

FORMER GAS WORKS, VICTORIA ROAD, PORT TALBOT

Ground Investigation Geoenvironmental Report

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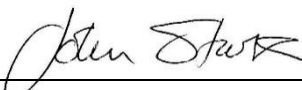
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Final Issue R1	31/01/20	P. Darby	J. Stark	R. McDermott
				
		Senior Engineering Geologist B.Sc.(Hons.),M.Sc., C.Geol., F.G.S.	Technical Manager B.Sc.(Hons.), C.Geol., FGS	Manager B.Sc.(Hons.),M.Sc., C.Geol., F.G.S.
<i>Disclaimer: Quantum Geotechnic Limited has prepared this report in accordance with the instructions of the above named Client for their sole and specific use. Any third parties who may use the information contained herein do so at their own risk.</i> Quantum Geotechnic Ltd, Plas Newydd, Swansea. SA4 0FQ T: 01554 744880 E: enquiries@quantumgeotech.co.uk				

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0.0 Foreword

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

0.1 General

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

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

0.2 Investigation Procedures

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

0.3 Routine Sampling

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

0.4 In-Situ Testing, Surveying & Instrumentation

Not applicable

0.5 Groundwater

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

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

0.6 Retention of Samples

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

1.0 Introduction

1.1 General

Upon the instructions of Samson Drilling (Client), Quantum Geotechnic Limited (QGL) has been commissioned to undertake a Ground Investigation to investigate potential geoenvironmental issues for a proposed commercial development at the Former Gas Works site, off Victoria Road, Port Talbot.

The proposed development is a storage building with associated car parking. The development will comprise the construction of hardstanding across the site.

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

1.2 Purpose of Ground Investigation

The purpose of the ground investigation is to allow a site-specific geo-environmental assessment of existing ground conditions, to aid with contaminant risk assessment for the proposed commercial development as recommended within the Phase 1 Preliminary Risk Assessment / Desk undertaken by QGL for the proposed development.

The investigation comprised a series of Trial Pits excavated across the site to assess the ground, permit in-situ testing and obtain soil and groundwater (where encountered) samples for geo-environmental lab analysis. Groundwater samples and landgas monitoring is undertaken on standpipes installed within boreholes drilled by the Client to allow risk assessment of risks posed from any generated landgas and information on prevailing groundwater levels.

2.0 Site Detail

2.1 Site Description

The area under review is located to the west of Port Talbot Town Centre, in the south eastern area of Aberavon.

The approximate National Grid Reference of the site is 275515, 189380 with a nearby postcode of SA12 6DB.

The site is relatively flat area with small vegetation and rough hardstanding. The site is approximately 400m² and rectangular in plan shape. To the northeast is wasteland whilst a combination of commercial, industrial and residential land uses are to the south east, south west and north west.

An aerial view of the site from current on-line mapping is presented below. The site has not been visited as part of this desk study assessment.



Figure 1: Site Ariel View

2.2 Published Geology

Details of the geology of the site is provided by the BGS's online resource Geology of Britain Viewer.

The superficial deposits are mapped as Blown Sand typically comprising wind blown deposits of Sand. Given the industrial history of the site, Made Ground may be present.

The geological mapping indicates the site to be underlain by strata from the Middle Coal Measures of the Carboniferous Period; typically, mudstones and sandstones with productive coal seams.

2.3 Previous Investigations

Phase 1 Assessment of Land Quality / Preliminary Risk Assessment (Ref: Q0151/DS), Nov 2019

The Phase 1 Assessment of Land Quality / Preliminary Risk Assessment (Desk Study) was undertaken by QGL in November 2019, report reference Q0151/DS.

Geo-environmental conclusions from the report are summarized as follows:

- Due to the historical industrial activity across the site and the anticipated presence of Made Ground, it is possible any near surface deposits could contain Heavy Metals, Total Petroleum Hydrocarbons, Polycyclic Aromatic Hydrocarbons and Asbestos.
- Off-site sources of contamination include Made Ground and historic and current land uses.
- Ground gas emissions from organic and potential Made Ground on site sources can be a risk to future site end users.
- Depending on the permeability of the ground on site, there is a possibility of leaching of contaminated soils into the groundwater which may also provide a migration pathway to nearby surface water bodies.
- The GroundSure® GeoInsight® report states that no radon protective measures are necessary.
- The superficial deposits on-site are Blown Sands classified as a 'Secondary A' aquifer meaning the strata contains 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.
- The South Wales Middle Coal Measures Formation is classified as a 'Secondary A' aquifer.
- The closest watercourse is 141m from the site.

The following evaluations and recommendations were made:

- In relation to any environmental/contaminated land issues, the desk study has identified the possibility, of near surface deposits being a potential source of land contamination that may pose a risk to future site users and controlled waters.
- For the purposes of development on site, it is recommended an intrusive ground investigation is undertaken, targeting potential sources of contamination and the depths at which they influence, and to identify suitable founding strata determine a suitable founding option. The potential for buried foundations, which would create a 'hard spot' and may cause significant magnitudes of differential settlement should be investigated.
- The investigation should include in-situ tests, soil sampling, and subsequent laboratory testing in order to gather the geo-environmental data required for environmental assessments to be made.
- The laboratory test results and in-situ test results should then be utilised in an Interpretative Report detailing the site findings and a preliminary assessment of human health risk and environmental risk. The findings of the intrusive investigation will be used to assess the requirement for any further intrusive ground investigation.

3.0 Fieldwork

3.1 General

The Ground Investigation was planned, with consideration given to the findings of the Preliminary Risk Assessment / Desk Study, and undertaken by QGL in January 2020. Site supervision and attendance by an Engineering Geologist from Quantum was provided on all aspects of the site works and subsequent reinstatement works of all exploratory hole locations.

No deviations from the Standards and Procedures adopted for the works were recorded.

Each area of investigation was fully CAT ('Cable Avoidance Tool') scanned prior to breaking ground.

A summary of the fieldworks is outlined below;

- 5 No. Machine Excavated Trial Pits
- Environmental Soil Sampling
- Logging of all samples retrieved

In addition 4 No. Cable Percussive Boreholes were drilled across the site by the client in 2019, which included the installation of a ground gas / groundwater monitoring standpipe. Drillers Logs and chemical laboratory test results are provided in Appendix III.

3.2 Exploratory Hole Locations

The exploratory hole locations were set out by a QGL Engineering Geologist.

Based on the conclusions of the QGL (2019) desk study, a combination of a targeted and non-targeted sampling strategy was designed in accordance with CLR4 and BS10175:2011+A2:2017. In total, sampling at 5 locations across the site have been undertaken (excluding those undertaken by the client in 2019).

An Exploratory Hole Location Plan is presented as Figure 1 in Appendix I.

3.3 Machine Excavated Trial Pits

5 No. Trial Pits were excavated using a JCB 3CX excavator. The positions are shown on the exploratory hole location plan in Appendix I.

This method of investigation allows direct sampling of the near surface deposits for identification purposes, as well as assessment of any salient features and Made Ground or disturbed ground. The trial pits were logged

in accordance with BS5930:2015; BS EN ISO 14688-1:2002 and BS EN ISO 14688-2:2004, and supervised at all times by an Engineering Geologist from QGL. All of the trial pits were backfilled with compacted layers of arisings upon completion of soakaway testing with suitable surface reinstatement where required.

A complete set of Engineering Geologist Trial Pit logs are presented within Appendix II.

Details of the Trial Pits including final depths in metres below ground level (mbgl) are provided below in Table 1.

Table 1: Trial Pit Detail

Exploratory Hole ID	Terminated Depth (mbgl)	Reason for Termination
TP1	2.2	Significant instability
TP2	2.5	Significant instability
TP3	1.8	Significant instability
TP4	3.2	Significant instability
TP5	1.8	Significant instability

3.4 Sampling - General

Environmental samples were taken where required within the superficial deposits for laboratory testing purposes. All samples are returned from site to Quantum's Laboratory for controlled storage within 24 hours of sampling to await test scheduling. Sample type and depths are all recorded on the Engineering Geologist's Exploratory Hole Logs found within the appropriate Appendix.

In addition, environmental samples were obtained by the Client from the boreholes drilled in 2019.

3.5 Landgas and Groundwater Monitoring

Of the four boreholes drilled by the client in October 2019, one was installed with a 50mm Ø HDPE combined landgas and groundwater monitoring standpipe to permit post-fieldwork monitoring visits. Table 2 details the installations undertaken.

Table 2: Borehole Installation Detail

Exploratory Hole ID	Installation Depth (mbgl)	Installation Response Zone (mbgl)
BH2	5.0	1.5-5.0

Each post-fieldwork monitoring visit included the measurement of the following parameters:

- O₂ (% v/v)
- CH₄ (% v/v)
- H₂S (ppm)
- CO (% v/v)
- Flow Rate (l/hr)
- Atmospheric Pressure (mb)
- Groundwater Level (mbgl/ mAOD)

1 No. post-fieldwork monitoring visit has been undertaken to date. The result of this visit is presented in Appendix V and discussed further in Section 6.7.

4.0 LABORATORY TESTING

4.1 General

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

4.2 Geoenvironmental Laboratory Testing

Geoenvironmental testing was carried out on selected soil and soil leachate samples gained from the ground investigation. The purpose of the testing is to gain a holistic view of any raised levels of contaminants that may exist onsite.

Table 3 details Geoenvironmental tests undertaken on selected soil samples with Table 3A listing tests undertaken on soil leachate samples.

Table 3: Geo-environmental tests undertaken on soil samples obtained by QGL

Analytical Parameter (Soil Analysis)	Accreditation Status	No of Tests	Analytical Parameter (Soil Analysis)	Accreditation Status	No of Tests
Asbestos in Soil	ISO 17025	5	Boron (water soluble)	MCERTS	5
General			Cadmium (aqua regia extractable)	MCERTS	5
pH - Automated	MCERTS	5	Chromium (aqua regia extractable)	MCERTS	5
Total Cyanide	MCERTS	5	Copper (aqua regia extractable)	MCERTS	5
Water Sol. Sulphate as SO ₄	MCERTS	5	Lead (aqua regia extractable)	MCERTS	5
Organic Matter	MCERTS	5	Mercury (aqua regia extractable)	MCERTS	5
			Nickel (aqua regia extractable)	MCERTS	5
			Selenium (aqua regia extractable)	MCERTS	5
Total Phenols			Vanadium (aqua regia extractable)	MCERTS	5
Total Phenols (monohydric)	MCERTS	5	Zinc (aqua regia extractable)	MCERTS	5
Speciated PAHs			Petroleum Hydrocarbons		
Naphthalene	MCERTS	5	TPH-CWG - Aliphatic >EC5 - EC6	MCERTS	5
Acenaphthylene	MCERTS	5	TPH-CWG - Aliphatic >EC6 - EC8	MCERTS	5
Acenaphthene	MCERTS	5	TPH-CWG - Aliphatic >EC8 - EC10	MCERTS	5
Fluorene	MCERTS	5	TPH-CWG - Aliphatic >EC10 - EC12	MCERTS	5
Phenanthrene	MCERTS	5	TPH-CWG - Aliphatic >EC12 - EC16	MCERTS	5
Anthracene	MCERTS	5	TPH-CWG - Aliphatic >EC16 - EC21	MCERTS	5
Fluoranthene	MCERTS	5	3TPH-CWG - Aliphatic >EC21 - C35	MCERTS	5
Pyrene	MCERTS	5	TPH-CWG - Aliphatic (EC5 - EC35)	MCERTS	5

Benzo(a)anthracene	MCERTS	5	TPH-CWG - Aromatic >EC5 - EC7	MCERTS	5
Chrysene	MCERTS	5	TPH-CWG - Aromatic >EC7 - EC8	MCERTS	5
Benzo(b)fluoranthene	MCERTS	5	TPH-CWG - Aromatic >EC8 - EC10	MCERTS	5
Benzo(k)fluoranthene	MCERTS	5	TPH-CWG - Aromatic >EC10 - EC12	MCERTS	5
Benzo(a)pyrene	MCERTS	5	TPH-CWG - Aromatic >EC12 - EC16	MCERTS	5
Indeno(1,2,3-cd)pyrene	MCERTS	5	TPH-CWG - Aromatic >EC16 - EC21	MCERTS	5
Dibenz(a,h)anthracene	MCERTS	5	TPH-CWG - Aromatic >EC21 - EC35	MCERTS	5
Benzo(ghi)perylene	MCERTS	5			
Total PAH					
Speciated Total EPA-16 PAHs	MCERTS	5			
Heavy Metals / Metalloids					
Arsenic (aqua regia extractable)	MCERTS	5			
Barium (aqua regia extractable)	MCERTS	5			
Beryllium (aqua regia extractable)	MCERTS	5			

Table 3A: Geo-environmental tests undertaken on soil leachate samples

Analytical Parameter (Soil Leachate Analysis)	Accreditation Status	No of Tests	Analytical Parameter (Soil Leachate Analysis)	Accreditation Status	No of Tests
			Boron (dissolved)	MCERTS	2
General			Cadmium (dissolved)	MCERTS	2
pH - Automated	MCERTS	2	Chromium (dissolved)	MCERTS	2
Total Cyanide	MCERTS	2	Copper (dissolved)	MCERTS	2
Sulphate as SO ₄	MCERTS	2	Lead (dissolved)	MCERTS	2
Hardness - Total	MCERTS	2	Mercury (dissolved)	MCERTS	2
			Nickel (dissolved)	MCERTS	2
			Selenium (dissolved)	MCERTS	2
Total Phenols			Vanadium (dissolved)	MCERTS	2
Total Phenols (monohydric)	MCERTS	2	Zinc (dissolved)	MCERTS	2
Speciated PAHs			Petroleum Hydrocarbons		
Naphthalene	MCERTS	2	TPH C6-C10	MCERTS	2
Acenaphthylene	MCERTS	2	TPH C10-C40	MCERTS	2
Acenaphthene	MCERTS	2			
Fluorene	MCERTS	2			
Phenanthrene	MCERTS	2			
Anthracene	MCERTS	2			
Fluoranthene	MCERTS	2			
Pyrene	MCERTS	2			
Benzo(a)anthracene	MCERTS	2			
Chrysene	MCERTS	2			
Benzo(b)fluoranthene	MCERTS	2			
Benzo(k)fluoranthene	MCERTS	2			
Benzo(a)pyrene	MCERTS	2			
Indeno(1,2,3-cd)pyrene	MCERTS	2			

Dibenz(a,h)anthracene	MCERTS	2			
Benzo(ghi)perylene	MCERTS	2			
Total PAH					
Speciated Total EPA-16 PAHs	MCERTS	2			
Heavy Metals / Metalloids					
Arsenic (dissolved)	MCERTS	2			
Barium (dissolved)	MCERTS	2			
Beryllium (dissolved)	MCERTS	2			

Analytical Parameter (Soil Leachate Analysis)	Accreditation Status	No of Tests	Analytical Parameter (Soil Leachate Analysis)	Accreditation Status	No of Tests
			Boron (dissolved)	MCERTS	1
General			Cadmium (dissolved)	MCERTS	1
pH - Automated	MCERTS	1	Chromium (dissolved)	MCERTS	1
Total Cyanide	MCERTS	1	Copper (dissolved)	MCERTS	1
Sulphate as SO ₄	MCERTS	1	Lead (dissolved)	MCERTS	1
Hardness - Total	MCERTS	1	Mercury (dissolved)	MCERTS	1
			Nickel (dissolved)	MCERTS	1
			Selenium (dissolved)	MCERTS	1
Total Phenols			Vanadium (dissolved)	MCERTS	1
Total Phenols (monohydric)	MCERTS	1	Zinc (dissolved)	MCERTS	1
Speciated PAHs			Petroleum Hydrocarbons		
Naphthalene	MCERTS	1	TPH-CWG - Aliphatic >EC5 - EC6	MCERTS	1
Acenaphthylene	MCERTS	1	TPH-CWG - Aliphatic >EC6 - EC8	MCERTS	1
Acenaphthene	MCERTS	1	TPH-CWG - Aliphatic >EC8 - EC10	MCERTS	1
Fluorene	MCERTS	1	TPH-CWG - Aliphatic >EC10 - EC12	MCERTS	1
Phenanthrene	MCERTS	1	TPH-CWG - Aliphatic >EC12 - EC16	MCERTS	1
Anthracene	MCERTS	1	TPH-CWG - Aliphatic >EC16 - EC21	MCERTS	1
Fluoranthene	MCERTS	1	TPH-CWG - Aliphatic >EC21 - EC35	MCERTS	1
Pyrene	MCERTS	1	TPH-CWG - Aliphatic (EC5 - EC35)	MCERTS	1
Benzo(a)anthracene	MCERTS	1	TPH-CWG - Aromatic >EC5 - EC7	MCERTS	1
Chrysene	MCERTS	1	TPH-CWG - Aromatic >EC7 - EC8	MCERTS	1
Benzo(b)fluoranthene	MCERTS	1	TPH-CWG - Aromatic >EC8 - EC10	MCERTS	1
Benzo(k)fluoranthene	MCERTS	1	TPH-CWG - Aromatic >EC10 - EC12	MCERTS	1
Benzo(a)pyrene	MCERTS	1	TPH-CWG - Aromatic >EC12 - EC16	MCERTS	1
Indeno(1,2,3-cd)pyrene	MCERTS	1	TPH-CWG - Aromatic >EC16 - EC21	MCERTS	1
Dibenz(a,h)anthracene	MCERTS	1	TPH-CWG - Aromatic >EC21 - EC35	MCERTS	1
Benzo(ghi)perylene	MCERTS	1			
Total PAH					
Speciated Total EPA-16 PAHs	MCERTS	1			
Heavy Metals / Metalloids					
Arsenic (dissolved)	MCERTS	1			

Barium (dissolved)	MCERTS	1
Beryllium (dissolved)	MCERTS	1

Table 10C: Geo-environmental tests undertaken on groundwater samples

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

In addition, Geo-Environmental laboratory testing was undertaken on samples of the Blown Sand collected by the Client when undertaking the drilling investigation in 2019 with the test results included within Appendix III.

5.0 Ground Conditions Encountered

5.1 General

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

5.2 Ground Conditions

5.2.1 Overview of Strata Encountered

The general sequence of the ground conditions encountered by QGL across the site comprised Made Ground overlying Blown Sand Deposits. Table 4 summarises the findings of the exploratory holes.

Table 4: Summary of Strata encountered in exploratory holes

General Strata Description	Depth of base of Strata mbgl				
	TP01	TP02	TP03	TP04	TP05
Tarmac	--	--	0.03	0.03	--
Made Ground	0.65	0.3	0.8	0.7	0.55
Blown Sands	2.2+	2.5+	1.8+	3.2+	1.8+

+ Depth of strata not proven

-- Strata not encountered

Tarmac

Exploratory holes undertaken in the central area of the site encountered Tarmac to depths of 0.03mbgl.

Made Ground

Made Ground deposits were encountered within each of the Trial Pits undertaken across the site to depths of between 0.3 and 0.8mbgl. The Made Ground Deposits were generally described as pale brown grey slightly silty sandy Gravel with low brick cobble content and gravel of sandstone, limestone, mudstone and brick. Plastic and iron bar inclusions were identified locally.

Blown Sand Deposits

Strata interpreted to be Blown Sand Deposits were encountered within each of the Trial Pits undertaken, immediately undying the Made Ground. The Blown Sand Deposits were proven to depths of between 1.8 and 3.2mbgl.

5.3 Groundwater Conditions

Groundwater was encountered within TP4 below 2.8mbgl.

Of the four boreholes drilled across the site by the client, three encountered seepage at depths of between 2.2 and 2.4mbgl. A water level of 2.06mbgl was measured within BH2 during post fieldwork monitoring.

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

5.4 Visual & Olfactory Evidence of Soil Contamination

Although a thin mantle of Made Ground was found across the site, no visual evidence of contamination was identified.

5.5 Visual & Olfactory Evidence of Groundwater & Surface Water Contamination

There was no evidence of any groundwater contamination or surface water contamination during the investigation works.

6.0 GEO-ENVIRONMENTAL CONSIDERATIONS

6.1 General

The following Section assesses the findings of the geo-environmental laboratory test results from samples obtained during the QGL ground investigation whilst consideration is also given to the results of testing undertaken on samples previously collected / tested by the client. The risks to human health and the environment are both considered herein. This Section sets out the preliminary Conceptual Site Model (CSM) for pollutant linkages and aims to review this CSM following assessment of the test result findings from the intrusive investigation.

The Pre-Investigation Conceptual Site Model is presented within Section 5.0 of the Phase 1 Desk Study Report produced by QGL (Ref Q0151/DS) in November 2019 and is summarised below:

The CSM has been developed for the proposed end use (commercial) and each factor has been assessed in terms of its relative position (on-site/off-site).

Sources

A number of potential sources of contamination both on-site and off-site were identified by the data review with consideration to the site and surrounding land's past, present and potential future uses. The most significant is the sites historic use as part of a Gas Works and any Made Ground associated with infilling of an historic river channel which crossed the site. Any Made Ground and near surface deposits have the potential to contain a number of contaminants such as heavy metals, petroleum hydrocarbons, polycyclic aromatic hydrocarbons and/or asbestos.

Also identified by the data review are numerous potentially contaminative historic and current industrial land uses in the surrounding area which may pose a risk to human health and controlled waters at the site.

Receptors

Considering the proposed site end use (commercial), a number of receptors have been identified at risk during and subsequent to the proposed development (on-site), and in the surrounding areas (off-site). These are summarised as follows:

On-site

- Future site users – construction workers (during development), commercial employees, customers, and visitors
- Controlled waters – groundwater, ('Secondary A') aquifer

Off-site

- Local site users – residents and visitors
- Nearby controlled waters – groundwater, River Afan
- Nearby buildings and services – primarily residential

- Possible services

Pathways

Completing the pollutant linkage between source and receptor are pathways – the way in which they are connected. The type of sources identified have a range of ways of contaminating the receptors, and typically fall into the following categories:

- Direct contact – including dermal contact and ingestion
- Dust or land-gas migration through air (above or below ground level) and subsequent inhalation
- Leaching of contaminants into groundwater and aqueous phase migration into areas of direct contact

Considering sources and receptors both on-site and off-site, pathways exist in three forms: on-site to on-site, on-site to off-site, and off-site to on-site.

Details of the pathways associated with each of the components are highlighted in the following set of tables:

Table 5: Existing Pollutant Linkages - Off site to on site

Potential Sources offsite	• MADE GROUND ASSOCIATED INFILLED GROUND • HISTORIC LAND USES – INC GAS WORKS, ELECTRICITY SUB-STATION, RAILWAY LINE, STEELWORKS / TINPLATE WORKS	
Potential Pathways off-site to on-site		Receptors onsite
• Migration of leachable mobile contaminants through groundwater • Windblown dust migration of contaminants • Migration of ground gas		Future Site Users including residents, visitors, staff and construction workers Groundwater: - Superficial Deposits: 'Secondary A' aquifer - Bedrock: 'Secondary A' aquifer

Table 6: Existing Pollutant Linkages - on site to off site

Potential Sources onsite	• MADE GROUND – INFILLED RIVER CHANNEL • HISTORIC LAND USES – GAS WORKS	
Potential Pathways on-site to off-site		Receptors off site
• Migration of leachable mobile contaminants through groundwater • Windblown dust migration of contaminants		Neighbouring site users Groundwater: - Surface water bodies - Superficial Deposits: 'Secondary A' aquifer - Bedrock: 'Secondary A' aquifer

Table 7: Existing Pollutant Linkages - on site to on site

Potential Sources onsite	- MADE GROUND – INFILLED RIVER CHANNEL - HISTORIC LAND USES – GAS WORKS
Potential Pathways on-site to on-site	Receptors onsite
- Dermal contact, ingestion of soil, water or dust - Inhalation of ground gases - Leaching of mobile contaminants	Future Site End Users including Workers, Construction Worker and Visitors. Buildings and infrastructure Groundwater: – Superficial Deposits: 'Secondary A' aquifer – Bedrock: 'Secondary A' aquifer

6.2 Human Health Risk Assessment

6.2.1 Legislative Background

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

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

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

Following publication of the 'Way Forward' document in late 2006, LQM/CIEH looked to review their GAC and add to them. By 2009 a 2nd Edition of 'The LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment' was published using updated methods and culminated in GAC for 82 substances.

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

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

6.2.2 Human Health Risk Assessment Criteria

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

By adopting the CLEA approach to human health risk assessment as defined in CLR11, a human health risk assessment has been undertaken for the proposed development adopting the most sensitive model of Commercial threshold values.

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

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

6.3 Soil Sample Test Results Comparisons

The results of chemical laboratory testing on selected soil samples obtained by QGL from the shallow lying soils are presented and discussed within this Section along with a summary of the testing undertaken on samples obtained and tested by the Client in 2019.

6.3.1 Heavy Metal and Inorganic Compounds

The results of levels of potential contaminants have been compared to generic assessment criteria as described above, for commercial end use. The test certificates are included in Appendix IV. The concentrations of heavy metal and inorganic compounds are summarised in the table below.

Table 8: Summary of Heavy Metals and Inorganic Soil Test Results

Determinant	QGL 2020 Results Range (mg/kg)	Client Samples 2019 Results Range (mg/kg)	LQM/CIEH (2015) GAC (mg/kg) Commercial End Use ⁽¹⁾	Exceedances
Arsenic (aqua regia extractable)	8.9-22	<1.0-9.6	640	0
Boron (water soluble)	0.2-0.8	<0.2	240,000	0
Cadmium (aqua regia extractable)	<0.2-1.1	<0.2	190	0
Chromium (aqua regia extractable)	13-230	5.5-11	8,600	0
Chromium (hexavalent)	<4.0	<4.0	6	0
Copper (aqua regia extractable)	130-91000	5.1-41	68,000	QGL 2020 TP5 0.5mbgl
Lead (aqua regia extractable)	54-580	4.2-18	2,300	0
Mercury (aqua regia extractable)	<0.3-2.9	<0.3	1,100	0
Nickel (aqua regia extractable)	6.5-27	4.1-7.7	980	0
Zinc (aqua regia extractable)	28-1100	15-34	730,000	0

Notes:

(1). GAC from LQM/CIEH S4ULs 2015. (2). GAC from LQM/CIEH 2009 & 2015. (3). GAC from DEFRA C4SL. (4). GAC from AtRisk adopting most sensitive end use for acute risk.

6.3.2 Polycyclic Aromatic Hydrocarbons

The results of levels of potential polycyclic aromatic hydrocarbon contaminants have been compared to generic assessment criteria as described, for a commercial end use for a Soil Organic Matter (SOM) content of 1% for a conservative approach. The test certificates are included in Appendix IV.

The concentrations of speciated Polycyclic Aromatic Hydrocarbon are summarised and compared in Table 9.

Table 9: Summary of Polycyclic Aromatic Hydrocarbon Soil Test Results

Determinant	QGL 2020 Results Range (mg/kg)	Client Samples 2019 Results Range (mg/kg)	LQM/CIEH (2015) GAC Commercial End Use (mg/kg)	
			1% SOM	Exceedances
Soil Organic Matter (SOM)	0.4-3.2			
Acenaphthene	<0.05-0.23	<0.05	84,000	0
Acenaphthylene	<0.05-0.62	<0.05	83,000	0
Anthracene	<0.05-1.1	<0.05-0.36	520,000	0
Benzo(a)anthracene	<0.05-7.7	<0.05-1.4	170	0
Benzo(a)pyrene	<0.05-8.5	<0.05-0.97	35	0
Benzo(b)fluoranthene	<0.05-9.4	<0.05-130	44	0
Benzo(ghi)perylene	<0.05-5.8	<0.05-0.53	3900	0
Benzo(k)fluoranthene	<0.05-5.7	<0.05-0.71	1200	0
Chrysene	<0.05-7.0	<0.05-1.1	350	0
Dibenz(a,h)anthracene	<0.05-1.6	<0.05	3.5	0
Fluoranthene	<0.05-9.1	<0.05-2.3	23,000	0
Fluorene	<0.05-0.3	<0.05	63,000	0
Indeno(1,2,3-cd)pyrene	<0.05-5.4	<0.05-0.4	500	0

Napthalene	<0.05-0.22	<0.05-0.81	190	0
Phenanthrene	<0.05-2.7	<0.05-1.4	22,000	0
Pyrene	<0.05-8.0	<0.05-1.7	54,000	0

Notes: (1). GAC from LQM/CIEH S4ULs 2015.

6.3.3 Total Petroleum Hydrocarbons

The results of levels of potential petroleum hydrocarbon contaminants have been compared to generic assessment criteria as described, for a commercial end use for a Soil Organic Matter (SOM) content of 1% for a conservative approach. The test certificates are included in Appendix IV. The concentrations of speciated Petroleum Hydrocarbons are summarised and compared in Table 10.

Table 10: Summary of Petroleum Hydrocarbon Soil Test Results

Determinand	QGL 2020 Results Range (mg/kg)	Client Samples 2019 Results Range (mg/kg)	LQM/CIEH (2015) GAC Commercial End Use (mg/kg)	
			1% SOM	Exceedances
TPH – Aliphatic EC5-6	<0.001	<0.001	3200	0
TPH – Aliphatic >EC6-8	<0.001	<0.001	7800	0
TPH – Aliphatic >EC8-10	<0.001	<0.001	2000	0
TPH – Aliphatic >EC10-12	<1.0-5.4	<1.0-5.8	9700	0
TPH – Aliphatic >EC12-16	<2.0-18	<2.0-26	59,000	0
TPH – Aliphatic >EC16-21	<8.0-35	<8.0-28		
TPH – Aliphatic >EC21-35	<8.0-230	<8.0-57		
TPH – Aliphatic >EC5-35	<10-230	<10-120		
TPH – Aromatic >EC5-7	<0.001	<0.001	26,000	0
TPH – Aromatic >EC7-8	<0.001	<0.001	56,000	0
TPH – Aromatic >EC8-10	<0.001	<0.001	3500	0
TPH – Aromatic >EC10-12	<1.0-4.4	<1.0-1.4	16,000	0
TPH – Aromatic >EC12-16	<2.0-13	<2.0-4.7	36,000	0
TPH – Aromatic >EC16-21	<10-98	<10-28	28,000	0
TPH – Aromatic >EC21-35	<10-670	<10-82	28,000	0

Notes: (1). GAC from LQM/CIEH S4ULs 2015. (2). GAC for C16 – C35 only quoted.

6.3.4 BTEX Compounds

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

6.3.5 Total Phenols

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

6.3.6 Asbestos

5 No. soil samples obtained from the QGL 2020 investigation were sent for routine Asbestos testing and identification. Asbestos fibres were detected in each of the samples of Made Ground tested (from TP1, TP2, TP3 and TP5). The Asbestos identified within the samples of Made Ground from TP1, TP2 and TP2 were Chrysotile and Amosite in the form of loose fibres. The Asbestos identified within the sample of Made Ground from TP5 was Amosite in the form of Sheeting / Board Debris.

Asbestos Quantification was undertaken on the samples of Blown Sand obtained by the Client (2019), with no fibres identified.

6.3.7 Volatile Organic Compounds (VOC's) and Semi Volatile Organic Compounds (SVOC's)

Sample obtained by the Client in 2019 were tested for volatile and semi volatile compounds with concentrations measured below the laboratory test detection limit.

6.4 Environmental Risk Assessment

The following section presents the findings of the soil leachate test results from testing undertaken on two samples obtained QGL and four samples obtained Client in 2019 and provides assessment in relation to risks to the environment, particularly controlled waters.

6.4.1 Soil Leachate Test Criteria

The risk to controlled waters, i.e. nearby watercourses and groundwater, is defined by the potential for any contaminants present on site to leach from the soils beneath the site. In total, six No. soil samples from the shallow underlying soils were subjected to leachate testing, two of which have been sampled by QGL. The result ranges are presented together with the threshold levels given by the United Kingdom Drinking Water Standards (UKDWS) as well as the relevant Environmental Quality Standards (EQS) guideline values.

6.4.2 Soil Leachate Test Results Comparisons

Table 11 presents the summarised findings of the soil leachate testing undertaken. The test certificates are included in Appendix IV.

Table 11: Summary of Soil Leachate Chemical Analysis

Determinant	Units	QGL 2020 Site Results Range (µg/l) Soil Leachate –	Cleint Samples 2019 Results Range (µg/l) Soil Leachate –	Environmental Quality Standards – Freshwater ¹	UK Drinking Water Standards ²	Exceedances
Arsenic	µg/l	9.2-33	5.8-12	50	10	0
Cadmium	µg/l	<0.08	<0.08	5	5	0
Chromium	µg/l	1.5-5.1	2.3-3.4	5 ³	50	0

Copper	µg/l	24-28	15.0	1 ³	2000	5 no QGL 2020 TP1 0.4mbgl QGL 2020 TP2 0.3mbgl Client 2019 BH1 0.5mbgl Client 2019 BH3 0.5mbgl Client 2019 BH4 0.5mbgl
Lead	µg/l	<1.0-1.7	4.0-7.9	4 ³	10	2 no Client 2019 BH3 0.5mbgl Client 2019 BH4 0.5mbgl
Mercury	µg/l	<0.5	<0.5	1	1	0
Nickel	µg/l	<0.3	0.6-1.5	50 ³	20	0
Zinc	µg/l	2.6-8.9	11-13	8 ³	5000	4 no QGL 2020 TP1 0.4mbgl Client 2019 BH1 0.5mbgl Client 2019 BH3 0.5mbgl Client 2019 BH4 0.5mbgl
Napthalene	µg/l	<0.01	<0.01	10	Not Available	0
Acenaphthylene	µg/l	<0.01	<0.01	Not Available	Not Available	0
Acenaphthene	µg/l	<0.01	<0.01	Not Available	Not Available	0
Fluorene	µg/l	<0.01	<0.01	Not Available	Not Available	0
Phenanthrene	µg/l	<0.01	<0.01	Not Available	Not Available	0
Anthracene	µg/l	<0.01	<0.01	Not Available	Not Available	0
Fluoranthene	µg/l	<0.01	<0.01	0.02	Not Available	0
Pyrene	µg/l	<0.01	<0.01	Not Available	Not Available	0
Benzo(a)anthracene	µg/l	<0.01	<0.01	Not Available	Not Available	0
Chrysene	µg/l	<0.01	<0.01	Not Available	Not Available	0
Benzo(b)fluoranthene	µg/l	<0.01	<0.01	Not Available	Not Available	0
Benzo(k)fluoranthene	µg/l	<0.01	<0.01	Not Available	Not Available	0
Benzo(a)pyrene	µg/l	<0.01	<0.01	0.03	0.001	0
Indeno(1,2,3-cd)pyrene	µg/l	<0.01	<0.01	Not Available	Not Available	0
Dibenz(a,h)anthracene	µg/l	<0.01	<0.01	Not Available	Not Available	0
Benzo(ghi)perylene	µg/l	<0.01	<0.01	Not Available	Not Available	0
TPH1 (C10-C40)	µg/l	<10	<10	Not Available	Not Available	0
TPH2 (C6-C10)	µg/l	<10	<10	Not Available	Not Available	0

¹Figures for Environmental Quality Standards (EQS) are Annual Average Concentrations derived from the Environment Agency ²UK Drinking Water Standards taken from; Water Supply (Water Quality) Regulations 1989 (SI 1989/1147) (as amended), and Water Supply (Water Quality) Regulations 2000 (SI 2000/3184) (as amended). ³Hardness Banding applied, lowest groundwater test result used i.e. **6.3mgCaCO₃/l** – using Table 2b: EGS for hardness related List 2 dangerous substances, EC Dangerous Substances Directive (76/464/EEC). NT – Not Tested. I/S – Insufficient Sample, NYS – Not Yet Specified

6.4.3 Groundwater Test Results Comparisons

Table 12 presents the summarised findings of the soil leachate testing undertaken. The test certificates are included in Appendix IV.

Table 12: Summary of Groundwater Chemical Analysis

Determinant	Units	Site Results Range (µg/l) Groundwater	Environmental Quality Standards – Freshwater ¹	UK Drinking Water Standards ²	Exceedances
Arsenic	µg/l	5.04	50	10	0
Cadmium	µg/l	0.02	5	5	0
Chromium	µg/l	2.0	50 ³	50	0
Copper	µg/l	7.5	10 ³	2000	0
Lead	µg/l	0.7	20 ³	10	0
Mercury	µg/l	<0.05	1	1	0
Nickel	µg/l	0.5	200 ³	20	0
Zinc	µg/l	1.6	75 ³	5000	0
Napthalene	µg/l	<0.01	10	Not Available	0
Acenaphthylene	µg/l	<0.01	Not Available	Not Available	0
Acenaphthene	µg/l	<0.01	Not Available	Not Available	0
Fluorene	µg/l	<0.01	Not Available	Not Available	0
Phenanthrene	µg/l	<0.01	Not Available	Not Available	0
Anthracene	µg/l	<0.01	Not Available	Not Available	0
Fluoranthene	µg/l	<0.01	0.02	Not Available	0
Pyrene	µg/l	<0.01	Not Available	Not Available	0
Benzo(a)anthracene	µg/l	<0.01	Not Available	Not Available	0
Chrysene	µg/l	<0.01	Not Available	Not Available	0
Benzo(b)fluoranthene	µg/l	<0.01	Not Available	Not Available	0
Benzo(k)fluoranthene	µg/l	<0.01	Not Available	Not Available	0
Benzo(a)pyrene	µg/l	<0.01	0.03	0.001	0
Indeno(1,2,3-cd)pyrene	µg/l	<0.01	Not Available	Not Available	0
Dibenz(a,h)anthracene	µg/l	<0.01	Not Available	Not Available	0
Benzo(ghi)perylene	µg/l	<0.01	Not Available	Not Available	0
TPH-CWG Aliphatic >C5-C6	µg/l	<1.0	Not Available	Not Available	0
TPH-CWG Aliphatic >C6-C8	µg/l	<1.0	Not Available	Not Available	0
TPH-CWG Aliphatic >C8-C10	µg/l	<1.0	Not Available	Not Available	0
TPH-CWG Aliphatic >C10-C12	µg/l	<1.0	Not Available	Not Available	0
TPH-CWG Aliphatic >C12-C16	µg/l	35	Not Available	Not Available	0
TPH-CWG Aliphatic >C16-C21	µg/l	53	Not Available	Not Available	0
TPH-CWG Aliphatic >C21-C35	µg/l	75	Not Available	Not Available	0
TPH-CWG Aromatic >C5-C7	µg/l	<1.0	Not Available	Not Available	0
TPH-CWG Aromatic >C7-C8	µg/l	<1.0	Not Available	Not Available	0
TPH-CWG Aromatic >C8-C10	µg/l	<1.0	Not Available	Not Available	0
TPH-CWG Aromatic >C10-C12	µg/l	<1.0	Not Available	Not Available	0
TPH-CWG Aromatic >C12-C16	µg/l	<1.0	Not Available	Not Available	0
TPH-CWG Aromatic >C16-C21	µg/l	<1.0	Not Available	Not Available	0
TPH-CWG Aromatic >C21-C35	µg/l	<1.0	Not Available	Not Available	0

¹Figures for Environmental Quality Standards (EQS) are Annual Average Concentrations derived from the Environment Agency ²UK Drinking Water Standards taken from: Water Supply (Water Quality) Regulations 1989 (SI 1989/1147) (as amended), and Water Supply (Water Quality) Regulations 2000 (SI 2000/3184) (as amended). ³Hardness Banding applied, lowest groundwater test result used i.e. **224mgCaCO₃/l** – using Table 2b: EGS for hardness related List 2 dangerous substances, EC Dangerous Substances Directive (76/464/EEC). NT – Not Tested. I/S – Insufficient Sample, NYS – Not Yet Specified

6.5 Recommendations on Contaminated Land

6.5.1 Human Health Risk of Site End Users

Copper was measured in a single sample of Made Ground (TP5 at 0.5mbgl) obtained by QGL above the relevant SGV. All other potential contaminants tested for within samples of Made Ground obtained QGL and samples of Blown Sand obtained by the Client (2019) were below the relevant SGV and GAC assessment criteria for commercial land use.

Based on the comparisons between the measured potential chemical contaminant concentrations and the relevant assessment criteria, the Copper measured with the Made Ground may pose a significant risk to future site users for commercial land use and should therefore be considered a potential contaminant source. Although potentially significantly elevated Copper concentrations were only measured in a single sample, given the small area of the site, this could be considered to be site wide.

Asbestos fibres were identified within four samples of Made Ground obtained by QGL from TP1, TP2, TP3 and TP5. Asbestos quantification has not been undertaken as part of this assessment and therefore it should be assumed Asbestos fibres are present within the Made Ground at concentrations that may pose a risk to human health.

It is anticipated the proposed development will involve the construction of impermeable surfacing across the entire site (including the Made Ground) which will act as a capping layer to remove the potential risk to future site users from the elevated Copper concentrations and Asbestos fibres within the Made Ground by removing the contamination pathway.

If impermeable surfacing is not be constructed as part of the proposed development, the potential contamination source (Made Ground) may be excavated and disposed of offsite or further assessment (site specific risk assessment, Asbestos Quantification testing) be undertaken to further assess the risk posed to future site users.

It is recommended the Local Authority Pollution Control Officer is contacted to discuss any proposed remedial action.

6.5.2 Human Health Risks during Construction

The geo-environmental laboratory testing showed raised potential contamination concentrations within the Made Ground deposits, therefore a risk to construction operatives from chemical contaminants from the shallow ground may exist. In addition, given four of the five samples of Made Ground tested were found to contain Asbestos fibres, there may be a risk to human health and as such, a risk to construction workers and neighboring site users will exists from air borne asbestos migration and subsequent inhalation.

Operatives working with, or likely to come into contact with made ground with the potential to harness raised concentrations of contaminants, should observe particular precautions concerning personal hygiene. They should be issued with the appropriate personal protective equipment and should be instructed in safe working methods. Any contractors undertaking any groundworks (excavations etc) within the Made Ground deposits on the site should employ suitable systems of work to minimise the risk of any Asbestos fibres becoming mobile / air borne.

It is recommended that the guidelines given in CIRIA Report C733 'asbestos in soil and made ground: a guide to understanding and managing risks' (2014) is consulted as regards risks to workers from ACM and to reduce the risk of mobilising any ACM that may be present.

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

6.5.3 Risk to the Environment and Controlled Waters

The risk to controlled waters, i.e. nearby water courses, is defined by the potential for any contaminants present on site to leach from the soils beneath the site, or to migrate from underground storage apparatus.

Potentially significantly elevated Copper and Zinc concentrations were measured within the soil leachate of the samples of Made Ground tested. Potentially significantly elevated Zinc, Copper and Lead concentration were measured within the soil leachate of samples of Blown Sand obtained by the Client (2019).

Groundwater was encountered within TP4 below 2.8mbgl. In addition, of the four boreholes were drilled across the site by the client, three encountered seepage at depths of between 2.2 and 2.4mbgl. A water level of 2.06mbgl was measured during post fieldwork monitoring.

Given the leachate derived from the samples of Blown Sand contained potentially significantly elevated concentrations of potential contaminants, which was found to contain groundwater, the potential for leachate generation exists.

Groundwater sampling and subsequent laboratory testing has been undertaken on samples obtained from the standpipe installed within BH2 drilled by the client. No potentially significantly elevated heavy metal contaminants were measured within the groundwater samples tested. Therefore, although the Made Ground present across the site contains potentially mobile heavy metals, the groundwater test results indicate these potential contaminants are not significantly adversely effecting groundwater quality below the site. In addition, it is believed the proposed development will comprise the construction impermeable hardstanding across the site which will further reduce the potential for leachate generation and therefore the risk from potentially mobile contaminants within the on-site soils is considered low.

Aliphatic Petroleum Hydrocarbons >C12-C16, <C16-C21 and >C21-C35 were measured within the groundwater sample however no relevant assessment criteria currently exists. In addition the Phase 1 Desk Study / PRA identified historic tanks to have potentially been present associated with the sites historic use as a Gas Works however, no potential hydrocarbon source was identified during the intrusive investigation (no visual evidence of hydrocarbon contamination and no potential hydrocarbon contamination within the near surface soils) and therefore, given the extensive historic and current heavy industrial land use in the surrounding area, it is anticipated the hydrocarbons identified within the groundwater below the site are derived from off-site potential contamination sources and as such, in terms of potential mobile hydrocarbon contamination, the site is not considered to pose a risk to controlled waters.

It is understood the proposed development design includes the use of Soakaways as a sustainable drainage solution. The use of soakaways will result in the concentration of water introduction into the soil which would increase the potential for leachate generation and is therefore not recommended.

6.7 Ground Gas Monitoring Results

At time of writing 1 No. post-fieldwork monitoring ground gas visits have been undertaken. Appendix V presents the monitoring records with the results discussed below.

The results show CH₄ concentrations of 0.0%v/v and CO₂ concentrations of 0.5%v/v. Maximum measured flow rate was recorded as 0.0l/hr whilst O₂ levels ranged between 21.0 and 21.2%v/v. No H₂S or Carbon Monoxide (CO) was recorded.

The potential risks posed by any recorded presence of potentially harmful gases can be assessed on a semi-quantitative basis by reference to the guidance in documents CIRIA 665 and BS8485. The assessment comprises multiplying the maximum measured steady gas flow rate (expressed as litres per hour) by the maximum steady gas concentration (expressed as percentage-by-volume; divided by 100) to derive a Gas Screening Value (GSV). The GSV can then be used to determine a risk classification and a Characteristic Situation for the site as defined in Table 12.

Table 12: Gas Screening Value and Characteristic Situation Classification

Characteristic Situation	Risk Classification	Gas Screening Value (l/hr) - GSV
1	Very low	<0.07
2	Low	>0.07, <0.7
3	Moderate	>0.7, <3.5
4	Moderate to High	>3.5, <15
5	High	>15, <70
6	Very High	>70

Based on the ground gas monitoring findings to date, no special precautions against ground gases are required.

6.8 Review of Conceptual Site Model (CSM)

The onsite investigation and subsequent laboratory testing has identified potentially significantly Heavy Metal concentrations within the Made Ground, above the prescribed Soil Guideline Values for commercial end use. The investigation also identified Asbestos fibres within the Made Ground.

The investigation identified the potential for leachate generation containing significantly elevated Heavy Metal concentrations that may pose a risk to controlled waters.

Based on the Ground Investigation findings the Conceptual Site Model can be revised, as presented in Table 13.

Table 13: Existing Pollutant Linkages – on-site to on-site

Potential Sources on-site	- ELEVATED HEAVY METALS WITHIN MADE GROUND DEPOSITS - ASBESTOS FIBRES WITHIN MADE GROUND DEPOSITS	
Potential Pathways off-site to on-site		Receptors on-site
- Dermal Contact - Ingestion - Inhalation		Construction Workers

The use of remedial measures as recommended within Section 6.6 will allow source-pathway-receptor (S-P-R) linkage to re-visted and the risk to future site users revised.

No risk to future site users is believed to exist given the proposed development is to comprise an impermeable surface; the contamination pathway between the source and future site users will be removed.

The risk / significance posed by mobile contaminants on the site is considered low to negligible given the findings of the investigation, the current and historic industrial nature of the area and the proposed construction of hardstanding across the site.

7.0 REFERENCES

British Geological Survey:

- British Geological Survey (BGS) Sheet SS-78-NE at 1:10,000 scale
- Geological Plan SS69NE, 1970, 1:10,560 Scale
- BGS Lexicon of Named Rock Units (www.bgs.ac.uk/lexicon)
- BGS Geology of Britain Viewer (www.bgs.ac.uk)

Previous Reports:

- Quantum Geotechnic Limited (2019) Former Gasworks, Land off Victoria Road, Port Talbot Preliminary Risk Assessment / Desk Study (Q0151/DS)

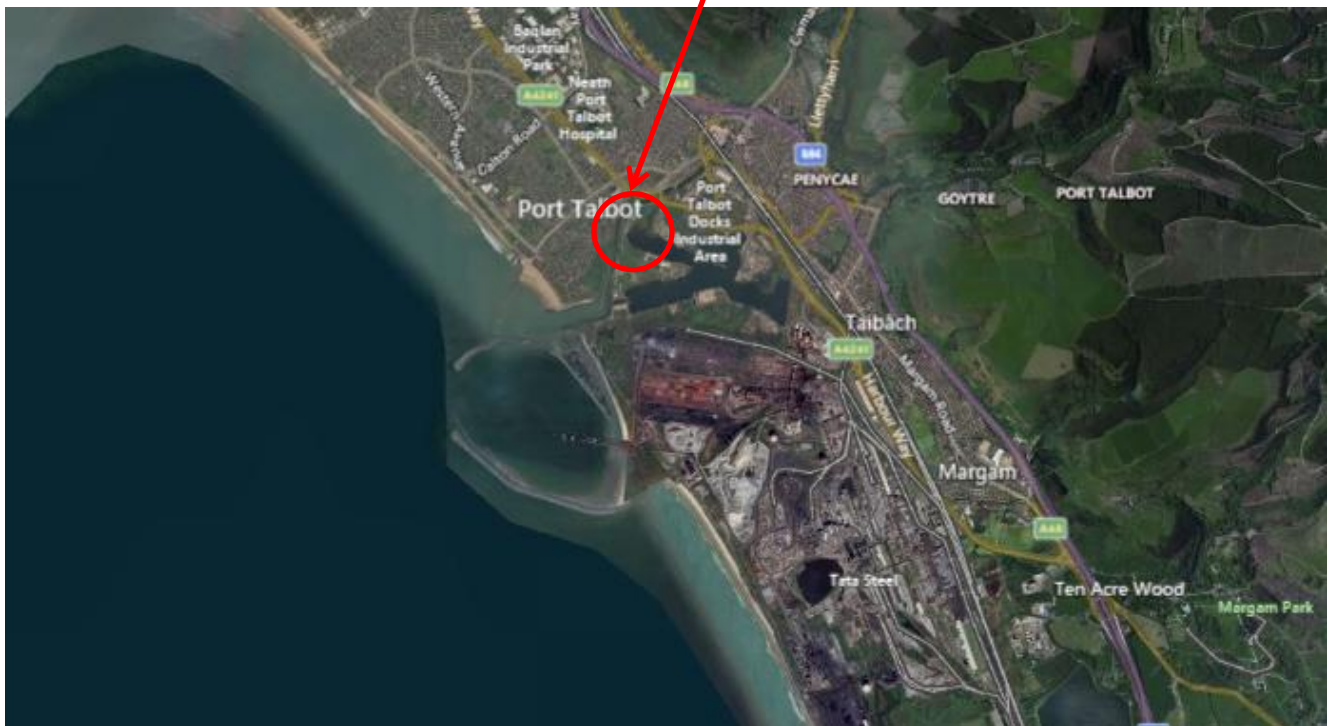
Specialist Publications:-

- British Code of Practice BS 5930:2015 '*Code of Practice for Site Investigations*'
- British Code of Practice BS 1377:1990 '*Methods of test for soils for civil engineering purposes*'.
- British Code of Practice BS 10175:2011 '*Code of Practice for Investigation of Potentially Contaminated Sites*'
- British Code of Practice BS EN ISO 14688-1:2002+A2:2013 Geotechnical investigation and testing. Identification and classification of soil. Identification and description
- British Code of Practice BS EN ISO 14688-2:2004+A2:2013 Geotechnical investigation and testing. Identification and classification of soil. Principles for a classification.
- British Code of Practice BS EN ISO 14689-1:2003 Ground Investigation and Testing – Identification and classification of rock
- Health and Safety Executive Guidance Note EH40/90
- CIRIA Report 143 'The Standard Penetration Test (SPT): Methods and Use', 1995.
- BRE (2005) Special Digest 1:2005, 3rd Edition, Concrete in aggressive ground. BRE, Garston.
- BRE (1994) Performance of building materials in contaminated land. BRE, Garston.
- BS 6031: 2009 Code of Practice for Earthworks.
- ICE UK Specification for Ground Investigation Second Edition.
- Specification for Highways Works Series 600 Earthworks
- Environment Agency Science Report SC050021/[various] (2009) *Soil Guideline Values*
- LQM/CIEH Publication S4UL3409 (2015) '*Generic Assessment Criteria for Human Health Risk Assessment*'
- World Health Organisation (2011) '*Guidelines for drinking-water quality, 4th edition*'
- Statutory Instruments (UK Legislation) 2016 No. 614 '*The Water Supply (Water Quality) Regulations*' retrieved from www.legislation.gov.uk/2016/614
- Statutory Instruments (UK Legislation) 2015 No. 1623 '*The Water Framework Directive (Standards and Classification) Directions (England and Wales)*'

APPENDIX I – SITE PLANS & FIGURES



The Site



Mapping sourced from www.bing.com



FIGURE 1

Project: Former Gas Works Off Victoria Road

Job No: Q

Drawing Title: Site Location Plan

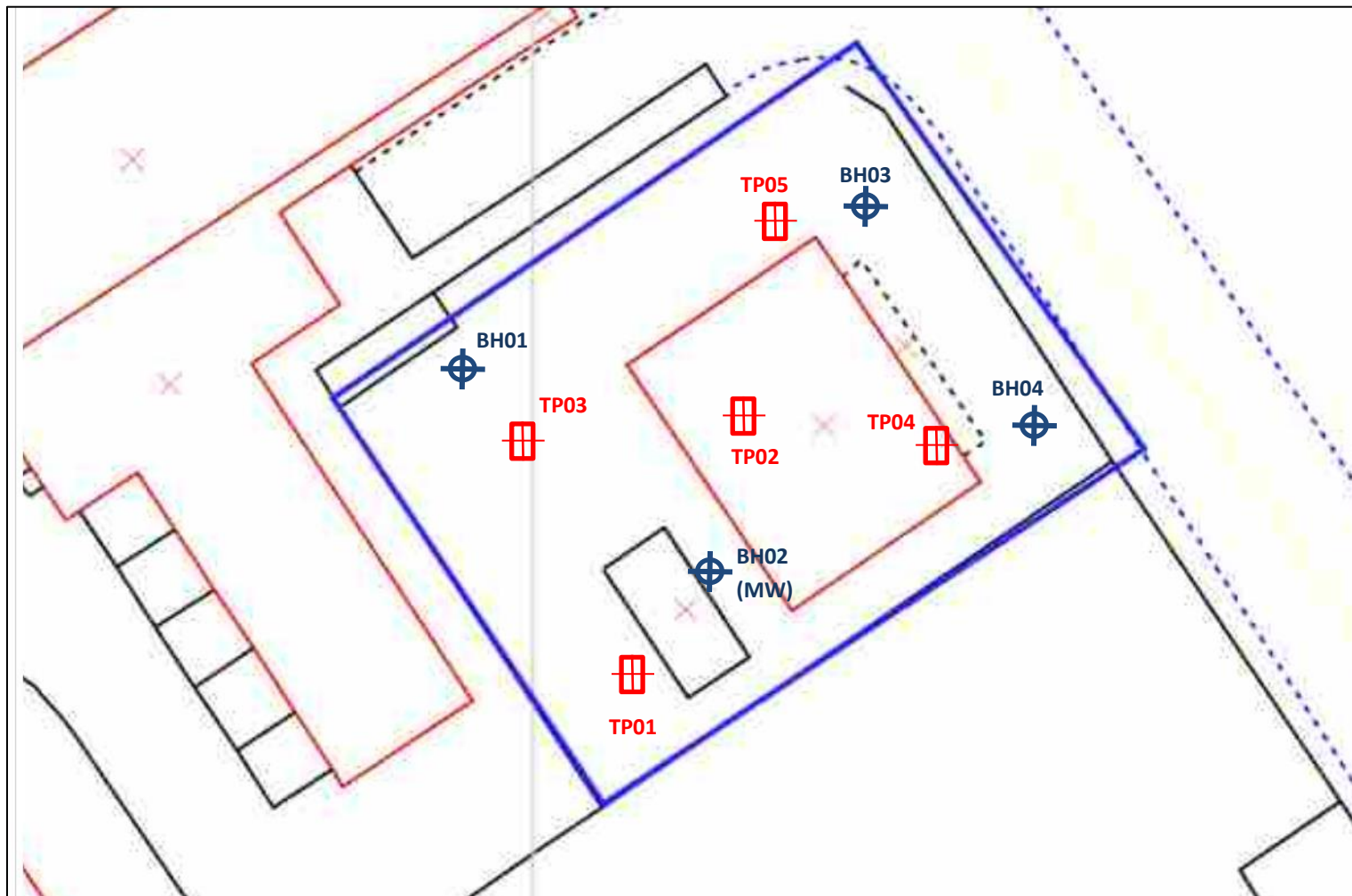


FIGURE 2

**Project: Former Gasworks Site
Off Victoria Road, Port Talbot**

Job No: Q0164

**Drawing Title: Exploratory Hole
Location Plan**



Client's Borehole Locations



QGL Trial Pit Locations



Plas Newydd Farm, Swansea
Tel: 01554 744880
Fax: 01554 776150
Email: enquiries@quantumgeotech.co.uk

APPENDIX II – TRIAL PIT ENGINEERS LOGS

Contract : Victoria Road Client : Samson drilling							Trial Pit No. TP1	
Dates : 7/1/19 - 7/1/19 Location :				Job Number : Q0151 Engineer : Quantum Geotechnic		Ground Level : Coordinates:		

m B.G.L.	Samples		Tests		Strata			WATER
	Depth	Type No.	Depth	Test Results	Depth (Thickness)	Description	Legend	
1	0.40 -	ES1			0.65	MADE GROUND: Pale brown grey slightly silty sandy Gravel with low cobble content of brick. Gravel is angular to sub angular sandstone, limestone, mudstone, brick and concrete.		(0.65)
	1.00 -	ES2			0.65	Orange yellow slightly silty SAND. Sand is fine to medium.		0.65
2	2.00 -	ES3			1.55	...becoming slightly gravelly from 1.9mbgl		(1.55)
					2.20	Trial Pit terminated at 2.2mbgl sides collapsing.		2.20

PLAN 	Groundwater: No groundwater encountered Stability: Sides collapsing - pit belling out Shoring: None	Remarks : Hole positioned in liaison with the client, CAT and Genny scanned prior to excavation. On completion trial pit backfilled with arisings compacted in reverse order to excavation.
-----------------	---	---

Equipment Used: JCB 3CX

	Ty Berwig, Bynea, Llanelli SA14 9ST Tel: 01554 744880 Fax: email: enquiries@quantumgeotech.co.uk	Operator: Jeff	Logged By: A Jones	Sheet No. 1 Of 2	m Per Page 5	All measurements in metres unless otherwise stated	
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Contract : Victoria Road

Client : Samson drilling

**Trial Pit No.
TP1**

Dates : 7/1/19 - 7/1/19

Job Number : Q0151

Ground Level :

Location :

Engineer : Quantum Geotechnic

Coordinates:



Ty Berwig, Bynea, Llanelli
SA14 9ST
Tel: 01554 744880
Fax:
email: enquiries@quantumgeotech.co.uk

Operator:
Jeff

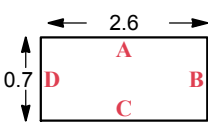
Logged By:
A Jones

Sheet No.
2 Of 2

m Per
Page

All measurements in
metres unless
otherwise stated



Contract : Victoria Road Client : Samson drilling							Trial Pit No. TP2				
Dates : 7/1/19 - 7/1/19 Location : Centre of site				Job Number : Q0151 Engineer : Quantum Geotechnic		Ground Level : Coordinates:					
m B.G.L.	Samples		Tests		Strata				WATER		
	Depth	Type No.	Depth	Test Results	Depth (Thickness)	Description	Legend	Depth (Thickness)			
1	0.20 -	ES1			0.30	MADE GROUND: Pale brown grey slightly silty sandy Gravel with low cobble content of brick. Gravel is angular to sub angular sandstone, limestone, mudstone, brick and concrete.		(0.30)			
	0.50 -	ES2			0.30	Orange yellow slightly silty SAND. Sand is fine to medium.		0.30			
	1.20 -	ES3			2.20	...becoming slightly gravelly from 2.4mbgl		(2.20)			
					2.50	Trial Pit terminated at 2.5mbgl sides collapsing.		2.50			
PLAN 			Groundwater: No groundwater encountered Stability: Sides collapsing - pit belling out Shoring: None			Remarks : Hole positioned in liaison with the client, CAT and Genny scanned prior to excavation. On completion trial pit backfilled with arisings compacted in reverse order to excavation.					
Equipment Used: JCB 3CX											
 Ty Berwig, Bynea, Llanelli SA14 9ST Tel: 01554 744880 Fax: email: enquiries@quantumgeotech.co.uk				Operator: Jeff		Logged By: A Jones		Sheet No. 1 Of 2	m Per Page 5	All measurements in metres unless otherwise stated	

Contract : Victoria Road Client : Samson drilling		Trial Pit No. TP2
Dates : 7/1/19 - 7/1/19 Location : Centre of site	Job Number : Q0151 Engineer : Quantum Geotechnic	Ground Level : Coordinates:



Contract : Victoria Road Client : Samson drilling							Trial Pit No. TP3	
Dates : 7/1/19 - 7/1/19 Location :			Job Number : Q0151 Engineer : Quantum Geotechnic			Ground Level : Coordinates:		

m B.G.L.	Samples		Tests		Strata				WATER	
	Depth	Type No.	Depth	Test Results	Depth (Thickness)	Description	Legend	Depth (Thickness)		
1	0.10 -	ES1			0.03	TARMAC		(0.03)		
					0.03	MADE GROUND: Black slightly silty slightly sandy Gravel. Gravel is angular to sub angular fine to medium sandstone and limestone, and medium to coarse tarmac.		0.03		
					0.12				(0.12)	
					0.15				0.15	
					0.65	MADE GROUND: Brown slightly clayey slightly silty sandy Gravel with low cobble content of brick and sandstone. Gravel is angular to sub angular fine to coarse sandstone, mudstone, brick, concrete and tar.			(0.65)	
	0.50 -	ES2			0.80	Orange yellow slightly silty slightly gravelly SAND. Sand is fine to medium.		0.80		
					1.00			(1.00)		
	1.50 -	ES3			1.80	Trial Pit terminated at 1.8mbgl, sides collapsing.		1.80		

PLAN 	Groundwater: No groundwater encountered Stability: Sides collapsing - pit belling out Shoring: None	Remarks : Hole positioned in liaison with the client, CAT and Genny scanned prior to excavation. On completion trial pit backfilled with arisings compacted in reverse order to excavation. 150mm cast pipe at 0.55mbgl - pit moved forward.
-----------------	---	---

Equipment Used: JCB 3CX

	Ty Berwig, Bynea, Llanelli SA14 9ST Tel: 01554 744880 Fax: email: enquiries@quantumgeotech.co.uk	Operator: Jeff	Logged By: A Jones	Sheet No. 1 Of 2	m Per Page 5	All measurements in metres unless otherwise stated	
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Contract : Victoria Road

Client : Samson drilling

Trial Pit No.

TP3

Dates : 7/1/19 - 7/1/19

Job Number : Q0151

Ground Level :

Location :

Engineer : Quantum Geotechnic

Coordinates:



Ty Berwig, Bynea, Llanelli
SA14 9ST
Tel: 01554 744880
Fax:
email: enquiries@quantumgeotech.co.uk

Operator:
Jeff

Logged By:
A Jones

Sheet No.
2 Of 2

m Per
Page

All measurements in
metres unless
otherwise stated



Contract : Victoria Road Client : Samson drilling							Trial Pit No. TP4	
Dates : 7/1/19 - 7/1/19 Location :			Job Number : Q0151 Engineer : Quantum Geotechnic			Ground Level : Coordinates:		

m B.G.L.	Samples		Tests		Strata			WATER
	Depth	Type No.	Depth	Test Results	Depth (Thickness)	Description	Legend	
1	0.20 -	ES1			0.03	TARMAC		(0.03)
					0.03	MADE GROUND: Brown grey slightly silty slightly sandy Gravel with low cobble content of brick. Gravel is angular to sub angular sandstone, limestone, mudstone, brick, tarmac and concrete with plastic and iron bar.		0.03
					0.67			(0.67)
					0.70	Orange yellow slightly silty slightly gravelly SAND. Sand is fine to medium.		0.70
2	0.60 -	ES2						
3	1.50 -	ES3						
	3.00 -	ES4				...becoming wet from 2.8mbgl		
					3.20	Trial Pit terminated at 3.2mbgl sides collapsing.		3.20

PLAN 	Groundwater: No groundwater encountered;,, becoming wet from 2.8mbgl Stability: Sides collapsing after depth of 2.8mbgl Shoring: None	Remarks : Hole positioned in liaison with the client, CAT and Genny scanned prior to excavation. On completion trial pit backfilled with arisings compacted in reverse order to excavation. 20mm blue plastic water pipe within yellow ducting at 0.5mbgl - pit moved forward 100mm cast pipe at far side of pit @0.5mbgl, exposed during pit collapse.
-----------------	---	---

Equipment Used: JCB 3CX

	Ty Berwig, Bynea, Llanelli SA14 9ST Tel: 01554 744880 Fax: email: enquiries@quantumgeotech.co.uk	Operator: Jeff	Logged By: A Jones	Sheet No. 1 Of 2	m Per Page 5	All measurements in metres unless otherwise stated	
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Contract : Victoria Road

Client : Samson drilling

Trial Pit No.

TP4

Dates : 7/1/19 - 7/1/19

Job Number : Q0151

Ground Level :

Location :

Engineer : Quantum Geotechnic

Coordinates:



Ty Berwig, Bynea, Llanelli
SA14 9ST
Tel: 01554 744880
Fax:
email: enquiries@quantumgeotech.co.uk

Operator:
Jeff

Logged By:
A Jones

Sheet No.
2 Of 2

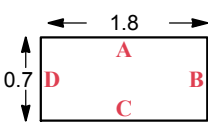
m Per
Page

All measurements in
metres unless
otherwise stated



Contract : Victoria Road Client : Samson drilling							Trial Pit No. TP5	
Dates : 7/1/19 - 7/1/19 Location :			Job Number : Q0151 Engineer : Quantum Geotechnic			Ground Level : Coordinates:		

m B.G.L.	Samples		Tests		Strata				WATER
	Depth	Type No.	Depth	Test Results	Depth (Thickness)	Description	Legend	Depth (Thickness)	
1	0.30 -	ES1			0.55	MADE GROUND: Brown grey slightly silty slightly sandy Gravel with low cobble content of brick. Gravel is angular to sub angular sandstone, limestone, mudstone, brick, tarmac and concrete with plastic and iron bar. ... pockets of green Sand / Gravel @0.5mbgl Orange yellow slightly silty slightly gravelly SAND. Sand is fine to medium.		(0.55)	
	0.50 -	ES2			0.55			0.55	
	1.50 -	ES3			1.25		(1.25)		
						1.80	Trial Pit terminated at 1.8mbgl sides collapsing.		

PLAN 		Groundwater: No groundwater encountered Stability: Sides collapsing Shoring: None		Remarks : Hole positioned in liaison with the client, CAT and Genny scanned prior to excavation. On completion trial pit backfilled with arisings compacted in reverse order to excavation.	
--	--	---	--	---	--

Equipment Used: JCB 3CX						
-------------------------	--	--	--	--	--	--

	Ty Berwig, Bynea, Llanelli SA14 9ST Tel: 01554 744880 Fax: email: enquiries@quantumgeotech.co.uk		Operator: Jeff	Logged By: A Jones	Sheet No. 1 Of 2	m Per Page 5	All measurements in metres unless otherwise stated	
--	--	--	-------------------	-----------------------	---------------------	-----------------	--	---

Contract : Victoria Road Client : Samson drilling		Trial Pit No. TP5
Dates : 7/1/19 - 7/1/19 Location :	Job Number : Q0151 Engineer : Quantum Geotechnic	Ground Level : Coordinates:



APPENDIX III – CLIENTS DRILLERS BOREHOLE LOGS

[illegible]

Site

Driller L.P. Green
Date 7.16.19.

LAND OFF VICTORIA B.C.
PORT ALBERT.

Borehole No. 1

Borehole Diameter 150 mm

Type of Boring 3+4.

CASING USED

Size	150mm	200mm	250mm
------	-------	-------	-------

Depth to 5.50

WATER STRIKES

Depth	9.40
-------	------

1890

(mean = 0.68)

0.7

07 1212 13421 131214

STANDING WATER LEVELS

Borehole depth

Casino death

Depth in Water

Time of Day

INSTALLATION DETAILS

Delays	hrs
Reasons	

CREW

Driller W. F. Osborn

2nd Man C. 1/51-111

3rd Man

Remarks

Remarks
Machias Riv and equipment de site. 24 March 84/11.

Signed by Diller

Signed for Client

Contract No		Site		Borehole No		2.																			
Rig		DAVID 2000		Borehole Diameter		150mm																			
Driller		W.F. GREEN		Type of Boring		S+H																			
Date		8.10.19.																							
CASING USED				Sealing Blows				PENETRATION TESTS				Casing/ Water Depth		CHISELLING											
Size		150mm 200mm 250mm		from		to		Type		No		Depth from		Depth to		75mm		75mm		75mm		75mm		75mm	
Depth to		550		91.00		91.00		ES		1		0.50		X6											
WATER STRIKES				Stone fill.		B		2		0.50		1A													
Depth		2.26		Borehole sealed.		04.50		ES		3		1A		X6											
Inflow (first med seepage)		SEB						3		4		1A													
Water level after 20 min		2.2						3		5		1A		+50											
Depth sealed off		—						3		6		2A													
STANDING WATER LEVELS								ES		7		2A		X6											
Borehole depth		550						3		8		3A													
Casing depth		550						3		9		4A													
Depth to Water		2.0						3		10		4.0		4.50											
Time of Day		4.30						3		11		5A													
INSTALLATION DETAILS																									
SLOTTER Pile S.O.-15																									
Pile Pile 150-91																									
GAS TAP FITTED																									
CABLE FITTED																									

Borehole No

2

Borehole Diameter 150

Type of Boring S + A.

Contract No	
Rig	DAWD 2000
Driller	W.P. Green
Date	8.10.19.

Site
Road Off Victoria Road,
Port Tabor.

Borehole No	2.
Borehole Diameter	150
Type of Boring	S + A

CASING USED

Size	150mm	200mm	250mm
------	-------	-------	-------

Depth to	5.50
----------	------

WATER STRIKES

Depth	2.26
-------	------

Inflow (fast med seepage)

Water level after 20 min 2.2

Depth sealed off

STANDING WATER LEVELS

Borehole depth

Casing depth

Depth to Water

Time of Day

INSTALLATION DETAILS

Slotted file 5.0-1.5

PLATE 1.50-CL

Gas The Filter

ENTERED.

Delays

Reasons

1

CREW

Driller
H. F. Green

2nd Man R. B. HILTY

3rd Man

Remarks

Signed by Driller

Signed for Client

Samson Drilling Services Borehole Log

[illegible]

APPENDIX IV – CHEMICAL LABORATORY TEST RESULTS

**Phil Darby**

Quantum Geotechnic Ltd
Ty Berwig
Bynea
Llanelli
SA14 9ST

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

e: PhilDarby@QuantumGeotech.co.uk

Analytical Report Number : 20-79958

Project / Site name:	Victoria Road	Samples received on:	09/01/2020
Your job number:	Q0151	Samples instructed on:	09/01/2020
Your order number:		Analysis completed by:	17/01/2020
Report Issue Number:	1	Report issued on:	17/01/2020
Samples Analysed:	2 leachate samples - 5 soil samples		

Signed:

Katarzyna Lewicka
Head of Reporting Section

For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :	soils	- 4 weeks from reporting
	leachates	- 2 weeks from reporting
	waters	- 2 weeks from reporting
	asbestos	- 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request.

Iss No 20-79958-1 Victoria Road Q0151

This certificate should not be reproduced, except in full, without the express permission of the laboratory.

The results included within the report are representative of the samples submitted for analysis.

Page 1 of 7

Analytical Report Number: 20-79958

Project / Site name: Victoria Road

Lab Sample Number	1406252	1406253	1406254	1406255	1406256
Sample Reference	TP1	TP2	TP3	TP5	TP5
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	0.40	0.30	0.50	0.30	0.50
Date Sampled	07/01/2020	07/01/2020	07/01/2020	07/01/2020	07/01/2020
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Stone Content	%	0.1	NONE	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	6.8	9.6
Total mass of sample received	kg	0.001	NONE	1.6	1.3

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	Chrysotile, Amosite - Loose Fibres	Chrysotile, Amosite - Loose Fibres	Chrysotile, Amosite - Loose Fibres	Amosite- Sheeting/Board Debris	-
Asbestos in Soil	Type	N/A	ISO 17025	Detected	Detected	Detected	Detected	Not-detected

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.4	8.2	9.0	8.8	8.0
Total Cyanide	mg/kg	1	MCERTS	4	< 1	< 1	21	11
Total Sulphate as SO ₄	mg/kg	50	MCERTS	340	1900	1300	2100	300
Sulphide	mg/kg	1	MCERTS	< 1.0	< 1.0	91	2.4	< 1.0
Organic Matter	%	0.1	MCERTS	0.9	2.9	3.2	1.8	0.4
Total Organic Carbon (TOC)	%	0.1	MCERTS	0.5	1.7	1.9	1.0	0.2

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
----------------------------	-------	---	--------	-------	-------	-------	-------	-------

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.22	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	0.62	< 0.05	0.40	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.23	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.30	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	0.80	2.7	0.76	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	0.28	1.1	0.16	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	2.1	2.6	9.1	1.6	< 0.05
Pyrene	mg/kg	0.05	MCERTS	5.4	2.0	8.0	1.2	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	2.9	1.3	7.7	1.2	< 0.05
Chrysene	mg/kg	0.05	MCERTS	3.1	1.2	7.0	1.0	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	3.1	1.4	9.4	1.4	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	1.2	1.0	5.7	0.57	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	1.6	1.1	8.5	0.92	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	1.5	0.62	5.4	0.61	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.64	< 0.05	1.6	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	1.8	0.72	5.8	0.66	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	24.0	13.0	73.2	10.2	< 0.80
-----------------------------	-------	-----	--------	------	------	------	------	--------

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	49	22	11	20	8.9
Boron (water soluble)	mg/kg	0.2	MCERTS	0.2	0.8	0.8	0.8	0.5
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	1.1	< 0.2	1.1	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	18	21	28	28	11
Copper (aqua regia extractable)	mg/kg	1	MCERTS	270	1000	130	4100	91000
Lead (aqua regia extractable)	mg/kg	1	MCERTS	57	230	54	580	61
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	2.9	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	11	27	12	24	6.5
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	190	590	100	1100	28

Analytical Report Number: 20-79958

Project / Site name: Victoria Road

Lab Sample Number	1406252	1406253	1406254	1406255	1406256
Sample Reference	TP1	TP2	TP3	TP5	TP5
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	0.40	0.30	0.50	0.30	0.50
Date Sampled	07/01/2020	07/01/2020	07/01/2020	07/01/2020	07/01/2020
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		

Monoaromatics & Oxygenates

Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Petroleum Hydrocarbons

TPH C10 - C40	mg/kg	10	MCERTS	440	340	1400	290	< 10
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	2.7	1.4	5.4	3.5	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	16	5.7	18	8.1	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	12	8.2	35	21	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	40	120	170	92	< 8.0
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	71	140	230	120	< 10
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	4.4	2.5	3.5	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	13	7.9	9.0	7.0	< 2.0
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	98	12	92	13	< 10
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	230	99	560	80	< 10
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	350	120	670	100	< 10



Analytical Report Number: 20-79958

Project / Site name: Victoria Road

Lab Sample Number				1406257	1406258			
Sample Reference				TP1	TP2			
Sample Number				None Supplied	None Supplied			
Depth (m)				0.40	0.30			
Date Sampled				07/01/2020	07/01/2020			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Leachate Analysis)				Units	Limit of detection	Accreditation Status		

General Inorganics

pH	pH Units	N/A	ISO 17025	7.7	7.8			
Total Cyanide	µg/l	10	ISO 17025	< 10	< 10			
Sulphate as SO ₄	mg/l	0.1	ISO 17025	1.2	1.6			
Sulphide	µg/l	5	NONE	< 5.0	< 5.0			
Total Organic Carbon (TOC)	mg/l	0.1	NONE	6.46	6.07			
Hardness - Total	mgCaCO ₃ /l	1	NONE	33.4	32.4			

Total Phenols

Total Phenols (monohydric)	µg/l	10	ISO 17025	< 10	< 10			
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Speciated PAHs

Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Indeno(1,2,3-cd)pyrene	µg/l	0.01	NONE	< 0.01	< 0.01			
Dibenz(a,h)anthracene	µg/l	0.01	NONE	< 0.01	< 0.01			
Benzo(ghi)perylene	µg/l	0.01	NONE	< 0.01	< 0.01			

Total PAH

Total EPA-16 PAHs	µg/l	0.2	NONE	< 0.2	< 0.2			
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Heavy Metals / Metalloids

Arsenic (dissolved)	µg/l	1.1	ISO 17025	33	9.2			
Boron (dissolved)	µg/l	10	ISO 17025	< 10	< 10			
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08	< 0.08			
Chromium (dissolved)	µg/l	0.4	ISO 17025	5.1	1.5			
Copper (dissolved)	µg/l	0.7	ISO 17025	24	28			
Lead (dissolved)	µg/l	1	ISO 17025	< 1.0	1.7			
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5	< 0.5			
Nickel (dissolved)	µg/l	0.3	ISO 17025	< 0.3	< 0.3			
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0	< 4.0			
Zinc (dissolved)	µg/l	0.4	ISO 17025	8.9	2.6			

Calcium (dissolved)	mg/l	0.012	ISO 17025	12	12			
Magnesium (dissolved)	mg/l	0.005	ISO 17025	0.68	0.69			

Petroleum Hydrocarbons

TPH1 (C10 - C40)	µg/l	10	NONE	< 10	< 10			
TPH2 (C6 - C10)	µg/l	10	NONE	< 10	< 10			



Analytical Report Number : 20-79958

Project / Site name: Victoria Road

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1406252	TP1	None Supplied	0.40	Brown sand with gravel and vegetation.
1406253	TP2	None Supplied	0.30	Brown loam and sand with gravel and tar.
1406254	TP3	None Supplied	0.50	Brown sand with gravel.
1406255	TP5	None Supplied	0.30	Brown loam and sand with gravel and rubble.
1406256	TP5	None Supplied	0.50	Green sand.

Analytical Report Number : 20-79958

Project / Site name: Victoria Road

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron in leachate	Determination of boron in leachate. Sample acidified and followed by ICP-OES.	In-house method based on MEWAM	L039-PL	W	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazine followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Metals by ICP-OES in leachate	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In-house method based on BS1377 Part 2, 1990, Classification tests	L019-UK/PL	W	NONE
Monohydric phenols in leachate	Determination of phenols in leachate by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	ISO 17025
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
NRA Leachate Prep	10:1 extract with de-ionised water shaken for 24 hours then filtered.	In-house method based on National Rivers Authority	L020-PL	W	NONE
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	BS1377 Part 3, 1990, Chemical and Electrochemical Tests""	L009-PL	D	MCERTS
pH at 20oC in leachate	Determination of pH in leachate by electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L005-PL	W	ISO 17025
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Speciated EPA-16 PAHs in leachate	Determination of PAH compounds in leachate by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L102B-PL	W	NONE
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE

Iss No 20-79958-1 Victoria Road Q0151

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The results included within the report are representative of the samples submitted for analysis.

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Analytical Report Number : 20-79958

Project / Site name: Victoria Road

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Sulphate in leachates	Determination of sulphate in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 1986 Methods for the Determination of Metals in Soil""	L039-PL	W	ISO 17025
Sulphide in leachate	Determination of sulphide in leachate by ion selective electrode.	In-house method	L010-PL	W	NONE
Sulphide in soil	Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode.	In-house method	L010-PL	D	MCERTS
Total cyanide in leachate	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	ISO 17025
Total Hardness of leachates	Determination of hardness in leachates by calculation from calcium and magnesium.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L045-PL	W	NONE
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests""	L009-PL	D	MCERTS
Total organic carbon in leachate	Determination of dissolved organic carbon in leachate by TOC/DOC NDIR analyser.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	NONE
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L038-PL	D	MCERTS
TPH Banding in Soil by FID	Determination of hexane extractable hydrocarbons in soil by GC-FID.	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	W	MCERTS
TPH1 (Leachates)	Determination of dichloromethane extractable hydrocarbons in leachate by GC-MS.	In-house method	L070-PL	W	NONE
TPH2 (Leachates)	Determination of hydrocarbons C6-C10 by headspace GC-MS.	In-house method based on USEPA8260	L088-PL	W	NONE
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/cleanup.	L088/76-PL	W	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

**Phil Darby**

Quantum Geotechnic Ltd
Ty Berwig
Bynea
Llanelli
SA14 9ST

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404

f: 01923 237404

e: reception@i2analytical.com

e: PhilDarby@QuantumGeotech.co.uk

Analytical Report Number : 20-81622

Project / Site name:	Victoria Road, Port Talbot	Samples received on:	14/01/2020
Your job number:	Q0151	Samples instructed on:	20/01/2020
Your order number:		Analysis completed by:	28/01/2020
Report Issue Number:	1	Report issued on:	28/01/2020
Samples Analysed:	1 water sample		

Signed: 

Zina Abdul Razzak
Senior Quality Specialist

For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request.

Iss No 20-81622-1 Victoria Road, Port Talbot Q0151

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The results included within the report are representative of the samples submitted for analysis.

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Analytical Report Number: 20-81622

Project / Site name: Victoria Road, Port Talbot

Lab Sample Number				1414851				
Sample Reference				BH2				
Sample Number				1				
Depth (m)				2.06				
Date Sampled				13/01/2020				
Time Taken				None Supplied				
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status					

General Inorganics

pH	pH Units	N/A	ISO 17025	7.5				
Total Cyanide	µg/l	10	ISO 17025	< 10				
Sulphate as SO ₄	µg/l	45	ISO 17025	22600				
Sulphate as SO ₄	mg/l	0.045	ISO 17025	22.6				
Sulphide	µg/l	5	NONE	< 5.0				
Total Organic Carbon (TOC)	mg/l	0.1	ISO 17025	8.04				
Hardness - Total	mgCaCO ₃ /l	1	ISO 17025	224				

Total Phenols

Total Phenols (monohydric)	µg/l	10	ISO 17025	11				
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Speciated PAHs

Naphthalene	µg/l	0.01	ISO 17025	< 0.01				
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01				
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01				
Fluorene	µg/l	0.01	ISO 17025	< 0.01				
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01				
Anthracene	µg/l	0.01	ISO 17025	< 0.01				
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01				
Pyrene	µg/l	0.01	ISO 17025	< 0.01				
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01				
Chrysene	µg/l	0.01	ISO 17025	< 0.01				
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01				
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01				
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01				
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01				
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01				
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01				

Total PAH

Total EPA-16 PAHs	µg/l	0.16	ISO 17025	< 0.16				
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Analytical Report Number: 20-81622

Project / Site name: Victoria Road, Port Talbot

Lab Sample Number				1414851				
Sample Reference				BH2				
Sample Number				1				
Depth (m)				2.06				
Date Sampled				13/01/2020				
Time Taken				None Supplied				
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status					

Heavy Metals / Metalloids

Arsenic (dissolved)	µg/l	0.15	ISO 17025	5.04				
Boron (dissolved)	µg/l	10	ISO 17025	77				
Cadmium (dissolved)	µg/l	0.02	ISO 17025	0.02				
Calcium (dissolved)	mg/l	0.012	ISO 17025	79				
Chromium (dissolved)	µg/l	0.2	ISO 17025	2.0				
Copper (dissolved)	µg/l	0.5	ISO 17025	7.5				
Lead (dissolved)	µg/l	0.2	ISO 17025	0.7				
Magnesium (dissolved)	mg/l	0.005	ISO 17025	6.6				
Mercury (dissolved)	µg/l	0.05	ISO 17025	< 0.05				
Nickel (dissolved)	µg/l	0.5	ISO 17025	0.5				
Selenium (dissolved)	µg/l	0.6	ISO 17025	1.0				
Zinc (dissolved)	µg/l	0.5	ISO 17025	1.6				

Monoaromatics & Oxygenates

Benzene	µg/l	1	ISO 17025	< 1.0				
Toluene	µg/l	1	ISO 17025	< 1.0				
Ethylbenzene	µg/l	1	ISO 17025	< 1.0				
p & m-xylene	µg/l	1	ISO 17025	< 1.0				
o-xylene	µg/l	1	ISO 17025	< 1.0				
MTBE (Methyl Tertiary Butyl Ether)	µg/l	1	ISO 17025	< 1.0				

Petroleum Hydrocarbons

TPH1 (C10 - C40)	µg/l	10	NONE	160				
TPH-CWG - Aliphatic >C5 - C6	µg/l	1	ISO 17025	< 1.0				
TPH-CWG - Aliphatic >C6 - C8	µg/l	1	ISO 17025	< 1.0				
TPH-CWG - Aliphatic >C8 - C10	µg/l	1	ISO 17025	< 1.0				
TPH-CWG - Aliphatic >C10 - C12	µg/l	10	NONE	< 10				
TPH-CWG - Aliphatic >C12 - C16	µg/l	10	NONE	35				
TPH-CWG - Aliphatic >C16 - C21	µg/l	10	NONE	53				
TPH-CWG - Aliphatic >C21 - C35	µg/l	10	NONE	75				
TPH-CWG - Aliphatic (C5 - C35)	µg/l	10	NONE	160				
TPH-CWG - Aromatic >C5 - C7	µg/l	1	ISO 17025	< 1.0				
TPH-CWG - Aromatic >C7 - C8	µg/l	1	ISO 17025	< 1.0				
TPH-CWG - Aromatic >C8 - C10	µg/l	1	ISO 17025	< 1.0				
TPH-CWG - Aromatic >C10 - C12	µg/l	10	NONE	< 10				
TPH-CWG - Aromatic >C12 - C16	µg/l	10	NONE	< 10				
TPH-CWG - Aromatic >C16 - C21	µg/l	10	NONE	< 10				
TPH-CWG - Aromatic >C21 - C35	µg/l	10	NONE	< 10				
TPH-CWG - Aromatic (C5 - C35)	µg/l	10	NONE	< 10				

U/S = Unsuitable Sample I/S = Insufficient Sample



Analytical Report Number : 20-81622

Project / Site name: Victoria Road, Port Talbot

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Boron in water	Determination of boron in water by acidification followed by ICP-OES. Accredited matrices: SW PW GW	In-house method based on MEWAM	L039-PL	W	ISO 17025
BTEX and MTBE in water (Monoaromatics)	Determination of BTEX and MTBE in water by headspace GC-MS. Accredited matrices: SW PW GW	In-house method based on USEPA8260	L073B-PL	W	ISO 17025
Metals in water by ICP-MS (dissolved)	Determination of metals in water by acidification followed by ICP-MS. Accredited Matrices: SW, GW, PW except B=SW,GW, Hg=SW,PW, Al=SW,PW.	In-house method based on USEPA Method 6020 & 200.8 "for the determination of trace elements in water by ICP-MS.	L012-PL	W	ISO 17025
Metals in water by ICP-OES (dissolved)	Determination of metals in water by acidification followed by ICP-OES. Accredited Matrices SW, GW, PW, PrW.(Al, Cu,Fe,Zn).	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Monohydric phenols in water	Determination of phenols in water by continuous flow analyser. Accredited matrices: SW PW GW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	ISO 17025
pH at 20oC in water (automated)	Determination of pH in water by electrometric measurement. Accredited matrices: SW PW GW	In house method.	L099-PL	W	ISO 17025
Speciated EPA-16 PAHs in water	Determination of PAH compounds in water by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards. Accredited matrices: SW PW GW	In-house method based on USEPA 8270	L102B-PL	W	ISO 17025
Sulphate in water	Determination of sulphate in water by acidification followed by ICP-OES. Accredited matrices: SW PW GW, PrW.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Sulphide in water	Determination of sulphide in water by ion selective electrode.	In-house method	L029-PL	W	NONE
Total cyanide in water	Determination of total cyanide by distillation followed by colorimetry. Accredited matrices: SW PW GW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	ISO 17025
Total Hardness of water	Determination of hardness in waters by calculation from calcium and magnesium. Accredited Matrices SW, GW, PW.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L045-PL	W	ISO 17025
Total organic carbon in water	Determination of dissolved organic carbon in water by TOC/DOC NDIR analyser. Accredited matrices: SW PW GW.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	ISO 17025
TPH1 (Waters)	Determination of dichloromethane extractable hydrocarbons in water by GC-MS.	In-house method	L070-PL	W	NONE
TPHCWG (Waters)	Determination of dichloromethane extractable hydrocarbons in water by GC-MS, speciation by interpretation.	In-house method	L070-PL	W	NONE

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

**Phil Darby**

Quantum Geotechnic Ltd
Ty Berwig
Bynea
Llanelli
SA14 9ST

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404

f: 01923 237404

e: reception@i2analytical.com

e: PhilDarby@QuantumGeotech.co.uk

Analytical Report Number : 19-67072

Project / Site name:	Victoria Road	Samples received on:	21/10/2019
Your job number:		Samples instructed on:	21/10/2019
Your order number:		Analysis completed by:	29/10/2019
Report Issue Number:	1	Report issued on:	29/10/2019
Samples Analysed:	3 leachate samples - 5 soil samples		

Signed:

Rexona Rahman
Head of Customer Services
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :	soils	- 4 weeks from reporting
	leachates	- 2 weeks from reporting
	waters	- 2 weeks from reporting
	asbestos	- 6 months from reporting

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Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request.

Iss No 19-67072-1 Victoria Road

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The results included within the report are representative of the samples submitted for analysis.

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Analytical Report Number: 19-67072

Project / Site name: Victoria Road

Lab Sample Number				1336681	1336682	1336683	1336684	1336685
Sample Reference				BH1	BH2	BH2	BH3	BH4
Sample Number				1	1	3	1	1
Depth (m)				0.50	0.50	1.00	0.50	0.50
Date Sampled				Deviating	Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	16	17	15	9.5	8.7
Total mass of sample received	kg	0.001	NONE	2.0	2.0	2.0	2.0	2.0

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
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General Inorganics

Organic Matter	%	0.1	MCERTS	0.4	0.2	0.1	0.3	0.6
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.81	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.18	1.4
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.36
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.25	2.3
Pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.19	1.7
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	1.4
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	1.1
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	1.1
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.71
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.97
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.40
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.53

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	< 0.80	< 0.80	1.43	11.9
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	9.6	8.6	< 1.0	3.3	8.0
Boron (water soluble)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	0.5
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	5.6	5.5	6.0	6.8	11
Copper (aqua regia extractable)	mg/kg	1	MCERTS	6.2	12	6.8	5.1	41
Lead (aqua regia extractable)	mg/kg	1	MCERTS	4.2	10	7.0	5.9	18
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	4.1	5.0	4.8	4.9	7.7
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	1.5	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	15	16	15	18	34

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Project / Site name: Victoria Road

Lab Sample Number				1336681	1336682	1336683	1336684	1336685
Sample Reference				BH1	BH2	BH2	BH3	BH4
Sample Number				1	1	3	1	1
Depth (m)				0.50	0.50	1.00	0.50	0.50
Date Sampled				Deviating	Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					

Monoaromatics & Oxygenates

Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Petroleum Hydrocarbons

TPH C10 - C40	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	260
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	5.8
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	26
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	28
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	57
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	120
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	1.4
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	4.7
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	28
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	82
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	120



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Lab Sample Number				1336681	1336682	1336683	1336684	1336685
Sample Reference				BH1	BH2	BH2	BH3	BH4
Sample Number				1	1	3	1	1
Depth (m)				0.50	0.50	1.00	0.50	0.50
Date Sampled				Deviating	Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					

VOCs

Chloromethane	µg/kg	1	ISO 17025	< 1.0	-	-	< 1.0	< 1.0
Chloroethane	µg/kg	1	NONE	< 1.0	-	-	< 1.0	< 1.0
Bromomethane	µg/kg	1	ISO 17025	< 1.0	-	-	< 1.0	< 1.0
Vinyl Chloride	µg/kg	1	NONE	< 1.0	-	-	< 1.0	< 1.0
Trichlorofluoromethane	µg/kg	1	NONE	< 1.0	-	-	< 1.0	< 1.0
1,1-Dichloroethene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	< 1.0
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	ISO 17025	< 1.0	-	-	< 1.0	< 1.0
Cis-1,2-dichloroethene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	< 1.0
1,1-Dichloroethane	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	< 1.0
2,2-Dichloropropane	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	< 1.0
Trichloromethane	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	< 1.0
1,1,1-Trichloroethane	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	< 1.0
1,2-Dichloroethane	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	< 1.0
1,1-Dichloropropene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	< 1.0
Trans-1,2-dichloroethene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	< 1.0
Benzene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	< 1.0
Tetrachloromethane	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	< 1.0
1,2-Dichloropropane	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	< 1.0
Trichloroethene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	< 1.0
Dibromomethane	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	< 1.0
Bromodichloromethane	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	< 1.0
Cis-1,3-dichloropropene	µg/kg	1	ISO 17025	< 1.0	-	-	< 1.0	< 1.0
Trans-1,3-dichloropropene	µg/kg	1	ISO 17025	< 1.0	-	-	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	< 1.0
1,1,2-Trichloroethane	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	< 1.0
1,3-Dichloropropane	µg/kg	1	ISO 17025	< 1.0	-	-	< 1.0	< 1.0
Dibromochloromethane	µg/kg	1	ISO 17025	< 1.0	-	-	< 1.0	< 1.0
Tetrachloroethene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	< 1.0
1,2-Dibromoethane	µg/kg	1	ISO 17025	< 1.0	-	-	< 1.0	< 1.0
Chlorobenzene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	< 1.0
1,1,1,2-Tetrachloroethane	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	< 1.0
p & m-Xylene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	< 1.0
Styrene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	< 1.0
Tribromomethane	µg/kg	1	NONE	< 1.0	-	-	< 1.0	< 1.0
o-Xylene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	< 1.0
1,1,2,2-Tetrachloroethane	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	< 1.0
Isopropylbenzene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	< 1.0
Bromobenzene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	< 1.0
n-Propylbenzene	µg/kg	1	ISO 17025	< 1.0	-	-	< 1.0	< 1.0
2-Chlorotoluene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	< 1.0
4-Chlorotoluene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	< 1.0
1,3,5-Trimethylbenzene	µg/kg	1	ISO 17025	< 1.0	-	-	< 1.0	< 1.0
tert-Butylbenzene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	< 1.0
1,2,4-Trimethylbenzene	µg/kg	1	ISO 17025	< 1.0	-	-	< 1.0	< 1.0
sec-Butylbenzene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	< 1.0
1,3-Dichlorobenzene	µg/kg	1	ISO 17025	< 1.0	-	-	< 1.0	< 1.0
p-Isopropyltoluene	µg/kg	1	ISO 17025	< 1.0	-	-	< 1.0	< 1.0
1,2-Dichlorobenzene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	< 1.0
1,4-Dichlorobenzene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	< 1.0
Butylbenzene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	< 1.0
1,2-Dibromo-3-chloropropane	µg/kg	1	ISO 17025	< 1.0	-	-	< 1.0	< 1.0
1,2,4-Trichlorobenzene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	< 1.0
Hexachlorobutadiene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	< 1.0
1,2,3-Trichlorobenzene	µg/kg	1	ISO 17025	< 1.0	-	-	< 1.0	< 1.0

Analytical Report Number: 19-67072

Project / Site name: Victoria Road

Lab Sample Number	1336681	1336682	1336683	1336684	1336685
Sample Reference	BH1	BH2	BH2	BH3	BH4
Sample Number	1	1	3	1	1
Depth (m)	0.50	0.50	1.00	0.50	0.50
Date Sampled	Deviating	Deviating	Deviating	Deviating	Deviating
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		

SVOCs

Aniline	mg/kg	0.1	NONE	< 0.1	-	-	< 0.1	< 0.1
Phenol	mg/kg	0.2	ISO 17025	< 0.2	-	-	< 0.2	< 0.2
2-Chlorophenol	mg/kg	0.1	MCERTS	< 0.1	-	-	< 0.1	< 0.1
Bis(2-chloroethyl)ether	mg/kg	0.2	MCERTS	< 0.2	-	-	< 0.2	< 0.2
1,3-Dichlorobenzene	mg/kg	0.2	MCERTS	< 0.2	-	-	< 0.2	< 0.2
1,2-Dichlorobenzene	mg/kg	0.1	MCERTS	< 0.1	-	-	< 0.1	< 0.1
1,4-Dichlorobenzene	mg/kg	0.2	MCERTS	< 0.2	-	-	< 0.2	< 0.2
Bis(2-chloroisopropyl)ether	mg/kg	0.1	MCERTS	< 0.1	-	-	< 0.1	< 0.1
2-Methylphenol	mg/kg	0.3	MCERTS	< 0.3	-	-	< 0.3	< 0.3
Hexachloroethane	mg/kg	0.05	MCERTS	< 0.05	-	-	< 0.05	< 0.05
Nitrobenzene	mg/kg	0.3	MCERTS	< 0.3	-	-	< 0.3	< 0.3
4-Methylphenol	mg/kg	0.2	NONE	< 0.2	-	-	< 0.2	< 0.2
Isophorone	mg/kg	0.2	MCERTS	< 0.2	-	-	< 0.2	< 0.2
2-Nitrophenol	mg/kg	0.3	MCERTS	< 0.3	-	-	< 0.3	< 0.3
2,4-Dimethylphenol	mg/kg	0.3	MCERTS	< 0.3	-	-	< 0.3	< 0.3
Bis(2-chloroethoxy)methane	mg/kg	0.3	MCERTS	< 0.3	-	-	< 0.3	< 0.3
1,2,4-Trichlorobenzene	mg/kg	0.3	MCERTS	< 0.3	-	-	< 0.3	< 0.3
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	-	-	0.81	< 0.05
2,4-Dichlorophenol	mg/kg	0.3	MCERTS	< 0.3	-	-	< 0.3	< 0.3
4-Chloroaniline	mg/kg	0.1	NONE	< 0.1	-	-	< 0.1	< 0.1
Hexachlorobutadiene	mg/kg	0.1	MCERTS	< 0.1	-	-	< 0.1	< 0.1
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	< 0.1	-	-	< 0.1	< 0.1
2,4,6-Trichlorophenol	mg/kg	0.1	MCERTS	< 0.1	-	-	< 0.1	< 0.1
2,4,5-Trichlorophenol	mg/kg	0.2	MCERTS	< 0.2	-	-	< 0.2	< 0.2
2-Methylnaphthalene	mg/kg	0.1	NONE	< 0.1	-	-	< 0.1	< 0.1
2-Chloronaphthalene	mg/kg	0.1	MCERTS	< 0.1	-	-	< 0.1	< 0.1
Dimethylphthalate	mg/kg	0.1	MCERTS	< 0.1	-	-	< 0.1	< 0.1
2,6-Dinitrotoluene	mg/kg	0.1	MCERTS	< 0.1	-	-	< 0.1	< 0.1
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	-	-	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	-	-	< 0.05	< 0.05
2,4-Dinitrotoluene	mg/kg	0.2	MCERTS	< 0.2	-	-	< 0.2	< 0.2
Dibenzofuran	mg/kg	0.2	MCERTS	< 0.2	-	-	< 0.2	< 0.2
4-Chlorophenyl phenyl ether	mg/kg	0.3	ISO 17025	< 0.3	-	-	< 0.3	< 0.3
Diethyl phthalate	mg/kg	0.2	MCERTS	< 0.2	-	-	< 0.2	< 0.2
4-Nitroaniline	mg/kg	0.2	MCERTS	< 0.2	-	-	< 0.2	< 0.2
Fluorene	mg/kg	0.05	MCERTS	< 0.05	-	-	< 0.05	< 0.05
Azobenzene	mg/kg	0.3	MCERTS	< 0.3	-	-	< 0.3	< 0.3
Bromophenyl phenyl ether	mg/kg	0.2	MCERTS	< 0.2	-	-	< 0.2	< 0.2
Hexachlorobenzene	mg/kg	0.3	MCERTS	< 0.3	-	-	< 0.3	< 0.3
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	-	-	0.18	1.4
Anthracene	mg/kg	0.05	MCERTS	< 0.05	-	-	< 0.05	0.36
Carbazole	mg/kg	0.3	MCERTS	< 0.3	-	-	< 0.3	< 0.3
Dibutyl phthalate	mg/kg	0.2	MCERTS	< 0.2	-	-	< 0.2	< 0.2
Anthraquinone	mg/kg	0.3	MCERTS	< 0.3	-	-	< 0.3	< 0.3
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	-	-	0.25	2.3
Pyrene	mg/kg	0.05	MCERTS	< 0.05	-	-	0.19	1.7
Butyl benzyl phthalate	mg/kg	0.3	ISO 17025	< 0.3	-	-	< 0.3	< 0.3
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	-	-	< 0.05	1.4
Chrysene	mg/kg	0.05	MCERTS	< 0.05	-	-	< 0.05	1.1
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	-	-	< 0.05	1.1
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	-	-	< 0.05	0.71
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	-	-	< 0.05	0.97
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	-	-	< 0.05	0.40
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	-	-	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	-	-	< 0.05	0.53

Analytical Report Number: 19-67072

Project / Site name: Victoria Road

Lab Sample Number				1336681	1336682	1336683	1336684	1336685
Sample Reference				BH1	BH2	BH2	BH3	BH4
Sample Number				1	1	3	1	1
Depth (m)				0.50	0.50	1.00	0.50	0.50
Date Sampled				Deviating	Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					

PCBs by GC-MS

PCB Congener 28	mg/kg	0.001	MCERTS	< 0.001	-	-	< 0.001	< 0.001
PCB Congener 52	mg/kg	0.001	MCERTS	< 0.001	-	-	< 0.001	< 0.001
PCB Congener 101	mg/kg	0.001	MCERTS	< 0.001	-	-	< 0.001	< 0.001
PCB Congener 118	mg/kg	0.001	MCERTS	< 0.001	-	-	< 0.001	< 0.001
PCB Congener 138	mg/kg	0.001	MCERTS	< 0.001	-	-	< 0.001	< 0.001
PCB Congener 153	mg/kg	0.001	MCERTS	< 0.001	-	-	< 0.001	< 0.001
PCB Congener 180	mg/kg	0.001	MCERTS	< 0.001	-	-	< 0.001	< 0.001

Total PCBs by GC-MS

Total PCBs	mg/kg	0.007	MCERTS	< 0.007	-	-	< 0.007	< 0.007
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Lab Sample Number				1336686	1336687	1336688		
Sample Reference				BH1	BH3	BH4		
Sample Number				1	1	1		
Depth (m)				0.50	0.50	0.50		
Date Sampled				Deviating	Deviating	Deviating		
Time Taken				None Supplied	None Supplied	None Supplied		
Analytical Parameter (Leachate Analysis)				Units	Limit of detection	Accreditation Status		

General Inorganics

pH	pH Units	N/A	ISO 17025	7.6	7.6	7.6		
Total Cyanide	µg/l	10	ISO 17025	< 10	110	23		
Sulphate as SO ₄	mg/l	0.1	ISO 17025	0.8	3.0	1.3		
Sulphide	µg/l	5	NONE	< 5.0	< 5.0	< 5.0		
Total Organic Carbon (TOC)	mg/l	0.1	NONE	3.77	3.99	4.29		
Hardness - Total	mgCaCO ₃ /l	1	NONE	23.0	26.3	21.3		

Total Phenols

Total Phenols (monohydric)	µg/l	10	ISO 17025	< 10	< 10	< 10		
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Speciated PAHs

Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01		
Indeno(1,2,3-cd)pyrene	µg/l	0.01	NONE	< 0.01	< 0.01	< 0.01		
Dibenz(a,h)anthracene	µg/l	0.01	NONE	< 0.01	< 0.01	< 0.01		
Benzo(ghi)perylene	µg/l	0.01	NONE	< 0.01	< 0.01	< 0.01		

Total PAH

Total EPA-16 PAHs	µg/l	0.2	NONE	< 0.2	< 0.2	< 0.2		
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Heavy Metals / Metalloids

Arsenic (dissolved)	µg/l	1.1	ISO 17025	5.8	12	7.7		
Boron (dissolved)	µg/l	10	ISO 17025	< 10	< 10	< 10		
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08	< 0.08	< 0.08		
Chromium (dissolved)	µg/l	0.4	ISO 17025	3.2	2.3	3.4		
Copper (dissolved)	µg/l	0.7	ISO 17025	15	15	15		
Lead (dissolved)	µg/l	1	ISO 17025	4.0	7.9	6.0		
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5	< 0.5	< 0.5		
Nickel (dissolved)	µg/l	0.3	ISO 17025	1.4	0.6	1.5		
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0	< 4.0	< 4.0		
Zinc (dissolved)	µg/l	0.4	ISO 17025	11	13	13		
Calcium (dissolved)	mg/l	0.012	ISO 17025	7.8	9.3	7.2		
Magnesium (dissolved)	mg/l	0.005	ISO 17025	0.87	0.74	0.78		

Petroleum Hydrocarbons

TPH1 (C10 - C40)	µg/l	10	NONE	< 10	< 10	< 10		
TPH2 (C6 - C10)	µg/l	10	NONE	< 10	< 10	< 10		



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* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1336681	BH1	1	0.50	Light brown sand with gravel.
1336682	BH2	1	0.50	Light brown sand with gravel.
1336683	BH2	3	1.00	Light brown sand with gravel.
1336684	BH3	1	0.50	Light brown sand with gravel.
1336685	BH4	1	0.50	Light brown sand with gravel and vegetation.

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Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron in leachate	Determination of boron in leachate. Sample acidified and followed by ICP-OES.	In-house method based on MEWAM	L039-PL	W	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazine followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Metals by ICP-OES in leachate	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In-house method based on BS1377 Part 2, 1990, Classification tests	L019-UK/PL	W	NONE
Monohydric phenols in leachate	Determination of phenols in leachate by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	ISO 17025
NRA Leachate Prep	10:1 extract with de-ionised water shaken for 24 hours then filtered.	In-house method based on National Rivers Authority	L020-PL	W	NONE
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	BS1377 Part 3, 1990, Chemical and Electrochemical Tests ^{mm}	L009-PL	D	MCERTS
PCB's By GC-MS in soil	Determination of PCB by extraction with acetone and hexane followed by GC-MS.	In-house method based on USEPA 8082	L027-PL	D	MCERTS
pH at 20oC in leachate	Determination of pH in leachate by electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L005-PL	W	ISO 17025
Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds in soil by extraction in dichloromethane and hexane followed by GC-MS.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Speciated EPA-16 PAHs in leachate	Determination of PAH compounds in leachate by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L102B-PL	W	NONE
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE

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The results included within the report are representative of the samples submitted for analysis.

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Project / Site name: Victoria Road

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Sulphate in leachates	Determination of sulphate in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 1986 Methods for the Determination of Metals in Soil""	L039-PL	W	ISO 17025
Sulphide in leachate	Determination of sulphide in leachate by ion selective electrode.	In-house method	L010-PL	W	NONE
Total cyanide in leachate	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	ISO 17025
Total Hardness of leachates	Determination of hardness in leachates by calculation from calcium and magnesium.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L045-PL	W	NONE
Total organic carbon in leachate	Determination of dissolved organic carbon in leachate by TOC/DOC NDIR analyser.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	NONE
TPH Banding in Soil by FID	Determination of hexane extractable hydrocarbons in soil by GC-FID.	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	W	MCERTS
TPH1 (Leachates)	Determination of dichloromethane extractable hydrocarbons in leachate by GC-MS.	In-house method	L070-PL	W	NONE
TPH2 (Leachates)	Determination of hydrocarbons C6-C10 by headspace GC-MS.	In-house method based on USEPA8260	L088-PL	W	NONE
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L088/76-PL	W	MCERTS
Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Sample Deviation Report



Sample ID	Other ID	Sample Type	Job	Sample Number	Sample Deviation Code	test_name	test_ref	Test Deviation code
BH1	1	L	19-67072	1336686	a			
BH1	1	S	19-67072	1336681	a			
BH2	1	S	19-67072	1336682	a			
BH2	3	S	19-67072	1336683	a			
BH3	1	L	19-67072	1336687	a			
BH3	1	S	19-67072	1336684	a			
BH4	1	L	19-67072	1336688	a			
BH4	1	S	19-67072	1336685	a			

APPENDIX V – POST FIELDWORK MONITORING RECORDS

LANDGAS & GROUNDWATER MONITORING RECORD SHEET

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Project Name:	Victoria Road, Port Talbot
Project No.:	Q0151
BH/TP No.:	BH02
Instruments Used:	Water Dip Meter Probe, GA2000 Gas Analyser

Installation Date:					
GL (mAOD)	Pipe	Type	Install. Depth (mbgl)	Response Zone (mbgl)	Stratum
	A	50mm			

[illegible]