



Blaendulais

Ground Investigation Report



July 2022

DRAFT

Ground Investigation Report

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PRESENTED TO

Neath Port Talbot County Borough Council
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EXECUTIVE SUMMARY

The Site	The site is located within the town of Seven Sisters, which is approximately 12 miles northeast of Port Talbot. The site is approximately 0.228ha in area and is centered on National Grid reference (NGR) SN 81942 08914. The approximate postcode for the site is SA10 9DN. The site address is Land opposite, 4 High St, Seven Sisters, Neath SA10 9DN. The site remained undeveloped until circa 1918 when several buildings (unknown uses) appeared on the northern and north-western parts of the site. These remained until a block of residential flats were built sometime between 1962 and 1987. It is anticipated that these flats, following construction, remained relatively unchanged. A small building is shown the south west corner of the site, labelled as PC (Public Convenience), on maps from 1987 to 2003. The PC is not visible on Google Street view (captured May 2011), however, what appears to be an electrical sub-station is present in its location. The surrounding area is dominated by further residential and commercial properties which occupy the south eastern and north eastern site boundaries. The site is bounded to the east by a railway line which had already been constructed at the time of the first OS map publication in 1877 and the A4109 beyond.
Geology	The published geological map for the area, BGS Sheet 231 (1979), and the BGS GeoIndex Onshore online viewer (2021) show the north of the site to be located on recent Glaciofluvial deposits (Diamicton Till). The south of the site is not shown to contain superficial deposits. The underlying bedrock is indicated to comprise South Wales Middle Coal Measures Formation of Carboniferous age characterised by Mudstone, Siltstone and Sandstone. The Coal Authority report for the site indicates that the Gorllwyn Seam outcrops beneath the site and could have been subject to unrecorded shallow mining activities.
Site Investigation	The site investigation was undertaken between 16th and 19th May 2022 and comprised: • Two combined dynamic sample and rotary open hole boreholes (BH01 and BH02) to a depth of 30metres, with sampling and SPTs in the upper 10metres. • Twelve windowless sample boreholes (WS01-WS12) to refusal at depths ranging between 0.4 and 2.9m bgl, with regular SPTs and samples taken. • One day of soakaway testing in two trial pits (TP03 and TP04) at depths of 1.4m bgl and 1.1m bgl. • Five TRL DCP locations to obtain indicative CBR values around the site. • Installation of gas/groundwater monitoring standpipes within both boreholes and one windowless sample borehole (WS08). • 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; • Topsoil • Made Ground – comprising general building demolition material or colliery spoil • Glaciofluvial deposits (Diamicton Till). • South Wales Middle Coal Measures Formation (Mudstone, Siltstone and Sandstone)
Geotechnical Assessment	Traditional shallow foundations (pad or strip) placed with Glacial 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 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-2 and the Aggressive Chemical Environment for Concrete (ACEC) site classification can be taken as AC-2. 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. A number of concrete obstructions were observed across the site including within the proposed building footprint. It will likely be necessary to grub out the existing foundations to allow for construction of any new foundations.
Coal Mining Risk Assessment	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 Gorwllyn seam.
Ground Contamination Assessment	Laboratory testing has recorded a limited number of exceedances on beryllium and arsenic, however within the context of the proposed development and the predominant hard standing the recorded concentrations are not considered to pose a significant risk to site users. Elevated concentrations of PAH have also been recorded in the soil derived leachate samples, with a single PAH compound identified within groundwater. However, given the limited nature of the exceedances and the low permeability of the subsurface strata the recorded concentrations are not considered to pose a risk to controlled waters.
Ground Gas Assessment	Ground gas monitoring undertaken on the site has recorded limited concentrations of carbon dioxide and methane within the subsurface. The site has been defined as a Characteristic Situation 1 (Very Low risk) whereby no ground gas protection measures are considered necessary within the context of the proposed development.
Conclusions and Recommendations	Based on the findings of the ground investigation, the following recommendations are outlined: • 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.
- A number of subsurface obstructions were encountered during the ground investigation thought to related to the previous land use as residential flats or the raised embankment on the southern site boundary to provide road access of the railway line. Considerable breaking out of these obstructions cannot be discounted during the construction phase to allow for the construction of new foundations or grubbing out for new areas of hardstanding and associated access.

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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 (Tt) was commissioned by Neath Port Talbot County Borough Council to undertake a ground investigation for a site known as Blaendulais (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:

- Twelve 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 10 metres;
- 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 construction of a childcare unit with areas of hardstanding for parking.

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 within the town of Seven Sisters, which is approximately 12 miles northeast of Port Talbot. The site is approximately 0.228ha in area and is centered on National Grid reference (NGR) SN 81942 08914.

The approximate postcode for the site is SA10 9DN.

The site address is Land opposite 4 High St, Seven Sisters, Neath SA10 9DN.

A site location plan is presented in Figure 1.

2.2 GENERAL AREA CONTEXT

Table 2-1 - Surrounding land uses

	Description
North	Series of residential and commercial properties
East	Railway line is situated along the eastern boundary with the A4109 beyond.
South	High Street and residential and commercial properties beyond.
West	High Street and residential and commercial properties beyond.

2.3 SITE DESCRIPTION

The site is currently unused however an existing electrical substation is situated in the southwest of the site. The whole site is generally overgrown by bramble, immature trees, long grass and other shrubs and is classified as a Brownfield site. There are also numerous mature trees around the boundaries of the site. The overall topography of the site is generally flat with localised terracing. The highest point being situated on the southern boundary of the site. The site slopes down to the northeast and flattens off for approximately 5m, then is stepped again parallel with the southern boundary of the site. The remainder of the site is relatively flat. It is a reasonable assumption that the stepped nature of the site is due to the construction the adjacent road (Commercial Street) to the south, which rises to provide access over the railway line.

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.231 Merthyr Tydfil Solid and Drift Edition / Solid Edition etc, 1:50 000 or 1:63,000 scale;
- BGS website (British Geological Survey, 2022); accessed 07/06/2022;
- Coal Authority Interactive Mapper (The Coal Authority, 2021), accessed 07/06/2022.

Made Ground

The BGS interactive mapping does not show the presence of any Made Ground on site. However, due to the known site history and the site being classified as a Brownfield site, Made Ground is anticipated to present beneath the surface across the site. The Made Ground is likely to be comprised of building demolition rubble.

Superficial Geology

The BGS Geoindex indicates that the superficial deposits are present in the northern part of the site. The superficial deposits on site are anticipated to comprise of Glaciofluvial deposits (Diamicton Till). These deposits are sedimentary deposits and glacial in origin. They are detrital, created by the action of ice and meltwater, they can form a wide range of deposits.

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

The hard copy Geological Survey of Great Britain Merthyr Tydfil map (Sheet 231 1:50,000 Series Drift or Solid) shows a mine entry to the north of the site (circa 100m) with some artificial ground beyond. No coal outcrops are shown to be present beneath the site and the regional geological dip is indicated to be 10 degrees to the south southwest.

The online Coal Authority Interactive map differs to the Geological map and indicates a proved coal seam outcropping beneath the site, trending south-southwest to north northeast close to the western boundary of the site and dipping to the right (east). This is also confirmed in the Coal Authority Report Consultant report, although the seam is indicated to stop circa 50m north of the site. The seam is identified as the Gorllwyn, workable with a bearing of 36 degrees.

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 Superficial Deposits of Diamicton Till are classified as a Secondary Undifferentiated Aquifer. This has been assigned in cases where it has not been possible to attribute either a Secondary A or B aquifer to the soil type due to the variable characteristics.

2.4.3 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. The entirety of the site is situated within an area where less than 1% of homes are above the action level.

2.5 SUMMARY OF SITE HISTORY

A Desktop study has been previously undertaken by SOCOTEC (Phase 1) 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 remained undeveloped until circa 1918 when several buildings (unknown uses) appeared on the northern and north-western parts of the site. These remained until a block of residential flats were built sometime between 1962 and 1987. It is anticipated that these flats, following construction, remained relatively unchanged. A small building is shown the south west corner of the site, labelled as PC (Public Convenience), on maps from 1987 to 2003. The PC is not visible on Google Street view (captured May 2011), however, what appears to be an electrical sub-station is present in its location.

The surrounding area is dominated by further residential and commercial properties which occupy the south eastern and north eastern site boundaries. The site is bounded to the east by a railway line which had already been constructed at the time of the first OS map publication in 1877 and the A4109 beyond.

3.0 SITE INVESTIGATION

The site investigation was undertaken between the 16th and 19th May 2022 and return 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 site investigation included the following:

- Two combined dynamic sample and rotary open hole boreholes (BH01 and BH02) to a depth of 30metres with SPTs.
- Twelve windowless sample boreholes (WS01-WS12) to refusal at depths ranging between 0.4 and 2.9m bgl, with regular SPTs and samples taken.
- One day of soakaway testing in two trial pits (TP03 and TP04) at depths of 1.4m bgl and 1.1m bgl.
- Five TRL DCP locations to obtain indicative CBR values around the site.
- Installation of gas/groundwater monitoring standpipes within both boreholes and one windowless sample borehole (WS08).
- 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.

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

Trial pits TP01 and TP02 both encountered probable concrete at depths of 0.6 and 0.7m bgl. Both were re-located and excavated as TP03 and TP04.

4.0 GROUND CONDITIONS ENCOUNTERED

4.1 STRATA ENCOUNTERED

The sequence of strata encountered beneath the site was;

- Topsoil
- Made Ground
- Superficial Glacial Till Deposits
- 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	Glacial Till Deposits	South Wales Middle Coal Measures
BH01	Ne	0.00 – 1.50	1.50 – 3.50	3.50 – 30.00
BH02	Ne	0.00 – 1.70	1.70 – 3.00	3.00 – 30.00
TP01	Ne	0.00 -0.60	Ne	Ne
TP02	Ne	0.00 -0.70	Ne	Ne
TP03	Ne	0.00 – 0.80	0.80 – 1.40	Ne
TP04	0.00 – 0.30	0.30 – 1.10	Ne	Ne
WS01	Ne	0.00 – 1.10	1.10 – 1.60	Ne
WS02	Ne	0.00 – 2.90	Ne	Ne
WS03	Ne	0.00 – 1.80	Ne	Ne
WS04	Ne	0.00 – 1.60	1.60 – 2.60	Ne
WS05	Ne	0.00 – 1.00	Ne	Ne
WS06	Ne	0.00 - 0.55	Ne	Ne
WS07	Ne	0.00 – 1.00	Ne	Ne
WS08	Ne	0.00 – 1.85	1.85 – 2.80	Ne
WS09	Ne	0.00 – 0.40	Ne	Ne
WS09A	Ne	0.00 – 1.00	Ne	Ne
WS10	Ne	0.00 -0.50	Ne	Ne
WS11	Ne	0.00 – 1.00	Ne	Ne
WS12	Ne	0.00 -0.90	Ne	Ne

4.1.1 Topsoil

Topsoil was encountered in one exploratory hole (TP04) position to a depth of 0.30mbgl and was described as “Dark brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular of sandstone and limestone.”

4.1.2 Made Ground

Made Ground was encountered in all the exploratory positions to a maximum depth of 2.90mbgl (WS02, base not proven. These soils were found to be variable in composition and comprised:

- Soft to firm, dark greyish brown, sandy gravelly clay with gravel of brick, concrete, sandstone, mudstone and old building material. 9plastic and metal)
- Light brown sandy cobbly gravel of concrete, brick and old building materials.
- Loose to dense dark brownish black silty sandy gravel of concrete, sandstone, mudstone, rare brick and occasional colliery spoil with low cobble content of the same.

4.1.3 Glacial Deposits

Glacial fluvial deposits were encountered in six exploratory hole positions that penetrated the full thickness of made ground at depths ranging between 0.8 to 1.85m bgl. The thickness of the Glacial fluvial deposits was only proved in the deep boreholes at depths of 3.0m and 3.50m bgl. These soils were found to be variable in composition comprising both fine grained (cohesive) and coarse grained (granular) soils.

The fine grained soils were typically recorded as firm and stiff mottled orangish grey brown sandy gravelly clay.

The coarse grained soils were recorded as medium dense and dense orangish brown clayey sandy gravel or orangish grey brown clayey gravelly sand.

4.1.4 Bedrock – South Wales Middle Coal Formation

Bedrock of South Wales Middle Coal Formation deposits was encountered in the two deep borehole positions at depths of 3.0m and 3.5m bgl. These rocks, were recorded as dark brown medium hard to hard inter bedded mudstone, sandstone and siltstone

Small traces of thin coal seams (>10cm thick) were recorded in BH01 at 5m and 10.2m bgl and in BH02 at 5 mbgl. No other coals seams, backfilled workings or voids were recorded Broken sandstone was recorded in BH02 between 12.0 and 12.3m bgl. .

4.2 GROUNDWATER

Groundwater was encountered in BH01, BH02, TP01 and BH12. Summarised below.

Hole ID	Water Strike Depth (mbgl)	Depth of water after 20 minutes (mbgl)
BH01	3.30	3.30
BH02	5.00	4.95

	8.50	8.50
TP01	0.60	0.55
WS12	0.90	0.88

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 to a maximum depth of 6.50m, 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 D.

4.3.2 TRL probes

DCP probing to provide California Bearing Ratio values for pavement design was undertaken in five exploratory positions up to 1.0m bgl adjacent to WS01, WS04, WS06, WS07 and WS11 where areas of hardstanding have been proposed.

Results are presented in Appendix E.

4.3.3 Soil Infiltration Testing

Two soil infiltration tests were carried out, designated as TP03 and TP04. The tests were undertaken within the Glacial-alluvial deposits and Made Ground. 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
TP03	0.80 – 1.40	GLACIAL ALLUVIAL	FAILED water level did not fall below the 75% volume line after 6 hours of testing. To record a result the water level is required to fall to 25% of the pits volume.
TP04	0.50 – 1.10	MADE GROUND	FAILED water level did not fall below the 75% volume line after 6 hours of testing. To record a result the water level is required to fall to 25% of the pits volume.

4.4 VISUAL OR OLFACTORY EVIDENCE OF CONTAMINATION

No evidence of contamination.

4.5 OBSTRUCTIONS

A number of the exploratory holes refused shallow on hard strata. Although not visible in many of the boreholes it is suspected that some of these refusals are due to historic concrete slabs or slabs related to the previous buildings on the site. Concrete was encountered in BH02 at 0.40m bgl which stopped the hand pitting requiring the rotary rig to progress through the concrete layer to 0.60m bgl.

TP01 also encountered concrete and a small orange 60mm pipe (drainage) at 0.60mbgl. The hole was terminated on this concrete obstruction.

WS08 and WS04 located on the raised site area on the southern boundary of the site that allows the road to climb over the railway line had refusals in the hand pits due to concrete slab at a depth of 0.20m. These were relocated away from the edge of the embankment closer to the roadside to get allow progress to a reasonable depth before further refusal.

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	5	BS1377:1990 Part 2:9.2
PSD: Sedimentation by Pipette	3	BS1377:1990 Part 2:9.4
BRE Digest SD1 Suite D (Brownfield site – pyrite present Total Sulphate, Water Soluble Sulphate, Total Sulphur, Water Soluble Nitrate, Water Soluble Chloride, Water Soluble Magnesium and pH determination)	5	BRE SD1:2005

5.2 ENVIRONMENTAL TESTING

Environmental chemistry was investigated by specialist chemical analysis of selected soil samples carried out by ALS Environmental Laboratories, 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;	5

○ Asbestos Screen; and, ○ Phenol.	
<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; ○ Inorganics – including pH, Sulphate, Chloride, Nitrite, Nitrate, Total Cyanide, Ammoniacal Nitrogen and NH₃ and NH₄ and Total Alkalinity ○ Speciated Petroleum Hydrocarbons (TPH CWG); ○ Speciated Polyaromatic Hydrocarbons (USEPA 16); ○ BTEX and MTBE; ○ Phenol.	2

6.0 GROUNDWATER AND GAS MONITORING

6.1 GROUNDWATER MONITORING

Groundwater levels were monitored on three occasions following the completion of the ground investigation, on 2nd, 9th, and 15th June. The monitoring data is presented in Appendix G and summarised in **Error! Not a valid bookmark self-reference.** 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
BH01	6.00	3.40	3.40	4.12
BH02	3.40	3.30	3.30	Dry
WS08	1.00	Dry	Dry	Dry

6.2 GROUND GAS MONITORING

Ground gas levels were monitored on three occasions following the completion of the ground investigation, on 2nd, 9th, and 15th June. The monitoring data is presented in Appendix G and in **Error! Not a valid bookmark self-reference.** 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)
BH01	<0.10	0.80	14.30	<1	<1	0.20
BH02	<0.10	0.90	14.10	<1	<1	0.10
WS08	<0.10	0.60	14.30	<1	<1	0.20

The results indicate measurable concentrations of carbon dioxide (maximum of 0.90%/vol in BH02l) and methane (maximum 0.10%/vol in all exploratory locations).

The maximum gas flow recorded across the monitoring round was a flow of 0.20l/hr, recorded at BH01 and WS08.

The monitoring rounds were undertaken during atmospheric pressure conditions ranging from 994mb to 998mb. A review of atmospheric pressure graphs on weatheronline.co.uk indicates that monitoring was undertaken during periods of steady pressure.

In addition, the ground gas monitoring results indicate hydrogen sulphide concentrations of <1 ppm across all monitoring rounds. Maximum concentrations of carbon monoxide of <1 ppm were recorded.

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

Two soil infiltration tests were undertaken over a single day of testing. Initially the test locations were identified as TP01 and TP02 with a target depth of 1.50m bgl. Upon excavation of both locations, hard strata was encountered at 0.60m and 0.70m bgl. As a result, the trial pits were terminated with new locations excavated in order to find favorable ground conditions.

Test locations TP03 and TP04 were excavated to 1.40m and 1.10m bgl respectively and did not reach target depth due to encountering hard strata. Infiltration tests were undertaken at these locations with details summarised in table 7-1.

Test locations were securely fenced and covered until the testing period was completed and excavations backfilled in as dug order upon completion

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
TP03	0.80	1.40	GLACIAL TILL
TP04	1.10	0.50	MADE GROUND

No repeat fills were undertaken within either test locations over one day of testing locations due to poor infiltration.

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
TP03	Failed	No test conducted	
TP04	Failed	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 water strike was encountered in both exploratory borehole locations (BH01 and BH02) at 3.40m bgl and 5.00m respectively with a second water strike being encountered in BH02 at 8.50m bgl.

TP01 also encountered groundwater seepage at a shallow depth of 0.60m bgl rising to 0.58m bgl over 20 minutes. Based on other exploratory hole locations and the strata encountered within TP01, it is likely that this was perched water.

Based on the findings of the fieldworks and post completion monitoring, it is anticipated that groundwater is at least 3.40m bgl or 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 Alluvial Deposits encountered in TP03 could generally be described as '*Mottled orangish grey sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to subrounded of sandstone, limestone and rare mudstone.*'

The Made Ground encountered in TP04 could generally be described as '*light brown laminated weathered colliery shale.*'

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

7.4.3 Ground Contamination

Significant ground contamination was not identified as part of the ground investigation, 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

At the time of writing the report, Tetra Tech is aware that the proposed development will include the development of a childcare unit (single storey) which will include hard standing areas for car parking and a bin store. It is current understood that the existing substation on site will remain.

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 H1061-21)
- Consultants Coal Mining Report (GS-8293535)
- British Geological Survey Geindex 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

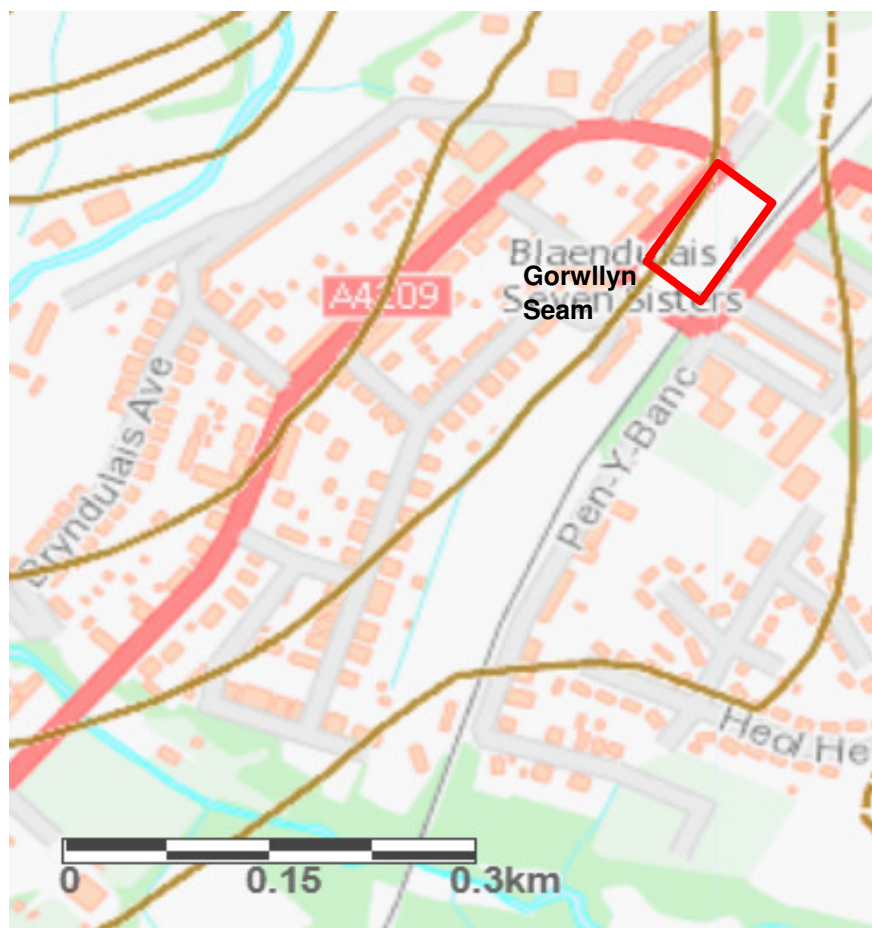
The Coal Authority Consultants Report (provided in Appendix I) states the following:

- Four coal seams lie beneath the property at a shallow depth to 150m depth and were last worked in 1944. 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 an outcrop seam of coal (Gorllywn).
- 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 no mine entries recorded within 100metres of the site boundary.
- 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.

The Coal Authority interactive maps were consulted prior to the investigation and show the site to lie within a development high risk area.. The Coal Authority Report identified the following Coal Seams:

- Gorwilyn Coal Seam being present below the site, outcropping 36°. The direction of the outcrop and the thickness is not detailed within the report.

Extract 1: From Coal Authority Interactive Mapping



Given the probable presence of a shallow outcropping coal seam beneath the site, deep boreholes were undertaken as part of the investigation to locate the seam and identify if it had been previously worked.

8.2 RISK ASSESSMENT AND MITIGATION STRATEGY

Table 9-1 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.
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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)		x	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 on an outcrop of the Gorllwyn Coal Seam. The Coal Authority Interactive Mapping of the area shows a large part of the site to be in a high-risk development area. This is directly related to the outcropping coal seam that could have been subject to unrecorded mining activity.	Moderate	Drilling of two rotary openhole boreholes to a depth of 30m bgl to confirm whether the depth to the Gorllwyn Seam and whether it has been worked beneath the site at shallow depth. Thin coal seams (>10cm) were recorded in both boreholes at a depth of circa 5mbgl and in BH01 at 10.2m bgl. It is not conclusive whether these represent the Gorllwyn seam. No evidence of working or voiding was detected and given the recorded thickness is unlikely to have been worked. Broken ground was encountered in BH02 at 12.00 to 12.30m bgl. Due to the discreet thickness it is unlikely that this is a working and rather a zone of fractured sandstone. No further mitigation necessary.	Low

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 150m depth.	High	Coal seams are present beneath the site. Boreholes drilled to 30m bgl identified thin (>10) coal seams at shallow depth but did not identify any workings or voids. Deeper coal seams, even if worked, are unlikely to impact the surface. No further mitigation necessary.	Low
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8.3 RISK ASSESSMENT AND MITIGATION STRATEGY

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.

There are no recorded mine entries within 100m of the site boundary.

The Consultants Coal Mining Report indicates that the site is within an area of historical coal mining activity. If ground conditions encountered during development appear different to what is present herein, then a specialist should be contacted.

The Gorllwyn Seam was potentially identified in both boreholes (BH01 and BH02) at 5.00m bgl respectively and were found not to be worked.

No further mitigation is deemed necessary.

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 identified 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	16	0 - 50	35	14	50	14
Undrained shear strength (kPa):						
- from SPT N values ¹	16	0 - 220	154	62	220	62
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 soils are considered too variable to assign characteristic geotechnical values.

9.1.2 Glacial Till (Fine Grained)

Shallow fine grained Glacial Till deposits were identified within four exploratory hole locations immediately below the Made Ground/topsoil deposits and varied in thickness between 0.5m and 2.0m. A summary is presented in the table below.

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

	No. of results	Range (min-max)	Average	Lower quartile	Upper quartile	Characteristic value ⁺
Natural moisture content (m - %)	5	7.6 - 21	14	7.7	18	18
Liquid limit (LL)	5	19 - 39	29	19	34	19

Plastic limit (PL)	5	11 – 16	14	11	16	14
Plasticity index (PI)	5	8 – 23	15	9	18	18
Modified Plasticity Index ¹	5	6 - 18	11	7	14	14
SPT N Values	5	9 – 50	36	19	50	19
Undrained shear strength (kPa):						
- from SPT N values ²	5	40 - 220	176	154	220	40
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⁾						

Due to the presence of obstructions within the made ground only limited SPT's were undertaken in the fine grained Glacial Deposits, of which 3 refused at 50 blows. SPT N values of 9 and 19 were recorded in WS01 and WS08, both undertaken at the top of the unit. However, the undrained shear strength of the soils increases rapidly with depth. Therefore, it is recommended that the following values are taken as design/characteristic values for this material.

- Undrained shear strength 65kPa
- SPT N Value 14
- Angle of shearing resistance, ϕ 31.3°

9.1.3 Glacial Till (Coarse Grained)

Shallow coarse grained Glacial Till deposits were identified within two exploratory hole locations immediately below the Made Ground/topsoil deposits and varied in thickness between 0.6m and 1.0m. Only three SPT-N values were obtained in the coarse grained Glacial Till deposits, one of 24 and two of 50. For the purposes of design/characteristic values the more conservative 24 value has been used which equates to an angle of shearing resistance of 34.3°.

9.1.4 South Wales Middle Coal Measures Formation

The South Wales Middle Coal Measure were confirmed in 2 exploratory hole locations BH01 and BH02 however it is suspected that many of the windowless sampler SPT refusals may have also been on either dense/very stiff Glacial Till or on the South Wales Middle Coal Measures Formation. All SPT-N tests undertaken in the confirmed South Wales Middle Coal Measures resulted in 50 SPT-N value.

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 new childcare unit with associated areas of hardstanding for car parking.

10.2 EARTHWORKS

Given the current levels of the site and the terraced nature of some of the area, minor earthworks (cut and fill) are anticipated. The majority of any cut materials are likely to be made ground and thus unsuitable for re-use as engineered fill. Given the small scale of the development it would likely be more cost effective to import clean granular fill.

10.3 FOUNDATIONS

Within the area of the proposed building Made Ground was encountered overlying shallow coarse-grained Glacial Till deposits however many of the windowless sample holes refused at shallow depth and concrete was encountered in BH02 at 0.40m bgl. Prior to development existing foundations will need to be grubbed out to allow excavation to the deeper natural deposits. The Made Ground deposits are thick in places, such as WS02 (2.9m bgl) and may be associated with former structures on site such as the toilet block previously located in the vicinity of WS01. Underlying the Glacial Till are the South Wales Middles Coal Measures Formation which was encountered in BH02 at 3.00m bgl.

Based on the above ground conditions and given the relatively low groundwater table it is considered that shallow spread foundations, strip or pads, placed within the shallow fine grained or coarse grained Glacial Till. Foundations should be placed at a minimum of 1.0m bgl but will likely need to be extended deeper where the made ground is of greater thickness and should penetrate the Glacial Deposits by at least 0.3m. 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 0.7m wide or a pad of no more than 1m².

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 inspected by a suitably experienced engineer or inspector to ensure the founding material is suitable natural deposits. Any Made Ground, soft, loose or otherwise unsuitable material 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 2.90m), 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 Glacial Till show moderate levels of water-soluble sulphates and generally neutral conditions. 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-2, and the Aggressive Chemical Environment for Concrete (ACEC) site classification be taken as AC-2.

10.6 TEMPORARY WORKS

The four 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 (3.30m 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 twelve results gathered within the Made Ground, CBR values were in the range of 1% to 45% (average 23%). 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.

The results within the shallow fine grained and coarse-grained alluvium ranged from 3% to 249%. A CBR value of 5% is recommended for pavement design.

Proof rolling of the formation level will be required and any loose or soft spots should be removed and replaced with an engineer fill, in accordance with a suitable specification. Due to potential obstructions there may also be a requirement to grub out existing foundations and any hard spots identified in the Made Ground deposits. 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 Glacial Till Made Ground deposits at TP03 and TP04 both failed after a day of testing suggesting the underlying geology is not suitable for soakaway drainage.

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 will consist of a childcare unit with associated outside play areas. As such the following screening assessment has been undertaken against a residential end use without plant uptake.

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

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

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	
					No. of exceedances	Location
Arsenic	5	4.2	43.4	40	1	TP02 0.50m
Beryllium	5	0.8	2.4	1.7	3	TP01 0.30m WS08 1.90m WS04 1.60m

As summarised in the table above arsenic and beryllium have been identified at concentrations which exceed the screening value for a residential without plant uptake end use. Consideration has also been given to the screening values applicable to a public open space (residential) setting to provide additional context to the assessment.

In this scenario the screening value for arsenic is increased to 79mg/kg and beryllium is increased to 2.2mg/kg, whereby only a single exceedance of beryllium it is recorded within WS08 (2.4mg/kg). These elevated concentrations are considered further in Section 15.0.

11.4 ASBESTOS

Asbestos was not identified in any of the samples sent for laboratory analysis. Suspected asbestos containing materials were not identified during the ground 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.

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
Benzo(a)pyrene	µg/l	0.076	<0.005	0.00017	1	WS03 0.7m
Benzo(ghi)perylene	µg/l	0.06	<0.005	0.0082	1	WS03 0.7m
Benzo(b)fluoranthene	µg/l	0.12	0.014	0.017	1	WS03 0.7m
Benzo(k)fluoranthene	µg/l	0.046	<0.008	0.017	1	WS03 0.7m
Fluoranthene	µg/l	0.008	0.09	0.0063	1	TP02 0.5m

Inland water EQS 2015

Five PAH compounds were identified within soil derived leachate samples at concentrations in excess of the adopted screening criteria. The recorded concentrations are considered to be limited within the context of the site setting and the aggressive nature of the leachate testing process. The recorded concentrations are however considered further in Section 15.0.

12.5 TIER 1 SCREENING ASSESSMENT – GROUNDWATER

One groundwater sample was obtained from the monitoring installations on the site and analysed for the suite of determinants outlined in Section 5.2. The results were screened against a suite of determinants outlined in Section 12.2.

The following table summarises the determinants which have been identified at concentrations in excess of the relevant WQS screening criteria.

Table 12-2 – Summary of Exceedances within Groundwater Samples

Determinant	Units	BH01	Screening Value #
Fluoranthene	µg/l	0.007	0.0063 [#]
Copper	µg/l	10	1 [*]
Nickel	µg/l	7	4 [#]

Inland water EQS 2015

* Freshwater EQS 2015

As can be seen in the table above fluoranthene, copper and nickel have been identified at concentrations in excess of the relevant EQS screening criteria.

As outlined in Section 12.2.1, the bioavailability of certain heavy metals can be taken into account within water samples. The M-BAT assessment tool has been used to determine a screening value taking into account the bioavailability of copper and nickel within the groundwater sample and the results are presented in the following table.

Table 12-3 – M-BAT adjusted Screening Values for Heavy Metals – Groundwater

Determinant	Sample	Concentration (µg/l)	Screening Value (µg/l)	M-BAT Screening Value (µg/l)	Exceedances
Copper	BH01	10	1	7.60	Yes
Nickel	BH01	7	4	16.93	No

The recorded concentrations of copper are therefore 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 6.2.

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. Based on the proposed development, the CS classification is considered the most appropriate.

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
- The site is also located within the South Wales Coalfield, with historical mine workings within the vicinity of the site.

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 largely low permeability. Therefore, there is limited potential for horizontal and vertical migration of ground gas;
- Buried service runs and 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	0.9	0.2	1.8×10^{-3}	1 (Low Risk)
Methane	0.1	0.2	2×10^{-4}	1 (Low Risk)

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 1 (Very Low Risk) based on the recorded concentrations of carbon dioxide and methane and maximum flow rates within the sub surface.

13.2.3 Carbon Monoxide and Hydrogen Sulphide

Maximum concentrations of carbon monoxide and hydrogen sulphide 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

The monitoring rounds was undertaken during rising, falling and steady pressures with no discernable variation in ground gas monitoring results recorded. The second monitoring round was undertaken following a period of falling pressure.

13.3 SUMMARY AND DISCUSSION

The site has been classified as Characteristic Situation 1 (Very Low Risk) based on the worst-case recorded concentrations of carbon dioxide and methane and maximum flow rates. Site classification of a Characteristic Situation 1 indicates gas protection measures are not 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 H. 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 H.

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 five samples analysed as part of the ground investigation were of made ground. The initial assessment identified 2no. samples (TP01 at 0.30m and TP03 at 0.55m) that were classified as potentially 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 H detail which samples this edit has been applied to.

After this amendment all samples have been classified as **non-hazardous**.

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 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.

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).

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

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 proposed development includes the development of a childcare facility with associated external play areas and parking.

15.3 CONCEPTUAL SITE MODEL

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

15.3.1 Potential Sources of Contamination

The main potential sources of contamination on the site are associated with existing features as well as historical land uses on the site as summarised below.

On site Sources

- Made Ground associated with former development on the site;
- Historical colliery workings.
- Existing Electrical Substation

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 (currently undeveloped)
- Future site users (childcare unit);
- Site workers during the redevelopment of the site;
- Adjacent site users (residential)

Wider Environment

- Secondary A Aquifer within superficial deposits;
- Surface waters (Dulais River);
- 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 I.

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 I						
Source	Pathway	Receptor	Consequence of risk being realised	Probability of risk being realised	Risk Classification	Potential risk management requirements
Made Ground associated with previous development	Direct dermal contact or ingestion of soils, or inhalation of dust and/or vapours	Current site users	Medium	Unlikely	Low Risk	Whilst elevated concentrations of arsenic and beryllium have been recorded in the made ground on site, the concentrations are considered to be relatively marginal and when the site is considered against a Public Open Space (residential) end use only one exceedance of beryllium is identified. It is also understood that the proposed development will consist of a building with play areas consisting of predominant hardstanding / surfacing whereby interaction with the underlying made ground will be limited. Risks to construction workers can be managed with the use of PPE, good hygiene practices and ongoing risk assessments.
		Future site users		Low Risk	Moderate / Low Risk	
		Construction workers		Low Risk	Moderate / Low Risk	
	Leaching and lateral/vertical migration of mobile contaminants	Surface water	Mild	Low Risk	Low Risk	Elevated concentrations of PAH compounds have been recorded in the soil derived leachate samples and whilst these pose a potential risk to groundwater the low permeability

		Groundwater		Low Risk	Low Risk	of the subsurface and aggressive nature of the leachate testing procedure these risks are considered to be limited. A single exceedance of PAH has been recorded in groundwater from the site
Asbestos	Inhalation	Current site users	Medium	Unlikely	Low Risk	Asbestos containing materials have not been identified during the ground investigation.
		Future site users		Unlikely	Low Risk	
		Construction workers		Unlikely	Low Risk	
Ground Gas associated with made ground and colliery workings.	Accumulation of gases and inhalation	Future site users	Severe	Unlikely	Moderate / Low Risk	The results of the ground gas monitoring undertaken across the site indicates that the site is categorised as Characteristic Situation 1 (Very Low Risk). As such, ground gas protection measures are not considered necessary as part of the proposed development.
		Construction workers		Unlikely	Moderate / Low Risk	

16.0 CONCLUSIONS AND RECOMMENDATIONS

16.1 GROUND CONTAMINATION

16.1.1 Summary

Only limited ground contamination has been identified in the made ground on the site however given the conservative nature of the assessment and the understanding that the site will be largely hardstanding / formal surfacing the recorded concentrations are not considered to pose a significant risk to future site users. Risks to construction workers can be managed through the adoption of good hygiene practices and use of PPE during the development.

With regards to the potential for mobile contamination, elevated concentrations of PAH compounds have been recorded in soil derived leachate samples, with a further exceedance recorded in groundwater on the site. However, given the limited nature of the exceedances, the aggressive nature of the testing procedures and low permeability identified during the soil infiltration testing the recorded concentrations are not considered to pose a significant risk to controlled waters.

16.1.2 Asbestos

Asbestos containing materials have not been identified on the site or during subsequent laboratory testing.

16.1.3 Ground Gas

Ground gas monitoring has identified low concentrations of ground gases in the sub surface such that the site has been classified as Characteristic Situation 1 (Very Low Risk), therefore no ground gas protection measures are deemed necessary within the proposed development.

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, two samples obtained from TP01 and TP05 were initially classified as hazardous due 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 therefore all samples have been classified as non-hazardous. 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 within the natural fine or coarse grained Glacial Till 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 0.70m wide. 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-2 and the Aggressive Chemical Environment for Concrete (ACEC) site classification can be taken as AC-2.

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 the Glacial Till deposits. Neither of the tests results in a fall to the 25% effective depth over the testing period (one day). It is therefore not considered suitable for the site to be serviced by soakaway type drainage.

16.4 RECOMMENDATIONS

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

- 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.

16.4.1 Potential Constraints

A number of subsurface obstructions were encountered during the ground investigation thought to related to the previous land use as residential flats or the raised embankment on the southern site boundary to provide road access of the railway line. Considerable breaking out of these obstructions cannot be discounted during the construction phase to allow for the construction of new foundations or grubbing out for new areas of hardstanding and associated access.

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.

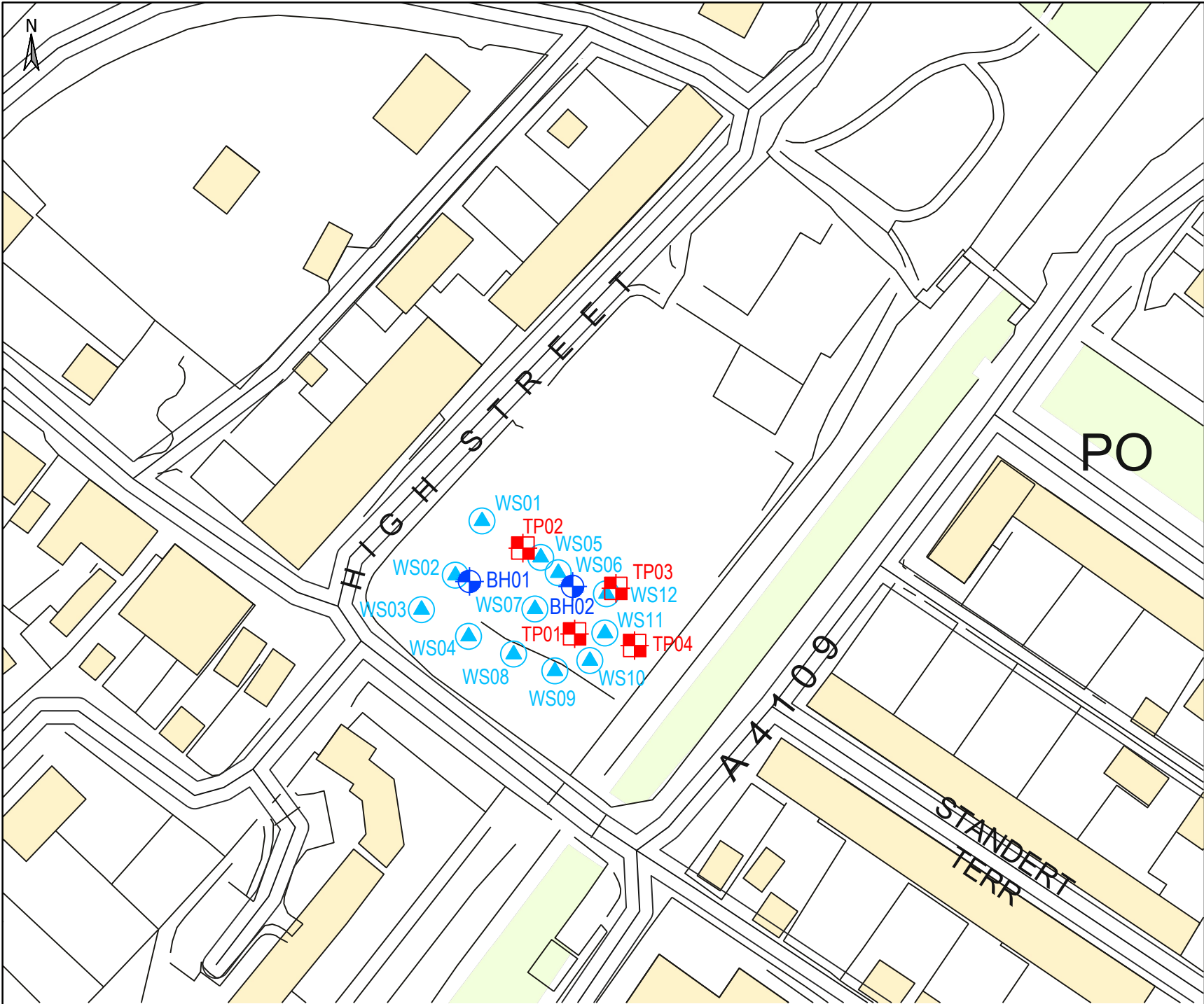
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FIGURES

Figure 1- Site Location Plan

Figure 2 – Site Investigation Layout Plan

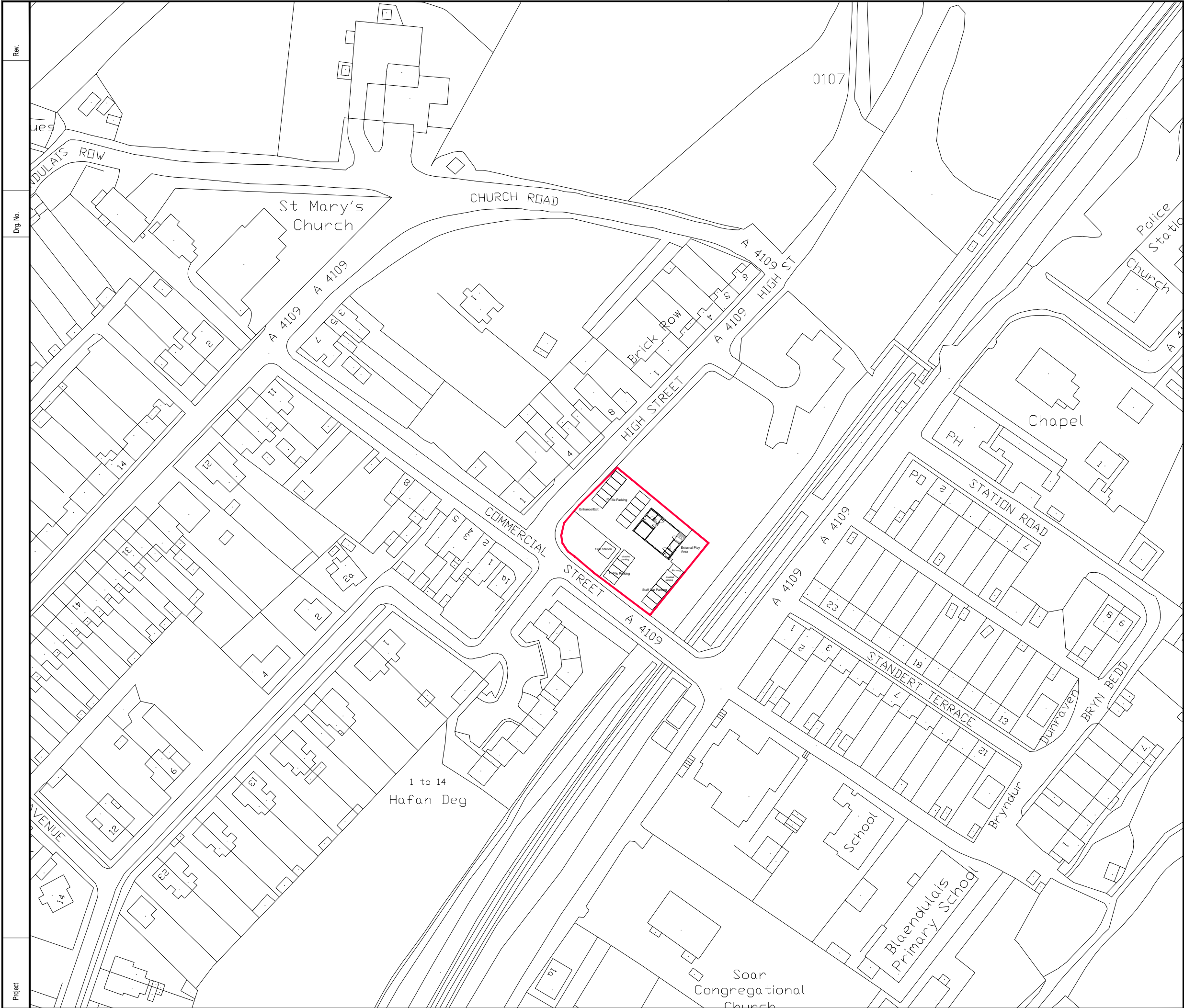


LEGEND:

- TRIAL PIT
- BOREHOLE
- WINDOW SAMPLE

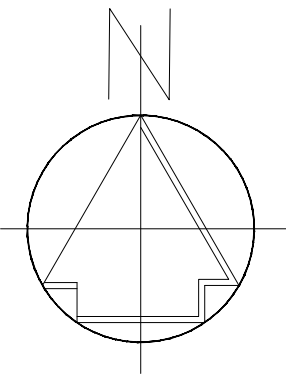
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Figure 3 – Proposed Development Plan



NOTES

1. All dimensions in millimetres unless otherwise stated.



Rev	Details	Dr	Ch	Apr	Date



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Castell-nedd Port Talbot
County Borough Council Cyngor Bwrdeistref Sirol
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BAGLAN ENERGY PARK SA11 2GG
www.npt.gov.uk

Project

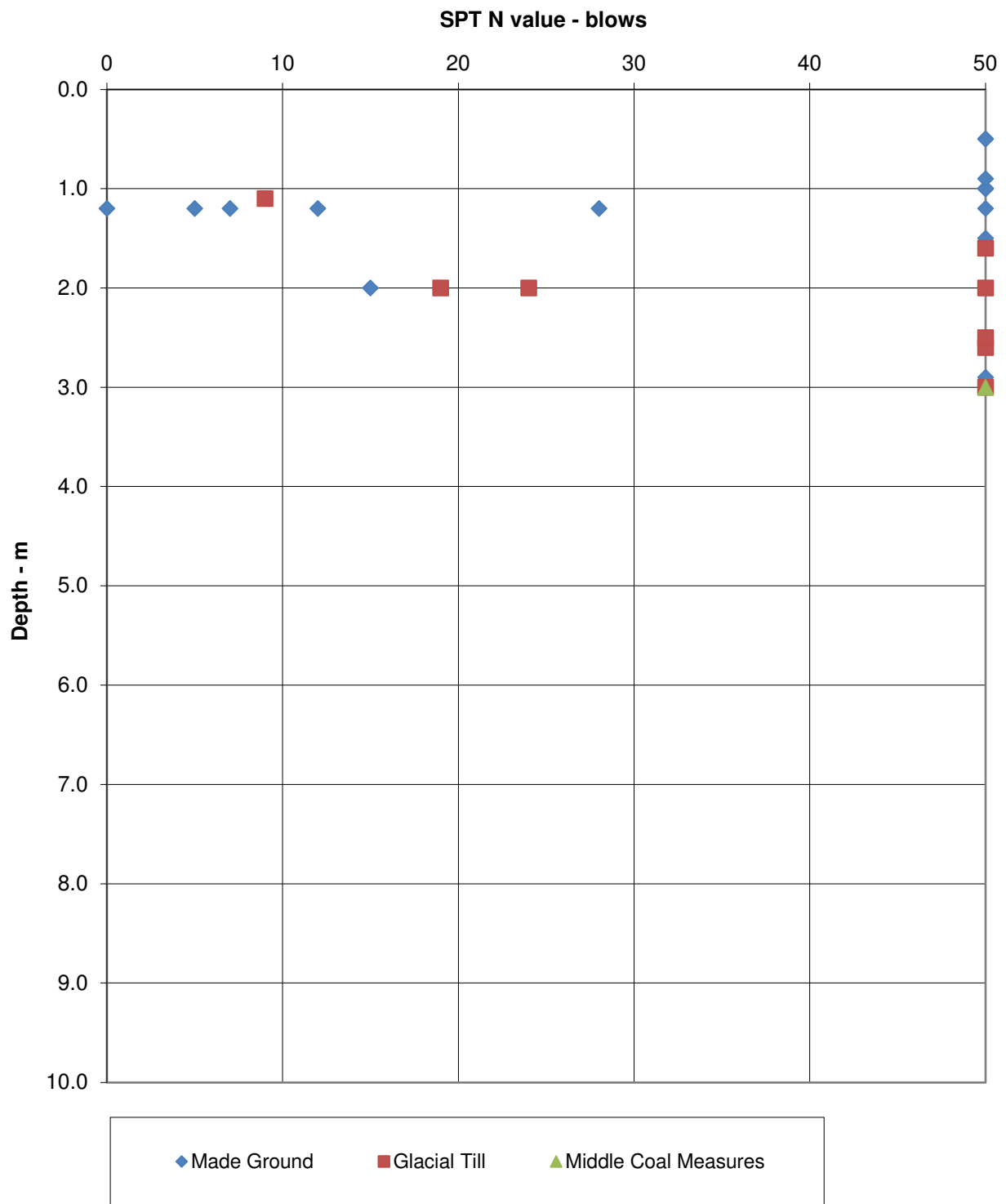
Childcare Grants
Blaendulais

Drawing Title

Location Plan

<u>File No.</u>		<u>Property Ref. No.</u>			
<u>Drawn</u>		<u>Checked</u>		<u>Approved</u>	
<u>Date</u>		<u>Date</u>		<u>Date</u>	
<u>Scales</u>	1:1250				
<u>Drawing No.</u>					<u>Rev.</u>

Figure 4 – SPT-N vs Depth Plot



Tetra Tech Ltd
 Longcross Court, Newport Rd, Cardiff, CF24 0AD
 Tel: 02920 892200
 Fax: 02920 455321



Project

Blaendulais

Client

NPTCBC

Drawing Title

SPT vs Depth Plot

Drawing No.

FIGURE 4

PLATES



Plate 1

BH01 - 0.00mbgl - 0.40mbgl



Plate 2

BH01 - 0.00mbgl - 0.40mbgl

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Plate 3

BH01 - 1.20mbgl - 2.50mbgl

Plate 4

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Plate 1

BH02 - 0.00mbgl - 0.30mbgl (concrete slab obstruction)



Plate 2

BH02 - 0.00mbgl - 0.30mbgl (concrete slab obstruction)

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Plate 3

BH02 - 0.00mbgl - 0.30mbgl (concrete slab obstruction)

Plate 4

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Plate 1

TP01 - 0.00mbgl - 1.50mbgl



Plate 2

TP01 - 0.00mbgl - 1.50mbgl

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Plate 3

TP01 - 0.00mbgl - 1.50mbgl



Plate 4

TP01 - 0.00mbgl - 1.50mbgl

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Plate 5

TP01 - 0.00mbgl - 1.50mbgl



Plate 6

TP01 - 0.00mbgl - 1.50mbgl

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Plate 1

TP02 - 0.00mbgl - 0.70mbgl



Plate 2

TP02 - 0.00mbgl - 0.70mbgl

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Plate 3

TP02 - 0.00mbgl - 0.70mbgl



Plate 4

TP02 - 0.00mbgl - 0.70mbgl

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Plate 1

TP03 - 0.00mbgl - 1.40mbgl



Plate 2

TP03 - 0.00mbgl - 1.40mbgl

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Plate 3

TP03 - 0.00mbgl - 1.40mbgl



Plate 4

TP03 - 0.00mbgl - 1.40mbgl

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Plate 1

TP04 - 0.00mbgl - 1.40mbgl



Plate 2

TP04 - 0.00mbgl - 1.40mbgl

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Plate 3

TP04 - 0.00mbgl - 1.40mbgl



Plate 4

TP04 - 0.00mbgl - 1.40mbgl

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Plate 1

WS01 - 0.00mbgl - 0.40mbgl



Plate 2

WS01 - 0.00 - 0.40mbgl

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Plate 3

WS01 - 0.00mbgl - 0.40mbgl



Plate 4

WS01 - 1.10mbgl - 1.60mbgl

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Plate 1

WS02 - 0.00 -1.20mbgl



Plate 2

WS02 - 0.00 -1.20mbgl

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Plate 3

WS02 - 0.00 -1.20mbgl

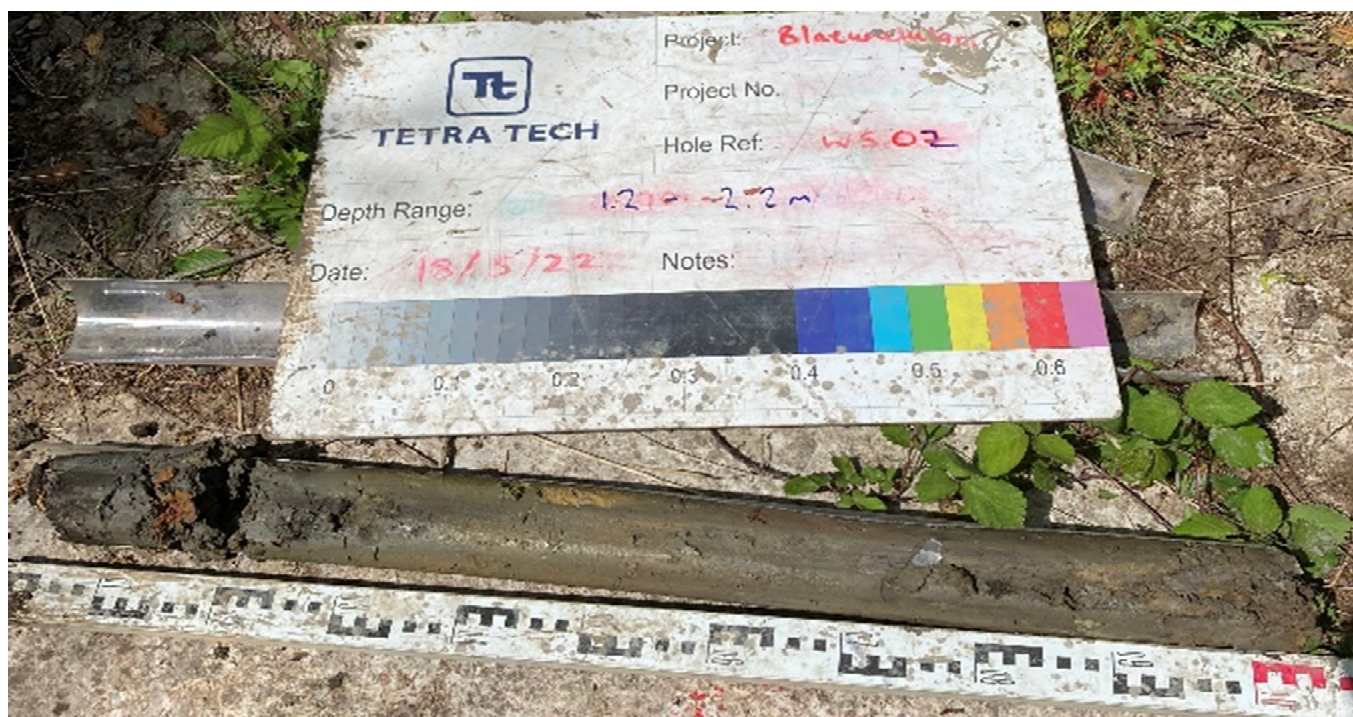


Plate 4

WS02 - 1.20 - 1.70mbgl

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Plate 5

WS02 - 1.70 - 2.20mbgl



Plate 6

WS02 - 2.20 - 2.90mbgl

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Plate 1

WS03 - 0.00mbgl - 1.00mbgl



Plate 2

WS03 - 0.00mbgl - 1.00mbgl

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Plate 1

WS04 - 1.20mbgl - 2.00mbgl



Plate 2

WS04 - 2.00mbgl - 2.60mbgl

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Plate 1

WS05 - 0.00mbgl - 1.00mbgl



Plate 2

WS05 - 0.00mbgl - 1.00mbgl

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Plate 3

WS05 - 0.00mbgl - 1.00mbgl

Plate 4

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Plate 1

WS06 - 0.00mbgl - 0.55mbgl



Plate 2

WS06 - 0.00mbgl - 0.55mbgl

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Plate 3

WS06 - 0.00mbgl - 0.55mbgl



Plate 4

WS06 - 0.00mbgl - 0.55mbgl

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Plate 1

WS07 - 0.00mbgl - 1.00mbgl



Plate 2

WS07 - 0.00mbgl - 1.00mbgl

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Plate 1

WS08 - 0.00mbgl - 1.00mbgl



Plate 2

WS08 - 0.00mbgl - 1.00mbgl

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Plate 3

WS08 - 1.20mbgl - 2.00mbgl



Plate 4

WS08 - 2.00mbgl - 2.90mbgl

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Plate 1

WS09 - 0.00mbgl - 1.00mbgl



Plate 2

WS09 - 0.00mbgl - 1.00mbgl

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Plate 3

WS09 - 0.00mbgl - 1.00mbgl

Plate 4

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Plate 1

WS10 - 0.00mbgl - 0.50mbgl



Plate 2

WS10 - 0.00mbgl - 0.50mbgl

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Plate 3

WS10 - 0.00mbgl - 0.50mbgl

Plate 4

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Plate 1

WS11 - 0.00mbgl - 1.10mbgl



Plate 2

WS11 - 0.00mbgl - 1.10mbgl

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Plate 1

WS12 - 0.00mbgl - 0.90mbgl



Plate 2

WS12- 0.00mbgl - 0.90mbgl

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Plate 3

WS12 - 0.00mbgl - 0.90mbgl

Plate 4

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Project :-
Blaendulais

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Project No.:

B035256

APPENDICES

APPENDIX A – REPORT CONDITIONS

APPENDIX A - REPORT CONDITIONS

GROUND INVESTIGATION

This report is produced solely for the benefit of Neath Port Talbot 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.

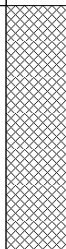
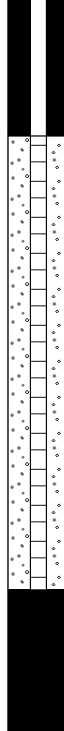
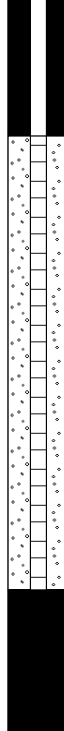
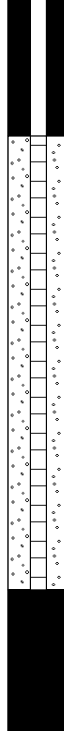
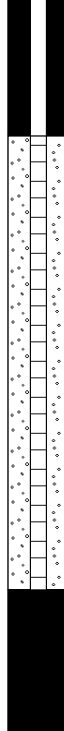
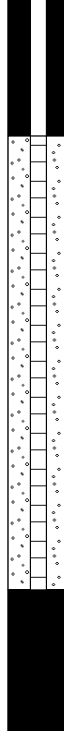
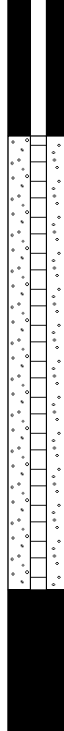
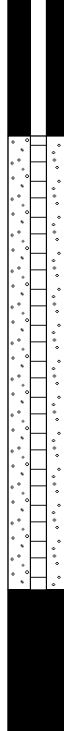
The assessment of ground conditions within this report is based upon the findings of the study undertaken. We have interpreted the ground conditions in between locations on the assumption that conditions do not vary significantly. However, no investigation can inspect each and every part of the site 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: Blaendulais Location: Seven Sisters Client: Neath Port Talbot County Borough Council						Location Details Easting: 281931.88 Northing: 208920.45 Level: 186.72mAOD Depth: 30.00m Logger: Gabriel Lloyd Type: WS+RO Inclination: °						Status FINAL		Borehole Number BH01		
												Sheet 1 of 3				
Method, Plant and Crew					Diameter		Casing		Groundwater						Scale: 1:50	
From (m) 0.00 3.50	To (m) 3.50 30.00	Type Window Sampler Rotary Open Hole	Plant Used Klemm Klemm	Crew Apex Drilling Services Apex Drilling Services	Depth (m) 1.20 30.00	Diam (mm) 300 96	Depth(m) 4.00 100	Strike (m) 3.40	Casing (m) -	Sealed (m) -	Rose To (m) 0.00	Time (mins) 0	Remarks		Checked By: NEB	
														Approved By: CBP	Start Date: 17/05/2022	
															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			
Grass over, dark grey sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to sub angular of sandstone, mudstone, brick, concrete and plastic. (MADE GROUND) MGR													SPT(C) 1.20m, N=0 (1,0/0,0,0,0)		1	
Medium dense becoming dense orangish grey brown, clayey sandy GRAVEL. Sand is fine to coarse. Gravel is angular to sub rounded of sandstone, siltstone and mudstone. TILL							1.50	185.22					SPT(C) 2.50m, N=50 (25 for 55mm/50 for 35mm)		2	
Dark brown medium hard to hard sandstone, mudstone and siltstone. (SOUTH WALES MIDDLE COAL MEASURES FORMATION)							3.00	183.72					SPT(C) 3.00m, N=50 (25 for 30mm/50 for 25mm)		3	
													SPT(C) 4.00m, N=50 (25 for 15mm/50 for 10mm)		4	
															5	
															6	
															7	
															8	
															9	
															10	
Observations / Remarks 1. Dynamic sampling to 3.50mbgl, with limited recovery due to the large cobbles and boulders. 2. Rotary open holed from 3.50mbgl to 30.00mbgl. 3. Ground water encountered at 3.40mbgl. 4. Standpipe installed. 5. *Based on drillers description and limited returns.										Sampling Runs					Hammer Information	
From (m) 1.20 2.50	To (m) 2.50 3.50	Diam (mm)	Recovery % 75 0	Remarks		Serial No. T44	Energy Ratio %									
						Project Number 784-B035256										

 Project: Blaendulais Location: Seven Sisters Client: Neath Port Talbot County Borough Council						Location Details Easting: 281931.88 Northing: 208920.45 Level: 186.72mAOD Depth: 30.00m Logger: Gabriel Lloyd Type: WS+RO Inclination: °						Status FINAL		Borehole Number BH01					
												Sheet 3 of 3							
Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time					Scale: 1:50					
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)	Checked By: NEB					
0.00 3.50	3.50 30.00	Window Sampler Rotary Open Hole	Klemm Klemm	Apex Drilling Services Apex Drilling Services	1.20 30.00	300 96	4.00	100						Approved By: CBP					
Strata Description							Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples, Tests and Rotary Coring							
Dark brown medium hard to hard sandstone, mudstone and siltstone. (SOUTH WALES MIDDLE COAL MEASURES FORMATION)												Depth (m)	Ref	Tests / Results					
							EOH at 30.00m - Reached Required Depth.								30.00	156.72			
Observations / Remarks 1. Dynamic sampling to 3.50mbgl, with limited recovery due to the large cobbles and boulders. 2. Rotary open holed from 3.50mbgl to 30.00mbgl. 3. Ground water encountered at 3.40mbgl. 4. Standpipe installed. 5. *Based on drillers description and limited returns.								Flushing					Hammer Information						
								From (m)	To (m)	Return Min %	Colour	Type	Serial No.	Energy Ratio %					
													T44						
								Groundwater					Project Number						
Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks	784-B035256													

Tt TETRA TECH Project: Blaendulais Location: Seven Sisters Client: Neath Port Talbot County Borough Council						Location Details						Status FINAL		Borehole Number			
						Easting: 281951.37 Northing: 298919.51 Level: 186.72mAOD Depth: 30.00m Logger: Gabriel Lloyd Type: WS+RO Inclination: °								BH02			
														Sheet 1 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 3.50	3.50 30.00	Window Sampler Rotary Open Hole	Klemm Klemm	Apex Drilling Services Apex Drilling Services	1.20 3.00	300 96	3.00	100	5.00 8.50	- -	- -	0.00 0.00	0 0		Checked By: NEB		
															Approved By: CBP		
																Start Date: 18/05/2022	
																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			
Grass over, grey sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular of sandstone, mudstone, brick, metal and concrete. (MADE GROUND) MGR Hard concrete at 0.40 to 0.60m bgl.								1.70	185.02			1.30 1.30 - 2.50	ES1 B1	SPT(C) 1.20m, N=50 (25 for 55mm/50 for 20mm)		1	
Orangish grey brown clayey gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse of subangular to subrounded of sandstone, siltstone and mudstone. TILL														SPT(C) 2.00m, N=50 (25 for 30mm/50 for 20mm)		2	
Dark brown medium hard to hard inter bedded mudstone, sandstone and siltstone. (SOUTH WALES MIDDLE COAL MEASURES FORMATION)								3.50	183.22					SPT(C) 3.00m, N=50 (25 for 40mm/50 for 30mm)		3	
..... Small traces of thin coal seams (>10cm).														SPT(C) 3.50m, N=50 (25 for 15mm/50 for 5mm) SPT(C) 3.50m, N=50 (25 for 15mm/50 for 5mm)		4	
														SPT(C) 5.00m, N=50 (25 for 5mm/50 for 10mm)		5	
														SPT(C) 6.50m, N=50 (25 for 0mm/50 for 0mm)		6	
																7	
																8	
																9	
																10	
Observations / Remarks											Sampling Runs				Hammer Information		
1. Dynamic sampling to 3.00mbgl, with limited recovery due to the large cobbles and boulders. 2. Rotary open holed from 3.00mbgl to 30.00mbgl. 3. Ground water encountered at 5.00mbgl and 8.50mbgl. 4. Standpipe installed. 5. *Based on drillers description and limited returns											From (m)	To (m)	Diam (mm)	Recovery %	Remarks	Serial No.	Energy Ratio %
											1.20 2.50	2.50 3.00		100 0		T44	
																	Project Number
											784-B035256						

[illegible]

[illegible]

[illegible]

[illegible]

 TETRA TECH 3 U R W H B laendulais / R A D R Q Seven Sisters & O M H Q Neath Port Talbot County Borough Council										/ R A D R Q W H L O V (D V W L Q J , " ~ 1 R U W K L Q J , " ~ / H Y H O , " ~ " P \$ 2 ' ' H S W K , " ~ P / R J J H U , " D E U L H O / D A S H G : 6 " Q F O L Q D W L R Q , " ~										6 W A X V) , 1 \$ /			% R U H K R O H 1 X P E H WS01 6 K H W H R I		
0 H M R G W D Q Q & U H Z) U R P P T R P 7 I S H 3 O D Q W 8 V H G & U H Z ' H S K P ' L D P P P ' H S K P ' L D P P P 6 W L R P H E D V L Q J S H O H S R V H 7 R L P H P L Q V 5 H P D U N V										* U R X Q W Z D 6 F D O H , " ~ & K H F N H G % \ , 1 (% \$ S S U R Y H G % \ , & % 3 6 W D U W ' D W H , " ~) L Q L V K ' D W H , " ~															
6 W W D ' H V A U R L Q S * U D V R Y D H I E U R Z Q L W R G J U H O V \ & / \$ < 0 H G L X M Q F B E E Q L V F V R E B V H D Y H O L V R I E Q V H O J B U R V D E J B D R I E U L F M E U R Q F U H S O W F W D D Q G J O D V V & R E E O H M D Q S J X O S 2 8 R I F R Q F U H 0 * 5										/ H J H O G H S W K S H G X F H G D W H U , Q V W P H Y H O P S 2 ' O H Y H O P D F N I L Q R 6 D P S O H V D Q G 7 H V W L Q J 7 H V W V 5 H V X O W V															
) L U P W R H G D R W V K E U R Z Q L W R G J U H O V \ & / \$ < 0 H G L X M Q F B E E Q L V F * U D Y H O L V V R E V X E U R D Q G H M Q R I D Q Q E R X G V * / \$ & , \$ / 7 , / / 7 , / /										% (6 % (6 6 3 7 6 P 1 ~ 6 3 7 6 ~ P ~ ~ I R U P P															
EOH at 1.60m - Refused on hard strata.																									
2 E V H W R Q V 5 H P D U N V 5 H I X W D O D E J O V E X H W W V 1 R M Z D H Q V R X I C % D F W I D D O M I G Q 2 M										6 D P S O L Q J 5 X Q V) U R P P T R P ' L D P P B H F R Y H U I 5 H P D U N V 6 H M L I R (Q H U J W S R ' \$ 5 7 ~ ~ 3 U R W H M P E H U 784-B035256															

[illegible]

 Project: Blaendulais Location: Seven Sisters Client: Neath Port Talbot County Borough Council										Location Details Easting: 281945.33 Northing: 208924.98 Level: 186.80mAOD Depth: 1.00m Logger: Gabriel Lloyd Type: WS Inclination: °							Status FINAL		Borehole Number WS05	
										Sheet 1 of 1										
Method, Plant and Crew						Diameter		Casing		Groundwater						Scale: 1:50				
From (m) 0.00	To (m) 1.00	Type Inspection Pit	Plant Used Window sample Rig	Crew South Wales Ground Testing	Depth (m) 1.00	Diam (mm) 300	Depth(m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks			Checked By: NEB			
															Approved By: CBP					
															Start Date: 18/05/2022					
															Finish Date: 18/05/2022					
Strata Description							Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing								
Dark greyish brown, sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular of brick, concrete, sandstone, mudstone and old building material. (MADE GROUND) MGR Dense dark to light brown, silty very sandy GRAVEL. Sand is fine to coarse. Gravel is angular to subangular of sandstone, mudstone, brick and concrete. (MADE GROUND). MGR								0.20	186.60			0.00 - 0.20 0.20 - 0.60 0.40	B1 B2 ES1	Tests / Results						
								1.00	185.80					SPT(S) 1.00m, 50 (22,23/50 for 10mm)			1			
																	2			
																	3			
EOH at 1.00m - Refused on Hard Strata.																		4		
																		5		
																		6		
																		7		
																		8		
																		9		
																		10		
Observations / Remarks 1. Refusal at 1.00mbgl due to hard strata. 2. No water encountered. Backfilled with arisings.										Sampling Runs					Hammer Information					
										From (m)	To (m)	Diam (mm)	Recovery %	Remarks	Serial No. DART346	Energy Ratio % 68				
															Project Number 784-B035256					

 Project: Blaendulais Location: Seven Sisters Client: Neath Port Talbot County Borough Council										Location Details Easting: 281944.24 Level: 186.74mAOD Logger: Gabriel Lloyd Northing: 208915.24 Depth: 1.00m Type: WS Inclination: °							Status FINAL		Borehole Number WS07																
										Sheet 1 of 1																									
Method, Plant and Crew						Diameter		Casing		Groundwater						Scale: 1:50																			
From (m) 0.00		To (m) 1.00		Type Inspection Pit		Plant Used Window Sample Rig		Crew South Wales Ground Testing		Depth (m) 1.00		Diam (mm) 300		Depth(m)		Diam (mm)		Strike (m)		Casing (m)		Sealed (m)		Rose To (m)		Time (mins)		Remarks		Checked By: NEB					
																										Approved By: CBP		Start Date: 18/05/2022		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											
Grass over dark grey sandy GRAVEL & COBBLES of subangular to angular sandstone, mudstone, concrete and brick. (MADE GROUND) MGR																						0.00 - 0.70		B1		SPT(S) 1.00m, 50 (18,24/50 for 70mm)									
																				0.50		ES1													
EOH at 1.00m - Refused on Hard strata.												1.00		185.74																1					
																														2					
																														3					
																														4					
																														5					
																														6					
																														7					
																														8					
																														9					
																														10					
Observations / Remarks										Sampling Runs										Hammer Information															
1. Refusal at 0.60mbgl due to hard strata. 2. No water encountered. Backfilled with arisings.										From (m)		To (m)		Diam (mm)		Recovery %		Remarks		Serial No.		Energy Ratio %													
																				DART346		68													
																				Project Number 784-B035256															

[illegible]

[illegible]

 Project: Blaendulais Location: Seven Sisters Client: Neath Port Talbot County Borough Council						Location Details						Status FINAL		Borehole Number WS09A			
						Easting: 281948.02 Northing: 208903.54 Level: 188.06mAOD Depth: 1.00m Logger: Gabriel Lloyd Type: WS 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		
0.00	1.00	Inspection Pit	Hand Digging Tools	South Wales Ground Testing	1.00	300									Approved By: CBP		
Strata Description							Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing					
												Depth (m)	Ref	Tests / Results			
Dark brown silty sandy clayey GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, angular to sub angular of sandstone, and rare concrete and brick. (MADE GROUND) MGR								1.00	187.06			0.10 - 0.30	B1	SPT(S) 1.00m, 50 (15,18/50 for 180mm)			
EOH at 1.00m - Refused on Hard Strata.											0.30	ES1					
																	1
																	2
																	3
																	4
																	5
																	6
																	7
																	8
																	9
																	10
Observations / Remarks										Sampling Runs					Hammer Information		
1. Refusal at 1.00mbgl due to hard strata. 2. No water encountered. Backfilled with arisings.										From (m)	To (m)	Diam (mm)	Recovery %	Remarks	Serial No.	Energy Ratio %	
															DART346	68	
															Project Number		
					784-B035256												

Tt TETRA TECH Project: Blaendulais Location: Seven Sisters Client: Neath Port Talbot County Borough Council						Location Details						Status		Borehole Number			
						Easting: 281954.64 Northing: 208905.49 Level: 186.88mAOD Depth: 0.50m Logger: Gabriel Lloyd Type: WS Inclination: °						FINAL		WS10			
																Sheet 1 of 1	
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	0.50	Inspection Pit	Hand Digging Tools	South Wales Ground Testing	0.50	300									Approved By: CBP		
															Start Date: 18/05/2022		
															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			
Grass over, dark brown sandy very gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular of sandstone and rare plastic. (MADE GROUND) MGR								0.50	186.38			0.00 - 0.50	81	SPT(S) 0.50m, 50 (22,23/50 for 40mm)			
EOH at 0.50m - Refused on Hard Strata.											0.40	ES1					
								0.50	186.38			0.40	ES1				
Observations / Remarks							Sampling Runs					Hammer Information					
1. Refusal at 0.50mbgl due to hard strata. 2. No water encountered. Backfilled with arisings.							From (m)	To (m)	Diam (mm)	Recovery %	Remarks	Serial No.	Energy Ratio %				
												DART346	68				
													Project Number				
						784-B035256											

TETRA TECH						Project: Blaendulais		Location Details Easting: 281957.48 Northing: 208910.69 Level: 186.72mAOD Depth: 1.10m Logger: Gabriel Lloyd Type: WS Inclination: °							Status FINAL		Borehole Number WS11				
						Client: Neath Port Talbot County Borough Council											Sheet 1 of 1				
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	1.10	Inspection Pit	Hand Digginf Tools	South Wales Ground Testing	1.00 1.10	300 90									Approved By: CBP						
																Start Date: 18/05/2022					
																Finish Date: 18/05/2022					
Strata Description							Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing									
Grass over, sandy gravelly CLAY. Sand is fine to coarse. Garvel is angular to subangualr of sandstone, concrete, brick and colliery spoil. (MADE GROUND) MGR								1.10	185.62			Depth (m)	Ref	Tests / Results							
												0.10 - 0.30	B1	SPT(S) 1.00m, 50 (15,22/50 for 85mm)							
EOH at 1.10m - Refused on Hard Strata.								1.10	185.62												
														0.30	ES1						
Observations / Remarks							Sampling Runs							Hammer Information							
1. Refusal at 1.10mbgl due to hard strata. 2. No water encountered. Backfilled with arisings.							From (m)	To (m)	Diam (mm)	Recovery %	Remarks	Serial No.	Energy Ratio %								
												DART346	68								
													Project Number								
												784-B035256									

[illegible]

APPENDIX C – TRL PROBE TEST RESULTS

Tetra Tech Environment



5th Floor, Longcross Court, 47 Newport Road, Cardiff
Tel: 02920 829200
Fax: 02920 455321
Environmental Consultancy
Ground Engineering Services

PROJECT No.: B035256

PROJECT NAME: Blaendulais

CLIENT: Neath Port Talbot Council

FIGURE No.: TRL01 / WS06

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: TRL01

Position: 1

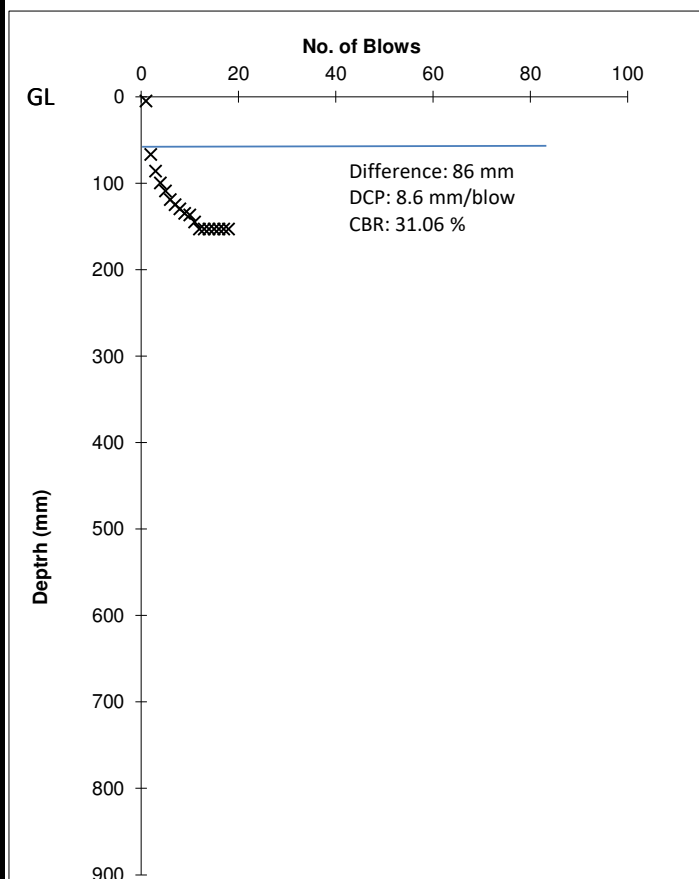
Date: 19th May 2022

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)
5	1	60	5				
62	2	122	67				
19	3	141	86				
14	4	155	100				
9	5	164	109				
10	6	174	119				
6	7	180	125				
5	8	185	130				
5	18	190	135				
2	19	192	137				
8	39	200	145				
8	59	208	153				
	60	208	153				
	70	208	153				
	71	208	153				
	81	208	153				
	82	208	153				
	83	208	153				
-208	93	0	-55				
	20		-55				
	21		-55				
	22		-55				
	23		-55				
	24		-55				
	25		-55				
	26		-55				
	27		-55				
	28		-55				

Test started at: 0 m below ground level

Zero Reading: 55 mm

Zero reading = start depth below ground surface



Data compiled by: CS
Data checked by: NEB

5th Floor, Longcross Court, 47 Newport Road, Cardiff
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Environmental Consultancy
Ground Engineering Services

PROJECT No.: B035256

PROJECT NAME: Blaendulais

CLIENT: Neath Port Talbot Council

FIGURE No.: TRL02 / WS01

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: TRL02 / WS01

Position: 1

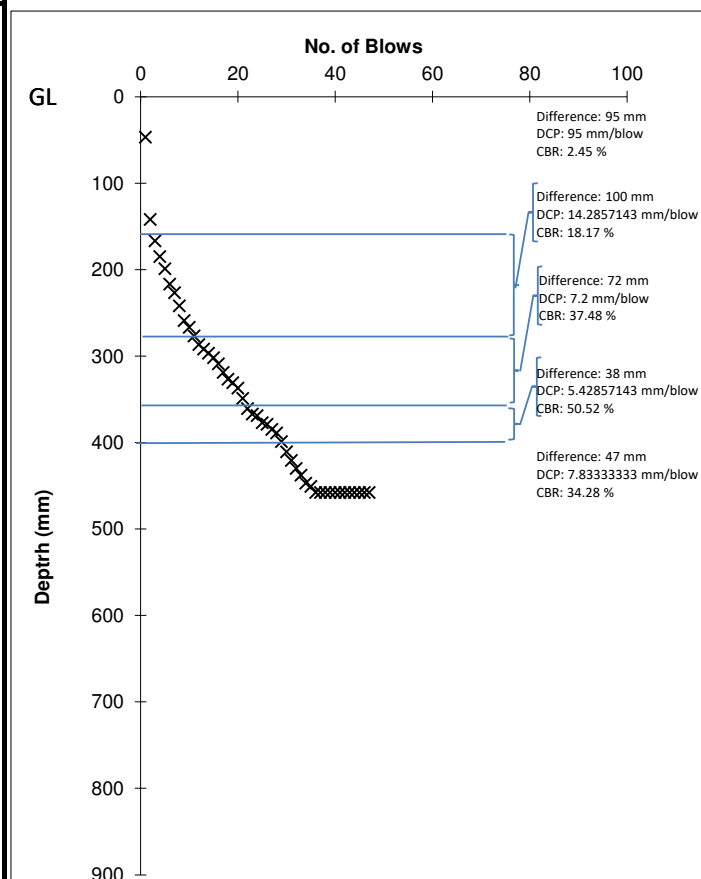
Date: 19th May 2022

[illegible]

Test started at: 0 m below ground level

Zero Reading: 43 mm

Zero reading = start depth below ground surface



Data compiled by: CS
Data checked by: NEB

Tetra Tech Environment



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Environmental Consultancy
Ground Engineering Services

PROJECT No.: B035256
PROJECT NAME: Blaendulais
CLIENT: Neath Port Talbot Council
FIGURE No.: TRL03 / WS11

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: TRL03

Position: 1

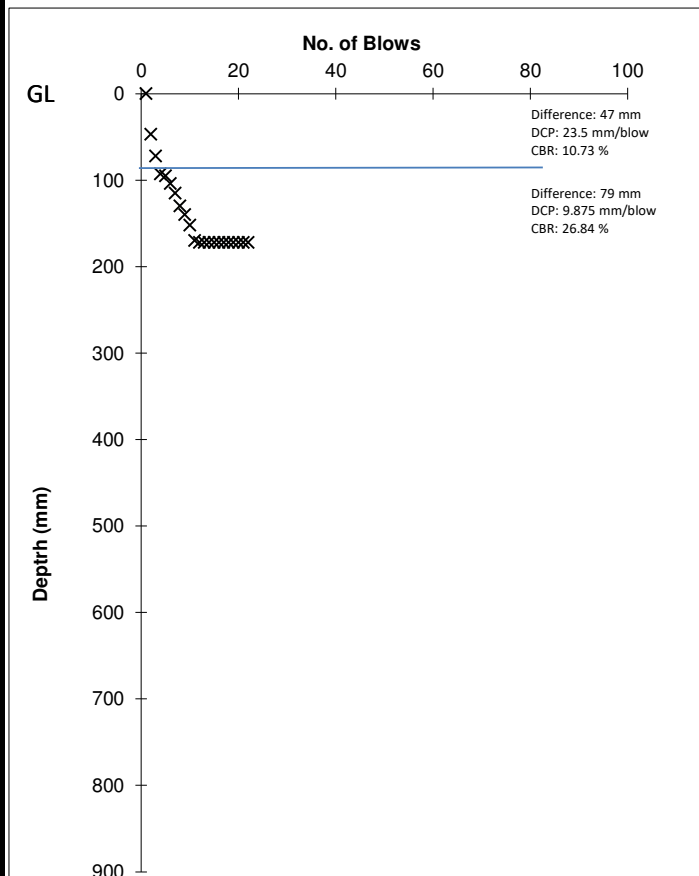
Date: 19th May 2022

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	50					
25	2	97	47				
21	3	122	72				
2	4	143	93				
9	5	145	95				
11	6	154	104				
15	7	165	115				
10	8	180	130				
12	18	190	140				
18	19	202	152				
2	39	220	170				
	59	222	172				
	60	222	172				
	70	222	172				
	71	222	172				
	81	222	172				
	82	222	172				
	83	222	172				
	93	222	172				
	20	222	172				
	21	222	172				
	22	222	172				
-222	23		-50				
	24		-50				
	25		-50				
	26		-50				
	27		-50				
	28		-50				

Test started at: 0 m below ground level

Zero Reading: 50 mm

Zero reading = start depth below ground surface



Data compiled by: GL
Data checked by: NEB

Tetra Tech Environment



5th Floor, Longcross Court, 47 Newport Road, Cardiff
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Environmental Consultancy
Ground Engineering Services

PROJECT No.: B035256

PROJECT NAME: Blaendulais

CLIENT: Neath Port Talbot Council

FIGURE No.: TRL04 / WS07

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: TRL04

Position: 1

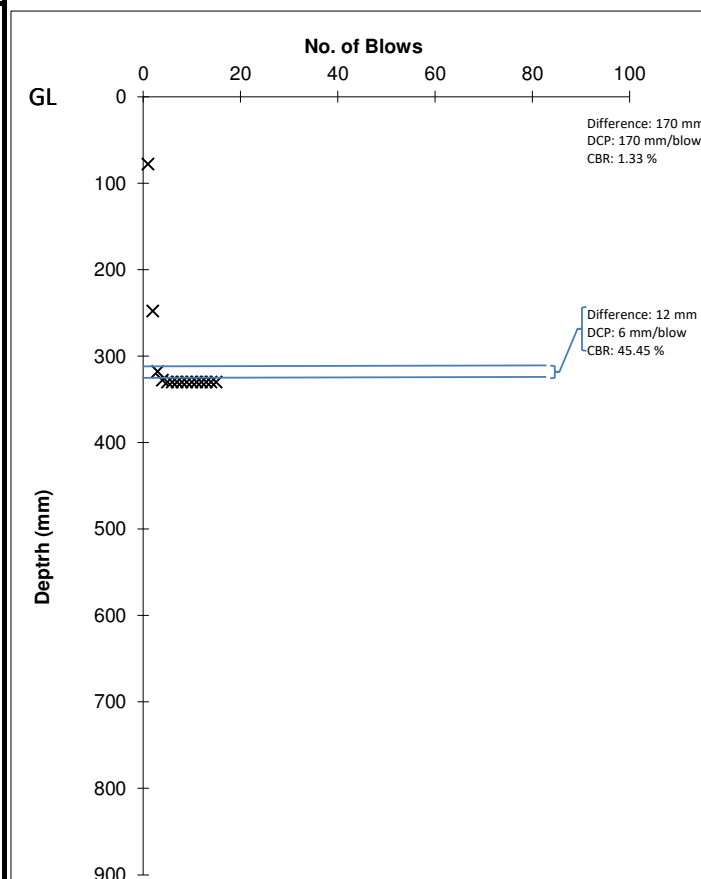
Date: 19th May 2022

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)
78	1	110	78				
170	2	280	248				
70	3	350	318				
10	4	360	328				
2	5	362	330				
	6	362	330				
	7	362	330				
	8	362	330				
	18	362	330				
	19	362	330				
	39	362	330				
	59	362	330				
	60	362	330				
	70	362	330				
	71	362	330				
-362	81		-32				
	82		-32				
	83		-32				
	93	0	-32				
	20		-32				
	21		-32				
	22		-32				
	23		-32				
	24		-32				
	25		-32				
	26		-32				
	27		-32				
	28		-32				

Test started at: 0 m below ground level

Zero Reading: 32 mm

Zero reading = start depth below ground surface



Data compiled by: GL
Data checked by: NEB

Tetra Tech Environment



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Ground Engineering Services

PROJECT No.: B035256

PROJECT NAME: Blaendulais

CLIENT: Neath Port Talbot Council

FIGURE No.: TRL05 / WS04

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: TRL05

Position: 1

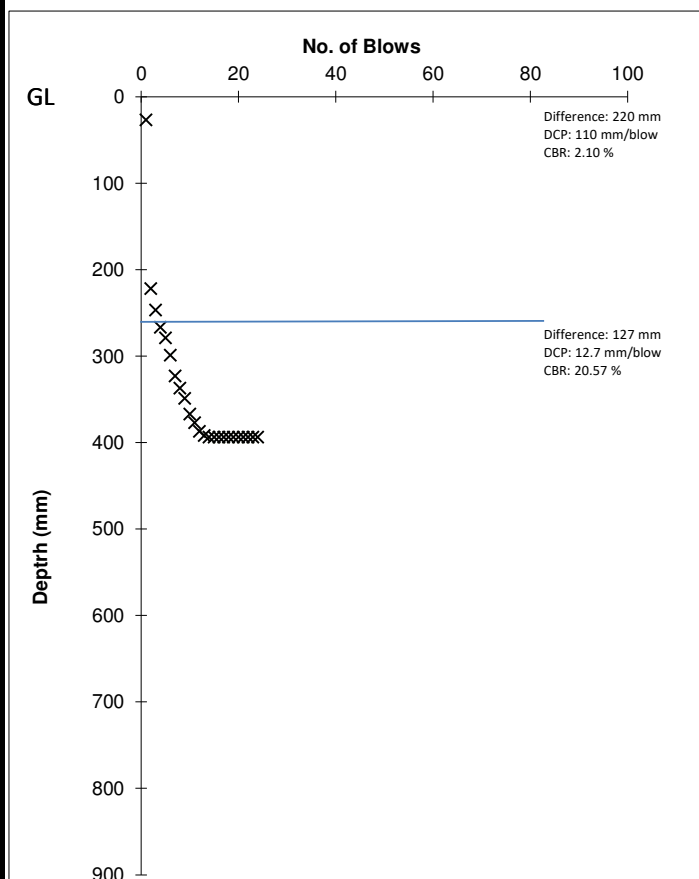
Date: 19th May 2022

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)
27	1	90	27				
195	2	285	222				
25	3	310	247				
20	4	330	267				
12	5	342	279				
20	6	362	299				
24	7	386	323				
14	8	400	337				
12	18	412	349				
18	19	430	367				
10	39	440	377				
10	59	450	387				
5	60	455	392				
2	70	457	394				
	71	457	394				
	81	457	394				
	82	457	394				
	83	457	394				
	93	457	394				
	20	457	394				
	21	457	394				
	22	457	394				
	23	457	394				
	24	457	394				
-457	25		-63				
	26		-63				
	27		-63				
	28		-63				

Test started at: 0 m below ground level

Zero Reading: 63 mm

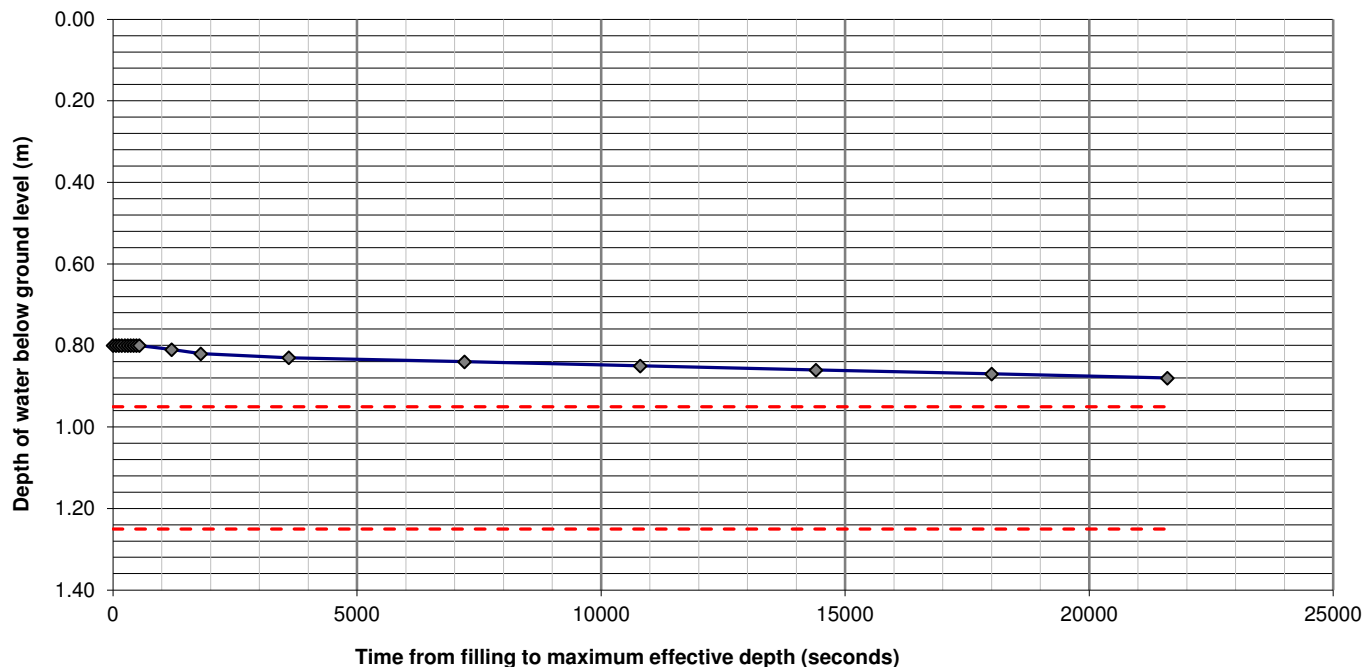
Zero reading = start depth below ground surface



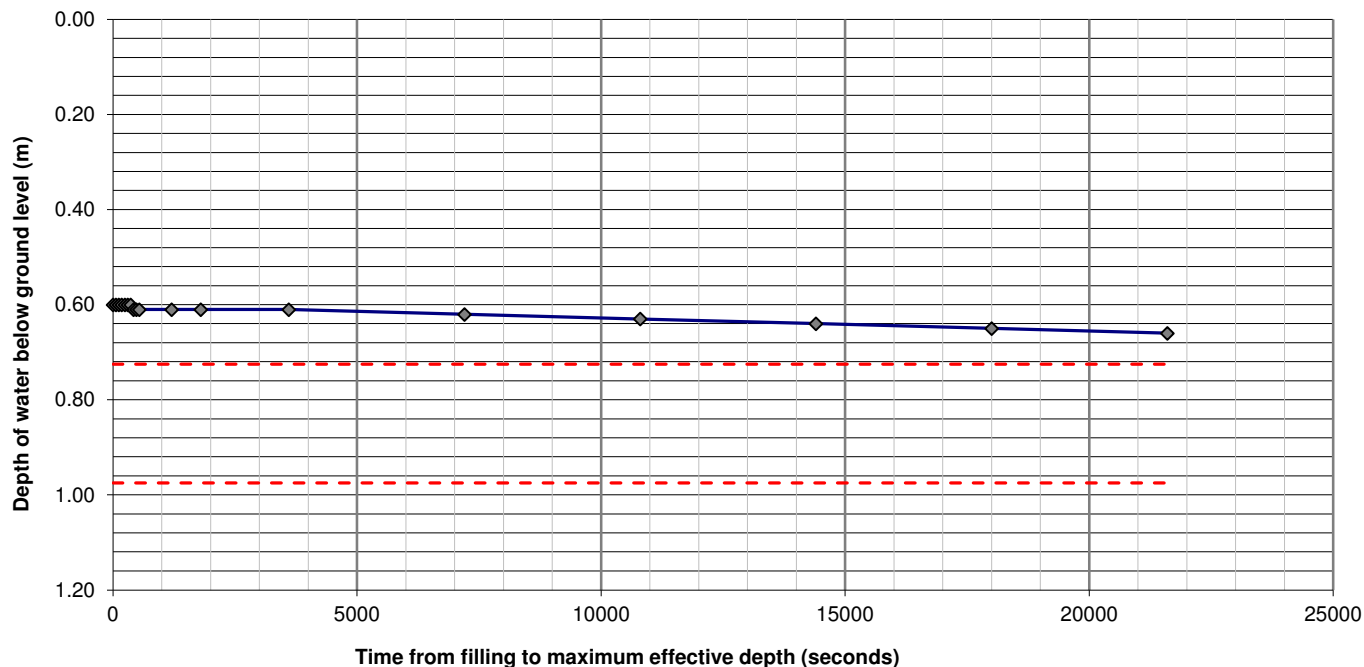
Data compiled by: GL
Data checked by: NEB

APPENDIX D – SOIL INFILTRATION TEST RESULTS

SOAKAWAY TEST - SOIL INFILTRATION RATE/PERMEABILITY CALCULATION

[illegible]

SOAKAWAY TEST - SOIL INFILTRATION RATE/PERMEABILITY CALCULATION

[illegible]

APPENDIX E – GEOTECHNICAL LABORATORY TEST RESULTS



Laboratory Report



Contract Number: 59665

Client Ref: **784-B035256**

Client PO:

Date Received: **24-05-2022**

Date Completed: **18-06-2022**

Report Date: **18-06-2022**

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: **Blaendulais**

For the attention of: **Gabriel Lloyd**

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
PSD Wet & Dry Sieve method BS 1377:1990 - Part 2 : 9.2 - * UKAS	5
PSD: Sedimentation by pipette carried out with Wet Sieve (Wet Sieve must also be selected) BS 1377:1990 - Part 2 : 9.4 - * UKAS	3
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

Unit 3-4, Heol Aur, Dafen Ind Estate, Dafen, Llanelli, Carmarthenshire SA14 8QN

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



59665

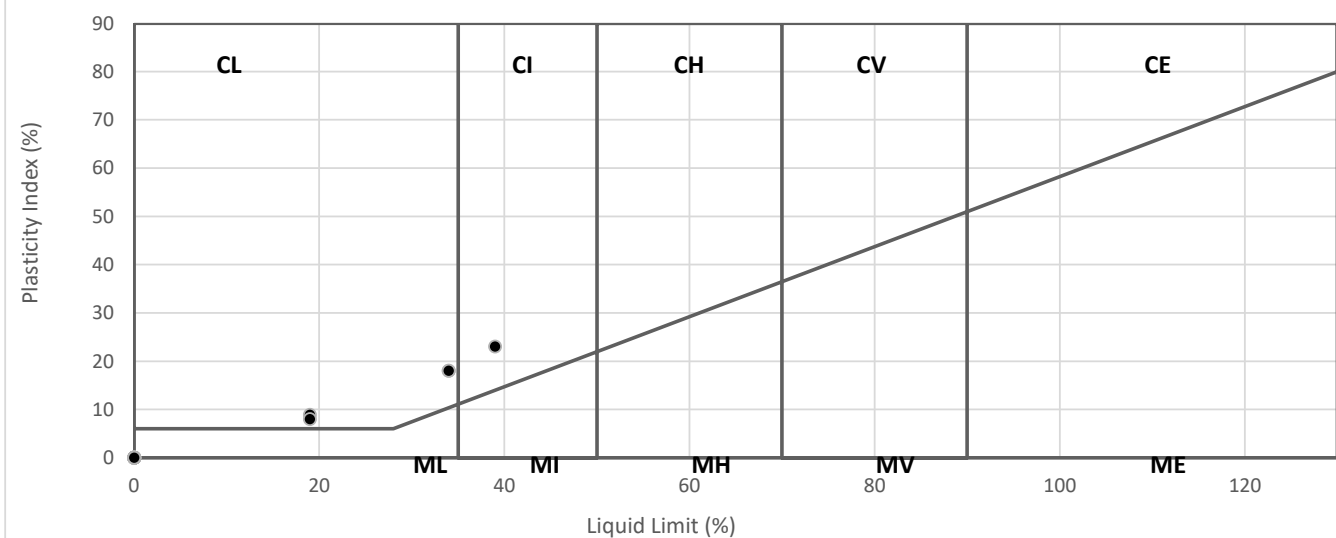
Blaendulais

784-B035256

[illegible]

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

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

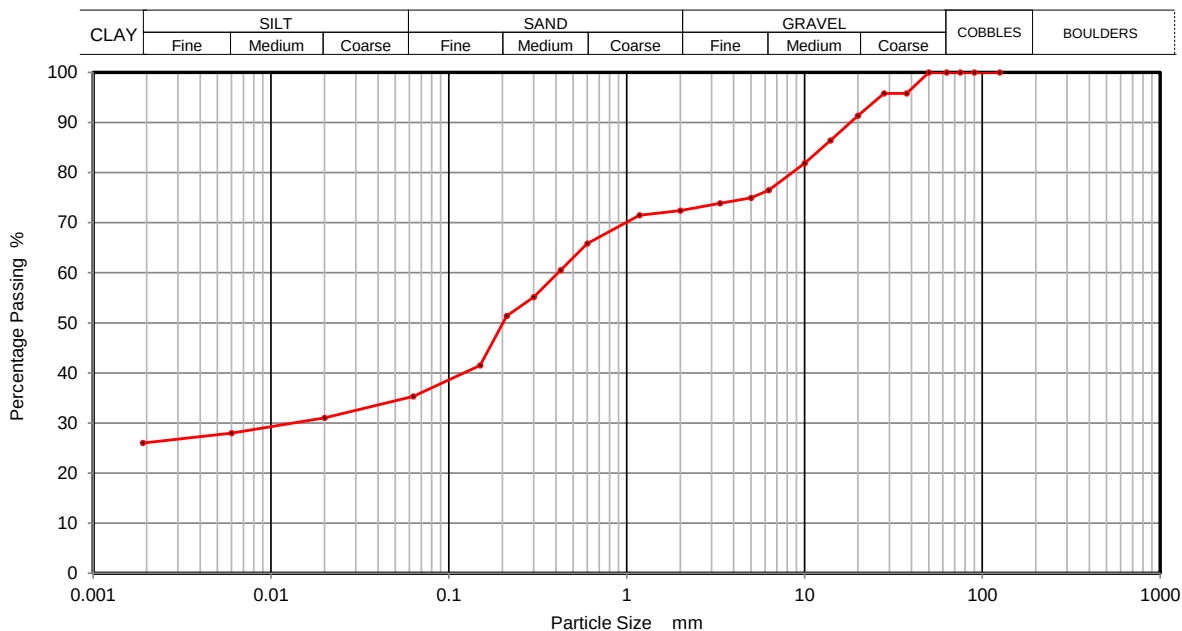


Operators			
Darcy Etheridge			

PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Contract Number	59665
Borehole/Pit No.	BH02
Sample No.	
Depth Top	1.30
Depth Base	2.50
Sample Type	B

Site Name	Blaendulais
Soil Description	*See description sheet
Date Tested	14/06/2022



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	31
90	100	0.0060	28
75	100	0.0020	26
63	100		
50	100		
37.5	96		
28	96		
20	91		
14	86		
10	82		
6.3	76		
5	75		
3.35	74		
2	72		
1.18	71		
0.6	66		
0.425	61		
0.3	55		
0.212	51		
0.15	41		
0.063	35		

Sample Proportions	% dry mass
Cobbles	0
Gravel	28
Sand	37
Silt	9
Clay	26

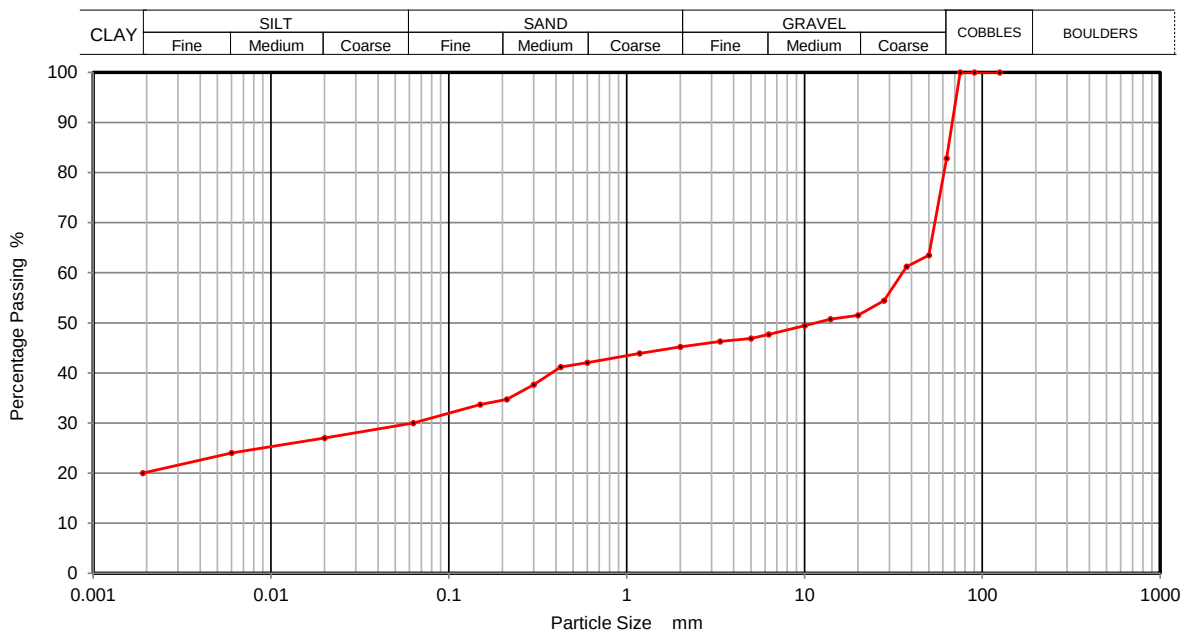
Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operator				
David Edwards				

PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Contract Number	59665
Borehole/Pit No.	TP03
Sample No.	
Depth Top	0.80
Depth Base	1.00
Sample Type	B

Site Name	Blaendulais
Soil Description	*See description sheet
Date Tested	14/06/2022



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	27
90	100	0.0060	24
75	100	0.0020	20
63	83		
50	63		
37.5	61		
28	54		
20	51		
14	51		
10	49		
6.3	48		
5	47		
3.35	46		
2	45		
1.18	44		
0.6	42		
0.425	41		
0.3	38		
0.212	35		
0.15	34		
0.063	30		

Sample Proportions	% dry mass
Cobbles	17
Gravel	38
Sand	15
Silt	10
Clay	20

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 59665

Borehole/Pit No. TP04

Site Name Blaendulais

Sample No.

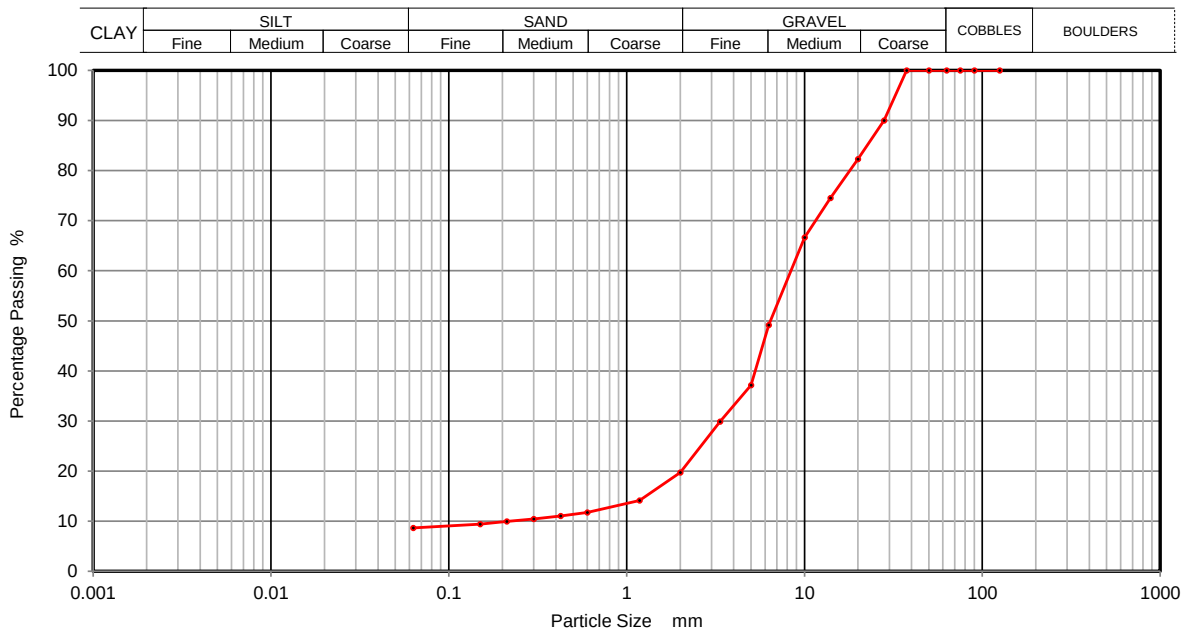
Soil Description *See description sheet

Depth Top 0.50

Depth Base 0.80

Date Tested 14/06/2022

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	90		
20	82		
14	75		
10	67		
6.3	49		
5	37		
3.35	30		
2	20		
1.18	14		
0.6	12		
0.425	11		
0.3	10		
0.212	10		
0.15	9		
0.063	9		

Sample Proportions	% dry mass
Cobbles	0
Gravel	80
Sand	11
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 59665

Borehole/Pit No. WS02

Site Name Blaendulais

Sample No.

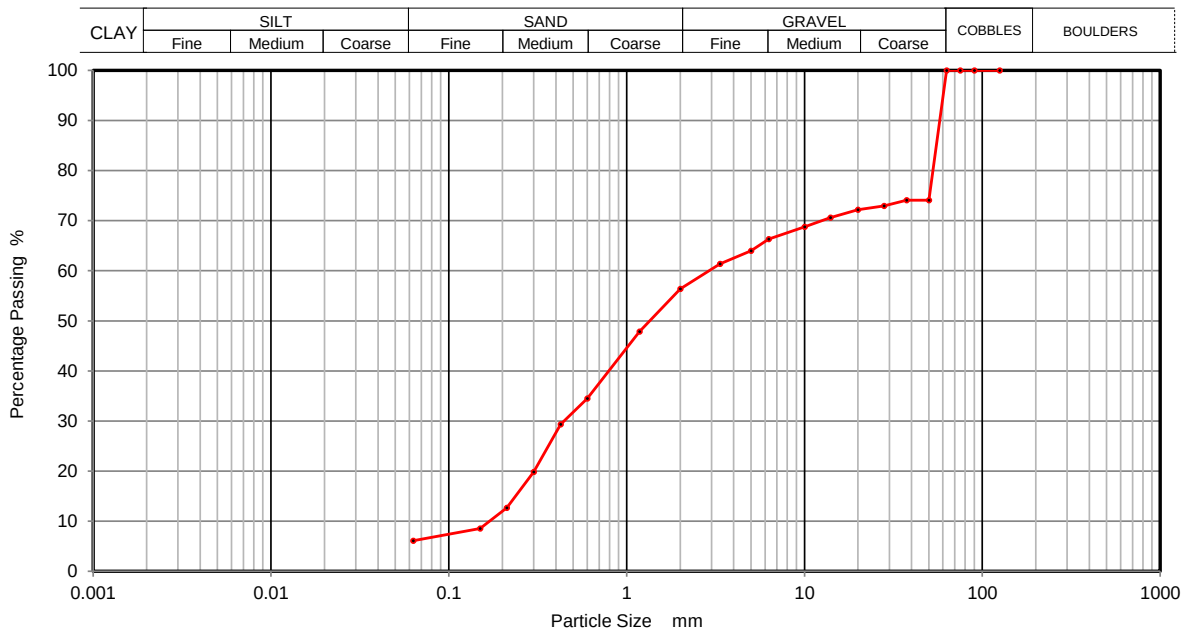
Soil Description *See description sheet

Depth Top 0.80

Depth Base

Date Tested 14/06/2022

Sample Type B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	74		
37.5	74		
28	73		
20	72		
14	71		
10	69		
6.3	66		
5	64		
3.35	61		
2	56		
1.18	48		
0.6	34		
0.425	29		
0.3	20		
0.212	13		
0.15	9		
0.063	6		

Sample Proportions	% dry mass
Cobbles	0
Gravel	44
Sand	50
Silt and Clay	6

Remarks

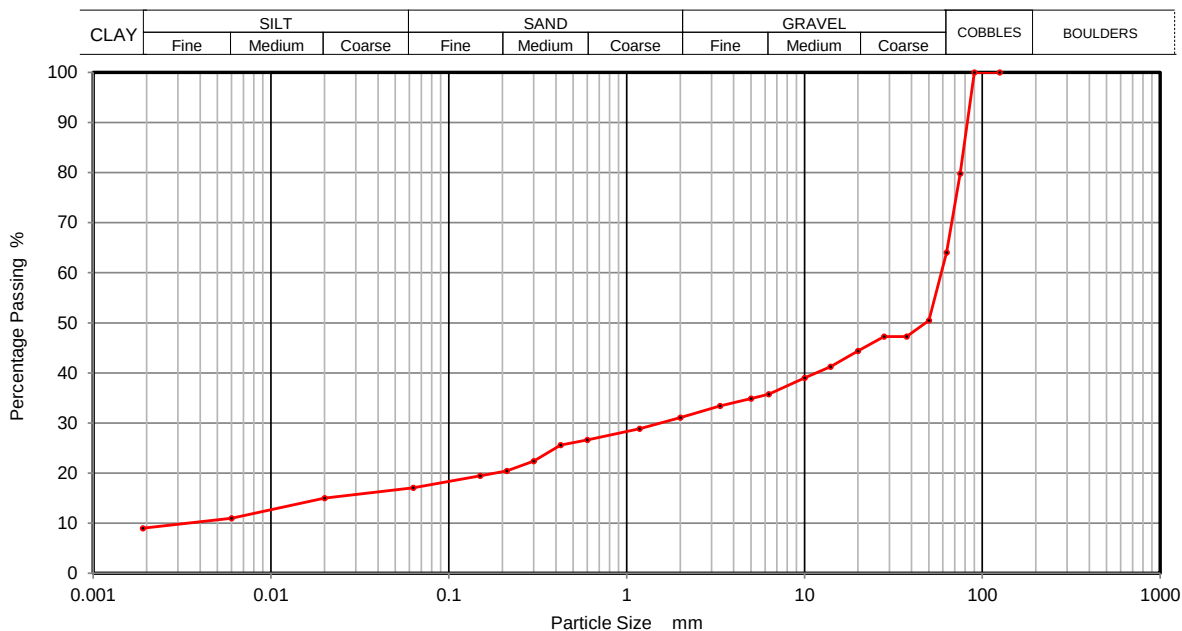
Preparation and testing in accordance with BS1377 unless noted below

Operator				
David Edwards				

PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Contract Number	59665
Borehole/Pit No.	WS07
Sample No.	
Depth Top	0.10
Depth Base	0.70
Sample Type	B

Site Name	Blaendulais
Soil Description	*See description sheet
Date Tested	14/06/2022



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	15
90	100	0.0060	11
75	80	0.0020	9
63	64		
50	50		
37.5	47		
28	47		
20	44		
14	41		
10	39		
6.3	36		
5	35		
3.35	33		
2	31		
1.18	29		
0.6	27		
0.425	26		
0.3	22		
0.212	20		
0.15	19		
0.063	17		

Sample Proportions	% dry mass
Cobbles	36
Gravel	33
Sand	14
Silt	8
Clay	9

Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operator				
David Edwards				



ANALYTICAL TEST REPORT

Contract no: 110034

Contract name: Blaendulais

Client reference: -

Clients name: Geo Site & Testing Services

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

Samples received: 06 June 2022

Analysis started: 06 June 2022

Analysis completed: 13 June 2022

Report issued: 13 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:

Megan Harris

Senior Reporting Administrator

Chemtech Environmental Limited

SOILS

Lab number			110034-1	110034-2	110034-3	110034-4	110034-5
Sample id			BH02	WS01A	WS06	WS07	WS12
Depth (m)			1.30-2.50	1.10-1.60	0.30-0.60	0.10-0.70	0.30-0.90
Date sampled			-	-	-	-	-
Test	Method	Units					
pH	CE004 ^U	units	6.9	7.4	8.6	7.3	7.3
Magnesium (2:1 water soluble)	CE061	mg/l Mg	1.7	<1	4.5	4.8	6.5
Chloride (2:1 water soluble)	CE049 ^U	mg/l Cl	2.5	2.4	12	1.7	1.4
Nitrate (2:1 water soluble)	CE049 ^U	mg/l NO ₃	<1	<1	<1	<1	1.2
Sulphate (2:1 water soluble)	CE061 ^U	mg/l SO ₄	18	<10	978	128	112
Sulphate (total)	CE062 ^U	mg/kg SO ₄	582	163	3999	530	369
Sulphate (total)	CE062 ^U	% w/w SO ₄	0.06	0.02	0.40	0.05	0.04
Sulphur (total)	CE119	mg/kg S	523	<100	2511	255	245
Sulphur (total)	CE119	% w/w S	0.05	<0.01	0.25	0.03	0.02

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)
110034-1	BH02	1.30-2.50	Y	All (NSD)
110034-2	WS01A	1.10-1.60	Y	All (NSD)
110034-3	WS06	0.30-0.60	Y	All (NSD)
110034-4	WS07	0.10-0.70	Y	All (NSD)
110034-5	WS12	0.30-0.90	Y	All (NSD)

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 OAD



Attention :	Nicholas Bool
Date :	31st May, 2022
Your reference :	784-B035256
Our reference :	Test Report 22/8081 Batch 1
Location :	Blaeudulais
Date samples received :	18th May, 2022
Status :	Final Report
Issue :	1

Five samples were received for analysis on 18th May, 2022 of which three 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: 784-B035256
Location: Blaeudulais
Contact: Nicholas Bool
EMT Job No: 22/8081

Report : Solid

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

EMT Sample No.	1-3	4-6	7-9								Please see attached notes for all abbreviations and acronyms		
Sample ID	TP01	TP02	TP03										
Depth	0.30	0.50	0.55										
COC No / misc													
Containers	V J T	V J T	J T										
Sample Date	16/05/2022	16/05/2022	16/05/2022										
Sample Type	Soil	Soil	Soil										
Batch Number	1	1	1										
Date of Receipt	18/05/2022	18/05/2022	18/05/2022								LOD/LOR	Units	Method No.
Arsenic #	35.7	43.4	16.9								<0.5	mg/kg	TM30/PM15
Beryllium	2.1	0.8	1.2								<0.5	mg/kg	TM30/PM15
Cadmium #	0.3	0.2	0.6								<0.1	mg/kg	TM30/PM15
Chromium #	35.5	39.9	29.1								<0.5	mg/kg	TM30/PM15
Copper #	87	62	292 ^{AA}								<1	mg/kg	TM30/PM15
Lead #	37	38	87								<5	mg/kg	TM30/PM15
Mercury #	<0.1	0.3	<0.1								<0.1	mg/kg	TM30/PM15
Nickel #	18.4	26.0	24.3								<0.7	mg/kg	TM30/PM15
Selenium #	<1	1	1								<1	mg/kg	TM30/PM15
Vanadium	21	17	24								<1	mg/kg	TM30/PM15
Water Soluble Boron #	0.8	0.3	0.4								<0.1	mg/kg	TM74/PM32
Zinc #	143	91	239								<5	mg/kg	TM30/PM15
PAH MS													
Naphthalene #	<0.04	0.04	0.07								<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	0.03	0.04								<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.05	<0.05	<0.05								<0.05	mg/kg	TM4/PM8
Fluorene #	<0.04	<0.04	<0.04								<0.04	mg/kg	TM4/PM8
Phenanthrene #	0.05	0.50	0.41								<0.03	mg/kg	TM4/PM8
Anthracene #	<0.04	0.14	0.09								<0.04	mg/kg	TM4/PM8
Fluoranthene #	0.13	0.95	0.79								<0.03	mg/kg	TM4/PM8
Pyrene #	0.10	0.68	0.58								<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	0.15	0.58	0.49								<0.06	mg/kg	TM4/PM8
Chrysene #	0.13	0.66	0.55								<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	0.21	1.12	0.98								<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	0.09	0.51	0.44								<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene #	0.07	0.41	0.36								<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	<0.04	0.10	0.09								<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	0.07	0.35	0.30								<0.04	mg/kg	TM4/PM8
PAH 16 Total	1.0	6.1	5.2								<0.6	mg/kg	TM4/PM8
Benzo(b)fluoranthene	0.15	0.81	0.71								<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	0.06	0.31	0.27								<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	90	89	92								<0	%	TM4/PM8

Element Materials Technology

Client Name: Tetra Tech
Reference: 784-B035256
Location: Blaeadulais
Contact: Nicholas Bool
EMT Job No: 22/8081

Report : Solid

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

EMT Sample No.	1-3	4-6	7-9								Please see attached notes for all abbreviations and acronyms		
Sample ID	TP01	TP02	TP03										
Depth	0.30	0.50	0.55										
COC No / misc													
Containers	V J T	V J T	J T										
Sample Date	16/05/2022	16/05/2022	16/05/2022										
Sample Type	Soil	Soil	Soil										
Batch Number	1	1	1										
Date of Receipt	18/05/2022	18/05/2022	18/05/2022								LOD/LOR	Units	Method No.
TPH CWG													
Aliphatics													
>C5-C6 (HS_1D_AL) #	<0.1 ^{SV}	<0.1	<0.1 ^{SV}								<0.1	mg/kg	TM36/PM12
>C6-C8 (HS_1D_AL) #	<0.1 ^{SV}	<0.1	<0.1 ^{SV}								<0.1	mg/kg	TM36/PM12
>C8-C10 (HS_1D_AL)	<0.1 ^{SV}	<0.1	<0.1 ^{SV}								<0.1	mg/kg	TM36/PM12
>C10-C12 (EH_CU_1D_AL) #	<0.2	<0.2	<0.2								<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 (EH_CU_1D_AL) #	<4	<4	<4								<4	mg/kg	TM5/PM8/PM16
>C16-C21 (EH_CU_1D_AL) #	<7	<7	<7								<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_CU_1D_AL) #	<7	<7	<7								<7	mg/kg	TM5/PM8/PM16
>C35-C44 (EH_1D_AL)	<7	<7	<7								<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-44 (EH+HS_1D_AL)	<26	<26	<26								<26	mg/kg	TM5/PM8/PM16
Aromatics													
>C5-EC7 (HS_1D_AR) #	<0.1 ^{SV}	<0.1	<0.1 ^{SV}								<0.1	mg/kg	TM36/PM12
>EC7-EC8 (HS_1D_AR) #	<0.1 ^{SV}	<0.1	<0.1 ^{SV}								<0.1	mg/kg	TM36/PM12
>EC8-EC10 (HS_1D_AR) #	<0.1 ^{SV}	<0.1	<0.1 ^{SV}								<0.1	mg/kg	TM36/PM12
>EC10-EC12 (EH_CU_1D_AR) #	<0.2	<0.2	<0.2								<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 (EH_CU_1D_AR) #	<4	<4	<4								<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 (EH_CU_1D_AR) #	<7	<7	25								<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_CU_1D_AR) #	145	<7	119								<7	mg/kg	TM5/PM8/PM16
>EC35-EC44 (EH_1D_AR)	29	<7	14								<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-44 (EH+HS_1D_AR)	174	<26	158								<26	mg/kg	TM5/PM8/PM16
Total aliphatics and aromatics(C5-44) (EH+HS_CU_1D_Total)	174	<52	158								<52	mg/kg	TM5/PM8/PM16
MTBE #	<5 ^{SV}	<5	<5 ^{SV}								<5	ug/kg	TM36/PM12
Benzene #	<5 ^{SV}	<5	<5 ^{SV}								<5	ug/kg	TM36/PM12
Toluene #	<5 ^{SV}	<5	<5 ^{SV}								<5	ug/kg	TM36/PM12
Ethylbenzene #	<5 ^{SV}	<5	<5 ^{SV}								<5	ug/kg	TM36/PM12
m/p-Xylene #	<5 ^{SV}	<5	<5 ^{SV}								<5	ug/kg	TM36/PM12
o-Xylene #	<5 ^{SV}	<5	<5 ^{SV}								<5	ug/kg	TM36/PM12
Total Phenols HPLC	0.37	0.15	<0.15								<0.15	mg/kg	TM26/PM21B
Hexavalent Chromium #	<0.3	<0.3	<0.3								<0.3	mg/kg	TM38/PM20
Sulphate as SO4 (2:1 Ext) #	0.0568	0.0048	0.0289								<0.0015	g/l	TM38/PM20
Chromium III	35.5	39.9	29.1								<0.5	mg/kg	NONE/NONE
Free Cyanide	<0.5	<0.5	<0.5								<0.5	mg/kg	TM89/PM45
Fraction Organic Carbon	0.019	0.017	0.242								<0.001	None	TM21/PM24
pH #	8.16	8.24	7.72								<0.01	pH units	TM73/PM11

Element Materials Technology

Client Name: Tetra Tech
Reference: 784-B035256
Location: Blaeudulais
Contact: Nicholas Bool
EMT Job No: 22/8081

Report : CEN 10:1 1 Batch

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

EMT Sample No.	4-6												
Sample ID	TP02												
Depth	0.50												
COC No / misc													
Containers	V J T												
Sample Date	16/05/2022												
Sample Type	Soil												
Batch Number	1												
Date of Receipt	18/05/2022												
											LOD/LOR	Units	Method No.
Please see attached notes for all abbreviations and acronyms													
TPH CWG													
Aliphatics													
>C5-C6	<10										<10	ug/l	TM36/PM69
>C6-C8	<10										<10	ug/l	TM36/PM69
>C8-C10	<10										<10	ug/l	TM36/PM69
>C10-C12	<5										<5	ug/l	TM5/PM16/PM30
>C12-C16	<10										<10	ug/l	TM5/PM16/PM30
>C16-C21	<10										<10	ug/l	TM5/PM16/PM30
>C21-C35	<10										<10	ug/l	TM5/PM16/PM30
Total aliphatics C5-35	<10										<10	ug/l	TM5/PM16/PM30/PM30
Aromatics													
>C5-EC7	<10										<10	ug/l	TM36/PM69
>EC7-EC8	<10										<10	ug/l	TM36/PM69
>EC8-EC10	<10										<10	ug/l	TM36/PM69
>EC10-EC12	<5										<5	ug/l	TM5/PM16/PM30
>EC12-EC16	<10										<10	ug/l	TM5/PM16/PM30
>EC16-EC21	<10										<10	ug/l	TM5/PM16/PM30
>EC21-EC35	<10										<10	ug/l	TM5/PM16/PM30
Total aromatics C5-35	<10										<10	ug/l	TM5/PM16/PM30/PM30
Total aliphatics and aromatics(C5-35)	<10										<10	ug/l	TM5/PM16/PM30/PM30/PM30
MTBE	<5										<5	ug/l	TM36/PM69
Benzene	<5										<5	ug/l	TM36/PM69
Toluene	<5										<5	ug/l	TM36/PM69
Ethylbenzene	<5										<5	ug/l	TM36/PM69
m/p-Xylene	<5										<5	ug/l	TM36/PM69
o-Xylene	<5										<5	ug/l	TM36/PM69
Total Phenols HPLC	<0.05										<0.05	mg/l	TM26/PM0
Sulphate as SO4 #	1.2										<0.5	mg/l	TM38/PM0
Chloride #	<0.3										<0.3	mg/l	TM38/PM0
Nitrate as NO3 #	0.5										<0.2	mg/l	TM38/PM0
Nitrite as NO2 #	<0.02										<0.02	mg/l	TM38/PM0
Ammoniacal Nitrogen as NH3 #	<0.03										<0.03	mg/l	TM38/PM0
Ammoniacal Nitrogen as NH4 #	<0.03										<0.03	mg/l	TM38/PM0
Total Cyanide #	<0.01										<0.01	mg/l	TM89/PM0
Dissolved Organic Carbon	<2										<2	mg/l	TM60/PM0
pH	7.15										<0.01	pH units	TM73/PM0
Total Alkalinity as CaCO3	62										<1	mg/l	TM75/PM0

Client Name: Tetra Tech
Reference: 784-B035256
Location: Blaeudulais
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
22/8081	1	TP01	0.30	3	Remigiusz Blichowski	26/05/2022	General Description (Bulk Analysis)	Light brown clay
					Remigiusz Blichowski	26/05/2022	Asbestos Fibres	NAD
					Remigiusz Blichowski	26/05/2022	Asbestos ACM	NAD
					Remigiusz Blichowski	26/05/2022	Asbestos Type	NAD
22/8081	1	TP02	0.50	6	Remigiusz Blichowski	26/05/2022	General Description (Bulk Analysis)	brown loose soil and stone
					Remigiusz Blichowski	26/05/2022	Asbestos Fibres	NAD
					Remigiusz Blichowski	26/05/2022	Asbestos ACM	NAD
					Remigiusz Blichowski	26/05/2022	Asbestos Type	NAD
22/8081	1	TP03	0.55	9	Remigiusz Blichowski	26/05/2022	General Description (Bulk Analysis)	Brown loose sand and stone
					Remigiusz Blichowski	26/05/2022	Asbestos Fibres	NAD
					Remigiusz Blichowski	26/05/2022	Asbestos ACM	NAD
					Remigiusz Blichowski	26/05/2022	Asbestos Type	NAD

Client Name: Tetra Tech
Reference: 784-B035256
Location: Blaeudulais
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.: 22/8081

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: 22/8081

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: 22/8081

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: 22/8081

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: 22/8081

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	

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



Attention : Nicholas Bool
Date : 10th June, 2022
Your reference : 784-B035256
Our reference : Test Report 22/8276 Batch 1
Location : Blaeadulais
Date samples received : 20th May, 2022
Status : Final Report
Issue : 1

Thirteen samples were received for analysis on 20th May, 2022 of which one was 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:



Phil Sommerton BSc

Senior Project Manager

Please include all sections of this report if it is reproduced

Element Materials Technology

Client Name: Tetra Tech
Reference: 784-B035256
Location: Blaeudulais
Contact: Nicholas Bool
EMT Job No: 22/8276

Report : CEN 10:1 1 Batch

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

[illegible]

Element Materials Technology

Client Name: Tetra Tech
Reference: 784-B035256
Location: Blaeudulais
Contact: Nicholas Bool
EMT Job No: 22/8276

Report : CEN 10:1 1 Batch

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

EMT Sample No.	31-33										Please see attached notes for all abbreviations and acronyms	
Sample ID	WS03											
Depth	0.70											
COC No / misc												
Containers	V J T											
Sample Date	18/05/2022											
Sample Type	Soil											
Batch Number	1											
Date of Receipt	20/05/2022									LOD/LOR	Units	Method No.
TPH CWG												
Aliphatics												
>C5-C6	<10									<10	ug/l	TM36/PM6
>C6-C8	<10									<10	ug/l	TM36/PM6
>C8-C10	<10									<10	ug/l	TM36/PM6
>C10-C12	<5									<5	ug/l	TM5/PM16/PM3
>C12-C16	<10									<10	ug/l	TM5/PM16/PM3
>C16-C21	<10									<10	ug/l	TM5/PM16/PM3
>C21-C35	<10									<10	ug/l	TM5/PM16/PM3
Total aliphatics C5-35	<10									<10	ug/l	TM5/TM36/PM16/PM3
Aromatics												
>C5-EC7	<10									<10	ug/l	TM36/PM6
>EC7-EC8	<10									<10	ug/l	TM36/PM6
>EC8-EC10	<10									<10	ug/l	TM36/PM6
>EC10-EC12	<5									<5	ug/l	TM5/PM16/PM3
>EC12-EC16	<10									<10	ug/l	TM5/PM16/PM3
>EC16-EC21	<10									<10	ug/l	TM5/PM16/PM3
>EC21-EC35	<10									<10	ug/l	TM5/PM16/PM3
Total aromatics C5-35	<10									<10	ug/l	TM5/TM36/PM16/PM3
Total aliphatics and aromatics(C5-35)	<10									<10	ug/l	TM5/TM36/PM16/PM3
MTBE	<5									<5	ug/l	TM36/PM6
Benzene	<5									<5	ug/l	TM36/PM6
Toluene	<5									<5	ug/l	TM36/PM6
Ethylbenzene	<5									<5	ug/l	TM36/PM6
m/p-Xylene	<5									<5	ug/l	TM36/PM6
o-Xylene	<5									<5	ug/l	TM36/PM6
Total Phenols HPLC	<0.05									<0.05	mg/l	TM26/PM6
Sulphate as SO4 #	4.3									<0.5	mg/l	TM38/PM6
Chloride #	1.9									<0.3	mg/l	TM38/PM6
Nitrate as NO3 #	1.5									<0.2	mg/l	TM38/PM6
Nitrite as NO2 #	<0.02									<0.02	mg/l	TM38/PM6
Ammoniacal Nitrogen as NH3 #	<0.03									<0.03	mg/l	TM38/PM6
Ammoniacal Nitrogen as NH4 #	0.03									<0.03	mg/l	TM38/PM6
Total Cyanide #	<0.01									<0.01	mg/l	TM89/PM6
Dissolved Organic Carbon	4									<2	mg/l	TM60/PM6
pH	8.38									<0.01	pH units	TM73/PM6
Total Alkalinity as CaCO3	90									<1	mg/l	TM75/PM6

Please see attached notes for all abbreviations and acronyms

Client Name: Tetra Tech
Reference: 784-B035256
Location: Blaeudulais
Contact: Nicholas Bool

Matrix : CEN 10:1 1 Batch

[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.: 22/8276

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

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: 22/8276

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
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/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
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			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 USEPA 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
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 GCFID 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
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
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

EMT Job No: 22/8276

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
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
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	

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



Attention : Nicholas Bool
Date : 7th June, 2022
Your reference : 784-B035256
Our reference : Test Report 22/8651 Batch 1
Location : Blaendlais
Date samples received : 26th May, 2022
Status : Final Report
Issue : 1

Six samples were received for analysis on 26th May, 2022 of which two 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:

A handwritten signature in black ink, appearing to read 'B. Leslie', written over a horizontal line.

Bruce Leslie
Project Manager

Please include all sections of this report if it is reproduced

Element Materials Technology

Client Name: Tetra Tech
Reference: 784-B035256
Location: Blaeudlais
Contact: Nicholas Bool
EMT Job No: 22/8651

Report : Solid

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

[illegible]

Element Materials Technology

Client Name: Tetra Tech
Reference: 784-B035256
Location: Blaeadlais
Contact: Nicholas Bool
EMT Job No: 22/8651

Report : Solid

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

EMT Sample No.	10-12	16-18									Please see attached notes for all abbreviations and acronyms		
Sample ID	WS08	WS04											
Depth	1.90	1.60											
COC No / misc													
Containers	V J T	V J T											
Sample Date	19/05/2022	19/05/2022											
Sample Type	Soil	Soil											
Batch Number	1	1											
Date of Receipt	26/05/2022	26/05/2022									LOD/LOR	Units	Method No.
TPH CWG													
Aliphatics													
>C5-C6 (HS_1D_AL) #	<0.1	<0.1									<0.1	mg/kg	TM36/PM12
>C6-C8 (HS_1D_AL) #	<0.1	<0.1									<0.1	mg/kg	TM36/PM12
>C8-C10 (HS_1D_AL)	<0.1	<0.1									<0.1	mg/kg	TM36/PM12
>C10-C12 (EH_CU_1D_AL) #	<0.2	<0.2									<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 (EH_CU_1D_AL) #	<4	<4									<4	mg/kg	TM5/PM8/PM16
>C16-C21 (EH_CU_1D_AL) #	<7	<7									<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_CU_1D_AL) #	<7	<7									<7	mg/kg	TM5/PM8/PM16
>C35-C44 (EH_1D_AL)	<7	<7									<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-44 (EH+HS_1D_AL)	<26	<26									<26	mg/kg	TM5/PM8/PM16
Aromatics													
>C5-EC7 (HS_1D_AR) #	<0.1	<0.1									<0.1	mg/kg	TM36/PM12
>EC7-EC8 (HS_1D_AR) #	<0.1	<0.1									<0.1	mg/kg	TM36/PM12
>EC8-EC10 (HS_1D_AR) #	<0.1	<0.1									<0.1	mg/kg	TM36/PM12
>EC10-EC12 (EH_CU_1D_AR) #	<0.2	<0.2									<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 (EH_CU_1D_AR) #	<4	<4									<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 (EH_CU_1D_AR) #	<7	<7									<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_CU_1D_AR) #	<7	<7									<7	mg/kg	TM5/PM8/PM16
>EC35-EC44 (EH_1D_AR)	<7	<7									<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-44 (EH+HS_1D_AR)	<26	<26									<26	mg/kg	TM5/PM8/PM16
Total aliphatics and aromatics(C5-44) (EH+HS_CU_1D_Total)	<52	<52									<52	mg/kg	TM5/PM8/PM16
MTBE #	<5	<5									<5	ug/kg	TM36/PM12
Benzene #	<5	<5									<5	ug/kg	TM36/PM12
Toluene #	<5	<5									<5	ug/kg	TM36/PM12
Ethylbenzene #	<5	<5									<5	ug/kg	TM36/PM12
m/p-Xylene #	<5	<5									<5	ug/kg	TM36/PM12
o-Xylene #	<5	<5									<5	ug/kg	TM36/PM12
Total Phenols HPLC	<0.15	<0.15									<0.15	mg/kg	TM26/PM21B
Natural Moisture Content	12.3	14.3									<0.1	%	PM4/PM0
Hexavalent Chromium #	<0.3	<0.3									<0.3	mg/kg	TM38/PM20
Sulphate as SO4 (2:1 Ext) #	0.0482	0.0626									<0.0015	g/l	TM38/PM20
Chromium III	33.4	42.7									<0.5	mg/kg	NONE/NONE
Free Cyanide	<0.5	<0.5									<0.5	mg/kg	TM89/PM45
Fraction Organic Carbon	0.009	0.015									<0.001	None	TM21/PM24
pH #	6.27	5.59									<0.01	pH units	TM73/PM11

Note:

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.

[illegible]

Client Name: Tetra Tech
Reference: 784-B035256
Location: Blaeudlais
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.: 22/8651

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EMT Job No: 22/8651

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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.	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
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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
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	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

EMT Job No: 22/8651

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
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 GCFID 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 GCFID 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
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
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		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.	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
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

APPENDIX G – GROUNDWATER AND GROUND GAS MONITORING DATA

Tetra Tech

LANDGAS AND GROUNDWATER MONITORING RESULTS



Site Name: Blaendulais
Job No.: B035256
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
BH02	0.0	0.9	0.0	0.9	14.1	84.9	nt	0	nt	0	10:00	
BH01	0.0	0.8	0.0	0.9	14.3	84.8	nt	0	nt	0	10:30	
WS08	0.0	0.6	0.0	0.6	14.3	85	nt	0	nt	0	10:45	

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)	
BH02	995	14.0	0.1	0.1	0.14	0.14	
BH01	995	14.0	0.1	0.1	0.13	0.13	
WS08	995	14.0	0.1	0.1	0.10	0.10	

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)	0.2	0.0	2 days prior (m bar)	1019
O ₂ (% vol)	21.1	21.1	1 day prior (m bar)	1018
PID (ppm)	nt	nt	during (m bar) am,midday,pm	1021, 1022, 1023
Atmos Press. (m bar)	1018	1018	1 day post (m bar)	1024

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)	
BH02	3.30	3.40	nd	nd	nt	nt	nt	nt	nt	nt	nt	nt	
BH01	3.40	6.00	nd	nd	nt	nt	nt	nt	nt	nt	nt	nt	
WS08	dry	1.00	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: Blaendulais
Job No.: B035256
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
BH02	0.1	0.2	0.1	0.2	20.8	78.9	nt	0	nt	0	11:30	
BH01	0.1	0.2	0.1	0.3	20.6	79.0	nt	0	nt	0	12:00	
WS08	0.1	0.5	0.1	0.5	20.4	79	nt	nt	nt	nt	13:00	

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)	
BH02	994	16.0	0.1	0.1	0.07	0.07	
BH01	994	16.0	0.1	0.1	0.09	0.09	
WS08	994	16.0	0.1	0.1	0.09	0.09	

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)	
BH02	3.30	3.40	nd	nd	nt	nt	nt	nt	nt	nt	nt	nt	
BH01	3.40	6.00	nd	nd	nt	nt	nt	nt	nt	nt	nt	nt	
WS08	dry	1.00	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: Blaendulais
Job No.: B035256
Client: Neath Port Talbot Council

Date Monitored:
Monitoring Engineer:
Weather:

15/06/22
 JM
 clear, 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
BH02	0.1	0.2	0.1	0.2	20.8	78.9	nt	0	nt	0	09:00	
BH01	0.1	0.4	0.1	0.4	16.9	82.9	nt	0	nt	0	09:30	
WS08	0.1	0.5	0.1	0.5	20.4	79	nt	0	nt	0	10:00	

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)	
BH02	998	16.0	0.1	0.1	-0.12	-0.05	
BH01	998	16.0	0.2	0.2	-0.17	-0.17	
WS08	998	16.0	0.2	0.2	0.12	0.12	

AMBIENT ATMOSPHERIC CONDITIONS				ATMOSPHERIC PRESSURE CONDITIONS			
Parameter	Before Monitoring	After Monitoring					
CH ₄ (% vol)	0.1	0.1	3 days prior (m bar)				1026
CO ₂ (% vol)	0.1	0.1	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)	998	998	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)	
BH02	DRY	3.40	nd	nd	nt	nt	nt	nt	nt	nt	nt	nt	
BH01	4.12	6.00	nd	nd	nt	nt	nt	nt	nt	nt	nt	nt	
WS08	DRY	1.00	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 – 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)



QAC9C-OHZNZ-AVD88

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

Job name

EMT-22-8081-Batch-1-202205311319

Description/Comments

Classification of samples collected from a Ground Investigation at Blaendulais. 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

784-B035256

Site

Blaendulais

Classified by

Name:
Katy Woodhouse
Date:
12 Jul 2022 10:40 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	TP01-16/05/2022-0.30m		Non Hazardous		2
2	TP02-16/05/2022-0.50m		Non Hazardous		5
3	TP03-16/05/2022-0.55m		Non Hazardous		7

Related documents

#	Name	Description
1	EMT-22-8081-Batch-1-202205311319.HWOL	Element .hwol file used to populate 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: 12 Jul 2022 10:40 GMT

Appendices	Page
Appendix A: Classifier defined and non GB MCL determinands	10
Appendix B: Rationale for selection of metal species	11
Appendix C: Version	12

Classification of sample: TP01-16/05/2022-0.30m

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

Sample details

Sample name: TP01-16/05/2022-0.30m	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)
--	---

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 }	033-003-00-0	215-481-4	1327-53-3	35.7	mg/kg	1.32	47.136	mg/kg	0.00471 %		
2	beryllium { beryllium oxide }	004-003-00-8	215-133-1	1304-56-9	2.1	mg/kg	2.775	5.828	mg/kg	0.000583 %		
3	boron { diboron trioxide; boric oxide }	005-008-00-8	215-125-8	1303-86-2	0.8	mg/kg	3.22	2.576	mg/kg	0.000258 %		
4	cadmium { cadmium oxide }	048-002-00-0	215-146-2	1306-19-0	0.3	mg/kg	1.142	0.343	mg/kg	0.0000343 %		
5	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }	215-160-9	1308-38-9		35.5	mg/kg	1.462	51.885	mg/kg	0.00519 %		
6	chromium in chromium(VI) compounds { chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex }	024-017-00-8			<0.3	mg/kg	2.27	<0.681	mg/kg	<0.0000681 %		<LOD
7	copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1	87	mg/kg	1.126	97.952	mg/kg	0.0098 %		
8	lead { lead chromate }	082-004-00-2	231-846-0	7758-97-6	37	mg/kg	1.56	57.713	mg/kg	0.0037 %		
9	mercury { mercury dichloride }	080-010-00-X	231-299-8	7487-94-7	<0.1	mg/kg	1.353	<0.135	mg/kg	<0.0000135 %		<LOD
10	nickel { nickel chromate }	028-035-00-7	238-766-5	14721-18-7	18.4	mg/kg	2.976	54.763	mg/kg	0.00548 %		
11	selenium { nickel selenate }	028-031-00-5	239-125-2	15060-62-5	<1	mg/kg	2.554	<2.554	mg/kg	<0.000255 %		<LOD
12	zinc { zinc chromate }	024-007-00-3	236-878-9	13530-65-9	143	mg/kg	2.774	396.703	mg/kg	0.0397 %		
13	TPH (C6 to C40) petroleum group		TPH		174	mg/kg		174	mg/kg	0.0174 %		
14	tert-butyl methyl ether; MTBE; 2-methoxy-2-methylpropane	603-181-00-X	216-653-1	1634-04-4	<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
15	benzene	601-020-00-8	200-753-7	71-43-2	<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
16	toluene	601-021-00-3	203-625-9	108-88-3	<0.005	mg/kg		<0.005	mg/kg	<0.0000005 %		<LOD

#	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		8.16 pH		8.16 pH	8.16 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		0.05 mg/kg		0.05 mg/kg	0.000005 %			
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		0.13 mg/kg		0.13 mg/kg	0.000013 %			
27	• pyrene 204-927-3		129-00-0		0.1 mg/kg		0.1 mg/kg	0.00001 %			
28	benzo[a]anthracene 601-033-00-9	200-280-6	56-55-3		0.15 mg/kg		0.15 mg/kg	0.000015 %			
29	chrysene 601-048-00-0	205-923-4	218-01-9		0.13 mg/kg		0.13 mg/kg	0.000013 %			
30	benzo[b]fluoranthene 601-034-00-4	205-911-9	205-99-2		0.15 mg/kg		0.15 mg/kg	0.000015 %			
31	benzo[k]fluoranthene 601-036-00-5	205-916-6	207-08-9		0.06 mg/kg		0.06 mg/kg	0.000006 %			
32	benzo[a]pyrene; benzo[def]chrysene 601-032-00-3	200-028-5	50-32-8		0.09 mg/kg		0.09 mg/kg	0.000009 %			
33	• indeno[123-cd]pyrene 205-893-2		193-39-5		0.07 mg/kg		0.07 mg/kg	0.000007 %			
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		0.07 mg/kg		0.07 mg/kg	0.000007 %			
36	• vanadium { divanadium pentaoxide; vanadium pentoxide } 023-001-00-8	215-239-8	1314-62-1		21 mg/kg	1.785	37.489 mg/kg	0.00375 %			
Total:									0.091 %		

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.: 0.0174%)

Classification of sample: TP02-16/05/2022-0.50m

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

Sample details

Sample name:	LoW Code:	
TP02-16/05/2022-0.50m	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 }				43.4	mg/kg	1.32	57.302	mg/kg	0.00573 %		
	033-003-00-0	215-481-4	1327-53-3									
2	beryllium { beryllium oxide }				0.8	mg/kg	2.775	2.22	mg/kg	0.000222 %		
	004-003-00-8	215-133-1	1304-56-9									
3	boron { diboron trioxide; boric oxide }				0.3	mg/kg	3.22	0.966	mg/kg	0.0000966 %		
	005-008-00-8	215-125-8	1303-86-2									
4	cadmium { cadmium oxide }				0.2	mg/kg	1.142	0.228	mg/kg	0.0000228 %		
	048-002-00-0	215-146-2	1306-19-0									
5	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }				39.9	mg/kg	1.462	58.316	mg/kg	0.00583 %		
		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 }				62	mg/kg	1.126	69.805	mg/kg	0.00698 %		
	029-002-00-X	215-270-7	1317-39-1									
8	lead { lead chromate }			1	38	mg/kg	1.56	59.273	mg/kg	0.0038 %		
	082-004-00-2	231-846-0	7758-97-6									
9	mercury { mercury dichloride }				0.3	mg/kg	1.353	0.406	mg/kg	0.0000406 %		
	080-010-00-X	231-299-8	7487-94-7									
10	nickel { nickel chromate }				26	mg/kg	2.976	77.383	mg/kg	0.00774 %		
	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 %		
	028-031-00-5	239-125-2	15060-62-5									
12	zinc { zinc chromate }				91	mg/kg	2.774	252.447	mg/kg	0.0252 %		
	024-007-00-3	236-878-9	13530-65-9									
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				<0.005 mg/kg		<0.005 mg/kg	<0.000005 %			<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				8.24 pH		8.24 pH	8.24 pH			
			PH								
20	naphthalene				0.04 mg/kg		0.04 mg/kg	0.000004 %			
	601-052-00-2	202-049-5	91-20-3								
21	acenaphthylene				0.03 mg/kg		0.03 mg/kg	0.000003 %			
		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				<0.04 mg/kg		<0.04 mg/kg	<0.000004 %			<LOD
		201-695-5	86-73-7								
24	phenanthrene				0.5 mg/kg		0.5 mg/kg	0.00005 %			
		201-581-5	85-01-8								
25	anthracene				0.14 mg/kg		0.14 mg/kg	0.000014 %			
		204-371-1	120-12-7								
26	fluoranthene				0.95 mg/kg		0.95 mg/kg	0.000095 %			
		205-912-4	206-44-0								
27	pyrene				0.68 mg/kg		0.68 mg/kg	0.000068 %			
		204-927-3	129-00-0								
28	benzo[a]anthracene				0.58 mg/kg		0.58 mg/kg	0.000058 %			
	601-033-00-9	200-280-6	56-55-3								
29	chrysene				0.66 mg/kg		0.66 mg/kg	0.000066 %			
	601-048-00-0	205-923-4	218-01-9								
30	benzo[b]fluoranthene				0.81 mg/kg		0.81 mg/kg	0.000081 %			
	601-034-00-4	205-911-9	205-99-2								
31	benzo[k]fluoranthene				0.31 mg/kg		0.31 mg/kg	0.000031 %			
	601-036-00-5	205-916-6	207-08-9								
32	benzo[a]pyrene; benzo[def]chrysene				0.51 mg/kg		0.51 mg/kg	0.000051 %			
	601-032-00-3	200-028-5	50-32-8								
33	indeno[123-cd]pyrene				0.41 mg/kg		0.41 mg/kg	0.000041 %			
		205-893-2	193-39-5								
34	dibenz[a,h]anthracene				0.1 mg/kg		0.1 mg/kg	0.00001 %			
	601-041-00-2	200-181-8	53-70-3								
35	benzo[ghi]perylene				0.35 mg/kg		0.35 mg/kg	0.000035 %			
		205-883-8	191-24-2								
36	vanadium { divanadium pentaoxide; vanadium pentoxide }				17 mg/kg	1.785	30.348 mg/kg	0.00303 %			
	023-001-00-8	215-239-8	1314-62-1								
Total:									0.0649 %		

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: TP03-16/05/2022-0.55m

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

Sample details

Sample name:	LoW Code:	
TP03-16/05/2022-0.55m	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 }				16.9	mg/kg	1.32	22.313	mg/kg	0.00223 %		
	033-003-00-0	215-481-4	1327-53-3									
2	beryllium { beryllium oxide }				1.2	mg/kg	2.775	3.33	mg/kg	0.000333 %		
	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 }				0.6	mg/kg	1.142	0.685	mg/kg	0.0000685 %		
	048-002-00-0	215-146-2	1306-19-0									
5	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }				29.1	mg/kg	1.462	42.531	mg/kg	0.00425 %		
		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 }				292	mg/kg	1.126	328.759	mg/kg	0.0329 %		
	029-002-00-X	215-270-7	1317-39-1									
8	lead { lead chromate }			1	87	mg/kg	1.56	135.704	mg/kg	0.0087 %		
	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 }				24.3	mg/kg	2.976	72.323	mg/kg	0.00723 %		
	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 %		
	028-031-00-5	239-125-2	15060-62-5									
12	zinc { zinc chromate }				239	mg/kg	2.774	663.021	mg/kg	0.0663 %		
	024-007-00-3	236-878-9	13530-65-9									
13	TPH (C6 to C40) petroleum group				158	mg/kg		158	mg/kg	0.0158 %		
			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		7.72 pH		7.72 pH	7.72 pH			
20	naphthalene 601-052-00-2	202-049-5	91-20-3		0.07 mg/kg		0.07 mg/kg	0.000007 %			
21	acenaphthylene 205-917-1	208-96-8			0.04 mg/kg		0.04 mg/kg	0.000004 %			
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			0.41 mg/kg		0.41 mg/kg	0.000041 %			
25	anthracene 204-371-1	120-12-7			0.09 mg/kg		0.09 mg/kg	0.000009 %			
26	fluoranthene 205-912-4	206-44-0			0.79 mg/kg		0.79 mg/kg	0.000079 %			
27	pyrene 204-927-3	129-00-0			0.58 mg/kg		0.58 mg/kg	0.000058 %			
28	benzo[a]anthracene 601-033-00-9	200-280-6	56-55-3		0.49 mg/kg		0.49 mg/kg	0.000049 %			
29	chrysene 601-048-00-0	205-923-4	218-01-9		0.55 mg/kg		0.55 mg/kg	0.000055 %			
30	benzo[b]fluoranthene 601-034-00-4	205-911-9	205-99-2		0.71 mg/kg		0.71 mg/kg	0.000071 %			
31	benzo[k]fluoranthene 601-036-00-5	205-916-6	207-08-9		0.27 mg/kg		0.27 mg/kg	0.000027 %			
32	benzo[a]pyrene; benzo[def]chrysene 601-032-00-3	200-028-5	50-32-8		0.44 mg/kg		0.44 mg/kg	0.000044 %			
33	indeno[123-cd]pyrene 205-893-2	193-39-5			0.36 mg/kg		0.36 mg/kg	0.000036 %			
34	dibenz[a,h]anthracene 601-041-00-2	200-181-8	53-70-3		0.09 mg/kg		0.09 mg/kg	0.000009 %			
35	benzo[ghi]perylene 205-883-8	191-24-2			0.3 mg/kg		0.3 mg/kg	0.00003 %			
36	vanadium { divanadium pentaoxide; vanadium pentoxide } 023-001-00-8	215-239-8	1314-62-1		24 mg/kg	1.785	42.844 mg/kg	0.00428 %			
Total:									0.143 %		

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.: 0.0158%)

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 chromate}

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

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: 2022.192.5237.9831 (11 Jul 2022)
HazWasteOnline Database: 2022.192.5237.9831 (11 Jul 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

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)



KLKP9-HPFWO-THJ27

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

Job name

EMT-22-8651-Batch-1-202206070928

Description/Comments

Classification of samples collected from a Ground Investigation at Blaendulais. 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

784-B035256

Site

Blaendulais

Classified by

Name:
Katy Woodhouse
Date:
12 Jul 2022 10:42 GMT
Telephone:

Company:
Tetra Tech (WYG (White Young Green))
5th Floor Longcross Court,
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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.

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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	WS08-19/05/2022-1.90m		Non Hazardous		2
2	WS04-19/05/2022-1.60m		Non Hazardous		4

Related documents

#	Name	Description
1	EMT-22-8651-Batch-1-202206070928.HWOL	Element .hwol file used to populate 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: 12 Jul 2022 10:42 GMT

Appendices	Page
Appendix A: Classifier defined and non GB MCL determinands	6
Appendix B: Rationale for selection of metal species	7
Appendix C: Version	8

Classification of sample: WS08-19/05/2022-1.90m

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

Sample details

Sample name:	LoW Code:
WS08-19/05/2022-1.90m	Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Moisture content:	Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)
12.3% (dry weight correction)	

Hazard properties

None identified

Determinands

Moisture content: 12.3% Dry Weight 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 }				5.6	mg/kg	1.32	6.584	mg/kg	0.000658 %	✓	
	033-003-00-0	215-481-4	1327-53-3									
2	beryllium { beryllium oxide }				2.4	mg/kg	2.775	5.931	mg/kg	0.000593 %	✓	
	004-003-00-8	215-133-1	1304-56-9									
3	boron { diboron trioxide; boric oxide }				0.2	mg/kg	3.22	0.573	mg/kg	0.0000573 %	✓	
	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) }				33.4	mg/kg	1.462	43.469	mg/kg	0.00435 %	✓	
		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 }				49	mg/kg	1.126	49.126	mg/kg	0.00491 %	✓	
	029-002-00-X	215-270-7	1317-39-1									
8	lead { lead chromate }			1	20	mg/kg	1.56	27.779	mg/kg	0.00178 %	✓	
	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 }				55.7	mg/kg	2.976	147.621	mg/kg	0.0148 %	✓	
	028-035-00-7	238-766-5	14721-18-7									
11	selenium { nickel selenate }				2	mg/kg	2.554	4.548	mg/kg	0.000455 %	✓	
	028-031-00-5	239-125-2	15060-62-5									
12	zinc { zinc chromate }				116	mg/kg	2.774	286.555	mg/kg	0.0287 %	✓	
	024-007-00-3	236-878-9	13530-65-9									
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		6.27 pH		6.27 pH	6.27 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		31 mg/kg	1.785	49.279 mg/kg	0.00493 %	✓		
Total:									0.0665 %		

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: WS04-19/05/2022-1.60m

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

Sample details

Sample name:	LoW Code:
WS04-19/05/2022-1.60m	Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Moisture content:	Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)
14.3% (dry weight correction)	

Hazard properties

None identified

Determinands

Moisture content: 14.3% Dry Weight 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 }				4.2	mg/kg	1.32	4.852	mg/kg	0.000485 %	✓	
	033-003-00-0	215-481-4	1327-53-3									
2	beryllium { beryllium oxide }				1.7	mg/kg	2.775	4.128	mg/kg	0.000413 %	✓	
	004-003-00-8	215-133-1	1304-56-9									
3	boron { diboron trioxide; boric oxide }				0.2	mg/kg	3.22	0.563	mg/kg	0.0000563 %	✓	
	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) }				42.7	mg/kg	1.462	54.601	mg/kg	0.00546 %	✓	
		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 }				26	mg/kg	1.126	25.611	mg/kg	0.00256 %	✓	
	029-002-00-X	215-270-7	1317-39-1									
8	lead { lead chromate }			1	20	mg/kg	1.56	27.293	mg/kg	0.00175 %	✓	
	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 }				24.6	mg/kg	2.976	64.056	mg/kg	0.00641 %	✓	
	028-035-00-7	238-766-5	14721-18-7									
11	selenium { nickel selenate }				2	mg/kg	2.554	4.469	mg/kg	0.000447 %	✓	
	028-031-00-5	239-125-2	15060-62-5									
12	zinc { zinc chromate }				72	mg/kg	2.774	174.749	mg/kg	0.0175 %	✓	
	024-007-00-3	236-878-9	13530-65-9									
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				5.59 pH		5.59 pH	5.59 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		24 mg/kg	1.785	37.484 mg/kg	0.00375 %	✓		
Total:									0.0442 %		

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

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) Worst 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 chromate}

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

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: 2022.192.5237.9831 (11 Jul 2022)
HazWasteOnline Database: 2022.192.5237.9831 (11 Jul 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

APPENDIX I – 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