

SUPPLEMENTARY PHASE 2 GROUND INVESTIGATION

LiDL (UK) GmbH
Bodhyfryd, Wrexham

Client: LiDL (UK) GmbH

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Executive Summary

Remada Ltd was commissioned by LiDL (UK) GmbH to conduct a Supplementary Phase 2 Ground Investigation at the site of former Police Headquarters, Bodhyfryd, Wrexham, LL12 7BW.

Summary of Phase 1 Desk Study

Wrexham Police Headquarters occupies a broadly triangular plot of land with concrete clad buildings of various heights and elevations and external car parks. A generator and diesel tank are located within a building to the west of the site and with a visible external fuel filling point at ground level within the building wall. An electrical sub-station and gas room are also located in the same part of the complex.

Historical maps indicate that the north-western zone of the site was in use as a timber yard and subsequently, a lane that passed through the site area was rebuilt as Park View. Wrexham Police Station was constructed at a similar time to the construction of Powell Road (1975-1984) which formed the northern and eastern boundary to the site.

Superficial Deposits are recorded as Devensian Glaciofluvial Sheet Deposits comprising sands and gravels and designated as Secondary (A) Aquifer. Bedrock underlying the majority of the site area is indicated as being the Salop Formation comprising mudstone, sandstone and conglomerate and designated as Secondary (A) Aquifer.

Phase 2 (BSL, 2017)

BSL's investigation comprised 12 window sample holes, five trial pit, and ground gas monitoring. Made ground was encountered on site to depths between 0.50m and 2.40m and deepest in raised embankments in the northern part of site. The natural soils generally comprised gravelly sands with bands of coal encountered in several exploratory holes. The sands were described as being locally clayey. No made ground was encountered in the southern part of the site.

Supplementary Intrusive Investigation

The investigation comprised the drilling of five (5 No) window sample holes (WS101 – WS105) and the excavation of five (5 No) trial pits at locations indicated on **Figure 2** on 29th March 2019. Plate bearing tests for the purpose of raft foundation design were not included within the proposed scope of work because the proposed formation level was not known, and a regrading of the existing topography appeared to be required.

The exploratory holes have proved that made ground is prevalent across the site ranging in thickness from 0.3m to >2.2m begl (2.4m begl in BSL investigation); being thickest within trial pits located within the raised landscape areas. The five window sample boreholes positioned within, or immediately adjacent to the footprint of the proposed structure where access was restricted, recorded made ground across the area ranging in thickness from 0.3m to approximately 1.5m begl (WS104 in the south eastern corner of the proposed store).

The materials encountered were granular including clayey gravelly sands and sands and gravels with secondary constituents including ash (rare), brick, coal, whole bricks, concrete and roadstone.

Beneath the made ground, the natural ground conditions at the site were found to be generally consistent and comprised granular superficial deposits typically described as loose or medium dense sand or sands and gravel, with gravel including quartzite, flint and sandstone. Bedrock was not encountered within the depth of investigation.

Human Health Assessment

The results of soil chemical analysis from the original investigation and supplementary investigation were compared to Human Health Generic Assessment Criteria for commercial land use.

None of the analytes tested for CLEA metals, TPHCWG, PAH, BTEX, Phenol or PCBs were detected at concentrations that exceeded the human health GAC protective of on-site workers. In addition, no asbestos was detected in the samples selected for analysis.



Water Resources Assessment

Localised TPH detections at WS101 and WS102 are heavy end and not indicative of diesel or oil and considered to be of low solubility / mobility and unlikely to present a more than negligible risk to the underlying aquifer.

Ground Gas

Based on the results of the four rounds of gas monitoring, BSL concluded that Characteristic Situation CS1 applied and that no gas protection measures were required however the site is located in an intermediate probability radon area and basic radon protection measures are required.

Coal Tar Assessment

Two samples of existing asphalt or macadam surfacing materials were scheduled for the analysis of TPH and PAH(17). PAH were less than the laboratory method detection limit and dibenzothiophene a biomarker present in coal tar was not detected to confirm that coal tars are not present.

Waste Classification

In general, the results of the chemical analysis indicates that the material would be classified as non hazardous waste. Made Ground sampled at WS101 0.1-0.2m produced at sum TPH concentration of 2,900mg/kg. There hydrocarbons were generally in the C21 to C35 range and there were low concentrations of PAHs present. There was no visual or olfactory evidence of hydrocarbon contamination and given that the hydrocarbons were not in the 'normal' weathered diesel carbon range the waste assessment has been undertaken assuming an unknown oil. This indicates that the sample would be classified as non hazardous waste.

Geotechnical Assessment

The proposed Lidl store footprint will occupy the western zone of the site at FFL = 84.00m AoD and will necessitate some earthworks regrading. In addition, there is potential for relict foundations and potential basements resulting from demolition of the existing structures.

Preliminary calculations indicate that for a traditional pad foundation (up to 2.0 wide) at a minimum of 1.5m depth, bearing within the loose sands of ϕ values = 29° a design bearing resistance of 200 kN/m² will be appropriate in order to satisfy the ultimate and serviceable limit states in accordance with Eurocode 7 - Geotechnical Design. This is only applicable for foundations with loads that are applied vertically and centrally. To satisfy the serviceable limit state settlement has been limited to 25mm.

Optimum moisture content test on the existing made ground (previously engineered fill material) indicate that in general the materials are wetter than optimum but could be used a fill material to achieve dry densities of greater than 1.83 Mg/m³ if managed appropriately. Shear box test on the existing made ground produced minimum strength parameters of ϕ values = 28.7° $c' = 0$ kN/m².

If pad foundations are selected as described above and a ground bearing floor slab is proposed, then made ground should be engineered as described above and include a capping layer of compacted 6F₂ material of minimum thickness 0.3m.

A plain slab or stiffened edge raft with a downstand pressure of 125 kPa is a potential solution to bear directly on a 0.3m layer of compacted sub-base bearing upon the earthworks fill compacted to 95% maximum dry density and $\phi = 29^\circ$ and / or natural deposits of $\phi = 29^\circ$. The earthworks fill material and compacted sub-base would require plate bearing testing to demonstrate suitability for a raft.

A Design Sulphate Class DS1 is considered appropriate for buried concrete and an ACEC Class of AC-1 is considered appropriate for the location.

Preliminary soakaway testing by BSL, 2017 recorded an infiltration rate of 5.56×10^{-5} m/sec (single test) within a trial pit test. Low volume, falling head tests were also undertaken within boreholes and results ranged from 1.26×10^{-4} m/sec (WS10) and 4.61×10^{-4} m/sec (WS03).



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Issue No /	Date	Prepared By	Technical Review	Authorised
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1 INTRODUCTION

Remada Ltd was commissioned by Lidl (UK) GmbH to undertake a Supplementary Phase 2 Ground Investigation of the former Police Headquarters, Bodhyfryd, Wrexham, LL12 7BW at the location indicated on Figure 1.

1.1 Objectives

The objectives of this assessment are as follows:

- to supplement the existing Ground Investigation data/information to examine whether there have been any potentially contaminative uses on-site or on nearby land;
- to develop a revised conceptual model of the site to identify plausible pollutant linkages;
- to provide further assessment of the ground conditions in relation to the proposed development in relation to construction design issues including the presence, nature, likely severity and extent of soil and groundwater contamination, which may be present, its potential environmental impact and likely requirement for further work;
- to provide further assessment of the ground conditions in relation to the proposed development in relation to construction design issues including the presence of made ground and its geotechnical characteristics for re-engineering; and
- Provide preliminary foundation design recommendations for the proposed development.

1.2 Scope of Work

The scope of the investigation is generally in accordance with BS10175:2011+A2 2017 and layout of this report has been designed with the Environment Agency's CLR11⁽¹⁾ in mind and guidance issued by the Environment Agency for land contamination reports.

The scope of work comprised:

- 5 No window sample boreholes to target depths of up to 5m including SPTs;
- 5 No trial pits of up to 2.5m to target the existing landscaped areas (earthworks);
- Suite of geotechnical classification and strength tests;
- 5 No soil samples submitted for speciated hydrocarbons, polycyclic aromatic hydrocarbons (PAH) and BTEX analysis and 2 No soils samples submitted for PCB analysis to further delineate soil contamination;
- 2 No samples of the car park surface material submitted for analysis of Coal Tar;
- 3 No samples from the landscaped areas (existing earth works) across the site submitted for WAC analysis, to enable potential future waste soil disposal; and
- Combined Factual & Interpretative Geoenvironmental Report.

1.3 Previous Reports

The following Phase 1 Investigation had been previously prepared for the site:

- Phase 1 Site Geoenvironmental Site Investigation. Remada Ltd Report 525.01.01 July 2017.



In addition, a Third-Party Report relating to the site has been made available to Remada for review:

- JB/C3664/7273 - Geo-Environmental Assessment Report – Wrexham Police Station – December 2017, Prepared by Brownfield Solutions Ltd (BSL);
- JB/C3664/7430 – Gas Assessment Letter Report - Wrexham Police Station – June 2018, Prepared by Brownfield Solutions Ltd (BSL).

The findings of the Remada Phase 1 report were summarised within the BSL report (ref JB/C3664/7273) and used to develop their 'detailed' Conceptual Site Model and scope of intrusive investigation work.

1.4 Limitations

The comments given in this report and the opinions expressed are based on the information reviewed and observations during site work. However, there may be conditions pertaining to the site that have not been disclosed by this assessment and therefore could not be taken into account.



2 SUMMARY OF PREVIOUS REPORTS

2.1 Phase 1 Investigation (Remada, 2017)

The Executive Summary and Conceptual Site Model (Table 1) presented within the previous Phase 1 Desk Study are reproduced below:

Site Setting

The Wrexham Police Headquarters occupies a broadly triangular plot of land with curved northern and eastern boundary formed by a landscape boundary to Powell Road and the A5152. A large car park is located in the north of the site area between Powell Road and the existing on site buildings. The Headquarters are a complex of concrete clad buildings of various heights and elevations, with a tower block located in the centre of the site. The plant room is located on Level 13, or the roof of the tower. A generator and diesel tank are located within a building in the west of the site and with a visible external fuel filling point at ground level within the building wall. An electrical sub-station and gas room are also located in the same part of the complex.

The Police Station is linked by way of footbridge to the County Court that is immediately to the south. A car park exists between the two buildings and extends to the west to form the site boundary with a Memorial Hall to the south. Bodhyfryd enables vehicular access from the south west and continues through the site beneath the elevated buildings to the roundabout at Powell Road. A further car park in the west of the site is accessed from Bodhyfryd.

Historical maps indicate that the north-western zone of the site was in use as a timber yard prior to the date of the earliest available historical map. Subsequently, a lane that passed through the site area was rebuilt as Park View, with land to the east being designated as playing fields. Wrexham Police Station was constructed at a similar time to the construction of Powell Road (1975-1984) which formed the northern and eastern boundary to the site.

Geological Mapping

There are no recorded deposits of Artificial Ground at the site. Superficial Deposits are recorded as Devensian Glaciofluvial Sheet Deposits comprising sands and gravels and designated as Secondary (A) Aquifer. Bedrock underlying the majority of the site area is indicated as being the Salop Formation comprising mudstone, sandstone and conglomerate and designated as Secondary (A) Aquifer.

Environmental Risk Assessment

The desk study has identified potential contaminative land uses including fuel filling and storage, the electricity substation room, and external vehicle parking. Potential contaminants include asbestos, metals, TPH, PAH, VOCs and PCBs. A nearby off-site petrol filling station to the east may also be a potential source of TPH, PAH and VOC contamination within soil and groundwater beneath the site.

For the proposed store, it was recommended that a Phase 2 intrusive ground investigation was carried out in order to determine the:

- *Potential contaminants associated with the site and the above former land uses;*
- *Required foundation depths.*

Geotechnical Assessment

It was recommended that a ground investigation was undertaken to complement existing data and enable preliminary foundation design and design of other structures potential future earthworks/development platform.



The intrusive ground investigation should be carried out in accordance with Lidl's standard scope of work.

2.2 Phase 2 Geo-Environmental Assessment Report (BSL, 2017)

Extracts of the Executive Summary and a detailed Conceptual Site Model presented within the previous Geo-Environmental Assessment are reproduced below:

Ground Conditions Encountered

BSL's investigation comprised 12 window sample holes and five trial pits. Made ground was encountered on site to depths between 0.50m and 2.40m. Made ground was deepest in raised embankments to the north of site. The natural soils encountered beneath the made ground and topsoil generally comprised gravelly sands with bands of coal encountered in several exploratory holes. The sands were described as being locally clayey. No made ground was encountered in the south of site.

Soil Contamination

The chemical analysis/laboratory testing on shallow soils from the site did not detect the presence of any contamination from asbestos, heavy metals or polyaromatic hydrocarbons within the site.

Samples were not obtained from the area around the on-site diesel generator, located inside a western building, with an external port present. BSL recommended that further investigation should be undertaken in this area to assess the potential risk from petroleum hydrocarbon contamination.

Ground Gases

During the site investigation carried out by BSL, three ground gas monitoring wells were installed at the site and four monitoring visits completed during the period from 30th November 2017 and 7th February 2018. The results indicate that during the monitoring period the atmospheric pressure range between 985mb and 1014mb and none of the readings exceeded the thresholds for methane (1% v/v) and carbon dioxide (5% v/v).

On the basis of the monitoring undertaken and in accordance with the guidance (Wilson and Card and BS8485:2015) the site was assessed as being Situation 1 and no precautions measures were considered necessary in respect of carbon dioxide or methane.

However, the site is within an area where 5-10% of properties are affected by radon and basic radon precautions are required.

Foundations and Floor Slabs

The BSL report indicated that pads and strip foundations that fully penetrated the encountered made ground were considered suitable. It was anticipated that based on the in-situ data that founding at a depth of approximately 1.50m bgl, an allowable bearing capacity of 200kN/m² should be available. In excess of 600mm of unsuitable soils were present on site and it was recommended that a suspended floor slab should be adopted.

Roads and Pavements

As part of the BSL investigation works, three plate loads tests were carried out across the site area. The results of the testing indicated that the CBR values for the shallow soils vary between 1.9% and 8.8%.

Buried Concrete

Characteristic sulphate values ranged from 0.0024g/l to 0.0079g/l (natural strata) and 0.0125g/l in the made ground the sulphate value. The pH values of the site ranged from 6.94 to 8.56, with an average of 7.95.



The report indicated that the results of laboratory pH and sulphate content indicate that ACEC Class AC-1 and sulphate class DS-1 conditions prevail in accordance with BRE Special Digest 1 "Concrete in aggressive ground" 2005.

Soakaways

A percolation test was undertaken where favourable granular strata was encountered, and subsequent falling head tests were undertaken in selected window sample boreholes. The results of the soakaway test recorded an infiltration rate of 5.56×10^{-5} m/sec (single test). The falling head tests recorded values ranging from 1.26×10^{-4} m/sec (WS10) and 4.61×10^{-4} m/sec (WS03).

Revised Conceptual Model

Brownfield Solutions presented the conceptual site model tabulated below:

Human health

Potential Source	Potential Pathway	Potential Receptor	Likelihood	Severity	Level of Risk
ON-SITE					
Made ground (heavy metals, PAHs)	Ingestion, direct contact, inhalation of dusts.	End-users	Unlikely	Medium	Low
Made ground (petroleum hydrocarbons)	Ingestion, direct contact, inhalation of vapours.	End-users	Low	Medium	Moderate/Low
Asbestos	Inhalation of fibres	End-users	Unlikely	Medium	Low
OFF-SITE					
Ground gases from landfill	Ingestion, direct contact, inhalation of vapours	End Users	Unlikely	Severe	Moderate/Low

Controlled Waters

Potential Source	Potential Pathway	Potential Receptor	Likelihood	Severity	Level of Risk
Made Ground (heavy metals, PAHs, petroleum hydrocarbons)	Migration through groundwater or granular soils	Controlled waters	Unlikely	Medium	Low

Table 1: BSL Conceptual Site Model



Review of the BSL, 2017 Geo-Environmental Assessment Report

At the request of Lidl, Remada Ltd carried out a review of the BSL report and noted that the scope of the investigation works did not fully conform to the Lidl scope for ground investigations. The review also noted the following;

- The investigation did not include the analysis for Petroleum Hydrocarbons, although potential sources were highlighted in the original Phase 1 report. This related to the on-site fuel store as well as the site car parks (asphalt hardstanding);
- The report by BSL indicated that there was a potential risk of hydrocarbons from the on-site fuel store, which could have a significant impact on the risk to both human health and controlled waters. However, it was indicated that this should be investigated post-demolition;
- The report and addendum gas letter indicated that the gas regime across the site is Characteristic Situation CS1 and that no gas protection measures are considered necessary;
- The results of the single soakaway test produced a typical infiltration rate for fine sands, the rates from the falling head tests (within boreholes) produced improved calculated infiltration rates but should be used with caution due to the low volumes of water used in this type of test. Whilst the results all indicate that soakaways are likely to be suitable for the site, for soakaway design purposes the single result from the trial pit test should be confirmed by further tests (in accordance with BRE guidance) in the locations of proposed soakaways within the development area.
- CBRs have been carried out across the site and recorded variable results.
- The BSL report also recommends the use of suspended floor slabs due to the thickness of the made ground.
- The redevelopment of the site is likely to include cut and fill works to provide a suitable development platform. The earthworks designers could specify a re-engineered fill material with a more consistent strength/higher CBR values that is likely to provide an opportunity to utilise an alternative floor slab or raft foundation;
- BSL have recommended the use of pad or strip foundations and indicated that a preliminary allowable bearing pressure of 200 kN/m² is anticipated for the soils encountered at a depth of 1.5m begl. This value is reported to be uncertain due to the variability of the in-situ SPT tests. No indication is given relating to the method of assessment.



3 ENVIRONMENTAL & GEOTECHNICAL INVESTIGATION METHODOLOGY

3.1 Sampling Strategy & Methodology

The investigation comprised the drilling of five (5 No) window sample holes (WS101 – WS105) and the excavation of five (5 No) trial pits at locations indicated on **Figure 2** on 29th March 2019. Exploratory locations were selected to enable an investigation of ground conditions beneath the proposed retail store, car park, the existing landscapes areas (earthworks) and the potential for hydrocarbon contamination/PCBs close to the former fuel storage area/sub-station.

It was anticipated that there would be a variable thickness of made ground at the site associated with the existing landscaped areas (earthworks) and cut and fill of the ground levels / formation of a development platform prior to the existing buildings being built.

All exploratory holes were logged by a suitably qualified Geo-environmental Engineer in general accordance with the recommendations of BS5930:2015. Detailed descriptions, together with relevant comments, are given in the Exploratory Hole Logs.

3.2 Intrusive Investigation

3.2.1 Window Sample Holes

Three of the window samples holes (WS101-103) were advanced to a target depth of 5m with the remaining two window sample holes (WS104 and WS105) refusing at depths of 3m and 4m, respectively.

Standard Penetration Tests (SPTs) in the window samples were carried out at 1.0m intervals as recorded on the borehole logs to assess the relative density and consistency of soils.

SPTs were conducted in accordance with BS EN ISO 22476-3 and the recorded SPT N-values are summarised on the borehole logs.

3.2.3 Trial Pits

The trial pits undertaken at four locations within the existing landscaped areas (earthworks) were excavated using a mini excavator. The trial pits were carried out in order to obtain bulk samples of the made ground, which were submitted to an accredited laboratory for geotechnical classification testing.

3.2.4 Plate Bearing Tests

Plate bearing test for the purpose of raft foundation design were not included within the proposed scope of work because the proposed formation level was not known, and a regrading of the existing topography appeared to be required. The plate bearing tests carried out as part of the original ground investigation by BSL recorded CBR values of between 1.9% and 8.8% for the shallow soils.

3.3 Soil Sampling

3.3.1 Environmental

To supplement the testing carried out as part of the original investigation, made ground and natural soils were selected by visual and olfactory means for subsequent analysis. Samples for chemical laboratory testing purposes were collected in amber glass jars, amber glass vials and plastic tubs and retained in a cool box for transport to the laboratory.

3.3.2 Geotechnical

To supplement the testing carried out as part of the original investigation, geotechnical samples were collected at depths indicated on the exploratory hole logs with samples retrieved from the trial pits within



the raised landscape areas across the site. The disturbed samples were placed in correctly labelled plastic bulk bags and were dispatched to the laboratory for testing with a completed chain of custody.

3.4 Gas and Groundwater Monitoring

3.4.1 Installations

Ground gas monitoring was not commissioned as part of these supplementary works. BSL installed monitoring standpipes within three boreholes, which were monitored on four occasions.

3.4.2 Monitoring

Based on the results of the monitoring, the report and addendum gas letter indicated that the gas regime across the site was Characteristic Situation CS1 and that no gas protection measures were required.

3.5 Quality Assurance and Quality Control

All samples were submitted to a United Kingdom Accredited Laboratory (UKAS) under a completed chain of custody. The laboratory carried out its own QA/QC programme to ensure that the quality of the analytical data conformed to the appropriate test method protocols.

3.6 Laboratory Testing

3.6.1 Soil Chemical Analysis

Five (5 No) soil samples were scheduled for the analysis of Total Petroleum Hydrocarbons (TPHCWG), Polyaromatic Hydrocarbons (PAH) and BTEX compounds (benzene, toluene, ethylbenzene and xylene). One sample from WS101 was scheduled for the analysis of PCBs.

One (1 No) sample of soils was analysed for PCBs, two (2 No) samples of the car park surface material were analysed for Coal Tar, and a further three (3 No) samples of made ground obtained from the landscaped areas were submitted for WAC analysis; and

The results of laboratory chemical analyses are presented at **Appendix A**.

3.6.2 Geotechnical

Bulk and disturbed samples recovered from the trial pit were submitted to an accredited laboratory for the following analyses in general accordance with BS1377:1990:

- 5 No Natural Moisture Contents
- 5 No Water soluble sulphate (SO₄) and pH
- 5 No Particle Size Distribution (PSDs)
- 5 No Optimum Moisture Content/Maximum Dry Density (OMC/MDD) assessment; and

The results of the geotechnical testing are presented at **Appendix B**.



4 GEOTECHNICAL & ENVIRONMENTAL INVESTIGATION FINDINGS

4.1 Ground Conditions

A brief description of the published geology is provided together with a summary of the ground conditions encountered during the intrusive investigation. Exploratory logs are presented at the end of the report.

4.1.1 Published Geology

The geological mapping suggests that there are no recorded deposits of Artificial Ground at the site, as it is directly underlain by granular Glaciofluvial Sheet Deposits (sands and gravels). The solid strata recorded beneath the majority of the site is the Salop Formation comprising mudstone, sandstone and conglomerate.

Previous GI data (BSL, 2017) indicates made ground deposits in the order of up to 2.4m thickness are present across much of the site.

The Glaciofluvial Sheet Deposits and the Salop Formation are both classified as being Secondary (A) Aquifers. The site is not located within 1km of a Source Protection Zone.

4.1.2 Made Ground

It would appear that in line with previous GI findings, the site has seen deposition of made ground over the years to raise the site surface to the current levels and also create raised landscape areas.

The raised landscaped areas are generally located along the curved north eastern boundary, which fronts on to Powell Road, and the south western boundary of the site.

A thin dressing of tarmacadam was present across the car park/hardstanding area (WS101 to WS103 and WS105) resting on a limestone gravel sub-base to a maximum recorded depth of 0.6m begl.

Overall, the exploratory holes have proved that made ground is prevalent across the site ranging in thickness from 0.3m to >2.2m begl (2.4m begl in BSL investigation); being thickest within trial pits located within the raised landscape areas. The five window sample boreholes positioned within, or immediately adjacent to the footprint of the proposed structure where access was restricted, recorded made ground across the area ranging in thickness from 0.3m to approximately 1.5m begl (WS104 in the south eastern corner of the proposed store).

The materials encountered were granular including clayey gravelly sands and sands and gravels with secondary constituents including ash (rare), brick, coal, whole bricks, concrete and roadstone.

In situ penetration testing undertaken on the made ground in the window sample holes gave highly variable results confirming the material is heterogeneous in terms of compaction / strength as well as composition.

It should be noted that the former police station is likely to have deep foundations and may include cellars or other substructures.

4.1.3 Superficial Deposits

Superficial deposits encountered on-site, beneath the made ground, comprised Glaciofluvial Sheet Deposits and were typically described as loose or medium dense sand or sands and gravel, with gravel including quartzite, flint and sandstone.

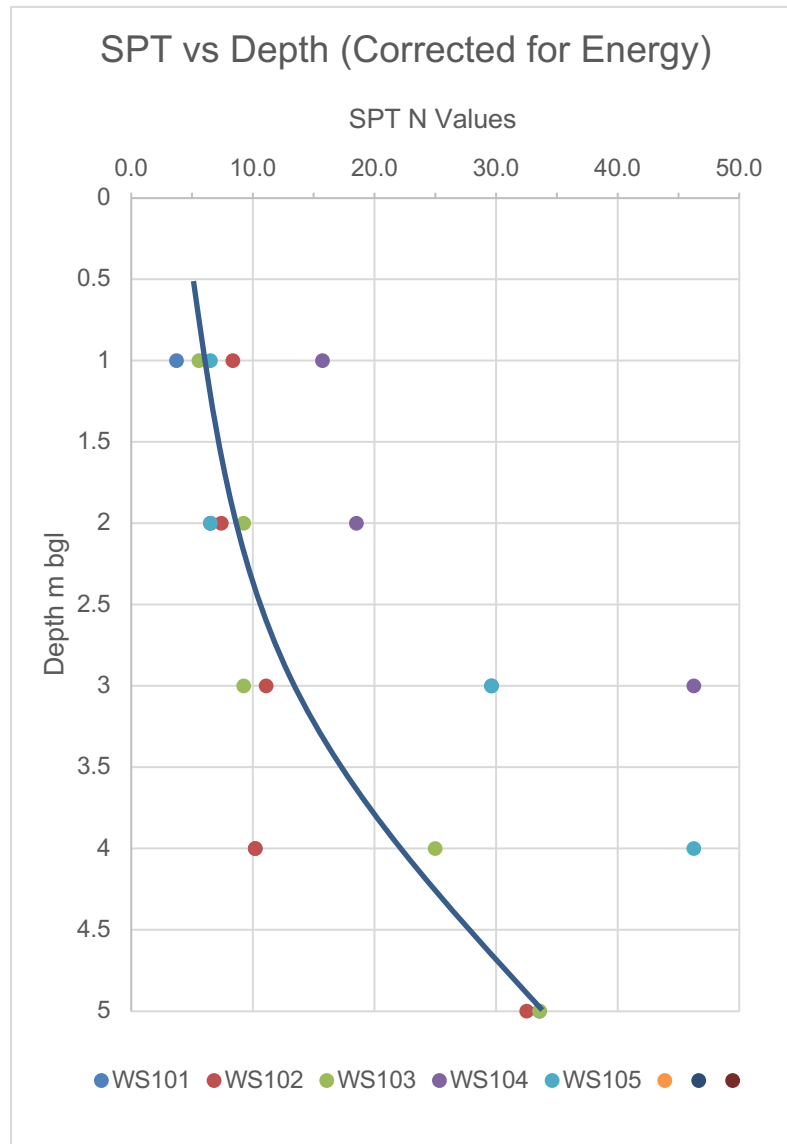
4.1.4 Bedrock

Bedrock was not encountered in any of the exploratory holes.

4.2 In-situ Testing

4.2.1 Standard Penetration Tests (SPTs)

In-situ SPTs were undertaken to assist with the interpretation of strata encountered and the results of uncorrected N-values versus depth are plotted in the graph below and the SPT hammer calibration certificate is presented at Appendix C.



Graph 1: Plot of SPT N Values Versus Depth

One of the window sample holes recorded an N value of less than 5, although the test was partially carried out within the made ground which extended to a depth of 1.1m bgl within borehole WS101 (N=4 in WS101 at 1m within the made ground/ Glaciofluvial Sheet Deposits). The shallow (1m bgl) N values within the Glaciofluvial Sheet Deposits reported values of between N=6 and N=17. The values recorded from 2m to 3m bgl varied between N=7 and N=50/245mm.

The SPT results suggest that the granular made ground is loose and the shallow Glaciofluvial Sheet Deposits are at least loose but that the relative density generally increases with depth.



4.2.2 Hand Shear Vane

No cohesive soils were encountered during the intrusive investigation and therefore no hand shear vanes were undertaken as part of the in-situ testing regime on site.

4.3 Soil Observations

There were no direct visible indicators of contamination such as asbestos within the sampled soils. However, the presence of various rubble, brick, clinker, coal etc plus the sheer quantity of made ground present suggested that it was unlikely to be site-derived and was from unknown sources.

4.4 Groundwater Observations

No groundwater seepages were noted during both phases of ground investigation works.

4.5 Chemical Analysis

4.5.1 Soils

Results of the supplementary soil chemical analysis are presented in **Table 2** at the end of the report and full laboratory certificates are presented in **Appendix B**. Results of the chemical analyses are summarised as follows.

The average TOC was 2.5%. Concentrations of TPH were detected above method detection limit (MDL) in two of the soil samples analysed. The hydrocarbons were generally heavy end hydrocarbons predominantly within the C21 to C35 carbon range but with a minor component within the C10 to C21 carbon range. Concentrations of PAHs were detected in three of samples analysed. PCBs were not detected.

4.6 Geotechnical Testing

Results of the geotechnical testing are summarised as follows and full laboratory certificates are presented in **Appendix E**.

Laboratory tests on bulk and disturbed samples produced:

Five Particle Size Distribution Tests (PSD Wet Sieve) undertaken on the revealed the following:

- The laboratory PSD test descriptions are similar to the site descriptions on the logs;
- Two of the samples of made ground from TP101 and TP102 were generally gravelly fine to coarse sands. The two samples of sand recorded between 13% and 22% fine material (silt and clay);
- Three of the samples of made ground from TP103, TP104 and TP105 were generally sandy gravels. The three samples of gravel recorded between 2% and 7% fine material (silt and clay).

Quick shear box tests were scheduled on three bulk samples of the granular made ground from TP101, TP103 & TP105 to determine the Angle of Shearing Resistance (ϕ). Quick shear box tests from bulk samples revealed the following:

- The three tests carried out on samples of made ground reported ϕ values that ranged from 28.7° to 29.9°;
- The effective cohesion (c') for all three samples was 0 kN/m².

The water soluble sulphate content from five samples tested as part of the original investigation ranged from <0.0015 g/l and 0.0125 g/l. The value for pH for nine samples tested from the original ground investigation varied between 6.95 and 8.56.



The water soluble sulphate content from the five samples of made ground tested as part of the supplementary investigation varied from 0.03 to 0.04 g/l in with pH varying from 6.83 to 7.69.

Dry Density/Moisture Content Relationship Testing was carried out on five bulk samples of made ground using a 4.5kg rammer. The results revealed the following:

- The two samples of sand from TP101 and TP102 reported maximum dry densities of 1.83 and 1.93 Mg/m³ respectively. The Optimum Moisture Content for both samples was recorded as being 10% and initial moisture contents were 14% and 15% respectively.
- The three samples of sand from TP103, TP104 and TP105 reported maximum dry densities of 1.97, 2.02 and 1.91 Mg/m³ respectively. The Optimum Moisture Content for the sample from TP04 was recorded as being 5% and the samples from TP103 and TP105 was 10% and initial moisture contents were 12%, 7.3% and 14% respectively.

4.7 Ground Gas Monitoring Results

Ground gas monitoring was not commissioned as part of these supplementary works. BSL previously installed monitoring standpipes within three boreholes, which were monitored on four monitoring visits.



5 GENERIC QUANTITATIVE RISK ASSESSMENT

5.1 Human Health Risk Assessment

In order to provide an up to date assessment of the risks to human health, Remada has adopted the most recent Generic Assessment Criteria (GAC) published by LQM/CIEH (S4ULs) and CL:AIRE/EIC/AGS for the assessment of potential risks to human health. The derivation of the GAC, methodology, input parameters and appropriate technical guidance (CLEA) be downloaded from <https://remada.sharepoint.com/:b:/g/ESIWX7s4iOhOubgCGxJJF7cB70ehj0L4cGkxKzJKwr3DpQ?e=OdHlXE>

5.2 Retail Zone

5.2.1 Assessment

Default parameters have been adopted for sandy loam of pH 7 and commercial land use. A Soil Organic Matter (SOM) content range of 4.3% has been adopted based on TOC values. In order to present a conservative assessment, the SOM content of 1% has been adopted for the assessment.

The depth to potential sources of contamination for indoor air pathways has been assumed to be 0.5m below building foundation level. The source has been conservatively assumed to be at ground level for outdoor air and direct contact pathways.

For commercial land use the CLEA version 1.06 critical receptor is conservatively modelled as a female working adult with an exposure duration of 49 years. In accordance with the default parameters it was assumed that employees spend most of their time indoors and that 80% of outdoor area is covered by hardstanding. As such, the potential exposure pathways have been assumed to be:

- Direct Soil and Indoor Dust Ingestion;
- Skin contact with soils and dusts;
- Inhalation of indoor and outdoor dusts and vapours.

Where GAC values for individual TPH fractions are not exceeded, the potential additive effect has been assessed by calculating overall TPH hazard index for each sample.

5.2.2 Comparison of Soil Analysis Results with Human Health GAC

A comparison of soil chemical analysis with GAC is presented as **Table 3**.

Metals & Inorganics Excluding Asbestos

Five soil samples were tested as part of the original ground investigation for a suite of potential contaminants including arsenic, chromium (III and VI), copper, lead, mercury, nickel, selenium and zinc. None of the analytes tested for were detected at concentrations that exceeded the human health GAC protective of on-site workers.

Asbestos

Five soil samples were screened as part of the original ground investigation for asbestos. There was no asbestos detected in the samples selected for analysis.

PAH

Five soil samples were analysed as part of the original ground investigation for speciated PAH (EPA 16). None of the analytes tested for were detected at concentrations that exceeded the human health GAC protective of on-site workers.



Six soil samples were analysed as part of this investigation for PAH(16) and no individual samples exceeded the laboratory method detection limit.

TPH & BTEX

Assessment of the potential for TPH and BTEX within the site soils was not carried out as part of the original investigation. It was recommended that following demolition works the area around the diesel tank and diesel generator (situated within the buildings) should be carried out.

To provide an initial assessment of these potential hydrocarbon sources, shallow soil samples were obtained from close to the buildings by Remada Ltd during the supplementary site investigation and concentrations were reported at WS101 and WS102

None of the analytes tested were detected at concentrations that exceeded the human health GAC protective of on-site workers.

PCBs

One sample from WS101 was analysed for PCBs and none of the analytes were present at greater than the laboratory method detection limit.

5.3 Controlled Waters Risk Assessment

During the two phases of investigation works a total of eight trial pits and eighteen window sample boreholes were advanced across the site area, to a maximum depth of 5.0m begl. During both phases of works groundwater was not encountered.

Localised TPH detections at WS101 and WS102 are heavy end and not indicative of diesel or oil and considered to be of low solubility / mobility and unlikely to present a more than negligible risk to the underlying aquifer.

The nearest surface watercourse recorded based on the Envirocheck report is Bache Brook / River Gwenfro approximately 450m to the south. The site is not located within a 1km of a designated Groundwater Source Protection Zone; however, the site is underlain by superficial deposits and solid strata that have been designated as a Secondary A Aquifer. Due to the distance to the recorded watercourse, the underlying aquifer should be considered to be the most sensitive receptor to the site.

5.4 Ground Gas Assessment

Ground gas monitoring was not commissioned as part of these supplementary works. BSL installed monitoring standpipes within three boreholes, which were monitored on four monitoring visits. Based on the results of the monitoring, the report and addendum gas letter indicated that the gas regime across the site was Characteristic Situation CS1 and that no gas protection measures were required, however Remada's Phase 1 report noted that the property is an intermediate probability radon area and basic radon protective measures are necessary.

5.5 Revised Conceptual Site Model

A revised Conceptual Site Model is presented as **Table 3** below.

5.7 Coal Tar Assessment

Two samples of existing asphalt or macadam surfacing materials were obtained from WS101 and WS102 and scheduled for the analysis of TPH and PAH(17). TPH was present in both samples, however, the concentrations of PAH were less than the laboratory method detection limit. Dibenzothiophene a biomarker present in coal tar was not detected in either sample and this in conjunction with no PAH contamination confirms that coal tars are not present. This would indicate that the surfacing materials at the site would be



classified as non hazardous waste and assigned the List of Wates code 17 03 02 for bituminous mixtures other than those mentioned in 17 03 01.

5.8 Waste Classification

In general, the results of the chemical analysis indicate that the material would be classified as non hazardous waste. Made Ground sampled at WS101 0.1-0.2m produced at sum TPH concentration of 2,900mg/kg. There hydrocarbons were generally in the C21 to C35 range and there were low concentrations of PAHs present. There was no visual or olfactory evidence of hydrocarbon contamination and given that the hydrocarbons were not in the 'normal' weathered diesel carbon range the waste assessment has been undertaken assuming an unknown oil. This indicates that the sample would be classified as non hazardous waste.

Three Waste Acceptance Criteria (WAC) analysis have been undertaken. The results indicate that one of the three samples (TP102 at 0.6m) did not meet the requirements for disposal in an inert landfill due to TOC and fluoride concentrations. In addition, WS101 at 0.1m had a concentration of TPH that exceeded the WAC requirements for disposal in an inert landfill. Therefore, based on these preliminary results the made ground should be classified as non hazardous.

5.9 Health & Safety Considerations

To ensure direct exposure of construction workers involved in the site redevelopment to any impacted contaminated shallow soils is minimised, the guidance stated in HSG 66 "Protection of Workers and the General Public During Redevelopment of Contaminated Land" should be followed.



Potential Source Areas	Potential Contaminant of Concern	Pathways	Potential Receptor	Exposure Route (Human unless otherwise stated)	Potential Identified Linkage (unmitigated)	Findings of Ground investigation	Risk (Un-mitigated)	Proposed Remediation (Mitigation) Measures	Residual Risk Estimation
On-site Sources Current Police Station / Fuel storage / sub-station / vehicle parking	Asbestos / Metals As, Be, Cd, Cu, Cr (VI), Cr (III) Hg, Ni, Se, Va, Zn, SO ₄ , TPH /PAH / VOCs/ SVOCs	Disturbance due to construction plant causing direct contact, dusts, vapours. Direct Contact with occupants of the proposed development	Occupants of the development / building fabric	• Direct Soil Ingestion	• Yes	<GAC	Negligible	N/A	N/A
				• Indoor Dust ingestion	• Yes	<GAC	Negligible	N/A	N/A
				• Skin Contact with Soils	• Yes	<GAC	Negligible	N/A	N/A
				• Skin Contact with Dust	• Yes	<GAC	Negligible	N/A	N/A
				• Inhalation of Outdoor Dust	• Yes	<GAC	Negligible	N/A	N/A
				• Ingestion of home grown produce	• Yes	<GAC	Negligible	N/A	N/A
Historical Timber yard / Park View Sports Pitches	Asbestos / Metals As, Be, Cd, Cu, Cr (VI), Cr (III) Hg, Ni, Se, Va, Zn, SO ₄ , TPH /PAH	Inhalation of vapours/ gases by occupants of proposed development	Occupants of the development / building fabric	• Inhalation of Outdoor Vapours	• Yes	<GAC	Negligible	N/A	N/A
				• Inhalation of Indoor Vapours	• Yes	<GAC	Negligible	N/A	N/A
				• Permeation of water supply pipework	• Yes	CS1	Negligible	N/A	N/A
				• Ingestion via permeated water supply pipework	• Yes	<GAC	Negligible	N/A	N/A
				• Leachate and migration within underlying soils & groundwater	• Yes	<GAC	Negligible	N/A	N/A
				• Leachate and migration within underlying soils & groundwater	• Yes	<GAC	Negligible	N/A	N/A
Off-site Sources Petrol filling station	TPH /PAH / VOCs	Leachate and migration within underlying soils & groundwater	Secondary (A) Aquifers	• Leachate and migration within underlying soils & groundwater	• Yes	<GAC	Negligible	N/A	N/A

Table 5: Refined Conceptual Site Model

Direct contact with subsurface soil and/or groundwater during redevelopment works are not assessed as part of the CSM. It is considered that risks to workers will be managed as part of any the redevelopment works at the site through the application of health and safety procedures, where required.



6 GEOTECHNICAL SITE ASSESSMENT

6.1 Geotechnical Considerations

An indicative site layout is presented as **Figure 2** showing the proposed store with a Finished Floor Level (FFL) = 84.80m AoD in the western part of the site with car parking to the east and south. Existing ground levels beneath the store footprint vary with access road beneath and adjacent to existing buildings with a low point in the south at 83.6m AoD to 85.2m AoD in the north. After the existing pavement and floor slab construction is removed the existing levels will be approximately 83.1m AoD to 84.7 mAoD which is within +/- 0.6m of store formation level of 84.3m AoD. Consequently some earthworks regrading will be required to produce the required formation level.

The five window sample boreholes positioned within, or immediately adjacent to the footprint of the proposed structure where access was restricted, recorded made ground across the area ranging in thickness from 0.3m to approximately 1.5m begl (WS104 in the south eastern corner of the proposed store), typically resting on superficial deposits comprising Glaciofluvial Sheet Deposits.

The Glaciofluvial Sheet Deposits were typically described as loose or medium dense sand or sands and gravel, with gravel including quartzite, flint and sandstone. SPT N values for the first test drive in WS101 to WS 105 below 84.3m AoD were between N = 7 & 20 and corresponding ϕ values = 29° is considered appropriate (Tomlinson Fig 2,13).

The values recorded from 2m to 3m begl varied between N=7 and N=50 for 245mm.

The bedrock strata (Salop Formation) recorded beneath the site was not encountered during this supplementary investigation.

No groundwater seepages were noted during both phases of ground investigation works. However, the investigation techniques used were rapid and may have masked small seepages.

It should be noted that existing foundations (potentially deep beneath the existing tower) and other buried structures (and possible basement areas) may be present beneath the site.

Details of the proposed permanent and variable design loads (actions) are not currently known although an indicative column load of 400kN has been provided.

6.2 Earthworks Regrading

Optimum moisture content test on the existing made ground (previously engineered fill material) indicate that in general the materials are wetter than optimum but could be used as a fill material to achieve dry densities of greater than 1.83 Mg/m³ if managed appropriately. Shear box test on the existing made ground produced minimum strength parameters of ϕ values = 28.7° $c' = 0$ kN/m².

The reuse of existing made ground as fill should be in accordance with an earthworks specification to achieve adequate compaction and benching of fill.

6.2 Design Approach

Design calculations in accordance with BS EN 1997-1: 2004 require the establishment of design values for actions, ground properties and ground resistances, definition of the limits that must not be exceeded (usually a serviceability limit state), the setting up of calculation models for the relevant ultimate or serviceability limit state, and the showing by such calculation that these limits will not be exceeded.

Design values for such calculations are derived by applying partial factors to characteristic values for actions, ground properties and ground resistances, and based upon the geotechnical model and following requirements of Design Approach 1, Combination 2 calculations have been undertaken. Table 7 provides

a summary of the partial factors applied to actions, soil parameters and resistance factors. To satisfy the serviceable limit state settlement has been limited to 25mm.

Geotechnical parameter			Symbol	Combination 1		Combination 2	
Partial factors ¹ on actions (γ_F) or effects of actions (γ_E)	Permanent	Unfavourable ²	γ_G	A1	1.35	A2	1.0
		Favourable ³			1.0		1.0
	Variable ⁴	Unfavourable	γ_Q		1.5		1.3
		Favourable ⁵			0		0
Partial factors on soil parameters (γ_M)	Angle of shearing resistance ⁶		$\gamma_{\phi'}$	M1	1.0	M2	1.25
	Effective cohesion		$\gamma_{c'}$		1.0		1.25
	Undrained shear strength		γ_{cu}		1.0		1.4
	Unconfined strength		γ_{qu}		1.0		1.4
	Weight density		$\gamma_{\gamma'}$		1.0		1.0
Partial resistance factors (γ_R) for spread foundations	Bearing		$\gamma_{R;v}$	R1	1.0	R1	1.0
	Slidings		$\gamma_{R;h}$		1.0		1.0

¹These factors are given for buildings only. Different factors apply to bridges and other structures

²In this case the upper characteristic value ($G_{k,sup}$) of the permanent action is used

³In this case the lower characteristic value ($G_{k,inf}$) of the permanent action is used

⁴There may be more than one variable action. The partial factor is applied to the leading variable action and modified (reduced) values

⁵The UK National Annex states that when variable actions are favourable Q_k is zero, rather than g_Q is zero

⁶This is applied to $\tan\phi'$ or $\tan\phi_{cv}'$ although it might be more appropriate to determine the design value ϕ_{cv} directly

Table 5: Summary of Partial Factors Applied to Actions, Soil Parameters and Resistance Factors

Preliminary calculations indicate that for a traditional pad foundation (up to 2.0 wide) at a minimum of 1.5m depth, bearing within the loose sands of ϕ values = 29° a design bearing resistance of 200 kN/m² will be appropriate in order to satisfy the ultimate and serviceable limit states in accordance with Eurocode 7 - Geotechnical Design. This is only applicable for foundations with loads that are applied vertically and centrally. To satisfy the serviceable limit state settlement has been limited to 25mm.

In the absence of design loads the bearing capacity assessment has been undertaken for Design Approach 1, Combination 2 only, and a further assessment taking account of anticipated loadings (permanent and variable) will be required during detailed design in order to confirm the limit states are satisfied. All foundations will need to fully penetrate any made ground and be founded a minimum of 150mm into the founding stratum.

6.4 Floor Slab

If pad foundations are selected as described above and a ground bearing floor slab is proposed, then made ground should be engineered as described above and include a capping layer of compacted 6F₂ material of minimum thickness 0.3m.

6.5 Raft Foundation

A plain slab or stiffened edge raft with a downstand pressure of 125 kPa is a potential solution to bear directly on a 0.3m layer of compacted sub-base bearing upon the earthworks fill compacted to 95% maximum dry density and ϕ = 29° and / or natural deposits of ϕ = 29°. The earthworks fill material and compacted sub-base would require plate bearing testing to demonstrate suitability for a raft.



6.6 Excavations and Temporary Works

During the advancement of the window sample boreholes, collapse of the boreholes was observed within granular superficial deposits, which was likely to be the result of the borehole penetrating weak zones including the made ground. Made ground materials observed within the trial pits also exhibited signs of instability. As such, it is considered that during development works, excavation side slopes within the Made Ground and the underlying natural sands are unlikely to remain stable even in the short term without support, dewatering (in deeper excavations) or without being battered back to a safe slope gradient. A detailed inspection of the side slopes should be made during excavation and a risk assessment carried out to fully assess the support measures required.

Although no groundwater seepages were noted during the ground investigation works, groundwater levels are subject to seasonal change and groundwater seepages, which could initiate collapse of granular soils, may be encountered during site works.

6.7 External Car Park Construction

Three in-situ plate load tests (450mm diameter plate) were carried out across the site as part of the original investigation works. CBR values derived from the plate load tests indicated that near surface the CBR values were variable with values of between 1.9 and 8.8% recorded. It is therefore considered that the made ground at the site will require ground improvement / compaction prior to construction of the car park.

6.8 Protection of Buried Concrete

In accordance with BRE SD1 for buried concrete in a brownfield site with mobile groundwater, analyses of selected samples for water soluble sulphate returned values of up to 0.04 g/l and pH >6.83. Therefore, a Design Sulphate Class DS-1 is considered appropriate for buried concrete and an ACEC Class of AC-1 is considered appropriate for the location.

6.9 Soakaway Tests

As part of the original investigation, a percolation test was undertaken within a trial pit where favourable granular strata were encountered. The results of the soakaway test recorded an infiltration rate of 5.56×10^{-5} m/sec (single test). Falling head tests were also undertaken within selected window sample boreholes and results ranged from 1.26×10^{-4} m/sec (WS10) and 4.61×10^{-4} m/sec (WS03).

Whilst the results all indicate that soakaways are likely to be suitable for the site, for soakaway design purposes the single result from the trial pit test should be confirmed by further tests (in accordance with BRE guidance – three tests per location) in the locations of proposed soakaways within the development area.

6.10 General Construction Advice

All formations should be cleaned, and subsequently inspected, by a suitably qualified engineer prior to placing concrete. Should any soft, compressible or otherwise unsuitable materials be encountered they should be removed and replaced by blinding concrete.

Foundation concrete, or alternatively, a blinding layer of concrete, should be placed immediately after excavation and inspection in order to protect the formation against softening and disturbance.

Generally, all formations should be placed wholly within the same material type, unless specific geotechnical inspection and assessment have been undertaken.

Where applicable ground beneath the proposed building footprint and potentially car parking may require to be stripped to reveal localised areas of made ground and structures. Excavations should be backfilled with suitably re-compacted materials to achieve formation level.



During foundation excavation works arisings should be constantly monitored for the presence of contamination.

The site soils include a number of obstructions including relict foundations, buried service and potential basements associated with the former police building; these will require consideration in the final design.



7 CONCLUSIONS & RECOMENDATIONS

7.1 Geoenvironmental

The following conclusions have been made based on the findings of this investigation.

7.1.1 Phase 2 Site Investigation

The site was historically a Police Headquarters including a tower block, which, at the time of the investigation was partially occupied. The police buildings could potentially include basements which would need to be located and the impact on the development assessed.

The five window sample boreholes positioned within, or immediately adjacent to the footprint of the proposed structure, recorded made ground ranging in thickness from 0.3m to approximately 1.5m begl. Overall, the exploratory holes have proved that made ground is prevalent across the site ranging in thickness from 0.3m to >2.2m begl (2.4m begl in BSL investigation); being thickest within trial pits located within the raised landscape areas. The materials encountered were granular including clayey gravelly sands and sands and gravels with secondary constituents including ash (rare), brick, coal, whole bricks, concrete and roadstone .

Beneath the made ground, the natural ground conditions at the site were found to be generally consistent and comprised granular superficial deposits typically described as loose or medium dense sand or sands and gravel, with gravel including quartzite, flint and sandstone . Bedrock was not encountered within the depth of investigation.

7.1.2 Human Health Risk Assessment Retail Zone

The results of soil chemical analysis from the original investigation and supplementary investigation were compared to Human Health Generic Assessment Criteria for commercial land use.

None of the analytes tested for CLEA metals, TPHCWG, PAH, BTEX, Phenol or PCBs were detected at concentrations that exceeded the human health GAC protective of on-site workers. In addition, no asbestos was detected in the samples selected for analysis.

7.1.3 Water Resources Risk Assessment

Localised TPH detections at WS101 and WS102 are heavy end and not indicative of diesel or oil and considered to be of low solubility / mobility and unlikely to present a more than negligible risk to the underlying aquifer.

7.1.4 Ground Gas Assessment

Gas monitoring was carried out on four monitoring visits by BSL using the monitoring standpipes installed within three of their borehole locations. Based on the results of the monitoring, the report and addendum gas letter indicated that the gas regime across the site was Characteristic Situation CS1 and that no gas protection measures were required, however Remada's Phase 1 report noted that the property is an intermediate probability radon area and basic radon protective measures are necessary.

7.1.5 Coal Tar Assessment

Two samples of existing asphalt or macadam surfacing materials were scheduled for the analysis of TPH and PAH(17). PAH were less than the laboratory method detection limit and Dibenzothiophene a biomarker present in coal tar was not detected to confirm that coal tars are not present.

7.16 Waste Classification

In general, the results of the chemical analysis indicates that the material would be classified as non hazardous waste. Made Ground sampled at WS101 0.1-0.2m produced at sum TPH concentration of



2,900mg/kg. There hydrocarbons were generally in the C21 to C35 range and there were low concentrations of PAHs present. There was no visual or olfactory evidence of hydrocarbon contamination and given that the hydrocarbons were not in the 'normal' weathered diesel carbon range the waste assessment has been undertaken assuming an unknown oil. This indicates that the sample would be classified as non hazardous waste.

7.2 Geotechnical

The existing development comprises a number of buildings, a road, external car parks and landscape bunds. The proposed Lidl store footprint will occupy the western zone of the site at FFL = 84.00m AoD and will necessitate some earthworks regrading. In addition, there is potential for relict foundations and potential basements resulting from demolition of the existing structures.

Preliminary calculations indicate that for a traditional pad foundation (up to 2.0 wide) at a minimum of 1.5m depth, bearing within the loose sands of ϕ values = 29° a design bearing resistance of 200 kN/m² will be appropriate in order to satisfy the ultimate and serviceable limit states in accordance with Eurocode 7 - Geotechnical Design. This is only applicable for foundations with loads that are applied vertically and centrally. To satisfy the serviceable limit state settlement has been limited to 25mm.

Optimum moisture content test on the existing made ground (previously engineered fill material) indicate that in general the materials are wetter than optimum but could be used a fill material to achieve dry densities of greater than 1.83 Mg/m³ if managed appropriately. Shear box test on the existing made ground produced minimum strength parameters of ϕ values = 28.7° $c' = 0$ kN/m².

If pad foundations are selected as described above and a ground bearing floor slab is proposed, then made ground should be engineered as described above and include a capping layer of compacted 6F₂ material of minimum thickness 0.3m.

A plain slab or stiffened edge raft with a downstand pressure of 125 kPa is a potential solution to bear directly on a 0.3m layer of compacted sub-base bearing upon the earthworks fill compacted to 95% maximum dry density and $\phi = 29^\circ$ and / or natural deposits of $\phi = 29^\circ$. The earthworks fill material and compacted sub-base would require plate bearing testing to demonstrate suitability for a raft.

A Design Sulphate Class DS1 is considered appropriate for buried concrete and an ACEC Class of AC-1 is considered appropriate for the location.

Preliminary soakaway testing by BSL, 2017 recorded an infiltration rate of 5.56×10^{-5} m/sec (single test) within a trial pit test. Low volume, falling head tests were also undertaken within boreholes and results ranged from 1.26×10^{-4} m/sec (WS10) and 4.61×10^{-4} m/sec (WS03).



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STUDY LIMITATIONS

IMPORTANT. This section should be read before reliance is placed on any of the information, opinions, advice, recommendations or conclusions contained in this report.

1. This report has been prepared by Remada, Ltd with all reasonable skill, care and diligence within the terms of the Appointment and with the resources and manpower agreed with (the 'Client'). Remada does not accept responsibility for any matters outside the agreed scope.

2. This report has been prepared for the sole benefit of the Client unless agreed otherwise in writing.

3. Unless stated otherwise, no consultations with authorities or funders or other interested third parties have been carried out. Remada is unable to give categorical assurance that the findings will be accepted by these third parties as such bodies may have published, more stringent objectives. Further work may be required by these parties.

4. All work carried out in preparing this report has used, and is based on, Remada's professional knowledge and understanding of current relevant legislation. Changes in legislation or regulatory guidance may cause the opinion or advice contained in this report to become inappropriate or incorrect. In giving opinions and advice pending changes in legislation, of which Remada is aware, have been considered. Following delivery of the report Remada has no obligation to advise the Client or any other party of such changes or their repercussions.

5. This report is only valid when used in its entirety. Any information or advice included in the report should not be relied upon until considered in the context of the whole report.

6. Whilst this report and the opinions made are to the best of Remada's belief, Remada cannot guarantee the accuracy or completeness of any information provided by third parties.

7. This report has been prepared based on the information reasonably available during the project programme. All information relevant to the scope may not have received.

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

9. The content of this report represents the professional opinion of experienced environmental consultants. Remada does not provide specialist legal or other professional advice. The advice of other professionals may be required.

10. Where intrusive investigation techniques have been employed they have been designed to provide a reasonable level of assurance on the conditions. Given the discrete nature of sampling, no investigation technique is capable of identifying all conditions present in all areas. In some cases the investigation is further limited by site operations, underground obstructions and above ground structures. Unless otherwise stated, areas beyond the boundary of the site have not been investigated.

11. If below ground intrusive investigations have been conducted as part of the scope, service tracing for safe location of exploratory holes has been carried out. The location of underground services shown on any drawing in this report has been determined by visual observations and electromagnetic techniques. No guarantee can be given that all services have been identified. Additional services, structures or other below ground obstructions, not indicated on the drawing, may be present on site.

12. Unless otherwise stated the report provides no comment on the nature of building materials, operational integrity of the facility or on any regulatory compliance issues.

13. Unless otherwise stated, samples from the site (soil, groundwater, building fabric or other samples) have NOT been analysed or assessed for waste classification purposes.



TABLES

Table 2: Comparison of Chemical Analyses with GAC

Laboratory Sample ID.:				803977	803978	803979	803980	803981	803982
Sample ID.:				WS101	WS102	WS101	WS102	WS105	WS103
Top Depth (m):				0.10	0.05	0.60	0.30	0.10	0.10
Bottom Depth (m):				0.20	0.15	0.80	0.60	0.35	0.30
Date Sampled:				29-Mar-2019	29-Mar-2019	29-Mar-2019	29-Mar-2019	29-Mar-2019	29-Mar-2019
GAC 2.5% SOM									
Determinand		Units	LOD						
Moisture		%	0.020	3.4	2.7	7.0	6.7	6.9	4.4
Aliphatic TPH >C5-C6	5900 ^{vd} (558)	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	17000 ^{vd} (322)	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	4800 ^{vd} (190)	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	23000 ^{vd} (118)	mg/kg	1.0	11	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	82000 ^{vd} (59)	mg/kg	1.0	16	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	1700000	mg/kg	1.0	16	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	1700000	mg/kg	1.0	4.9	15	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C35-C44	1700000	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons		mg/kg	5.0	48	15	< 5.0	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	46000 ^{vd} (2260)	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	110000 ^{vd} (1920)	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	8100 ^{vd} (1500)	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	28000 ^{vd} (899)	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	37000	mg/kg	1.0	6.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	28000	mg/kg	1.0	43	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	28000	mg/kg	1.0	2400	23	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C35-C44	28000	mg/kg	1.0	420	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons		mg/kg	5.0	2800	23	< 5.0	< 5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons		mg/kg	10.0	2900	38	< 10	< 10	< 10	< 10
Naphthalene	460 ^{vd} (183)	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	97000 ^{vd} (212)	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	97000 ^{vd} (141)	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	68000	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	22000	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene	540000	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	23000	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.48	< 0.10
Pyrene	54000	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.72	< 0.10
Benzo[a]anthracene	170	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	350	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	45	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	1200	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	35	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno[1,2,3-c,d]Pyrene	510	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz[a,h]Anthracene	3.6	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	4000	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's		mg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Benzene	47	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	110000 ^{vd} (1920)	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	13000 ^{vd} (1220)	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene	14000 ^{vd} (1470)	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene	15000 ^{vd} (1120)	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
PCB 28		mg/kg	0.010	< 0.010					
PCB 52		mg/kg	0.010	< 0.010					
PCB 90+101		mg/kg	0.010	< 0.010					
PCB 118		mg/kg	0.010	< 0.010					
PCB 153		mg/kg	0.010	< 0.010					
PCB 138		mg/kg	0.010	< 0.010					
PCB 180		mg/kg	0.010	< 0.010					
Total PCBs (7 Congeners)		mg/kg	0.10	< 0.10					

NC: No published criteria

vap: Screening criteria presented exceed the vapour saturation limit, which is presented in brackets.

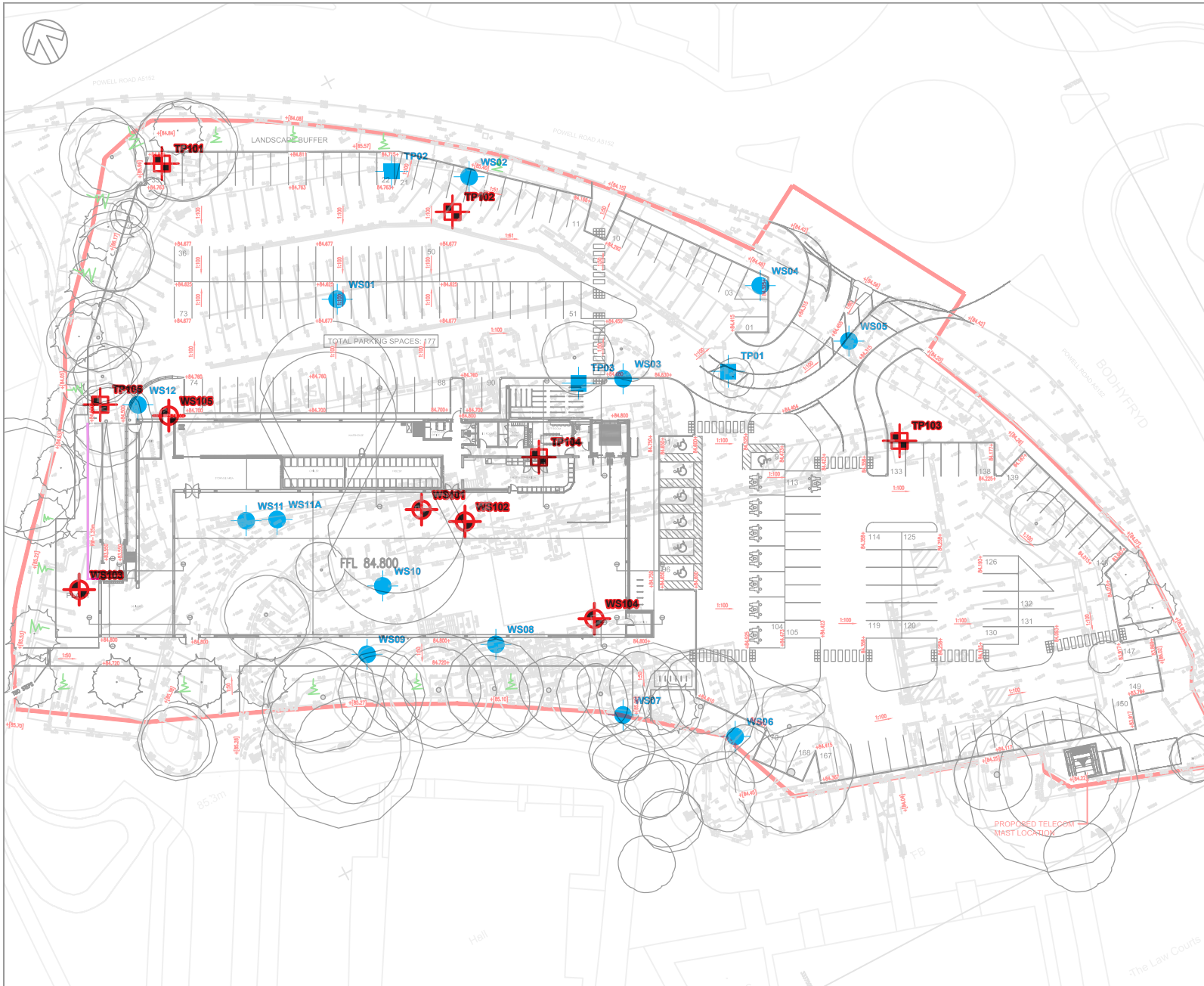
sol: Screening criteria presented exceed the solubility saturation limit, which is presented in brackets.

dir: Screening criteria based on threshold protective of direct skin contact (guideline in brackets based on health effects following long term exposure provided for illustration only).

(1): For assessment based on the use of the surrogate marker approach the GAC for Coal Tar must be used instead of benzo(a)pyrene.



FIGURES



General Notes

- TO BE READ WITH ALL OTHER CD CONSULTANTS LID DRAWINGS AND SPECIFICATIONS.
- DO NOT SCALE THIS DRAWING.
- CONTRACTOR TO VERIFY LOCATION OF ALL EXISTING SERVICES PRIOR TO COMMENCEMENT.
- ALL WORKS TO BE UNDERTAKEN IN ACCORDANCE WITH LID SPECIFICATION.

LEGEND

+51.610

PROPOSED SPOT LEVEL

+51.610

EXISTING/TIE-IN LEVEL

1:100

PROPOSED CROSSFALL

RETAINING WALL

EARTH BATTER
1:3 MAX. SIDE SLOPE (UNLESS INDICATED OTHERWISE)

101	FIRST ISSUE	20/02/10
	Revision/Issue	Date

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Drawing Title

PROPOSED LEVELS

Architect

Project

LIDL WREXHAM

Scale

1:250 @ A1

Date

20/02/10

Draw No

16056-001

Rev

T01

- Legend
- WS105

Remada Window Sample 2019
- TP103

Remada Trial Pit 2019
- WS01

BSL Window Sample 2017
- TP01

BSL Trial Pit 2017

Notes

Project Title		
Wrexham Police Headquarters		
Drawing Title		
Exploratory Location Plan		
Client		
Lidl Great Britain Ltd		
Drawn	GJ	Approved GJ
Scale	NTS	Size A3
		Job No. 525.03
		Date 27.03.19

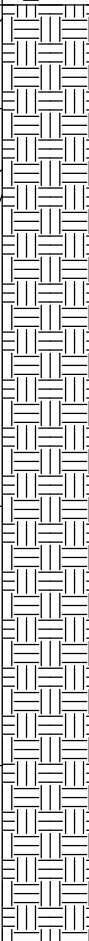
Remada



EXPLORATORY LOGS

BOREHOLE LOG

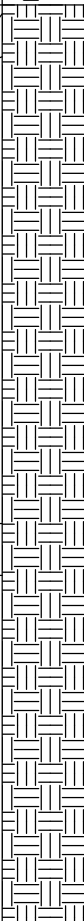
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Job No 525.03	Date 29-03-19	Ground Level (m) 83.90	Co-Ordinates () E 350,685.3 N 333,738.4	
Contractor Global				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA			Instrument/ Backfill	
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)		DESCRIPTION
0.00	ES	N4		83.82		0.08	Asphalt.	
0.10	ES				(0.52)	Grey sandy gravel of limestone. MADE GROUND.		
0.60	ES			83.30	0.60	Loose brown slightly clayey silty fine to coarse sand. Gravel includes angular to subrounded quartzite, coal, brick and concrete fragments.		
1.00	ES			82.95	0.95	MADE GROUND.		
1.10		82.80		1.10	Loose red brown slightly gravelly fine to coarse sand. Gravel includes angular to rounded quartzite and brick fragments.			
					Loose red brown slightly gravelly fine to coarse SAND. Gravel includes angular to rounded quartzite and brick fragments.			
2.00		N7			(1.80)	2.2 become light red brown.		
3.00		N32		81.00	2.90	Medium dense orange brown locally light brown gravelly fine to coarse SAND. Gravel includes subangular to rounded fine to coarse quartzite, limestone and sandstone.		
4.00		N11		79.50	4.40	Medium dense orange brown slightly silty fine to coarse SAND.		
4.80		N32	78.45	5.45				
					</			

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
											NVO - No Visual or Olfactory Evidence of Contamination
All dimensions in metres Scale 1:43.75			Client Lidl (UK) GmbH			Method/ Plant Used Competitor Window Sampler			Logged By KB		

BOREHOLE LOG

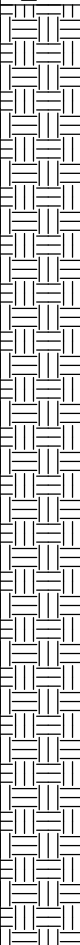
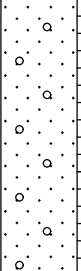
Project Lidl Wrexham				BOREHOLE No WS102	
Job No 525.03	Date 29-03-19	Ground Level (m) 83.65	Co-Ordinates () E 350,689.3 N 333,744.5		
Contractor Global				Sheet 1 of 1	

SAMPLES & TESTS			Water	STRATA			Instrument/ Backfill	
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick- ness)		DESCRIPTION
0.00	ES	N9		83.60		0.05	Asphalt.	
0.05	ES			83.35		0.30	Grey sandy gravel of limestone.	
0.30	ES						Loose orange brown slightly gravelly slightly silty fine to coarse SAND. Gravel includes subrounded to rounded quartzite.	
					@0.7 becomes gravelly.			
1.00					@ 1.5 becomes slightly gravelly.			
				(2.70)				
2.00		N8						
3.00		N12		80.65	3.00	Medium dense orange brown slightly gravelly slightly silty fine to coarse SAND. Gravel includes subrounded to rounded quartzite.		
				80.35	3.30	Medium dense red brown slightly silty fine to coarse SAND.		
4.00		N11						
					(2.15)			
5.00		N31						
				78.20	5.45			

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Dia. mm	Water Depth	From	To	Hours	From	To	
											NVO - No Visual or Olfactory Evidence of Contamination
All dimensions in metres Scale 1:43.75			Client Lidl (UK) GmbH			Method/ Plant Used Competitor Window Sampler			Logged By KB		

BOREHOLE LOG

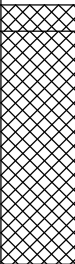
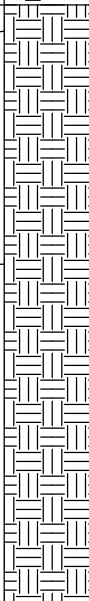
Project Lidl Wrexham				BOREHOLE No WS103	
Job No 525.03	Date 29-03-19	Ground Level (m) 85.30	Co-Ordinates () E 350,685.1 N 333,694.1		
Contractor Global				Sheet 1 of 1	

SAMPLES & TESTS			Water	STRATA			Instrument/ Backfill	
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick- ness)		DESCRIPTION
0.00	ES	N6		85.24		0.06	Asphalt.	
0.10	ES			(0.54)		Red brown clayey slightly sandy gravel of limestone.		
0.60	ES			84.70		0.60	Loose red brown locally slightly clayey gravelly fine to coarse sand. Gravel includes subangular to rounded quartzite and brick.	
				84.40		0.90		
1.00	N10				(1.80)	@1.8 becomes medium dense.		
2.00								
3.00							N10	
	82.30			3.00	Medium dense orange brown locally black silty SAND & GRAVEL. Gravel includes subangular to subrounded fine to coarse quartzite, coal and sandstone.			
4.00	N27					(2.45)		
5.00	N32							
		79.85	5.45					

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Dia. mm	Water Depth	From	To	Hours	From	To	
											NVO - No Visual or Olfactory Evidence of Contamination
All dimensions in metres Scale 1:43.75			Client Lidl (UK) GmbH			Method/ Plant Used Competitor Window Sampler			Logged By KB		

BOREHOLE LOG

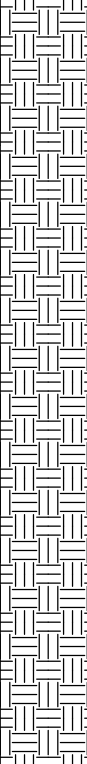
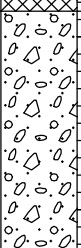
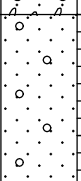
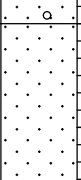
Project Lidl Wrexham				BOREHOLE No WS104	
Job No 525.03	Date 29-03-19	Ground Level (m) 85.10	Co-Ordinates () E 350,647.8 N 333,743.4		
Contractor Global				Sheet 1 of 1	

SAMPLES & TESTS			Water				STRATA	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick- ness)	DESCRIPTION	
1.00	N17		84.95		0.15	Grass (sparse) over brown silty fine to coarse sand. MADE GROUND.		
					(1.35)	Dense grey sandy GRAVEL. Gravel is angular to subangular fine to coarse limestone.		
2.00	N20		83.60		1.50	Medium dense light orange brown silty SAND & GRAVEL. Gravel includes subangular to rounded fine to coarse quartzite and flint.		
					(1.95)			
3.00	N50/ 240 mm		81.65		3.45			

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
											NVO - No Visual or Olfactory Evidence of Contamination. The boundary at 1.5m (between the limestone gravel and the natural sand and gravel was estimated due to the constant collapse of limestone gravel during the drilling works.
All dimensions in metres Scale 1:43.75			Client Lidl (UK) GmbH			Method/ Plant Used Competitor Window Sampler			Logged By KB		

BOREHOLE LOG

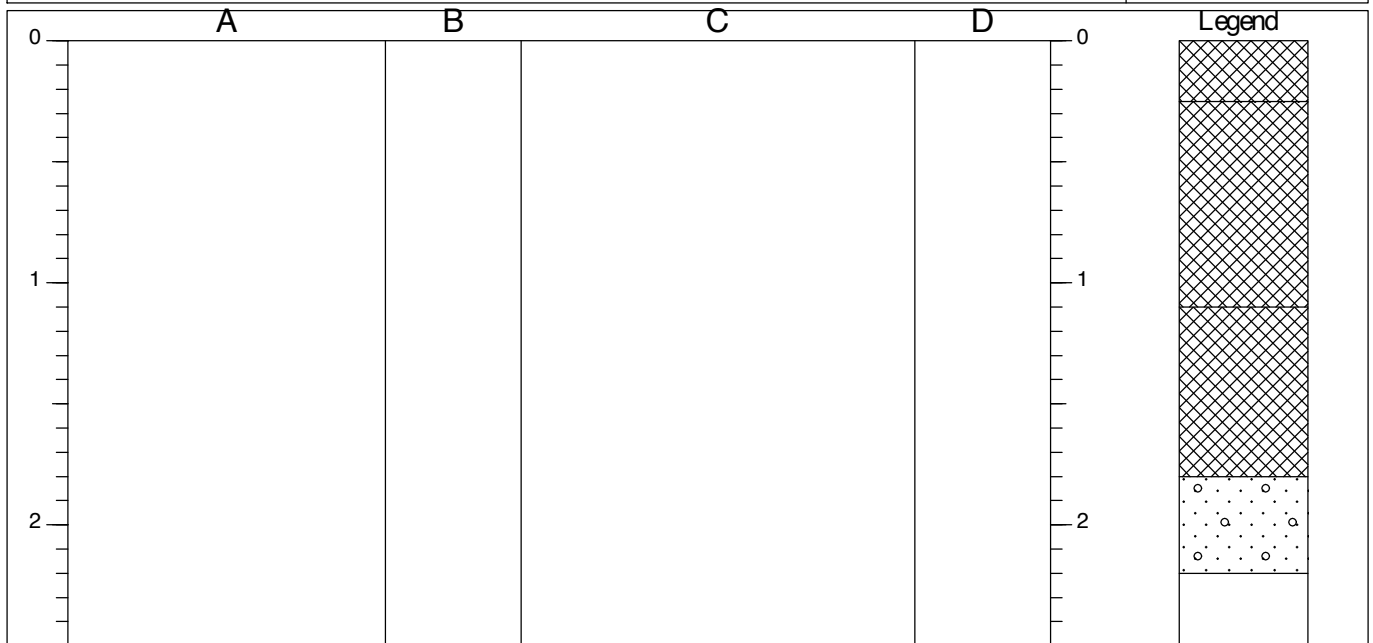
Project Lidl Wrexham				BOREHOLE No WS105	
Job No 525.03	Date 29-03-19	Ground Level (m) 85.24	Co-Ordinates () E 350,706.3 N 333,705.1		
Contractor Global				Sheet 1 of 1	

SAMPLES & TESTS			Water				STRATA		Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick- ness)	DESCRIPTION		
0.10	ES	N7		85.17		0.07	Asphalt.		
				84.89		0.35	Grey sandy gravel of limestone.		
0.40	ES				(0.50)	Loose brown locally clayey gravelly fine to coarse sand. Gravel includes angular to subrounded quartzite, coal, brick and concrete fragments.			
					84.39	0.85			
1.00					(1.45)	Medium dense orange brown silty SAND & GRAVEL. Gravel includes subangular to rounded fine to coarse quartzite and flint. (Roots observed to 1.6m).			
2.00				N7	82.94		2.30		Medium dense orange brown gravelly silty fine to coarse SAND. Gravel includes subangular to rounded fine to coarse quartzite and flint.
							(1.10)		
3.00				N32	81.84		3.40		Medium dense orange brown slightly gravelly fine to coarse SAND. Gravel includes subangular to rounded fine to coarse quartzite and sandstone.
							(1.05)		
4.00		N50/ 245 mm	80.79		4.45				

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing		Water Depth	From	To	Hours	From	To	
			Depth	Dia. mm							NVO - No Visual or Olfactory Evidence of Contamination
All dimensions in metres Scale 1:43.75			Client Lidl (UK) GmbH			Method/ Plant Used Competitor Window Sampler			Logged By KB		

TRIAL PIT LOG

Project Lidl Wrexham				TRIAL PIT No TP101
Job No 525.03	Date 29-03-19	Ground Level (m) 86.08	Co-Ordinates () E 350,747.1 N 333,719.0	
Contractor				Sheet 1 of 1

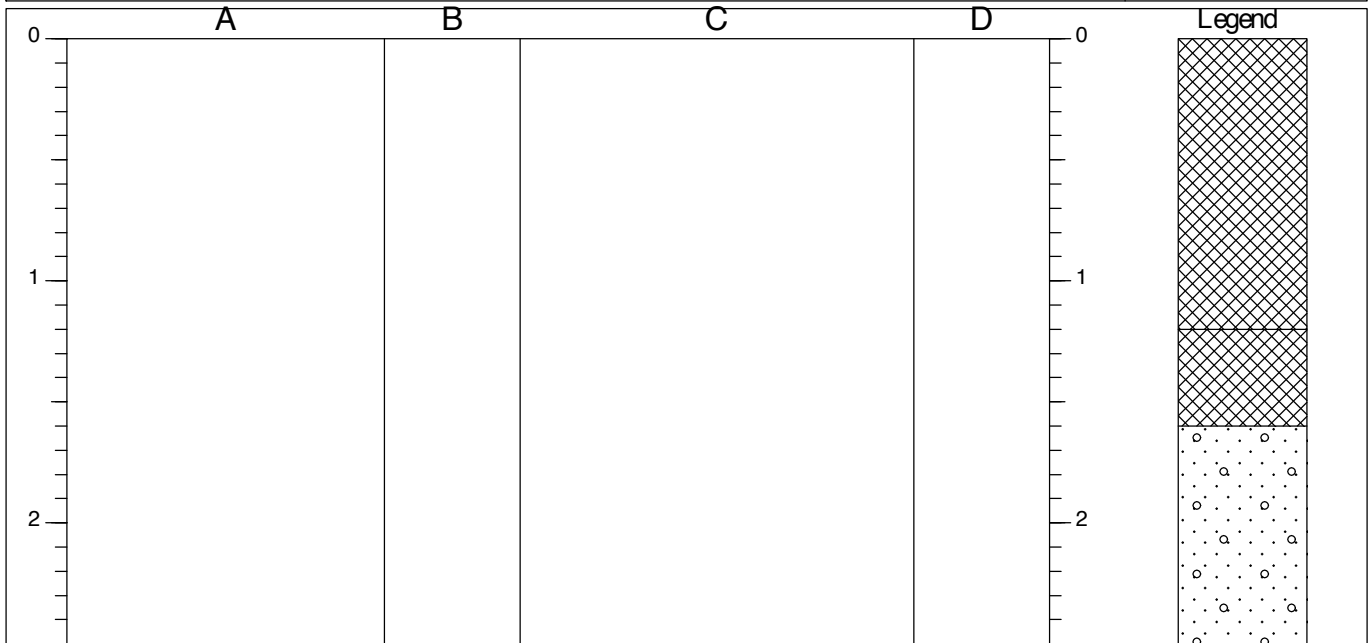


STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests
0.00-0.25		Grass over dark brown slightly gravelly silty fine to medium sand. Gravel includes subangular to rounded fine to coarse quartzite, flint and igneous material. MADE GROUND.	0.50	ES	τ(HV) = kPa
0.25-1.10		Loose brown locally slightly clayey slightly gravelly fine to medium sand. Gravel includes angular to subrounded fine to coarse quartzite, brick, plastic, pottery and concrete fragments. Occasional cobbles of concrete and sandstone.			
1.10-1.80		Loose brown locally slightly clayey sand and gravel. Gravel includes angular to subrounded fine to coarse quartzite, brick, coal and concrete fragments. MADE GROUND.	1.10	B	τ(HV) = kPa
1.80-2.20		Loose orange brown locally slightly clayey slightly gravelly fine to coarse SAND. Gravel includes subangular to rounded fine to coarse quartzite. (Possibly Reworked Natural).			

Shoring/Support: Stability:		GENERAL REMARKS NVO - No Visual or Olfactory Evidence of Contamination. iPhone coordinates approximate only. Roots observed to a depth of 1.6m. Hard digging from 1.9m and minor collapse of fill material - mini digger struggled and could not dig beyond 2.2m.	
All dimensions in metres Scale 1:31.25	Client Lidl (UK) GmbH		Method/ Plant Used 2 Tonne Mini digger

TRIAL PIT LOG

Project Lidl Wrexham				TRIAL PIT No TP102
Job No 525.03	Date 29-03-19	Ground Level (m) 85.65	Co-Ordinates () E 350,736.1 N 333,750.4	
Contractor				Sheet 1 of 1



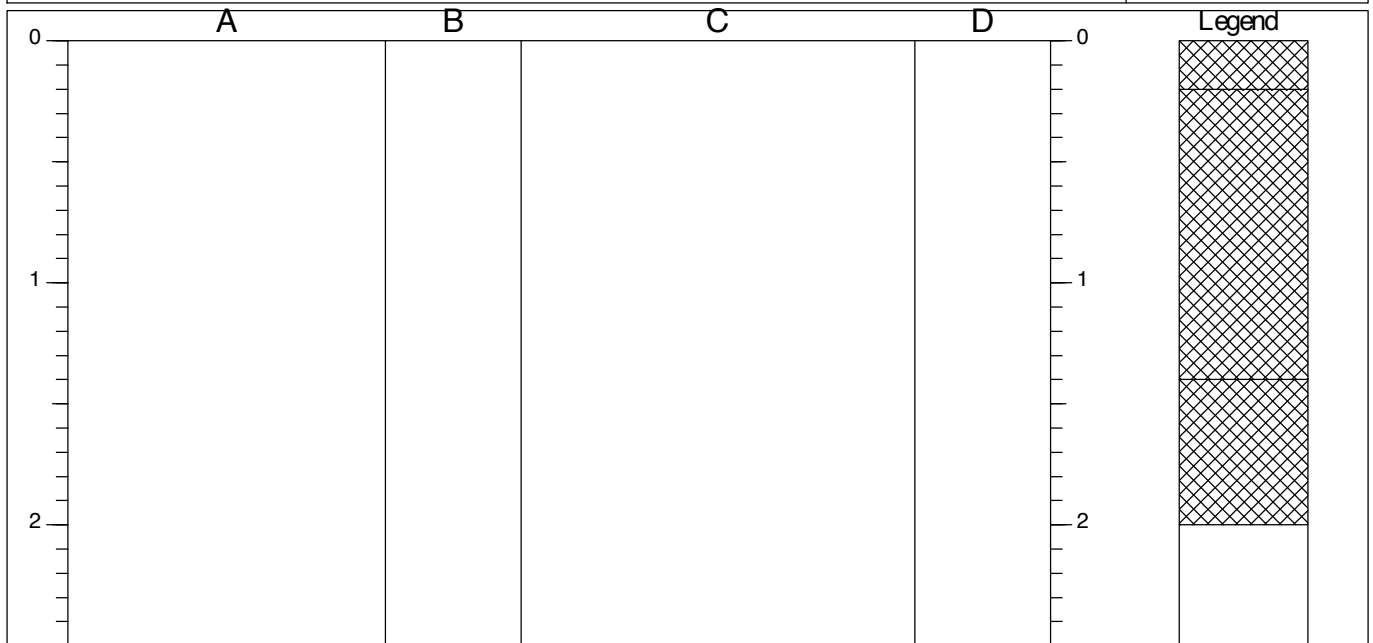
STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests
0.00-1.20		Grass over dark brown locally grey slightly gravelly silty fine to coarse sand. Gravel includes angular to subrounded fine to coarse quartzite, brick and concrete fragments. MADE GROUND. @ 9.6 becomes gravelly and includes rare pieces of rebar.	0.60	ES	τ (HV) = kPa
1.20-1.60		Loose orange brown locally dark brown slightly gravelly silty fine to coarse sand. Gravel includes angular to subrounded fine to coarse quartzite, brick and concrete fragments.	1.20	B	τ (HV) = kPa
1.60-2.50		Loose orange brown locally dark brown slightly gravelly silty fine to coarse SAND. Gravel includes subangular to rounded fine to coarse quartzite. (Possible Reworked Natural).			

Shoring/Support: Stability: 	GENERAL REMARKS NVO - No Visual or Olfactory Evidence of Contamination. iPhone coordinates approximate only. No collapse of side of trial pit during excavation. Hard digging from 1.9m - mini digger struggled and could not dig beyond 2.5m.
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All dimensions in metres Scale 1:31.25	Client Lidl (UK) GmbH	Method/ Plant Used 2 Tonne Mini Digger	Logged By KB
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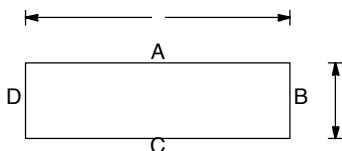
TRIAL PIT LOG

Project Lidl Wrexham				TRIAL PIT No TP103
Job No 525.03	Date 29-03-19	Ground Level (m) 85.90	Co-Ordinates () E 350,690.3 N 333,786.3	
Contractor				Sheet 1 of 1



STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests
0.00-0.20		Grass over dark grey slightly gravelly fine to coarse sand. Gravel includes angular to subrounded fine to coarse quartzite and flint.			
0.20-1.40		Loose dark brown locally dark grey sand and gravel. Gravel includes angular to subrounded fine to coarse quartzite, flint, tarmac, fabric and concrete fragments. Occasional cobble and boulder size concrete and tarmac. MADE GROUND. Roots observed to 1.4m.	1.10	B	$\sigma(HV) = \text{kPa}$
1.40-2.00		Loose dark brown locally dark grey sandy gravel. Gravel includes angular to subrounded fine to coarse quartzite, flint, brick, roadstone and concrete fragments. MADE GROUND.			

Shoring/Support:
Stability:



GENERAL REMARKS

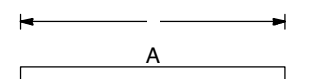
NVO - No Visual or Olfactory Evidence of Contamination. iPhone coordinates approximate only. No collapse of side of trial pit during excavation. Pit positioned away from all CAT signals. Roots observed to a depth of 1.4m. Continuous significant

All dimensions in metres Scale 1:31.25	Client Lidl (UK) GmbH	Method/ Plant Used 2 Tonne Mini Digger	collapse of gravel in sidewalls below 1.4m and mini digger could not dig below 2.0m.
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TRIAL PIT LOG

Project Lidl Wrexham				TRIAL PIT No TP104
Job No 525.03	Date 29-03-19	Ground Level (m) 85.34	Co-Ordinates () E 350,704.6 N 333,754.8	
Contractor				
				Sheet 1 of 1

STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests
0.00-0.70		Grass over dark brown slightly gravelly silty fine to coarse sand. Gravel includes angular to subrounded fine to coarse quartzite, flint, brick and wood. MADE GROUND.	0.40	ES	τ (HV) = kPa
0.70-1.50		Loose orange brown silty sand and gravel. Gravel includes subangular to subrounded fine to coarse quartzite, flint and wood. MADE GROUND. Brick only to 1.0m.	0.70	B	τ (HV) = kPa

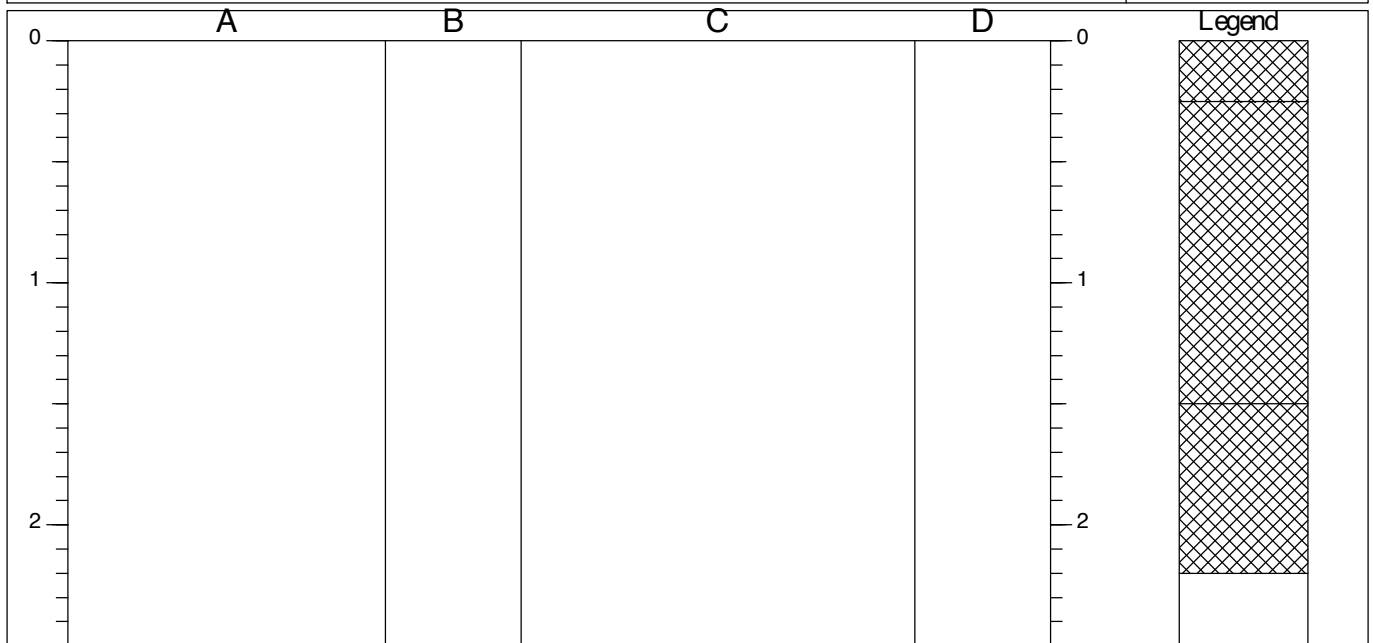
Shoring/Support: Stability: 	GENERAL REMARKS
	NVO - No Visual or Olfactory Evidence of Contamination. iPhone coordinates approximate only. No collapse of side of trial pit during excavation. Pit positioned in only location away from all CAT signals. Concrete encountered at 0.45m bgl at

All dimensions in metres Scale 1:31.25	Client Lidl (UK) GmbH	Method/ Plant Used 2 Tonne Mini Digger	crossed by the trial pit, which was extended towards tower and large tree stump. Tree stump and concrete prevented deepening below 1.5m.
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Report ID: AGS4 UK TP || Project: 525.03 WREXHAM TRIAL PITS.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 03 April 2019

TRIAL PIT LOG

Project Lidl Wrexham				TRIAL PIT No TP105
Job No 525.03	Date 29-03-19	Ground Level (m) 86.25	Co-Ordinates () E 350,709.8 N 333,696.5	
Contractor				Sheet 1 of 1



STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests
0.00-0.25		Grass over dark brown gravelly silty fine to coarse sand. Gravel includes angular to subrounded fine to coarse quartzite, ash, plastic, brick and limestone. MADE GROUND.			
0.25-1.50		@ 0.7 becomes gravelly sand. Loose dark brown locally dark grey silty sand and gravel. Gravel includes angular to subrounded fine to coarse quartzite, ash, plastic, brick and concrete fragments. MADE GROUND. @ 0.7 becomes gravelly sand.	0.30	ES	τ(HV) = kPa
			1.30	B	τ(HV) = kPa
1.50-2.20		Loose dark brown locally dark grey silty sand and gravel. Gravel includes angular to subrounded fine to coarse quartzite, roadstone, brick, breeze block and concrete fragments. MADE GROUND.			

Shoring/Support: Stability:		GENERAL REMARKS NVO - No Visual or Olfactory Evidence of Contamination. iPhone coordinates approximate only. No collapse of side of trial pit during excavation. Hard digging from 1.5m and mini digger could not dig beyond 2.0m.
All dimensions in metres Scale 1:31.25	Client Lidl (UK) GmbH	Method/ Plant Used 2 Tonne Mini Digger
		Logged By KB



APPENDIX A

Laboratory Chemical Analysis



Final Report

Report No.:	19-11399-1		
Initial Date of Issue:	10-Apr-2019		
Client	Remada Ltd		
Client Address:	Forward House 17 High Street Henley in Arden B95 5AA		
Contact(s):	Greg Jones		
Project	525.03 Wrexham Lidl		
Quotation No.:		Date Received:	02-Apr-2019
Order No.:		Date Instructed:	02-Apr-2019
No. of Samples:	11		
Turnaround (Wkdays):	7	Results Due:	10-Apr-2019
Date Approved:	10-Apr-2019		
Approved By:			
Details:	Robert Monk, Technical Manager		

Project: 525.03 Wrexham Lidl

Client: Remada Ltd	Chemtest Job No.:				19-11399	19-11399
Quotation No.:	Chemtest Sample ID.:				803972	803973
	Client Sample ID.:				WS102	WS103
	Sample Type:				MISCSOLID	MISCSOLID
	Top Depth (m):				0.05	0.06
	Date Sampled:				29-Mar-2019	29-Mar-2019
Determinand	Accred.	SOP	Units	LOD		
Chromatogram (TPH)	N			N/A	See Attached	See Attached
Fuel Type	N	2670		N/A	H.Oil	H.Oil
TPH >C6-C10	N	2670	mg/kg	1.0	< 1.0	< 1.0
TPH >C10-C21	N	2670	mg/kg	1.0	83	24
TPH >C21-C40	N	2670	mg/kg	1.0	4900	1500
Total TPH >C6-C40	N	2670	mg/kg	10.0	5000	1500
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	8.8	53
Coal Tar Quantification (%)	N		%	0.001	0.50	0.15
Coal Tar Quantification	N		mg/kg	10.0	5000	1500
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	5000	1500
Total Petroleum Hydrocarbons	N	2680	mg/kg	10	5000	1500
Naphthalene	N	2700	mg/kg	0.10	< 0.10	< 0.10
Acenaphthylene	N	2700	mg/kg	0.10	< 0.10	< 0.10
Acenaphthene	N	2700	mg/kg	0.10	< 0.10	< 0.10
Fluorene	N	2700	mg/kg	0.10	< 0.10	< 0.10
Phenanthrene	N	2700	mg/kg	0.10	< 0.10	< 0.10
Anthracene	N	2700	mg/kg	0.10	< 0.10	< 0.10
Fluoranthene	N	2700	mg/kg	0.10	< 0.10	< 0.10
Pyrene	N	2700	mg/kg	0.10	< 0.10	< 0.10
Benzo[a]anthracene	N	2700	mg/kg	0.10	< 0.10	< 0.10
Chrysene	N	2700	mg/kg	0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	N	2700	mg/kg	0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	N	2700	mg/kg	0.10	< 0.10	< 0.10
Benzo[a]pyrene	N	2700	mg/kg	0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	N	2700	mg/kg	0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	N	2700	mg/kg	0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	N	2700	mg/kg	0.10	< 0.10	< 0.10
Coronene	N	2700	mg/kg	0.10	< 0.10	< 0.10
Total Of 17 PAH's	N	2700	mg/kg	2.0	< 2.0	< 2.0
Double Ratio Fluoranthene:Pyrene	M	2700		0.010	< 0.010	< 0.010
Double Ratio Benzo(a)Anthracene:Chrysene	M	2700		0.010	< 0.010	< 0.010
N-Nitrosodimethylamine	N	2790	mg/kg	0.50	< 0.50	< 0.50
Phenol	N	2790	mg/kg	0.50	< 0.50	< 0.50
2-Chlorophenol	N	2790	mg/kg	0.50	< 0.50	< 0.50
1,3-Dichlorobenzene	N	2790	mg/kg	0.50	< 0.50	< 0.50
1,4-Dichlorobenzene	N	2790	mg/kg	0.50	< 0.50	< 0.50
1,2-Dichlorobenzene	N	2790	mg/kg	0.50	< 0.50	< 0.50
2-Methylphenol	N	2790	mg/kg	0.50	< 0.50	< 0.50
Bis(2-Chloroisopropyl)Ether	N	2790	mg/kg	0.50	< 0.50	< 0.50

Project: 525.03 Wrexham Lidl

Client: Remada Ltd	Chemtest Job No.:				19-11399	19-11399
Quotation No.:	Chemtest Sample ID.:				803972	803973
	Client Sample ID.:				WS102	WS103
	Sample Type:				MISCSOLID	MISCSOLID
	Top Depth (m):				0.05	0.06
	Date Sampled:				29-Mar-2019	29-Mar-2019
Determinand	Accred.	SOP	Units	LOD		
Hexachloroethane	N	2790	mg/kg	0.50	< 0.50	< 0.50
N-Nitrosodi-n-propylamine	N	2790	mg/kg	0.50	< 0.50	< 0.50
4-Methylphenol	N	2790	mg/kg	0.50	< 0.50	< 0.50
Nitrobenzene	N	2790	mg/kg	0.50	< 0.50	< 0.50
Isophorone	N	2790	mg/kg	0.50	< 0.50	< 0.50
2-Nitrophenol	N	2790	mg/kg	0.50	< 0.50	< 0.50
2,4-Dimethylphenol	N	2790	mg/kg	0.50	< 0.50	< 0.50
Bis(2-Chloroethoxy)Methane	N	2790	mg/kg	0.50	< 0.50	< 0.50
2,4-Dichlorophenol	N	2790	mg/kg	0.50	< 0.50	< 0.50
1,2,4-Trichlorobenzene	N	2790	mg/kg	0.50	< 0.50	< 0.50
Naphthalene	N	2790	mg/kg	0.50	< 0.50	< 0.50
4-Chloroaniline	N	2790	mg/kg	0.50	< 0.50	< 0.50
Hexachlorobutadiene	N	2790	mg/kg	0.50	< 0.50	< 0.50
4-Chloro-3-Methylphenol	N	2790	mg/kg	0.50	< 0.50	< 0.50
2-Methylnaphthalene	N	2790	mg/kg	0.50	< 0.50	< 0.50
4-Nitrophenol	N	2790	mg/kg	0.50	< 0.50	< 0.50
Hexachlorocyclopentadiene	N	2790	mg/kg	0.50	< 0.50	< 0.50
2,4,6-Trichlorophenol	N	2790	mg/kg	0.50	< 0.50	< 0.50
2,4,5-Trichlorophenol	N	2790	mg/kg	0.50	< 0.50	< 0.50
2-Chloronaphthalene	N	2790	mg/kg	0.50	< 0.50	< 0.50
2-Nitroaniline	N	2790	mg/kg	0.50	< 0.50	< 0.50
Acenaphthylene	N	2790	mg/kg	0.50	< 0.50	< 0.50
Dimethylphthalate	N	2790	mg/kg	0.50	< 0.50	< 0.50
2,6-Dinitrotoluene	N	2790	mg/kg	0.50	< 0.50	< 0.50
Acenaphthene	N	2790	mg/kg	0.50	< 0.50	< 0.50
3-Nitroaniline	N	2790	mg/kg	0.50	< 0.50	< 0.50
Dibenzofuran	N	2790	mg/kg	0.50	< 0.50	< 0.50
2,4-Dinitrotoluene	N	2790	mg/kg	0.50	< 0.50	< 0.50
Fluorene	N	2790	mg/kg	0.50	< 0.50	< 0.50
Diethyl Phthalate	N	2790	mg/kg	0.50	< 0.50	< 0.50
4-Nitroaniline	N	2790	mg/kg	0.50	< 0.50	< 0.50
2-Methyl-4,6-Dinitrophenol	N	2790	mg/kg	0.50	< 0.50	< 0.50
Azobenzene	N	2790	mg/kg	0.50	< 0.50	< 0.50
4-Bromophenylphenyl Ether	N	2790	mg/kg	0.50	< 0.50	< 0.50
Hexachlorobenzene	N	2790	mg/kg	0.50	< 0.50	< 0.50
Pentachlorophenol	N	2790	mg/kg	0.50	< 0.50	< 0.50
Phenanthrene	N	2790	mg/kg	0.50	< 0.50	< 0.50
Anthracene	N	2790	mg/kg	0.50	< 0.50	< 0.50
Carbazole	N	2790	mg/kg	0.50	< 0.50	< 0.50
Di-N-Butyl Phthalate	N	2790	mg/kg	0.50	< 0.50	< 0.50

Project: 525.03 Wrexham Lidl

Client: Remada Ltd	Chemtest Job No.:				19-11399	19-11399
Quotation No.:	Chemtest Sample ID.:				803972	803973
	Client Sample ID.:				WS102	WS103
	Sample Type:				MISCSOLID	MISCSOLID
	Top Depth (m):				0.05	0.06
	Date Sampled:				29-Mar-2019	29-Mar-2019
Determinand	Accred.	SOP	Units	LOD		
Fluoranthene	N	2790	mg/kg	0.50	< 0.50	< 0.50
Pyrene	N	2790	mg/kg	0.50	< 0.50	< 0.50
Butylbenzyl Phthalate	N	2790	mg/kg	0.50	< 0.50	< 0.50
Benzo[a]anthracene	N	2790	mg/kg	0.50	< 0.50	< 0.50
Chrysene	N	2790	mg/kg	0.50	< 0.50	< 0.50
Bis(2-Ethylhexyl)Phthalate	N	2790	mg/kg	0.50	< 0.50	< 0.50
Di-N-Octyl Phthalate	N	2790	mg/kg	0.50	< 0.50	< 0.50
Benzo[b]fluoranthene	N	2790	mg/kg	0.50	< 0.50	< 0.50
Benzo[k]fluoranthene	N	2790	mg/kg	0.50	< 0.50	< 0.50
Benzo[a]pyrene	N	2790	mg/kg	0.50	< 0.50	< 0.50
Indeno(1,2,3-c,d)Pyrene	N	2790	mg/kg	0.50	< 0.50	< 0.50
Dibenz(a,h)Anthracene	N	2790	mg/kg	0.50	< 0.50	< 0.50
Benzo[g,h,i]perylene	N	2790	mg/kg	0.50	< 0.50	< 0.50
Moisture	N		%	0.10	< 0.10	< 0.10
Interpretive Report	N			N/A	See Below	See Below
SVOC TIC	N	2790	mg/kg	N/A	None Detected	None Detected

Sample 803972 does not contain coal tar contamination.

Dibenzothiophene, a biomarker present in coal tar, has not been detected by SVOC analysis. This, in conjunction with no PAH contamination, confirms no coal tar is present.

Sample 803973 does not contain coal tar contamination.

Dibenzothiophene, a biomarker present in coal tar, has not been detected by SVOC analysis. This, in conjunction with no PAH contamination, confirms no coal tar is present.

Project: 525.03 Wrexham Lidl

Client: Remada Ltd	Chemtest Job No.:				19-11399	19-11399	19-11399	19-11399	19-11399	19-11399
Quotation No.:	Chemtest Sample ID.:				803977	803978	803979	803980	803981	803982
	Client Sample ID.:				WS101	WS102	WS101	WS102	WS105	WS103
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.10	0.05	0.60	0.30	0.10	0.10
	Bottom Depth (m):				0.20	0.15	0.80	0.60	0.35	0.30
	Date Sampled:				29-Mar-2019	29-Mar-2019	29-Mar-2019	29-Mar-2019	29-Mar-2019	29-Mar-2019
Determinand	Accred.	SOP	Units	LOD						
Moisture	N	2030	%	0.020	3.4	2.7	7.0	6.7	6.9	4.4
Soil Colour	N	2040		N/A	Brown	Brown	Brown	Brown	Brown	Brown
Other Material	N	2040		N/A	None	Stones	None	Stones	None	Stones
Soil Texture	N	2040		N/A	Clay	Loam	Clay	Sand	Clay	Sand
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	11	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	16	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	16	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	4.9	15	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	48	15	< 5.0	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	6.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	43	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	2400	23	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	420	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	2800	23	< 5.0	< 5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	2900	38	< 10	< 10	< 10	< 10
Naphthalene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.48	< 0.10
Pyrene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.72	< 0.10
Benzo[a]anthracene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10

Results - Soil

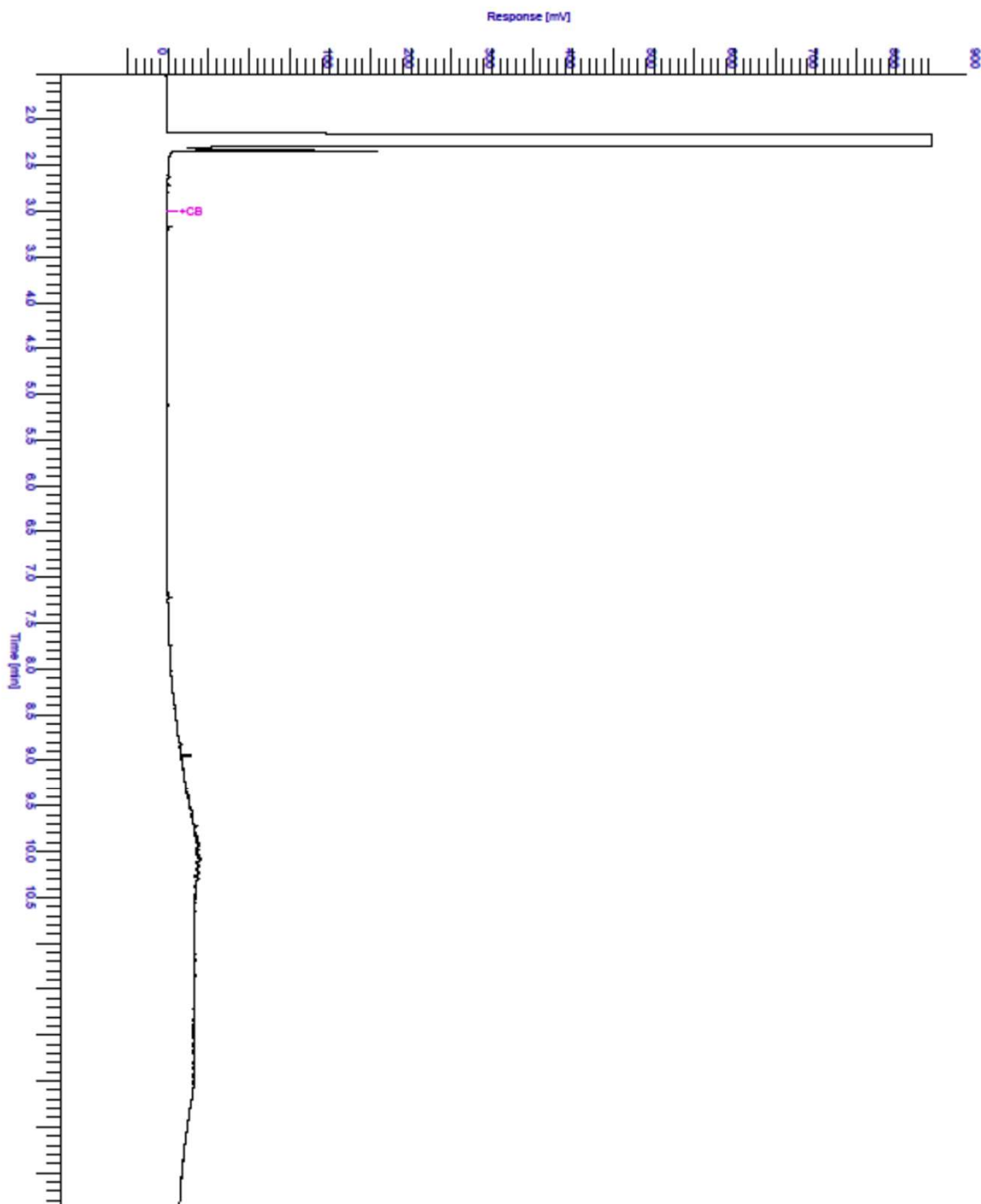
Project: 525.03 Wrexham Lidl

Client: Remada Ltd	Chemtest Job No.:				19-11399	19-11399	19-11399	19-11399	19-11399	19-11399
Quotation No.:	Chemtest Sample ID.:				803977	803978	803979	803980	803981	803982
	Client Sample ID.:				WS101	WS102	WS101	WS102	WS105	WS103
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.10	0.05	0.60	0.30	0.10	0.10
	Bottom Depth (m):				0.20	0.15	0.80	0.60	0.35	0.30
	Date Sampled:				29-Mar-2019	29-Mar-2019	29-Mar-2019	29-Mar-2019	29-Mar-2019	29-Mar-2019
Determinand	Accred.	SOP	Units	LOD						
Total Of 16 PAH's	M	2700	mg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Benzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
PCB 28	M	2815	mg/kg	0.010	< 0.010					
PCB 52	M	2815	mg/kg	0.010	< 0.010					
PCB 90+101	M	2815	mg/kg	0.010	< 0.010					
PCB 118	M	2815	mg/kg	0.010	< 0.010					
PCB 153	M	2815	mg/kg	0.010	< 0.010					
PCB 138	M	2815	mg/kg	0.010	< 0.010					
PCB 180	M	2815	mg/kg	0.010	< 0.010					
Total PCBs (7 Congeners)	N	2815	mg/kg	0.10	< 0.10					

TPH Chromatogram on Misc Sample: 803972

Chromatogram

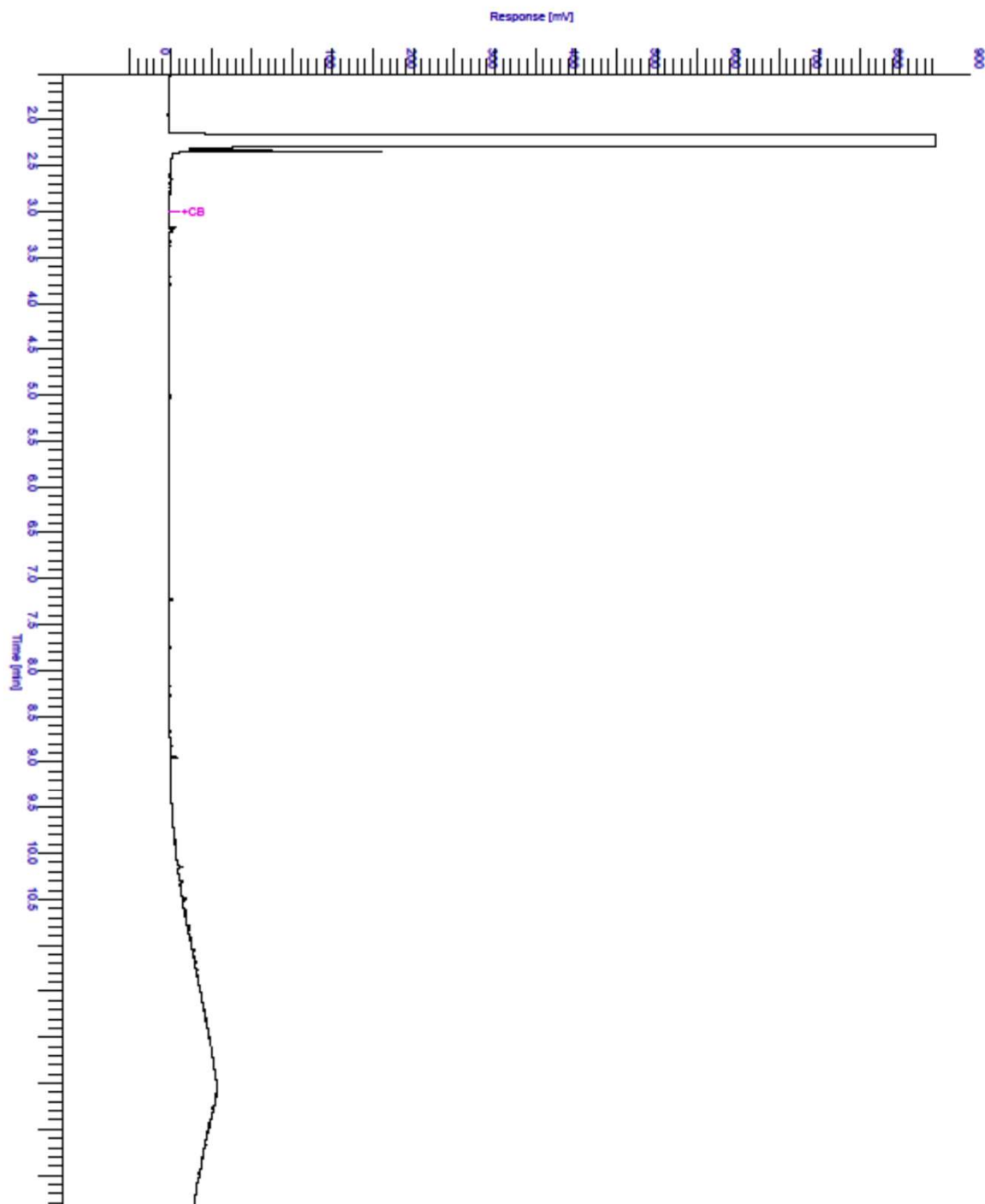
Sample Name : 803972_mxl-19-11399 Sample #: 042 Page 1 of 1
FileName : T:\2019\GC23\Apr0804_6_TPH2B\0804_6_TPH2B_A042.raw
Date : 10/04/2019 17:16:58
Method :
Start Time : 0.00 min End Time : 12.36 min Time of Injection: 09/04/2019 07:29:49
Plot Offset: -2.57 mV Plot Scale: 996.4 mV Low Point: -2.57 mV High Point: 993.88 mV



TPH Chromatogram on Misc Sample: 803973

Chromatogram

Sample Name : 803973_mxl-19-11399 Sample #: 043 Page 1 of 1
FileName : T:\2019\GC23\Apr0804_6_TPH2B\0804_6_TPH2B_A043.raw
Date : 10/04/2019 17:17:13
Method :
Start Time : 0.00 min End Time : 12.36 min Time of Injection: 09/04/2019 07:49:49
Plot Offset: -2.92 mV Plot Scale: 996.8 mV Low Point : -2.92 mV High Point : 993.88 mV



Results - 2 Stage WAC

Project: 525.03 Wrexham Lidl

Chemtest Job No: 19-11399 Chemtest Sample ID: 803974 Sample Ref: Sample ID: TP101 Sample Location: Top Depth(m): 0.50 Bottom Depth(m): 0.70 Sampling Date: 29-Mar-2019							Landfill Waste Acceptance Criteria			
							Inert Waste Landfill	Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill	
				Limits						
Determinand	SOP	Accred.	Units							
Total Organic Carbon	2625	M	%				2.0	3	5	
Loss On Ignition	2610	M	%				8.2	--	10	
Total BTEX	2760	M	mg/kg				< 0.010	6	--	
Total PCBs (7 Congeners)	2815	M	mg/kg				< 0.10	1	--	
TPH Total WAC (Mineral Oil)	2670	M	mg/kg				< 10	500	--	
Total (Of 17) PAH's	2700	N	mg/kg				< 2.0	100	--	
pH	2010	M					8.3	--	>6	
Acid Neutralisation Capacity	2015	N	mol/kg				0.0080	--	To evaluate	
Eluate Analysis								Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg		
			2:1 mg/l	8:1 mg/l	2:1 mg/kg	Cumulative mg/kg 10:1				
Arsenic	1450	U	< 0.0010	< 0.0010	< 0.050	< 0.050	0.5	2	25	
Barium	1450	U	0.012	0.011	< 0.50	< 0.50	20	100	300	
Cadmium	1450	U	< 0.00010	< 0.00010	< 0.010	< 0.010	0.04	1	5	
Chromium	1450	U	< 0.0010	< 0.0010	< 0.050	< 0.050	0.5	10	70	
Copper	1450	U	< 0.0010	< 0.0010	< 0.050	< 0.050	2	50	100	
Mercury	1450	U	< 0.00050	< 0.00050	< 0.0010	< 0.0050	0.01	0.2	2	
Molybdenum	1450	U	0.0031	0.0024	< 0.050	< 0.050	0.5	10	30	
Nickel	1450	U	< 0.0010	< 0.0010	< 0.050	< 0.050	0.4	10	40	
Lead	1450	U	0.0052	0.0059	0.010	0.058	0.5	10	50	
Antimony	1450	U	< 0.0010	< 0.0010	< 0.010	< 0.010	0.06	0.7	5	
Selenium	1450	U	0.0077	0.0067	0.015	0.068	0.1	0.5	7	
Zinc	1450	U	< 0.0010	< 0.0010	< 0.50	< 0.50	4	50	200	
Chloride	1220	U	48	2.3	95	76	800	15000	25000	
Fluoride	1220	U	0.64	0.59	1.3	5.9	10	150	500	
Sulphate	1220	U	7.1	2.3	14	29	1000	20000	50000	
Total Dissolved Solids	1020	N	160	120	320	1300	4000	60000	100000	
Phenol Index	1920	U	< 0.030	< 0.030	< 0.30	< 0.50	1	-	-	
Dissolved Organic Carbon	1610	U	18	12	< 50	130	500	800	1000	

Solid Information	
Dry mass of test portion/kg	0.175
Moisture (%)	12

Leachate Test Information	
Leachant volume 1st extract/l	0.326
Leachant volume 2nd extract/l	1.400
Eluant recovered from 1st extract/l	0.204

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - 2 Stage WAC

Project: 525.03 Wrexham Lidl

Chemtest Job No: 19-11399							Landfill Waste Acceptance Criteria			
Chemtest Sample ID: 803975							Limits			
Sample Ref:							Inert Waste Landfill	Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill	
Sample ID: TP102										
Sample Location:										
Top Depth(m): 0.60										
Bottom Depth(m): 0.80										
Sampling Date: 29-Mar-2019										
Determinand	SOP	Accred.	Units							
Total Organic Carbon	2625	M	%				3.6	3	5	6
Loss On Ignition	2610	M	%				7.4	--	--	10
Total BTEX	2760	M	mg/kg				< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg				< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	M	mg/kg				< 10	500	--	--
Total (Of 17) PAH's	2700	N	mg/kg				< 2.0	100	--	--
pH	2010	M					8.4	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg				0.0090	--	To evaluate	To evaluate
Eluate Analysis			2:1 mg/l	8:1 mg/l	2:1 mg/kg	Cumulative mg/kg 10:1	Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg			
Arsenic	1450	U	< 0.0010	0.0013	< 0.050	< 0.050	0.5	2	25	
Barium	1450	U	0.0086	0.013	< 0.50	< 0.50	20	100	300	
Cadmium	1450	U	< 0.00010	< 0.00010	< 0.010	< 0.010	0.04	1	5	
Chromium	1450	U	< 0.0010	< 0.0010	< 0.050	< 0.050	0.5	10	70	
Copper	1450	U	< 0.0010	< 0.0010	< 0.050	< 0.050	2	50	100	
Mercury	1450	U	< 0.00050	< 0.00050	< 0.0010	< 0.0050	0.01	0.2	2	
Molybdenum	1450	U	0.0034	0.0029	< 0.050	< 0.050	0.5	10	30	
Nickel	1450	U	< 0.0010	< 0.0010	< 0.050	< 0.050	0.4	10	40	
Lead	1450	U	0.0067	0.010	0.013	0.095	0.5	10	50	
Antimony	1450	U	0.0010	0.0010	< 0.010	< 0.010	0.06	0.7	5	
Selenium	1450	U	0.0074	0.0071	0.015	0.071	0.1	0.5	7	
Zinc	1450	U	< 0.0010	< 0.0010	< 0.50	< 0.50	4	50	200	
Chloride	1220	U	27	6.5	53	93	800	15000	25000	
Fluoride	1220	U	1.5	0.93	3.0	10	10	150	500	
Sulphate	1220	U	8.0	3.1	16	38	1000	20000	50000	
Total Dissolved Solids	1020	N	130	110	260	1100	4000	60000	100000	
Phenol Index	1920	U	< 0.030	< 0.030	< 0.30	< 0.50	1	-	-	
Dissolved Organic Carbon	1610	U	12	13	< 50	130	500	800	1000	

Solid Information	
Dry mass of test portion/kg	0.175
Moisture (%)	13

Leachate Test Information	
Leachant volume 1st extract/l	0.324
Leachant volume 2nd extract/l	1.400
Eluant recovered from 1st extract/l	0.239

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - 2 Stage WAC

Project: 525.03 Wrexham Lidl

Chemtest Job No: 19-11399 Chemtest Sample ID: 803976 Sample Ref: Sample ID: TP105 Sample Location: Top Depth(m): 0.30 Bottom Depth(m): 0.50 Sampling Date: 29-Mar-2019							Landfill Waste Acceptance Criteria Limits		
							Inert Waste Landfill	Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill
Determinand	SOP	Accred.	Units						
Total Organic Carbon	2625	M	%				1.8	3	5
Loss On Ignition	2610	M	%				3.8	--	10
Total BTEX	2760	M	mg/kg				< 0.010	6	--
Total PCBs (7 Congeners)	2815	M	mg/kg				< 0.10	1	--
TPH Total WAC (Mineral Oil)	2670	M	mg/kg				< 10	500	--
Total (Of 17) PAH's	2700	N	mg/kg				< 2.0	100	--
pH	2010	M					9.4	--	>6
Acid Neutralisation Capacity	2015	N	mol/kg				0.10	--	To evaluate
Eluate Analysis			2:1 mg/l	8:1 mg/l	2:1 mg/kg	Cumulative mg/kg 10:1	Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg		
Arsenic	1450	U	< 0.0010	< 0.0010	< 0.050	< 0.050	0.5	2	25
Barium	1450	U	0.020	0.034	< 0.50	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.00010	< 0.010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.0010	< 0.050	< 0.050	0.5	10	70
Copper	1450	U	< 0.0010	< 0.0010	< 0.050	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.00050	< 0.0010	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0036	0.0020	< 0.050	< 0.050	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.0010	< 0.050	< 0.050	0.4	10	40
Lead	1450	U	0.0033	< 0.0010	< 0.010	< 0.010	0.5	10	50
Antimony	1450	U	0.0038	0.0029	< 0.010	0.030	0.06	0.7	5
Selenium	1450	U	0.0071	0.0062	0.014	0.063	0.1	0.5	7
Zinc	1450	U	< 0.0010	< 0.0010	< 0.50	< 0.50	4	50	200
Chloride	1220	U	18	2.8	36	53	800	15000	25000
Fluoride	1220	U	0.74	0.65	1.5	6.6	10	150	500
Sulphate	1220	U	26	8.8	52	120	1000	20000	50000
Total Dissolved Solids	1020	N	140	85	270	930	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.030	< 0.30	< 0.50	1	-	-
Dissolved Organic Carbon	1610	U	13	10	< 50	110	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.175
Moisture (%)	7.1

Leachate Test Information	
Leachant volume 1st extract/l	0.337
Leachant volume 2nd extract/l	1.400
Eluant recovered from 1st extract/l	0.289

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

SOP	Title	Parameters included	Method summary
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1450	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2015	Acid Neutralisation Capacity	Acid Reserve	Titration
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8, >C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35–C44 Aromatics: >C5–C7, >C7–C8, >C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35–C44	Dichloromethane extraction / GCxGC FID detection
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenzo[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2790	Semi-Volatile Organic Compounds (SVOCs) in Soils by GC-MS	Semi-volatile organic compounds(cf. USEPA Method 8270)	Acetone/Hexane extraction / GC-MS
2815	Polychlorinated Biphenyls (PCB) ICES7 Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
640	Characterisation of Waste (Leaching)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key

- U UKAS accredited
- M MCERTS and UKAS accredited
- N Unaccredited
- S This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
- SN This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
- T This analysis has been subcontracted to an unaccredited laboratory
- I/S Insufficient Sample
- U/S Unsuitable Sample
- N/E not evaluated
- < "less than"
- > "greater than"

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.com



APPENDIX B

Geotechnical Test Results



Contract Number: 43726

Client Ref: **525.03**

Report Date: **19-04-2019**

Client PO:

Client **Remada Limited**

**Forward house, 17 high street, Henley in Arden
B95 5AA**

Contract Title: **Wrexham**
For the attention of: **Greg Jones**

Date Received: **04-04-2019**
Date Commenced: **04-04-2019**
Date Completed: **19-04-2019**

Test Description	Qty
PSD Wet Sieve method BS 1377:1990 - Part 2 : 9.2 - * UKAS	5
Water Soluble Sulphate 2:1 extract BS 1377:1990 - Part 3 : 5.3 - @ Non Accredited Test	5
pH value of soil BS 1377:1990 - Part 3 : 9.5 - @ Non Accredited Test	5
Dry Den/MC (4.5kg Rammer Method 1 Litre Mould) BS 1377:1990 - Part 4 : 3.5 - * UKAS	5
Immediate Shear Strength - set of 3 60 x 60 mm Shear Box Specimens by Direct Shearing (note suitable for free draining material only) BS 1377:1990 - Part 7 : 4 - * UKAS	3
Disposal of samples for job	1

Notes: Observations and Interpretations are outside the UKAS Accreditation

* - denotes test included in laboratory scope of accreditation

- denotes test carried out by approved contractor

@ - denotes non accredited tests

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

Approved Signatories:

Ben Sharp (Contracts Manager) - Emma Sharp (Office Manager) - Paul Evans (Quality/Technical Manager)

Richard John (Advanced Testing Manager) - Sean Penn (Administrative/Accounts Assistant) - Wayne Honey (Administrative/Quality Assistant)



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

Contract Number

43726

Borehole/Pit No.

TP101

Site Name

Wrexham

Sample No.

Soil Description

Brown slightly silty fine to coarse gravelly fine to coarse SAND.

Depth Top

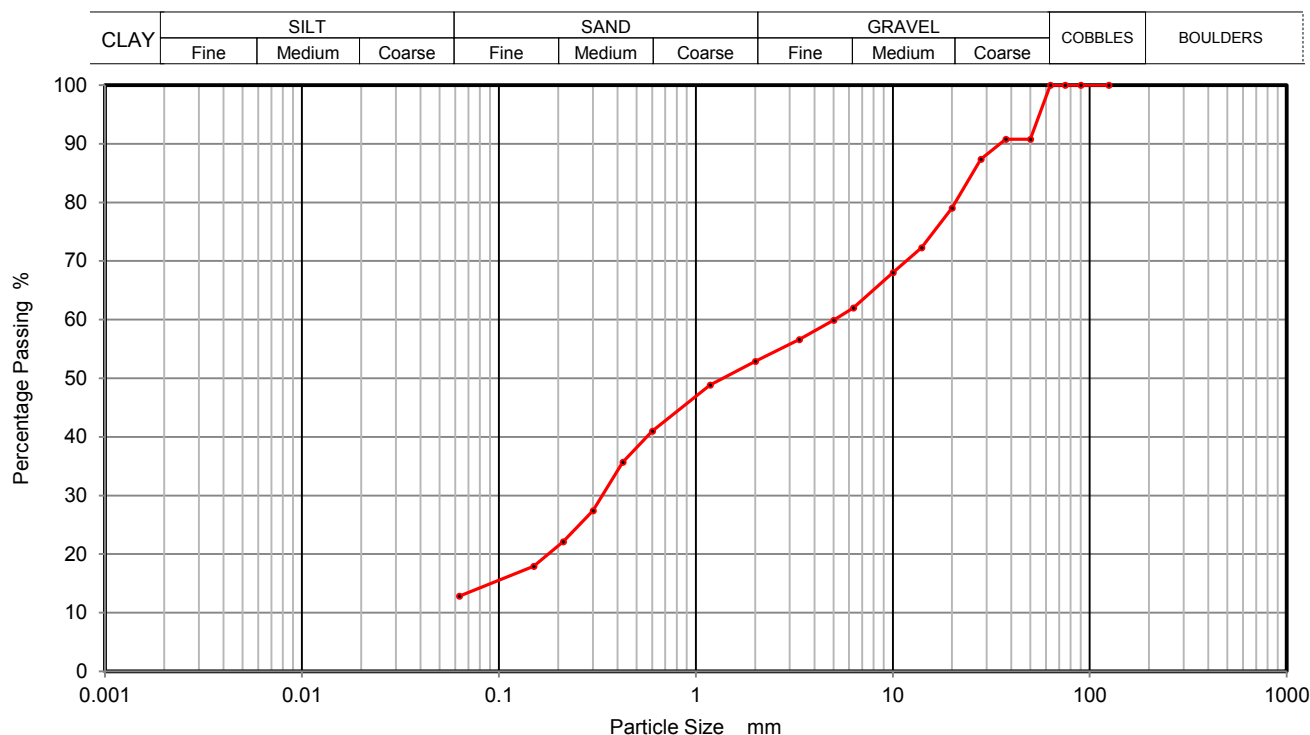
1.20

Depth Base

1.40

Sample Type

B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	91		
37.5	91		
28	87		
20	79		
14	72		
10	68		
6.3	62		
5	60		
3.35	57		
2	53		
1.18	49		
0.6	41		
0.425	36		
0.3	27		
0.212	22		
0.15	18		
0.063	13		

Sample Proportions	% dry mass
Cobbles	0
Gravel	47
Sand	40
Silt and Clay	13

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	17/04/2019	Ben Sharp	
RO/MH	Approved	18/04/2019	Paul Evans	



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

Contract Number **43726**

Borehole/Pit No. **TP102**

Site Name **Wrexham**

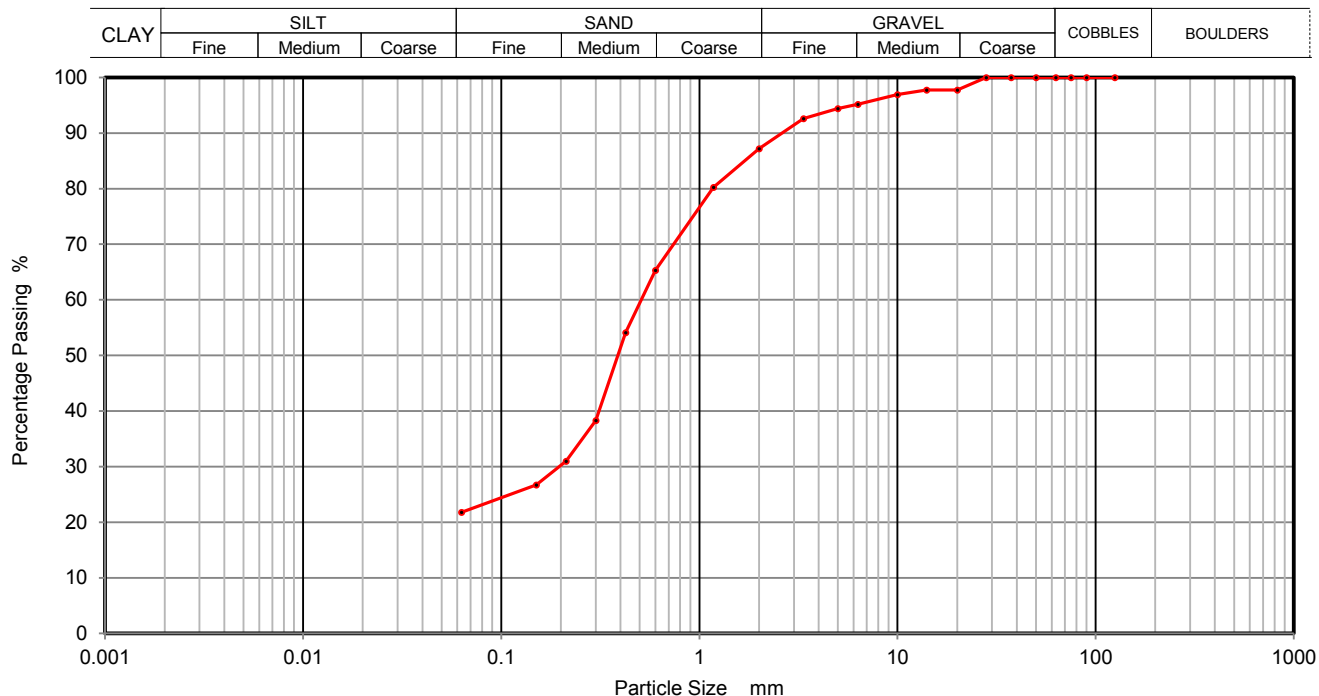
Sample No.

Soil Description
Brown fine to coarse gravelly silty/clayey fine to coarse SAND

Depth Top **1.20**

Depth Base **1.40**

Sample Type **B**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	98		
14	98		
10	97		
6.3	95		
5	94		
3.35	93		
2	87		
1.18	80		
0.6	65		
0.425	54		
0.3	38		
0.212	31		
0.15	27		
0.063	22		

Sample Proportions	% dry mass
Cobbles	0
Gravel	13
Sand	65
Silt and Clay	22

Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	18/04/2019	Ben Sharp	
RO/MH	Approved	19/04/2019	Paul Evans	



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

Contract Number

43726

Borehole/Pit No.

TP103

Site Name

Wrexham

Sample No.

Soil Description

Brown slightly silty fine to coarse sandy fine to coarse GRAVEL.
Contains some cobbles

Depth Top

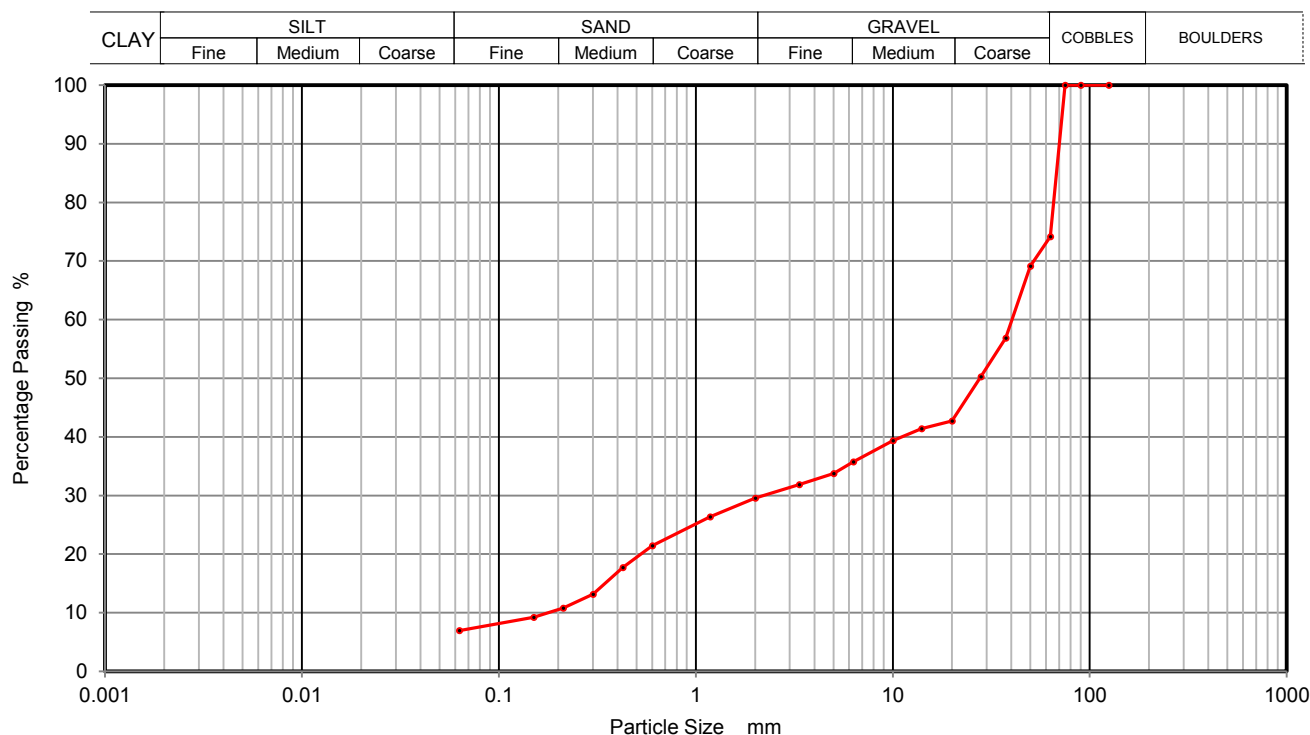
1.10

Depth Base

1.30

Sample Type

B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	74		
50	69		
37.5	57		
28	50		
20	43		
14	41		
10	39		
6.3	36		
5	34		
3.35	32		
2	30		
1.18	26		
0.6	21		
0.425	18		
0.3	13		
0.212	11		
0.15	9		
0.063	7		

Sample Proportions	% dry mass
Cobbles	26
Gravel	44
Sand	23
Silt and Clay	7

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	17/04/2019	Ben Sharp	
RO/MH	Approved	18/04/2019	Paul Evans	



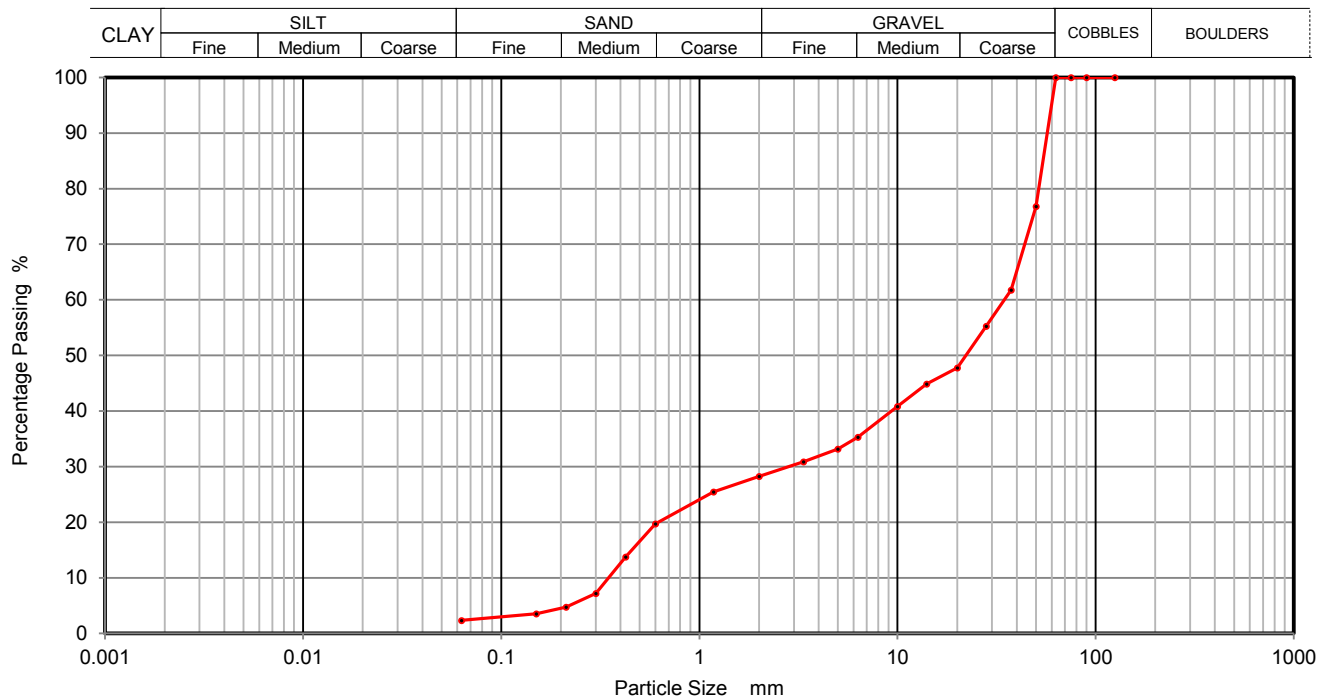


PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number **43726**

Borehole/Pit No. **TP104**

Site Name	Wrexham	Sample No.	
Soil Description	Brown slightly silty/clayey fine to coarse sandy fine to coarse GRAVEL	Depth Top	0.70
		Depth Base	0.90
		Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	77		
37.5	62		
28	55		
20	48		
14	45		
10	41		
6.3	35		
5	33		
3.35	31		
2	28		
1.18	25		
0.6	20		
0.425	14		
0.3	7		
0.212	5		
0.15	4		
0.063	2		

Sample Proportions	% dry mass
Cobbles	0
Gravel	72
Sand	26
Silt and Clay	2

Remarks
 Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	18/04/2019	Ben Sharp	
RO/MH	Approved	19/04/2019	Paul Evans	





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

Contract Number

43726

Borehole/Pit No.

TP105

Site Name

Wrexham

Sample No.

Soil Description

Brown slightly silty fine to coarse sandy fine to coarse GRAVEL.
Contains some cobbles

Depth Top

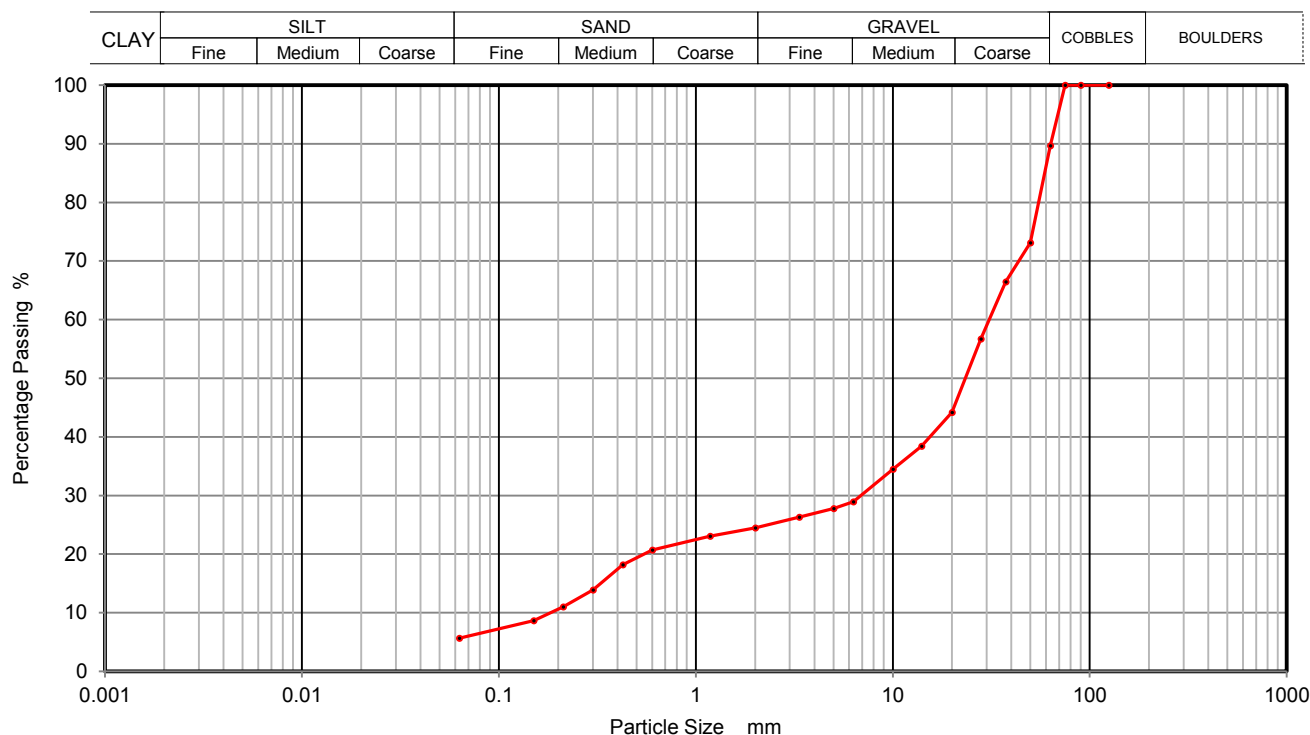
1.30

Depth Base

1.50

Sample Type

B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	90		
50	73		
37.5	66		
28	57		
20	44		
14	38		
10	35		
6.3	29		
5	28		
3.35	26		
2	24		
1.18	23		
0.6	21		
0.425	18		
0.3	14		
0.212	11		
0.15	9		
0.063	6		

Sample Proportions	% dry mass
Cobbles	10
Gravel	66
Sand	18
Silt and Clay	6

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	17/04/2019	Ben Sharp	
RO/MH	Approved	18/04/2019	Paul Evans	



Site Name

Wrexham

Sample No

Depth Top

1.20

Compaction Method

4.5 Kg Rammer

Depth Base

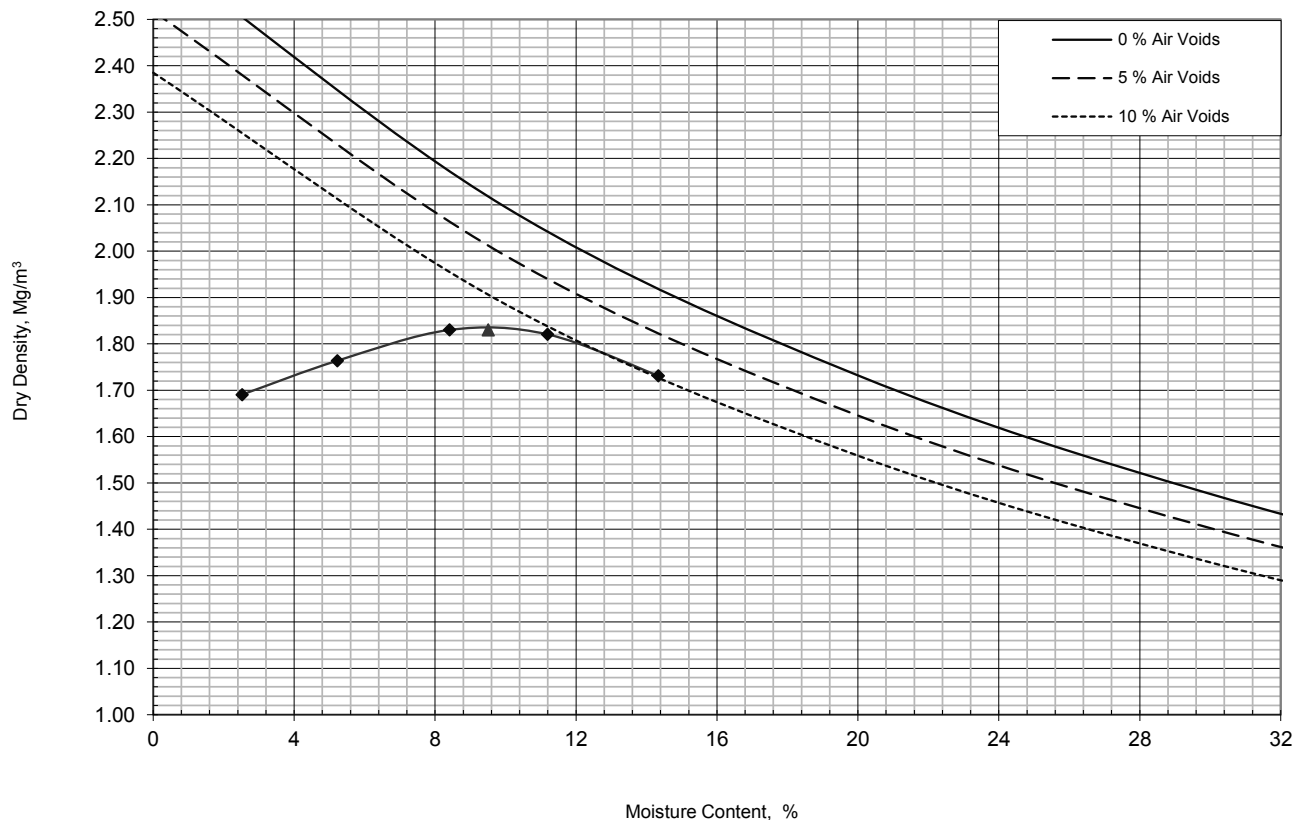
1.40

Compaction Clause

BS1377:Part 4:1990, Clause 3.5

Sample Type

0



Compaction Point	1	2	3	4	5							
Moisture Content	2.5	5.2	8.4	11	14							
Bulk Density	1.73	1.86	1.98	2.02	1.98							
Dry Density	1.69	1.76	1.83	1.82	1.73							

Initial Moisture Content	14	%
Maximum Dry Density	1.83	Mg/m3
Optimum Moisture Content	10	%
Particle Density	2.65 Assumed	Mg/m3
Material Retained 37.5mm	9	%
Material Retained 20mm	12	%

Operators	Checked	18/04/2019	Ben Sharp	
CA	Approved	19/04/2019	Paul Evans	

Site Name

Wrexham

Sample No

Depth Top

1.20

Compaction Method

4.5 Kg Rammer

Depth Base

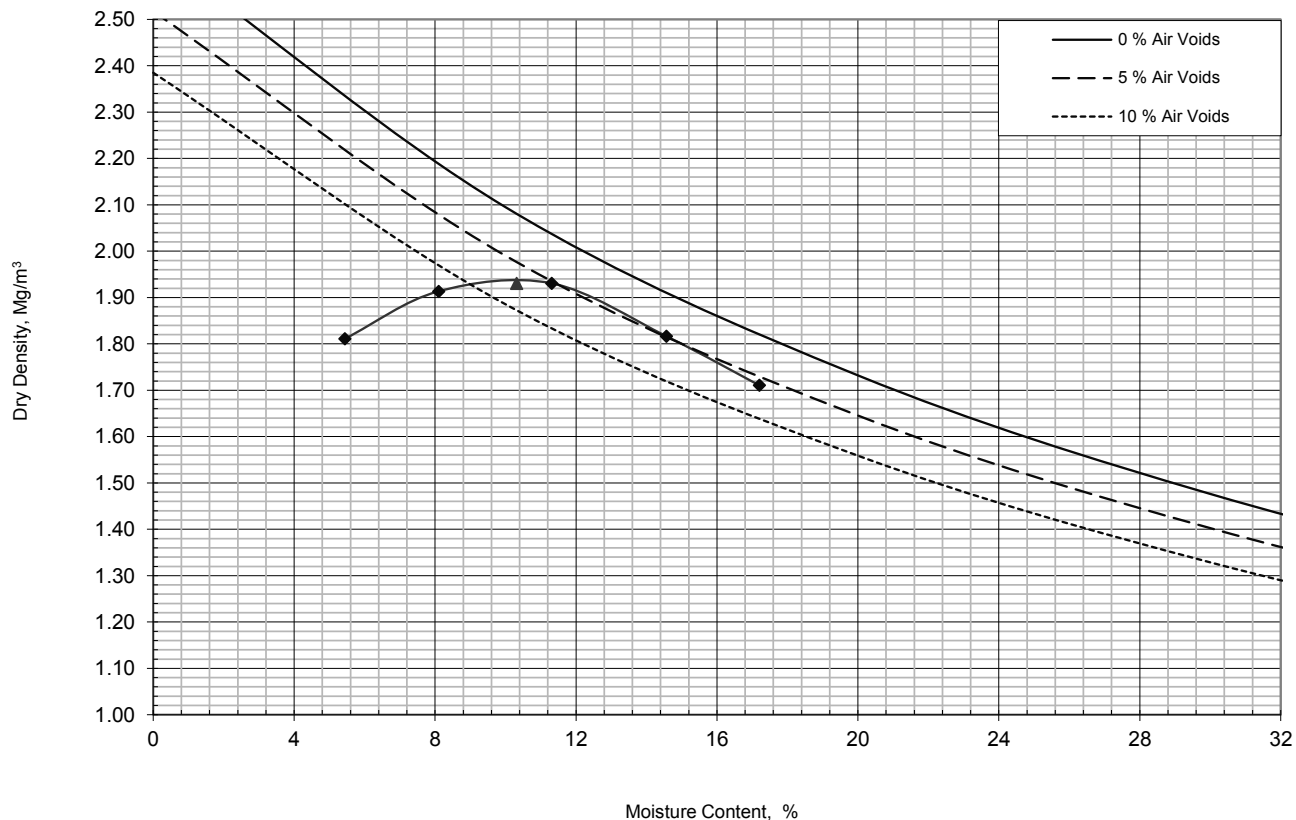
1.40

Compaction Clause

BS1377:Part 4:1990, Clause 3.5

Sample Type

0



Compaction Point	1	2	3	4	5							
Moisture Content	5.4	8.1	11	15	17							
Bulk Density	1.91	2.07	2.15	2.08	2.00							
Dry Density	1.81	1.91	1.93	1.82	1.71							

Initial Moisture Content	15	%
Maximum Dry Density	1.93	Mg/m3
Optimum Moisture Content	10	%
Particle Density	2.65 Assumed	Mg/m3
Material Retained 37.5mm	0	%
Material Retained 20mm	2	%

Operators	Checked	18/04/2019	Ben Sharp	
CA	Approved	19/04/2019	Paul Evans	

Site Name

Wrexham

Sample No

Depth Top

1.10

Compaction Method

4.5 Kg Rammer

Depth Base

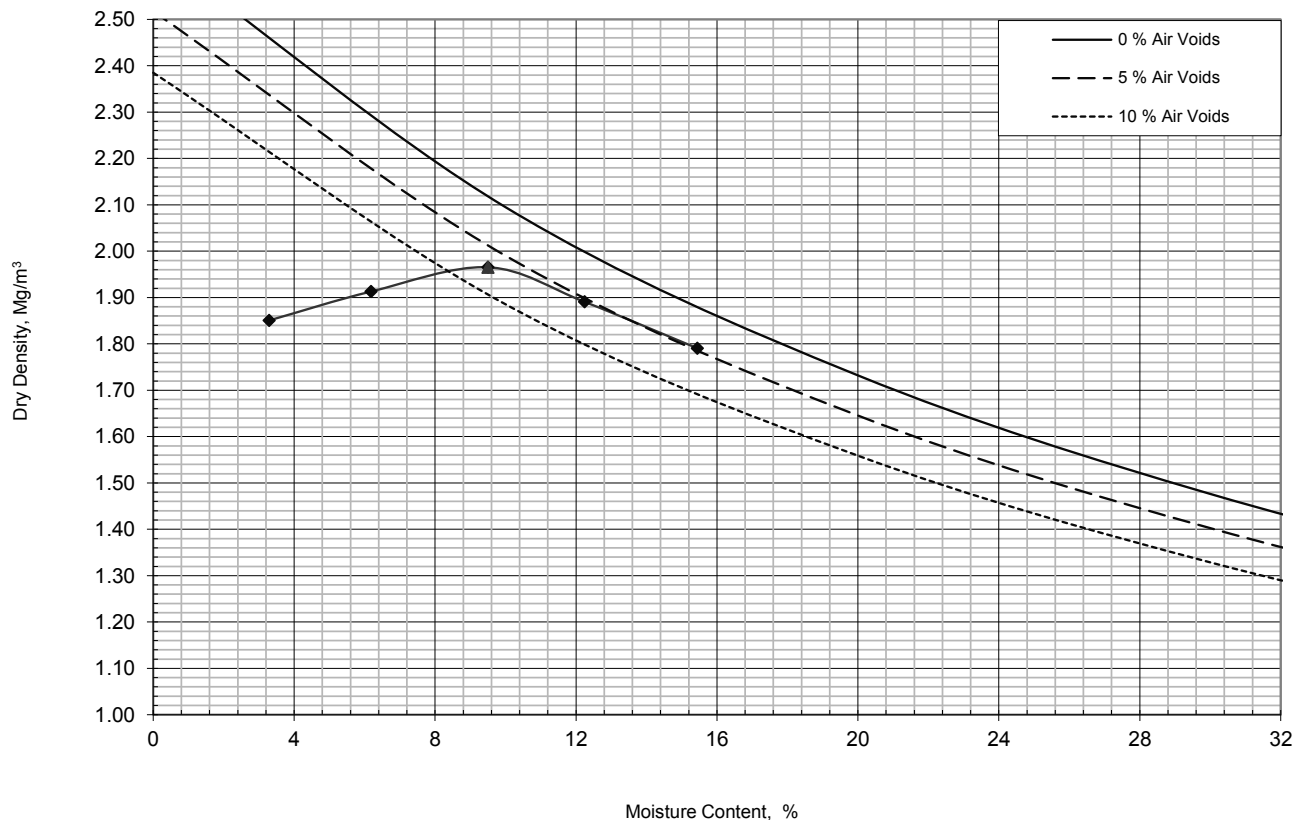
1.30

Compaction Clause

BS1377:Part 4:1990, Clause 3.5

Sample Type

0



Compaction Point	1	2	3	4	5							
Moisture Content	3.3	6.2	9.5	12	15							
Bulk Density	1.91	2.03	2.15	2.12	2.07							
Dry Density	1.85	1.91	1.97	1.89	1.79							

Initial Moisture Content	12	%
Maximum Dry Density	1.97	Mg/m3
Optimum Moisture Content	10	%
Particle Density	2.65 Assumed	Mg/m3
Material Retained 37.5mm	43	%
Material Retained 20mm	4	%

Operators	Checked	18/04/2019	Ben Sharp	
CA	Approved	19/04/2019	Paul Evans	

Site Name

Wrexham

Sample No

Depth Top

0.70

Compaction Method

4.5 Kg Rammer

Depth Base

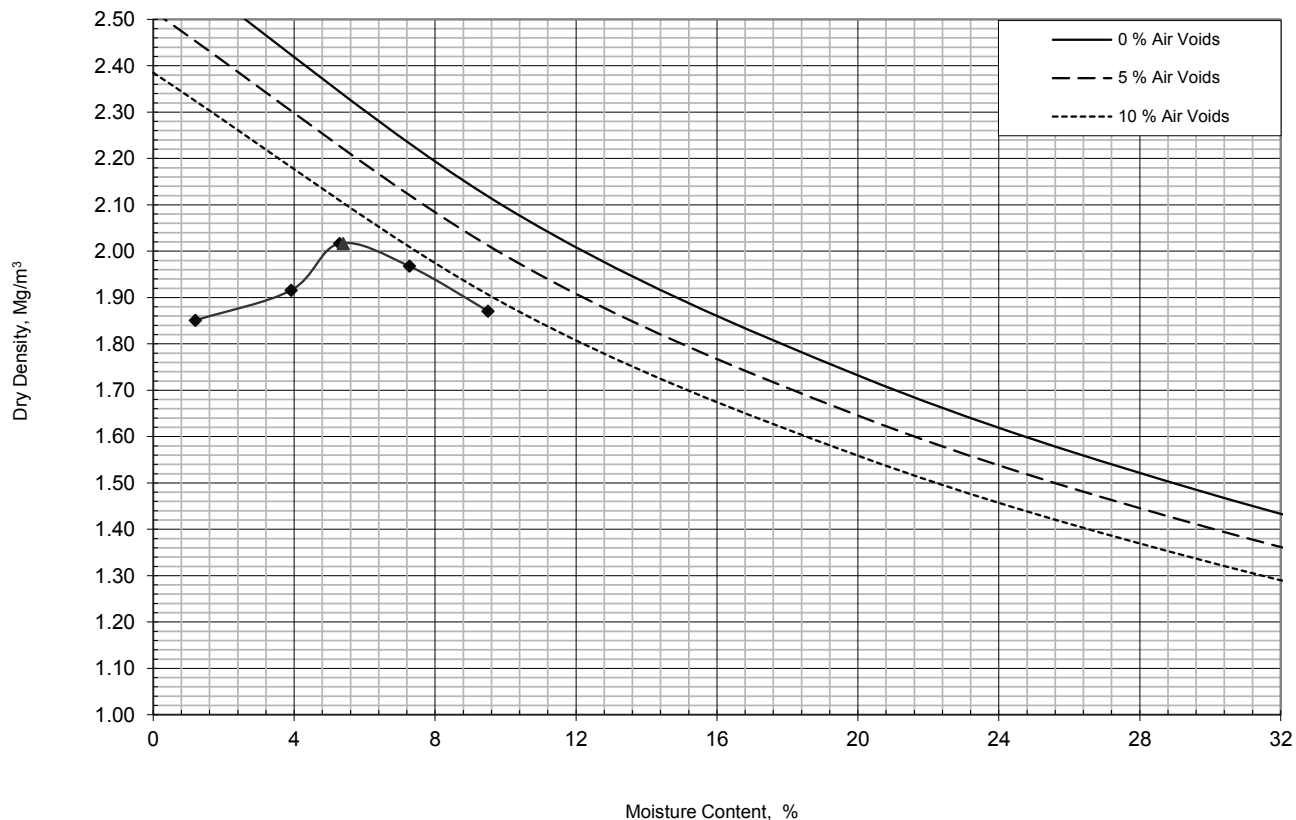
0.90

Compaction Clause

BS1377:Part 4:1990, Clause 3.5

Sample Type

0



Compaction Point	1	2	3	4	5							
Moisture Content	1.2	3.9	5.3	7.3	9.5							
Bulk Density	1.87	1.99	2.12	2.11	2.05							
Dry Density	1.85	1.92	2.02	1.97	1.87							

Initial Moisture Content	7.3	%
Maximum Dry Density	2.02	Mg/m3
Optimum Moisture Content	5	%
Particle Density	2.65 Assumed	Mg/m3
Material Retained 37.5mm	38	%
Material Retained 20mm	14	%

Operators	Checked	18/04/2019	Ben Sharp	
CA	Approved	19/04/2019	Paul Evans	

Site Name

Wrexham

Sample No

Depth Top

1.30

Compaction Method

4.5 Kg Rammer

Depth Base

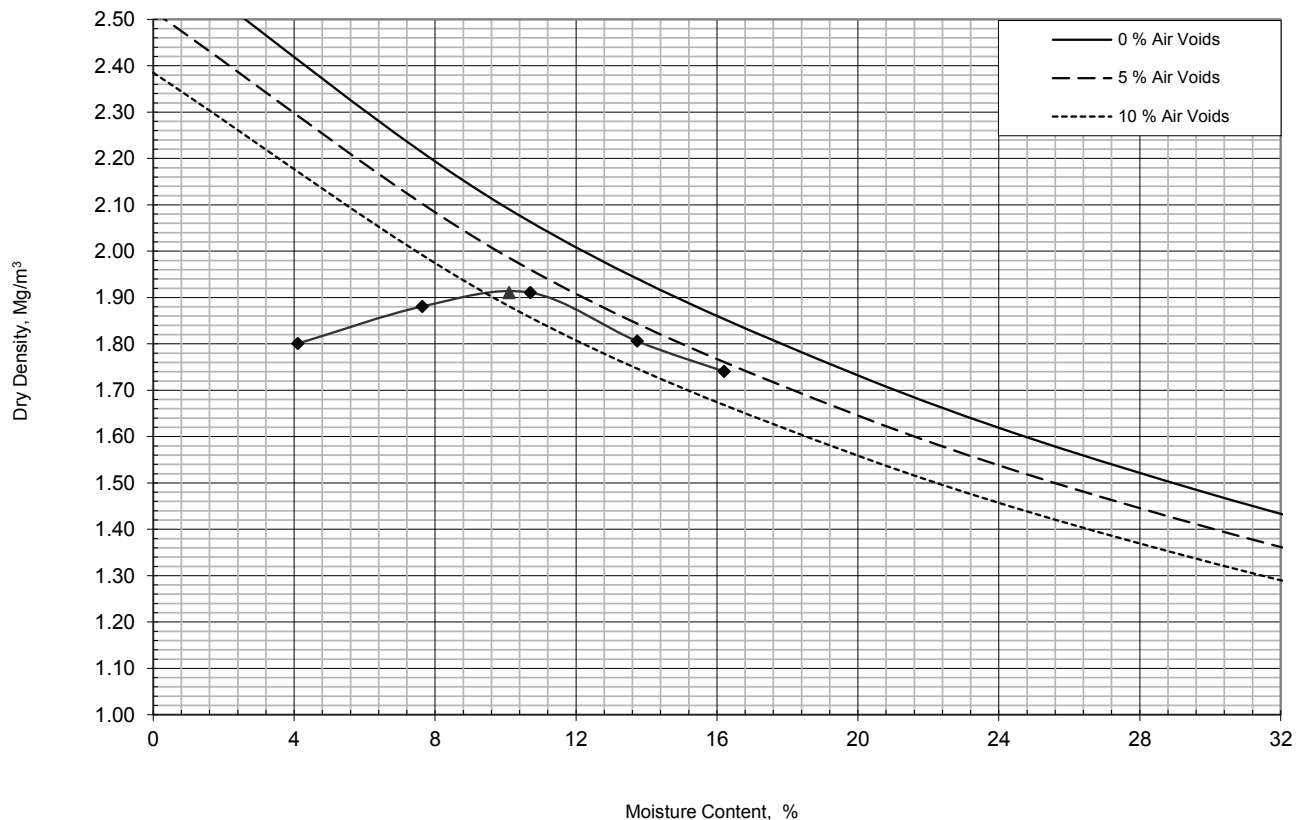
1.50

Compaction Clause

BS1377:Part 4:1990, Clause 3.5

Sample Type

0



Compaction Point	1	2	3	4	5							
Moisture Content	4.1	7.6	11	14	16							
Bulk Density	1.87	2.02	2.12	2.05	2.02							
Dry Density	1.80	1.88	1.91	1.81	1.74							

Initial Moisture Content	14	%
Maximum Dry Density	1.91	Mg/m3
Optimum Moisture Content	10	%
Particle Density	2.65 Assumed	Mg/m3
Material Retained 37.5mm	34	%
Material Retained 20mm	22	%

Operators

Checked

18/04/2019

Ben Sharp

CA

Approved

19/04/2019

Paul Evans

Test Report: Quick Shearbox Test

BS1377:Part 7:4.5 :1990.

Borehole:
Sample Number :

TP101

Depth (m) from: 1.20
Depth (m) to: 1.40

Sample Type:	B
Particle Density - Mg/m ³ :	2.65 (Assumed)
Specimen Tested:	Submerged, Remoulded material above 2.00mm removed

Sample Description:

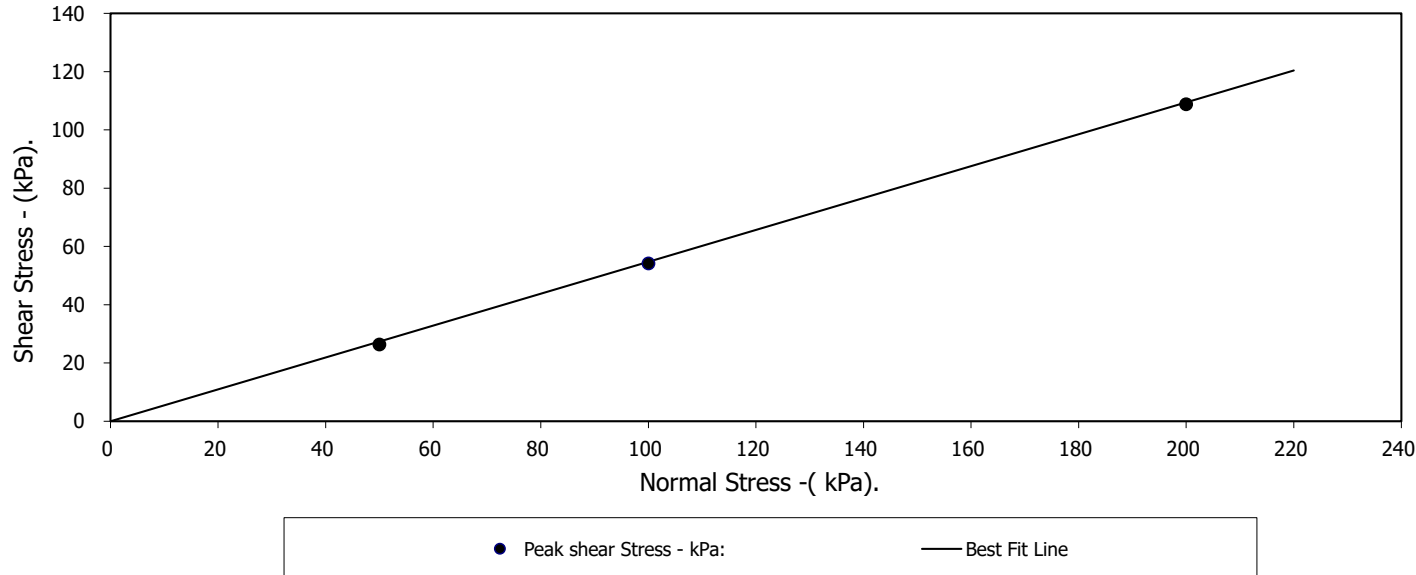
Brown slightly silty fine to coarse gravelly fine to coarse SAND.

STAGE	1	2	3
Initial Conditions			
Height - mm:	23.98	23.98	23.98
Length - mm:	60.00	60.00	60.00
Moisture Content - %:	14	14	14
Bulk Density - Mg/m ³ :	1.98	1.98	1.98
Dry Density - Mg/m ³ :	1.73	1.73	1.73
Voids Ratio:	0.5314	0.5315	0.5312
Normal Pressure- kPa	50	100	200
Consolidation			
Consolidated Height - mm:	23.96	23.70	23.45
Shear			
Rate of Strain (mm/min)	0.625	0.625	0.625
Strain at peak shear stress (mm)	3.40	5.43	6.52
Peak shear Stress - kPa:	26	54	109

PEAK

Angle of Shearing Resistance:(θ)	28.7
Effective Cohesion - kPa:	0

FAILURE CONDITIONS



DP Gans

Checked Page 1 by:

19/04/19

Date

DP Gans

Approved Page 1 by:

19/04/19

Date

Contract No.:
43726

Client Ref Number:
525.03

030704 QSHEARBOX

Test Report: Quick Shearbox Test

BS1377:Part 7:4.5 :1990.

Borehole: TP103 Depth (m) from: 1.10
Sample Number : Depth (m) to: 1.30

Sample Type:	B
Particle Density - Mg/m ³ :	2.65 (Assumed)
Specimen Tested:	Submerged, Remoulded material above 2.00mm removed

Sample Description:

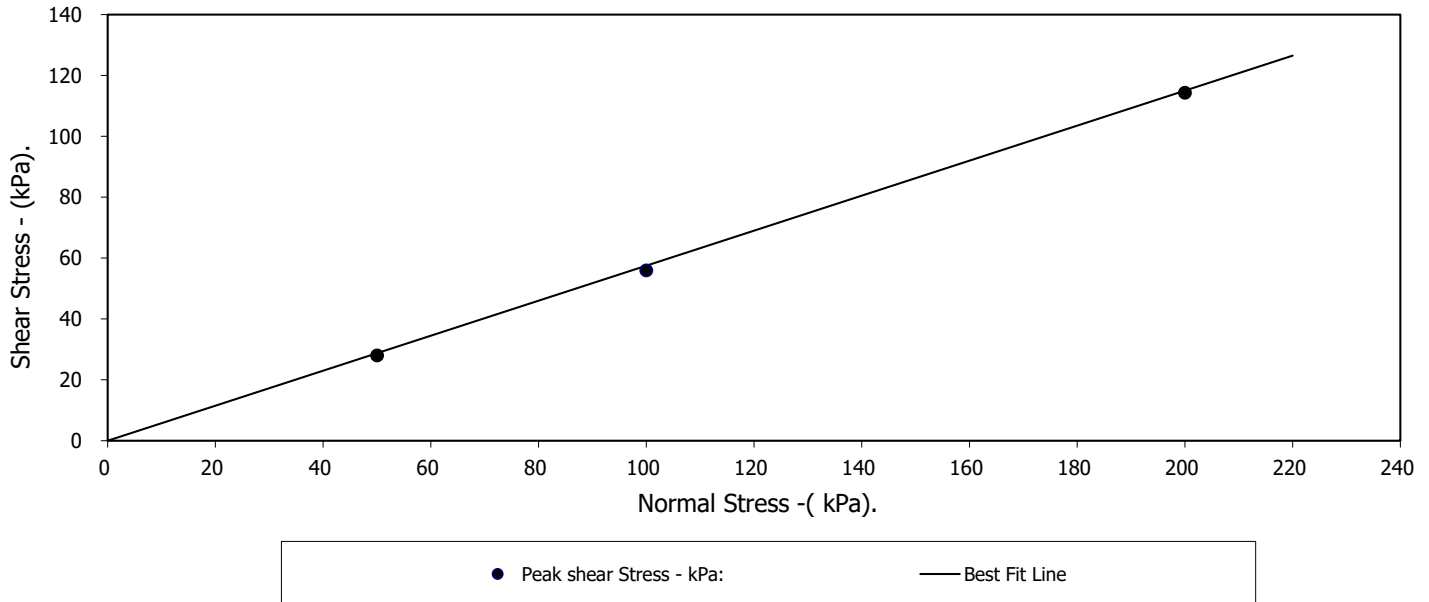
Brown slightly silty fine to coarse sandy fine to coarse GRAVEL. Contains some cobbles

STAGE	1	2	3
Initial Conditions			
Height - mm:	23.98	23.98	23.98
Length - mm:	60.00	60.00	60.00
Moisture Content - %:	12	12	12
Bulk Density - Mg/m ³ :	1.95	1.95	1.95
Dry Density - Mg/m ³ :	1.73	1.73	1.73
Voids Ratio:	0.5276	0.5275	0.5277
Normal Pressure- kPa	50	100	200
Consolidation			
Consolidated Height - mm:	23.96	23.83	23.70
Shear			
Rate of Strain (mm/min)	0.625	0.625	0.625
Strain at peak shear stress (mm)	4.65	4.61	4.47
Peak shear Stress - kPa:	28	56	114

PEAK

Angle of Shearing Resistance:(θ)	29.9
Effective Cohesion - kPa:	0

FAILURE CONDITIONS



DP QianS

18/04/19

Checked Page 1 by: Date

DP QianS

18/04/19

Approved Page 1 by: Date

Contract No.:

43726

Client Ref Number:

525.03

Wrexham

Test Report: Quick Shearbox Test

BS1377:Part 7:4.5 :1990.

Borehole: TP105 Depth (m) from: 1.30
Sample Number : Depth (m) to: 1.50

Sample Type:	B
Particle Density - Mg/m ³ :	2.65 (Assumed)
Specimen Tested:	Submerged, Remoulded material above 2.00mm removed

Sample Description:

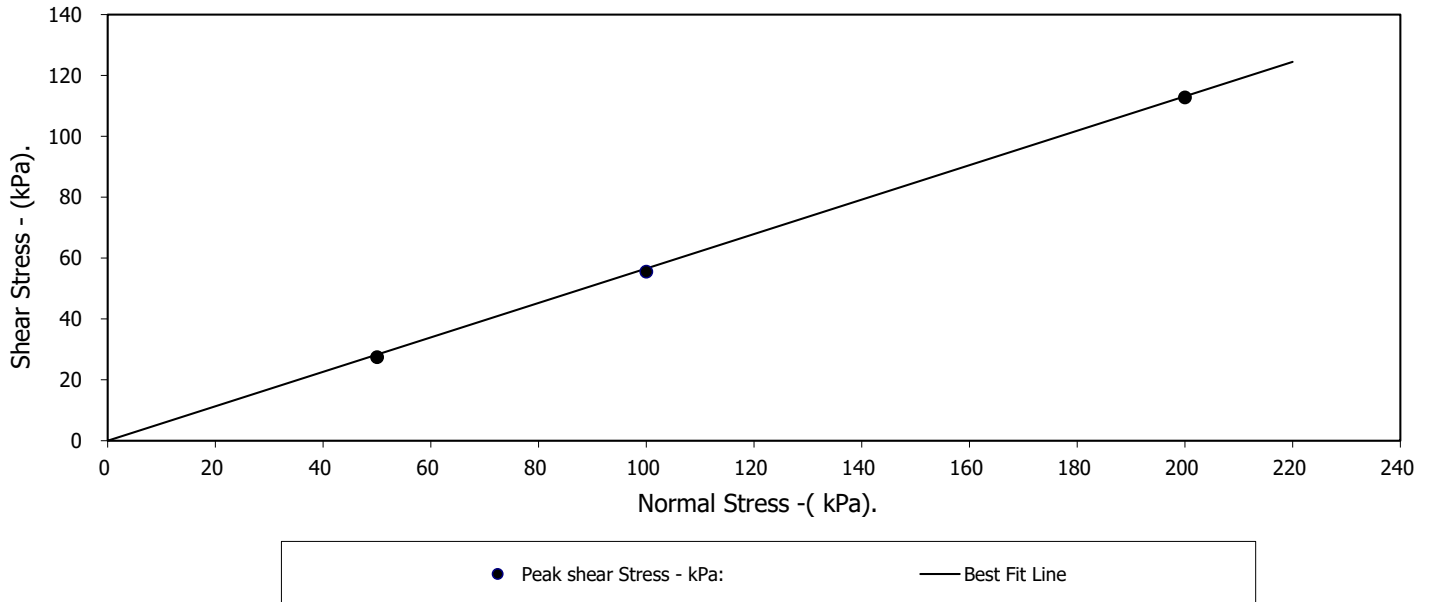
Brown slightly silty fine to coarse sandy fine to coarse GRAVEL. Contains some cobbles

STAGE	1	2	3
Initial Conditions			
Height - mm:	23.98	23.98	23.98
Length - mm:	60.00	60.00	60.00
Moisture Content - %:	14	14	14
Bulk Density - Mg/m ³ :	1.93	1.93	1.93
Dry Density - Mg/m ³ :	1.70	1.70	1.70
Voids Ratio:	0.5606	0.5605	0.5609
Normal Pressure- kPa	50	100	200
Consolidation			
Consolidated Height - mm:	23.97	23.91	23.85
Shear			
Rate of Strain (mm/min)	0.625	0.625	0.625
Strain at peak shear stress (mm)	3.95	2.95	2.42
Peak shear Stress - kPa:	28	56	113

PEAK

Angle of Shearing Resistance:(θ)	29.5
Effective Cohesion - kPa:	0

FAILURE CONDITIONS



DP Gans

18/04/19

Checked Page 1 by: Date

DP Gans

18/04/19

Approved Page 1 by: Date

Contract No.:

43726

Client Ref Number:

525.03

Wrexham



APPENDIX C

SPT Hammer Calibration Certificate



Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

Dynamic sampling uk ltd
5-8 victory parkway
victory road
Derby
DE24 8ZF

Hammer Ref: RD..300
Test Date: 17/08/2018
Report Date: 23/08/2018
File Name: RD..300.spt
Test Operator: A.PARKER.

Instrumented Rod Data

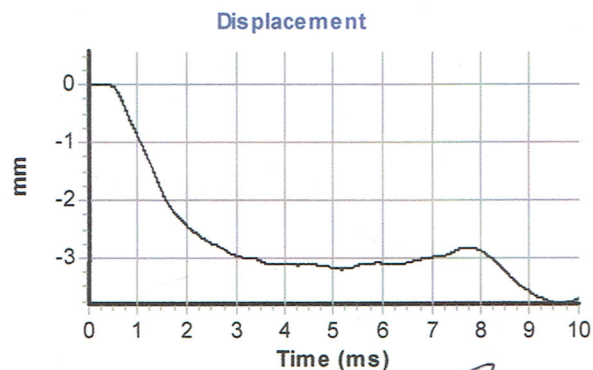
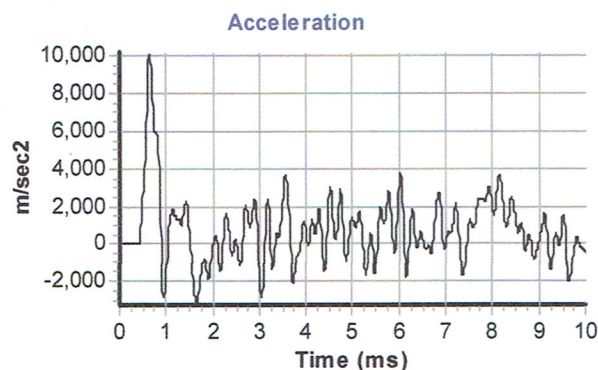
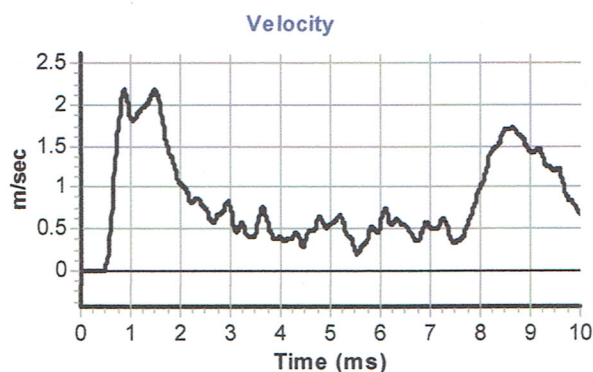
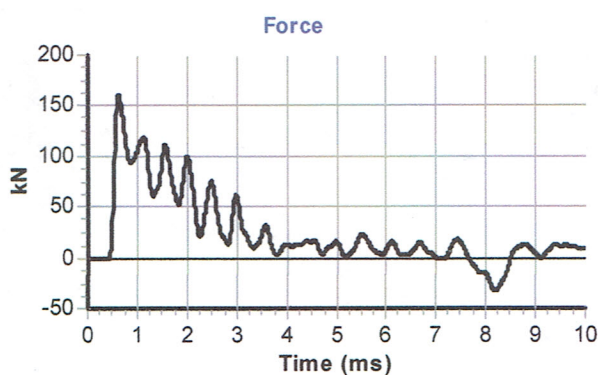
Diameter d_r (mm): 54
Wall Thickness t_r (mm): 6.9
Assumed Modulus E_a (GPa): 208
Accelerometer No.1: 6455
Accelerometer No.2: 6457

Hammer Information

Hammer Mass m (kg): 63.5
Falling Height h (mm): 760
String Length L (m): 15.0

Comments / Location

Regional drillings rig tested at Dynamic
samplings yard.



Calculations

Area of Rod A (mm^2): 1021
Theoretical Energy E_{theor} (J): 473
Measured Energy E_{meas} (J): 348

Energy Ratio E_r (%): **74**

Signed: A.parker.

Title: Associate Director.

The recommended calibration interval is 12 months