



Cwmavon

Ground Investigation Report



July 2022

DRAFT

Ground Investigation Report

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July, 2022

PRESENTED TO

Neath Port Talbot County Borough Council

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EXECUTIVE SUMMARY

The Site	The site is located approximately 2.85km north of Port Talbot. The site is approximately 0.168ha in area and is centered on National Grid Reference (NGR) 278512, 192486. The approximate postcode of the site is SA12 9ED. The site address is: Car park opposite 91 Waun Wen Road, Cwmafan, Port Talbot, SA12 9ED. The SOCOTEC desk top study and field reconnaissance report (Report No. H1060-21) supplied by Neath Port Talbot County Borough Council outlined the following summary of the sites and it's key risks. The site is located adjacent to a former copper works and is shown on the historical mapping of the site (circa 1880) as well as a coal pit, coke ovens and gas works located to the west of the site. The eastern portion of the site historically consisted of gardens associated with the residential properties on Cunard Row. A number of tramways are also identified within the north west site boundary. By the 1920-1930s the tramway and an associated slag heap are labelled as disused and the residential properties of Cunard Row have been demolished. Re-profiling and restoration was undertaken in the 1970s and by the end of the decade the new residential properties of Waun Wen have been built and the area of the existing car park developed. These features persist today. A mineshaft (7m north of the site boundary) and coal outcrop running through the site were identified during the DTS and represent two of the main risks associated with the redevelopment of the site and which the ground investigation has been commissioned to resolve. Due to the coal mining legacy issues there is a medium to high risk of geotechnical hazards associated with the site and the historic industrial setting suggests a low to moderate risk of geo-environmental hazards. The DTS also suggests that current and historic land uses will be sources of contamination including car parking, hard standing past mining, former tramways and former slag heaps.
Geology	Made Ground (Artificial deposits) are indicated to be present across the site and surrounding areas. Superficial Deposits are shown to be present on BGS mapping within the site boundary. These sedimentary deposits are fluvial in origin. They are detrital, ranging from coarse to fine grained and form beds and lenses of deposits reflecting channels, floodplains and levees of a river or estuary. The underlying bedrock is indicated to comprise the South Wales Middle Coal Measures Formation (Mudstone, Siltstone and Sandstone) of Carboniferous Age. There are a number of linear features trending in an east-west direction within the bedrock formation. The site is located on or near a sub-surface outcrop of the the Lower Nine Foot Top Leaf Coal Seam.
Site Investigation	The site investigation was undertaken between 16th and 19th May 2022. The scope of the investigation specified by Neath Port Talbot Council is based on the desk top study undertaken by SOCOTEC <i>Report No. H1060-21</i> and included the following: • Geophysical survey to locate mineshaft shown to be north of the site and outside the red line boundary. • Clearance of buried services prior to excavation and the location and level of each exploratory hole location surveyed.

	• Two combined dynamic sample, rotary core and rotary open hole boreholes to a depth of 30metres, with sampling and SPTs in the upper 10metres. • Two days of windowless sampling to five metres, or refusal, with SPTs and samples. • One day of soakaway testing in two trial pits not exceeding 1.5metres depth. • Five TRL DCP test locations to obtain indicative CBR values around the site. • Installation of gas/groundwater monitoring standpipes within the one borehole and two windowless samples and three return visits to measure gas/groundwater levels. • On-site inspection and logging of recovered samples. • Representative soil samples taken and submitted for geotechnical classification testing. • Representative soil samples submitted and tested for a suite of potential contaminants.
Ground Conditions	The sequence of strata encountered beneath the site comprised; • Made Ground • Superficial Alluvium Deposits • South Wales Middle Coal Measures Formation (Mudstone, Siltstone and Sandstone)
Geotechnical Assessment	Traditional shallow foundations (pad or strip) placed at least 1.20m bgl with the natural Alluvium deposits may be designed to an allowable net bearing capacity of 120kPa which will result in settlement of no more than 25mm for foundations. Given the thickness of made ground across the site, foundations excavations will likely need to be extended to depths of 1.6 to 2.8 m bgl. Foundations excavations through the made ground are likely to be unstable and require shoring. Given the presence of a significant thickness of variable made ground across the site, the use of suspended floor slabs is recommended. For buried concrete the Design Sulphate Class for the site can be taken as DS-1 and the Aggressive Chemical Environment for Concrete (ACEC) site classification can be taken as AC-1. Dewatering of temporary excavations may not be required but should be anticipated during winter months. A conservative CBR value of 5% is recommended for preliminary pavement design.
Coal Mining Risk Assessment	The risk assessment indicates that there is a Low to Moderate Risk of ground instability as a result of a recorded mine entry (shaft) being present on the northern site boundary. The nature of the backfill and cap is defined in the consultants coal mining report and the location confirmed by use of geophysical methods. A development exclusion zone should be placed around the mineshaft location. The risk assessment indicates that there is a Low Risk of ground instability as a result of deep or shallow recorded/unrecorded mining and mining geology beneath the site. Following the drilling of two rotary openhole boreholes no workings were encountered in the Lower Nine Foot Top Leaf seam.

Ground Contamination Assessment	The results of the laboratory testing have indicated elevated Arsenic s in two samples (WS04 and TP01) in Made Ground at concentrations which pose a potential risk to human health. The results have also indicated elevated heavy metal and PAH concentrations in soil derived leachate testing at concentrations which pose a potential risk to underlying groundwater. Due to access constraints (parked cars during monitoring) groundwater sampling could not be undertaken and as such the potential impact to groundwater cannot be discounted. Based on the significant thickness of Made Ground noted across the site associated with the substantial industrial historical land use on site, the potential for localised previously unidentified contamination cannot be discounted.
Ground Gas Assessment	Ground gas monitoring indicates the site is representative of CS2 (Low Risk) due to the identification of elevated concentrations of carbon dioxide. Basic ground gas protection measures will be required in all new developments on the site.
Conclusions and Recommendations	Based on the findings of the ground investigation, the following recommendations are outlined: • Given the thicker made ground in the northern site area and the exclusion zone required around the historic mineshaft, switching the development around with the car park in the north and childcare unit in the south will potentially be a better option from a geotechnical perspective. • A groundwater sample should be obtained from BH02 to assess the impact to groundwater from the overlying Made Ground; • In the event that soft landscaping/ grass cover is proposed on the site (particularly in the external play area) the area will require capping with a minimum thickness of 600mm of clean, imported capping material to provide a suitable barrier between the identified contamination and potential site users; • A Reactive Strategy should be developed for the site to outline the requirements for identification, assessment and management of any areas of previously unidentified contamination encountered during the development phase; • Movement of materials on the site should be undertaken in conjunction with a Materials Management Plan in line with the recommendations in the CL:AIRE Code of Practice to confirm any materials utilised on site are geotechnically and chemically suitable for re-use and to ensure all materials leaving site are disposed of at a suitable waste disposal facility; • It remains the responsibility of the contractor as waste producer to classify any waste materials and identify a suitable off site disposal facility.

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ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
AOD	above Ordnance Datum
Bgl	below ground level
BGS	British Geological Survey
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes
C4SL	Category 4 Screening Levels
CIEH	Chartered Institute of Environmental Health
CLEA	Contaminated Land Exposure Assessment
CoC	Constituent of Concern
CSM	Conceptual Site Model
DEFRA	Department of Environment, food and Rural Affairs
DQRA	Detailed Quantitative Risk Assessment
DTS	Desktop Study
DRO	Diesel Range Organics
DWS	Drinking Water Standard
EA	Environment Agency (England)
EPH	Extractable Petroleum Hydrocarbons
EQS	Environmental Quality Standards
FOC	Fraction Organic Carbon
GPR	Ground Penetrating Radar
LOD	Limit of detection
LQM	Land Quality Management
NRW	Natural Resources Wales
OS	Ordnance Survey
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PPE	Personal Protection Equipment
ppm	parts per million
PRO	Petroleum Range Organics
SGV	Soil Guideline Values
SOM	Soil Organic Matter
SVOC	Semi-volatile organic compounds
TPH	Total Petroleum Hydrocarbon
TSV	Tier 1 Screening Values
VOC	Volatile Organic Carbon
VPH	Volatile Petroleum Hydrocarbons
AOD	above Ordnance Datum

1.0 INTRODUCTION

1.1 INSTRUCTION

Tetra Tech Environment Planning Transport Ltd (Tetra Tech) was commissioned by Neath Port Talbot County Borough Council to undertake a ground investigation for a site known as Cwmavon (known hereafter as “the site”).

The location of the site is shown on Figure 1.

1.2 BRIEF

The brief was to provide an intrusive ground investigation to provide information on the ground conditions and enable a geotechnical assessment and contaminated land risk assessment to support the proposed development of the site.

The work was designed to comprise the following elements:

- Ten window sample boreholes to a maximum depth of 5.00m bgl with Standard Penetration Tests (SPTs) conducted at 1m intervals throughout the full depth of the holes;
- Two mechanically excavated trial pits to facilitate infiltration tests undertaken to BRE 365;
- Two combined dynamic sample, rotary core and rotary open hole boreholes to a depth of 30metres, with sampling and SPTs in the upper 10metres;
- Five TRL DCP locations to obtain indicative CBR values around the site;
- Installation of three ground gas and groundwater monitoring wells;
- On-site inspection and logging of recovered samples;
- Representative soil samples taken and submitted for geotechnical classification testing;
- Representative soil samples submitted and tested for a suite of potential contaminants;
- Three return visits to monitor ground gas and groundwater levels;
- Preparation of a Ground Investigation report.

1.3 PROPOSED DEVELOPMENT

It is understood that the proposed development will involve the construction of new a childcare unit (single story) with areas of hardstanding for parking. A proposed (outline) development plan from the client is presented as Figure 3.

1.4 REPORT SCOPE

This report includes the following key elements:

- Full factual records of the site works carried out;
- Summary of the ground conditions encountered;
- In-Situ testing results;
- Environmental laboratory testing results;
- Geotechnical laboratory testing results;
- Interpretation of Geotechnical and Environmental laboratory data, including a qualitative ground contamination risk assessment (compliant with CIRIA 552 (CIRIA, 2001) methodology);

- An executive summary of the report to allow a rapid, layman's overview.

1.5 LIMITATIONS

The recommendations and opinions expressed in this report are based on information obtained as part of the desk study or provided by others. Information provided from other sources is taken in good faith and Tetra Tech cannot guarantee its accuracy.

This report is subject to the report conditions presented in Appendix A.

The information contained in this report is intended for the use of the Neath Port Talbot County Borough Council and Tetra Tech can take no responsibility for the use of this information by any third party or for uses other than that described in this report or detailed within the terms of our engagement.

2.0 SUMMARY OF SITE INFORMATION

2.1 LOCATION

The site is located approximately 2.85km north of Port Talbot. The site is approximately 0.168ha in area and is centered on National Grid Reference (NGR) 278512, 192486. The approximate postcode of the site is SA12 9ED.

The site address is: 91 Waun Wen Road, Cwmafan, Port Talbot, SA12 9ED.

A site location plan is presented in Figure 1.

2.2 GENERAL AREA CONTEXT

Table 2-1 - Surrounding land uses

	Description
North	Waun Wen Road and Residential properties beyond.
East	Waun Wen Road and Residential properties beyond.
South	Residential properties and a series of shops including a laundrette, pharmacy, Co-Op and a fish and chip takeaway shop.
West	Waun Wen Road and Residential properties beyond.

2.3 SITE DESCRIPTION

In its current state, the site is a public car park located within a largely residential area with commercial units to the southwest. The site comprises an area of approximately 30m by 40m and slopes gently down towards the southwest. The site is mainly hard standing (car parking area) with grass verges. The B4286 is located approximately 50m to the east of the site.

2.4 GEOLOGY, HYDROGEOLOGY, HYDROLOGY AND RADON

2.4.1 Geology

Details of the geology underlying the site have been obtained from the following sources:

- British Geological Survey (BGS) Sheet No. 247 Swansea Solid and Drift Edition, 1:50,000;
- BGS website (British Geological Survey, 2022); accessed 30/05/2022
- Coal Authority Interactive Mapper (The Coal Authority, 2022), accessed 30/05/2022;

Made Ground

The BGS interactive mapping indicates the presence of Made Ground – Artificial deposits across the site. In addition, the Coal Authority Interactive Mapper shows the presence of a mine shaft located on the northern boundary of the site.

Superficial Geology

The BGS Geoindex indicates that the superficial deposits on site are anticipated to comprise Alluvial deposits (clay, silt, sand and gravel), superficial Deposits formed up to 2 million years ago in the Quaternary Period. Local environment previously dominated by rivers.

This is described as typically soft to firm consolidated, compressible silty clay, but can contain layers of silt, sand, peat and basal gravel.

Solid Geology

The BGS Geoindex indicates that the solid geology underlying the site is comprised of the South Wales Middle Coal Measures Formation (Mudstone, Siltstone and Sandstone) of Carboniferous Age. There are a number of linear features running in an east-west direction within the bedrock formation. A linear feature denoting an inferred outcrop of a coal seam is located beneath or close to the southern boundary of the site and is considered most likely to be the Lower 9ft Top Leaf.

The BGS Geoindex describes the formation as *“grey, (productive) coal-bearing mudstones/siltstones, with seatearths and minor sandstones”*.

2.4.2 Hydrogeology

The South Wales Middle Coal Measures Formation is designated as a Secondary A Aquifer. These are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

The Alluvial superficial deposits are likely to be classified as a Secondary A Aquifer. These are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

2.4.3 Hydrology

The nearest surface water feature to the site is the River Afan located c.220m south east of the site, flowing in a broadly north east to south west direction.

2.4.4 Radon

The BRE document 211 (Scivyer, 2015) mapping coverage for the site area was consulted and indicates that the site is located within an area where no radon protection measures are required for new developments, as the maximum radon potential is 3-5%.

2.5 SUMMARY OF SITE HISTORY

A desktop study and field reconnaissance has been previously undertaken by SOCOTEC in January 2021 (Report No. H1060-21) and was supplied to Tetra Tech as part of the tender documentation. The site history was outlined in Section 5 of the SOCOTEC report which is summarised below.

The site was historically (circa 1880's) located adjacent to a former copper works (to the north west of the site) with the eastern half being within the gardens of several residential properties located on Cunard Row. A Coal Pit (Meadow), coke ovens and gas works are located to the west with numerous tramways and stockpiles. A tramway and probable slag heap are shown to have extended onto the northwest corner of the site by 1920-1930's with both the copper works and Meadow pit labelled as disused. The residential properties along Cunard row also appear to have been demolished around this time. Re-profiling/restoration of the site and surrounding land appears to have taken place in the early 1970's with the construction of the existing residential properties and Waun Wen by the end of the decade. The site remained undeveloped during this period probably reflecting its current use as a car park.

In addition, it is understood that a mineshaft is present just north of the red line boundary, backfilled with slag waste.

2.6 SUMMARY OF DESKTOP STUDY

A summary of the SOCOTEC desktop study (Report No. H1060-21) key findings is presented below:

- Historical mining has occurred in the areas surrounding and beneath the site. There is a potential risk to the development from instability due to the presence of past underground mining.
- A mine entry is recorded as 7m north of the site. Given the age of the source data and the potential for errors in the location of such mine entries there is a risk that this entry may be located closer or even on the site.
- The report states that geo-environmental and geotechnical hazards may both be encountered on this site – geotechnical hazards are likely to be medium to high, while geo-environmental hazards may be low to moderate risk.
- There is potential current and historical sources of contamination, which include vehicle parking, hard standing, past mining, former tramways and a former slag heap. Soils beneath the site are likely to be contaminated with a clear pathway linkage for these to pose a risk to the end users and maintenance workers post development and construction workers during development.

The report was finalised with the following recommendations:

- Further investigation into the location of the mine entry to the north of the site to accurately locate this feature. This may utilise but not be limited to mining record searches, geophysical searches or intrusive investigation to prove the location or otherwise.
- Trial pits or dynamic windowless sampling around the site to acquire suitable geotechnical and geo-environmental samples across the site.
- Depending on the nature of the proposed structure a light cable percussive borehole to 10 m for foundation design and to provide deeper samples for geotechnical and geo-environmental testing. The requirement of these will depend on the final development.
- Deep (30 m) rotary probe holes to prove sufficient coverage of superficial deposits or competent bedrock and to allow an assessment of the risk posed by any potential past shallow mine workings.
- Combined groundwater and ground gas monitoring installations to allow long term monitoring.
- In situ soakaways in trial pits and/or boreholes if soakaways form part of the proposed development.
- Geo-environmental testing to include asbestos, metals, hydrocarbons (including SVOC and VOCs), inorganic and organic compounds and potentially PCBs.
- Geotechnical lab testing and assessment of the soils for foundation design and risk from mining.
- Geo-environmental assessment of the soils beneath the site for human health risk assessment and waste disposal

3.0 SITE INVESTIGATION

The site investigation was undertaken between the 16th and 19th May 2022. Three groundwater and ground gas monitoring visits were undertaken on 2nd, 9th, and 15th June 2022 following the completion of the ground investigation.

Details of the fieldwork methods are given in the notes section at the end of this report.

3.1 SCOPE

The scope of the investigation was specified by Neath Port Talbot Council and is based on the desk top study undertaken by SOCOTEC *Report No. H1060-21* and included the following:

- Geophysical survey to locate the mineshaft shown to be north of the site and outside the red line boundary.
- Two combined dynamic sample, rotary core and rotary open hole boreholes to a depth of 30metres, with sampling and SPTs in the upper 10metres.
- Two days of windowless sampling to five metres, or refusal, with SPTs and samples.
- One day of soakaway testing in two trial pits not exceeding 1.5metres depth, anticipated as two locations.
- Five TRL DCP locations to obtain indicative CBR values around the site.
- Installation of gas/groundwater monitoring standpipes within the one borehole and two windowless samples and three return visits to measure gas/groundwater levels.
- Each location will be scanned and cleared of buried services prior to excavation and the location and level of each pit will be surveyed in.
- Installation of three ground gas and groundwater monitoring wells;
- On-site inspection and logging of recovered samples;
- Representative soil samples taken and submitted for geotechnical classification testing;
- Representative soil samples taken, submitted and tested for a suite of potential contaminants;
- Three return visits to monitor ground gas and groundwater levels.

The ground investigation was designed to provide an overall assessment of ground conditions.

Figure 2 shows the layout of the exploratory holes advanced during the site investigation. Exploratory hole logs including photographic plates are presented in Appendix B.

3.2 CHANGES IN SCOPE

The original scope was for TP01 and TP02 to be excavated to a maximum depth of 1.50m bgl. However, upon excavating both locations the thickness of Made Ground was deeper than anticipated and as a result both locations were excavated to 2.0m bgl to facilitate the infiltration testing.

4.0 GROUND CONDITIONS ENCOUNTERED

4.1 STRATA ENCOUNTERED

The sequence of strata encountered beneath the site was;

- Topsoil
- Made Ground
- Superficial Deposits – Alluvium (Fine and Coarse)
- South Wales Middle Coal Formation

A summary of each stratum depth is provided in the table below, with descriptions of each stratum detailed in the subsequent sections. Exploratory hole logs including photographic plates can also be seen in Appendix B.

Table 4-1 – Summary of Ground Conditions Encountered

Location	Depth to base of strata (m bgl)				
	Topsoil	Made Ground	Alluvium		Bedrock
			Fine grained	Coarse grained	South Wales Middle Coal Formation
TP01	GL-0.30	0.30-1.40	1.40-2.00*	NE	NE
TP02	GL-0.30	0.30-1.45	1.45-2.10*	NE	NE
WS01	GL-0.15	0.15-2.30	2.30-2.80*	NE	NE
WS02	GL-0.10	0.10-2.30	2.30-2.50*	NE	NE
WS03	GL-0.20	0.20-0.50	1.20-2.50*	0.50-1.20	NE
WS04	NE	GL-1.70	1.70-1.90*	NE	NE
WS05	NE	GL-1.20	NE	1.20-2.00*	NE
WS06	GL-0.10	0.10-1.56	1.56-2.30*	NE	NE
WS07	NE	GL-1.20	1.20-1.80*	NE	NE
WS08	GL-0.10	0.10-1.30	1.30-1.60*	NE	NE
WS09	NE	GL-1.70	1.70-2.00	2.00-2.50*	NE
WS10	NE	GL-1.40	1.40-1.80*	NE	NE
WS11	NE	GL-0.60	NE	0.60-1.90*	NE
BH01	NE	GL-1.90	NE	1.90-10.50	10.50-30.00* (Coal Seam 28.30 – 29.00)
BH02	NE	GL-1.50	1.50-2.40	2.40-12.00	12.00-30.00* (Coal Seam 18.80 – 19.50)

*Base of strata not encountered.

NE – Not encountered

4.1.1 Topsoil

Topsoil was found to be locally present on the grass verges which surround the car park. It was encountered in a total of seven of the exploratory hole locations. The topsoil can typically be described as *'Grass turf over, blackish brown slightly ashy sandy gravelly SILT. Sands are fine to medium. Gravels are fine to coarse of subangular to subrounded siltstone and mudstone.'* Minor traces of ash were noted throughout the topsoil. The thickness of this strata typically ranges from 0.10 to 0.20m bgl and reached a maximum thickness of 0.30m within the Trial Pit Locations.

4.1.2 Made Ground

Made Ground was encountered in all exploratory hole positions, located on the northern and eastern boundaries as well as the central part of the site. Typically, the Made Ground was found to be at its thickest on the northern and eastern boundary of the site.

The Made Ground was encountered to a maximum depth of 2.80m bgl, located in WS01 and was found to be situated beneath the thin veneer of topsoil. The Made Ground could generally be described across the site as *'blackish brown silty sandy cobbly GRAVEL. Sands are fine to medium. Gravel is fine to coarse of tabular subangular sandstone and mudstone with frequent anthropogenic material of reworked concrete, orange brick, slag, blue wrappers, and white porcelain tile.'*

4.1.3 Alluvium Deposits

Superficial deposits, which were interpreted as Fine- and Coarse-Grained Alluvium Deposits on site, was encountered in all exploratory hole locations and was found to be immediately underlying the Topsoil and Made Ground.

The Fine-Grained Alluvium Deposits encountered across the site could generally be described as *'Orangish brown, with occasional greyish brown mottling, sandy gravelly CLAY. Sands are fine to medium. Gravels are fine to coarse subangular to subrounded sandstone and becoming more abundant with depth'* which was identified in WS07.

A granular component was also identified and generally consisted of *'Greyish black silty sandy GRAVEL. Sands are fine to medium. Gravels are fine to coarse of subangular to subrounded of coal gravels, sandstone, quartz with a rare cobble of subrounded sandstone at 1.70m bgl'* which was in the central part of the site in WS05.

4.1.4 Bedrock – South Wales Middle Coal Measures Formation

The bedrock of the Middle Coal Measure Formation was encountered in two of the exploratory borehole positions, BH01 and BH02 at 10.50m bgl and 12.00m bgl respectively. Due to the nature of the drilling, there was no sample recovery and as a result the interpretation of the Coal Measures Bedrock is based upon the drillers description and arisings from drilling. The arisings could typically be described as *'grey silty sandy GRAVEL. Sands are fine to medium. Gravels are fine to coarse subangular tabular siltstone'*.

A single coal seam was encountered in each of the exploratory hole locations. In BH01 a 0.7m thick seam was encountered at 28.3m bgl and in BH02 a coal seam of the same thickness was encountered at 18.8mbgl. At no point during the drilling was there a loss of drilling flush suggesting it is unlikely there is presence of shallow mine workings. The driller could only note changes in strata by monitoring the rate of progress. This has likely resulted in some of the detail in the stratigraphic changes being lost.

4.2 GROUNDWATER

The investigation did not identify any groundwater strikes in the Dynamic Sampling or Trial Pit exploratory locations.

A few horizons within the Alluvial Deposits appeared damp on recovery. It could be suggested that groundwater may have been encountered if drilling was commenced further.

Groundwater strikes were identified in both exploratory borehole locations (BH01 and BH02) at 7.00m bgl and 6.40m bgl respectively. As a result, an installation was installed in BH02 to monitor changes in the groundwater level.

4.3 IN SITU TESTING

4.3.1 Standard Penetration Testing

Standard Penetration Tests, using a solid cone, were undertaken in two of the boreholes every 1.50m until refusal, and every 1.00m in the dynamic window sample locations, in accordance with BS EN ISO 22476-3 (2005) and BS5930 (2015) to assess the relative density of the superficial deposits encountered within the boreholes.

As stipulated by BS5930:2015, the SPT N-values represented on the borehole logs are the uncorrected results which were obtained in the field, and these are presented on the boreholes logs in Appendix B.

4.3.2 TRL probes – Dynamic Cone Penetrometer

DCP probing to provide California Bearing Ratio values for pavement design was undertaken in five exploratory positions up to 1.0m bgl next to each of the window sample locations and below the original tarmac.

Results are presented in Appendix C.

4.3.3 Soil Infiltration Testing

Two soil infiltration tests were carried out, designated as TP01 and TP02. The tests were undertaken within the shallow fine-grained alluvial deposits. Due to the original scope for a single day of infiltration testing only one test was completed within TP01 and two within TP02.

The results of these tests can be found in Appendix D and are summarised in the table below.

Table 4-2 – Summary of Soil Infiltration Testing

Location	Depth	Strata	Hydraulic Conductivity (m/sec)		
			Test 1	Test 2	Test 3
TP01	2.00	Yellowish brown slightly sandy gravelly CLAY/SILT.	Test not completed	No test conducted	
TP02	2.10	Yellowish brown slightly sandy gravelly CLAY/SILT.	7.86×10^{-5}	6.64×10^{-5}	No test conducted

4.4 VISUAL OR OLFACTORY EVIDENCE OF CONTAMINATION

No visual or olfactory evidence of gross contamination was encountered during the investigation. However, Made Ground was encountered across the entirety of the site, and this may be subject to change following laboratory analysis.

4.5 OBSTRUCTIONS

A drainage survey has not been conducted on the site and was not part of the ground investigation.

No underground services were identified during the intrusive ground investigation.

Before the works started the site and locations were cleared for services. Two drainage gullies and drains were located on the eastern boundary of the site at 0.90m bgl, along with an electricity cable connecting the two streetlights on the southern boundary. This was located at a depth of 0.45m bgl.

No in-ground obstructions were encountered during the site investigation, although there was frequent building waste identified within TP02.

5.0 LABORATORY TESTING

5.1 GEOTECHNICAL TESTING

A programme of laboratory testing was carried out on samples taken from the various strata encountered during the site investigation. Geotechnical testing was scheduled by Tetra Tech and carried out by GSTL Ltd, an approved supplier in accordance with the requirements of Tetra Tech quality system and UKAS accredited for a range of geotechnical tests. The test procedures used were generally in accordance with the methods described in BS1377:1990. Details of the specific tests used in each case are given in Table 5-1. Laboratory geotechnical test results are given in Appendix E.

Table 5-1 - Summary of Geotechnical Testing

Test	No.	Test Method
Moisture Content	5	BS1377:1990 Part 2:3.2
4 Point Liquid & Plastic Limit	5	BS1377:1990 Part 2:4.3&5.3
PSD: Wet Sieve method	6	BS1377:1990 Part 2:9.2
BRE Suite D: pH, Acid Soluble Sulphate, Water Soluble Sulphate and Total Sulphur	5	BRE SD1:2005

5.2 ENVIRONMENTAL TESTING

Environmental chemistry was investigated by specialist chemical analysis of selected soil samples carried out by Element, an approved supplier in accordance with the requirements of Tetra Tech quality system and UKAS and MCERTS accredited for a range of chemical analyses. The testing was scheduled by Tetra Tech and is summarised in Table 5-2 for soil samples. The test results are included in Appendix F.

Table 5-2 - Summary of Environmental Testing

Test suite	No.
<u>Soil Samples:</u> - Tetra Tech Suite C - Heavy metals including Chromium (Hexavalent), Boron (water soluble), Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Vanadium and Zinc; - Inorganics – including pH, Water soluble Sulphate as SO₄ (2:1 Extract), Cyanide (Easily liberatable- low level); - Speciated Petroleum Hydrocarbons (TPH CWG); - Speciated Polyaromatic Hydrocarbons (USEPA 16); - BTEX and MTBE; - Asbestos Screen; and, - Phenol.	5
<u>Soil Derived Leachate Samples and Groundwater Suites</u> - Tetra Tech Leachate Suite C - Heavy metals including Antimony, Boron, Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium and Zinc;	2

- | | |
|---|--|
| <ul style="list-style-type: none">○ Inorganics – including pH, Sulphate, Chloride, Nitrite, Nitrate, Total Cyanide, Ammoniacal Nitrogen and NH_3 and NH_4 and Total Alkalinity○ Speciated Petroleum Hydrocarbons (TPH CWG);○ Speciated Polyaromatic Hydrocarbons (USEPA 16);○ BTEX and MTBE;○ Phenol. | |
|---|--|

6.0 GROUNDWATER AND GAS MONITORING

6.1 GROUNDWATER MONITORING

Groundwater levels were monitored on three occasions following the completion of the ground investigation, between 2nd, 9th, and 15th June. The monitoring data is presented in Appendix G and summarised in Table 6-1 below.

Table 6-1- Summary of groundwater levels

Location	Base of borehole (m bgl)	Depth to water (m bgl)		
		01/06/2022	09/06/2022	15/06/2022
WS04	1.90	Dry	Dry	Dry
WS05	2.00	Dry	Dry	Dry
BH02	10.50	3.40	-	-

Access to BH02 during rounds two and three was not possible due to the presence of cars parked over the monitoring installation.

6.2 GROUND GAS MONITORING

Ground gas levels were monitored on three occasions following the completion of the ground investigation, between 2nd, 9th, and 15th June. The monitoring data is presented in Appendix G and in Table 6-2 below.

Table 6-2 – Summary of phase 1 Ground Gas monitoring

Location	Max. Methane (peak) (% vol)	Max. Carbon Dioxide (peak) (% vol)	Min. Oxygen (steady) (% vol)	Max. Carbon Monoxide (steady) (ppm)	Max. Hydrogen Sulphide (steady) (ppm)	Max. Borehole flow (peak) (l/h)
WS04	0.10	4.60	12.90	<1	<1	0.20
WS05	0.10	7.40	11.90	1	<1	0.20
BH02	0.10	0.10	20.80	<1	<1	0.10

The results indicate measurable concentrations of carbon dioxide (maximum of 7.60%/vol) and methane (maximum 0.1%/vol).

The maximum gas flow recorded across the monitoring round was a flow of 0.20l/hr, recorded at both WS04 and WS05.

The monitoring rounds were undertaken during atmospheric pressure conditions ranging from 1012mb to 1016mb.

In addition, the ground gas monitoring results indicate hydrogen sulphide concentrations of <1ppm across all monitoring rounds. Maximum concentrations of carbon monoxide of 1 ppm was recorded on the recorded on the third visit in WS05.

7.0 SOIL INFILTRATION TESTING

7.1 BACKGROUND

On 7th January 2019, the Welsh Government introduced Schedule 3 of the Flood and Water Management Act 2010 which requires new developments to consider the feasibility of Sustainable Drainage Systems (SuDS) at the design stage. New developments over 100m² or including more than one property must obtain approval of the drainage system from the SuDS Approval Body (SAB) prior to the commencement of construction.

To support the assessment study, preliminary soil infiltration testing has been undertaken as part of the site investigation to provide information on the potential infiltration rates within the sub-strata on the site.

Soil infiltration tests have been undertaken in line with BRE 365 (2016) methodology and any deviations from this approach are documented within the following section. Where possible, locations and depths of test pits were determined based on the proposed drainage design.

7.2 TEST LOCATIONS

The two soil infiltration test locations were outlined left to Tetra Tech to position on site and were located on the eastern boundary of the site on the grass verge in straight line running from North to South. The locations were chosen to give a general understanding of the permeability parameters present on site.

The ground investigation specification from Neath Port Talbot Council stipulated that Trial Pit locations were to be excavated to a maximum depth of 1.50m bgl. However, upon excavation the Made Ground identified was found to be at a depth of 1.40m bgl and 1.45m bgl in TP01 and TP02 respectively. As a result, a deviation from the specification was required to find favourable ground conditions for infiltration testing meaning both locations were excavated further to 2.00m bgl.

7.3 SOIL INFILTRATION TESTS

Two soil infiltration tests were undertaken within a machine excavated trial pit as summarised in the following table.

Table 7-1 Summary of Soil Infiltration Test Locations

Test Location	Depth to Base (m bgl)	Top of Target Strata (m bgl)	Target strata
TP01	2.00	1.40	Alluvium Deposits
TP02	2.10	1.45	Alluvium Deposits

Two repeat fills were undertaken within TP02 and a single fill in TP01 over one day of testing. Test locations were securely fenced and covered until the testing period was completed and excavations backfilled on completion.

The results of the soil infiltration tests are presented in the following table. Full test results are included in Appendix D of this report.

Table 7-2 Summary of Soil Infiltration Test Results

Test Location	Soil Infiltration Rate (m/s)		
	Test 1	Test 2	Test 3
TP01	Test not completed	No test conducted	
TP02	7.86×10^{-5}	6.64×10^{-5}	No test conducted

7.4 GROUND CONDITIONS

7.4.1 Depth to groundwater

Due to the shallow nature of the soil infiltration testing, a trial pit was not excavated adjacent to the test location to identify the groundwater level.

No water strikes were encountered in any of the inspection pits or the exploratory window sample locations. A groundwater strike was encountered in both exploratory borehole locations (BH01 and BH02) at 6.40m bgl and 7.00m bgl respectively.

Based on the findings of the fieldworks and post completion monitoring, it is anticipated that groundwater is at least 3.40m bgl if not deeper. It should be noted that groundwater levels can vary seasonal and year on year and at the time of investigation the site was dry.

7.4.2 Strata Type

The Alluvium Deposits encountered across the site could generally be described as '*yellowish brown slightly sandy gravelly CLAY/SILT. Sands are fine to medium. Gravels are fine to medium of subangular to subrounded sandstone*'.

Full logs of the exploratory pits are included in Appendix B.

7.4.3 Ground Contamination

The results of the laboratory testing have indicated elevated Arsenic in two samples (WS04 and TP01) in Made Ground at concentrations which pose a potential risk to human health. The results have also indicated elevated heavy metal and PAH concentrations in soil derived leachate testing. A contamination assessment is presented in Sections 11.0 and 12.0.

7.5 CONSTRAINTS AND LIMITATIONS

The information presented above is intended to assess the feasibility of soakaway drainage in order to support the development of the drainage strategy. Further testing, groundwater monitoring and ground investigation may be required to support a full SAB application or to inform the development of the final design process.

Ground conditions can vary throughout the year, including the location of the groundwater table. Consideration should be given to the potential effects of seasonal variation when reviewing the data above. It should be noted that the entirety of the site was dry at the time of investigation.

8.0 COAL MINING RISK ASSESSMENT

All information collated on ground conditions is based on extrapolation from data available on adjacent sites and from literature sources. In summary, the following data sources have been consulted.

- Coal Authority Interactive Map Viewer 2022
- British Geological Survey (BGS) Sheet No. 247 (Swansea) Solid and Drift Edition, 1:50 000 and 1:10,560 scale;
- SOCOTEC Phase 1 Desk Study (report number H1060-21)
- Consultants Coal Mining Report (GS-8293497)
- British Geological Survey Geoindex Online Mapping
- British Geological Survey Borehole Database, comprising borehole logs of shafts and borehole records adjacent to the site.
- Tetra Tech records of borehole drilled on site.

8.1 BGS AND COAL AUTHORITY REPORT SUMMARY

The BGS geology map indicates that the site is underlain by the South Wales Middle Coal Measures Formation. This formation generally consists of grey, (productive) coal-bearing mudstones/siltstones, with seatearths and minor sandstones.

Extract 1: From BGS Geoindex



The two boreholes drilled on site (BH01 and BH02) recorded 10.5m of overburden (1.9m MG and 8.6m Alluvium) and 12m of overburden (1.5m MG and 10.5m Alluvium), respectively. A 0.7m thick intact coal seam was encountered in both boreholes at depths of 28.3m bgl and 18.8m bgl, respectively. This has been inferred to the Lower Nine Foot Top Leaf as identified in the Coal Authority report. Based on the distance between the boreholes (12m) this would imply a dip to the north of circa 30 degrees, although the BGS information implies it is steeper. This would position the seam outcrop approximately 10-12m south of the BH02 and the site.

The Coal Authority Consultants Report (provided in Appendix I) states the following:

- Six coal seams lie beneath the property at a shallow depth to 100m depth and were last worked in 1953. Any movement in the ground due to coal mining activity associated with these workings should have stopped by now. In addition, the property is in an area where the Coal Authority believe there is coal at or close to the surface.
- The property also lies within in a surface area that could be affected by underground mining in two seams of coal at depth ranging from 27-177m depth, and last worked in 1863.
- The Coal Authority believe that there are not probable unrecorded shallow workings on the site.
- Spine roadways have not been recorded at shallow depth.
- The site is not within influencing distance of current mining activity and the Coal Authority has no plans to grant licenses in the area relating to underground mining. However, reserves of coal exist in the local area which could be worked at some time in the future.
- There are two mine entries (shafts) are located within close proximity to the site. Shaft 278912-038 is located 7m norther of the site and is identified as being treated/filled with rubble and scrap metal and capped to NCB specification with reinforced concrete in 1977. Shaft 278192-066 is located further away to the east and is unlikely to impact the site.
- The Coal Authority is not aware of any damage due to geological faults or other lines of weakness that may have been affected by coal mining.
- The site is not within a boundary of an opencast site from which coal has been removed by opencast methods.
- The property does not lie within 500 metres of the boundary of an opencast site from which coal is being removed by opencast methods and there are no licenses to remove coal by opencast method within.
- The Coal Authority has not received a damage notice or claim for the subject property or any property within 50m of the site since 31st October 1994.
- The Coal Authority has no record of a mine gas emission requiring action within 500m of the enquiry boundary.
- 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.
- The property is not in an area where a relevant notice has been published under the Coal Industry Act 1975/Coal Industry Act 1994.
- No notices have been given, under section 46 of the Coal Mining Subsidence Act 1991, stating that the land is at risk of subsidence.
- The property is not in an area where a notice to withdraw support. 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.

8.2 GPR SURVEY SUMMARY

A geophysical survey investigation was undertaken at the site on 6th May 2022. The aim of the survey was to map the location of the mine shaft (278192-038) ahead of planned site development

Two complimentary geophysical techniques were used in the investigation. These included Ground Penetrating Radar (GPR) and Fluxgate magnetometry. The fluxgate magnetometer readings were acquired at 0.5m centres along the length of the survey area. A grid of GPR profiles was acquired across the entire survey area. Profiles were spaced at c.0.5m centres.. The full geophysical survey report is presented in Appendix J.

The survey recorded the features of interest. These are summarised below:

Four high amplitude positive magnetic anomalies typically associated with backfilled depressions were identified within the survey area. Two identified responses to the west of the survey area appear to be related to buried utilities/services. The GPR results corroborate this interpretation. The two more significant responses identified east of the survey area are a single truncated response cut in two by a relatively shallow (c.0.5m) buried utility.

Extract 2: From Geophysical Survey Report



Evidence from the geophysical surveys suggests the capped mineshaft is located beneath the carriageway of Waun Wen. An asphaltic patch repair over a circa 10m section of the carriageway may be an indication of subsidence associated with the former mineshaft. This also corresponded to an area of anomalous response identified by the magnetometer data.

8.3 RISK ASSESSMENT AND MITIGATION STRATEGY

Table 8-1 summarises the key hazards identified by review of the available data sources, the factors affecting risk posed by each hazard and an assessment of the estimated risk proposed to any redevelopment of the site.

Assessing risks from coal mining is based upon guidance provided by the Coal Authority following a 'risk based' approach implemented through PPG 14 – Development on Unstable Land.

The risk posed has been assessed as one of three categories.

High risk	Based upon the data available there is a significant risk of shallow ground instability associated with coal mining. Investigation will be required as part of the site re-development. Mitigation measures likely to be required.
Moderate risk	Based upon the data available there is a potentially significant risk of shallow ground instability associated with coal mining. Investigation will be required as part of the site re-development. Mitigation measures may be required.
Low risk	Based upon the data available there is a low risk of shallow ground instability associated with coal mining. No further assessment or investigation is recommended.

The table below summarises the potential risks associated with coal mining legacy at the site.

Table 8-1 – Coal Mining Risk Categories

Coal Mining Legacy	Yes	No	Risk Assessment
Underground coal and ironstone mining (recorded)	✓		Required
Shallow (<30m) underground coal and ironstone mining (recorded)	✓		Required
Underground coal and ironstone mining (unrecorded)	✓		Required
Shallow (<30m) underground coal and ironstone mining (unrecorded)	✓		Required
Recorded Mine entries (Shafts and adits)	✓		Required
Coal and ironstone mining geology	✓		Required
Record of previous mine gas emissions		x	Not Required
Record of coal mining surface hazard		x	Not Required
Surface mining (recorded/unrecorded)		x	Not Required

Based on the information obtained from this assessment, the following risk assessment has been compiled (Table 8-2), which identifies plausible risks at the site that require mitigation in the context of the proposed end use.

Table 8-2 – Coal Mining Risk Assessment

Hazard	Area of site affected	Factors affecting risk	Risk estimate	Mitigation Recommendation	Risk estimate (post recommendation)
Collapse of workings (recorded and unrecorded) shallow coal seams <30m Coal Mining Seams	Entire Site	The Coal Authority believes that there is potential for coal at or close to the surface which may have been worked in the past from shallow depths (<30m). The Coal Authority recommends that the potential for such should be considered prior to development. The site is located above and close to the conjectured outcrop of the Lower Nine Foot Top Leaf Seam. The Coal Authority Interactive Mapping of the area shows a High Risk Development area extending across the site, which is likely associated with the outcropping coal seam and associated high risk of unrecorded shallow mine workings..	Moderate	Drilling of two rotary openhole boreholes to a depth of 30m bgl to confirm whether the depth to the Lower Nine Foot Top Leaf Seam and whether it has been worked beneath the site at shallow depth. The Lower Nine Foot Top Leaf seam was encountered in BH01 and BH02 at 28.30 and 18.80m bgl, respectively and neither showed evidence of being worked or that voiding was present in these seams during drilling. The encountered depths align with the expected regional dip and inferred outcrop of the coal seam close to the southern boundary of the site. Over the majority of the site there is sufficient rock cover above the seam that even it had been worked and associated collapse would not propagate to surface (based on the x10 seam thickness rule of thumb) No further mitigation necessary.	Low

Recorded Mine Entries	North Boundary	The GS-8293497 report, coal authority interactive maps and Groundsure reports all highlight the existence of an abandoned mine shaft being present on the north site boundary. During the walkover and site works the presumed location of the mine shaft was identified by a patch of patched/ re-surfaced asphalt.	High	Following the site visit and geophysical investigation of the location the mineshaft does appear to be situated on the northern site boundary and was located by a positive magnetic response associated with the slag backfill and reinforced cap installed in 1977. Based on the findings of the geophysical survey, the location of the shaft being outside the sites redline boundary and given it has previously been capped to NCB specification, no further mitigation is considered necessary for the proposed development. However, if settlement of the carriageway is ongoing, physical investigation of the shaft maybe prudent. An exclusion zone around capped mine shafts is normally maintained. The exclusion zone is based on a 45-degree angle from the top of the shaft/rockhead to ground level (circa 10.5 radius around the shaft location).	Low to Moderate
Collapse of workings (recorded and unrecorded) deep coal and ironstone seams.	Entire Site	The property is in a surface area that could be affected by underground mining of four seams from shallow (<30m) to 177m depth.	High	Coal seams are present beneath the site, but they have not been worked and no voids were encountered during drilling. Deeper coal seams, even if worked, are unlikely to impact the surface. No further mitigation necessary.	Low

8.4 RISK ASSESSMENT AND MITIGATION STRATEGY CONCLUSIONS

The risk assessment indicates that there is a **Low Risk** of ground instability as a result of deep or shallow recorded/unrecorded mining and mining geology beneath the site. Two coal seams were identified in two separate boreholes (BH01 and BH02) at 28.30 and 18.80m bgl respectively and were found not to be worked. No further mitigation is deemed necessary..

The risk assessment indicates that there is a **Low to Moderate Risk** of ground instability as a result of the recorded mine entry being present in close proximity to the northern boundary of the site. The Mining Consultant Report indicates that the mine shaft was filled with rubble and scrap metal and has been capped to NCB specification with reinforced concrete in 1977.

Two complimentary geophysical techniques were used in the investigation. These included Ground Penetrating Radar (GPR) and Fluxgate magnetometry to accurately identify the location of the mine shaft. The investigation concluded that the disused mine shaft exists beneath the carriageway of Waun Wen, along the northern boundary of the site but does not encroach the car park. Heavy plant is advised to avoid this particular location if and when the municipal car park is developed.

As the Coal Authority report stipulates the details of the backfill and that the shaft has been capped by concrete in conjunction with the results from the geophysics survey (outlined in section 9.1) it can be concluded that no further mitigation is necessary as the identified mine shaft does not pose a risk to the site itself.

A development exclusion zone should be applied to the shaft location calculated on the basis of 45° degrees from the top of bedrock (10.5m).An indicative exclusion has been recorded on Figure 2.

9.0 GEOTECHNICAL ASSESSMENT

9.1 SOIL PROPERTIES

The ranges of the various soil properties measured are discussed below, to aid in the selection of design values. However, the appropriate choice of characteristic and design values will depend on the particular analysis and design philosophy used and should be selected by the designer.

Where characteristic values are given, these are reasonably conservative estimates of a measured or assessed property that may be used to represent the overall behaviour of the material. Design values are similar but also take into account the ground-structure interaction for a given structure so need to be selected by the designer. It is recommended, however, that design values used do not exceed the characteristic values given in this report.

9.1.1 Made Ground

Made ground deposits were encountered in all exploratory hole locations. The SPT-N vs Depth plot for the site is presented in Figure 4. A summary of the in-situ testing is presented below.

Table 9-1 - Summary of test results within the Made Ground

	No. of results	Range (min-max)	Average	Lower quartile	Upper quartile	Characteristic value+
SPT N Values	9	2 – 50	17	7	20	7
Undrained shear strength (kPa):						
- from SPT N values ¹	9	9 - 220	75	31	88	31
• from hand vanes	7	6 - 61	30	23	32	30
Notes: + suggested characteristic values are appropriate for most normal applications but designers should satisfy themselves that they are suitable for the specific application and design method they are using; 1 Estimated from a correlation by Stroud and Butler (1975) ⁽⁴⁾						

The made ground deposits were variable in composition and density/strength and are not considered suitable to support structural loads.

9.1.2 Alluvial Deposits (Fine Grained)

Shallow fine-grained alluvial deposits were identified within 12 exploratory hole locations immediately below the Made Ground/Topsoil and varied in thickness between 0.2m and 1.3m. A summary is presented in the table 9-2 below.

Table 9-2 - Summary of test results within the fine-grained alluvial deposits

	No. of results	Range (min-max)	Average	Lower quartile	Upper quartile	Characteristic value+
Natural moisture content (m - %)	5	22 - 29	24	22	23	24
Liquid limit (LL)	5	31 – 40	36	35	38	36

Plastic limit (PL)	5	18 – 19	19	19	19	19
Plasticity index (PI)	5	12 – 21	17	17	19	17
Modified Plasticity Index ¹	5	11 – 20	16	16	18	16
SPT N Values	16	5 – 50	36	16	50	16
Undrained shear strength (kPa):						
- from SPT N values ²	16	22 – 220	158	70	220	70
- from hand vanes	8	16 – 30	20	18	23	20
Notes: + suggested characteristic values are appropriate for most normal applications but designers should satisfy themselves that they are suitable for the specific application and design method they are using; * Estimated from a correlation from Peck, Hansen and Thornburn, Foundation Engineering, Wiley, 2nd ed., (1974) ⁽⁶⁾ 1 Modified Plasticity Index (I'P) is defined as: I'P = (PI x %passing 425um)/100%; 2 Estimated from a correlation by Stroud and Butler (1975) ⁽⁴⁾						

The hand vanes results are notably lower than undrained shear strength estimated from a correlation with SPT N values. Whilst hand vanes are a direct measurement of shear strength, the high coarse-grained content of the Alluvium in conjunction with undertaking them in windowless sample liner is likely to be resulting in lower values. Based on the above, it is recommended that the following values are taken as design/characteristic values for this material:

- Undrained shear strength* 60kPa
- SPT N Value 16
- Angle of shearing resistance, ϕ 32°

*Conservative value based on correlation with SPT N value and discounting the hand vane results.

9.1.3 Alluvial Deposits (Coarse Grained)

Coarse grained alluvial deposits were identified within 6 positions immediately below the Made Ground or below the fine grained alluvial deposits. SPTs at the base of the windowless sample boreholes that terminated at shallow depths also suggest a change from fine grained alluvial deposits to a coarser horizon. The windowless sample positions all refused on hard strata at depths ranging between 1.6m and 2.8m bgl being notably deeper on towards the northern boundary. The coarse grained deposits varied in thickness between 7.5m and 9.6m the base of the coarse grained deposits was only proven in the deeper dynamic sample/rotary boreholes. A summary of in-situ testing is presented in the table below.

Table 9-3 - Summary of test results within the coarse-grained alluvial deposits

	No. of results	Range (min-max)	Average	Lower quartile	Upper quartile	Characteristic value+
SPT N Values	14	9	47	50	50	47
Notes: + suggested characteristic values are appropriate for most normal applications but designers should satisfy themselves that they are suitable for the specific application and design method they are using.						

It should be noted all but 3 of the SPT's undertaken in the coarse-grained Alluvium refused at 50 blows and where thick deposits were encountered (WS05 and WS11) lower values were recorded at the top of the unit

indicating the soils to be of loose density. Based on the above, it is recommended that the following values are taken as design/characteristic values for this material ignoring the upper, loose horizon:

- SPT N Value 47
- Angle of shearing resistance, ϕ 40°

10.0 GEOTECHNICAL DESIGN CONSIDERATIONS

10.1 PROPOSED DEVELOPMENT

The proposed development plan is presented at the end of this report in Figure 3 and comprises a childcare unit with areas of hardstanding for parking. Currently the unit is proposed to be constructed in the northern half of the site, with site access and car parking in the southern half of the site. Given the shallower depth to suitable founding strata in the southern half of the site and the presence of the shaft exclusion zone encroaching onto the northern boundary, switch the development around with the building located in the southern half of the site will potentially be a better option from a geotechnical perspective.

10.2 EARTHWORKS

Given the current levels of the site, significant earthworks (cut and fill) are not anticipated at this stage.

10.3 FOUNDATIONS

The Alluvium deposits encountered at depths of 0.5m to 2.3m bgl are considered a suitable founding stratum to support the proposed single story structure. Foundation excavations will need to extend through the made ground and penetrate the upper soft/loose horizons by approximately 0.5m. This is likely to result in deep excavations on the northern area of the site of up to 2.8m bgl reducing to 1.6-1.8m bgl on the southern area of the site. The made ground is likely to be unstable and shoring will likely be required. Based on the limited groundwater monitoring undertaken, it is expected to be below 3m bgl and thus unlikely to be encountered in foundation excavations.

It is considered that shallow spread foundations, strip or pads, placed within the fine- or coarse-grained alluvium, at a minimum depth of 1.0m bgl, would be a suitable foundation option for the proposed childcare unit. Shallow footings may be designed to an allowable net bearing pressure of 120kPa, giving a factor of safety greater than 3 against ultimate bearing capacity failure, and should result in settlement less than 25mm for a strip footing of no greater than 0.5m wide or a pad of no more than 0.5m².

If foundations cross from a fine to a coarse-grained soil, reinforcement of the foundation may be required to prevent differential settlement. Foundation excavations should be extended where deeper Made Ground is encountered.

Foundation excavations should be inspected by a suitably experienced engineer or inspector to ensure the founding material is suitable natural deposits. Any soft, loose or otherwise unsuitable material such as the shallow Made Ground or the soft/loose upper horizons of the Alluvium should be excavated and replaced by compacted granular backfill or lean concrete.

10.4 FLOOR SLABS

Due to variable composition, strength/density and thickness of Made Ground (up to 2.30m), ground bearing floor slabs are not considered suitable without treatment. Given the small nature of the development, the use of suspended floor is considered the best option.

10.5 CHEMICAL ATTACK ON BURIED CONCRETE

Chemical tests undertaken on representative samples from the Made Ground and Alluvium show low levels of water-soluble sulphates and generally slightly alkaline conditions (in places up to pH8.4). Based on these conditions, it is recommended that for foundations the Design Sulphate Class for the site, as defined in BRE Special Digest 1, be taken as DS-1, and the Aggressive Chemical Environment for Concrete (ACEC) site classification be taken as AC-1.

10.6 TEMPORARY WORKS

The two trials pits excavated for the infiltration tests were found to have poor to moderate side wall stability particularly through the made ground deposits. It is considered that shoring or battering of even shallow excavations in the short term will be required. Groundwater is likely to be encountered at deeper depths (3.40m bgl) and dewatering of excavations is unlikely to be required. However, works were carried out in the spring and there may be seasonal variations that result in the need for dewatering.

10.7 PAVEMENTS

Based on the 14 results gathered within the Made Ground, CBR values were in the range of 5.5% to 138% (average 44%). Given the very variable nature of the results obtained it is recommended a conservative value of 5% is adopted for pavement design within this stratum.

Proof rolling of the formation level will be required and any loose or soft spots should be removed and replaced with an engineered fill, in accordance with a suitable specification. The formation level will also need to be protected during inclement weather from deterioration.

Prior to placement of the founding material and the construction of the road pavement, the sub-formation and formation will need to be inspected and checked in accordance with a suitable specification to ensure the ground conditions are as expected. All testing should be carried out in accordance with DMRB IAN 73/06 to confirm that the ground conditions at the time of construction are consistent with the previous design parameters.

10.8 DRAINAGE

Soakaway testing within the shallow fine-grained alluvial deposits at TP01 and TP02 has yielded soil infiltration values of the magnitude 10^{-5} m/s in TP02 with two tests undertaken in the single day of infiltration testing requested. The infiltration testing in TP01 unfortunately failed after a full day of testing resulting in an infiltration less than the required 75% by volume.

11.0 GROUND CONTAMINATION ASSESSMENT – HUMAN HEALTH

11.1 INTRODUCTION

The UK Contaminated Land Regime (CLR) allows for a tiered approach to the assessment of ground contamination which is designed to allow increasingly site-specific assessment. In order to assess the potential risk posed by contaminants contained within the soils at the study area a generic quantitative risk assessment (gQRA) has been undertaken by comparing recorded concentrations of chemical constituents in soil with Generic Assessment Criteria (GAC) to identify whether, at the concentrations recorded, the presence of the constituent has the potential to adversely affect the health of site users (a Tier 1 assessment). GAC are set at levels where potential exposure is deemed to be within acceptable limits.

If the recorded concentrations of a particular constituent are below the GAC then the risk is generally considered to be acceptable and further assessment / or mitigation measures are not required. Where a substance is recorded at concentrations higher than GAC this does not necessarily indicate that a particular risk is present, however, it does typically signify the requirement to undertake further assessment in line with the UK tiered risk assessment framework.

11.2 ASSESSMENT CRITERIA

11.2.1 Generic Assessment Criteria

The following GAC for soils have been utilised for the screening process, in order of preference:

- CL:AIRE published C4SL (DEFRA, 2014);
- CIEH/LQM published S4UL (LQM/CIEH, 2015);
- Tetra Tech internal Tier 1 Screening Criteria (issue 15) derived using the derivation tool CLEA version 1.06, in line with the current UK Contaminated Land Regime.

C4SL are currently available for arsenic, benzene, benzo(a)pyrene, cadmium, chromium VI and lead¹. The C4SL were originally developed to support the categorisation of sites in accordance with Part 2A are also, based on DEFRA guidance, considered suitable for use during the assessment of sites as part of the planning process.

Where C4SLs are not available, 'Suitable for Use Levels' (S4UL) developed by CIEH/LQM have been used. The S4UL provide GAC based on minimal or tolerable risk intended to be protective of human health for individual or mixtures of substances. It is considered conservative and appropriate to use these values for contaminants for which C4SL are unavailable. GAC for volatile and semi-volatile organic compounds (VOC and SVOC) not presented in the S4UL document are sourced from CL:AIRE (CL:AIRE, January 2010).

Where no published screening values are available Tetra Tech have derived their own values (easily liberatable cyanide).

The CLEA model states that "For most exposure pathways, the contamination is assumed to be at or within one metre of the surface" (Environment Agency, 2009). It is considered that at depths greater than 1.0m, the probability of human exposure via the direct contact pathways are significantly reduced, leaving inhalation of volatile compounds as the dominant pathway with regard to human health risks. Typically, volatile compounds only significantly affect the indoor inhalation pathway. The same screening concentrations have been used for all depths at this stage, though it is noted that these are highly conservative for depths below 1.00m bgl.

¹ Arsenic, benzene, benzo(a)pyrene, cadmium, chromium VI, lead assuming 6% SOM (1% SOM C4SL also published for benzene).

11.2.2 Proposed End Use

Screening criteria have been developed for the following land use scenarios:

- Residential with plant uptake;
- Residential without plant uptake;
- Allotments;
- Public open space (park and residential);
- Commercial / Industrial.

The proposed development on site comprises the construction of a childcare unit including external play areas and areas of hard standing for parking. As such the following screening assessment has been undertaken against a residential without plant uptake in the first instance to provide a conservative assessment. Where exceedances are identified the result have been subsequently screened against a Public Open Space near residential housing end use.

11.2.3 Soil Organic Matter

For organic contaminants, the generic soil screening values have been derived for a range of concentrations of soil organic matter (1%, 2.5%, 6%). In order to provide a conservative assessment the GAC derived for a 1% SOM have been adopted.

11.3 TIER 1 – SOIL SCREENING

A total of five soil samples collected from the site were submitted for chemical laboratory analysis. Full copies of laboratory certificates for all soil analysis are included in Appendix F.

The samples obtained were of Made Ground from locations across the site. As described in Section 4.1, a significant thickness of Made Ground was noted on site, up to a maximum depth of 2.30m bgl at WS01 and WS02 in the north of the site. Made Ground was noted to comprise blackish brown silty cobbly gravel containing anthropogenic materials of concrete, brick, slag, plastic and ceramics.

Comparison of the chemical analysis results with the generic assessment criteria for a residential without plant uptake end use has identified the following exceedances, as detailed in Table 11-1.

Table 11-1 - Summary of Constituents of Concern

Constituent of Concern	No. of Samples	Min	Max	SSV	Exceedances	
		(mg/kg)			No. of exceedances	Location(s)
Arsenic	5	28.4	322.9	40	3	WS09 0.70m WS04 1.40m TP01 0.70m
Benzo(bk)fluoranthene	5	<0.07	5.68	3.9	1	WS01 1.40m
Dibenzo(ah)anthracene	5	<0.04	0.48	0.31	2	WS04 1.40m TP01 0.70m
Benzo(b)fluoranthene	5	<0.05	4.09	3.9	1	WS04 1.40m

The analysis of the laboratory results has indicated three samples where the concentration of arsenic exceeds the GAC for a residential without plant uptake (40mg/kg), however it should be noted the samples from WS09 0.70m only marginally exceeds the GAC with a concentration of 43.2mg/kg. It should also be noted that given

the proposed end use, assessment against the residential without plant uptake end use is considered conservative. When assessed against the GAC for a public open space near residential housing (79 mg/kg), the concentrations at WS04 1.40m (153.4 mg/kg) and TP01 0.70m (322.9mg/kg) are still noted to exceed the GAC and as such are considered to pose a potential risk to human health. Consequently, these are considered further in Section 15.0.

The analysis has also indicated a limited number of exceedances of PAH compounds against the GAC for a residential end use without plant uptake. It should be noted that the concentrations only marginally exceed the GACs and in addition the PAH concentrations are below the GACs for a public open space near residential housing. These concentrations are not considered to pose a significant risk to human health but are discussed further in Section 15.0.

11.4 ASBESTOS

Five samples were collected and analysed for the presence of asbestos containing materials. The laboratory results indicated that there were no positive identifications of asbestos within soil samples. No asbestos containing materials (ACM's) were identified soils during the site investigation.

12.0 GROUND CONTAMINATION ASSESSMENT – WIDER ENVIRONMENT

12.1 INTRODUCTION

The potential for contaminated groundwater on site to adversely affect controlled water receptors (groundwater and surface water bodies) has been assessed at this stage by direct comparison of analytical data from the Tetra Tech ground investigation with relevant Water Quality Standards (WQS).

Similarly, the potential for soil contamination to impact controlled waters has been assessed by comparing analytical data from soil derived leachate tests directly against WQS.

12.2 ASSESSMENT CRITERIA

In light of the environmental setting of the site under consideration. The following water quality standards have been adopted, in order of preference.

- Water Framework Directive (WFD),
- Environmental Quality Standards (EQS);²
- WHO 2008 - Petroleum Products in Drinking Water (WHO 2008)
- UK Drinking Water Standards³.

12.2.1 Bioavailability

For certain heavy metals (copper, zinc, manganese, nickel and lead) the bioavailability of the metal within the water can be calculated to generate a bespoke screening criteria based on other groundwater parameters. This assessment is undertaken utilising the Metal Bioavailability Assessment Tool (M-BAT) which was developed using the EQS_(bioavailable) developed in line with the Water Framework Directive.

In the case of copper, zinc, manganese and nickel the assessment takes into account the concentration of calcium, Dissolved Organic Carbon (DOC) and pH of the water sample. The assessment for lead only takes the DOC of the sample into account. A spreadsheet has been developed for the assessment by the UK Technical Advisory Group on the Water Framework Directive.

12.3 SOIL DERIVED LEACHATE METHODOLOGY

Soil derived leachate samples can be used to identify potentially mobile contamination within soil samples collected from the site. It should be noted that the laboratory test methodology indicates a potential mobility of contaminants and is usually considered to reflect a worst-case situation and unlikely to represent on-site conditions.

The laboratory preparation of leachate samples is likely to produce higher concentrations of leachable components than conditions encountered on site and as such the following assessment is considered to be inherently conservative in nature. Furthermore, the resulting data are screened against criteria intended to be protective of water bodies and drinking water supplies and are not intended to assess the potential significance of contaminant mobility.

² Where WFD 2015 are not presented revoked WFD 2010 standards are used

³ WHO 2005; WHO 2008; UK Water Supply Regulations 2010 and 1989 Regulations. Priority given to UK drinking water standards

12.4 TIER 1 SCREENING ASSESSMENT – SOIL DERIVED LEACHATE

Two soil derived leachate samples were screened against a suite of determinants outlined in Section 12.2. Both were samples were of Made Ground.

The following table summarises the determinants which have been identified at concentrations in excess of the adopted screening value.

Table 12-1 – Summary of Exceedances within Soil Derived Leachate Samples

Determinant	Units	Maximum	Minimum	Screening Value	Exceedances	
					No.	Location
Arsenic	µg/l	24	19.6	10 ⁺	2	WS08 0.50m WS05 0.70m
Copper	µg/l	12	8	1 [*]	2	WS08 0.50m WS05 0.70m
Fluoranthene	µg/l	0.219	0.017	0.0063 [*]	2	WS08 0.50m WS05 0.70m
Benzo(a)pyrene	µg/l	0.046	0.008	0.00017 [*]	2	WS08 0.50m WS05 0.70m
Benzo(ghi)perylene	µg/l	0.027	0.006	0.0082 [*]	1	WS08 0.50m
Benzo(b)fluoranthene	µg/l	0.0071	0.01	0.017 [*]	1	WS08 0.50m
Benzo(k)fluoranthene	µg/l	0.027	<0.08	0.017 [*]	1	WS08 0.50m

* Freshwater waters EQS 2015

+Drinking Water Standards 2010

Analysis of the laboratory results indicates exceedances of arsenic, copper and a number of PAH compounds identified within soil derived leachate samples at concentrations in excess of the adopted screening criteria. Concentrations of copper can be considered within the context of the bioavailability of the heavy metal based on other soil parameters. The M-BAT tool has been used to calculate site specific screening criteria for these determinants, with the results presented in the table below.

Table 12-2 – M-BAT adjusted Screening Values for Heavy Metals – Soil Derived Leachate

Determinant	Sample	Concentration (µg/l)	Screening Value (µg/l)	M-BAT Screening Value (µg/l)	Exceedance
Copper	WS08	12	1	1.72	Yes
	WS05	8	1	2.96	Yes

As presented in the table above, when bioavailability is taken into consideration copper is considered to pose a potential risk to the wider environment.

The recorded concentrations of copper and PAHs are considered further within the risk assessment presented in Section 15.0.

13.0 PRELIMINARY GROUND GAS ASSESSMENT

13.1 INTRODUCTION

Three return ground gas monitoring visits were undertaken between the 2nd June and 15th June 2022. Full factual site records of the gas monitoring results are presented in Appendix G and summarised in Section 0.

13.1.1 Ground Gas Monitoring

Ground gases are monitored within boreholes on the site recording the following parameters.

- Concentrations of ground gases;
 - Methane (%v/v);
 - Carbon dioxide (%v/v);
 - Oxygen (%v/v);
 - Carbon monoxide (ppm);
 - Hydrogen sulphide (ppm);
- Borehole flow rate (l/hr);
- Depth to groundwater;
- Atmospheric pressure trends;

Where groundwater levels are noted to be above the screened sections of the boreholes the data is not considered to be representative of the ground gas regime and are therefore not used within the risk assessment process.

Atmospheric pressure trends are recorded on site during the monitoring process, but are also noted in the preceding three days, and one day after each monitoring visit. Falls in atmospheric pressure are generally considered to indicate a higher potential for ground gas migration from the sub surface and as such monitoring during periods of falling pressure are considered to represent worst case scenarios as outlined in the CL:AIRE Technical Bulletin TB17 (CL:AIRE, August 2018).

13.1.2 Land Gas Risk Assessment Methodology

The key reference document which has been used to undertake the semi-quantitative land gas assessment presented in this report is CIRIA C665 (CIRIA, 2007). This provides a framework for assessment of land gas risk to buildings/structures with foundations (i.e. houses and/or commercial properties).

The risk assessment process is based on a Source-Pathway-Receptor Conceptual Site Model Methodology, with consideration given to the potential sources likely to be present on the site and the ground gas monitoring regime designed to reflect the scale of the source potential.

The collected data has been used for the purposes of undertaking a semi-quantitative assessment in accordance with the CIRIA 665 methodology. The calculation used to calculate the gas screening value (GSV) for the site, together with the relevant definition of units, is as follows:

$$\text{GSV (litres of gas/hr)} = \text{borehole flow rate (l/hr)} \times \text{gas concentration (volume/100)}$$

The calculated GSV values are used to determine the Characteristic Situation (CS) for the site in terms of methane and carbon dioxide, based on the conditions outlined in Table 13-1 below.

CS classification is applicable to all buildings, with the exception of low-rise housing with a ventilated underfloor void, in these situations, the NHBC Traffic Light System is adopted. As the this development is for a childcare unit, the NHCC Traffic Light System is not considered appropriate in this instance and as such has not been included.

Table 13-1 –GSV Classification (Modified Wilson and Card Methodology)

Characteristic Situation	Risk Classification	Gas Screening Value Threshold (l/hr)	Additional Considerations
1	Very Low Risk	<0.07	Methane concentration <1% Carbon dioxide <5%
2	Low Risk	<0.7	Borehole flow rate <70 l/hr
3	Moderate Risk	<3.5	-
4	Moderate to High Risk	<15	Quantitative risk assessment required to evaluate scope of protective measures
5	High Risk	<70	-
6	Very High Risk	>70	-

13.2 PRELIMINARY GROUND GAS RISK ASSESSMENT

13.2.1 Conceptual Site Model

The following sections outline the anticipated Source-Pathway- Receptor model associated with the proposed development on site.

Sources

The following potential sources have been identified on and off site.

- Made Ground deposits;
- Mine workings associated with South Wales Coalfield, with a shallow mine working located on the northern boundary;

Pathways

The following potential pathways have been identified which may act as preferential pathways for ground gas migration:

- The underlying strata have been classified as sands and gravels with varying components of clays and silts. Therefore, there is potential for some horizontal and vertical migration of ground gas;
- Buried service runs and existing foundations, including sub-floor voids.

Receptors

Within the context of ground gases, the following enclosed structures are considered to represent potential receptors.

- Structures and enclosed areas within proposed development.

13.2.2 Risk Assessment – Methane and Carbon Dioxide

In order to assess the significance of ground gases at the site, measured concentrations and flow rates have been used to derive Gas Screening Values (GSVs). GSVs are the product of gas concentration and gas flow measured in a borehole and provide an indication of the flow of the particular gas in question out of the ground.

Due to the limited data obtained from the site the worst-case values have been used within the risk assessment. Based on a maximum flow recorded of 0.2l/hr and the maximum recorded concentration of carbon dioxide (CO₂) and methane (CH₄) during the three monitoring visits, the GSVs have been calculated as presented in Table 13-2.

Table 13-2 – Initial GSV Calculations

	Maximum Concentration (%)	Maximum Flow Rate (l/hr)	GSV (l/hr)	Characteristic Situation (Wilson and Card)
Carbon Dioxide	7.4	0.2	0.0148	CS2 (Low Risk)
Methane	0.1	0.2	0.002	

These values have been compared with the Revised Wilson and Card Classification presented in Table 13-1.

The risk assessment process indicates the site is representative of Characteristic Situation 2 (Low Risk) based on the recorded concentrations of carbon dioxide (7.4%) and methane and maximum flow rates within the sub surface.

13.2.3 Carbon Monoxide and Hydrogen Sulphide

Maximum concentrations of carbon monoxide were recorded at 1ppm at WS05. The remaining visits and hydrogen sulphide concentrations were recorded at <1ppm throughout the monitoring period. The recorded concentrations are considered to be suitably low to negate the requirement for additional risk assessment.

13.2.4 Atmospheric Pressure Trends

Assessment of the atmospheric pressure conditions in each of the monitoring indicates that Round 1 was undertaken during falling pressure conditions, whereas Rounds 2 and 3 were undertaken during rising pressure conditions.

13.3 SUMMARY AND DISCUSSION

The site has been classified as Characteristic Situation 2 (Low Risk) based on the worst-case recorded concentrations of carbon dioxide and methane and maximum flow rates. Site classification of a Characteristic Situation 2 indicates basic gas protection measures are required within new developments.

14.0 WASTE CLASSIFICATION ASSESSMENT

Waste classification is a two stage process, with the first step comprising a hazard assessment of the soil quality data in line with the guidance set out in the Environment Agency waste classification technical guidance WM3⁴ document. Once the hazardous properties of the materials are known, the second step is to assess the potential performance of the materials in a landfill, undertaken by considering the results of waste acceptance criteria (WAC) testing.

14.1.1 Waste Classification

The chemical analysis data obtained from the ground investigation has been used to make a preliminary assessment of whether soils from the study area would be classified as hazardous waste. The assessment provides an initial indication of the classification of the soils in the event that they are disposed to landfill. Note the decision as to whether soils are deemed to be hazardous waste ultimately rests with the receiving landfill.

The waste classification report is presented as Appendix G. The assessment was undertaken using HazWasteOnline, web-based software for waste classification. The software follows Environment Agency guidance and European regulations. Assessment sheets are presented in Appendix K.

In making the assessment the following assumptions have been made:

- TPH are not derived from petrol or diesel. There was no visual or olfactory evidence of hydrocarbons observed during the ground investigation and the long term presence of the mound on the study area means that storage of such fuels is unlikely to have taken place at the site.

The 5no. samples analysed as part of the ground investigation were of made ground. The initial assessment identified 4no. samples that were classified as hazardous as a result of the presence of flammable liquids. After a review of the exploratory hole logs this hazardous property has been removed from all the samples where it was identified by the software as there was no visual or olfactory evidence of flammable liquids such as hydrocarbons observed during the ground investigation. The assessment sheets in Appendix K detail which samples this edit has been applied to.

After this amendment 1 no. sample, namely TP01 at 0.70m was classified as hazardous due to HP14 (Ecotoxic) based on elevated copper and elevated zinc concentrations.

All other samples have been classified as non-hazardous waste.

As mentioned above, the second stage of the assessment relates to the identification of a suitable receiving landfill facility based in Waste Acceptance Criteria (WAC) testing data. As present, no such data is available and as such a suitable receiving facility cannot be identified. Should materials be designated for off-site disposal as part of the proposed redevelopment of the site, it is recommended that additional testing is undertaken prior to disposal to include WAC testing, particularly in the area surrounding TP01 to allow for a final classification in consultation with the landfill sites and waste disposal contractors.

14.1.2 Materials Management

Any material excavated on site may be classified as waste and it is the responsibility of the holder of a material to form their own view on whether or not it is waste. This includes determining when waste that has been treated in some way can cease to be classed as waste for a particular purpose.

⁴ Environment Agency 2018. Technical Guidance WM3: Guidance on the classification and assessment of waste (Version 1.1).

If site-won material is to be reused on site, or soils other than primary aggregate or aggregates produced under the WRAP Protocol, imported to site, a Materials Management Plan will be required, signed off by a Qualified Person as defined in the 'Development Industry Code of Practice' (CL:AIRE, 2011).

15.0 CONCEPTUAL SITE MODEL AND PRELIMINARY GROUND CONTAMINATION RISK ASSESSMENT

15.1 OVERVIEW

The information presented in the previous sections of this report have been collated and evaluated to establish an initial qualitative risk assessment for the site. A conceptual model of the site has been generated based on information derived from this Phase 1 Geo-environmental Assessment, supplemented by information attained during the Tetra Tech site walkover.

The site has been considered with regard to current UK legislation and guidance, namely Part 2A of the Environmental Protection Act 1990 and the Contaminated Land (England) Regulations 2006, as amended, and in accordance with current UK good practice guidelines (for example BS10175:2011).

In general, ground contamination can occur through several causes, particularly from historical operations and activities. Contamination can result from either on-site sources or from on-site migration from off-site sources, leading to long term liabilities under recent legislation for any site owner.

For a risk of pollution or environmental harm to occur as a result of ground contamination, all of the following elements must be present:

- Source, i.e. a substance that is capable of causing pollution or harm;
- Pathway, i.e. a route by which the contaminant can reach a target; and
- Receptor (target), i.e. something which could be adversely affected by the contaminant.

If one of these elements is absent there can be no significant risk. If all are present then the magnitude of the risk is a function of the magnitude and mobility of the source, the sensitivity of the receptor and the nature of the migration pathway.

15.2 CURRENT SITE USAGE AND PROPOSED DEVELOPMENT

The site is currently used as a hard standing car park within the wider residential area. The proposed development is for the construction of a childcare unit with hard standing car parking. The proposed plan provided to Tetra Tech indicates an area of "External Play Area" in the east of the site, although the ground cover in this area has not been specified.

15.3 CONCEPTUAL SITE MODEL

The key source, pathways and receptor model is outlined below within the context of potential development of the site.

As the proposed development is for the construction of a childcare unit with External Play Area and hard standing car parking, the following risk assessment is undertaken in the context of a residential without plant uptake end use scenario to provide a conservative approach in the first instance, with exceedances also assessed a public open space end use.

15.3.1 Potential Sources of Contamination

The ground investigation has highlighted a significant thickness of Made Ground across the site with the maximum thickness of 2.30m bgl recorded at WS01 and WS02 along the northern boundary of the site. Given the location of the site within a former industrial area, as well as former and current site users there is the significant potential for ground contamination. The main potential sources of contamination in Made Ground on the site are summarised below.

On site Sources

- Heavy metals associated with historic site uses including the former refuse stockpiles from the historic copper works north of the site;
- Hydrocarbons including PAHs associated with the former refuse stockpiles on site, former tramway in the northwest and current site use as a car park;
- Potential for ACM associated with the former tramway in the north of the site and demolition of former buildings
- General contaminants in Made Ground associated with construction of present-day car park (potential cut and fill to level site);
- Localised previously unidentified contaminations.

15.3.2 Potential Contaminant Pathways

The following contaminant pathways are considered to potentially be active based on the current site use and proposed development:

Human Exposure Pathways

- Direct dermal contact or ingestion of soils, or inhalation of dust and/or vapours (i.e. human interaction with surface and sub-surface materials).

Environmental Pathways

- Leaching and horizontal or vertical migration through the unsaturated ground, either through permeable sub-surface materials and/or preferential pathways;
- Lateral and vertical migration of groundwater through permeable sub-surface materials and/ or preferential pathways;
- Leaching to surface water run-off/drainage;
- The migration and accumulation of gases or vapours through permeable sub-surface materials and/ or preferential pathways.

15.3.3 Potential Receptors at Risk

The following potential receptors have been identified:

Human Health

- Current site users (car park users);
- Future site users (childcare unit, including young children);
- Site workers during the redevelopment of the site;

Wider Environment

- Secondary A Aquifer within Alluvium and South Wales Middle Coal Formation;
- Surface waters i.e. River Afan 220m south east;
- Plant uptake; and
- Building Infrastructure and supply pipes.
- Adjacent Properties

15.4 GROUND CONDITIONS RISK ASSESSMENT

The source, pathway, receptor linkages identified in the previous section are outlined and a qualitative risk assessment shown in the following tables.

The risk assessment considers the site within an area context and assesses potential risks to identified receptors in relation to the existing site setting and the proposed development. CIRIA C552 has been used to define the risk rating presented in the Qualitative Risk Assessment matrix, the methodology for which is presented in

Appendix H.

Table 15-1 – CIRIA C552 Qualitative Risk Assessment

This matrix is based on CIRIA C552 risk evaluation methodology, definitions for risk ratings is presented in Appendix D						
Source	Pathway	Receptor	Consequence of risk being realised	Probability of risk being realised	Risk Classification	Potential risk management requirements
Heavy metals associated with the former stockpiles associated with the historic copper works north of the site	Direct dermal contact or ingestion of soils, or inhalation of dust and/or vapours	Current site users	Medium	Unlikely	Low Risk	The site is currently hard standing in its entirety and as such the risk to current site users is considered to be low.
		Future site users		Likely	Moderate Risk	However, the laboratory results have indicated elevated concentrations of Arsenic at levels which are considered to pose a potential risk to future site users. Whilst the development plans indicate much of the site will be covered by either the building footprint or hardstanding, the potential remains for direct contact to contaminated soils to future site users in the area of the external play area. To restrict the exposure pathway it is recommended that either hard standing ground cover is used in this area or installation of a capping layer of clean imported material (minimum 600mm thickness) should the area be designated for soft landscaping and/or grass cover.
		Construction Workers		Low Likelihood	Moderate/ Low Risk	Risks to construction works should be managed through appropriate Health and Safety procedures including use of appropriate PPE /

						RPE and adoption of good hygiene practices on site.
	Leaching and lateral/vertical migration of mobile contaminants	Groundwater (Secondary A Aquifer)	Medium	Low likelihood	Moderate/ Low Risk	The results of the laboratory analysis has indicated marginally elevated copper in the soil derived leachate samples. Given the marginal nature of the exceedances and the conservative method of the leachate testing, this is not considered to pose a significant risk to the wider water environment. This is further mitigated due to the distance to the nearest surface water body.
		Surface water (River Afan)		Unlikely	Low Risk	
Hydrocarbon (including PAHs) associated with former refuse stockpiles, former tramway in the NW and current use of the site as a car park.	Direct dermal contact or ingestion of soils, or inhalation of dust and/or vapours	Current site users	Medium	Unlikely	Low Risk	The results of the laboratory testing has indicated low concentrations of TPH below their respective GACs for both a residential without plant uptake and public open space near residential developments. The results also show relatively low concentrations of PAHs which marginally exceed the GACs for a residential without plant uptake. On this basis, the potential risk to human health is considered to be low.
		Future site users		Unlikely	Low Risk	
		Construction Workers		Unlikely	Low Risk	

	Leaching and lateral/vertical migration of mobile contaminants	Groundwater (Secondary A Aquifer)	Medium	Low likelihood	Moderate / Low	The results of the soil derived leachate testing indicates concentration of TPH below the LOD. However, the results show marginal exceedances against the TSVs for a small number of PAH compounds.
		Surface water (River Afan)		Unlikely	Low Risk	
ACM associated with the former tramway in the north of the site and demolition of former buildings on site	Direct dermal contact or ingestion of soils, or inhalation of dust and/or vapours	Current site users	Medium	Unlikely	Low Risk	The results of the laboratory testing has not indicated the presence of ACM in the samples tested. However, based on the former land uses on the site the potential for ACM cannot be discounted. It is recommended that a reactive approach is undertaken during development works to identify suitable procedures should ACM be encountered.
		Future site users		Low Likelihood	Moderate/ Low Risk	
		Construction Workers		Low Likelihood	Moderate/ Low Risk	
General contaminants in Made Ground associated cut and fill activities	Direct dermal contact or ingestion of soils, or inhalation of	Current site users	Medium	Unlikely	Low Risk	The results of the laboratory testing has indicated relatively low contaminants concentrations and as such there is not considered to be significant degree of contamination.

for construction of present-day car park	dust and/or vapours	Future site users		Unlikely	Low Risk	On this basis, the risk to human health is considered to be low. As above, risks to construction works should be managed through appropriate Health and Safety procedures including use of appropriate PPE / RPE and adoption of good hygiene practices on site.
		Construction Workers		Low Likelihood	Moderate/ Low Risk	
	Leaching and lateral/vertical migration of mobile contaminants	Groundwater (Secondary A Aquifer)	Medium	Low likelihood	Low Risk	The results of the soil derive leachate laboratory testing has indicated relatively low contaminants concentrations and as such there is not considered to be significant degree of contamination. On this basis, the risk the wider water environment is considered to be low.
		Surface water (River Afan)		Unlikely	Low Risk	
Localised previously unidentified ground contamination	Direct dermal contact or ingestion of soils, or inhalation of dust and/or vapours	Current site users	Medium	Unlikely	Low Risk	Based on the former industrial land uses on site, the potential for contamination not previously encountered during the GI cannot be discounted. On this basis, a reactive approach is recommended during the development phase of the GI to identify and manage localised area of contamination.
		Future site users		Low Likelihood	Moderate/ Low Risk	

		Construction Workers		Low Likelihood	Moderate/ Low Risk	
	Leaching and lateral/vertical migration of mobile contaminants	Groundwater (Secondary A Aquifer)	Medium	Low Likelihood	Moderate/ Low Risk	Based on the former industrial land uses on site, the potential for contamination not previously encountered during the GI cannot be discounted. However, based on the depth to the groundwater noted during monitoring and the presence of low permeability clay/silts, the potential risk to groundwater is considered to be moderate/low. Based on the distance of over 200m to the River Afan the risk to surface waters is considered to be low.
		Surface water (River Afan)		Unlikely	Low Risk	

16.0 CONCLUSIONS AND RECOMMENDATIONS

16.1 GROUND CONTAMINATION

16.1.1 Summary

The ground investigation found ground conditions to comprise a significant thickness of Made Ground, up to 2.30m depth in WS01 and WS02 in the north of the site overlying superficial deposits of alluvium ranging from sand to clay/silts. The South Wales Middle Coal Measure Formation was encountered in both of the deeper boreholes (BH01 and BH02) from a minimum depth of 10.50m bgl. During the investigation coal was encountered at 28.30-2.900m bgl in BH01 and 18.80-19.50m bgl in BH02.

The results of the laboratory testing indicated that based on the current site use as a hard standing car park, the risk to current site users from contaminants in Made Ground is low. In addition, the risk to future site users of the proposed childcare unit is considered to be generally moderate/low from contaminants in Made Ground associated with former and current site use. However, a moderate risk has been identified with respect to elevated Arsenic in the east of the site, in the area of the proposed External Play Area. Should this area be designated for grass cover or soft landscaping there is the potential for direct contact with contaminated soils and as such it is recommended that a clean capping layer of a minimum of 600mm thickness is installed.

The results have also indicated a generally moderate/low risk to construction workers during the development phase of works. As specified in the table above, these risks can be managed through appropriate health and safety measures including the use of suitable PPE and good hygiene practices on site.

During the monitoring rounds following the ground investigation, groundwater was encountered during the first round in BH02 at a depth of 3.40m bgl. During this round groundwater was purged from the borehole in order to develop the well to allow for future sampling. However, during both of the subsequent monitoring rounds BH02 was inaccessible due to the presence of parked cars. As such, no groundwater samples have been obtained for the site. Based on the significant thickness of Made Ground identified across the site associated with various historical land uses the potential for an impact to underlying groundwater cannot be discounted. However, based on the relatively low contaminant concentrations indicated in the soil derived leachate testing results, presence of low permeability clay/silts across the site and depth to groundwater (c.3m bgl) the potential risk has been classified as moderate/low. It is recommended that a round of groundwater sampling is undertaken prior to development to confirm the impact to groundwater, particularly with respect to heavy metals.

It should be noted that the conclusions and assessment conducted above is based on observations and data gathered throughout the course of the ground investigation. However, given the extensive industrial historical use of the site and noted of presence of Made Ground across the site, a moderate/low risk has been identified associated with potential localised contamination in Made Ground not previously identified during the GI. A reactive strategy should be prepared for the development phase of works to identify any such contamination.

16.1.2 Asbestos

The results of the laboratory testing did not identify asbestos containing materials in the samples obtained during the ground investigation.

16.1.3 Ground Gas

The site has been classified as Characteristic Situation 2 (Low Risk) based on the worst-case recorded concentrations of carbon dioxide and methane and maximum flow rates. Site classification of a Characteristic Situation 2 indicates that basic gas protection measures may be required for future developments on the site. Any protection measures should be designed in line with the requirements of BS8485:2015+A1:2019.

16.1.4 Waste

An initial waste assessment has been undertaken on the five samples obtained during the ground investigation. The results indicated that the majority of samples have been classified as non-hazardous. However, one sample obtained from the north east of the site has been classified as hazardous due to elevated heavy metal concentrations. This assessment is intended to provide an indicative assessment only. If materials are designated for off-site disposal during the development phase it is recommended that additional testing of the materials/area requiring disposal is undertaken to include WAC testing to identify a suitable receiving landfill facility.

16.2 GEOTECHNICAL

Traditional shallow foundations (pad or strip) placed at least 1.20m bgl with natural Alluvium deposits may be designed to an allowable net bearing capacity of 120kPa which will result in settlement of no more than 25mm for foundations of no more than 0.50m wide. Given the thickness of made ground across the site, foundations excavations will likely need to be extended to depths of 1.6 to 2.8 m bgl. Foundations excavations through the made ground are likely to be unstable and require shoring..

Given the presence of a significant thickness of variable made ground across the site, the use of suspended floor slabs is recommended.

For buried concrete the Design Sulphate Class for the site can be taken as DS-1 and the Aggressive Chemical Environment for Concrete (ACEC) site classification can be taken as AC-1.

Dewatering of temporary excavations may not be required but should be anticipated during winter months.

A conservative CBR value of 5% is recommended for preliminary pavement design.

16.3 SOIL INFILTRATION TESTING

Soil infiltration testing was undertaken in 2no. locations on site, within shallow fine-grained alluvial deposits. The testing in the northeast of the site indicated that the water level did not fall to the 25% effective depth over the testing period (one day). The testing from the southeast of the site was successful over 2 fills and yielded soil infiltration values between 6.64×10^{-5} m/s and 7.86×10^{-5} m/s.

16.4 RECOMMENDATIONS

Based on the findings of the ground investigation, the following recommendations are outlined:

- Given the thicker made ground in the northern site area and the exclusion zone required around the historic mineshaft, switching the development around with the car park in the north and childcare unit in the south will potentially be a better option from a geotechnical perspective.
- A groundwater sample should be obtained from BH02 to assess the impact to groundwater from the overlying Made Ground;
- In the event that soft landscaping/ grass cover is proposed on the site (particularly in the external play area) the area will require capping with a minimum thickness of 600mm of clean, imported capping material to provide a suitable barrier between the identified contamination and potential site users;
- A Reactive Strategy should be developed for the site to outline the requirements for identification, assessment and management of any areas of previously unidentified contamination encountered during the development phase;
- Movement of materials on the site should be undertaken in conjunction with a Materials Management Plan in line with the recommendations in the CL:AIRE Code of Practice to confirm any materials utilised on site are geotechnically and chemically suitable for re-use and to ensure all materials leaving site are disposed of at a suitable waste disposal facility;

- It remains the responsibility of the contractor as waste producer to classify any waste materials and identify a suitable off site disposal facility.

17.0 NOTES

1. Standards

All boring operations, sampling of soils, *in situ* testing and geotechnical laboratory testing have been carried out in accordance with the recommendations of the British Standards BS 5930(2015)⁽¹⁾, BS 1377 (1990)⁽²⁾ and BS10175 (2001)⁽³⁾.

Soil and rock descriptions follow the recommendations of BS 593. Where descriptions or classifications are based on other documents (e.g. BS 8004 (1986) or CIRIA Project Report 11 (1993)), this is stated in the report text.

2. Site methods

Unless specifically stated otherwise, the following methods are used for exploratory holes.

- Holes described as cable percussive are bored using a light cable percussive rig. Standard penetration tests are carried out where appropriate, as shown in the logs. Disturbed and undisturbed samples are taken from the exploratory holes at the depths on the records.
- Window sampling generally uses the windowless sampling method, using a tracked Geotool.
- Dynamic probes are usually heavy dynamic probes, using the same tracked Geotool used for window sampling.

3. Definitions and abbreviations

The following terms are used in the exploratory hole logs

Samples

U	Undisturbed 102mm dia. sample
TW	Thin Walled undisturbed 102mm dia. sample
B	Bulk sample
D	Small disturbed sample
W	Water sample
CBR	California Bearing Ratio test or CBR value obtained from Mexiprobe test

In situ tests

S	Standard penetration test (SPT)
N	SPT N value (blows/300mm)
HP	Hand penetrometer – shear strength
SV	Hand shear vane – shear strength
VOC	Volatile organic compounds (ppm)
PID	Photo-ionisation detector – used to detect the presence of VOCs.

Core recovery and rock quality

TCR	Total core recovery (%)
SCR	Solid core recovery (%)
RQD	Rock quality designation (%)
FI	Fracture index
NR	No recovery
NI	Not intact

Rotary drilling sizes

Index letter	Nominal diameter (mm)	
	Borehole	Core
N	75	54
H	99	76
P	120	92
S	146	113

Water strikes

▽	Level of water strike
▼	Water level rose to this level (see Remarks at foot of log for details)

Depth means depth below existing ground level unless otherwise specified. Values specified in soil descriptions given in the exploratory hole logs are depths unless otherwise specified.

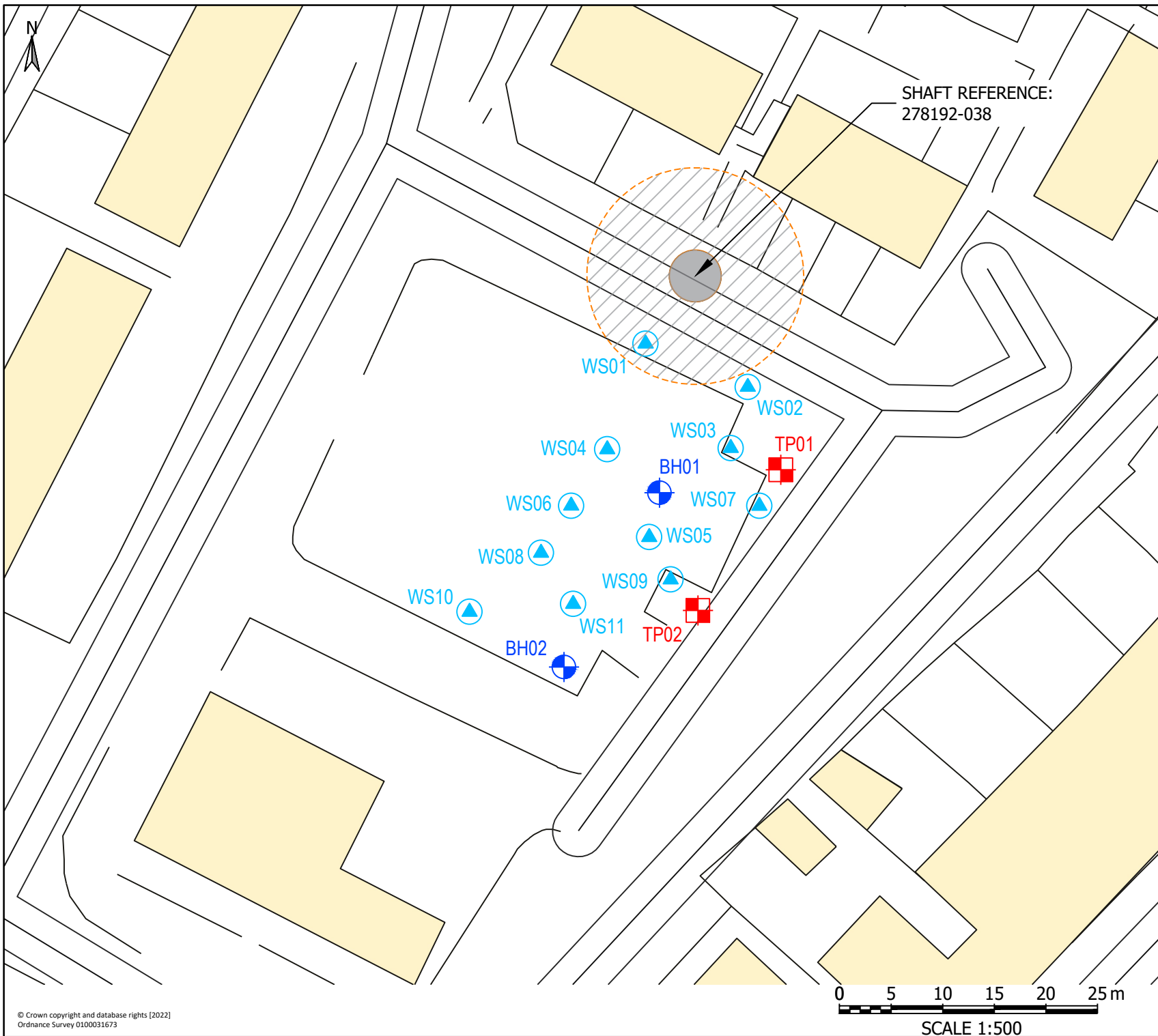
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FIGURES

Figure 1- Site Location Plan

Figure 2 – Site Investigation Layout Plan



LEGEND:

-  TRIAL PIT
-  BOREHOLE
-  WINDOW SAMPLE
-  MINE SHAFT
-  10.5m BUFFER ZONE
AROUND SHAFT

[illegible]

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	Client

NEATH PORT TALBOT COUNCIL

Project Name

CWMAYON

	Sheet Title
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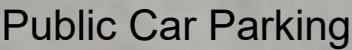
SITE INVESTIGATION LAYOUT PLAN

TTE Project Number	Drawn By	Date	Checked By	Date	Approved By	Date	Scale @ A4	Suitability
784-B035234	PP	27.06.22	-	27.06.22	-	27.06.22	As Shown	S0
Client Project Number	Originator	Volume/System	Level/Location	Type/Code	Role	Number	Revision	
B035234	- TTE	- 00	- XX	- DR	- U	- 0002	P01	

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TTE_MT_v1

Figure 3 – Proposed Site Development Plan



External Play Area

Staff Car Parking

Bin store

Rev	Details	Dr	Ch	Apr	Date
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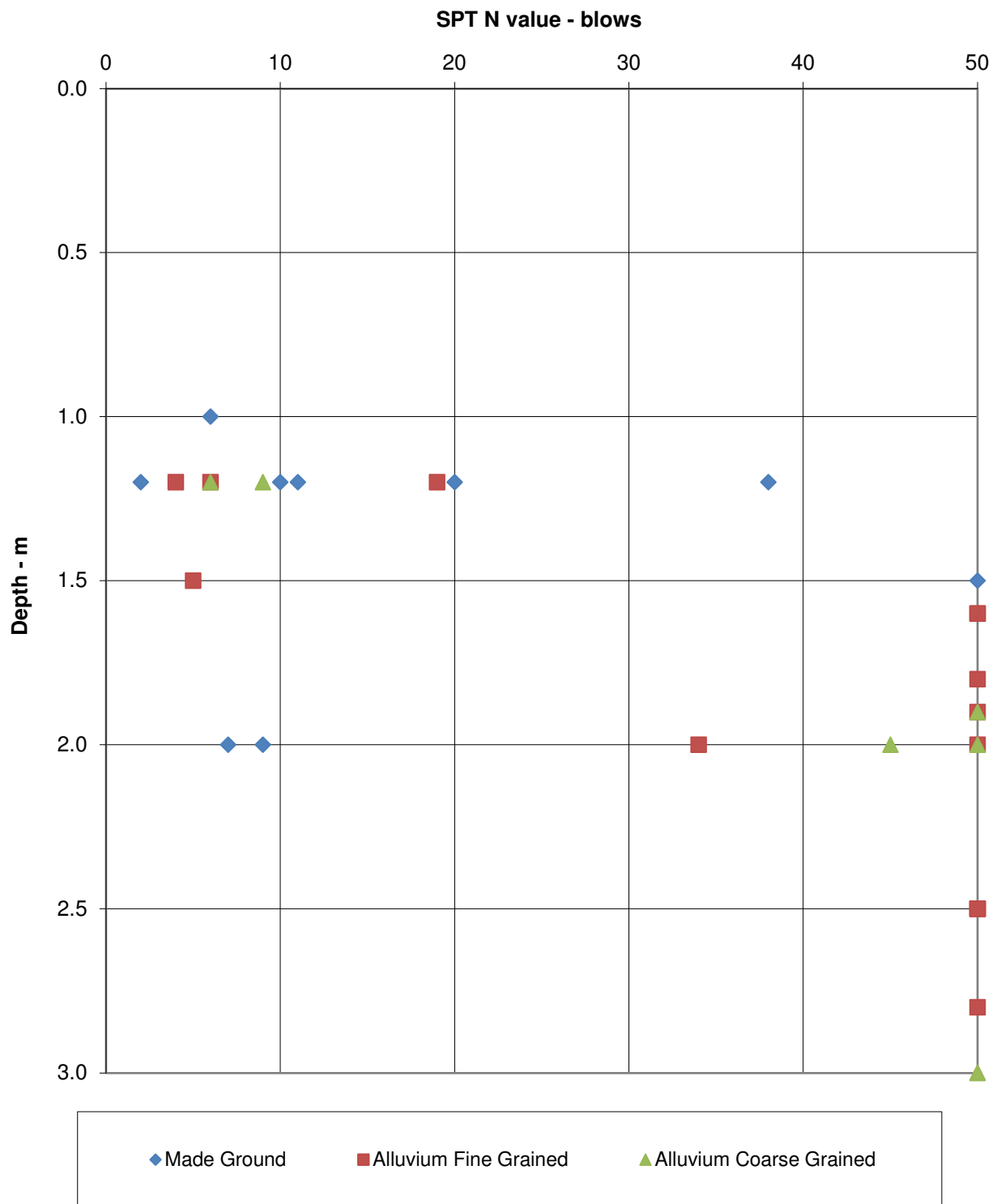
Project

Childcare Grants

Drawing Title

File No.		Property Ref. No.		
<u>Drawing</u>		<u>Checked</u>	<u>Approved</u>	
<u>Date</u>		<u>Date</u>	<u>Date</u>	May'19
<u>Scales</u>	As Shown			
<u>Drawing No.</u> A1				<u>Rev.</u>

Figure 4 – SPT N value plot against depth.



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Drawing Title

**SPT vs Depth Plot
BH1 & BH2**

Drawing No.

FIGURE 4

PLATES



Plate 1

WS01 inspection pit following excavation to 1.20m bgl.



Plate 2

WS01 inspection pit arisings

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Plate 3

WS01 sample recovery with refusal at 2.50m bgl.



Plate 4

WS02 inspection pit following excavation to 1.20m bgl.

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Plate 5

WS02 inspection pit arisings



Plate 6

WS02 sample recovery with refusal at 2.50m bgl.

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Plate 7

WS03 inspection pit following excavation to 1.20m bgl.



Plate 8

WS03 inspection pit arisings

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Plate 9

WS03 sample recovery



Plate 10

WS04 inspection pit following excavation to 1.20m bgl.

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Plate 11

WS04 inspection pit arisings



Plate 12

WS04 sample recovery from 1.20-1.90m bgl.

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Plate 13 WS05 inspection pit following excavation to 1.20m bgl.



Plate 14 WS05 inspection pit arisings

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Plate 15

WS05 sample recovery from 1.20-2.00m bgl.



Plate 16

WS06 inspection pit following excavation to 1.20m bgl.

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Plate 17

WS06 inspection pit arisings



Plate 18

WS06 sample recovery

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Plate 19

WS07 inspection pit following excavation to 1.20m bgl.



Plate 20

WS07 inspection pit arising

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Plate 21

WS07 sample recovery from 1.20-1.80m bgl.



Plate 22

WS08 inspection pit following excavation to 1.20m bgl.

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Plate 23

WS08 inspection pit arisings



Plate 24

WS08 sample recovery

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Plate 25

WS09 inspection pit and arisings following excavation to 1.20m bgl.



Plate 26

WS09 inspection pit arisings

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Plate 27

WS10 sample recovery from 1.20-2.00m bgl



Plate 28

WS10 inspection pit and arisings following excavation to 1.20m bgl.

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Plate 29

WS10 inspection pit arisings



Plate 30

WS10 sample recovery from 1.20-1.80m bgl.

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Plate 31

WS11 inspection pit following excavation to 1.20m bgl.



Plate 32

WS11 inspection pit arisings

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Plate 33

WS11 sample recovery



Plate 34

TP01 following excavation to 2.0m bgl.

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Plate 35

TP01 arisings following excavation



Plate 36

TP01 arisings following excavation

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Plate 37

TP02 following excavation to 2.10m bgl.



Plate 38

TP02 following excavation to 2.10m bgl.

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Plate 39

TP02 arisings following excavation



Plate 40

TP02 arisings following excavation

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Plate 41

BH01 inspection pit following excavation to 1.00m bgl.



Plate 42

BH01 inspection pit arisings

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Plate 43

BH01 sample recovery from 1.50-3.00m bgl.



Plate 44

BH01 sample recovery from 9.00-10.50m bgl. Poor recovery from dynamic sampling

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Plate 45

BH02 inspection pit following excavation to 1.20m bgl



Plate 46

BH02 arisings following excavation

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Plate 47

BH02 sample recovery from 1.50-3.00m bgl.



Plate 48

Sample recovery from BH02. Poor recovery from dynamic sampling runs

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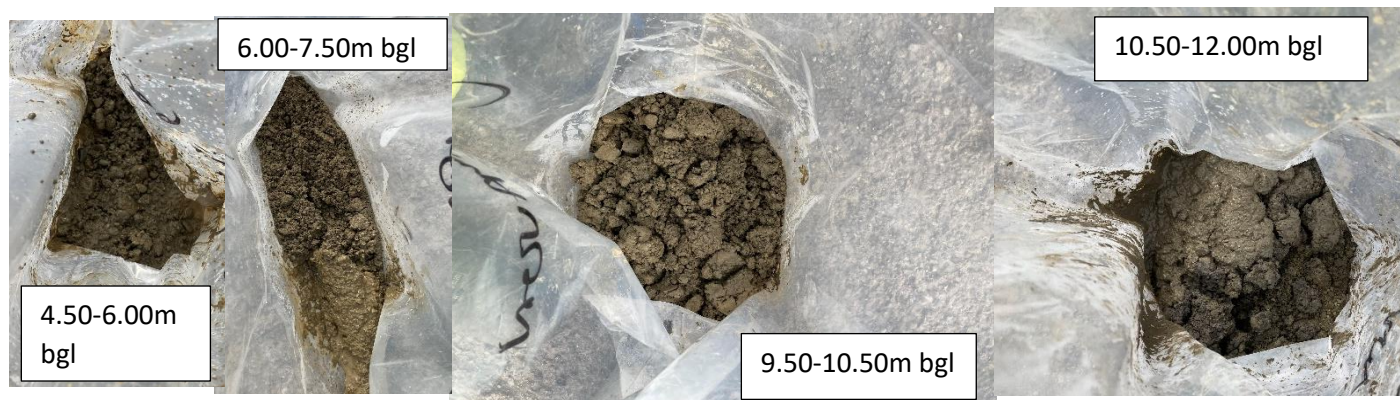


Plate 49

Sample recovery from BH02. Poor recovery from dynamic sampling runs

Plate 50

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APPENDICES

APPENDIX A – REPORT CONDITIONS

APPENDIX A - REPORT CONDITIONS

GROUND INVESTIGATION

This report is produced solely for the benefit of Neath Port Talbot County Borough Council and no liability is accepted for any reliance placed on it by any other party unless specifically agreed in writing otherwise.

This report refers, within the limitations stated, to the condition of the site at the time of the inspections. No warranty is given as to the possibility of future changes in the condition of the site.

This report is based on a visual site inspection, reference to accessible referenced historical records, information supplied by those parties referenced in the text and preliminary discussions with local and Statutory Authorities. Some of the opinions are based on unconfirmed data and information and are presented as the best that can be obtained without further extensive research. Where ground contamination is suspected but no physical site test results are available to confirm this, the report must be regarded as initial advice only, and further assessment should be undertaken prior to activities related to the site. Where test results undertaken by others have been made available these can only be regarded as a limited sample. The possibility of the presence of contaminants, perhaps in higher concentrations, elsewhere on the site cannot be discounted.

Whilst confident in the findings detailed within this report because there are no exact UK definitions of these matters, being subject to risk analysis, we are unable to give categoric assurances that they will be accepted by Authorities or Funds etc. without question as such bodies often have unpublished, more stringent objectives. This report is prepared for the proposed uses stated in the report and should not be used in a different context without reference to Tetra Tech. In time improved practices or amended legislation may necessitate a re-assessment.

The assessment of ground conditions within this report is based upon the findings of the study undertaken. We have interpreted the ground conditions in between locations on the assumption that conditions do not vary significantly. However, no investigation can inspect each and every part of the site and therefore changes or variances in the physical and chemical site conditions as described in this report cannot be discounted.

The report is limited to those aspects of land contamination specifically reported on and is necessarily restricted and no liability is accepted for any other aspect especially concerning gradual or sudden pollution incidents. The opinions expressed cannot be absolute due to the limitations of time and resources imposed by the agreed brief and the possibility of unrecorded previous use and abuse of the site and adjacent sites. The report concentrates on the site as defined in the report and provides an opinion on surrounding sites. If migrating pollution or contamination (past or present) exists further extensive research will be required before the effects can be better determined.

APPENDIX B – EXPLORATORY HOLE LOGS

Tt TETRA TECH Project: Cwmavon Location: Cwmavon Client: Neath Port Talbot Council						Location Details						Status DRAFT		Borehole Number BH01			
						Easting: 278519.54 Northing: 192484.01 Level: 41.74mAOD Depth: 30.00m Logger: J Craddock Type: WS+RO Inclination: °											
						Method, Plant and Crew						Diameter		Casing		Groundwater	
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks	Checked By: NEB	Approved By: CBP	
0.00 1.20 10.50	1.20 10.50 30.00	Inspection Pit Dynamic Windowless Sampling Rotary Open Hole	Klemm Klemm Klemm	Apex Drilling Apex Drilling Apex Drilling			10.50	152	7.00	-	-	7.00	60		Start Date: 16/05/2022	Finish Date: 17/05/2022	
Strata Description							Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing					
												Depth (m)	Ref	Tests / Results			
Black macadam tarmac MADE GROUND Grey sandy GRAVEL. Sands are fine to medium. Gravels are fine to medium subangular of road subbase and ballast. MADE GROUND Very dense black sandy cobbly GRAVEL. Sands are fine to medium. Gravels are fine to coarse of subangular, blocky sandstone, mudstone, limestone, slag and mine waste. MADE GROUND								0.10	41.64								
								0.30	41.44								
												0.70	ES1	SPT(C) 1.50m, N=50 (6,9/50 for 296mm)			
Very dense orangish brown silty sandy cobbly GRAVEL. Sands are fine to medium. Gravels are fine to medium of subangular to subrounded of spherical and tabular sandstone. Horizon has rare cobbles of the same. ALLUVIUM - COARSE								1.90	39.84			1.90 - 3.00	B1	SPT(C) 3.00m, N=50 (25 for 130mm/50 for 22mm)			
Very dense greyish brown silty sandy GRAVEL. Sands are fine to coarse. Gravels are fine to coarse of subangular to subrounded tabular and spherical sandstone. ALLUVIUM - COARSE								3.00	38.74								

 Project: Cwmavon Location: Cwmavon Client: Neath Port Talbot Council										Location Details Easting: 278519.54 Northing: 192484.01 Level: 41.74mAOD Depth: 30.00m Logger: J Craddock Type: WS+RO Inclination: °						Status DRAFT		Borehole Number BH01	
										Sheet 2 of 3									
Method, Plant and Crew						Diameter		Casing		Groundwater						Scale: 1:50			
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks	Checked By: NEB				
0.00 1.20 10.50	1.20 10.50 30.00	Inspection Pit Dynamic Windowless Sampling Rotary Open Hole	Klemm Klemm Klemm	Apex Drilling Apex Drilling Apex Drilling			10.50	152	7.00	-	-	7.00	60		Approved By: CBP				
Strata Description							Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing							
												Depth (m)	Ref	Tests / Results					
Very dense greyish brown silty sandy GRAVEL. Sands are fine to coarse. Gravels are fine to coarse of subangular to subrounded tabular and spherical sandstone. ALLUVIUM - COARSE								10.50	31.24					SPT(C) 10.50m, N=50 (25 for 71mm/50 for 41mm) SPT(C) 10.50m, N=50 (25 for 71mm/50 for 41mm)					
Arisings described as grey silty sandy GRAVEL. Sands are fine to medium. Gravels are fine to coarse of subangular tabular siltstone. Description based on open hole drilling methods. BEDROCK - SOUTH WALES MIDDLE COAL FORMATION																			
																11			
																12			
																13			
																14			
																15			
																16			
																17			
																18			
																19			
																20			
Observations / Remarks										Sampling Runs				Hammer Information					
ES = Environmental Sample B = Bulk Disturbed Sample C = Cone Penetration Test (SPT) D = Disturbed Sample										From (m)	To (m)	Diam (mm)	Recovery %	Remarks	Serial No.	Energy Ratio %			
															Klemm				
																Project Number			
						784-B035234													

 Project: Cwmavon Location: Cwmavon Client: Neath Port Talbot Council						Location Details Easting: 278510.29 Northing: 192467.11 Level: 41.27mAOD Depth: 30.00m Logger: J Craddock Type: WS+RO Inclination: °						Status DRAFT		Borehole Number BH02																																									
								Sheet 1 of 3																																															
Method, Plant and Crew <table><tr><td>From (m)</td><td>To (m)</td><td>Type</td><td>Plant Used</td><td>Crew</td></tr><tr><td>0.00 1.20 10.50</td><td>1.20 10.50 30.00</td><td>Inspection Pit Dynamic Windowless Sampling Rotary Open Hole</td><td>Klemm Klemm Klemm</td><td>Apex Drilling Apex Drilling Apex Drilling</td></tr></table>						From (m)	To (m)	Type	Plant Used	Crew	0.00 1.20 10.50	1.20 10.50 30.00	Inspection Pit Dynamic Windowless Sampling Rotary Open Hole	Klemm Klemm Klemm	Apex Drilling Apex Drilling Apex Drilling	Diameter <table><tr><td>Depth (m)</td><td>Diam (mm)</td></tr><tr><td></td><td></td></tr></table>		Depth (m)	Diam (mm)			Casing <table><tr><td>Depth(m)</td><td>Diam (mm)</td><td>Strike (m)</td><td>Casing (m)</td><td>Sealed (m)</td><td>Rose To (m)</td><td>Time (mins)</td><td>Remarks</td></tr><tr><td>10.50</td><td>152</td><td>6.40</td><td>-</td><td>-</td><td>6.40</td><td>60</td><td></td></tr></table>		Depth(m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks	10.50	152	6.40	-	-	6.40	60		Groundwater <table><tr><td>Scale:</td><td>1:50</td></tr><tr><td>Checked By:</td><td>NEB</td></tr><tr><td>Approved By:</td><td>CBP</td></tr><tr><td>Start Date:</td><td>17/05/2022</td></tr><tr><td>Finish Date:</td><td>18/05/2022</td></tr></table>						Scale:	1:50	Checked By:	NEB	Approved By:	CBP	Start Date:	17/05/2022	Finish Date:	18/05/2022
From (m)	To (m)	Type	Plant Used	Crew																																																			
0.00 1.20 10.50	1.20 10.50 30.00	Inspection Pit Dynamic Windowless Sampling Rotary Open Hole	Klemm Klemm Klemm	Apex Drilling Apex Drilling Apex Drilling																																																			
Depth (m)	Diam (mm)																																																						
Depth(m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks																																																
10.50	152	6.40	-	-	6.40	60																																																	
Scale:	1:50																																																						
Checked By:	NEB																																																						
Approved By:	CBP																																																						
Start Date:	17/05/2022																																																						
Finish Date:	18/05/2022																																																						
Strata Description						Legend		Depth (m)		Reduced Level (mAOD)		Water Level (m)		Inst / Backfill		Samples and Testing <table><tr><td>Depth (m)</td><td>Ref</td><td>Tests / Results</td></tr><tr><td></td><td></td><td></td></tr></table>				Depth (m)	Ref	Tests / Results																																	
Depth (m)	Ref	Tests / Results																																																					
Black macadam tarmac MADE GROUND								0.10		41.17																																													
Grey sandy GRAVEL. Sands are fine to medium. Gravels are fine to medium subangular of road subbase and ballast. MADE GROUND								0.30		40.97																																													
Blackish brown, becoming reddish brown with depth, slightly ashy silty sandy GRAVEL. Sands are fine to medium. Gravels are fine to coarse of tabular fissile coal gravels. MADE GROUND																0.60 ES1																																							
Firm greyish brown with frequent orangish brown mottling gravelly CLAY. Gravels are fine to medium of tabular fissile siltstone with occasional in-situ coal gravels. ALLUVIUM - FINE								1.50		39.77						1.50 - 2.40 B1 SPT(C) 1.50m, N=5 (1,0/1,1,1,2)																																							
																2.00 ES2																																							
Very dense grey silty sandy GRAVEL. Sands are fine to coarse. Gravels are fine to coarse, subangular to subrounded sandstone with occasional subrounded cobbles of the same. ALLUVIUM - COARSE								2.40		38.87																																													
																																																							
																																																							
																																																							
																																																							
																																																							
																																																							
																																																							
																																																							
																																																							
																																																							
																																																							
																																																							
																																																							
																																																							
																																																							
																																																							
																																																							
																																																							
																																																							
																																																							
																																																							
																																																							
																																																							
																																																							
																																																							

Tt TETRA TECH Project: Cwmavon Location: Cwmavon Client: Neath Port Talbot Council						Location Details						Status		Borehole Number				
						Easting: 278510.29 Northing: 192467.11 Level: 41.27mAOD Depth: 30.00m Logger: J Craddock Type: WS+RO Inclination: °						DRAFT		BH02				
														Sheet 2 of 3				
Method, Plant and Crew					Diameter		Casing		Groundwater									
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks	Scale:	1:50		
0.00 1.20 10.50	1.20 10.50 30.00	Inspection Pit Dynamic Windowless Sampling Rotary Open Hole	Klemm Klemm Klemm	Apex Drilling Apex Drilling Apex Drilling			10.50	152	6.40	-	-	6.40	60		Checked By:	NEB		
																Approved By:	CBP	
																Start Date:	17/05/2022	
																Finish Date:	18/05/2022	
Strata Description							Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing						
												Depth (m)	Ref	Tests / Results				
Very dense grey silty sandy GRAVEL. Sands are fine to coarse. Gravels are fine to coarse, subangular to subrounded sandstone with occasional subrounded cobbles of the same. ALLUVIUM - COARSE								10.50				10.50 - 12.00	B3	SPT(C) 10.50m, N=50 (25 for 27mm/50 for 15mm) SPT(C) 10.50m, N=50 (25 for 27mm/50 for 15mm)				
Arisings described as grey silty sandy GRAVEL. Sands are fine to medium. Gravels are fine to coarse of subangular tabular siltstone. Description based on open hole drilling methods. BEDROCK - SOUTH WALES MIDDLE COAL FORMATION								12.00	29.27					SPT(C) 12.00m, N=50 (25 for 27mm/50 for 26mm)				
Coal seam (Lower 9ft Top Leaf)								18.80	22.47									
Arisings described as grey silty sandy GRAVEL. Sands are fine to medium. Gravels are fine to coarse of subangular tabular siltstone. Description based on open hole drilling methods. BEDROCK - SOUTH WALES MIDDLE COAL FORMATION								19.50	21.77									
Observations / Remarks												Sampling Runs			Hammer Information			
ES = Environmental Sample B = Bulk Disturbed Sample C = Cone Penetration Test (SPT) D = Disturbed Sample												From (m)	To (m)	Diam (mm)	Recovery %	Remarks	Serial No.	Energy Ratio %
												10.50	11.50	117	55		Klemm	
																		Project Number
												784-B035234						

[illegible]

[illegible]

[illegible]

Tt TETRA TECH Project: Cwmavon Location: Cwmavon Client: Neath Port Talbot Council						Location Details						Status		Borehole Number				
						Easting: 278526.43 Northing: 192488.33 Level: 41.92mAOD Depth: 2.50m Logger: J Craddock Type: WS Inclination: °						DRAFT		WS03				
																Sheet 1 of 1		
Method, Plant and Crew					Diameter		Casing		Groundwater							Scale: 1:25		
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks	Checked By: NEB			
0.00 1.20	1.20 2.50	Inspection Pit Dynamic Windowless Sampling	Dart 346 Dart 346	South Wales Ground Testing South Wales Ground Testing											Approved By: CBP			
															Start Date: 16/05/2022			
															Finish Date: 16/05/2022			
Strata Description						Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing							
											Depth (m)	Ref	Tests / Results					
Grass turf over, brown silty sandy GRAVEL. Sands are fine to medium. Gravels are fine to coarse of subangular to subrounded siltstone and sandstone. TOPSOIL							0.20	41.72				0.10	ES1	HV 0.18m, (p)=32 kPa (r)= kPa				
Blackish brown silty sandy cobbly GRAVEL. Sands are fine to medium. Gravels are fine to medium of subangular to subrounded sandstone with anthropogenic materials of porcelain tile and glass. MADE GROUND												0.20 - 0.50	B1					
Yellowish brown slightly clayey silty sandy GRAVEL. Sands are fine to medium. Gravels are fine to coarse subangular to subrounded of sandstone with occasional subrounded cobbles of the same. ALLUVIUM - GRANULAR												0.35	ES2					
Very stiff becoming hard brownish grey, becoming orangish brown with depth, sandy SILT. Sands are fine to medium. ALLUVIUM - COHESIVE							0.50	41.42				0.50 - 1.20	B2	HV 0.50m, (p)=28 kPa (r)= kPa				
												1.20 - 2.30	B3					
												1.50	ES3					
							1.20	40.72						HV 1.70m, (p)=30 kPa (r)= kPa HV 1.90m, (p)=24 kPa (r)= kPa SPT(C) 2.00m, N=34 (2,1/1,7,15,11)				
EOH at 2.50m -							2.50	39.42						SPT(C) 2.50m, N=50 (12,13/50 for 155mm)				
Observations / Remarks												Sampling Runs				Hammer Information		
ES = Environmental Sample B = Bulk Disturbed Sample C = Cone Penetration Test (SPT) D = Disturbed Sample No groundwater strike encountered												From (m)	To (m)	Diam (mm)	Recovery %	Remarks	Serial No.	Energy Ratio %
												1.20 2.00	2.00 2.50	117 87	80 70		Dart 346	68
																		Project Number
												784-B035234						

 Project: Cwmavon Location: Cwmavon Client: Neath Port Talbot Council						Location Details Easting: 278520.62 Northing: 192475.59 Level: 41.60mAOD Depth: 1.60m Logger: J Craddock Type: WS Inclination: °						Status DRAFT		Borehole Number WS08		
								Sheet 1 of 1								
Method, Plant and Crew					Diameter		Casing		Groundwater						Scale: 1:25	
From (m) 0.00 1.00	To (m) 1.00 1.60	Type Inspection Pit Dynamic Windowless Sampling	Plant Used Dart 346 Dart 346	Crew South Wales Ground Testing South Wales Ground Testing	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks		Checked By: NEB
																Approved By: CBP
																Start Date: 16/05/2022
																Finish Date: 16/05/2022
Strata Description							Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing				
												Depth (m)	Ref	Tests / Results		
Grass turf over, becoming loose from 1.20m bgl, blackish brown silty sandy cobbly GRAVEL. Sands are fine to medium. Gravel is fine to coarse of tabular subangular sandstone and mudstone with frequent anthropogenic material of reworked concrete, smashed glass in-situ at 0.20m bgl, with a thin layer of concrete and bricks at 0.50m bgl. MADE GROUND												0.25 - 1.20	B1			
												0.50	ES1			
														SPT(C) 1.00m, N=6 (5,2/2,2,1,1)		1
Hard yellowish brown slightly sandy gravelly CLAY/SILT. Sands are fine to medium. Gravels are fine to medium of subangular to subrounded sandstone with occasional wooded plant detritus throughout stratum. ALLUVIUM - COHESIVE								1.30	40.30			1.40	D1			
EOH at 1.60m -								1.60	40.00					SPT(C) 1.60m, N=60 (20,18/60 for 230mm)		
																2
																3
																4
																5
Observations / Remarks ES = Environmental Sample B = Bulk Disturbed Sample C = Cone Penetration Test (SPT) D = Disturbed Sample No groundwater strike encountered											Sampling Runs				Hammer Information	
						From (m) 1.20	To (m) 1.60	Diam (mm) 102	Recovery % 60	Remarks		Serial No. Dart 346	Energy Ratio % 68			
												Project Number 784-B035234				

Tetra Tech	Project: Cwmavon		Location Details Easting: 278531.28 Northing: 192486.20 Level: 42.13mAOD Depth: 2.00m Logger: J Craddock Type: TP Ordnance Survey Great Britain National Grid				Status DRAFT		Pit Number TP01 Sheet 1 of 1	
	Hole Information		Groundwater				Scale: 1:25			
	Pit Dimensions	Orientation: ° Shoring: Stability: Poor to Moderate Plant: JCB 3X	Strike (m)	Rose To (m)	After (mins)	Remarks	Checked By: NEB Approved By: CBP Start Date: 17/05/2022 Finish Date: 17/05/2022			
	0.65m 2.20m									
Strata Description			Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing		
								Depth (m)	Ref	Tests / Results
Grass turf over, silty sandy cobbly GRAVEL. Sands are fine to medium. Gravels are fine to coarse of sandstone and mudstone with frequent anthropogenic material of white porcelain tile, glass, orange brick and steel wires. MADE GROUND								0.70	ES1	
Yellowish brown slightly sandy gravelly CLAY/SILT. Sands are fine to medium. Gravels are fine to medium of subangular to subrounded sandstone. ALLUVIUM - COHESIVE				1.40	40.73			1.40 - 2.00 1.50	B1 ES2	
EOH at 2.00m -				2.00	40.13					
Observations / Remarks									Longcross Court, Cardiff, CF24 0AD 029 2082 9200	
ES = Environmental Sample B = Bulk Disturbed Sample No groundwater strike encountered									Project Number 784-B035234	

[illegible]

APPENDIX C – TRL PROBE TEST RESULTS



DCP-CBR Corellation

$$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \times \text{Log}_{10} (\text{mm/blow})$$

DCP -Modulus E Corellation

$$E = 17.6 (\text{CBR})^{0.64} \text{ MPa}$$

In situ CBR by TRL Probe

Reference: WS03 / TRL03

Position: WS03 / TRL03

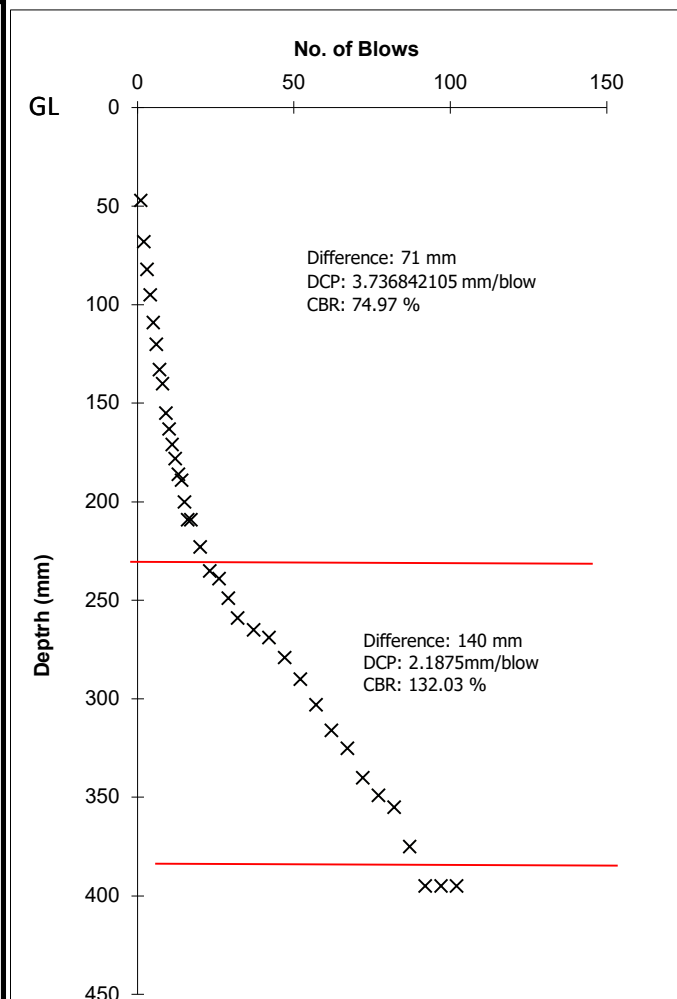
Date: 16th May 2022

mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)	mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)
47	1	152	47				
21	2	173	68				
14	3	187	82				
13	4	200	95				
14	5	214	109				
11	6	225	120				
13	7	238	133				
7	8	245	140				
15	9	260	155				
8	10	268	163				
8	11	276	171				
7	12	283	178				
8	13	291	186				
3	14	294	189				
11	15	305	200				
9	16	314	209				
0	17	314	209				
14	18	328	223				
12	19	340	235				
4	20	344	239				
10	21	354	249				
10	22	364	259				
6	23	370	265				
4	24	374	269				
10	25	384	279				
11	26	395	290				
13	29	408	303				
13	30	421	316				
9	31	430	325				
15	32	445	340				
9	33	454	349				
6	34	460	355				
20	35	480	375				
20	36	500	395				
0	37	500	395				
0	38	500	395				

Test started at: 0 m below ground level

Zero Reading: 105 mm

Zero reading = start depth below ground surface



Notes: Refusal at 0.395m bgl - TRL bouncing



DCP-CBR Corellation

$$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \times \text{Log}_{10}(\text{mm/blow})$$

DCP -Modulus E Corellation

$$E = 17.6 (\text{CBR})^{0.64} \text{ MPa}$$

In situ CBR by TRL Probe

Reference: WS06 / TRL06

Position: WS06 / TRL06

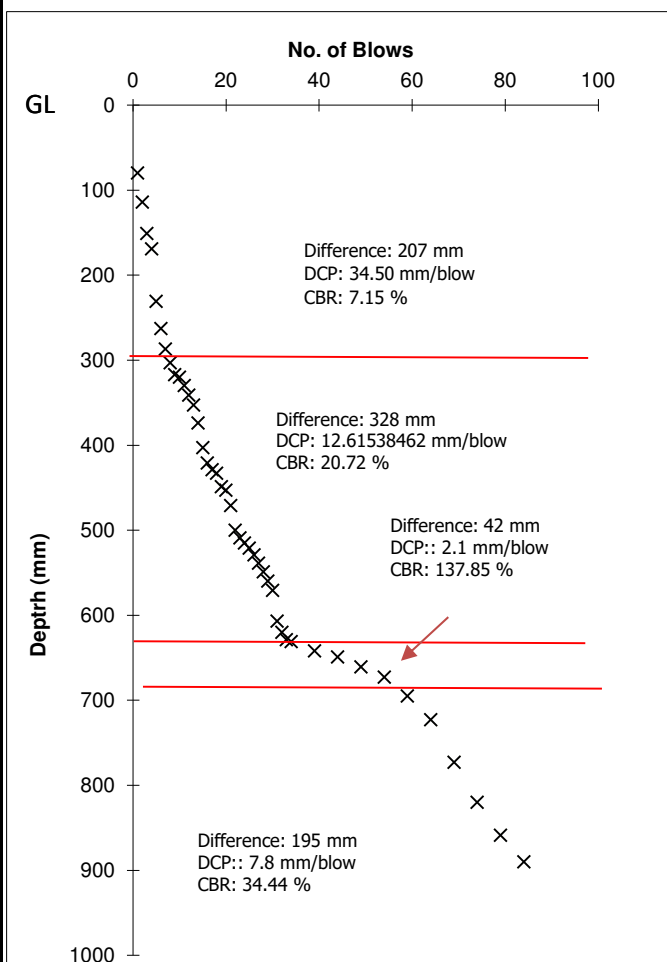
Date: 16th May 2022

mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)	mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)
80	1	141	141				
34	2	175	175				
37	3	212	212				
18	4	230	230				
62	5	292	292				
32	6	324	324				
24	7	348	348				
16	8	364	364				
14	9	378	378				
3	10	381	381				
10	11	391	391				
11	12	402	402				
12	13	414	414				
21	14	435	435				
29	15	464	464				
18	16	482	482				
8	17	490	490				
4	18	494	494				
16	19	510	510				
4	20	514	514				
18	21	532	532				
29	22	561	561				
9	23	570	570				
6	24	576	576				
6	25	582	582				
8	26	590	590				
10	27	600	600				
10	28	610	610				
11	29	621	621				
11	30	632	632				
36	31	668	668				
13	32	681	681				
9	33	690	690				
2	34	692	692				
11	39	703	703				
7	44	710	710				
12	49	722	722				
12	54	734	734				
22	59	756	756				
28	64	784	784				
50	69	834	834				
47	74	881	881				
39	79	920	920				
31	84	951	951				

Test started at: 0 m below ground level

Zero Reading: 61 mm

Zero reading = start depth below ground surface





DCP-CBR Corellation

$$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \times \text{Log}_{10} (\text{mm/blow})$$

DCP -Modulus E Corellation

$$E = 17.6 (\text{CBR})^{0.64} \text{ MPa}$$

In situ CBR by TRL Probe

Reference: WS08 / TRL08

Position: WS08 / TRL08

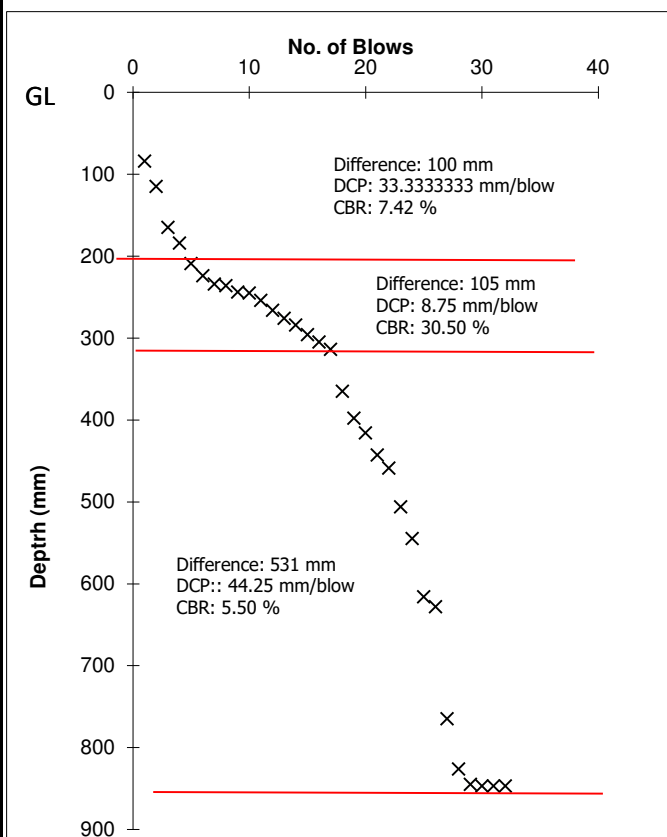
Date: 16th May 2022

mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)	mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)
84	1	140	84				
31	2	171	115				
50	3	221	165				
19	4	240	184				
25	5	265	209				
15	6	280	224				
10	7	290	234				
2	8	292	236				
8	9	300	244				
1	10	301	245				
9	11	310	254				
12	12	322	266				
10	13	332	276				
8	14	340	284				
12	15	352	296				
9	16	361	305				
9	17	370	314				
51	18	421	365				
33	19	454	398				
18	20	472	416				
27	21	499	443				
16	22	515	459				
47	23	562	506				
39	24	601	545				
71	25	672	616				
12	26	684	628				
137	27	821	765				
61	28	882	826				
19	29	901	845				
2	30	903	847				
0	31	903	847				
0	32	903	847				

Test started at: 0 m below ground level

Zero Reading: 56 mm

Zero reading = start depth below ground surface





DCP-CBR Corellation

$$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \times \text{Log}_{10} (\text{mm/blow})$$

DCP -Modulus E Corellation

$$E = 17.6 (\text{CBR})^{0.64} \text{ MPa}$$

In situ CBR by TRL Probe

Reference: WS09 / TRL09

Position: WS09 / TRL09

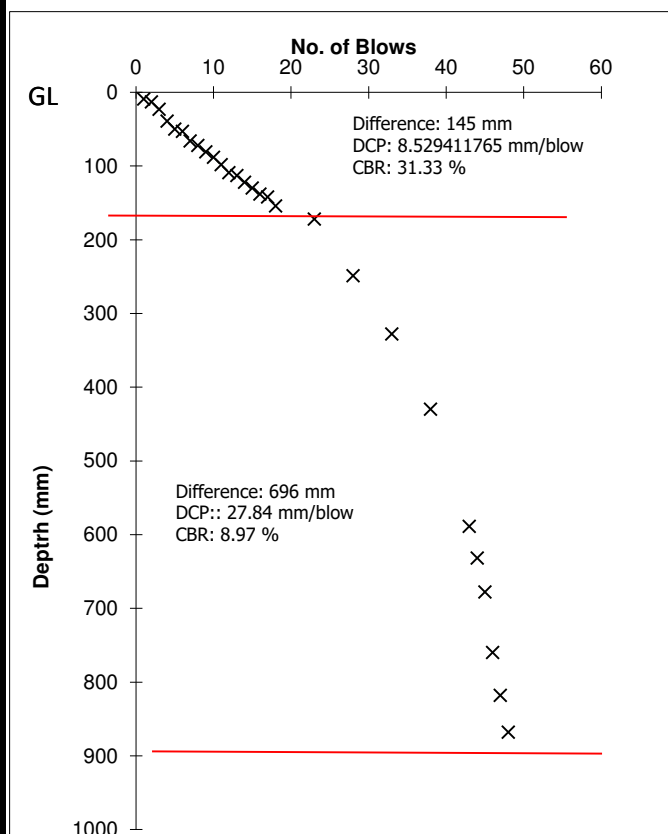
Date: 17th May 2022

mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)	mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)
9	1	91	9				
4	2	95	13				
10	3	105	23				
16	4	121	39				
11	5	132	50				
3	6	135	53				
13	7	148	66				
6	8	154	72				
9	9	163	81				
7	10	170	88				
10	11	180	98				
11	12	191	109				
4	13	195	113				
9	14	204	122				
8	15	212	130				
8	16	220	138				
4	17	224	142				
12	18	236	154				
18	23	254	172				
77	28	331	249				
79	33	410	328				
102	38	512	430				
159	43	671	589				
43	44	714	632				
46	45	760	678				
82	46	842	760				
58	47	900	818				
50	48	950	868				

Test started at: 0 m below ground level

Zero Reading: 82 mm

Zero reading = start depth below ground surface





DCP-CBR Corellation

$$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \times \text{Log}_{10}(\text{mm/blow})$$

DCP -Modulus E Corellation

$$E = 17.6 (\text{CBR})^{0.64} \text{ MPa}$$

In situ CBR by TRL Probe

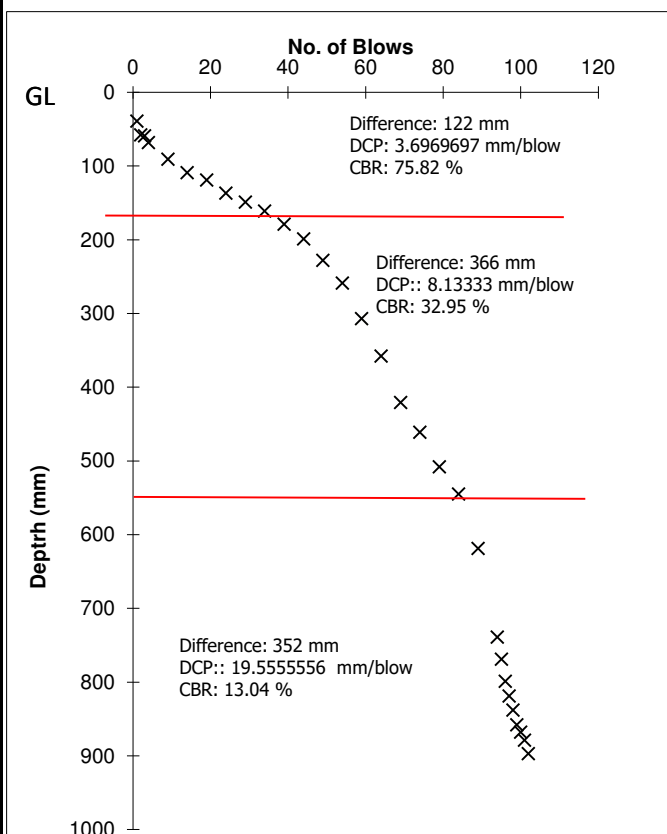
Reference: WS10 / TRL10

Position: WS10 / TRL10

Date: 17th May 2022

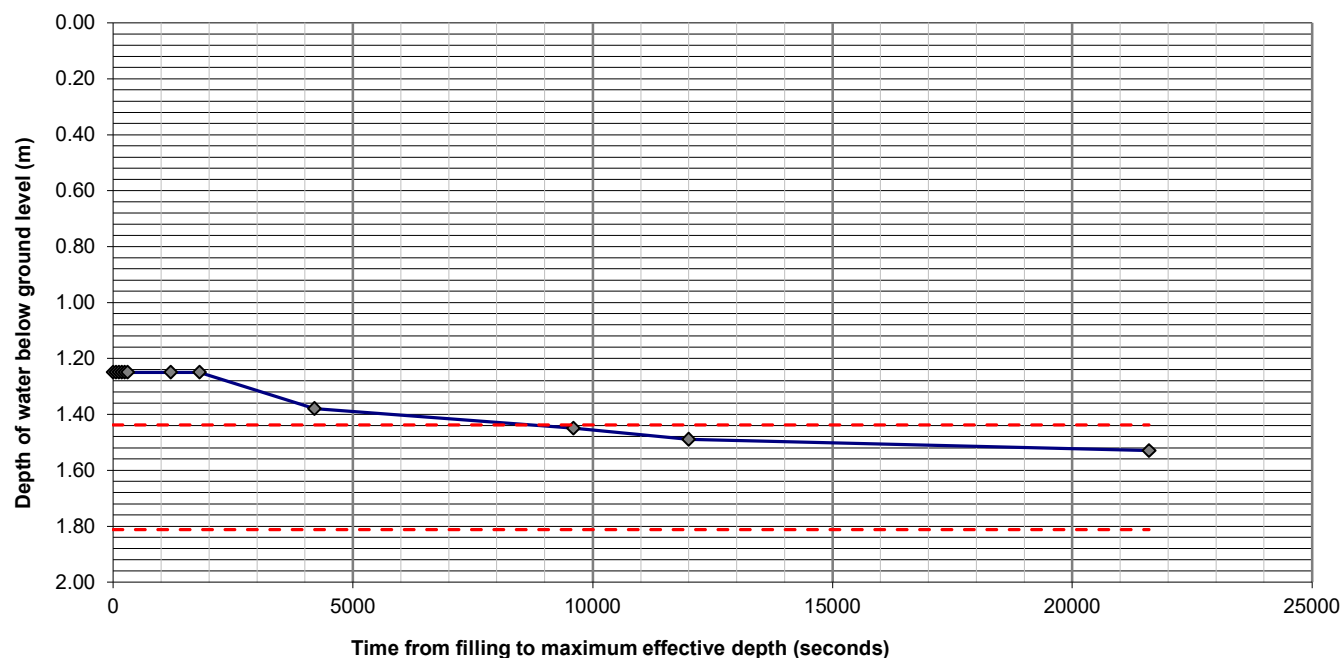
mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)	mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)
39	1	102	39				
19	2	121	58				
1	3	122	59				
9	4	131	68				
23	9	154	91				
18	14	172	109				
10	19	182	119				
18	24	200	137				
12	29	212	149				
12	34	224	161				
18	39	242	179				
20	44	262	199				
29	49	291	228				
31	54	322	259				
48	59	370	307				
51	64	421	358				
63	69	484	421				
40	74	524	461				
47	79	571	508				
37	84	608	545				
74	89	682	619				
120	94	802	739				
30	95	832	769				
30	96	862	799				
20	97	882	819				
19	98	901	838				
20	99	921	858				
10	100	931	868				
11	101	942	879				
18	102	960	897				

Test started at: 0 m below ground level
Zero Reading: 63 mm
Zero reading = start depth below ground surface



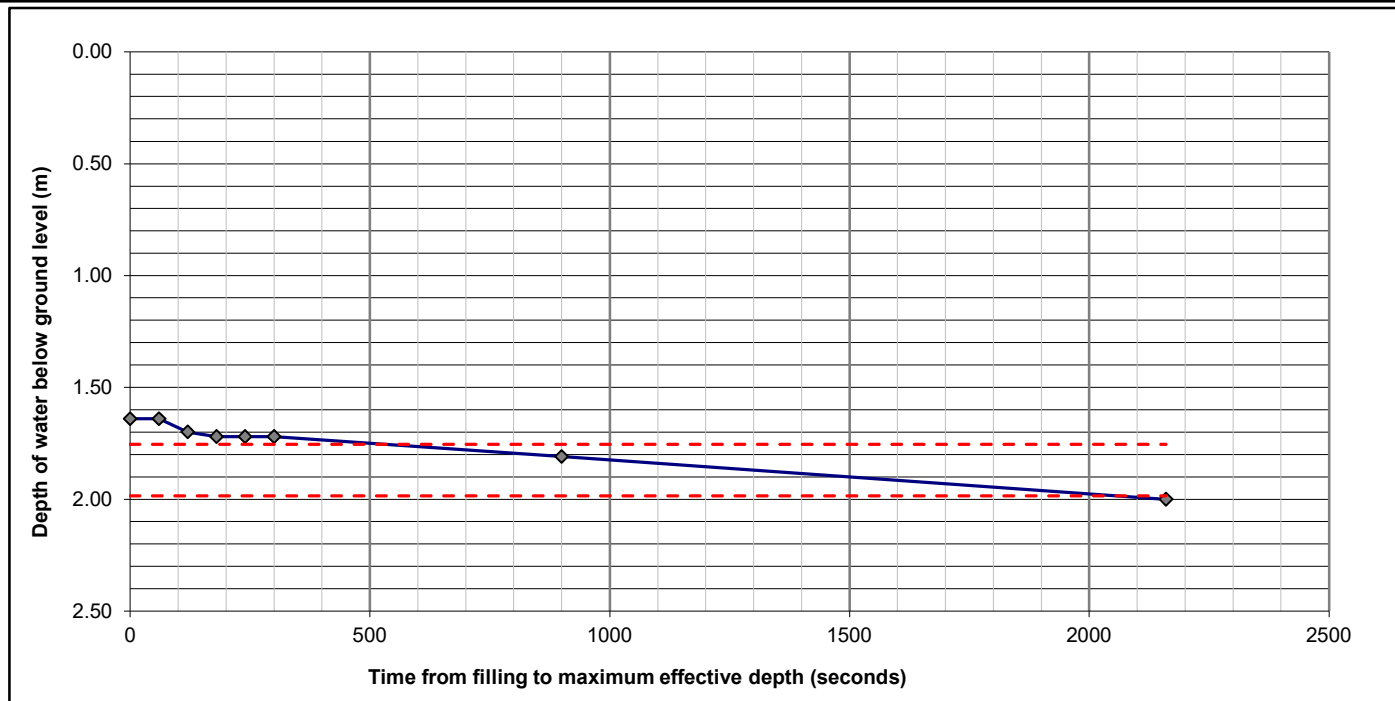
APPENDIX D – SOIL INFILTRATION TEST RESULTS

SOAKAWAY TEST - SOIL INFILTRATION RATE/PERMEABILITY CALCULATION



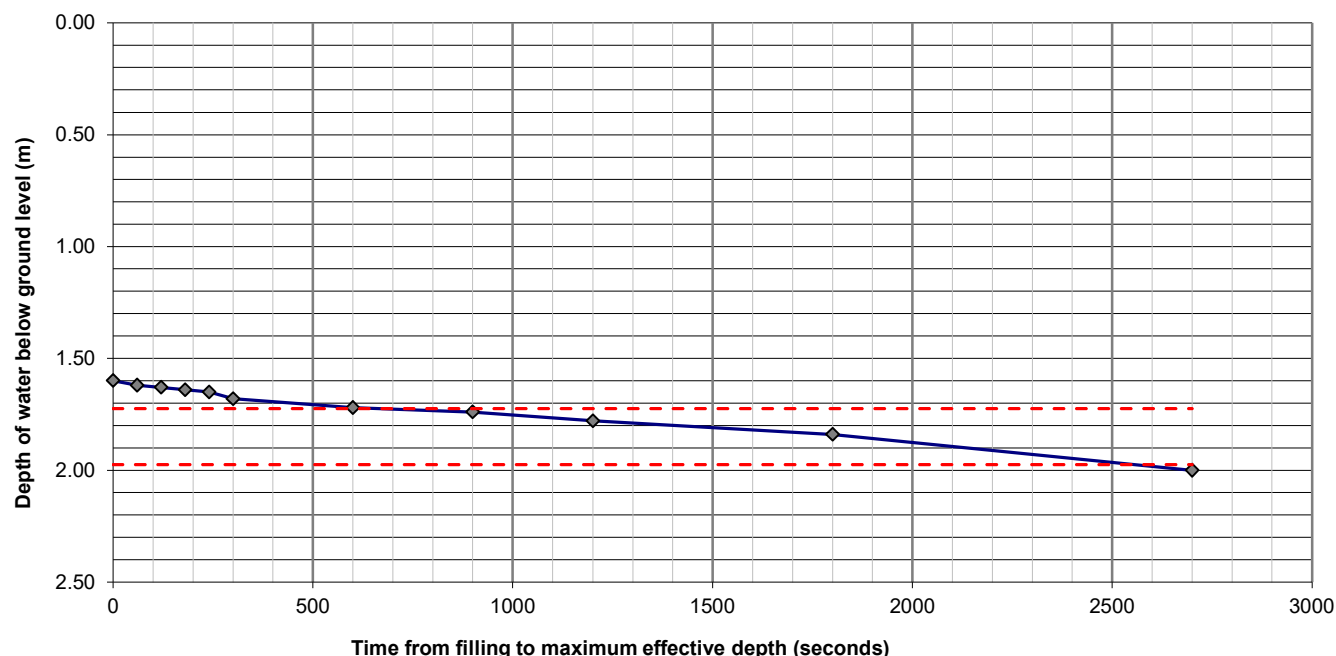
Time Elapsed (s)	Time Elapsed (mins)	Distance to water surface from ground level (m)	PIT LENGTH (m):	2.25	Pit construction	
			PIT WIDTH (m):	0.65	Open, no gravel backfill.	
			PIT DEPTH (m):	2.00		
	0.00	1.250	INPUT PARAMETERS:			
60	1.00	1.250	Total volume of pit		(m ³)	1.10
120	2.00	1.250	Pit volume between 75% and 25% depths = L x W x ½D		(m ³)	0.55
180	3.00	1.250	Effective depth of Pit		(m)	0.75
240	4.00	1.250	Proportion of pit volume occupied by gravel solids		(0-1)	0.00
300	5.00	1.250	Maximum potential volume of Water		(m ³)	1.10
1200	20.00	1.250	Level of water in pit at 75% effective depth (p ₇₅)		(m)	0.19
1800	30.00	1.250	Level of water in pit at 25% effective depth (p ₂₅)		(m)	0.56
4200	70.00	1.380				
9600	160.00	1.450	Effective volume between 75% & 25% depth V _{p75-25} = V x P _g		(m ³)	0.55
12000	200.00	1.490	Surface area of pit up to 50% effective depth (A _{p50})		(m ²)	3.64
21600	360.00	1.530				
			Time at 75% effective depth (p ₇₅)		(s)	8642
			Time at 25% effective depth (p ₂₅)		(s)	#N/A
			Time for outflow for 75% and 25% effective depth (Tp75-25)		(s)	#N/A
			OUTPUT:			
			SOIL INFILTRATION RATE (f)	V _{p75 - 25}	(m/s)	#N/A
				A _{p50} x T _{p75 - 25}		
			WATER INPUT:		500 l 7 mins	
			GEOLOGY OF TEST SECTION:			
			Yellowish brown silty sandy gravelly CLAY.			

SOAKAWAY TEST - SOIL INFILTRATION RATE/PERMEABILITY CALCULATION



Time Elapsed (s)	Time Elapsed (mins)	Distance to water surface from ground level (m)	PIT LENGTH (m):		2.20	Pit construction	
			PIT WIDTH (m):		0.65	Open, no gravel backfill.	
			PIT DEPTH (m):		2.10		
	0.00	1.640	INPUT PARAMETERS:				
60	1.00	1.640	Total volume of pit		(m ³)	0.66	
120	2.00	1.700	Pit volume between 75% and 25% depths = L x W x ½D		(m ³)	0.33	
180	3.00	1.720	Effective depth of Pit		(m)	0.46	
240	4.00	1.720	Proportion of pit volume occupied by gravel solids		(0-1)	0.00	
300	5.00	1.720	Maximum potential volume of Water		(m ³)	0.66	
900	15.00	1.810	Level of water in pit at 75% effective depth (p ₇₅)		(m)	0.12	
2160	36.00	2.000	Level of water in pit at 25% effective depth (p ₂₅)		(m)	0.35	
			Effective volume between 75% & 25% depth V _{p75-25} = V x P _g		(m ³)	0.33	
			Surface area of pit up to 50% effective depth (A _{p50})		(m ²)	2.74	
			Time at 75% effective depth (p ₇₅)		(s)	534	
			Time at 25% effective depth (p ₂₅)		(s)	2061	
			Time for outflow for 75% and 25% effective depth (Tp75-25)		(s)	1528	
			OUTPUT:				
			SOIL INFILTRATION RATE (f)		V _{p75 - 25}	(m/s)	7.86E-05
					A _{p50} x T _{p75 - 25}		
			WATER INPUT:		500	l	5 mins
			GEOLOGY OF TEST SECTION:				
			Yellowish brown silty sandy gravelly CLAY.				
	</						

SOAKAWAY TEST - SOIL INFILTRATION RATE/PERMEABILITY CALCULATION



Time Elapsed (s)	Time Elapsed (mins)	Distance to water surface from ground level (m)				
	0.00	1.600				
60	1.00	1.620				
120	2.00	1.630				
180	3.00	1.640				
240	4.00	1.650				
300	5.00	1.680				
600	10.00	1.720				
900	15.00	1.740				
1200	20.00	1.780				
1800	30.00	1.840				
2700	45.00	2.000				

APPENDIX E – GEOTECHNICAL LABORATORY TEST RESULTS



Laboratory Report



Contract Number: 59693

Client Ref: **784-B035234**

Client PO: **7006230**

Date Received: **27-05-2022**

Date Completed: **22-06-2022**

Report Date: **22-06-2022**

Client: **Tetra Tech**
5th Floor
Longcross Court
47 Newport Road
Cardiff
CF24 0AD

This report has been checked and approved by:

Brendan Evans
Office Administrator

Contract Title: **Cwmavon**

For the attention of: **Nicholas Bool**

Test Description	Qty
Moisture Content BS 1377:1990 - Part 2 : 3.2 - * UKAS	5
4 Point Liquid & Plastic Limit BS 1377:1990 - Part 2 : 4.3 & 5.3 - * UKAS	5
Particle Density (Gas Jar) BS 1377:1990 - Part 2 : 8.2 - * UKAS	6
PSD Wet & Dry Sieve method BS 1377:1990 - Part 2 : 9.2 - * UKAS	6
BRE Full Suite includes pH, water & acid soluble sulphate, total sulphur, magnesium, chloride and nitrate Sub-contracted Test	5
Disposal of samples for job	1

Notes: **Observations and Interpretations are outside the UKAS Accreditation**

* - denotes test included in laboratory scope of accreditation

- denotes test carried out by approved contractor

@ - denotes non accredited tests

This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved Signatories:

Brendan Evans (Office Administrator) - Emma Sharp (Business Support Manager) - Paul Evans (Director)

Richard John (Quality/Technical Manager) - Shaun Jones (Laboratory manager) - Shaun Thomas (Site Manager)

Wayne Honey (Health and Safety Coordinator/ Quality Assistant)

GEO Site & Testing Services Ltd

Units 3-4, Heol Aur, Dafen, Llanelli, Carmarthenshire, Wales SA14 8QN

Tel: 01554 784040 Fax: 01554 784041 info@gstl.co.uk gstl.co.uk

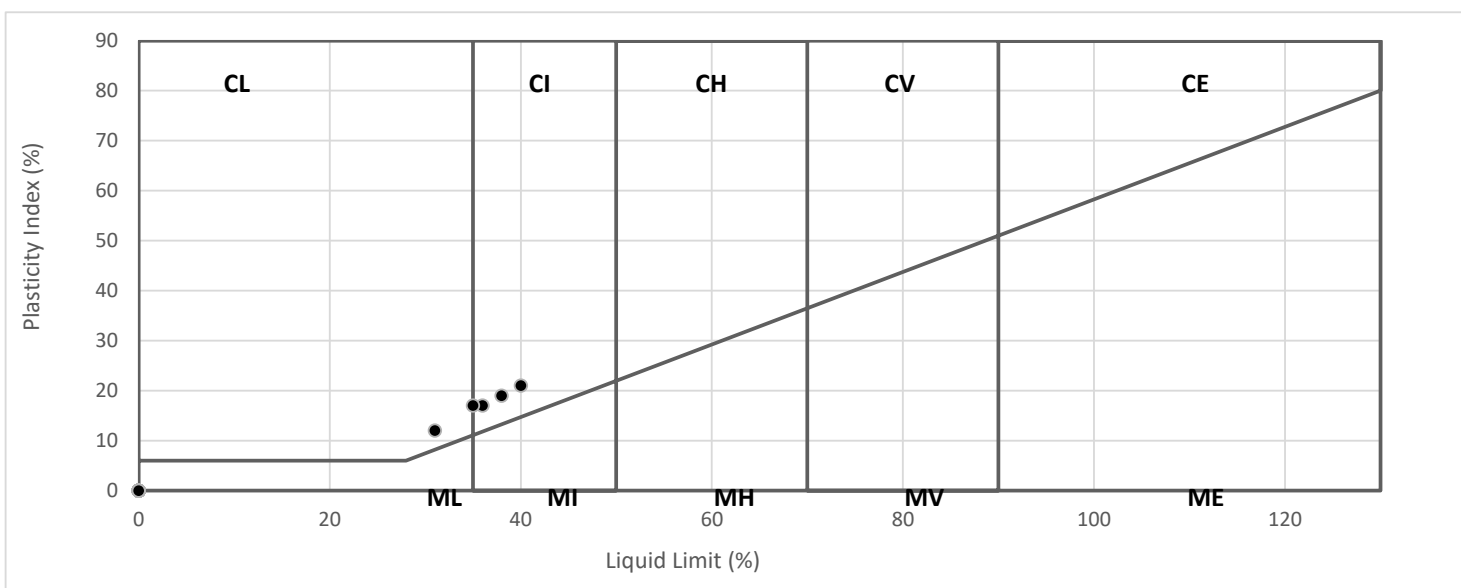


Contract Number	59693	
Project Location	Cwmavon	
Date Tested	16/06/2022	

[illegible]

Symbols: NP : Non Plastic # : Liquid Limit and Plastic Limit Wet Sieved

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION BS 5930:1999+A2:2010



Operators			
Jason Smith			

**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

Contract Number 59693

Borehole/Pit No. BH01

Site Name Cwmavon

Sample No. 1

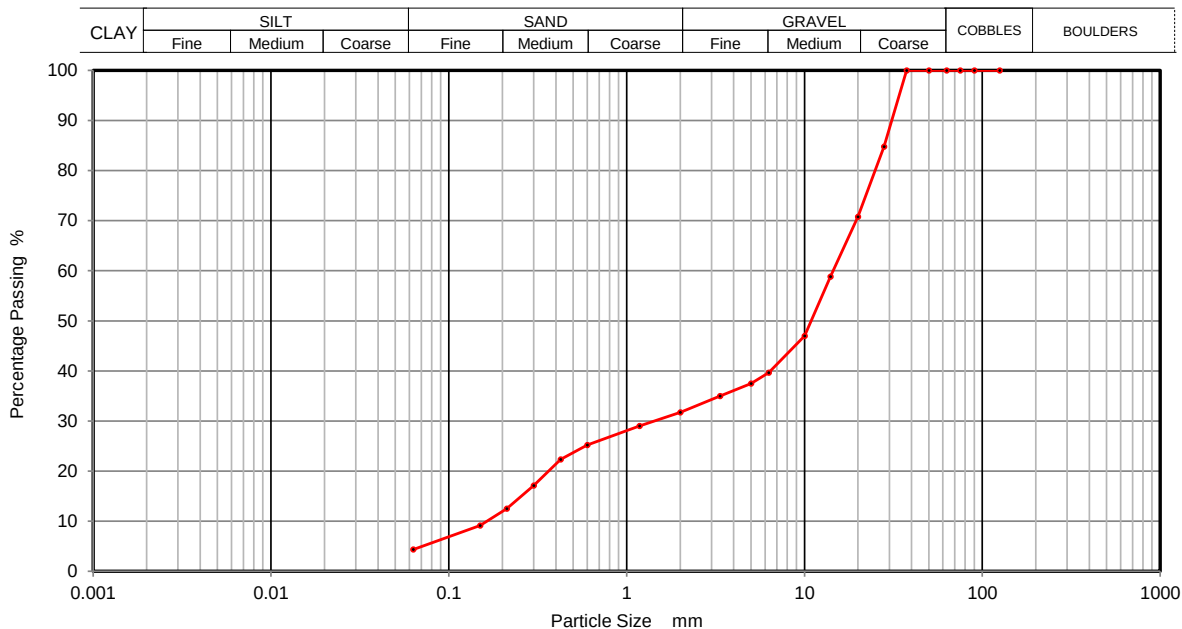
Soil Description *See description sheet

Depth Top 1.90

Depth Base 3.00

Date Tested 17/06/2022

Sample Type B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	85		
20	71		
14	59		
10	47		
6.3	40		
5	37		
3.35	35		
2	32		
1.18	29		
0.6	25		
0.425	22		
0.3	17		
0.212	13		
0.15	9		
0.063	4		

Sample Proportions	% dry mass
Cobbles	0
Gravel	68
Sand	28
Silt and Clay	4

Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operator				
David Edwards				

**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

Contract Number 59693

Borehole/Pit No. TP01

Site Name Cwmavon

Sample No. 1

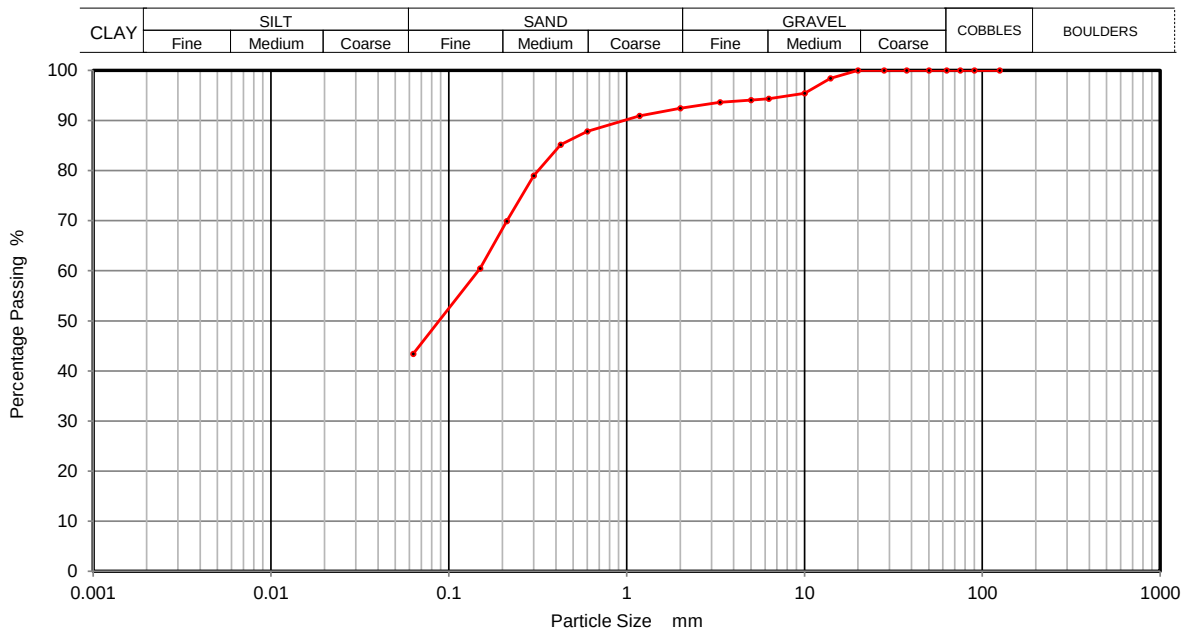
Soil Description *See description sheet

Depth Top 1.40

Depth Base 2.00

Date Tested 17/06/2022

Sample Type B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	98		
10	95		
6.3	94		
5	94		
3.35	94		
2	92		
1.18	91		
0.6	88		
0.425	85		
0.3	79		
0.212	70		
0.15	60		
0.063	43		

Sample Proportions	% dry mass
Cobbles	0
Gravel	8
Sand	49
Silt and Clay	43

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator				
David Edwards				

**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

Contract Number 59693

Borehole/Pit No. TP02

Site Name Cwmavon

Sample No. 1

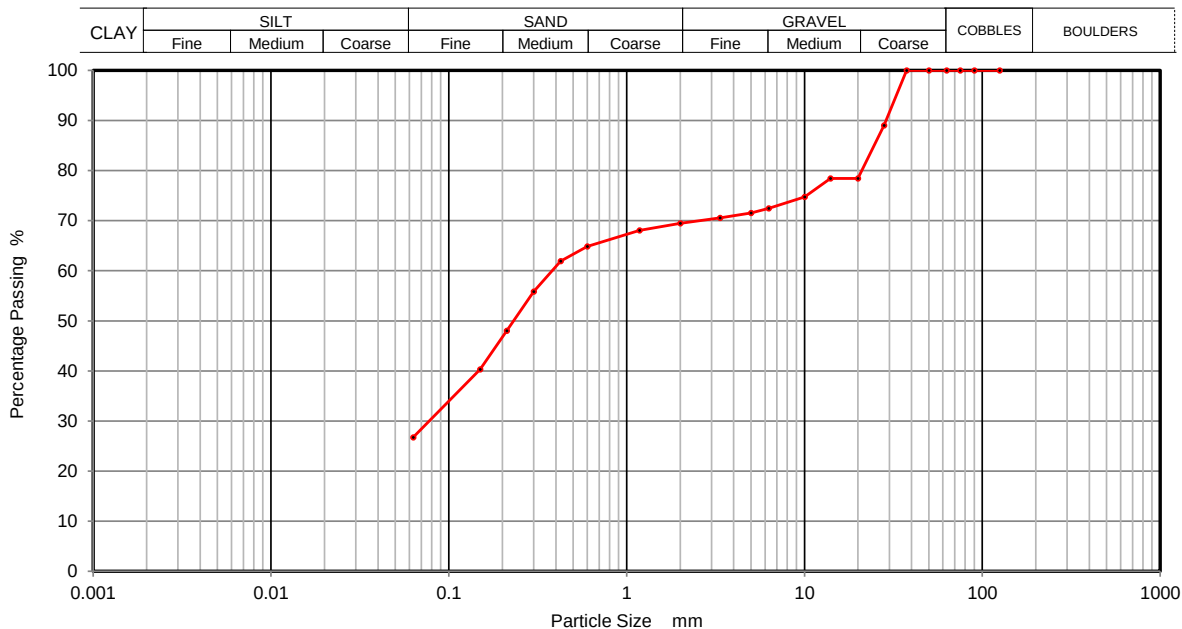
Soil Description *See description sheet

Depth Top 1.45

Depth Base 2.00

Date Tested 17/06/2022

Sample Type B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	89		
20	78		
14	78		
10	75		
6.3	72		
5	72		
3.35	71		
2	69		
1.18	68		
0.6	65		
0.425	62		
0.3	56		
0.212	48		
0.15	40		
0.063	27		

Sample Proportions	% dry mass
Cobbles	0
Gravel	31
Sand	42
Silt and Clay	27

Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operator				
David Edwards				

**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

Contract Number 59693

Borehole/Pit No. WS03

Site Name Cwmavon

Sample No. 2

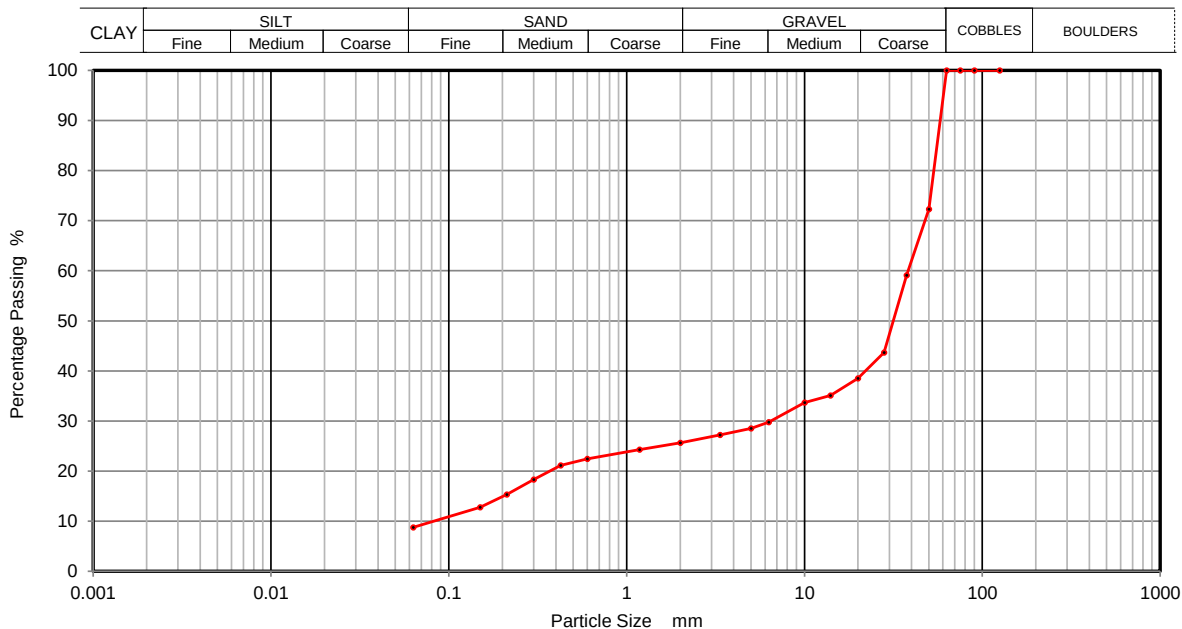
Soil Description *See description sheet

Depth Top 0.50

Depth Base 1.20

Date Tested 17/06/2022

Sample Type B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	72		
37.5	59		
28	44		
20	39		
14	35		
10	34		
6.3	30		
5	29		
3.35	27		
2	26		
1.18	24		
0.6	22		
0.425	21		
0.3	18		
0.212	15		
0.15	13		
0.063	9		

Sample Proportions	% dry mass
Cobbles	0
Gravel	74
Sand	17
Silt and Clay	9

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator				
David Edwards				

**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

Contract Number 59693

Borehole/Pit No. WS03

Site Name Cwmavon

Sample No. 3

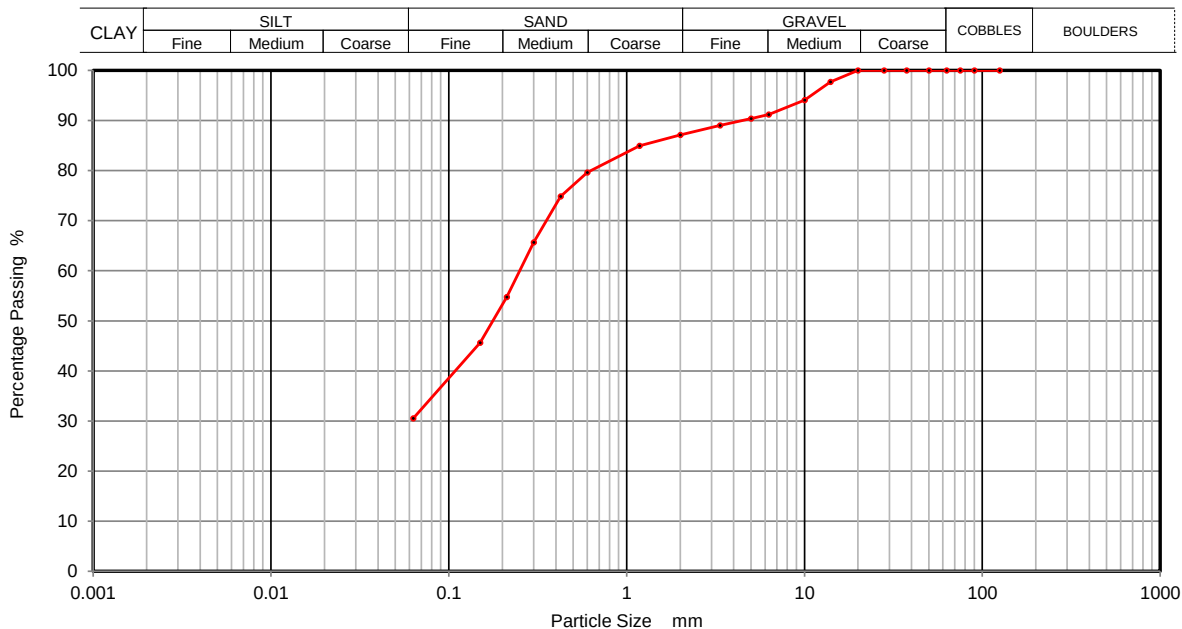
Soil Description *See description sheet

Depth Top 1.20

Depth Base 2.30

Date Tested 17/06/2022

Sample Type B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	98		
10	94		
6.3	91		
5	90		
3.35	89		
2	87		
1.18	85		
0.6	80		
0.425	75		
0.3	66		
0.212	55		
0.15	46		
0.063	31		

Sample Proportions	% dry mass
Cobbles	0
Gravel	13
Sand	56
Silt and Clay	31

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator				
David Edwards				

**PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2**

Contract Number 59693

Borehole/Pit No. WS07

Site Name Cwmavon

Sample No. 2

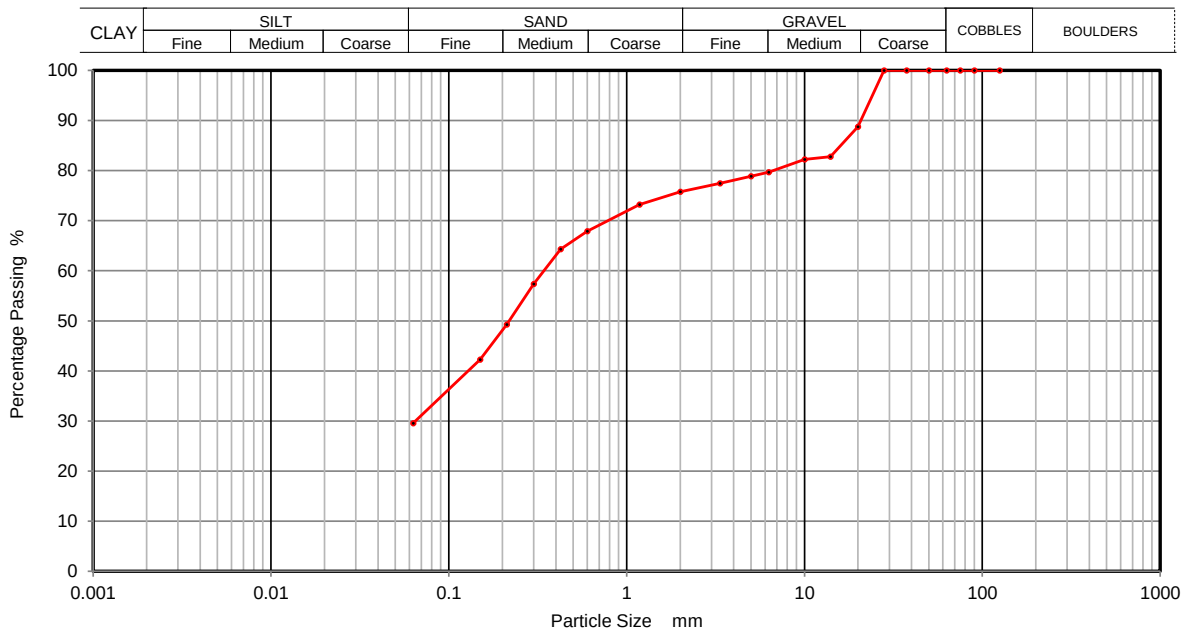
Soil Description *See description sheet

Depth Top 1.20

Depth Base 1.80

Date Tested 17/06/2022

Sample Type B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	89		
14	83		
10	82		
6.3	80		
5	79		
3.35	77		
2	76		
1.18	73		
0.6	68		
0.425	64		
0.3	57		
0.212	49		
0.15	42		
0.063	30		

Sample Proportions	% dry mass
Cobbles	0
Gravel	24
Sand	46
Silt and Clay	30

Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operator				
David Edwards				

Contract Number	59693	
Project Location	Cwmavon	
Date Tested	17/06/2022	

[illegible]

<u>Key</u>	<u>Reported As</u>
Moisture Content	%
Bulk Density	Mg/m ³
Dry Density	Mg/m ³
Particle Density	Mg/m ³
Air Voids	%

Operators				
Conal Aliffe				



ANALYTICAL TEST REPORT

Contract no: 110206

Contract name: Cmwavon

Client reference: 784-B035234

Clients name: Geo Site & Testing Services

Clients address: Unit 3 and 4 Heol Aur
Dafen Industrial Estate, Dafen
Llanelli, Carmarthenshire
SA14 8QN

Samples received: 10 June 2022

Analysis started: 10 June 2022

Analysis completed: 17 June 2022

Report issued: 17 June 2022

Key

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

Approved by:

Rachael Burton

Reporting Team Lead

Chemtech Environmental Limited

SOILS

Lab number			110206-1	110206-2	110206-3	110206-4	110206-5
Sample id			BH01	WS04	WS05	WS07	WS07
Depth (m)			1.90-3.00	0.30-1.20	0.30-1.20	0.40-1.20	1.20-1.80
Sample Type			B1	B1	B1	B1	B2
Date sampled			-	-	-	-	-
Test	Method	Units					
pH	CE004 ^U	units	8.4	8.3	8.3	8.4	8.1
Magnesium (2:1 water soluble)	CE061	mg/l Mg	4.0	5.5	1.9	2.0	2.5
Chloride (2:1 water soluble)	CE049 ^U	mg/l Cl	3.3	5.5	4.7	6.4	4.9
Nitrate (2:1 water soluble)	CE049 ^U	mg/l NO ₃	3.5	46	40	30	32
Sulphate (2:1 water soluble)	CE061 ^U	mg/l SO ₄	47	204	57	22	17
Sulphate (total)	CE062 ^U	mg/kg SO ₄	224	1308	714	400	356
Sulphate (total)	CE062 ^U	% w/w SO ₄	0.02	0.13	0.07	0.04	0.04
Sulphur (total)	CE119	mg/kg S	108	1046	745	459	379
Sulphur (total)	CE119	% w/w S	0.01	0.10	0.07	0.05	0.04

Chemtech Environmental Limited

METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE004	pH	Based on BS 1377, pH Meter	As received	U	-	units
CE061	Magnesium (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry		1	mg/l Mg
CE049	Chloride (2:1 water soluble)	Aqueous extraction, IC-COND	Dry	U	1	mg/l Cl
CE049	Nitrate (2:1 water soluble)	Aqueous extraction, IC-COND	Dry	U	1	mg/l NO ₃
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	U	10	mg/l SO ₄
CE062	Sulphate (total)	Acid extraction, ICP-OES	Dry	U	100	mg/kg SO ₄
CE062	Sulphate (total)	Acid extraction, ICP-OES	Dry	U	0.01	% w/w SO ₄
CE119	Sulphur (total)	Acid extraction, ICP-OES	Dry		100	mg/kg S
CE119	Sulphur (total)	Acid extraction, ICP-OES	Dry		0.01	% w/w S

Chemtech Environmental Limited

DEVIATING SAMPLE INFORMATION

Comments

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

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

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

Key

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

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
110206-1	BH01	1.90-3.00	N	
110206-2	WS04	0.30-1.20	N	
110206-3	WS05	0.30-1.20	N	
110206-4	WS07	0.40-1.20	N	
110206-5	WS07	1.20-1.80	N	

Chemtech Environmental Limited

ADDITIONAL INFORMATION

Notes

Opinions and interpretations expressed herein are outside the UKAS accreditation scope.

Unless otherwise stated, Chemtech Environmental Ltd was not responsible for sampling.

All testing carried out at Unit 6 Parkhead, Stanley, DH9 7YB, except for subcontracted testing.

Methods, procedures and performance data are available on request.

Results reported herein relate only to the material supplied to the laboratory.

This report shall not be reproduced except in full, without prior written approval.

Samples will be disposed of 4 weeks from initial receipt unless otherwise instructed.

For soils and solids, all results are reported on a dry basis. Samples dried at no more than 30°C in a drying cabinet.

Analytical results are inclusive of stones, where applicable.

APPENDIX F – CHEMICAL LABORATORY TEST RESULTS

Tetra Tech
5th Floor, Longcross Court
47 Newport Rd
Cardiff
Cardiff
UK
CF24 0AD



Attention :	Nicholas Bool
Date :	9th June, 2022
Your reference :	B035234
Our reference :	Test Report 22/8363 Batch 1
Location :	Cwmavon
Date samples received :	21st May, 2022
Status :	Final Report
Issue :	1

Thirty samples were received for analysis on 21st May, 2022 of which seven were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:



Liza Klebe

Project Co-ordinator

Please include all sections of this report if it is reproduced

Element Materials Technology

Client Name: Tetra Tech
Reference: B035234
Location: Cwmavon
Contact: Nicholas Bool
EMT Job No: 22/8363

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	13-15	31-33	34-36	37-39	46-48						Please see attached notes for all abbreviations and acronyms		
Sample ID	BH02	WS09	WS01	WS04	TP01								
Depth	2.00	0.70	0.50	1.40	0.70								
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T								
Sample Date	18/05/2022 10:00	17/05/2022 10:00	18/05/2022 09:40	17/05/2022 11:45	17/05/2022 10:00								
Sample Type	Soil	Soil	Soil	Soil	Soil								
Batch Number	1	1	1	1	1								
Date of Receipt	21/05/2022	21/05/2022	21/05/2022	21/05/2022	21/05/2022						LOD/LOR	Units	Method No.
Arsenic #	30.8	43.2	28.4	153.4	322.9 ^{AA}						<0.5	mg/kg	TM30/PM15
Beryllium	1.3	1.6	0.9	1.5	1.6						<0.5	mg/kg	TM30/PM15
Cadmium #	<0.1	<0.1	0.3	<0.1	<0.1						<0.1	mg/kg	TM30/PM15
Chromium #	14.3	24.3	28.8	20.8	77.6						<0.5	mg/kg	TM30/PM15
Copper #	34	148	126	214	939 ^{AA}						<1	mg/kg	TM30/PM15
Lead #	14	58	79	133	258						<5	mg/kg	TM30/PM15
Mercury #	<0.1	0.2	<0.1	<0.1	<0.1						<0.1	mg/kg	TM30/PM15
Nickel #	30.8	38.7	22.7	48.8	28.6						<0.7	mg/kg	TM30/PM15
Selenium #	<1	<1	<1	3	<1						<1	mg/kg	TM30/PM15
Vanadium	17	35	22	37	60						<1	mg/kg	TM30/PM15
Water Soluble Boron #	0.4	0.5	0.6	0.8	0.7						<0.1	mg/kg	TM74/PM32
Zinc #	77	545	225	157	1061						<5	mg/kg	TM30/PM15
PAH MS													
Naphthalene #	<0.04	0.16	0.27	0.12	0.22						<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	0.05	0.82	0.06	0.23						<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.05	<0.05	<0.05	<0.05	<0.05						<0.05	mg/kg	TM4/PM8
Fluorene #	<0.04	<0.04	0.25	0.11	0.11						<0.04	mg/kg	TM4/PM8
Phenanthrene #	<0.03	0.84	3.95	0.83	1.54						<0.03	mg/kg	TM4/PM8
Anthracene #	<0.04	<0.04	2.36	0.10	0.33						<0.04	mg/kg	TM4/PM8
Fluoranthene #	<0.03	0.28	8.32	0.41	3.07						<0.03	mg/kg	TM4/PM8
Pyrene #	<0.03	0.33	6.66	0.38	2.50						<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	<0.06	0.18	3.96	0.38	1.73						<0.06	mg/kg	TM4/PM8
Chrysene #	<0.02	0.49	3.67	0.42	2.17						<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	<0.07	0.49	5.68	0.50	3.77						<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	<0.04	0.21	3.19	0.21	1.65						<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene #	<0.04	0.16	2.15	0.11	1.40						<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	<0.04	0.07	0.48	<0.04	0.35						<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	<0.04	0.18	1.72	0.11	1.20						<0.04	mg/kg	TM4/PM8
PAH 16 Total	<0.6	3.4	43.5	3.7	20.3						<0.6	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05	0.35	4.09	0.36	2.71						<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02	0.14	1.59	0.14	1.06						<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	90	96	92	83	94						<0	%	TM4/PM8

Element Materials Technology

Client Name: Tetra Tech
Reference: B035234
Location: Cwmavon
Contact: Nicholas Bool
EMT Job No: 22/8363

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	13-15	31-33	34-36	37-39	46-48						Please see attached notes for all abbreviations and acronyms		
Sample ID	BH02	WS09	WS01	WS04	TP01								
Depth	2.00	0.70	0.50	1.40	0.70								
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T								
Sample Date	18/05/2022 10:00	17/05/2022 10:00	18/05/2022 09:40	17/05/2022 11:45	17/05/2022 10:00								
Sample Type	Soil	Soil	Soil	Soil	Soil								
Batch Number	1	1	1	1	1								
Date of Receipt	21/05/2022	21/05/2022	21/05/2022	21/05/2022	21/05/2022						LOD/LOR	Units	Method No.
TPH CWG													
Aliphatics													
>C5-C6 (HS_1D_AL) #	<0.1	<0.1 ^{SV}	<0.1 ^{SV}	<0.1 ^{SV}	<0.1 ^{SV}						<0.1	mg/kg	TM36/PM12
>C6-C8 (HS_1D_AL) #	<0.1	<0.1 ^{SV}	<0.1 ^{SV}	<0.1 ^{SV}	<0.1 ^{SV}						<0.1	mg/kg	TM36/PM12
>C8-C10 (HS_1D_AL)	<0.1	<0.1 ^{SV}	<0.1 ^{SV}	<0.1 ^{SV}	<0.1 ^{SV}						<0.1	mg/kg	TM36/PM12
>C10-C12 (EH_CU_1D_AL) #	<0.2	3.2	<0.2	7.7	<0.2						<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 (EH_CU_1D_AL) #	<4	<4	<4	9	<4						<4	mg/kg	TM5/PM8/PM16
>C16-C21 (EH_CU_1D_AL) #	<7	<7	<7	<7	<7						<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_CU_1D_AL) #	<7	<7	<7	<7	<7						<7	mg/kg	TM5/PM8/PM16
>C35-C44 (EH_1D_AL)	<7	<7	<7	<7	<7						<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-44 (EH+HS_1D_AL)	<26	<26	<26	<26	<26						<26	mg/kg	TM5/PM8/PM16
Aromatics													
>C5-EC7 (HS_1D_AR) #	<0.1	<0.1 ^{SV}	<0.1 ^{SV}	<0.1 ^{SV}	<0.1 ^{SV}						<0.1	mg/kg	TM36/PM12
>EC7-EC8 (HS_1D_AR) #	<0.1	<0.1 ^{SV}	<0.1 ^{SV}	<0.1 ^{SV}	<0.1 ^{SV}						<0.1	mg/kg	TM36/PM12
>EC8-EC10 (HS_1D_AR) #	<0.1	<0.1 ^{SV}	<0.1 ^{SV}	<0.1 ^{SV}	<0.1 ^{SV}						<0.1	mg/kg	TM36/PM12
>EC10-EC12 (EH_CU_1D_AR) #	<0.2	<0.2	<0.2	<0.2	<0.2						<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 (EH_CU_1D_AR) #	<4	11	<4	17	<4						<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 (EH_CU_1D_AR) #	<7	37	22	43	22						<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_CU_1D_AR) #	<7	91	133	97	163						<7	mg/kg	TM5/PM8/PM16
>EC35-EC44 (EH_1D_AR)	<7	<7	<7	<7	14						<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-44 (EH+HS_1D_AR)	<26	139	155	157	199						<26	mg/kg	TM5/PM8/PM16
Total aliphatics and aromatics(C5-44) (EH+HS_CU_1D_Total)	<52	139	155	157	199						<52	mg/kg	TM5/PM8/PM16
MTBE #	<5	<5 ^{SV}	<5 ^{SV}	<5 ^{SV}	<5 ^{SV}						<5	ug/kg	TM36/PM12
Benzene #	<5	<5 ^{SV}	<5 ^{SV}	<5 ^{SV}	<5 ^{SV}						<5	ug/kg	TM36/PM12
Toluene #	<5	<5 ^{SV}	<5 ^{SV}	<5 ^{SV}	<5 ^{SV}						<5	ug/kg	TM36/PM12
Ethylbenzene #	<5	<5 ^{SV}	<5 ^{SV}	<5 ^{SV}	<5 ^{SV}						<5	ug/kg	TM36/PM12
m/p-Xylene #	<5	<5 ^{SV}	<5 ^{SV}	<5 ^{SV}	<5 ^{SV}						<5	ug/kg	TM36/PM12
o-Xylene #	<5	<5 ^{SV}	<5 ^{SV}	<5 ^{SV}	<5 ^{SV}						<5	ug/kg	TM36/PM12
Total Phenols HPLC	<0.15	<0.15	<0.15	<0.15	<0.15						<0.15	mg/kg	TM26/PM21B
Hexavalent Chromium #	<0.3	<0.3	<0.3	<0.3	<0.3						<0.3	mg/kg	TM38/PM20
Sulphate as SO4 (2:1 Ext) #	0.0026	0.0250	0.0065	0.0114	0.0889						<0.0015	g/l	TM38/PM20
Chromium III	14.3	24.3	28.8	20.8	77.6						<0.5	mg/kg	NONE/NONE
Free Cyanide	<0.5	<0.5	<0.5	<0.5	<0.5						<0.5	mg/kg	TM89/PM45
Fraction Organic Carbon	0.006	0.321	0.132	0.340	0.105						<0.001	None	TM21/PM24
pH #	7.87	7.58	8.07	7.71	8.35						<0.01	pH units	TM73/PM11

Client Name: Tetra Tech
Reference: B035234
Location: Cwmavon
Contact: Nicholas Bool
EMT Job No: 22/8363

Solids: V=60g VOC jar. J=250g glass jar. T=plastic tub

Please see attached notes for all abbreviations and acronyms

Element Materials Technology

Client Name: Tetra Tech
Reference: B035234
Location: Cwmavon
Contact: Nicholas Bool
EMT Job No: 22/8363

Report : CEN 10:1 1 Batch

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	64-66	82-84											
Sample ID	WS08	WS05											
Depth	0.50	0.70											
COC No / misc													
Containers	V J T	V J T											
Sample Date	16/05/2022 13:00	16/05/2022 15:00											
Sample Type	Soil	Soil											
Batch Number	1	1											
Date of Receipt	21/05/2022	21/05/2022											
Please see attached notes for all abbreviations and acronyms											LOD/LOR	Units	Method No.
TPH CWG													
Aliphatics													
>C5-C6	<10	<10									<10	ug/l	TM36/PM69
>C6-C8	<10	<10									<10	ug/l	TM36/PM69
>C8-C10	<10	<10									<10	ug/l	TM36/PM69
>C10-C12	<5	<5									<5	ug/l	TM5/PM16/PM30
>C12-C16	<10	<10									<10	ug/l	TM5/PM16/PM30
>C16-C21	<10	<10									<10	ug/l	TM5/PM16/PM30
>C21-C35	<10	<10									<10	ug/l	TM5/PM16/PM30
Total aliphatics C5-35	<10	<10									<10	ug/l	TM5/PM16/PM30/PM30
Aromatics													
>C5-EC7	<10	<10									<10	ug/l	TM36/PM69
>EC7-EC8	<10	<10									<10	ug/l	TM36/PM69
>EC8-EC10	<10	<10									<10	ug/l	TM36/PM69
>EC10-EC12	<5	<5									<5	ug/l	TM5/PM16/PM30
>EC12-EC16	<10	<10									<10	ug/l	TM5/PM16/PM30
>EC16-EC21	<10	<10									<10	ug/l	TM5/PM16/PM30
>EC21-EC35	<10	<10									<10	ug/l	TM5/PM16/PM30
Total aromatics C5-35	<10	<10									<10	ug/l	TM5/PM16/PM30/PM30
Total aliphatics and aromatics(C5-35)	<10	<10									<10	ug/l	TM5/PM16/PM30/PM30/PM30
MTBE	<5	<5									<5	ug/l	TM36/PM69
Benzene	<5	<5									<5	ug/l	TM36/PM69
Toluene	<5	<5									<5	ug/l	TM36/PM69
Ethylbenzene	<5	<5									<5	ug/l	TM36/PM69
m/p-Xylene	<5	<5									<5	ug/l	TM36/PM69
o-Xylene	<5	<5									<5	ug/l	TM36/PM69
Total Phenols HPLC	<0.05	<0.05									<0.05	mg/l	TM26/PM0
Sulphate as SO4 #	6.2	4.9									<0.5	mg/l	TM38/PM0
Chloride #	0.5	0.7									<0.3	mg/l	TM38/PM0
Nitrate as NO3 #	0.3	0.5									<0.2	mg/l	TM38/PM0
Nitrite as NO2 #	<0.02	<0.02									<0.02	mg/l	TM38/PM0
Ammoniacal Nitrogen as NH3 #	0.04	<0.03									<0.03	mg/l	TM38/PM0
Ammoniacal Nitrogen as NH4 #	0.04	<0.03									<0.03	mg/l	TM38/PM0
Total Cyanide #	<0.01	<0.01									<0.01	mg/l	TM89/PM0
Dissolved Organic Carbon	4	2									<2	mg/l	TM60/PM0
pH	9.08	11.27									<0.01	pH units	TM73/PM0
Total Alkalinity as CaCO3	36	106									<1	mg/l	TM75/PM0

Client Name: Tetra Tech
Reference: B035234
Location: Cwmavon
Contact: Nicholas Bool

Note:

Asbestos Screen analysis is carried out in accordance with our documented in-house methods PM042 and TM065 and HSG 248 by Stereo and Polarised Light Microscopy using Dispersion Staining Techniques and is covered by our UKAS accreditation. Detailed Gravimetric Quantification and PCOM Fibre Analysis is carried out in accordance with our documented in-house methods PM042 and TM131 and HSG 248 using Stereo and Polarised Light Microscopy and Phase Contrast Optical Microscopy (PCOM). Asbestos sub-samples are retained for not less than 6 months from the date of analysis unless specifically requested.

The LOQ of the Asbestos Quantification is 0.001% dry fibre of dry mass of sample.

Where the sample is not taken by a Element Materials Technology consultant, Element Materials Technology cannot be responsible for inaccurate or unrepresentative sampling.

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analyst Name	Date Of Analysis	Analysis	Result
22/8363	1	BH02	2.00	15	Charlotte Taylor	31/05/2022	General Description (Bulk Analysis)	soil/stones
					Charlotte Taylor	31/05/2022	Asbestos Fibres	NAD
					Charlotte Taylor	31/05/2022	Asbestos ACM	NAD
					Charlotte Taylor	31/05/2022	Asbestos Type	NAD
22/8363	1	WS09	0.70	33	Charlotte Taylor	31/05/2022	General Description (Bulk Analysis)	soil/stones
					Charlotte Taylor	31/05/2022	Asbestos Fibres	NAD
					Charlotte Taylor	31/05/2022	Asbestos ACM	NAD
					Charlotte Taylor	31/05/2022	Asbestos Type	NAD
22/8363	1	WS01	0.50	36	Remigiusz Blichowski	31/05/2022	General Description (Bulk Analysis)	Black burned sand
					Remigiusz Blichowski	31/05/2022	Asbestos Fibres	NAD
					Remigiusz Blichowski	31/05/2022	Asbestos ACM	NAD
					Remigiusz Blichowski	31/05/2022	Asbestos Type	NAD
22/8363	1	WS04	1.40	39	Remigiusz Blichowski	31/05/2022	General Description (Bulk Analysis)	Black burned dust and stone
					Remigiusz Blichowski	31/05/2022	Asbestos Fibres	NAD
					Remigiusz Blichowski	31/05/2022	Asbestos ACM	NAD
					Remigiusz Blichowski	31/05/2022	Asbestos Type	NAD
22/8363	1	TP01	0.70	48	Remigiusz Blichowski	31/05/2022	General Description (Bulk Analysis)	Black burned sand
					Remigiusz Blichowski	31/05/2022	Asbestos Fibres	NAD
					Remigiusz Blichowski	31/05/2022	Asbestos ACM	NAD
					Remigiusz Blichowski	31/05/2022	Asbestos Type	NAD

Client Name: Tetra Tech
Reference: B035234
Location: Cwmavon
Contact: Nicholas Bool

[illegible]

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 22/8363

SOILS and ASH

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. Asbestos samples are retained for 6 months.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C. Ash samples are dried at 37°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overestimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

STACK EMISSIONS

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation for Dioxins and Furans and Dioxin like PCBs has been performed on XAD-2 Resin, only samples which use this resin will be within our MCERTS scope.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

Laboratory records are kept for a period of no less than 6 years.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

Customer Provided Information

Sample ID and depth is information provided by the customer.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range
AA	x5 Dilution

HWOL ACRONYMS AND OPERATORS USED

HS	Headspace Analysis.
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent.
CU	Clean-up - e.g. by florisil, silica gel.
1D	GC - Single coil gas chromatography.
Total	Aliphatics & Aromatics.
AL	Aliphatics only.
AR	Aromatics only.
2D	GC-GC - Double coil gas chromatography.
#1	EH_Total but with humics mathematically subtracted
#2	EU_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +).
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry.

EMT Job No: 22/8363

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM16/PM30	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE/Water samples are extracted with solvent using a magnetic stirrer to create a vortex.			AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM16/PM30/PM69	please refer to PM16/PM30 and PM69 for method details			AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details			AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.			AD	Yes

EMT Job No: 22/8363

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			AR	Yes
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM21B	As Received samples are extracted in Methanol: Water (60:40) by reciprocal shaker.			AR	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry); WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM14	Preparation of waters and leachates for metals by ICP OES/ICP MS. Samples are filtered for Dissolved metals, and remain unfiltered for Total metals then acidified	Yes		AR	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry); WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry); WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GC/FID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GC/FID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GC/FID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM69	One part soil is mixed with 10 parts water in a vial leaving no headspace. The mixture is shaken and then left to leach for 24 hours before VOC analysis.			AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013	PM0	No preparation is required.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AD	Yes

EMT Job No: 22/8363

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013I	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM60	TC/TOC analysis of Waters by High Temperature Combustion followed by NDIR detection. Based on the following modified standard methods: USEPA 9060A (2002), APHA SMEWW 5310B:1999 22nd Edition, ASTM D 7573, and USEPA 415.1.	PM0	No preparation is required.			AR	Yes
TM65	Asbestos Bulk Identification method based on HSG 248 Second edition (2021)	PM42	Modified SCA Blue Book V.12 draft 2017 and WM3 1st Edition v1.1:2018. Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM0	No preparation is required.			AR	Yes
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM74	Analysis of water soluble boron (20:1 extract) by ICP-OES.	PM32	Hot water soluble boron is extracted from dried and ground samples using a 20:1 ratio.	Yes		AD	Yes
TM75	Modified US EPA method 310.1 (1978). Determination of Alkalinity by Metrohm automated titration analyser.	PM0	No preparation is required.			AR	Yes
TM89	Modified USEPA method OIA-1667 (1999). Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM0	No preparation is required.	Yes		AR	Yes
TM89	Modified USEPA method OIA-1667 (1999). Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide, Sulphide and Thiocyanate analysis.			AR	Yes
NONE	No Method Code	NONE	No Method Code			AD	Yes

EMT Job No: 22/8363

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
NONE	No Method Code	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.				
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.			AR	

APPENDIX G – GROUNDWATER AND GROUND GAS MONITORING DATA

Tetra Tech

LANDGAS AND GROUNDWATER MONITORING RESULTS



Site Name: Cwmavon
Job No.: B035234
Client: Neath Port Talbot Council

Date Monitored:
Monitoring Engineer:
Weather:

02/06/22
 JTC
 dry, warm

EQUIPMENT USED			
Type	Make	Serial	Last Calibrated
Gas Analyser	Landtec GA5000	G502044	Nov-21
Interface Meter	Solinst	122-004988-1	n/a

LANDGAS CONCENTRATIONS - INSTALLATION CONDITIONS												
Exploratory Hole No	Peak		Steady									
	CH ₄ (% vol)	CO ₂ (% vol)	CH ₄ (% vol)	CO ₂ (% vol)	O ₂ (% vol)	BAL (%)	PID (ppm)	H ₂ S (ppm)	HCN (ppm)	CO (ppm)	Time	Remarks
WS04	0.1	0.2	0.1	0.2	20.8	78.9	nt	0	nt	0	10:00	
WS05	0.1	0.2	0.1	0.1	20.6	79.2	nt	0	nt	0	10:30	
BH02	0.1	0.1	0.1	0.1	20.8	79	nt	0	nt	0	11:45	

LANDGAS - PHYSICAL PARAMETERS							
Exploratory Hole No	Atmos Pressure (m bar)	Atmos Temp (°C)	BH Flow		BH Pressure		Remarks
			Peak (L/hr)	Steady (L/hr)	Peak (mbar)	Steady (mbar)	
WS04	1014	16.0	0.2	0.1	0.05	0.05	
WS05	1013	16.0	0.1	0.1	0.02	0.02	
BH02	1014	16.0	0.1	0.1	0.51	0.50	

AMBIENT ATMOSPHERIC CONDITIONS			ATMOSPHERIC PRESSURE CONDITIONS	
Parameter	Before Monitoring	After Monitoring		
CH ₄ (% vol)	0.0	0.0	3 days prior (m bar)	1026
CO ₂ (% vol)	0.2	0.0	2 days prior (m bar)	1028
O ₂ (% vol)	21.1	21.1	1 day prior (m bar)	1023
PID (ppm)	nt	nt	during (m bar) am,midday,pm	1019, 1020, 1019
Atmos Press. (m bar)	1018	1018	1 day post (m bar)	1018

GROUNDWATER / NAPL - PHYSIO-CHEMICAL PARAMETERS													
Exploratory Hole No	Water Surface (mbgl)	Base Depth (mbgl)	LNAPL Surface (mbgl)	DNAPL Surface (mbgl)	Water Quality Indicators								Remarks
					ORP (mV)	SPC (µs/cm)	C (µs/cm)	Ph (value)	DO (mg/L)	Dissolved Solids (ppt)	Resistivity (Ω-cm)	Temp (°C)	
WS04	dry	1.90	nd	nd	nt	nt	nt	nt	nt	nt	nt	nt	
WS05	dry	2.00	nd	nd	nt	nt	nt	nt	nt	nt	nt	nt	
BH02	3.40	6.00	nd	nd	nt	nt	nt	nt	nt	nt	nt	nt	

Notes nt = not tested
 nd = not detected

Data Compiled by: JTC
 Data Checked by: NEB

Tetra Tech

LANDGAS AND GROUNDWATER MONITORING RESULTS



Site Name: Cwmavon
Job No.: B035234
Client: Neath Port Talbot Council

Date Monitored:
Monitoring Engineer:
Weather:

09/06/22
 JTC
 overcast, warm

EQUIPMENT USED			
Type	Make	Serial	Last Calibrated
Gas Analyser	Landtec GA5000	G502044	Nov-21
Interface Meter	Solinst	122-004988-1	n/a

LANDGAS CONCENTRATIONS - INSTALLATION CONDITIONS												
Exploratory Hole No	Peak		Steady									
	CH ₄ (% vol)	CO ₂ (% vol)	CH ₄ (% vol)	CO ₂ (% vol)	O ₂ (% vol)	BAL (%)	PID (ppm)	H ₂ S (ppm)	HCN (ppm)	CO (ppm)	Time	Remarks
WS04	0.1	4.6	0.1	4.0	12.9	83	nt	0	nt	0	12:30	
WS05	0.1	7.4	0.1	4.6	12.5	82.8	nt	0	nt	0	13:00	
BH02	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt		

LANDGAS - PHYSICAL PARAMETERS							
Exploratory Hole No	Atmos Pressure (m bar)	Atmos Temp (°C)	BH Flow		BH Pressure		Remarks
			Peak (L/hr)	Steady (L/hr)	Peak (mbar)	Steady (mbar)	
WS04	1012	16.0	0.1	0.1	0.07	0.07	
WS05	1012	16.0	0.1	0.1	0.09	0.09	
BH02	nt	ntn	nt	nt	nt	nt	

AMBIENT ATMOSPHERIC CONDITIONS			ATMOSPHERIC PRESSURE CONDITIONS	
Parameter	Before Monitoring	After Monitoring		
CH ₄ (% vol)	0.0	0.0	3 days prior (m bar)	1019
CO ₂ (% vol)	0.0	0.0	2 days prior (m bar)	1012
O ₂ (% vol)	21.4	21.5	1 day prior (m bar)	1008
PID (ppm)	nt	nt	during (m bar) am,midday,pm	1017, 1017, 1015
Atmos Press. (m bar)	1017	1015	1 day post (m bar)	1018

GROUNDWATER / NAPL - PHYSIO-CHEMICAL PARAMETERS													
Exploratory Hole No	Water Surface (mbgl)	Base Depth (mbgl)	LNAPL Surface (mbgl)	DNAPL Surface (mbgl)	Water Quality Indicators								Remarks
					ORP (mV)	SPC (µs/cm)	C (µs/cm)	Ph (value)	DO (mg/L)	Dissolved Solids (ppt)	Resistivity (Ω-cm)	Temp (°C)	
WS04	dry	1.90	nd	nd	nt	nt	nt	nt	nt	nt	nt	nt	
WS05	dry	2.00	nd	nd	nt	nt	nt	nt	nt	nt	nt	nt	
BH02	nt	nt	nd	nd	nt	nt	nt	nt	nt	nt	nt	nt	
			nd	nd	nt	nt	nt	nt	nt	nt	nt	nt	

Notes nt = not tested
 nd = not detected

Data Compiled by: JTC
 Data Checked by: NEB

Tetra Tech

LANDGAS AND GROUNDWATER MONITORING RESULTS



Site Name: Cwmavon
Job No.: B035234
Client: Neath Port Talbot Council

Date Monitored:
Monitoring Engineer:
Weather:

15/06/22
 JM
 overcast, warm

EQUIPMENT USED			
Type	Make	Serial	Last Calibrated
Gas Analyser	Landtec GA5000	G502044	Nov-21
Interface Meter	Solinst	122-004988-1	n/a

LANDGAS CONCENTRATIONS - INSTALLATION CONDITIONS												
Exploratory Hole No	Peak		Steady									
	CH ₄ (% vol)	CO ₂ (% vol)	CH ₄ (% vol)	CO ₂ (% vol)	O ₂ (% vol)	BAL (%)	PID (ppm)	H ₂ S (ppm)	HCN (ppm)	CO (ppm)	Time	Remarks
WS04	0.1	4.3	0.1	4.3	13.1	82.5	nt	0	nt	0	11:00	
WS05	0.1	7.2	0.1	7.2	11.9	80.8	nt	0	nt	1	11:30	
BH02	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	12:00	

LANDGAS - PHYSICAL PARAMETERS							Remarks
Exploratory Hole No	Atmos Pressure (m bar)	Atmos Temp (°C)	BH Flow		BH Pressure		
			Peak (L/hr)	Steady (L/hr)	Peak (mbar)	Steady (mbar)	
WS04	1016	16.0	0.1	0.1	0.19	-0.33	
WS05	1016	16.0	0.2	0.2	0.03	0.00	
BH02	nt	ntn	nt	nt	nt	nt	

AMBIENT ATMOSPHERIC CONDITIONS			ATMOSPHERIC PRESSURE CONDITIONS	
Parameter	Before Monitoring	After Monitoring		
CH ₄ (% vol)	0.1	0.1	3 days prior (m bar)	1019
CO ₂ (% vol)	0.1	0.1	2 days prior (m bar)	1012
O ₂ (% vol)	20.8	20.8	1 day prior (m bar)	1008
PID (ppm)	nt	nt	during (m bar) am,midday,pm	1017, 1017, 1015
Atmos Press. (m bar)	1016	1016	1 day post (m bar)	1018

GROUNDWATER / NAPL - PHYSIO-CHEMICAL PARAMETERS													
Exploratory Hole No	Water Surface (mbgl)	Base Depth (mbgl)	LNAPL Surface (mbgl)	DNAPL Surface (mbgl)	Water Quality Indicators								Remarks
					ORP (mV)	SPC (µs/cm)	C (µs/cm)	Ph (value)	DO (mg/L)	Dissolved Solids (ppt)	Resistivity (Ω-cm)	Temp (°C)	
WS04	DRY	1.90	nd	nd	nt	nt	nt	nt	nt	nt	nt	nt	
WS05	DRY	2.00	nd	nd	nt	nt	nt	nt	nt	nt	nt	nt	
BH02	nt	nt	nd	nd	nt	nt	nt	nt	nt	nt	nt	nt	
			nd	nd	nt	nt	nt	nt	nt	nt	nt	nt	

Notes nt = not tested
 nd = not detected

Data Compiled by: JM
 Data Checked by: NEB

APPENDIX H – CIRIA C552 RISK METHODOLOGY

The following tables are derived from CIRIA C552 and have been used to define the risk rating presented in the Qualitative Risk Assessment matrix.

Classification of consequence

Classification	Definition
Severe	Short term (acute) risk to human health likely to result in 'significant harm' as defined by the Environment Protection Act 1990, Part IIA. Short term risk of pollution (note; Water Resources Act contains no scope for considering significant pollution) of sensitive water resource. Catastrophic damage to building/property. A short-term risk to a particular ecosystem, or organism forming part of such ecosystem. (Note the definitions of ecological systems within the Draft Circular on Contaminated Land DETR, 2000).
Medium	Chronic damage to human health ('significant harm', as defined In DETR, 2000). Pollution of sensitive water resources (note; Water Resources Act contains no scope for considering significant pollution). A significant change in a particular ecosystem, or an organism forming part of such an ecosystem. (Note the definitions of ecological systems within the Draft Circular on Contaminated Land DETR, 2000).
Mild	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services ('significant harm', as defined In DETR, 2000). Damage to sensitive buildings/structures/services or the environment.
Minor	Harm, although not necessarily significant harm, which may result in a financial loss, or expenditure to resolve. Non-permanent health effects to human health (easily prevented by means such as personal protective clothing etc). Easily repairable effects of damage to buildings, structures and services.

Classification of probability

Classification	Definition
High likelihood	There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term or there is evidence at the receptor of harm or pollution.
Likely	There is a pollutant linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period that such an event would take place, and is even less likely in the shorter term.
Unlikely	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long term.

Matrix of consequence against probability to gain a risk classification

		Consequence			
		Severe	Medium	Mild	Minor
Probability	High Likelihood	Very High Risk	High Risk	Moderate Risk	Moderate/Low Risk
	Likely	High Risk	Moderate Risk	Moderate/Low Risk	Low Risk
	Low likelihood	Moderate Risk	Moderate/Low Risk	Low Risk	Very Low Risk
	Unlikely	Moderate/Low Risk	Low Risk	Very Low Risk	Very Low Risk

APPENDIX I – COAL AUTHORITY REPORT



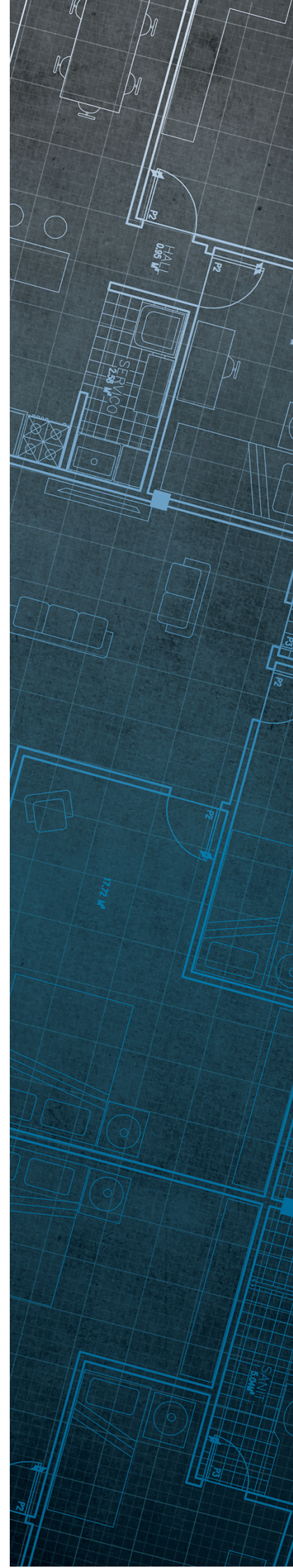
The Coal
Authority

Consultants Coal Mining Report

Preswylfa, Cunard Row, Salem Road,
Cwmavon, Sa12 9ed
Torfaen

Date of enquiry:	27 October 2021
Date enquiry received:	27 October 2021
Issue date:	27 October 2021

Our reference:	51002704195001
Your reference:	GS-8293497



Consultants

Coal Mining Report

This report is based on and limited to the records held by the Coal Authority at the time the report was produced.

Client name

GROUNDSURE LIMITED

Enquiry address

Preswylfa, Cunard Row, Salem Road, Cwmavon,
Sa12 9ed
Torfaen

How to contact us

0345 762 6848 (UK)
+44 (0)1623 637 000 (International)

200 Lichfield Lane
Mansfield
Nottinghamshire
NG18 4RG

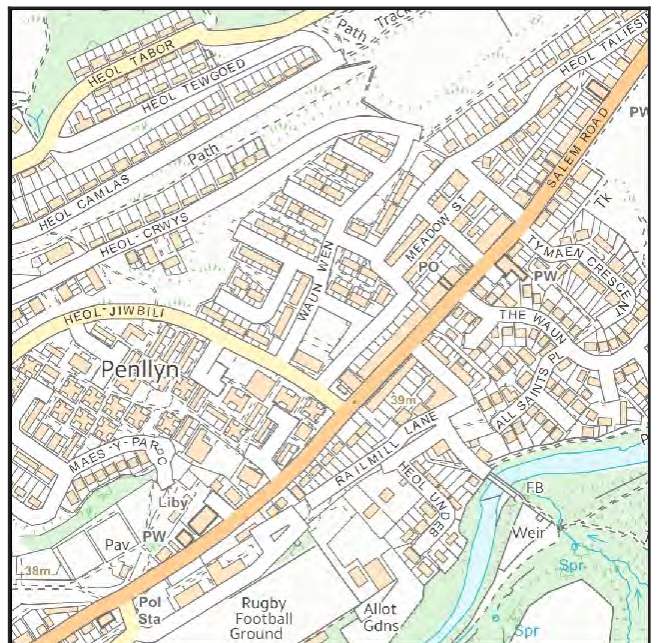
www.groundstability.com

 @coalauthority

 /company/the-coal-authority

 /thecoalauthority

 /thecoalauthority



Approximate position of property



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Section 1 – Mining activity and geology

Past underground mining

Colliery	Seam	Mineral	Coal Authority reference	Depth (m)	Direction to working	Dipping rate of seam worked (degrees)	Dipped direction of seam worked	Extraction thickness (cm)	Year last mined
MEADOW	LOWER NINE FOOT TOP LEAF	Coal	4XRG	27	North-East	22.4	North	169	1863
MEADOW	LOWER NINE FOOT (TOP LEAF)	Coal	4XQ8	150	Beneath Property	26.6	North	140	1861
MEADOW	LOWER NINE FOOT (TOP LEAF)	Coal	4XQ7	158	North-West	23.8	North	140	1860
MEADOW	LOWER NINE FOOT (TOP LEAF)	Coal	4XQ6	169	North-West	16.2	North	140	1862
unnamed	FIVE FOOT GELLIDEG	Coal	4XPZ	177	Beneath Property	32.0	North	91	1860

Probable unrecorded shallow workings

None.

Spine roadways at shallow depth

No spine roadway recorded at shallow depth.

Mine entries

Entry type	Reference	Grid reference	Treatment description	Mineral	Conveyancing details
Shaft	278192-006	278396 192458	This shaft was filled with steel and copper slag in 1969.	Coal	
Shaft	278192-038	278523 192505	This Shaft was filled with rubble and scrap metal and capped to NCB specification with reinforced concrete in 1977.	Coal	Afan Borough Council 13/10/1976

Abandoned mine plan catalogue numbers

The following abandoned mine plan catalogue numbers intersect with some, or all, of the enquiry boundary:

SWR2093	SWR2009	SWR2012
2680	PO0	SWR2654
R12069		

Please contact us on 0345 762 6848 to determine the exact abandoned mine plans you require based on your needs.

Outcrops

Seam name	Mineral	Seam workable	Distance to outcrop (m)	Direction to outcrop	Bearing of outcrop
LOWER NINE FOOT TOP LEAF	Coal	Yes	Within	N/A	98

Geological faults, fissures and breaklines

No faults, fissures or breaklines recorded.

Opencast mines

None recorded within 500 metres of the enquiry boundary.

Coal Authority managed tips

None recorded within 500 metres of the enquiry boundary.

Section 2 – Investigative or remedial activity

Please refer to the 'Summary of findings' map (on separate sheet) for details of any activity within the area of the site boundary.

Site investigations

None recorded within 50 metres of the enquiry boundary.

Remediated sites

None recorded within 50 metres of the enquiry boundary.

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.

Mine gas

None recorded within 500 metres of the enquiry boundary.

Mine water treatment schemes

None recorded within 500 metres of the enquiry boundary.

Section 3 – Licensing and future mining activity

Future underground mining

None recorded.

Coal mining licensing

None recorded within 200 metres of the enquiry boundary.

Court orders

None recorded.

Section 46 notices

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

Withdrawal of support notices

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.

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.

Section 4 – Further information

The following potential risks have been identified and as part of your risk assessment should be investigated further.

Development advice

The site is within an area of historical coal mining activity. Should you require advice and/or support on understanding the mining legacy, its risks to your development or what next steps you need to take, please contact us.

For further information on specific site or ground investigations in relation to any issues raised in Section 4, please call us on 0345 762 6848 or email us at groundstability@coal.gov.uk.

Section 5 – Data definitions

The datasets used in this report have limitations and assumptions within their results. For more guidance on the data and the results specific to the enquiry boundary, please **call us on 0345 762 6848** or **email us at groundstability@coal.gov.uk**.

Past underground coal mining

Details of all recorded underground mining relative to the enquiry boundary. Only past underground workings where the enquiry boundary is within 0.7 times the depth of the workings (zone of likely physical influence) allowing for seam inclination, will be included.

Probable unrecorded shallow workings

Areas where the Coal Authority believes there to be unrecorded coal workings that exist at or close to the surface (less than 30 metres deep).

Spine roadways at shallow depth

Connecting roadways either, working to working, or, surface to working, both in-seam and cross measures that exist at or close to the surface (less than 30 metres deep), either within or within 10 metres of the enquiry boundary.

Mine entries

Details of any shaft or adit either within, or within 100 metres of the enquiry boundary including approximate location, brief treatment details where known, the mineral worked from the mine entry and conveyance details where the mine entry has previously been sold by the Authority or its predecessors British Coal or the National Coal Board.

Abandoned mine plan catalogue numbers

Plan numbers extracted from the abandoned mines catalogue containing details of coal and other mineral abandonment plans deposited via the Mines Inspectorate in accordance with the Coal Mines Regulation Act and Metalliferous Mines Regulation Act 1872. A maximum of 9 plan extents that intersect with the enquiry boundary will be included. This does not infer that the workings and/or mine entries shown on the abandonment plan will be relevant to the site/property boundary.

Outcrops

Details of seam outcrops will be included where the enquiry boundary intersects with a conjectured or actual seam outcrop location (derived by either the British Geological Survey or the Coal Authority) or intersects with a defined 50 metres buffer on the coal (dip) side of the outcrop. An indication of whether the Coal Authority believes the seam to be of sufficient thickness and/or quality to have been worked will also be included.

Geological faults, fissures and breaklines

Geological disturbances or fractures in the bedrock. Surface fault lines (British Geological Survey derived data) and fissures and breaklines (Coal Authority derived data) intersecting with the enquiry boundary will be included. In some circumstances faults, fissures or breaklines have been known to contribute to surface subsidence damage as a consequence of underground coal mining.

Opencast mines

Opencast coal sites from which coal has been removed in the past by opencast (surface) methods and where the enquiry boundary is within 500 metres of either the licence area, site boundary, excavation area (high wall) or coaling area.

Coal Authority managed tips

Locations of disused colliery tip sites owned and managed by the Coal Authority, located within 500 metres of the enquiry boundary.

Site investigations

Details of site investigations within 50 metres of the enquiry boundary where the Coal Authority has received information relating to coal mining risk investigation and/or remediation by third parties.

Remediated sites

Sites where the Coal Authority has undertaken remedial works either within or within 50 metres of the enquiry boundary following report of a hazard relating to coal mining under the Coal Authority's Emergency Surface Hazard Call Out procedures.

Coal mining subsidence

Details of alleged coal mining subsidence claims made since 31 October 1994 either within or within 50 metres of the enquiry boundary. Where the claim relates to the enquiry boundary confirmation of whether the claim was accepted, rejected or whether liability is still being determined will be given. Where the claim has been discharged, whether this was by repair, payment of compensation or a combination of both, the value of the claim, where known, will also be given.

Details of any current 'Stop Notice' deferring remedial works or repairs affecting the property/site, and if so the date of the notice.

Details of any request made to execute preventative works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991. If yes, whether any person withheld consent or failed to comply with any request to execute preventative works.

Mine gas

Reports of alleged mine gas emissions received by the Coal Authority, either within or within 500 metres of the enquiry boundary that subsequently required investigation and action by the Coal Authority to mitigate the effects of the mine gas emission.

Mine water treatment schemes

Locations where the Coal Authority has constructed or operates assets that remove pollutants from mine water prior to the treated mine water being discharged into the receiving water body.

These schemes are part of the UK's strategy to meet the requirements of the Water Framework Directive. Schemes fall into 2 basic categories: Remedial – mitigating the impact of existing pollution or Preventative – preventing a future pollution incident.

Mine water treatment schemes generally consist of one or more primary settlement lagoons and one or more reed beds for secondary treatment. A small number are more specialised process treatment plants.

Future underground mining

Details of all planned underground mining relative to the enquiry boundary. Only those future workings where the enquiry boundary is within 0.7 times the depth of the workings (zone of likely physical influence) allowing for seam inclination will be included.

Coal mining licensing

Details of all licenses issued by the Coal Authority either within or within 200 metres of the enquiry boundary in relation to the under taking of surface coal mining, underground coal mining or underground coal gasification.

Court orders

Orders in respect of the working of coal under the Mines (Working Facilities and Support) Acts of 1923 and 1966 or any statutory modification or amendment thereof.

Section 46 notices

Notice of proposals relating to underground coal mining operations that have been given under section 46 of the Coal Mining Subsidence Act 1991.

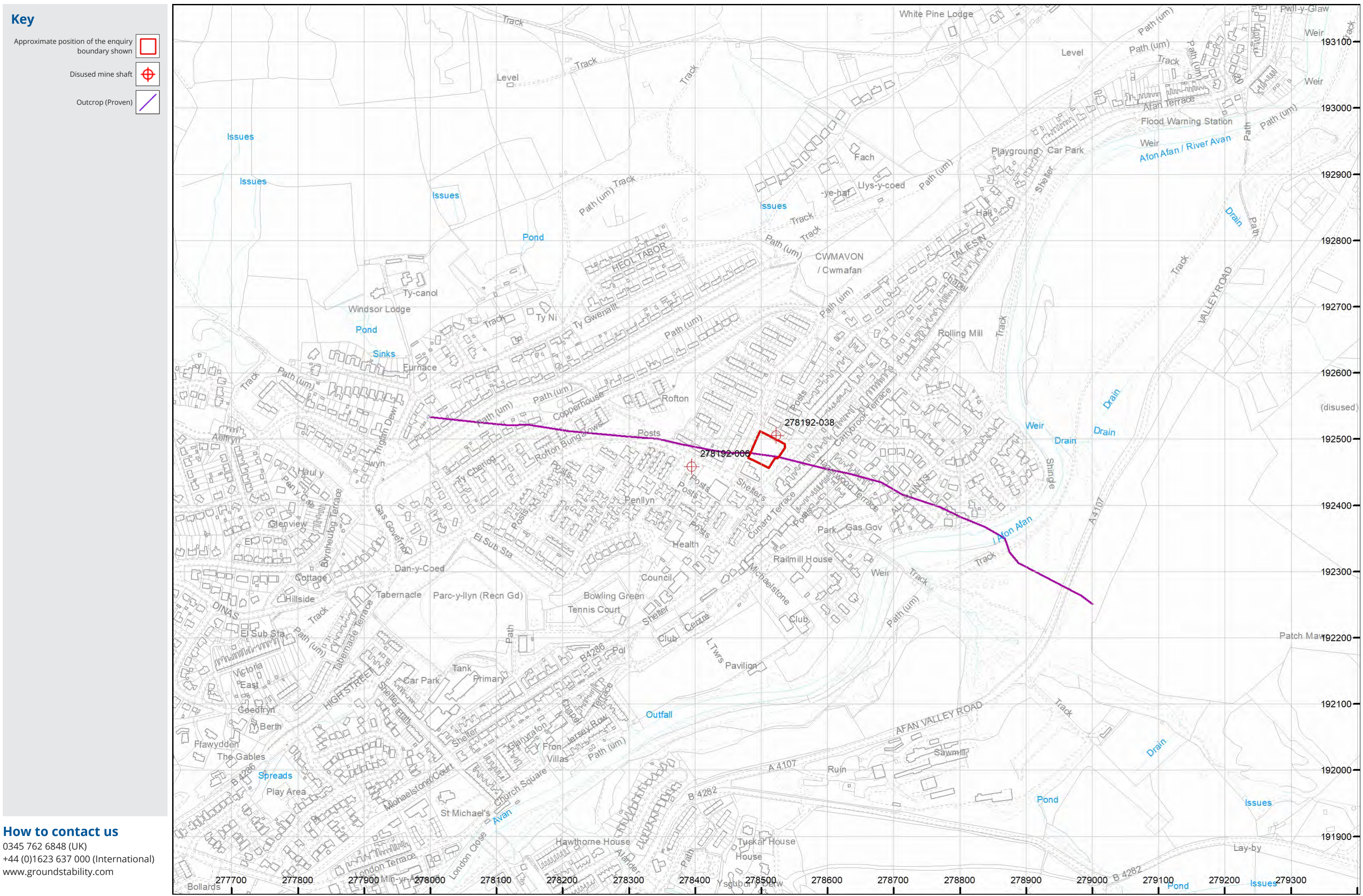
Withdrawal of support notices

Published notices of entitlement to withdraw support and the date of the notice. Details of any revocation notice withdrawing the entitlement to withdraw support given under Section 41 of the Coal Industry Act 1994.

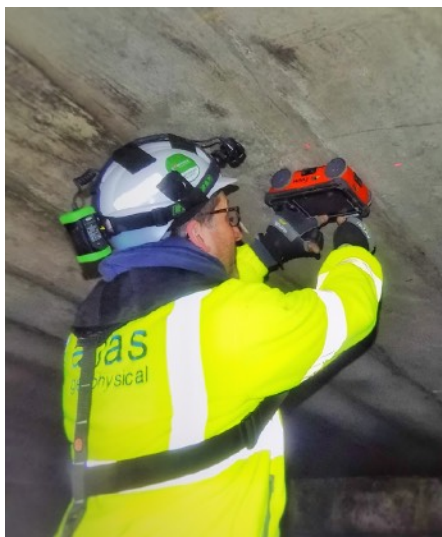
Payment to owners of former copyhold land

Relevant notices which may affect the property and any subsequent notice of retained interests in coal and coal mines, acceptance or rejection notices and whether any compensation has been paid to a claimant.

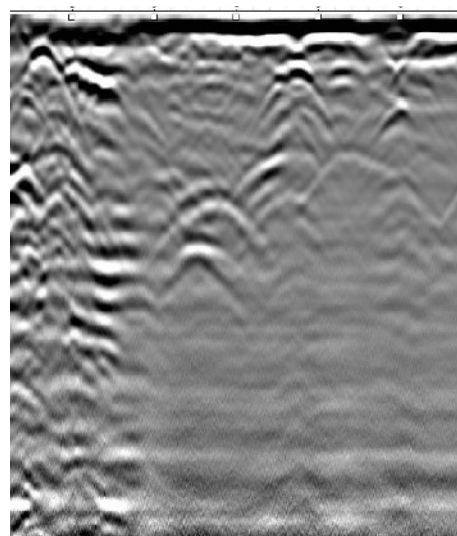
The map highlights any specific surface or subsurface features within or near to the boundary of the site.



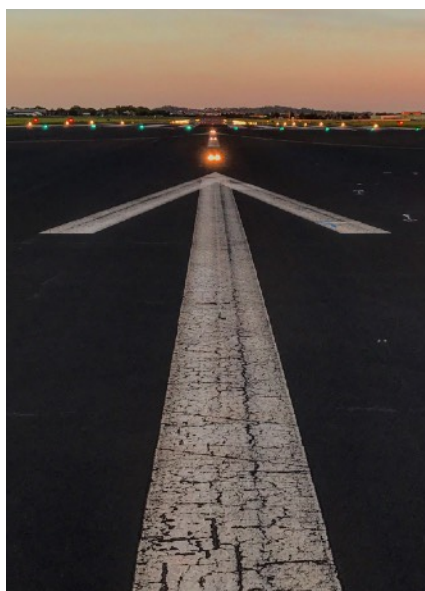
APPENDIX J – GEOPHYSICAL SURVEY REPORT



atlas geophysical



Cwmafan Childcare Unit Geophysical Survey



Revision I.

This report documents a Geophysical survey in Cwmafan, South Wales. The principal aim of the investigation was to determine the location of a disused mineshaft beneath a potential new development.

Client: Tetra Tech
Project Number: AG1693
Date of issue: June 2022

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Distribution Sheet**Cwmafan Childcare Unit
Geophysical Survey
Tetra Tech Limited**

DISTRIBUTION			
Date:	Issued to	Name	Issue No.
June 2022		Mr N Bool	1

Approval Sheet and Forward

Cwmafan Childcare Unit Geophysical Survey Tetra Tech Limited

Report Status/Issue No: Final/1		Date of Issue June 2022
Issued to: Tetra Tech Ltd		Project No: AG1693
	Name:	Signature:
Author:	A. Birtwisle BSc FGS	
Issued from AGL Location: Wales	Unit 12, Swansea Valley Business Park, Ystalyfera, SA9 2EB	(t) 01639 874 104 (f) 08703 835 590 (e) info@atlasgeo.co.uk (w) www.atlasgeo.co.uk

FOREWORD

1. This report has been prepared by Atlas Geophysical Limited with all reasonable skill, care and diligence within the terms of the contract with the Client and the limitations of the resources devoted to it by agreement with the Client.
2. This report shall not be used for engineering or contractual purposes unless signed above by the author and the approver and unless the report status is 'Final'.

1. Introduction

- 1.2. Atlas Geophysical Limited was commissioned to conduct a Geophysical Survey on a section of highway in the former industrial area of Cwmafan, South Wales.
- 1.3. The survey was undertaken on 6th May 2022.
- 1.4. The GPR element of the investigation complied with Ofcom regulations and was undertaken within approximately 50m of Lat: 51°37'06"N, 003°45'22"W (OSGB SS785295). Data were acquired between 0930BST and 1430BST.
- 1.5. The principal aim of the investigation was to locate evidence of a disused mineshaft in the vicinity of a proposed new development.

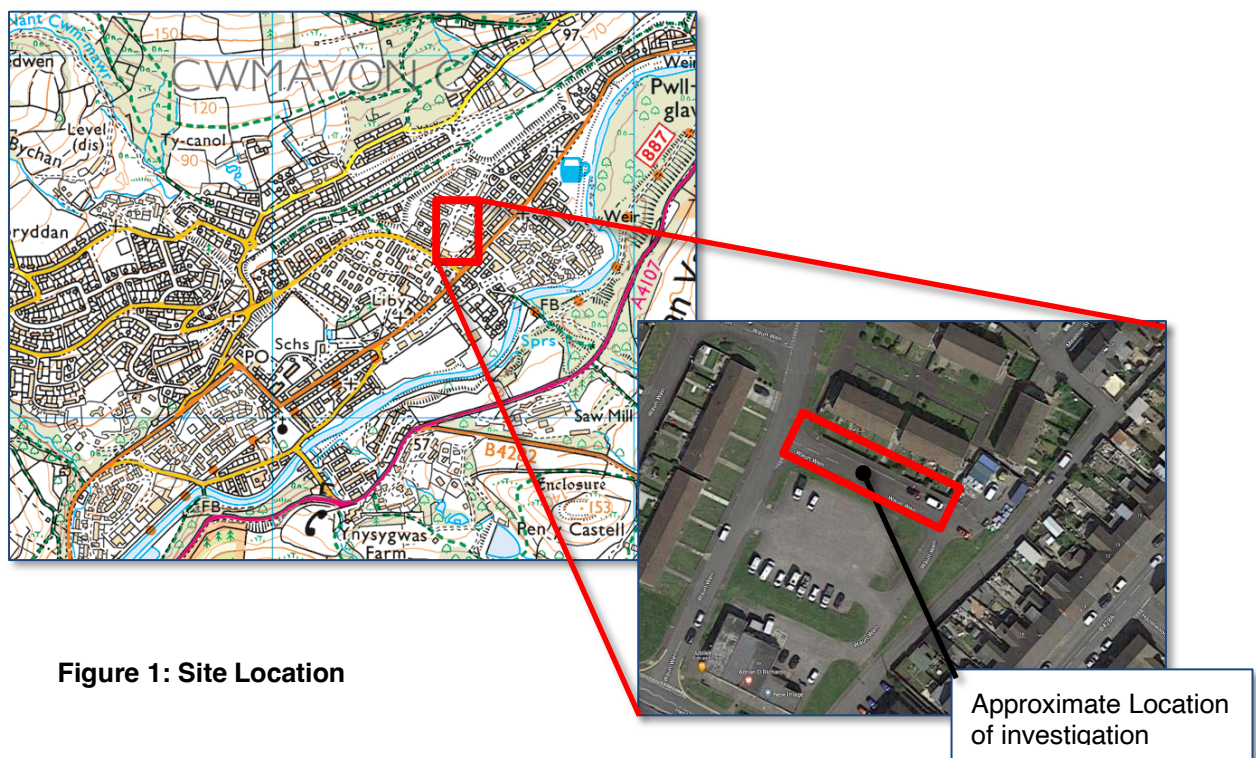


Figure 1: Site Location

- 1.6. The proposed survey area encompassed an access road (Waun Wen) leading to a municipal car park and nearby properties.
- 1.7. Two complimentary geophysical techniques were used in the investigation. These included Ground Penetrating Radar (GPR) and Fluxgate magnetometry.
- 1.8. The fluxgate magnetometer readings were acquired at 0.5m centres along the length of the survey area.
- 1.9. A grid of GPR profiles was acquired across the entire survey area. Profiles were spaced at c.0.5m centres.
- 1.10. Survey conditions were generally good. The ground was dry, with no apparent areas of standing water or saturated ground at the surface.
- 1.11. Access to the complete survey area was reduced due to parked cars on Waun Wen. Heras Fencing surrounding a Welsh Water compound prevented access to the municipal car park south of Waun Wen.

2. Historic Background

- 2.2. The area covered by the geophysical survey was heavily industrialised for much of the 19th and 20th centuries.
- 2.3. Post War redevelopment of the land has removed all traces of the previous coal mining and metal working industry that once occupied the site.

3. Geological Background

- 3.2. Cwmafan is located within the Afan river valley. The bedrock within the valley is overlaid with a layer of quaternary alluvium comprising sands and silty deposits.
- 3.2.1. The alluvial deposits lie directly above the South Wales Middle Coal Measure formation. The Carboniferous bedrock comprises of mudstone, sandstone and siltstone interbedded with coal seams.

4. Magnetometer/Gradiometer Survey Methodology

- 4.2. The prospecting method used for this geophysical investigation was magnetometry. The system used was the MXPDA five-sensor fluxgate magnetometer array manufactured by Sensys (Germany).
- 4.3. The sensing elements of a fluxgate magnetometer consist of one or more cores of magnetic alloy, around which are wound coils through which an alternating current can be passed. Variations in the electrical properties of the circuits with the magnetisation of the cores can be converted into voltages proportional to the external magnetic field along the vertical core axis.
- 4.4. The Sensys MXPDA has a measurement range of $\pm 8,000\text{nT}$ (nano-Tesla)
- 4.5. The sensors were mounted on a wheeled frame/cart approximately 0.5m apart.
- 4.6. The measurements acquired by the sensors are digitised and fed into a small ruggedised field computer (PDA) and saved for future download and subsequent analysis.
- 4.7. The Sensys MXPDA does not require a linear grid to be marked out before the survey. It acquires spatial information directly from an RTK-GNSS receiver mounted on the array frame.
- 4.7.1. For this survey, a GeoMax Zenith 25 GNSS system was used that acquired NTRIP RTK corrections via GSM, removing the need for a static base station.

The Zenith 25 is capable of measurement accuracy of $\pm 10\text{mm}$ (X, Y) and $\pm 25\text{mm}$ (Z)

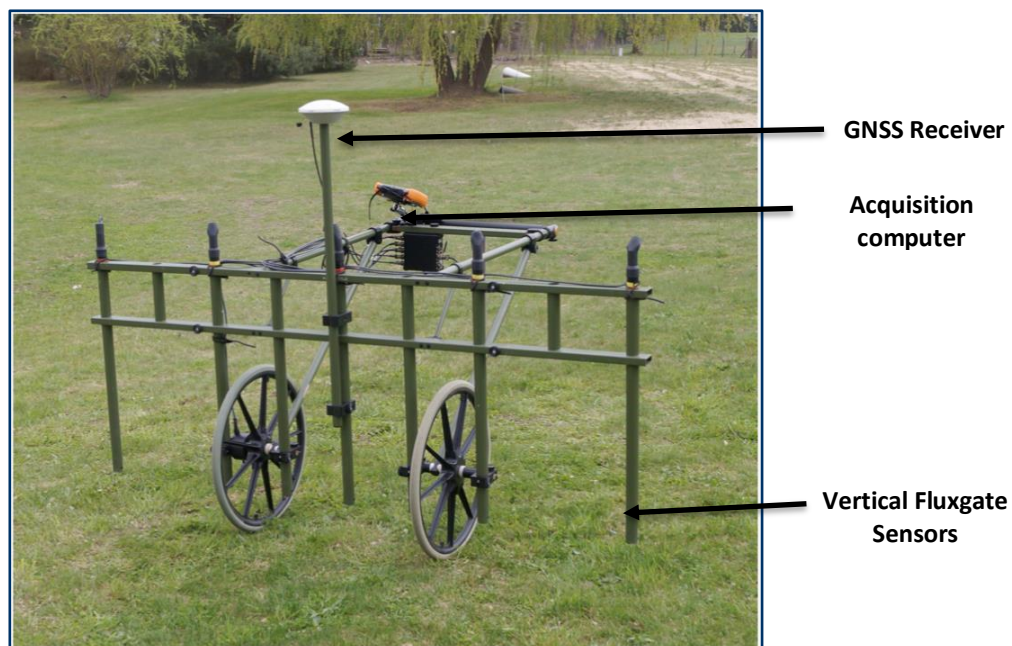


Figure 2: Sensys MXPDA

- 4.8. Once switched on, the wheeled frame was pushed in a series of parallel transects across the survey area. After data acquisition, the information was transferred to a Windows-based PC for post-processing and analysis.

5. GPR Survey Methodology

- 5.2. Ground Penetrating Radar (GPR) methods rely on observing the reflections from short-duration pulses of electromagnetic energy. These pulses (or scans) are transmitted into the pavement or structure, and reflections from material boundaries or embedded features (rebars, services, or voids) are detected by a receiver. The time duration between each scan and reflected signal is recorded in conjunction with a distance between scans to provide a continuous cross-section of the pavement or structure, enabling rapid assessment of thickness and condition over large areas. By assessing the amplitude, phase, and scatter of received signals, it is possible to determine the material thickness and construction changes. In many cases, it is often possible to assess cracking and changes in compaction, bond, and relative moisture content.
 - 5.2.1. GPR can detect voids and separation within or between material layers by mapping changes in the amplitude of radio energy reflected from a material boundary or from within an otherwise homogeneous material. Variations in the amplitude of the reflected radio energy can also occur for other reasons: a general increase in moisture content or micro-cracking may cause absorption or scattering of the GPR energy and, therefore, a reduction in signal quality and strength, whilst water at a material boundary or the presence of metalwork or clay may give rise to reflections of greater amplitude. The analysis of this information relies on a degree of subjective interpretation, and limited direct exposure is typically required to verify the results. GPR is effective at mapping the extent of voids but cannot generally be used to determine the depth of a void.
- 5.3. The GPR equipment used in this investigation included a 350HS radar antenna manufactured by GSSI; the antennas operate at a centre frequency of 350MHz. The 350MHz antenna was set to scan a 130ns time range (approximately *5.2m) *Assumes a transmission velocity of 0.08m/ns as the subsurface conditions were likely to be damp.
- 5.4. The antennae were mounted on a cart and manoeuvred around the site by hand. A distance measuring encoder attached to the cart controlled the scan rate. The system was calibrated to scan every 30mm for all data acquired.
- 5.5. A grid of GPR profiles was acquired across the entire survey area. Profiles were spaced at c.0.5m centres.
- 5.6. Survey conditions were generally good. The ground was dry, with no apparent areas of standing water or saturated ground at the surface.
- 5.7. Access to the complete survey area was reduced due to parked cars on Waun Wen. Heras Fencing surrounding a Welsh Water compound prevented access to the municipal car park south of Waun Wen.
- 5.8. The data were recorded onto the hard disk of the radar control unit [field computer], which was mounted on the GPR cart, which stored the data during the survey and enabled it to be downloaded to a PC for post-processing and interpretation in the office at the end of the survey.

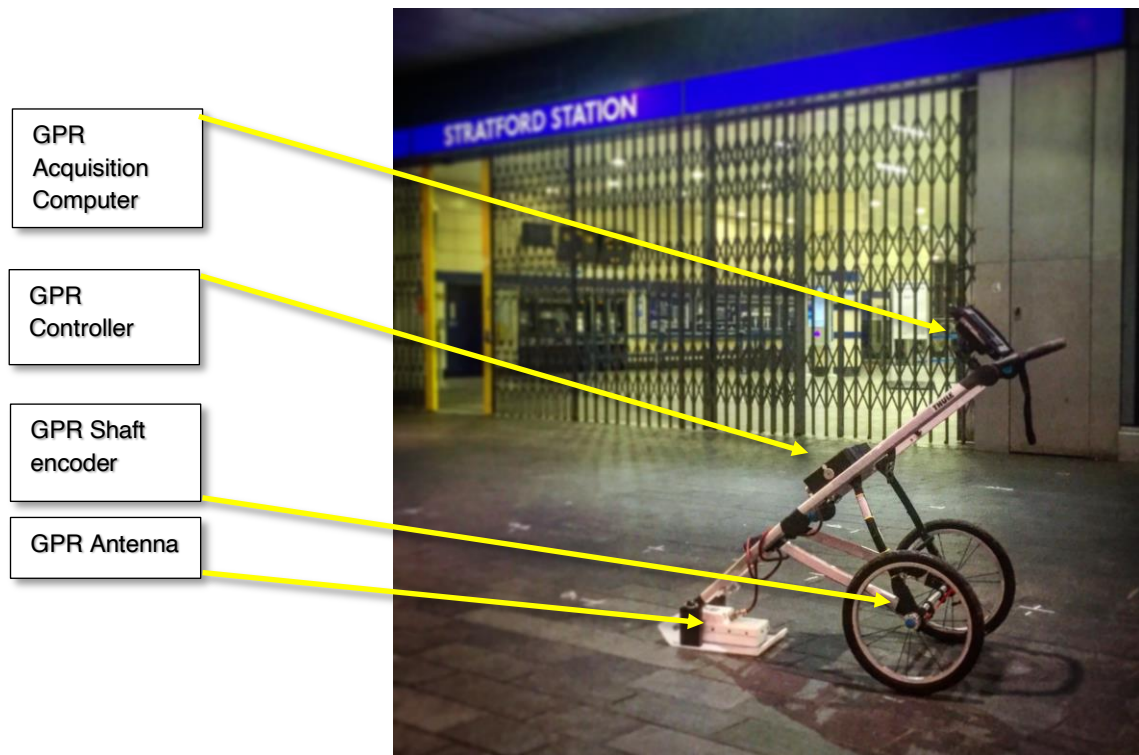


Figure 3: Typical GPR setup

6. Analysis of GPR Data

6.2. Significant post-acquisition data processing is required to assist in analysing the GPR result. The four primary processing stages involve:

- Declipping the data to rebuild the over-gained waveforms and fall beyond the dynamic threshold of the GPR receiver.
- Start-time correction compensates for signal drift and lifts the first half-wave so that $t=0$ and subsequent depths/thickness results are relevant.
- Dynamic correction to compensate for the transmitter/receiver offset.
- Noise removal to filter extraneous background/system noise.

6.3. The measurement of thickness or depth relies on multiplying the two-way travel time by the velocity of the radio signals passing through the materials under investigation.

6.4. An average velocity value of 0.09m/ns has been assumed for all depth calculations based on experience from similar sites and hyperbolic curve matching from buried targets (utilities) within the survey area.

6.5. Caution is advisable with all depth calculations as moisture variations can affect the reliability of such information. It is always recommended that core data or trial pits be used to help interpretation of GPR data more accurately.

6.6. The depth measurements should be approximated, not as an absolute value.

6.7. The interpretation and analysis of the GPR data involve identifying the main elements of the structure under investigation and establishing the characteristics of its base condition.

Variations in construction and condition can be identified and compared with similar structures investigated elsewhere, enabling mapping anomalies and variations.

The arrangement and condition of structural components can be determined by analysing three primary variables in the GPR data. 1. Amplitude. 2. Phase. 3. The velocity of the reflected signals from within the material and from the material boundaries.

This provides information regarding the material type and the continuity of the signal, which gives an idea of the shape of the component and the travel time of radio pulses through the material that indicates the layer thickness or depth to embedded anomalies.

6.8. It should be noted that while GPR can be used to map the location of a buried utility effectively, it cannot generally be used to determine the diameter of the utility or its use.

6.9. It should be noted that with any non-destructive technique, depth calculations could only be deemed reliable when compared with direct exposure. The transmission of electromagnetic signals and subsequent clarity of results can be affected by slight variations in material porosity, density, moisture content, and interface conditions between material types.

7. Findings from the GPR Investigation

7.2. The results of the GPR survey have been processed, and exported sections presented on Drawing AG1645-01 are discussed below.

7.2.1. Fluxgate Magnetometer Results.

The data presented below are acquired using a fluxgate magnetometer and represent the geomagnetic response from materials within a metre of the ground surface.

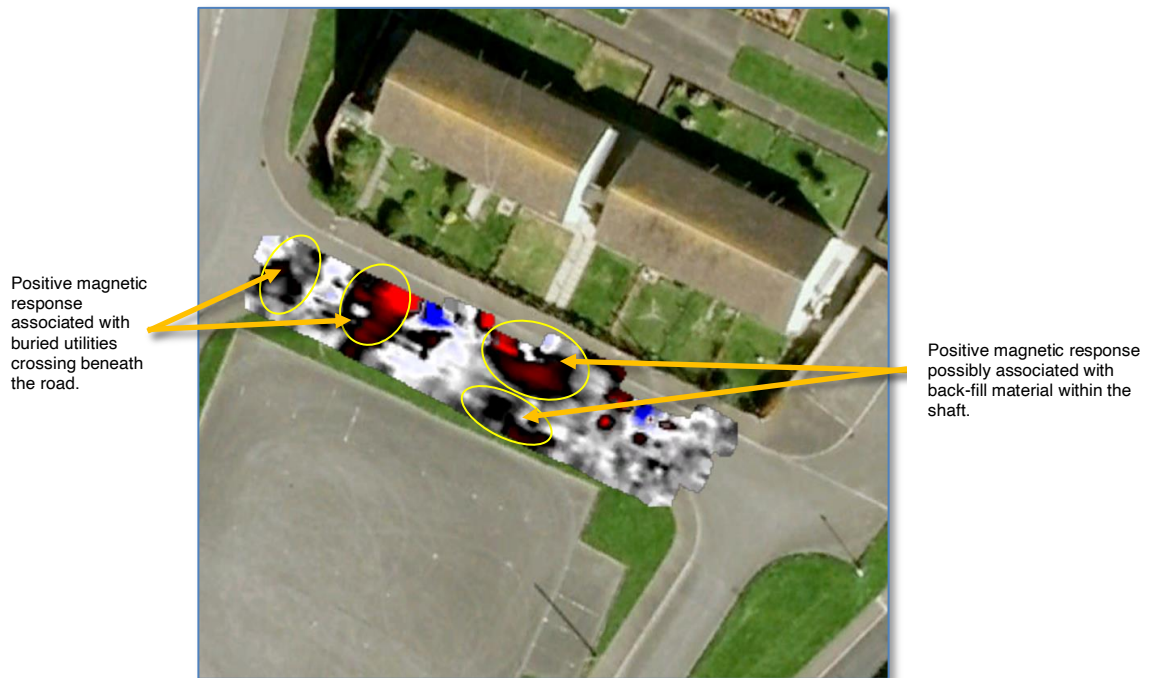
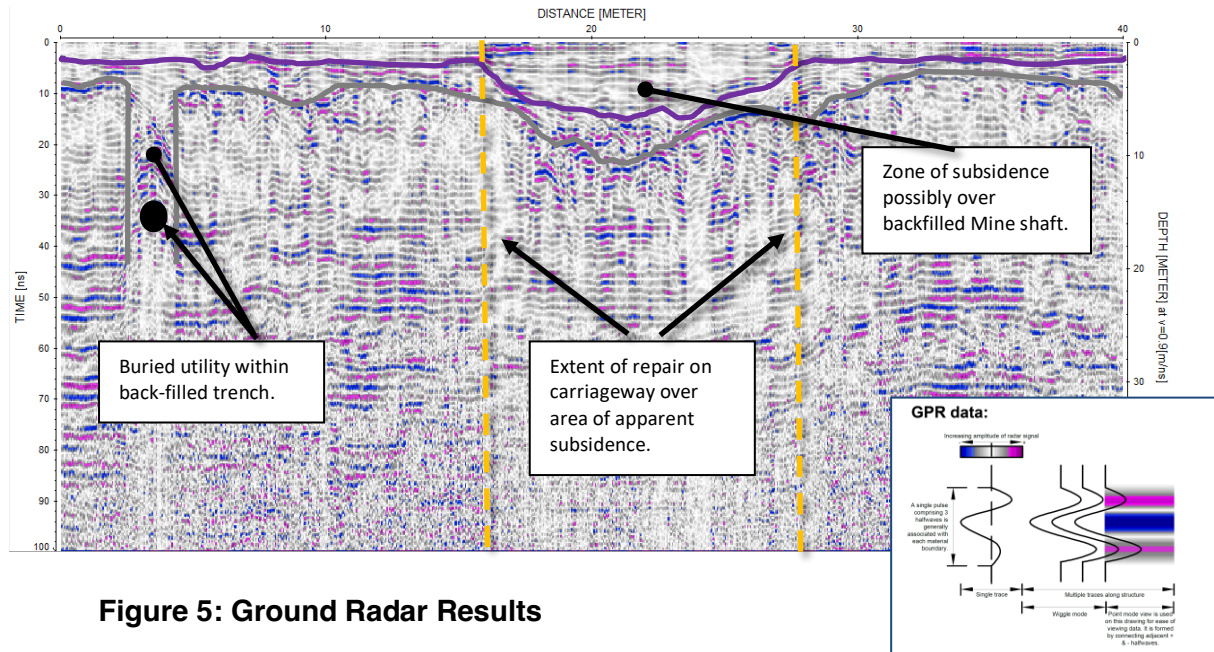


Figure 4: Fluxgate Magnetometer Results

- 7.2.1.1. Four high amplitude positive magnetic anomalies typically associated with backfilled depressions were identified within the survey area.
- 7.2.1.2. Two identified responses to the west of the survey area appear to be related to buried utilities/services. The GPR results corroborate this interpretation.
- 7.2.1.3. The two more significant responses identified east of the survey area are a single truncated response cut in two by a relatively shallow (c.0.5m) buried utility.

7.2.2. Ground Penetrating Radar Results.

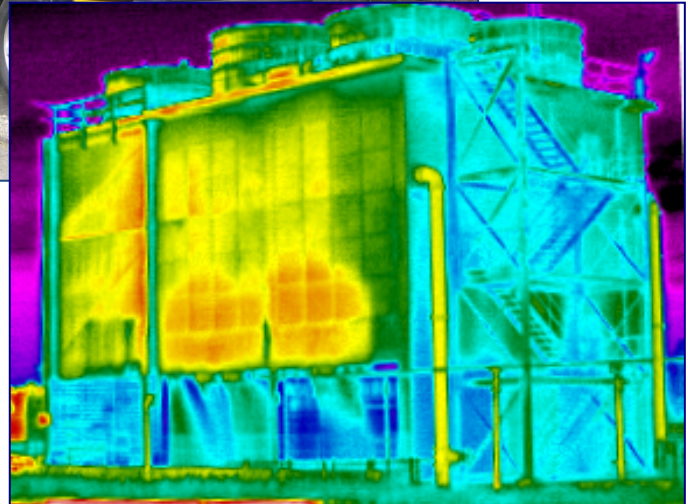
The data presented below is an example of GPR data acquired along the length of Waun Wen with crude interpretation for reference.



- 7.2.2.1. The datum for the GPR profile above was at the western end of the survey area and increased chainage in an easterly direction.
- 7.2.2.2. The backfilled trench containing a buried utility observed in the magnetometer data can be seen clearly in the GPR section.
- 7.2.2.3. A patch repair over a c.10m section of carriageway appears to be an area of subsidence filled with over 0.5m of asphaltic material. The area of subsidence may be caused by differential compaction of materials within the backfilled mine shaft.
- 7.2.2.4. The area of subsidence also corresponds to the area of anomalous response identified in the magnetometer data.

8. Conclusions & Recommendations

- 8.2. Evidence from the Geophysical surveys suggests the disused mine shaft exists beneath the carriageway of Waun Wen/
- 8.3. An asphaltic repair to the carriageway if potentially filling subsidence caused by material within the backfilled shaft compacting.
- 8.4. Heavy plants are advised to avoid this particular location if and when the municipal car park is developed.
- 8.4.1. It is recommended that intrusive investigation of the anomalies through targeted trial/inspection pits is undertaken to ascertain the true nature of the anomalies observed.



atlas geophysical

www.atlasgeo.co.uk
info@atlasgeo.co.uk

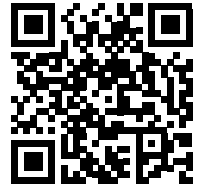
t: +44 (0) 1639 874 104
 f: +44 (0) 8703 835 590

APPENDIX K – HAZWASTE ONLINE WASTE CLASSIFICATION REPORT

Waste Classification Report

HazWasteOnline™ classifies waste as either **hazardous** or **non-hazardous** based on its chemical composition, related legislation and the rules and data defined in the current UK or EU technical guidance (Appendix C) (note that HP 9 Infectious is not assessed). It is the responsibility of the classifier named below to:

- understand the origin of the waste
- select the correct List of Waste code(s)
- confirm that the list of determinands, results and sampling plan are fit for purpose
- select and justify the chosen metal species (Appendix B)
- correctly apply moisture correction and other available corrections
- add the meta data for their user-defined substances (Appendix A)
- check that the classification engine is suitable with respect to the national destination of the waste (Appendix C)



3ZSX4-8HSW4-WHIOQ

To aid the reviewer, the laboratory results, assumptions and justifications managed by the classifier are highlighted in **pale yellow**.

Job name

EMT-22-8363-Batch-1-202206090925

Description/Comments

Classification of samples collected during a ground investigation at the site in Cwmavon. Classification has been undertaken in line with EA Guidance WM3 Waste Classification: Guidance on the classification and assessment of Waste (1st Edition V1.1) 2018

Project

B035234

Site

Cwmavon

Classified by

Name:
Katy Woodhouse
Date:
29 Jun 2022 13:18 GMT
Telephone:

Company:
Tetra Tech (WYG (White Young Green))
5th Floor Longcross Court,
47 Newport Road
Cardiff
CF24 0AD

HazWasteOnline™ provides a two day, hazardous waste classification course that covers the use of the software and both basic and advanced waste classification techniques. Certification has to be renewed every 3 years.

HazWasteOnline™ Certification:

CERTIFIED

Course
Hazardous Waste Classification

Date
07 Nov 2019

Next 3 year Refresher due by Nov 2022

Job summary

#	Sample name	Depth [m]	Classification Result	Hazard properties	Page
1	BH02-18/05/2022-2.00m		Non Hazardous		2
2	WS09-17/05/2022-0.70m		Non Hazardous		4
3	WS01-18/05/2022-0.50m		Non Hazardous		7
4	WS04-17/05/2022-1.40m		Non Hazardous		10
5	TP01-17/05/2022-0.70m		Hazardous	HP 14	13

Related documents

#	Name	Description
1	EMT-22-8363-Batch-1-202206090925.HWOL	.hwol file used to create the Job
2	Example waste stream template for contaminated soils	waste stream template used to create this Job

Report

Created by: Katy Woodhouse

Created date: 29 Jun 2022 13:18 GMT

Appendices

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Appendix A: Classifier defined and non GB MCL determinands	16
Appendix B: Rationale for selection of metal species	17
Appendix C: Version	18

Classification of sample: BH02-18/05/2022-2.00m

 **Non Hazardous Waste**
 Classified as **17 05 04**
 in the List of Waste

Sample details

Sample name:	LoW Code:	
BH02-18/05/2022-2.00m	Chapter:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
	Entry:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 0% No Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number									
1	arsenic { arsenic trioxide }				30.8	mg/kg	1.32	40.666	mg/kg	0.00407 %		
	033-003-00-0	215-481-4	1327-53-3									
2	beryllium { beryllium oxide }				1.3	mg/kg	2.775	3.608	mg/kg	0.000361 %		
	004-003-00-8	215-133-1	1304-56-9									
3	boron { diboron trioxide; boric oxide }				0.4	mg/kg	3.22	1.288	mg/kg	0.000129 %		
	005-008-00-8	215-125-8	1303-86-2									
4	cadmium { cadmium oxide }				<0.1	mg/kg	1.142	<0.114	mg/kg	<0.0000114 %		<LOD
	048-002-00-0	215-146-2	1306-19-0									
5	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }				14.3	mg/kg	1.462	20.9	mg/kg	0.00209 %		
		215-160-9	1308-38-9									
6	chromium in chromium(VI) compounds { chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex }				<0.3	mg/kg	2.27	<0.681	mg/kg	<0.0000681 %		<LOD
	024-017-00-8											
7	copper { dicopper oxide; copper (I) oxide }				34	mg/kg	1.126	38.28	mg/kg	0.00383 %		
	029-002-00-X	215-270-7	1317-39-1									
8	lead { lead chromate }			1	14	mg/kg	1.56	21.837	mg/kg	0.0014 %		
	082-004-00-2	231-846-0	7758-97-6									
9	mercury { mercury dichloride }				<0.1	mg/kg	1.353	<0.135	mg/kg	<0.0000135 %		<LOD
	080-010-00-X	231-299-8	7487-94-7									
10	nickel { nickel chromate }				30.8	mg/kg	2.976	91.669	mg/kg	0.00917 %		
	028-035-00-7	238-766-5	14721-18-7									
11	selenium { nickel selenate }				<1	mg/kg	2.554	<2.554	mg/kg	<0.000255 %		<LOD
	028-031-00-5	239-125-2	15060-62-5									
12	zinc { zinc sulphate }				77	mg/kg	2.469	190.136	mg/kg	0.019 %		
	030-006-00-9	231-793-3 [1] 231-793-3 [2]	7446-19-7 [1] 7733-02-0 [2]									
13	TPH (C6 to C40) petroleum group				<52	mg/kg		<52	mg/kg	<0.0052 %		<LOD
			TPH									
14	tert-butyl methyl ether; MTBE; 2-methoxy-2-methylpropane				<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
	603-181-00-X	216-653-1	1634-04-4									
15	benzene				<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
	601-020-00-8	200-753-7	71-43-2									
16	toluene				<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
	601-021-00-3	203-625-9	108-88-3									

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number								
17	ethylbenzene 601-023-00-4	202-849-4	100-41-4		<0.005 mg/kg		<0.005 mg/kg	<0.0000005 %			<LOD
18	xylene 601-022-00-9	202-422-2 [1] 203-396-5 [2] 203-576-3 [3] 215-535-7 [4]	95-47-6 [1] 106-42-3 [2] 108-38-3 [3] 1330-20-7 [4]		<0.01 mg/kg		<0.01 mg/kg	<0.000001 %			<LOD
19	pH		PH		7.87 pH		7.87 pH	7.87 pH			
20	naphthalene 601-052-00-2	202-049-5	91-20-3		<0.04 mg/kg		<0.04 mg/kg	<0.000004 %			<LOD
21	acenaphthylene 205-917-1		208-96-8		<0.03 mg/kg		<0.03 mg/kg	<0.000003 %			<LOD
22	acenaphthene 201-469-6		83-32-9		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %			<LOD
23	fluorene 201-695-5		86-73-7		<0.04 mg/kg		<0.04 mg/kg	<0.000004 %			<LOD
24	phenanthrene 201-581-5		85-01-8		<0.03 mg/kg		<0.03 mg/kg	<0.000003 %			<LOD
25	anthracene 204-371-1		120-12-7		<0.04 mg/kg		<0.04 mg/kg	<0.000004 %			<LOD
26	fluoranthene 205-912-4		206-44-0		<0.03 mg/kg		<0.03 mg/kg	<0.000003 %			<LOD
27	pyrene 204-927-3		129-00-0		<0.03 mg/kg		<0.03 mg/kg	<0.000003 %			<LOD
28	benzo[a]anthracene 601-033-00-9	200-280-6	56-55-3		<0.06 mg/kg		<0.06 mg/kg	<0.000006 %			<LOD
29	chrysene 601-048-00-0	205-923-4	218-01-9		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
30	benzo[b]fluoranthene 601-034-00-4	205-911-9	205-99-2		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %			<LOD
31	benzo[k]fluoranthene 601-036-00-5	205-916-6	207-08-9		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
32	benzo[a]pyrene; benzo[def]chrysene 601-032-00-3	200-028-5	50-32-8		<0.04 mg/kg		<0.04 mg/kg	<0.000004 %			<LOD
33	indeno[123-cd]pyrene 205-893-2		193-39-5		<0.04 mg/kg		<0.04 mg/kg	<0.000004 %			<LOD
34	dibenz[a,h]anthracene 601-041-00-2	200-181-8	53-70-3		<0.04 mg/kg		<0.04 mg/kg	<0.000004 %			<LOD
35	benzo[ghi]perylene 205-883-8		191-24-2		<0.04 mg/kg		<0.04 mg/kg	<0.000004 %			<LOD
36	vanadium { divanadium pentaoxide; vanadium pentoxide } 023-001-00-8	215-239-8	1314-62-1		17 mg/kg	1.785	30.348 mg/kg	0.00303 %			
Total:									0.0487 %		

Key

- User supplied data
- Determinand values ignored for classification, see column 'Conc. Not Used' for reason
- Determinand defined or amended by HazWasteOnline (see Appendix A)
- Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
- <LOD** Below limit of detection
- ND** Not detected
- CLP: Note 1 Only the metal concentration has been used for classification

Classification of sample: WS09-17/05/2022-0.70m

 **Non Hazardous Waste**
 Classified as **17 05 04**
 in the List of Waste

Sample details

Sample name: WS09-17/05/2022-0.70m	LoW Code: Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites) Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)
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Hazard properties

None identified

Determinands

Moisture content: 0% No Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number									
1	arsenic { arsenic trioxide }				43.2	mg/kg	1.32	57.038	mg/kg	0.0057 %		
	033-003-00-0	215-481-4	1327-53-3									
2	beryllium { beryllium oxide }				1.6	mg/kg	2.775	4.441	mg/kg	0.000444 %		
	004-003-00-8	215-133-1	1304-56-9									
3	boron { diboron trioxide; boric oxide }				0.5	mg/kg	3.22	1.61	mg/kg	0.000161 %		
	005-008-00-8	215-125-8	1303-86-2									
4	cadmium { cadmium oxide }				<0.1	mg/kg	1.142	<0.114	mg/kg	<0.0000114 %		<LOD
	048-002-00-0	215-146-2	1306-19-0									
5	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }				24.3	mg/kg	1.462	35.516	mg/kg	0.00355 %		
		215-160-9	1308-38-9									
6	chromium in chromium(VI) compounds { chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex }				<0.3	mg/kg	2.27	<0.681	mg/kg	<0.0000681 %		<LOD
	024-017-00-8											
7	copper { dicopper oxide; copper (I) oxide }				148	mg/kg	1.126	166.631	mg/kg	0.0167 %		
	029-002-00-X	215-270-7	1317-39-1									
8	lead { lead chromate }			1	58	mg/kg	1.56	90.469	mg/kg	0.0058 %		
	082-004-00-2	231-846-0	7758-97-6									
9	mercury { mercury dichloride }				0.2	mg/kg	1.353	0.271	mg/kg	0.0000271 %		
	080-010-00-X	231-299-8	7487-94-7									
10	nickel { nickel chromate }				38.7	mg/kg	2.976	115.181	mg/kg	0.0115 %		
	028-035-00-7	238-766-5	14721-18-7									
11	selenium { nickel selenate }				<1	mg/kg	2.554	<2.554	mg/kg	<0.000255 %		<LOD
	028-031-00-5	239-125-2	15060-62-5									
12	zinc { zinc sulphate }				545	mg/kg	2.469	1345.767	mg/kg	0.135 %		
	030-006-00-9	231-793-3 [1] 231-793-3 [2]	7446-19-7 [1] 7733-02-0 [2]									
13	TPH (C6 to C40) petroleum group				139	mg/kg		139	mg/kg	0.0139 %		
			TPH									
14	tert-butyl methyl ether; MTBE; 2-methoxy-2-methylpropane				<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
	603-181-00-X	216-653-1	1634-04-4									
15	benzene				<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
	601-020-00-8	200-753-7	71-43-2									
16	toluene				<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
	601-021-00-3	203-625-9	108-88-3									

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number								
17	• ethylbenzene 601-023-00-4	202-849-4	100-41-4		<0.005 mg/kg		<0.005 mg/kg	<0.0000005 %			<LOD
18	• xylene 601-022-00-9	202-422-2 [1] 203-396-5 [2] 203-576-3 [3] 215-535-7 [4]	95-47-6 [1] 106-42-3 [2] 108-38-3 [3] 1330-20-7 [4]		<0.01 mg/kg		<0.01 mg/kg	<0.000001 %			<LOD
19	• pH		PH		7.58 pH		7.58 pH	7.58 pH			
20	naphthalene 601-052-00-2	202-049-5	91-20-3		0.16 mg/kg		0.16 mg/kg	0.000016 %			
21	• acenaphthylene 205-917-1		208-96-8		0.05 mg/kg		0.05 mg/kg	0.000005 %			
22	• acenaphthene 201-469-6		83-32-9		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %			<LOD
23	• fluorene 201-695-5		86-73-7		<0.04 mg/kg		<0.04 mg/kg	<0.000004 %			<LOD
24	• phenanthrene 201-581-5		85-01-8		0.84 mg/kg		0.84 mg/kg	0.000084 %			
25	• anthracene 204-371-1		120-12-7		<0.04 mg/kg		<0.04 mg/kg	<0.000004 %			<LOD
26	• fluoranthene 205-912-4		206-44-0		0.28 mg/kg		0.28 mg/kg	0.000028 %			
27	• pyrene 204-927-3		129-00-0		0.33 mg/kg		0.33 mg/kg	0.000033 %			
28	benzo[a]anthracene 601-033-00-9	200-280-6	56-55-3		0.18 mg/kg		0.18 mg/kg	0.000018 %			
29	chrysene 601-048-00-0	205-923-4	218-01-9		0.49 mg/kg		0.49 mg/kg	0.000049 %			
30	benzo[b]fluoranthene 601-034-00-4	205-911-9	205-99-2		0.35 mg/kg		0.35 mg/kg	0.000035 %			
31	benzo[k]fluoranthene 601-036-00-5	205-916-6	207-08-9		0.14 mg/kg		0.14 mg/kg	0.000014 %			
32	benzo[a]pyrene; benzo[def]chrysene 601-032-00-3	200-028-5	50-32-8		0.21 mg/kg		0.21 mg/kg	0.000021 %			
33	• indeno[123-cd]pyrene 205-893-2		193-39-5		0.16 mg/kg		0.16 mg/kg	0.000016 %			
34	dibenz[a,h]anthracene 601-041-00-2	200-181-8	53-70-3		0.07 mg/kg		0.07 mg/kg	0.000007 %			
35	• benzo[ghi]perylene 205-883-8		191-24-2		0.18 mg/kg		0.18 mg/kg	0.000018 %			
36	• vanadium { divanadium pentaoxide; vanadium pentoxide } 023-001-00-8	215-239-8	1314-62-1		35 mg/kg	1.785	62.481 mg/kg	0.00625 %			
Total:									0.199 %		

Key

- User supplied data
- Determinand values ignored for classification, see column 'Conc. Not Used' for reason
- Determinand defined or amended by HazWasteOnline (see Appendix A)
-  Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
- <LOD** Below limit of detection
- ND** Not detected
- CLP: Note 1 Only the metal concentration has been used for classification

Supplementary Hazardous Property Information

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and <= 75°C"

Force this Hazardous property to non hazardous because Not considered flammable per WFD HP3 definition 6 indents testing. Annex III of the Waste Framework Directive (WFD) Council Directive 2008/98/EC. No evidence of a free draining liquid phase

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.0139%)

Classification of sample: WS01-18/05/2022-0.50m

 **Non Hazardous Waste**
 Classified as **17 05 04**
 in the List of Waste

Sample details

Sample name:	LoW Code:	
WS01-18/05/2022-0.50m	Chapter:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
	Entry:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 0% No Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number									
1	arsenic { arsenic trioxide }				28.4	mg/kg	1.32	37.497	mg/kg	0.00375 %		
	033-003-00-0	215-481-4	1327-53-3									
2	beryllium { beryllium oxide }				0.9	mg/kg	2.775	2.498	mg/kg	0.00025 %		
	004-003-00-8	215-133-1	1304-56-9									
3	boron { diboron trioxide; boric oxide }				0.6	mg/kg	3.22	1.932	mg/kg	0.000193 %		
	005-008-00-8	215-125-8	1303-86-2									
4	cadmium { cadmium oxide }				0.3	mg/kg	1.142	0.343	mg/kg	0.0000343 %		
	048-002-00-0	215-146-2	1306-19-0									
5	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }				28.8	mg/kg	1.462	42.093	mg/kg	0.00421 %		
		215-160-9	1308-38-9									
6	chromium in chromium(VI) compounds { chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex }				<0.3	mg/kg	2.27	<0.681	mg/kg	<0.0000681 %		<LOD
	024-017-00-8											
7	copper { dicopper oxide; copper (I) oxide }				126	mg/kg	1.126	141.862	mg/kg	0.0142 %		
	029-002-00-X	215-270-7	1317-39-1									
8	lead { lead chromate }			1	79	mg/kg	1.56	123.225	mg/kg	0.0079 %		
	082-004-00-2	231-846-0	7758-97-6									
9	mercury { mercury dichloride }				<0.1	mg/kg	1.353	<0.135	mg/kg	<0.0000135 %		<LOD
	080-010-00-X	231-299-8	7487-94-7									
10	nickel { nickel chromate }				22.7	mg/kg	2.976	67.561	mg/kg	0.00676 %		
	028-035-00-7	238-766-5	14721-18-7									
11	selenium { nickel selenate }				<1	mg/kg	2.554	<2.554	mg/kg	<0.000255 %		<LOD
	028-031-00-5	239-125-2	15060-62-5									
12	zinc { zinc sulphate }				225	mg/kg	2.469	555.592	mg/kg	0.0556 %		
	030-006-00-9	231-793-3 [1] 231-793-3 [2]	7446-19-7 [1] 7733-02-0 [2]									
13	TPH (C6 to C40) petroleum group				155	mg/kg		155	mg/kg	0.0155 %		
			TPH									
14	tert-butyl methyl ether; MTBE; 2-methoxy-2-methylpropane				<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
	603-181-00-X	216-653-1	1634-04-4									
15	benzene				<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
	601-020-00-8	200-753-7	71-43-2									
16	toluene				<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
	601-021-00-3	203-625-9	108-88-3									

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number								
17	ethylbenzene 601-023-00-4	202-849-4	100-41-4		<0.005 mg/kg		<0.005 mg/kg	<0.0000005 %			<LOD
18	xylene 601-022-00-9	202-422-2 [1] 203-396-5 [2] 203-576-3 [3] 215-535-7 [4]	95-47-6 [1] 106-42-3 [2] 108-38-3 [3] 1330-20-7 [4]		<0.01 mg/kg		<0.01 mg/kg	<0.000001 %			<LOD
19	pH		PH		8.07 pH		8.07 pH	8.07 pH			
20	naphthalene 601-052-00-2	202-049-5	91-20-3		0.27 mg/kg		0.27 mg/kg	0.000027 %			
21	acenaphthylene 205-917-1	208-96-8			0.82 mg/kg		0.82 mg/kg	0.000082 %			
22	acenaphthene 201-469-6	83-32-9			<0.05 mg/kg		<0.05 mg/kg	<0.000005 %			<LOD
23	fluorene 201-695-5	86-73-7			0.25 mg/kg		0.25 mg/kg	0.000025 %			
24	phenanthrene 201-581-5	85-01-8			3.95 mg/kg		3.95 mg/kg	0.000395 %			
25	anthracene 204-371-1	120-12-7			2.36 mg/kg		2.36 mg/kg	0.000236 %			
26	fluoranthene 205-912-4	206-44-0			8.32 mg/kg		8.32 mg/kg	0.000832 %			
27	pyrene 204-927-3	129-00-0			6.66 mg/kg		6.66 mg/kg	0.000666 %			
28	benzo[a]anthracene 601-033-00-9	200-280-6	56-55-3		3.96 mg/kg		3.96 mg/kg	0.000396 %			
29	chrysene 601-048-00-0	205-923-4	218-01-9		3.67 mg/kg		3.67 mg/kg	0.000367 %			
30	benzo[b]fluoranthene 601-034-00-4	205-911-9	205-99-2		4.09 mg/kg		4.09 mg/kg	0.000409 %			
31	benzo[k]fluoranthene 601-036-00-5	205-916-6	207-08-9		1.59 mg/kg		1.59 mg/kg	0.000159 %			
32	benzo[a]pyrene; benzo[def]chrysene 601-032-00-3	200-028-5	50-32-8		3.19 mg/kg		3.19 mg/kg	0.000319 %			
33	indeno[123-cd]pyrene 205-893-2	193-39-5			2.15 mg/kg		2.15 mg/kg	0.000215 %			
34	dibenz[a,h]anthracene 601-041-00-2	200-181-8	53-70-3		0.48 mg/kg		0.48 mg/kg	0.000048 %			
35	benzo[ghi]perylene 205-883-8	191-24-2			1.72 mg/kg		1.72 mg/kg	0.000172 %			
36	vanadium { divanadium pentaoxide; vanadium pentoxide } 023-001-00-8	215-239-8	1314-62-1		22 mg/kg	1.785	39.274 mg/kg	0.00393 %			
Total:									0.117 %		

Key

- User supplied data
- Determinand values ignored for classification, see column 'Conc. Not Used' for reason
- Determinand defined or amended by HazWasteOnline (see Appendix A)
- Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
- <LOD** Below limit of detection
- ND** Not detected
- CLP: Note 1 Only the metal concentration has been used for classification

Supplementary Hazardous Property Information

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and ≤ 75°C"

Force this Hazardous property to non hazardous because Not considered flammable per WFD HP3 definition 6 indents testing. Annex III of the Waste Framework Directive (WFD) Council Directive 2008/98/EC. No evidence of a free draining liquid phase

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.0155%)

Classification of sample: WS04-17/05/2022-1.40m

 **Non Hazardous Waste**
 Classified as **17 05 04**
 in the List of Waste

Sample details

Sample name:	LoW Code:	
WS04-17/05/2022-1.40m	Chapter:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
	Entry:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 0% No Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number									
1	arsenic { arsenic trioxide }				153.4	mg/kg	1.32	202.538	mg/kg	0.0203 %		
	033-003-00-0	215-481-4	1327-53-3									
2	beryllium { beryllium oxide }				1.5	mg/kg	2.775	4.163	mg/kg	0.000416 %		
	004-003-00-8	215-133-1	1304-56-9									
3	boron { diboron trioxide; boric oxide }				0.8	mg/kg	3.22	2.576	mg/kg	0.000258 %		
	005-008-00-8	215-125-8	1303-86-2									
4	cadmium { cadmium oxide }				<0.1	mg/kg	1.142	<0.114	mg/kg	<0.0000114 %		<LOD
	048-002-00-0	215-146-2	1306-19-0									
5	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }				20.8	mg/kg	1.462	30.4	mg/kg	0.00304 %		
		215-160-9	1308-38-9									
6	chromium in chromium(VI) compounds { chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex }				<0.3	mg/kg	2.27	<0.681	mg/kg	<0.0000681 %		<LOD
	024-017-00-8											
7	copper { dicopper oxide; copper (I) oxide }				214	mg/kg	1.126	240.94	mg/kg	0.0241 %		
	029-002-00-X	215-270-7	1317-39-1									
8	lead { lead chromate }			1	133	mg/kg	1.56	207.455	mg/kg	0.0133 %		
	082-004-00-2	231-846-0	7758-97-6									
9	mercury { mercury dichloride }				<0.1	mg/kg	1.353	<0.135	mg/kg	<0.0000135 %		<LOD
	080-010-00-X	231-299-8	7487-94-7									
10	nickel { nickel chromate }				48.8	mg/kg	2.976	145.242	mg/kg	0.0145 %		
	028-035-00-7	238-766-5	14721-18-7									
11	selenium { nickel selenate }				3	mg/kg	2.554	7.662	mg/kg	0.000766 %		
	028-031-00-5	239-125-2	15060-62-5									
12	zinc { zinc sulphate }				157	mg/kg	2.469	387.68	mg/kg	0.0388 %		
	030-006-00-9	231-793-3 [1] 231-793-3 [2]	7446-19-7 [1] 7733-02-0 [2]									
13	TPH (C6 to C40) petroleum group		TPH		157	mg/kg		157	mg/kg	0.0157 %		
14	tert-butyl methyl ether; MTBE; 2-methoxy-2-methylpropane				<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
	603-181-00-X	216-653-1	1634-04-4									
15	benzene				<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
	601-020-00-8	200-753-7	71-43-2									
16	toluene				<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
	601-021-00-3	203-625-9	108-88-3									

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number								
17	ethylbenzene 601-023-00-4	202-849-4	100-41-4		<0.005 mg/kg		<0.005 mg/kg	<0.0000005 %			<LOD
18	xylene 601-022-00-9	202-422-2 [1] 203-396-5 [2] 203-576-3 [3] 215-535-7 [4]	95-47-6 [1] 106-42-3 [2] 108-38-3 [3] 1330-20-7 [4]		<0.01 mg/kg		<0.01 mg/kg	<0.000001 %			<LOD
19	pH		PH		7.71 pH		7.71 pH	7.71 pH			
20	naphthalene 601-052-00-2	202-049-5	91-20-3		0.12 mg/kg		0.12 mg/kg	0.000012 %			
21	acenaphthylene 205-917-1		208-96-8		0.06 mg/kg		0.06 mg/kg	0.000006 %			
22	acenaphthene 201-469-6		83-32-9		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %			<LOD
23	fluorene 201-695-5		86-73-7		0.11 mg/kg		0.11 mg/kg	0.000011 %			
24	phenanthrene 201-581-5		85-01-8		0.83 mg/kg		0.83 mg/kg	0.000083 %			
25	anthracene 204-371-1		120-12-7		0.1 mg/kg		0.1 mg/kg	0.00001 %			
26	fluoranthene 205-912-4		206-44-0		0.41 mg/kg		0.41 mg/kg	0.000041 %			
27	pyrene 204-927-3		129-00-0		0.38 mg/kg		0.38 mg/kg	0.000038 %			
28	benzo[a]anthracene 601-033-00-9	200-280-6	56-55-3		0.38 mg/kg		0.38 mg/kg	0.000038 %			
29	chrysene 601-048-00-0	205-923-4	218-01-9		0.42 mg/kg		0.42 mg/kg	0.000042 %			
30	benzo[b]fluoranthene 601-034-00-4	205-911-9	205-99-2		0.36 mg/kg		0.36 mg/kg	0.000036 %			
31	benzo[k]fluoranthene 601-036-00-5	205-916-6	207-08-9		0.14 mg/kg		0.14 mg/kg	0.000014 %			
32	benzo[a]pyrene; benzo[def]chrysene 601-032-00-3	200-028-5	50-32-8		0.21 mg/kg		0.21 mg/kg	0.000021 %			
33	indeno[123-cd]pyrene 205-893-2		193-39-5		0.11 mg/kg		0.11 mg/kg	0.000011 %			
34	dibenz[a,h]anthracene 601-041-00-2	200-181-8	53-70-3		<0.04 mg/kg		<0.04 mg/kg	<0.000004 %			<LOD
35	benzo[ghi]perylene 205-883-8		191-24-2		0.11 mg/kg		0.11 mg/kg	0.000011 %			
36	vanadium { divanadium pentaoxide; vanadium pentoxide } 023-001-00-8	215-239-8	1314-62-1		37 mg/kg	1.785	66.052 mg/kg	0.00661 %			
Total:									0.138 %		

Key

- User supplied data
- Determinand values ignored for classification, see column 'Conc. Not Used' for reason
- Determinand defined or amended by HazWasteOnline (see Appendix A)
- Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
- <LOD Below limit of detection
- ND Not detected
- CLP: Note 1 Only the metal concentration has been used for classification

Supplementary Hazardous Property Information

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and <= 75°C"

Force this Hazardous property to non hazardous because Not considered flammable per WFD HP3 definition 6 indents testing. Annex III of the Waste Framework Directive (WFD) Council Directive 2008/98/EC. No evidence of a free draining liquid phase

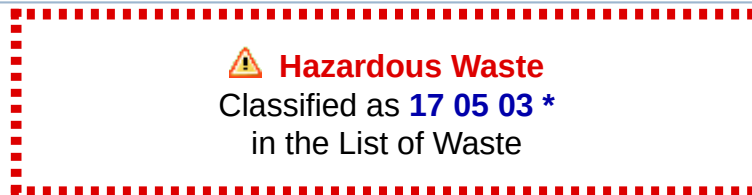
Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.0157%)

Classification of sample: TP01-17/05/2022-0.70m



Sample details

Sample name:	LoW Code:
TP01-17/05/2022-0.70m	Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
	Entry: 17 05 03 * (Soil and stones containing hazardous substances)

Hazard properties

HP 14: Ecotoxic "waste which presents or may present immediate or delayed risks for one or more sectors of the environment"

Hazard Statements hit:

Aquatic Chronic 1; H410 "Very toxic to aquatic life with long lasting effects."

Because of determinands:

dicopper oxide; copper (I) oxide: (compound conc.: 0.106%)

zinc sulphate: (compound conc.: 0.262%)

Determinands

Moisture content: 0% No Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number								
1	arsenic { arsenic trioxide }				322.9 mg/kg	1.32	426.333 mg/kg	0.0426 %			
	033-003-00-0	215-481-4	1327-53-3								
2	beryllium { beryllium oxide }				1.6 mg/kg	2.775	4.441 mg/kg	0.000444 %			
	004-003-00-8	215-133-1	1304-56-9								
3	boron { diboron trioxide; boric oxide }				0.7 mg/kg	3.22	2.254 mg/kg	0.000225 %			
	005-008-00-8	215-125-8	1303-86-2								
4	cadmium { cadmium oxide }				<0.1 mg/kg	1.142	<0.114 mg/kg	<0.0000114 %			<LOD
	048-002-00-0	215-146-2	1306-19-0								
5	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }				77.6 mg/kg	1.462	113.417 mg/kg	0.0113 %			
		215-160-9	1308-38-9								
6	chromium in chromium(VI) compounds { chromium(VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex }				<0.3 mg/kg	2.27	<0.681 mg/kg	<0.0000681 %			<LOD
	024-017-00-8										
7	copper { dicopper oxide; copper (I) oxide }				939 mg/kg	1.126	1057.209 mg/kg	0.106 %			
	029-002-00-X	215-270-7	1317-39-1								
8	lead { lead chromate }			1	258 mg/kg	1.56	402.432 mg/kg	0.0258 %			
	082-004-00-2	231-846-0	7758-97-6								
9	mercury { mercury dichloride }				<0.1 mg/kg	1.353	<0.135 mg/kg	<0.0000135 %			<LOD
	080-010-00-X	231-299-8	7487-94-7								
10	nickel { nickel chromate }				28.6 mg/kg	2.976	85.121 mg/kg	0.00851 %			
	028-035-00-7	238-766-5	14721-18-7								
11	selenium { nickel selenate }				<1 mg/kg	2.554	<2.554 mg/kg	<0.000255 %			<LOD
	028-031-00-5	239-125-2	15060-62-5								
12	zinc { zinc sulphate }				1061 mg/kg	2.469	2619.924 mg/kg	0.262 %			
	030-006-00-9	231-793-3 [1] 231-793-3 [2]	7446-19-7 [1] 7733-02-0 [2]								
13	TPH (C6 to C40) petroleum group				199 mg/kg		199 mg/kg	0.0199 %			
			TPH								

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
14	tert-butyl methyl ether; MTBE; 2-methoxy-2-methylpropane				<0.005 mg/kg		<0.005 mg/kg	<0.0000005 %		<LOD
	603-181-00-X	216-653-1	1634-04-4							
15	benzene				<0.005 mg/kg		<0.005 mg/kg	<0.0000005 %		<LOD
	601-020-00-8	200-753-7	71-43-2							
16	toluene				<0.005 mg/kg		<0.005 mg/kg	<0.0000005 %		<LOD
	601-021-00-3	203-625-9	108-88-3							
17	ethylbenzene				<0.005 mg/kg		<0.005 mg/kg	<0.0000005 %		<LOD
	601-023-00-4	202-849-4	100-41-4							
18	xylene				<0.01 mg/kg		<0.01 mg/kg	<0.000001 %		<LOD
	601-022-00-9	202-422-2 [1] 203-396-5 [2] 203-576-3 [3] 215-535-7 [4]	95-47-6 [1] 106-42-3 [2] 108-38-3 [3] 1330-20-7 [4]							
19	pH				8.35 pH		8.35 pH	8.35 pH		
20	naphthalene				0.22 mg/kg		0.22 mg/kg	0.000022 %		
	601-052-00-2	202-049-5	91-20-3							
21	acenaphthylene				0.23 mg/kg		0.23 mg/kg	0.000023 %		
		205-917-1	208-96-8							
22	acenaphthene				<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
		201-469-6	83-32-9							
23	fluorene				0.11 mg/kg		0.11 mg/kg	0.000011 %		
		201-695-5	86-73-7							
24	phenanthrene				1.54 mg/kg		1.54 mg/kg	0.000154 %		
		201-581-5	85-01-8							
25	anthracene				0.33 mg/kg		0.33 mg/kg	0.000033 %		
		204-371-1	120-12-7							
26	fluoranthene				3.07 mg/kg		3.07 mg/kg	0.000307 %		
		205-912-4	206-44-0							
27	pyrene				2.5 mg/kg		2.5 mg/kg	0.00025 %		
		204-927-3	129-00-0							
28	benzo[a]anthracene				1.73 mg/kg		1.73 mg/kg	0.000173 %		
	601-033-00-9	200-280-6	56-55-3							
29	chrysene				2.17 mg/kg		2.17 mg/kg	0.000217 %		
	601-048-00-0	205-923-4	218-01-9							
30	benzo[b]fluoranthene				2.71 mg/kg		2.71 mg/kg	0.000271 %		
	601-034-00-4	205-911-9	205-99-2							
31	benzo[k]fluoranthene				1.06 mg/kg		1.06 mg/kg	0.000106 %		
	601-036-00-5	205-916-6	207-08-9							
32	benzo[a]pyrene; benzo[def]chrysene				1.65 mg/kg		1.65 mg/kg	0.000165 %		
	601-032-00-3	200-028-5	50-32-8							
33	indeno[123-cd]pyrene				1.4 mg/kg		1.4 mg/kg	0.00014 %		
		205-893-2	193-39-5							
34	dibenz[a,h]anthracene				0.35 mg/kg		0.35 mg/kg	0.000035 %		
	601-041-00-2	200-181-8	53-70-3							
35	benzo[ghi]perylene				1.2 mg/kg		1.2 mg/kg	0.00012 %		
		205-883-8	191-24-2							
36	vanadium { divanadium pentaoxide; vanadium pentoxide }				60 mg/kg	1.785	107.111 mg/kg	0.0107 %		
	023-001-00-8	215-239-8	1314-62-1							
Total:								0.49 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Hazardous result
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
ND	Not detected
CLP: Note 1 Only the metal concentration has been used for classification	

Supplementary Hazardous Property Information

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and ≤ 75°C"

Force this Hazardous property to non hazardous because Not considered flammable per WFD HP3 definition 6 indents testing. Annex III of the Waste Framework Directive (WFD) Council Directive 2008/98/EC. No evidence of a free draining liquid phase

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.0199%)

Appendix A: Classifier defined and non GB MCL determinands

■ chromium(III) oxide (worst case) (EC Number: 215-160-9, CAS Number: 1308-38-9)

Description/Comments: Data from C&L Inventory Database

Data source: <https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/33806>

Data source date: 17 Jul 2015

Hazard Statements: Acute Tox. 4; H332 , Acute Tox. 4; H302 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Resp. Sens. 1; H334 , Skin Sens. 1; H317 , Repr. 1B; H360FD , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

■ TPH (C6 to C40) petroleum group (CAS Number: TPH)

Description/Comments: Hazard statements taken from WM3 1st Edition 2015; Risk phrases: WM2 3rd Edition 2013

Data source: WM3 1st Edition 2015

Data source date: 25 May 2015

Hazard Statements: Flam. Liq. 3; H226 , Asp. Tox. 1; H304 , STOT RE 2; H373 , Muta. 1B; H340 , Carc. 1B; H350 , Repr. 2; H361d , Aquatic Chronic 2; H411

■ ethylbenzene (EC Number: 202-849-4, CAS Number: 100-41-4)

GB MCL index number: 601-023-00-4

Description/Comments:

Additional Hazard Statement(s): Carc. 2; H351

Reason for additional Hazards Statement(s):

20 Nov 2021 - Carc. 2; H351 hazard statement sourced from: IARC Group 2B (77) 2000

■ pH (CAS Number: PH)

Description/Comments: Appendix C4

Data source: WM3 1st Edition 2015

Data source date: 25 May 2015

Hazard Statements: None.

■ acenaphthylene (EC Number: 205-917-1, CAS Number: 208-96-8)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 17 Jul 2015

Hazard Statements: Acute Tox. 4; H302 , Acute Tox. 1; H330 , Acute Tox. 1; H310 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315

■ acenaphthene (EC Number: 201-469-6, CAS Number: 83-32-9)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 17 Jul 2015

Hazard Statements: Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410 , Aquatic Chronic 2; H411

■ fluorene (EC Number: 201-695-5, CAS Number: 86-73-7)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 06 Aug 2015

Hazard Statements: Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

■ phenanthrene (EC Number: 201-581-5, CAS Number: 85-01-8)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 06 Aug 2015

Hazard Statements: Acute Tox. 4; H302 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Carc. 2; H351 , Skin Sens. 1; H317 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410 , Skin Irrit. 2; H315

■ anthracene (EC Number: 204-371-1, CAS Number: 120-12-7)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 17 Jul 2015

Hazard Statements: Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Skin Sens. 1; H317 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

■ fluoranthene (EC Number: 205-912-4, CAS Number: 206-44-0)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 21 Aug 2015

Hazard Statements: Acute Tox. 4; H302 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

▪ **pyrene** (EC Number: 204-927-3, CAS Number: 129-00-0)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 2014

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 21 Aug 2015

Hazard Statements: Skin Irrit. 2; H315 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

▪ **indeno[123-cd]pyrene** (EC Number: 205-893-2, CAS Number: 193-39-5)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 06 Aug 2015

Hazard Statements: Carc. 2; H351

▪ **benzo[ghi]perylene** (EC Number: 205-883-8, CAS Number: 191-24-2)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 28/02/2015

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 23 Jul 2015

Hazard Statements: Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

Appendix B: Rationale for selection of metal species

arsenic {arsenic trioxide}

Reasonable case CLP species based on hazard statements/molecular weight and most common (stable) oxide of arsenic. Industrial sources include: smelting; main precursor to other arsenic compounds (edit as required)

beryllium {beryllium oxide}

Reasonable case CLP species based on hazard statements/molecular weight. Industrial sources include: most common (non alloy) form, used in ceramics (edit as required)

boron {diboron trioxide; boric oxide}

Reasonable case CLP species based on hazard statements/ molecular weight, physical form and low solubility. Industrial sources include: fluxing agent for glass/enamels; additive for fibre optics, borosilicate glass (edit as required)

cadmium {cadmium oxide}

Reasonable case CLP species based on hazard statements/molecular weight, very low solubility in water. Industrial sources include: electroplating baths, electrodes for storage batteries, catalysts, ceramic glazes, phosphors, pigments and nematocides. (edit as required) Worst case compounds in CLP: cadmium sulphate, chloride, fluoride & iodide not expected as either very soluble and/or compound's industrial usage not related to site history (edit as required)

chromium in chromium(III) compounds {chromium(III) oxide (worst case)}

Reasonable case species based on hazard statements/molecular weight. Industrial sources include: tanning, pigment in paint, inks and glass (edit as required)

chromium in chromium(VI) compounds {chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex}

Worst case species based on hazard statements/molecular weight (edit as required)

copper {dicopper oxide; copper (I) oxide}

Reasonable case CLP species based on hazard statements/molecular weight and insolubility in water. Industrial sources include: oxidised copper metal, brake pads, pigments, antifouling paints, fungicide. (edit as required) Worse case copper sulphate is very soluble and likely to have been leached away if ever present and/or not enough soluble sulphate detected. (edit as required)

lead {lead chromate}

Worst case CLP species based on hazard statements/molecular weight (edit as required)

mercury {mercury dichloride}

Worst case CLP species based on hazard statements/molecular weight (edit as required)

nickel {nickel chromate}

Worst case CLP species based on hazard statements/molecular weight (edit as required)

selenium {nickel selenate}

Worst case CLP species based on hazard statements/molecular weight (edit as required)

zinc {zinc sulphate}

Zinc chromate (worst case) discounted due to the laboratory results for chromium VI for all samples as <0.3mg/lg (<LOD). Zinc Sulphate selected as next most conservative species.

vanadium {divanadium pentaoxide; vanadium pentoxide}

Selected as most appropriate

Appendix C: Version

HazWasteOnline Classification Engine: **WM3 1st Edition v1.2.GB - Oct 2021**
HazWasteOnline Classification Engine Version: 2022.176.5209.9795 (25 Jun 2022)
HazWasteOnline Database: 2022.176.5209.9795 (25 Jun 2022)

This classification utilises the following guidance and legislation:

WM3 v1.2.GB - Waste Classification - 1st Edition v1.2.GB - Oct 2021

CLP Regulation - Regulation 1272/2008/EC of 16 December 2008

1st ATP - Regulation 790/2009/EC of 10 August 2009

2nd ATP - Regulation 286/2011/EC of 10 March 2011

3rd ATP - Regulation 618/2012/EU of 10 July 2012

4th ATP - Regulation 487/2013/EU of 8 May 2013

Correction to 1st ATP - Regulation 758/2013/EU of 7 August 2013

5th ATP - Regulation 944/2013/EU of 2 October 2013

6th ATP - Regulation 605/2014/EU of 5 June 2014

WFD Annex III replacement - Regulation 1357/2014/EU of 18 December 2014

Revised List of Waste 2014 - Decision 2014/955/EU of 18 December 2014

7th ATP - Regulation 2015/1221/EU of 24 July 2015

8th ATP - Regulation (EU) 2016/918 of 19 May 2016

9th ATP - Regulation (EU) 2016/1179 of 19 July 2016

10th ATP - Regulation (EU) 2017/776 of 4 May 2017

HP14 amendment - Regulation (EU) 2017/997 of 8 June 2017

13th ATP - Regulation (EU) 2018/1480 of 4 October 2018

14th ATP - Regulation (EU) 2020/217 of 4 October 2019

15th ATP - Regulation (EU) 2020/1182 of 19 May 2020

The Chemicals (Health and Safety) and Genetically Modified Organisms (Contained Use)(Amendment etc.) (EU Exit)

Regulations 2020 - UK: 2020 No. 1567 of 16th December 2020

The Waste and Environmental Permitting etc. (Legislative Functions and Amendment etc.) (EU Exit) Regulations 2020 - UK: 2020 No. 1540 of 16th December 2020

GB MCL List - version 1.1 of 09 June 2021