



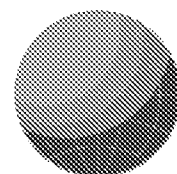
Stage 1: Tier 2 Site Investigation GQRA Report

Project Reference: P21.152/SIR Rev.01

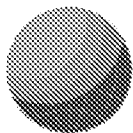
Riverside Industrial Estate, Littlehampton

Prepared For

LCP



IMPACT
GEOTECHNICAL



Report Approval

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28/05/2021

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Revision – Requested by	Nature of Revision	Date
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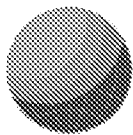
Client

Additional gas monitoring

09/11/2021

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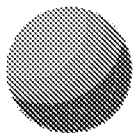
Appendix A – Hole Location Plan

Appendix B – Stratigraphic Logs

Appendix C – Photographs

Appendix D – Laboratory Test Certificates

Appendix E – Monitoring Results



Trading Terms

Unless specifically stated within the tender/quotation or unless identified within the introduction to this report it is confirmed that this report has been compiled wholly in accord with Impact Geotechnical Ltd's terms of engagement. This report is provided for sole use by the Client and is confidential to them. No responsibility whatsoever for the contents of the report will be accepted to anyone other than the Client.

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Context

This report is written in the context of an agreed scope of work between Impact Geotechnical Ltd and the Client and should not be used in a different context. In light of additional information becoming available, improved practices and changes in legislation amendment or re-interpretation of the report in whole or part may be necessary after its original submission.

Professional Interpretation

The recommendations made and opinions expressed in the report are based on the conditions revealed by the site works together with an assessment of the data from the insitu and laboratory testing or in respect of the desktop reports. No responsibility can be accepted for conditions that have not been revealed by the research, site works and testing.

The Client is advised that the conditions observed on site by Impact Geotechnical Ltd at the time of any site survey may be subject to change. Certain indicators of the presence of hazardous substances may have been latent at the time of the most recent site reconnaissance and they may subsequently have become evident. It is not possible to assess areas which are inaccessible or where access is not granted and IGL accept no liability for risks subsequently identified therein.

The Conceptual Model, Risk Assessment and sampling regime has been formulated in accordance with current UK guidance at time of production based upon the relevant information gained from Stage1, Stage 2 and Stage 3 Risk Assessments. While the model and assessment offer opinions and interpretations of these guidelines, the comments made are for guidance only and no liability can be accepted for their accuracy. It is possible that aspects of Geo-environmental reports may need to be altered following consultation with the statutory regulatory bodies to suit planning requirements.

Intrusive Field Operations

The data collected through direct operations in the production of this report has been so obtained, unless directly otherwise stated, in accordance with current UK guidance, law or accepted industry practice, including but not limited to: BS.5930: 1990 Code of Practice for Site Investigations (Amendment 3: 2015+A1:2020), & BS.10175: 2011 + A2: 2017 Investigations into Potentially Contaminated Sites. Exact exploratory locations will depend upon access conditions, site use and plant capability, IGL do not accept liability for issues arising from material identified between or outside of the area of exploratory locations.

Laboratory Testing

Unless stated otherwise within the text, all geotechnical and material laboratory tests have been performed in accordance with the relevant British Standard Documents. Laboratory testing for contaminated land assessment is completed under the UKAS / MCERTS accreditation schemes, unless identified as otherwise in the report.

Human Health Risk Assessment Criteria

The Environment Agency has undertaken revision of the Soil Guideline Values (SGVs) which are partially complete. Where standards are available using the "new" approach, these have been utilised for correlative purposes. Where standards have not yet been revised, guidance following the "old" approach has been utilised. Please note that upon release of the remaining guidelines, the standards contained within this report may be subject to change. In addition, the second edition of the LQM CIEH guidance has now been released and will be utilised in favour of previously published guideline values.

Third Parties

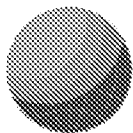
The findings and opinions conveyed in this report are based on information obtained from a variety of sources, including that from previous Site investigations and chemical testing laboratories. IGL has assumed that such information is correct. IGL cannot and does not guarantee the authenticity or reliability of the information it has relied upon and can accept no responsibility for inaccuracies with the data supplied by other parties.

The accuracy of the historical map extracts supplied cannot be guaranteed and it should be noted that different conditions may have existed between mapping sheet editions. Therefore, there can be no certainty that all areas of contamination have been identified during the Stage 1: Tier 1 Preliminary Risk Assessment.

Definitions

Reference to the word "contamination" in this report does not relate to the statutory definition of contaminated land under 1990 Environmental Protection Act unless otherwise stated. The definition used in this report is: "Land that contains substances that, when present in sufficient quantities or concentrations, are likely to cause harm, directly or indirectly, to man, to the environment, or on occasion to other targets" (NATO CCMS, 1985).

IGL 2020



1.0 INTRODUCTION

Impact Geotechnical Ltd (IGL) were instructed by LCP Properties (the Client) (Q21.181.01, dated: April 2021), to carry out a Stage 1: Tier 2 Site Investigation and Generic Quantitative Risk Assessment (GQRA) Report at Riverside Industrial Estate, Littlehampton, West Sussex BN17 5DF (hereafter referred to as the “site”).

The site is formed by an overspill car parking area within an Industrial Estate, occupying the northwest corner of the demise. Historically the area was used in the 1970s as a mobile crane associated with material handling, and was previously undeveloped land within the flood plain to the River Arun.

Current proposals are for the construction of a new portal framed industrial unit, this will be detached from the neighbouring premises, but will effectively form the western end to a line of similar buildings. Proposed development plans can be viewed in **Appendix A**.

Intrusive works were conducted from 26th to 27th April 2021 and comprised the following:

- One deep borehole advanced with a traditional shell and auger rig, to a maximum depth of 20.00mbgl (below ground level);
- Installation of a standpipe within the borehole to allow for continued groundwater and ground gas monitoring;
- Four Windowless sample boreholes taken to a maximum depth of 5.00mbgl to provide site coverage;
- Two hand excavated trial pits to allow the buried construction form of the neighbouring building’s foundations to be ascertained; and
- Ground gas monitoring on three occasions to allow assessment of the risk posed by soil gas production.

An additional three rounds of ground gas monitoring (totalling six rounds) were undertaken during October 2021.

DTS Raeburn (DTSR) have previously completed a Stage 1: Tier 1 Preliminary Risk Assessment (PRA) (Ref: E13353/1, Date: July 2020) which should be read in conjunction with this report.

The purposes of this investigation are two-fold, 1) to provide necessary design parameters for the underlying ground conditions to allow temporary and permanent geotechnical design, and 2) refine the potential pollutant linkages as identified within the PRA Report.

2.0 SITE LAYOUT

2.1 General Layout

Site details are presented in the table below.

Site Address	Riverside Industrial Estate (Adjacent Unit H), Bridge Road, Littlehampton BN17 5DF
National Grid Reference	501750, 102560
Site Area	0.13 ha
Site Ownership	Private (Client)
Site Access	Via the main access roadway through Riverside Industrial Estate.
Site Boundaries	North / west – Chain line fence within soft verge to edge of car park, leading to embankment for Bridge Road beyond.
	South – Open boundary onto access road through industrial estate / parking for adjacent units
	East – Flank wall to neighbouring industrial unit
Ground Cover	Soft landscaping (overgrown soft verge to northwest elevation) – 10%
	Hardstanding (concrete car park) – 90%
Site Topography and Elevation	The site is predominantly level and based on a review of Ordnance Survey maps, situated at approximately 5mAOD.

The site is formed by a broadly triangular area at the northwest corner of the Riverside Industrial Estate; at the time of the investigation the area was in use as overflow car parking and predominantly laid to concrete hardstanding. The northwestern flank is formed by a soft verge which had recently been cleared but had evidently been overgrown by brambles and shrubs.

This verge extends to the site boundary which is formed by a chain link fence, beyond which an embankment of ~4-5m height is present supporting Bridge Road. A Culverted stream passes beneath the verge, with portals to the southwest and northeast of the site area, beyond which the stream flows through an open ditch.

2.2 Surrounding Area

The site is within a commercial setting with the land to the south and east formed by the industrial estate; beyond Bridge Road to the north are trade counter shop units and a supermarket. The river Arun flows ~75-100m west of the site.

2.3 Topography

The site area is flat, however a steep embankment is noted beyond the northwest boundary.

2.4 Ground and Surface Water

No evidence of groundwater was visible during the site walkover. A culverted stream flows beneath the northwestern elevation of the site, and subsequently with open ditches to the southwest and northeast.

2.5 Trees and Vegetation

The majority of the site is laid to concrete hardstanding and is devoid of vegetation. The northwestern edge to the site area had been recently cleared but had apparently been overgrown by weeds and shrubs. Mature deciduous trees are noted to the embankment slope to the northwest.

3.0 PHYSICAL SETTING

3.1 Geology and Hydrogeology

The Geology of Britain Viewer (BGS, 2021) indicates the site is underlain by Superficial Deposits of Raised Marine Deposits, over Bedrock Geology of the Lewes Nodular Chalk Formation.

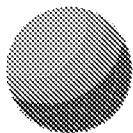
The table below identifies the expected composition of the published strata and the associated aquifer classification.

Superficial / Drift Geology	
Unit Name	Raised Marine Deposits
Geology Description	Clay and silt with bands of sand and gravel
Aquifer Class	Secondary A Aquifer
Aquifer Description	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
Bedrock / Solid Geology	
Unit Name	Lewes Nodular Chalk Formation
Geology Description	Firm white fractured and bedded chalk, with pervasive nodular flint seams.
Aquifer Class	Principal
Aquifer Description	These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer.

3.2 Geological Hazards

The British Geological Survey (BGS) has provided the available published Geological Hazard directory information for the study site. The information returned is displayed in the table below.

Hazard	Risk Level
Landslides	Very Low
Ground dissolution of soluble rocks	Very Low
Collapsible Rocks	Very Low
Running Sands	Very Low
Compressible Ground	Negligible
Shrink Swell Clays	Negligible



3.3 Hydrology

Surface Water Features – The nearest surface water feature to the site is a drainage ditch located adjacent the northwest boundary. This flows into the River Arun about 250m to the south.

3.4 Controlled Waters

Abstraction Licences – There are not water abstractions within 250m of the site boundary.

Source Protection Zones – The site is not located within 1000m of a Source Protection Zone.

4.0 PREVIOUS REPORTS

A Stage 1: Tier 1 Preliminary Risk Assessment (PRA) Report was completed by DTS Raeburn LTD (DTSR) in June 2020 (Ref: E13353/1). The purpose of the PRA was *“To carry out a preliminary risk assessment (PRA) in accordance with the risk assessment framework presented in CLR11, in order to assess whether the area is potentially contaminated or whether there are other potential geo-environmental liabilities”*.

The DTSR report should be read in conjunction with this document.

The brief site history provided by the report summary indicates: “The site formed part of a field until the early 1970’s when travelling cranes (associated with a precast concrete works to the south), were located in its eastern section. By the early 1980’s the Riverside Industrial Estate had been constructed and the site had taken its present day form as an area of hardstanding / car parking”.

Following a site walkover, review of historical maps, and information on public record, potential sources of contamination have been identified:

- Potential Made Ground associated with historical site uses (dependant on nature and source of material, but may include hydrocarbons, metals, cyanide, phenol, PAH, asbestos, soil gas)
- Previous use of eastern section for travelling cranes (former concrete works) (hydrocarbons, asbestos).
- Various industrial uses within 500m of the site (metals, petroleum hydrocarbons, PAH compounds, phenol, cyanide, sulphates, acids/alkalis, asbestos).
- Historic landfill within 250m of the site (soil gas)

The report indicates that the potential for soft and firm clay soils near the surface and potential for shallow groundwater would suggest that conventional foundation systems may not be suitable.

The report indicates that the risk posed by soil gases is considered to be sufficient to warrant further assessment to allow for completion of a suitable GQRA.

The following tables are provided within the report to characterise the risk presented by on site and off site potential sources:



Table 8.1 Ground contamination assessment with respect to on-site sources

On-site Sources	Potential Contaminants	Pathway	Receptor	Risk Classification
Potential made ground	Hydrocarbons	Direct contact with contaminated material, ingestion of soil, inhalation of air	<u>Human health:</u> Construction workers	Low to moderate
	Metals		<u>Human health:</u> Site end users	Low to moderate
	Cyanide			
	Phenol	Direct contact	<u>Development end use</u>	Low to moderate
	PAH			
Asbestos				
Soil gas				
Former travelling cranes	Hydrocarbons	Leachate migration into pore water from soil contamination, free product flow, dilution and dispersion into groundwater	<u>Groundwater:</u> Secondary A and Principal aquifer status of the underlying superficial geology and bedrock respectively	Low to moderate
	Asbestos			
		Hydrogeological flow within groundwater, surface water run-off	<u>Surface Water:</u> Adjacent drainage ditch and River Arun 250m south	Low to moderate

Table 8.2 Ground contamination assessment with respect to off-site sources

Off-site Sources	Potential Contaminants	Pathway	Receptor	Risk Classification
Various industrial uses within 500m and historic landfill	Metals	Direct contact with contaminated material, ingestion of soil, inhalation of air	<u>Human health:</u> Construction workers	Low to moderate
	Hydrocarbons		<u>Human health:</u> Site end users	Low to moderate
	PAH	Direct contact	<u>Development end use</u>	Low to moderate
	Phenol		<u>Groundwater:</u> Secondary A and Principal aquifer status of the underlying superficial geology and bedrock respectively	Low to moderate
	Cyanide			Hydrogeological flow within groundwater, surface water run-off south
	Sulphate	Nearby drainage ditch and River Arun 250m south		
	Acids/alkalis		Low to moderate	
Asbestos	Low to moderate			
Soil gas		Low to moderate		

Recommendations following Preliminary Risk Assessment

The following table presents the recommendations for further assessment presented by the DTSR report in response to the potential Source-Pathway-Receptor Relationships identified:

Table 9.1 Summary of main identified risks

Hazard/Risk	Cause	Possible Impact/Consequence	Recommendations
Potential soil and groundwater contamination	Former use of travelling cranes in east of the site and potential made ground	Possible impact on human health if disturbed and possible need for remediation. Cost and programming implications.	Intrusive investigation recommended.
Soil gas/vapours	Release of gas from potential made ground beneath the site and nearby historic landfill	Possible need for gas protection measures. Cost and programming implications.	Gas monitoring recommended.
Geotechnical considerations	Relatively poor ground conditions	Possible need for piled foundations. Cost and programming implications	Intrusive investigation recommended.

Actual fieldworks conducted, are detailed in Section 5.0 of this report.

5.0 FIELDWORKS

5.1 Site Management and Preparation

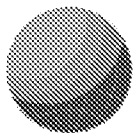
The following intrusive works were undertaken on 26th and 27th April 2021, supervised by an Engineer from IGL. Where applicable, the works were carried out in accordance with statutory guidance including BS5930:1999 *Code of Practice for Site Investigations (Amendment 3: 2015+A1: 2020)*, BS 10175:2011+A2:2017 *Investigation of Potentially Contaminated Sites: Code of Practice*, and BS ISO 5667-11 *Water Quality-Sampling-Guidance on Sampling of Groundwater*.

Prior to any excavations taking place a Cable Avoidance Tool (CAT) was used to check for the position of any underlying electrical services. In addition, starter pits were excavated to 1.20 metres below ground level (mbgl) to clear test locations prior to any intrusive work, where possible.

A plan indicating intrusive locations can be viewed in **Appendix A**.

5.2 Cable Percussive Boreholes

- One cable percussive borehole (BH1) was advanced to a maximum depth of 20.00mbgl using a traditional shell and auger rig. The exploratory hole was originally scheduled to be completed at the southwest corner of the proposed building, however on site constraints (illegal parking in area) lead to the hole being completed at the northwest corner.



- Insitu SPT (Standard Penetration Testing) testing was completed at regular intervals throughout the drilling programme.
- On completion, the borehole was installed as dual-purpose gas and groundwater monitoring wells constructed with 50mm internal diameter HDPE plain and slotted pipe. The response zone of the wells was designed to target groundwater within the underlying chalk bedrock and collect gas from shallow soils.
- A filter pack of washed gravel was placed in the well annulus to just above the screen sections, and the annulus was sealed to the surface with bentonite. The monitoring well was finished with flush to ground level traffic-rated steel cover.

5.3 Window Sample Boreholes

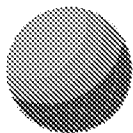
- Four window sample boreholes were drilled using a tracked window sampling rig to a maximum depth of 5.00mbgl. Locations were selected to achieve site coverage, as well as targeting the historical travelling crane in the east of the site area.
- Insitu SPT testing was completed throughout the drilling of each window sample.
- All window sample holes were backfilled with arisings on completion.

5.4 Trial Pits

- Two trial pits were advanced in locations indicated by the consulting structural engineer by means of hand excavation in order to determine the dimensions to the buried pad foundations to the neighbouring building to the east of the site (Unit H)
- Upon completion the buried construction form was measured and sketched, with the underlying soils conditions recorded.
- Both trial pits were backfilled in reverse order using arising soils and reinstated to match the existing finish.

5.5 Soil Sample Collection

- All intrusive locations were logged, visual and/or olfactory evidence of contamination noted and representative soil sample removed in accordance with current protocol for geotechnical and geo-environmental parameters.
- Selected samples were placed in sealed glass jars or plastic tubs (dependent on the exact laboratory requirements and analysis to be undertaken) and stored in a temperature controlled environment before transit. Samples were handled using a fresh pair of nitrile gloves.



6.0 GROUND CONDITIONS

6.1 Soils

The following table summarises the strata conditions encountered during the intrusive works:

Stratum	Depth Range Encountered
Surface Cover (WS1-4 / TP1-2)	GL – max.0.15m
Made Ground	GL-0.15m to 0.50-0.90m
Raised Marine Deposit	0.50-0.90m to 1.40-2.90m
Lewes Nodular Chalk Formation	1.60-1.90m to >6.00m

6.1.1 – Surface Cover

Window sample and trial pit locations were completed within the car parking area which was surfaced by concrete hardstanding of 100-150mm thickness, generally recorded with one layer of 8mm diameter steel mesh reinforcement.

6.1.2 – Made Ground

The surface material to BH1 was recorded as Dark brown sandy Silt with numerous roots to a depth of 0.20mbgl.

Subsequent soils in BH1, and the subbase to the concrete slab elsewhere were recorded as light brown / grey brown sandy Gravel or Sand and Gravel. The gravel component was described as flint and locally concrete. This material ranged in thickness from 50-450mm and was encountered to a maximum depth of 0.50mbgl.

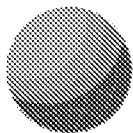
Further Made Ground soils were described in WS1, WS3 and WS4 and were described as reworked grey brown gravelly sandy Clay / Silt, with the gravels described as concrete. This material was described to a maximum depth of 0.90mbgl.

6.1.3 – Raised Marine Deposits

The initial natural soil across the site is described as a variable cohesive deposit which is a slightly variable orange brown / grey / greenish grey locally slightly gravelly, slightly organic silty Clay, generally firm consistency; where the gravels are of flint. The base depth of this material varied from 0.80m to >2.00mbgl.

Within BH1 and WS1, a subsequent horizon in this stratum was recorded as firm to stiff consistency buff / light brown very gravelly Silt /Clay. The gravels were described as chalk. Locally this material was described as a very clayey / silty Gravel.

Within WS1 only a further horizon within the Raised Marine Deposits was recorded, described as dark grey mottled vey gravelly, sandy, organic Silt to a maximum depth of 2.90mbgl.



6.1.4 -- Lewes Nodular Chalk

The chalk was initially described within BH1 and WS1-3 to be recovered in a Structureless condition as a silty Gravel / gravelly Silt. Gravels were described as very weak, low density chalk.

Below a depth of 7.00mbgl within BH1, the intact chalk clasts recovered were described as weak to medium strong. Nodular flint seams were estimated to be present at medium to wide spacings on the basis of the arisings soils from BH1.

Please refer to the stratigraphic logs contained within Appendix B for a more detailed description.

6.2 Groundwater

Groundwater readings recorded during drilling and the subsequent monitoring rounds indicate levels of 2.20-2.40mbgl

6.3 Visual and Olfactory Observations of Contamination

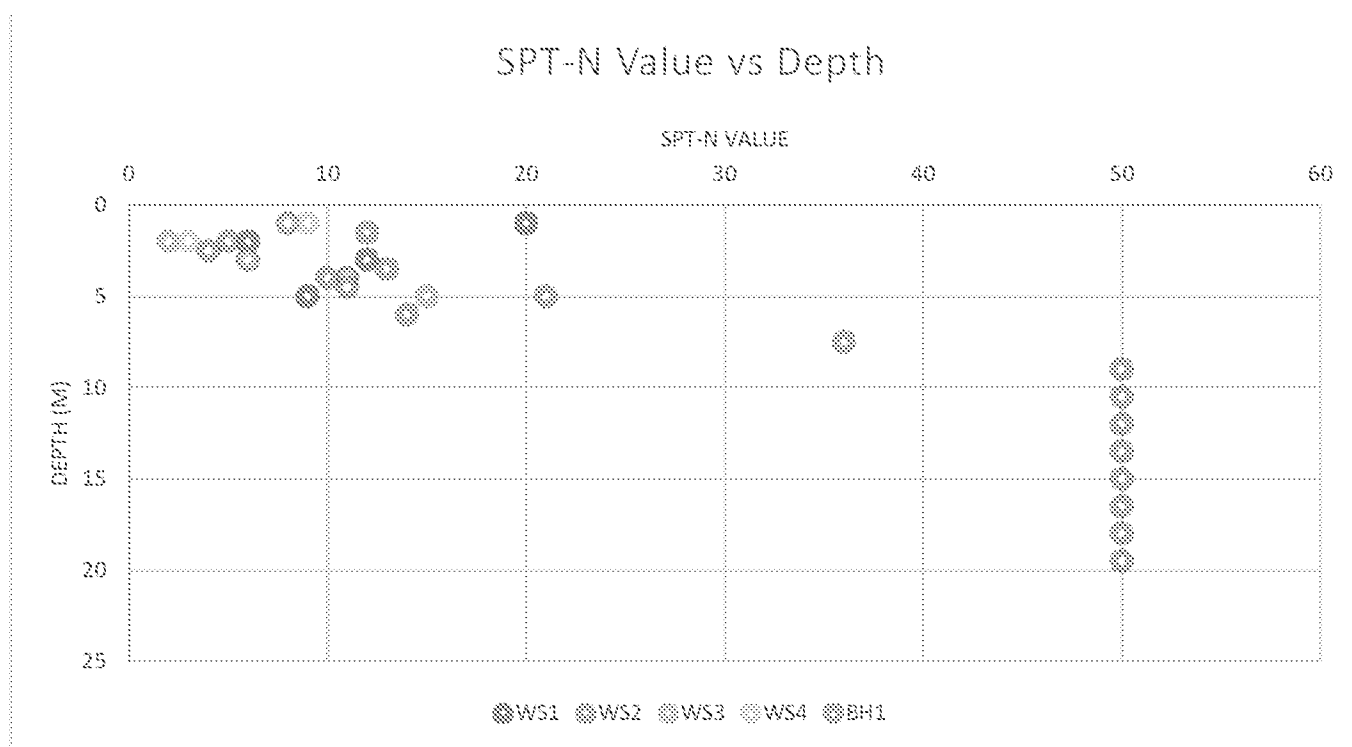
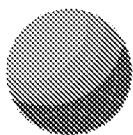
With the exception of anthropogenic materials encountered within the Made Ground soils, no visual or olfactory evidence of soil or groundwater contamination was noted during the investigation works.

6.4 Insitu Testing

6.4.2 Standard Penetration Testing

Standard Penetration testing was completed throughout the drilling of BH1 at 1.00m centres to 5.00mbgl, 1.50m centres thereafter and at 1.00m centres in WS1-WS4. This form of testing is completed using a 63.5kg drop hammer weight, over a 750mm drop, measuring the blow counts for six, 75mm increments. The first two values are recorded as seating blows, with the remaining four values, added together to provide an 'N-value'.

The graph below (over page) summarises the results of this testing, by conversion to equivalent SPT-N values.



This form of testing indicates that the materials in the upper 3.00mbgl (raised Marine & Weathered Chalk) are generally of low strength, with the majority of N-values <10, indicative of loose granular or soft cohesive soils.

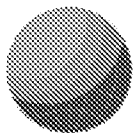
The weathered Chalk material encountered at 3.00-6.00mbgl would be considered to be of approximately Low to Medium strength, with SPT N-values of N=9-21. Whilst the use of the SPT test in Chalk can be problematic, generally it is considered that N-values of N<25 are representative of weathered and/or structureless chalks; this would be congruent with the logging engineer's description.

Below 7.50mbgl SPT N-values are consistently N>35, with those below 9.00 N>50. This would be considered to be indicative of the depth to less weathered / intact Chalk.

6.5 Existing Foundations

The construction form of the existing foundations was explored within TP1-4. The table below summarises the findings of these investigations.

Trial Pit	Foundation Type	Base Depth (mm)	Thickness (mm)	Projection (mm)	Founding Soil
TP1	Concrete Pad	1150	900	900	Firm silty Clay
TP2	Concrete Pad	1150	800	750	Sandy Gravel of Chalk



7.0 GROUND GAS/ SOIL VAPOUR MONITORING

7.1 Design of Gas Monitoring Program

In accordance with BS8576:2013 *Guidance on investigations for ground gas – permanent gases and volatile organic compounds*, the extent of monitoring that was deemed necessary was based on the generation potential of the source, i.e. what is the risk that large volumes of gas can be generated and can plausibly migrate to pose a credible hazard to the identified receptors.

The following points were pertinent in the design of the gas monitoring program:

- The maximum depth of Made Ground encountered on site was 0.90mbgl which was found to comprise reworked natural soils and 'inert' construction materials with no putrescible materials. Natural strata were recorded as slightly organic clays, overlying carbonate bedrock;
- On site soils contain a low organic content – with a maximum value of 3.60% recorded.
- The DTSR report identified the nearest landfill at 250m southwest. Although this is identified as a potential risk, it is considered that the risk to the site from a feature at this distance is negligible. Furthermore, the facility in question has been inactive for 46 years, suggesting that gas production would now be minor and was located on the opposite side of a tidal estuary.

Consequently, the potential for soil gas production is considered to be 'very low' to 'negligible' and the monitoring regime conducted was intended to act as a screening exercise in order to close out the potential risk identified in the DTSR report.

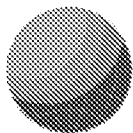
Monitoring was conducted in accordance with BS5930:1999/2020 and BS8576:2013, over six monitoring rounds of BH1. An initial three rounds was undertaken over the period 4th-12th May 2021. Three subsequent rounds were completed over the period 12th-28th October 2021.

All boreholes were monitored for the presence of soil gases including oxygen, carbon dioxide, methane. In addition, gas flow rates, downhole pressure and atmospheric pressure were also measured using a GA5000 gas analyser. Gas monitoring was completed over a three minute period recording the steady and peak concentrations of each gas.

7.2 Monitoring Results

The results from the six monitoring rounds are summarised in the tables overleaf. Atmospheric pressure was noted to be decreasing during Monitoring Round 2 (MR2), Monitoring Round 4 (MR4) and Monitoring Round 5 (MR5).

Monitoring sheets can be viewed in **Appendix E**.



	Minimum	Maximum	Comments
Flow Rate (L/hr)	0	0.4	
Peak CH ₄ (%)	0	0.2	
Peak CO ₂ (%)	0.2	8.1	
Minimum O ₂ (%)	5.9	19.9	
H ₂ S (ppm)	0	0	
CO (ppm)	0	5	Concentration decreased across monitoring rounds

The levels observed in MR1-MR2 were generally comparable with atmospheric air. The levels recorded in MR3, MR4, MR5 and MR6 were substantially different, with reduced oxygen levels and elevated levels of carbon dioxide.

It is considered that the worst case scenario in terms of gas production would be during Monitoring Round 5 due to the decreasing atmospheric pressure as well as the details of the gassing regime. Worst case maximum gas levels and flow rates recorded will be used to calculate a Gas Screening Value (GSV).

The GSV will be subsequently compared to CIRIA Values supplied within CIRIA Document C665 *Assessing Risks posed by hazardous ground gases to buildings* (2007).

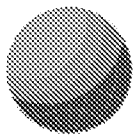
Carbon Dioxide GSV

$$\left[\frac{\text{Worst Case Concentration}}{100} \right] \times \text{Worst Case Flow Rate} = \text{GSV}$$
$$(8.10\% / 100) \times 0.40\text{L/hr} = \underline{0.032\text{L/hr}}$$

7.3 Significance of Results

In response to the calculated GSV for carbon dioxide, the site would fall into 'Characteristic Situation 1' in accordance with CIRIA C665 and would be classified as somewhere between 'Green' and 'Amber 1' in accordance with NHBC guidance.

Following six rounds of ground gas monitoring and in accordance with CIRIA C665 no special precautions with respect to ground gas mitigation are required within the design of the proposals. This on the basis that the site falls into Characteristic Situation 1 mindful of the bullet points outlined in Section 7.1.



8.0 LABORATORY TESTING

8.1 Geotechnical Testing

8.1.1 Atterberg Limits and Natural Moisture Content

In total, six disturbed samples of the underlying soils were submitted for determination of their Natural Moisture Content (NMC) and Plasticity Index (PI).

The samples tested for NMC were selected from depths between 1.00m and 2.45mbgl. Results ranged between 15% and 41%.

The results indicate Liquid Limits between 27% and 64% and Plastic Limits between 12% and 23%. Once the portion retained on the 425µm had been taken into account (0-64%), the Modified PI results lie between 3% and 41%.

Based upon these results the raised marine deposits have highly variable plasticity classifications, reflecting the variability of the soil composition, including Low plasticity and High plasticity Clay. In accordance with the NHBC guidance (chapter 4.2 'Building Near Trees') these results indicate a spectrum of shrinkage potential including non-shrinkable, Low, medium and high shrinkage potentials.

The average for the 3no. Modified PI result from samples at 1.00m depth is recorded as 30%, which would be indicative of medium shrinkage potential material, it is suggested that these cohesive soils are assumed to be of medium shrinkage potential for design purposes.

8.1.2 Sulphate and pH Analysis

Thirteen samples were submitted for determination of pH and Water Soluble Sulphate concentration.

Water soluble sulphate concentrations were found to range from <10mg/l to 380g/l, with pH levels ranging from 7.6 to 11.7.

8.1.3 Saturated Moisture Content

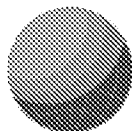
Classification testing of chalk samples was conducted upon disturbed samples recovered from BH1 over the depth range 4.50-14.50mbgl; it should be noted that due to the highly disruptive method of drilling the chalk samples analysed cannot be considered representative of intact material.

Saturation Moisture Content was recorded to range from 22-23%, with dry density ranging from 1.66-1.70Mg/m³. These results would be indicative of a medium density Chalk.

8.2 Geo-Environmental Analysis

8.2.1 Soil Analysis

Six soil samples obtained from depths ranging between 0.30 and 0.80mbgl were submitted to DETS, a UKAS and MCERTS accredited laboratory testing facility, for a screen of contamination testing from both the Made Ground and shallow underlying natural soils. Although not all samples were tested for all analytical determinands, suites included an asbestos screen, heavy metals and hydrocarbons including speciated Total Petrol Hydrocarbons (TPH



LQM aromatic/aliphatic split), BTEX, MTBE and speciated Polycyclic Aromatic Hydrocarbons (PAH), as well as a background suite of pH, SOM, total cyanide, and total phenols.

Rationale for Analysis

Specific soil samples were selected in order to fully refine previously identified contamination pollutant linkages and specifically based on contaminants of concern highlighted within the DTSR Report. Sample rationale is detailed in the subsequent table.

Source/ Location	Hole ID	Sample Depth (mbgl)	Analysis	Rationale for Sample/ Analysis
Area of the site previously occupied by the travelling crane	WS1	0.30	Asbestos Screen, TPH, PAHS, BTEX, MTBE and heavy metals	Samples from the area previously developed for the use of a travelling crane within a cement works, samples from the Made Ground and therefore representing the worst case scenario.
	WS2			
Coverage of site area	WS1	0.60	TPH, PAHS, BTEX, MTBE and heavy metals	Samples from upper natural soils to assess any downward migration of contaminants.
	WS2	0.80		
Coverage of site area	WS3 / WS4	0.30	Asbestos Screen, TPH, PAHS, BTEX, MTBE and heavy metals	Samples taken from Made Ground soils representing likely worst case scenario.

Screening Criteria

The results of this laboratory testing have been compared to published guidance criteria, widely referred to by consultants and Regulatory Authorities within the industry, and include the following:

The UK Soil Guideline (SGVs) for selected metals, BTEX and phenols, produced by the EA and the Department of Environment, Food and Rural Affairs (DEFRA), 2009;

Suitable 4 Use Levels (S4ULs) Generic Assessment Criteria (GAC) for 82no. contaminants developed by the Chartered Institute of Environmental Health (CIEH) in partnership with Land Quality Management Ltd (2015). It is anticipated that this screening criteria will be applied by the Local Authorities, but it should be noted that the CIEH S4ULs have not been issued through the EA or DEFRA;

A further set of GAC for 35no. mainly organic contaminants not already covered by SGV or S4ULs produced by the CIEH and published by Contaminated Land: Applications In Real Environments (CL:AIRE) in conjunction with the Association of Geotechnical and Environmental Specialists (AGS) and the Environmental Industries Commission (EIC), 2010; and,

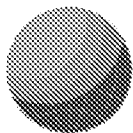
Provisional Category 4 Screening Levels (pC4SL) for lead, which have been produced by CL:AIRE (2014).

Comparisons were made against guidance criteria for the 'Commercial land use setting, based on the end use of the site and the fact that areas of soft landscaping are proposed as shared spaces. Results were compared to the conservative 1.00% soil organic matter values unless otherwise stated.

8.2.2 Soil Results

A summary of soil results is presented in the following tables, with a discussion of results below.

Organic Matter and Asbestos



Organic matter content ranged from <0.10 - 3.60%. Following the asbestos screen, asbestos was not identified within any of the analysed samples.

Heavy Metals

All determinands were found to be significantly below the relevant GAC values. Additionally, the results returned were only slightly elevated against 'background' levels.

PAHs

Levels of PAH returned were significantly below the GAC thresholds and generally below the laboratory limit of detection. The exception to this is WS4 at 0.30m which recorded several PAH species above 'background' concentrations; this is possibly related to ash material in the soil which is noted to have been described as 'grey, brown'.

TPH

Recorded values were almost entirely below the laboratory limits of detection. The exception is WS4 0.30m, where the Aromatic ranges >C12 – C35 recorded slightly elevated values, albeit that these are several orders of magnitude below the GAC values.

BTEX/ MTBE

All returned values were below the laboratory limits of detection and therefore significantly below the GAC thresholds.

Full laboratory test results can be found in Appendix D.

9.0 DISCUSSION OF GROUND CONDITIONS

9.1 Soil Engineering Properties

Current proposals are for the construction of a new detached portal framed industrial unit, within the eastern portion of the site.

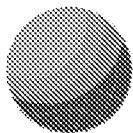
9.1.1 – Surface Cover and Made Ground

Window sample and trial pit locations were completed within the car parking area which was surfaced by concrete hardstanding of 100-150mm thickness, generally recorded with one layer of 8mm diameter steel mesh reinforcement.

The surface material to BH1 was recorded as Dark brown sandy Silt with numerous roots to a depth of 0.20mbgl.

Subsequent soils in BH1, and the subbase to the concrete slab elsewhere were recorded as light brown / grey brown sandy Gravel or Sand and Gravel. The gravel component was described as flint and locally concrete. This material ranged in thickness from 50-450mm and was encountered to a maximum depth of 0.50mbgl.

Further Made Ground soils were described in WS1, WS3 and WS4 and were described as reworked grey brown gravelly sandy Clay / Silt, with the gravels described as concrete. This material was described to a maximum depth of 0.90mbgl.



9.1.2 -- Raised Marine Deposits

The initial natural soil across the site is described as a variable cohesive deposit which is a slightly variable orange brown / grey / greenish grey locally slightly gravelly, slightly organic silty Clay, generally firm consistency; where the gravels are of flint. The base depth of this material varied from 0.80m to >2.00mbgl.

Within BH1 and WS1, a subsequent horizon in this stratum was recorded as firm to stiff consistency buff / light brown very gravelly Silt / Clay. The gravels were described as chalk. Locally this material was described as a very clayey / silty Gravel.

Within WS1 only a further horizon within the Raised Marine Deposits was recorded, described as dark grey mottled very gravelly, sandy, organic Silt to a maximum depth of 2.90mbgl.

Insitu testing results within the superficial soils recorded variable values, which is considered to be reflective of the variable composition of the soils. Generally, however, the SPT N-values are reflective of low strength material comprising soft / loose materials.

Laboratory testing of these variable soils has indicated highly variable plasticity indices, with results including both high and low plasticity classifications. Similarly, the shrinkage potential of the soils, in accordance with NHBC guidance indicates variable classification, albeit that a medium shrinkage potential is considered most appropriate for design purposes.

9.1.3 -- Lewes Nodular Chalk

The chalk was initially described within BH1 and WS1-3 to be recovered in a Structureless condition as a silty Gravel / gravelly Silt. Gravels were described as very weak, low density chalk.

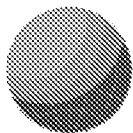
Below a depth of 7.00mbgl within BH1, the intact chalk clasts recovered were described as weak to medium strong. Nodular flint seams were estimated to be present at medium to wide spacings on the basis of the arisings soils from BH1

Insitu testing indicates relatively low strength within the Chalk bedrock to a depth of ~6.00mbgl with SPT N-values of N=9-21 which would be considered to be representative of highly weathered and structureless Chalk. Below 7.50mbgl SPT N-values are consistently N>35, with those below 9.00 N>50. This would be considered to be indicative of the depth to less weathered / intact Chalk.

Saturation Moisture Content testing of the Chalk indicates it is a medium density material. These results should be treated with a degree of caution as the substrate was disturbed by the drilling process and therefore may be an underestimate.

9.1.4 -- Groundwater

Groundwater readings recorded during drilling and the subsequent monitoring rounds indicate levels of 2.20-2.40mbgl.



9.2 Shallow Foundations

The Made Ground soils encountered across the site would not be considered suitable as a bearing stratum; soils of this origin are frequently present in a weak and variable condition such that unacceptable settlement would be anticipated even under light loading intensities.

Additionally, the upper superficial soils encountered within this investigation are of variable, but generally, low strength. It is expected that spread foundations would likely span over soils of variable composition and with variable consolidation characteristics. As a consequence, spread type foundations are not considered viable for the development and a piled foundation should be considered.

9.3 Deep Foundations

Piled foundations are considered to be the most suitable for the new development, it is envisaged that a CFA type pile will be most prudent as this will overcome issues with sloughing to the sides of the excavation through the upper superficial soils and will cause relatively little disturbance to neighbouring properties.

It is expected that pile foundations of 10-12m in length would be suitable on the basis of the ground conditions encountered, a table of safe working loads for outline pile layout design only is presented below:

Pile Length (m)	Safe Working Load	
	300mm	450mm
12.00m	1250	1800

The above figures are offered based on the following:

- No shaft friction within the upper 3.00m to account for pile sleeving through shrinkable soils
- Piles are installed from current ground levels
- Groundwater conditions are controlled during the installation of the piles, using casing or CFA techniques
- A factor of safety of 3 against both shaft friction and end bearing capacity
- Piles in pile groups are installed at correct minimum distances from one another, or designed accordingly

It is possible that pile groups may be required as part of final pile designs. The total working loads of a pile group may be considerably less than the separate totals combined, as a result of interaction of the piles.

Once the full development design and layout plans including anticipated loadings are known then it is recommended that a piling contractor is consulted to confirm the most appropriate pile design and construction methods. Actual design working loads will be dependent on the type of pile and installation method.

The ground conditions should be assessed prior to piling for piling mat designs, particularly where soft/ loose soils or Made Ground soils are encountered.

In response to the presence of variably low to high shrinkage potential soils, compressible material should be incorporated around the sides ground beams in accordance with NHBC guidance. Pile sleeving should also be considered within the shrinkable soils around the zone of tree root influence.

9.4 Floor Slabs

The floor slab design will depend on the final foundation designs and is dependent on the underlying materials, including bearing capacity and the presence of any cohesive or Made Ground Soils.

Laboratory testing results indicate that a medium shrinkage potential classification would be appropriate for the upper Raised Marine Deposit soils. Whilst it may prove impractical to include for a suspended floor, consideration should be given to the construction of a suitably thick subbase to overcome issues regarding volume change of cohesive soils. The design of such a floor should be completed by a structural engineer.

9.5 Excavations and Groundwater

It is likely that excavations of less than 1.20mbgl may require support to their faces due to the variable composition of the Made Ground. Should excavations be taken below this then adequate support should be provided in order to satisfy statutory safety regulations.

Groundwater has been identified up to 2.20mbgl during site works.

Therefore, any excavation made below groundwater levels on site is expected to be subject to the inflow of groundwater which is expected to result in the further instability of excavation faces, particularly where granular soils are encountered. It is strongly recommended that provision is made in the specification of ground works for dewatering.

If groundwater is identified within any of the excavations during the construction phase then it should be dealt with appropriately and removed using good engineering practices.

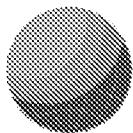
9.6 Retaining Structures

The design of any temporary retaining structures to support excavation faces should be made assuming the following moderately conservative parameters:

Material	Effective angle of friction (ϕ')	Effective Cohesion; c' (kPa)	Bulk Density kN/m^3
Made Ground	24	0	16
Raised Marine Deposits	23-24	0	18

9.7 Aggressive Chemical Environment to Concrete

Sulphate concentrations within the Made Ground and Natural soils were found to range from <10mg/l to 380mg/l and pH levels were noted to range from 7.6 to 11.7 suggesting that a design class of DS-1 and a sub class of AC-1 should be adopted for buried concrete structures within these soils, (Reference made to current BRE SD1 Guidelines) based on the soils tested.



10.0 GEO-ENVIRONMENTAL DISCUSSION

10.1 Discussion of Findings

10.1.1 Investigation Rationale

The preliminary CSM (DTS Raeburn LTD (DTSR) in June 2020 (Ref: E13353/1)) identified a number of potential contamination linkages associated with the onsite and off-site present and historical land use. The assigned risk levels to human health and controlled waters were consistently 'Low to Moderate'.

Based on the PRA findings, it was deemed that a GQRA would be required in order to assess the potential pollutant linkages identified.

The aims of the GQRA were to: establish any impact due to contaminated Made Ground and the former travelling crane; and establish the ground gas risk.

10.1.2 Significance of Soil Testing Results

No exceedances of the GAC thresholds were identified within the soils tested, with values recorded significantly below the guidance levels for the proposed commercial setting. No significant visual or olfactory evidence of contamination was observed during intrusive works.

No asbestos was identified through screening.

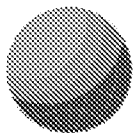
Slight elevations of Lead were recorded in the Made Ground in WS1, and of PAH and TPH in the Made Ground of WS4. Those samples tested from natural soils recorded results which would be considered congruent with natural soils.

Groundwater analysis was not completed as part of the investigation, despite the Preliminary Risk Assessment identifying a 'Low to Moderate' Risk to Groundwater and Surface waters. The following justification is provided for the omission of this testing:

- The testing of soils has identified only minor elevations of common contaminants that could be expected based on the industrial land use with no exceedances of the GAC.
- No evidence of vertical migration of contaminants was identified.
- Whilst the site is acknowledged to be situated over a superficial Secondary A Aquifer and subsequently Principal Bedrock Aquifer, the site is not located within a source protection zone or within 250m of a potable water abstraction; therefore the vulnerability of the aquifer is limited.
- A surface water feature, albeit culverted, forms the northwestern site boundary. Whilst the vulnerability of this feature is acknowledged, it flows through an industrial estate, which is to continue to operate; therefore, the regional impact to this water feature is likely to be more significant than that of the site itself.

10.1.3 Ground Gas Regime

The site has been classified as Characteristic Situation 1 following the ground gas monitoring regime, based on a calculated GSV of 0.032L/hr. Therefore, the site is considered to have a **Low** risk from ground gas. As a result, no special precautions with respect to ground gas mitigation are required within the design of the proposals.



10.2 Refined Conceptual Site Model and Risk Assessment

The refined Conceptual Site Model (CSM) has been formulated in accordance with BS EN ISO 21365:2019 *Soil Quality – Conceptual Site Models for Potentially Contaminated Sites* and following information collated within the Site Investigation conducted and is intended to complete the GQRA, in accordance with LCRM 2020. In summary, the preliminary CSM identified the following sources of contamination:

1. Potential Made Ground associated with historical site use of site
2. Previous use of eastern section for travelling cranes.
3. Various industrial uses within 500m of the site.
4. Historic landfill within 250m of the site.

Following the GQRA undertaken on site to date, including soil laboratory testing and ground gas monitoring, the risks from the identified potential sources of contamination to relevant receptors are considered to be **Low**. This is defined as, 'the site should be considered suitable for the present or future use and environmental setting. Contaminants may be present but unlikely to have unacceptable impact on key targets'. As such, whilst pollutant linkages were addressed and identified with the Preliminary CSM, these do not need to be further refined.

11.0 GEO-ENVIRONMENTAL RECOMMENDATIONS

The following recommendations are based on the plans proposed at the time of writing this report and may be subject to change.

The design of the site investigation incorporated information from previous reports along with consideration of the preliminary development plans. Potential contamination sources were investigated as far as reasonably practicable and within the permitted timeframe.

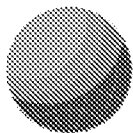
Following the investigation to date, a **Low** risk has been identified to the site from potential sources of contamination. Consequently, no specific requirements are needed for contaminated soil/ground gas mitigation within the design of the proposals. Moreover, a Remediation Options Appraisal and Remediation Strategy are not specifically mandatory. Nevertheless, some basic recommendations have been made for the purposes of due diligence.

11.1 Watching Brief

A watching brief should be maintained on site, particularly during ground works. This must be undertaken as part of good working practices and in case there are any areas of unidentified contamination.

During any ground works, an appraisal of the exposed soils should be made by the on-site manager or developer's nominated person. If any material is noted to show visual and/or olfactory sign of contamination this material should be stockpiled separately and tested prior to its appropriate removal off site or re-use where necessary. A suitably qualified environmental specialist should be contacted to advise what further investigation is required.

The on-site manager / developer's nominated person should be able to display the relevant level of qualification and/or experience in managing construction works on contaminated land.



11.2 Services

It would be recommended that barrier type pipework is used within this development for potable water supply, in line with current best practice.

It is recommended the services are situated within lined trenches. The trenches should be lined with a geotextile membrane and backfilled with clean fill, such as pea shingle, which will demarcate the services from the surrounding soils, protecting both the services and the future maintenance workers.

11.3 Decommissioning of Monitoring Wells

The client or site owner should ensure that the installed monitoring wells and their protective covers are not damaged or covered until such time as data is no longer required from them. Additional costs may be incurred if it is necessary to reinstate damaged wells.

Nevertheless, the monitoring wells installed on site will require eventual decommissioning. IGL should be consulted prior to decommissioning. This process should be completed in accordance with the EA's (2012) guidance document 'Good Practice for Decommissioning Redundant Boreholes and Wells'.

The above referenced document provides the following guidance - The ground should be restored as closely as possible to its pre-drilled condition. The well should be backfilled with clean (washed), uncontaminated materials so that the permeability of the selected materials are similar to the properties of the geological strata against which they are placed. The backfilled well will then mimic the surrounding natural strata and groundwater flow, and quality will be protected.

11.4 Statutory Consultees

We would recommend that this report be forwarded to the relevant Statutory Consultees including the Local Council's Environmental Health and Planning Department to seek their comments and subsequent approval prior to works commencing on site.

APPENDICES

Appendix A – Site Plan

Appendix B – Stratigraphic Logs

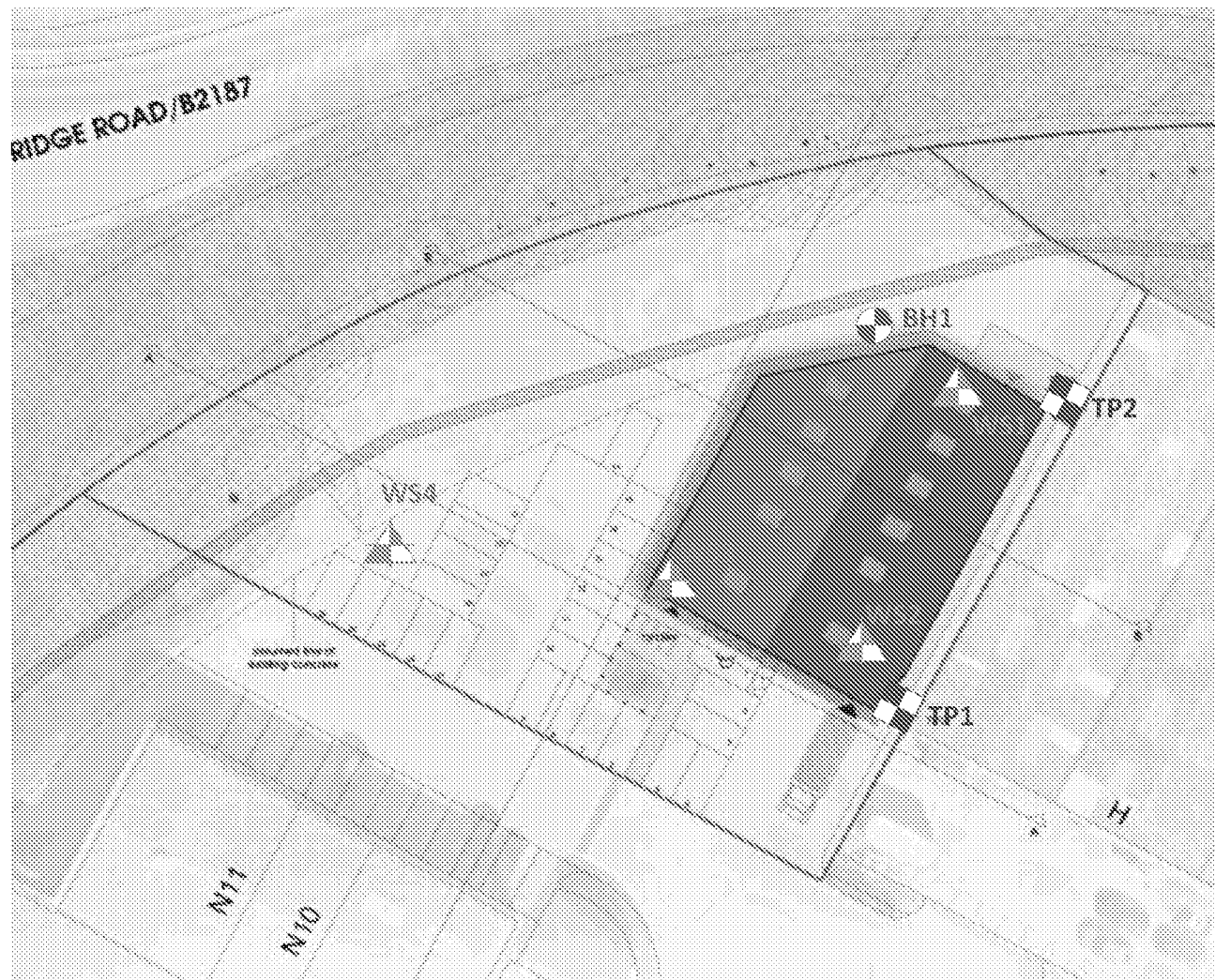
Appendix C – Photographs

Appendix D – Laboratory Certificates

Appendix E – Monitoring Results

APPENDIX A

Site Plan



Notes:

1. Do not scale from this drawing.
2. All dimensions must be checked on site prior to commencement of work.
3. Where applicable this drawing is to be read in conjunction with other consultants drawings.
4. This drawing is the copyright of Impact Geotechnical Ltd.

AFUN DISTRICT COUNCIL LU/407/21/DOC

Drawing Title:

Site Investigation Plan

Project Reference:

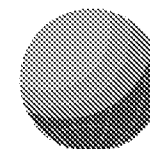
P21.152

Site Name:

Riverside Industrial
Estate

Revision: 0

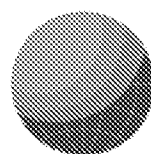
Drawn by: GC
Scale: Not to Scale



IMPACT
GEOTECHNICAL

APPENDIX B

Stratigraphic Logs



IMPACT
GEOTECHNICAL



Percussion Drilling Log

Project Name: Riverside Industrial Estate		Client: LCP Property		Date: 26/04/2021 - 27/04/2021	
Location: Littlehampton, West Sussex		Contractor: IGL			
Project No. : P21.152		Crew Name:		Drilling Equipment:	
Borehole Number BH1	Hole Type CP	Level	Logged By GC	Scale 1:50	Page Number Sheet 1 of 2

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	ES		0.20			MADE GROUND Dark brown sandy Silt. Sand is fine to Coarse. Numerous Roots.	
		0.70	ES		0.60			MADE GROUND Light grey sand and gravel. Sand is medium to coarse. Gravel is sub-angular to sub-rounded fine to coarse sized concrete.	
		1.50	D		1.50			Firm consistency orange brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is sub-angular to sub-rounded fine to coarse sized flint.	1
		1.50	ES						
		1.50	SPT	N=12 (1,4/3,3,3,3)				Firm to stiff consistency buff off white mottled brown very gravelly very SILT / CLAY. Sand is fine to coarse. Gravel is sub-angular to sub-rounded fine to coarse sized Chalk. Locally silty / clayey Gravel.	2
		2.50	D		2.60			Recovered as: Structureless CHALK Composed of off white and locally light brown silty Gravel / Gravelly Silt. Gravel is sub-angular to sub-rounded fine to coarse sized Chalk. Medium to widely spaced nodular rinded flint.	3
		2.50	SPT	N=4 (1,2/1,1,1,1)					
		3.50	D						4
		3.50	SPT	N=13 (1,2/1,2,5,5)					
		4.50	D						5
		4.50	SPT	N=11 (2,3/2,1,4,4)					
		5.50	D						6
		6.00	D						
		6.00	SPT	N=14 (3,2/3,4,3,4)					

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks Hand Excavated pit to 1.00mbgl. Groundwater encountered at 2.30mbgl										
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Percussion Drilling Log

Project Name: Riverside Industrial Estate		Client: LCP Property		Date: 26/04/2021 - 27/04/2021	
Location: Littlehampton, West Sussex		Contractor: IGL			
Project No. : P21.152		Crew Name:		Drilling Equipment:	
Borehole Number BH1	Hole Type CP	Level	Logged By GC	Scale 1:50	Page Number Sheet 2 of 2

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		10.50 10.50	D SPT	N=50 (25 for 105mm/50 for 60mm)				Recovered as: Structureless CHALK Composed of off white and locally light brown silty Gravel / Gravelly Silt. Gravel is sub-angular to sub-rounded fine to coarse sized Chalk. Medium to widely spaced nodular rinded flint.	11
		11.50	D						
		12.00 12.00	D SPT	N=50 (25 for 75mm/50 for 180mm)					12
		13.00	D						13
		13.50 13.50	D SPT	N=50 (25 for 75mm/50 for 105mm)					14
		14.50	D						
		15.00 15.00	D SPT	N=50 (25 for 105mm/50 for 150mm)					15
		16.00	D						16
		16.50 16.50	D SPT	N=50 (25 for 75mm/50 for 95mm)					17
		17.50	D						
		18.00 18.00	D SPT	N=50 (25 for 75mm/50 for 95mm)					18
		19.00	D						19
		19.50 19.50	D SPT	N=50 (25 for 75mm/50 for 135mm)					
					20.00			End of Borehole at 20.000m	20

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks Hand Excavated pit to 1.00mbgl. Groundwater encountered at 2.30mbgl										
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Percussion Drilling Log

Project Name: Riverside Industrial Estate		Client: LCP Property		Date: 26/04/2021	
Location: Littlehampton, West Sussex		Contractor: IGL			
Project No. : P21.152		Crew Name:		Drilling Equipment:	
Borehole Number WS1	Hole Type WLS	Level	Logged By GC	Scale 1:50	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10			0.10			Concrete	
		0.20			0.20			MADE GROUND Light grey sand and gravel. Sand is medium to coarse. Gravel is sub-angular to sub-rounded fine to coarse sized concrete.	
		0.30	ES		0.30			MADE GROUND Reworked grey sandy Silt. sand is fine to medium. Scattered sub-angular to sub-rounded medium to coarse sized flint and concrete gravel.	1
		0.60	ES		0.60			Firm consistency orange brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is sub-angular to sub-rounded fine to coarse sized flint.	
		1.00	D		1.00			Firm to stiff consistency buff off white mottled brown very gravelly very SILT / CLAY. Sand is fine to coarse. Gravel is sub-angular to sub-rounded fine to coarse sized Chalk. Locally silty / clayey Gravel.	2
		1.00	SPT	N=20 (1,4/4,5,5,6)	1.00			<u>Thin bed of silty sandy Clay.</u>	
		1.50	D		1.50			Firm and locally soft consistency dark grey mottled very gravelly sandy organic SILT. Gravel is sub-angular to sub-rounded medium to coarse sized Chalk. organic odour.	3
		2.00	D		2.00			Structureless CHALK Composed of pale grey and locally off white silty Gravel and locally gravelly Silt. Gravel is sub-angular to sub-rounded, medium to coarse sized chalk.	4
		2.00	SPT	N=6 (1,1/1,1,2,2)	2.00				
		2.30	ES		2.30				
		2.90	D		2.90				
		3.00	SPT	N=12 (5,5/5,3,2,2)	3.00				
		3.50 - 4.00	D		3.50 - 4.00				
		4.00	SPT	N=11 (3,3/3,3,3,2)	4.00				
		4.50 - 5.00	D		4.50 - 5.00				
		5.00	SPT	N=9 (3,3/2,2,2,3)	5.00			End of Borehole at 5.000m	5
									6
									7
									8
									9
									10

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks Hand Excavated pit to 1.00mbgl. Groundwater encountered at 2.40mbgl										
--	--	--	--	--	--	--	--	--	--	---



Percussion Drilling Log

Project Name: Riverside Industrial Estate		Client: LCP Property		Date: 26/04/2021	
Location: Littlehampton, West Sussex		Contractor: IGL			
Project No. : P21.152		Crew Name:		Drilling Equipment:	
Borehole Number WS2	Hole Type WLS	Level	Logged By GC	Scale 1:50	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.10			Concrete. 1 layer of 8mm diameter steel reinforcement.	
		0.40	ES		0.55			MADE GROUND Light brown Sand and Gravel. Sand is Medium to coarse. Gravel is sub-angular to sub-rounded fine to coarse sized flint.	
		0.80	ES					Firm consistency greenish grey mottled slightly sandy slightly organic SILT / CLAY. Sand is fine to medium.	1
		1.00	D						
		1.00	SPT	N=8 (1,0/2,2,2,2)					
		1.50	ES		1.40				
		2.00	D						
		2.00	SPT	N=5 (1,1/1,1,2,1)					2
		2.50 - 3.00	D						
		3.00	SPT	N=6 (1,1/1,1,2,2)					3
		3.50 - 4.00	D						
		4.00	SPT	N=10 (2,4/3,3,2,2)					4
		4.50 - 5.00	D						
		5.00	SPT	N=21 (4,3/6,7,5,3)	5.00				5
								End of Borehole at 5.000m	
									6
									7
									8
									9
									10

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks										
Hand Excavated pit to 1.00mbgl. Groundwater encountered at 2.20mbgl										
COUNCIL LU/407/21/DOC										



Percussion Drilling Log

Project Name: Riverside Industrial Estate		Client: LCP Property		Date: 26/04/2021	
Location: Littlehampton, West Sussex		Contractor: IGL			
Project No. : P21.152		Crew Name:		Drilling Equipment:	
Borehole Number WS3	Hole Type WLS	Level	Logged By GC	Scale 1:50	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	ES	N=8 (1,1/2,2,2,2)	0.15			Concrete. 1 layer of 8mm diameter steel reinforcement.	
		0.70	ES		0.40			MADE GROUND Grey brown Sand and Gravel. Sand is Medium to coarse. Gravel is sub-angular to sub-rounded fine to coarse sized flint.	
		1.00	D		0.90			MADE GROUND Grey sandy gravelly Cobbley Clay. Sand is fine to coarse. Gravel is sub-angular to sub-rounded medium to coarse sized concrete. Cobbles are of concrete.	
		1.00	SPT					Firm consistency greenish grey mottled slightly sandy slightly organic SILT / CLAY. Sand is fine to medium.	
		1.30	ES					Becoming soft consistency brown mottled pale grey at 1.20m	
		1.50	D	N=2 (1,1/1,0,1,0)	1.90			Recovered as: Structureless CHALK Composed of off white and locally light brown silty Gravel / Gravelly Silt. Gravel is sub-angular to sub-rounded fine to coarse sized Chalk.	
		2.00	D						
		2.00	SPT						
		2.50 - 3.00	D	N=6 (1,1/1,2,1,2)					
		3.00	SPT						
		3.50 - 4.00	D						
		4.00 - 5.00	D	N=11 (1,2/2,2,2,5)					
		4.00	SPT						
									
				5.00	SPT	N=15 (4,3/6,4,3,2)	5.00		



Percussion Drilling Log

Project Name: Riverside Industrial Estate		Client: LCP Property		Date: 26/04/2021	
Location: Littlehampton, West Sussex		Contractor: IGL			
Project No. : P21.152		Crew Name:		Drilling Equipment:	
Borehole Number WS4	Hole Type WLS	Level	Logged By GC	Scale 1:50	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	ES	N=9 (1,2/2,3,2,2)	0.15			Concrete. 1 layer of 8mm diameter steel reinforcement.	1
		0.60	ES		0.50			MADE GROUND Grey brown Sand and Gravel. Sand is Medium to coarse. Gravel is sub-angular to sub-rounded fine to coarse sized flint.	
		1.00	D		0.90			MADE GROUND Brown grey mottled slightly gravelly sandy Clay. Sand is fine to coarse. Gravel is sub-angular to sub-rounded fine to coarse sized flint and concrete.	
		1.00	ES		Stiff consistency brownish grey mottled slightly sandy silty CLAY. Sand is fine.				
		1.00	SPT						
		1.50	D	N=3 (1,0/1,1,0,1)	2.00		Becoming soft consistency at 1.80m	2	
		2.00	D				End of Borehole at 2.000m		
		2.00	SPT						

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks										
Hand Excavated pit to 1.00mbgl. No Groundwater encountered										
COUNCIL LU/407/21/DOC										



IMPACT
GEOTECHNICAL

Trial Pit Log

TP No.
TP1
Sheet 1 of 1

Project Name: Riverside Industrial Estate	Project No P21.152	Co-ords -	Hole Type TP
Location: Littlehampton, West Sussex		Level -	Scale NTS
Client: LCP Property		Date(s) 27/04/2021	Logged By GC

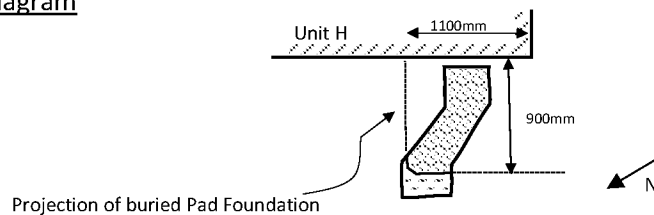
Well	Sample and Insitu Testing			Results	Depth (m)	Level (m ATD)	Legend	Stratum Description
	Water Strikes	Depth(s)	Type					
					0.10			1. Concrete, 1 layer of 8mm diameter steel reinforcement
					0.30			2. MADE GROUND: Light brown Sand and Gravel. Sand is medium to coarse. Gravel is subangular to subrounded, medium to
					1.25			3. Firm greenish grey slightly organic SILT / CLAY
								End of hole at 1.25mbgl

1.0

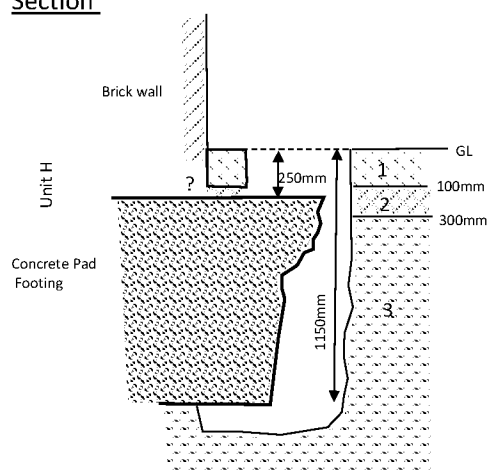
2

TP1 Section Diagram

Plan View



Section



Remarks

No groundwater encountered.



IMPACT
GEOTECHNICAL

Trial Pit Log

TP No.
TP2
Sheet 1 of 1

Project Name: Riverside Industrial Estate	Project No P21.152	Co-ords -	Hole Type TP
Location: Littlehampton, West Sussex		Level -	Scale NTS
Client: LCP Property		Date(s) 27/04/2021	Logged By GC

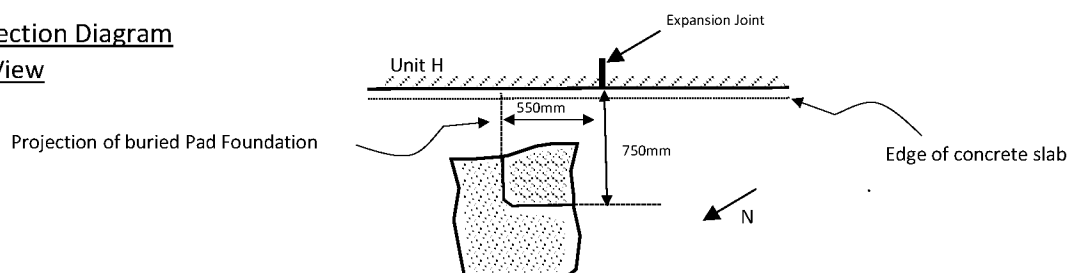
Well	Sample and Insitu Testing			Results	Depth (m)	Level (m ATD)	Legend	Stratum Description
	Water Strikes	Depth(s)	Type					
					0.10			1. Concrete, 1 layer of 8mm diameter steel reinforcement
					0.30			2. MADE GROUND: Light brown Sand and Gravel. Sand is medium to coarse. Gravel is subangular to subrounded, medium to
					0.75			3. Stiff brown slightly gravelly silty CLAY. Gravel is subangular to subrounded, medium to coarse sized flint.
					1.25			4. Medium dense buff sandy Gravel. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse sized chalk.
								End of hole at 1.25mbgl

1.0

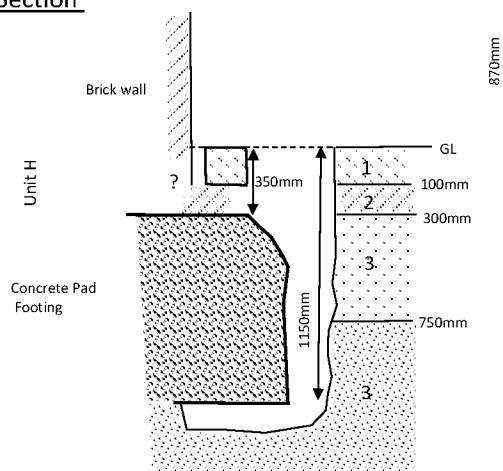
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TP2 Section Diagram

Plan View

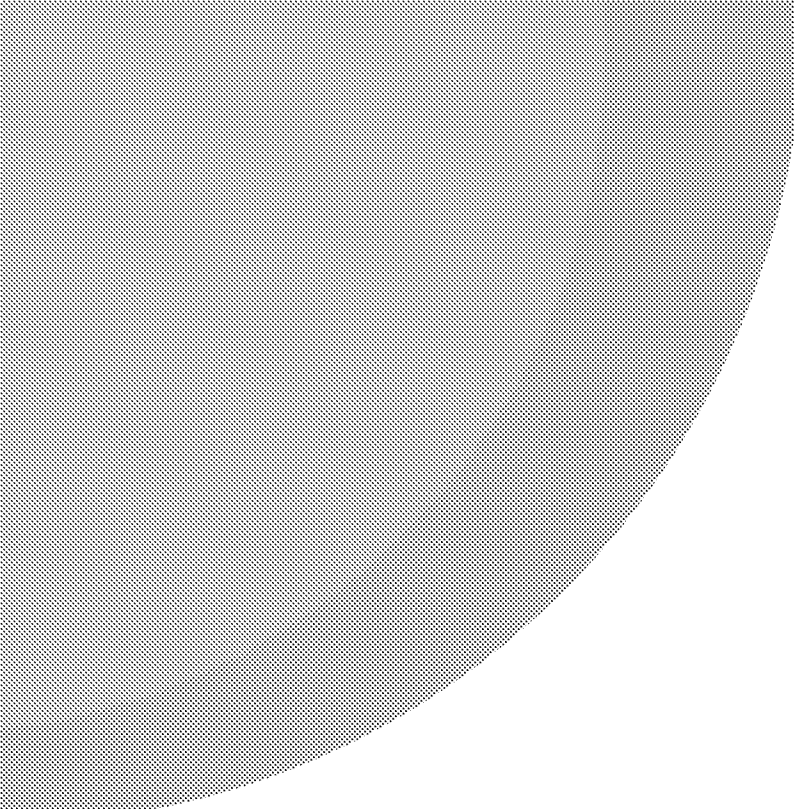


Section



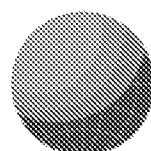
Remarks

No groundwater encountered.



APPENDIX C

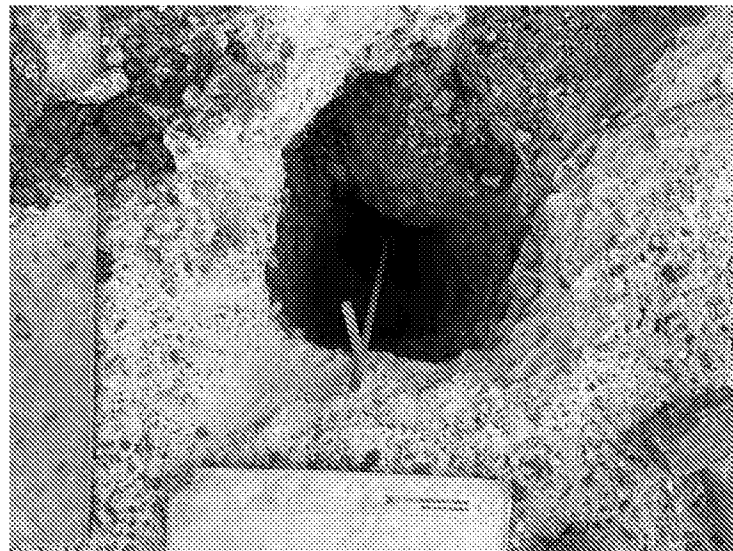
Photographs



1.



2.



3.



4.



Investigation Photographs

Project Ref: P21.152

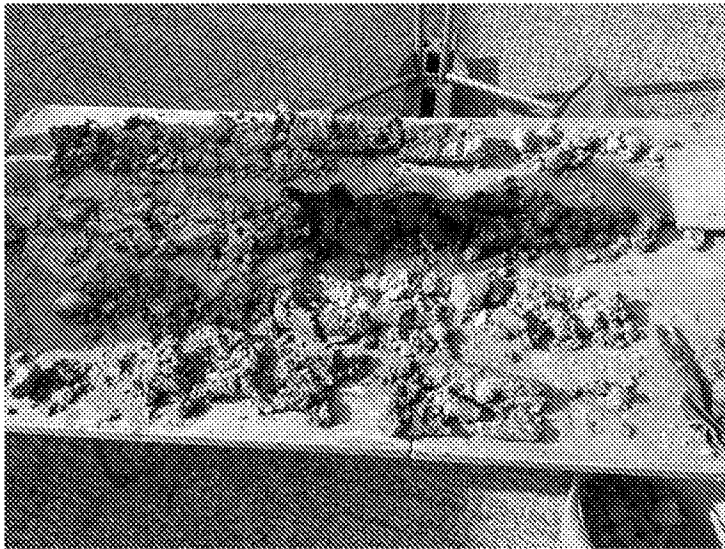
ARUN DISTRICT COUNCIL LU/407/21/DOC

Site Name: Riverside Industrial Estate

1. TP1
2. TP1
3. TP2
4. TP2.



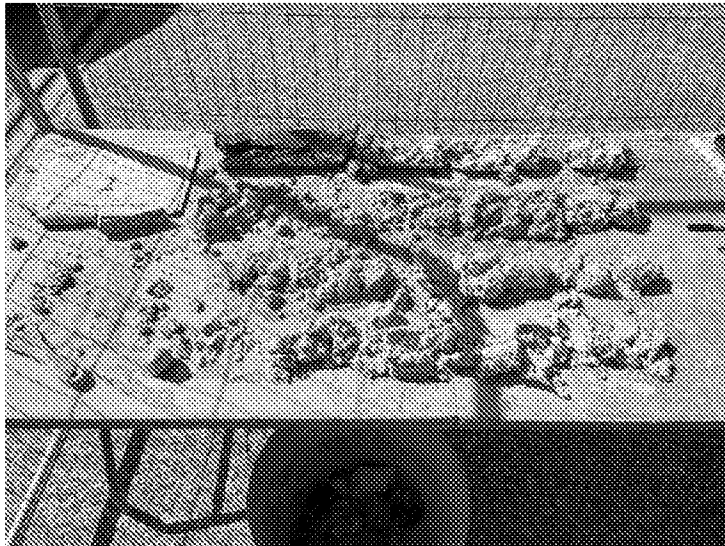
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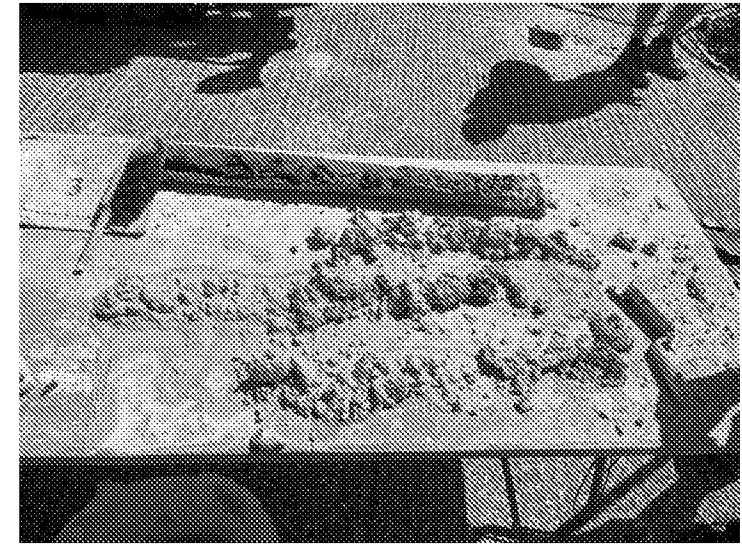
6.



7.



8.



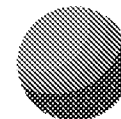
Investigation Photographs

Project Ref: P21.152

ARUN DISTRICT COUNCIL LU/407/21/DOC

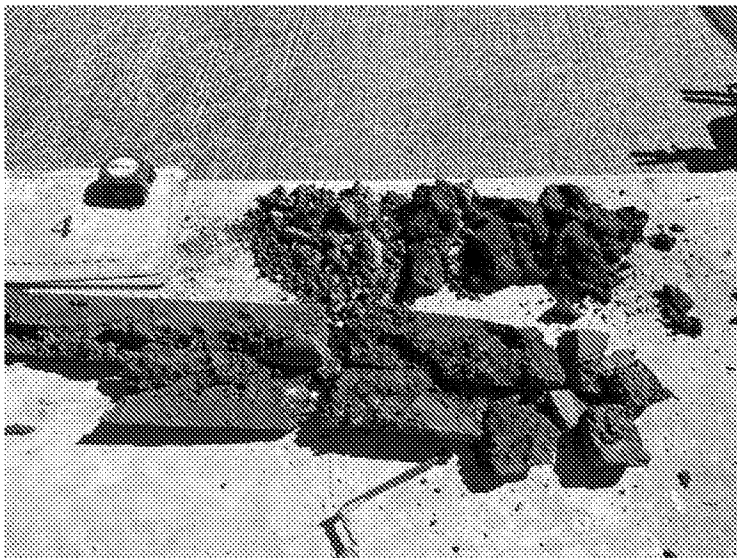
Site Name: Riverside Industrial Estate

5. WS1
6. WS2
7. WS2
8. WS3



IMPACT
GEOTECHNICAL

9.



10.



Investigation Photographs

Project Ref: P21.152

ARUN DISTRICT COUNCIL LU/407/21/DOC

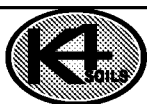
Site Name: Riverside Industrial Estate

9. WS4
10. BH1



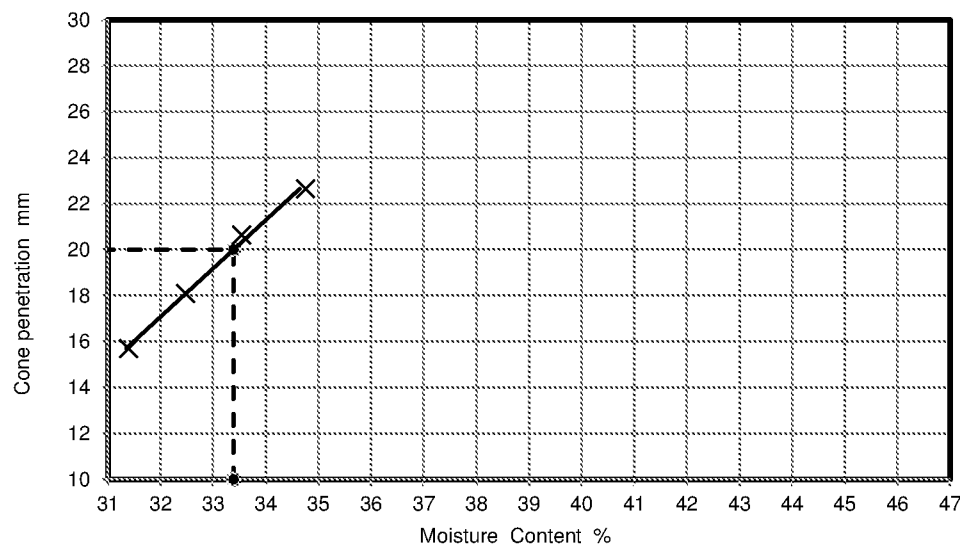
APPENDIX D

Laboratory Certificates



LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

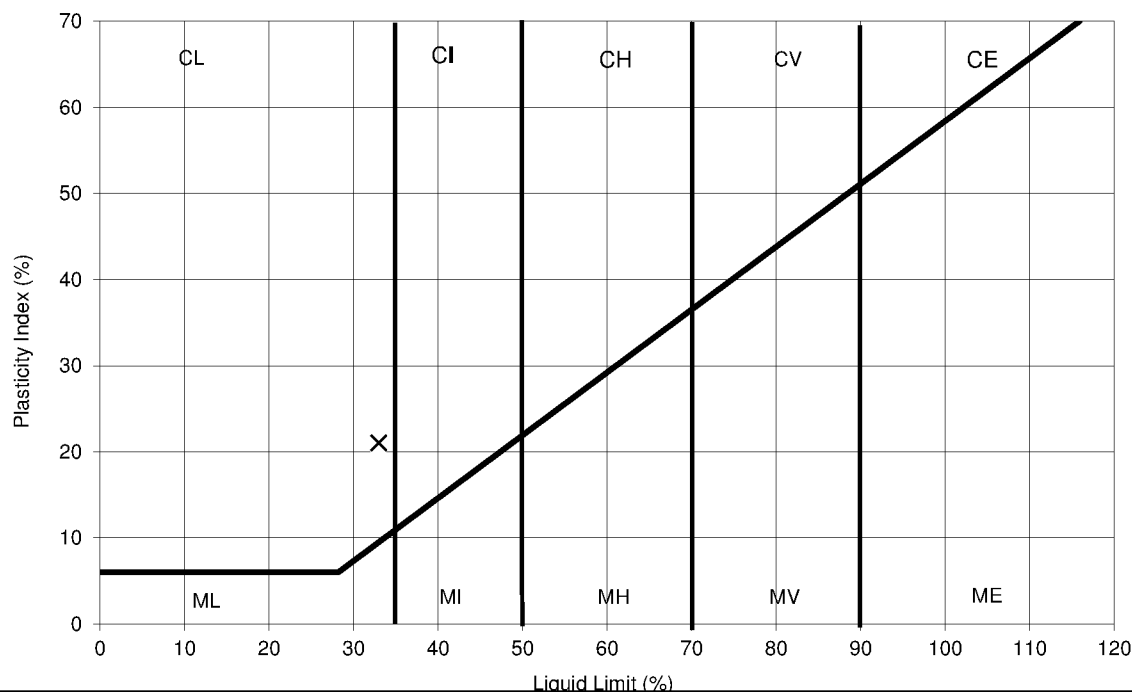
	LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX			Job No.	29990	
				Borehole/Pit No.	WS1	
Site Name	Riverside Industrial Estate			Sample No.	1	
Project No.	P21.152	Client	Impact Geotechnical	Depth Top	1.00	m
Soil Description	Light brown sandy gravelly silty CLAY with calcareous deposits (gravel is fmc and sub-angular to sub-rounded and chalk gravel)			Depth Base	-	m
				Sample Type	D	
				Samples received	27/04/2021	
				Schedules received	02/05/2021	
				Project Started	04/05/2021	
				Date Tested	25/05/2021	



NATURAL MOISTURE CONTENT	18	%
% PASSING 425µm SIEVE	64	%
LIQUID LIMIT	33	%
PLASTIC LIMIT	12	%
PLASTICITY INDEX	21	%

Remarks

PLASTICITY INDEX



TEST METHOD

BS1377: Part 2 :Clause 4.3 : 1990 Determination of the liquid limit by the cone penetrometer method
BS1377: Part 2 :Clause 5.0 : 1990: Determination of the plastic limit and plasticity index
BS1377: Part 2 :Clause 3.2 : 1990:Determination of the moisture content by the oven drying method

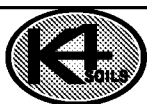
Checked and Approved

Initials: J.P
Date: 27/05/2021

2519

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

MSF-5 R2



LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

Job No. 29990

Borehole/Pit No. WS1

Site Name Riverside Industrial Estate

Sample No. 2

Project No. P21.152 Client Impact Geotechnical

Depth Top 2.00 m

Depth Base 2.45 m

Sample Type ES

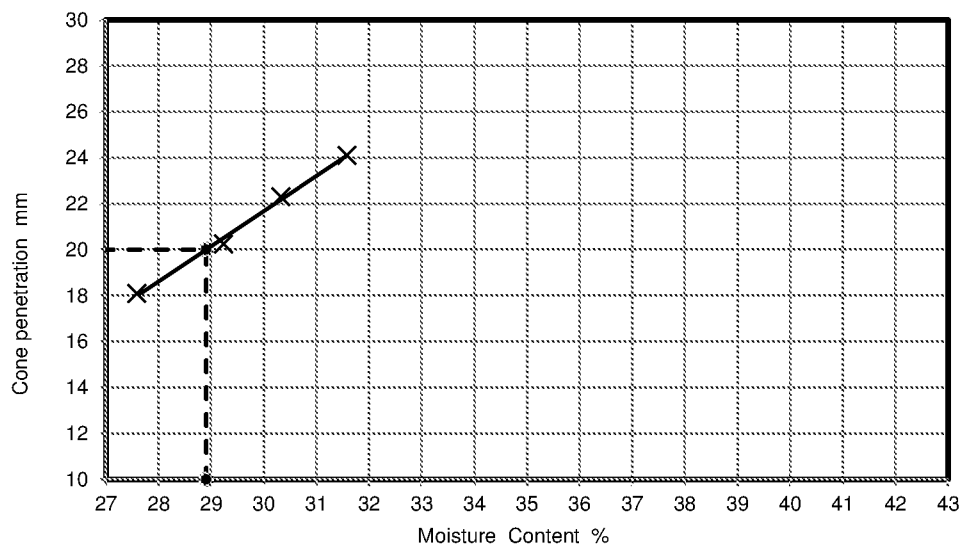
Samples received 27/04/2021

Schedules received 02/05/2021

Project Started 04/05/2021

Date Tested 25/05/2021

Soil Description Off white putty CHALK with fmc sub-angular to angular flint and chalk gravel



NATURAL MOISTURE CONTENT 24 %

% PASSING 425µm SIEVE 36 %

LIQUID LIMIT 29 %

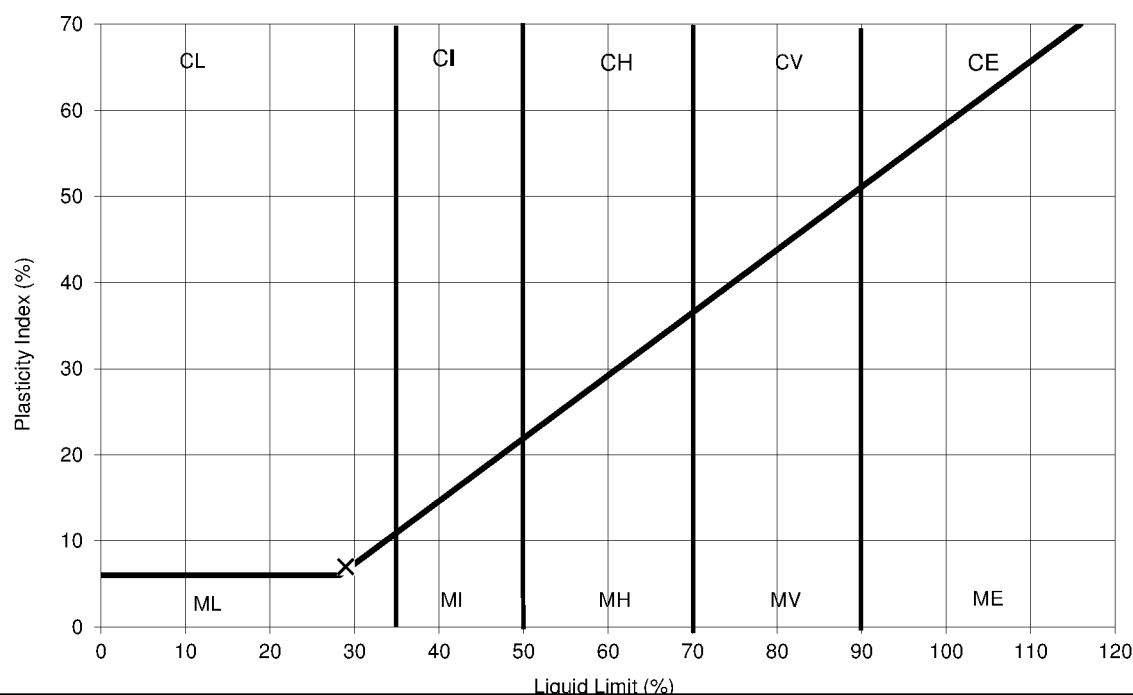
PLASTIC LIMIT 22 %

PLASTICITY INDEX 7 %

Remarks

Sample washed to obtain test fraction

PLASTICITY INDEX



TEST METHOD

BS1377: Part 2 :Clause 4.3 : 1990 Determination of the liquid limit by the cone penetrometer method

BS1377: Part 2 :Clause 5.0 : 1990: Determination of the plastic limit and plasticity index

BS1377: Part 2 :Clause 3.2 : 1990:Determination of the moisture content by the oven drying method

Checked and Approved

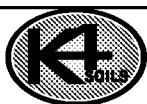
Initials: J.P

Date: 27/05/2021

2519

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

MSF-5 R2



LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

Job No.

29990

Borehole/Pit No.

WS2

Site Name

Riverside Industrial Estate

Sample No.

1

Project No.

P21.152

Client

Impact Geotechnical

Depth Top

1.00

m

Depth Base

-

m

Sample Type

D

Samples received

27/04/2021

Schedules received

02/05/2021

Project Started

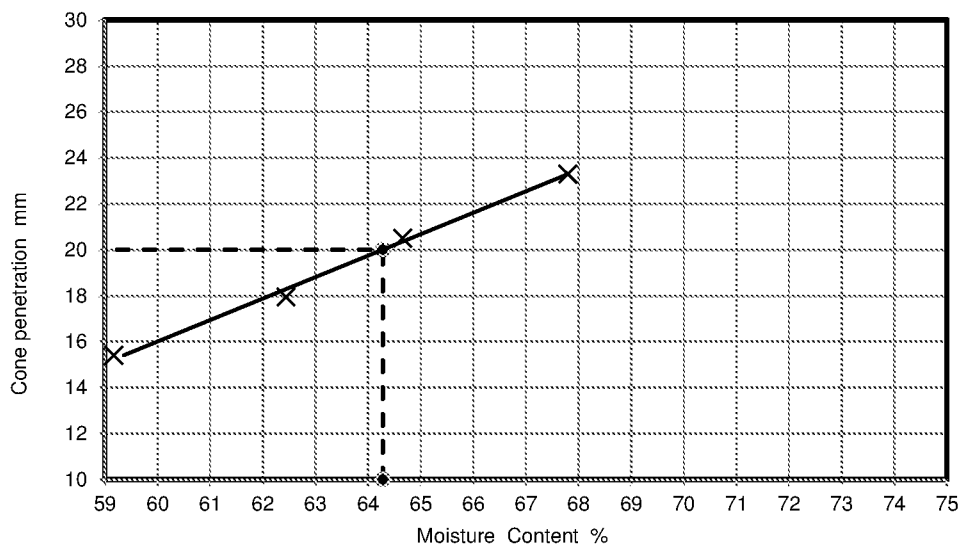
04/05/2021

Date Tested

25/05/2021

Soil Description

Brown mottled dark grey slightly gravelly slightly sandy silty CLAY (gravel is fm and sub-angular to angular)



NATURAL MOISTURE CONTENT

28

%

% PASSING 425µm SIEVE

93

%

LIQUID LIMIT

64

%

PLASTIC LIMIT

20

%

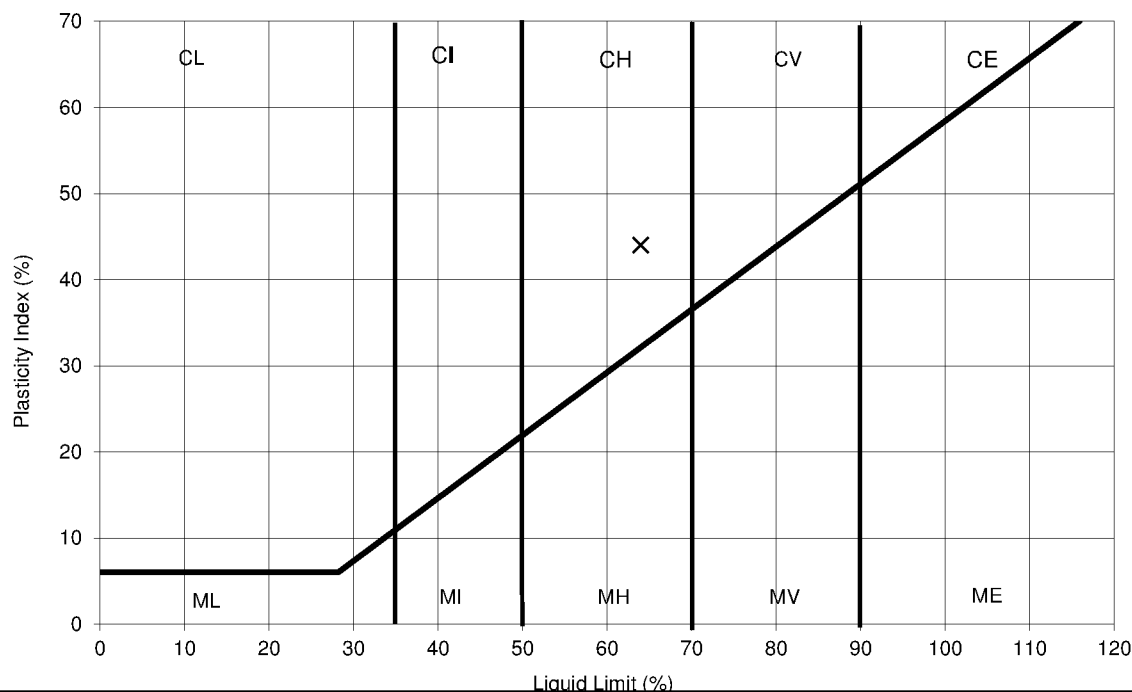
PLASTICITY INDEX

44

%

Remarks

PLASTICITY INDEX



TEST METHOD

BS1377: Part 2 :Clause 4.3 : 1990 Determination of the liquid limit by the cone penetrometer method

BS1377: Part 2 :Clause 5.0 : 1990: Determination of the plastic limit and plasticity index

BS1377: Part 2 :Clause 3.2 : 1990:Determination of the moisture content by the oven drying method

Checked and Approved

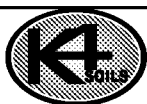
Initials: J.P

Date: 27/05/2021

2519

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

MSF-5 R2



LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

Job No. 29990

Borehole/Pit No. WS3

Site Name Riverside Industrial Estate

Sample No. 1

Project No. P21.152 Client Impact Geotechnical

Depth Top 1.50 m

Depth Base - m

Sample Type D

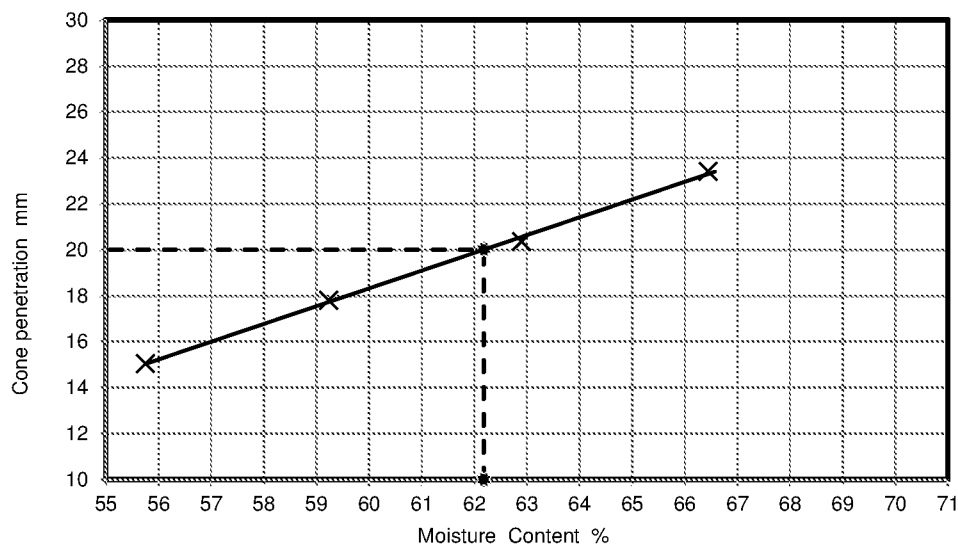
Samples received 27/04/2021

Schedules received 02/05/2021

Project Started 04/05/2021

Date Tested 25/05/2021

Soil Description Brown slightly sandy silty CLAY



NATURAL MOISTURE CONTENT

41 %

% PASSING 425µm SIEVE

100 %

LIQUID LIMIT

62 %

PLASTIC LIMIT

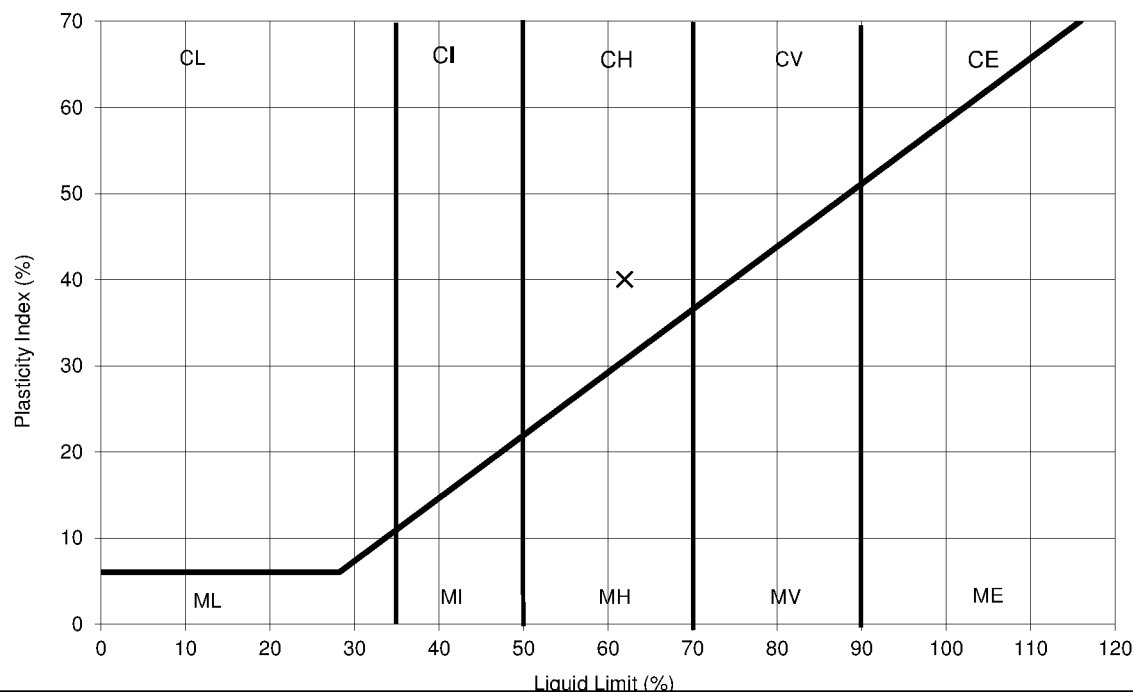
22 %

PLASTICITY INDEX

40 %

Remarks

PLASTICITY INDEX



TEST METHOD

BS1377: Part 2 :Clause 4.3 : 1990 Determination of the liquid limit by the cone penetrometer method

BS1377: Part 2 :Clause 5.0 : 1990: Determination of the plastic limit and plasticity index

BS1377: Part 2 :Clause 3.2 : 1990:Determination of the moisture content by the oven drying method

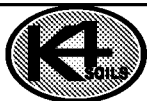
Checked and Approved

Initials: J.P
Date: 27/05/2021

MSF-5 R2



2519



LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

Job No.

29990

Borehole/Pit No.

WS4

Site Name

Riverside Industrial Estate

Sample No.

2

Project No.

P21.152

Client

Impact Geotechnical

Depth Top

1.00

m

Depth Base

-

m

Sample Type

ES

Samples received

27/04/2021

Schedules received

02/05/2021

Project Started

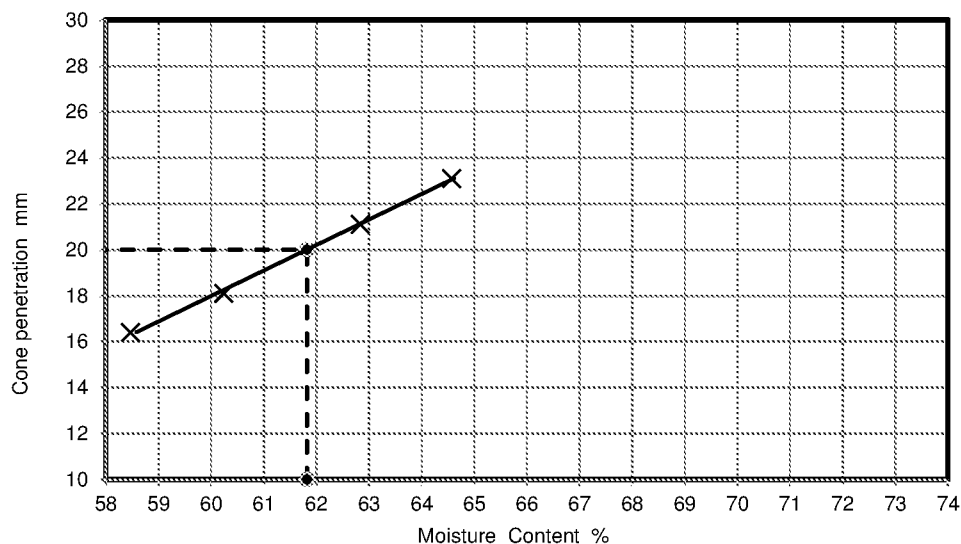
04/05/2021

Date Tested

25/05/2021

Soil Description

Brown and bluish grey slightly gravelly slightly sandy silty CLAY (gravel is fm and sub-angular)


NATURAL MOISTURE CONTENT

31

%

% PASSING 425µm SIEVE

95

%

LIQUID LIMIT

62

%

PLASTIC LIMIT

23

%

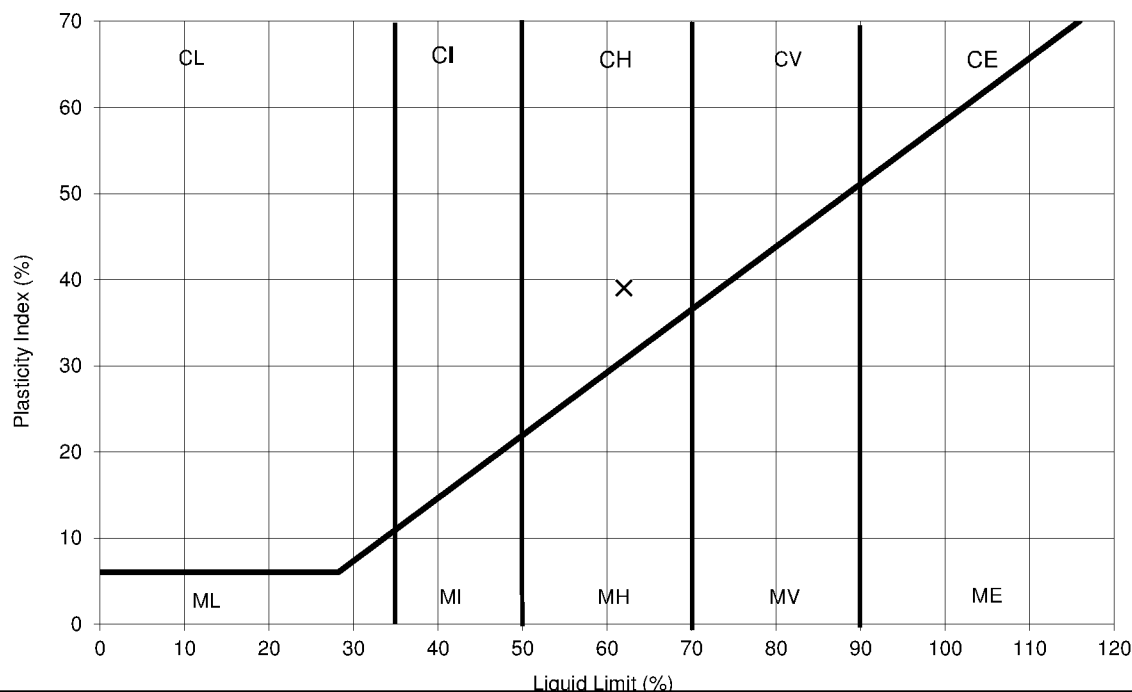
PLASTICITY INDEX

39

%

Remarks

PLASTICITY INDEX



TEST METHOD

BS1377: Part 2 :Clause 4.3 : 1990 Determination of the liquid limit by the cone penetrometer method

BS1377: Part 2 :Clause 5.0 : 1990: Determination of the plastic limit and plasticity index

BS1377: Part 2 :Clause 3.2 : 1990:Determination of the moisture content by the oven drying method

Test Report by: K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford Herts WD18 9PU

Checked and Approved

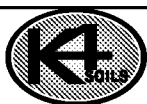
Initials: J.P

Date: 27/05/2021

2519

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

MSF-5 R2



LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

Job No. 29990

Borehole/Pit No. BH1

Site Name Riverside Industrial Estate

Sample No. 1

Project No. P21.152 Client Impact Geotechnical

Depth Top 1.50 m

Depth Base - m

Sample Type D

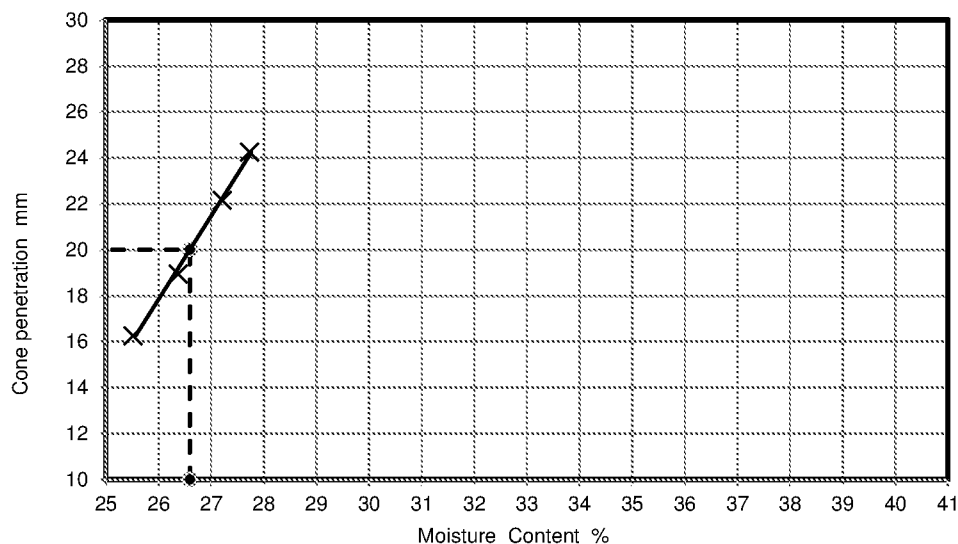
Samples received 27/04/2021

Schedules received 02/05/2021

Project Started 04/05/2021

Date Tested 25/05/2021

Soil Description Brown sandy silty CLAY with pockets of off white gravelly chalk (gravel is fmc and sub-angular and chalk gravel)

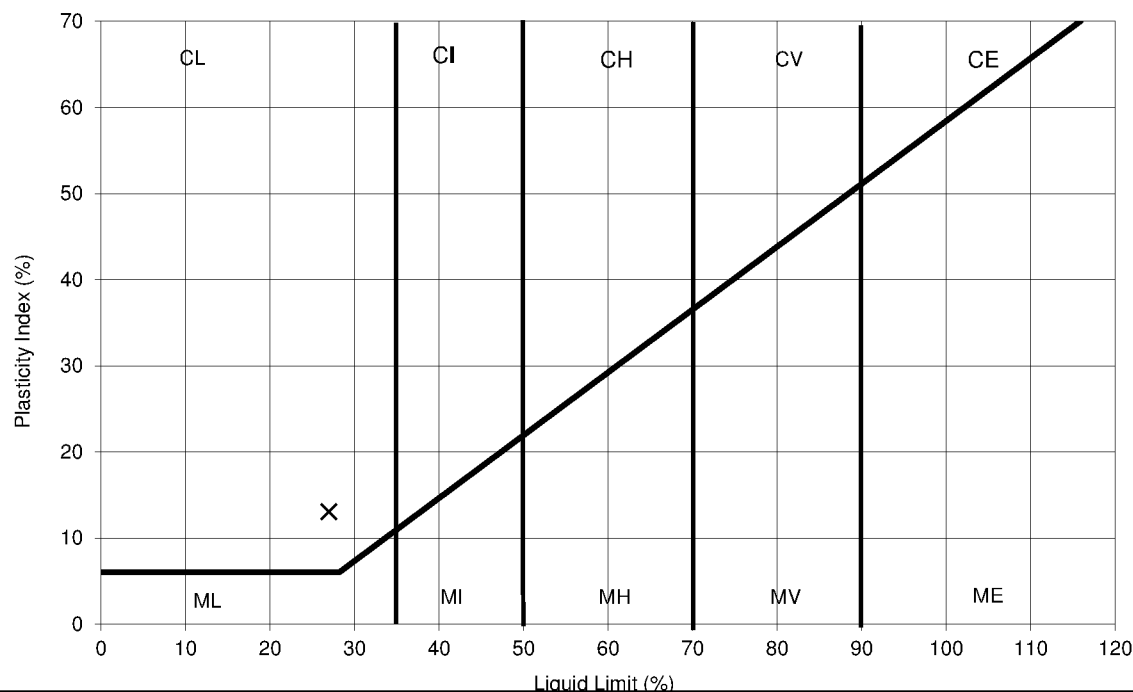


NATURAL MOISTURE CONTENT	15	%
% PASSING 425µm SIEVE	57	%
LIQUID LIMIT	27	%
PLASTIC LIMIT	14	%
PLASTICITY INDEX	13	%

Remarks

Sample washed to obtain test fraction

PLASTICITY INDEX



TEST METHOD

BS1377: Part 2 :Clause 4.3 : 1990 Determination of the liquid limit by the cone penetrometer method

BS1377: Part 2 :Clause 5.0 : 1990: Determination of the plastic limit and plasticity index

BS1377: Part 2 :Clause 3.2 : 1990:Determination of the moisture content by the oven drying method

Checked and Approved

Initials: J.P
Date: 27/05/2021

2519

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

MSF-5 R2

		Sulphate Content (Gravimetric Method) for 2:1 Soil: Water Extract and pH Value - Summary of Results Tested in accordance with BS1377 : Part 3 : 2018, Clause 7.6 & Clause 12							
Job No. 29990		Project Name Riverside Industrial Estate						Programme Samples received 27/04/2021 Schedule received 02/05/2021	
Project No. P21.152		Client Impact Geotechnical						Project started 04/05/2021 Testing Started 17/05/2021	
Hole No.	Sample				Soil description	Dry Mass passing 2mm %	SO4 Content mg/l	pH	Remarks
	Ref	Top m	Base m	Type					
WS1	1	1.50	-	D	Off white CHALK with chalk fragments and fmc and sub-angular gravel and brown sandy silty CLAY with fines and fmc and sub-angular flint gravel	71	240	7.69	
WS2	1	1.00	-	D	Brown mottled dark grey slightly gravelly slightly sandy silty CLAY (gravel is fm and sub-angular to angular)	97	330	7.71	
WS3	1	1.00	-	D	Brown slightly sandy silty CLAY	100	300	7.70	
WS4	2	1.00	-	ES	Brown and bluish grey slightly gravelly slightly sandy silty CLAY (gravel is fm and sub-angular)	98	380	7.69	
BH1	1	2.50	-	D	Off white gravelly CHALK with chalk clay inclusions (gravel is fmc and sub-angular chalk and flint gravel)	48	300	7.67	
BH1	1	5.50	-	D	Off white medium to coarse CHALK gravel and flint gravel	2	300	7.73	
BH1	1	12.00	-	D	Off white putty CHALK with occasional gravel size lumps	92	260	7.64	

	Test Report by K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU Telephone: 01924 473333 Email: james@k4soils.com							Checked and Approved Initials J.P. Date: 27/05/2021
	Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)							MSF-5-R29
	2519							MSF-5-R29

					Saturation Moisture Content - Summary of Results Tested in accordance with BS1377 : Part 2 : 1990, clause 3.3 unless annotated otherwise.					
Job No.		Project Name							Programme	
29990		Riverside Industrial Estate							Samples received	27/04/2021
									Schedule received	02/05/2021
Project No.		Client							Project started	
P21.152		Impact Geotechnical							Testing Started	
Hole No.	Sample				Description	SMC %	NMC %	Bulk Density Mg/m3	Dry Density Mg/m3	Remarks - Sample size complies with BS1377:1990: Part 2 (Yes/No)
	Ref	Top m	Base m	Type						
BH1	-	4.50	5.10	D	Off white putty CHALK with intact chalk fragments	23	22	2.05	1.67	No
BH1	-	13.00	-	D	Off white putty CHALK with intact chalk fragments	23	23	2.04	1.66	No
BH1	-	14.50	-	D	Off white putty CHALK with intact chalk fragments	22	22	2.07	1.70	No
		Test Report by K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford Herts WD18 9BU 							Checked and Approved Initials J.P Date: 27/05/2021	
2519		Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)							MSF-5-R18	

[illegible]



Graham Carter
Impact Geotechnical Ltd
26 Anmore Road
Denmead
Hants
PO7 6NP

DETS Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN

DETS Report No: 21-05692

Site Reference: Riverside Industrial Estate (RIE)

Project / Job Ref: P21.152

Order No: None Supplied

Sample Receipt Date: 04/05/2021

Sample Scheduled Date: 04/05/2021

Report Issue Number: 1

Reporting Date: 10/05/2021

Authorised by:



Dave Ashworth
Technical Manager

Dates of laboratory activities for each tested analyte are available upon request.

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Soil Analysis Certificate						
DETS Report No: 21-05692	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Impact Geotechnical Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Riverside Industrial Estate (RIE)	TP / BH No	WS1	WS1	WS2	WS2	WS3
Project / Job Ref: P21.152	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	Depth (m)	0.30	0.60	0.40	0.80	0.30
Reporting Date: 10/05/2021	DETS Sample No	540957	540958	540959	540960	540961

Determinand	Unit	RL	Accreditation	(n)			
Asbestos Screen ^(S)	N/a	N/a	ISO 17025	Not Detected		Not Detected	Not Detected
pH	pH Units	N/a	MCERTS	8.1	8.0	9.9	11.5
Total Cyanide	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	70	13	30	< 10
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.07	0.01	0.03	< 0.01
Organic Matter	%	< 0.1	MCERTS	3.6	0.4	< 0.1	0.2
Arsenic (As)	mg/kg	< 2	MCERTS	18	19	4	2
Cadmium (Cd)	mg/kg	< 0.2	NONE	0.3	< 0.2	< 0.2	< 0.2
Chromium (Cr)	mg/kg	< 2	MCERTS	20	16	9	5
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	37	6	5	< 4
Lead (Pb)	mg/kg	< 3	MCERTS	56	8	4	6
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	16	16	4	< 3
Selenium (Se)	mg/kg	< 2	MCERTS	< 3	< 3	< 3	< 3
Zinc (Zn)	mg/kg	< 3	MCERTS	67	33	12	11
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Method Description page describes if the test is performed on the dried or as-received portion

Subcontracted analysis (S)

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Soil Analysis Certificate						
DETS Report No: 21-05692	Date Sampled	None Supplied				
Impact Geotechnical Ltd	Time Sampled	None Supplied				
Site Reference: Riverside Industrial Estate (RIE)	TP / BH No	WS4				
Project / Job Ref: P21.152	Additional Refs	None Supplied				
Order No: None Supplied	Depth (m)	0.30				
Reporting Date: 10/05/2021	DETS Sample No	540962				

Determinand	Unit	RL	Accreditation	(n)				
Asbestos Screen ^(S)	N/a	N/a	ISO 17025					
pH	pH Units	N/a	MCERTS	11.7				
Total Cyanide	mg/kg	< 2	NONE	< 2				
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	66				
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.07				
Organic Matter	%	< 0.1	MCERTS	0.7				
Arsenic (As)	mg/kg	< 2	MCERTS	12				
Cadmium (Cd)	mg/kg	< 0.2	NONE	0.6				
Chromium (Cr)	mg/kg	< 2	MCERTS	15				
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2				
Copper (Cu)	mg/kg	< 4	MCERTS	21				
Lead (Pb)	mg/kg	< 3	MCERTS	52				
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1				
Nickel (Ni)	mg/kg	< 3	MCERTS	13				
Selenium (Se)	mg/kg	< 2	MCERTS	< 3				
Zinc (Zn)	mg/kg	< 3	MCERTS	138				
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2				

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Method Description page describes if the test is performed on the dried or as-received portion
 Subcontracted analysis (S)



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Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 21-05692	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Impact Geotechnical Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Riverside Industrial Estate (RIE)	TP / BH No	WS1	WS1	WS2	WS2	WS3
Project / Job Ref: P21.152	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	Depth (m)	0.30	0.60	0.40	0.80	0.30
Reporting Date: 10/05/2021	DETS Sample No	540957	540958	540959	540960	540961

Determinand	Unit	RL	Accreditation	(n)				
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	0.51
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	0.16
Fluoranthene	mg/kg	< 0.1	MCERTS	0.14	< 0.1	0.29	< 0.1	0.93
Pyrene	mg/kg	< 0.1	MCERTS	0.15	< 0.1	0.32	< 0.1	0.83
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.14	< 0.1	0.27
Chrysene	mg/kg	< 0.1	MCERTS	0.16	< 0.1	0.16	< 0.1	0.30
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	0.24	< 0.1	0.17	< 0.1	0.30
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	0.11
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	0.19	< 0.1	0.14	< 0.1	0.24
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	0.16	< 0.1	< 0.1	< 0.1	0.17
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	0.17	< 0.1	< 0.1	< 0.1	0.17
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	< 1.6	< 1.6	< 1.6	4

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Soil Analysis Certificate - Speciated PAHs

DETS Report No: 21-05692	Date Sampled	None Supplied				
Impact Geotechnical Ltd	Time Sampled	None Supplied				
Site Reference: Riverside Industrial Estate (RIE)	TP / BH No	WS4				
Project / Job Ref: P21.152	Additional Refs	None Supplied				
Order No: None Supplied	Depth (m)	0.30				
Reporting Date: 10/05/2021	DETS Sample No	540962				

Determinand	Unit	RL	Accreditation	(n)				
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1				
Acenaphthylene	mg/kg	< 0.1	MCERTS	0.12				
Acenaphthene	mg/kg	< 0.1	MCERTS	0.65				
Fluorene	mg/kg	< 0.1	MCERTS	1				
Phenanthrene	mg/kg	< 0.1	MCERTS	8.69				
Anthracene	mg/kg	< 0.1	MCERTS	2.35				
Fluoranthene	mg/kg	< 0.1	MCERTS	15.60				
Pyrene	mg/kg	< 0.1	MCERTS	14.10				
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	6.16				
Chrysene	mg/kg	< 0.1	MCERTS	5.39				
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	6.12				
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	1.82				
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	5.49				
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	3.41				
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	0.71				
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	3.21				
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	74.7				



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Soil Analysis Certificate - EPH Texas Banded						
DETS Report No: 21-05692	Date Sampled	None Supplied	None Supplied	None Supplied		
Impact Geotechnical Ltd	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: Riverside Industrial Estate (RIE)	TP / BH No	WS1	WS2	WS4		
Project / Job Ref: P21.152	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: None Supplied	Depth (m)	0.60	0.80	0.30		
Reporting Date: 10/05/2021	DETS Sample No	540958	540960	540962		

Determinand	Unit	RL	Accreditation	(n)
EPH Texas (>C16 - C21)	mg/kg	< 1	MCERTS	< 1
				< 1
				19

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Soil Analysis Certificate - TPH CWG Banded

DETS Report No: 21-05692	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Impact Geotechnical Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Riverside Industrial Estate (RIE)	TP / BH No	WS1	WS1	WS2	WS2	WS3
Project / Job Ref: P21.152	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	Depth (m)	0.30	0.60	0.40	0.80	0.30
Reporting Date: 10/05/2021	DETS Sample No	540957	540958	540959	540960	540961

Determinand	Unit	RL	Accreditation	(n)					
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2	< 2
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2	< 2
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	< 3	< 3
Aliphatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	< 3	< 3
Aliphatic >C21 - C34	mg/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	< 10	< 10
Aliphatic (C5 - C34)	mg/kg	< 21	NONE	< 21	< 21	< 21	< 21	< 21	< 21
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2	< 2
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2	< 2
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2	< 2
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	< 3	< 3
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	< 10	< 10
Aromatic (C5 - C35)	mg/kg	< 21	NONE	< 21	< 21	< 21	< 21	< 21	< 21
Total >C5 - C35	mg/kg	< 42	NONE	< 42	< 42	< 42	< 42	< 42	< 42

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Soil Analysis Certificate - TPH CWG Banded

DETS Report No: 21-05692	Date Sampled	None Supplied				
Impact Geotechnical Ltd	Time Sampled	None Supplied				
Site Reference: Riverside Industrial Estate (RIE)	TP / BH No	WS4				
Project / Job Ref: P21.152	Additional Refs	None Supplied				
Order No: None Supplied	Depth (m)	0.30				
Reporting Date: 10/05/2021	DETS Sample No	540962				

Determinand	Unit	RL	Accreditation	(n)				
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01				
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05				
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	< 2				
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	< 2				
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	< 3				
Aliphatic >C16 - C21	mg/kg	< 3	MCERTS	< 3				
Aliphatic >C21 - C34	mg/kg	< 10	MCERTS	< 10				
Aliphatic (C5 - C34)	mg/kg	< 21	NONE	< 21				
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01				
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05				
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2				
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	< 2				
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	6				
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	50				
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	120				
Aromatic (C5 - C35)	mg/kg	< 21	NONE	176				
Total >C5 - C35	mg/kg	< 42	NONE	176				



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Soil Analysis Certificate - BTEX / MTBE						
DETS Report No: 21-05692	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Impact Geotechnical Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Riverside Industrial Estate (RIE)	TP / BH No	WS1	WS1	WS2	WS2	WS3
Project / Job Ref: P21.152	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	Depth (m)	0.30	0.60	0.40	0.80	0.30
Reporting Date: 10/05/2021	DETS Sample No	540957	540958	540959	540960	540961

Determinand	Unit	RL	Accreditation	(n)				
Benzene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Toluene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	< 5
Ethylbenzene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
p & m-xylene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
o-xylene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
MTBE	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	< 5

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Soil Analysis Certificate - BTEX / MTBE						
DETS Report No: 21-05692	Date Sampled	None Supplied				
Impact Geotechnical Ltd	Time Sampled	None Supplied				
Site Reference: Riverside Industrial Estate (RIE)	TP / BH No	WS4				
Project / Job Ref: P21.152	Additional Refs	None Supplied				
Order No: None Supplied	Depth (m)	0.30				
Reporting Date: 10/05/2021	DETS Sample No	540962				

Determinand	Unit	RL	Accreditation	(n)				
Benzene	ug/kg	< 2	MCERTS	< 2				
Toluene	ug/kg	< 5	MCERTS	< 5				
Ethylbenzene	ug/kg	< 2	MCERTS	< 2				
p & m-xylene	ug/kg	< 2	MCERTS	< 2				
o-xylene	ug/kg	< 2	MCERTS	< 2				
MTBE	ug/kg	< 5	MCERTS	< 5				



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Soil Analysis Certificate - Sample Descriptions

DETS Report No: 21-05692

Impact Geotechnical Ltd

Site Reference: Riverside Industrial Estate (RIE)

Project / Job Ref: P21.152

Order No: None Supplied

Reporting Date: 10/05/2021

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
^ 540957	WS1	None Supplied	0.30	12.8	Brown sandy clay with stones and concrete
^ 540958	WS1	None Supplied	0.60	10.4	Light brown sandy clay with stones
^ 540959	WS2	None Supplied	0.40	7	Light brown sandy clay with stones
^ 540960	WS2	None Supplied	0.80	19	Brown sandy clay with stones
^ 540961	WS3	None Supplied	0.30	6.1	Brown sandy gravel with stones
^ 540962	WS4	None Supplied	0.30	7.7	Brown sandy gravel with stones and concrete

Moisture content is part of procedure E003 & is not an accredited test

Insufficient Sample ^{1/5}

Unsuitable Sample ^{4/5}

^ no sampling date provided; unable to confirm if samples are within acceptable holding times



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Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 21-05692

Impact Geotechnical Ltd

Site Reference: Riverside Industrial Estate (RIE)

Project / Job Ref: P21.152

Order No: None Supplied

Reporting Date: 10/05/2021

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 - C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	Fraction Organic Carbon (FOC)	Determination of TOC by combustion analyser.	E027
Soil	D	Organic Matter (SOM)	Determination of TOC by combustion analyser.	E027
Soil	D	TOC (Total Organic Carbon)	Determination of TOC by combustion analyser.	E027
Soil	AR	Exchangeable Ammonium	Determination of ammonium by discrete analyser.	E029
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCS	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received

APPENDIX E

Monitoring Results

Borehole Monitoring Record

Project Name:	Riverside Industrial Estate	Project Reference:	P21.152
Date:	04/05/2021	Personnel:	GC
Weather:	Sunny, 30% Cloud Cover	Ground Conditions:	Dry
Temp (°C):	14	Humidity (%):	55%
Atmospheric Pressure:	1006 Steady	Monitoring Round:	MR1

Groundwater Records

Well No.	BH1									
Borehole Diameter (mm):	50									
Time Monitored	14:23									
Groundwater level (m bgl)	2.40									
Depth of installation (m bgl)	5.00									
Volume Purged	-									
Water Appearance	Off white, silty									
Atmospheric Pressure (mb)	1006									
Downhole Pressure (mb)	-0.09									
Flow Rate (l/hr)	0.4									
Methane (%)	Max.	0								
	Steady	0								
Carbon Dioxide (%)	Max.	0.2								
	Steady	0.2								
Oxygen (%)	Min.	19.5								
	Steady	19.5								
VOCs (ppm)	-									
H ₂ S (ppm)	0									
Carbon Monoxide (ppm)	5									
Notes:										

Borehole Monitoring Record

Project Name:	Riverside Industrial Estate	Project Reference:	P21.152
Date:	07/05/2021	Personnel:	GC
Weather:	Sunny, 30% Cloud Cover	Ground Conditions:	Dry
Temp (°C):	13	Humidity (%):	70%
Atmospheric Pressure:	1019 Decreasing	Monitoring Round:	MR2

Groundwater Records

Well No.	BH1									
Borehole Diameter (mm):	50									
Time Monitored	14:00									
Groundwater level (m bgl)	2.40									
Depth of installation (m bgl)	5.00									
Volume Purged	-									
Water Appearance	Off white, silty									
Atmospheric Pressure (mb)	1006									
Downhole Pressure (mb)	0.12									
Flow Rate (l/hr)	0.4									
Methane (%)	Max.	0.2								
	Steady	0.1								
Carbon Dioxide (%)	Max.	1.7								
	Steady	1.6								
Oxygen (%)	Min.	19.3								
	Steady	19.3								
VOCs (ppm)	-									
H ₂ S (ppm)	0									
Carbon Monoxide (ppm)	4									
Notes:										

Borehole Monitoring Record

Project Name:	Riverside Industrial Estate	Project Reference:	P21.152
Date:	12/05/2021	Personnel:	GC
Weather:	Overcast, dry	Ground Conditions:	Dry
Temp (°C):	12	Humidity (%):	85%
Atmospheric Pressure:	1009 Increasing	Monitoring Round:	MR3

Groundwater Records

Well No.	BH1									
Borehole Diameter (mm):	50									
Time Monitored	17:25									
Groundwater level (m bgl)	2.40									
Depth of installation (m bgl)	5.00									
Volume Purged	-									
Water Appearance	Off white, silty									
Atmospheric Pressure (mb)	1009									
Downhole Pressure (mb)	-0.09									
Flow Rate (l/hr)	0.4									
Methane (%)	Max.	0.1								
	Steady	0.1								
Carbon Dioxide (%)	Max.	4.3								
	Steady	4.3								
Oxygen (%)	Min.	5.9								
	Steady	6.1								
VOCs (ppm)	-									
H ₂ S (ppm)	0									
Carbon Monoxide (ppm)	1									
Notes:										

Borehole Monitoring Record

Project Name:	Riverside Industrial Estate	Project Reference:	P21.240
Date:	12/10/2021	Personnel:	RG
Weather:	Sunny with some cloud	Ground Conditions:	Dry
Temp (°C):	10	Humidity (%):	70%
Atmospheric Pressure:	1025 Decreasing	Monitoring Round:	MR4

Groundwater Records

Well No.	BH1									
Borehole Diameter (mm):	50									
Time Monitored	08:45									
Groundwater level (m bgl)	2.30									
Depth of installation (m bgl)	5.00									
Volume Purged	-									
Water Appearance	Off white, silty									
Atmospheric Pressure (mb)	1025									
Downhole Pressure (mb)	+0.09									
Flow Rate (l/hr)	0									
Methane (%)	Max.	0.2								
	Range	0.2								
Carbon Dioxide (%)	Max.	7.4								
	Range	5.2 – 7.4								
Oxygen (%)	Min.	7.4								
	Range	7.4 – 11.3								
VOCs (ppm)	-									
H ₂ S (ppm)	0									
Carbon Monoxide (ppm)	0									
Notes:										

Borehole Monitoring Record

Project Name:	Riverside Industrial Estate	Project Reference:	P21.240
Date:	18/10/2021	Personnel:	GC
Weather:	Sunny with some cloud	Ground Conditions:	Dry
Temp (°C):	10	Humidity (%):	70%
Atmospheric Pressure:	1016 Decreasing	Monitoring Round:	MR5

Groundwater Records

Well No.	BH1									
Borehole Diameter (mm):	50									
Time Monitored	11:09									
Groundwater level (m bgl)	2.25									
Depth of installation (m bgl)	5.00									
Volume Purged	-									
Water Appearance	Off white, silty									
Atmospheric Pressure (mb)	1016									
Downhole Pressure (mb)	+0.19									
Flow Rate (l/hr)	0.2									
Methane (%)	Max.	0.2								
	Range	0.2								
Carbon Dioxide (%)	Max.	8.1								
	Range	8.0 – 8.1								
Oxygen (%)	Min.	11.5								
	Range	11.5 - 11.6								
VOCs (ppm)	-									
H ₂ S (ppm)	0									
Carbon Monoxide (ppm)	0									
Notes:										

Borehole Monitoring Record

Project Name:	Riverside Industrial Estate	Project Reference:	P21.240
Date:	28/10/2021	Personnel:	BW
Weather:	Sunny with some cloud	Ground Conditions:	Dry
Temp (°C):	12	Humidity (%):	75%
Atmospheric Pressure:	1012 Steady	Monitoring Round:	MR6

Groundwater Records

Well No.	BH1									
Borehole Diameter (mm):	50									
Time Monitored	08:45									
Groundwater level (m bgl)	2.20									
Depth of installation (m bgl)	5.00									
Volume Purged	-									
Water Appearance	Off white, silty									
Atmospheric Pressure (mb)	1012									
Downhole Pressure (mb)	+0.20									
Flow Rate (l/hr)	0.1									
Methane (%)	Max.	0.2								
	Range	0.2								
Carbon Dioxide (%)	Max.	4.1								
	Range	4.0 – 4.1								
Oxygen (%)	Min.	14.9								
	Range	14.9 – 19.9								
VOCs (ppm)	-									
H ₂ S (ppm)	0									
Carbon Monoxide (ppm)	0									
Notes:										