

OAK ROAD, WREXHAM

VOLUME 3: PHASE 2 REPORT: FACTUAL AND INTERPRETATIVE REPORT

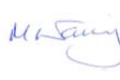
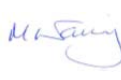
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**SOCOTEC****REPORT STRUCTURE**

DATE	TITLE	REPORT No
June 2020	VOLUME 1: PHASE 1 REPORT: DESK STUDY AND SITE RECONNAISSANCE	F9042-19/1
June 2020	VOLUME 2: PHASE 2 REPORT : CONTAMINATED LAND ASSESSMENT FACTUAL AND INTERPRETATIVE REPORT	F9042-19/2
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1 INTRODUCTION

SOCOTEC UK Limited was commissioned in August 2019 by Conrad Energy Limited (Conrad Energy), to carry out a Phase 1 investigation (Desk Study and Site Reconnaissance) at a site close to Wrexham. This was required to obtain both geotechnical and geoenvironmental information for a small scale flexible fuelled power generation project. Subsequently in December 2019 SOCOTEC was instructed by Conrad Energy to carry out an associated intrusive investigation (ie Phase 2).

The scope of the investigation was specified by SOCOTEC and comprised boreholes, dynamic sampling, trial pitting, utility and topographic surveys, monitoring, laboratory testing and reporting. The investigation was performed in accordance with the contract specification, and the general requirements of BS 5930 (2015), BS EN 1997-2 (2007), BS EN ISO 22475-1 (2006) and other relevant related standards identified below. The fieldwork took place between 18 and 21 February 2020.

The desk study is presented as Volume 1. A geoenvironmental assessment based on close to surface samples only is presented as Volume 2. This report (Volume 3) presents the factual records of the fieldwork, monitoring and laboratory testing together with a geotechnical and geoenvironmental assessment based on the investigation findings. The information is also presented as digital data as defined in AGS (2017).

2 SITE SETTING

2.1 Location and Description

The site is located approximately 5 km east of Wrexham, to the south east of the Wrexham Industrial Estate, at National Grid Reference SJ386495, see Site Location Plan in Appendix A.

The site comprises a roughly rectangular shaped plot covering an area of approximately 0.3 hectares. The ground surface had been cleared by a backhoe excavator several months prior to the site work and as such was primarily topsoil, small ground level plants and long overgrown grass along the parameter of Oak Road. Some stockpiles of cleared vegetation was present within the site notably to the east of the overhead power cable, including evidence that mature trees had been



felled. The aerial photograph used in the Site Plan in Appendix A, shows substantial trees in the northern part of the site were present. These were being cleared during the Desk Study site visit in August 2019, see Volume 1 for more details.

The site boundary comprised a wooden bar fence along the west and south, a palisade fence along the northern boundary and palisade fencing and mature trees on the east boundary.

The site is generally level, with a gully (approximately 1.5 m deep) running roughly north west – south east from a roughly central location towards the south east corner of the site. At the west end of the gully there is a concrete service chamber cover, with a pipe exit on the eastern side. A pipe entry is shown on the north bank of the gully several metres away and these may have once been a single pipe but are now no longer connected. A rusted drum is located on the north side of the concrete service chamber. No identifying marks were apparent to indicate its origin or former content.

An electrical overhead line (OHL) crosses the site from north to south in the eastern part of the site, with an OHL tower located on site.

2.2 Published Geology and Previous Ground Investigations

2.2.1 Published Geological Information

The published geological map for the area, (BGS Sheet 122, 1967), and the BGS GeoIndex Onshore online viewer (2019) show the site located on Till comprising diamicton which is an unsorted and unstratified generally overconsolidated material deposited by glacial processes and typically consists of clay, sand, gravel and boulders. The underlying solid geology comprises Triassic Kinnerton Sandstone Formation (sandstone) on the east of the site and Permian and Carboniferous Salop Formation (mudstone, sandstone, conglomerate) on the west of the site.

Local BGS boreholes between 90 and 190 m to south and east record clay (Till) to a maximum depth of 32 m, overlying a sand layer proven to 34 m. Rockhead was not shown in any of the available BGS logs.



Localised areas of Made Ground are possible due to the development in the surrounding area and the realignment of Oak Road, although this is anticipated to be thin.

2.2.2 Previous Investigations

Both a desk study (Volume 1) and geoenvironmental assessment (Volume 2) have been carried out at this site. The desk study indicates a generally low geoenvironmental risk relating to the proposed end use. Geotechnical aspects indicate shallow Made Ground overlying Till, with groundwater anticipated to be within any granular lenses within the Till.

The on site history is summarised below :

- The earliest maps reviewed (1872/1873) record the site to be fields with an unnamed road running east to west central to the site area. A small pond is shown on the north west corner of the site. (no longer shown by 1897).
- By 1949 the road alignment on site now covers the south west corner only. Railway sidings are indicated on this map only as extending into the west of the site.
- By 1971/1972 the OHL is shown running north south through the east of the site.
- 1982 shows Oak Road in the current alignment along the southern site boundary. No further changes are noted up to the recent 2019 mapping.
- Not shown on the maps (due to security reasons) is an historic military site which is identified as including the site area. This was Royal Ordnance Factory (ROF) Wrexham and, between construction in January 1940 until the end of WWII when it was decommissioned, the site produced cordite. The site appears to have covered a large area, including the current Industrial Estate and surrounding area. Detailed maps of the site have not been located but there is no current indication that any structures were present within the site boundary. Many of the structures were demolished however anecdotal evidence indicates some buildings are still extant in the undeveloped local areas to the south of the site.

An historical features plan is presented in Appendix A showing selected on site features.

The sources identified within the Preliminary Risk Assessment (PRA) are :

- Potential localised Made Ground, including an unknown drum on site
- Off site electrical substation (78 m west)
- Off site infilled ponds within 250 m of the site boundary

The geoenvironmental assessment indicated that the ground surfacing on site does not contain contaminants that exceed the GAC for the commercial land use scenario, and the potential risk to workers for the majority of contaminations in the soil at the site is low. However a moderate risk for TPH contamination via direct contact is present. This related to potential contaminants from a rusted oil drum identified during the desk study.

3 FIELDWORK

3.1 General

The sampling locations were selected by SOCOTEC and set out from local features. The coordinates and ground levels of the positions were surveyed by SOCOTEC to National Grid and Ordnance Datum. The locations are shown on the Site Plan in Appendix A.

Positions were selected so as to be evenly distributed across the site, with a higher concentration within the area of the proposed development. The distribution of exploratory holes was also designed to maintain safe distances from the overhead power lines and gas mains. Subsequently on site, a number of the positions encountered obstructions and had to be moved.

3.2 Exploratory Holes

The exploratory holes are listed in the following table.

**TABLE 1 : SUMMARY OF EXPLORATORY HOLES**

TYPE	QUANTITY	DEPTH RANGE (m)	REMARKS
Cable Percussion Boring	2	10.00 to 12.70m	BH02 and BH03
Dynamic (Windowless) sampling	2	3.45 to 5.45m	WS03 and WS04
Hand dug inspection pits	14	0.45 to 1.20m	HDP01*, HDP01A*, HDP2*, HDP2A*, HDP3*, HDP4*, HDP4A*, HDP5*, HDP5A*, HDP06, WS1*, WS1A*, WS2* and BH01

* terminated due to obstructions and repositioned where possible

The exploratory hole logs are presented in Appendix B. These include descriptions of the strata encountered together with details of the equipment and methods used, sampling and field testing carried out, water depths and other field observations. Explanation of the terms and abbreviations used on the logs is given in the Key to Exploratory Hole Records in Appendix B, along with other explanatory information. Soil descriptions are in accordance with BS EN ISO 14688-1 (2018), and the guidance of BS 5930 (2015).

Standard penetration tests (SPT) in the boreholes and dynamic sampling holes were carried out in accordance with BS EN ISO 22476-3+A1 (2011) and the SPT hammer energy ratio certificates are included in Appendix B. The results are presented on the logs as uncorrected N values.

On completion of the fieldwork, geotechnical samples were transported to the Deeside office of SOCOTEC for temporary retention, with those required for testing being transferred to the SOCOTEC laboratory at Carcroft, near Doncaster. Geoenvironmental samples were transported from site directly to the SOCOTEC laboratory at Bretby, near Burton-on-Trent.

Photographs of the liners associated with the dynamic sampling are presented in Appendix F.

3.3 Groundwater and Gas Monitoring

Gas and groundwater monitoring instrumentation was installed in boreholes selected by SOCOTEC; details are shown on the logs and summarised in Appendix C. Records of monitoring carried out by



SOCOTEC after the fieldwork period are presented in Appendix C and summarised in the table below.

TABLE 2 : SUMMARY OF MONITORING

TYPE	QUANTITY	REMARKS
Gas and Groundwater Monitoring Visits	4	28 February, 10, 13 and 24 March 2020

3.4 Utility and Topographic Survey

An utility and topographic survey was undertaken by SOCOTEC prior to commencement of the intrusive ground investigation works, as shown on the drawing presented in Appendix A. The utility survey was carried out using electromagnetic and radar technology.

The utility survey plan shows the location of the several unidentified underground responses, which may be the gas mains indicated to be present on utility records provided by Conrad Energy. The survey also traced a water pipe which was visible in the gully in the centre of the site. It should be noted that a survey of this type cannot state categorically that other features are not present, and ground workers should therefore remain vigilant and adopt suitable precautionary measures during excavation works.

4 LABORATORY TESTING

4.1 Geotechnical Testing

Geotechnical laboratory testing was scheduled by SOCOTEC and was carried out in accordance with BS 1377 (1990). The testing is summarised below and the results are presented in Appendix D.

TABLE 3 : SUMMARY OF GEOTECHNICAL LABORATORY TESTING

TYPE	QUANTITY
Water Content Determination	9
Atterberg Limit Determination	9



TYPE	QUANTITY
Particle Size Distribution Analysis	9
pH, Total Sulphur, Acid and Water Soluble Sulphate Content of Soils	6
Unconsolidated Undrained Triaxial Compression Testing	4

4.2 Geoenvironmental Testing

Geoenvironmental laboratory testing was scheduled by SOCOTEC on selected soil samples recovered during the fieldwork. The testing is summarised in the table below and the results are presented in Appendix E.

TABLE 4 : SUMMARY OF GEOENVIRONMENTAL LABORATORY TESTING

TYPE	QUANTITY
Soil contamination suite	11
Leachate suite	4

5 GROUND CONDITIONS AND GROUNDWATER

5.1 Strata Encountered

Descriptions of the strata encountered are given on the exploratory hole records. The downward succession encountered is broadly uniform across the majority of the site, as summarised in Table 5 below and shown on the geological cross-section presented as Section Line 1 in Appendix A. However, the south west corner of the site encountered shallow obstructions in all exploratory holes, see the Site Plan with Obstructions A5 in Appendix A and Table 6 below. As such the thickness of Made Ground and the underlying natural material are not confirmed in this area.

TABLE 5 : SUMMARY OF GROUND CONDITIONS

STRATUM	TOP DEPTH (M)	THICKNESS (M)	REMARKS
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STRATUM	TOP DEPTH (M)	THICKNESS (M)	REMARKS
Made Ground	Ground Level	0.80 to 1.50	Encountered in all exploratory holes. BH01, WS01, WS01A, WS02 and HDP01 to HDP06 terminated in Made Ground.
Glacial Till	0.80 to 1.50	Penetrated for max of 12.70. Base not proven	Encountered in BH02, BH03, WS03 and WS04. Top at 29.57 to 29.88 mOD, maximum penetration to 18.25 mOD.

TABLE 6 : SUMMARY OF OBSTRUCTIONS

HOLE ID	DEPTH (M)	DEPTH (MOD)	MATERIAL
HDP01	0.45	30.18	Concrete
HDP01A	0.45	30.18	Concrete
HDP02	0.50	30.13	Concrete
HDP02A	0.50	30.13	Concrete
HDP03	0.50	30.04	Concrete
HDP04	0.35	30.12	Macadam
HDP04A	0.35	30.12	Macadam
HDP05	0.75	29.69	Concrete
HDP05A	0.70	29.74	Concrete
WS01	0.65	29.85	Concrete
WS01A	0.65	29.86	Concrete
WS02	0.70	29.80	Concrete

As can be seen in the above table, the obstructions were encountered around 30 mOD. Taking in conjunction with the A5 plan, and the location of previous roads on the site (see Volume 1 and Section 2.2.2 of this report), it is possible these indicate the previous road construction is still present on site. The historic features plan in Appendix A shows the approximate location of the previous roads across the site.

5.2 Made Ground

The term Made Ground has been used in this report in the traditional sense of describing any anthropogenic (man-made) material, rather than specifically for non-engineered material.



The ground surface material predominantly comprises a cohesive layer of brown locally orange sandy gravelly clay with rare rootlets and roots (up to 50 mm dia.) and rare cobbles of concrete. The field consistency of the material is generally soft, becoming firm with depth. The gravel includes man-made fragments, including brick, ceramic and concrete.

In the north-west corner of the site (HDP05 and HDP05A) the surface material consists of brown silty gravelly sand, underlain by brown gravel of mudstone and concrete. At several locations (see Table 6) further penetration was obstructed by concrete and macadam within inspection pits, as discussed above, see Site Plan with Obstructions in Appendix A.

A granular layer of variable thickness comprising yellowish grey sand and gravel of quartzite, brick and limestone was identified in two holes (BH03 and WS03) between 0.50 and 1.00 m depth.

Three Atterberg limit determinations measured liquid limits of between 39 and 51 %, plastic limits between 21 and 24 % and plasticity index values of 18 to 28 %. These results indicate that the materials tested comprise clays of medium to high plasticity, see Plasticity Chart Figure 1. Natural moisture contents range from 21 to 22 % and are around the plastic limit value, see Figure 2.

The fine grained nature of the majority of the Made Ground encountered means they will be susceptible to potential shrinkage and swelling in response to moisture content changes. Based on the Standard 'Building near trees', published by the National House Building Council (NHBC, 2018), the plasticity index values indicate that the materials may be considered as having a low to medium volume change potential.

5.3 Glacial Till

The Glacial Till comprises predominantly slightly sandy slightly gravelly clay. The consistency of the clay in the two cable percussive holes (BH02 and BH03) which are located centrally on the site, is soft to firm at shallow depth and becomes stiff below around 2 m. In the two window sample holes, which are located closer to the northern perimeter, the clays have a generally firm to stiff consistency, becoming very stiff below 2 m.

Six Atterberg limit determinations measured liquid limits of between 46 and 56 %, plastic limits between 21 and 24 % and plasticity index values of 24 to 32 %. These results indicate that the

materials tested comprise clay of a medium to high plasticity (see Plasticity Chart Figure 1). Natural moisture contents range from 17 to 26 %, and are generally around the plastic limit value, see Figure 2.

The plasticity index values indicate that the materials may be considered as having a medium volume change potential (NHBC, 2018).

Nineteen SPTs carried out in the Glacial Till gave N60 values of between 11 and 46 (N values between 9 and 40), with an indication of a slight increase in strength with depth see Figure 3. These results are indicative of medium to high strength material, see Figure 4.

Four unconsolidated undrained triaxial tests measured undrained shear strengths of between 107 and 195 kPa, indicating high to very high strength, see Figure 4.

5.4 Groundwater

Groundwater entry was observed within the Made Ground in WS03 at 1.20 m, rising to 1.10 m after 20 minutes. Seepages were observed within the Made Ground in HDP01 and HDP04 at 0.45 m and 0.30 m respectively. The other holes were noted as dry, although these observations do not necessarily indicate an absence of groundwater due to the short duration over which the holes were open.

The results of the groundwater monitoring carried out in the installations during February and March 2020 and are summarised in Table 7.

TABLE 7 : SUMMARY OF INSTALLATIONS AND MONITORING

HOLE ID	RESPONSE ZONE (M)	GROUNDWATER DEPTH (M)	STRATUM	REMARKS
BH02	0.50 to 1.00	Dry	Made Ground	Pipe dropped to 1.30m and crosses strata boundary. On first visit base of borehole damp, dry on other visits. No water encountered during drilling
BH03	3.00 to 5.00	0.68 to 0.73	Glacial Till	No water encountered during drilling
WS03	1.20 to 2.20	0.00 to 0.21	Glacial Till	Groundwater at surface on two visits.
WS04	2.00 to 3.00	1.33 to 1.40	Glacial Till	No water encountered during drilling



Groundwater readings indicate shallow groundwater, though it is worth noting the monitoring occurred during the winter period and water levels may be different at other times of the year.

The groundwater information obtained should not be regarded as necessarily indicative of longer term equilibrium conditions. It will be appreciated that seasonal fluctuations in groundwater level occur, and that variation in levels may also occur in response to other effects such as tidal influence, groundwater abstraction/recharge, construction dewatering, etc.

6 PROPOSED WORKS

From information and the most recent development plan provided by Conrad Energy it is understood that the proposed development will comprise a small scale flexible fuelled power generation project.

This will include but is not limited to the following:

- Gas engines (4 to 6 No.) adjacent to associated transformers.
- Oil Tanks
- Amenity Buildings
- Gas Kiosk
- Ecological mitigation area along the route of the OHL across the site.

On the current version of the plan, WXM-GA-01 Rev G (28 May 2020), presented in Appendix A, all of the proposed development is on the west side of the OHL route. An underground storage tank is shown on Rev G. From information provided by Conrad Energy (June 2020) the detailed design is not yet confirmed. The tank is a form of a bund for the transformer to safely store any oil. No further details are available and as such no foundation considerations have been made.



7 GEOTECHNICAL ENGINEERING ASSESSMENT

7.1 Foundations

7.1.1 General

No structural loads have been provided by the client for this particular project. However, based on previous works for Conrad Energy on similar projects the plant items are likely to be reasonably light, situated on concrete slabs, and any structures are assumed to be single storey and lightly loaded. The gas engines are assumed to comprise the most critical components, and a potential bearing pressure beneath the concrete slabs on which these will be constructed has been estimated as follows:

- Gas engine dimensions (footprint) = 4 x 18 m
- Possible slab dimensions = 4 x 22 m = 88 m²
- Assumed generator load (<65000 kg) = <650 kN
- Theoretical average bearing pressure = $650/88 = 7.5 \text{ kN/m}^2$ (or kPa)

It should be recognised that while the bearing pressure calculated above is relatively small, localised actual bearing pressures may be higher, depending on load distribution of the generator unit itself and the soil – foundation interaction arising from the foundation and the ground strength. Any variation in the gas engine weight assumed above should also be taken into account when calculating the actual bearing pressure applicable in this instance.

It is also emphasised that only static loads are being considered in this assessment. The possible effects of dynamic loading are beyond the scope of this report.

7.1.2 Ground Conditions

The Made Ground encountered at the site is assessed as comprising predominantly soft clays, becoming firm with depth, and with lateral variations (for example an area of predominantly granular materials in the north-west part of the site). The Made Ground is of unknown origin, but has likely been placed to provide a level working area at the edge of the industrial estate, with minimal (if any)



engineering control in terms of material selection, placement and compaction. Due to its generally poor geotechnical properties, and its unpredictable variability, the Made Ground is considered to be unsuitable as a load bearing stratum for foundations to structures.

Glacial Till is present beneath the Made Ground at the north end of the site, at approximately 0.8 to 1.5 m depth (29.57 to 29.88 mOD), see Cross Section Line 1. These natural materials are generally of higher strength and lower compressibility than the Made Ground, and should be suitable for foundation purposes. However, due to the volume change potential of these fine grained soils, the former presence of vegetation on the site (which included some mature trees) is considered to be a significant factor that will influence foundation type and depth. This is discussed in more detail below. The south west corner of the site encountered obstructions in multiple locations, as discussed in Section 5. As such in this area of the site we are unable to confirm the thickness of the obstructions, or the underlying ground conditions. At this stage it is assumed that the natural material beneath the south west of the site is likely to be similar to that in the northern part of the site. Should the ground conditions be significantly different across the site then foundations in this area may need to be redesigned. It should be considered that any investigation in this area would need to take into account the gas mains indicated trending north south and east west.

7.1.3 Foundations

A shallow foundation solution would comprise founding within the natural Glacial Till. As discussed above the recent presence of mature trees on the site indicates the volume change potential of the soil needs to be taken into account.

Foundations to all permanent structures should take account of the effects of soil desiccation caused by previous or existing trees. The NHBC standard makes recommendations in terms of minimum foundation depths based on :

- soil type (ie volume change potential) - the Glacial Till is considered to have a medium volume change potential.
- distance of trees from foundations – in the northern part of the site this would be close to 0 m, based on aerial photo images.



- tree types and heights when removed – both deciduous and broad leaf trees appear to have been present, with heights estimated around 15 to 20 m. These would indicate a high water demand. The zone of tree influence is estimated to be 1.25 x mature height, which in the case of the conifer previously central to the site would indicate approximately 23 m zone of influence, per tree.

Based on the above parameters, the area of the site closest to the previous trees indicates a minimum foundation depth exceeding 2.5 m. Greater than 10 m from the nearest tree the minimum foundation depth would reduce to around 1.3 m.

A typical foundation for the gas engines would be that they would be on concrete slabs supported by shallow strip foundations. An alternative would be a raft type foundations supported by a layer of non-shrinkable granular fill. The thickness of the fill would be related to the minimum foundation depth recommendations mentioned above. However, this is not deemed viable if the minimum foundation depths are greater than 2.5 m. If such depths are appropriate it might be more cost effective to use a raft of short piles.

7.2 Excavations

Any shallow excavations required into the Made Ground and underlying natural deposits would generally be within the scope of conventional backhoe excavators, although pneumatic tools or breakers may be required to assist in the excavation of the macadam and concrete obstructions that were encountered in several locations in the southern and western areas of the site (see Site Plan with obstructions in Appendix A). These obstructions were encountered at depths ranging from 0.35 to 0.75 m. However, as they could not be penetrated by the investigation plant, their thickness has not been confirmed. The materials in excavations should be exposed for as little time as is practicable in order to minimise the risk of softening, particularly where water is present.

Available groundwater information suggests that shallow excavations open for a short period of time are likely to be subject to groundwater ingress, though rates would be expected to be low due to the predominantly cohesive/fine soils present. Dealing with these should be manageable by local sump pumping.



It should be noted that the side stability of excavations may be relatively poor in the lower strength materials, requiring suitable support or being cut to an appropriate batter angle. An appropriate risk assessment should be undertaken for all excavations that may require man entry, with slopes and support designed accordingly.

7.3 Chemical Considerations for Buried Concrete

Six soil samples, recovered from between 0.20 and 2.45 m, were tested for pH, total sulphur, water soluble and acid soluble sulphate content. The test results are summarised in Table 7, together with the assessed Design Sulphate (DS) and Aggressive Chemical Environment for Concrete (ACEC) in following the approach of BRE Special Digest 1 (2005). The site has been considered as brownfield with pyrite and mobile groundwater, as the most conservative situation. The recommendations in the BRE digest should be followed for the design of subsurface concrete.

TABLE 8 : DS AND ACEC ASSESSMENT

No of results	RANGE OF TEST VALUES				CALCULATED VALUES			DESIGN SULPHATE CLASS	ACEC CLASS
	Acid Soluble Sulphate (%)	Total Sulphur (%)	pH	Water Soluble Sulphate (mg/l)	Total Potential Sulphate (TPS % SO ₄)	Oxidisable Sulphides (OS % SO ₄)	Pyrite probably present?		
3 Made Ground results	0.04 to 0.09	0.06 to 0.08	8.1 to 8.4	21 to 155	0.25 Highest value	0.19 Highest value	No	DS-1	AC-1
3 Glacial Till results	0.02 to 0.04	0.03	8.5 to 9.0	73 to 109	0.11 Highest value	0.07 Highest value	No	DS-1	AC-1

8 GEOENVIRONMENTAL ASSESSMENT

8.1 Summary of Conceptual Site Model

In line with existing legislation and the current regime for the management of contaminated land, assessments are undertaken using a risk based approach. It is necessary to define a Conceptual



Site Model (CSM) for the site which identifies the potential sources of contamination, the receptors and the pathways that can connect them. In order for there to be a risk from contamination, one or more relevant pollutant linkages must exist, connecting a contamination source, a receptor (an entity which might be affected by the contamination) and a pathway (or mechanism) by which the receptor can be exposed to the contaminant.

A Desk Study was previously published for this site (SOCOTEC Report number F9042-19/1 Volume 1, 2019) which has been used to identify the likely contaminants, their sources and their spatial distribution across the site with respect to the current assessment. A contaminated land report (SOCOTEC Report number F9042-19/2, Volume 2) covered surface samples tested on site. The analysis from this volume is also covered below.

It is understood that the proposed development will comprise the installation of a gas engine and associated plant, see Section 6.

8.1.1 Summary of Potential Sources

The Preliminary Risk Assessment and CSM from the Desk Study indicates there is a low to moderate risk from Made Ground and historical site uses. A summary of the potential sources is presented in Table 9.

TABLE 9 : POTENTIAL SOURCES OF CONTAMINATION

SITE USE / ACTIVITY AND AREA	SOURCES	CONTAMINANTS
Underlying services and other general Made Ground; small historical pond on site; former ROF cordite factory	Potential for localised made ground.	Heavy metals and metalloids, oil/fuel, hydrocarbons, polycyclic aromatic hydrocarbons (PAHs), asbestos
Offsite infilled ponds located within 250 of the perimeter of the site.	Organic rich infill potentially generating ground gases.	Gases including methane and carbon dioxide.
Electrical substation located approximately 78 m to the west.	Leaching and migration of contaminants.	PCB's.
On site historic railway sidings	Potential for localised made ground.	Heavy metals and metalloids, oil/fuel, hydrocarbons, polycyclic aromatic hydrocarbons (PAHs), asbestos



On site OHL tower	Leaching of contaminants.	PCB's.
Unidentified drum on site	Leaching of contaminants.	Unknown.
Offsite industrial sites and landfills within 250 m of the perimeter of the site	Potential for localised made ground.	Heavy metals and metalloids, oil/fuel, solvents, hydrocarbons, polycyclic aromatic hydrocarbons (PAHs), asbestos

8.1.2 Potential Pathways and Receptors

To develop a further understanding of the potential risks posed by contaminants to human receptors, the pathways through which contaminants may impact sensitive receptors need to be identified. The following were identified in the Desk Study as potential migration pathways:

- Direct soil, soil dust and/or water ingestion.
- Inhalation of soil dust, soil vapour and/or water vapour.
- Dermal contact with contaminated soil, soil dust and/or water.
- Lateral and vertical migration of gases and/or vapours through permeable strata.
- Permeable ground conditions/rainfall infiltration.
- Leaching of contaminants from soils into soil pore water and shallow groundwater.
- Downward migration of soil pore water and shallow groundwater.
- Lateral groundwater flow.
- Preferential pathways including existing and proposed service trenches.
- Surface water runoff into drains.
- Permeation through /into potable water pipes (if present on site) followed by direct contact and /or ingestion of contaminated water.
- Ground gas migration and ingress into buildings

SOCOTEC understands that the proposed infrastructure developments at the site are not intended to be used as a workplace in the long term, and will only be frequented by construction and maintenance workers over short periods of time, hence the following have been identified as potential human receptors:

- Construction workers.



- Current and Future site users
- Maintenance workers.
- Built environment

Controlled waters receptors include the following:

- Glacial Till is a Secondary (Unproductive) Aquifer
- Kinnerton Sandstone is a Secondary A Aquifer
- Unnamed brook 65 m to the south, and may be in a culvert
- Zone III Source Protection Zone 33 m south west and Zone II 85 m south west;

8.2 Human Health Risk Assessment

8.2.3 Technical Approach

In accordance with Environment Agency guidance CLR 11, Model Procedures for the Management of Land Contamination, (EA, 2004), human health risk assessment follows a tiered approach. The first tier ordinarily comprises a Preliminary Risk Assessment, completed as part of the aforementioned desk study. Following the ground investigation, the Preliminary Risk Assessment has been further developed below into an updated Conceptual Site Model.

Further tiers of risk assessment include Generic Quantitative Risk Assessment (GQRA) and Detailed Quantitative Risk Assessment (DQRA), which use data derived from the ground investigation and known details about the proposed use of the site to assess risks to identified receptors. The assessment included in this report comprises a GQRA, which is undertaken by comparing soil contaminant concentrations with conservative Generic Assessment Criteria (GAC).

Generic Assessment Criteria (GAC) for various land use and exposure scenarios have been selected from the following sources:

- CL:AIRE Category 4 Screening Levels (C4SL);
- LQM Suitable for Use Levels (S4UL); and
- CL:AIRE/EIC/AGS GAC



The GAC have been derived using the Environment Agency Contaminated Land Exposure Assessment (CLEA) model, for a range of land uses and exposure scenarios, including:

- Residential with the consumption of homegrown produce;
- Residential without the consumption of homegrown produce;
- Commercial;
- Allotments;
- Public Open Space near residential housing (POSresi); and
- Public Open Space public park scenario (POSpark)¹

Provisional C4SL values for a total of six priority substances (arsenic, benzene, benzo(a)pyrene, cadmium, hexavalent chromium and lead) were produced by CL:AIRE, and published in December 2013. A policy companion document was published by DEFRA in March 2014, which confirmed the final C4SL for these determinants.

The final C4SL values are considered to represent 'relevant technical tools', as per paragraph 4.21(c) of the Contaminated Land Part IIA Statutory Guidance. Their purpose is to identify land that falls within Category 4 (Human Health) as defined by the Statutory Guidance, i.e. land that is definitely not Contaminated Land as defined by the Part IIA legislation.

It should be noted that the C4SLs have been derived using toxicological criteria that are presented as posing a 'low level of toxicological concern'. This is in comparison with previous Soil Guidelines Values (SGVs) and LQM GAC, which were derived using toxicological criteria that represent a 'minimal risk' to human health.

The LQM Suitable for Use Levels (S4ULs) have been derived in accordance with the changes in exposure modelling presented within the C4SL framework, whilst still using a set of toxicological criteria that are set within the 'minimal risk' range. The S4ULs were published to offer a set of collated information on the toxicity and transport properties for a number of common contaminants, and should be seen as suitable for use in planning and change of use assessments, as well as Part IIA assessments.

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The CL:AIRE/EIC/AGS Generic Assessment Criteria were published in December 2009. Assessment criteria were produced using the CLEA model for a total of 35 No. less common contaminants, in accordance with the CLEA guidance. The GAC were intended to compliment the SGVs produced by the Environment Agency, and the LQM GAC that were current at the time. These have been used in the assessment for contaminants where S4ULs and C4SLs are not available.

The SOCOTEC approach to human health risk assessment in reuse assessments is to use the various assessment criteria in the following order of preference: S4UL > EIC GAC > C4SLs. Note that for some contaminants this will not be possible, for example lead has a C4SL but not an S4UL or a EIC GAC.

Where contaminants fail the initial screen against S4UL or EIC GAC, a further assessment may be possible by screening against C4SLs. Where this is undertaken it should be clearly understood that the C4SLs represent 'low risk' rather than 'minimal risk' GAC.

SOCOTEC understands the proposed development will comprise the installation of a gas engine and associated infrastructure. Therefore, it is considered that Commercial land use GAC are the most appropriate assessment criteria.

8.3 Human Health Generic Quantitative Risk Assessment

8.3.4 In Situ Soils

A total of eleven soil samples were analysed for a range of brownfield contaminants. The maximum recorded concentrations of contaminants in the in situ soil samples obtained have been primarily compared with Commercial GAC (adjusted for 1.0% SOM).

TABLE 10 : COMPARISON OF MAXIMUM MEASURED CONCENTRATIONS WITH COMMERCIAL GAC

DETERMINAND	MAXIMUM MEASURED CONCENTRATION (mg/Kg)	GENERIC ASSESSMENT CRITERION (GAC) (mg/Kg)	NO. OF RESULTS EXCEEDING GAC (NO. OF TESTS IN BRACKETS)
Metals & semi- metals			



Arsenic	12.5	640	0 (11)
Cadmium	1.2	190	0 (11)
Chromium III	48.1	8600	0 (11)
Chromium VI	0.2	33	0 (11)
Copper	189.6	68000	0 (11)
Lead ¹	235.2	2330	0 (11)
Mercury ²	<0.5	1100	0 (11)
Nickel	53.5	980	0 (11)
Selenium	<0.5	12000	0 (11)
Zinc	638.8	730000	0 (11)
Polycyclic Aromatic Hydrocarbons			
Acenaphthene	0.5	84000	0 (11)
Acenaphthylene	1.04	83000	0 (11)
Anthracene	1.71	520000	0 (11)
Benzo(a)anthracene	5.05	170	0 (11)
Benzo(a)pyrene	5.12	35	0 (11)
Benzo(b)fluoranthene	6.46	44	0 (11)
Benzo(g,h,i)perylene	2.5	3900	0 (11)
Benzo(k)fluoranthene	2.13	1200	0 (11)
Chrysene	4.84	350	0 (11)
Dibenzo(a,h)anthracene	0.79	3.5	0 (11)
Fluoranthene	8.07	23000	0 (11)
Fluorene	1.07	63000	0 (11)
Indeno(1,2,3,c,d)pyrene	3.2	500	0 (11)
Napthalene	0.22	190	0 (11)
Phenanthrene	4.48	22000	0 (11)
Pyrene	6.84	54000	0 (11)
Total Petroleum Hydrocarbons and BTEX			
TPH (C6-C40)	155	N/A	N/A
GRO C8-C10 ³	<2.70	7800	0 (11)
TPH >EC10-C12 ³	<2.70	9700	0 (11)
TPH >EC12-16 ³	4.07	36000	0 (11)
TPH >EC16-21 ³	35.9	28000	0 (11)
TPH >EC21-35 ³	8.66	28000	0 (11)
Other Compounds			
Asbestos	No asbestos identified in sample	Asbestos detected	0 (11)



Phenol (total)	<0.7	760	0 (11)
Cyanide (total)	<0.7	157	0 (11)
pH (range of results, pH units)	7.5 to 9	N/A	N/A

¹C4SL²GAC for Inorganic Mercury used³Most conservative aliphatic/aromatic GAC used

Eight Made Ground and three natural strata samples were tested as part of the contamination assessment. As highlighted in Table 10 none of the chemical contaminants exceeded the GAC for commercial land use. Eight Made Ground samples were analysed within the Volume 2 report, none of the chemical contaminants presented in the Volume 2 report exceeded the GAC for the commercial land use.

No asbestos containing materials were identified in any of the samples tested.

8.4 Risk to Site Users

As highlighted in Table 10, concentrations of the chemical contaminants have not been recorded in excess of their GAC for a commercial land use scenario, indicating that the site soils will not pose an unacceptable risk to future site users from these contaminants.

8.5 Risk to Construction and/or Maintenance Workers

The CLEA model cannot be used to assess the acute risks to construction and/or maintenance workers from soil contamination. CLEA only deals with chronic long term risks.

In order to assess potential risks to these workers reference has been made to the thresholds for hazardous waste (EA, 2011). Soils with concentrations of hazardous contaminants (e.g. harmful, toxic, carcinogenic) above certain thresholds are classified as hazardous for disposal. These types of contaminated soils would potentially pose a risk to construction and/or maintenance workers. No asbestos was detected in any of the samples tested.

Based on the chemical analysis results in Section 8.3, the levels of the majority of contaminants in the soil at the site are such that they are unlikely to pose a hazard to construction and/or



maintenance workers. However, it is considered that TPH contamination in the vicinity of ES7 (Volume 2) could pose a moderate risk via direct contact, ingestion/inhalation of soil particles.

A TPH interpretation of the gas chromatographic data was scheduled on the ES7 sample following completion of the main analysis and this indicated mineral oil in the range nC18-nC40+.

Contact with soil should be avoided and standard site hygiene procedures should be implemented, such as wearing gloves and overalls and providing adequate washing facilities. Eating, drinking and smoking should be banned in the working areas to prevent inadvertent ingestion of the soil.

8.6 Technical Approach to Controlled Water Risk Assessment

The assessment of risks to controlled waters follows guidance provided by the EA (Remedial Targets Methodology, Hydrogeological Risk Assessment for Land Contamination (2006)) and DEFRA in the Contaminated Land (England) Regulations 2006 (SI 2006/1380) and consolidated regulations.

The nearest named surface water receptor to the site is the unnamed brook approximately 65 m to the south. The site is located upon superficial deposits that are classified as a Secondary A (Unproductive) Aquifer (Glacial Till). For the purpose of this assessment, the concentrations of potential contaminants in the leachate samples collected from the site have been compared to relevant fresh water Environmental Quality Standards (EQS) and United Kingdom Drinking Water Standards (UKDWS) where available.

8.7 Leachate Screening

Leachates were prepared from four soil samples, three Made Ground and one natural ground. Leachate preparation was completed in accordance with National Rivers Authority (NRA) R&D Note 301. The chemical analysis results are summarised in Table 11 together with relevant EQS and UKDWS values.



TABLE 11 : COMPARISON OF MAXIMUM MEASURED CONCENTRATIONS FROM SOIL LEACHATE

DETERMINAND	MAXIMUM MEASURED CONCENTRATION (ug/l)	EQS (ug/l)	NO. OF RESULTS EXCEEDING EQS (NO. OF TESTS IN BRACKETS)	UKDWS (ug/l)	NO. OF RESULTS EXCEEDING UKDWS (NO. OF TESTS IN BRACKETS)
Metals & semi- metals					
Arsenic	1	50	0 (4)	10	0 (4)
Cadmium	0.05	0.08	0 (4)	5	0 (4)
Chromium	1	4.7	0 (4)	50	0 (4)
Chromium VI	<3	3.4	0 (4)	50	0 (4)
Copper	5	1	2 (4) BH03 1m, HDP02 0.2m	2000	0 (4)
Lead	2	1.2	1 (4) HDP02 0.2m	10	0 (4)
Mercury ²	<0.03	0.07	0 (4)	1	0 (4)
Nickel	2	4	0 (4)	20	0 (4)
Selenium ¹	<1	-	n/a	10	0 (4)
Zinc	7	10.9	0 (4)	-	n/a
Polycyclic Aromatic Hydrocarbons					
Acenaphthene	0.04	-	n/a	-	n/a
Acenaphthylene	0.04	-	n/a	-	n/a
Anthracene	<0.01	0.1	0 (4)	-	n/a
Benzo(a)anthracene	<0.01	-	n/a	-	n/a
Benzo(a)pyrene	<0.01	0.00017	4 (4) 4nr <LOD	0.01	0 (4)
Benzo(b)fluoranthene	<0.01	0.00017	4 (4) 4nr <LOD	0.1	0 (4)
Benzo(g,h,i)perylene	<0.01	0.00017	4 (4) 4nr <LOD	0.1	0 (4)
Benzo(k)fluoranthene	<0.01	0.00017	4 (4) 4nr <LOD	0.1	0 (4)
Chrysene	<0.01	-	n/a	-	n/a
Dibenzo(a,h)anthracene	<0.01	-	n/a	-	n/a
Fluoranthene	<0.01	0.0063	4 (4) 4nr <LOD	-	n/a
Fluorene	<0.01	-	n/a	-	n/a
Indeno(1,2,3,c,d)pyrene	<0.01	0.00017	4 (4) 4nr <LOD	0.1	0 (4)
Napthalene	0.11	22.4	0 (4)	-	n/a
Phenanthrene	<0.01	-	n/a	-	n/a
Pyrene	<0.01	-	n/a	-	n/a



Other Compounds					
Cyanide (free)	<20	1	4 (4) *4nr <LOD	50	0 (4)
Phenol	<50	7.7	4 (4) *4nr <LOD	50	0 (4)
LOD = laboratory limit of detection ³ Most conservative aliphatic/aromatic GAC used					

In addition to the above, recordable concentrations of the following contaminant were recorded above the laboratory detection limit in the leachate samples analysed

- TPH C12-16 10 and 20 ug/l (BH03 1.00 m, HDP02 0.20 m and WS3 1.00m)

Concentrations of the remaining individual TPH bandings were recorded below the laboratory limit of detection (LOD) in the leachate samples analysed.

8.8 Risks to Controlled Waters

Comparison of the analysis results in Table 11 indicate that concentrations of a number of determinants in soil leachate samples analysed have been detected above controlled water EQS. These are summarised in Table 12 below.

TABLE 12 : SUMMARY OF SOIL LEACHATE EXCEEDING EQS

CONTAMINANT	REMARKS	RISK LEVEL
Copper	Two samples (BH03 1.00 m, HDP02 0.20 m) exceeded EQS. Soil concentrations recorded as low, as such unlikely that a source is present on site.	Low
Lead	1 sample (HDP02 0.20 m) marginally exceeded EQS. Soil concentrations recorded as low, as such unlikely that a source is present on site.	Low
Phenol	All four leachate concentrations recorded below LOD. Soil concentrations are also recorded below LOD, as such it is considered unlikely that a source is present on site.	Low



Cyanide	All four leachate concentrations recorded below LOD. Soil concentrations are also recorded below LOD, as such it is considered unlikely that a source is present on site.	Low
PAH (various)	All four leachate concentrations recorded below LOD for six analytes. Soil concentrations recorded as low, as such unlikely that a source is present on site.	Low

LOD = Limit of detection

Potential risks to controlled water receptors will be dependent upon the end development. It is understood that the development area will comprise a gas engine, associated buildings and hardstanding. The presence of cohesive Made Ground and natural deposits (Glacial Till) beneath the site will also help to mitigate the vertical and lateral migration of leachate /shallow groundwater towards the nearby surface watercourse. On this basis, and given the distance to nearest surface water receptor (65 m), the risk of site derived substances impacting it is considered to be low. It is also possible that surface water could transmit leached contaminants directly to the brook, however, hardstanding would break this pathway. Likewise, the fact that none of the soil leachate concentrations exceeded any of the UK DWS combined with the presence of low permeability Glacial Till below the site indicates that the risks to groundwater in the Superficial and bedrock aquifers and nearby SPZ is considered to be low to very low, respectively.

8.9 Site Conceptual Model

In Section 8.2 potential sources of contamination, pathways and receptors were identified for the site based on the available information. These potential pollutant linkages constituted the preliminary conceptual model for the site.

The results of the ground investigation have been used to refine the conceptual model and to define the specific source-pathway-receptor pollutant linkages for the site based on the proposed development.

TABLE 13 : SUMMARY OF SOURCE-PATHWAY-RECEPTOR POLLUTANT LINKAGES

SOURCE	PATHWAY	RECEPTOR
--------	---------	----------



Soil leachate contamination (heavy metals, cyanide, phenol and individual PAH compounds)	• Surface Water Runoff	• Surface water drainage and drains • Unnamed Brook • Superficial deposits aquifers
	• Leaching and downward migration	
	• Lateral Groundwater Migration	

8.10 Remediation Recommendations

The chemical analysis of the two phases of soil testing indicates that the majority of contaminants are not present at concentrations which could pose an unacceptable risk to construction workers or future end users of the site. On the basis of the current investigation and risk assessment, no specific remedial measures are deemed necessary to mitigate potential contamination risk to future site end users for the majority of the site. The exception was an elevated concentration of TPH in the soil sample in ES7 at 0.10 m (see Volume 2 report) which whilst it did not exceed the Commercial end use GAC was elevated when compared to the rest of the site. Where excavation work is to be carried out in the vicinity of ES7, then contact with soil should be avoided and standard site hygiene procedures should be implemented, such as wearing gloves and overalls and providing adequate washing facilities. Eating, drinking and smoking should be banned in the working areas to prevent inadvertent ingestion of the soil.

Asbestos has not been detected in any of the soil samples tested.

There is considered to be a low risk to controlled waters from concentrations of heavy metals, cyanide, phenol and individual PAH compounds detected in the leachate samples from the site.

Due to the limited nature of all site investigations, there always remains the possibility that pockets of previously undiscovered contamination may be encountered during the development. If any unusual or fibrous materials or signs of contamination spillages are found during the works the area should be fenced off and advice sought on the nature of the possible contamination.

9 GROUND GAS ASSESSMENT

For the assessment of sites, in terms of the potential for ground gas to present a hazard, the risk based methodology detailed in CIRIA Report C665 (2007) is used. This is primarily based on the



method of characterising a site as proposed by Wilson and Card (1999). The method is predominantly centred on a conceptual model which relates possible sources of gas to likely receptors via potential pathways.

As discussed within the Desk Study localised Made Ground could be a source of gas generation. However, the generally fine soil ground conditions lower the likelihood of the presence of any pathways capable of conveying ground gas from external sources to within the site area.

Three monitoring visits were carried out during February and March 2020 following the main investigation fieldworks, for measurement of gas and groundwater levels within the installed standpipes. The results are summarised in Table 14 below. Gas concentrations were generally close to atmospheric conditions, with the levels of potentially hazardous gases very low or below the equipment detection limit. The measured gas emission flow rates were close to zero, with the exception of one high result on BH02.

Due to the high groundwater levels present, the gas monitoring data for BH03, WS03 and WS04 may be unreliable as the groundwater level was above the top of the response zone. However, the results are similar to BH02, which did not have shallow groundwater.

The gas risk is assessed by considering both the concentration of gas and the emission rate, in terms of a Gas Screening Value (GSV). This is defined as the gas concentration multiplied by the gas flow, the worst case scenario from the monitoring data being established using the maximum of each. Based on the information available, although gas concentrations for carbon dioxide were slightly elevated, the measured flow rates had an overall range of <0.1 to 25.5 l/hr, see Table 14, but typically no more than 0.8 l/hr. The calculated GSV, based on combinations of gas concentrations and flow, is therefore less than the 0.07 l/hr value defining the upper limit of Characteristic Situation 1 in the CIRIA guidance. This is normally associated with natural soils and 'typical made ground' and is considered as very low risk. As such, no special precautions are likely to be required.

**TABLE 14 : SUMMARY OF GAS MONITORING**

DETERMINAND	UNITS	MAXIMUM CONCENTRATIONS		REMARKS
		Min	Max	
Methane, CH ₄	% vol	ND	ND	
Oxygen, O ₂	% vol	19.0	26.9	
Carbon Dioxide, CO ₂	% vol	0.1	2.2	
Carbon Monoxide, CO	ppm	ND	5	
Flow	l/hr	ND	25.5	Generally ND to 0.8 l/hr
Atmospheric Pressure	mbar	997	1027	
Peak and steady readings recorded, highest value used within the table above.				
ND = Not Detected (recorded as 0.0, below gas box level of detection)				



10 REFERENCES

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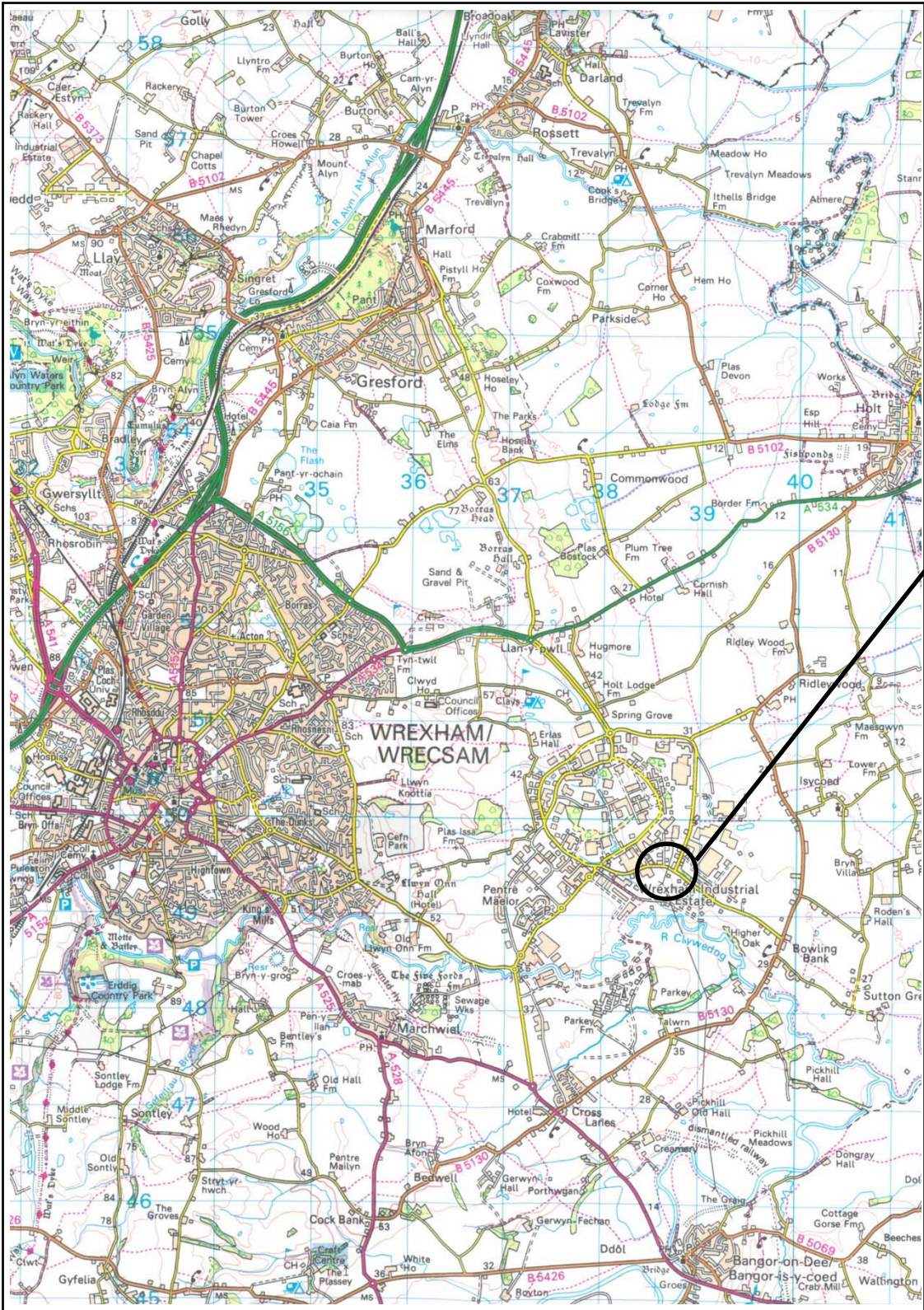


APPENDIX A

FIGURES AND DRAWINGS

Site Location Plan	A1
Site Plan	A2
Section Line Plan	A3
Section Line	Section Line 1
Historic Features Plan	A4
Site Plan with Obstruction Locations	A5
Plasticity Chart	Figure 1
Moisture Content and Atterberg Limits Profile	Figure 2
SPT N Depth Profile	Figure 3
Undrained Shear Strength Profile	Figure 4
Proposed Site Plan	WXM-GA-01 Rev E
Utility Drawing	L9090Util

Site Location Plan

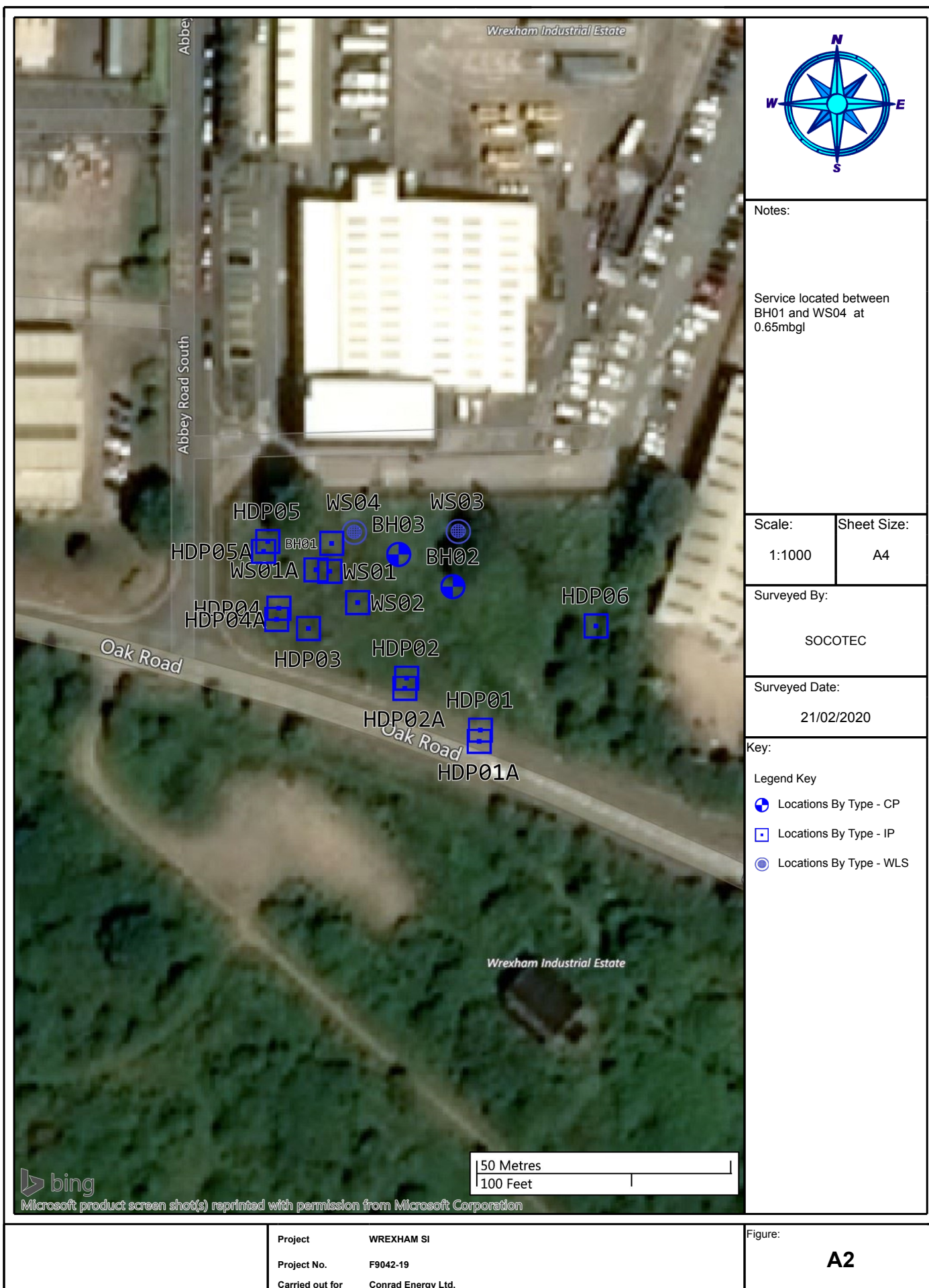


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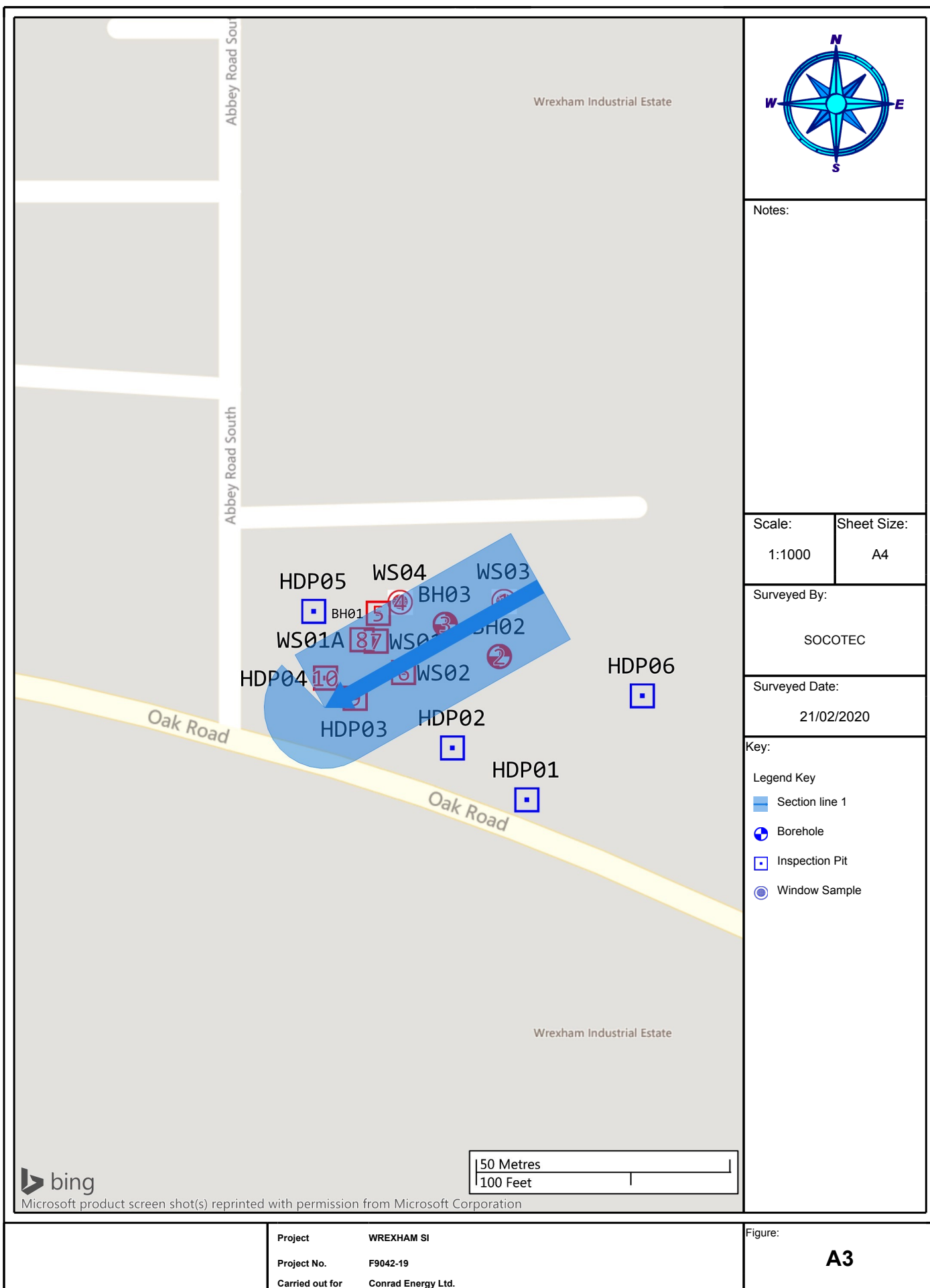
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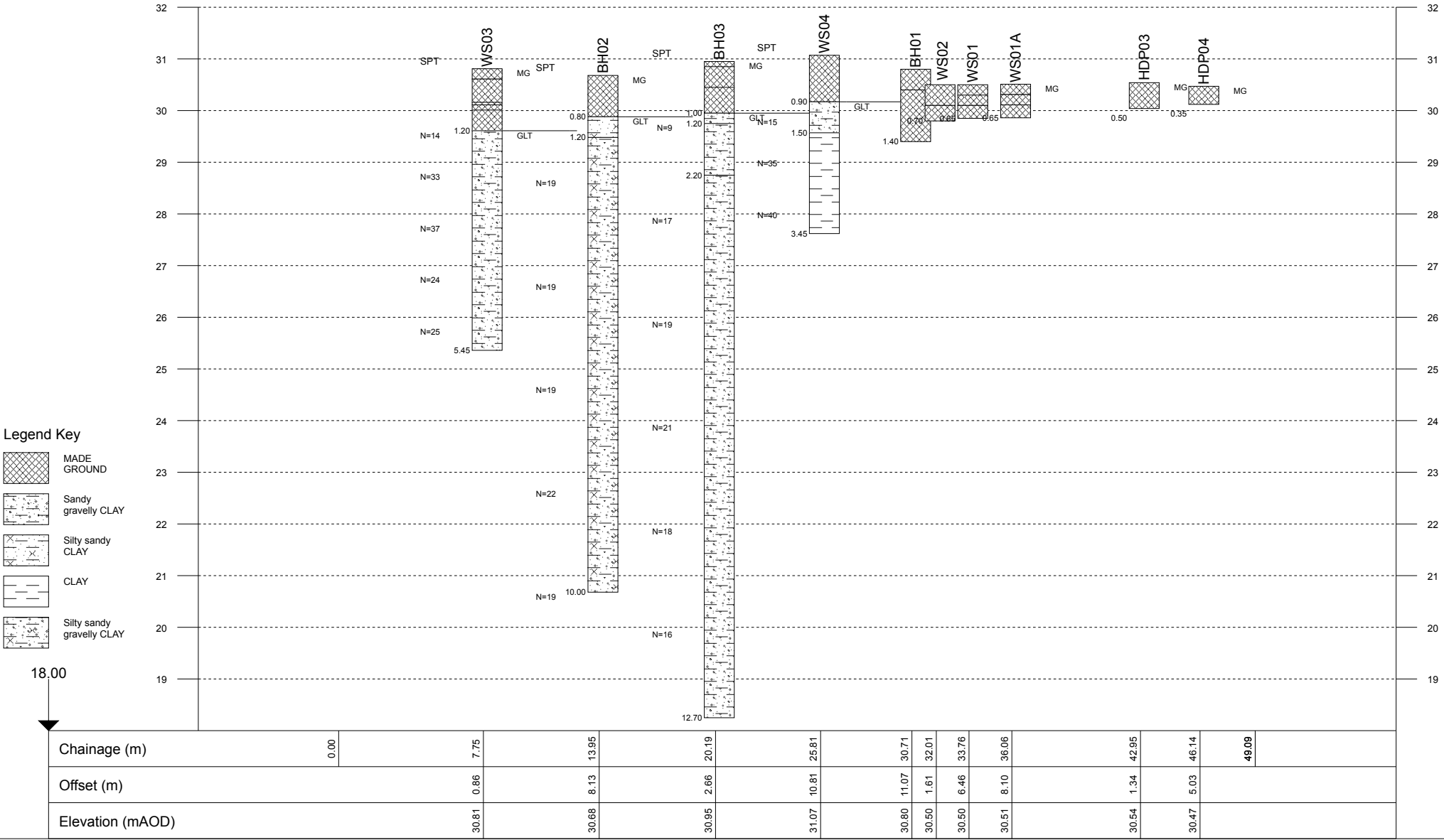
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Site Plan

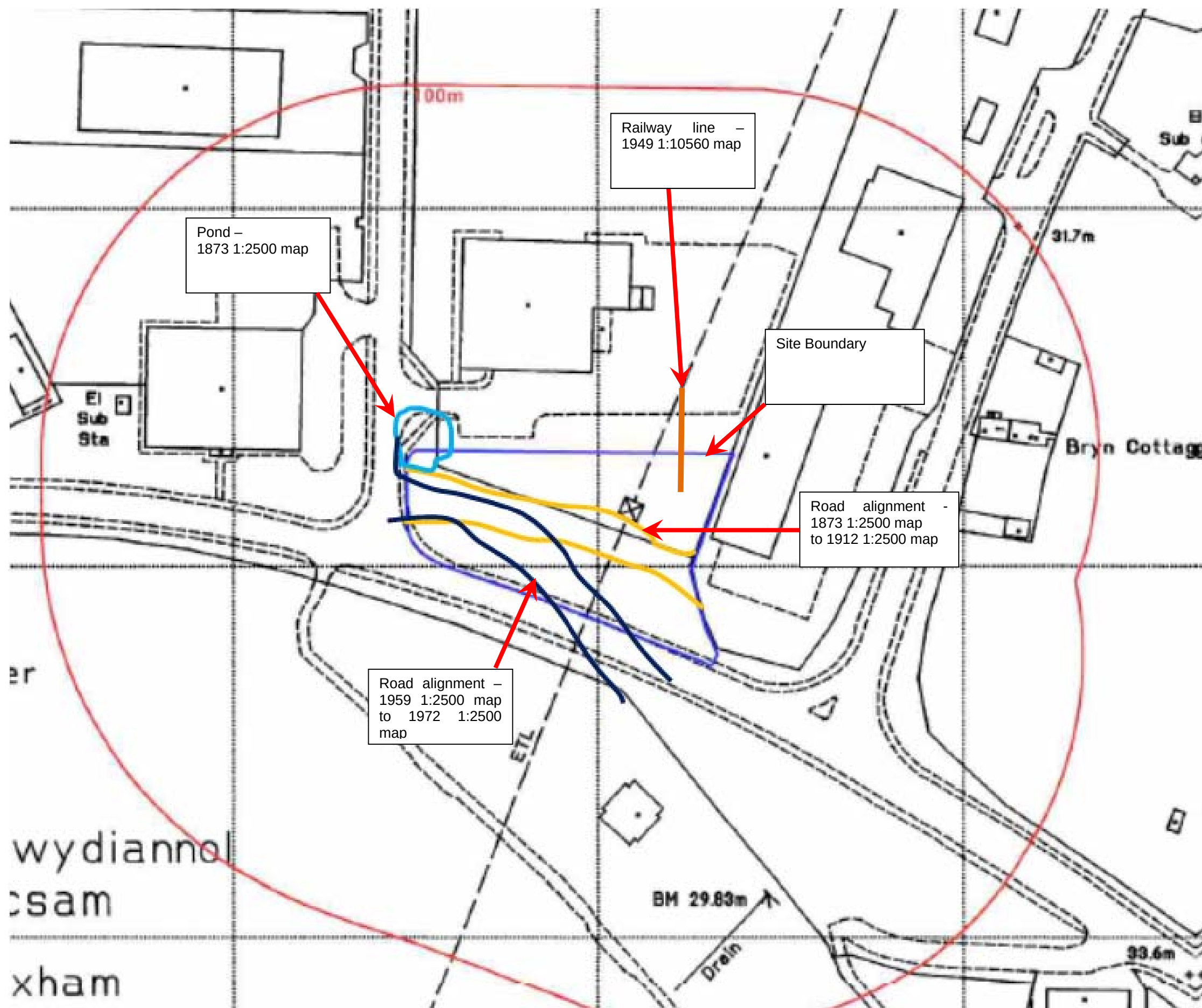


Section Line Plan





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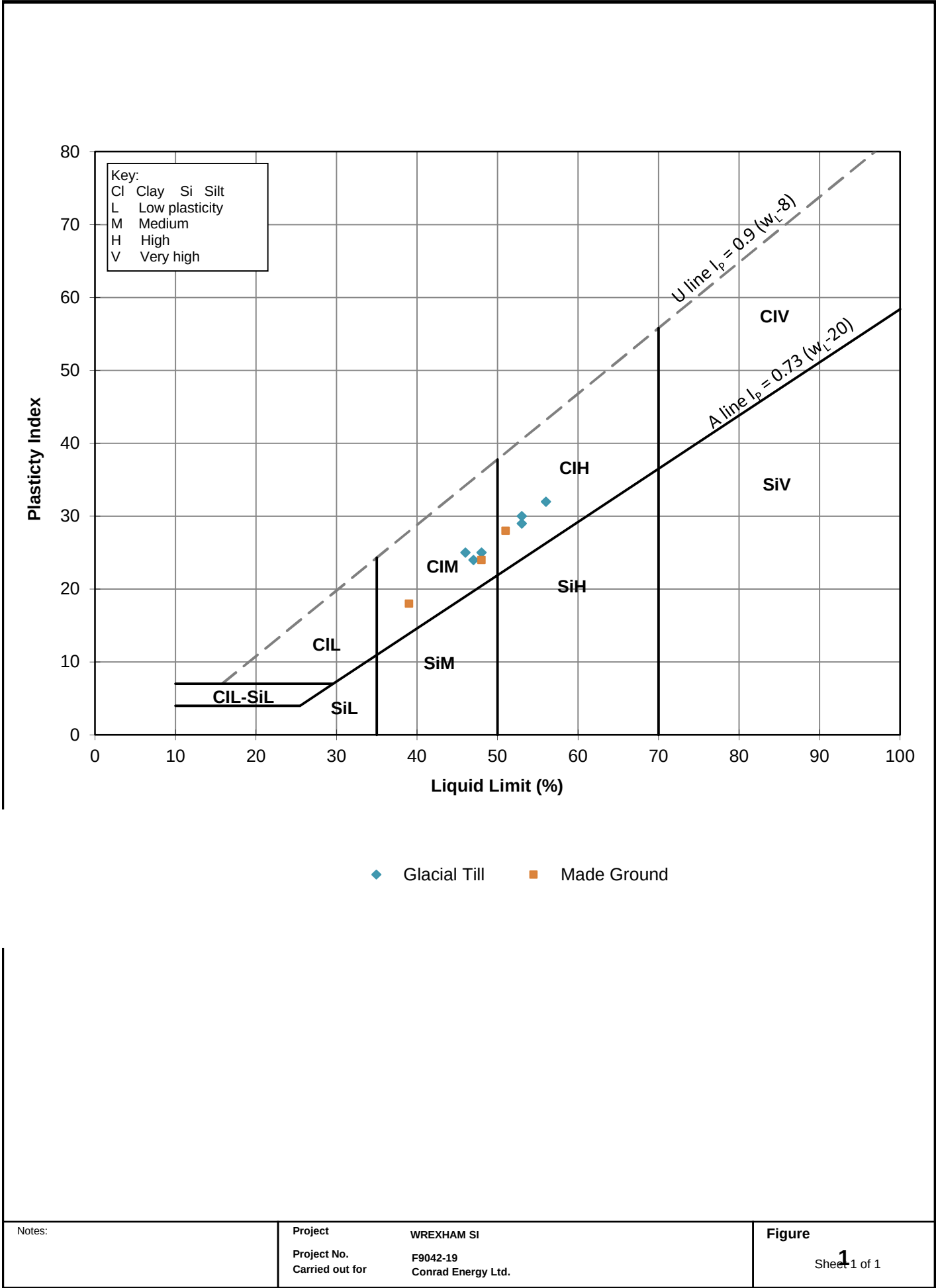


Title HISTORIC FEATURES PLAN	
Project Wrexham Industrial Estate	
Client Conrad Energy	
Notes: Features are approximate only based on historical map locations.	
Scale NTS	
 SOCOTEC	
Project No F9042-19/3	Figure No A4

Site Plan with Obstruction Locations



Plasticity Chart



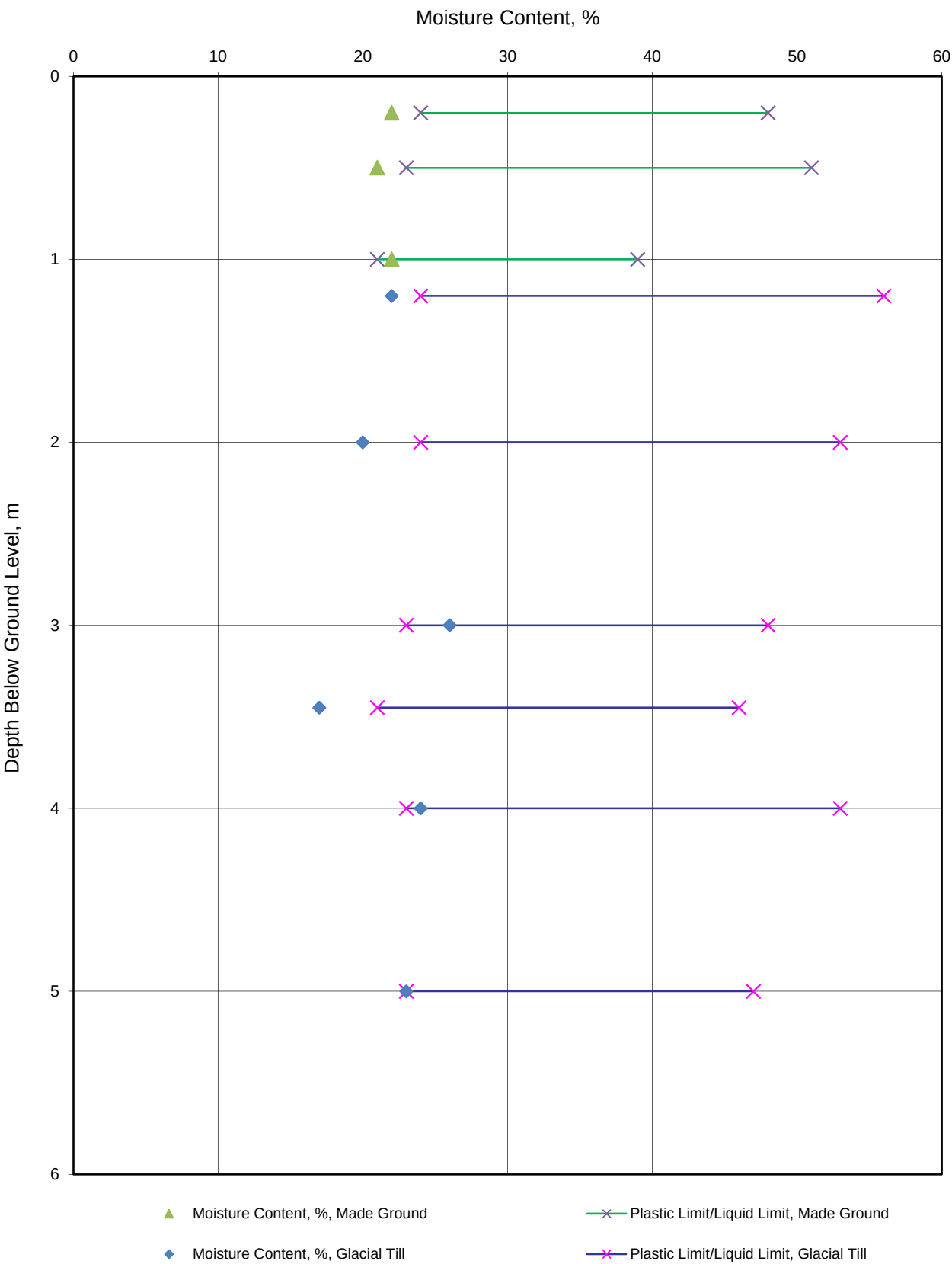
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Figure

1
Sheet 1 of 1

Moisture Content and Atterberg Limits Profile

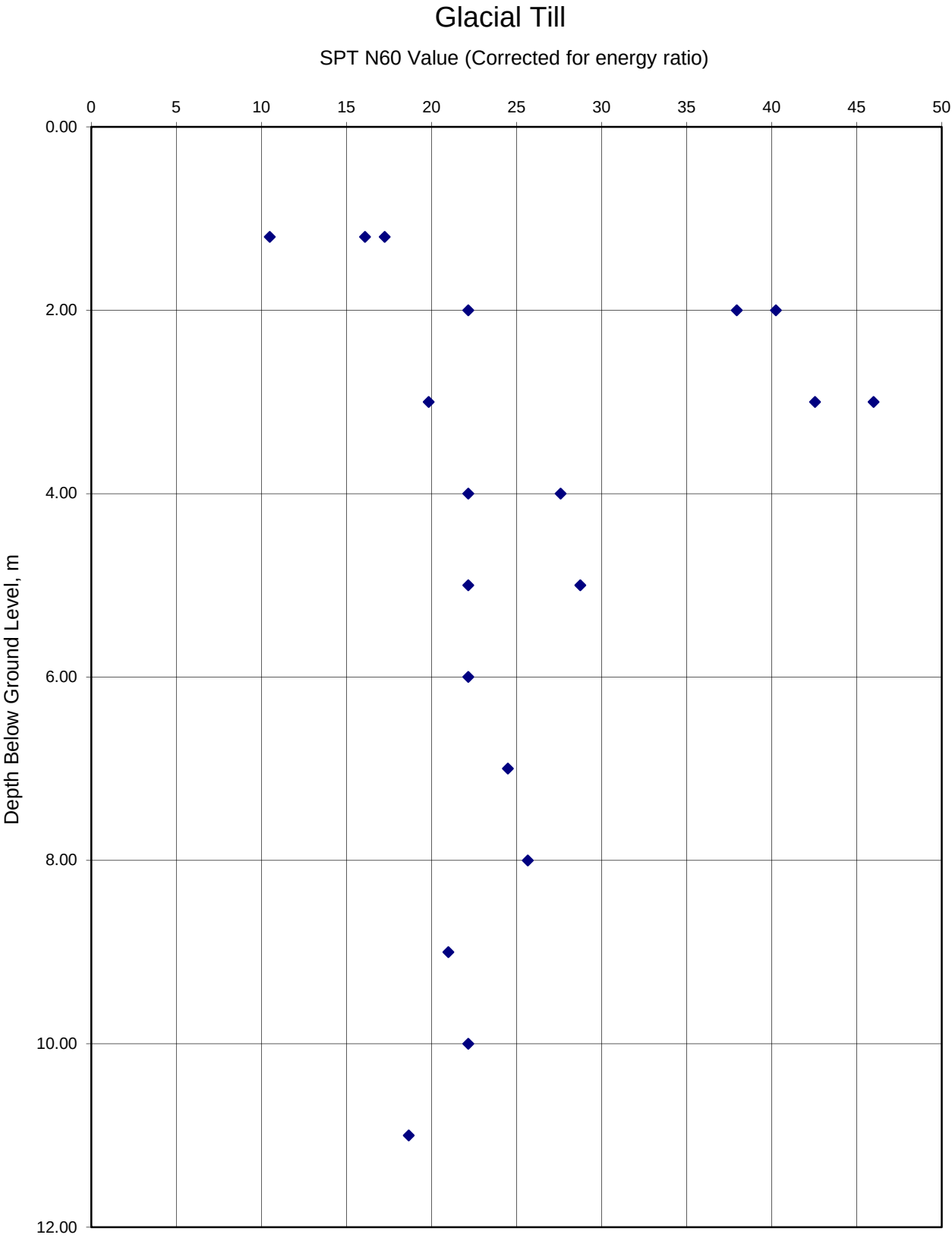


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Project WREXHAM SI
Project No. F9042-19
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Figure
2

SPT N Value - Depth Profile



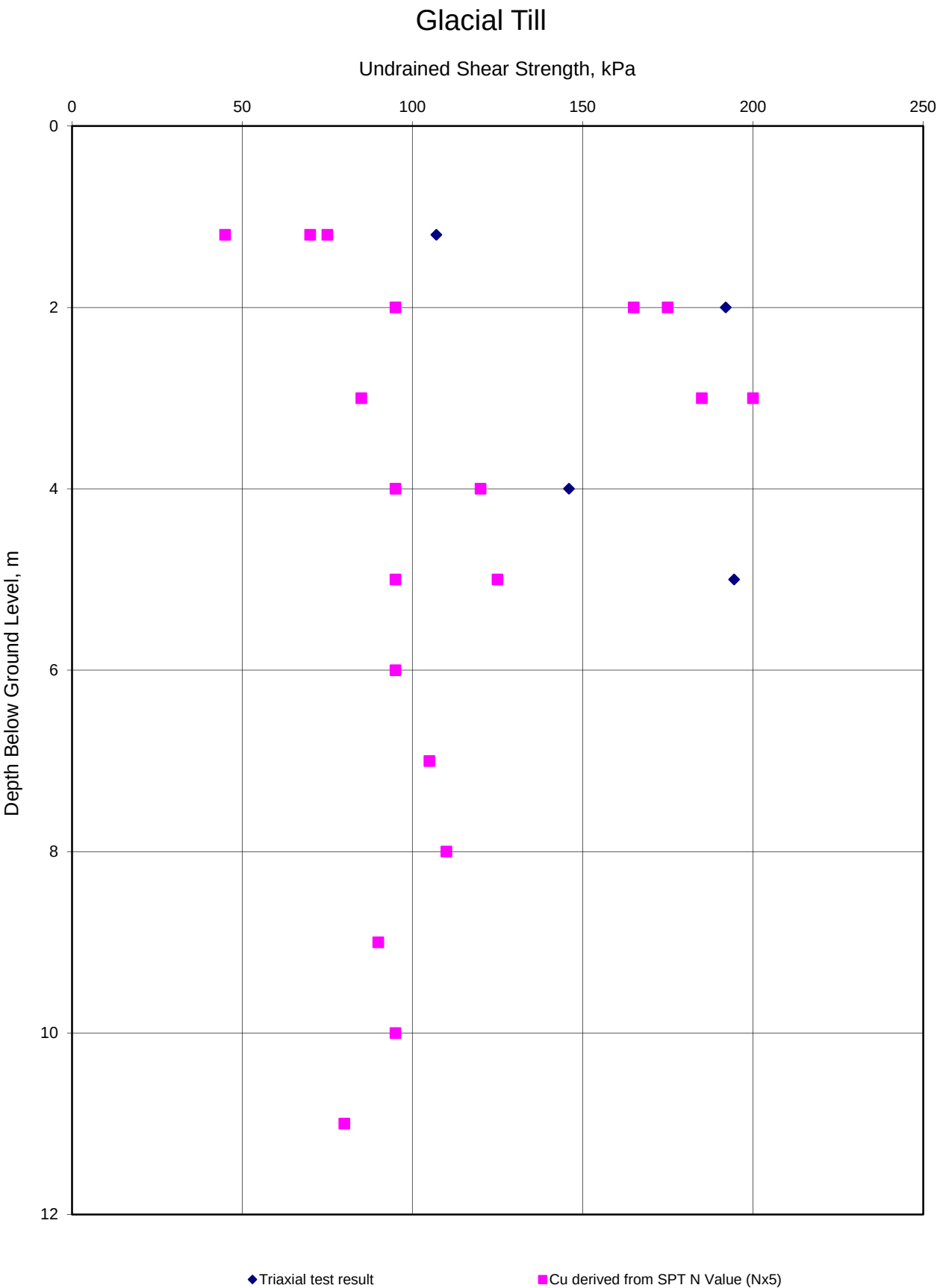
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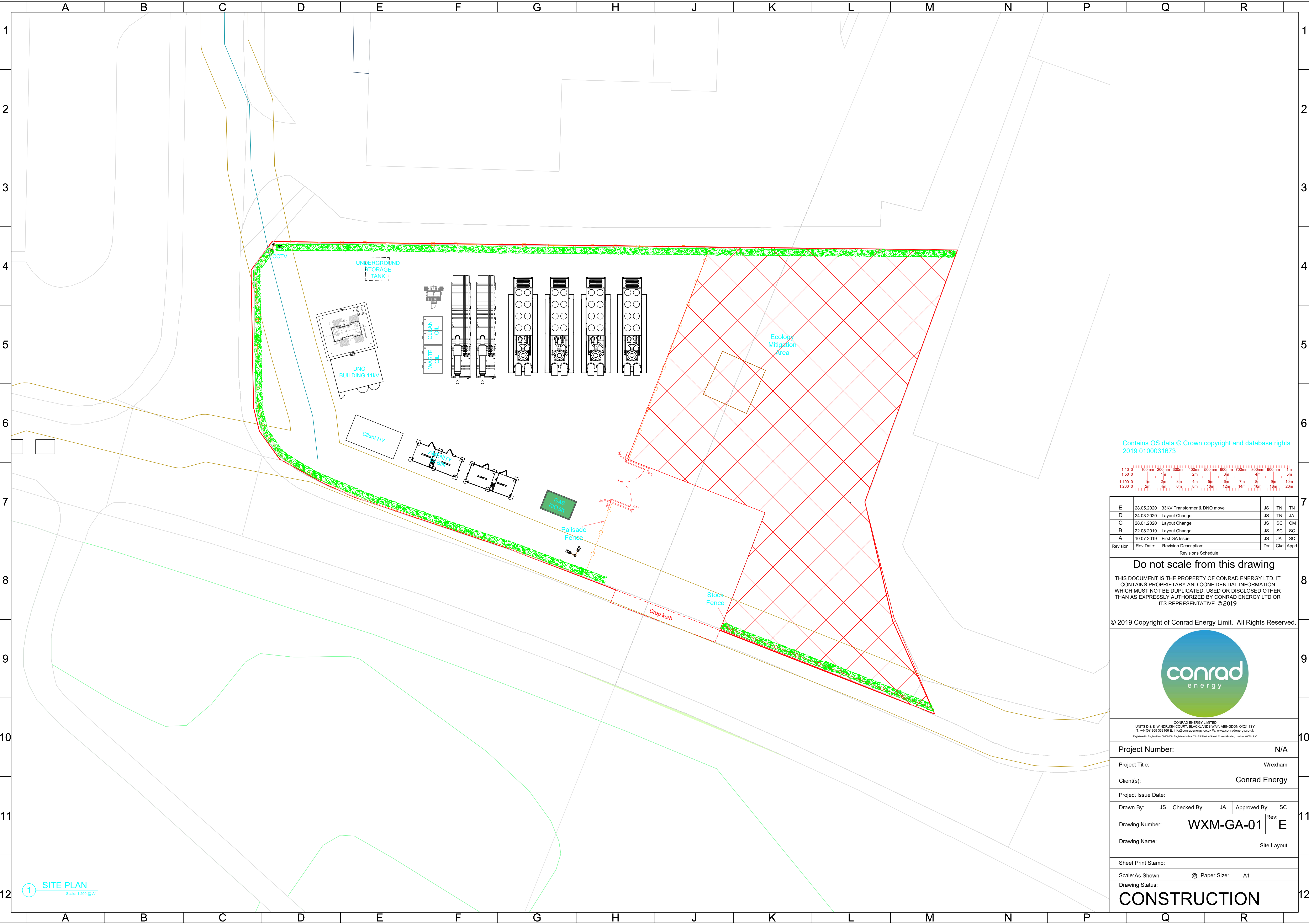
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Sheet 1 of 1

Undrained Shear Strength Profile

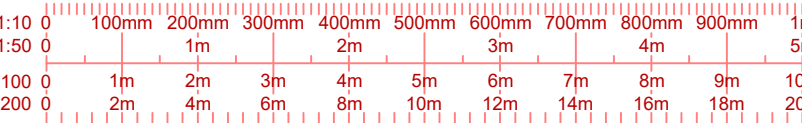


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Notes:	Project	WREXHAM SI	Figure 4 Sheet 1 of 1
	Project No.	F9042-19	
	Carried out for	Conrad Energy Ltd.	



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E	28.05.2020	33KV Transformer & DNO move	JS	TN	TN
D	24.03.2020	Layout Change	JS	TN	JA
C	28.01.2020	Layout Change	JS	SC	CM
B	22.08.2019	Layout Change	JS	SC	SC
A	10.07.2019	First GA Issue	JS	JA	SC
Revision	Rev Date:	Revision Description:	Drm	Ckd	Appd

Revisions Schedule

Do not scale from this drawing

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Registered in England No. 08860055 Registered Office: T1 - 75 Shafes Street, Covent Garden, London, WC2D 8UD

Project Number: N/A

Project Title: Wrexham

Client(s): Conrad Energy

Project Issue Date:

Drawn By: JS Checked By: JA Approved By: SC

Drawing Number: WXM-GA-01 Rev: E

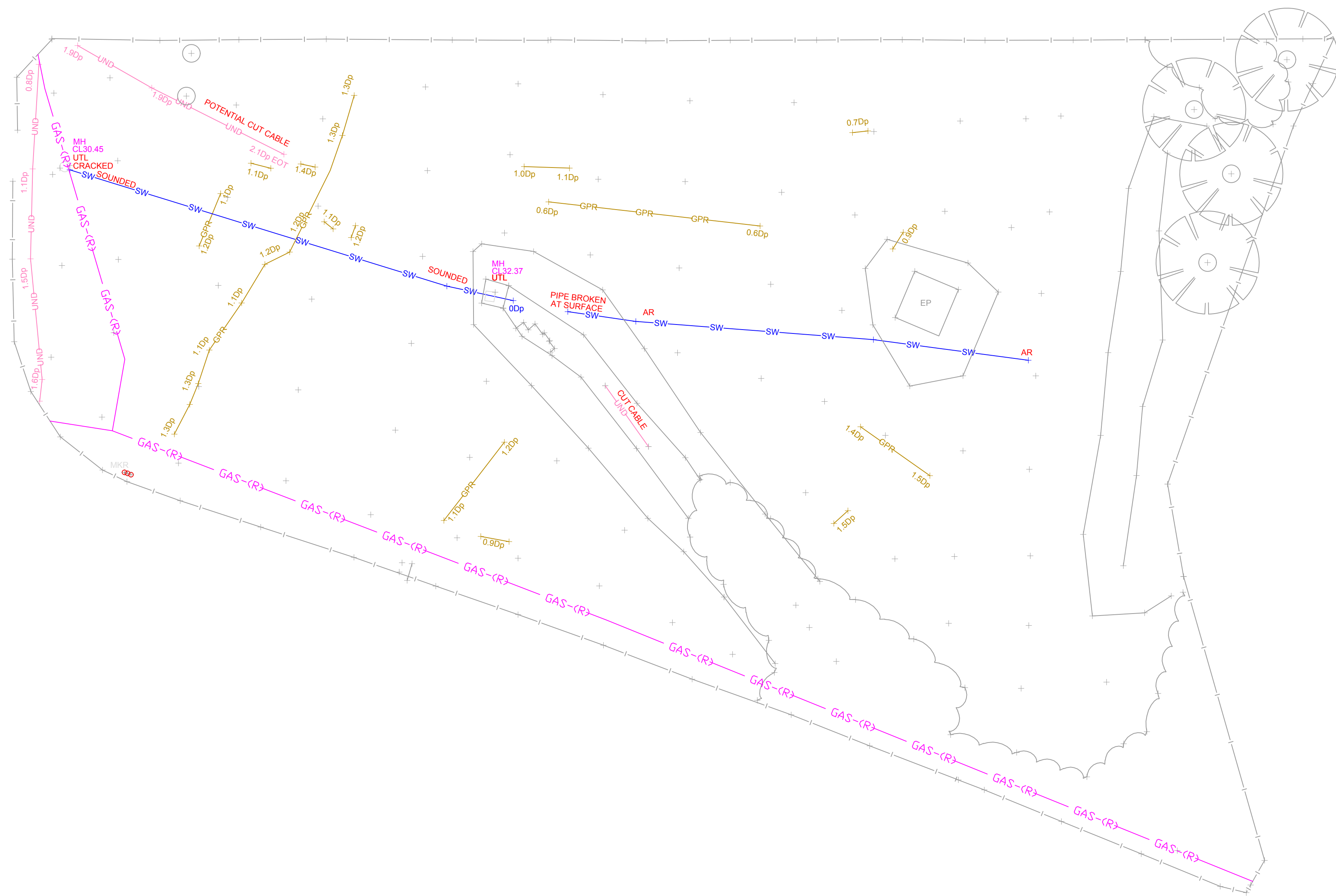
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Scale: As Shown @ Paper Size: A1

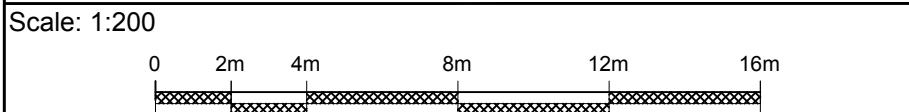
Drawing Status:

CONSTRUCTION

[illegible]

Skilled and experienced staff and industry standard electromagnetic and radar technology and methods are used to locate and trace subsurface utilities. The use of these methods is not limited to non-invasive surveys. Non-invasive surveys may be adversely affected by factors outside of the surveyor's control. It should be noted that not all buried pipes, conduits, or cables are detectable and mapped in this manner due to their depth, location, material type, geometry, or proximity to other utilities. Therefore, whilst the surveyor uses best endeavours, even an appropriate and professionally executed survey may not be able to detect all buried utilities. The surveyor's accuracy of location of utilities refers to the top of the feature and is considered to have an accuracy of $\pm 10\%$. Unless otherwise stated existing record information that was used to assist in the survey shall be used by the statutory utility provider should be regarded as indicative only.

Any ground works or excavation in the vicinity of services shown should be undertaken in accordance with the guidelines contained within the Health and Safety Executive publication HSG47 "Avoiding Danger from Underground Services".



0	TT	Aug 2019	JM	JM	Issued
Rev.	Drawn	Date	Checked	Approved	Details

Survey Date: 27/08/19	Surveyor: DJ/TT	Drawn By: TT
--------------------------	--------------------	-----------------

Client:

Contractor:


SOCOTEC

Geotechnical House
18 - 19 Drome Road
Deeside Industrial Park
Deeside, Flintshire
CH5 2NY
United Kingdom

www.socotec.co.uk

surveys-geophysics@socotec.com
Tel: +44(0)1244 286200

Contract:

OAK ROAD, WREXHAM

DWG:

Topographic Drawing
L9090-19

Original Sheet Size: A1	Scale: Horiz.:1:200 Vert.:N/A	Rev.: 0
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APPENDIX B

EXPLORATORY HOLE RECORDS

Key to Exploratory Hole Records	Key
SPT Hammer Energy Ratio Report	PBD10 0046
Borehole Logs	BH02 and 03
Window Sample Logs	WS03 and 04
Inspection Pit Logs	BH01, HDP01 to 06 and WS01 to 02

Key to Exploratory Hole Records

SAMPLES

Undisturbed

U	Driven tube sample	} nominally 100 mm diameter and full recovery unless otherwise stated
UT	Driven thin wall tube sample	
TW	Pushed thin wall tube sample	
P	Pushed piston sample	
L	Liner sample from dynamic (windowless) sampling. Full recovery unless otherwise stated	
CBR	CBR mould sample	
BLK	Block sample	
C / CS	Core sample (from rotary core) taken for laboratory testing.	
AMAL	Amalgamated sample	

Disturbed

D	Small sample
B	Bulk sample

Other

W	Water sample
G	Gas sample

	Environmental chemistry samples (in more than one container where appropriate)
ES	Soil sample
EW	Water sample

Comments

Sample reference numbers are assigned to every sample taken. A sample reference of 'NR' indicates that, while an attempt was made to take a tube sample, there was no recovery.

Samples taken from borehole installations (ie water or gas) after hole construction are not shown on the exploratory hole logs.

Specimens for point load testing undertaken on site (or other non-lab location) are not shown on the log.

IN SITU TESTS

SPT S or SPT C	Standard Penetration Test, open shoe (S) or solid cone (C)
----------------	--

The Standard Penetration Test is defined in BS EN ISO 22476-3:2005+A1:2011. The incremental blow counts are given in the Field Records column; each increment is 75 mm unless stated otherwise and any penetration under self-weight in mm (SW) is noted. Where the full 300 mm test drive is achieved the total number of blows for the test drive is presented as N = ** in the Test column. Where the test drive blows reach 50 the total blow count beyond the seating drive is given (without the N = prefix).

IV	<i>in situ</i> vane shear strength, peak (p) and remoulded (r)
HV	Hand vane shear strength, peak (p) and remoulded (r)
PP	Pocket penetrometer test, converted to shear strength
KFH, KRH, KPI	Permeability tests (KFH = falling head, KRH = rising head; KPI = packer inflow); results provided in Field Records column (one value per stage for packer tests)

DRILLING RECORDS

The mechanical indices (TCR/SCR/RQD & If) are defined in BS 5930:2015

TCR	Total Core Recovery, %
SCR	Solid Core Recovery, %
RQD	Rock Quality Designation, %
If	Fracture spacing, mm. Minimum, typical and maximum spacing measurements are presented.
NI	Non-intact - used where the core is fragmented (ie no Solid Core).
NA	Not-applicable - used where a measurement is not applicable (eg. If, SCR and RQD in non-rock materials).

Flush returns, estimated percentage with colour where relevant, are given in the Records column

CRF	Core recovered in the following run (length in m)
AZCL	Assessed zone of core loss

GROUNDWATER



Groundwater entry

Depth to groundwater after standing period

Notes:

See report text for full references of standards.

Updated October 2018

Project WREXHAM SI
Project No. F9042-19
Carried out for Conrad Energy Ltd.

Key

Key to Exploratory Hole Records

INSTALLATION

Details of standpipe/piezometer installations are given on the Record. Legend column shows installed instrument depths including slotted pipe section or tip depth, response zone filter material type and layers of backfill.

Standpipe/ piezometer

The type of instrument installed is indicated by a code in the Legend column at the depth of the response zone:

SP	Standpipe				
SPIE	Standpipe piezometer	Plain		Slotted	Piezometer
PPIE	Pneumatic piezometer	Pipe		Pipe	Tip
EPIE	Electronic piezometer				

Inclinometer or Slip Indicator

The installation of vertical profiling instruments is indicated on the Record. The base of tubing is shown in the Legend column.

ICE	The type of instrument installed is indicated by a code in the Legend column at the base of the tubing:
ICM	Biaxial inclinometer
SLIP	Inclinometer tubing for use with probe Slip indicator

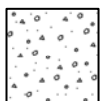
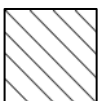
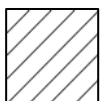
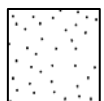
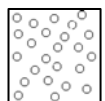
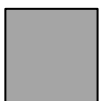
Settlement Points or Pressure Cells

The installation of single point instruments is indicated on the Record. The location of the measuring device is shown in the Legend column. The type of instrument installed is indicated by a code in the Legend column:

ESET	Electronic settlement cell/gauge
ETM	Magnetic extensometer settlement point
EPCE	Electronic embedment pressure cell
PPCE	Electronic push in pressure cell

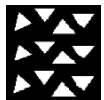
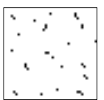
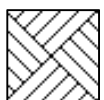
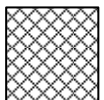
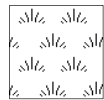
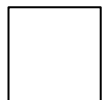
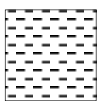
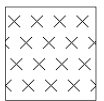
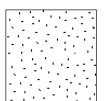
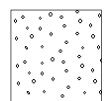
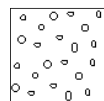
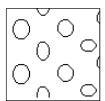
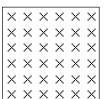
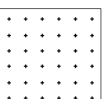
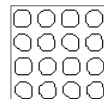
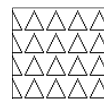
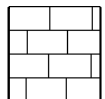
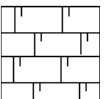
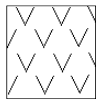
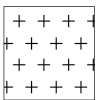
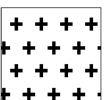
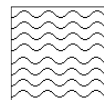
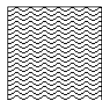
INSTALLATION / BACKFILL LEGENDS

A legend describing the installation is shown in the rightmost column. Legend symbols used to describe the backfill materials are indicated below.

Macadam	Concrete	Grout	Bentonite	Sand	Gravel	Arising
						

STRATUM LEGENDS

The legend symbols used for graphical representation of soils, rocks and other materials on the borehole logs are shown below. For soils with significant proportions of secondary soil types, a combination of two or more symbols may be used.

Macadam	Concrete	Topsoil	Made Ground / Fill	Peat	Void or No Information	
						
Clay	Silt	Sand	Gravel	Cobbles	Boulders	Coal
						
Mudstone	Siltstone	Sandstone	Conglomerate	Breccia	Limestone	Chalk
						
Igneous (Fine)	Igneous (Med)	Igneous (Coarse)	Metamorphic (Fine)	Metamorphic (Med)	Metamorphic (Coarse)	Tuff
						

Notes:

See report text for full references of standards.

Updated October 2018

Project **WREXHAM SI**
Project No. **F9042-19**
Carried out for **Conrad Energy Ltd.**

Key

Sheet 2 of 3

Key to Exploratory Hole Records

NOTES

- 1 Soils and rocks are described in accordance with BS EN ISO 14688-1:2018 and 14689-1:2018 respectively and the guidance of BS 5930:2015.
- 2 For fine soils, consistency determined during description is reported for those strata where undisturbed samples are available. Where the logger considers that the sample may not be representative of the condition in situ, for whatever reason, the reported consistency is given in brackets. The reliability of the sample is indicated by Probably or Possibly as appropriate. Hence (Probably firm) indicates the logger is reasonably confident of the assessment, but (Possibly firm) means less certainty. Where the samples available are too disturbed to allow a reasonable assessment of the in situ condition, no consistency is given.
- 3 Evidence of the occurrence of very coarse particles (cobbles and boulders) is presented on the logs. However, because of their size in relation to the exploratory hole these records may not be fully representative of their size and frequency in the ground mass.
- 4 The declination of bedding and joints is given with respect to the normal to the core axis. Thus in a vertical borehole this will be the dip.
- 5 The assessment of SCR, RQD and Fracture Spacing excludes artificial fractures.
- 6 Observations of discernible groundwater entries during the advancement of the exploratory hole are given at the foot of the log and in the Legend column. The absence of a recorded groundwater entry should not, however, be interpreted as a groundwater level below the base of the borehole. Under certain conditions groundwater entry may not be observed, for instance, drilling with water flush or overwater, or boring at a rate faster than water can accumulate in the borehole. Similarly, where water entry observations do exist, groundwater may also be present at higher elevations in the ground than where recorded in the borehole. In addition, where appropriate, water levels in the hole at the time of recovering individual samples or carrying out in situ tests and at shift changes are given in the Records column.
- 7 The borehole logs present the results of Standard Penetration Tests recorded in the field without correction or interpretation. However, in certain ground conditions (eg high hydraulic head or where very coarse particles are present) some judgement may be necessary in considering whether the results are representative of in situ mass conditions.

REFERENCES

- 1 BS EN ISO 14688-1:2018 : Geotechnical investigation and testing - Identification and classification of soil. Part 1 Identification and description. British Standards Institution
- 2 BS EN ISO 14689-1 : 2018 : Geotechnical investigation and testing - Identification and classification of rock. Part 1 Identification and description. British Standards Institution
- 3 BS EN ISO 22476-3:2005+A1 : 2011 : Geotechnical investigation and testing - Field testing. Part 3 Standard penetration test. British Standards Institution
- 4 BS 5930 : 2015 : Code of practice for ground investigations. British Standards Institution

Notes:

See report text for full references of standards.

Updated October 2018

Project **WREXHAM SI**
 Project No. **F9042-19**
 Carried out for **Conrad Energy Ltd.**

Key

Sheet 3 of 3

SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

ARCHWAY ENGINEERING (UK) LTD
AINLEYS INDUSTRIAL ESTATE
ELLAND
WEST YORKSHIRE
HX5 9JP

SPT Hammer Ref: 0046
Test Date: 07/06/2019
Report Date: 07/06/2019
File Name: 0046.spt
Test Operator: JL

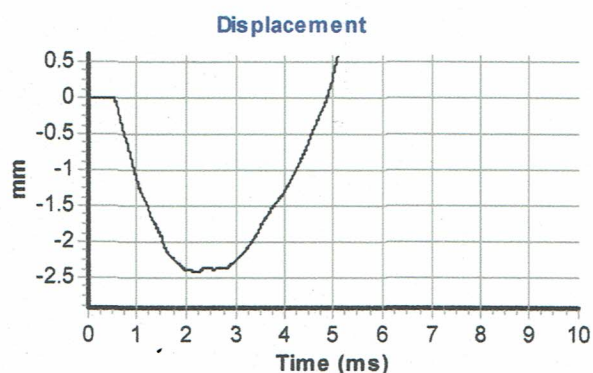
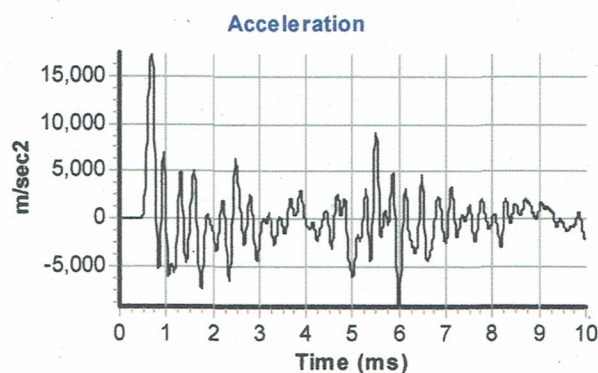
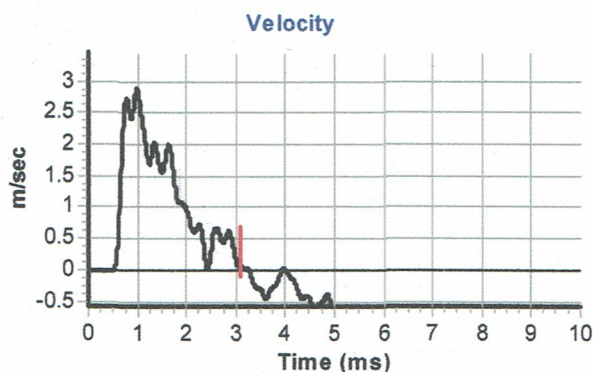
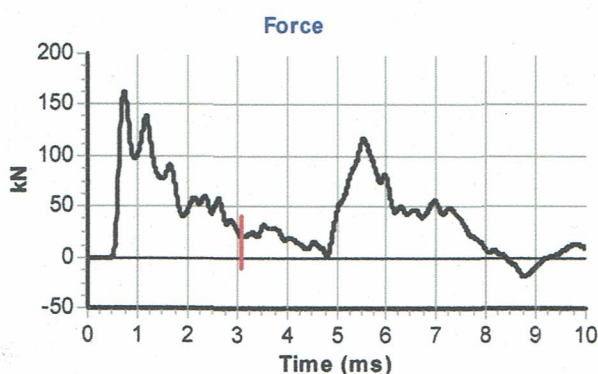
Instrumented Rod Data

Diameter d_r (mm): 54
Wall Thickness t_r (mm): 6.5
Assumed Modulus E_a (GPa): 208
Accelerometer No.1: 7080
Accelerometer No.2: 11609

SPT Hammer Information

Hammer Mass m (kg): 63.5
Falling Height h (mm): 760
SPT String Length L (m): 10.0

Comments / Location



Calculations

Area of Rod A (mm^2): 970
Theoretical Energy E_{theor} (J): 473
Measured Energy E_{meas} (J): 326

Energy Ratio E_r (%): **69**

Signed: S. HOWARTH
Title: FITTER

The recommended calibration interval is 12 months



SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

James Fisher Testing Services
Ruby House
40a Hardwick Grange
Woolton
Warrington
WA1 4RF

SPT Hammer Ref: PBD10
Test Date: 06/01/2020
Report Date: 13/01/2020
File Name: PBD10.spt
Test Operator: OT

Instrumented Rod Data

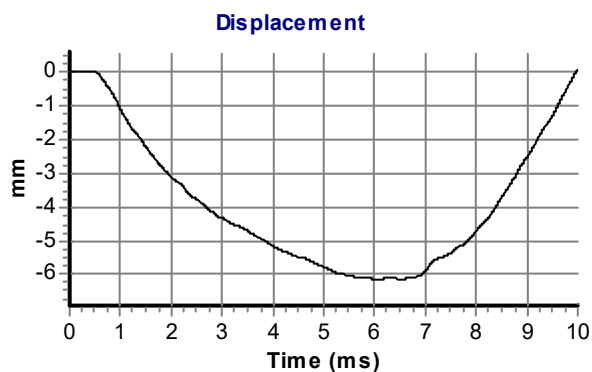
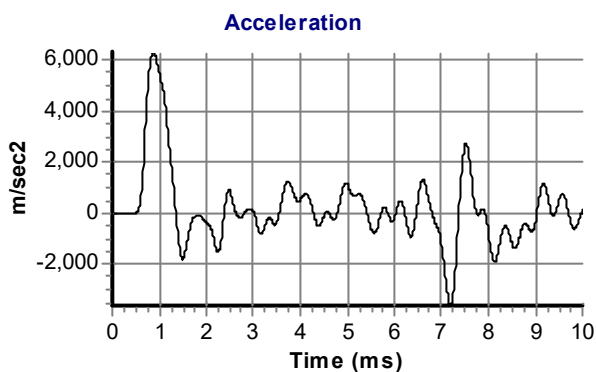
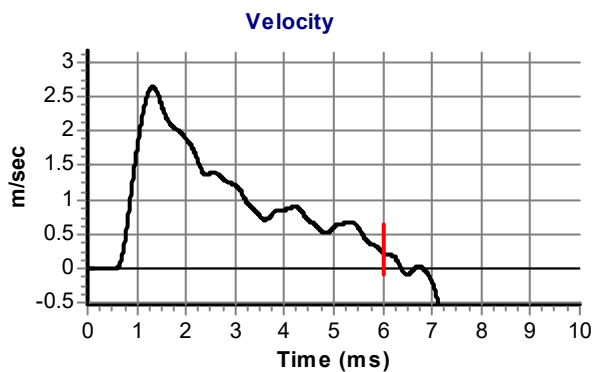
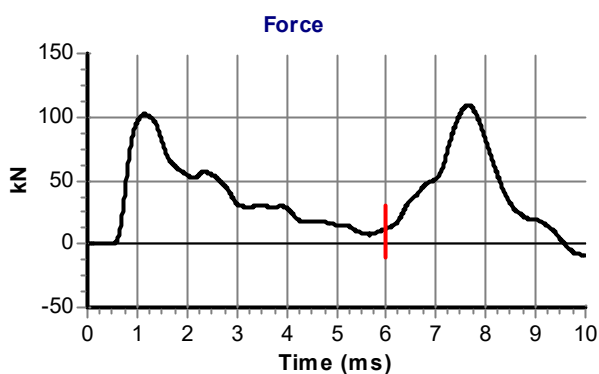
Diameter d_r (mm): 54
Wall Thickness t_r (mm): 6.5
Assumed Modulus E_a (GPa): 208
Accelerometer No.1: 8965
Accelerometer No.2: 8966

SPT Hammer Information

Hammer Mass m (kg): 63.5
Falling Height h (mm): 760
SPT String Length L (m): 14.5

Comments / Location

Client: PB Drilling
Location: JFTS Laboratory
Hammer Type: Trip



Calculations

Area of Rod A (mm²): 970
Theoretical Energy E_{theor} (J): 473
Measured Energy E_{meas} (J): 331

Energy Ratio E_r (%): **70**

Signed: Oliver Turpin
Title: Team Leader

Borehole Log



Drilled Logged Checked Approved	DH JT AG MW	Start 20/02/2020 End 20/02/2020	Equipment, Methods and Remarks Dando 2000 Hand dug inspection pit to 1.20m. Cable percussion boring to 10.00m. No groundwater encountered.		Depth from (m) 0.00	to (m) 10.00	Diameter (mm) 150	Casing Depth (m) 10.00	Ground Level 30.68 mOD Coordinates (m) E 338692.20 National Grid N 349519.36	
Samples and Tests					Strata Description					
Depth	Type & No.	Records	Date Casing	Time Water	Main	Detail	Depth, Level (Thickness)	Legend	Backfill	
0.00 - 0.80 0.20 0.50 0.80 - 1.20 1.00 1.20 - 1.65 1.60 1.65 - 1.90 2.00 - 2.45 2.00 2.00 - 2.45	B 1 ES 1 ES 2 B 2 ES 3 UT 3 B 5 D 4 SPTS D 6 B 7	38 blows 60% rec	2.00	Dry	MADE GROUND: Soft to firm brown gravelly CLAY. Gravel is angular fine to coarse of brick and concrete. Soft dark brown sandy silty CLAY. (GLACIAL TILL) Stiff brown slightly gravelly slightly sandy CLAY. Gravel is subrounded fine to coarse of various lithologies. (GLACIAL TILL)		(0.80) 0.80 +29.88 (0.40) 1.20 +29.48			
3.00 - 3.45 3.45 - 3.70 4.00 - 4.45 4.00 - 4.45 4.00 - 4.45 5.00 - 5.45 5.45 - 5.70 6.00 - 6.45 6.00 - 6.45 6.00 - 6.45 7.00 - 7.45 7.45 8.00 - 8.45 8.00 - 8.45 8.00 - 8.45 9.00 - 9.45 9.45 - 9.70	UT 8 D 9 SPTS D 10 B 11 UT 12 D 13 SPTS D 14 B 15 UT 16 D 17 SPTS D 19 B 20 UT 21 D 22	42 blows 100% rec N=19 (3,4/4,4,5,6) 40 blows 100% rec N=19 (4,5/5,4,5,5) 37 blows 100% rec N=22 (3,4/4,5,6,7) 34 blows 100% rec	3.00 4.00 5.00 6.00 7.00 8.00	Dry Dry Dry Dry Dry			(8.80)			
			20/02/20 10.00	1700 Dry			10.00 +20.68			
Groundwater Entries No. Depth Strike (m) Remarks					Depth Sealed (m)		Depth Related Remarks Depths (m) Remarks 1.20 - 10.00 SPT Hammer ID: PBD10 ER=70%			
Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.					Project Project No. Carried out for			Borehole BH02 Sheet 1 of 2		
Scale 1:50 © Copyright SOCOTEC UK Limited 20/05/2020 17:04:55					Project Project No. Carried out for			Borehole BH02 Sheet 1 of 2		

Borehole Log



Drilled Logged Checked Approved	DH JT AG MW	Start 20/02/2020 End 20/02/2020	Equipment, Methods and Remarks Dando 2000 Hand dug inspection pit to 1.20m. Cable percussion boring to 10.00m. No groundwater encountered.		Depth from (m) 0.00	to (m) 10.00	Diameter (mm) 150	Casing Depth (m) 10.00	Ground Level 30.68 mOD Coordinates (m) E 338692.20 National Grid N 349519.36
Samples and Tests					Strata Description				
Depth	Type & No.	Records	Date Casing	Time Water	Main	Detail	Depth, Level (Thickness)	Legend	Backfill
10.00 - 10.45 10.00 - 10.45	SPTS D 23	N=19 (3,4/4,5,5,5)	10.00	Dry	END OF EXPLORATORY HOLE				
Groundwater Entries					Depth Related Remarks			Hard Boring	
No.	Depth	Strike (m)	Remarks	Depth Sealed (m)	Depths (m)	Remarks	Depths (m)	Duration (mins)	Tools used
Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column. Scale 1:50 © Copyright SOCOTEC UK Limited 20/05/2020 17:04:55					Project WREXHAM SI Project No. F9042-19 Carried out for Conrad Energy Ltd.			Borehole BH02 Sheet 2 of 2	

Borehole Log



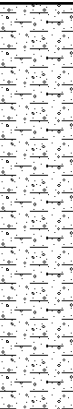
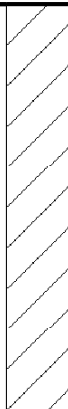
Drilled	DH	Start	Equipment, Methods and Remarks	Depth from	to	Diameter	Casing Depth	Ground Level	30.95 mOD
Logged	KH	19/02/2020	Dando 2000 Hand dug inspection pit to 1.20m. Cable percussion boring to 12.70m.	(m)	(m)	(mm)	(m)	Coordinates (m)	E 338681.56
Checked	AG	End	No groundwater encountered.	0.00	12.70	150	12.00	National Grid	N 349525.86
Approved	MW	20/02/2020							

Samples and Tests				Strata Description					
Depth	Type & No.	Records	Date	Time	Main	Detail	Depth, Level	Legend	Backfill
			Casing	Water			(Thickness)		
0.00 - 0.10	D 2				MADE GROUND: Soft greyish brown slightly sandy slightly gravelly silty CLAY with rare rootlets and roots (up to 80mm dia.). Gravel is subangular to subrounded fine and medium of mixed lithologies including quartzite, brick and siltstone. MADE GROUND: Firm brown slightly sandy slightly gravelly CLAY with low cobble content. Gravel is angular to subrounded fine to coarse of quartzite, brick, ceramic and mudstone. Cobbles are subangular of concrete. MADE GROUND: Yellowish grey slightly silty fine to coarse SAND and angular to subrounded fine to coarse GRAVEL of quartzite and mudstone. Soft to firm orangish brown mottled grey slightly gravelly slightly sandy CLAY. Gravel is subangular to subrounded fine and medium of quartzite and mudstone. (GLACIAL TILL) Soft to firm orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine of mudstone and siltstone. (GLACIAL TILL) Stiff orangish brown mottled blue and grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine and medium of quartzite and siltstone. (GLACIAL TILL)		0.10 (0.10) +30.85		
0.00 - 0.10	B 1						(0.40)		
0.10 - 0.50	B 3								
0.20	ES 5						0.50 +30.45		
0.20	D 4						(0.50)		
0.50 - 1.00	B 6						1.00 +29.95		
0.60	ES 8						(0.20) +29.75		
0.60	D 7								
1.00	ES 11						(1.00)		
1.00	D 10								
1.00 - 1.20	B 9			Dry			2.20 +28.75		
1.20 - 1.65	SPTS	N=9 (1,2/2,2,2,3)							
1.20	HV	p 91kPa, r 25kPa							
1.20 - 1.65	D 12								
1.20 - 1.65	B 13								
2.00 - 2.45	UT 14	60 blows 100% rec	2.00	Dry					
2.20 - 2.50	B 16								
2.45 - 2.70	D 15								
3.00 - 3.45	SPTS	N=17 (3,3/4,4,4,5)	3.00	Dry					
3.00 - 3.45	D 17								
3.00 - 3.45	B 18								
4.00 - 4.45	UT 19	45 blows 100% rec	4.00	Dry					
4.45 - 4.70	D 20								
5.00 - 5.45	SPTS	N=19 (2,4/4,4,5,6)	5.00	Dry		5.00-10.70 Gravel becomes fine and less frequent.			
5.00 - 5.45	D 21								
5.00 - 5.45	B 22								
6.00 - 6.45	UT 23	37 blows 100% rec	6.00	Dry					
6.45 - 6.70	D 24								
7.00 - 7.45	SPTS	N=21 (3,4/4,6,5,6)	7.00	Dry					
7.00 - 7.45	D 25								
7.00 - 7.45	B 26						(10.50)		
8.00 - 8.45	UT 27	33 blows 100% rec	8.00	Dry					
8.45 - 8.70	D 28								
9.00 - 9.45	SPTS	N=18 (3,3/4,4,5,5)	9.00	Dry					
9.00 - 9.45	D 29								
9.00 - 9.45	B 30								

Groundwater Entries				Depth Related Remarks				Hard Boring		
No.	Depth	Strike (m)	Remarks	Depth Sealed (m)	Depths (m)	Remarks		Depths (m)	Duration (mins)	Tools used
					1.20 - 12.70	SPT Hammer ID: PBD10 ER=70%				

Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column. Scale 1:50 © Copyright SOCOTEC UK Limited 20/05/2020 17:04:55				Project WREXHAM SI Project No. F9042-19 Carried out for Conrad Energy Ltd.				Borehole BH03 Sheet 1 of 2		
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Drilled	DH	Start	Equipment, Methods and Remarks				Depth from	to	Diameter	Casing Depth	Ground Level	30.95 mOD
Logged	KH	19/02/2020	Dando 2000 Hand dug inspection pit to 1.20m. Cable percussion boring to 12.70m. No groundwater encountered.				(m)	(m)	(mm)	(m)	Coordinates (m)	E 338681.56
Checked	AG	End					0.00	12.70	150	12.00	National Grid	N 349525.86
Approved	MW	20/02/2020										
Samples and Tests							Strata Description					
Depth		Type & No.	Records	Date	Time	Main	Detail	Depth, Level (Thickness)	Legend	Backfill		
				Casing	Water							
10.00 - 10.45		UT 31	30 blows 100% rec	9.00	Dry	Stiff orangish brown mottled blue and grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine and medium of quartzite and siltstone. (GLACIAL TILL)						
10.45 - 10.70		D 32		19/02/20 9.00	1700 Dry							
11.00 - 11.45		SPTS	N=16 (2,3/4,4,4,4)	20/02/20 11.00	0800 Dry							
11.00 - 11.45		D 33										
11.00 - 11.45		B 34										
12.00 - 12.45		UT 35	28 blows 60% rec	12.00	Dry	END OF EXPLORATORY HOLE		12.70	+18.25			
12.45 - 12.70		D 36		20/02/20 12.00	1700 Dry							
Groundwater Entries						Depth Related Remarks		Hard Boring				
No.	Depth	Strike (m)	Remarks	Depth Sealed (m)		Depths (m)	Remarks	Depths (m)	Duration (mins)	Tools used		
Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.						Project WREXHAM SI		Borehole				
Scale 1:50						Project No. F9042-19		BH03				
© Copyright SOCOTEC UK Limited						Carried out for Conrad Energy Ltd.		Sheet 2 of 2				
AGS												

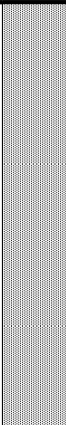
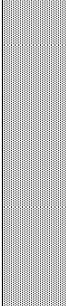
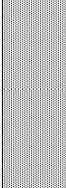
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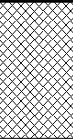
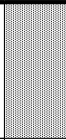
Borehole Log



Drilled	NF	Start	Equipment, Methods and Remarks			Depth from	to	Diameter	Casing Depth	Ground Level	31.07 mOD
Logged	JT	19/02/2020	Global Geo Hand dug inspection pit to 1.20m. Dynamic (windowless) sampling to 3.45m. No groundwater encountered.			1.20	2.00	87		Coordinates (m)	E 338672.72
Checked	AG	End				2.00	3.00	77		National Grid	N 349530.32
Approved	MW	19/02/2020									
Samples and Tests						Strata Description					
Depth	Type & No.	Records	Date Casing	Time Water	Main	Detail	Depth, Level (Thickness)	Legend	Backfill		
0.20	ES 1				MADE GROUND: Dark brown sandy angular to subangular fine to coarse GRAVEL of brick and concrete with occasional ash.		(0.90)				
1.00	D 2				MADE GROUND: Stiff to very stiff brown slightly gravelly slightly sandy CLAY. Gravel is subangular to subrounded fine to medium of quartz and quartzite.		0.90 +30.17				
1.00 - 1.50	B 3	N=15 (2,3/3,3,4,5)					(0.60)				
1.20 - 1.65	SPTS	100% rec, diameter 87mm			Stiff becoming very stiff brown CLAY. (GLACIAL TILL)		1.50 +29.57				
1.20 - 2.00	L						(1.95)				
2.00 - 2.45	SPTS	N=35 (4,5/7,7,9,12)									
2.00 - 3.00	L	80% rec, diameter 77mm									
3.00 - 3.45	SPTS	N=40 (5,5/8,8,10,14)	19/02/20	1700 Dry	END OF EXPLORATORY HOLE		3.45 +27.62				
Groundwater Entries											
No.	Depth	Strike (m)	Remarks	Depth Sealed (m)	Depth Related Remarks		Hard Boring				
					Depths (m)	Remarks	Depths (m)	Duration (mins)	Tools used		
					1.20 - 3.45	SPT Hammer ID: Dart 0046 ER= 69%					
Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.					Project WREXHAM SI		Borehole				
Scale 1:50 © Copyright SOCOTEC UK Limited 20/05/2020 17:05:39					Project No. F9042-19		WS04				
					Carried out for Conrad Energy Ltd.		Sheet 1 of 1				

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Logged KH		Start 18/02/2020	Equipment, Methods and Remarks Hand tools Hand dug inspection pit to 1.40m. Borehole abandoned due to potential service at 1.40m. No groundwater encountered.		Dimension and Orientation Width 0.30 m Length 0.30 m		A D B C ➔		Ground Level 30.80 mOD		
Checked AG		End 18/02/2020							Coordinates (m) E 338668.30		
Approved MW									National Grid N 349528.21		
Samples and Tests			Strata Description								
Depth	Type & No.	Records	Main			Detail	Depth, Level (Thickness)	Legend	Backfill		
0.20	ES3		MADE GROUND: Soft brown slightly gravelly sandy CLAY with rare rootlets and roots (up to 50mm dia.). Gravel is subangular to subrounded fine and medium of mudstone, brick and quartzite.				(0.40)				
0.20	D2										
0.20	B1		MADE GROUND: Firm orangish brown slightly sandy slightly gravelly CLAY. Gravel is angular to subangular fine to coarse of mixed lithologies including mudstone, limestone, brick and ceramic tiles.			0.60 Large orange patterned tile (40x50x20mm).	0.40 +30.40				
0.40 - 0.80	B4										
0.50	ES6		END OF EXPLORATORY HOLE				(1.00)				
0.50	D5										
1.00	ES7						1.40 +29.40				

Logged	JT	Start	19/02/2020	Equipment, Methods and Remarks	Hand tools Hand dug inspection pit to 0.45m. Terminated at 0.45m due to concrete. No groundwater encountered	Dimension and Orientation	Width 0.30 m Length 0.30 m	A B C D	Ground Level	30.63 mOD	Coordinates (m)	E 338697.30	National Grid	N 349490.93		
Checked	AG	End	19/02/2020													
Approved	MW															
Samples and Tests				Strata Description												
Depth		Type & No.		Records		Main			Detail		Depth, Level (Thickness)		Legend		Backfill	
0.20 0.20 0.20		ES1 D2 B3				MADE GROUND: Soft brown sandy gravelly CLAY. Gravel is angular fine to coarse of concrete, brick and sandstone.					(0.45)					
						MADE GROUND: CONCRETE. END OF EXPLORATORY HOLE					0.45 (0.00) +30.18					

Logged JT		Start 19/02/2020	Equipment, Methods and Remarks Hand tools Hand dug inspection pit to 0.45m. Moved 1.00m from HDP01. Terminated at 0.45m due to concrete. No groundwater encountered		Dimension and Orientation Width 0.30 m Length 0.30 m		Ground Level 30.63 mOD		
Checked AG		End 19/02/2020			A B C D		Coordinates (m) E 338696.99		
Approved MW							National Grid N 349488.70		
Samples and Tests			Strata Description						
Depth	Type & No.	Records	Main		Detail	Depth, Level (Thickness)	Legend	Backfill	
			MADE GROUND: Brown sandy gravelly CLAY. Gravel is angular fine to coarse of concrete, brick and sandstone.			(0.45)			
			MADE GROUND: CONCRETE. END OF EXPLORATORY HOLE			0.45 (0.00) +30.18			
Groundwater Entries			Remarks			Stability			
No.	Depth	Strike (m)	Remarks	Remarks		Stable			
						Shoring			
						None			
						Weather			
Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.			Project WREXHAM SI			Trial Pit			
Scale 1:25			Project No. F9042-19			HDP01A			
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Logged JT		Start 19/02/2020	Equipment, Methods and Remarks Hand tools Hand excavated trial pit to 0.50m. Moved 1.00m from HDP02. Terminated at 0.50m due to concrete. No groundwater encountered.		Dimension and Orientation Width 0.30 m Length 0.30 m		Ground Level 30.63 mOD		
Checked AG		End 19/02/2020			A D B C ➔		Coordinates (m) E 338682.39		
Approved MW							National Grid N 349499.37		
Samples and Tests			Strata Description						
Depth	Type & No.	Records	Main		Detail	Depth, Level (Thickness)	Legend	Backfill	
			MADE GROUND: Soft dark brown sandy CLAY.			(0.50)			
			MADE GROUND: CONCRETE. END OF EXPLORATORY HOLE			0.50 (0.00) +30.13			

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Trial Pit Log



Logged JT Checked AG Approved MW		Start 19/02/2020 End 19/02/2020	Equipment, Methods and Remarks Hand tools Hand dug inspection pit to 0.75m. Terminated at 0.75m due to concrete. No groundwater encountered.	Dimension and Orientation Width 0.30 m Length 0.30 m A B C D		Ground Level 30.44 mOD Coordinates (m) E 338655.58 National Grid N 349528.76	
Samples and Tests			Strata Description				
Depth	Type & No.	Records	Main	Detail	Depth, Level (Thickness)	Legend	Backfill
0.20 0.20	ES1 D6		MADE GROUND: Dark brown gravelly silty fine to coarse SAND. MADE GROUND: Greyish brown sandy angular fine to coarse GRAVEL of concrete and sandstone. MADE GROUND: Soft brown sandy gravelly CLAY. Gravel is angular to subrounded fine to coarse of various lithologies.		(0.10) +30.34 (0.10) +30.24 0.20		
0.50 0.50 0.50	ES2 D4 B3				(0.55)		
			MADE GROUND: CONCRETE. END OF EXPLORATORY HOLE		0.75 (0.00) +29.69		
Groundwater Entries No. Depth Strike (m) Remarks			Remarks Depth (m) Remarks		Stability Stable Shoring None Weather		
Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column. Scale 1:25 © Copyright SOCOTEC UK Limited 20/05/2020 17:06:32			Project WREXHAM SI Project No. F9042-19 Carried out for Conrad Energy Ltd.		Trial Pit HDP05 Sheet 1 of 1		

Trial Pit Log



Logged JT Checked AG Approved MW		Start 19/02/2020 End 19/02/2020	Equipment, Methods and Remarks Hand tools Hand dug inspection pit to 0.70m. Moved 1.50m from HDP05. Terminated at 0.70m due to concrete No groundwater encountered	Dimension and Orientation Width 0.30 m Length 0.30 m A B C D		Ground Level 30.44 mOD Coordinates (m) E 338654.68 National Grid N 349526.82		
Samples and Tests			Strata Description					
Depth	Type & No.	Records	Main	Detail	Depth, Level (Thickness)	Legend	Backfill	
			MADE GROUND: Dark brown silty gravelly fine to coarse SAND.		(0.10) 0.10 +30.34			
			MADE GROUND: Greyish brown sandy angular fine to coarse GRAVEL of concrete and sandstone.		(0.10) 0.20 +30.24			
			MADE GROUND: Soft brown sandy gravelly CLAY. Gravel is angular to subrounded fine to coarse of various lithologies.		(0.50)			
			MADE GROUND: CONCRETE. END OF EXPLORATORY HOLE		0.70 (0.00) +29.74			
Groundwater Entries No. Depth Strike (m) Remarks			Remarks Depth (m) Remarks			Stability Stable Shoring None Weather		
Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column. Scale 1:25 © Copyright SOCOTEC UK Limited 20/05/2020 17:06:32			Project WREXHAM SI Project No. F9042-19 Carried out for Conrad Energy Ltd.			Trial Pit HDP05A Sheet 1 of 1		

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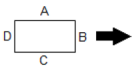
Logged JT		Start 19/02/2020		Equipment, Methods and Remarks Hand tools Hand dug inspection pit to 1.20m. No groundwater encountered.		Dimension and Orientation Width 0.30 m Length 0.30 m		A D B C ➔		Ground Level 30.47 mOD					
Checked AG		End 19/02/2020								Coordinates (m) E 338720.47					
Approved MW										National Grid N 349511.22					
Samples and Tests				Strata Description											
Depth		Type & No.		Records		Main		Detail		Depth, Level (Thickness)		Legend		Backfill	
0.20		ES1				MADE GROUND: Dark brown sandy angular fine to coarse GRAVEL of brick and concrete with occasional ash and medium cobble content. Cobbles are angular of brick and concrete.				(0.90)					
0.50 0.50 0.50		ES2 D4 B5													
1.00 1.00 1.00		ES3 D6 B7													
						MADE GROUND: Soft brown sandy slightly gravelly CLAY with occasional fragments of ceramic pipe. Gravel is angular fine to coarse of brick and concrete.				0.90 +29.57 (0.30)					
						END OF EXPLORATORY HOLE				1.20 +29.27					

Trial Pit Log



Logged KH Checked AG Approved MW		Start 18/02/2020 End 18/02/2020	Equipment, Methods and Remarks Hand tools Hand dug inspection pit to 0.65m. No groundwater encountered. Terminated at 0.65m due to concrete obstruction.	Dimension and Orientation Width 0.20 m Length 0.20 m A B C D		Ground Level 30.50 mOD Coordinates (m) E 338667.82 National Grid N 349522.70	
Samples and Tests			Strata Description				
Depth	Type & No.	Records	Main	Detail	Depth, Level (Thickness)	Legend	Backfill
0.00 - 0.20	B1	18/02/20 Dry	MADE GROUND: Soft greyish brown slightly sandy slightly gravelly CLAY with frequent rootlets and roots (up to 80mm dia.). Gravel is angular to subrounded fine and medium of brick, timber and quartzite.	0.65 Concrete obstruction	(0.20)		
0.20	ES3		MADE GROUND: Firm to stiff grey slightly sandy gravelly CLAY. Gravel is angular to subangular medium and coarse of predominantly quartzite.		0.20 +30.30		
0.20 - 0.40	D2				(0.20)		
0.30	B4				0.40 +30.10		
0.40 - 0.60	D5				(0.25)		
0.50	B6		MADE GROUND: Firm to stiff orangish brown slightly sandy slightly gravelly CLAY. Gravel is angular to subrounded fine to coarse of mixed lithologies including brick, siltstone, mudstone, quartzite and ceramic.				
0.50	ES8		END OF EXPLORATORY HOLE		0.65 +29.85		
0.50	D7						
Groundwater Entries			Remarks		Stability		
No.	Depth	Strike (m)	Remarks	Remarks	Shoring		
					Weather		
Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.			Project WREXHAM SI		Trial Pit		
Scale 1:25 © Copyright SOCOTEC UK Limited 20/05/2020 17:06:32			Project No. F9042-19		WS01		
AGS			Carried out for Conrad Energy Ltd.		Sheet 1 of 1		

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Logged KH		Start 18/02/2020	Equipment, Methods and Remarks Hand tools Hand dug inspection pit to 0.65m. No groundwater encountered. Terminated at 0.65m due to concrete slab.		Dimension and Orientation Width 0.20 m Length 0.20 m 		Ground Level 30.51 mOD	
Checked AG		End 18/02/2020					Coordinates (m) E 338665.02	
Approved MW							National Grid N 349523.04	
Samples and Tests			Strata Description					
Depth	Type & No.	Records	Main		Detail	Depth, Level (Thickness)	Legend	Backfill
0.20 - 0.40	B1	18/02/20 Dry	MADE GROUND: Soft greyish brown slightly sandy slightly gravelly CLAY with frequent rootlets and roots (up to 40mm). Gravel is angular to subangular fine and medium of mixed lithologies including brick, timber and quartzite.			(0.20)		
0.30	D2		MADE GROUND: Firm to stiff grey slightly sandy gravelly CLAY with low cobble content. Gravel is angular to subangular medium and coarse of predominantly quartzite. Cobbles are subangular of quartzite.			(0.20) +30.31		
			MADE GROUND: Firm to stiff orangish brown slightly sandy slightly gravelly CLAY. Gravel is angular to subrounded fine to coarse of mixed lithologies including brick, siltstone, mudstone, ceramics and quartzite.			(0.20) +30.11		
			END OF EXPLORATORY HOLE		0.65 Concrete obstruction	(0.25)		
						0.65 +29.86		
Groundwater Entries			Remarks			Stability		
No.	Depth	Strike (m)	Remarks	Remarks		Shoring		
						Weather		
Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.			Project WREXHAM SI			Trial Pit		
Scale 1:25			Project No. F9042-19			WS01A		
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APPENDIX C

INSTRUMENTATION AND MONITORING

Monitoring Installation Details

Table C1

Groundwater Monitoring

Table C2

Gas Monitoring

Table C3

Monitoring Installation Details

Instrument Reference	Instrument Type (See Notes)	Installation Date, dd/mm/yyyy	Pipe Diameter, mm	Instrument Base, mbgl	Response Zone Range, mbgl	Pipe Top Details	Headworks	Remarks
BH02 (1)	SP	20/02/2020	50	1.00	0.50 to 1.00	Gas tap	Flush cover	
BH03 (1)	SP	20/02/2020	50	5.00	3.00 to 5.00	Gas tap	Flush cover	
WS03 (1)	SP	18/02/2020	50	2.20	1.20 to 2.20	Gas tap	Flush cover	
WS04 (1)	SP	19/02/2020	50	3.00	2.00 to 3.00	Gas tap	Flush cover	

Notes: Notes: Type: SP - Standpipe



Project **WREXHAM SI**
 Project No. **F9042-19**
 Carried out for **Conrad Energy Ltd.**

Figure

C1

Groundwater Monitoring

Instrument Reference	Instrument Type	Instrument Base, mbgl	Date Time dd/mm/yyyy hh:mm:ss	Groundwater depth, mbgl	Comments
BH02 (1)	SP	1.00	28/02/2020 00:00:00	Dry	Pipe dropped to 1.30m.
BH02 (1)	SP	1.00	13/03/2020 14:20:00	Dry	
BH02 (1)	SP	1.00	24/03/2020 12:19:00	Dry	
BH03 (1)	SP	5.00	28/02/2020 11:48:00	0.68	
BH03 (1)	SP	5.00	10/03/2020 11:46:00	0.70	
BH03 (1)	SP	5.00	24/03/2020 12:36:00	0.73	
WS03 (1)	SP	2.20	28/02/2020 11:12:00	0.21	
WS03 (1)	SP	2.20	10/03/2020 11:23:00	0.00	Gas monitoring stopped due to ingress of water into machine
WS03 (1)	SP	2.20	24/03/2020 12:36:00	0.00	Unable to monitor gas due to high water table
WS04 (1)	SP	3.00	28/02/2020 12:06:00	1.39	
WS04 (1)	SP	3.00	10/03/2020 12:05:00	1.33	
WS04 (1)	SP	3.00	24/03/2020 13:00:00	1.40	

Notes: Type: SP - Standpipe, SPIE - Standpipe Piezometer, HPIE - Hydraulic Piezometer, PPIE - Pneumatic Piezometer, EPIE - Vibrating Wire Piezometer, PWEL - Pumping Well



Project WREXHAM SI
Project No. F9042-19
Carried out for Conrad Energy Ltd.

C2

Gas Monitoring

							Gas Concentrations						
Instrument Reference	Instrument Base, mbgl	Date Time dd/mm/yyyy hh:mm:ss	Air Temperature, oC	Barometric Pressure, mbar	Gas Differential Pressure, Pa	Gas Flow Rate, l/hr	Carbon Dioxide, %vol	Carbon Monoxide, ppm	Hydrogen Sulphide, ppm	Nitrogen, %vol	Oxygen, %vol	Methane, %vol	
BH02 (1)	1.00	13/03/2020 14:20:00	8.0	1014		0.2	0.6	ND	ND	80.0	20.6	ND	
BH02 (1)	1.00	13/03/2020 14:25:00	8.0	1014		0.3	1.9	ND	ND	79.0	19.1	ND	
BH02 (1)	1.00	24/03/2020 12:19:00	8.0	1026	-5.0	0.0	0.1	1.0	ND	78.5	26.9	ND	
BH02 (1)	1.00	24/03/2020 12:30:00	8.0	1026	2.0	0.0	2.2	1.0	ND	78.8	19.0	ND	
BH03 (1)	5.00	28/02/2020 11:48:00	4.0	1000		0.3	0.1	ND	ND	77.4	22.5	ND	
BH03 (1)	5.00	28/02/2020 11:53:00	4.0	1000		0.8	0.1	ND	ND	77.6	22.3	ND	
BH03 (1)	5.00	10/03/2020 11:46:00	14.0	999		0.2	0.1	2.0	ND	78.7	21.2	ND	
BH03 (1)	5.00	10/03/2020 11:51:00	14.0	999		0.2	0.2	1.0	ND	78.9	20.9	ND	
BH03 (1)	5.00	24/03/2020 12:36:00	8.0	1027		0.0	0.3	1.0	ND	78.5	21.2	ND	
BH03 (1)	5.00	24/03/2020 12:51:00	8.0	1027		25.5	0.2	1.0	ND	78.7	21.1	ND	
WS03 (1)	2.20	28/02/2020 11:12:00	3.0	1000	354.0	0.4	0.2	3.0	ND	77.8	21.4	ND	
WS03 (1)	2.20	28/02/2020 11:17:00	3.0	1000	354.0	0.7	0.1	ND	ND	77.6	22.1	ND	
WS03 (1)	2.20	10/03/2020 11:23:00	14.0	999			0.2	5.0	ND	81.0	21.0	ND	
WS04 (1)	3.00	10/03/2020 12:05:00	14.0	997	0.0	0.1	0.1	1.0	ND	78.7	21.2	ND	
WS04 (1)	3.00	10/03/2020 12:08:00	14.0	997	0.0	0.2	0.1	1.0	ND	78.7	21.2	ND	
WS04 (1)	3.00	24/03/2020 13:00:00	8.0	1026	10.0	0.0	0.1	2.0	ND	78.2	21.4	ND	
WS04 (1)	3.00	24/03/2020 13:15:00	8.0	1026	10.0	0.0	0.3	1.0	ND	78.5	21.2	ND	

Notes: ND - not detected

Project **WREXHAM SI**
 Project No. **F9042-19**
 Carried out for **Conrad Energy Ltd.**

C3



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APPENDIX D
GEOTECHNICAL LABORATORY TEST RESULTS

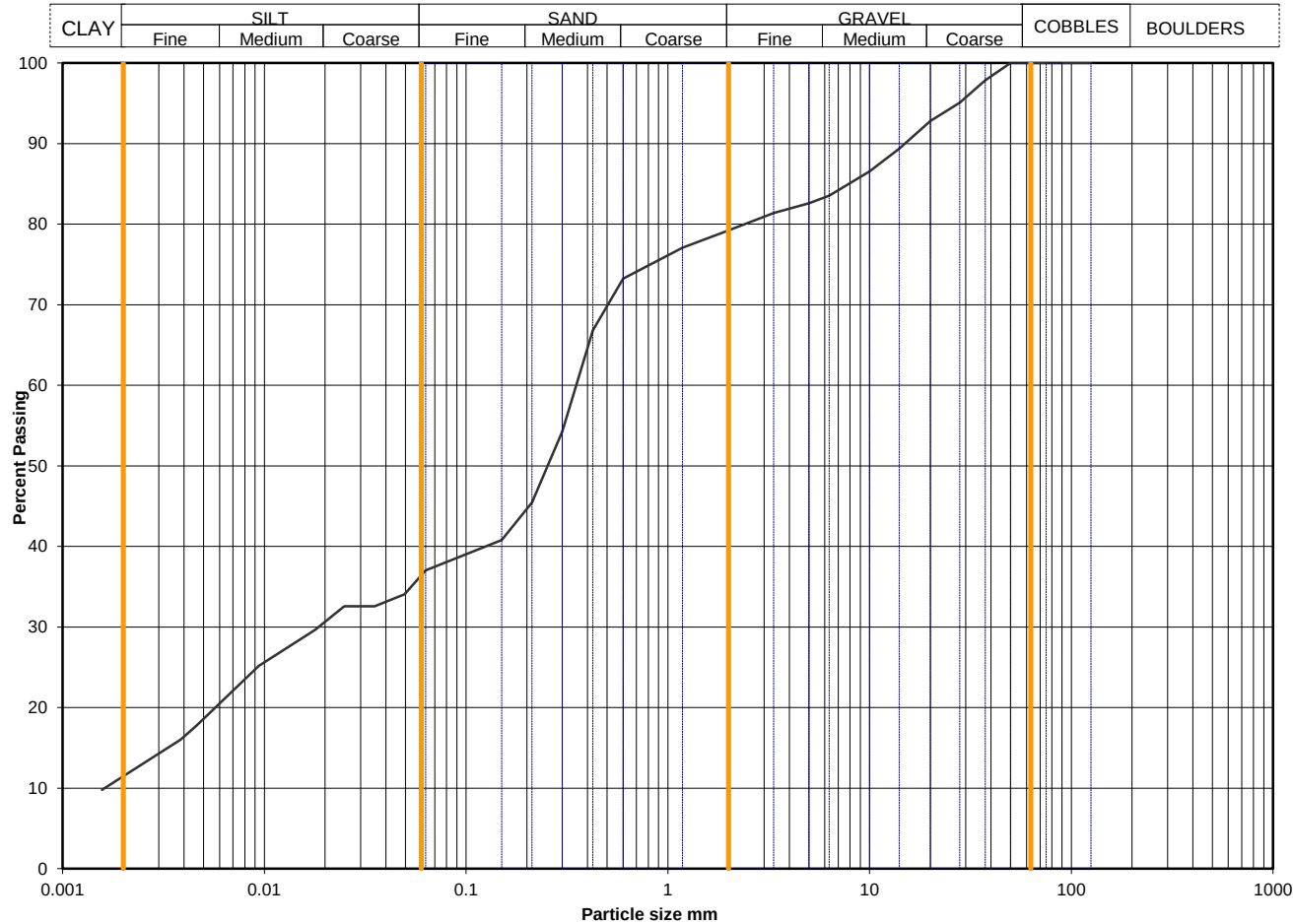
Index Properties – Summary of Results	INDX
Particle Size Distribution Analyses	PSD
Unconsolidated Undrained Triaxial Compression Tests – Summary of Results	UUSUM
Certificate of Analysis	20030214

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Printed: 27/03/2020 14:49

Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:	Hole No	BH01
	F9042-1920200219030919	Sample Depth (m BGL)	0.20 - 0.20
		Sample Type and No	B1
		Specimen Ref	

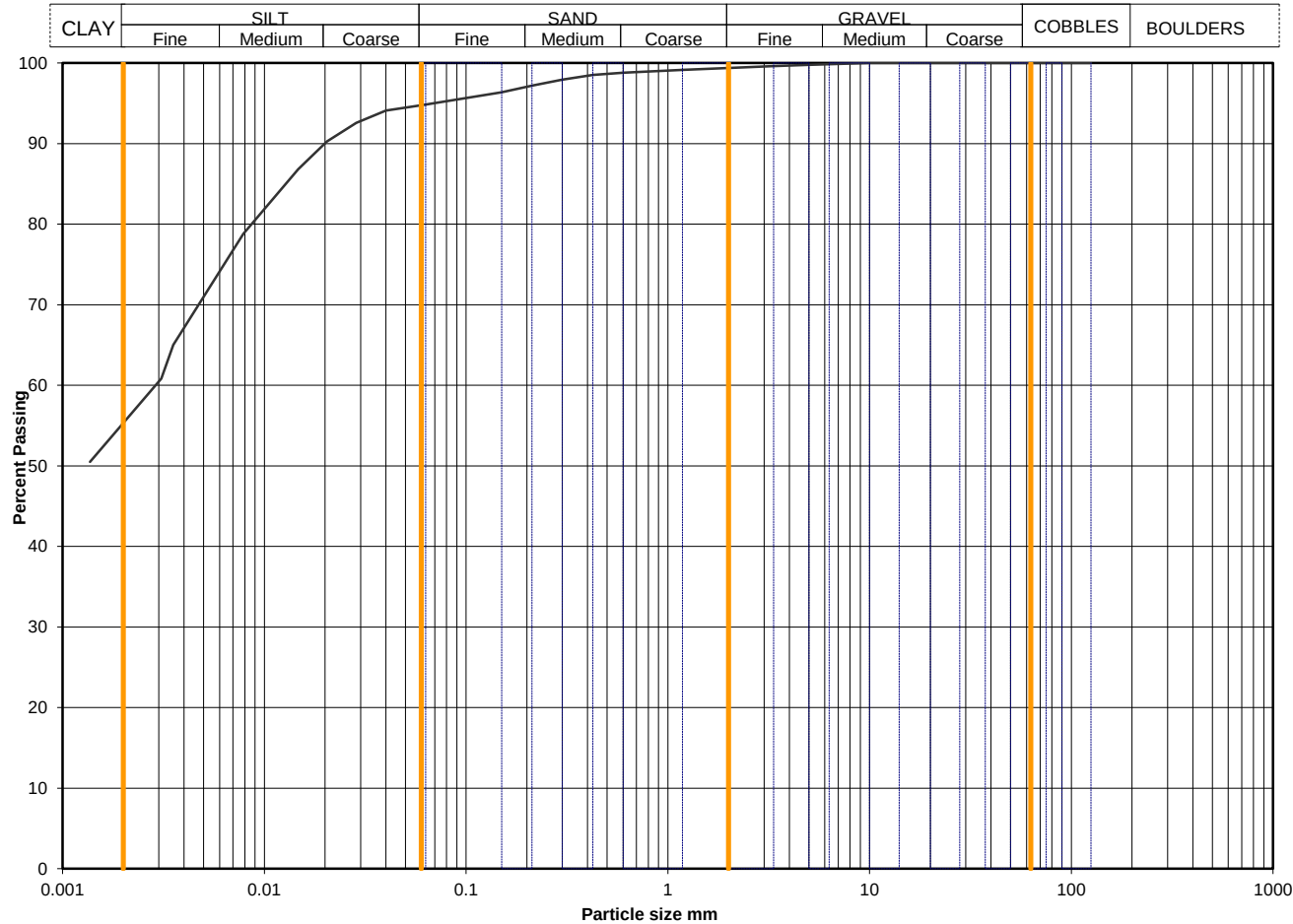


Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	37
90	100	0.0495	34
75	100	0.0352	33
63	100	0.0249	33
50	100	0.0178	30
37.5	98	0.0094	25
28	95	0.0046	18
20	93	0.0038	16
14	89	0.0016	10
10	87		
6.3	84		
5.0	83		
3.35	81		
2.00	79		
1.18	77		
0.600	73	Particle density, Mg/m3	
0.425	67	2.65 assumed	
0.300	54		
0.212	45	Dry mass of sample, kg	
0.150	41	5.5	
0.063	37		

Soil description	Dark brown slightly gravelly sandy silty CLAY with rootlets.		
Preparation / Pretreatment	Sieve: pre dried, Hydro: as BS1377		
Remarks			
Sample Proportions	Cobbles / boulders Gravel Sand Silt Clay	Whole	*<60mm
		0.0	0.0
		20.7	20.7
		42.2	42.2
		25.6	25.6
		11.5	11.5
*<60mm values to aid description only			
Uniformity Coefficient		D60 / D10	217
Test Method	BS 1377 : Part 2 : 1990		
	Sieving	9.2 wet sieve	
	Sedimentation	9.5 hydrometer	

Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:	Hole No	BH02
	F9042-1920200224095259	Sample Depth (m BGL)	0.80 - 1.20
		Sample Type and No	B2
		Specimen Ref	

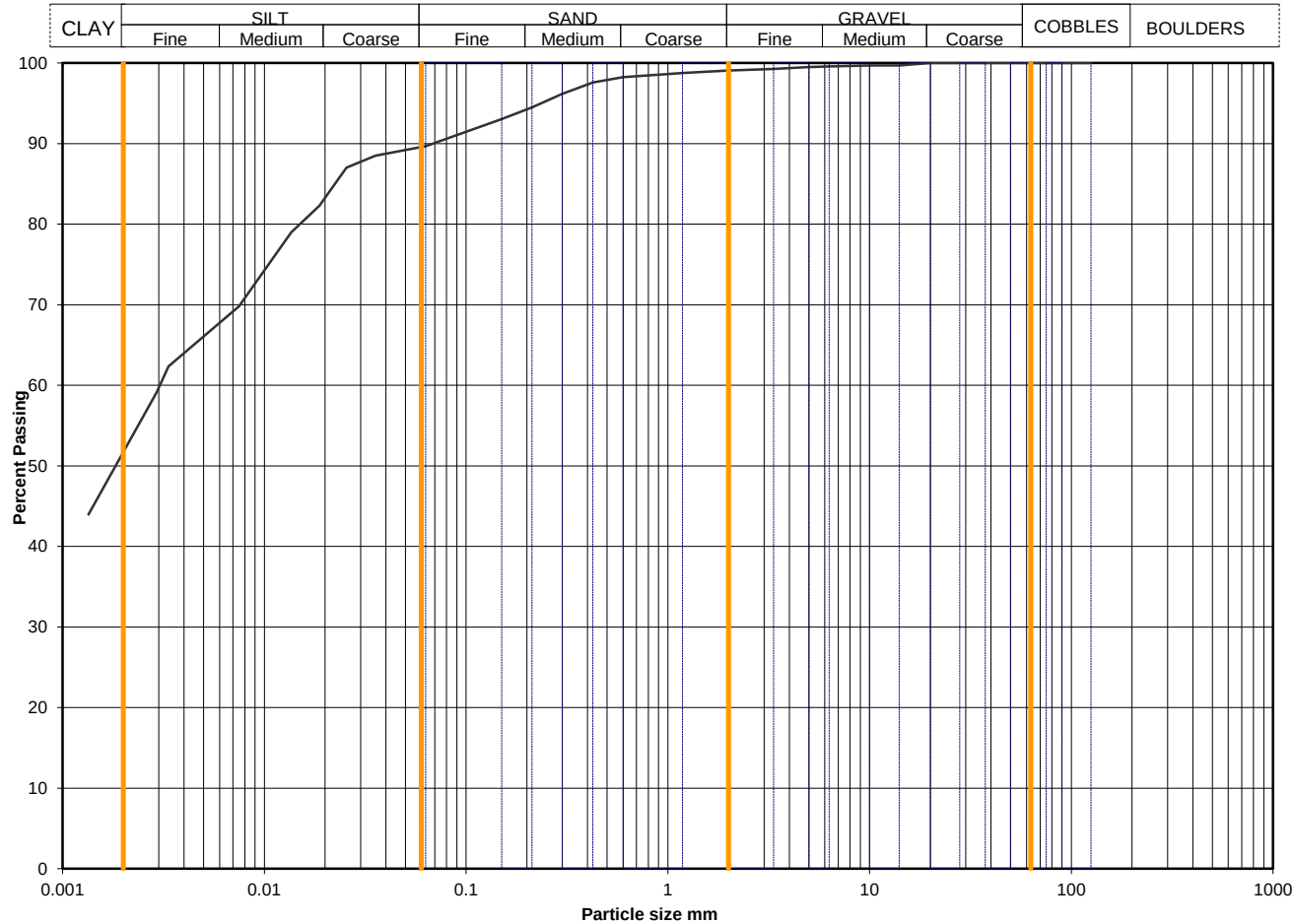


Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	95
90	100	0.0401	94
75	100	0.0286	93
63	100	0.0204	90
50	100	0.0147	87
37.5	100	0.0079	79
28	100	0.0035	65
20	100	0.0031	61
14	100	0.0014	50
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	99		
1.18	99	Particle density, Mg/m3 2.65 assumed	
0.600	99		
0.425	99		
0.300	98	Dry mass of sample, kg 0.8	
0.212	97		
0.150	96		
0.063	95		

Soil description	Brown slightly sandy CLAY.		
Preparation / Pretreatment	Sieve: pre dried, Hydro: as BS1377		
Remarks			
Sample Proportions *<60mm values to aid description only	Cobbles / boulders Gravel Sand Silt Clay	Whole	*<60mm
		0.0	0.0
		0.6	0.6
		4.5	4.5
		39.6	39.6
		55.3	55.3
Uniformity Coefficient D60 / D10		Not applicable	
Test Method	BS 1377 : Part 2 : 1990		
	Sieving	9.3 dry sieve	
	Sedimentation	9.5 hydrometer	

Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:	Hole No	BH02
	F9042-1920200224095344	Sample Depth (m BGL)	2.00 - 2.45
		Sample Type and No	B7
		Specimen Ref	

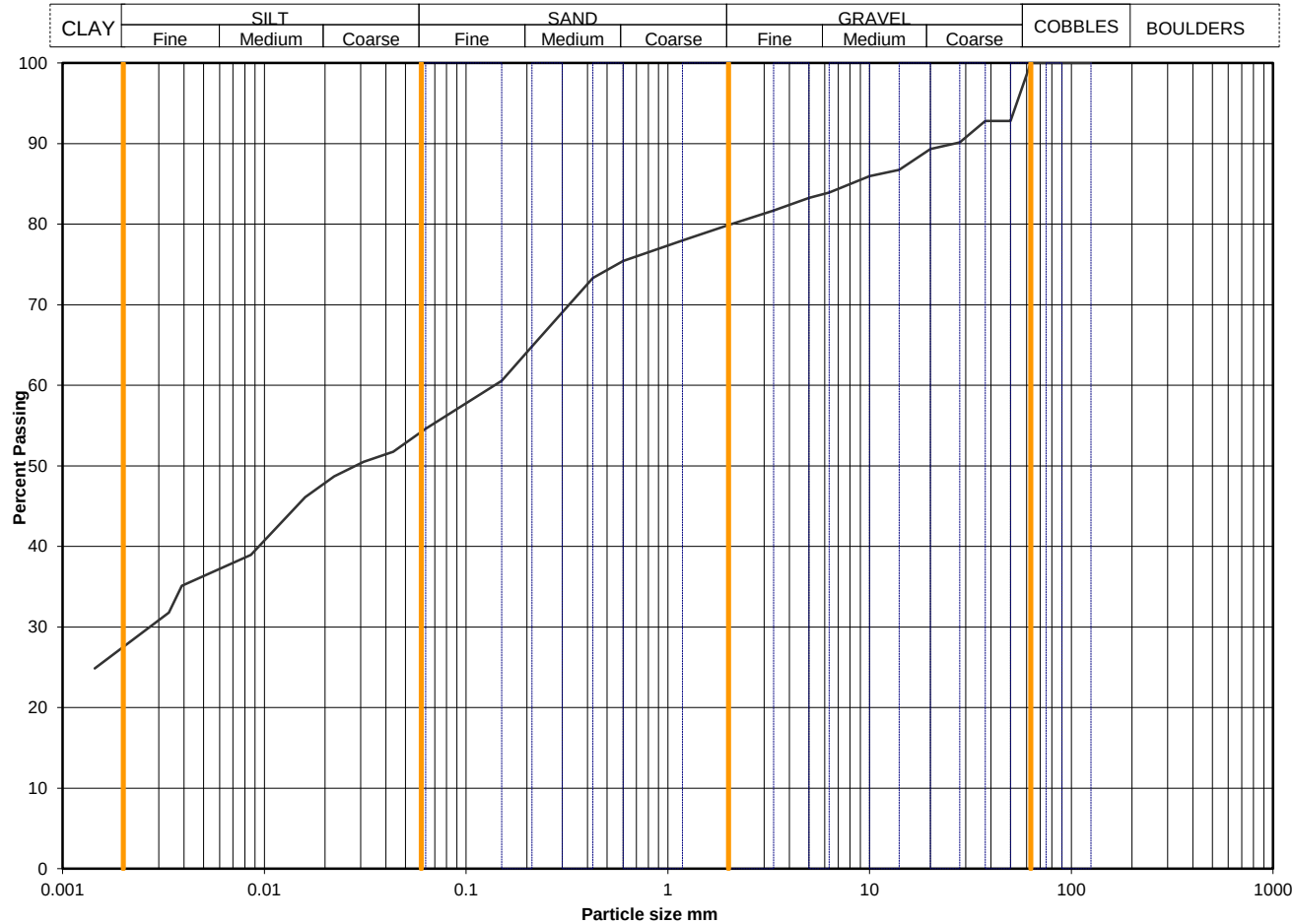


Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	90
90	100	0.0356	89
75	100	0.0255	87
63	100	0.0187	82
50	100	0.0136	79
37.5	100	0.0075	70
28	100	0.0033	62
20	100	0.0029	59
14	100	0.0013	44
10	100		
6.3	100		
5.0	99		
3.35	99		
2.00	99		
1.18	99	Particle density, Mg/m3 2.65 assumed	
0.600	98		
0.425	98		
0.300	96	Dry mass of sample, kg 1.5	
0.212	95		
0.150	93		
0.063	90		

Soil description	Brown slightly sandy CLAY.		
Preparation / Pretreatment	Sieve: pre dried, Hydro: as BS1377		
Remarks			
Sample Proportions	Cobbles / boulders Gravel Sand Silt Clay	Whole	*<60mm
		0.0	0.0
		0.9	0.9
		9.4	9.4
		38.0	38.0
Test Method	BS 1377 : Part 2 : 1990		
	Sieving	9.2	wet sieve
	Sedimentation	9.5	hydrometer
Uniformity Coefficient		D60 / D10	Not applicable

Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:	Hole No	BH03
		Sample Depth (m BGL)	1.00 - 1.20
	F9042-1920200220121717	Sample Type and No	B9
		Specimen Ref	

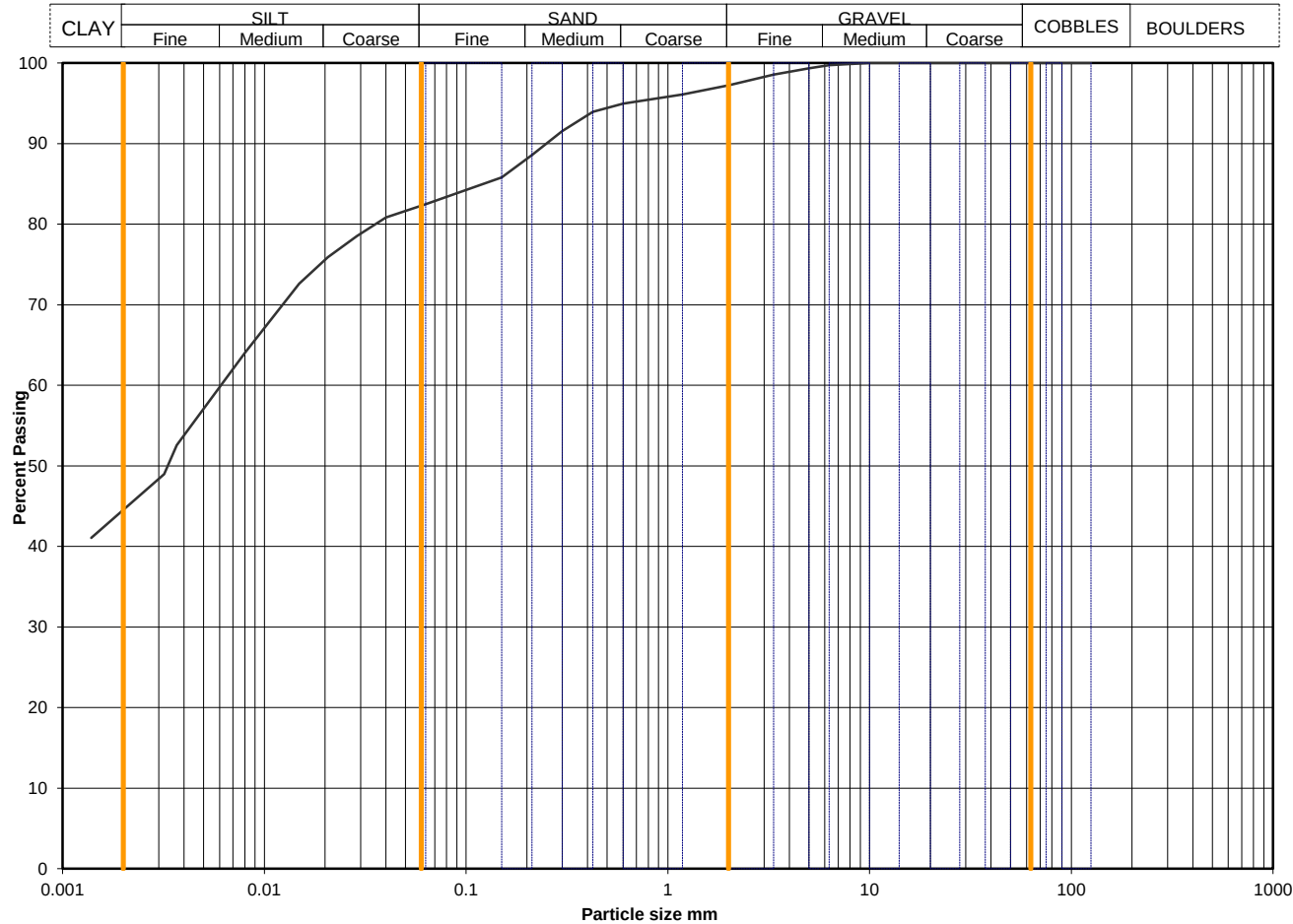


Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	55
90	100	0.0435	52
75	100	0.0310	50
63	100	0.0222	49
50	93	0.0159	46
37.5	93	0.0086	39
28	90	0.0039	35
20	89	0.0034	32
14	87	0.0014	25
10	86		
6.3	84		
5.0	83		
3.35	82		
2.00	80		
1.18	78		
0.600	75	Particle density, Mg/m3	
0.425	73	2.65	assumed
0.300	69		
0.212	65	Dry mass of sample, kg	
0.150	61	2.9	
0.063	55		

Soil description	Brown slightly sandy slightly gravelly CLAY.		
Preparation / Pretreatment	Sieve: pre dried, Hydro: as BS1377		
Remarks			
Sample Proportions	Cobbles / boulders Gravel Sand Silt Clay	Whole	*<60mm
		0.0	0.0
		20.1	20.1
		25.3	25.3
		27.1	27.1
		27.5	27.5
*<60mm values to aid description only			
Uniformity Coefficient		D60 / D10	Not applicable
Test Method	BS 1377 : Part 2 : 1990		
	Sieving	9.2 wet sieve	
	Sedimentation	9.5 hydrometer	

Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:	Hole No	BH03
	F9042-1920200220121750	Sample Depth (m BGL)	1.20 - 1.65
		Sample Type and No	B13
		Specimen Ref	

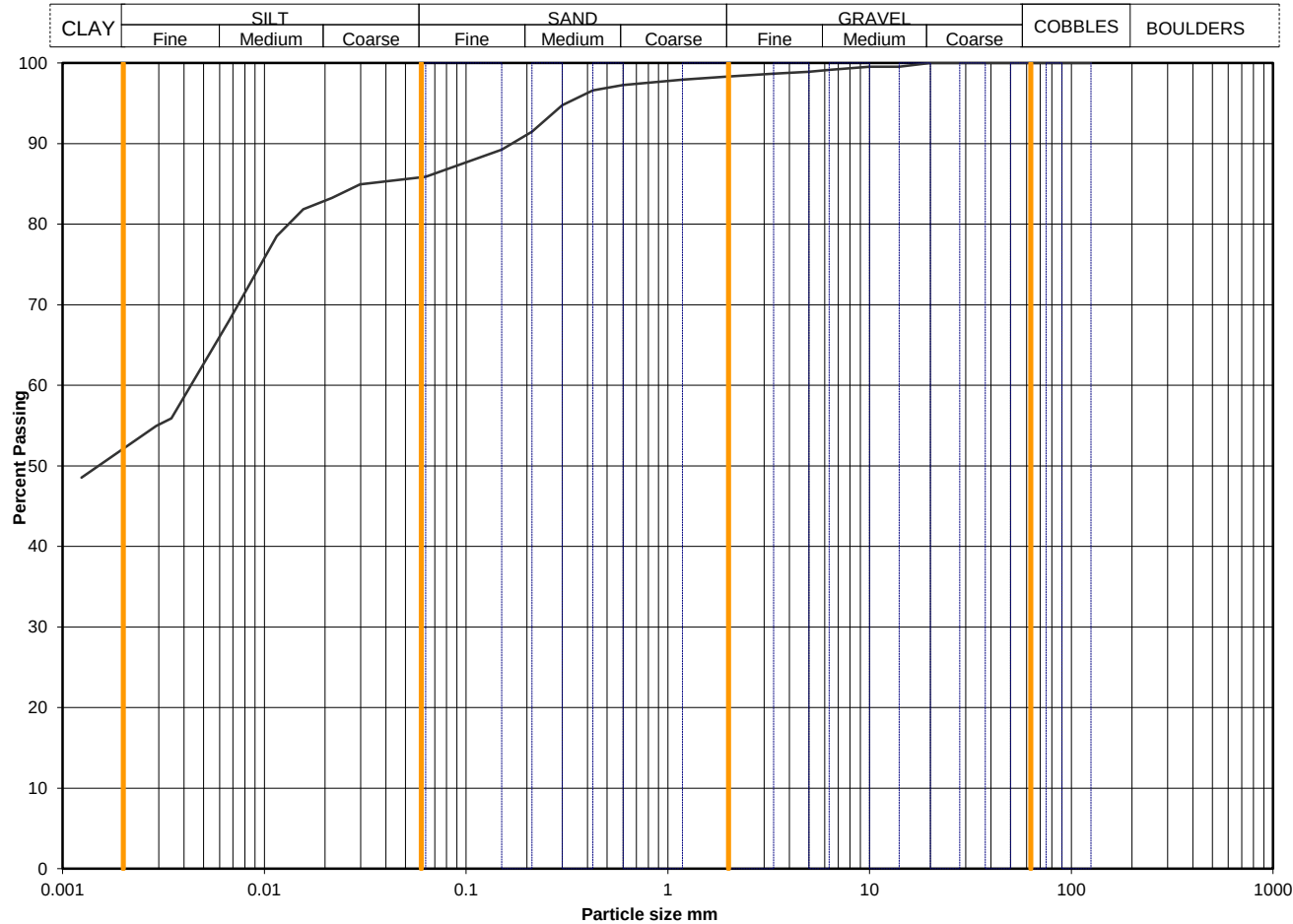


Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	82
90	100	0.0401	81
75	100	0.0287	79
63	100	0.0206	76
50	100	0.0149	73
37.5	100	0.0080	64
28	100	0.0037	53
20	100	0.0032	49
14	100	0.0014	41
10	100		
6.3	100		
5.0	99		
3.35	99		
2.00	97		
1.18	96	Particle density, Mg/m3 2.65 assumed	
0.600	95		
0.425	94		
0.300	92	Dry mass of sample, kg 1.0	
0.212	89		
0.150	86		
0.063	82		

Soil description	Brown slightly sandy slightly gravelly CLAY.		
Preparation / Pretreatment	Sieve: pre dried, Hydro: as BS1377		
Remarks			
Sample Proportions	Cobbles / boulders Gravel Sand Silt Clay	Whole	*<60mm
		0.0	0.0
		2.8	2.8
		14.8	14.8
		37.9	37.9
		44.5	44.5
*<60mm values to aid description only			
Uniformity Coefficient D60 / D10		Not applicable	
Test Method	BS 1377 : Part 2 : 1990		
	Sieving	9.2 wet sieve	
	Sedimentation	9.5 hydrometer	

Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:	Hole No	BH03
	F9042-1920200220121951	Sample Depth (m BGL)	5.00 - 5.45
		Sample Type and No	B22
		Specimen Ref	

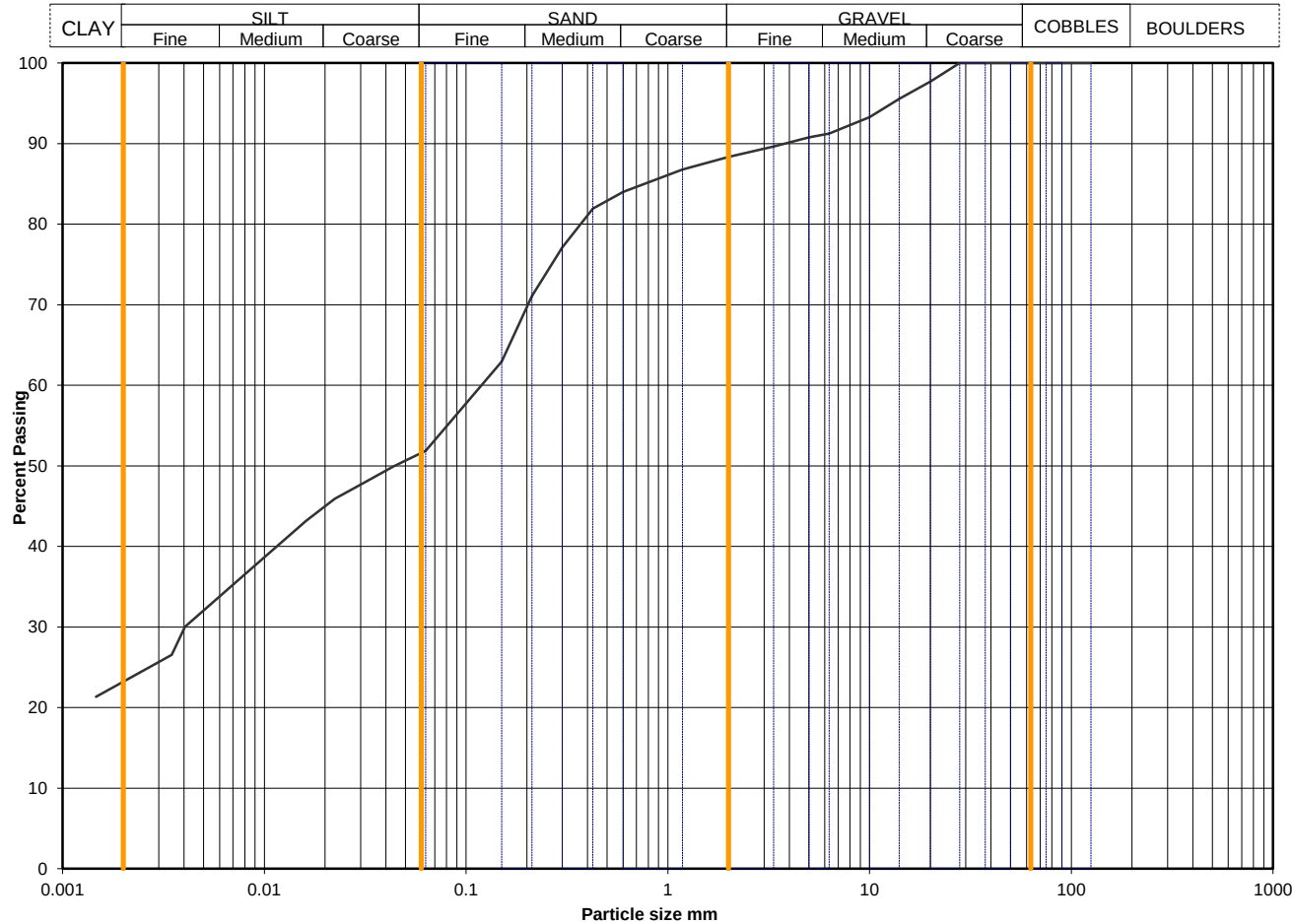


Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	86
90	100	0.0298	85
75	100	0.0216	83
63	100	0.0156	82
50	100	0.0115	79
37.5	100	0.0067	68
28	100	0.0035	56
20	100	0.0029	55
14	100	0.0012	49
10	100		
6.3	99		
5.0	99		
3.35	99		
2.00	98		
1.18	98		
0.600	97	Particle density, Mg/m3	
0.425	97	2.65 assumed	
0.300	95	Dry mass of sample, kg	
0.212	91	1.2	
0.150	89		
0.063	86		

Soil description	Brown slightly sandy slightly gravelly CLAY.		
Preparation / Pretreatment	Sieve: pre dried, Hydro: as BS1377		
Remarks			
Sample Proportions	Cobbles / boulders	Whole	*<60mm
	Gravel	0.0	0.0
	Sand	1.7	1.7
	Silt	12.4	12.4
	Clay	33.8	33.8
*<60mm values to aid description only			
Uniformity Coefficient		D60 / D10	Not applicable
Test Method	BS 1377 : Part 2 : 1990		
	Sieving	9.2 wet sieve	
	Sedimentation	9.5 hydrometer	

Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:	Hole No	HDP06
	F9042-1920200224120147	Sample Depth (m BGL)	1.00 - 1.00
		Sample Type and No	B7
		Specimen Ref	

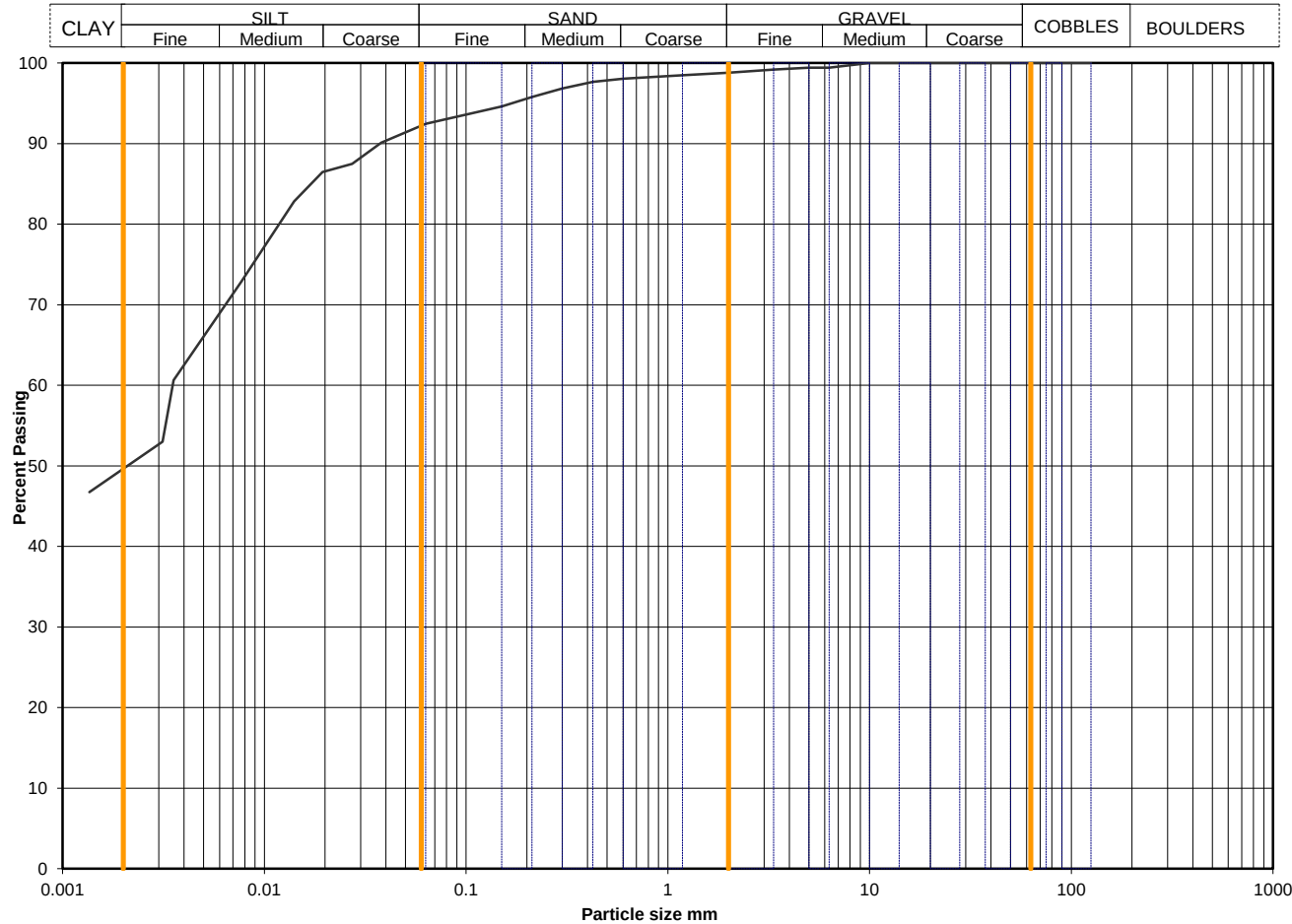


Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	52
90	100	0.0435	50
75	100	0.0312	48
63	100	0.0224	46
50	100	0.0161	43
37.5	100	0.0086	37
28	100	0.0040	30
20	98	0.0035	27
14	96	0.0015	21
10	93		
6.3	91		
5.0	91		
3.35	90		
2.00	88		
1.18	87		
0.600	84	Particle density, Mg/m3	
0.425	82	2.65 assumed	
0.300	77	Dry mass of sample, kg	
0.212	71	3.8	
0.150	63		
0.063	52		

Soil description	Dark brown slightly gravelly sandy CLAY.		
Preparation / Pretreatment	Sieve: pre dried, Hydro: as BS1377		
Remarks			
Sample Proportions	Cobbles / boulders Gravel Sand Silt Clay	Whole	*<60mm
		0.0	0.0
		11.6	11.6
		36.5	36.5
		28.7	28.7
		23.2	23.2
*<60mm values to aid description only			
Uniformity Coefficient		D60 / D10	Not applicable
Test Method	BS 1377 : Part 2 : 1990		
	Sieving	9.2 wet sieve	
	Sedimentation	9.5 hydrometer	

Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:	Hole No	WS03
	F9042-1920200219025713	Sample Depth (m BGL)	2.00 - 4.00
		Sample Type and No	B18
		Specimen Ref	

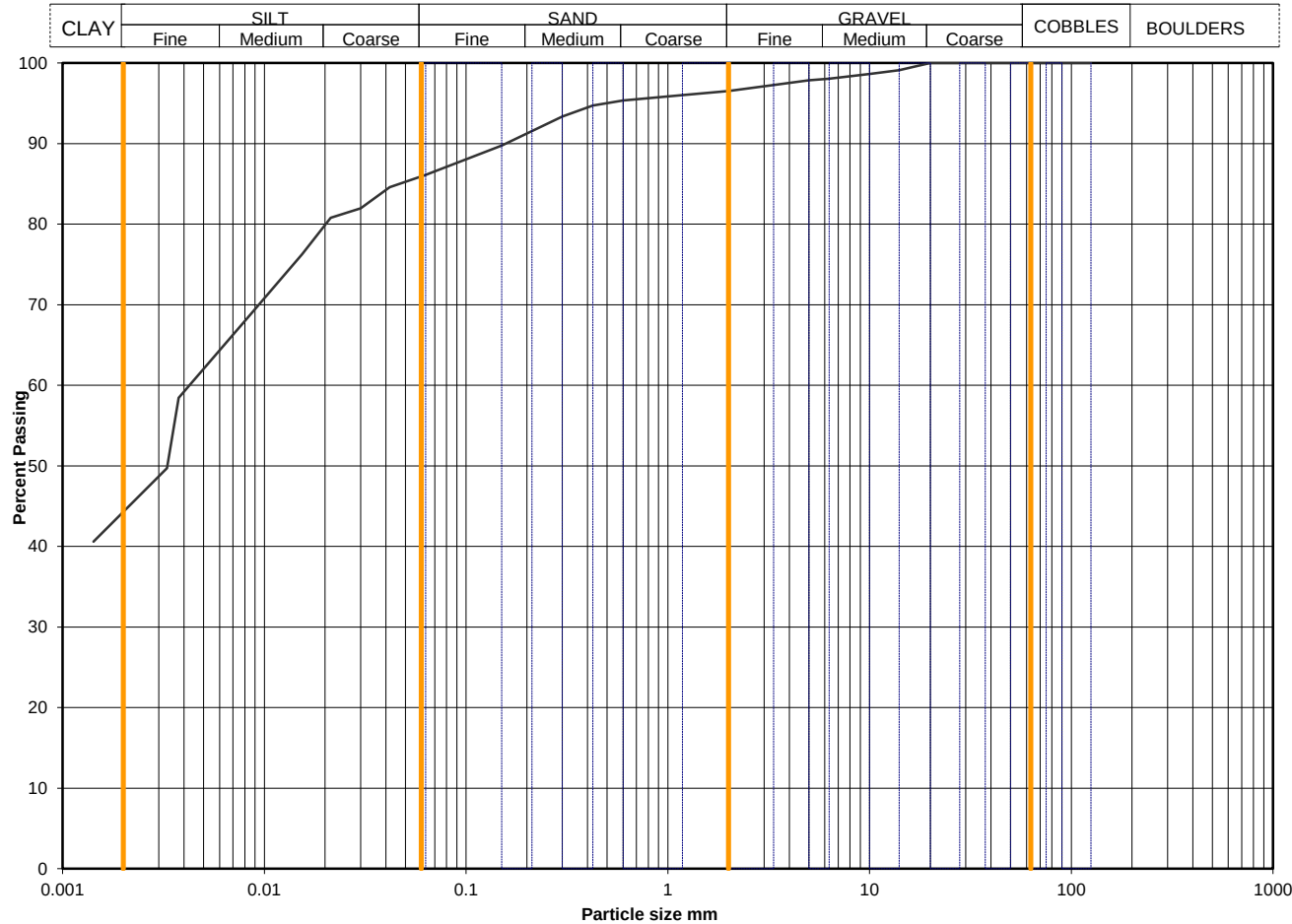


Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	92
90	100	0.0379	90
75	100	0.0273	87
63	100	0.0194	86
50	100	0.0141	83
37.5	100	0.0077	73
28	100	0.0035	61
20	100	0.0031	53
14	100	0.0014	47
10	100		
6.3	99		
5.0	99		
3.35	99		
2.00	99		
1.18	98	Particle density, Mg/m3 2.65 assumed	
0.600	98		
0.425	98	Dry mass of sample, kg 0.7	
0.300	97		
0.212	96		
0.150	95		
0.063	92		

Soil description	Brown slightly sandy slightly gravelly CLAY.		
Preparation / Pretreatment	Sieve: pre dried, Hydro: as BS1377		
Remarks			
Sample Proportions	Cobbles / boulders	Whole	*<60mm
	Gravel	0.0	0.0
	Sand	1.3	1.3
	Silt	6.3	6.3
	Clay	42.8	42.8
*<60mm values to aid description only			
Uniformity Coefficient		D60 / D10	Not applicable
Test Method	BS 1377 : Part 2 : 1990		
	Sieving	9.2 wet sieve	
	Sedimentation	9.5 hydrometer	

Particle Size Distribution Analysis

Sample Details:	SAMPLE ID:	Hole No	WS04
	F9042-1920200224121127	Sample Depth (m BGL)	1.00 - 1.50
		Sample Type and No	B3
		Specimen Ref	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	86
90	100	0.0419	85
75	100	0.0300	82
63	100	0.0213	81
50	100	0.0154	76
37.5	100	0.0082	68
28	100	0.0038	58
20	100	0.0033	50
14	99	0.0014	41
10	99		
6.3	98		
5.0	98		
3.35	97		
2.00	97		
1.18	96		
0.600	95	Particle density, Mg/m3	
0.425	95	2.65	assumed
0.300	93		
0.212	92	Dry mass of sample, kg	
0.150	90	0.9	
0.063	86		

Soil description	Brown mottled grey slightly sandy slightly gravelly CLAY.		
Preparation / Pretreatment	Sieve: pre dried, Hydro: as BS1377		
Remarks			
Sample Proportions	Cobbles / boulders	Whole	*<60mm
	Gravel	0.0	0.0
	Sand	3.5	3.5
	Silt	10.4	10.4
	Clay	41.8	41.8
*<60mm values to aid description only		44.3	44.3
Uniformity Coefficient		D60 / D10	Not applicable
Test Method	BS 1377 : Part 2 : 1990		
	Sieving	9.2 wet sieve	
	Sedimentation	9.5 hydrometer	

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SOCOTEC

Environmental Chemistry
SOCOTEC UK
Ashby Rd, Bretby,
Burton-on-Trent, UK
DE15 0YZ

Certificate of Analysis

Project No: 20030214

Client: SOCOTEC Geotechnical

Quote Number: BEC20037086

Project Reference: F9042-19

Site Name: F9042-19 Wrexham SI

Contact: Melody Wareing

Address: Geotechnical House
18-19 Drome Road
Deeside
Flintshire

Post Code: CH5 2NY

E-Mail: melody.wareing@socotec.com

Phone No: 01244 288200

Number of Samples Received: 6

Date Received: 14/03/2020

Analysis Date: 24/03/2020

Date Issued: 24/03/2020

Job Status: Complete

Account Manager
Martin Palmer

Authorised by the Operations Manager
Becky Batham



Client: SOCOTEC Geotechnical

Project Name: F9042-19 Wrexham SI

Project No: 20030214

Date Issued: 24/03/2020

Samples Analysed

Sample Reference	Text ID	Sample Date	Sample Type
BH01-5-D-0.50	20030214-001	18/02/2020 00:00:00	SOLID
BH02-4-D-1.65	20030214-002	20/02/2020 00:00:00	SOLID
BH03-12-D-1.20	20030214-003	19/02/2020 00:00:00	SOLID
BH03-15-D-2.45	20030214-004	19/02/2020 00:00:00	SOLID
HDP02-2-D-0.20	20030214-005	18/02/2020 00:00:00	SOLID
WS02-5-D-0.50	20030214-006	18/02/2020 00:00:00	SOLID



Client: SOCOTEC Geotechnical
 Project Name: F9042-19 Wrexham SI
 Project No: 20030214
 Date Issued: 24/03/2020

Analysis Results

					20030214					
					001	002	003	004	005	006
					BH01-5-D-0.50	BH02-4-D-1.65	BH03-12-D-1.20	BH03-15-D-2.45	HDP02-2-D-0.20	WS02-5-D-0.50
					SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
					18/02/2020	20/02/2020	19/02/2020	19/02/2020	18/02/2020	18/02/2020
Analysis	Method Code	MDL	Units	Accred						
pH (2.5:1 extraction)	PHSOIL	1	pH units	U	8.4	9.0	8.6	8.5	8.1	8.2
Sulphur as S	WSLM59	0.005	% m/m	N	0.066	0.033	0.030	0.039	0.085	0.054
Water Soluble Sulphate as SO4	ICPWSS	10	mg/l	U	155	109	73	106	35	21
Acid Soluble Sulphate as SO4	ICPACIDS	20	mg/kg	U	920	421	272	477	605	440
Total Moisture at 35°C	CLANDPREP	0.1	%	N	17.1	16.0	20.7	18.9	23.2	19.5
Description of Solid Material	CLANDPREP		-	N	CLAY	CLAY	CLAY	CLAY	CLAY	CLAY





Client: SOCOTEC Geotechnical

Project Name: F9042-19 Wrexham SI

Project No: 20030214

Date Issued: 24/03/2020

<u>Deviating Sample Report</u>			Incorrect Container	Incorrect Label	Headspace	Incorrect/No Preservative	No Sampling Date	Holding Time	Handling Time
Sample Reference	Text ID	Reported Name							
BH01-5-D-0.50	20030214-001	PHSOIL						✓	
BH01-5-D-0.50	20030214-001	ICPWSS						✓	
BH02-4-D-1.65	20030214-002	PHSOIL						✓	
BH02-4-D-1.65	20030214-002	ICPWSS						✓	
BH03-12-D-1.20	20030214-003	PHSOIL						✓	
BH03-12-D-1.20	20030214-003	ICPWSS						✓	
BH03-15-D-2.45	20030214-004	PHSOIL						✓	
BH03-15-D-2.45	20030214-004	ICPWSS						✓	
HDP02-2-D-0.20	20030214-005	PHSOIL						✓	
HDP02-2-D-0.20	20030214-005	ICPWSS						✓	
WS02-5-D-0.50	20030214-006	PHSOIL						✓	
WS02-5-D-0.50	20030214-006	ICPWSS						✓	

Analysis Basis

Analysis

CLANDPREP
ICPACIDS
ICPWSS
PHSOIL
TSBRE1
WSLM59

Analysis Type

PHYS
METALS
METALS
INORGANIC
INORGANIC
INORGANIC

Analysis Basis

As Received
Air Dried & Ground
Air Dried & Ground
As Received
Air Dried & Ground
Air Dried & Ground



Client: SOCOTEC Geotechnical

Project Name: F9042-19 Wrexham SI

Project No: 20030214

Date Issued: 24/03/2020

Additional Information

This report refers to samples as received, and SOCOTEC Uk Ltd takes no responsibility for accuracy or competence of sampling by others.

Results within this report relate only to the samples tested.

In the accreditation column of analysis report the codes are as follows:

- U = UKAS accredited analysis
- M = MCERT accredited analysis
- N = Unaccredited analysis

Any units marked with ^ signify results are reported on a dry weight basis of 105° c

All Air Dried and Ground Samples (ADG) are oven dried at less than 35° c.

This report shall not be reproduced except in full and with approval from the laboratory.

Opinions and interpretations given are outside the scope of our UKAS accreditation.

Any samples marked with * are not covered by our scope of UKAS accreditation, if applicable further report notes have been added.

Any solid samples where the Major Constituents are not one of the following (Sand, Silt, Clay, Made Ground) are not one of our accredited matrix types.

Any samples marked with ‡ have had MCERTS accreditation removed for this result

Any samples marked with a tick in the deviant table is deviant for the specific reason.

Any samples reported as IS, NA, ND mean the following:

- IS = Insufficient Sample to complete analysis
- NA = Sample is not amenable for the required analysis
- ND = Results cannot be determined

End of Certificate of Analysis

APPENDIX E
GEOENVIRONMENTAL LABORATORY TEST RESULTS

Certificate of Analysis

2002034, 20020348



SOCOTEC

Environmental Chemistry
SOCOTEC UK
Ashby Rd, Bretby,
Burton-on-Trent, UK
DE15 0YZ

Certificate of Analysis

Project No: 20020347

Client: SOCOTEC Geotechnical

Quote Number: BEC20015722

Project Reference: F9042-19

Site Name: F9042-19 Wrexham SI

Contact: Melody Wareing

Address: Geotechnical House
18-19 Drome Road
Deeside
Flintshire

Post Code: CH5 2NY

E-Mail: melody.wareing@socotec.com

Phone No: 01244 288200

Number of Samples Received: 7

Date Received: 25/02/2020

Analysis Date: 10/03/2020

Date Issued: 12/03/2020

Job Status: Complete

Account Manager
Martin Palmer

Authorised by the Operations Manager
Becky Batham



Client: SOCOTEC Geotechnical

Project Name: F9042-19 Wrexham SI

Project No: 20020347

Date Issued: 12/03/2020

Samples Analysed

Sample Reference	Text ID	Sample Date	Sample Type
BH01-3-ES-0.20	20020347-001	18/02/2020 11:52:31	SOLID
BH01-6-ES-0.50	20020347-002	18/02/2020 11:52:36	SOLID
BH01-7-ES-1.00	20020347-003	18/02/2020 11:52:36	SOLID
WS01-8-ES-0.50	20020347-004	18/02/2020 11:52:36	SOLID
WS03-2-ES-0.20	20020347-005	18/02/2020 11:52:36	SOLID
WS03-8-ES-1.00	20020347-006	18/02/2020 11:52:36	SOLID
WS03-15-ES-1.20	20020347-007	18/02/2020 11:52:36	SOLID



Client: SOCOTEC Geotechnical
 Project Name: F9042-19 Wrexham SI
 Project No: 20020347
 Date Issued: 12/03/2020

Analysis Results

					20020347					
					001	002		003	004	005
					BH01-3-ES-0.20	BH01-6-ES-0.50		BH01-7-ES-1.00	WS01-8-ES-0.50	WS03-2-ES-0.20
					SOLID	LPL	SOLID	SOLID	SOLID	SOLID
					18/02/2020	18/02/2020	18/02/2020	18/02/2020	18/02/2020	18/02/2020
Analysis	Method Code	MDL	Units	Accred						
pH	WSLM2 & 3	1	pH units	U		8.1				
pH (2.5:1 extraction)	PHSOIL	1	pH units	UM	8.1			8.3	8.2	8.3
Chromium (VI) as Cr	KONENS	0.003	mg/l	U		<0.003				
Chromium (VI) as Cr	KONENS	0.1	mg/kg	N	<0.1			<0.1	<0.1	<0.1
Phenol Index	SFAPI	0.5	mg/kg^	U	<0.7			<0.6	<0.7	<0.7
Total Cyanide	SFAPI	0.02	mg/l	U		<0.02				
Total Cyanide	SFAPI	0.5	mg/kg^	UM	<0.7			<0.6	<0.7	<0.7
Arsenic as As	ICPMSS	0.3	mg/kg^	UM	6.1			8.0	9.5	9.1
Cadmium as Cd	ICPMSS	0.2	mg/kg^	UM	0.3			1.2	0.5	0.3
Copper as Cu	ICPMSS	1.6	mg/kg^	UM	189.6			38.9	25.3	23.7
Lead as Pb	ICPMSS	0.7	mg/kg^	UM	42.2			235.2	86.2	58.3
Mercury as Hg	ICPMSS	0.5	mg/kg^	UM	<0.5			<0.5	<0.5	<0.5
Nickel as Ni	ICPMSS	2	mg/kg^	UM	16.2			25.6	32.5	31.5
Selenium as Se	ICPMSS	0.5	mg/kg^	UM	<0.5			<0.5	<0.5	<0.5
Total Chromium as Cr	ICPMSS	1.2	mg/kg^	UM	18.5			28.3	35.2	32.0
Zinc as Zn	ICPMSS	16	mg/kg^	UM	100.1			336.2	177.6	117.0



Analysis Results

					20020347		
					006	007	
					WS03-8-ES-1.00		WS03-15-ES-1.20
					LPL	SOLID	SOLID
					18/02/2020	18/02/2020	18/02/2020
Analysis	Method Code	MDL	Units	Accred			
pH	WSLM2 & 3	1	pH units	U	7.9		
pH (2.5:1 extraction)	PHSOIL	1	pH units	UM			8.3
Chromium (VI) as Cr	KONENS	0.003	mg/l	U	<0.003		
Chromium (VI) as Cr	KONENS	0.1	mg/kg	N			<0.1
Phenol Index	SFAPI	0.5	mg/kg^	U			<0.7
Total Cyanide	SFAPI	0.02	mg/l	U	<0.02		
Total Cyanide	SFAPI	0.5	mg/kg^	UM			<0.7
Arsenic as As	ICPMSS	0.3	mg/kg^	UM			12.3
Cadmium as Cd	ICPMSS	0.2	mg/kg^	UM			<0.2
Copper as Cu	ICPMSS	1.6	mg/kg^	UM			29.7
Lead as Pb	ICPMSS	0.7	mg/kg^	UM			26.6
Mercury as Hg	ICPMSS	0.5	mg/kg^	UM			<0.5
Nickel as Ni	ICPMSS	2	mg/kg^	UM			53.5
Selenium as Se	ICPMSS	0.5	mg/kg^	UM			<0.5
Total Chromium as Cr	ICPMSS	1.2	mg/kg^	UM			48.1
Zinc as Zn	ICPMSS	16	mg/kg^	UM			87.7

					20020347					
					001	002		003	004	005
					BH01-3-ES-0.20	BH01-6-ES-0.50		BH01-7-ES-1.00	WS01-8-ES-0.50	WS03-2-ES-0.20
					SOLID	LPL	SOLID	SOLID	SOLID	SOLID
					18/02/2020	18/02/2020	18/02/2020	18/02/2020	18/02/2020	18/02/2020
Arsenic as As	ICPMSW (Dissolved)	0.001	mg/l	U		<0.001				
Cadmium as Cd	ICPMSW (Dissolved)	0.00002	mg/l	U		0.00004				
Total Chromium as Cr	ICPMSW (Dissolved)	0.001	mg/l	U		<0.001				
Copper as Cu	ICPMSW (Dissolved)	0.001	mg/l	U		<0.001				
Lead as Pb	ICPMSW (Dissolved)	0.001	mg/l	U		<0.001				
Mercury as Hg	ICPMSW (Dissolved)	0.00003	mg/l	U		<0.00003				
Nickel as Ni	ICPMSW (Dissolved)	0.001	mg/l	U		<0.001				
Selenium as Se	ICPMSW (Dissolved)	0.001	mg/l	U		<0.001				
Zinc as Zn	ICPMSW (Dissolved)	0.002	mg/l	U		<0.002				
Acenaphthene	PAHMSW	0.01	µg/l	U		0.04				
Acenaphthylene	PAHMSW	0.01	µg/l	U		0.01				
Anthracene	PAHMSW	0.01	µg/l	U		<0.01				
Benzo[a]anthracene	PAHMSW	0.01	µg/l	U		<0.01				
Benzo[a]pyrene	PAHMSW	0.01	µg/l	U		<0.01				
Benzo[b]fluoranthene	PAHMSW	0.01	µg/l	U		<0.01				
Benzo[g,h,i]perylene	PAHMSW	0.01	µg/l	U		<0.01				
Benzo[k]fluoranthene	PAHMSW	0.01	µg/l	U		<0.01				
Chrysene	PAHMSW	0.01	µg/l	U		<0.01				

					20020347		
					006	007	
					WS03-8-ES-1.00	WS03-15-ES-1.20	
					LPL	SOLID	SOLID
					18/02/2020	18/02/2020	18/02/2020
Arsenic as As	ICPMSW (Dissolved)	0.001	mg/l	U	<0.001		
Cadmium as Cd	ICPMSW (Dissolved)	0.00002	mg/l	U	0.00005		
Total Chromium as Cr	ICPMSW (Dissolved)	0.001	mg/l	U	<0.001		
Copper as Cu	ICPMSW (Dissolved)	0.001	mg/l	U	0.001		
Lead as Pb	ICPMSW (Dissolved)	0.001	mg/l	U	<0.001		
Mercury as Hg	ICPMSW (Dissolved)	0.00003	mg/l	U	<0.00003		
Nickel as Ni	ICPMSW (Dissolved)	0.001	mg/l	U	<0.001		
Selenium as Se	ICPMSW (Dissolved)	0.001	mg/l	U	<0.001		
Zinc as Zn	ICPMSW (Dissolved)	0.002	mg/l	U	<0.002		
Acenaphthene	PAHMSW	0.01	µg/l	U	0.03		
Acenaphthylene	PAHMSW	0.01	µg/l	U	0.04		
Anthracene	PAHMSW	0.01	µg/l	U	<0.01		
Benzo[a]anthracene	PAHMSW	0.01	µg/l	U	<0.01		
Benzo[a]pyrene	PAHMSW	0.01	µg/l	U	<0.01		
Benzo[b]fluoranthene	PAHMSW	0.01	µg/l	U	<0.01		
Benzo[g,h,i]perylene	PAHMSW	0.01	µg/l	U	<0.01		
Benzo[k]fluoranthene	PAHMSW	0.01	µg/l	U	<0.01		
Chrysene	PAHMSW	0.01	µg/l	U	<0.01		

					20020347					
					001	002		003	004	005
					BH01-3-ES-0.20	BH01-6-ES-0.50		BH01-7-ES-1.00	WS01-8-ES-0.50	WS03-2-ES-0.20
					SOLID	LPL	SOLID	SOLID	SOLID	SOLID
					18/02/2020	18/02/2020	18/02/2020	18/02/2020	18/02/2020	18/02/2020
Dibenzo[a,h]anthracene	PAHMSW	0.01	µg/l	U		<0.01				
Fluoranthene	PAHMSW	0.01	µg/l	U		<0.01*				
Fluorene	PAHMSW	0.01	µg/l	U		<0.01				
Indeno[1,2,3-cd]pyrene	PAHMSW	0.01	µg/l	U		<0.01				
Naphthalene	PAHMSW	0.01	µg/l	U		0.11				
Phenanthrene	PAHMSW	0.01	µg/l	U		<0.01				
Pyrene	PAHMSW	0.01	µg/l	U		<0.01*				
Total PAH 16	PAHMSW	0.16	µg/l	U		<0.30				
Acenaphthene	PAHMSUS	0.08	mg/kg^	UM	<0.11			0.50	<0.11	<0.10
Acenaphthylene	PAHMSUS	0.08	mg/kg^	U	<0.11			1.04	<0.11	<0.10
Anthracene	PAHMSUS	0.08	mg/kg^	U	<0.11			1.71	<0.11	<0.10
Benzo[a]anthracene	PAHMSUS	0.08	mg/kg^	UM	0.17			5.05	0.51	0.11
Benzo[a]pyrene	PAHMSUS	0.08	mg/kg^	UM	0.18			5.12	0.62	<0.10
Benzo[b]fluoranthene	PAHMSUS	0.08	mg/kg^	UM	0.24			6.46	0.68	0.13
Benzo[g,h,i]perylene	PAHMSUS	0.08	mg/kg^	UM	0.11			2.50	0.36	<0.10
Benzo[k]fluoranthene	PAHMSUS	0.08	mg/kg^	UM	<0.11			2.13	0.27	<0.10
Chrysene	PAHMSUS	0.08	mg/kg^	UM	0.21			4.84	0.49	0.11
Dibenzo[a,h]anthracene	PAHMSUS	0.08	mg/kg^	UM	<0.11			0.79	<0.11	<0.10

					20020347		
					006		007
					WS03-8-ES-1.00		WS03-15-ES-1.20
					LPL	SOLID	SOLID
					18/02/2020	18/02/2020	18/02/2020
Dibenzo[a,h]anthracene	PAHMSW	0.01	µg/l	U	<0.01		
Fluoranthene	PAHMSW	0.01	µg/l	U	<0.01*		
Fluorene	PAHMSW	0.01	µg/l	U	<0.01		
Indeno[1,2,3-cd]pyrene	PAHMSW	0.01	µg/l	U	<0.01		
Naphthalene	PAHMSW	0.01	µg/l	U	0.08		
Phenanthrene	PAHMSW	0.01	µg/l	U	<0.01		
Pyrene	PAHMSW	0.01	µg/l	U	<0.01*		
Total PAH 16	PAHMSW	0.16	µg/l	U	<0.27		
Acenaphthene	PAHMSUS	0.08	mg/kg^	UM			<0.11
Acenaphthylene	PAHMSUS	0.08	mg/kg^	U			<0.11
Anthracene	PAHMSUS	0.08	mg/kg^	U			<0.11
Benzo[a]anthracene	PAHMSUS	0.08	mg/kg^	UM			<0.11
Benzo[a]pyrene	PAHMSUS	0.08	mg/kg^	UM			<0.11
Benzo[b]fluoranthene	PAHMSUS	0.08	mg/kg^	UM			<0.11
Benzo[g,h,i]perylene	PAHMSUS	0.08	mg/kg^	UM			<0.11
Benzo[k]fluoranthene	PAHMSUS	0.08	mg/kg^	UM			<0.11
Chrysene	PAHMSUS	0.08	mg/kg^	UM			<0.11
Dibenzo[a,h]anthracene	PAHMSUS	0.08	mg/kg^	UM			<0.11

					20020347					
					001	002		003	004	005
					BH01-3-ES-0.20	BH01-6-ES-0.50		BH01-7-ES-1.00	WS01-8-ES-0.50	WS03-2-ES-0.20
					SOLID	LPL	SOLID	SOLID	SOLID	SOLID
					18/02/2020	18/02/2020	18/02/2020	18/02/2020	18/02/2020	18/02/2020
Fluoranthene	PAHMSUS	0.08	mg/kg^	UM	0.22			8.07	0.77	0.13
Fluorene	PAHMSUS	0.08	mg/kg^	UM	<0.11			1.07	<0.11	<0.10
Indeno[1,2,3-cd]pyrene	PAHMSUS	0.08	mg/kg^	UM	0.14			3.20	0.49	<0.10
Naphthalene	PAHMSUS	0.08	mg/kg^	UM	<0.11			0.14	<0.11	<0.10
Phenanthrene	PAHMSUS	0.08	mg/kg^	UM	<0.11			4.48	0.20	<0.10
Pyrene	PAHMSUS	0.08	mg/kg^	UM	0.22			6.84	0.73	0.12
Total PAH 16	PAHMSUS	1.28	mg/kg^	U	<2.32			54.0	<5.76	<1.75
Dimethylphenols	PHEHPLCUV	0.05	mg/l	U		<0.05				
Methylphenols	PHEHPLCUV	0.05	mg/l	U		<0.05				
Phenol	PHEHPLCUV	0.05	mg/l	U		<0.05				
Total Phenols	PHEHPLCUV	0.2	mg/l	U		<0.20				
Trimethylphenols	PHEHPLCUV	0.05	mg/l	U		<0.05				
>C10-C12	TPHFID	0.01	mg/l	U		<0.01				
>C12-C16	TPHFID	0.01	mg/l	U		<0.01				
>C16-C21	TPHFID	0.01	mg/l	U		<0.01				
>C21-C35	TPHFID	0.01	mg/l	U		<0.01				
>C8-C10	TPHFID	0.01	mg/l	U		<0.01*				
Total TPH	TPHFID	0.01	mg/l	U		0.02				

					20020347		
					006		007
					WS03-8-ES-1.00		WS03-15-ES-1.20
					LPL	SOLID	SOLID
					18/02/2020	18/02/2020	18/02/2020
Fluoranthene	PAHMSUS	0.08	mg/kg^	UM			<0.11
Fluorene	PAHMSUS	0.08	mg/kg^	UM			<0.11
Indeno[1,2,3-cd]pyrene	PAHMSUS	0.08	mg/kg^	UM			<0.11
Naphthalene	PAHMSUS	0.08	mg/kg^	UM			<0.11
Phenanthrene	PAHMSUS	0.08	mg/kg^	UM			<0.11
Pyrene	PAHMSUS	0.08	mg/kg^	UM			<0.11
Total PAH 16	PAHMSUS	1.28	mg/kg^	U			<1.71
Dimethylphenols	PHEHPLCUV	0.05	mg/l	U	<0.05		
Methylphenols	PHEHPLCUV	0.05	mg/l	U	<0.05		
Phenol	PHEHPLCUV	0.05	mg/l	U	<0.05		
Total Phenols	PHEHPLCUV	0.2	mg/l	U	<0.20		
Trimethylphenols	PHEHPLCUV	0.05	mg/l	U	<0.05		
>C10-C12	TPHFID	0.01	mg/l	U	<0.01		
>C12-C16	TPHFID	0.01	mg/l	U	<0.01		
>C16-C21	TPHFID	0.01	mg/l	U	<0.01		
>C21-C35	TPHFID	0.01	mg/l	U	0.02		
>C8-C10	TPHFID	0.01	mg/l	U	<0.01*		
Total TPH	TPHFID	0.01	mg/l	U	0.03		

					20020347					
					001	002		003	004	005
					BH01-3-ES-0.20	BH01-6-ES-0.50		BH01-7-ES-1.00	WS01-8-ES-0.50	WS03-2-ES-0.20
					SOLID	LPL	SOLID	SOLID	SOLID	SOLID
					18/02/2020	18/02/2020	18/02/2020	18/02/2020	18/02/2020	18/02/2020
>C10-C12	TPHFIDUS	2	mg/kg^	U	<2.65			<2.43	<2.66	<2.61
>C12-C16	TPHFIDUS	2	mg/kg^	U	4.07			<2.43	<2.66	<2.61
>C16-C21	TPHFIDUS	2	mg/kg^	U	7.47			4.50	6.98	6.61
>C21-C35	TPHFIDUS	5	mg/kg^	U	53.3			21.9	28.8	31.4
>C8-C10	TPHFIDUS	2	mg/kg^	U	<2.65			<2.43	<2.66	<2.61
Total TPH	TPHFIDUS	10	mg/kg^	UM	79.6			31.9	40.0	42.8
Total Moisture at 105°C	TMSS	0.1	%	U	24.4			17.6	24.9	23.4
Total Moisture at 35°C	CLANDPREP	0.1	%	N	23.7			16.5	22.4	23.8
Colour of Material	CLANDPREP		-	N	Brown			Brown	Brown	Brown
Major Constituents	CLANDPREP		-	N	SILT			CLAY	CLAY	CLAY
Minor Constituents	CLANDPREP		-	N	Gravel			Gravel	Gravel	Gravel
Miscellaneous Constituents	CLANDPREP		-	N	Root Fibres			Brick	Brick	Brick
Equivalent Weight of Dry Material (kg)	Leachate Preparation NRA 10:1		kg	N			0.090			
Fraction above 5 mm (%)	Leachate Preparation NRA 10:1		%	N			0			
Fraction of non-crushable material (%)	Leachate Preparation NRA 10:1		%	N			0			
Volume of Water for 10:1 Leach (ltr)	Leachate Preparation NRA 10:1		l	N			0.870			
Weight of Sample Leached (kg)	Leachate Preparation NRA 10:1	0.1	kg	N			0.120			
Asbestos Identification	SUB020		-	N	NAIIS			NAIIS	NAIIS	NAIIS

					20020347		
					006		007
					WS03-8-ES-1.00		WS03-15-ES-1.20
					LPL	SOLID	SOLID
					18/02/2020	18/02/2020	18/02/2020
>C10-C12	TPHFIDUS	2	mg/kg^	U			<2.67
>C12-C16	TPHFIDUS	2	mg/kg^	U			<2.67
>C16-C21	TPHFIDUS	2	mg/kg^	U			<2.67
>C21-C35	TPHFIDUS	5	mg/kg^	U			8.66
>C8-C10	TPHFIDUS	2	mg/kg^	U			<2.67
Total TPH	TPHFIDUS	10	mg/kg^	UM			<13.4
Total Moisture at 105°C	TMSS	0.1	%	U			25.1
Total Moisture at 35°C	CLANDPREP	0.1	%	N			25.6
Colour of Material	CLANDPREP		-	N			Brown
Major Constituents	CLANDPREP		-	N			CLAY
Minor Constituents	CLANDPREP		-	N			None
Miscellaneous Constituents	CLANDPREP		-	N			None
Equivalent Weight of Dry Material (kg)	Leachate Preparation NRA 10:1		kg	N		0.090	
Fraction above 5 mm (%)	Leachate Preparation NRA 10:1		%	N		0	
Fraction of non-crushable material (%)	Leachate Preparation NRA 10:1		%	N		0	
Volume of Water for 10:1 Leach (ltr)	Leachate Preparation NRA 10:1		l	N		0.874	
Weight of Sample Leached (kg)	Leachate Preparation NRA 10:1	0.1	kg	N		0.116	
Asbestos Identification	SUB020		-	N			NAIIS



CONTRACT NO: S11450-7
DATE OF ISSUE: 05.03.20

RESULTS: (cont.)

Table 1: Qualitative Results

SOCOTEC Job I.D: 20020347

IOM sample number	Client sample number	ACM type detected	PLM result
S71261	20020347-001-8	-	No Asbestos Detected
S71262	20020347-003-8	-	No Asbestos Detected
S71263	20020347-004-8	-	No Asbestos Detected
S71264	20020347-005-8	-	No Asbestos Detected
S71265	20020347-007-8	-	No Asbestos Detected

Our detection limit for this method is 0.001%.

COMMENTS:

IOM Consulting cannot accept responsibility for samples that have been incorrectly collected or despatched by external clients.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.

AUTHORISED BY:

D Third
Scientific Technician

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY: SOCOTEC UK Ltd
Environmental Chemistry
PO Box 100
Burton upon Trent
Staffordshire
DE15 0XD

CONTRACT NO: S11450-7

DATE OF ISSUE: 05.03.20

DATE SAMPLES RECEIVED: 27.02.20

DATE SAMPLES ANALYSED: 05.03.20

DESCRIPTION: Five soil/loose aggregate samples.

ANALYSIS REQUESTED: Qualitative analysis of samples for determination of presence/type of asbestos.

METHODS:

Our method involves initial examination of the samples followed by detailed analysis of representative sub-samples. The sub-samples are analysed qualitatively for asbestos by polarised light and dispersion staining as described by the Health and Safety Executive in HSG 248.

RESULTS:

Initial Screening

No asbestos was detected in any of the soil samples by stereo-binocular and polarised light microscopy.

A summary of the results is given in Table 1.

Additional Report Notes

[illegible]



Client: SOCOTEC Geotechnical

Project Name: F9042-19 Wrexham SI

Project No: 20020347

Date Issued: 12/03/2020

<u>Deviating Sample Report</u>			Incorrect Container	Incorrect Label	Headspace	Incorrect/No Preservative	No Sampling Date	Holding Time	Handling Time
Sample Reference	Text ID	Reported Name							
BH01-3-ES-0.20	20020347-001	SFAPI						✓	
BH01-7-ES-1.00	20020347-003	SFAPI						✓	
WS01-8-ES-0.50	20020347-004	SFAPI						✓	
WS03-2-ES-0.20	20020347-005	SFAPI						✓	
WS03-15-ES-1.20	20020347-007	SFAPI						✓	

Analysis Basis

Analysis

CLANDPREP
ICPMSS
ICPMSSW (Dissolved)
KONENS
Leachate Preparation NRA 10:1
Leachate Preparation NRA 10:1
PAHMSUS
PAHMSW
PHEHPLCUV
PHSOIL
SFAPI
SFAPI
SUB020
TMSS
TPHFID
TPHFIDUS
WSLM2 & 3

Analysis Type

PHYS
METALS
METALS
INORGANIC
PHYS
PHYS
ORGANIC
ORGANIC
ORGANIC
INORGANIC
INORGANIC
INORGANIC
SUBCON
PHYS
ORGANIC
ORGANIC
INORGANIC

Analysis Basis

As Received
Air Dried & Ground
Filtered
Filtered
As Received
As Received
As Received
Filtered
Filtered
As Received
As Received
Filtered
As Received
Filtered
As Received
Filtered
As Received
Filtered



Client: SOCOTEC Geotechnical

Project Name: F9042-19 Wrexham SI

Project No: 20020347

Date Issued: 12/03/2020

Additional Information

This report refers to samples as received, and SOCOTEC Uk Ltd takes no responsibility for accuracy or competence of sampling by others.

Results within this report relate only to the samples tested.

In the accreditation column of analysis report the codes are as follows:

- U = UKAS accredited analysis
- M = MCERT accredited analysis
- N = Unaccredited analysis

Any units marked with ^ signify results are reported on a dry weight basis of 105° c

All Air Dried and Ground Samples (ADG) are oven dried at less than 35° c.

This report shall not be reproduced except in full and with approval from the laboratory.

Opinions and interpretations given are outside the scope of our UKAS accreditation.

Any samples marked with * are not covered by our scope of UKAS accreditation, if applicable further report notes have been added.

Any solid samples where the Major Constituents are not one of the following (Sand, Silt, Clay, Made Ground) are not one of our accredited matrix types.

Any samples marked with ‡ have had MCERTS accreditation removed for this result

Any samples marked with a tick in the deviant table is deviant for the specific reason.

Any samples reported as IS, NA, ND mean the following:

- IS = Insufficient Sample to complete analysis
- NA = Sample is not amenable for the required analysis
- ND = Results cannot be determined

End of Certificate of Analysis



SOCOTEC

Environmental Chemistry
SOCOTEC UK
Ashby Rd, Bretby,
Burton-on-Trent, UK
DE15 0YZ

Certificate of Analysis

Project No: 20020348

Client: SOCOTEC Geotechnical

Quote Number: BEC20015722

Project Reference: F9042-19

Site Name: F9042-19 Wrexham SI

Contact: Melody Wareing

Address: Geotechnical House
18-19 Drome Road
Deeside
Flintshire

Post Code: CH5 2NY

E-Mail: melody.wareing@socotec.com

Phone No: 01244 288200

Number of Samples Received: 7

Date Received: 25/02/2020

Analysis Date: 05/03/2020

Date Issued: 06/03/2020

Job Status: Complete

Account Manager
Martin Palmer

Authorised by the Operations Manager
Becky Batham



Client: SOCOTEC Geotechnical

Project Name: F9042-19 Wrexham SI

Project No: 20020348

Date Issued: 06/03/2020

Samples Analysed

Sample Reference	Text ID	Sample Date	Sample Type
BH02-3-ES-1.00	20020348-001	20/02/2020 12:20:08	SOLID
BH03-11-ES-1.00	20020348-002	19/02/2020 12:20:13	SOLID
HDP01-1-ES-0.20	20020348-003	19/02/2020 12:20:13	SOLID
HDP02-1-ES-0.20	20020348-004	19/02/2020 12:20:13	SOLID
HDP04-1-ES-0.20	20020348-005	19/02/2020 12:20:13	SOLID
HDP06-1-ES-0.20	20020348-006	19/02/2020 12:20:13	SOLID
HDP06-3-ES-1.00	20020348-007	19/02/2020 12:20:13	SOLID



Client: SOCOTEC Geotechnical
 Project Name: F9042-19 Wrexham SI
 Project No: 20020348
 Date Issued: 06/03/2020

Analysis Results

					20020348					
					001	002		003	004	
					BH02-3-ES-1.00	BH03-11-ES-1.00		HDP01-1-ES-0.20	HDP02-1-ES-0.20	
					SOLID	LPL	SOLID	SOLID	LPL	SOLID
					20/02/2020	19/02/2020	19/02/2020	19/02/2020	19/02/2020	19/02/2020
Analysis	Method Code	MDL	Units	Accred						
pH	WSLM2 & 3	1	pH units	U		7.9			7.9	
pH (2.5:1 extraction)	PHSOIL	1	pH units	UM	8.7		7.9	8.0		
Chromium (VI) as Cr	KONENS	0.003	mg/l	U		<0.003			<0.003	
Chromium (VI) as Cr	KONENS	0.1	mg/kg	N	<0.1		<0.1	0.2		
Phenol Index	SFAPI	0.5	mg/kg^	U	<0.7		<0.7	<0.6		
Total Cyanide	SFAPI	0.02	mg/l	U		<0.02			<0.02	
Total Cyanide	SFAPI	0.5	mg/kg^	UM	<0.7		<0.7	<0.6		
Arsenic as As	ICPMSS	0.3	mg/kg^	UM	12.5		9.8	10.6		
Cadmium as Cd	ICPMSS	0.2	mg/kg^	UM	0.3		0.3	0.9		
Copper as Cu	ICPMSS	1.6	mg/kg^	UM	30.4		21.9	40.7		
Lead as Pb	ICPMSS	0.7	mg/kg^	UM	25.1		44.3	199.6		
Mercury as Hg	ICPMSS	0.5	mg/kg^	UM	<0.5		<0.5	<0.5		
Nickel as Ni	ICPMSS	2	mg/kg^	UM	48.9		31.2	27.4		
Selenium as Se	ICPMSS	0.5	mg/kg^	UM	<0.5		<0.5	<0.5		
Total Chromium as Cr	ICPMSS	1.2	mg/kg^	UM	46.7		35.6	24.3		
Zinc as Zn	ICPMSS	16	mg/kg^	UM	94.1		119.6	638.8		



Analysis Results

					Project ID 20020348		
					Sample ID		
					Customer ID		
					Sample Type		
					Sampling Date		
Analysis	Method Code	MDL	Units	Accred	005	006	007
pH	WSLM2 & 3	1	pH units	U	HDP04-1-ES-0.20	HDP06-1-ES-0.20	HDP06-3-ES-1.00
pH (2.5:1 extraction)	PHSOIL	1	pH units	UM	8.0	7.9	7.5
Chromium (VI) as Cr	KONENS	0.003	mg/l	U			
Chromium (VI) as Cr	KONENS	0.1	mg/kg	N	<0.1	<0.1	<0.1
Phenol Index	SFAPI	0.5	mg/kg^	U	<0.6	<0.6	<0.6
Total Cyanide	SFAPI	0.02	mg/l	U			
Total Cyanide	SFAPI	0.5	mg/kg^	UM	<0.6	<0.6	<0.6
Arsenic as As	ICPMSS	0.3	mg/kg^	UM	8.5	11.8	11.5
Cadmium as Cd	ICPMSS	0.2	mg/kg^	UM	0.5	0.3	0.6
Copper as Cu	ICPMSS	1.6	mg/kg^	UM	23.8	39.6	34.5
Lead as Pb	ICPMSS	0.7	mg/kg^	UM	73.5	35.5	33.9
Mercury as Hg	ICPMSS	0.5	mg/kg^	UM	<0.5	<0.5	<0.5
Nickel as Ni	ICPMSS	2	mg/kg^	UM	22.9	36.9	27.2
Selenium as Se	ICPMSS	0.5	mg/kg^	UM	<0.5	<0.5	<0.5
Total Chromium as Cr	ICPMSS	1.2	mg/kg^	UM	22.1	26.5	30.5
Zinc as Zn	ICPMSS	16	mg/kg^	UM	185.5	77.3	198.9

					20020348					
					001	002		003	004	
					BH02-3-ES-1.00	BH03-11-ES-1.00		HDP01-1-ES-0.20	HDP02-1-ES-0.20	
					SOLID	LPL	SOLID	SOLID	LPL	SOLID
					20/02/2020	19/02/2020	19/02/2020	19/02/2020	19/02/2020	19/02/2020
Arsenic as As	ICPMSW (Dissolved)	0.001	mg/l	U		<0.001			0.001	
Cadmium as Cd	ICPMSW (Dissolved)	0.00002	mg/l	U		<0.00002			0.00003	
Total Chromium as Cr	ICPMSW (Dissolved)	0.001	mg/l	U		<0.001			0.001	
Copper as Cu	ICPMSW (Dissolved)	0.001	mg/l	U		0.002			0.005	
Lead as Pb	ICPMSW (Dissolved)	0.001	mg/l	U		<0.001			0.002	
Mercury as Hg	ICPMSW (Dissolved)	0.00003	mg/l	U		<0.00003			<0.00003	
Nickel as Ni	ICPMSW (Dissolved)	0.001	mg/l	U		0.001			0.002	
Selenium as Se	ICPMSW (Dissolved)	0.001	mg/l	U		<0.001			<0.001	
Zinc as Zn	ICPMSW (Dissolved)	0.002	mg/l	U		0.002			0.007	
Acenaphthene	PAHMSW	0.01	µg/l	U		0.01			0.03	
Acenaphthylene	PAHMSW	0.01	µg/l	U		<0.01			0.01	
Anthracene	PAHMSW	0.01	µg/l	U		<0.01			<0.01	
Benzo[a]anthracene	PAHMSW	0.01	µg/l	U		<0.01			<0.01	
Benzo[a]pyrene	PAHMSW	0.01	µg/l	U		<0.01			<0.01	
Benzo[b]fluoranthene	PAHMSW	0.01	µg/l	U		<0.01			<0.01	
Benzo[g,h,i]perylene	PAHMSW	0.01	µg/l	U		<0.01			<0.01	
Benzo[k]fluoranthene	PAHMSW	0.01	µg/l	U		<0.01			<0.01	
Chrysene	PAHMSW	0.01	µg/l	U		<0.01			<0.01	

					20020348		
					005	006	007
					HDP04-1-ES-0.20	HDP06-1-ES-0.20	HDP06-3-ES-1.00
					SOLID	SOLID	SOLID
					19/02/2020	19/02/2020	19/02/2020
Arsenic as As	ICPMSW (Dissolved)	0.001	mg/l	U			
Cadmium as Cd	ICPMSW (Dissolved)	0.00002	mg/l	U			
Total Chromium as Cr	ICPMSW (Dissolved)	0.001	mg/l	U			
Copper as Cu	ICPMSW (Dissolved)	0.001	mg/l	U			
Lead as Pb	ICPMSW (Dissolved)	0.001	mg/l	U			
Mercury as Hg	ICPMSW (Dissolved)	0.00003	mg/l	U			
Nickel as Ni	ICPMSW (Dissolved)	0.001	mg/l	U			
Selenium as Se	ICPMSW (Dissolved)	0.001	mg/l	U			
Zinc as Zn	ICPMSW (Dissolved)	0.002	mg/l	U			
Acenaphthene	PAHMSW	0.01	µg/l	U			
Acenaphthylene	PAHMSW	0.01	µg/l	U			
Anthracene	PAHMSW	0.01	µg/l	U			
Benzo[a]anthracene	PAHMSW	0.01	µg/l	U			
Benzo[a]pyrene	PAHMSW	0.01	µg/l	U			
Benzo[b]fluoranthene	PAHMSW	0.01	µg/l	U			
Benzo[g,h,i]perylene	PAHMSW	0.01	µg/l	U			
Benzo[k]fluoranthene	PAHMSW	0.01	µg/l	U			
Chrysene	PAHMSW	0.01	µg/l	U			

					20020348					
					001	002		003	004	
					BH02-3-ES-1.00	BH03-11-ES-1.00		HDP01-1-ES-0.20	HDP02-1-ES-0.20	
					SOLID	LPL	SOLID	SOLID	LPL	SOLID
					20/02/2020	19/02/2020	19/02/2020	19/02/2020	19/02/2020	19/02/2020
Dibenzo[a,h]anthracene	PAHMSW	0.01	µg/l	U		<0.01			<0.01	
Fluoranthene	PAHMSW	0.01	µg/l	U		<0.01*			<0.01*	
Fluorene	PAHMSW	0.01	µg/l	U		<0.01			<0.01	
Indeno[1,2,3-cd]pyrene	PAHMSW	0.01	µg/l	U		<0.01			<0.01	
Naphthalene	PAHMSW	0.01	µg/l	U		0.04			0.10	
Phenanthrene	PAHMSW	0.01	µg/l	U		<0.01			<0.01	
Pyrene	PAHMSW	0.01	µg/l	U		<0.01*			<0.01*	
Total PAH 16	PAHMSW	0.16	µg/l	U		<0.19			<0.27	
Acenaphthene	PAHMSUS	0.08	mg/kg^	UM	<0.11		<0.11	<0.10		
Acenaphthylene	PAHMSUS	0.08	mg/kg^	U	<0.11		<0.11	<0.10		
Anthracene	PAHMSUS	0.08	mg/kg^	U	<0.11		<0.11	<0.10		
Benzo[a]anthracene	PAHMSUS	0.08	mg/kg^	UM	<0.11		<0.11	0.24		
Benzo[a]pyrene	PAHMSUS	0.08	mg/kg^	UM	<0.11		<0.11	0.23		
Benzo[b]fluoranthene	PAHMSUS	0.08	mg/kg^	UM	<0.11		<0.11	0.28		
Benzo[g,h,i]perylene	PAHMSUS	0.08	mg/kg^	UM	<0.11		<0.11	0.14		
Benzo[k]fluoranthene	PAHMSUS	0.08	mg/kg^	UM	<0.11		<0.11	0.11		
Chrysene	PAHMSUS	0.08	mg/kg^	UM	<0.11		<0.11	0.23		
Dibenzo[a,h]anthracene	PAHMSUS	0.08	mg/kg^	UM	<0.11		<0.11	<0.10		

					20020348		
					005	006	007
					HDP04-1-ES-0.20	HDP06-1-ES-0.20	HDP06-3-ES-1.00
					SOLID	SOLID	SOLID
					19/02/2020	19/02/2020	19/02/2020
Dibenzo[a,h]anthracene	PAHMSW	0.01	µg/l	U			
Fluoranthene	PAHMSW	0.01	µg/l	U			
Fluorene	PAHMSW	0.01	µg/l	U			
Indeno[1,2,3-cd]pyrene	PAHMSW	0.01	µg/l	U			
Naphthalene	PAHMSW	0.01	µg/l	U			
Phenanthrene	PAHMSW	0.01	µg/l	U			
Pyrene	PAHMSW	0.01	µg/l	U			
Total PAH 16	PAHMSW	0.16	µg/l	U			
Acenaphthene	PAHMSUS	0.08	mg/kg^	UM	<0.10	<0.10	<0.10
Acenaphthylene	PAHMSUS	0.08	mg/kg^	U	<0.10	<0.10	<0.10
Anthracene	PAHMSUS	0.08	mg/kg^	U	<0.10	<0.10	<0.10
Benzo[a]anthracene	PAHMSUS	0.08	mg/kg^	UM	0.64	0.12	<0.10
Benzo[a]pyrene	PAHMSUS	0.08	mg/kg^	UM	0.79	<0.10	<0.10
Benzo[b]fluoranthene	PAHMSUS	0.08	mg/kg^	UM	0.98	0.13	<0.10
Benzo[g,h,i]perylene	PAHMSUS	0.08	mg/kg^	UM	0.51	<0.10	<0.10
Benzo[k]fluoranthene	PAHMSUS	0.08	mg/kg^	UM	0.38	<0.10	<0.10
Chrysene	PAHMSUS	0.08	mg/kg^	UM	0.67	0.15	<0.10
Dibenzo[a,h]anthracene	PAHMSUS	0.08	mg/kg^	UM	0.12	<0.10	<0.10



Client: SOCOTEC Geotechnical
 Project Name: F9042-19 Wrexham SI
 Project No: 20020348
 Date Issued: 06/03/2020

					20020348					
					001	002		003	004	
					BH02-3-ES-1.00	BH03-11-ES-1.00		HDP01-1-ES-0.20	HDP02-1-ES-0.20	
					SOLID	LPL	SOLID	SOLID	LPL	SOLID
					20/02/2020	19/02/2020	19/02/2020	19/02/2020	19/02/2020	19/02/2020
Fluoranthene	PAHMSUS	0.08	mg/kg^	UM	<0.11		<0.11	0.31		
Fluorene	PAHMSUS	0.08	mg/kg^	UM	<0.11		<0.11	<0.10		
Indeno[1,2,3-cd]pyrene	PAHMSUS	0.08	mg/kg^	UM	<0.11		<0.11	0.18		
Naphthalene	PAHMSUS	0.08	mg/kg^	UM	<0.11		<0.11	<0.10		
Phenanthrene	PAHMSUS	0.08	mg/kg^	UM	<0.11		<0.11	0.11		
Pyrene	PAHMSUS	0.08	mg/kg^	UM	<0.11		<0.11	0.29		
Total PAH 16	PAHMSUS	1.28	mg/kg^	U	<1.69		<1.73	<2.74		
Dimethylphenols	PHEHPLCUV	0.05	mg/l	U		<0.05			<0.05	
Methylphenols	PHEHPLCUV	0.05	mg/l	U		<0.05			<0.05	
Phenol	PHEHPLCUV	0.05	mg/l	U		<0.05			<0.05	
Total Phenols	PHEHPLCUV	0.2	mg/l	U		<0.20			<0.20	
Trimethylphenols	PHEHPLCUV	0.05	mg/l	U		<0.05			<0.05	
>C10-C12	TPHFID	0.01	mg/l	U		<0.01			<0.01	
>C12-C16	TPHFID	0.01	mg/l	U		<0.01			<0.01	
>C16-C21	TPHFID	0.01	mg/l	U		<0.01*			<0.01*	
>C21-C35	TPHFID	0.01	mg/l	U		0.01			0.02	
>C8-C10	TPHFID	0.01	mg/l	U		<0.01			<0.01	
Total TPH	TPHFID	0.01	mg/l	U		0.03			0.04	



					20020348		
					005	006	007
					HDP04-1-ES-0.20	HDP06-1-ES-0.20	HDP06-3-ES-1.00
					SOLID	SOLID	SOLID
					19/02/2020	19/02/2020	19/02/2020
Fluoranthene	PAHMSUS	0.08	mg/kg^	UM	0.87	0.20	<0.10
Fluorene	PAHMSUS	0.08	mg/kg^	UM	<0.10	<0.10	<0.10
Indeno[1,2,3-cd]pyrene	PAHMSUS	0.08	mg/kg^	UM	0.66	<0.10	<0.10
Naphthalene	PAHMSUS	0.08	mg/kg^	UM	<0.10	0.22	<0.10
Phenanthrene	PAHMSUS	0.08	mg/kg^	UM	0.20	0.25	<0.10
Pyrene	PAHMSUS	0.08	mg/kg^	UM	0.88	0.15	<0.10
Total PAH 16	PAHMSUS	1.28	mg/kg^	U	<7.20	<2.10	<1.60
Dimethylphenols	PHEHPLCUV	0.05	mg/l	U			
Methylphenols	PHEHPLCUV	0.05	mg/l	U			
Phenol	PHEHPLCUV	0.05	mg/l	U			
Total Phenols	PHEHPLCUV	0.2	mg/l	U			
Trimethylphenols	PHEHPLCUV	0.05	mg/l	U			
>C10-C12	TPHFID	0.01	mg/l	U			
>C12-C16	TPHFID	0.01	mg/l	U			
>C16-C21	TPHFID	0.01	mg/l	U			
>C21-C35	TPHFID	0.01	mg/l	U			
>C8-C10	TPHFID	0.01	mg/l	U			
Total TPH	TPHFID	0.01	mg/l	U			

					20020348					
					001	002		003	004	
					BH02-3-ES-1.00	BH03-11-ES-1.00		HDP01-1-ES-0.20	HDP02-1-ES-0.20	
					SOLID	LPL	SOLID	SOLID	LPL	SOLID
					20/02/2020	19/02/2020	19/02/2020	19/02/2020	19/02/2020	19/02/2020
>C10-C12	TPHFIDUS	2	mg/kg^	U	<2.64		<2.70	<2.57		
>C12-C16	TPHFIDUS	2	mg/kg^	U	<2.64		<2.70	3.85		
>C16-C21	TPHFIDUS	2	mg/kg^	U	2.85		<2.70	23.4		
>C21-C35	TPHFIDUS	5	mg/kg^	U	11.1		14.8	111		
>C8-C10	TPHFIDUS	2	mg/kg^	U	<2.64		<2.70	<2.57		
Total TPH	TPHFIDUS	10	mg/kg^	UM	16.1		20.3	155		
Total Moisture at 105°C	TMSS	0.1	%	U	24.2		25.8	22.1		
Total Moisture at 35°C	CLANDPREP	0.1	%	N	18.1		24.2	20.6		
Colour of Material	CLANDPREP		-	N	Brown		Brown	Brown		
Major Constituents	CLANDPREP		-	N	CLAY		CLAY	SILT		
Minor Constituents	CLANDPREP		-	N	Gravel		Silt	Clay		
Miscellaneous Constituents	CLANDPREP		-	N	na		Gravel	Gravel		
Equivalent Weight of Dry Material (kg)	Leachate Preparation NRA 10:1		kg	N			0.090			0.090
Fraction above 5 mm (%)	Leachate Preparation NRA 10:1		%	N			0			0
Fraction of non-crushable material (%)	Leachate Preparation NRA 10:1		%	N			0			0
Volume of Water for 10:1 Leach (ltr)	Leachate Preparation NRA 10:1		l	N			0.871			0.866
Weight of Sample Leached (kg)	Leachate Preparation NRA 10:1	0.1	kg	N			0.119			0.124
Asbestos Identification	SUB020		-	N	NAIIS		NAIIS	NAIIS		

					20020348		
					005	006	007
					HDP04-1-ES-0.20	HDP06-1-ES-0.20	HDP06-3-ES-1.00
					SOLID	SOLID	SOLID
					19/02/2020	19/02/2020	19/02/2020
>C10-C12	TPHFIDUS	2	mg/kg^	U	<2.56	<2.47	<2.49
>C12-C16	TPHFIDUS	2	mg/kg^	U	<2.56	3.93	<2.49
>C16-C21	TPHFIDUS	2	mg/kg^	U	30.3	35.9	3.23
>C21-C35	TPHFIDUS	5	mg/kg^	U	94.8	59.4	12.2
>C8-C10	TPHFIDUS	2	mg/kg^	U	<2.56	<2.47	<2.49
Total TPH	TPHFIDUS	10	mg/kg^	UM	134	102	18.0
Total Moisture at 105°C	TMSS	0.1	%	U	21.9	18.9	19.8
Total Moisture at 35°C	CLANDPREP	0.1	%	N	17.3	12.5	18.1
Colour of Material	CLANDPREP		-	N	Brown	Red/Brown	Brown
Major Constituents	CLANDPREP		-	N	SILT	MADE GROUND	SILT
Minor Constituents	CLANDPREP		-	N	Clay	None	Gravel
Miscellaneous Constituents	CLANDPREP		-	N	Gravel	na	Brick
Equivalent Weight of Dry Material (kg)	Leachate Preparation NRA 10:1		kg	N			
Fraction above 5 mm (%)	Leachate Preparation NRA 10:1		%	N			
Fraction of non-crushable material (%)	Leachate Preparation NRA 10:1		%	N			
Volume of Water for 10:1 Leach (ltr)	Leachate Preparation NRA 10:1		l	N			
Weight of Sample Leached (kg)	Leachate Preparation NRA 10:1	0.1	kg	N			
Asbestos Identification	SUB020		-	N	NAIIS	NAIIS	NAIIS



CONTRACT NO: S11450-8
DATE OF ISSUE: 05.03.20

RESULTS: (cont.)

Table 1: Qualitative Results

SOCOTEC Job I.D: 20020348

IOM sample number	Client sample number	ACM type detected	PLM result
S71266	20020348-001-8	-	No Asbestos Detected
S71267	20020348-002-8	-	No Asbestos Detected
S71268	20020348-003-8	-	No Asbestos Detected
S71269	20020348-005-8	-	No Asbestos Detected
S71270	20020348-006-8	-	No Asbestos Detected
S71271	20020348-007-8	-	No Asbestos Detected

Our detection limit for this method is 0.001%.

COMMENTS:

IOM Consulting cannot accept responsibility for samples that have been incorrectly collected or despatched by external clients.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.

AUTHORISED BY:

D Third
Scientific Technician

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY: SOCOTEC UK Ltd
Environmental Chemistry
PO Box 100
Burton upon Trent
Staffordshire
DE15 0XD

CONTRACT NO: S11450-8

DATE OF ISSUE: 05.03.20

DATE SAMPLES RECEIVED: 27.02.20

DATE SAMPLES ANALYSED: 05.03.20

DESCRIPTION: Six soil/loose aggregate samples.

ANALYSIS REQUESTED: Qualitative analysis of samples for determination of presence/type of asbestos.

METHODS:

Our method involves initial examination of the samples followed by detailed analysis of representative sub-samples. The sub-samples are analysed qualitatively for asbestos by polarised light and dispersion staining as described by the Health and Safety Executive in HSG 248.

RESULTS:

Initial Screening

No asbestos was detected in any of the soil samples by stereo-binocular and polarised light microscopy.

A summary of the results is given in Table 1.



Additional Report Notes

Method Code	Sample ID	The following information should be taken into consideration when using the data contained within this report
TPHFID	20020348-002, 004	The Primary process control data associated with this Test has not wholly met the requirements of the Laboratory Quality Management System QMS with one or more target analytes falling outside acceptable limits. However the remaining data gives the Laboratory confidence that the test has performed satisfactorily and that the validity of the data may not have been significantly affected. However in line with our QMS policy we have removed accreditation, where applicable, from the affected analytes (C16-C21) . These circumstances should be taken into consideration when utilising the data.
PAHMSW	20020348-002, 004	The Secondary process control data associated with this Test has not wholly met the requirements of the Laboratory Quality Management System QMS with one or more target analytes falling outside acceptable limits. However the remaining data gives the Laboratory confidence that the test has performed satisfactorily (including the Primary Process Control) and that the validity of the data may not have been significantly affected. However in line with our QMS policy we have removed accreditation , where applicable, from the affected analytes (Flouranthene & Pyrene) . These circumstances should be taken into consideration when utilising the data.



Client: SOCOTEC Geotechnical

Project Name: F9042-19 Wrexham SI

Project No: 20020348

Date Issued: 06/03/2020

<u>Deviating Sample Report</u>			Incorrect Container	Incorrect Label	Headspace	Incorrect/No Preservative	No Sampling Date	Holding Time	Handling Time
Sample Reference	Text ID	Reported Name							
BH03-11-ES-1.00	20020348-002	SFAPI						✓	
HDP01-1-ES-0.20	20020348-003	SFAPI						✓	
HDP04-1-ES-0.20	20020348-005	SFAPI						✓	
HDP06-1-ES-0.20	20020348-006	SFAPI						✓	
HDP06-3-ES-1.00	20020348-007	SFAPI						✓	

Analysis Basis

Analysis

CLANDPREP
ICPMSS
ICPMSSW (Dissolved)
KONENS
Leachate Preparation NRA 10:1
Leachate Preparation NRA 10:1
PAHMSUS
PAHMSW
PHEHPLCUV
PHSOIL
SFAPI
SFAPI
SUB020
TMSS
TPHFID
TPHFIDUS
WSLM2 & 3

Analysis Type

PHYS
METALS
METALS
INORGANIC
PHYS
PHYS
ORGANIC
ORGANIC
ORGANIC
INORGANIC
INORGANIC
INORGANIC
SUBCON
PHYS
ORGANIC
ORGANIC
INORGANIC

Analysis Basis

As Received
Air Dried & Ground
Filtered
Filtered
As Received
As Received
As Received
Filtered
Filtered
As Received
As Received
Filtered
As Received
Filtered
As Received
Filtered
As Received
Filtered



Client: SOCOTEC Geotechnical

Project Name: F9042-19 Wrexham SI

Project No: 20020348

Date Issued: 06/03/2020

Additional Information

This report refers to samples as received, and SOCOTEC UK Ltd takes no responsibility for accuracy or competence of sampling by others.

Results within this report relate only to the samples tested.

In the accreditation column of analysis report the codes are as follows:

- U = UKAS accredited analysis
- M = MCERT accredited analysis
- N = Unaccredited analysis

Any units marked with ^ signify results are reported on a dry weight basis of 105° C

All Air Dried and Ground Samples (ADG) are oven dried at less than 35° C.

This report shall not be reproduced except in full and with approval from the laboratory.

Opinions and interpretations given are outside the scope of our UKAS accreditation.

Any samples marked with * are not covered by our scope of UKAS accreditation, if applicable further report notes have been added.

Any solid samples where the Major Constituents are not one of the following (Sand, Silt, Clay, Made Ground) are not one of our accredited matrix types.

Any samples marked with ‡ have had MCERTS accreditation removed for this result

Any samples marked with a tick in the deviant table is deviant for the specific reason.

Any samples reported as IS, NA, ND mean the following:

- IS = Insufficient Sample to complete analysis
- NA = Sample is not amenable for the required analysis
- ND = Results cannot be determined

End of Certificate of Analysis



SOCOTEC

APPENDIX F PHOTOGRAPHS

Window Sample Liners

Plate 1 to 2



WS03 1.20 to 4.00m



WS03 4.00 to 5.00m

Notes:	Project	Wrexham	Plate 1
	Project No.	F9042-19	
	Carried out for	Conrad Energy Ltd.	



WS04 1.20 to 3.00m

Notes:

Project Wrexham
Project No. F9042-19
Carried out for Conrad Energy Ltd.

Plate 2