



LAND OFF SAPCOTE ROAD, BURBAGE

PHASE II GEO-ENVIRONMENTAL INVESTIGATION FOR MORRO PARTNERSHIPS LTD & EMH HOUSING & REGENERATION LTD

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Revision - 1

PHASE II GEO-ENVIRONMENTAL INVESTIGATION: LAND OFF SAPCOTE ROAD, BURBAGE

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Executive Summary

This presents the salient points of the report and should not be referred to in isolation. The conclusions and recommendations presented below are considered reasonable based on the findings of the site investigation. However, these cannot be guaranteed to gain regulatory approval and therefore copies of this report should be sent to the appropriate Regulatory Authorities and / or other organisations (as appropriate) by the Client for their comments and approval prior to undertaking any irrecoverable works associated with the subject site.

Enabling / Earthworks	Significant building footprints occupy the site which will require demolition prior to redevelopment. It may be possible to crush and re-use demolition materials although potential asbestos containing materials were noted to some of the building roofs. Should topographical modification / re-profiling of the site be warranted as part of future proposed layouts, then an earthworks specification and re-appraisal of foundation depths may be required. Specific testing (e.g. waste acceptance criteria testing) may be required at the discretion of the Client's designated waste handler if the off-site movement / disposal of soils is undertaken. Where applicable, such requirements must be verified directly with them by the Client. Additionally, where soils are imported there will be the necessity to ensure compliance with all regulatory licensing procedures (i.e. U1, MMP etc) and also to validate the soils prior to importation, subject to the approval of the Local Authority. The movement of all materials to, from and within the site's boundaries will need to be covered in advance by the appropriate exemptions / licences etc. A number of geotechnical hazards have been identified and highlighted earlier in this report that should be taken into consideration.
Foundations	At this stage, it is considered that some foundations should be able to be terminated within the underlying natural soils across the site at a minimum depth of 0.60m begl, although deep made ground, soft soils and water seepages may mean that considerably deeper foundations will be required. A nett allowable bearing pressure of 80kN/m² should be assigned across the majority of the site in the underlying undisturbed natural soils at 2m begl, generally increasing with depth. If significant changes to the current topography are proposed then further assessment will be needed. Localised reduction of bearing capacity of 50kN/m² should be assigned within WS01 & WS05 at 2m depth which should also be confirmed by your structural engineer. As outlined previously; due to the identified deep made ground, soft soils and water seepages; an alternative single foundation solution may be required such as piled or raft etc, in this instance early discussion with your structural engineer should be sought in order to design the most suitable solution for the site. Granular soils were noted across the site. Where groundwater is encountered in granular soils / pockets within influencing distance of foundations, bearing capacities of granular soils will be reduced (significant groundwater was not encountered at this stage). If encountered during foundation excavations, then Geo-Matters Ltd should be contacted for further advice.
Floor Slabs	At this stage ground bearing floor slabs should be appropriate where <u>less</u> than 0.60m of unsuitable soils are encountered (e.g. made ground). Where this is not the case a suspended floor would be a viable alternative.

Building Near Trees	Significant cohesive soils were not recorded across the site; therefore, foundation designs should not need to be adjusted locally in accordance with NHBC Standards (Chapter 4.2). Following demolition, a watching brief around the western boundary may be required due to trees in this area and to determine soil properties.
Groundwater	Significant groundwater was not encountered within the exploratory investigation works at the site, however, the investigation techniques used were rapid and may have masked small seepages. In view of this dewatering is unlikely to be required at the site subject to prevailing weather conditions.
Road Construction	As a standard / generic approach, CBR values of less than 2% can usually be anticipated in made ground, CBR values of between 2% and 5% can be anticipated in natural cohesive soils and values of between 5% and 10% in natural granular soils respectively based on general road construction guidance literature. However, <i>in situ</i> CBR tests should be considered to confirm specific conditions in the areas of proposed road construction. All road construction proposals should be agreed with the Local Authority prior to finalising designs.
Drainage	The site is not considered to be suitable for the use of in situ drainage soakaways due to the deep made ground and relatively shallow damp soils. The look-and-see initial infiltration rate testing indicated the soils not to be suitable for soakaways, although if soakaways are to be proposed however, then <i>in situ</i> testing in accordance to BRE Digest 365 will need to be undertaken. All soakaway designs should be approved by the relevant statutory authority prior to implementation and must adhere to the standard design and ground setting requirements, upon which your appointed drainage design engineers should advise you. All drainage proposals are subject to <i>in situ</i> testing and should be agreed with the Local Authority prior to finalising designs.
Excavations	Generally good stability was noted in the exploratory locations completed across the site for the short time they remained open but deep made ground has been identified. The strata should be assumed to be unstable as a precautionary measure. No man entry into unsupported excavations should therefore be allowed without an appropriate risk assessment by the Client and / or their appointed site contractors. Reference to CIRIA report 97 (1983) should be made to establish a suitable means of support or battering of excavation sides.
Mining	No precautions relating to mining are considered necessary as outlined in the 3 rd Party Phase I Desk Study, subject to regulatory authority approval.
Sulphate Classification	In accordance with BRE Guidance Special Digest 1 (2005) the characteristic values of water soluble sulphate concentration and pH for soils indicates a site wide Design Sulphate Class DS-1 and an Aggressive Chemical Environment for Concrete (ACEC) classification of AC-1s. Minimum concrete specification should be in accordance with NHBC Standards, Section 3.1.
Contamination	Chemical analysis results have been compared with current relevant guidance and site-specific screening values which indicates that there are minor localised elevated levels of contaminants present at the site.
Remediation	Remediation works to protect human health are considered necessary requiring a remedial strategy to the approval of the Local Authority / NHBC.
Ground Gas and Radon	Elevated CO ₂ readings were recorded within the gas monitoring programme undertaken. The assessment using CL:AIRE RB 17 indicates that the site would fall under the 'low/medium risk' category as ground gas has been identified. As such the guidance concludes that the site could be classified as Modified Wilson and Card Characteristic Situation 2 (equivalent to NHBC Amber 1 Traffic Light, if the floor slabs are to utilise a sub-floor void of at least 150mm) where ground gas protection measures are considered necessary in new buildings constructed at the site, subject to regulatory approval. No radon protection measures are required subject to regulatory Authority approval.

Topsoil	Topsoil was not encountered within any of the exploratory holes that were completed during the recent intrusive works, therefore topsoil importation will be required for the proposed redevelopment of residential dwellings with private gardens. It is reiterated that the movement, importation and / or exportation of all soils must be undertaken in full compliance with all regulatory licensing procedures (i.e. U1, MMP etc), and validation of soils prior to any importation will be required, subject to the approval of the Local Authority / NHBC.
Further Works	• The Client will need to liaise with appropriately licensed waste management contractors to determine requirements for additional analysis etc. should materials be considered for off-site removal / disposal; • Remedial Strategy to inform the measures required to address the minor localised contamination; • Watching brief following demolition within the former building footprints to assess soil characteristics; • Re-use / importation of soils will need to be covered through a CL:AIRE DoWCoP (MMP).

The executive summary given above is an overview of the key findings and conclusions of the report. There may be other information contained in the body of the report which puts into context the findings of the executive summary. No reliance should be placed on the executive summary until the whole report has been read in full.

1.0 INTRODUCTION

1.1 Preamble

Geo-Matters Ltd were appointed by Morro Partnerships Ltd & EMH Housing & Regeneration Ltd (hereafter referred to as 'the Client') to undertake a Phase II Geo-Environmental Investigation at Land off Sapcote Road, Burbage (hereafter referred to as 'the site').

1.2 Report Status

This report provides factual geotechnical and environmental information, alongside associated construction issues and recommendations, in relation to a proposed residential development as outlined on the proposed development plan as supplied by the client (see Section 1.4 below and our notes concerning our terms and conditions at the end of this report).

The findings and recommendations made in this report are based on published information and plans made available by the Client prior to the site works, and site investigation works undertaken in September 2023 with return visits for gas monitoring through September - November 2023. Geo-Matters Ltd. cannot accept responsibility for the reliability and authenticity of published information or reports prepared by third parties.

The possibility of significant variation in ground conditions existing between sampling locations cannot be discounted. Confirmation of ground conditions between exploratory holes should be undertaken if deemed necessary. There may be other conditions prevailing on site which have not been revealed by this investigation and which have not been taken into account by this report. Responsibility cannot be accepted for any conditions not revealed by these exploratory locations, investigation and assessment. It should be noted that ground gas and groundwater levels and quality may vary due to seasonal and other effects.

An arboriculturalist / invasive plant species survey has not been undertaken by Geo-Matters Ltd. although any potential areas of concern have been highlighted where/if observed. Invasive plant species may not have been observed due to seasonal variations and / or access restrictions.

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unauthorised third party comes into possession of this report, they rely on it at their own risk and the authors do not owe them a Duty of Care or Skill.

1.3 Previous Reports

Geo-Matters Ltd have been made aware of one previous report relating to the site:

- Georisk Management – Phase 1 desk study dated May 2020 Ref:20109/01

1.4 Proposed Development

This report has been prepared on the understanding that the development proposal for the site comprises residential development with private gardens and associated access roads.

Should the development proposals alter (e.g. inc type or foundation option), then the recommendations in this report may be subject to change. Whilst it may be utilised by others for reference purposes at the Client's discretion, it has not been prepared for any other purposes (e.g. waste classification etc.) and therefore additional works may be required by third parties dependent upon their own requirements / works.

Drawings showing the Proposed Layout Plan, Site Location Plan, General Site Features, General Photographic Record and Exploratory Hole Layout Plans are presented within Appendices I, II, III, IV and V respectively.

1.5 Site Location & Description

The site is accessed off Sapcote Road, Burbage, approx 800m east of the centre of Hinckley as presented on the Site Location Plan (Drawing 002) in Appendix II. The site is roughly centred at National Grid Reference 444170, 293350.

A Site Features Plan and a General Site Photographs showing the general aspects of the site are included in Appendix III and Appendix IV respectively.

Site Features:

The full site features are presented in the above referenced report although main points have been reiterated for completeness:

- The site covers an approximate area of 0.5ha and is occupied by brick buildings where a former double glazing window supplier, e-cigarette company, a former hand car-wash and a former musical instrument

suppliers were housed. Two electricity substations are observed to the west of the buildings.

Surrounding Features:

- The site is located amongst a residential area with former sand pits around the site which have been filled historically.

2.0 RATIONALE FOR PHASE II INVESTIGATION

2.1 Scope of Environmental Investigation

The following potential sources of contamination have been identified based on the recent visits to the site by Geo-Matters Ltd, which required further assessment through intrusive works at the site:

Table 2.1 Potential Sources of Contamination

Potential Onsite Sources	Associated Potential Contaminants^{a,b}	
	<i>Metals and Inorganics</i>	<i>Organics and Others</i>
Made Ground	General Suite ¹	TPH, PAHs, Asbestos & Gas
Potential Offsite Sources	<i>Metals and Inorganics</i>	<i>Organics and Others</i>
Made Ground / Backfilled Pits	General Suite ¹	Gas

^a Professional experience alongside DoE Industry Profiles and CLR8 (withdrawn but used for reference)

^b Subject to Local Authority comments / planning conditions

Acronyms – TPH = Total Petroleum Hydrocarbons, PAHs = Polycyclic Aromatic Hydrocarbons

¹ – 'General Suite' shall comprise heavy metals including pH, phenols, sulphate, speciated PAHs ('US EPA 16') and moisture content.

The Phase II Environmental Investigation will comprise the recovery of soil samples from all exploratory holes positioned to provide optimum coverage across accessible areas of the site as outlined on the Exploratory Hole Layout Plan presented in Appendix V and identified in Table 2.2 below in general accordance with BS5930:2015.

Samples will be selected for analysis on the basis of their on-site visual descriptions with particular attention given to samples displaying any olfactory evidence of contamination. All samples will be taken in snap top plastic containers and 250ml amber glass jars or vials. All samples will be placed in cooled containers and transported to Geo-Matters Ltd.'s storage facility before awaiting transfer to a UKAS / MCERTS accredited laboratory.

Table 2.2: Exploratory Hole Layout Rationale

Potential Source / Issue	Exploratory Holes
General Site Coverage	All WS's
Potential Gassing Issue	Installed Wells
Soakaway Potential	WS2 & WS5

The samples taken during the intrusive investigation will be analysed for a range of contaminants in accordance with NHBC Standards Chapter 4.1 'Land Quality –

managing ground conditions' and CLR 8 'Potential Contaminants for the Assessment of Land' (withdrawn but used for reference purposes where applicable).

The soil samples will be analysed for the following parameters: arsenic, cadmium, chromium, copper, nickel, zinc, lead, mercury, selenium, hexavalent chromium, sulphate, phenols, speciated polyaromatic hydrocarbons (PAHs) and asbestos, with selected samples analysed for total petroleum hydrocarbons (TPH) if deemed necessary.

If samples are observed to display visual or olfactory evidence of contamination (e.g. evidence of hydrocarbon staining or odours) they shall be scheduled for appropriate additional analysis.

2.2 Scope of Geotechnical Investigation

The geotechnical investigation will comprise the advancement of exploratory locations across accessible areas of the site to determine the geomorphological characteristics of the site. The visual description of the soils will be used as the basis of determining the basic engineering properties of the soils encountered and all soils logging will be in accordance to BS5930:2015 where applicable.

During site works, samples will be collected; where necessary; to allow for classification testing and chemical analysis to be undertaken to determine the potential effects of soil upon the performance of building materials.

Equivalent *in situ* SPT's will be taken within all window sampler boreholes to allow strength profiling of the underlying strata to be determined.

3.0 SITE WORKS

All fieldwork and soil descriptions were carried out in general accordance with BS EN 14688 'Geotechnical Investigation and Testing – Identification and Classification of Soil' and / or BS5930:2015. Each of the exploratory locations was positioned on site by Geo-Matters Ltd. The locations of these exploratory holes are shown on the Exploratory Hole Layout Plan presented in Appendix V.

Prior to any excavation, the locations were checked for the presence of underground services by a specialist utilities detection team, and with reference to service plans where supplied. Where necessary exploratory holes were re-located to areas deemed to be a safe distance from identified services (see limitations section for further information).

All exploratory locations were backfilled with the arisings once representative samples had been obtained, look-and-see soakaway potential tests or completed with a ground gas monitoring well where required.

3.1 Scope of Investigation

A summary of the ground investigation undertaken by Geo-Matters Ltd is outlined in the table below:

Table 3.1: Method of Investigation

Method of Investigation	no.	Max Depth (m)	Sampling Regime
Window Sample Boreholes	7	5m	1 & 2

¹ – 500ml plastic tubs, 250ml amber jars and 40ml glass vials.

² – Bulk bags.

The investigation was carried out under the supervision of a suitably qualified Engineer from Geo-Matters Ltd.

Disturbed samples were collected from each discrete horizon within the exploratory holes (where possible) to provide soils for laboratory testing.

Exploratory Hole Logs are presented in Appendix VI.

3.2 Limitations to the Investigation

There were some ongoing limitations where boreholes needed to be moved in places i.e. buildings, site operations and significant services. All proposed boreholes were advanced at the site.

4.0 PHASE II GEOTECHNICAL ASSESSMENT

4.1 Ground Conditions

The geotechnical element of the works was undertaken concurrently with the environmental investigation. The ground conditions encountered within the exploratory locations are summarised in the table below with the logs presented in Appendix VI.

Table 4.1: Summary of Ground Conditions at the Site

General Description	Maximum Thickness (m)
MADE GROUND comprising tarmac cover over concrete and brick fragments and occasional black ashy subbase	0.50
MADE GROUND comprising reworked brown clay with brick fragments	1.55
MADE GROUND comprising reworked sandy clay with brick fragments in an ashy clinker matrix	1.00
MADE GROUND loose tarmac chippings	0.20
Orange clayey silty SAND	4.75 ⁺
Orange slightly sandy slightly clayey SILT	1.25 ⁺
Grey SAND & GRAVEL	0.80
Grey clayey SILT	1.50 ⁺

⁺ Not fully penetrated at all locations

4.1.1 Soils – Made Ground / Topsoil

Made Ground

Made ground was encountered in all of the exploratory hole locations and comprised brick, reworked sandy clay or concrete in the main.

Topsoil

Topsoil was absent from the site

The made ground across the site is not generally considered to be suitable bearing strata for the proposed development due to the variability of composition and strength associated with such materials.

4.1.2 Soils – Natural Strata

Across the site the natural strata beneath the made ground were generally recorded to comprise a mix of firm orange brown sandy CLAY / sandy SILT and or medium dense orange brown clayey SAND in the main indicative of the Glacial Till Deposits of the Wolston Sand & Gravel and Oadby Member.

The natural strata encountered across the site are considered to be a suitable bearing stratum for the proposed development.

4.1.3 Water and Excavations

No significant groundwater was encountered within any of the exploratory holes completed during the recent works at the site although three occurrences of 'damp' soils were noted between 1.4m and 3.5m within the boreholes advanced. The sides were generally stable during these works.

4.2 Contamination and Performance of Building Materials

4.2.1 Sulphates

pH and water soluble sulphate concentrations in 8 no. soil samples were analysed as part of the investigation. pH values indicate generally near neutral conditions to be present.

Table 4.3: Summary of Soil Analysis for Concrete Specification

Determinand	Units	No. of Samples	Min	Max
pH	N/A	8	6.9	8.3
Water Soluble Sulphate	g/l	8	<0.01	0.14

The results were assessed in accordance with the requirements of BRE Special Digest 1 (2005), 'Concrete in Aggressive Ground', assuming mobile groundwater conditions and brownfield soils.

As 8 no. soil samples were tested the mean of the highest 20% of the sulphate test results (rounded up to the nearest 100mg/l, which in this case is 200mg/l) and the lowest 20% of the pH results (which is 6.9) are the characteristic values for the site.

Accordingly, **DS1 – AC1s** conditions are present across the site in accordance with BRE Special Digest 1 'Concrete in Aggressive Ground 2005'. Minimum concrete specification should be in accordance with NHBC Standards, Section 3.1.

4.3 Geotechnical Testing

The geotechnical laboratory testing was carried out in accordance with BS EN 14688 'Geotechnical Investigation and Testing – Identification and Classification of Soil'. Full details of the test results are presented in Appendix VII.

Plasticity Testing

6 no. representative soil sample was tested for Plasticity Index, and water content, the results are presented in Table 4.4 (overleaf):

Table 4.4: Plasticity Index Results

Determinand	No. of Samples	Range %	Remark
Water Content	6	6.5 - 21	-
% passing 425µm test sieve	6	99 - 100	-
Plasticity Index (unmodified)	6	NP - 11	Non - Low
Modified Plasticity Index	6	NP	Non-Plastic

NP = Non-Plastic

From the results outlined in Table 4.4, on-site soils have been calculated to exhibit non-plastic characteristics, therefore **NON-PLASTIC** volume change potential should be used as the maximum classification when calculating foundation depths across the development site in accordance with the relevant standards (e.g. NHBC Standards, Chapter 4.2).

Standard Penetration Tests

Equivalent *in situ* standard penetration tests (SPTs) were undertaken at regular intervals within the strata in the window sampler exploratory holes advanced across the site. The SPT 'N' values generally increased with depth. The SPT results are summarised in Table 4.5 and 4.6 (below).

Table 4.5: Summary of *In Situ* SPT Results

Strata	Range Reported	Remark
MADE GROUND	2 - 6	Very loose
Clayey silty SAND	8 - 32	Medium dense
Sandy clayey SILT	2 - 32	Very soft becoming stiff
Clayey SILT	30	Firm

Table 4.6: *In Situ* SPT 'N' Value Results v Depth Table

Depth (m)	Range Reported
1	2 - 16
2	8 - 18
3	8 - 30
4	14 - 32
5	21

4.4 Ground Gas & Radon

Due to the sensitive nature of the parts of the proposed redevelopment (residential housing) and identified potential ground gas sources an initial ground gas monitoring programme was considered prudent to confirm the absence of risks. A ground gas monitoring exercise was therefore commenced concurrently with the site investigation works discussed herein.

The monitoring data comprises 6no. return visits (Oct - November 2023) from the available monitoring standpipes during varying atmospheric pressures.

Ground gas monitoring sheets are included in Appendix VIII.

4.4.1 Ground Gas Assessment Methodology

Interpretation of gas monitoring data is specified in CIRIA C665 (2007) 'Assessing risks posed by hazardous ground gases to buildings', BS 8485:2015+A1:2019 'Code of Practice for the Design or Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings' and other related guidance (as appropriate C735). This guidance includes the calculation of volumetric flow rates of ground based on maximum recorded gas concentrations and maximum recorded gas flow rates. Limiting factors are applied to the gas monitoring results and characteristic situation is then applied to the site. This provides a worst-case scenario in relation to the ingress of gas to future structures.

4.4.2 Ground Gas Assessment and Volumetric Flow Rate Calculations

Summary gas data and volumetric flow rate calculations are shown in Table 4.7 below.

Table 4.7 Calculation of Volumetric Flow Rates

Monitoring Point	Maximum Steady CH ₄ %v/v	Maximum Steady CO ₂ % v/v	Maximum Steady Flow Rate (l/hr)	Max Volumetric Flow Rate (l/hr) CH ₄	Max Volumetric Flow Rate (l/hr) CO ₂
WS1	0.2	8.1	0.1	0.0002	0.008
WS3	0.0	8.0	0.2	0.0	0.016
WS6	0.0	3.8	0.2	0.0	0.008

*Maximum steady state ground gas concentration multiplied by maximum steady state flow rate to provide a worst-case & conservative risk assessment.

As summarised in Table 10.1 above, the monitoring recorded near **ZERO** steady state volumetric flow rate for methane (CH₄) and **0.016 l/hr** for Carbon Dioxide (CO₂).

4.4.3 Ground Gas Classification and Selection of Protection Measures

Based on the above, and the fact that elevated methane or carbon dioxide concentrations have been detected, an overall site classified in accordance with BS8485:2015+A1:2019 is **CS2** (equivalent NHBC **Amber 1** ie LOW/MEDIUM RISK) requiring ground gas precautions to be installed. Based upon the categorisation of the proposed development (private residential dwellings, as described in Table 3 of BS8485:2015), a 'Type A' building type has been established. Based upon Table 4 of BS8485:2015, this would require a 'gas protection score' of 3.5 points

4.5 Radon

The property is in low probability radon area (<1% of homes are estimated to be at or above the Action Level). The Environmental Data Report; presented within the 3rd Party Phase I Report; states that **NO** radon protective measures are necessary in the construction of new dwellings at the site.

4.6 Geotechnical Hazards for the Proposed Development

It is understood that the proposed redevelopment at the site is to comprise a residential end use. Table 4.8; below; summarises the main geotechnical hazards identified during intrusive works associated with the proposed development.

Table 4.8: Summary of Geotechnical Hazards

Hazard	Comment
Services	Underground and above ground services are known to cross the site which may need taking into account during redevelopment and / or diverting.
Variable Ground Conditions	Should foundations straddle variable natural soil types (i.e. cohesive / granular) although not expected to be significant at this stage, then suitable mesh reinforcement should be provided within foundations to prevent the potential for differential settlement.
Slopes	Gentle elevation changes are present in some areas of the site. Pending final layout proposals, minor cut and fill works may be required. Geo-Matters Ltd should be contacted for further advice if such works are proposed
Trees	Onsite soils have been proved to exhibit non-plastic volume change potential; therefore, foundation should not need deepening within the influencing distance of trees. There are trees on the south western boundary therefore if significant cohesive soils are noted during demolition in that area then additional PI sampling would be recommended.
Granular Soils & Groundwater	If significant water is found during construction, then further assessment may need to be considered as groundwater within sand will reduce the bearing capacity of these materials. Inconsistent damp soils have been located at four locations at depths of 1.40m begl, 1.8m begl, 3.1m begl and 3.5m begl.
Deep Made Ground	Made Ground has been recorded on site up to 1.80m begl which will require foundations deepening across these areas.
Soft Ground	Low SPT's in natural soils at standard founding depth has been recorded in the natural soils at WS5, delineation works may be required in this area depending on the proposed layout in the area. Higher SPT's were recorded at deeper depths.
Combination of issues	Due to deep made ground, water and soft ground it may be necessary to undertake an alternative foundation solution i.e. piled / raft etc.

At this stage, it is considered that all foundations should terminate through the made ground into the underlying natural granular soils across the site at a minimum depth of 0.60m begl.

Due to ground variability we've attempted to provide different scenarios (water / soft ground / stratum) of the allowable bearing capacity as outlined overleaf:

- Nett allowable bearing pressures; at 1m begl; range between approx 10kN/m² (WS5) and 80kN/m² (WS2, WS4 & WS7) in the underlying undisturbed natural soils.
- Nett allowable bearing pressures; at 2m begl; range between approx 50kN/m² (WS1 & WS5) and 80kN/m² (WS2, WS3, WS4, WS6 & WS7) in the underlying undisturbed natural soils at the specified founding depths, generally increasing with depth.
- Nett allowable bearing pressures; at 3m begl would be approx 80kN/m² across all boreholes in the underlying undisturbed natural soils at the specified founding depths, generally increasing with depth.

If significant changes to the current topography are proposed then further assessment will be needed.

Traditional foundations terminating within the natural soils should be suitable for the proposed low-rise residential end-use across some areas of the site with trenchfill or other alternative foundation options available in other areas. If consideration is being undertaken to have a single foundation solution across the site then you may require an alternative solution (i.e. piled / raft). All available foundation solutions should also be confirmed/agreed by your structural engineer.

Granular soils were noted across the site. Where groundwater is encountered in granular soils / pockets within influencing distance of foundations, bearing capacities of granular soils will be reduced (**significant groundwater was not encountered at this stage**). If encountered during foundation excavations, then Geo-Matters Ltd should be contacted for further advice.

Foundations may need to be deepened within the influencing distance of trees if significant cohesive soils are noted following demolition and examination of the natural soils beneath the former building footprints.

4.7 Look and See Initial Infiltration Tests

Two of the window sampler boreholes were filled with water and monitored before backfilling to have an initial 'look-and-see' assessment on suitability for return BRE 365 infiltration rate testing.

The chosen locations (WS2 & WS5) were left overnight and checked again the following day, although the water level had dropped slightly, it was not deemed sufficient enough to recommend further assessment.

5.0 ANALYSIS, RESULTS AND INTERPRETATION

5.1 Chemical Analyses of Soils

In December 2014 DEFRA released a set of 'Category 4 Screening Levels' (C4SLs) for a select number of determinands. These are screening values which were intended to indicate a level at which land may be considered as 'suitable for use' and 'definitely not contaminated'. Third parties (e.g. LQM, CIEH etc.) have used DEFRA's general risk assessment approach and methodology to calculate further screening values for additional determinands which are common to brownfield / redevelopment sites across the UK. However, these third party values have been derived based upon health criteria values (HCVs) which represent a lower (minimal) risk level and are therefore more conservative. In order to allow a thorough assessment of risks to human health based on the proposed end use, a tiered assessment has been undertaken which uses the more conservative of these authoritative values as an initial screening exercise.

A combined set of Tier 1 Screening Values (T1SVs) shall therefore be used in consideration of potential risks to future end-users at the subject site with reference to the proposed residential end-use with private gardens.

Due to ongoing revisions to the contaminated land assessment framework (including the derivation and release of authoritative screening values), the following assessment (and related conclusions / recommendations) may be revised by Geo-Matters Ltd should replacement screening values etc. be released in the near future.

5.1.1 Testing

Representative soil samples from the exploratory locations were analysed for the range of contaminants outlined in Section 2.1. Representative samples of the near surface and underlying natural strata were analysed. The environmental analysis was scheduled by Geo-Matters Ltd and carried out by a UKAS / MCERTS accredited laboratory. The full details of the chemical test results are presented in Appendix VII and are summarised in Table 5.1 overleaf.

Table 5.1: Laboratory Analysis of Soil Samples Residential

Determinand	no. of Samples Analysed	Concentration Range (mg/kg)	Tier 1 Screening Values (mg/kg)	no. Exceeding Threshold
Metals				
Arsenic	8	5 - 12	37.0 ^b	0
Cadmium	8	<0.2 – 0.3	26.0 ^b	0
Chromium (Total)	8	8 - 25	910.0 ^b	0
Chromium VI	8	<2.0	6.0 ^b	0
Lead	8	8 - 128	200.0 ^a	0
Selenium	8	<2	250.0 ^b	0
Nickel	8	8 - 29	180.0 ^b	0
Copper	8	11 - 42	2400.0 ^b	0
Zinc	8	37 - 131	3700.0 ^b	0
Mercury	8	<1	40.0 ^b	0
Organics and Inorganics				
Benzo(a)pyrene	8	<0.1 – 3.91	2.2 ^b	2
TPH C6 – C10	4	<1	27 ^b	0
TPH C10 – C25	4	<1 - 18	74 ^b	0
TPH C25 – C40	4	<6 - 76	1100 ^b	0
Asbestos in Soils	4	Non-Detected	D ^c	0
Phenols	8	<2	280.0 ^b	0
pH	8	6.9 – 8.3	N/A	-
Water Sol. Sulphate (g/l)	8	<0.01 – 0.14	0.500	-

^a DEFRA C4SL values for a residential with plant uptake end use;

^b LQM 'S4UL' values (at 1% SOM for organics) for a residential with plant uptake end use (Copyright Land Quality Management Ltd reproduced with permission; Publication Number S4UL3676 All Rights Reserved);

^c Geo-Matters Ltd general screening level;

* Contaminants all recorded below the highest laboratory limit of detection; and
N/A = Not Applicable, ND = Not Detected, D = Detected.

Metals

The results were compared with the referenced Tier 1 Screening Values (T1SVs) which are an initial and conservative set of values which are considered most appropriate (overall) to the proposed residential end use with private gardens – therefore assessment targets would be residential with plant uptake.

None of the samples analysed for zootoxic or phytotoxic metals recorded concentrations in excess of their respective T1SVs. On this basis, no risks have been identified from these determinands at the subject site.

Inorganics and Organics

In lieu of published DEFRA Category 4 Screening Levels for inorganics and organics, the results have been assessed by comparison to available alternative T1SVs including the LQM / CIEH Generic Assessment Criteria (2nd Edition).

Inorganics

The pH values recorded from the soil samples varied between 6.9 and 8.3, indicating that the near neutral soil conditions prevail within soils at the site.

Organics

The significance of the PAH laboratory results have been assessed using the T1SV for benzo(a)pyrene. This is considered, in terms of toxicity, to present the greatest hazard to human health. The T1SV of 2.2mg/kg (residential end use with plant uptake) was exceeded within two of the samples tested. On this basis, localised risks have been identified from PAHs at the subject site based on the proposed residential end use with private gardens.

Total Petroleum Hydrocarbons (TPH)

4 no. samples were analysed for TPH across the site. The samples analysed did not record concentrations in excess of the respective Tier 1 Screening Values (T1SVs). On this basis, no risks have been identified from TPH at the subject site based on the proposed residential end use with private gardens.

Asbestos

No asbestos containing materials or free fibres were recorded in the 4 no. samples analysed, and on this basis, no risks have been identified from these determinands at the subject site based on the proposed residential end use with private gardens.

General Contaminants

Visual, Olfactory and Field Measurements

No significant visual or olfactory evidence of any other potential contamination was noted within any other exploratory locations advanced at the site.

5.2 CLEA Statistical Analysis

In August 2008, the Environment Agency (EA) withdrew the core regulatory guidance documents for the assessment of human health risks from contaminated land (CLR7 to CLR10), including the soil guideline value (SGV) documents. The newly published EA guidance documents (SC050021.TR1, SC050021.SR2 and SC050021.SR3) have been consulted; alongside the CL:AIRE / CIEH guidance note on statistical interpretation of contaminated land data; and the risk assessment for the subject site has been undertaken in broad accordance with these documents. With reference to the documents listed above, statistical analysis on sample data is not required for determinands where no exceedances above the relevant T1SV were recorded. With reference to the documents listed above, statistical analysis

on sample data is not required for determinands where exceedances above the relevant T1SV were not recorded or when there is an insufficient number of test results to make use of statistical analyses. Therefore, further statistical analysis is not considered necessary at this stage.

5.3 Summary of Chemical Analysis

The chemical analysis undertaken to date has indicated that the majority of soil concentrations in the samples tested are below the respective assessment criteria based on a proposed residential end use with private gardens. Only two samples within the shallow ashy made ground return concentrations in excess of their respective assessment criteria requiring minor remedial works.

6.0 PHASE II ENVIRONMENTAL ASSESSMENT

6.1 Phase II Conceptual Model

6.1.1 Site Summary

The results of the scheduled chemical analysis were compared with the appropriate T1SVs based on the proposed most sensitive redevelopment of residential with gardens end use.

6.1.2 Source-Pathway-Receptor Characterisation and Risk Assessment

The results of the chemical testing analyses indicate no elevated determinands have been recorded at concentrations sufficient to act as a source in a SOURCE-PATHWAY-RECEPTOR scenario.

6.1.3 Identified Pollutant Linkages

In view of the above; the pollutant linkages have been reassessed as listed in Table 6.1 (overleaf).

Table 6.1: Identified Pollutant Linkages

Potential Source	Pathway	Receptors					SPL*
		Controlled Waters	Ground workers	End-users	Flora	Building materials	
Metal / metalloids and inorganics in SOIL	Direct Ingestion	N/A	N/A	N/A	N/A	N/A	N/A
	Dermal Contact	N/A	N/A	N/A	N/A	N/A	N/A
	Inhalation	N/A	N/A	N/A	N/A	N/A	N/A
	Leaching/direct movement	N/A	N/A	N/A	N/A	N/A	N/A
Asbestos containing materials in SOIL	Inhalation	N/A	N/A	N/A	N/A	N/A	N/A
Organics/ Inorganics in SOIL (hydrocarbons, pathogenic bacteria, SVOCs, PAH etc.)	Direct Ingestion	✓	✓	✓	✓	N/A	✓
	Dermal Contact	✓	✓	✓	N/A	N/A	✓
	Inhalation	N/A	N/A	N/A	N/A	N/A	N/A
	Leaching/direct movement	✓	✓	✓	N/A	N/A	✓
Metal / metalloids and inorganics In CONTROLLED WATERS	Direct Ingestion	N/A	N/A	N/A	N/A	N/A	N/A
	Dermal Contact	N/A	N/A	N/A	N/A	N/A	N/A
	Inhalation	N/A	N/A	N/A	N/A	N/A	N/A
	Leaching/direct movement	N/A	N/A	N/A	N/A	N/A	N/A
Organics in CONTROLLED WATERS (hydrocarbons, PAH etc.)	Direct Ingestion	N/A	N/A	N/A	N/A	N/A	N/A
	Dermal Contact	N/A	N/A	N/A	N/A	N/A	N/A
	Inhalation	N/A	N/A	N/A	N/A	N/A	N/A
	Leaching/direct movement	✓	N/A	N/A	✓	N/A	✓
GROUND GAS (Carbon Dioxide and Methane)	Direct Ingestion	✓	✓	✓	N/A	N/A	✓
	Dermal Contact	N/A	N/A	N/A	N/A	N/A	N/A
	Inhalation	N/A	✓	✓	N/A	N/A	✓
	Leaching/direct movement	N/A	✓	✓	N/A	N/A	✓

* Subject to Local Authority approval.

6.1.4 Model Status, Uncertainty and Justification

The conceptual model is considered to represent the current site conditions based on the information derived from the site investigation.

6.2 Risk Assessment

6.2.1 Qualitative Risk Assessment

The regulatory framework within England which addresses risks from contaminated land is presented within and across several regimes. This includes sections 78 (A) to (YC) in Part IIA of the Environmental Protection Act 1990 (which was retrospectively inserted by Section 57 of the Environment Act 1995), Building Regulations, Environmental Permitting Regulations and the National Planning Policy Framework (NPPF) 2018. The contaminated land regime (principally under Part IIA of the EPA (1990)) sets out a risk-based approach within which the identification and remediation of contaminated land presenting unacceptable risks to people and the environment is described. Related regimes (such as those listed above) provide additional guidance through frameworks which focus on specific subsequent scenarios (e.g. re-use of land for new uses).

In the context of the planning system (as identified within the NPPF), the reuse of brownfield land is endorsed (s.118 pp35) and an emphasis is placed upon remediating and mitigating contaminated land (where appropriate). The NPPF states that (s.178/179 pp51-52):

"Planning policies and decisions should also ensure that:

- a site is suitable for its proposed use taking account of ground conditions and any risks arising from land instability and contamination. This includes risks arising from natural hazards or former activities such as mining, and any proposals for mitigation including land remediation (as well as potential impacts on the natural environment arising from that remediation);*
- after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990; and*
- adequate site investigation information prepared by a competent person is available to inform these assessments".*

"Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner".

And additionally, the NPPF states that (s. 180 pp52):

"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including

cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development”.

The core legislation (Part IIA) adopts the principle of a 'suitable for use' approach for; the assessment of contaminated land, the derivation of a site-specific risk assessment and subsequent determination of a remedial strategy. Action is only required if unacceptable risks are posed to human health or to the environment, taking into account the current land-use and geo-environmental settings.

The legislation places a responsibility on the Local Authority to determine whether the land under its jurisdiction is contaminated by consideration of whether: -

- ***Significant harm is being caused;***
- ***There is a significant possibility of significant harm being caused; or***
- ***Pollution of controlled waters is being caused or is likely to be caused.***

The statutory guidance describes a risk assessment methodology in terms of 'significant pollutants' and 'pollutant linkages', using SOURCE-PATHWAY-RECEPTOR' scenarios for the site.

On the basis of the above and also upon available data, the geo-environmental setting and proposed end-uses, a qualitative Source-Pathway-Receptor risk assessment (Table 6.2) is presented overleaf.

Table 6.2: Qualitative Risk Assessment Summary Table

Source	Pathway	Target (Receptor)	Comments	Risk Level	Action*
Metals / Metalloids in soils and dust	Direct ingestion (active) Inhalation (passive) Dermal contact.	Ground workers, End users	Significant contamination was not encountered	LOW	NO FURTHER ACTION REQUIRED
Metals / Metalloids in soils and dust	Near surface soils	Plants within the proposed landscaped areas and gardens.	Significant contamination was not encountered	LOW	NO FURTHER ACTION REQUIRED
Metal / Metalloids compounds in waters	As above (plus skin contact)	Ground workers, Site users	Significant groundwater was not encountered	LOW	NO FURTHER ACTION REQUIRED
Inorganics in soils and dust	Direct ingestion (active) Inhalation (passive)	Ground workers, End-users and the Property	Significant contamination was not encountered	LOW	NO FURTHER ACTION REQUIRED
Organic compounds in soils and dust	As above (plus skin contact)	Ground workers, Site Users	Localised contamination was encountered	LOW	REMOVAL OR CAPPING REQUIRED
Organic compounds in waters	As above (plus skin contact)	Ground workers, Site Users	Significant groundwater was not encountered	LOW	NO FURTHER ACTION REQUIRED
Ground Gas	Inhalation (Passive), Ingress	End-Users	Low level gas production has been recorded	LOW	GAS MITIGATION MEASURES WILL BE REQUIRED
Asbestos in Soil	Inhalation (passive), Ingress	End Users	Significant contaminated was not encountered	LOW	NO FURTHER ACTION REQUIRED

Notes: LOW / MODERATE / HIGH - Risk level is assigned a low / moderate / high qualitative value, based on assessed requirement for action in context of Part II EPA 90.

* Subject to Local Authority Approval.

6.3 Site Status

Human Health Risks

The Phase II Conceptual Model and the Qualitative Risk Assessment outlined above indicate that soils; in the main; at the site should be treated as **uncontaminated** in the context of the proposed re-development of the site for the most sensitive receptor of residential land-use with private gardens, subject to regulatory authority approval.

Localised minor contamination of PAH's were identified in a layer of ashy made ground at WS1 @ 0.9m begl and WS4 @ 0.10m begl requiring small scale remedial works.

Ground Gas & Radon

Significant ground gas levels were not recorded during the monitoring programme undertaken at the site.

An assessment using CL:AIRE RB 17 indicates that the site would fall under the 'low/medium risk' category as minor ground gas levels have been identified. As such the guidance concludes that the site could be classified as Modified Wilson and Card **Characteristic Situation 2** (equivalent to NHBC **AMBER 1** Traffic Light, if the floor slabs are to utilise a sub-floor void of at least 150mm) where ground gas protection measures are considered necessary in new buildings constructed at the site, subject to regulatory approval.

Low Radon classification is recorded for the site **not** requiring any radon precautions to be installed on all new proposed residential housing.

Controlled Water Risks

Damp soils which may be indicative of minor groundwater seepages have been encountered, but inconsistently, during the recent works at the site, however, the investigation techniques used were rapid. No significant contamination has been identified and no consistent ground water encountered therefore risk to controlled waters is deemed to be low.

6.4 Material Re-use / Importation

Thought should be given to re-using soils around the site where possible, the minor contamination would not prevent re-use depending on scenario. Topsoil has not been identified at the site therefore there will be the need for importation for use within the proposed residential development. All movement of soils; import and re-use; should be documented within a CL:AIRE Materials Management Plan.

7.0 RECOMMENDATIONS

The conclusions and recommendations presented below are considered reasonable based on the findings of the site investigation. However, these cannot be guaranteed to gain regulatory approval and therefore copies of this report should be sent to the appropriate Regulatory Authorities and / or other organisations (as appropriate) by the Client for their comments and approval prior to undertaking any irrecoverable works associated with the subject site.

- 7.1 Enabling / Earthworks:** Significant building footprints occupy the site which will require demolition prior to redevelopment. It may be possible to crush and re-use demolition materials although potential asbestos containing materials were noted to some of the building roofs.

Should topographical modification / re-profiling of the site be warranted as part of future proposed layouts, then an earthworks specification and re-appraisal of foundation depths may be required.

Specific testing (e.g. waste acceptance criteria testing) may be required at the discretion of the Client's designated waste handler if the off-site movement / disposal of soils is undertaken. Where applicable, such requirements must be verified directly with them by the Client. Additionally, where soils are imported there will be the necessity to ensure compliance with all regulatory licensing procedures (i.e. U1, MMP etc) and also to validate the soils prior to importation, subject to the approval of the Local Authority.

The movement of all materials to, from and within the site's boundaries will need to be covered in advance by the appropriate exemptions / licences etc.

A number of geotechnical hazards have been identified and highlighted earlier in this report that should be taken into consideration.

- 7.2 Foundations:** At this stage, it is considered that some foundations should be able to be terminated within the underlying natural soils across the site at a minimum depth of 0.60m begl, although deep made ground, soft soils and water seepages may mean that considerably deeper foundations will be required.

A nett allowable bearing pressure of 80kN/m² should be assigned across the majority of the site in the underlying undisturbed natural soils at 2m begl, generally increasing with depth. If significant changes to the current topography are

proposed then further assessment will be needed. Localised reduction of bearing capacity of 50kN/m² should be assigned within WS01 & WS05 at 2m depth which should also be confirmed by your structural engineer.

As outlined previously; due to the identified deep made ground, soft soils and water seepages; an alternative single foundation solution may be required such as piled or raft etc, in this instance early discussion with your structural engineer should be sought in order to design the most suitable solution for the site.

Granular soils were noted across the site. Where groundwater is encountered in granular soils / pockets within influencing distance of foundations, bearing capacities of granular soils will be reduced (**significant groundwater was not encountered at this stage**). If encountered during foundation excavations, then Geo-Matters Ltd should be contacted for further advice.

- 7.3 Floor Slabs:** At this stage ground bearing floor slabs should be appropriate where less than 0.60m of unsuitable soils are encountered (e.g. made ground). Where this is not the case a suspended floor would be a viable alternative.
- 7.4 Road Construction:** As a standard / generic approach, CBR values of less than 2% can usually be anticipated in made ground, CBR values of between 2% and 5% can be anticipated in natural cohesive soils and values of between 5% and 10% in natural granular soils respectively based on general road construction guidance literature. However, *in situ* CBR tests should be considered to confirm specific conditions in the areas of proposed road construction. All road construction proposals should be agreed with the Local Authority prior to finalising designs.
- 7.5 Groundwater:** Significant groundwater was not encountered within the exploratory investigation works at the site, however, the investigation techniques used were rapid and may have masked small seepages. In view of this dewatering is unlikely to be required at the site subject to prevailing weather conditions.
- 7.6 Building Near Trees:** Significant cohesive soils were not recorded across the site; therefore, foundation designs should not need to be adjusted locally in accordance with NHBC Standards (Chapter 4.2). Following demolition, a watching brief around the western boundary may be required due to trees in this area and to determine soil properties.

7.7 Drainage: The site is not considered to be suitable for the use of in situ drainage soakaways due to the deep made ground and relatively shallow damp soils. The look-and-see initial infiltration rate testing indicated the soils not to be suitable for soakaways, although if soakaways are to be proposed however, then *in situ* testing in accordance to BRE Digest 365 will need to be undertaken. All soakaway designs should be approved by the relevant statutory authority prior to implementation and must adhere to the standard design and ground setting requirements, upon which your appointed drainage design engineers should advise you. All drainage proposals are subject to *in situ* testing and should be agreed with the Local Authority prior to finalising designs.

7.8 Ground Gas and Radon: Elevated CO₂ readings were recorded within the gas monitoring programme undertaken.

The assessment using CL:AIRE RB 17 indicates that the site would fall under the 'low/medium risk' category as ground gas has been identified. As such the guidance concludes that the site could be classified as Modified Wilson and Card Characteristic Situation 2 (equivalent to NHBC Amber 1 Traffic Light, if the floor slabs are to utilise a sub-floor void of at least 150mm) where ground gas protection measures are considered necessary in new buildings constructed at the site, subject to regulatory approval.

The property is not located in a Radon Affected Area therefore **no** radon protection measures are required subject to regulatory Authority approval.

7.9 Mining: No precautions relating to mining are considered necessary as outlined in the 3rd Party Phase I Desk Study, subject to regulatory authority approval.

7.10 Excavations: Generally good stability was noted in the exploratory locations completed across the site for the short time they remained open but deep made ground has been identified. The strata should be assumed to be unstable as a precautionary measure. No man entry into unsupported excavations should therefore be allowed without an appropriate risk assessment by the Client and / or their appointed site contractors. Reference to CIRIA report 97 (1983) should be made to establish a suitable means of support or battering of excavation sides.

7.11 Sulphate Classification: In accordance with BRE Guidance Special Digest 1 (2005) the characteristic values of water soluble sulphate concentration and pH for soils indicates a site wide Design Sulphate Class DS-1 and an Aggressive Chemical

Environment for Concrete (ACEC) classification of AC-1s. Minimum concrete specification should be in accordance with NHBC Standards, Section 3.1.

7.12 Contamination: Chemical analysis results have been compared with current relevant guidance and site-specific screening values which indicates that there are **minor localised** elevated levels of contaminants present at the site.

7.13 Remediation: Remediation works to protect human health are considered **necessary** requiring a remedial strategy to the approval of the Local Authority / NHBC.

7.14 Topsoil: Topsoil was not encountered within any of the exploratory holes that were completed during the recent intrusive works, therefore topsoil importation will be required for the proposed redevelopment of residential dwellings with private gardens.

It is reiterated that the movement, importation and / or exportation of all soils must be undertaken in full compliance with all regulatory licensing procedures (i.e. U1, MMP etc), and validation of soils prior to any importation will be required, subject to the approval of the Local Authority / NHBC.

7.15 Further Works: At this stage the following further works are deemed necessary, subject to comments from the Regulatory Authorities.

- The Client will need to liaise with appropriately licensed waste management contractors to determine requirements for additional analysis etc. should materials be considered for off-site removal / disposal;
- Remedial Strategy to inform the measures required to address the minor localised contamination;
- Watching brief following demolition within the former building footprints to assess soil characteristics;
- Re-use / importation of soils will need to be covered through a CL:AIRE DoWCoP (MMP).

INFORMATION SOURCES

Geological data	British Geological Survey (BGS) 1:50,000 scale Series, Solid and Drift Edition; 3 rd Party Phase I Desktop Study report for the site
Environmental	BRE Report BR211 '<i>Radon: Protective Measures for New Buildings</i>' (2015 Edition). Environment Agency (EA) & DEFRA: "<i>Model Procedures for the Management of Land Contamination – Contaminated Land Report 11</i>" (CLR11) (2004). Department for Environment, Food and Rural Affairs (DEFRA) – "<i>SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document</i>" (December 2014). DEFRA and Contaminated Land: Applications in Real Environments (CL:AIRE) "<i>SP1010 – Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination: Final Project Report</i>" (Revision 2 dated 24th September 2014). Chartered Institute of Environmental Health (CIEH): "<i>Professional Practice Note: Reviewing human health risk assessment reports invoking contaminant oral bioavailability measurements or estimates</i>" (2009). CL:AIRE in Association with EIC and AGS: "<i>Soil Generic Assessment Criteria for Human Health Risk Assessment</i>" (updated January 2010 version) (<i>Reference purposes</i>).
Historical	3 rd Party Phase I Desktop Study report for the site

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The findings and recommendations made in this report are based on published information (as referenced in Section 3 and at the end of this report). Geo-Matters Ltd cannot accept responsibility for the reliability and authenticity of published information or reports prepared by third parties. There may be conditions prevailing on site which have not been revealed by this assessment and which have not been taken into account by this report. Responsibility cannot be accepted for any conditions not revealed by this investigation and assessment. It should be noted that groundwater levels etc. may vary due to seasonal and other effects. Whilst it may be utilised by others for reference purposes at the Client's discretion, it has not been prepared for any other purposes (e.g. waste classification, drainage excavations etc.) and therefore additional works may be required by third parties dependent upon their own requirements / works. Any works which are proposed at greater depths than reported herein may require confirmatory investigation works as necessary.

Should the development proposals alter (e.g. layout, type or foundation option), then the recommendations in this report may be subject to change.

The conclusions and recommendations presented herein are considered reasonable based on the assessments of the site undertaken by Geo-Matters Ltd. However, these cannot be guaranteed to gain regulatory approval and therefore copies of this report should be sent to the appropriate regulatory authorities and / or other organisations (as appropriate) by the Client for their comments and approval prior to undertaking any irrecoverable works associated with the site.

The possibility of significant variation in ground conditions existing between / beneath test locations / depths cannot be discounted and must be considered within the design proposals for the subject site. All soakaway designs should be approved by the relevant statutory authority prior to implementation and must adhere to the standard design and ground setting requirements, upon which your appointed drainage design engineers should advise you.

Standard Risk Assessment – Considerations and Methodology

Geo-Matters Ltd have based our standard risk assessment methodology upon current legislation and prevailing best practice and available guidance. This includes the DEFRA / EA document 'Contaminated Land Report 11 (CLR11) Model Procedures for the Management of Land Contamination' (23) and the NHBC / EA / CIEH document 'Guidance for the Safe Development of Housing on Land Affected by Contamination' (2008).

Our risk assessment methodology is based upon a phased approach, which takes the following steps:

1. Hazard Identification and Assessment:

- a. Preliminary risk assessment;
- b. Derivation of initial conceptual site model (CSM); and
- c. Identification of feasible pollutant linkages (which leads onto step '2' if identified).

2. Risk Estimation and Evaluation:

- a. Investigation of the identified potential risks (as highlighted in CSM);
- b. Completion of Generic Quantitative Risk Assessment (GQRA); and
- c. Evaluation of risks / confirmation of pollutant linkages (leading onto step '3' if identified).

3. Remediation Design / Implementation / Verification:

- a. Completion of Detailed Quantitative Risk Assessment (DQRA) if necessary;
- b. Collation of remedial strategy;
- c. Implementation of remedial strategy / validation; and
- d. Final reporting.

Risk terminology and classification is defined through standard wording and descriptions, as contained in the documents referenced above. This includes the balance, comparison and assessment of risk as a dynamic categorisation / classification of probability vs. possible consequence(s), as shown in the table A1 below:

Table A1: Risk Categorisation					
Probability (Likelihood)		Consequence			
		<i>Severe</i>	<i>Medium</i>	<i>Mild</i>	<i>Minor</i>
	<i>High Likelihood</i>	Very High Risk	High Risk	Moderate Risk	Moderate / Low Risk
	<i>Likely</i>	High Risk	Moderate Risk	Moderate / Low Risk	Low Risk
	<i>Low Likelihood</i>	Moderate Risk	Moderate / Low Risk	Low Risk	Very Low Risk
	<i>Not likely</i>	Moderate / Low Risk	Low Risk	Very Low Risk	Very Low Risk

Risk levels are described as follows:

Table A1: Risk Level Descriptions	
Term	Description
Very High Risk	A high probability exists that severe / significant harm could arise to someone or something from the hazard which has been identified. Remedial action is required.
High Risk	Harm is likely to arise to someone or something from the hazard which has been identified. Remedial action is usually required.
Moderate Risk	Harm could potentially arise to someone or something from the hazard which has been identified without remedial action, although it is considered to be relatively <u>unlikely</u> that such harm would be severe.
Low Risk	Harm could theoretically arise to someone or something from the hazard which has been identified without remedial action, although it is considered that any effects would be mild.
Very Low Risk	Harm is not likely to arise to someone or something from the hazard which has been identified.

The NHBC / EA / CIEH document 'Guidance for the Safe Development of Housing on Land Affected by Contamination' (2008) defines the following (reproduced verbatim):

"Severity (consequence) can be defined as the adverse effects (or harm) arising from a defined hazard, which impairs the quality of human health or the environment in the short or longer term. For example a consequence defined as "Severe" could be defined as "Highly elevated concentrations likely to result in 'significant harm' to human health as defined by the EPA 1990, Part 2A, if exposure occurs". The type and form of the contaminant needs to be known in order to understand the effect on humans and therefore severity of potential harm. For instance different forms of cyanide behave differently. Complex cyanide ("blue billy") is relatively "non toxic" whereas free cyanide is "highly toxic" (Environment Agency 2002b).

Probability can be defined as the chance of a particular event occurring in a given period of time. For example, a "High Likelihood" could be defined as "where an event would appear very likely in the short-term and almost inevitable over the long-term, or there is evidence at the receptor of harm or pollution"

APPENDIX I

Proposed Layout Plan



DO NOT SCALE
NOTES:



Approx. Site Boundary



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CLIENT:

Morro Partnerships Ltd & EMH
Housing & Regeneration Ltd

PROJECT:

Sapcote Road, Burbage

TITLE:

Proposed Site Layout Plan

SCALE@SIZE :

NTS

ISSUE:

Final

DESIGN/DRAWN :

AT

DATE:

Nov. 2023

PROJECT No:

GML23150

DRAWING No:

001

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The proposed layout plan shown is an extract taken from Drawing P2-03 'Proposed Site Plan' dated July 2021 by Staniforth Architects.

APPENDIX II

Site Location Plan



DO NOT SCALE

NOTES:

 Approx. Site Location

 Approx. Site Boundary



GEOMATTERS
consulting engineers

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CLIENT:
Morro Partnerships Ltd & EMH
Housing & Regeneration Ltd

PROJECT:
Sapcote Road, Burbage

TITLE:
Site Location Plan

SCALE@SIZE : NTS	ISSUE: Final
DESIGN/DRAWN : AT	DATE: Nov. 2023
PROJECT No: GML23150	DRAWING No: 002

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APPENDIX III

Site Features Plan



DO NOT SCALE

NOTES:

 Approx. Site Boundary



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CLIENT:

Morro Partnerships Ltd & EMH
Housing & Regeneration Ltd

PROJECT:

Sapcote Road, Burbage

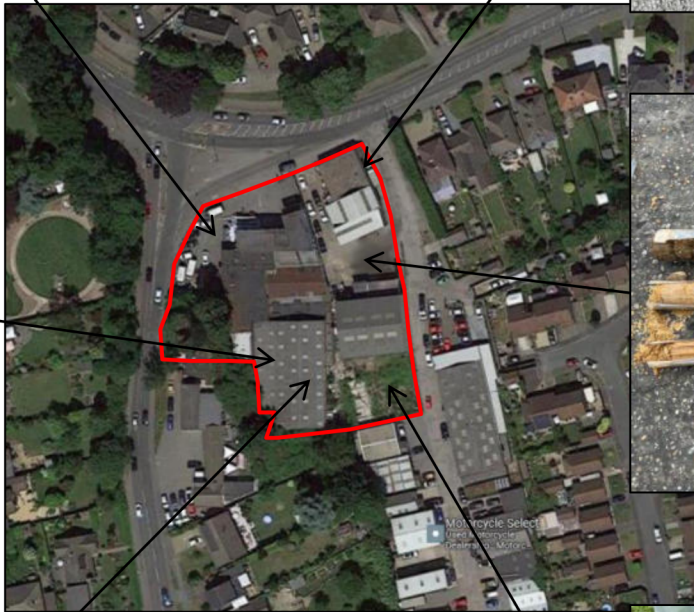
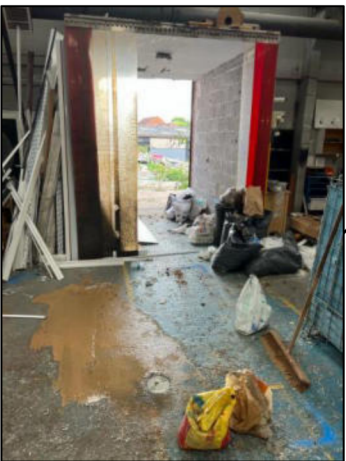
TITLE:

Site Features Plan

SCALE@SIZE : NTS	ISSUE: Final
DESIGN/DRAWN : AT	DATE: Nov. 2023
PROJECT No: GML23150	DRAWING No: 003

APPENDIX IV

General Photographic Record



DO NOT SCALE
NOTES:



Approx. Site Boundary



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CLIENT:

Morro Partnerships Ltd & EMH
Housing & Regeneration Ltd

PROJECT:

Sapcote Road, Burbage

TITLE:

General Photographic Record

SCALE@SIZE :
NTS

ISSUE:
Final

DESIGN/DRAWN :
AT

DATE:
Nov. 2023

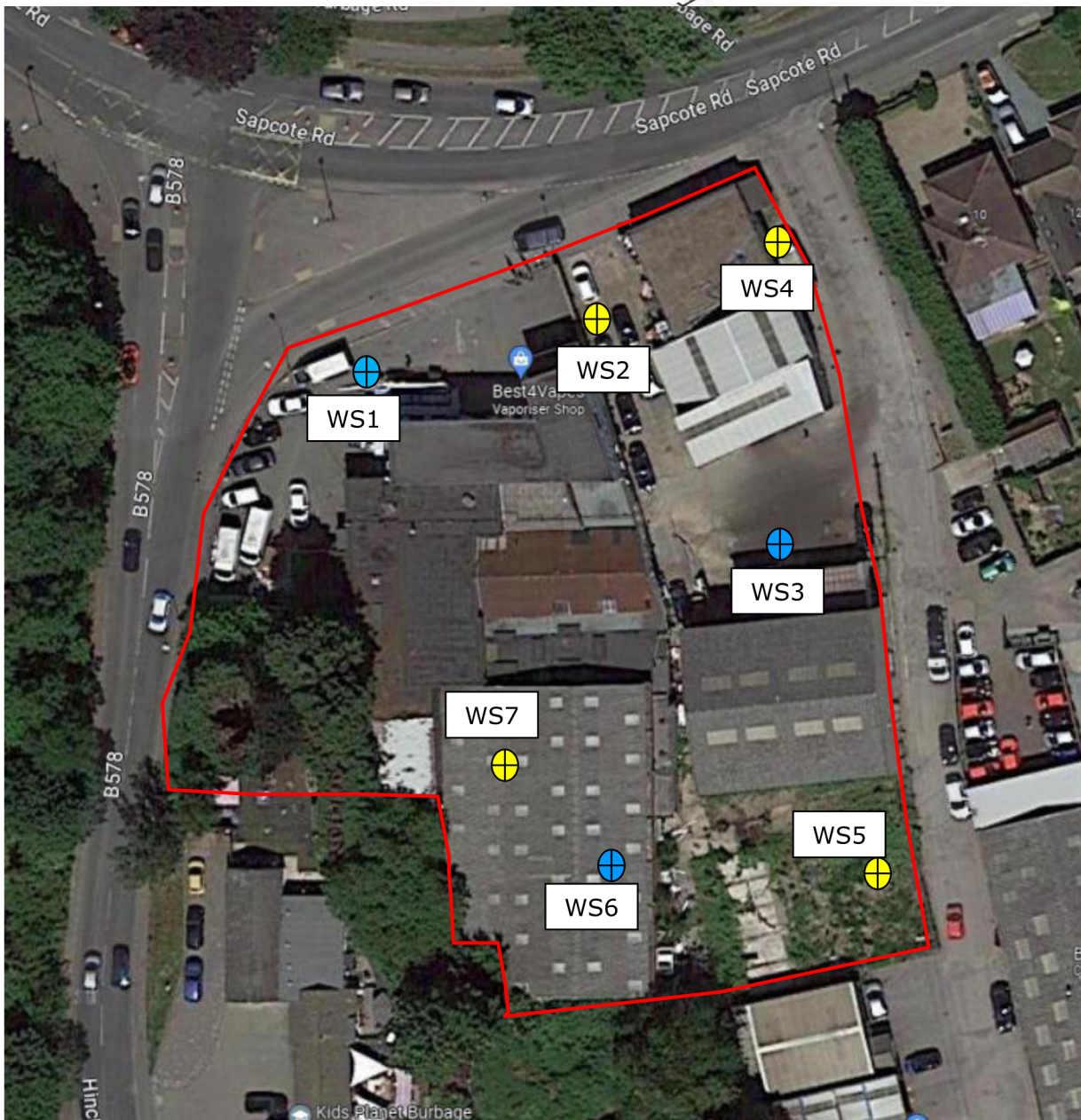
PROJECT No:
GML23150

DRAWING No:
004

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APPENDIX V

Exploratory Hole Layout Plan



DO NOT SCALE

NOTES:

-  Approx Exploratory Locations
-  Well Installations

GEOMATTERS
consulting engineers

www.geo-matters.com
info@geo-matters.com

CLIENT:
Morro Partnerships Ltd & EMH
Housing & Regeneration Ltd

PROJECT:
Sapcote Road, Burbage

TITLE:
Exploratory Hole Layout Plan

SCALE@SIZE : NTS	ISSUE: Final
DESIGN/DRAWN : ML	DATE: Nov. 2023
PROJECT No: GML23150	DRAWING No: 005

APPENDIX VI

Exploratory Hole Logs

		Site: Sapcote Road,Burbage		WS1	
		Client: Morro Partnerships Ltd & EMH Housing & Regeneration Ltd			
Contractor: RP Drilling		Project No: GML23150		Sheet: 1 of 1	
Equipment: Window Sampler Rig		Logged by: GML		Date: 22nd September 2023	
Field Monitoring and Sampling		Strata		Legend	
Depth (m)	Type	Result (SPT)	depth (m)	Description	
0.90	JTV	N = 3	0.40	MADE GROUND comprising tarmacadam, concrete and brick fragments	
			0.50	MADE GROUND comprising black ashy sub-base	
			0.80	MADE GROUND comprising reworked brown clay with brick fragments	
			1m	MADE GROUND comprising reworked sandy clay with brick fragments in an ashy clinker matrix	
1.80	JTV	N = 9	1.80	 Damp soils	
2m			Medium dense orange slightly clayey silty SAND		
3m			Firm orange brown slightly sandy slightly clayey SILT		
3.20					
2.50	B	N = 16	5m	Exploratory location completed at 4.45m depth.	
3.50				N = 26	
Sheet 1 of 1		Groundwater:		Date : 22/09/23	
		No groundwater encountered during excavation.		Drilled by: RP	
EXPLORATORY RECORD		Remarks:			
		1)			
		HSV = Hand Shear Vane (kPa), PP = Pocket Penetrometer (daN/cm ²)			

		Site: Sapcote Road, Burbage		WS2
		Client: Morro Partnerships Ltd & EMH Housing & Regeneration Ltd		
Contractor: RP Drilling		Project No: GML23150		Sheet: 1 of 1
Equipment: Window Sampler Rig		Logged by: GML		Date: 22nd September 2023
Field Monitoring and Sampling		Strata		Legend
Depth (m)	Type	Result (SPT)	depth (m)	Description
0.80 0.90	JTV B	N = 8	0.15	MADE GROUND comprising un-reinforced concrete
			0.25	MADE GROUND comprising brown gravelly sub-base
1.50	JTV	N = 8	1m	Medium dense orange fine to coarse slightly clayey silty SAND
			2m	
3.50		N = 8	3m	
			4m	 Damp soils
		N = 14		
		N = 21		
Exploratory location completed at 5.00m depth.				
Sheet 1 of 1		Groundwater: No groundwater encountered during excavation.		Date : 22/09/23 Drilled by: RP
EXPLORARY RECORD		Remarks: 1)		
		HSV = Hand Shear Vane (kPa), PP = Pocket Penetrometer (daN/cm ²)		

		Site: Sapcote Road,Burbage		WS3
		Client: Morro Partnerships Ltd & EMH Housing & Regeneration Ltd		
Contractor: RP Drilling		Project No: GML23150		Sheet: 1 of 1
Equipment: Window Sampler Rig		Logged by: GML		Date: 22nd September 2023
Field Monitoring and Sampling		Strata		Legend
Depth (m)	Type	Result (SPT)	depth (m)	Description
0.50	JTV	N = 6	0.15	MADE GROUND comprising un-reinforced concrete
			1m	MADE GROUND comprising reworked sandy clay with brick fragments
1.80	JTV	N = 12	1.70	Medium dense orange fine to coarse slightly clayey silty SAND
3.10		N = 29	3m	 Damp soils
			4m	
		N = 32	5m	Exploratory location completed at 4.00m depth.
Sheet 1 of 1		Groundwater: No groundwater encountered during excavation.		Date : 22/09/23 Drilled by: RP
EXPLORATORY RECORD		Remarks: 1)		
		HSV = Hand Shear Vane (kPa), PP = Pocket Penetrometer (daN/cm ²)		

		Site: Sapcote Road, Burbage		WS4
		Client: Morro Partnerships Ltd & EMH Housing & Regeneration Ltd		
Contractor: RP Drilling		Project No: GML23150		Sheet: 1 of 1
Equipment: Window Sampler Rig		Logged by: GML		Date: 22nd September 2023
Field Monitoring and Sampling		Strata		Legend
Depth (m)	Type	Result (SPT)	depth (m)	Description
0.10	JTV		0.20	MADE GROUND comprising loose tarmac chippings
1.00	JTV	N = 8	1m	Medium dense light brown slightly clayey silty SAND
1.50	B			
		N = 9	2m	
		N = 8	3m	
		N = 29		
			5m	Exploratory location completed at 4.00m depth.
Sheet 1 of 1		Groundwater:		Date : 22/09/23
		No groundwater encountered during excavation.		Drilled by: RP
EXPLORATORY RECORD		Remarks:		
		1)		
		HSV = Hand Shear Vane (kPa), PP = Pocket Penetrometer (daN/cm ²)		

		Site: Sapcote Road, Burbage		WS5
		Client: Morro Partnerships Ltd & EMH Housing & Regeneration Ltd		
Contractor: RP Drilling		Project No: GML23150		Sheet: 1 of 1
Equipment: Window Sampler Rig		Logged by: GML		Date: 22nd September 2023
Field Monitoring and Sampling		Strata		Legend
Depth (m)	Type	Result (SPT)	depth (m)	Description
1.20 1.40 2.50	JTV	N = 2	0.20	MADE GROUND comprising loose tarmac chippings and concrete fragments
			1m	Loose becoming medium dense orange light brown slightly clayey sandy SILT
				 Damp soils
	B	N = 11	2m	
			2.30	Firm grey clayey SILT
3m				
		N = 30	4m	Exploratory location completed at 3.50m depth.
			5m	
Sheet 1 of 1		Groundwater:		Date : 22/09/23
		No groundwater encountered during excavation.		Drilled by: RP
EXPLORATORY RECORD		Remarks:		
		1)		
		HSV = Hand Shear Vane (kPa), PP = Pocket Penetrometer (daN/cm ²)		

		Site: Sapcote Road,Burbage		WS6
		Client: Morro Partnerships Ltd & EMH Housing & Regeneration Ltd		
Contractor: RP Drilling		Project No: GML23150		Sheet: 1 of 1
Equipment: Window Sampler Rig		Logged by: GML		Date: 22nd September 2023
Field Monitoring and Sampling		Strata		Legend
Depth (m)	Type	Result (SPT)	depth (m)	Description
0.90	JTV	N = 2	0.15	MADE GROUND comprising un-reinforced concrete
			1m	MADE GROUND comprising concrete clay brick fragments in a sandy matrix
2.20	JTV	N = 15	1.40	Firm orange brown slightly sandy clayey SILT
			3m	
3.70	B	N = 32		
			5m	Exploratory location completed at 4.00m depth.
Sheet 1 of 1		Groundwater: No groundwater encountered during excavation.		Date : 22/09/23 Drilled by: RP
EXPLORARY RECORD		Remarks: 1)		
		HSV = Hand Shear Vane (kPa), PP = Pocket Penetrometer (daN/cm ²)		

		Site: Sapcote Road, Burbage		WS7
		Client: Morro Partnerships Ltd & EMH Housing & Regeneration Ltd		
Contractor: RP Drilling		Project No: GML23150		Sheet: 1 of 1
Equipment: Window Sampler Rig		Logged by: GML		Date: 22nd September 2023
Field Monitoring and Sampling		Strata		Legend
Depth (m)	Type	Result (SPT)	depth (m)	Description
0.30	JTV	N = 16	0.20	MADE GROUND comprising un-reinforced concrete
			0.50	MADE GROUND comprising concrete clay brick fragments in a sandy matrix
1.10	JTV		1m	Medium dense orange light brown slightly clayey silty SAND
		N = 18	2.00	Firm brown slightly sandy clayey SILT
2.30	B	N = 27	3m	
			4m	
			5m	
				Exploratory location completed at 3.50m depth.
Sheet 1 of 1		Groundwater: No groundwater encountered during excavation.		Date : 22/09/23 Drilled by: RP
EXPLORARY RECORD		Remarks: 1)		
		HSV = Hand Shear Vane (kPa), PP = Pocket Penetrometer (daN/cm ²)		

APPENDIX VII

Laboratory Testing Data Certificates



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104 Bond Gate
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Derby
DE74 2NR

Derwentside Environmental Testing Services Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410

DETS Report No: 23-12284

Site Reference: Burbage

Project / Job Ref: None Supplied

Order No: ML/GML23150/001

Sample Receipt Date: 03/10/2023

Sample Scheduled Date: 03/10/2023

Report Issue Number: 1

Reporting Date: 09/10/2023

Authorised by:



Dave Ashworth
Technical Manager

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

Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.



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Soil Analysis Certificate						
DETS Report No: 23-12284	Date Sampled	22/09/23	22/09/23	22/09/23	22/09/23	22/09/23
Geo-Matters Limited	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Burbage	TP / BH No	WS1	WS2	WS2	WS3	WS4
Project / Job Ref: None Supplied	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: ML/GML23150/001	Depth (m)	0.90	0.80	1.50	0.50	0.10
Reporting Date: 09/10/2023	DETS Sample No	677970	677971	677972	677973	677974

Determinand	Unit	RL	Accreditation	(n)			
Asbestos Screen ^(S)	N/a	N/a	ISO17025	Not Detected		Not Detected	Not Detected
pH	pH Units	N/a	MCERTS	7.1		8.3	7.3
Total Sulphate as SO ₄	mg/kg	< 200	MCERTS	563		< 200	419
Total Sulphate as SO ₄	%	< 0.02	MCERTS	0.06		< 0.02	0.04
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	45		25	33
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.04		0.03	0.03
TOC (Total Organic Carbon)	%	< 0.1	MCERTS	3.9		< 0.1	0.9
Arsenic (As)	mg/kg	< 2	MCERTS	12		8	11
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	0.3		< 0.2	< 0.2
Chromium (Cr)	mg/kg	< 2	MCERTS	13		8	25
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2		< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	42		12	19
Lead (Pb)	mg/kg	< 3	MCERTS	128		8	15
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1		< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	23		13	29
Selenium (Se)	mg/kg	< 2	MCERTS	< 2		< 2	< 2
Zinc (Zn)	mg/kg	< 3	MCERTS	101		51	59
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 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)

(n) Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation



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Soil Analysis Certificate					
DETS Report No: 23-12284	Date Sampled	22/09/23	22/09/23	22/09/23	22/09/23
Geo-Matters Limited	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Burbage	TP / BH No	WS4	WS5	WS6	WS6
Project / Job Ref: None Supplied	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied
Order No: ML/GML23150/001	Depth (m)	1.00	1.20	0.90	2.20
Reporting Date: 09/10/2023	DETS Sample No	677975	677976	677977	677978

Determinand	Unit	RL	Accreditation					
Asbestos Screen ^(S)	N/a	N/a	ISO17025					Not Detected
pH	pH Units	N/a	MCERTS		7.0		7.2	7.1
Total Sulphate as SO ₄	mg/kg	< 200	MCERTS		268		< 200	255
Total Sulphate as SO ₄	%	< 0.02	MCERTS		0.03		< 0.02	0.03
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS		< 10		12	56
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS		< 0.01		0.01	0.06
TOC (Total Organic Carbon)	%	< 0.1	MCERTS		0.1		0.6	1.1
Arsenic (As)	mg/kg	< 2	MCERTS		11		8	8
Cadmium (Cd)	mg/kg	< 0.2	MCERTS		< 0.2		< 0.2	< 0.2
Chromium (Cr)	mg/kg	< 2	MCERTS		12		10	9
Chromium (hexavalent)	mg/kg	< 2	NONE		< 2		< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS		17		11	14
Lead (Pb)	mg/kg	< 3	MCERTS		10		21	25
Mercury (Hg)	mg/kg	< 1	MCERTS		< 1		< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS		17		9	10
Selenium (Se)	mg/kg	< 2	MCERTS		< 2		< 2	< 2
Zinc (Zn)	mg/kg	< 3	MCERTS		59		43	44
Total Phenols (monohydric)	mg/kg	< 2	NONE		< 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: 23-12284		Date Sampled	22/09/23			
Geo-Matters Limited		Time Sampled	None Supplied			
Site Reference: Burbage		TP / BH No	WS7			
Project / Job Ref: None Supplied		Additional Refs	None Supplied			
Order No: ML/GML23150/001		Depth (m)	1.10			
Reporting Date: 09/10/2023		DETS Sample No	677980			

Determinand	Unit	RL	Accreditation				
Asbestos Screen ^(S)	N/a	N/a	ISO17025				
pH	pH Units	N/a	MCERTS	8.0			
Total Sulphate as SO ₄	mg/kg	< 200	MCERTS	435			
Total Sulphate as SO ₄	%	< 0.02	MCERTS	0.04			
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	137			
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.14			
TOC (Total Organic Carbon)	%	< 0.1	MCERTS	0.7			
Arsenic (As)	mg/kg	< 2	MCERTS	5			
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	< 0.2			
Chromium (Cr)	mg/kg	< 2	MCERTS	8			
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2			
Copper (Cu)	mg/kg	< 4	MCERTS	11			
Lead (Pb)	mg/kg	< 3	MCERTS	20			
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1			
Nickel (Ni)	mg/kg	< 3	MCERTS	8			
Selenium (Se)	mg/kg	< 2	MCERTS	< 2			
Zinc (Zn)	mg/kg	< 3	MCERTS	37			
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: 23-12284	Date Sampled	22/09/23	22/09/23	22/09/23	22/09/23
Geo-Matters Limited	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Burbage	TP / BH No	WS1	WS2	WS3	WS4
Project / Job Ref: None Supplied	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied
Order No: ML/GML23150/001	Depth (m)	0.90	1.50	0.50	0.10
Reporting Date: 09/10/2023	DETS Sample No	677970	677972	677973	677974

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	0.20	< 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	1.41	< 0.1	< 0.1	0.19	< 0.1
Anthracene	mg/kg	< 0.1	MCERTS	0.58	< 0.1	< 0.1	0.14	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	6.91	< 0.1	< 0.1	0.65	< 0.1
Pyrene	mg/kg	< 0.1	MCERTS	6.39	< 0.1	< 0.1	0.99	< 0.1
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	4.37	< 0.1	< 0.1	0.72	< 0.1
Chrysene	mg/kg	< 0.1	MCERTS	3.92	< 0.1	< 0.1	0.87	< 0.1
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	4.43	< 0.1	< 0.1	3.20	< 0.1
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	1.67	< 0.1	< 0.1	0.95	< 0.1
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	3.91	< 0.1	< 0.1	3.64	< 0.1
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	2.06	< 0.1	< 0.1	2.57	< 0.1
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	0.46	< 0.1	< 0.1	0.57	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	1.70	< 0.1	< 0.1	2.48	< 0.1
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	37.8	< 1.6	< 1.6	17.2	< 1.6

(n) Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation



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Soil Analysis Certificate - Speciated PAHs

DETS Report No: 23-12284	Date Sampled	22/09/23	22/09/23	22/09/23		
Geo-Matters Limited	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: Burbage	TP / BH No	WS6	WS7	WS7		
Project / Job Ref: None Supplied	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: ML/GML23150/001	Depth (m)	2.20	0.30	1.10		
Reporting Date: 09/10/2023	DETS Sample No	677978	677979	677980		

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	< 1.6	< 1.6		



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Soil Analysis Certificate - EPH Banded (Type E)

DETS Report No: 23-12284	Date Sampled	22/09/23	22/09/23	22/09/23	22/09/23
Geo-Matters Limited	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Burbage	TP / BH No	WS1	WS2	WS4	WS6
Project / Job Ref: None Supplied	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied
Order No: ML/GML23150/001	Depth (m)	0.90	0.80	1.00	0.90
Reporting Date: 09/10/2023	DETS Sample No	677970	677971	677975	677977

Determinand	Unit	RL	Accreditation				
EPH (C6 - C8)	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
EPH (>C8 - C10)	mg/kg	< 1	MCERTS	11	< 1	< 1	< 1
EPH (>C10 - C12)	mg/kg	< 1	MCERTS	10	< 1	< 1	< 1
EPH (>C12 - C16)	mg/kg	< 1	MCERTS	2	< 1	< 1	< 1
EPH (>C16 - C21)	mg/kg	< 1	MCERTS	18	< 1	< 1	< 1
EPH (>C21 - C35)	mg/kg	< 6	NONE	76	< 6	< 6	< 6
EPH (C6 - C35)	mg/kg	< 6	NONE	118	< 6	< 6	< 6



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Soil Analysis Certificate - Sample Descriptions	
DETS Report No: 23-12284	
Geo-Matters Limited	
Site Reference: Burbage	
Project / Job Ref: None Supplied	
Order No: ML/GML23150/001	
Reporting Date: 09/10/2023	

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
\$ 677970	WS1	None Supplied	0.90	13.6	Black sandy clay with stones
\$ 677971	WS2	None Supplied	0.80	11.1	Light brown sand
\$ 677972	WS2	None Supplied	1.50	10	Light brown sand
\$ 677973	WS3	None Supplied	0.50	20.4	Grey clay with brick
\$ 677974	WS4	None Supplied	0.10	5.7	Brown sandy clay with stones
\$ 677975	WS4	None Supplied	1.00	7.2	Light brown sand
\$ 677976	WS5	None Supplied	1.20	16.2	Light brown sandy clay
\$ 677977	WS6	None Supplied	0.90	8.8	Light brown sandy clay with stones
\$ 677978	WS6	None Supplied	2.20	14.9	Light brown sandy clay
\$ 677979	WS7	None Supplied	0.30	7	Brown sandy clay with stones
\$ 677980	WS7	None Supplied	1.10	7	Brown sandy clay

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

Insufficient Sample ^{1/5}

Unsuitable Sample ^{4/5}

\$ samples exceeded recommended holding times



DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410



Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 23-12284

Geo-Matters Limited

Site Reference: Burbage

Project / Job Ref: None Supplied

Order No: ML/GML23150/001

Reporting Date: 09/10/2023

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 @ 450°C	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

TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS

Tested in Accordance with: BS 1377-2:1990: Clause 4.4 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

Client: Geo-Matters Limited
Client Address: 104 Bondgate, Castle Donington,
DE74 2NR

Contact: Mark Lewis
Site Address: Burbage

Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Client Reference: GML23150
Job Number: 23-60582-1
Date Sampled: Not Given
Date Received: 05/10/2023
Date Tested: 17/10/2023
Sampled By: Client - ML

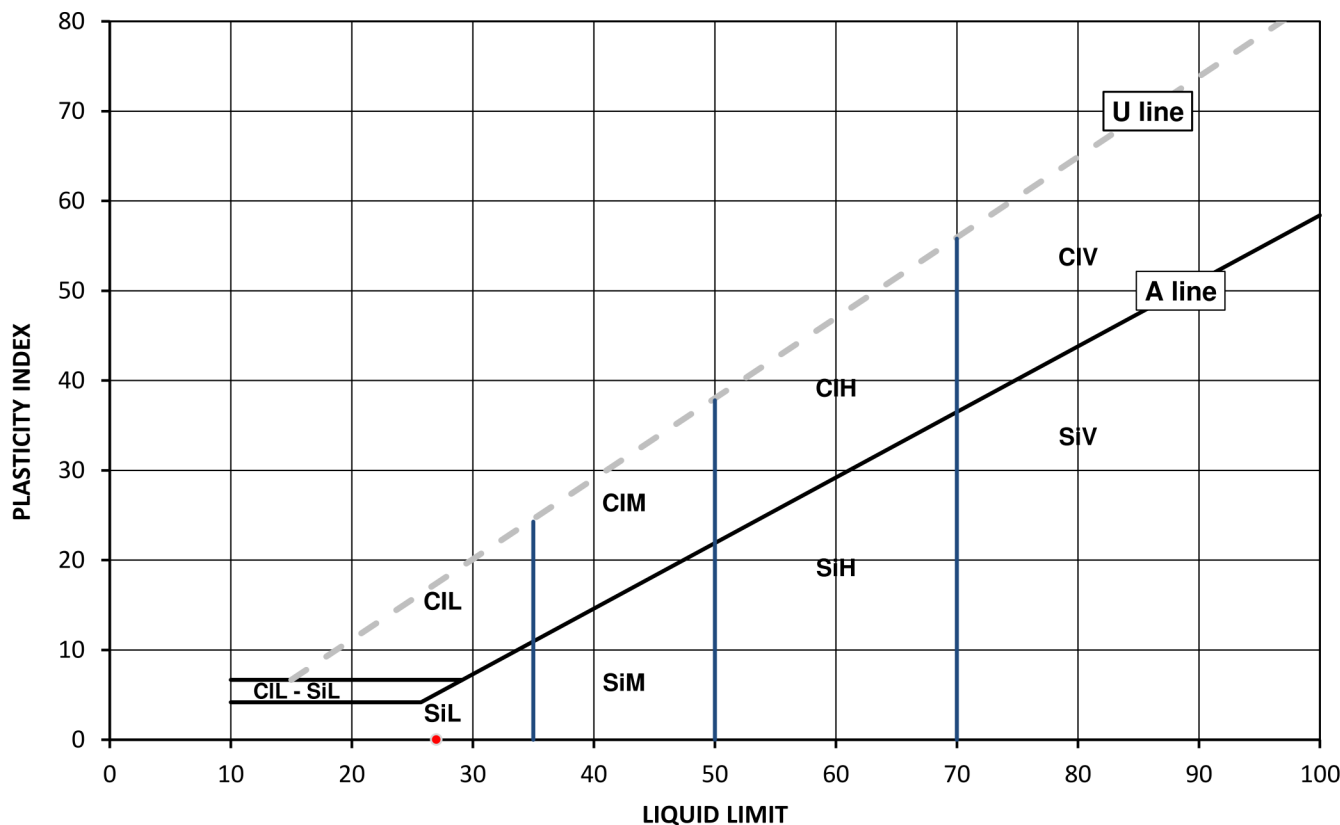
Test Results:

Laboratory Reference: 2834862
Hole No.: WS1
Sample Reference: Not Given
Sample Description: Brownish grey slightly gravelly very sandy slightly clayey SILT

Depth Top [m]: 3.50
Depth Base [m]: Not Given
Sample Type: B

Sample Preparation: Tested after >425 µm removed by hand

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
21	27	NP	NP	99



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Plasticity	Liquid Limit
Cl Clay	L Low	below 35
Si Silt	M Medium	35 to 50
	H High	50 to 70
	V Very high	exceeding 70
	O Organic	append to classification for organic material (eg CIHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks: NP - non plastic

Signed:

Monika Janoszek
PL Environmental & Geotechnical Lab Production Specialist
for and on behalf of i2 Analytical Ltd

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4041

**TEST CERTIFICATE****DETERMINATION OF LIQUID AND PLASTIC LIMITS**

Tested in Accordance with: BS 1377-2:1990: Clause 4.4 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

Environmental Science

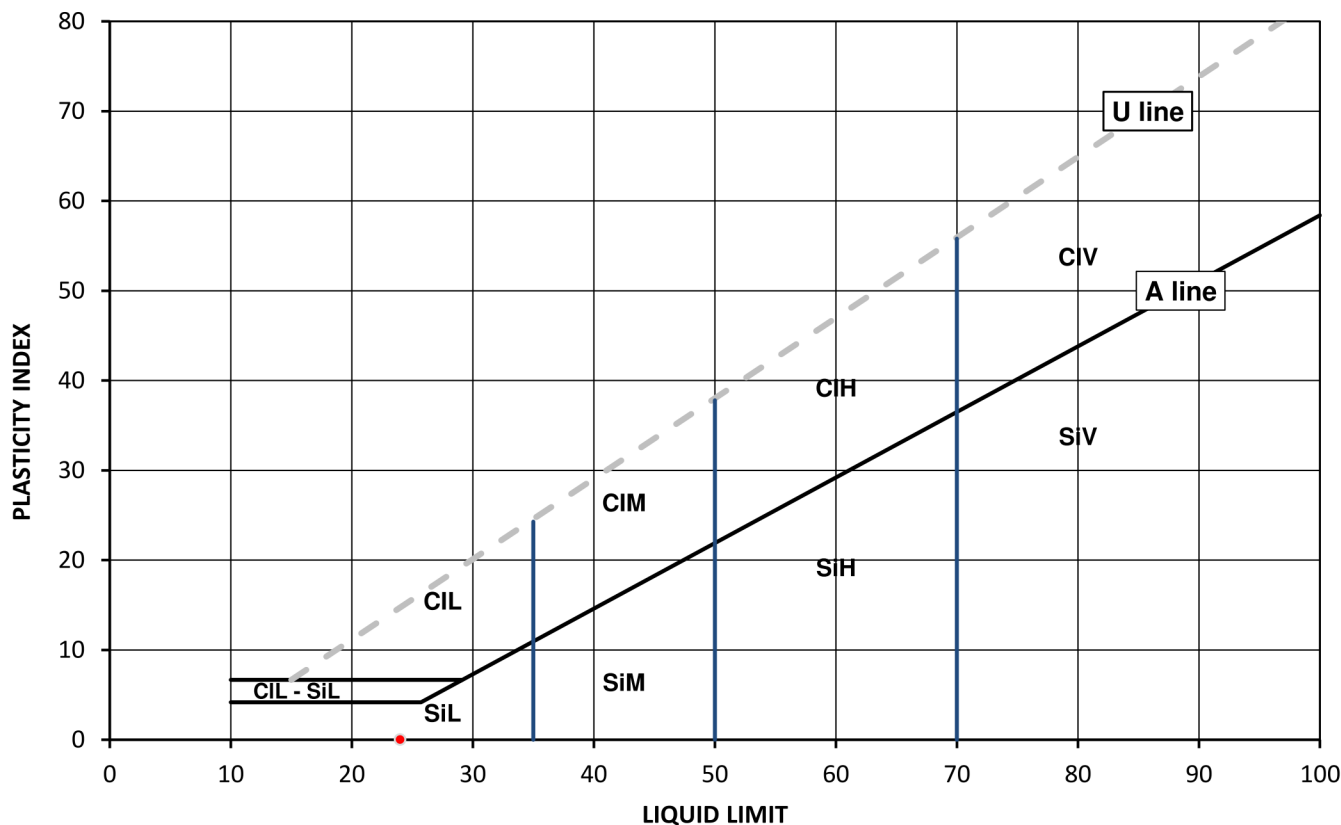
Client: Geo-Matters Limited
Client Address: 104 Bondgate, Castle Donington,
DE74 2NRContact: Mark Lewis
Site Address: Burbage

Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Client Reference: GML23150
Job Number: 23-60582-1
Date Sampled: Not Given
Date Received: 05/10/2023
Date Tested: 16/10/2023
Sampled By: Client - ML**Test Results:**Laboratory Reference: 2834863
Hole No.: WS2
Sample Reference: Not Given
Sample Description: Brown clayey SANDDepth Top [m]: 0.90
Depth Base [m]: Not Given
Sample Type: B

Sample Preparation: Tested in natural condition

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
9.6	24	NP	NP	100



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Clay	Plasticity	Liquid Limit
Cl	Clay	L Low	below 35
Si	Silt	M Medium	35 to 50
		H High	50 to 70
		V Very high	exceeding 70
		O Organic	append to classification for organic material (eg CIHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks: NP - non plastic

Signed:

Monika Janoszek
PL Environmental & Geotechnical Lab Production Specialist
for and on behalf of i2 Analytical Ltd

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4041

**TEST CERTIFICATE****DETERMINATION OF LIQUID AND PLASTIC LIMITS**

Tested in Accordance with: BS 1377-2:1990: Clause 4.4 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

Client: Geo-Matters Limited
Client Address: 104 Bondgate, Castle Donington,
DE74 2NR

Contact: Mark Lewis
Site Address: Burbage

Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Client Reference: GML23150
Job Number: 23-60582-1
Date Sampled: Not Given
Date Received: 05/10/2023
Date Tested: 16/10/2023
Sampled By: Client - ML

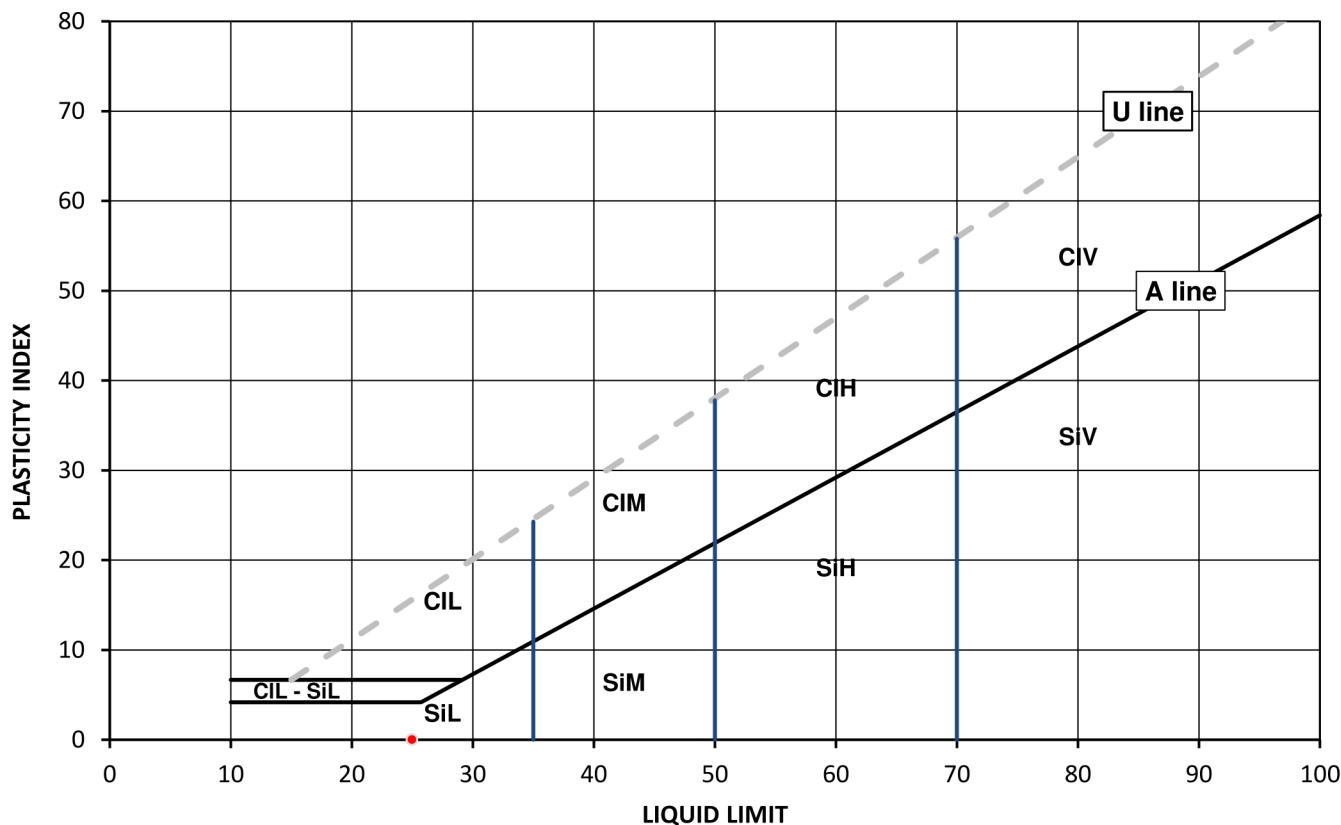
Test Results:

Laboratory Reference: 2834864
Hole No.: WS4
Sample Reference: Not Given
Sample Description: Yellow slightly clayey SAND

Depth Top [m]: 1.50
Depth Base [m]: Not Given
Sample Type: B

Sample Preparation: Tested in natural condition

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
6.5	25	NP	NP	100



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Plasticity	Liquid Limit
Cl Clay	L Low	below 35
Si Silt	M Medium	35 to 50
	H High	50 to 70
	V Very high	exceeding 70
	O Organic	append to classification for organic material (eg CIHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks: NP - non plastic

Signed:

Monika Janoszek
PL Environmental & Geotechnical Lab Production Specialist
for and on behalf of i2 Analytical Ltd

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Page 1 of 1

Date Reported: 31/10/2023

GF 232.13



4041

**TEST CERTIFICATE****DETERMINATION OF LIQUID AND PLASTIC LIMITS**

Tested in Accordance with: BS 1377-2:1990: Clause 4.4 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

Client: Geo-Matters Limited
Client Address: 104 Bondgate, Castle Donington,
DE74 2NR

Contact: Mark Lewis
Site Address: Burbage

Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Client Reference: GML23150
Job Number: 23-60582-1
Date Sampled: Not Given
Date Received: 05/10/2023
Date Tested: 16/10/2023
Sampled By: Client - ML

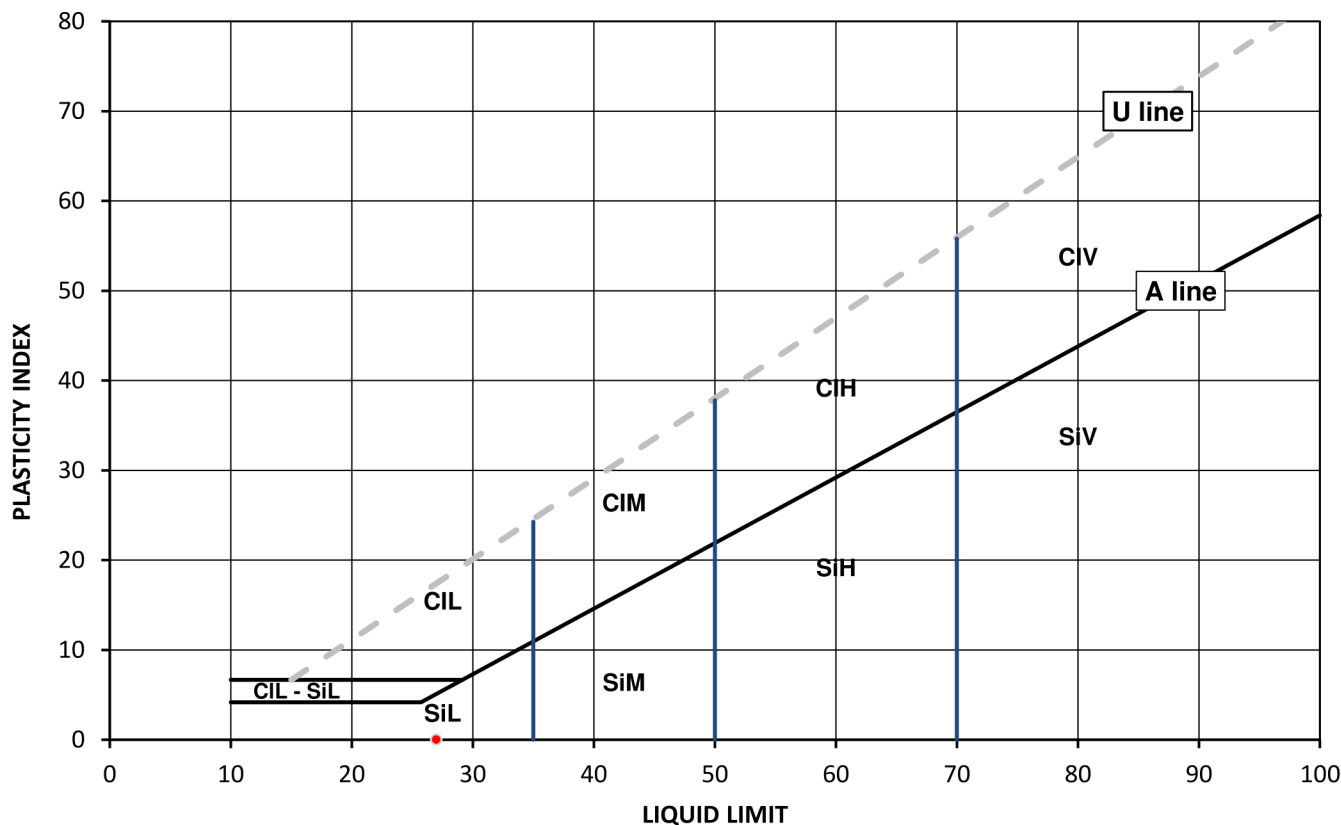
Test Results:

Laboratory Reference: 2834865
Hole No.: WS5
Sample Reference: Not Given
Sample Description: Brown very sandy slightly clayey SILT

Depth Top [m]: 2.50
Depth Base [m]: Not Given
Sample Type: B

Sample Preparation: Tested in natural condition

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
20	27	NP	NP	100



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Clay	Plasticity	Liquid Limit
Cl	Clay	L Low	below 35
Si	Silt	M Medium	35 to 50
		H High	50 to 70
		V Very high	exceeding 70
		O Organic	append to classification for organic material (eg CIHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks: NP - non plastic

Signed:



Monika Janoszek
PL Environmental & Geotechnical Lab Production Specialist
for and on behalf of i2 Analytical Ltd

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4041

**TEST CERTIFICATE****DETERMINATION OF LIQUID AND PLASTIC LIMITS**

Tested in Accordance with: BS 1377-2:1990: Clause 4.4 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

Client: Geo-Matters Limited
Client Address: 104 Bondgate, Castle Donington,
DE74 2NR

Contact: Mark Lewis
Site Address: Burbage

Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Client Reference: GML23150
Job Number: 23-60582-1
Date Sampled: Not Given
Date Received: 05/10/2023
Date Tested: 16/10/2023
Sampled By: Client - ML

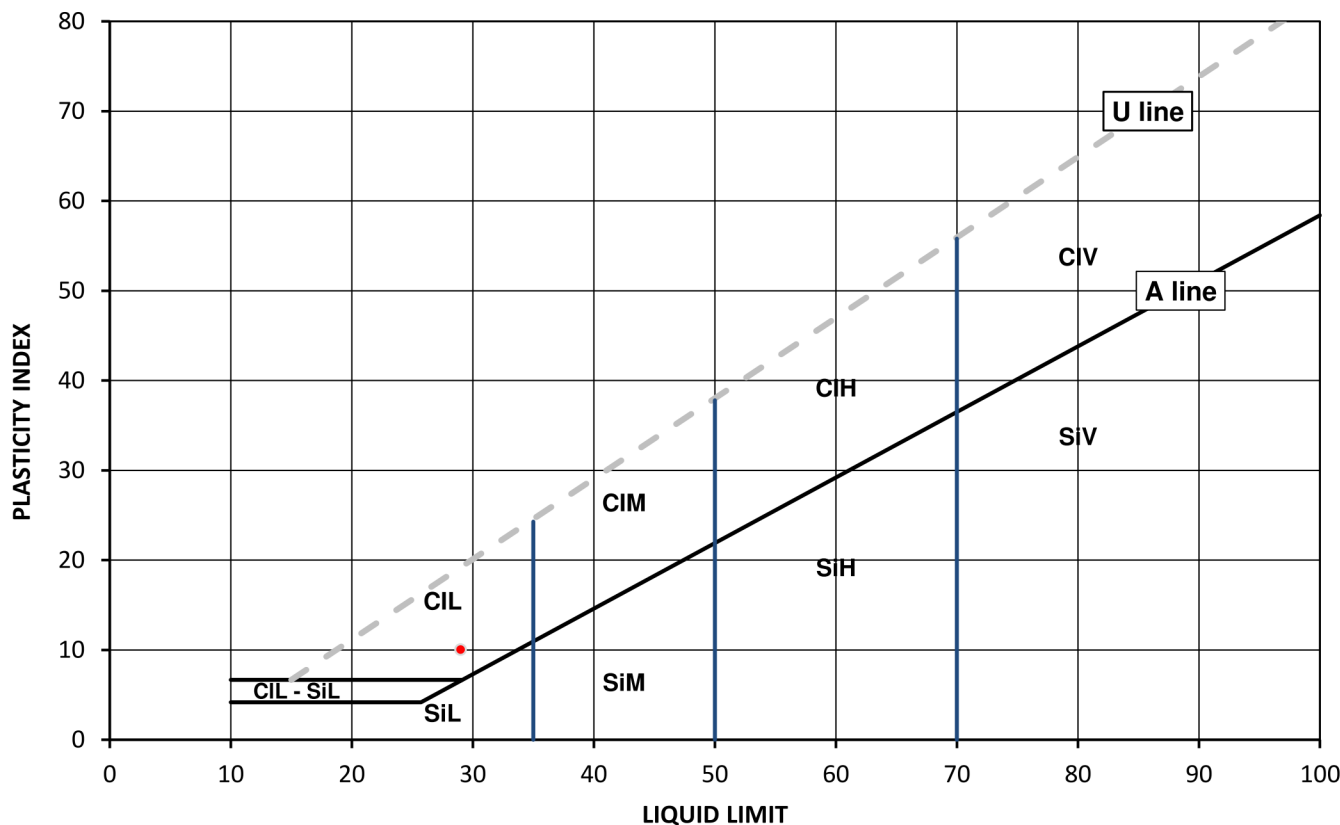
Test Results:

Laboratory Reference: 2834866
Hole No.: WS6
Sample Reference: Not Given
Sample Description: Brown very sandy slightly silty CLAY

Depth Top [m]: 3.70
Depth Base [m]: Not Given
Sample Type: B

Sample Preparation: Tested in natural condition

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
19	29	19	10	100



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Plasticity	Liquid Limit
Cl	Clay	L Low below 35
Si	Silt	M Medium 35 to 50
		H High 50 to 70
		V Very high exceeding 70
	O Organic	append to classification for organic material (eg CIHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Monika Janoszek
PL Environmental & Geotechnical Lab Production Specialist
for and on behalf of i2 Analytical Ltd

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Date Reported: 31/10/2023

GF 232.13



4041

**TEST CERTIFICATE****DETERMINATION OF LIQUID AND PLASTIC LIMITS**

Tested in Accordance with: BS 1377-2:1990: Clause 4.4 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

Environmental Science

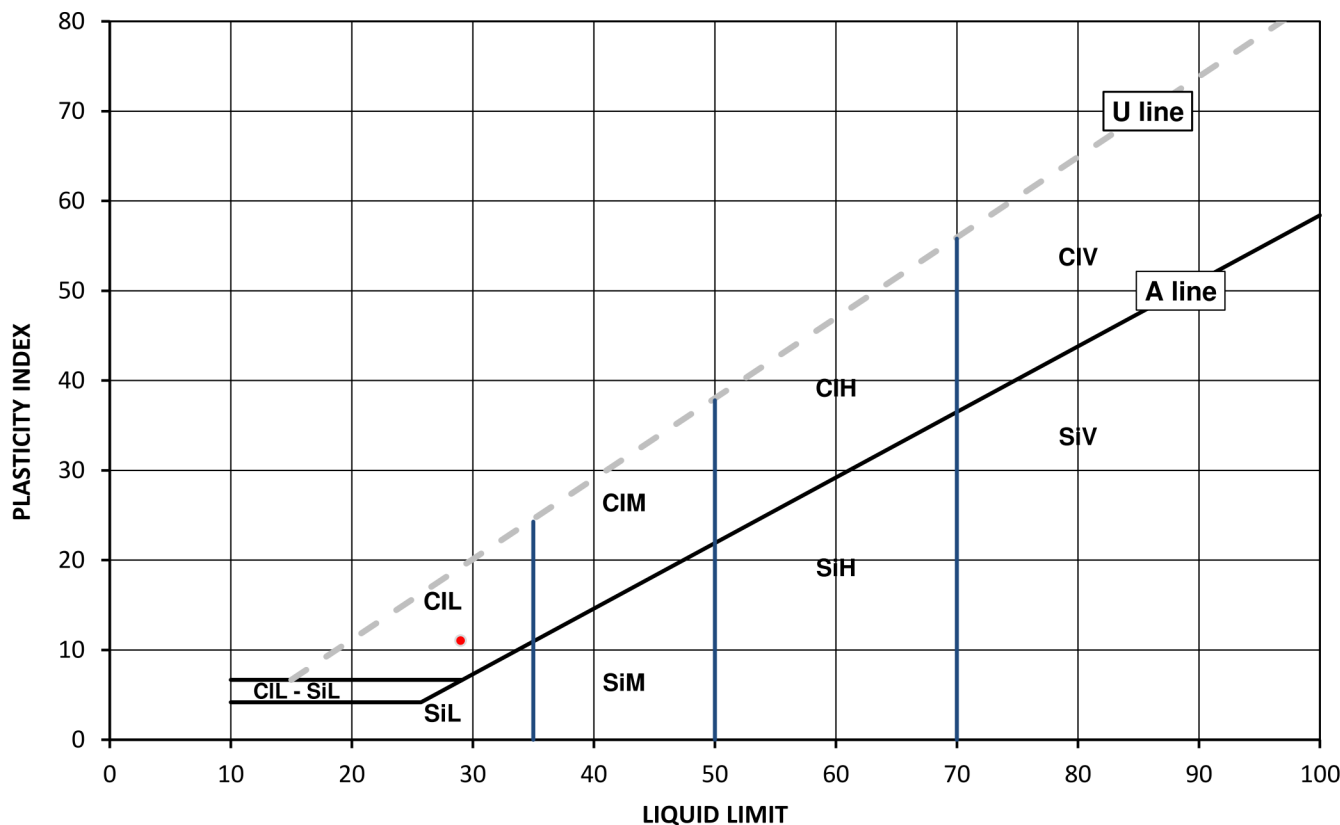
Client: Geo-Matters Limited
Client Address: 104 Bondgate, Castle Donington,
DE74 2NRContact: Mark Lewis
Site Address: Burbage

Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Client Reference: GML23150
Job Number: 23-60582-1
Date Sampled: Not Given
Date Received: 05/10/2023
Date Tested: 16/10/2023
Sampled By: Client - ML**Test Results:**Laboratory Reference: 2834867
Hole No.: WS7
Sample Reference: Not Given
Sample Description: Brown sandy CLAYDepth Top [m]: 2.30
Depth Base [m]: Not Given
Sample Type: B

Sample Preparation: Tested in natural condition

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
18	29	18	11	100



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Clay	Plasticity	Liquid Limit
CI	Clay	L Low	below 35
Si	Silt	M Medium	35 to 50
		H High	50 to 70
		V Very high	exceeding 70
		O Organic	append to classification for organic material (eg CIHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Monika Janoszek
PL Environmental & Geotechnical Lab Production Specialist
for and on behalf of i2 Analytical Ltd

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Page 1 of 1

Date Reported: 31/10/2023

GF 232.13



SUMMARY REPORT

SUMMARY OF CLASSIFICATION TEST RESULTS

Tested in Accordance with:

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

4041

Client: Geo-Matters Limited
Client Address: 104 Bondgate, Castle Donington,
DE74 2NR

Water Content by BS 1377-2:1990: Clause 3.2
Atterberg by BS 1377-2: 1990:
Clause 4.3 (4 Point Test), Clause 4.4 (1 Point Test) and 5

Client Reference: GML23150
Job Number: 23-60582-1
Date Sampled: Not Given
Date Received: 05/10/2023
Date Tested: 16/10 - 17/10/2023
Sampled By: Client - ML

Contact: Mark Lewis
Site Address: Burbage

Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	Water Content BS 1377-2 [W] %	Water Content BS EN ISO 17892-1 [W] %	Atterberg				Density			Total Porosity# %		
		Reference	Depth Top m	Depth Base m	Type					% Passing 425um	WL %	Wp %	Ip %	bulk Mg/m3	dry Mg/m3	PD Mg/m3			
2834862	WS1	Not Given	3.50	Not Given	B	Brownish grey slightly gravelly very sandy slightly clayey SILT	Atterberg 1 Point	21		99	27	NP	NP						
2834863	WS2	Not Given	0.90	Not Given	B	Brown clayey SAND	Atterberg 1 Point	9.6		100	24	NP	NP						
2834864	WS4	Not Given	1.50	Not Given	B	Yellow slightly clayey SAND	Atterberg 1 Point	6.5		100	25	NP	NP						
2834865	WS5	Not Given	2.50	Not Given	B	Brown very sandy slightly clayey SILT	Atterberg 1 Point	20		100	27	NP	NP						
2834866	WS6	Not Given	3.70	Not Given	B	Brown very sandy slightly silty CLAY	Atterberg 1 Point	19		100	29	19	10						
2834867	WS7	Not Given	2.30	Not Given	B	Brown sandy CLAY	Atterberg 1 Point	18		100	29	18	11						

Note: # Non accredited; NP - Non plastic

Comments:

Signed:



Monika Janoszek
PL Environmental & Geotechnical Lab Production Specialist
for and on behalf of i2 Analytical Ltd

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SUMMARY REPORT

DETERMINATION OF WATER CONTENT

Tested in Accordance with: BS 1377-2: 1990: Clause 3.2

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

4041

Client: Geo-Matters Limited
Client Address: 104 Bondgate, Castle Donington,
DE74 2NR

Contact: Mark Lewis
Site Address: Burbage

Client Reference: GML23150
Job Number: 23-60582-1
Date Sampled: Not Given
Date Received: 05/10/2023
Date Tested: 16/10 - 17/10/2023
Sampled By: Client - ML

Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	WC	Sample preparation / Oven temperature at the time of testing			
		Reference	Depth Top m	Depth Base m	Type							
2834862	WS1	Not Given	3.50	Not Given	B	Brownish grey slightly gravelly very sandy slightly clayey SILT		21	Sample was quartered, oven dried at 106.1 °C			
2834863	WS2	Not Given	0.90	Not Given	B	Brown clayey SAND		9.6	Sample was quartered, oven dried at 108.8 °C			
2834864	WS4	Not Given	1.50	Not Given	B	Yellow slightly clayey SAND		6.5	Sample was quartered, oven dried at 106.1 °C			
2834865	WS5	Not Given	2.50	Not Given	B	Brown very sandy slightly clayey SILT		20	Sample was quartered, oven dried at 106 °C			
2834866	WS6	Not Given	3.70	Not Given	B	Brown very sandy slightly silty CLAY		19	Sample was quartered, oven dried at 106 °C			
2834867	WS7	Not Given	2.30	Not Given	B	Brown sandy CLAY		18	Sample was quartered, oven dried at 108.8 °C			

Comments:

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Signed:



Monika Janoszek
PL Environmental & Geotechnical Lab Production Specialist
for and on behalf of i2 Analytical Ltd



4041

**TEST CERTIFICATE****DETERMINATION OF PARTICLE SIZE DISTRIBUTION**

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

Client: Geo-Matters Limited
Client Address: 104 Bondgate, Castle Donington,
DE74 2NR

Contact: Mark Lewis
Site Address: Burbage

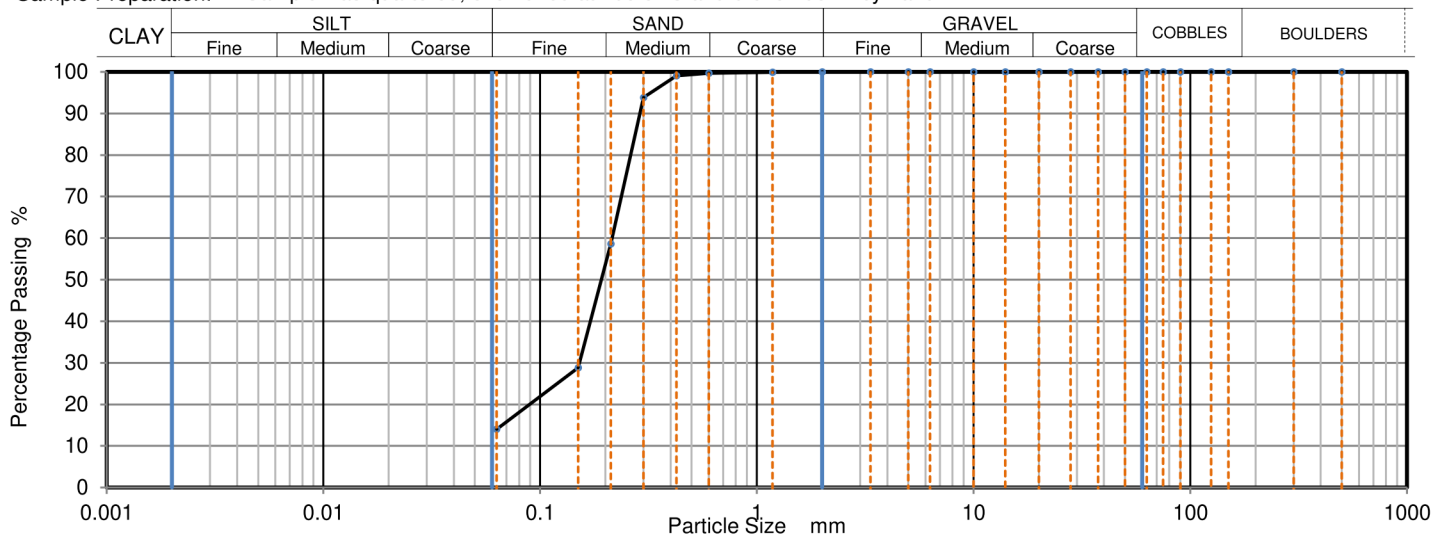
Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Client Reference: GML23150
Job Number: 23-60582-1
Date Sampled: Not Given
Date Received: 05/10/2023
Date Tested: 16/10/2023
Sampled By: Client - ML

Test Results:

Laboratory Reference: 2834863
Hole No.: WS2
Sample Reference: Not Given
Sample Description: Brown clayey SAND
Sample Preparation: Sample was quartered, oven dried at 108.8 °C and broken down by hand.

Depth Top [m]: 0.90
Depth Base [m]: Not Given
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
150	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	99		
0.3	94		
0.212	59		
0.15	29		
0.063	15		

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	85
Fines <0.063mm	15

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	> 3.4
Curvature Coefficient	

Uniformity and Curvature Coefficient calculated in accordance with BS EN ISO 14688-2:2018

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks:**Signed:**

Monika Janoszek
PL Environmental & Geotechnical Lab Production Specialist
for and on behalf of i2 Analytical Ltd

Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report relate only to the sample(s) submitted for testing.



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**TEST CERTIFICATE****DETERMINATION OF PARTICLE SIZE DISTRIBUTION**

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

Client: Geo-Matters Limited
Client Address: 104 Bondgate, Castle Donington,
DE74 2NR

Contact: Mark Lewis
Site Address: Burbage

Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Client Reference: GML23150
Job Number: 23-60582-1
Date Sampled: Not Given
Date Received: 05/10/2023
Date Tested: 16/10/2023
Sampled By: Client - ML

Test Results:

Laboratory Reference: 2834867

Hole No.: WS7

Sample Reference: Not Given

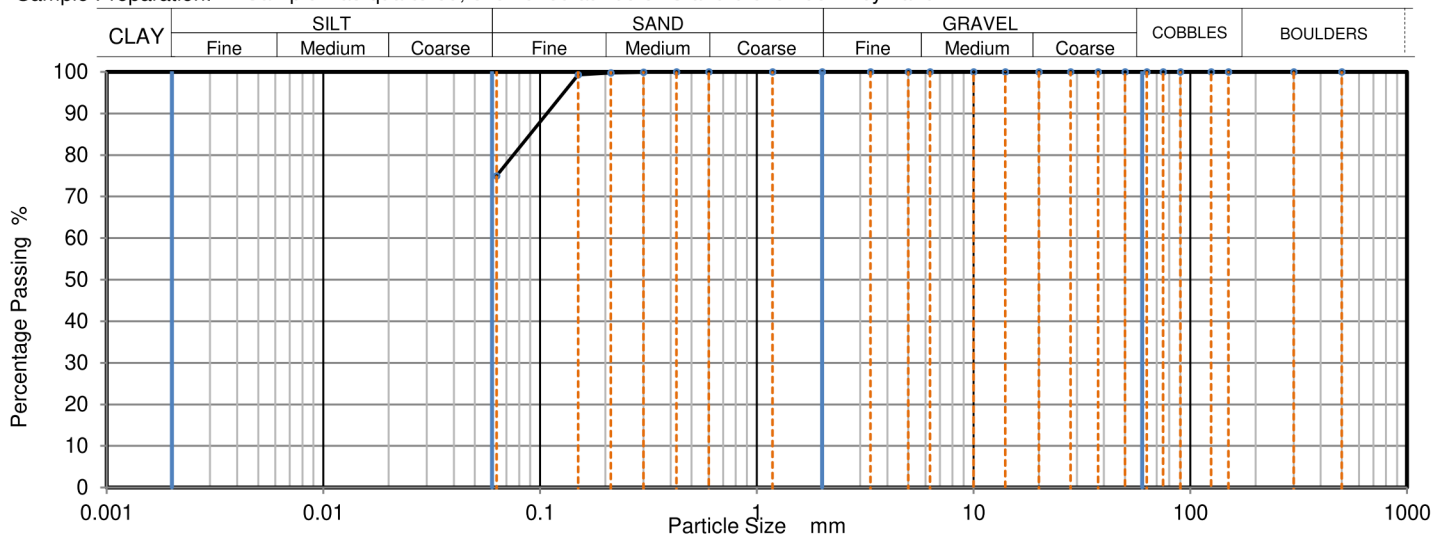
Sample Description: Brown sandy CLAY

Sample Preparation: Sample was quartered, oven dried at 108.8 °C and broken down by hand.

Depth Top [m]: 2.30

Depth Base [m]: Not Given

Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
150	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	100		
0.212	100		
0.15	99		
0.063	75		

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	25
Fines <0.063mm	75

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	N/A
Curvature Coefficient	

Uniformity and Curvature Coefficient calculated in accordance with BS EN ISO 14688-2:2018

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks:

Signed:



Monika Janoszek
PL Environmental & Geotechnical Lab Production Specialist
for and on behalf of i2 Analytical Ltd

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APPENDIX VIII

Ground Gas Monitoring Sheets

Monitoring of Soil Gas and Groundwater

Site Name & Project Code:	Burbage – GML23150
Data Entered By:	GML
Date of Visit:	6/10/2023
Equipment Used:	GA2000 – Infrared Gas Analyser and Electronic Dip Meter
Specifications:	BS:5930 (2015), BS8485:2015+A1:2019, CL:AIRE RB17
Site Observations:	Sunny
Pressure at Start & End (mb):	Start: 996mb End: 996mb

Borehole No. / Ref:	LEL % by vol		Methane % by vol		Carbon Dioxide % by vol		Oxygen % by vol*		Gas Flow (l/hr)		Groundwater (m)	
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Depth to Water	Depth to Base
WS1	004	004	0.2	0.2	1.1	1.1	18.1	18.1	0.0	0.0	3.36	3.36
WS3	000	000	0.0	0.0	6.3	6.3	7.1	7.1	0.1	0.1	2.90	2.93
WS6	000	000	0.0	0.0	0.0	0.0	19.1	19.1	0.1	0.1	EMPTY	3.96

Key

- Text shown in bold indicates either steady carbon dioxide $\geq 5.00\%$ by volume or steady methane $\geq 1.00\%$ by volume.
- * The 'Peak' oxygen reading is taken as the lowest recorded.
- L.E.L. Lower Explosive Limit (100% L.E.L. = 5% flammable gas).
- NR = Not Recorded

Site Notes:

Monitoring of Soil Gas and Groundwater

Site Name & Project Code:	Burbage – GML23150
Data Entered By:	GML
Date of Visit:	13/10/2023
Equipment Used:	GA2000 – Infrared Gas Analyser and Electronic Dip Meter
Specifications:	BS:5930 (2015), BS8485:2015+A1:2019, CL:AIRE RB17
Site Observations:	Sunny
Pressure at Start & End (mb):	Start: 1010mb End: 1010mb

Borehole No. / Ref:	LEL % by vol		Methane % by vol		Carbon Dioxide % by vol		Oxygen % by vol*		Gas Flow (l/hr)		Groundwater (m)	
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Depth to Water	Depth to Base
WS1	000	000	0.0	0.0	8.2	8.1	9.6	9.6	0.1	0.1	EMPTY	3.36
WS3	000	000	0.0	0.0	3.5	3.5	5.1	5.1	0.2	0.2	1.82	2.93
WS6	000	000	0.0	0.0	4.0	3.8	16.3	16.3	0.2	0.2	EMPTY	3.96

Key

- Text shown in bold indicates either steady carbon dioxide $\geq 5.00\%$ by volume or steady methane $\geq 1.00\%$ by volume.
- * The 'Peak' oxygen reading is taken as the lowest recorded.
- L.E.L. Lower Explosive Limit (100% L.E.L. = 5% flammable gas).
- NR = Not Recorded

Site Notes:

Monitoring of Soil Gas and Groundwater

Site Name & Project Code:	Burbage – GML23150
Data Entered By:	GML
Date of Visit:	19/10/2023
Equipment Used:	GA2000 – Infrared Gas Analyser and Electronic Dip Meter
Specifications:	BS:5930 (2015), BS8485:2015+A1:2019, CL:AIRE RB17
Site Observations:	Overcast
Pressure at Start & End (mb):	Start: 1001mb End: 1001mb

Borehole No. / Ref:	LEL % by vol		Methane % by vol		Carbon Dioxide % by vol		Oxygen % by vol*		Gas Flow (l/hr)		Groundwater (m)	
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Depth to Water	Depth to Base
WS1	000	000	0.0	0.0	1.7	1.7	17.6	17.6	0.0	0.0	EMPTY	3.36
WS3	000	000	0.0	0.0	5.8	5.8	8.9	8.9	0.1	0.1	2.24	2.93
WS6	000	000	0.0	0.0	1.5	1.5	19.4	19.4	0.1	0.1	EMPTY	3.96

Key

- Text shown in bold indicates either steady carbon dioxide $\geq 5.00\%$ by volume or steady methane $\geq 1.00\%$ by volume.
- * The 'Peak' oxygen reading is taken as the lowest recorded.
- L.E.L. Lower Explosive Limit (100% L.E.L. = 5% flammable gas).
- NR = Not Recorded

Site Notes:

Monitoring of Soil Gas and Groundwater

Site Name & Project Code:	Burbage – GML23150
Data Entered By:	GML
Date of Visit:	27/10/2023
Equipment Used:	GA2000 – Infrared Gas Analyser and Electronic Dip Meter
Specifications:	BS:5930 (2015), BS8485:2015+A1:2019, CL:AIRE RB17
Site Observations:	Overcast
Pressure at Start & End (mb):	Start: 1010mb End: 1010mb

Borehole No. / Ref:	LEL % by vol		Methane % by vol		Carbon Dioxide % by vol		Oxygen % by vol*		Gas Flow (l/hr)		Groundwater (m)	
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Depth to Water	Depth to Base
WS1	000	000	0.0	0.0	6.7	6.7	13.1	13.1	0.0	0.0	2.85	3.36
WS3	000	000	0.0	0.0	8.0	8.0	3.1	3.1	0.2	0.2	2.90	2.93
WS6	000	000	0.0	0.0	2.8	2.8	17.5	17.5	0.6	0.2	3.89	3.96

Key

- Text shown in bold indicates either steady carbon dioxide $\geq 5.00\%$ by volume or steady methane $\geq 1.00\%$ by volume.
- * The 'Peak' oxygen reading is taken as the lowest recorded.
- L.E.L. Lower Explosive Limit (100% L.E.L. = 5% flammable gas).
- NR = Not Recorded

Site Notes:

Monitoring of Soil Gas and Groundwater

Site Name & Project Code:	Burbage – GML23150
Data Entered By:	GML
Date of Visit:	02/11/2023
Equipment Used:	GA2000 – Infrared Gas Analyser and Electronic Dip Meter
Specifications:	BS:5930 (2015), BS8485:2015+A1:2019, CL:AIRE RB17
Site Observations:	Overcast
Pressure at Start & End (mb):	Start: 996mb End: 996mb

Borehole No. / Ref:	LEL % by vol		Methane % by vol		Carbon Dioxide % by vol		Oxygen % by vol*		Gas Flow (l/hr)		Groundwater (m)	
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Depth to Water	Depth to Base
WS1	000	000	0.0	0.0	2.1	2.1	16.3	16.3	0.0	0.0	3.01	3.36
WS3	000	000	0.0	0.0	5.3	5.3	9.2	9.2	0.0	0.0	EMPTY	2.93
WS6	000	000	0.0	0.0	1.4	1.4	18.7	18.7	0.1	0.1	3.94	3.96

Key

- Text shown in bold indicates either steady carbon dioxide $\geq 5.00\%$ by volume or steady methane $\geq 1.00\%$ by volume.
- * The 'Peak' oxygen reading is taken as the lowest recorded.
- L.E.L. Lower Explosive Limit (100% L.E.L. = 5% flammable gas).
- NR = Not Recorded

Site Notes:

Monitoring of Soil Gas and Groundwater

Site Name & Project Code:	Burbage – GML23150
Data Entered By:	GML
Date of Visit:	09/11/2023
Equipment Used:	GA2000 – Infrared Gas Analyser and Electronic Dip Meter
Specifications:	BS:5930 (2015), BS8485:2015+A1:2019, CL:AIRE RB17
Site Observations:	Overcast
Pressure at Start & End (mb):	Start: 1001mb End: 1001mb

Borehole No. / Ref:	LEL % by vol		Methane % by vol		Carbon Dioxide % by vol		Oxygen % by vol*		Gas Flow (l/hr)		Groundwater (m)	
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Depth to Water	Depth to Base
WS1	000	000	0.0	0.0	1.8	1.8	18.7	18.7	0.0	0.0	3.15	3.36
WS3	000	000	0.0	0.0	5.2	5.2	7.2	7.2	0.1	0.1	EMPTY	2.93
WS6	000	000	0.0	0.0	1.9	1.9	17.4	17.4	0.0	0.0	EMPTY	3.96

Key

- Text shown in bold indicates either steady carbon dioxide $\geq 5.00\%$ by volume or steady methane $\geq 1.00\%$ by volume.
- * The 'Peak' oxygen reading is taken as the lowest recorded.
- L.E.L. Lower Explosive Limit (100% L.E.L. = 5% flammable gas).
- NR = Not Recorded

Site Notes: