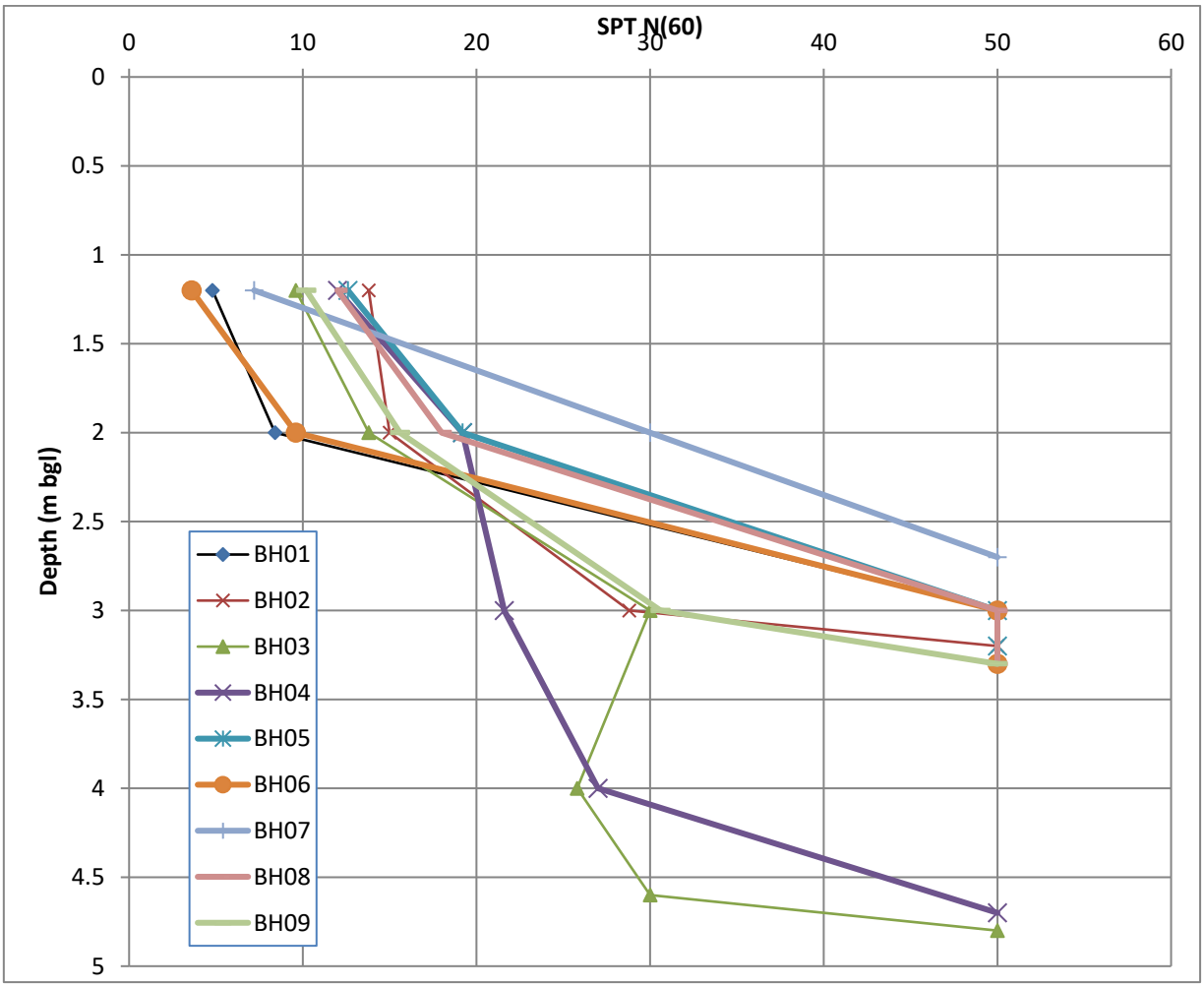
	Plastic Limit (%) Plasticity Index (%)	16 – 23 15 – 40	20 28	
Water Soluble Sulphate as SO_4	mg/l	30 – 50		4
pH	pH Units	7.23 – 7.93		4
Maximum Dry Density	Mg/m^3	1.82 – 1.9	1.86	2
Optimum Moisture Content	%	13 - 14	13.5	2
SPT 'N' Value		6 – 50+	37	32

Note: Oversize material (>75mm) would have been removed as part of the test procedure, prior to sieving, and therefore the presence of any large cobbles or boulders would not be revealed by the test results. In addition, the PSD is only representative of the material at the point of sampling: given the potential variability of Made Ground, significant variation may be encountered across the site.

7.2.2 SPTs

Results of the in situ SPT tests were corrected (to N_{60} values) using the equipment's energy ratio (E_r) found on their corresponding calibration certificates (in accordance with BS EN ISO 22476-3) and the N_{60} values against depth are presented as Figure 2.

Figure 2: Summary of corrected (N_{60}) SPT results v Depth



7.2.3 Plate Load Tests

4 No. plate tests were undertaken below the proposed building footprints to assess the bearing capacity of the near surface deposits.

A summary of the measured settlement under the various pressure increments at each test location is presented in Table 9.

Table 9: Plate Load test result summary

Load (kN/m^2)	Settlement (mm)			
	PLT 1	PLT2	PLT3	PLT4
0.0	0	0	0	0
50.2	0.63	0.27	2.31	1.46
100.4	3.46	0.97	6.31	2.99
150.6	5.16	2.64	11.24	4.94
200.8	9.62	5.31	18.10	6.79
251.0	--	9.90	--	8.70

-- Unable to induce load

7.2.4 Strata Summary

Made Ground Deposits

Particle Size Distribution tests undertaken on two samples of the demolition material showed the deposits to be slightly silty / clayey slightly sandy Gravel with high cobble content, generally consistent with the Engineers description. No SPT's were undertaken within these deposits.

The Dry Density / Moisture Content Relationship testing undertaken on a single sample of the Demolition Material found the Maximum Dry Density to be 1.62Mg/m^3 with an optimum moisture content (OMC) 18%. The moisture content of the material was measured as 26%, indicating the material to be wet of OMC.

Particle Size Distribution tests undertaken on three samples of the Reworked Natural Ground showed the deposits to generally be sandy gravelly Clay with low to medium cobble content, generally consistent with the Engineers description. The Atterberg Limit testing undertaken indicates the fines content of this material to be Clay. The Plasticity Index of these deposits was measured between 22 and 25%. The Modified Plasticity Index is calculated to range between 15 and 17% indicating low to medium plasticity / low to medium swell potential.

SPT tests undertaken within the Reworked Natural Ground measured SPT 'N' values of between 16 and 50+. It should be noted high SPT 'N' values may be due to encountering cobbles or boulders during the test, potentially resulting in elevated 'N' values.

Glacial Deposits

Particle Size Distribution tests undertaken on seven samples of the Glacial material showed the deposits to generally be sandy gravelly, locally very gravelly, Clay with variable cobble content. The Atterberg Limit tests undertaken indicate the fines content of this material to be Clay. The Plasticity Index of these deposits was measured between 15 and 40%. The Modified Plasticity Index is calculated to range between 15 and 40%, indicating low to medium plasticity / low to medium swell potential.

SPT tests undertaken within the Glacial Deposits measured SPT 'N' values of between 8 and 50+, with the values generally increasing with depth.

The SPT 'N' values and Plasticity Index of the Glacial Deposits indicate undrained shear strengths of between 30 and 250kN/m^2 after Stroud (1974). Given the variability of SPT 'N' values with depth and the effect the presence of cobbles is likely to have on the test results, the following undrained shear strength values have been determined based on the lower quartile SPT 'N' values, which are considered appropriate for design purposes:

At 1.2 mbgl: c_u = 40kN/m^2
At 2.0 mbgl: c_u = 80kN/m^2

The Dry Density / Moisture Content Relationship testing undertaken on two samples of the Glacial Deposits found the Maximum Dry Density to 1.82 and 1.90Mg/m^3 with optimum moisture contents of 13 and 14%. The moisture content of the material was measured as 13 and 23%, which is close to and wet of OMC.

7.3 Earthworks

7.3.1 Site Preparation

Prior to commencing any earthworks / groundwork for the development, any live services on and in the vicinity of the site should be accurately located and protected, or if required, diverted.

Any exposed formations should be protected from the effects of the weather, site traffic, or water in order to prevent deterioration of this surface. It is recommended that any exposed formations be protected with a minimum thickness of 200mm of suitable granular material or a thin layer of blinding concrete, which should be placed immediately after excavation and exposure.

Any topsoil present should be stripped and, where required for further use, stockpiled in an area provided by the Contractor and agreed by the Engineer.

7.3.2 Cutting and Filling

Details of the development, in terms of levels, are not known to the writer at this time, but any significant cuttings are considered unlikely. Depending on the foundation solution for the main school building, excavation and replacement of the Made Ground material, including above the suspected concrete slab identified below former school building may be required. Replacement of the Made Ground will have to be undertaken to an engineering specification, dependent on the new building design.

Testing of limited samples for re-use as engineered fill indicate that a satisfactory mechanical state of compaction can be achieved, with maximum dry densities of in excess of 90% achievable, however given significant quantities of groundwater was found perched above the concrete slab, if the Made Ground above the concrete slab is to be re-used, treatment in the form of drying out will be required. If site won fill material is to be used, it is recommended further earthworks focused investigation and testing is undertaken.

7.3.3 Excavation Plant

From observations made during the trial pitting, it is considered that excavations within the near surface deposits should be possible with the correct capacity/size 360° tracked excavators, utilising suitable excavating buckets.

Breaking equipment may be required for excavations through the possible concrete identified below the location of the former school building, the full extent of which is unknown.

7.3.4 Stability of Excavation Sides

The excavations undertaken across the site remained stable however, given the locally granular and variable nature of the Made Ground, some instability of excavation sides may occur. Instability within the Glacial

Deposits is not anticipated. If excavation sides are to remain open, they should be battered back to a suitably designed safe angle.

Reference should be made to CIRIA Report No. 97 'Trenching Practise' and BS 8004 'Foundations' for guidance on excavation works.

7.3.5 Groundwater

Relatively shallow groundwater was only encountered in the central area of the site, likely to be perched above the possible concrete below the area of the former school building, with the water encountered at a depth of 1.0mbgl. In addition, post fieldwork groundwater monitoring measured groundwater at 0.75mbgl at the location of BH06 as detailed in Table 10.

Groundwater controls such as sump pumping may be required where any excavation extends below 1.0mbgl within this area of the site.

Shallow groundwater was not encountered within exploratory holes undertaken outside of the footprint of former school building. Significant quantities of groundwater are not anticipated to be encountered in areas outside of the footprint of the former school building.

Table 10: Summary of Groundwater Readings in Standpipes

Exploratory Hole ID	Installation Response Zone Depth (m.bgl)	Range of Water Readings (mbgl)
BH03	1.0 – 9.0	9.7
BH04	3.5 – 12.5	Dry
BH06	1.0 – 10.0	0.75
BH09	10.5 – 30.0	19.69

It should be noted that groundwater levels are subject to diurnal, seasonal, and climatic conditions or may vary spatially across the site due to other causes, and it is recommended that groundwater control is undertaken in accordance with appropriate guidance such as CIRIA Report C515 (2000).

7.3.6 Drainage Considerations

Soakaway tests were undertaken as part of this investigation within the Glacial Deposits in areas of proposed landscaping and hardstanding (MUGA, car parks and play areas) in accordance with BRE Digest 365. The results are presented in Appendix V.

Table 11 summarises the soakaway test results.

Table 11: Summary of Soakaway Test Results

Exploratory Hole ID	Test No.	Test Depth (mbgl)	Permeability Result Recorded (m/sec)
TP01	1	1.22 – 2.00	30mm drop over 1hr test period Insufficient to calculate soil infiltration rate.
TP02	1	1.54 – 3.00	90mm drop over 4hr test period Insufficient to calculate soil infiltration rate.
TP06	1	1.58 – 3.00	20mm drop over 4hr test period Insufficient to calculate soil infiltration rate.
TP02	1	2.05 – 3.00	0mm drop over 4hr test period Insufficient to calculate soil infiltration rate.

Based on the above permeability tests and calculations, soakaways are not considered feasible for the development.

7.4 Foundation Assessment

7.4.1 Foundation Recommendations

Although the Plate Load Tests indicate the Made Ground may have a relatively high bearing capacity, the Made Ground is not considered suitable for founding significant structures due to its potential heterogeneity and uncompacted nature and therefore potential for differential settlements.

The underlying Glacial Deposits are likely to provide a suitable founding strata and should provide an allowable bearing capacity of 65kN/m^2 at 1.2mbgl (where present) and in excess of 125kN/m^2 at 2.0mbgl (where present). The developer must ensure the founding strata is proof rolled and any soft spots excavated and replaced with suitable fill.

Main School Building

The Made Ground below the proposed main school building in the central area of the site has been proven to extend to depths in excess of 3.0mbgl, with potential buried structures (concrete) identified locally. Due to the depth and nature of the Made Ground, the use of shallow trench fill, pad or strip foundations is not considered suitable for large sections of the proposed main school building. In addition, possible buried structures (concrete and although not encountered, buried walls) associated with the former building on the site, are potentially present below the footprint of the proposed school building which would act as a 'hard spot', potentially causing excessive magnitudes of differential settlement in structures founded above. The full extent of the concrete is not fully known. It is recommended further investigation, potentially looking at historic site plans / records, is undertaken to assess the presence and full extents of any buried structures. Given the presence of large quantities of groundwater and limitations associated with the drilling methodology, establishing the extent of the concrete slab through intrusive investigations proved difficult, particularly with boulders being recorded at similar depths to the possible concrete within the boreholes.

It is recommended that consideration be given to the following options which would provide suitable founding methods for the main school building where the deeper Made Ground is known to be present:

- A raft foundation or reinforced strip foundation in conjunction with excavation/replacement ground improvement; i.e. excavation of the existing poor ground and buried structures, and replacement with an engineered fill. Alternatively, it may be possible to re-use the existing material following a selection/screening/treatment process, followed by placement in accordance with an appropriate earthworks engineering specification, which would require further earthworks specific testing on specific strata.

- A piled foundation system with suspended floor slab. Piles should be designed by an experienced and competent specialist piling contractor who should select appropriate design parameters and guarantee safe working loads together with maximum total and differential settlements, which should be within acceptable tolerances for the proposed structures. The choice of piling technique should be agreed with the contractor and should take into account the potential presence of buried structure and boulders. Soil parameters for the strata to be penetrated will depend on the piling technique selected and the precise method of working. Driven piles should only be considered if vibrations and environmental constraints can be maintained within acceptable limits. If a piled foundation solution is the preferred option, it is recommended further detailed investigation is undertaken to determine the characteristics and competency of the bedrock deposits and allow suitable pile design.

Once the extent of any buried structures and deeper Made Ground are determined, it may be possible to combine the above options with shallow foundations placed within the Glacial Deposits however, the potential magnitudes of differential settlement that may occur should then be considered.

Childcare Building

The Made Ground below the footprint of the proposed Childcare Building, located in the western area of the site, was identified to be less than 2.0m in thickness and to be directly underlain by the Glacial Deposits. Based on current ground levels, trench fill or pad foundations extending through the Made Ground to found on competent Glacial Deposits, in conjunction with a suspended floor slab, should provide a suitable founding solution.

6.4.2 Foundation Concrete Class Designation

The Aggressive Chemical Environment for Concrete (ACEC) classification for the site has been assessed according to the guidelines within BRE Special Digest 1 (2005). For classification purposes, based on the BRE guidance, the groundwater must be classed as 'mobile' unless proven to be 'static' over a 24hr period.

The pH values of the Made Ground samples taken from across the site ranged from 7.18 to 7.57. The levels of water-soluble sulphate (SO_4) content of the tested soil samples varied between 30mg/l and 40mg/l. Based on the above, the Design Sulphate (DS) class for the Made Ground is DS-1, and the Aggressive Chemical Environment for Concrete (ACEC) classification is AC-1, assuming 'mobile' groundwater conditions in a 'Brownfield' situation.

The pH values of the samples of Glacial Deposits taken from across the site ranged from 7.23 to 7.63. The levels of water-soluble sulphate (SO_4) content of the tested soil samples varied between 30mg/l and 50mg/l. Based on the above, the Design Sulphate (DS) class for the Glacial Deposits is DS-1, and the Aggressive Chemical Environment for Concrete (ACEC) classification is AC-1, assuming 'mobile' groundwater conditions in a 'Brownfield' situation.

Therefore, the Design Sulphate (DS) class for the site is DS-1, and the Aggressive Chemical Environment for Concrete (ACEC) site classification is AC-1, assuming 'mobile' groundwater conditions in a 'Brownfield' situation.

7.5 Pavement Design

CBR testing has been undertaken within the shallow Made Ground across the footprint of the proposed MUGA, in the north eastern area of the site. CBR values between 3% and 7% were measured.

Based on the in-situ testing, laboratory analysis and visual assessment of the in-situ materials, it should be assumed CBR values will change across the site, it is recommended a CBR value of 3% is assumed for design purposed below the proposed MUGA. If formation levels are such the MUGA is not founded on the in-situ Made Ground, additional testing is recommended on the formation strata to confirm competency.

Proof rolling of all founding surfaces should be carried out and where soft spots are identified they should be removed and replaced with suitable compacted granular fill material. Testing should be carried out on founding surfaces to confirm quality/strength of the strata to confirm adequate design.

8.0 GEO-ENVIRONMENTAL CONSIDERATIONS

8.1 General

The proposed development, at time of writing, is to take the form of a primary school, including associated areas of soft landscaping that it is assumed will be used by children.

The potential risks to the development have been assessed by consideration of the potential pollution linkages (PPL). For a risk to exist there must be a source of contamination, a receptor that may be harmed, and a pathway by which the receptor could be exposed to the contaminant. Only when all three factors are present can a pollution linkage, and consequently an unacceptable risk exist. The conceptual site model (CSM) considers all three elements and the potential for pollution linkages that may exist.

The information gained from the land use assessment has been collated to identify the potential pathways that may exist between any contamination source and its receptors. Each of these components is highlighted in Tables 11 to 13 below by considering past land uses of the site (see Section 2.2 Site History)

8.2 Human Health Risk Assessment

8.2.1 Legislative Background

There have been several major changes in Contaminated Land non-statutory guidance over the past decade, in particular relating to Contaminated Land Regime (CLR) documentation and their derivatives i.e. Soil Guideline Values and Toxicological Reports. In 2006, DEFRA commenced work on their 'Way Forward' exercise which aimed to redefine the way contaminated land is assessed with the aid of devising revamped technical guidance and soil guideline values. A working group of various environmental consultancies/ establishments/ stakeholders set about determining how the non-statutory guidance of CLEA 2002 may be amended to be increasingly user friendly for assessors of contaminated land and ultimately to help in defining whether land qualifies as contaminated land under Part IIA Environmental Protection Act 1990. July 2008 saw the findings of this exercise published. Firstly, the document entitled *'Guidance on the Legal Definition of Contaminated Land'* was published followed closely by the publication of the fourteen measures derived to improve contaminated land non-statutory technical guidance i.e. CLR Publications.

In light of these improvements, the toxicology of various contaminants and therefore the generic soil guideline values, has been revised by EA and DEFRA. The revised paper published in August 2008 is entitled *'Human Health Toxicological Assessment of Contaminants in Soil"*. Based on the findings of this paper, EA are developing a new set of Toxicological Reports and subsequently a new, expanded set of SGV'. Upon publishing, these new SGV's may then be used in assessing risks to human health.

In parallel to much of these developments, in 2006/07 it was recognised that due to the limited number of revised SGVs being produced, the Chartered Institute of Environmental Health (CIEH) co-jointly with Land Quality Management (LQM) researched and developed an additional or alternate set of Soil Guideline Values known as Generic Assessment Criteria (GAC) values, producing GACs for 31 contaminants for Residential, Allotment and Commercial End Land Uses. These new values complete with details of how they were derived and including toxicological datasets was published in a single document 'The LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment'.

Following publication of the '*Way Forward'* document in late 2006, LQM/CIEH looked to review their GAC and add to them. By 2009 a 2nd Edition of 'The LQM/CIEH Generic Assessment Criteria for Human Health Risk

Assessment' was published using updated methods and culminated in GAC for 82 substances.

In 2013, a cross-government steering group commenced the development of a new set of Generic Assessment Criteria as driven by DEFRA. The newly derived Guideline Values are termed C4SLs – Category 4 Screening Levels and are considered more pragmatic (but still precautionary) by DEFRA and were proposed as more suitable and sensible comparison values.

In November 2014, the LQM/CIEH produced its third set of Generic Assessment Criteria for 89 potential contaminants as knowledge of toxicity and interaction continued to progress, thus replacing the 2nd Edition with the new publication entitled *'The LQM/CIEH S4ULs for Human Health Risk Assessment'*. This most recent set of GACs are referred to as 'S4ULs' – Suitable for Use Levels'

8.2.2 Human Health Risk Assessment Criteria

For the purposes of Quantum Geotechnic Ltd assessments, the most recent and applicable SGVs, GACs, SU4Ls and C4SLs are used based on site end use and development and overall suitability. These are all referenced within the text. SU4Ls take precedence in QGL assessments. Where these are not available or suitable, C4SLs are adopted.

By adopting the CLEA approach to human health risk assessment as defined in CLR11, a human health risk assessment has been undertaken for the proposed development adopting the Residential Land Use with Plant Uptake threshold values, as the most stringent values available.

The assessment criteria used in this assessment is that presented by LQM/CIEH in their publication *The LQM/CIEH S4ULs for Human Health Risk Assessment (2015)*. The *S4ULs* (Suitable for Use Levels) used have been derived in accordance with UK legislation, national as well as Environment Agency policy and using a modified version of the Environment Agency CLEA software and available guidance provided to the contaminated land practitioner community for the purpose of deriving Generic Assessment Criteria (GAC).

The LQM/CIEH S4ULs are intended for use in assessing potential risks posed to human health by contaminants in soil and as transparently derived and cautious 'trigger values' above which further assessment or remedial action may be necessary. By using the LQM/CIEH S4AULs, Quantum Geotechnic acknowledges *Copyright Land Quality Management Ltd reproduced with permission; Publication Number S4AUL3409. All Rights Reserved.*

8.3 Soil Sample Test Results Comparisons

The results of chemical laboratory testing on selected soil samples from the shallow lying soils are presented and discussed within this Section.

8.3.1 Heavy Metal and Inorganic Compounds

The results of levels of potential contaminants have been initially compared to generic assessment criteria as described above, for a Residential end use with Plant Uptake as being considered the most appropriate for the proposed development. The test certificates are included in Appendix X. The concentrations of heavy metal and inorganic compounds are summarised in the table over page.

Table 11: Summary of Heavy Metals and Inorganic Soil Test Results

Determinand	Results Range (mg/kg)	LQM/CIEH 2015 Generic Assessment Criteria *Residential Land Use with Plant Uptake* (mg/kg)	No. Of Exceedances
Arsenic	7.4 - 24	37	0
Cadmium	<0.1 – 0.45	11	0
Chromium	7.8 – 22	910	0
Lead	14 – 170	200	0
Mercury	<0.1 – 0.28	40	0
Boron (water soluble)	<0.4 – 0.9	290	0
Copper	6.2 – 50	2,400	0
Nickel	5.5 – 39	130	0
Zinc	8.5 – 100	3,700	0
Cyanide (total)	<0.5	NYS	
Total Phenols	<0.3	1,500	0

8.3.2 Polycyclic Aromatic Hydrocarbons

The results of levels of potential polycyclic aromatic hydrocarbon contaminants have been compared to generic assessment criteria as described and for a Soil Organic Matter (SOM) content of 1.0% as the lowest recorded SOM was 0.76%. The test certificates are included in Appendix X. The concentrations of speciated Polycyclic Aromatic Hydrocarbon are summarised and compared in Table 12.

Table 12: Summary of Polycyclic Aromatic Hydrocarbon Soil Test Results

Determinand	Site Results Range (mg/kg)	LQM/CIEH 2015 Generic Assessment Criteria *Residential with Plant Uptake* (mg/kg)	No. Of Exceedances
		1.0% SOM	
Naphthalene	<0.10 – 0.57	*2.3*	0
Acenaphthylene	< 0.05 – 0.55	*170*	0
Acenaphthene	< 0.10 – 1.4	*210*	0
Fluorene	<0.10 – 1.8	*170*	0
Phenanthrene	<0.10 – 10	*95*	0
Anthracene	<0.10 – 2.0	*2,400*	0
Fluoranthene	<0.10 – 12	*280*	0
Pyrene	<0.10 – 9.7	*620*	0
Benzo(a)anthracene	<0.10 – 6.6	*7.2*	0
Chrysene	<0.10 – 6.4	*15*	0
Benzo(b)fluoranthene	<0.10 – 7.9	*2.6*	2 TP07 at 0.5mbgl TP01 at 0.5mbgl
Benzo(k)fluoranthene	<0.10 – 3.3	*77*	0
Benzo(a)pyrene	<0.10 – 5.4	*2.2*	2 TP07 at 0.5mbgl TP01 at 0.5mbgl
Indeno(1,2,3-cd) pyrene	<0.10 – 3.5	*27*	0
Dibenz(a,h)anthracene	< 0.10 – 1.6	*0.24*	3 TP07 at 0.5mbgl TP01 at 0.5mbgl BH02 at 0.3mbgl
Benzo(ghi)perylene	<0.10 – 3.4	*320*	0

8.3.3 *Total Petroleum Hydrocarbons*

The results of levels of potential petroleum hydrocarbon contaminants have been compared to generic assessment criteria as described and for a Soil Organic Matter (SOM) content of 1.0%. The test certificates are included in Appendix X. The concentrations of speciated Petroleum Hydrocarbons are summarised and compared in Table 13.

Table 13: Summary of Petroleum Hydrocarbon Soil Test Results

Determinand	Site Results Range (mg/kg)	LQM/CIEH 2015 Generic Assessment Criteria Residential with Plant Uptake (mg/kg)	No. of Exceedances
		1.0% SOM	
TPH – Aliphatic >EC5-EC6	< 1	*42*	0
TPH – Aliphatic >EC6-EC8	< 1	*100*	0
TPH – Aliphatic >EC8-EC10	< 1	*27*	0
TPH – Aliphatic >EC10-EC12	< 1 – 5.9	*130*	0
TPH – Aliphatic >EC12-EC16	< 1 – 16	*1,100*	0
TPH – Aliphatic >EC16-EC21	< 1 – 2.4	NYS	-
TPH – Aliphatic >EC21-EC35	< 1 – 680	NYS	-
TPH – Aliphatic >EC16-EC35	<2 – 170	*6,500*	0*
TPH – Aliphatic EC5-EC35	<10 – 390	NYS	-
TPH – Aromatic >EC5-EC7	<1	*70*	0
TPH – Aromatic >EC7-EC8	<1	*130*	0
TPH – Aromatic >EC8-EC10	<1	*34*	0
TPH – Aromatic >EC10-EC12	<1	*74*	0
TPH – Aromatic >EC12-EC16	<1	*140*	0
TPH – Aromatic >EC16-EC21	<1 – 6.3	*260*	0
TPH – Aromatic >EC21-EC35	<1 – 1,100	*1,100*	0
TPH – Aromatic >EC5-EC35	<1 – 1,100	NYS	-

*Note: * Combined total of EC16-EC21 + EC21-EC35*

8.3.4 *Monoaromatics and Oxygenates*

Benzene, Toluene, Ethylbenzene and Xylene compounds as well as MTBE were all tested within the soil samples. All recorded concentrations of <1.0µg/kg.

8.3.5 *Total Phenols*

Total Phenols (monohydric) all recorded values of <1.0mg/kg.

8.3.6 *Asbestos*

Asbestos fibres were identified within a single sample from the Made Ground within TP05 at a depth of 0.8mbgl. Asbestos identification found this to be Chrysotile measured at 0.69%.

No asbestos or asbestos containing material (ACM) were recorded in the remaining selected samples tested.

8.4 Soil Leachate Test Results Comparisons

The risk to controlled waters, i.e. nearby watercourses and groundwater, is defined by the potential for any contaminants present on site to leach from the soils beneath the site. 5 No. soil samples from the shallow

underlying soils were subjected to leachate testing whilst testing was also undertaken on a single sample of relatively shallow groundwater sampled from the monitoring installation within Borehole BH06 during post fieldwork monitoring. The result ranges are presented together with the threshold levels given by the United Kingdom Drinking Water Standards (UKDWS) as well as the relevant Environmental Quality Standards (EQS) guideline values.

Tables 14 and 15 present the summarised findings of the soil leachate and groundwater testing undertaken respectively. The test certificates are included in Appendix X.

Table 14: Summary of Soil Leachate Chemical Analysis

Determinand	Units	Results Range (µg/l)	Environmental Quality Standards – Freshwater[1]	Environmental Quality Standards – Saltwater[1]	UK Drinking Water Standards[2]
Arsenic	µg/l	<0.1 – 2.3	50	25	10
Cadmium	µg/l	<0.08 – 0.17	5	2.5	5
Chromium	µg/l	<1 – 14	20	15	50
Copper	µg/l	1.5 – 7.6	6-10	5	2000
Lead	µg/l	< 1.0	4-10	25	10
Mercury	µg/l	< 0.5	1	0.3	1
Nickel	µg/l	< 1.0 – 3.1	50-150	30	20
Zinc	µg/l	2.5 – 14	75	*Not Available*	5000
Boron	µg/l	34 – 75	2,000	7,000	1,000
Total Phenols	µg/l	<10	30	30	0.5
Naphthalene	µg/l	<0.01	*Not Available*	*Not Available*	*Not Available*
Acenaphthylene	µg/l	<0.01	*Not Available*	*Not Available*	*Not Available*
Acenaphthene	µg/l	<0.01	*Not Available*	*Not Available*	*Not Available*
Fluorene	µg/l	<0.01	*Not Available*	*Not Available*	*Not Available*
Phenanthrene	µg/l	<0.01	*Not Available*	*Not Available*	*Not Available*
Anthracene	µg/l	<0.01	*Not Available*	*Not Available*	*Not Available*
Fluoranthene	µg/l	<0.01	*Not Available*	*Not Available*	*Not Available*
Pyrene	µg/l	<0.01	*Not Available*	*Not Available*	*Not Available*
Benzo(a)anthracene	µg/l	<0.01	*Not Available*	*Not Available*	*Not Available*
Chrysene	µg/l	<0.01	*Not Available*	*Not Available*	*Not Available*
Benzo(b)fluoranthene	µg/l	<0.01	*Not Available*	*Not Available*	*Not Available*
Benzo(k)fluoranthene	µg/l	<0.01	*Not Available*	*Not Available*	*Not Available*
Benzo(a)pyrene	µg/l	<0.01	*Not Available*	*Not Available*	*Not Available*
Indeno(1,2,3-cd) pyrene	µg/l	<0.01	*Not Available*	*Not Available*	*Not Available*
Dibenz (a, h) anthracene	µg/l	<0.01	*Not Available*	*Not Available*	*Not Available*
Benzo(ghi)perylene	µg/l	<0.01	*Not Available*	*Not Available*	*Not Available*
Total PAH	µg/l	<0.2	*Not Available*	*Not Available*	0.1
TPH C10 – C40	µg/l	< 10	*10*	*10*	10

[1]Figures for Environmental Quality Standards (EQS) are Annual Average Concentrations derived from the Environment Agency
[2]UK Drinking Water Standards taken from; Water Supply (Water Quality) Regulations 1989 (SI 1989/1147) (as amended), and Water Supply (Water Quality) Regulations 2000 (SI 2000/3184) (as amended).

Table 15: Summary of Groundwater Chemical Analysis

Determinand	Units	Results Range (µg/l)	Environmental Quality Standards – Freshwater[1]	Environmental Quality Standards – Saltwater[1]	UK Drinking Water Standards[2]
Arsenic	µg/l	1.5	50	25	10
Cadmium	µg/l	< 0.08	5	2.5	5
Chromium	µg/l	< 1.0	20	15	50
Copper	µg/l	< 1.0	6-10	5	2000
Lead	µg/l	< 1.0	4-10	25	10
Mercury	µg/l	< 0.5	1	0.3	1
Nickel	µg/l	2.5	50-150	30	20
Zinc	µg/l	4.5	75	*Not Available*	5000
Boron	µg/l	73	2,000	7,000	1,000

Total Phenols	µg/l	<30	30	30	0.5
Naphthalene	µg/l	<0.1	*Not Available*	*Not Available*	*Not Available*
Acenaphthylene	µg/l	<0.1	*Not Available*	*Not Available*	*Not Available*
Acenaphthene	µg/l	<0.1	*Not Available*	*Not Available*	*Not Available*
Fluorene	µg/l	<0.1	*Not Available*	*Not Available*	*Not Available*
Phenanthrene	µg/l	<0.1	*Not Available*	*Not Available*	*Not Available*
Anthracene	µg/l	<0.1	*Not Available*	*Not Available*	*Not Available*
Fluoranthene	µg/l	<0.1	*Not Available*	*Not Available*	*Not Available*
Pyrene	µg/l	<0.1	*Not Available*	*Not Available*	*Not Available*
Benzo(a)anthracene	µg/l	<0.1	*Not Available*	*Not Available*	*Not Available*
Chrysene	µg/l	<0.1	*Not Available*	*Not Available*	*Not Available*
Benzo(b)fluoranthene	µg/l	<0.1	*Not Available*	*Not Available*	*Not Available*
Benzo(k)fluoranthene	µg/l	<0.1	*Not Available*	*Not Available*	*Not Available*
Benzo(a)pyrene	µg/l	<0.1	*Not Available*	*Not Available*	*Not Available*
Indeno(1,2,3-cd) pyrene	µg/l	<0.1	*Not Available*	*Not Available*	*Not Available*
Dibenz (a, h) anthracene	µg/l	<0.1	*Not Available*	*Not Available*	*Not Available*
Benzo(ghi)perylene	µg/l	<0.1	*Not Available*	*Not Available*	*Not Available*
Total PAH	µg/l	<0.2	*Not Available*	*Not Available*	0.1
TPH C10 – C40	µg/l	< 10	*10*	*10*	10

[1]Figures for Environmental Quality Standards (EQS) are Annual Average Concentrations derived from the Environment Agency
[2]UK Drinking Water Standards taken from; Water Supply (Water Quality) Regulations 1989 (SI 1989/1147) (as amended), and Water Supply (Water Quality) Regulations 2000 (SI 2000/3184) (as amended).

8.5 Ground Gas Risk Assessment

Monitoring of land-gas concentrations being emitted from the installed standpipes have been carried out on single return visit. A summary of the monitoring results to date are displayed over page (Table 16) with full details presented in Appendix VI.

Table 16: Ground Gas & Groundwater Monitoring Results Ranges

Borehole Installation	Determinands						
	Flow (L/hr)	CH_4 (% v/v)	CO_2 (% v/v)	O_2 (% v/v)	CO (ppm)	H_2S (ppm)	Atmospheric Pressure (mb)
BH03	-0.9	0.0	2.2	10.5	0	0	975
BH04	0.0	0.0	0.2	20.0	0	0	974
BH06	1.2	0.0	0.0	18.8	0	0	975
BH09	-4.6	0.0	0.5	16.8	0	0	975

The ground gas concentrations measured show some reduced levels of Oxygen (O_2) with low concentrations of Carbon Dioxide (CO_2) and Methane (CH_4). No presence of Carbon Monoxide (CO) or Hydrogen Sulphide (H_2S) was recorded.

The results of the monitoring visits are interpreted below, however conclusions drawn from these results may change following the additional monitoring visits to be undertaken.

The potential risks posed by any recorded presence of potentially harmful gases can be assessed on a semi-quantitative basis by reference to the guidance in documents CIRIA 665 and BS8485. The assessment comprises multiplying the maximum measured steady gas flow rate (expressed as litres per hour) by the maximum steady gas concentration (expressed as percentage-by-volume; divided by 100) to derive a Gas Screening Value (GSV). The GSV can then be used to determine a risk classification and a Characteristic Situation for the site as defined in Table 17.

Table 17: Ground Gas Risk Classifications & Characteristic Situation

Characteristic Situation	Risk Classification	Gas Screening Value (l/hr) - GSV
CS1	Very low	<0.07
CS2	Low	>0.07 to <0.7
CS3	Moderate	>0.7 to <3.5
CS4	Moderate to High	>3.5 to <15
CS5	High	>15 to <70
CS6	Very High	>70

The maximum flow recorded in any boreholes was 1.2 litre/hour in borehole BH06 with a maximum gas concentration of 6.7% CO_2 recorded in Borehole BH09. The resulting GSV is 0.08. This places the site within Characteristic Situation 2, indicating a low risk classification.

Given the proposed end use of the site is a school, protective measures suitable for use within a residential development are recommended. Typical protective measures recommended in accordance with CIRIA C665 are:

- Reinforced concrete cast in-situ floor slab (suspended, non-suspended or raft) with at least 1200g DPM[2] and underfloor venting
- Beam and block or pre-cast concrete and 2000g DPM/reinforced gas membrane and underfloor venting
- All joints and penetrations sealed

8.6 Recommendations on Contaminated Land

8.6.1 Human Health Risk of Site End Users

The concentration of Benzo(b)fluoranthene, Benzo(a)pyrene and Dibenzo(a,h)anthracene within the samples of Made Ground within Trial Pit TP07 described as black silty Clay and TP01 described as dark grey to black slightly silty sandy Gravel were measured above the relevant assessment criteria for Residential End Use with Plant Uptake. The Dibenzo(a,h)anthracene concentration measured within the sample of Demolition material within BH02 was also above the relevant assessment criteria for Residential End Use with Plant Uptake.

The potential contaminants identified within the Made Ground within TP01 and TP07 may pose a risk to future site users. As TP01 and TP07 are located in areas of proposed soft landscaping, a pathway may exist between the Made Ground (potential contaminant source), and future site users (receptor). Although no statistical analysis has been undertaken, given the test results and visual assessment of the Made Ground across the site, these pockets of Made Ground differ from all other areas of the site and may be considered a potential contamination 'hotspot'. If this Made Ground is to remain in-situ as part of the development, the following remedial options may be considered suitable to reduce the risk to future site users:

- The installation of a suitable designed capping layer above the potentially contaminated material to remove the potential contamination pathway.
- Excavation of the potentially contaminated material and disposal off site or placement below a capping layer / hardstanding in another area of the development.
- Further accessibility testing and a site specific assessment to further assess the risk posed to future site users.

The potential contamination identified within the Made Ground within BH02, if it is to remain in-situ, will be

capped by hardstanding as part of the proposed development and at the concentrations measured, a contamination pathway is unlikely to exist and therefore the potential contamination is unlikely to pose a significant risk to site users. If the development layout was to change, this conclusion should be re-assessed to ensure not potential contamination pathway would exists.

Asbestos fibres within the Made Ground in TP05 at the quantities measured, may pose risk to future site users. This Made Ground is anticipated to be fill material above possible buried structures. TP05 is located below the proposed main school building footprint and within the vicinity of the proposed hard plant area and as such, a pathway between this material and future site users is unlikely to exist and therefore this risk to future site users is considered low. Based on the findings of the investigation, the buried structures are not expected to extend below areas of soft landscaping proposed to the south of the main school building however, if alternative sources of information indicate buried structures are present below proposed areas of soft landscaping, further investigation in these areas is recommended to establish the nature of the fill material and if further remediation will be required.

8.6.2 Human Health Risks during Construction

The geo-environmental laboratory testing showed raised potential contamination concentrations within the Made Ground deposits, therefore a risk to construction operatives from chemical contaminants from the shallow ground may exist.

In addition, given the Made Ground associated with fill material above an anticipated buried structure was found to contain Asbestos at quantities that may pose a risk to human health, a risk to construction workers and neighboring site users will exists from air borne migration when undertaking excavations within the area of TP05.

Operatives working with, or likely to come into contact with made ground with the potential to harness raised concentrations of contaminants, should observe particular precautions concerning personal hygiene. They should be issued with the appropriate personal protective equipment and should be instructed in safe working methods.

The presence of Asbestos fibres suggests there is a potential risk, particularly during any groundworks, including post construction if the Made Ground is to remain on site, in the area of TP05. It is recommended that the guidelines given in CIRIA Report C733 'asbestos in soil and made ground: a guide to understanding and managing risks' (2014) is consulted as regards risks to workers from ACM.

In addition, instructions should be issued in the recognition of potentially hazardous materials including oily and odorous soil and water and also any discoloured or fibrous substances for example. Operatives should be warned to avoid contact between hands and mouth before washing. The consumption of food must be confined to designated clean areas with suitable welfare including washing facilities should be provided.

8.6.3 Risk to the Environment and Controlled Waters

Leachate testing of selected soil samples did not identify any potentially significantly raised contamination concentrations within the soil leachate. Therefore the risk to controlled waters from potentially mobile contaminants at the site is considered low.

Chemical testing of groundwater samples obtained is to be undertaken and conclusions drawn solely from the soil leachate test results may change depending on the potential contaminant concentrations measured within the groundwater samples.

8.6.4 Waste Acceptance Criteria Testing

Waste Acceptance Criteria Testing was undertaken on five samples from across the site with the results summarised in Table 17

Table 17: Waste Acceptance Criteria Summary

Sample	Strata	Landfill Classification	Comments
TP01 – 0.5m	Made Ground	Hazardous Waste Landfill	Significantly elevated Total Organic Carbon and Loss on Ignition
TP03 – 0.5m	Glacial Till	Inert Waste Landfill	
TP04 – 0.2m	Made Ground – Demolition Material	Inert Waste Landfill	
TP05 – 0.8mbgl	Made Ground – Reworked Natural Ground with demolition waste	Inert Waste Landfill	
TP09 – 0.4mbgl	Glacial Till	Inert Waste Landfill	

These results in isolation indicate handling of the soils if disposed of to a waste facility and do not constitute a waste classification.

8.7 Conceptual Site Model (CSM)

No formal preliminary risk assessment was undertaken by QG on this site and hence no site-specific Conceptual Site Model developed.

The onsite investigation and subsequent laboratory testing has identified potentially significantly elevated localised Benzo(a)pyrene, Benzo(b)fluoranthene and Dibenzo(a,h)anthracene concentrations within the Made Ground in the area of the proposed MUGA, which may extend below areas of proposed soft landscaping.

Based on the Ground Investigation findings the following Conceptual Site Model has been determined, as presented in Table 18.

Table 18: *Existing Pollutant Linkages* – ***on-site to on-site***

Potential Sources on-site	• **ELEVATED PAH'S WITHIN MADE GROUND DEPOSITS** • **ASBESTOS FIBRES LOCALLY WITHIN MADE GROUND DEPOSITS**
Potential Pathways off-site to on-site	**Receptors on-site**
• Dermal Contact • Ingestion	**Future Site Users including visitors** **Construction Workers and Neighbouring Site Users**

9.0 REFERENCES

British Geological Survey:

- BGS Sheet 232 '*Abergavenny*' (Drift and Solid editions) at 1:50,000 scale.
- SO-10-NE 6 inch to 1 mile geological map at 10,560 scale
- BGS online maps and lexicon database – www.bgs.co.uk

Specialist Publications:

- British Code of Practice BS 5930:2015 *'Code of Practice for Site Investigations'*
- British Code of Practice BS 1377:1990 *'Methods of test for soils for civil engineering purposes'.*
- British Code of Practice BS 10175:2011+A2:2017 *'Code of Practice for Investigation of Potentially Contaminated Sites'*
- British Code of Practice BS EN ISO 14688-1:2018 Geotechnical investigation and testing. Identification and classification of soil. Identification and description
- British Code of Practice BS EN ISO 14688-2:2018 Geotechnical investigation and testing. Identification and classification of soil. Principles for a classification.
- British Code of Practice BS EN ISO 14689-1:2018 Ground Investigation and Testing – Identification and classification of rock
- Health and Safety Executive Guidance Note EH40/90
- BRE (2005) Special Digest 1:2005, 3rd Edition, Concrete in aggressive ground. BRE, Garston.
- BS 6031: 2009 Code of Practice for Earthworks.
- ICE UK Specification for Ground Investigation Second Edition.
- Specification for Highways Works Series 600 Earthworks
- Environment Agency Science Report SC050021/*[various]* (2009) *Soil Guideline Values*
- LQM/CIEH Publication S4UL3409 (2015) *'Generic Assessment Criteria for Human Health Risk Assessment'*
- World Health Organisation (2011) *'Guidelines for drinking-water quality, 4th edition'*
- Statutory Instruments (UK Legislation) 2016 No. 614 *'The Water Supply (Water Quality) Regulations'* retrieved from www.legislation.gov.uk/2016/614
- Statutory Instruments (UK Legislation) 2015 No. 1623 *'The Water Framework Directive (Standards and Classification) Directions (England and Wales)'*

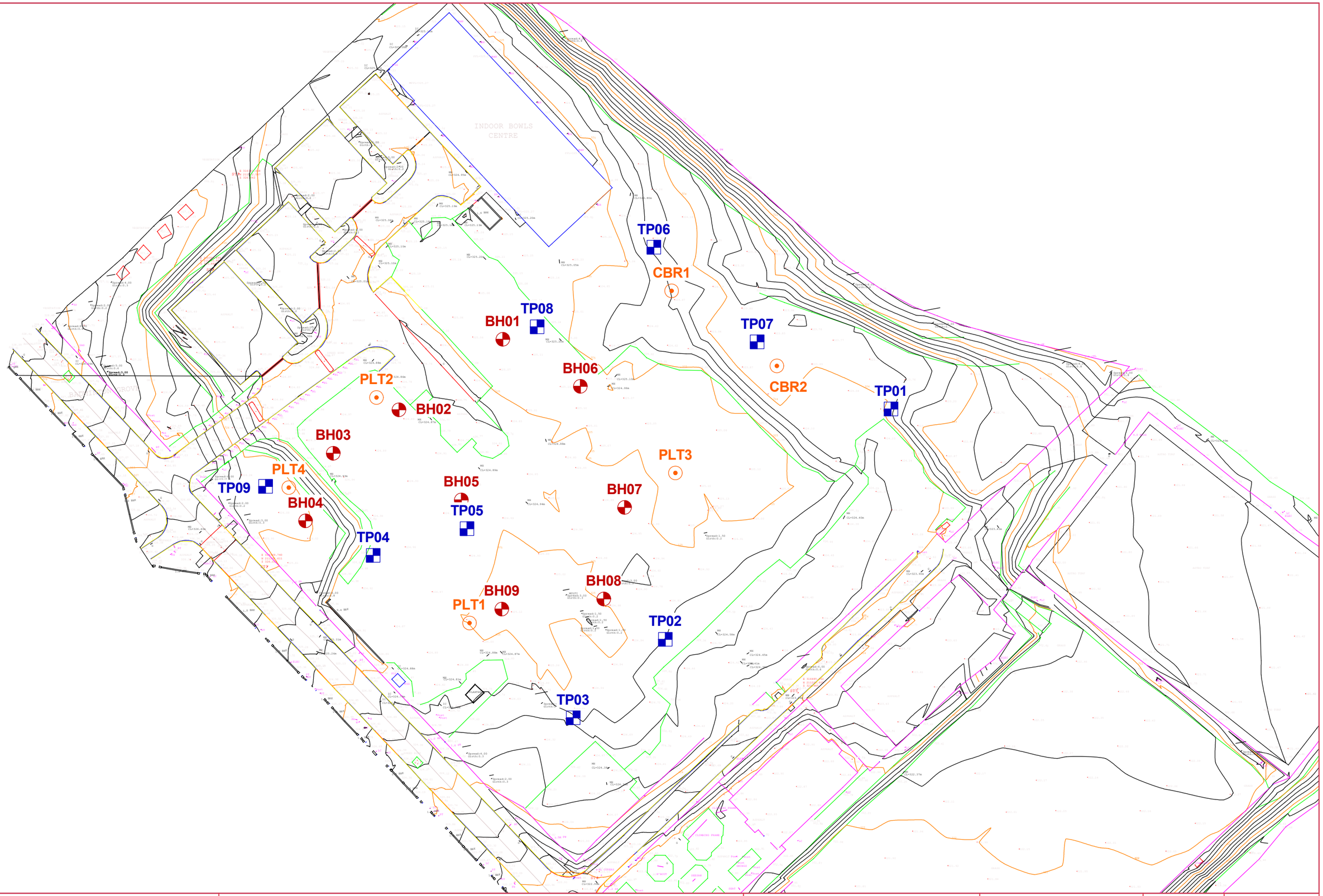
APPENDIX I – SITE PLANS AND FIGURES

Mapping sourced from www.bing.com

Quantum Geotech

FIGURE 1

Project:	**Glyncoed Primary School**
Job No:	**Q0215**
Drawing Title:	**Site Location Plan**



Quantum
Plas Newydd
SA 0FQ
Tel: 01554 744880
Fax:
Email: enquries@quantumgeotech.co.uk

KEY
Borehole | Trial Pit | Dynamic Probe | In-situ Test
Window Sample | Sampling Point | Historical Borehole

PROJECT
GLYNCOED SCHOOL, EBBW VALE

DRAWING TITLE:
EXPLORATORY HOLE LOCATION PLAN

JOB NO.	FIGURE NO.
Q0215	2
DATE	SCALE
25/06/20	1:750

A
0

Rev | Initials | Notes | Date

Ebbw Vale Bowls
Bowls Carpark (8 spaces)
Bowls Carpark (18 spaces)
Staff Carpark (16 spaces)
Staff Carpark (21 spaces)
Visitors Carpark (22 spaces)
Service Yard
Binstores & Sprinkler Tank
Plant
Kit
Hall
Community Play
Hard Play
MUGA (40x20m)
Primary School
KS2
KS1
Nursery
Childcare
Shared Play
932.185 m² Childcare Site
12,968.376 m² Primary School Site
Hard Play
Soft Play
Nature / Attentuation Pond
Soft Play
Allotment Road
Allotment Road
BADMINTON GROVE
Bryn Glas
Tir-Y-Berth
Badminton Grove
Glyn Coed Primary School
N

DRAFT - DISCUSSIONS ONLY

Ebbw Fawr Primary - Glyn Coed
Site Massing Option 4
Bleanau Gwent County Borough Council
Community Services

Blaenau Gwent County Borough Council

Scale 1:1000 @ A3
11 March 2020 | TS1298 SK07

APPENDIX II – COAL AUTHORITY MINING REPORT

The Coal Authority

CON29M
coal mining report

BLAENAU GWENT INOOR BOOWLS CLUB, BLAENAU GWENT INDOOR BOWLS CENTRE, BADMINTON GROVE, EBBW VALE, BLAENAU GWENT, NP23 5UW

Known or potential coal mining risks

Further action

No further reports from the Coal Authority are required. Further information on any next steps can be found in our Professional opinion.

For more information on our reports please visit www.groundstability.com

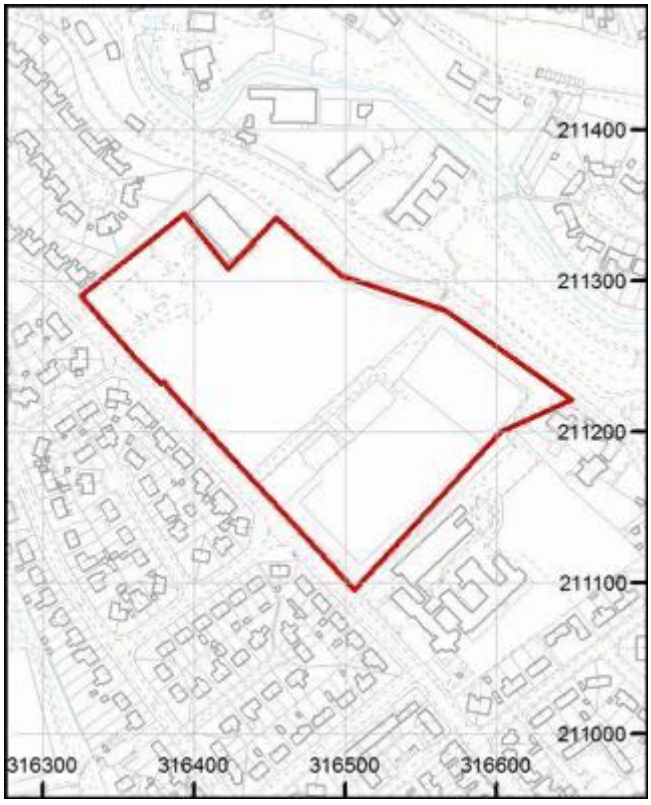
Professional opinion

According to the official mining information records held by the Coal Authority at the time of this search, evidence of, or the potential for, coal mining related features have been identified. In view of the coal mining circumstances we would recommend that any planned or future development should follow detailed technical advice before beginning work on site. Please see page 3 for further details on Future development.

Enquiry boundary

Key

Approximate position of enquiry boundary shown



We can confirm that the location is **on the coalfield**

Map data

This report is prepared in accordance with the latest Law Society's Guidance Notes 2018, the User Guide 2018 and the Coal Authority's Terms and Conditions applicable at the time the report was produced.

Accessibility

If you would like this information in an alternative format, please contact our communications team on 0345 762 6848 or email communications@coal.gov.uk.

Professional opinion

Future development

If development proposals are being considered, technical advice relating to both the investigation of coal and former coal mines and their treatment should be obtained before beginning work on site. All proposals should apply specialist engineering practice required for former mining areas. No development should be undertaken that intersects, disturbs or interferes with any coal or coal mines without first obtaining the permission of the Coal Authority. Developers should be aware that the investigation of coal seams, mine workings or mine entries may have the potential to generate and/or displace underground gases. Associated risks both to the development site and any neighbouring land or properties should be fully considered when undertaking any ground works. The need for effective measures to prevent gases migrating onto any land or into any properties, either during investigation or remediation work, or after development must also be assessed and properly addressed.

If you are looking to develop, or undertake works, within a coal mining development high risk area your Local Authority planning department may require a Coal Mining Risk Assessment to be undertaken by a qualified mining geologist or engineer. Should you require any additional information then please contact the Coal Authority on 0345 762 6848 or email cmra@coal.gov.uk.

Detailed findings

Information provided by the Coal Authority in this report is compiled in response to the Law Society's CON29M Coal Mining enquiries. The said enquiries are protected by copyright owned by the Law Society of 113 Chancery Lane, London WC2A 1PL.

The Coal Authority owns the copyright in this report and the information used to produce this report is protected by our database rights. All rights are reserved and unauthorised use is prohibited. If we provide a report for you, this does not mean that copyright and any other rights will pass to you. However, you can use the report for your own purposes.

1 Past underground coal mining

The property is not within a surface area that could be affected by any past recorded underground coal mining.

However the property is in an area where the Coal Authority believes there is coal at or close to the surface. This coal may have been worked at some time in the past. The potential presence of coal workings at or close to the surface should be considered, particularly prior to any site works or future development activity, as ground movement could still be a risk. Your attention is drawn to the Professional opinion sections of the report.

2 Present underground coal mining

The property is not within a surface area that could be affected by present underground mining.

3 Future underground coal mining

The property is not in an area where the Coal Authority has received an application for, and is currently considering whether to grant a licence to remove or work coal by underground methods.

The property is not in an area where a licence has been granted to remove or otherwise work coal using underground methods.

The property is not in an area likely to be affected from any planned future underground coal mining.

However, reserves of coal exist in the local area which could be worked at some time in the future.

No notices have been given, under section 46 of the Coal Mining Subsidence Act 1991, stating that the land is at risk of subsidence.

4 Mine entries

There are no recorded coal mine entries known to the Coal Authority within, or within 20 metres, of the boundary of the property.

This information is based on the information that the Coal Authority has at the time of this enquiry.

Based on the Coal Authority's knowledge of the mining circumstances at the time of this enquiry, there may be unrecorded mine entries in the local area that do not appear on Coal Authority records.

5 Coal mining geology

The Coal Authority is not aware of any damage due to geological faults or other lines of weakness that have been affected by coal mining.

6 Past opencast coal mining

The property is not within the boundary of an opencast site from which coal has been removed by opencast methods.

7 Present opencast coal mining

The property does not lie within 200 metres of the boundary of an opencast site from which coal is being removed by opencast methods.

8 Future opencast coal mining

There are no licence requests outstanding to remove coal by opencast methods within 800 metres of the boundary.

The property is not within 800 metres of the boundary of an opencast site for which a licence to remove coal by opencast methods has been granted.

9 Coal mining subsidence

The Coal Authority has not received a damage notice or claim for the subject property, or any property within 50 metres of the enquiry boundary, since 31 October 1994.

There is no current Stop Notice delaying the start of remedial works or repairs to the property.

The Coal Authority is not aware of any request having been made to carry out preventive works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991.

10 Mine gas

The Coal Authority has no record of a mine gas emission requiring action.

11 Hazards related to coal mining

The property has not been subject to remedial works, by or on behalf of the Coal Authority, under its Emergency Surface Hazard Call Out procedures.

12 Withdrawal of support

The property is not in an area where a notice to withdraw support has been given.

The property is not in an area where a notice has been given under section 41 of the Coal Industry Act 1994, cancelling the entitlement to withdraw support.

13 Working facilities order

The property is not in an area where an order has been made, under the provisions of the Mines (Working Facilities and Support) Acts 1923 and 1966 or any statutory modification or amendment thereof.

14 Payments to owners of former copyhold land

The property is not in an area where a relevant notice has been published under the Coal Industry Act 1975/Coal Industry Act 1994.

Statutory cover

Coal mining subsidence

In the unlikely event of any coal mining related subsidence damage, the Coal Authority or the mine operator has a duty to take remedial action in respect of subsidence caused by the withdrawal of support from land or property in connection with lawful coal mining operations.

When the works are the responsibility of the Coal Authority, our dedicated public safety and subsidence team will manage the claim. The house or land owner ("the owner") is covered for these works under the terms of the Coal Mining Subsidence Act 1991 (as amended by the Coal Industry Act 1994). Please note, this Act does not apply where coal was worked or gotten by virtue of the grant of a gale in the Forest of Dean, or any other part of the Hundred of St. Briavels in the county of Gloucester.

If you believe your land or property is suffering from coal mining subsidence damage and you need more information on what to do next, please use the following link to our website which sets out what your rights are and what you need to consider before making a claim.
www.gov.uk/government/publications/coal-mining-subsidence-damage-notice-form

Coal mining hazards

Our public safety and subsidence team provide a 24 hour a day, 7 days a week hazard reporting service, to help protect the public from hazards caused by past coal workings, such as a mine shaft or shallow working collapse. To report any hazards please call 01623 646 333. Further information can be found on our website: www.gov.uk/coalauthority.

Glossary

Key terms

adit - horizontal or sloped entrance to a mine

coal mining subsidence - ground movement caused by the removal of coal by underground mining

Coal Mining Subsidence Act 1991 - the Act setting out the duties of the Coal Authority to repair damage caused by coal mining subsidence

coal mining subsidence damage - damage to land, buildings or structures caused by the removal of coal by underground mining

coal seams - bed of coal of varying thickness

future opencast coal mining - a licence granted, or licence application received, by the Coal Authority to excavate coal from the surface

future underground coal mining - a licence granted, or licence application received, by the Coal Authority to excavate coal underground. Although it is unlikely, remaining coal reserves could create a possibility for future mining, which would be licensed by the Coal Authority

mine entries - collective name for shafts and adits

payments to owners of former copyhold land - historically, copyhold land gave rights to coal to the copyholder. Legislation was set up to allow others to work this coal, but they had to issue a notice and pay compensation if a copyholder came forward

shaft - vertical entry into a mine

site investigation - investigations of coal mining risks carried out with the Coal Authority's permission

stop notice - a delay to repairs because further coal mining subsidence damage may occur and it would be unwise to carry out permanent repairs

subsidence claim - a formal notice of subsidence damage to the Coal Authority since it was established on 31 October 1994

withdrawal of support - a historic notice informing landowners that the coal beneath their property was going to be worked

working facilities orders - a court order which gave permission, restricted or prevented coal mine workings

APPENDIX III – BOREHOLE LOGS

Contract : Glyncoed School, Ebbw Vale

Client : Blaenau Gwent County Borough Council

Borehole No. BH01

Dates : 1/6/20 - 1/6/20

Location :

Job Number : Q0215

Engineer :

Ground Level : 325.12 m A.O.D. *Level to Ordnance Datum*

Coordinates: 316421.21 E 211286.36 N *Co-ordinates to Local Grid*

m B.G.L.	Samples Depth	Samples Type No. Blows	Insitu Test Results Depth	Insitu Test Results Test Results	Strata Depth (Thick-ness)	Strata Description	Strata Legend	Strata Red. Level A.O.D.	Water
0	0.30	ES1			(1.00)	MADE GROUND - Greyish brown and grey silty sandy GRAVEL with medium cobble content. Gravel is fine to coarse sub-rounded to angular sandstone, concrete and brick. Cobbles are angular brick and concrete.		(1.00)	
	0.50 0.50 - 1.00	ES2 B3							
1	1.00	ES4			1.00			324.12	
	1.20 1.20 - 1.70	SPTLS5 B6	1.20	SPT (S) 8 (2-1-**2-2-2-2**)		Brownish grey slightly gravelly CLAY and low cobble content. Gravel is fine to coarse sub-rounded to sub-angular sandstone and mudstone. Cobbles are sub-rounded sandstone.			
2	2.00 2.00 - 2.50	ES7 SPTLS8 B9	2.00	SPT (S) 14 (2-2-**3-3-4-4**)	(2.00)	..... dark grey below 2.1mbgl		(2.00)	
3			3.00	SPT (C) 50/200mm (9-13-**15-17-18/50mm**-)	3.00	Terminated at 3.0mbgl upon refusal		322.12	
4									
5									
6									
7									
8									
9									

Hole Progress / Water Obs

Date / Time	H. Depth	C. Depth	Water

Casing

Depth	Cas. Dia.
2.00	200.00

Groundwater

Struck	Rose To	Behaviour	Sealed

Chiselling

From	To	Hours
2.70	3.00	1:30

Equipment / plant used: Dando 2000

Remarks: No Groundwater Encountered. Hand excavated service clearance pit undertaken to 1.2mbgl

Quantum
Plas Newydd
SA 0FQ
Tel: 01554 744880
Fax:
email: enquries@quantumgeotech.co.uk

Operator:	Logged By.	Sheet No.	m Per Page	
Samson Drilling	P Darby	1 Of 1	10	All measurements in metres unless otherwise stated

AGS